

Final Report
on
Assessment of Drinking Water Security in the Selected Areas of
South-West Coastal Region of Bangladesh



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Ministry of Water Resources, Government of Bangladesh
&
Institute of Disaster Management (IDM)
Khulna University of Engineering & Technology (KUET)

Executive Summary

Surging population and human activities along with global climate change have enormously increased the vulnerability of the water system. Considering the existing situations of water security, a good number of initiatives are taken from the Government of Bangladesh (through different relevant departments), different research organizations, national and international NGOs of which a wide variety of initiatives are taken into consideration for subsequent actions. However, a great deal is yet to be done for assuring the water security, especially for drinking water. Considering the immense importance of drinking water, the research team of the 'Institute of Disaster Management (IDM)' of Khulna University of Engineering & Technology (KUET) and 'Water Resources Planning Organization (WARPO)' has designed a joint research project in the South-West Coastal belt of Bangladesh. The research project is aligned with WARPO's visions in addition to National Policy for Safe Water Supply and Sanitation, Coastal Zone Policy, Bangladesh Delta Plan and SDGs in manifold ways. The policies ensure right of access to safe water and sanitation services for all at an affordable cost along with provide safe and sustainable water supply. National Water Policy 1999 ensures the availability of water to all users of society, particularly the poor, and considered the particular needs of women and children. Besides, stressed enhancing the role of women in water management as they have a significant role in this manner. In the case of supplying drinking water, the policy will facilitate the availability of safe and affordable drinking water supplies through various means, including rainwater harvesting and conservation. The research project is completely aligned with those policies and it could bring a positive outcome to achieve the goals of the policies.

The study has aimed to evaluate drinking water situation in terms of the availability, accessibility, and quality. The study area covered 18 selected Unions of three coastal Districts -Khulna, Bagerhat and Satkhira. Indexing method was used to portray the availability, accessibility and quality scenario of drinking water separately at the Union, Upazila, and District level. Afterwards, overall drinking water situation along with drinking water availability, accessibility, quality maps have been created using spatial analyses. At the final stage of the project, an application (WATapp) for android mobile devices has been developed which shows the drinking water index of Khulna, Satkhira and Bagerhat districts in different dimensions.

People of the study area drink water from different types of sources, such as, Pond Sand Filter, (PSF), pond, rain water, Reverse Osmosis (RO) plant, shallow tubewell etc. In the aspect of availability, result shows that majority of the households collect water from private sources followed by the Government and non-government ones. Overall, water availability condition seems to be better in Khulna than Bagerhat and Satkhira District. Whereas, in case of accessibility, the findings indicate that the majority of families gather water from sources more than 300 meters away, which is twice the national standard (150 m) for Bangladesh. Largely, households of Satkhira district have higher access to the source than Khulna and Bagerhat districts. According to the findings of drinking water quality, only 1% water sources were of good quality and the rest 99% are poor or very poor for drinking purpose during dry season mainly due to the presence of E. Coli in the sources in very large quantity. Overall, the water quality of Bagerhat district is relatively better than Khulna and Satkhira Districts in both seasons. Furthermore, the water security condition in 18 disaster hotspots in the South-west coastal region is poor to very poor. However, in comparison, Satkhira has better water security with an average index score of 2.82 whereas Khulna and Bagerhat have of 2.55 and 2.48 respectively.

New policy interventions should emphasize on implementation of some new sources of potable water since 42% households claimed that they faces water scarcity for 3 to 4 months in dry season. Around 33% of the surveyed respondent's residence were located at a distance of 500 m or more from the drinking water collection points. In addition, it was found that around 55% households require more than 15 minutes of travelling to collect drinking water. Furthermore, road condition needs to be taken care of in order to ensure water accessibility as 50% household use fully kutchra road for fetching water. The longest distance between the water source and the house has been found to be 10km. Besides, the shortest distance traveled was 0km because of the location of the source within the

home. The mobile application (WATapp) is designed as a decision making tool which will provide an instant overview of the drinking water security situation. The output of the project work will help the policy makers and they can obtain a baseline for effective planning and execution with priority-based planning.

For the future course of action, some adaptation and transformation mechanisms could be undertaken based on the outputs of the research. The research outputs indicate that the drinking water is scarce in the study areas. Water is available for drinking purpose from diversified sources which mostly do not meet the quality of national or WHO standard. So, government could put their effort to ensure a good number of potable water sources which will safeguard better accessibility to drinking water sources. Government should keep an eye on the management of the RO plants as the concentrated water is dumped in the nearby area and the used filters are managed improperly in most of the cases which incur greater threats to the environment in the long run. Around 90% PSFs were found out of service for the lack of some minute maintenance. A small amount of fund could be allocated to revive the sources. The related ponds should be protected and maintained properly. Rain water should be collected in a safe manner and try to circumvent the roofs made of asbestos sheets. Some health issues are found in the local residents which could be monitored as “Water vs Health” program and take action as per the outputs of the program.

Through the mobile application all information and research outputs could be utilized by the local government and policy makers to take drinking water related decision in short time. The mobile app is accessible to the marginal people also for drinking water related information. In addition, the database can also be used as a baseline for any future study related to water. To make this endeavor of IDM, KUET and WARPO meaningful, all the rest of the unions should be taken under consideration in the extended research. And it is worthy to have the study for all over the country and prepare a dynamic baseline of drinking water for Bangladesh.

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List of Abbreviations and Acronyms

AAAQ	Availability, Accessibility, Acceptability and Quality
AHP	Analytic Hierarchy Process
APHA	American Public Health Association
BADC	Bangladesh Agricultural Development Corporation
BBS	Bangladesh Bureau of Statistics
BCCSAP	Bangladesh Climate Change Strategy and Action Plan
BDP	Bangladesh Delta Plan
BMDA	Barind Multipurpose Development Authority
BUET	Bangladesh University of Engineering and Technology
BWA	Bangladesh Water Act
BWDB	Bangladesh Water Development Board
CDS	Coastal Development Strategy
CZPo	Coastal Zone Policy
DGPS	Digital Global Positioning System
DO	Dissolved Oxygen
DPHE	Department of Public Health Engineering
EC	Electric Conductivity
FC	Fecal Coliform
FGD	Focus Group Discussions
GIS	Geographic Information System
GOB	Government of Bangladesh
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
IDM	Institute of Disaster Management
IDW	Inverse Distance Weighting
IWFM	Institute of Water and Flood Management
IWRM	Integrated Water Resource Management
KII	Key Informant Interview
KUET	Khulna University of Engineering & Technology
LGED	Local Government Engineering Department
ME	Mean Error
MoEFCC	Ministry of Environment, Forest and Climate Change
NAPA	National Adaptation Programme of Action
NGO	Non-Government Organization
NSDS	National Sustainable Development Strategy
PSF	Pond Sand Filtering
RMSE	Root Mean Square Error
RO	Reverse Osmosis
RWHS	Rain Water Harvesting System
SDG	Sustainable Development Goals
TDS	Total Dissolved Solid
USGS	U.S. Geological Survey
WARPO	Water Resources and Planning Organization
WASH	Water and Sanitation Hygiene

WHO	World Health Organization
WQI	Water quality index

Chapter One

INTRODUCTION

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INTRODUCTION

1.1 Background of the Study

Water security is one of the increasingly recognized challenges worldwide. Human livelihood requires consistent availability and continuous accessibility to an acceptable quality of water. The scarcity of safe drinking water is increasing due to an increase in population, changing lifestyles and urbanization (Abedin and Shaw, 2013). Increasing population and human activities along with global climate change have enormously increased the vulnerability of the water system. Around 13 percent of the total world urban population lives in coastal zones and of these, more than 75 percent lives in Asia (ADB, 2013). The effect of this is more adverse in developing countries like Bangladesh. Specifically, the southwest coastal region, being under tidal influence and dependent on fresh water supplies from upstream, that has a unique brackish water ecosystem. Scarcity of safe drinking water is an acute problem in the coastal regions which is mainly caused by seasonal drought, coastal flood, cyclone, and salinity intrusion. The context is also severely affecting agriculture, health, fisheries, and the ecosystem of the region (Rahman *et al.*, 2017). Therefore, water security assessment can be perceived in terms of availability, accessibility, and quality. Water availability encompasses the quantity of water that can be used for human purposes without significant harm to ecosystems or other users, whereas accessibility is the availability within a reasonable distance and time, and which is affordable and free of gender and class discrimination, and the quality embodies that the commodity is safe for consumption and aesthetically acceptable. So, it is important not only to address the importance of water security but also to measure its intensity to deal with this challenge. Since, water security varies based on locality, appropriate indicators are needed to measure the level of water security that can reflect changes at the local level. Addressing such vulnerabilities and challenges is a high priority as this will help to stimulate and implement policy actions.

Considering the existing situations of water security, a good number of initiatives are taken from different bodies and at different levels like the Government of Bangladesh (through different relevant departments), research organizations, national and international NGOs etc. A wide variety of initiatives is taken into consideration along with subsequent actions. However, a great deal is yet to be done for assuring the water security. A little endeavor is taken by the ‘Institute of Disaster Management (IDM)’ of Khulna University of Engineering & Technology (KUET) to contribute at national level for minimizing the challenges to ensure the ‘water security’ through this research project. Primarily, the research is for piloting the main concept at a small scale and after a productive outcome from the project and successful implementation of this outcome, there will be a great chance to go for a large scale which may cover the whole country. Considering the immense importance of water related challenges, specifically in the south-west coastal region of Bangladesh, the research team has designed the joint research project titled “Drinking water security Assessment in South-West Coastal Region of Bangladesh”. The specific objectives of the project are as follows:

- To identify the availability of water in local level and delineate the factors affecting.
- To analyze the accessibility of water and its consequences on the coastal residents.
- To assess the water quality and its spatial and seasonal distribution/trends.

There are some organizations, which are directly dealing with water issues and are involved in the different research initiatives related to water in Bangladesh. Water Resources and Planning Organization (WARPO) is one of them. The objectives of the research and the existing different Government Policies match deeply with each other. Moreover, the relevant policies are also related to WARPO. In National Water Policy (1999) governs the availability of safe and affordable drinking water supplies through various means, including rainwater harvesting and conservation at clause 4.6 a. Water resources virtually depend on the equitable sharing and management of Transboundary Rivers in the context of Bangladesh. The Southwest region of Bangladesh, in particular, suffers from

a serious safe drinking water crisis (Akber, 2010). There are several reasons that make safe water unavailable for the people of Bangladesh. One is water related problems in the extremes such as flood, storm surge, cyclones etc. during monsoon and water scarcity during dry season (Rahman and Rahman, 2015; Rahaman, 2005).

Although, according to the literature, a few studies have been conducted in the assessment of drinking water quality of south west coastal region of Bangladesh, assessment of drinking water insecurity (Benneyworth *et al.*, 2016; Rahman *et al.*, 2016; Hossain *et al.*, 2021), drinking water quality, exposure and health risk assessment for the school-going children at school time (Rahman *et al.*, 2021) revealed that the water quality of this area is highly impaired due to anthropogenic activities. These studies were conducted using traditional monitoring methods which do not calculate water quality index or do not show any marked seasonal variations of drinking water quality.

Hence, to overcome these limitations, this study intended to map the drinking water quality coupled with water quality indexing related to of disaster hot spots of south west coastal region of Bangladesh by applying ArcGIS based on the spatial interpolation analysis IDW and in accordance with the tested water quality data obtained during two seasons (dry and wet) in the study period. The main objectives of this study are to assess the physicochemical and microbiological properties of drinking water by sampling and testing of the significant water quality parameters and calculation of water quality index and represent their spatio-temporal distribution by using GIS-based tools of interpolation along the study area. This integrated approach has the most promising outlook for solving the problem of drinking water insecurity in coastal Bangladesh.

The Coastal Zone Policy (2005) emphasises the intensity of coverage of safe drinking water facilities (clause 4.2 b), encouraging rainwater harvesting and water conservation (clause 4.2.2) which are directly related to water security. The action plan proposed by the Government of Bangladesh regarding Sustainable Development Goals (SDG)-6 includes access to safe, adequate and equitable water supply for all with a target of improving 100% water supply coverage in urban and rural area by 2020. Another important target is ensuring safe yield from ground water sources of water and their preservation and conservation by 2020 through appropriate actions and continuous monitoring up to 2030. Equitable access to safe and affordable drinking water for all is one of the goals of Sustainable Development Goals (SDGs) which is cited at Goal 6.1. Again, the goal 2 of Delta Plan Specific Goals aims to ensure reliable and adequate provision of freshwater to support equitable and sustainable economic development, environmental sustainability and livelihood security. This includes: i) sufficient and timely provision of safe surface and groundwater for drinking, agriculture, fisheries, environment, navigation, industry, etc.; and ii) controlling pollution, ensuring water quality and providing sanitation at acceptable levels in relation to defined standards as well as environmental, health, agricultural and industrial needs.

However, there are a number of challenges for achieving these targets including protecting water sources and introducing sustainable management of groundwater and surface water will be a priority given Bangladesh's extreme reliance on limited groundwater sources. Considering all those things for achieving SDG 6, the water security analysis and preparation of digital water security map for southwest coastal region of Bangladesh are more rational. The project covers the interest of the all the said policies which are very important for the sustainable development of Bangladesh.

Research works of different organizations also endeavored to address the water security issue in the coastal Bangladesh. Study conducted by the Institute of Water and Flood Management (IWFM), Bangladesh University of Engineering and Technology (BUET), the University of Dhaka and the University of Oxford found substantial low coverage of safe drinking water, despite exponential growth of privately installed tube-wells in the past decades (Discussion Paper, 2018). Vanderbilt University, USA and Khulna University, Bangladesh investigated drinking water insecurity in respect to water access and quality in the south-western coastal Bangladesh in 2012-2013. According to the authors, residents of the Dacope Upazilla use far less groundwater than the national average due to its unacceptable quality. Moreover, salinity and rainwater scarcity force them to use multiple water sources with questionable quality throughout the year (Benneyworth *et al.*, 2016). Rahman and Islam (2018) from Patuakhali Science and Technology University and Pabna University of Science and

Technology, Bangladesh conducted study in Kamarkhola of Dacope Upazilla under Khulna District, Bangladesh on safe drinking water scarcity. They have pointed out saline water intrusion, reduction of upstream flow, sea level rise, disasters, polder, arsenic contamination, shrimp cultivation in brackish water, excessive use of underground water and lack of appropriate aquifer are the constraints of potable water supply in the coastal area of Bangladesh. Islam et al. (2013) studied the perceptions of the communities exposed to severe water scarcity in the coastal regions. The perceptions indicate that the local people might not have the knowledge to understand the changing phenomenon regarding water security, but they do have the experience to cope against such adversities. They have their own adaptation measures e.g. rainwater harvesting, pond water conservation etc. Rahman et al. (2017) assessed fresh water security in coastal Bangladesh from the perspective of salinity, community perception & adaptation and concluded that a well-coordinated approach from local and central government, NGOs and community people will be effective in reducing the scarcity of safe drinking water in coastal Bangladesh. Chan et al. (2016) studied water governance in Bangladesh from institutional and political context and drew policy insights for implementing Integrated Water Resource Management (IWRM) approach to achieve SDGs.

1.1.1 Policies for Safe Drinking Water

1.1.1.1 Global Perspective

About 71% of our globe is covered with water (The U.S. Geological Survey's (USGS) Water Science School 2019) where only 3% is fresh water and two-thirds of it is frozen in glaciers or unavailable to us. In consequence, 1.1 billion people around the globe do not have access to clean water, and a total of 2.7 billion people face water scarcity for at least one month of the year (World Wildlife Fund 2022).

In the light of achieving a better and more sustainable future for all, the United Nations General Assembly set up 17 interlinked SDGs in 2015, which are intended to be attained by 2030. Specifically, SDG 6 depicts clean water and sanitation, which will ensure the availability and sustainable management of water and sanitation for all by 2030 with having 8 targets and 11 indicators (United Nations 2021). Except Target 2, all others are directly related to water and water management which are as follows:

- Target 6.1: By 2030, achieve universal and equitable access to safe and affordable drinking water for all
- Target 6.3: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
- Target 6.4: By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
- Target 6.5: By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate
- Target 6.6: By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes
- Target 6.a: By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
- Target 6.b: Support and strengthen the participation of local communities in improving water and sanitation management

Despite progress, considerable hurdles remain in achieving Sustainable Development Goal 6 and resolving large disparities in access to basic water and sanitation services across and within nations. To address the SDG 6 obstacles, a paradigm shift is required: water should be viewed as a fundamental human right to which all people are entitled beyond discrimination, rather than just a natural resource to be managed and consumed, which is from the right to an adequate standard of living under Article 11(1) of the International Covenant on Economic, Social and Cultural Rights. The

key elements of the water right are availability; accessibility; affordability; quality and safety; and acceptability (United Nations 2022) are given in the Table 1.

Table 1: Definition of the key elements of water right

Key Elements of Water Right	Definition
Availability	The water supply for each person must be sufficient and continuous to cover personal and domestic uses, which comprise water for drinking, washing clothes, food preparation and personal and household hygiene. There must be a sufficient number of sanitation facilities within or in the immediate vicinity of each household, and all health or educational institutions, workplaces and other public places to ensure that all the needs of each person are met.
Accessibility	Water and sanitation facilities must be physically accessible and within safe reach for all sections of the population, taking into account the needs of particular groups, including persons with disabilities, women, children and older persons.
Affordability	Water services must be affordable to all. No individual or group should be denied access to safe drinking water because they cannot afford to pay.
Quality and safety	Water for personal and domestic use must be safe and free from micro-organisms, chemical substances and radiological hazards that constitute a threat to a person's health. Sanitation facilities must be hygienically safe to use and prevent human, animal and insect contact with human excreta.
Acceptability	All water and sanitation facilities must be culturally acceptable and appropriate, and sensitive to gender, life-cycle and privacy requirements.

Source: (United Nations 2022)

The Danish Institute for Human Rights (2014) developed an AAAQ framework based on AAAQ (Availability, Accessibility, Acceptability and Quality) criteria that consist of specific standards, generic indicators and generic benchmarks (Table 2). This framework acts as a tool for assessing the safe drinking water scenario in a specific geographical area. The following table shows the AAAQ water – standards and generic indicators for assessing safe drinking water.

Table 2: AAAQ water – Standards and Generic Indicators

Criteria		Human Rights Standard (Adequacy)	Generic Indicator
Availability		Sufficient water	- Quantity of water used per person per day
		Regularity of water	- Number of disconnections - Period of unavailability of water Incidents of unavailability of water over time
Accessibility	Physical accessibility	Reasonable distance/number of outlets / waiting time	- Total collection time, including waiting time
		Security	- % of rights holders report that they have not experienced threats/assaults
		Equitable distribution	- Number of people per water outlet
	Economic accessibility	Affordability	- Total (direct + indirect) costs as the proportion of income and as the proportion of the total cost of fulfilling basic needs/right
	Non-discrimination	Non-discrimination	- % of rights holders report they have not been subjected to discrimination - % of individuals belonging to vulnerable groups report they have not been subjected to discrimination - % of other AAAQ indicators where no discrimination is detected
Access to information	Information access	- % of rights holders with access to information about water-related issues - % of disconnections/changes in water delivery advised to the public with adequate notice	
Acceptability		Consumer acceptability: odour, colour, taste	- % of rights holders who are satisfied with odour, colour and taste - Number of complaints about odour, colour and taste
		Cultural acceptability: gender, life-cycle, privacy	- Adaptions to cultural, gender, life-cycle and privacy considerations
Quality		Safe water / sufficient quality	- % of water is compliant with WHO quality standards
			- % of rights holders use improved water sources
		Prevent, treat, control water-related disease	- Prevalence of waterborne disease

Source: (The Danish Institute for Human Rights 2014)

1.1.1.2 Policies for Safe Drinking Water: National Perspective

Following sustainable development goals, Bangladesh has made remarkable progress in advancing access to water services by increasing access to drinking water to 98% (Bangladesh Bureau of Statistics (BBS) and UNICEF Bangladesh 2019). It turns out that Bangladesh has made significant strides in achieving universal access to improved water sources where 95% population meet the basic water supply criteria (available within thirty minutes). Having said that water quality and equitable access in hard to reach areas remain the main challenge nationwide (UNICEF Bangladesh 2018). However, Bangladesh has taken many initiatives through the formulation of policy, strategy, plans, etc. with times for striving the situation. A few of the relevant initiatives are discussed below.

1.1.1.2.1 National Policy for Safe Water Supply and Sanitation 1998

National Policy for Safe Water Supply and Sanitation 1998 aims to ensure access to safe water and sanitation services for all at an affordable cost. The policy mentioned several steps and strategies for achieving the goal. The issue of physical accessibility and quality of water was given more priority keeping less focus on the availability of water and, acceptability and affordability of the people. Access to a basic level of services in water to all citizens, ensuring proper storage, management and use of surface water without contamination, and measures for storage and use of rainwater are the emphases of the policy. Providing safe drinking water to every family in the urban areas, and increasing current safe drinking water coverage in rural areas by reducing the average number of users per tube-well from 105 to 50 in the near future are major-specific goals. On top of that, the policy highlights ensuring the supply of quality water through observance of accepted quality standards. However, several strategies for implementing the policy are mentioned to achieve the goal. Major strategies are participation of the users in all phases of the water project, community cost-sharing and introduction of economic pricing for services, more priority to under-served and un-served areas, adoption of appropriate technologies based on specific regions, geological situations and social groups, controlling and preventing contamination of drinking water, etc. Interestingly, the provision of providing credit facilities for the poor to bear the costs of water and sanitation service was made. But equity in getting water quantity and pricing considering the poorest section of the large population is not mentioned (Government of the People's Republic of Bangladesh 1998).

1.1.1.2.2 National Strategy for Water Supply and Sanitation 2014

The goal of the National Strategy for Water Supply and Sanitation 2014 is to provide safe and sustainable water supply, sanitation and hygiene services for all, leading to better health and well-being. The major objective of the strategy sets to provide a uniform strategic guideline to the sector stakeholders, including the government institutions, private sector and NGOs, for achieving the sector goal. 17 strategies were made under their themes viz. WASH interventions, emerging challenges, and Sector governance to achieve the goal. Major WASH intervention strategies are ensuring safe drinking water, giving priority to arsenic mitigation, adopting specific approaches for hard to reach areas and vulnerable people, mainstreaming gender, etc. It is mentionable that recovering the cost of services while keeping a safety net for the poor is the key strategy that will ensure the equity and affordability of the poor people. Under each strategy there are a set of directions was made to reach the goal. An implementation plan of the National Strategy for Water Supply and Sanitation for each strategy was made mentioning the lead, partners and milestones at the end (Government of the People's Republic of Bangladesh 2014).

1.1.1.2.3 National Water Policy, 1999

National Water Policy 1999 emphasizes managing the water resources of the country in a comprehensive, integrated and equitable manner and acts towards fulfilling the national goals of economic development, poverty alleviation, food security, public health and safety, decent standard of living for the people and protection of the natural environment. The policy ensures the availability of water to all users of society, particularly the poor, and considered the particular needs of women and children. Besides, stressed enhancing the role of women in water management as they have a significant role in this manner. In the case of supplying drinking water, the policy will facilitate the availability of safe and affordable drinking water supplies through various means, including rainwater harvesting and conservation. Besides, it accentuates preserving natural depressions and water bodies in major urban areas for recharge of underground aquifers and rainwater management and creating awareness in checking pollution and waste (Government of the People's Republic of Bangladesh 1999).

1.1.1.2.4 National Policy for Arsenic Mitigation and Implementation Plan, 2004

The policy provides a guideline for reducing the impact of arsenic on people and the environment comprehensively and sustainably. It highlights the arsenic aspect of the quality of safe drinking water which supplements the National Water Policy 1998, National Policy for Safe Water Supply and

Sanitation 1998 in fulfilling the national goals of poverty alleviation, public health and food security. In the arsenic affected areas, the policy facilitates access to safe water for drinking and cooking through the implementation of alternative water supply options with maintaining Bangladesh Standards for drinking water as defined in ‘Environmental Conservation Act 1995 and Rules 1997, Schedule - 3’. It also ensured the physical accessibility of providing a safe source of drinking water at a reasonable distance on an emergency basis. In addition, in case of availability of drinking water, 8 litres of water per capita per day will be ensured for piped water supply in the rural areas where the supply will be mainly for drinking and cooking (Government of the People’s Republic of Bangladesh 2004).

1.1.1.2.5 Coastal Zone Policy 2005

Coastal Zone Policy 2005 provides broad direction to all parties involved in the administration and development of the coastal zone in such a way that coastal residents may live and work in a safe and pleasant environment without impairing the integrity of the natural environment. The policy adopts a set of associated actions which leads to increasing the intensity of coverage of safe drinking water facilities. It encourages the establishment of appropriate infrastructures within the polders for freshwater storage and other water utilization and promoted rainwater harvesting and conservation. Furthermore, It spotlights the excavation of the existing ponds and tanks for the conservation of water and promotes the local technology for water treatment (such as pond sand filtering - P.S.F.) for the supply of safe water. On top of that, it emphasizes the management of groundwater and its sustainable use. It is acknowledged that gender disparities and gaps exist in the coastal zone, particularly in the areas of livelihoods, assets, and resources, as inadequate safe drinking water for household purposes adds to a heavy burden for poor women. Zoning regulations for the establishment of new industries and their effluent discharge possibilities are a focus in this policy document for ensuring fresh and safe water availability in the coastal zone (Government of the People’s Republic of Bangladesh 2005a).

1.1.1.2.6 Coastal Development Strategy, 2006

The Coastal Development Strategy (CDS) 2006 followed the Coastal Zone Policy (CZPo) 2005, which prepares for coordinated priority actions and arrangements for their implementation through selecting strategic priorities and setting targets. The strategy document identified nine strategic priorities based on targeting areas viz. regions (islands and chars, exposed coastal zone/districts; high tsunami risk area; South-West region); disadvantaged groups (erosion victims, women and children, fisher and small farmers); issues (shrimp culture, land zoning; groundwater management, climate change); and opportunities (tourism, renewable energy, marine fisheries). Among them, the first one is ensuring fresh and safe water availability as lack of availability and access to safe drinking water is a major issue, reaching a crisis level in the southwest. The government of Bangladesh has already taken several initiatives where some are ongoing and others will be implemented in future (Government of the People’s Republic of Bangladesh 2006).

1.1.1.2.7 Bangladesh Delta Plan 2100

The Bangladesh Delta Plan (BDP) 2100 is a long-term water-centric integrated techno-economic mega plan that encompasses a delta vision and strategies that allow for the long-term integration of sector plans and policies and the presentation of actionable interventions with a roadmap for implementation. Delta Plan sets the vision to achieve a safe, climate-resilient and prosperous delta and keeps the mission to ensure long term water and food security, economic growth and environmental sustainability while effectively reducing vulnerability to natural disasters and building resilience to climate change and other delta challenges through robust, adaptive and integrated strategies and equitable water governance. BDP 2100 has six specific goals where Goal 2 depicts enhancing water security and efficiency of water usage. All strategies including freshwater, drinking water and water management issues are discussed hereunder national level, hotspot level, and cross-cutting issues. at the hotspot level, water-stressed zones are identified and the necessary initiatives to be taken to tackle the problems are mentioned (Government of the People’s Republic of Bangladesh 2018).

1.1.1.2.8 Bangladesh Water Act 2013

The Bangladesh Water Act 2013 (BWA) is a framework law that aims to integrate and coordinate the country's water resource management through establishing a new, integrated approach to the protection, improvement and sustainable use of the country's rivers, lakes, estuaries, coastal waters and groundwater. This act will ensure the best use of water resources, legitimate the water rights of the poor and disadvantaged, an optimal and efficient way of using scarce water resources, etc. To do so, several key measures were taken viz. water rights, Adoption of the National Water Policy and National Water Resources Plan, Water resource protection/pollution control and water quality standards and most importantly Water Stressed Areas and Safe Yield. The act acknowledged access to drinking water and water for domestic usage as a basic right along with the affordability for the poor and disadvantaged for water. In addition, the act defined the water-stressed areas based on certain issues and put restrictions on water abstraction and usage. It also emphasizes the water quality to certain standards. In the water-stressed areas drinking water gets the highest priority followed by domestic usage (Government of the People's Republic of Bangladesh 2013a).

1.1.1.2.9 Bangladesh Climate Change Strategy and Action Plan 2009

Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009 is considered a living document to tackle climate change based on COP 2009, which targets the Vision 2021 and includes the ambition for a substantial eradication of poverty by 2021. The Plan will be a living document that will be updated and modified as needed in the future. BCCSAP 2009 has two parts where part one describes the background issues based on physical and climatic contexts, socio-economic realities, policies, etc. and the consequent rationale of the strategies on climate change based on the vision of future development, and the second part elaborates a set of programmes based on six pillars or broader areas of interventions viz. (a) food security, social protection and health (b) Comprehensive disaster management (c) Infrastructure (d) Research and knowledge management (e) Mitigation and low carbon management (f) Capacity building and institutional strengthening. Under each theme, several programmes are mentioned along with the rationale, justification, and facilitating agencies. A couple of water related programmes are mentioned in the plan especially adaptation against draught, water and sanitation programmes in climate-vulnerable areas, etc. (Government of the People's Republic of Bangladesh 2009).

1.1.1.2.10 The National Adaptation Programme of Action 2005

The National Adaptation Programme of Action (NAPA) 2005 aims to develop a countrywide program that encompasses the immediate and urgent adaptation activities that address the current and anticipated adverse effects of climate change, including extreme events. Future coping strategies and mechanisms are proposed based on existing processes and practices, with the major focus of adaptation science to adjust the detrimental effects of climate change. NAPA suggested fifteen future adaptation strategies. Mentionable strategies are (a) Providing drinking water to coastal communities to combat enhanced salinity due to sea-level rise (b) Promotion of research on drought, flood and saline tolerant varieties of crops to facilitate adaptation in the future (c) Reduction of climate change hazards through coastal afforestation with community participation (d) Capacity building for integrating climate change in planning, designing of infrastructure, conflict management and land-water zoning for water management institutions. Finally, NAPA mentioned 15 projects along with their type, primary implementing agency, and total cost. In addition, each project is detailed with the future outcomes, description, rationale, etc. (Government of the People's Republic of Bangladesh 2005b).

1.1.1.2.11 The National Sustainable Development Strategy (2010-2021)

The National Sustainable Development Strategy (NSDS) (2010-2021) sets the objectives to formulate strategies to meet the challenges of economic, social and environmental sustainability faced by the economy and to meet the international obligation of our country to global sustainable development principles and agenda. The NSDS (2010-21) has identified five Strategic Priority Areas areas viz. sustained economic growth, development of priority sectors, social security and protection, environment, natural resources and disaster management along with three cross-cutting issues. Regarding safe drinking water supply under quality health and Sanitation services, the NSDS (2010-

21) facilitated ensuring every household's access to safe drinking water by supplying technology for purifying arsenic-contaminated water as well as surface water including desalinization in the coastal areas. Research should be undertaken to develop affordable desalinization techniques. NSDS set an indicator to assess the accessibility to pure drinking water with % of the population with access to pure drinking water (Government of the People's Republic of Bangladesh 2013b).

1.1.1.2.12 Pro Poor Strategy for Water and Sanitation Sector in Bangladesh 2020

The strategy concludes that hardcore poor households need to get 100% subsidies but they must also share 100% of the operation and maintenance costs of water and sanitation facilities. The pro-poor strategy is based on four pillars: (1) an operational definition of hardcore poor households; (2) a definition of a basic minimum service level; (3) identification and organization of the poor households; and (4) the development of the mechanism for administering subsidies. The basic minimum services for safe water supply will be characterized by (a) For the purpose of drinking, cooking and personal hygiene, the basic minimum level of service is defined as 50 liters per person per day, (b) Collection time of safe drinking water from source should be within 30 minutes of the household premise, and (c) The drinking water must meet the national water quality standards (Government of the People's Republic of Bangladesh 2020).

Chapter Two
MATERIALS AND METHODS

Chapter Two

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2.1 Study Area

Coastal Bangladesh is separated into three sub-zones (e.g., south-eastern, south-central, and south-western) and consists of 19 districts. The study focused on the south-western coastline zone, which includes the districts of Khulna, Bagerhat, and Satkhira (Figure 1). The study conducted in Five unions named Southkhali, Dhansagar, Khontakata, Rayenda, Khaulia under two upazillas or sub districts (Sarankhola and Morrelganj) of Bagerhat district, nine unions named Deluti, Garuikhali, Sholadana, Lata, Kamarkhola, Sutarkhali, Tildanga, DakshinBedkashi, Uttar Bedkashi under three upazillas (Paikgacha, Dacope and Koyra) of Khulna district and four union named Gabura, Padma Pukur, Pratap Nagar, Sreeula under two upazillas (Shyamnagar, Assasuni) of Satkhira district. Due to its proximity to the Bay of Bengal, low elevation, freshwater scarcity, and salinization, the southwestern coastal region is highly vulnerable (Johnson & Humphreys, 2021). Frequent cyclones and cyclone-induced storm surges put coastal inhabitants in Bangladesh at great risk, causing harm to fresh water sources. Salinity intrusion is one of the major water-related problems in the southwestern coastal region which hampers drinking water availability, accessibility and quality.

2.2 Methodologies used for the Assessment of Water Availability and Accessibility

2.2.1 Identification of Indicators

Dimensions of water availability consist of a number of complex or simple variables. These variables are identified through extensive literature review. Ownership of the source, number of available sources in wet and dry season, demand-source ratio and duration of water scarcity have been considered as the variables or indicators of water availability index as shown in Table 3.

Table 3: Indicators of household level water availability index

Indicators	Measurement Unit
Ownership	Qualitative
Number of Available sources in Dry Season	Number of sources
Number of Available sources in Wet Season	Number of sources
Demand-Source Ratio	Lt/number of sources
Duration of Water Scarcity	Month/year

Distance of sources, mode of transport, condition of road, travel time, queuing time, water price-income ratio have been considered as important Accessibility index as shown in Table 4. Other social variables like equality, safety and security also have been considered here.

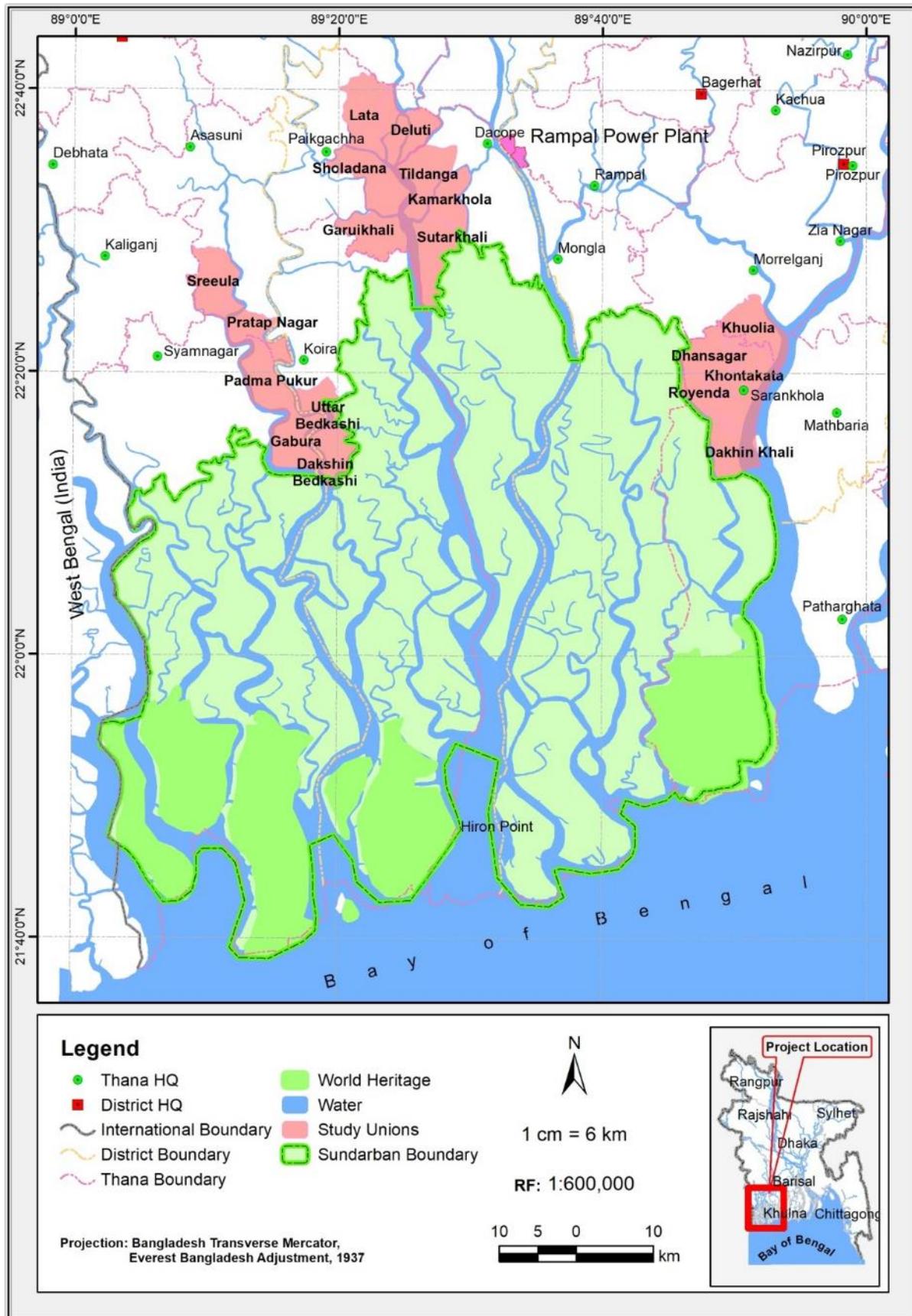


Figure 1: Map of the study area.

Table 4: Indicators of household level water accessibility index

Indicators	Measurement Unit	Standard
Distance of source	meter	No more than 500 meter (Thurstans et al. 2018,WHO 2017)
Mode of transport	Qualitative	-
Condition of road	Qualitative	-
Travel Time	minutes	No more than 15 min (Thurstans et al. 2018)
Queuing Time	minutes	No more than 15 min (Thurstans et al. 2018)
Water price-income ratio	%	No more than 5% of household monthly income (Peprah et al. 2015,Smet 2009)
Equality	Qualitative	-
Safety	Qualitative	-
Security	Qualitative	-

2.2.2 Survey Design

A solid survey design has been outlined to make the data collection more effective which correspond to the objectives of the research and the frequency at which the data will be collected. The main purpose was to make the data clean and reliable. Total twenty-seven questions were formed to collect the data regarding the indicators of availability (see appendix A). The questionnaire has been developed in both Bangla and English languages. Survey was decided to conduct using Google form and surveyors were trained for using it. It also has been decided on which date and how the survey will be conducted. Beside questionnaire survey, it was decided that at least three focus group discussions (FGDs) will be conducted in each of three union. Location and time of FGDs were also decided at this stage through rapport building and by consultation with Key Informants. A structured format has been developed to collect the experts' opinions through Google Form.

2.2.3 Sample Size Calculation

For calculating the sample size of each study area, population for the year 2021 has been predicted. Population data for the year 2011 and 2014 has been collected from the Bangladesh Bureau of Statistics (BBS 2011, 2014). The population growth rates were computed from these data and the number of households was predicted for the year 2021 based on that growth rate. Sample Size has been decided at 10% error and 90% confidence level. Table 6 shows the sample size and distribution of this samples under different unions, upazillas or districts. Following equations have been used to calculate the sample size-

$$Sample\ Size = \frac{\frac{p(1-p)z^2}{e^2}}{1 + \left(\frac{p(1-p)z^2}{Ne^2}\right)} \quad (1)$$

Where, N means population size, e is margin of error and z means z-score which is the number of standard deviations a given proportion is away from the mean. Table 5 has been used to find the right z-score.

Table 5: Z-value at different confidence level

Desired confidence level	z-score
80%	1.28
85%	1.44
90%	1.65
95%	1.96
99%	2.58

Table 6: Sample size calculation and distribution

District	Upazilla	Union Name	Numbers of household 2011	Predicted Numbers of household 2021	Sample Size
Bagerhat	Sarankhola	Southkhali	6179	7058	68
		Dhansagar	4890	6000	67
		Khontakata	7622	7890	68
		Rayenda	9463	10394	68
	Morrelganj	Khaulia	5568	5702	68
Khulna	Paikgacha	Deluti	5474	7663	68
		Garuikhali	5090	7126	68
		Sholadana	5857	8200	68
		Lata	5729	8020	68
	Dacope	Kamarkhola	3490	4886	67
		Sutarkhali	5667	7933	68
		Tildanga	5288	7403	68
	Koyra	DakshinBedkashi	7452	11178	68
		Uttar Bedkashi	7114	10671	68
Satkhira	Shyamnagar	Gabura	12389	18584	68
		Padma Pukur	12106	18159	68
	Assasuni	Pratap Nagar	9967	14953	68
		Srecula	13004	19506	68

2.2.4 Data Collection

A detail questionnaire survey has been conducted to collect the data from the households of the study area. Consents of the participants were taken and the purpose of the study were fully described before questioning. In each union, at least three focused group discussions (FGDs) have been carried out to investigate the strength, opportunity, weakness and threat. The information collected from this has helped to verify the data about indicators specially the social indicators. Opinions from ten different key informants and experts *i.e.* academicians, administrative personnel, public representative of the unions etc. have been used for identifying, weighting and ranking the indicators. Key informants also enlightened the overall scenario of the study area.

2.2.5 Secondary Data Collection

Somer of the relevant data are collected from previous reports from BWDB, BADC, BMDA, DPHE and MoEFCC. Detailed digital layouts or shape files of existing houses and roads have collected from secondary sources like private firms. The data has been updated in deta detail through digitization of present field survey information. In some cases, freely available satellite images on Google earth have been used for this task. After that, location of selected water sources and location of households have been compared and verified using Geographic Information System (GIS). For this research, each

indicator of water availability and accessibility has been compared with a standard value for that indicator which was collected from different secondary resources or literatures. Secondary sources include published and unpublished literatures, websites and web pages. Household data from Bangladesh Bureau of Statistics (BBS) has been used for sampling.

2.2.6 Scaling and Normalization

All raw data values have been converted to comparable scales based on expert opinions and minimum standard found from the literature review. A likert scale has been used to rate each variable where minimum value refers to poor availability and accessibility, and maximum value refers to high availability (Table 7) and accessibility (Table 8). Measurement unit of each variable is given in the former table.

Table 7: Scaling for household level water availability Index

Indicators	Scale			
	1	2	3	4
Ownership	Govt.	NGO	Community	Private
Available sources in dry season	≤1	2	3	>3
Available sources in wet season	≤1	2	3	>3
Demand-Source Ratio	>21	14.1-21	7.1-14	≤7
Duration of Water Scarcity	5-6 months	3-4 months	1-2 months	0

Table 8: Scaling for household level water accessibility index

Indicators	Scale			
	1	2	3	4
Distance (km)	>0.5	0.301- 0.5	0.101 – 0.3	≤0.1
Mode of transport	Boat, Truck	Van, Rickshaw, Bicycle	Walk	No Transport Required
Condition of road	Kutchra	Kutchra and Pucca	Pucca	No Road Required
Travel Time	>15	11-15	6-10	≤5
Queuing Time	>15	11-15	6-10	≤5
Water price-income ratio	>5%	2.6% - 5%	1.1% - 2.5%	≤1%
Equality	Gender Inequality	Economic and Social Inequality	Racial and Religious Inequality	Equal
Safety	Injury and Accident	Physical Stress	Mental Stress	No Stress
Security	Physical Assault	Thievery	Verbal Assault	No Violence

2.2.7 Correlation and Reliability Analysis

At the very beginning of the study, the variables have been analyzed for significantly high correlations (Pearson's $R > 0.70$) between individual variables. No such high correlations have been found and therefore those variables have been kept from further consideration. The correlations among variables are shown in the Table 9 and 10.

Table 9: Inter-item correlation matrix and significance for availability index

Parameters	Ownership	Available Source in Dry Season	Available Source Wet Season	Demand-Source Ratio	Water Scarcity
Ownership	1	-0.011	-0.010	-0.040	-0.033
Available Source in Dry Season	-0.011	1	0.494	0.383	-0.034
Available Source Wet Season	-0.010	0.494	1	0.308	-0.106
Demand-Source Ratio	-0.040	0.383	0.308	1	-0.087
Water Scarcity	-0.033	-0.034	-0.106	-0.087	1

Table 10: Inter-item correlation matrix and significance for accessibility index

Parameters	Distance of source	Mode of transport	Condition of road	Travel time	Queuing time	Water price-income Ratio	Equality	Safety	Security
Distance of source	1	0.229	-0.036	0.78	0.195	0.272	0.129	0.132	0.144
Mode of transport	0.229	1	-0.094	0.172	0.036	0.471	0.018	0.056	0.053
Condition of road	-0.036	-0.094	1	-0.083	-0.019	-0.074	0.001	0.164	0.054
Travel Time	0.780	0.172	-0.083	1	0.218	0.223	0.139	0.202	0.154
Queuing Time	0.195	0.036	-0.019	0.218	1	0.037	0.015	-0.087	0.019
Water price-income ratio	0.272	0.471	-0.074	0.223	0.037	1	0.043	0.093	0.063
Equality	0.129	0.018	0.001	0.139	0.015	0.043	1	0.224**	0.460
Safety	0.132	0.056	0.164	0.202	-0.087	0.093	0.224	1	0.272
Security	0.144	0.053	0.054	0.154	0.019	0.063	0.460	0.272	1
	0.000	0.069	0.064	0.000	0.523	0.031	0.000	0.000	

2.2.8 Weighting and Aggregating

The weight refers to the relative importance of a certain indicator in the overall evaluation. The greater the weight, the higher the importance of the indicator and the higher the overall impact. For this study, a widely used techniques for deriving weights, known as Analytic Hierarchy Process (AHP) has been applied to determine the weight of indicators. At first, expert's opinions have been systematically collected by means of pairwise comparisons of indicators. Elements of each pair are compared in relation to the objective, and the intensity of their importance is determined by introducing a scale from 1 to 9 (Geopel, 2013). An excel template formulated by Goepel was used for this analysis and the derived weights for the indicators are shown in Table 11 and 12.

Table 11: Data driven weight for availability index

Indicator (I_n)	Weights (W_n)
Ownership (O)	11.1%
No of Available Source in Dry Season (ASD)	18.7%
No of Available Source Wet Season (ASW)	7.4%
Demand-Source Ratio (DS)	24.8%
Water Scarcity (WS)	38.0%

Table 12: Data driven weight for availability index

Indicator (I_m)	Weights (W_m)
Distance of source (D)	11.9%
Mode of transport (M)	4.4%
Condition of roI(C)	7.6%
Travel time (T)	14.1%
Queuing time (Q)	6.1%
Water price-income ratio (W)	22.9%
EItY (E)	6.3%
Safety (S_1)	12.6%
Security (S_2)	14.2%

Once the scores of all the variables are derived, the composite drinking water availability (I_{av}) has been calculated by assigning derived weight over the indicators as mentioned in Equation (2).

$$I_{av} = \frac{1}{n} \sum_{n=1}^n I_n \times W_n$$

Where, I_{av} indicates overall water availability in a place, n is the number of selected indicators, I_n represents value measured for each indicator from 1 to 4 scale and W_n represents the weights of the indicators.

The composite drinking water accessibility (I_{av}) has been calculated by assigning derived weight over the indicators as mentioned in Equation (3).

Where, I_{ac} indicates overall water availability in a place, n is the number of selected indicators, I_m represents value measured for each indicator from 1 to 4 scale and W_m represents the weights of the indicators.

2.2.9 Developing Drinking Water Availability and Accessibility Index Map

For developing water availability index map five indicators or parameters have been considered. Similarly, nine and sixteen parameters have been considered for developing water accessibility index map. Maps generated for each indicators were weighted and overlaid using weighted overlay method in ArcGIS. Then resulted maps have been classified using equal interval classification methods. The spatial maps for overall drinking water availability were categorized under four levels of water availability namely not available, slightly available, moderately available and highly available. Similarly, spatial maps for overall drinking water accessibility were categorized under four levels of water accessibility namely not accessible, slightly accessible, moderately accessible and highly accessible.

2.2.10 Analysis

In the final stage, the availability and accessibility condition of the study area have been analyzed at union, upazilla and district level based on the affecting factors. Statistical Package for Social Sciences (SPSS) and Microsoft Excel have been used for performing the analysis. In addition, the influences and consequences of different indicators on the coastal residents have been analyzed by linking the data from FGDs and KIIs.

2.3 Methodologies used for the Assessment of Water Quality

2.3.1 Water Sampling

Drinking water quality is a vital indicator to determine the water quality index and the adequate treatment procedure. Also water quality varies with geographic location, weather, human activities; site-specific conditions (Halder, Dey, & Bosu, 2020). In the first part of the study, available sources in the study area were assessed. For the selection of the source for water sampling, expert opinion and purposive sampling method were used. Selected sources were then fixed using digital global positioning system (DGPS). Total number of 160 water samples was taken in order to assess the physico-chemical and microbiological characteristics of the study area.

2.3.2 Water Quality Analysis

Water quality assessment was carried out to generate a database of water quality indicators for the study area. Physical, chemical and microbiological parameters were measured to provide baseline information on water quality of study area during dry and wet seasons of study period. In this study situ measurement were adopted to determine unstable parameters including; pH, temperature, electric conductivity (EC) and DO by handheld multi-water quality probe (HANNA HI-9828, USA), and locations ascertained using a Trimble GeoXT 6000. The collected water samples from selected sources were analyzed for Physico-Chemical and microbiological parameters namely; total dissolved solid (TDS), total hardness, arsenic (As), total coliform (TC), fecal coliform (FC), alkalinity, sulphate (SO_4^{2-}), nitrate (NO_3^-), phosphate (PO_4^{3-}), chloride (Cl). Except few parameters in the field, all the other parameters were analysed in the Laboratory of Environmental Science Discipline of Khulna University.

2.3.3 Development of Water Quality Index (WQI) Model

Water quality index (WQI) is an exceptionally valuable tool for evaluating the overall quality of water (Ketata, Gueddari, & Bouhlia, 2011). It reduces the large number of data into single value and facilitates easy understanding of the information. WQI is utilized to determine the suitability of the water for drinking purposes (Ketata, Gueddari, & Bouhlia, 2011).

WQI has been estimated in three steps utilizing weighed arithmetic index approaches (Ramakrishnaiah, Sadashivaiah, & Ranganna, 2009; Patil & Dandge, 2021) Firstly, selected 15 water quality parameters are very important in assessment of drinking water quality as well as has been assigned a w_i (weight) shown in Table 13. A weight value ranging from 1 to 5 is assigned to water quality determinants for estimating water quality index. Nitrate, E. Coli, Arsenic, Salinity and Iron are usually assigned with the maximum weight of 5, while 4 is assigned to Sulphate, pH and EC. Bicarbonate, Alkalinity and Cl⁻ is assigned 3 and 2 is assigned to Ca²⁺ and magnesium and Temperature are assigned a weight of 1 according to Krishna et al (2015) and Vasanthavigar *et al.*, (2010). The maximum weight are generally allocated for those parameters due to their significant role in WQI and the minimum weight are allocated for those parameters that could not be harmful to human health (Patil & Dandge, 2021). In next step, W_i (relative weight) is calculated by using the equation 4.

Here, relative weight is represented by W_i , weight of each selected water quality parameter is described by w_i , number of water quality parameters is represented by n . Table 13 represents the calculated W_i (relative weight) values of every water quality parameter.

$$W_i = w_i / \sum_{i=1}^n w_i \dots \dots \dots (4)$$

Table 13: Assigned weight and calculated relative weight for selected parameters

Parameter	Standards as per GOB (2022)	w _i (Weight)	W _i (Relative weight)
Temperature	-	1	0.02
Arsenic	0.05	5	0.1
Nitrate	45	5	0.1
Fecal Coliform	0	5	0.1
Salinity	-	5	0.104
Iron	0.3-1.0	5	0.104
Sulphate	250	4	0.083
pH	6.5-8.5	4	0.083
EC	400	4	0.083
Bicarbonate	125-350	3	0.063
Phosphate	0.1	1	0.021
Cl ⁻	250	3	0.063
Ca ²⁺	75	2	0.042
DO		1	0.021
Alkalinity		1	0.021
Magnesium	30-35	1	0.021
Total		50	1

In third stage, using equation 5 q_i (quality rating scale) for individual water quality parameter is computed by dividing it's observed value in respective water sample by its corresponding standard as per the drinking water guidelines prescribed by the GOB (2022) and the outcome is multiplied by 100.

$$q_i = \frac{C_i}{S_i} * 100 \dots \dots \dots (5)$$

Here, quality rating is defined by q_i, concentration of individual chemical (C_i) characteristics in every water sample, as well as S_i is the Bangladesh standard of drinking water for individual chemical characteristics as per (GOB, 2022) guidelines.

Firstly, using equation 6 S_i is determined for computing WQI for every chemical parameter by multiplying quality rating with relative weight, finally the summation of sub-index is utilized to calculate WQI according to the given equation 7.

$$S_{iI} = W_i * q_i \dots \dots \dots (6)$$

$$WQI = \sum S_{iI} \dots \dots \dots (7)$$

Here, sub index (S_{iI}) is the ith water quality parameter; the rating q_i depends on concentration of ith parameter along with number of water quality parameters (n) undertaken for calculating WQI. WQI values are organized in 5 categories, "Excellent water" to "Water, unsuitable for drinking".

2.3.4 Spatial Modeling and Surface Interpolation through Kriging

To conduct the geostatistical analysis, the "Kriging" interpolation technique was used within the spatial analyst extension module (Matheron, 1962) in ArcGIS 9.3 software. Kriging is a multistep process; it includes exploratory statistical analysis of the data, variogram modeling, creating the surface, and (optionally) exploring a variance surface. Kriging is most appropriate when you know there is a spatially correlated distance or directional bias in the data. The spatial analyses were carried out with prepared maps using this technique. The spatial transformation was performed to determine the most appropriate model to use with the parameters of the generated maps (Ryu, Kim, Cha, & Lee, 2002). The ordinary Kriging formula is shown in equation 8.

$$Z(S_0) = \sum \lambda_i Z(S_i) \dots \dots \dots (8)$$

where:

$Z(s_i)$ is the measured value at the location (ith),
 λ_i is the unknown weight for the measured value at the location (ith) and
 s_0 is the estimation location.

The unknown weight (λ_i) depends on the distance to the location of the prediction and the spatial relationships among the measured values. The statistical model estimates the unmeasured values using known values. A small difference occurs between the true value $Z(s_0)$ and the predicted value, $\sum \lambda_i Z(s_i)$. Therefore, the statistical prediction is minimized using the equation 9.

$$[Z(S_0) - \sum \lambda_i Z(S_i)]^2 \dots \dots \dots (9)$$

The Kriging interpolation technique is made possible by transferring data into the GIS environment. In this way, analysis in areas that have no data can be conducted. The following criteria were used to evaluate the model: the average error (ME) must be close to 0 and the square root of the estimated error of the mean standardized (RMSE) must be close to 1 (Johnston, Hoef, & Kriviruchok, 2001).

Table 14: Water quality standards and weight wise influence

Parameter	Standards as per GOB (2022)	wi (Weight)	Wi (Relative weight)	Influence% (Weightage Value)
Arsenic	0.05	5	0.114	11.364
Nitrate	45	5	0.114	11.364
Total Coliform	0	5	0.114	11.364
Fecal Coliform	0	5	0.114	11.364
Iron	0.3-1.0	5	0.114	11.364
Sulphate	250	4	0.091	9.091
pH	6.5-8.5	4	0.091	9.091
EC	400	4	0.091	9.091
Phosphate	0.1	1	0.023	2.273
Cl ⁻	250	3	0.068	6.818
Ca ²⁺	75	2	0.045	4.545
Magnesium	30-35	1	0.023	2.273
Total		44	1	100

Table 15: Normalization in four defined category

Parameter	Standards as per GOB (2022)	Range	Range Value	Category
Arsenic	0.05	0-0.03	4	Good
		0.03-0.05	3	Poor
		0.05-0.09	2	Very Poor
		>0.9	1	Unsuitable
Nitrate	45	0-0.5	4	Good
		0.5-1.5	3	Poor
		1.5-2.5	2	Very Poor
		2.5-7.5	1	Unsuitable
		>7.5	5	Unsuitable
Fecal Coliform	0	0-100	4	Good
		100-400	3	Poor
		400-700	2	Very Poor
		700-1000	1	Unsuitable
		>1000	1	Unsuitable
Total Coliform	0	0-200	4	Good
		200-1500	3	Poor
		1500-5000	2	Very Poor
		5000-10000	1	Unsuitable
		>10000	1	Unsuitable
Iron	0.3-1.0	0-0.3	4	Good
		0.3-0.6	3	Poor
		0.6-0.9	2	Very Poor
		>0.9	1	Unsuitable
Sulfate	250	0-15	4	Good
		15-30	3	Poor
		30-50	2	Very Poor
		50-70	1	Unsuitable
		70-90	1	Unsuitable

pH	6.5-8.5	5.9-6.6	1	Unsuitable
		6.6-6.9	2	Very Poor
		6.9-7.2	4	Good
		7.2-8.6	3	Poor
		>8.6	1	Unsuitable
EC	400	100-200	4	Good
		200-400	3	Poor
		400-700	2	Very Poor
		700-1000	1	Unsuitable
		>1000	1	Unsuitable
Phosphate	0.1	<0.1	4	Good
		0.1-0.4	3	Poor
		0.4-0.8	2	Very Poor
		0.8-1.2	2	Very Poor
		>1.2	1	Unsuitable
Cl ⁻	250	0-50	1	Unsuitable
		50-100	2	Very Poor
		100-250	4	Good
		250-500	3	Poor
		>500	1	Unsuitable
Ca ²⁺	75	0-25	2	Very Poor
		25-50	3	Poor
		50-75	4	Good
		75-100	1	Unsuitable
		>100	2	Very Poor
Magnesium	30-35	0-10	2	Poor
		10-25	3	Poor
		25-35	4	Good
		35-70	2	Very Poor
		>70	1	Unsuitable

2.3.5 Developing Drinking Water Quality Map

Water quality maps are prepared as per the following score, where 4 indicate the water source is highly secured and 1 indicates not secured at all. In Table 16 the indexing values are explained.

Table 16: Score and Category of the Indexing

Value	Category
4	Highly secure
3	Moderate secure
2	Slightly secure
1	Not secure

2.4 Developing Overall Drinking Water Security Map

Finally, the results of the total water security index for drinking water have been calculated by giving equal priority to all three domains of water security- water availability, water accessibility and water quality. The value close to 1 indicates poor water security and the value close to 4 indicates higher water security. Separate maps for water availability, water accessibility and water quality in the union, upazila and district level have been produced using ArcGIS software. Total water security map for drinking water has been prepared combining these three maps using weighted overlay and equal interval classification methods.

2.5 Mobile Application Development

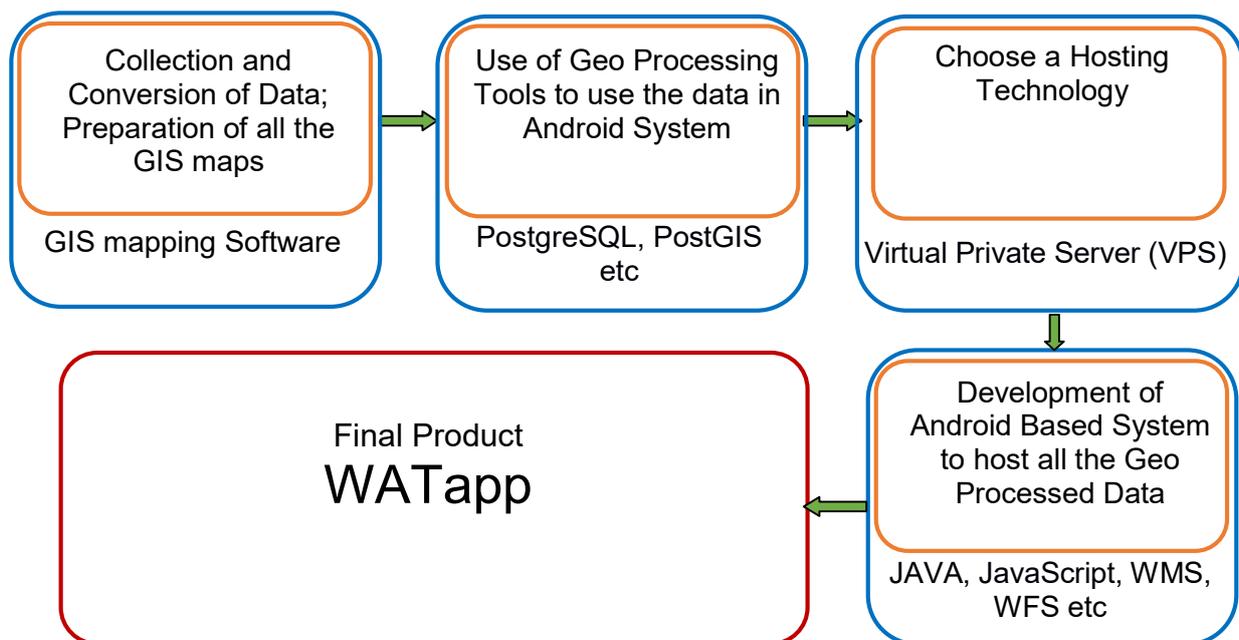
An Android based mobile application has been developed to ensure the easy access to all sort of data and other findings from the research project. As a result, decision makers and policy makers need less time to make any relevant decision. The local people can also use the application as per their necessity.

To develop the mobile based application all the data are put together as per their types. GIS maps are being prepared to show the availability, accessibility and quality of the drinking water of the study area. All the GIS maps are then converted to android based system. Several software are being used to do all the necessary conversion and preparation techniques. The application has been developed by the following tools and technologies

- Geo Processing Tools
- Hosting Technologies
- Application Development Tools and Technologies

In addition the following software are used to develop the application.

Geo Processing Tools, GIS Mapping Software, PostgreSQL, PostGIS, Geo-Server, Virtual Private Server (VPS), JAVA, JavaScript, OpenLayers, GeoRSS, KML (Keyhole Markup Language), Geography Markup Language (GML), GeoJSON, Web Map Service (WMS) or Web Feature Service (WFS).



Flowchart 1: Android mobile based software development.

Chapter Three
RESULTS AND DISCUSSION ON WATER
AVAILABILITY

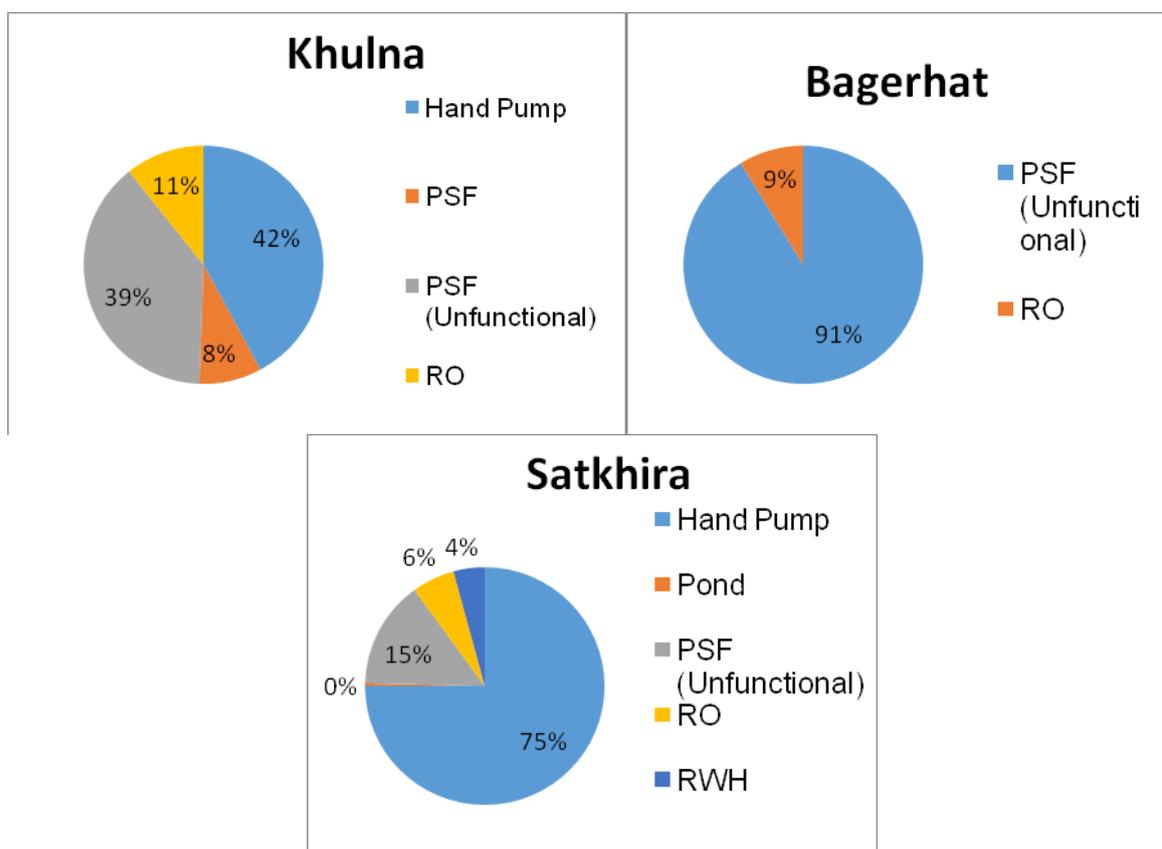
Chapter Three

RESULTS AND DISCUSSION ON WATER AVAILABILITY

Water unavailability is a major problem worldwide. Though Bangladesh is a country of river, lakes and ponds, the availability of safe drinking water sources still remains a cause of concern here. The first objective of this project was to identify the availability of water in local level and delineate the factors affecting. For indexing water availability, this research has considered five significant factors that indicate, determine and affect drinking water accessibility in the coastal region of Bangladesh. The indicators considered for water availability index are ownership, available sources in dry seasons, available sources in wet season, water demand-source ratio and duration of water supply. This chapter describe the existing drinking water availability condition of the study areas at union, upazllia and district level in light of the above mentioned indicators.

3.1 Water Availabilty Situation at Union Level

The condition of ownership is good in Rayenda and bad in Khontakata compared to other unions of Bagerhat District (Table 17). A key informant, Md. Abdul Mannan Jomaddar, an member of ward 6, Rayenda union, has told that people own tube wells and ponds. But water from tubewell are used for drinking purposes and ponds are used for household purposes. The condition of source ownership is also bad in Dhansagar union. It is found from another KII (Moinul Islam, Chairman of Dhansagar Union), there is no functional PSF in the area. There are some non functional PSF in the word 6 but word 1 has no PSF. During wet season people mainly/fully depends on RWH and during dry season people depends on direct pond water after filtering with potassium alum locally known as fitkari. In Khaulia union, the number of available sources in dry seasons are found to be highest. According to a key informant, Dipak Kumar Das, head master of a local school in Khaulia, main sources of drinking water for people are PSF and RWH. In dry season they depend on on pond and tubewell. In wet season, the number of available sources is found to be highest in Khontakata union. On the other hand, Southkhali union has lowest available sources in both dry and wet seasons. The duration of water scarcity is lower in Southkhali union in comparison with other unions and hence get the highest score. The score is lower for Rayenda union. Khaulia union occupies the highest position in terms of demand-source ratio and the lowest position is occupied by Southkhali union. In case of total availability, Khaulia union is ahead of other unions. On the other hand, Southkhali union is lagging behind in terms of total availability. The types of sources are presented in the following pie-charts.



Pie-Chart 1: The types of drinking water sources in the study area.

Table 17: Variable wise water availability condition in different unions of Bagerhat

Indicators	Dhansagar	Khontakata	Khaulia	Rayenda	Southkhali
Ownership	2.941	2.818	3.175	3.267	3.186
Available Source in Dry Season	1.118	1.323	1.351	1.133	1.000
Available Source in Wet Season	1.647	1.737	1.684	1.700	1.305
Demand-source Ratio	2.118	2.202	2.667	2.089	1.831
Duration of Water Scarcity	2.324	2.404	2.298	2.267	2.525
Total availability	2.065	2.148	2.264	2.080	2.051

Different forms of water delivery technologies, including as PSF, RO, and RWHS, have been discovered in various locations around the Khaulia union, in addition to pond water. In comparison to other unions of Bagerhat, the Khaulia union has maximum RO in number. People of Khaulia have also habituated of treating raw pond, canal, and river water with potassium alum or lime during periods of water scarcity. As a result, during the dry season, the Khaulia union has the most drinking water available sources. Among other unions, Khaulia union also has the highest demand source ratio. For the reasons stated above, the total water availability in the Khaulia union is better than in other unions. Although there are fewer PSF and RO in Southkhali, the respondents expressed satisfaction with the water quality and availability. Furthermore, many of them have large water storage tanks that they got from regional NGOs. As a result, they store adequate rainwater for the dry season's water scarcity. As a result, it has a shorter term of water scarcity than other unions of Bagerhat. Southkhali

union is falling behind other unions in Bagerhat in terms of overall availability due to the lowest available sources in the dry and wet seasons, as well as the lowest demand source ratio. A key informant interview (Md. Saiful Islam Halim, ward member) from Southkhali union has described that the union has approximately 90-100 PSF and only a single RO plant donated by a NGO to Southkhali primary school which is currently functional. It can filter 500l/day tk/L. The school maintains the RO by selling the water. Still, local people use RWH as main drinking water source during rainy season because of high price of RO water and for dry season, they use PSF as main drinking water source. Nowadays the practice of RWH is increasing as Govt and NGOs provide containers almost free of cost to the poor people.

The condition of ownership is good in Lata and bad in Garuikhali compared to other unions of Khulna District (Table 18). According to Pushpa Rani Sarkar, a school teacher and a key informant of Lata union, there are several tube-wells which cover almost all the villages but water is not drinkable. In Tildanga union, the numbers of available sources both in dry season and wet season are found to be highest. In Garuikhali union, the numbers of available sources in dry season and in Sholadana unions the numbers of available sources in wet season are found to be lowest. The duration of water scarcity is lower in Uttar Bedkashi union in comparison with other union and hence gets the highest score. The score is lower for Deluti and Kamarkhola unions. Key informant from Uttar Bedkashi, school teacher Srabony Adhikari has said that local people drink tube well water for all the months whereas key informant from Kamarkhola union, ward member Md. Ajijul Biswas has said that water becomes scarce during dry season as the quality of water in ponds degrades due to evaporation. Tildanga union occupies the highest position in terms demand-source ration and the lowest position is occupied by Uttar Bedkashi union. In case of total availability, Tildanga union is ahead of other unions. On the other hand, Garuikhali union is lagging behind in terms of total availability.

Tildanga has the most available drinking water sources for dry and wet seasons among the investigated unions in Khulna, with eleven ROs in addition to PSF and RWHS. Tildanga also has the highest demand source ratio of all the unions. That is why, when compared to other unions, Tildanga has the highest total drinking water availability. Mrs. Shibani Biswas, Head Teacher of a local School in Tildanga union has informed that the main sources of drinking water are shallow tube-wells round the year. In the rainy season, people usually collect and store rain water (KII).

In Uttar Bedkashi, the duration of water scarcity is the shortest among the union of Khulna due to huge number of hand pumps are available there. Aside from that, Garuikhali has a limited amount of water sources, with only four PSF and one RO. As a result, the Garuikhali union has the lowest total availability of drinking water.

Table 18: Variable wise water availability condition in different unions of Khulna

	Dakshin Bedkashi	Deluti	Garuikhal	Kamarkhola	Lata	Sholadana	Sutarkahli	Tildanga	Uttar Bedkashi
Ownership	2.782	2.781	1.529	2.825	3.517	2.677	2.952	3.429	2.361
Available Source in Dry Season	1.350	1.547	1.086	1.238	1.418	1.154	1.556	1.732	1.194
Available Source in Wet Season	2.028	2.063	1.986	2.079	2.088	1.585	2.143	2.339	1.972
Demand-source Ratio	2.860	3.016	2.871	2.889	2.890	2.692	3.175	3.482	2.389
Duration of Water Scarcity	2.430	2.000	2.114	2.000	2.517	2.615	2.302	2.625	2.667
Total availability	2.344	2.258	2.035	2.175	2.483	2.483	2.439	2.739	2.237

The condition of ownership is good in Pratap Nagar and bad in Gabura compared to other unions (Table 19). A key informant, Md. Afzal Hossain (school teacher) reported that most of the houses in Pratap Nagar have their own tubewell. Some poor households still collect their drinking water from elsewhere. In Satkhira district, the number of available sources in dry seasons is found to be highest in Padma Pukur whereas in wet season, highest available source is found in Gabura. Pratap Nagar union has lowest available sources both in dry and wet seasons. The duration of water scarcity is lower in Sreeula union in comparison with other unions; hence it gets the highest score. The score is lower for Padma Pukur union. As per a KII (Supada Dutta, Teacher), around 420 tubewells are located in Padma Pukur union. Still, this union occupies the highest position in terms of demand-source ratio and the lowest position is occupied by Pratap Nagar union. In case of total availability, Sreeula union is ahead of other unions. On the other hand, Gabura union is lagging behind in terms of total availability. Figure 2 shows the union level water availability map for three districts.

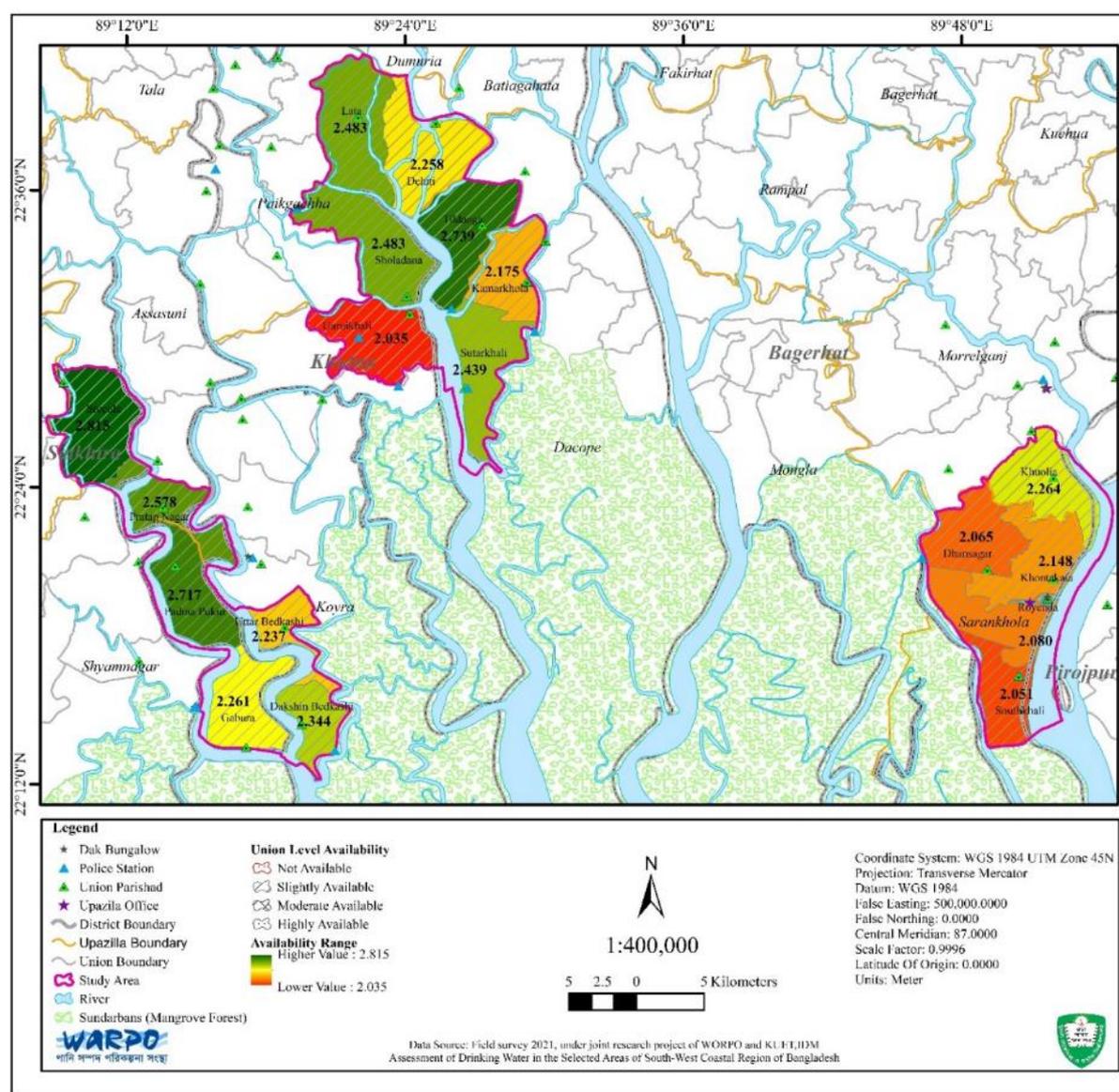


Figure 2: Union level water availability map of the three districts.

Table 19: Variable wise water availability condition in different unions of Satkhira

	Gabura	Padma Pukur	Pratap Nagar	Sreeula
Ownership	2.090	2.509	2.857	2.646
Available Source in Dry Season	1.141	1.491	1.114	1.481
Available Source in Wet Season	1.962	1.877	1.171	1.658
Demand-Source Ratio	2.769	3.175	2.543	2.949
Duration of Water Scarcity	2.590	3.246	3.514	3.658
Total availability	2.261	2.717	2.578	2.815

Sreeula union has the highest drinking water availability among the several unions in Satkhira, due to the union's ninety hand pumps and four RO. As per an interview with Sanower hossain (Teacher), a key informant, people of Sreeula have continuous source of tube well water near their house. As a result, the duration of water scarcity in Sreeula is also lowest. Gabura has 38 PSF, which work

effectively during the rainy season, but the rain-fed ponds dry up during the dry season and become inoperable due to poor maintenance. Gabura also has the longest period of water shortage compared to other unions due to its lack of hand pumps and RO, and as a result, it has the lowest overall drinking water availability among the Shatkhira unions.

3.2 Water Availability Situation at Upazilla Level

Among seven study upazillas, Morrelganj and Sarankhola upazilla belongs to Bagerhat district. Assasuni and Shyamnagar upazilla belongs to Satkhira district. Rest of the upazillas namely Dacope and Paikgacha fall under Khulna district.

Main sources of drinking water in all upazillas are Pond Sand Filter (PSF), community based Rainwater Harvesting System (RWHS), household based RWHS, shallow tube well, deep tube well etc (Shaibur et al. 2019). In Shyamnagar upazilla 39.1% household uses sources owned by government whereas in Dacope upazilla, only 8.3 % household uses sources provided by government. The percentage of NGO and community provided sources are highest in Dacope which are consecutively 28.6% and 37.5%. According to a research Sarankhola and Paikgacha have very few sources provided by NGOs where the percentages are below 10%. Besides, Sarankhola and Koyra upazilla have lowest percentages of community sources. Sarankhola upazilla has the highest percentage of private sources which is about 63.4% of the total sources in that upazilla. According to a research, shallow tube well and PSF are least successful options in Sarankhola in terms of safe drinking water. RWH is the least used source due to higher cost though can be a potential safe source (Sultana et al. 2013). Figure 3(a) shows the percentage distribution of household as per ownership condition for different upazillas.

Sarankhola upazilla has the highest percentage in terms of only one available sources in dry season. About 82.2% households in that upazilla can use only one source in dry season. It is found from FGDs that during dry season, RWH is not possible and in shallow tubewell water goes below the water table. Therefore, only few options remain for the households to collect water. On the other hand, Morrelganj upazilla has the lowest percentage (52.4%) of households who use only single source. Surprisingly, about 47.6% of people in Morrelganj upazilla uses two sources even in the dry season. According to a research, lost of pond were excavated in Morrelganj for shrimp culture and people often use water from those pond though they are not safe for drinking (Munirul et al. 2010, Mahmud et al. 2014). Figure 3(b) shows the percentage distribution of households as per source availability in dry season for different upazillas.

In wet season, the percentage (52.4%) of households depends on only one source is high for Morrelganj upazilla and low for Dacope and Koyra Upazilla. However, in Koyra upazilla, more than 97% of households depend on two sources during wet season. In Shyamnagar, Sarankhola and Dacope, significant amount households uses more than two sources during wet season. Different types of drinking sources like Pond Sand Filter (PSF), community based Rainwater Harvesting System (RWHS), household based RWHS, shallow tube well, deep tube well etc becomes available in wet season (Shaibur et al. 2019). Specially, RWH is a potential safe source though it is the least used source due to higher cost though (Sultana et al. 2013). Notably, only 19% households in Morrelganj use two sources for collecting drinking water in wet season. Figure 3(c) shows the percentage distribution of households as per source availability in wet season for different upazillas.

In Sarankhola Upazilla, maximum household (52.2%) has high demand for drinking water with few sources available according to decided scale. In Dacope Upazilla, only 9.9% household have condition like this. About 42.9% households in Morrelganj have low demand for drinking water in proportion with the available source. From this research it has been found that households in Morrelganj have household member no more than 6 which might be reason for lower demand for water. On the other hand, in Sarankhola, households have no more than 5 member on an average. So, the main reason for higher demand-source ratio in Sarankhola district is fewer available sources. Households of Koyra Upazilla has stayed behind in terms of low demand. Figure 3(d) shows the percentage distribution of households as per demand-source ratio for different upazillas.

About 76.2% households of Morrelganj Upzilla suffer from three to four months of water scarcity which is the highest among all upazillas. Climate change, seasonal cultivation of shrimp, fewer available sources are the main reasons for prolonged water scarcity (Munirul et al. 2010, Mahmud et al. 2014). In Assasuni upazilla, only 0.9% of households face this type of extreme condition. About 63.4% households of this upazilla have no water scarcity over the year which is the maximum among all upazillas. In Sornkhola, more than 36% households suffers from water scarcity for at least one to two months. About 35.7% and 30.4% households of consecutive Assasuni and Sarankhola upazillas faces one to two months of water scarcity. Local people of these upazilla have reported that, people suffer from a short duration of water scarcity due to ground water depletion especially in the dry season. Figure 3(e) shows the percentage distribution of households as per duration of water scarcity for different upazillas.

From Table 20, it is seen that the condition of ownership is comparatively good in Sarankhola Upazilla and worst in Shyamnagar Upazilla. In terms of available sources in dry season, the average condition is comparatively good in Dacope and Morrelganj. On the other hand, this condition is worst in Sarankhola Upazilla. However, in wet season, the average condition is good in Dacope and bad in Assasuni Upazilla. Average score for demand-source ratio is found to be highest in Dacope and lowest in Sarankhola. As per duration of water scarcity, the condition of Assasuni Upazilla is good and bad in Paikgacha Upazilla. Figure 4 shows upazilla level water availability map for three districts.

Table 20: Variable-wise water availability condition in different upazillas

Indicators	Assasuni	Dacope	Koyra	Morrelganj	Paikgacha	Sarankhola	Shyamnagar
Ownership	2.705	3.033	2.713	2.952	2.655	3.078	2.275
Available Source in Dry Season	1.366	1.497	1.200	1.476	1.313	1.181	1.297
Available Source in Wet Season	1.509	2.182	1.991	1.762	1.943	1.625	1.920
Demand-source Ratio	2.821	3.177	2.191	2.762	2.925	2.131	2.949
Duration of Water Scarcity	3.625	2.298	3.017	2.238	2.271	2.369	2.870
Total availability	2.745	2.439	2.363	2.270	2.272	2.111	2.459

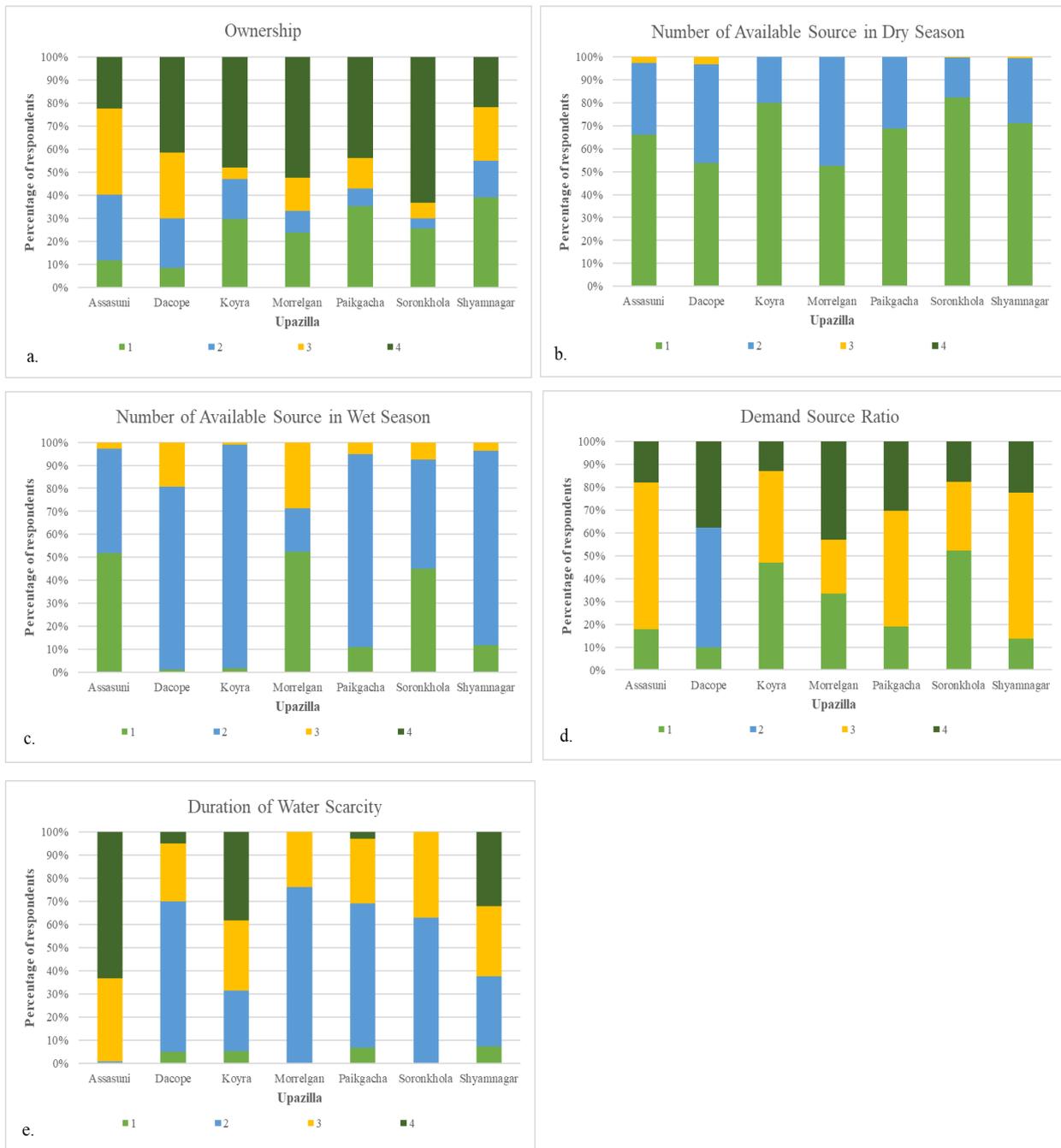


Figure 3: Upazilla wise percentage distribution of households as per different indicators.

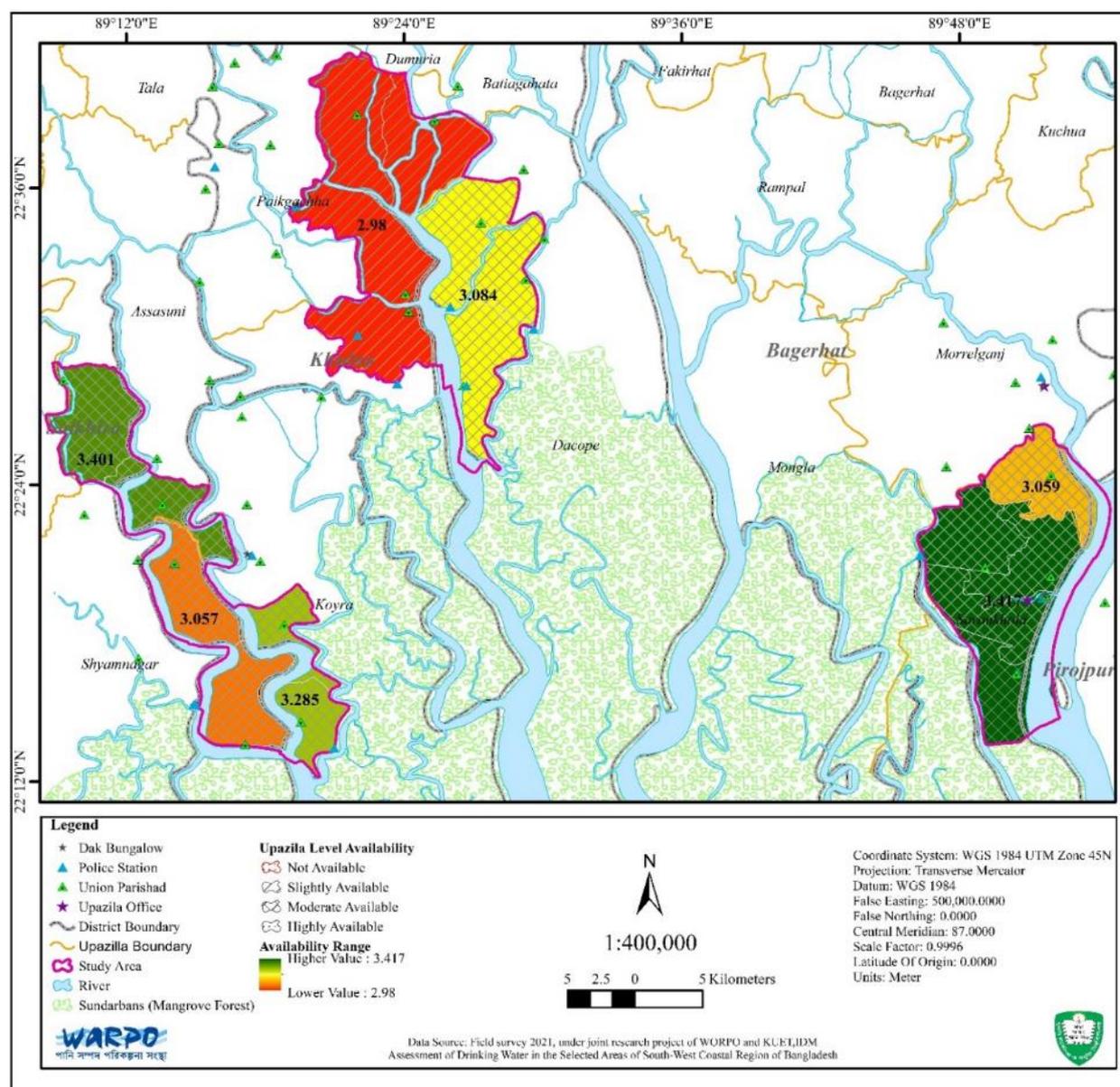


Figure 4: Upazilla level water availability map

3.3 Water Availability Situation at District Level

According to the surveys in Bagerhat district, 62.9% households collect water from private sources. 25.4% households depend on the sources provided by the government or non-government organization. In dry season, number of available sources are less than 1 according to the 80.4% of households. In wet season, as more sources are available for drinking water, only 45.3% household use less than 1 source. Besides, 45.9% households use more than 2 sources for collecting drinking water. According to research, tubewells are not that popular and very rarely used in Bagerhat district due to lack of fresh water aquifer in suitable depth and highly saline ground water. Due to these conditions of existing water sources, people are forced to depend on pond, PSF or RWH (Hossain et al. 2017). According to the FGDs, local people can harvest rain water during wet season which works as a potential source for drinking water. Therefore, during wet season the number of available sources seems to increase in different regions of Bagerhat district. Demand-source ration is lower than 7 by the 50.9% of households which means 50.9% of the surveyed household in Bagerhat district has admissible amount of water sources to fulfill their demand for drinking water. Oppositely, demand-source ratio is and higher than 21 by the 19% of households which means 19% households has fewer sources in comparison to their demand. According to 64% of the households, duration of water

scarcity is within 1 to 2 months. Another 36% households said that, duration of water scarcity is within 3 to 4 months (Appendix B1).

In Khulna district, it is found that 43.7% households collect water from private sources. 25.6% households depend on the sources provided by the government or non-government organization. A group of researchers has found that, water sources in Khulna district are owned by community people whom don't have financial capability to own a source (Benneyworth et al. 2016). Another study indicates that ownership of tubewells and privately funded RWH storage tank depends on the wealth differences (Ferdous Hoque 2021). In dry season, number of available sources are less than 1 according to the 66% of households whereas 32.9% households can use two sources. In wet season, as more sources are available for drinking water, 85.4% households use more than 2 sources for collecting drinking water. Rainwater is used extensively in the monsoon season, but not available year-round because lack of storage (Benneyworth et al. 2016). Therefore, during wet season the number of available sources seems to increase than during dry season in different regions of Khulna district. Another study shows increasing dependence on vendor for getting water during dry season specially by rich people (Ferdous Hoque 2021). Demand-source ratio is lower than 7 by the 21.7% of households which means 21.7% of the surveyed household in Khulna district has admissible amount of water sources to fulfill their demand for drinking water. Oppositely, demand-source ratio is higher than 21 by the 21.3% of households which means 21.3% households has fewer sources in comparison to their demand. It According to 27.7% of the households, duration of water scarcity is within 1 to 2 months. Another 55.8% households said that, duration of water scarcity is within 3 to 4 months (Appendix B2).

According to research, Shatkhira district is subject to different disasters like floods, tidal surge, erosion and cyclones with added effect of climate change. River water in the area is saline and thus availability of potable water for drinking purpose is already a big challenge (Farhana 2011). Installed PSFs by government or local NGOs are also vulnerable to different hazards. Local people consider RWH as the potential sources for drinking water. From this research it has been found that, 22.1% households collect water from private sources. On the other hand, 26.9% households depend on the sources provided by the government or non-government organization. In dry season, number of available sources are less than 1 according to the 69.1% of households whereas only 29.3% households can use two sources. In wet season, a completely opposite scenario has been found. As more sources are available for drinking water, 67.1% households use more than 2 sources for collecting drinking water. Besides, 29.7% households depend on 1 source for collecting drinking water. According to the FGDs, local people can harvest rain water during wet season which works as a potential source for drinking water. Therefore, during wet season the number of available sources seems to increase in different regions of Satkhira district. Demand-source ratio is lower than 7 by the 24.6% of households which means 24.6% of surveyed households in Satkhira district has admissible amount of water sources t fulfill their demand for drinking water. Oppositely, demand-source ratio is higher than 21 by the 11.6% of householdswhich means that the said households has fewer sources in comparison to their demand. . According to 27.6% of the households, duration of water scarcity is within 1 to 2 months. Another 56.0% households commented to have water scarcity for 3 to 4 months (Appendix B3).

The condition of ownership is good in Bagerhat and bad in Khulna compared to other districts. In Khulna, the number of available sources in dry seasons are found to be highest whereas Bagerhat shows the lowest available source in the same season. In case of number of available sources in wet season, Satkhira occupies the best position and Khulna occupies the lowest. The duration of water scarcity is lower in Satkhira in comparison with other districts and hence get the highest score. The score is lower for Khulna. Besides, Khulna occupies the highest position in terms demand-source ration and the lowest position is occupied by Bagerhat.

3.4 Overall Scenario of Water Availability

According to the surveys in all three districts, 44.7% households collect water from private sources, 14.5% households use community source and 36.4% households depend on the sources provided by the government or non-government organization. Number of available sources in both wet and dry season does not exceed 3 for one household in any of the three districts. According to 70.8% households, they can use 1 source in dry season. On the other hand, 63% households agreed that it is the same for wet season as well. Demand-source ratio is lower than 7 by the 21.4% of households and higher than 21 by 9.7% of households. According to 18.3% of the households, there is no drinking water scarcity, whereas 36.1% household said that the duration of water scarcity is within 1 to 2 months. Another 41.6% households claimed that, the duration is 3 to 4 months. According to only 4% households, duration of water scarcity is 5 to 6 months (Appendix C). Figure 5 shows district level water availability map for three districts.

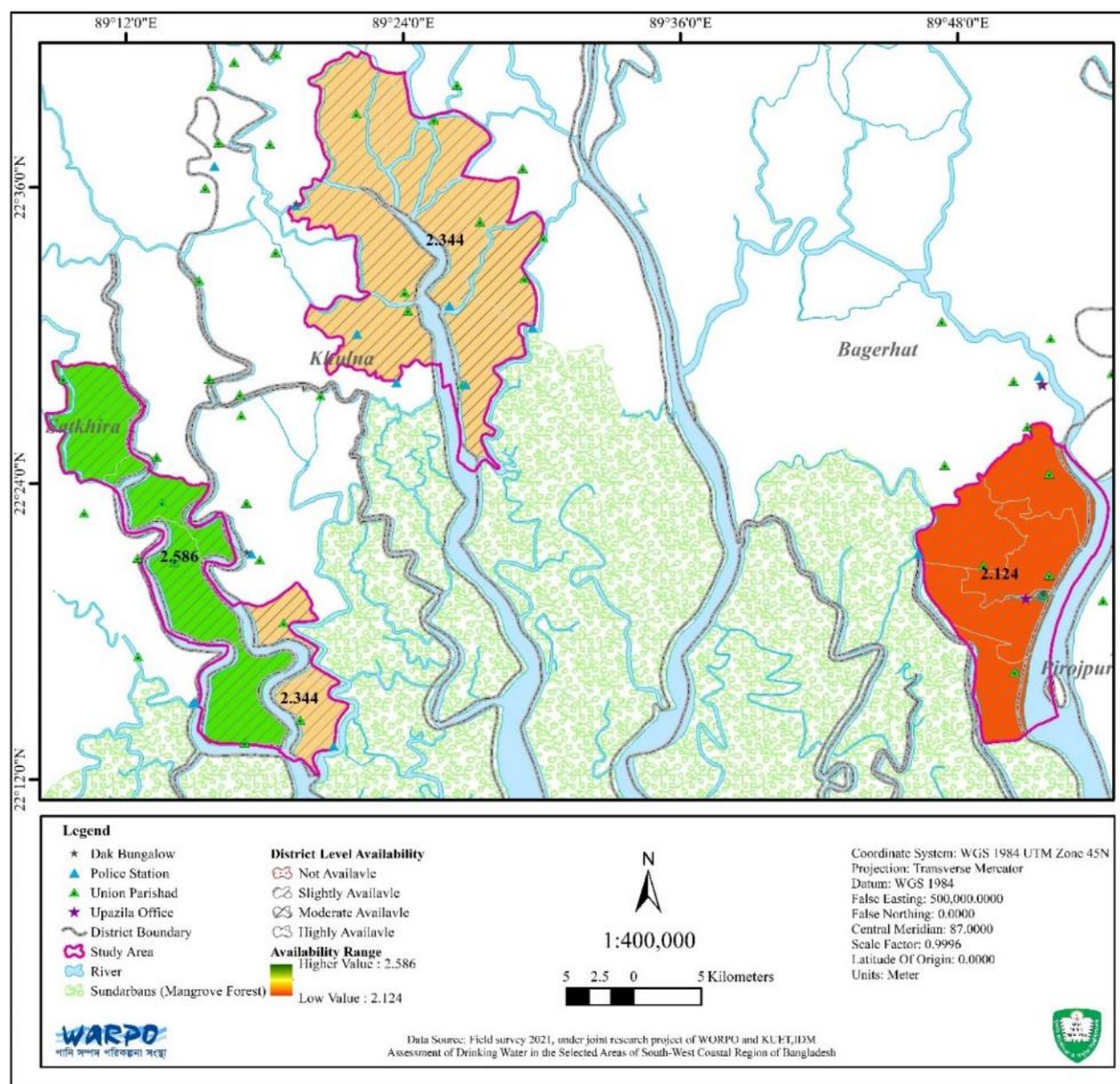


Figure 5: District level water availability map.

Chapter Four
RESULTS AND DISCUSSION ON WATER
ACCESSIBILITY

Chapter Four

RESULTS AND DISCUSSION ON WATER ACCESSIBILITY

Access to drinking water is a key measure of social and economic progress. Access to these services irrespective of gender, race and religion has always been considered as a human right rather than just a privilege. The second objective of this project was to analyze the accessibility of water and its consequences on the coastal residents. For indexing water accessibility, this research has considered nine significant factors that indicate, determine and affect drinking water accessibility in the coastal region of Bangladesh. The indicators considered for water accessibility index are distance from source, mode of transport, road condition, traveltime, queuing time, water cost-income ratio, equality, safety and security. This chapter describe the existing drinking water accessibility condition of the study areas at union, upazilla and district level in light of mentioned indicators.

4.1 Water Accessibility Situation at Union Level

From the following Table 21, it is seen that in people of Dhansagar union of Bagerhat district have to travel shorter distance to collect water on an average whereas Rayenda union households have to travel far on an average in comparison with other unions. Water price income ratio is also lower for this union. In terms of transport, Southkhali and Dhansagar union produces the best result among all unions and Khontakata union suffers most. Dipak Kumar, principal of primary school in Khontakata union was a primary key informant of this project. He has said that people have to walk long distance which creates difficulty for them to carry water. The condition of road is found to be worst in Dhansagar union. This condition is better in Khontakata union compared to other unions. Southkhali is occupying a good position in terms of travel time. On the other hand, Rayenda is occupying the worst condition under same indicator. All unions are showing equally good results in terms of queuing time. The worst condition in terms of road condition, equality, safety and security are found in Rayenda union. Cost-income ratio is comparatively high in Khontakata union whereas the ratio is comparatively low in Southkhali union. In terms of equality, safety and security, consecutively Southkhali, Dhansagar and Khaulia union are lagging behind but in case of total accessibility, Southkhali union is ahead of others. On the other hand, Khaulia union is lagging behind in terms of total accessibility.

Table 21: Variable-wise water accessibility condition in different unions of Bagerhat

Indicators	Dhansagar	Khontakata	Khaulia	Rayenda	Southkhali
Distance from source	2.971	2.020	2.333	1.933	2.729
Mode of transport	3.000	2.737	2.947	2.789	3.034
Road condition	1.500	2.172	1.597	2.056	1.881
Travel time	2.677	1.859	2.228	1.744	2.780
Queuing time	4.000	4.000	4.000	4.000	4.000
Cost -Income ratio	3.706	3.556	3.579	3.622	3.814
Equality	3.941	3.838	3.895	3.856	3.542
Safety	2.735	3.253	2.614	3.256	3.119
Security	3.765	3.737	3.579	3.811	3.814
Total accessibility	3.197	3.029	2.989	3.023	3.268

From Table 22, it is seen that among all the unions of Khulna District, residents of Garuikhali union have to travel shorter distance while the residents of Deluti Union have to travel longer distance to collect water. Among all unions, Tildanga union is staying ahead in terms of transport mode whereas

Sholadana union is lagging behind. All the unions under study have poor road condition on an average. Among this, Sholadana is in slightly better condition. According to a key informant, Mrs. Shibani Biswas (Head Teacher, Satyapeer), the condition of internal roads of Tildanga union is too bad. The households in Lata union need less travel time for collecting water whereas the other Unions need more time to travel to the source and come back to house. In Guruikhali, people do not have to wait at the source while collecting water. In Southkhali union, people are waiting more in comparison with other unions. Cost income ratio is low in Deluti union and high in Sholadana union. Water collection, in terms of both safety and security Sholadana union is lagging behind. The condition of equality is worse in Tildanga union. In case of total accessibility, Lata union is ahead of other unions. On the other hand, Sholadana union is lagging behind in terms of total accessibility.

Table 22: Variable wise water accessibility condition in different unions of Khulna

Indicators	Dakshin Bedkashi	Deluti	Garuikhali	Kamarkhola	Lata	Sholadana	Sutarkhali	Tildanga	Uttar Bedkashi
Distance from source	1.972	1.094	2.200	1.810	2.088	1.646	1.952	2.089	2.028
Mode of transport	3.087	2.828	2.957	3.302	3.308	2.662	3.095	3.393	3.083
Road condition	1.756	1.391	2.300	1.064	2.033	2.308	1.127	1.911	1.694
Travel time	1.953	1.031	1.900	1.778	2.363	1.523	2.016	1.821	1.861
Queuing time	3.539	3.438	4.000	3.079	3.934	3.554	3.460	3.321	3.139
Cost -Income ratio	3.494	3.797	3.200	3.635	3.418	2.939	3.508	3.750	3.528
Equality	3.950	4.000	3.957	4.000	3.978	3.908	3.905	3.857	4.000
Safety	3.718	3.219	3.814	3.984	3.868	3.108	3.714	3.964	3.833
Security	3.936	4.000	3.986	4.000	3.956	3.754	3.937	3.946	3.944
Total accessibility	3.071	2.810	3.107	3.034	3.204	2.764	3.026	3.164	3.063

From the following Table 23 and figure 6, it is seen that among all the unions of Satkhira District, residents of Sreeula union travels shorter distance while the residents of Gabura union travels longer distance to collect water. In most unions, residents use van, rickshaw and bicycle except in Sreeula Union where they mostly walk to collect water from the source. All the unions under study have poor road condition. The road condition of Pratap Nagar in comparatively better than other unions. In terms of travel time, people from Pratap Nagar union suffer least whereas people form Gabura suffers most. In all union except in Gabura, people need to wait less than 5 minutes to collect water. Cost-income ratio is low in Pratap Nagar union whereas the ratio is high in Gabura union. Respondents from all unions of Satkhira District reported to get equal treatment during water collection with a minor exception of Gabura Union. Households of Gabura Union reported to feel no stress while the households of other Unions reported to feel mental stress during water collection. In terms of security, no violence has been reported by the respondents of the Pratap Nagar union. In case of total accessibility, Sreeula union is ahead of other unions. On the other hand, Gabura union is lagging behind in terms of total accessibility.

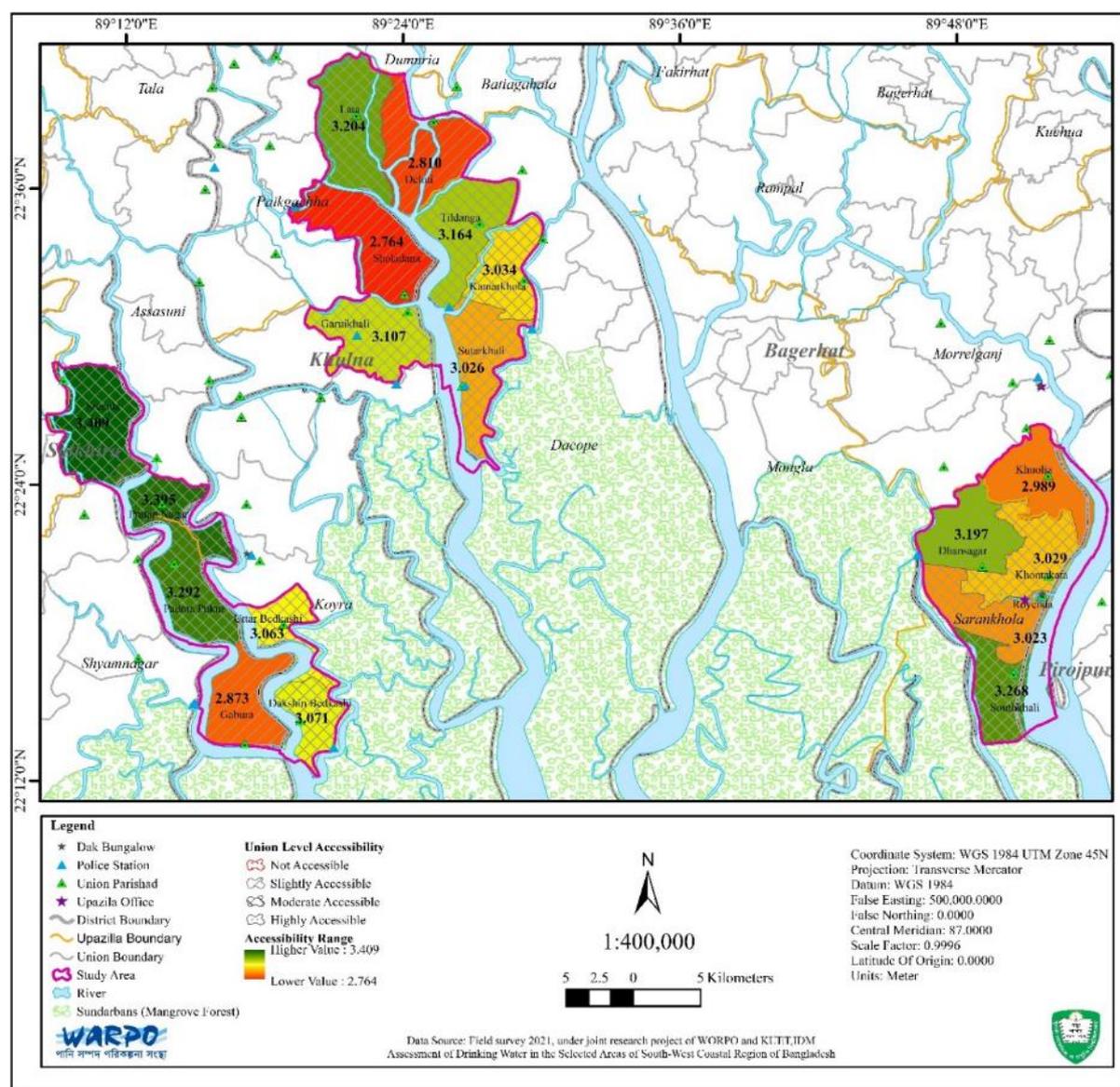


Figure 6: Union level water accessibility map

Table 23: Variable wise water accessibility condition in different unions of Satkhira

Indicators	Gabura	Padma Pukur	Pratap Nagar	Sreeula
Distance from source	1.923	2.579	2.886	3.038
Mode of transport	2.910	2.930	2.857	3.101
Road condition	1.192	1.421	1.857	1.595
Travel time	1.885	3.263	2.971	2.987
Queuing time	3.872	4.000	4.000	4.000
Cost -Income ratio	3.346	3.491	3.800	3.760
Equality	3.962	4.000	4.000	4.000
Safety	2.872	3.386	3.429	3.532
Security	3.846	3.983	4.000	3.987
Total accessibility	2.873	3.292	3.395	3.409

4.2 Water Accessibility Situation at Upazila Level

Among seven study upazillas, Morrelganj and Sarankhola upazilla belongs to Bagerhat district. Assasuni and Shyamnagar upazilla belongs to Satkhira district. Rest of the upazillas namely Dacope and Paikgacha fall under Khulna district.

In Paikgacha upazilla, more than 65% household travel at least 500m to reach to the source which is very concerning. This percentage is 22.3% for Assasuni upazilla which is very low in comparison with other upazillas. According to the 54.5% household of Assasuni, the distance to the source is less than 100m. Besides, in Morrelganj upazilla, about 47.6% households travel less than 100m. Only 15.3% households of Paikgacha upazilla agreed that the source is within 100m. From FGDs it is found that, most of the people in Paikgacha use tubewell for the purpose of drinking which are very far from their house rather than ponds most of which are located besides their house. According to FGDs, Assasuni upazilla have more than 800 deep and shallow tubewells which makes the sources within close reach of the households. From a research it is found that, Assasuni Upazilla has better road network which might also be the reason for lesser travel distance to the sources (Amin et al. 2016). Figure 7(a) shows the percentage distribution of household as per distance to source for different upazillas.

Less than 5% households from Dacope, Koyra, Paikgacha and Sarankhola upazilla use truck or boat to travel to source or to transport water. In Assasuni and Paikgacha, more than 26% households use van, rickshaw or bicycle to transport water from source. Most of the people from all upazilla have to walk to collect and transport water. This percentage is high for Shyamnagar upazilla which is about 73.2%. Local people reported that a considerable amount of people do not need to transport water as they have their own sources within their house. As per this research 39.1% surveyed households in Shyamnagar have their own sources which is the highest among other upazillas. This is one of the main the reason people walk to the sources instead of using other transports. Figure 7(b) shows the percentage distribution of household as per the mode of transport for different upazillas.

According to less than 5% households in all upazillas, no road is required to go to the source. Maximum people in all upazillas uses kutcha road to collect water except in Paikgacha upazilla. In Paikgacha upazilla, maximum people (39.5%) uses mixed road. In Morrelganj, Sarankhola and Paikgacha, a certain percentages of people use pucca road. It is found from another research that Paikgacha has good connectivity of pucca roads which are mainly constructed by Local Government Engineering Department (LGED) and Roads & Highway Department. In Shyamnagar upazilla, no surveyed people use pucca road to collect water (Shama *et al.*, 2020). About 73.5% people from Dacope and 71.2% people from Shyamnagar upazilla use kutcha road. According to a study, lots of rural roads were rebuilt under the food/cash-for-work programs by local government and NGOs in Shyamnagar upazilla which might be the reason for high percentage of kutcha road as well as their usage (Masud-All-Kamal and Hassan 2018). Figure 7(c) shows the percentage distribution of household as per road condition for different upazillas.

About 66.9% household of Paikgacha upazilla travel more than 15 minutes to go to and come back from the source. On the other hand, only 24.1% people of Assasuni upazilla travel more than 15 minutes. In Assasuni, 48.2% households requires less than 5 minutes to travel. This percentage is also considerably high and above 40% in Shyamnagar and Morrelganj upazilla. From FGDs it is found that few existing RO are the main sources of drinking water in Paikgacha union. The location and distance of these sources are main reason for higher travel time. There are several other RO plant in Paikgacha but most of those are used by few wealthy people as the cost is too high for general people to bear. On the other hand, Assasuni and Shyamnagar upazilla have many available water sources and good road condition which are causing lower travel time for water collection in these two upazillas (Amin et al. 2016, Masud-All-Kamal and Hassan 2018). Figure 7(d) shows the percentage distribution of household as per travel time for different upazillas.

In Sarankhola, Morrelganj and Assasuni, 100% people do not have to wait or queue for collecting water. Also, maximum households in other upazillas do not need to wait or queue for collecting water though in Dacope and Koyra, these amounts are comparatively lower than other upazillas. In Dacope and Koyra Upazilla, consecutively 12.7% and 10.4% households requires queuing for more than 15

minutes. The Dacope and Koyra Upazila has scarcity of safe drinking water due to increasing salinity (Shaibur et al. 2021) which is creating pressure deep tubewell. According to FGDs, rapid depletion of ground water by extensive extraction and fast growing population are also responsible for extra queuing time during water collection in tubewell. Iure 8(e) shows the percentage distribution of households as per queuing time for different upazillas.

Cost-income ratio is low according to the maximum households of all upazillas. More than 80% people in Assasuni, Dacope, Koyra and Morrelganj upazilla agreed that cost-income ratio is very low and negligible. According to this research, in Assasuni and Morrelganj upazilla people have an average income of more than 14000 Taka. Besides, in Dacope and Koyra, people have an average income of more than 10000 Taka. Higher income are mainly the reason for lower cost-income ratio compared to other upazillas. Still, a certain percentages of people in Paikgacha and Shyamnagar claimed to have a considerably high cost income ratio. According to the local people of Shyamnagar, the cost they bear are mainly for transporting water, purifying water and maintaining sources. Sometimes they use tablet and most people can't afford to purify water stuff so they drink what they get. Figure 7(f) shows the percentage distribution of household as per queuing time for different upazillas.



Figure 7: Upazilla-wise percentage distribution of households as per different indicators.

More than 90% people in all upazillas are glad in terms of equality. In Morrelganj, 4.8% households face religious inequality. Few people in Sarankhola and Dacope faces socio-economic inequality. About 3.8% people in Sarankhola faces gender inequality. In terms of safety, more than 95% people in Dacope and Koyra were pleased as they face no stress while collecting water. Very negligible amount of people is worried about mental stress. About 29% people in Shyamnagar and 28.6% people in Morrelganj suffers from physical stresses during water collection. About 13.1% households in Sarankhola upazilla and 11.6% households in Shyamnagar upazilla have faced injuries or accidents while collecting drinking water. More than 90% people in all upazillas except in Sarankhola are satisfied in terms of security. In Koyra and Shyamnagar, consecutively 7.8% and 7.2% households have faced verbal assaults. Very few people (1.3%), only from Sarankhola upazillas, has faced the act of thievery sometimes. Some people from Sarankhola, Paikgacha and Morrelganj upazillas have suffered from physical assaults which are very concerning. It is found from a study that social capital in coastal areas of Bangladesh are relative rich which is responsible for their strong community bondage. This is the main reason for higher equality, safety and security in this region (Masud-All-Kamal and Hassan 2018, Kadir 2021). Figure 7(g), 7(h), 7(i) show the percentage distribution of household as per equality, safety and security for different upazillas. Figure 8 shows upazila level water accessibility map for three districts.

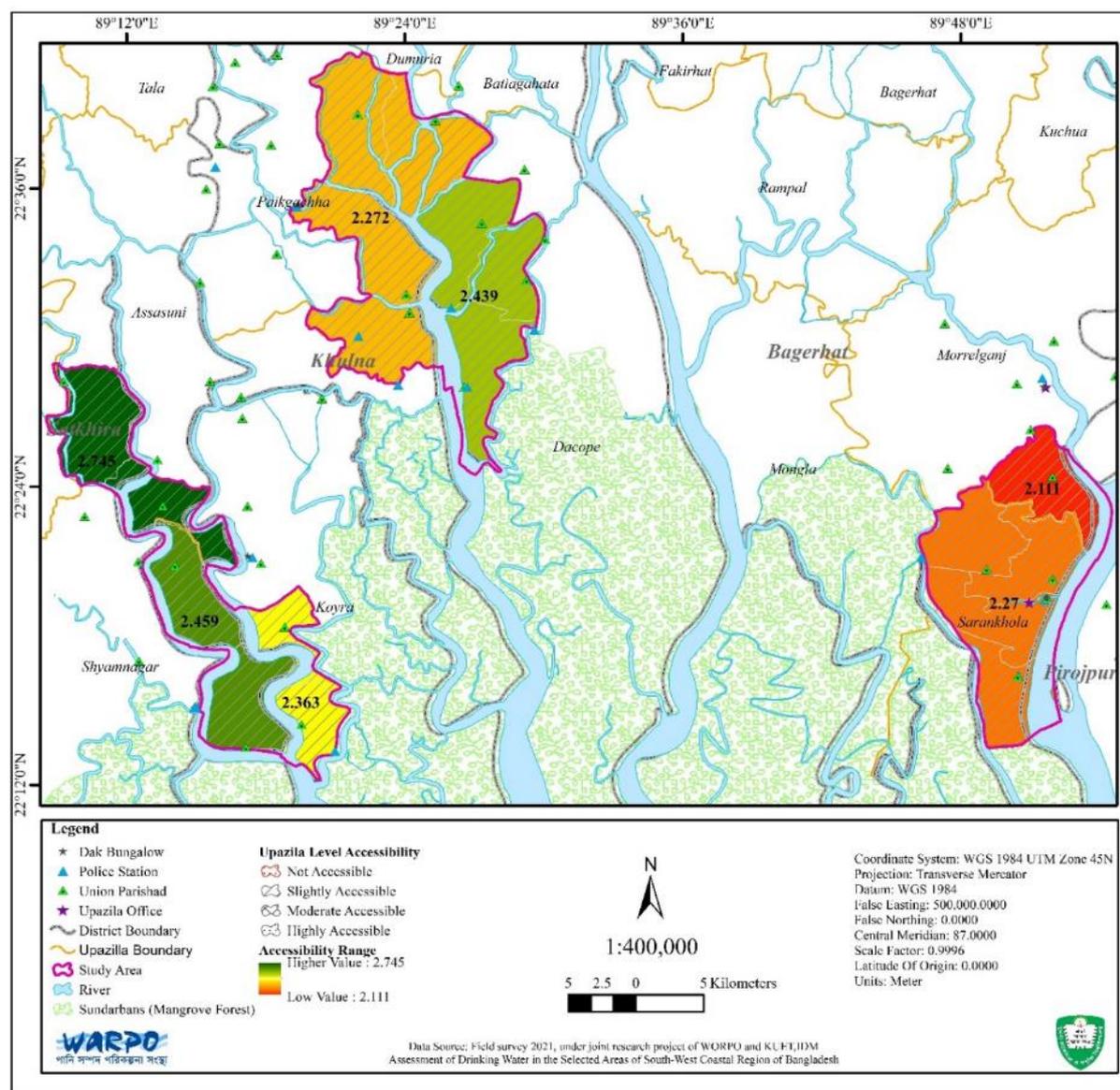


Figure 8: Upazila level accessibility map.

From Table 24 it is seen that, in terms of distance, Morrelganj upazilla is in good condition whereas Paikgacha upazilla is in worst condition. As per transport mode, the condition of Morrelganj is good but the condition of Sarankhola is bad in comparison with other upazillas. The average condition of road is found to be good comparatively in Paikgacha upazilla and very bad in Shyamnagar upazilla. In terms of travel time, Morrelganj upazilla has got the highest score whereas Paikgacha upazilla has got the lowest score. In the question of queuing time, all upazillas are in good condition but Assasuni, Morrelganj and Sarankhola upazillas score highest. Average condition of cost-income ratio are found to be good in Morrelganj and bad in Paikgacha. In terms of equality and security, the average score Assasuni upazilla is highest among all upazillas. Koyra Upazilla has got the highest score in terms of safety.

Table 24: Variable wise water accessibility condition in different upazillas

Indicators	Assasumi	Dacope	Koyra	Morrelganj	Paikgaacha	Sarankhola	Shyamnagar
Distance from source	2.973	1.934	2.617	3.000	1.737	2.222	2.232
Mode of transport	3.027	3.260	3.113	3.286	2.968	2.838	2.920
Road condition	1.688	1.348	1.687	2.000	2.046	1.925	1.283
Travel time	2.964	1.950	2.496	3.095	1.737	2.072	2.493
Queuing time	4.000	3.298	3.409	4.000	3.747	4.000	3.928
Cost -income ratio	3.768	3.635	3.687	3.810	3.327	3.628	3.413
Equality	4.000	3.923	3.965	3.952	3.961	3.803	3.978
Safety	3.509	3.884	3.948	3.286	3.527	3.063	3.073
Security	3.991	3.961	3.922	3.857	3.925	3.741	3.906
Total Accessibility	3.401	3.084	3.285	3.417	2.980	3.059	3.057

4.3 Water Accessibility Situation at District Level

As per the national standard of Bangladesh, a source should be within 50m of the household premise (GoB, 2005). According to the survey in Bagerhat district, 29.5% households have water sources within 100m of their house and 43.3% households have houses located more than 500m far from the sources. 10.5% household requires no transport to collect water while 17.8% uses rickshaw and van to reach the sources and for transporting water. Majority of the people, about 68.7% walks to the source for collecting water. As per FGDs, people are willing to carry heavier loads instead of using other transport because of higher transportation cost. 47.7% household use fully kutcha road to go to the source and 32.2% household use fully pucca roads. Only 4.1% households require no road because they have their own source close to their house. 24.3% household requires less than 5 minutes to travel to the source and come back to the house whereas 52.3% households require more than 15 minutes for travelling. Beside this, 100% households do not have to wait for more than 5 minutes. A study indicated that PSFs in the Bagerhat district have been installed randomly based on the availability of rain fed ponds. Therefore, users have to travel several distances to collect water. Moreover, lower cost of PSF are causing substantial queuing time (Hossain 2017). People from FGDs also told that these sources are also frequently damaged by natural disaster, lack of regular cleaning and proper maintenance. They often become dysfunctional within a short time after installation. Water price – income ratio is less than 0.01 for 78.1% household which means price of water is not burden for them. Still, this ratio is more than 0.05 is for 3.5% household. A study shows that women and girls are generally responsible for water collection (Hossain 2017). About 92.1% households get equal treatment and 59.6% households feel no stress during water collection. However, 26.6% households which is a considerable amount, faces physical stress and 12.6% people have suffered from injuries and accidents. On the other hand, 88.3% household faces no violence during water collection (Appendix E1).

The field survey in Khulna District reveals 21.5% households have water sources within 100m of their house whereas 53% households use sources that are located at least 500m distant to their houses. This distance creates a huge mental burden to the women of the house as they are solely responsible for collecting drinking water. Field survey suggests 33.3% households require no transport to collect water since the sources are within very close distance to the house while 45.6% needs to walk to reach the sources and for transporting water. Only 17.7% uses van, rickshaw and bicycle for collecting water as those sources situated far away from their household. 46.6% households use fully kutcha road, 20.1% households use fully pucca roads and 32.2% households use mixed road to go to the source. According to a study, road networks in coastal part of Khulna district often are damaged by cyclone, storm surge and floods which causes a hindrance for collecting potable water (Kumar et al.

2010). Consequently, 56.5% households of the study area require more than 15 minutes traveling to the source and coming back to the house. Households that are situated close to the source (20.8%) require less than 5 minutes traveling to the source. Interestingly, 75.6% households do not need to wait for more than 5 minutes. As most of the people uses ponds and PSF (Benneyworth et al. 2016), they do not have to wait unlike collecting water from tubewell. 8.1% people wait for more than 15 minutes in queue for collecting water as the source is tube-well and it takes time to pump water. Water price – income ratio is less than 0.01 for 71.8% household which means price of water is not burden for them. The main reason for lower cost-income ratio is higher average income of the people from Khulna District. Still, this ratio is more than 0.05 is for 5.9% household. About 97.6% households get equal treatment and about 86.5% people feel no stress during water collection. In addition, 95.7% households never face violence during water collection (Appendix E2).

According to the survey in Satkhira District, 37.8% households have water sources within 100m of their house whereas 31.3% households located more than 500m of the sources. Due to popularity of shrimp culture in Satkhira district, most of the available ponds are not safe for collecting drinking water (Farhana 2011). Therefore, people who wants to collect safe drinking water have to travel far. About 59.8% of the households walk to reach the sources of the water while 18.5% require no transport to collect water. Only 21.7% uses van, rickshaw and bicycle for collecting water. According to FGDs, people prefer to walk to the source to save money and for that they are even willing to carry heavier loads. 60.6% households use fully kutcha road, only 7.2% households use fully pucca roads and 32.1% households use both kutcha and pucca to go to the source. Consequently, 34.5% households of the study area require more than 15 minutes to travel to the source and come back to the house whereas 44.2% households require less than 5 minutes. Remarkably, 97.2% households of Satkhira District do not need to wait for more than 5 minutes in queue for collecting water. Water price – income ratio is less than 0.01 for 71.5% household which means price of water is not burden for them. Higher average income of the people of Satkhira district and comparatively lower water price is the main reason for this lower ratio. Local people reported that, they pay little mainly for water purification and transportation. In case of sources owned by community they have to pay an yearly maintenance cost which is very negligible as per them. Still, this ratio is more than 0.05 is for 1.2% household. About 99.6% households get equal treatment. On the other hand, 95.2% households never face no violence during water collection. About 67.1% households feel no stress during collecting water. In contrast, 25.7% respondents feel physical stress during water collection from the source (Appendix E3).



Figure 9: Overall Scenario of Drinking Water Accessibility in three Districts.

From the figure 9, it is seen that in Bagerhat, people have to travel shorter distance within short period of time to collect water. In Khulna, people have to travel on an average a long distance from their home to the source of water to collect water. In terms of mode of transport, Khulna produces the best result among all districts and Bagerhat is in worst condition. Condition of road is best in Khulna. On the other hand, condition of road in Satkhira is bad compared to other two districts. People in Satkhira suffers less in terms of travel time and queuing time. People in Khulna suffers most in terms of travel time. Water price income ratio is higher for Bagerhat district and lower for Khulna district. Satkhira is also in good position in terms of equality and security whereas Khulna is in good position in terms of safety. Bagerhat district is in the lowest position in terms of equality, safety and security. Figure 10 shows district level water accessibility map for three districts.

4.4 Overall Scenario of Water Accessibility

According to the survey, overall 40.7% households have water sources within 100m of their house and 32.8% households have houses located more than 500m far from the sources. The longest distance between the water source and the house has been found to be 10km. Besides, the shortest distance traveled was 0km because of the location of the source within the home. 25.1% household requires no transport to collect water while 22.5% uses rickshaw and van to reach the sources and for transporting water. Majority (51.5%) people walk to the source for collecting water. 50.4% household use fully kutcha road to go to the source and 20.9% household use fully pucca roads. Only 1.3% households require no road. 26.8% household requires less than 5 minutes to travel to the source and come back to the house whereas 54.8% households require more than 15 minutes for travelling. Beside this, maximum (79%) households do not have to wait for more than 5 minutes. Only 9.8% people waits for more than 15 minutes in the source for collecting water. Water price – income ratio is less than 0.01 for 73.3% household which means price of water is not burden for them. Still, this ratio is more than 0.05 is for 9.2% household. 96.2% households get equal treatment and 74.5% household feel no physical or mental stress during water collection. On the other hand, 90.3% household faces no violence during water collection (see Appendix F).

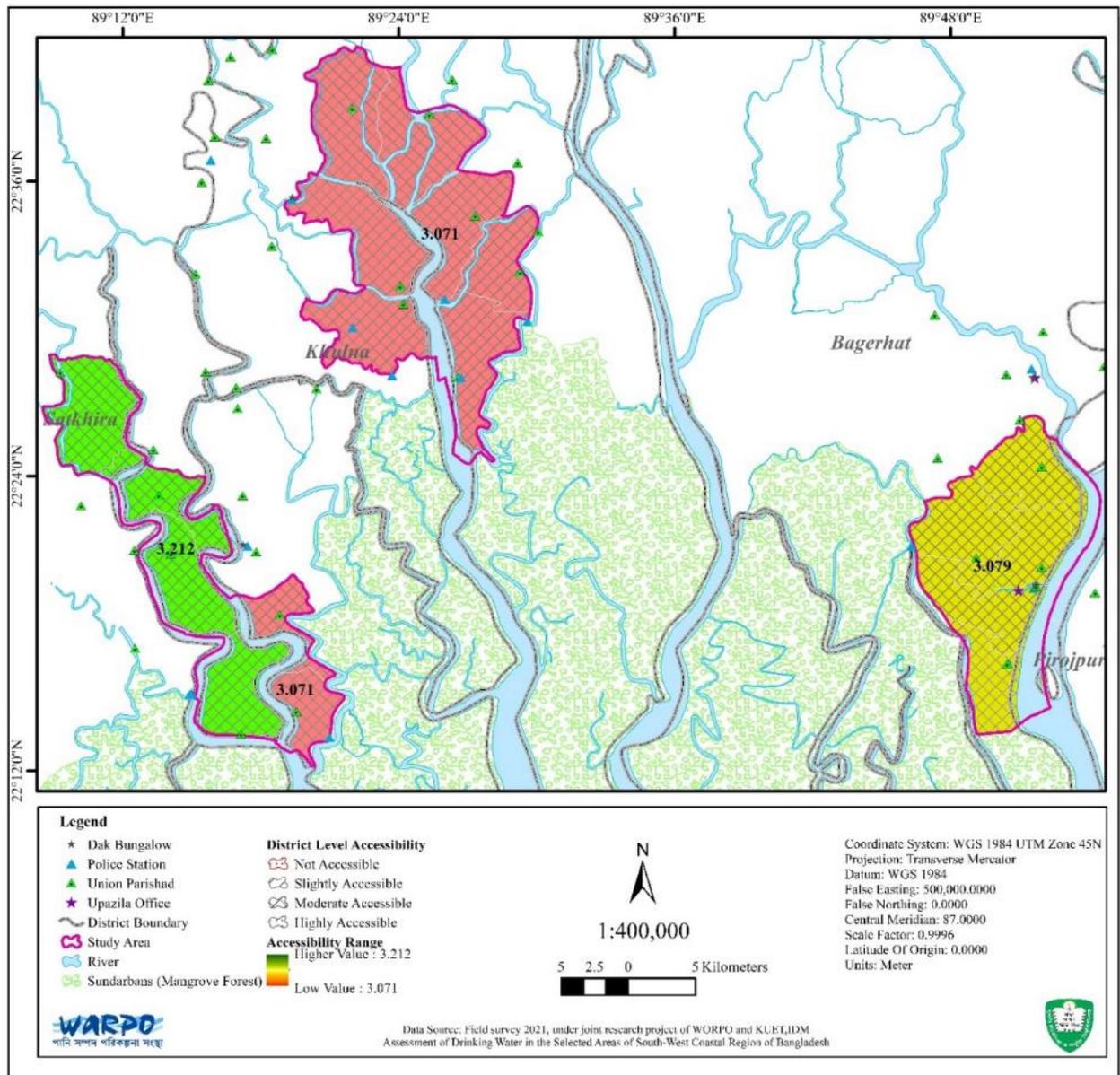


Figure 10: District level water accessibility map.

Chapter Five
RESULTS AND DISCUSSION ON WATER QUALITY

Chapter Five

RESULTS AND DISCUSSION ON WATER QUALITY

5.1 Results and Discussion

A total of 91 numbers samples during dry season and wet season of 2022 were collected from various locations of the study area as per the standard protocol prescribed by (APHA, 1998). Significant physicochemical characteristics of collected water samples in study area has been examined statistically as well as outcomes like standard deviation, mean, minimum, and maximum parameters are depicted in Table 22. Also the correlation matrix between water quality parameters is given in Table 23. The chemical, physical and biological parameters of the analytical outcomes of water sample have been compared to GOB guideline Standards for public health as well as drinking standards (GOB, 2020).

5.1.1 pH

pH is the measure of hydrogen ion concentration value in water which indicates whether a solution is acidic, neutral or basic (Khan & Jhariya, 2017). The pH required has to be in the range of 6.5–8.5 for the drinking purpose (GOB, 2020). In present study although the pH concentration is ranges from 5.93 to 8.23 for ground water and 5.44 to 9.12, however the pH value of majority water samples are within the permissible limit as prescribed by GOB, 2020. Average values of pH representative slightly alkaline nature of ground water and surface water for both seasons. This may be because of pollution of water through seepage of wastewater from the nearby agricultural field.

5.1.2 Electrical conductivity (EC)

Conductance is a calculation of the electric flow capability of water that is specifically related to ion concentration in the water (EPA, 2012). The greater the salinity amount, the less the oxygen absorbed. An abrupt rise or decline in conductivity in the water body may indicate pollution (Dandge and Patil, 2021). In the present investigation values observed for conductivity during dry season ranged from 0.27-15.02 mS/cm for ground water and 0.1-11.83 mS/cm for surface water whereas during wet season these values ranged from 0.88-14.96 mS/cm for ground water and 0.28-8.88 mS/cm for surface water, the minimum conductivity values were observed at Lata union of Paikgacha upazila under Khulna district with 0.1 mS/cm for surface water. Conductivity of the water sample for the entire study area stands at an average of 4.57 mS/cm for ground water and 1.57 mS/cm for surface water. This data reveals that, there is high solute dissolution in groundwater, slow ion-exchange between soil as well as water, or basically soluble geologic rock and mineral forms in the area. There have been significant period changes in EC, which indicate higher values throughout dry after wet seasons that can be due to the high evaporation rate during dry season. During post-monsoon months, lower conductivity levels are attributed to precipitation dilution.

5.1.3 Escherichia coli

E. coli is present in large numbers in the normal intestinal flora of humans and animals, where it normally causes no harm. Though, in other parts of the body, E. coli can be responsible for serious illness, such as urinary tract infections, bacteraemia and meningitis (Patil & Dandge, 2021) Total coliforms can also live and grow in water distribution systems, mostly in the presence of biofilms (WHO, 2011). It was significantly detected in all collected water samples for both surface and ground water in study area. The highest total coliforms 57000 was observed at 7 no. word of Khoulia union of Morelganj upazila of Bagerhat district. This significant presence of E. coli may be attributed to surface runoff and percolation process, signifying that the bacteriological water in these areas was not safe and required treatment before drinking.

5.1.4 Sulphate

Sulphate occur naturally in several minerals and are used commercially, mainly in the various chemical industries. They are discharged into water by industrial wastes and through atmospheric deposition; though, the highest levels generally occur in water mostly are from natural sources. In present study the Sulphate concentration is ranges from 5.88-26.37 mg/L for ground water and 5.02-98.93 mg/L for surface water during dry season whereas during wet season these values ranged from 0.09-1.27 mg/L for ground water and 0.06-2.09 mg/L for surface water which show that it is within the permissible limit as prescribed by (GOB, 2020). Groundwater samples are undersaturated with respect to gypsum and gypsum dissolution, thus leading to an increased level of calcium and sulphate along groundwater flow direction. Other than this, overuse of sulphate fertilizers and surface runoff from agricultural field can be considered as a primary source of increasing sulphate concentration in surface water.

5.1.5 Chloride

The salts such as NaCl (sodium), KCl (potassium) and CaCl₂ (calcium), are chloride containing and commonly spread in nature. The weathering cycle absorbs chlorides from several rocks into the water and soil (WHO, 1996). Based on the following, cation is the sensation of taste threshold of chloride anion in water. Sense of perception thresholds for sodium and calcium chloride in water are in the array 200–300 mg/L (Zoeteman, 1990). The anthropogenic sources of chlorides in water sources is inorganic fertilizer made with potash, sewage contamination and industrial effluents landfill leachates, animal fodders, irrigation drainage. In the study area chloride concentration ranges from 49.63-1382 mg/L for ground water and 10.63-439.58 mg/L for surface water during dry season whereas during wet season these values ranged from 48.41-1310 mg/L for ground water and 12.88-510.2 mg/L for surface water with the maximum value of 1382 mg/L has been observed in few number of ground water samples. The presence of chloride in slightly higher amounts at some sites can be because of both natural as well as anthropogenic procedures such as shrimp and curb farming. In wet season, the average value of chloride is higher than to dry season because of increasing level of water which dissolves more salt from soil in wet season.

5.1.6 Nitrate

Nitrate concentration above 45 mg/l (GOB, 2020), causes methemoglobinemia (blue baby syndrome), gastric cancer, thyroid disease and diabetes (Kumar, 2014). Hence, increasing nitrate contamination seriously threatens public drinking water supply and human health (Kumar, 2014). The main source of nitrate concentration in drinking water is anthropogenic activity. Nitrate concentration ranges from 0.06-35.32 mg/L for ground water and 0.06-4.22 mg/L for surface water during dry season whereas during wet season these values ranged from 0.00-6.90 mg/L for ground water and 0.01-1.09 mg/L for surface water in the study area. Higher level of nitrate at some sites might have been either due to overuse of fertilizers or due to leaching. Increasing concentration of nitrate were associated with greater well depth and higher percentage of agricultural land use. The high concentration of nitrate in drinking water has adverse effects on human health and causes and gastric carcinomas and blue baby syndrome in children which is commonly known as Methemoglobinemia.

5.1.7 Calcium

The high concentration of calcium ions can cause abdominal ailments and is undesirable for domestic use as it causes encrustation and scaling (Kumar, 2014). In the present study area calcium concentration ranges from 12.02-130.2 mg/L for ground water and 10.63-439.58 mg/L for surface water during dry season whereas during wet season these values ranged from 2.46-56.04 mg/L for ground water and 12.88-510.2 mg/L for surface water. Calcium dissolution from natural sources is removed to such a large degree to surface water. This can be discharged from anthropogenic sources into ground water.

5.1.8 Magnesium

Magnesium is an essential element for human being, it is important for normal bone structure in the body. Water with high levels of magnesium or calcium is considered as hard and is undesirable for domestic purposes. In the study area magnesium concentration ranges from 3.64-132.46 mg/L for ground water and 2.43-107.51 mg/L for surface water during dry season whereas during wet season

these values ranged from 1.72-50.75 mg/L for ground water and 0.90-62.02 mg/L for surface water. Both the highest calcium and magnesium concentrations exceed the permissible limit as prescribed by GOB 2022 for the same water sample in the study area.

5.1.9 Phosphate

Phosphate is a common constituent of agricultural fertilizers, manure, and organic wastes in sewage and industrial effluent. It is an essential element for plant life, but when there is too much of it in water, it can speed up eutrophication (a reduction in dissolved oxygen in water bodies caused by an increase of mineral and organic nutrients) of rivers and lakes. Soil erosion is a major contributor of Phosphate to streams. Bank erosion occurring during floods can transport a lot of Phosphate from the river banks and adjacent land into a stream, lake, or other water body. In the study area magnesium concentration ranges from 0.02-31.05 mg/L for ground water and 0.62-1.40 mg/L for surface water during dry season whereas during wet season these values ranged from 0.02-11.59 mg/L for ground water and 0.01-0.61 mg/L for surface water.

5.1.10 Arsenic

Arsenic occurs naturally as a trace component in many rocks and sediments. Whether the arsenic is released from these geologic sources into groundwater depends on the chemical form of the arsenic, the geochemical conditions in the aquifer, and the biogeochemical processes that occur. Arsenic also can be released into groundwater as a result of human activities, such as mining, and from its various uses in industry, in animal feed, as a wood preservative, and as a pesticide. In drinking-water supplies, arsenic poses a problem because it is toxic at low levels and is a known carcinogen. In present study arsenic concentration has been found in two water samples with one sample (0.1 mg/L) cross the permissible limit as prescribed by GOB 2022 during dry season and the other collected water samples show zero concentration of arsenic.

5.2 Water Quality Index (WQI)

Water quality index is one of the most successful tools to represent information on the quality of streams, lakes or any water body (Patil & Dandge, 2021). WQI is a scientific equation used to transform large number of water quality data into a single number which is easily understandable to lay man (Tyagi & Sharma, 2014). It serves the understanding of water quality issues by integrating complex data and generating a score that describes water quality status (Reza & Singh, 2010) WQI value is computed for the suitability of surface and groundwater for domestic uses human (Ravikumar, 2011).

To evaluate water suitability for drinking purposes water quality index of the study area was calculated using different water quality parameters during dry season of 2022. For the present investigation, calculated WQI values are classified into four types as shown in Table 25. Also the water quality index range of the study area is shown in Table 29 and Table 30 for dry and wet seasons respectively.

The water quality index data of the present study revealed that, only 1% water sources were of good quality and other 99% not good with a significant portion of water sources poor or very poor for drinking purpose during dry season and there were no good quality of water sources in wet season as given in Table 26. The high WQI values in water samples were principally due to the occurrence of extremely higher values of E.Coli which is very alarming. The higher concentration of water quality parameters like nitrate, electrical conductivity and chloride also accountable for high WQI values in the study area.

Table 25: Water classification based on Water Quality Index

WQI Value	Category	Water Quality
<2000	4	Good water
2000-4000	3	Poor water
4000-6000	2	Very poor water
>6000	1	Water unsuitable for drinking

Table 26: Water quality index range of the study area (Dry Season)

Water Quality	Area (Sq.km)			Area (%)		
	Khulna	Bagerhat	Satkhira	Khulna	Bagerhat	Satkhira
Good water	0.00	0.04	0.00	0.00	0.005	0.00
Poor water	275.97	188.44	90.98	39.14	26.73	12.90
Very poor water	80.18	2.25	67.87	11.37	0.32	9.63
Total	356.15	190.73	158.85	50.51	27.06	22.53

Table 27: Water quality index range of the study area (Wet Season)

Water Quality	Area (Sq.km)			Area (%)		
	Khulna	Bagerhat	Satkhira	Khulna	Bagerhat	Satkhira
Poor water	218.04	160.86	123.93	30.90	22.79	17.56
Very poor water	138.11	29.87	34.92	19.57	4.23	4.95
Total	356.15	190.73	158.85	50.51	27.06	22.53

Table 28: Percentage of water sources based on water quality

Water Quality	% of Water Sources (Dry Season)			% of Water Sources (Wet Season)		
	Khulna	Bagerhat	Satkhira	Satkhira	Bagerhat	Satkhira
Good water	0	1	0	0	0	0
Poor water	43	24	13	39	21	16
Very poor water	7	3	9	11	7	6
Total	50	28	22	50	28	22

Figure 11, 12 and 13 show the spatial distribution of WQI in the study area, based on Kriging interpolation technique. In Table 26 and 27 the Water quality index range of the study area of Wet Season and dry season are presented after the analysis. Whereas table 28 represents the water sources based on water quality. The spatial maps depicted that all part of the study area falls under the category of “Poor water” and “Very poor water” except few villages of Bagerhat district which falls under the category of “Good water” during dry season and there were no good quality of water sources in wet season. These are due to the sources situated very close to latrine or directly connected to on site sanitation systems. Also some ponds in Bagerhat district were found very much unprotected due to daily activities of surrounding population and animals. The study reveals that the drinking water quality was better during the dry season, as compared to that of wet season for Khulna and Bagerhat districts. On the other hand for Satkhira district the drinking water quality was better during the wet season, as compared to that of dry season. These are because of people of Khulna and Bagerhat districts mainly depend on surface water as pond, PSF and RWH etc. and people of Satkhira district mainly depend on ground water as tubewell. And in the wet season the possibility of contamination from various sources of surface water are relatively high than dry season. Figure 14 of the next chapter shows the overall water security for study area at a glance.

Table 29 (a): Statistical analysis of physico-chemical water quality parameters for ground water

Parameter	Standards GOB (2022)	Minimum		Maximum		Mean		Standard Deviation	
		Dry S.	Wet S.	Dry S.	Wet S.	Dry S.	Wet S.	Dry S.	Wet S.
pH	6.5-8.5	5.93	6.87	8.23	8.2	7.33	7.51	0.62	0.38
EC (mS/cm)	0.4	0.27	0.88	15.02	14.96	4.86	4.27	3.97	3.76
Total Coliform (cfu/100ml)	0	135	90	45530	4068	3186	1004	8326	803
Faecal Coliform (cfu/100ml)	0	13	20	2304	1687	642	531	584	526
Sulfate (mg/L)	250	5.88	0.09	26.37	1.27	12.65	0.50	2.83	0.43
Chloride (mg/L)	250	49.63	48.41	1382	1310	364.8	383.5	352.8	346.5
Nitrate (mg/L)	45	0.06	0.00	35.32	6.90	5.67	0.76	9.35	1.46
Calcium (mg/L)	75	12.02	2.46	130.2	56.04	39.14	16.93	28.19	12.96
Magnesium (mg/L)	30-35	3.64	1.72	132.46	50.75	39.03	16.31	29.72	12.48
Phosphate (mg/L)	0.1	0.02	0.02	31.05	11.59	3.72	0.90	6.97	2.08
Arsenic (mg/L)	0.05	0	0	0.1	0	0.00	0	0.01	0

Table 29 (b): Statistical analysis of physico-chemical water quality parameters for surface water

Parameter	Standards GOB (2022)	Minimum		Maximum`		Mean		Standard Deviation	
		Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season
pH	6.5-8.5	5.44	6.7	9.12	8.23	7.25	7.42	0.58	0.42
EC (mS/cm)	0.4	0.1	0.28	11.83	8.88	0.89	2.24	1.67	1.53
Total Coli (cfu/100ml)	0	40	34	57000	11800	5185	1813	11510	2705
Fical Coli (cfu/100ml)	0	10	6	3540	10010	422	809	486	1839
Sulfate (mg/L)	250	5.02	0.06	98.93	2.09	27.93	0.74	22.14	0.60
Chloride (mg/L)	250	10.63	12.88	439.58	510.2	74.75	107.83	90.10	106.13
Nitrate (mg/L)	45	0.06	0.01	4.22	1.09	0.95	0.27	0.81	0.32
Calcium (mg/L)	75	10.63	12.88	439.58	510.2	74.75	107.82	90.10	106.12
Magnesium (mg/L)	30-35	2.43	0.90	107.51	62.02	18.59	9.16	16.47	9.68
Phosphate (mg/L)	0.1	0.62	0.01	1.40	0.61	0.48	0.16	0.31	0.13
Arsenic (mg/L)	0.05	0	0	0	0	0	0	0	0

Table 30(a): Correlation matrix between water quality parameters for Dry Season

	pH	TC	FC	EC	Ca	Mg	Cl-	Arsenic	SO ₄ ²⁻	PO ₄ ³⁻	Nitrate
pH	1										
TC	0.09501	1									
FC	0.149065	0.417488	1								
EC (mS)	0.142599	-0.00685	0.212704	1							
Ca(mg/L)	0.129438	0.008761	0.113136	0.554782	1						
Mg(mg/L)	0.146707	-0.03956	0.10113	0.679993	0.648779	1					
Cl- (mg/L)	0.256388	-0.01508	0.093706	0.707349	0.467454	0.589721	1				
Arsenic (mg/L)	0.117231	-0.02105	0.015945	0.342059	-0.00908	-0.02328	0.314224	1			
SO₄²⁻ (mg/L)	0.079488	0.258827	-0.0371	-0.09033	0.175821	0.084743	-0.1424	-0.08463	1		
PO₄³⁻ (mg/L)	0.017755	-0.00951	0.158009	0.579883	0.29595	0.217807	0.356757	0.100131	-0.14263	1	
Nitrate(mg/L)	-0.00348	0.025542	0.269112	0.396824	0.215688	0.136971	0.227453	0.104348	-0.17316	0.582457	1

Table 30(b): Correlation matrix between water quality parameters for Wet Season

	pH	TC	FC	EC	Ca	Mg	Cl-	Arsenic	SO ₄ ²⁻	PO ₄ ³⁻	Nitrate
pH	1										
TC	0.043001	1									
FC	0.103415	0.790789	1								
EC	0.082107	-0.03595	0.034928	1							
Ca	0.017851	0.058878	0.100996	0.485936	1						
Mg	0.036351	0.002481	-0.00408	0.580198	0.630263	1					
Cl-	0.018641	0.005059	-0.03607	0.562735	0.524635	0.514639	1				
Arsenic	0	0	0	0	0	0	0	1			
SO₄²⁻	0.020528	0.001093	-0.09697	0.005962	0.101204	0.099341	-0.04187	0	1		
PO₄³⁻	-0.07002	-0.07107	-0.06007	-0.09405	-0.04212	0.033873	-0.06069	0	-0.08432	1	
Nitrate	0.019023	-0.04023	-0.08071	-0.07166	0.01402	0.028849	0.112168	0	-0.04707	-0.02119	1

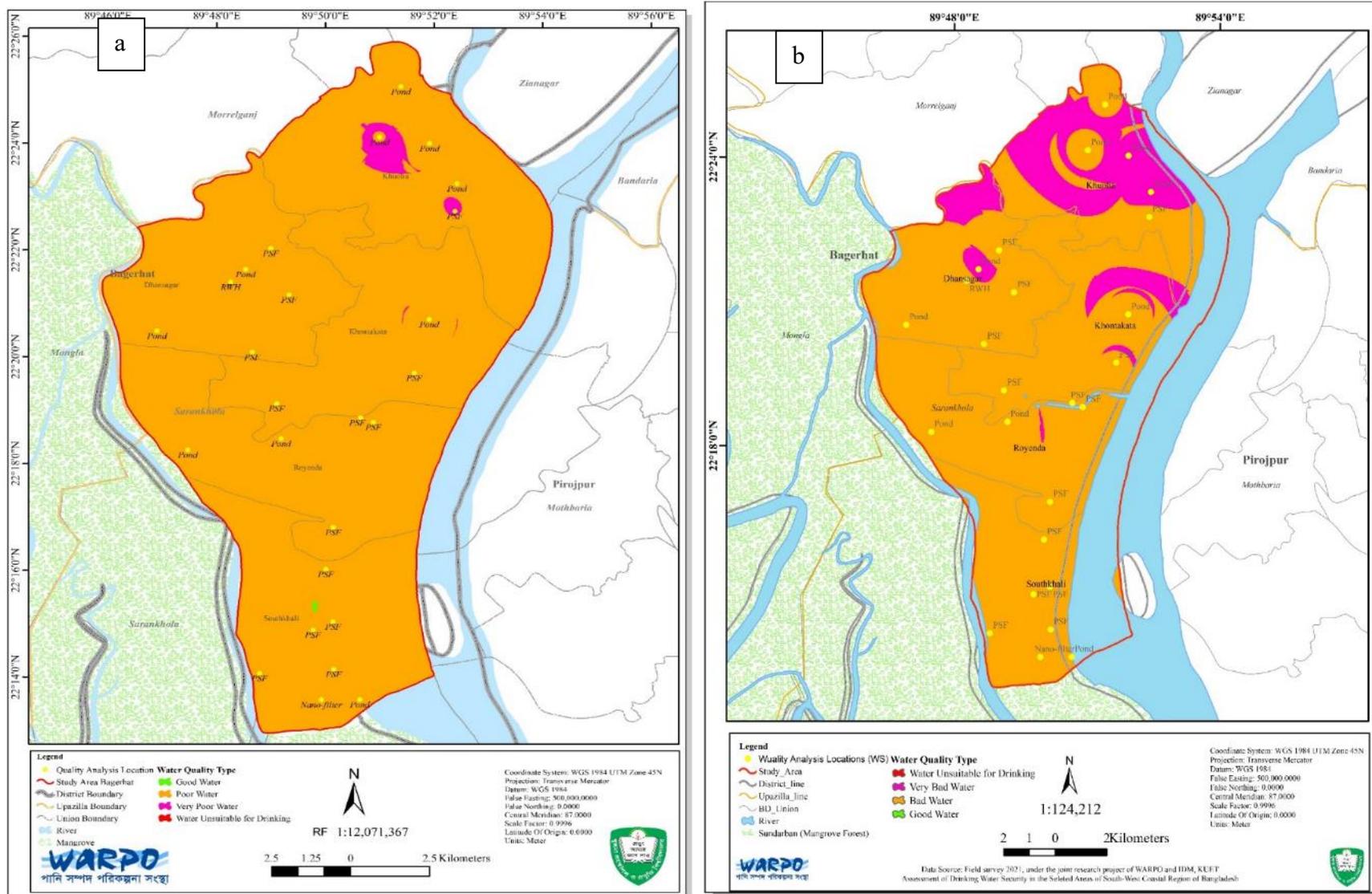


Figure 11: Spatial distribution of WQI during (a) dry season and (b) wet season for Bagerhat area.

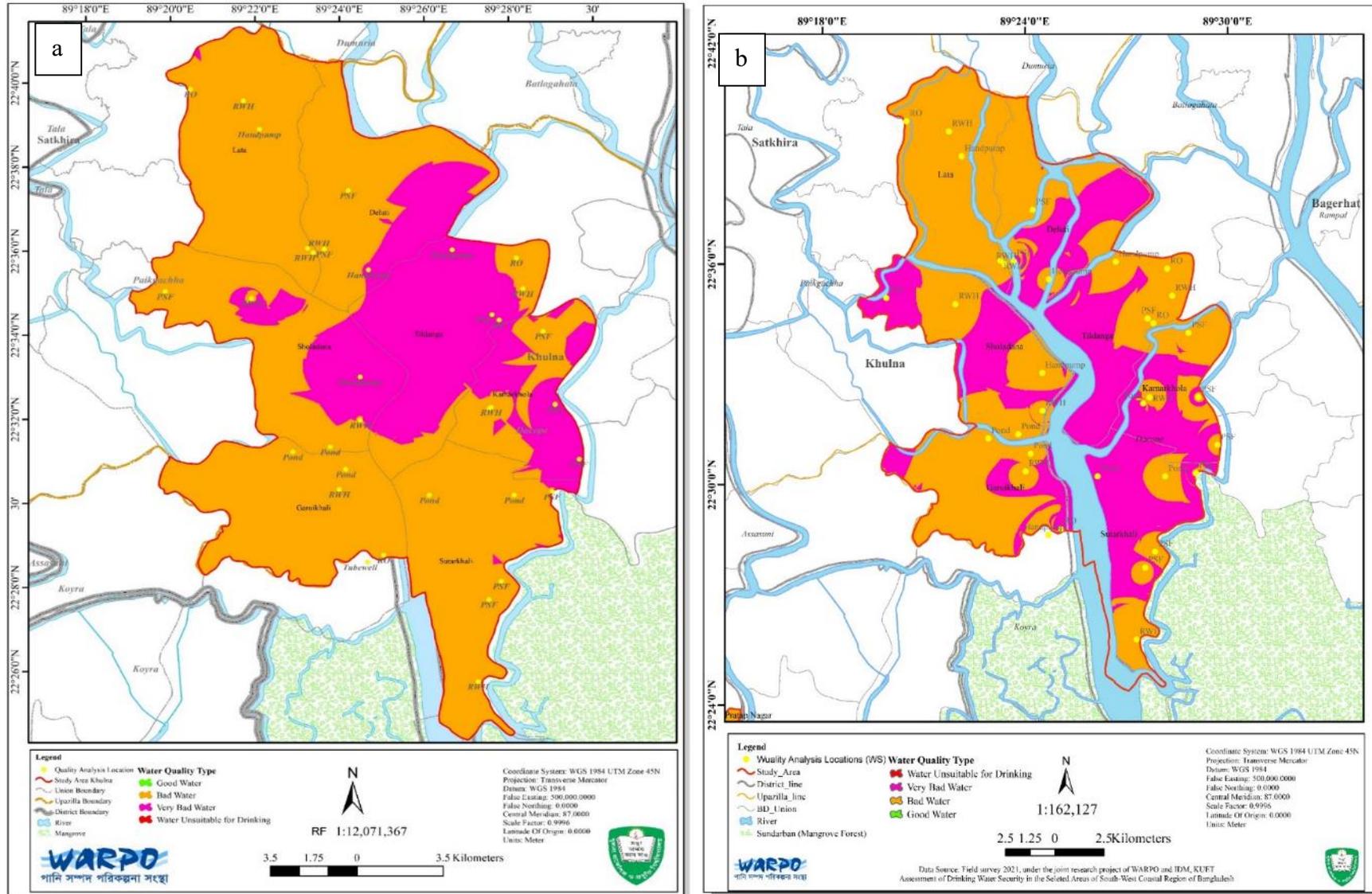


Figure 12: Spatial distribution of WQI during (a) dry season and (b) wet season for Khulna area.

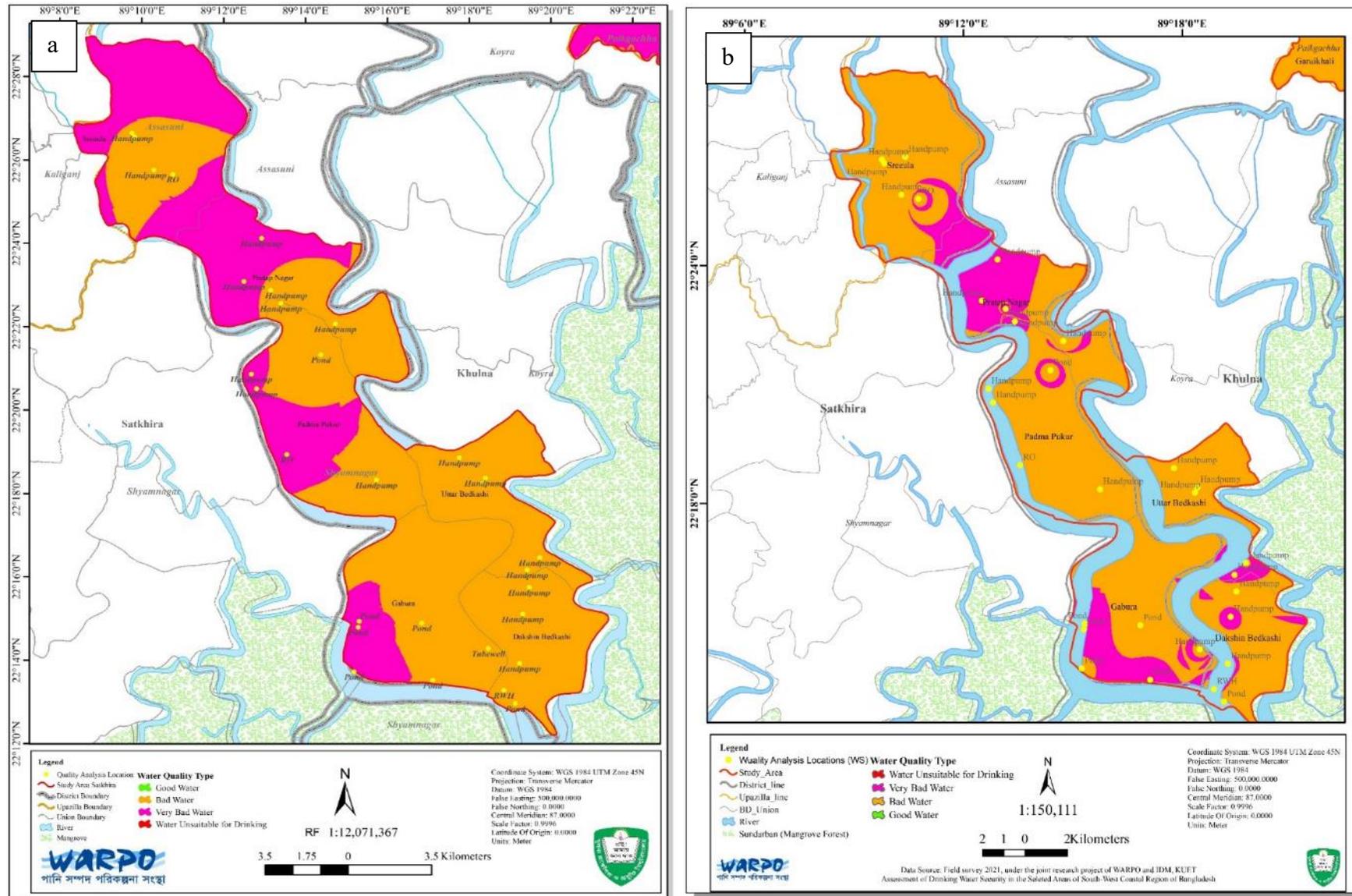


Figure 13: Spatial distribution of WQI during (a) dry season and (b) wet season for Satkhira area.

Chapter Six
OVERALL WATER SECURITY OF THE STUDY AREA

Chapter Six OVERALL WATER SECURITY OF THE STUDY AREA

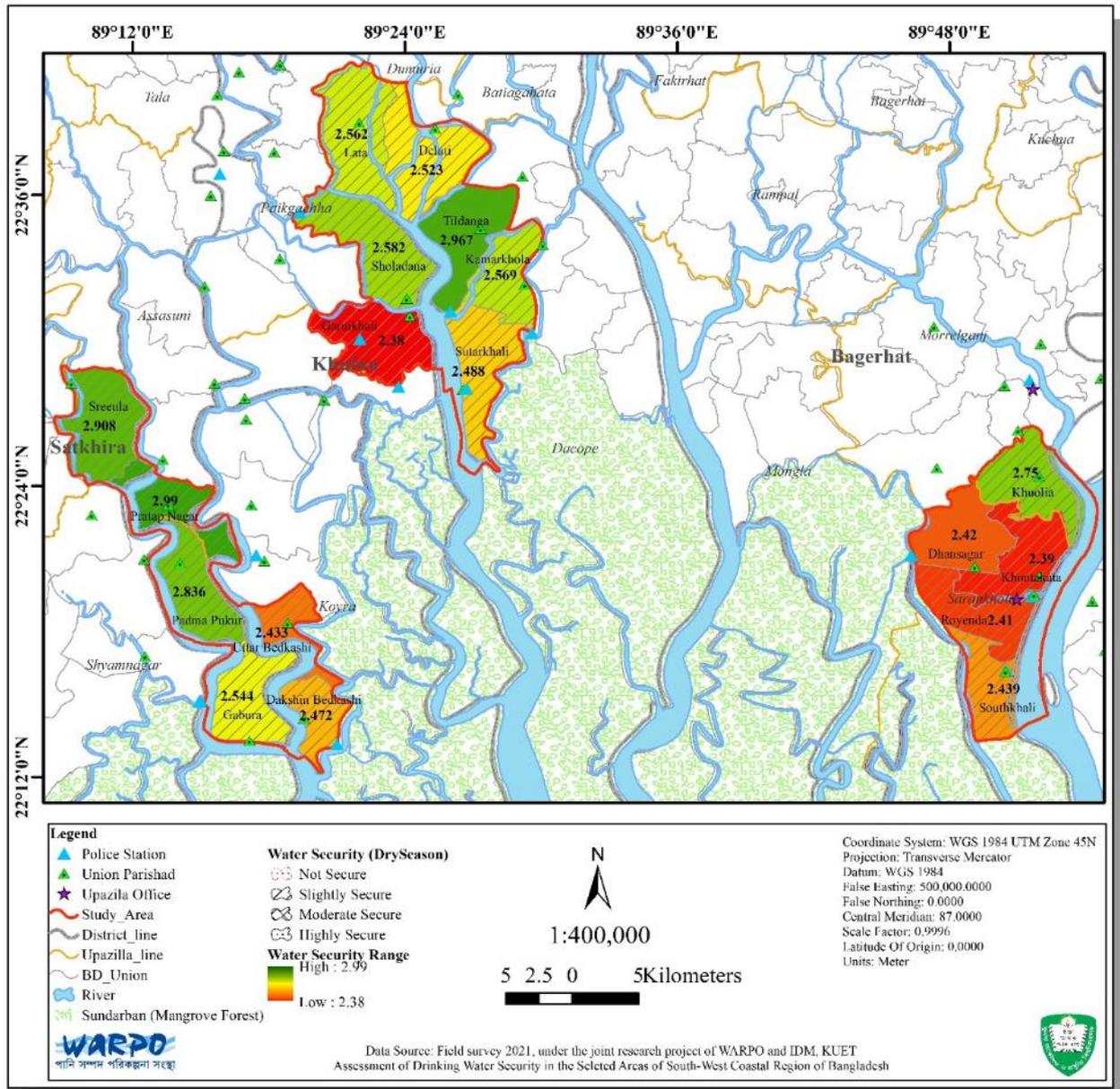


Figure 14: Overall water security for dry season of the study area.

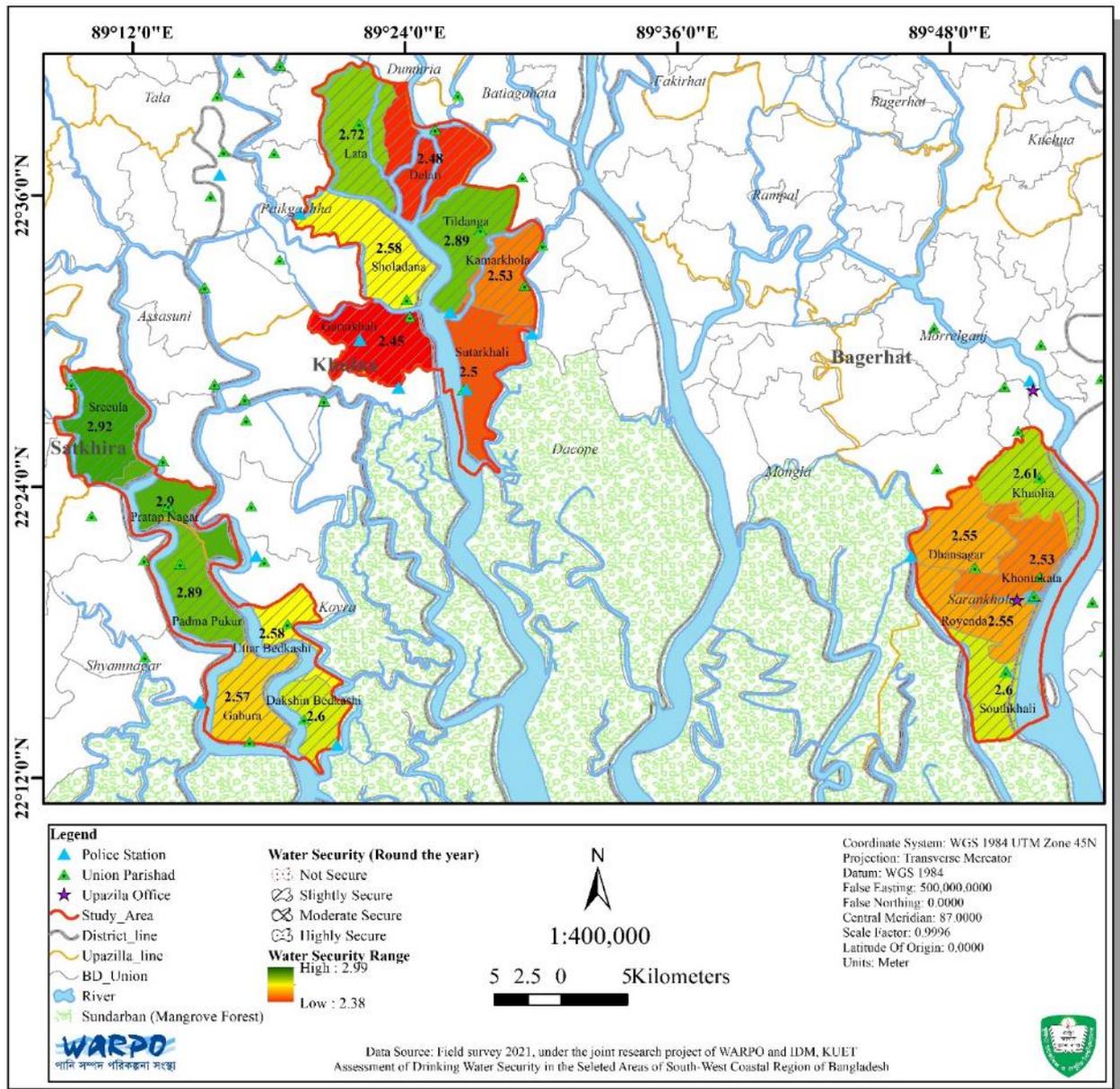


Figure 15: Overall water security for wet season of the study area.

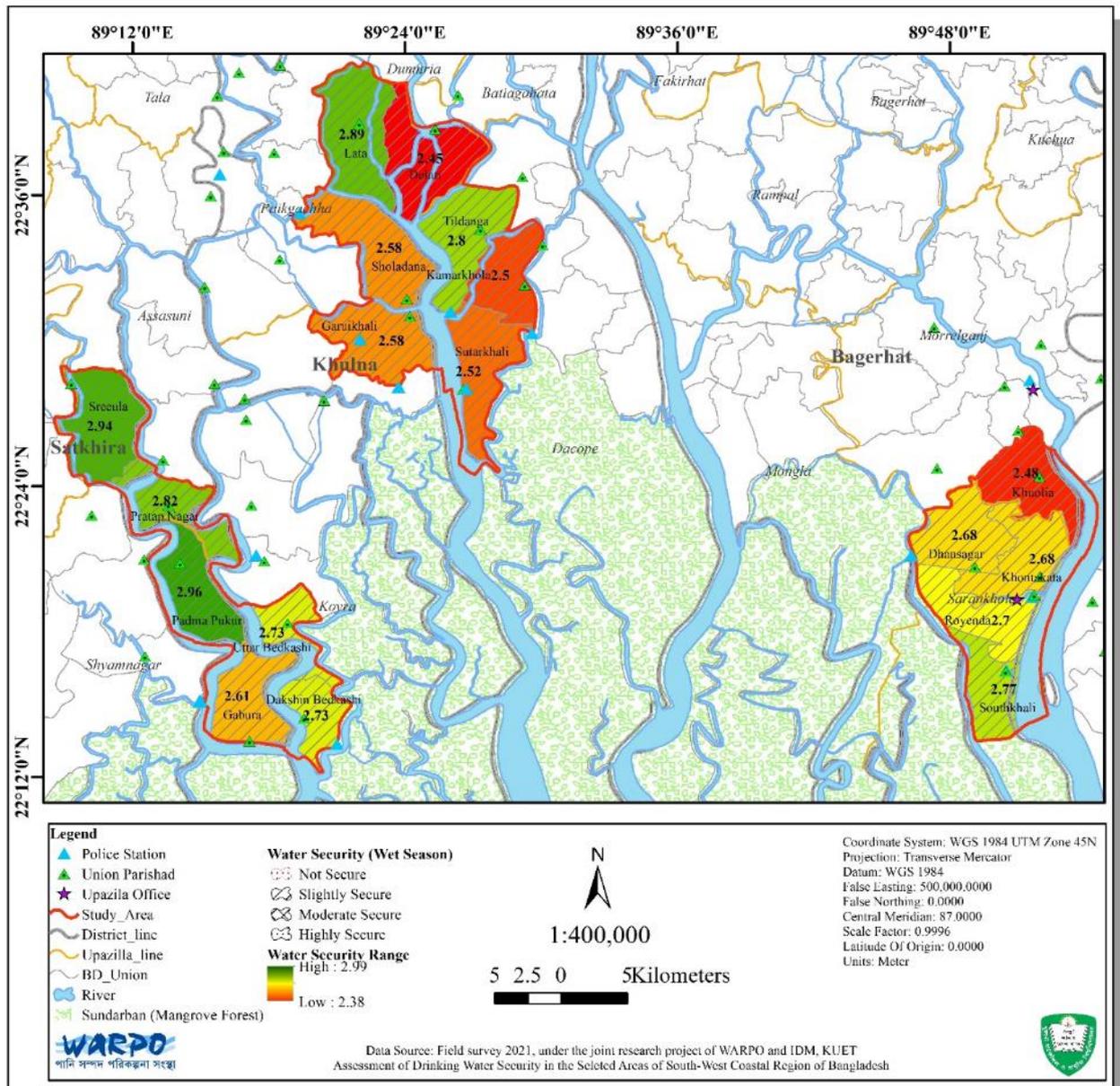


Figure 16: Overall water security for round the year of the study area.

- Overall water security condition in 18 disaster hotspots in the South-west coastal region in poor to very poor.
- However, in comparison, Satkhira has better water security with an average score of 2.82 whereas Khulna and Bagerhat have scores of 2.55 and 2.48 respectively.

Chapter Seven
DEVELOPMENT OF ANDROID MOBILE
APPLICATION- WATAPP

Chapter Seven

DEVELOPMENT OF ANDROID MOBILE APPLICATION-WATapp

7.0 General Information

WATapp is a mobile application which is developed to get information regarding the drinking water availability, accessibility and quality situation. It is available in Google Play Store. It contains the outputs of the current study. The application is designed as a decision making tool that will provide an instant overview of the water security situation of Khulna, Satkhira and Bagerhat Districts of south-western Bangladesh.

7.1 Developing Components of the Application

The application has been developed by the following tools and technologies

- Geo Processing Tools
- Hosting Technologies
- Application Development Tools and Technologies

Geo Processing Tools will discuss the tools used to create maps from collected data.

Hosting Technologies section will provide a short overview of every technology used to host our database and other servers.

Application Development Tools and Technologies section will provide a short introduction of those languages and tools what we used to create our app.

7.2 Geo Processing Tools

Geoprocessing is a framework and collection of tools used to handle geographical and related data. The entire array of geoprocessing tools may be used to undertake spatial analysis or automate the management of GIS data. In our application we used different tools for process our data.

7.2.1 GIS Mapping Software

GIS software lets us produce maps and other graphic displays of geographic information for analysis and presentation. With these capabilities a GIS is a valuable tool to visualize spatial data.

A GIS stores data on geographical features and their characteristics. Geographic Information Systems store information using spatial indices that make it possible to identify the features located in any arbitrary region of a map

7.2.2 PostgreSQL

PostgreSQL is a robust, open-source object-relational database system that uses and extends the SQL language and has several capabilities for safely storing and scaling the most complex data demands.

PostgreSQL includes several capabilities designed to assist developers in building applications, and administrators in protecting data integrity and building fault-tolerant settings, and we can manage our data regardless of how large or small the dataset. PostgreSQL is very extendable in addition to being free and open source.

7.2.3 PostGIS

PostGIS is a PostgreSQL object-relational database system plugin that supports the storage of GIS (Geographic Information Systems) objects in the database. PostGIS contains utilities for analyzing and processing GIS objects, as well as support for GIST-based R-Tree spatial indexes.

7.2.4 Geo-Server

GeoServer is a Java-based server for viewing and editing geographical data. GeoServer provides tremendous freedom in map generation and data sharing by utilizing open standards established by the Open Geospatial Consortium (OGC).

GeoServer data may be seen in a variety of popular mapping apps, including Google Maps, Google Earth, Microsoft Bing Maps, and MapBox. GeoServer may also communicate with standard GIS systems such as ESRI ArcGIS. is a PostgreSQL object-relational database system plugin that supports the storage of GIS (Geographic Information Systems) objects in the database. PostGIS contains utilities for analyzing and processing GIS objects, as well as support for GiST-based R-Tree spatial indexes.

7.3 Hosting Technologies

Following Technology is used to host our PostgreSQL database and Geo Server in online.

- Virtual Private Server (VPS)

7.3.1 Virtual Private Server (VPS)

A virtual private server (VPS), also called a virtual dedicated server (VDS), is a virtual server that appears to the user as a dedicated server, but that is actually installed on a virtual computer here for our application we used Linux CentOS 7 VPS server.

7.4 Development Tools and Technologies

The following technologies are used to develop our application.

- JAVA
- JavaScript
- Openlayers

7.4.1 JAVA

Java is a high-level, class-based, object-oriented programming language with a low number of implementation dependencies. It is a general-purpose programming language designed to allow programmers to write once and execute anywhere, which means that generated Java code may run on any platform that supports Java without the need for recompilation. The Android platform enables developers to manage and control Android devices by writing managed programs in Java.

7.4.2 JavaScript

JavaScript (JS) is a lightweight, interpreted, object-oriented programming language with first-class functions. It is best known as a scripting language for Web pages, although it is also used in many non-browser applications. It is a multi-paradigm, prototype-based scripting language that supports object-oriented, imperative, and functional programming techniques.

7.4.3 OpenLayers

OpenLayers is an open-source JavaScript toolkit for presenting map data in web browsers as slippy maps. It provides an API for developing powerful web-based geospatial apps akin to Google Maps and Bing Maps.

OpenLayers supports GeoRSS, KML (Keyhole Markup Language), Geography Markup Language (GML), GeoJSON, and map data from any source utilizing OGC-standards such as Web Map Service (WMS) or Web Feature Service (WFS).

Chapter Eight

CONCLUSION AND RECOMMENDATION

Chapter Eight

CONCLUSION AND RECOMMENDATION

8.1 Conclusion

The research project has identified the challenges related to drinking water security in southwestern coastal zone of Bangladesh. To evaluate the overall drinking water situation, the study has determined the availability of it to the local inhabitants, assessed its accessibility to the individuals, and analyzed the quality of it. The research has used an indexing method to represent the findings of the study at the union, upazila, and district level. Spatial analyses were also completed in order to create drinking water availability, accessibility, quality and overall water security map. And at the final stage of the project work an application (WATAPP) for Android mobile devices has been developed. This application will be a quick source of information related to drinking water situation for the local decision makers along with the national policy makers.

The AAAQ model is used to assess the drinking water situation of the study area. In the aspect of availability, result shows that majority of the households collect water from private sources followed by the Government and non-government sources. Overall water availability condition seems to be better in Khulna than Bagerhat and Satkhira District. In terms of accessibility, the findings indicate that the majority of families gather water from sources more than 100 meters away, which is twice the national standard for Bangladesh. Overall water accessibility condition seems households of Satkhira district have higher access to the source than Khulna and Bagerhat district. According to the findings of drinking water quality, only 1% water sources were of good quality and other 99% not good with a significant portion of water sources poor or very poor for drinking purpose during dry season due to occurrence of extremely higher values of E.Coli in the source. Over all water quality shows that Bagerhat district was relatively better than Khulna and Satkhira during dry season. The Overall water security condition in 18 disaster hotspots in the South-west coastal region in poor to very poor. However, in comparison, Satkhira has better water security with an average score of 2.82 whereas Khulna and Bagerhat have scores of 2.55 and 2.48 respectively. Surprisingly, the acceptability of the drinking water quality to the local inhabitants was found satisfactory. This is due to their habituations to taking this water for long.

The application (WATAPP) is designed as a decision making tool that will provide an instant overview of the water security situation of Khulna, Satkhira and Bagerhat districts of south-western Bangladesh. The output of the project work will help the policy makers and they can obtain a baseline for effective planning and execution with priority-based planning.

New policy interventions should emphasize on implementation of some new sources of potable water because 42% households claimed that they faces water scarcity for 3 to 4 months in dry season and 33% household's houses located more than 500m far from the water collection sources and 55% household require more than 15 minutes for travelling to collect water. Road condition needs to be taken care of in order to insure water accessibility because 50% household use fully kutchra road for fetching water.

For the future course of action, some adaptation and transformation mechanisms could be under taken based on the outputs of the research. For this purpose, all the rest of the unions should be taken under consideration of these three districts for analysis. In addition, to have a dynamic baseline of drinking water, the study could be replicated for all over the country. Through the mobile application all the data and information could be utilized by the policy makers and marginal people. The database can also be used as a baseline for any future study related to drinking water. The 1st version of the mobile application should be further developed to make it more user friendly.

8.2 Recommendation

- Government could take initiative through local administration to create more sources of drinking water for round the year
- PSF is a better option where ground water is not drinkable. However, the attached pond should be adequately protected.
- A long term plan could be taken to have a centralized drinking water supply in the study area
- There should have a plan from local government/DPHE regarding the installation of RO plants as it has some environmental impacts.
- The RO plants should be operated in a more environmentally concerned manner. The concentrated water should be disposed off in a safe zone where agricultural production will not be hampered.
- The used filters should be disposed off properly or could be returned to the suppliers for better management.
- An awareness development program could be taken for the local inhabitants regarding potable water
- The potable water sources should be ensured within the standard distance (500 m)
- To maintain the drinking water quality at an acceptable level, the surroundings of any source should be clean enough and monitored properly *i.e.* restriction on movement of cattle and poultry
- WATapp should be updated at a regular basis, so that it could be used for any decision making related to drinking water in the study area
- The outputs should be used for any further study or policy making on drinking water of the study area
- An database should be produced for the whole country as a baseline information

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Appendix

APPENDICES

APPENDIX-A: Questionnaire

Questionnaire Survey
(For research purpose only)
“Water Security Assessment in South-West Coastal Region of Bangladesh”
Institute of Disaster Management (IDM)
Khulna University of Engineering & Technology (KUET)

Surveyor will introduce himself/herself and communicate the following message before the survey to get informed consent of the respondent.

Hello! My name is _____ and I am currently working for IDM-KUET to conduct this survey. The purpose of this survey is to analyse the present situation of the water security in the south-west coastal region. The information will be used by IDM-KUET and WARPO for research purposes only. You have been selected by chance to participate in this survey. Your participation is completely voluntary and your response will be kept completely confidential. Anytime you may discontinue the survey if you want so.

IDENTIFICATION INFORMATION

Questionnaire ID:	<input type="text"/>	<input type="text"/>	<input type="text"/>	Latitude	Longitude

Village	Union	Thana	District

SECTION 01: DEMOGRAPHIC AND SOCIO-ECONOMIC INFORMATION

101. Name of the respondent	102. Sex ¹	103. Age	104. Religion ²	105. No. of family member	106. No. of earning member	107. Occupation: Main Earning Member	108. Occupation: 2 nd earning member	109. Occupation: 3 rd earning member

110. Average monthly household income	111. Total owned land	112. Total leased (taken) land

¹ Sex 1=Male, 2=Female

² Religion 1= Islam, 2= Hindu, 3= Christian, 4= Buddhist, 5= Others

SECTION 02: WATER AVAILABILITY

[Code: 1= Hand Pump, 2= Pond, 3= River, 4= Rain Water Harvesting (RWH), 5= Reverse Osmosis (RO), 6= Managed Aquifer Recharge (MAR), 7= Pond Sand Filter (PSF), 8= Others]

113.	Which of the above sources of drinking water are available in your locality? (use code) (<i>Multiple responses are possible</i>)	
114.	Who is the owner of the Source? (<i>Multiple responses are possible</i>) (Code: 1=Private, 2= Government, 3=NGO)	Hand Pump
		Pond
		River
		RWH
		RO
		MAR
		PSF
	Others	

115.	Which of the above sources of drinking water does your household use? (<i>Multiple responses are possible</i>)		
116.	What is your main source of water in Dry Season (Oct-Mar)? (<i>Multiple responses</i>)		
117.	What is your main source of water in Wet Season (April -September)?		
118.	Which months do you face scarcity?	Dry Season	Wet Season
119.	Who fetches water most often? (<i>Multiple Response are possible</i>) [Code: 1= Adult male, 2= Adult Female, 3= Male child, 4= Female child, 5=Elderly, 6=Outside the family, 7= Others]		

120.	In which time of the day drinking water is collected? (<i>Multiple Response are possible</i>) [Code= Early Morning, 2= Noon, 3= Afternoon, 4= Evening, 5=Night, 6=Others]	
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121.	How much drinking water your family members collect/ purchase?	½ Pot (< 5 Litre)	Per day		Per week	
		1 Pot (< 10 Litre)	Per day		Per week	
		2 Pot (< 20 Litre)	Per day		Per week	
		3 pot (<30 Litre)	Per day		Per week	
		4 Pot (<40 Litre)	Per day		Per week	
		Others()	Per day		Per week	

122.	In which mode you received/ Intake water? (x/√)	No transportation needed	
		Purchased from supplier (<i>Escape Q. 123,124</i>)	
		Transported from cost-free source (<i>Escape Q. 125, 126</i>)	

123.	What is the mode of transporting water (if applicable) from the main source to the house? (<i>Multiple Response are possible</i>) [Code: 1= Walk, 2= Bicycle, 3= Rickshaw, 4=Van, 5=Truck, 6= Boat, 7=Others]				
124.	What is the cost for transporting from source?	Per Day		Perweek	
125.	What is the purchase cost?	Per Day		Per week	
126.	What is the cost for purifying?	Per Day		Per week	
127.	What is the cost for maintaining source?	Per Day		Per week	

SECTION 03: WATER ACCESSIBILITY

128.	What yourfamily members think about their ability to bear the cost of drinking water?	Capable	
		Notcapable	
129.	What is the distance (in Kilometer) of the main source from the house?		
130.	A) What is the pathway (if applicable) to go to the main source of drinking water?	Formal Road	Kutchha
			Pucca
		No pathway	
	B) What is the condition of the pathway (if applicable) used for transporting water? (use code) [Code: 1=Very Bad, 2= Bad, 3= Moderate, 4= Good, 5= Very Good]		
131.	A) Time required to go to the source (in minute)		
	B) Queuing/ Waiting time(in minute)		
	C) Time required to come back from the source(in minute)		
132.	A) Is there any time restriction for collecting water? [Code: 1=Yes, 0= No]		
	B) If yes, which time (range) of the day is restricted?		
133.	Do the household member(s) ever face any problem* while collecting water? <i>(Multiple Response are possible)</i> [Code: 1= Never, 2=Injury, 3=Physical stress, 4=Mental stress, 5=Other (specify)] *Resulting from carrying heavy loads or bad condition of pathway		
134.	Do the household member(s) face any kind of violence while collecting water? <i>(Multiple Response are possible)</i> [Code: 1= No Violence, 2= Sexual Harassment, 3= Physical Assault, 4= Verbal Violence, 5= Thievery, 6=Other (specify)]		
135.	A) Do the household member(s) face any unjust or prejudicial treatment ³ especially on the grounds of religion, race, sex, occupation, social status, or economic status while collecting water? <i>(Multiple Response are possible)</i>		

³ Treatment 1=Equal treatment, 2=Gender discrimination, 3= Religious discrimination, 4= Racial discrimination, 5= Occupational discrimination, 6= Economic discrimination, 7= Discrimination due to unequal social status

SECTION 04: WATER QUALITY

136.	Are you satisfied with the quality of drinking water? [Code: 1=Yes, 0= No]	
137.	A) Have you or members of your household suffered (or suffering) from bad water quality? [Code: 1=Yes, 0= No]	
	B) If yes, what diseases ⁴ have you suffered from?	
138.	Where, do you think, highest drinking water quality is found? [Code: 1= Hand Pump, 2= Pond, 3= River, 4= Rain Water Harvesting (RWH), 5= Reverse Osmosis (RO), 6= Managed Aquifer Recharge (MAR), 7= Pond Sand Filter (PSF), 8= Others]	

139.	Which months do you think maximum water quality found? <i>(Multiple Response are possible)</i>	Dry Season (Oct-Mar)	Wet Season (Apr-Sep)

140.	A) Do your drinking water sources have the following? [Code: 1=Yes, 0=No]	Bad Taste	Odour	Color
	B) If yes, what are the sources? [Code: 1= Hand Pump, 2= Pond, 3= River, 4= Rain Water Harvesting (RWH), 5= Reverse Osmosis (RO), 6= Managed Aquifer Recharge (MAR), 7= Pond Sand Filter (PSF), 8= Others]			
	C) If yes, what is the level? [Code: 1=Acceptable limit, 2=Slightly extreme, 3=Extreme, 4=Very extreme, 5=Unacceptable]			

141.	If drinking water quality is not acceptable, what is the main cause? <i>(Multiple Response are possible)</i> [Code: 1=Bathing, 2=Washing, 3=Cattle bathing, 4=Fishing, 5=Outlet of toilet/latrine, 6=Other (specify)]	
142.	How would you grade the quality of your drinking water from the main source? [Code: 1= Good, 2= Moderately Good, 3= Moderately Bad, 4= Bad, 5=Unacceptable]	

143.	Compared to 15 years ago, have there been any changes in the quality of your drinking water from the SAME source? (use ×/√)		2005	2010	2020
		1=Improved to a Great Extent			
		2=Improved to Some Extent			
		3=Stayed the Same			
		4=Worsened to Some Extent			
		5=Worsened to a Great Extent			
	6=Didn't use this Source Before				

144.	A) Does your household treat drinking water to make it safer to drink? [Code: 1=Yes, 0=No]	
	B) If no, why don't you treat water? (use ×/√)	1=Water is Safe to Drink
		2=Water is Unsafe, but I Don't Think It
		3=Too Expensive
		4=No Knowledge of Treatment Options
		5=Not Enough Time
	6=Unavailability of Treatment Technologies	

⁴ Diseases 1=Cholera, 2=Dysentery, 3= Typhoid, 4=Hypertension, 5=Skin rash, 6=Other (specify)

		7=Other (Specify)	
	C) If yes, what does your household do to make water safer to drink? (use x/√)	1=Boil the Water	
		2=Add Bleach/Chlorine	
		3=Sieve It Through Cloth	
		4=Water Filtering Device	
		5=Other Filter (Ceramic, Sand, Composite)	
		6=Let It Stand And Settle	
		7=Other (Specify)	
145.	Does your household have a water storage container for storing drinking water? [Code: 1=Yes, 0=No]		
	B) If yes, what is the capacity of storage container? [Code: 1=< 5 Litre, 2= <10 Litre, 3=<20 Litre, 4=<30 Litre, 5=<40 Litre, 6=Others (specify)]		
146.	How often does your household usually clean the drinking water storage container? [Code: 1=Several times per week, 2=Once a week, 3=Once a month, 4=Once every three months, 5=Once every six months, 6=Less often than half yearly]		
147.	Do your source of drinking water are saline?[Code: 1=Yes, 0=No]		
148.	What do you think about the source of saline water? <i>(Multiple Response are possible)</i> [Code: 1= Cyclone, 2= Natural flood, 3= Embankment failure, 4= Excessive extraction of ground water, 5=Shrimp/Crab farming, 6=Other(specify)]		
149.	Phone Number:		

Name and Signature of the Surveyor:

Date:

Thank you very much

APPENDIX-B1: Scale Wise Distribution (Bagerhat)

Scale wise distribution of households under different indicators of availability for Bagerhat District

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
Ownership				
1.00	87	25.4	25.4	25.4
2.00	16	4.7	4.7	30.1
3.00	24	7.0	7.0	37.1
4.00	215	62.9	62.9	100.0
Available Source in Dry Season				
1.00	275	80.4	80.4	80.4
2.00	66	19.3	19.3	99.7
3.00	1	.3	.3	100.0
4.00	0	0	0	100.0
Available Source in Wet Season				
1.00	155	45.3	45.3	45.3
2.00	157	45.9	45.9	91.2
3.00	30	8.8	8.8	100.0
4.00	0	0	0	100.0
Demand Source Ratio				
1.00	174	50.9	50.9	50.9
2.00	0	0.0	0.0	50.9
3.00	103	30.1	30.1	81.0
4.00	65	19.0	19.0	100.0
Duration of Water Scarcity				
1.00	0	0.0	0.0	0.0
2.00	219	64.0	64.0	64.0
3.00	123	36.0	36.0	100.0
4.00	0	0.0	0.0	100.0

APPENDIX-B2: Scale Wise Distribution (Khulna)

Scale wise distribution of households under different indicators of availability for Khulna District

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
Ownership				
1.00	148	25.6	25.6	25.6
2.00	82	14.2	14.2	39.9
3.00	95	16.5	16.5	56.3
4.00	252	43.7	43.7	100.0
Available Source in Dry Season				
1.00	381	66.0	66.0	66.0
2.00	190	32.9	32.9	99.0
3.00	6	1.0	1.0	100.0
4.00	0	0	0	100.0
Available Source in Wet Season				
1.00	125	21.7	21.7	21.7
2.00	0	0.0	0.0	21.7
3.00	283	49.0	49.0	70.7
4.00	169	29.3	29.3	100.0
Demand Source Ratio				
1.00	34	5.9	5.9	5.9
2.00	322	55.8	55.8	61.7
3.00	160	27.7	27.7	89.4
4.00	61	10.6	10.6	100.0
Duration of Water Scarcity				
1.00	306	53.0	53.0	53.0
2.00	105	18.2	18.2	71.2
3.00	42	7.3	7.3	78.5
4.00	124	21.5	21.5	100.0

APPENDIX-B3: Scale Wise Distribution (Shatkhira)

Scale wise distribution of households under different indicators of availability for Satkhira District

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
Ownership				
1.00	302	25.9	25.9	25.9
2.00	151	12.9	12.9	38.8
3.00	193	16.5	16.5	55.3
4.00	522	44.7	44.7	100.0
Available Source in Dry Season				
1.00	828	70.9	70.9	70.9
2.00	329	28.2	28.2	99.1
3.00	11	0.9	0.9	100.0
4.00	0	0	0	100.0
Available Source in Wet Season				
1.00	263	22.5	22.5	22.5
2.00	817	69.9	69.9	92.5
3.00	88	7.5	7.5	100.0
4.00	0	0	0	100.0
Demand Source Ratio				
1.00	338	28.9	28.9	28.9
3.00	0	0.0	0.0	28.9
3.00	546	46.7	46.7	75.7
4.00	284	24.3	24.3	100.0
Duration of Water Scarcity				
1.00	44	3.8	3.8	3.8
2.00	584	50.0	50.0	53.8
3.00	364	31.2	31.2	84.9
4.00	176	15.1	15.1	100.0

APPENDIX-C: Scale Wise Distribution (Availability)

Scale wise distribution of all households under different indicators of availability

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
Ownership				
1.00	67	26.9	26.9	26.9
2.00	53	21.3	21.3	48.2
3.00	74	29.7	29.7	77.9
4.00	55	22.1	22.1	100.0
Available Source in Dry Season				
1.00	172	69.1	69.1	69.1
2.00	73	29.3	29.3	98.4
3.00	4	1.6	1.6	100.0
4.00	0	0	0	100.0
Available Source in Wet Season				
1.00	74	29.7	29.7	29.7
2.00	167	67.1	67.1	96.8
3.00	8	3.2	3.2	100.0
4.00	0	0	0	100.0
Demand Source Ratio				
1.00	39	15.7	15.7	15.7
2.00	0	0.0	0.0	15.7
3.00	160	64.3	64.3	79.9
4.00	50	20.1	20.1	100.0
Duration of Water Scarcity				
1.00	10	4.0	4.0	4.0
2.00	43	17.3	17.3	21.3
3.00	81	32.5	32.5	53.8
4.00	115	46.2	46.2	100.0

APPENDIX-D1: Scale Wise Distribution in Bagerhat (Accessibility)

Scale wise Distribution of households under different indicators of Accessibility for Bagerhat District

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
Distance				
1.00	148	43.3	43.3	43.3
2.00	53	15.5	15.5	58.8
3.00	40	11.7	11.7	70.5
4.00	101	29.5	29.5	100.0
Mode of Transport				
1.00	10	2.9	2.9	2.9
2.00	61	17.8	17.8	20.8
3.00	235	68.7	68.7	89.5
4.00	36	10.5	10.5	100.0
Condition of Road				
1.00	163	47.7	47.7	47.7
2.00	55	16.1	16.1	63.7
3.00	110	32.2	32.2	95.9
4.00	14	4.1	4.1	100.0
Travel Time				
1.00	179	52.3	52.3	52.3
2.00	19	5.6	5.6	57.9
3.00	61	17.8	17.8	75.7
4.00	83	24.3	24.3	100.0
Queuing Time				
1.00	0	0.0	0.0	0.0
2.00	0	0.0	0.0	0.0
3.00	0	0.0	0.0	0.0
4.00	342	100.0	100.0	100.0
Cost-Income Ratio				
1.00	12	3.5	3.5	3.5
2.00	24	7.0	7.0	10.5
3.00	39	11.4	11.4	21.9
4.00	267	78.1	78.1	100.0
Equality				
1.00	12	3.5	3.5	3.5
2.00	13	3.8	3.8	7.3
3.00	2	.6	.6	7.9
4.00	315	92.1	92.1	100.0
Safety				
1.00	43	12.6	12.6	12.6
2.00	91	26.6	26.6	39.2
3.00	4	1.2	1.2	40.4
4.00	204	59.6	59.6	100.0
Security				
1.00	21	6.1	6.1	6.1
2.00	4	1.2	1.2	7.3
3.00	15	4.4	4.4	11.7
4.00	302	88.3	88.3	100.0

APPENDIX-D2: Scale Wise Distribution in Khulna (Accessibility)

Scale wise Distribution of households under different indicators of Accessibility for Khulna District

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
Distance				
1.00	306	53.0	53.0	53.0
2.00	105	18.2	18.2	71.2
3.00	42	7.3	7.3	78.5
4.00	124	21.5	21.5	100.0
Mode of Transport				
1.00	20	3.5	3.5	3.5
2.00	102	17.7	17.7	21.1
3.00	263	45.6	45.6	66.7
4.00	192	33.3	33.3	100.0
Condition of Road				
1.00	269	46.6	46.6	46.6
2.00	186	32.2	32.2	78.9
3.00	116	20.1	20.1	99.0
4.00	6	1.0	1.0	100.0
Travel Time				
1.00	326	56.5	56.5	56.5
2.00	72	12.5	12.5	69.0
3.00	59	10.2	10.2	79.2
4.00	120	20.8	20.8	100.0
Queuing Time				
1.00	47	8.1	8.1	8.1
2.00	31	5.4	5.4	13.5
3.00	63	10.9	10.9	24.4
4.00	436	75.6	75.6	100.0
Cost-Income Ratio				
1.00	34	5.9	5.9	5.9
2.00	61	10.6	10.6	16.5
3.00	68	11.8	11.8	28.2
4.00	414	71.8	71.8	100.0
Equality				
1.00	1	.2	.2	.2
2.00	13	2.3	2.3	2.4
4.00	0	0.0	0.0	2.4
4.00	563	97.6	97.6	100.0
Safety				
1.00	11	1.9	1.9	1.9
2.00	63	10.9	10.9	12.8
3.00	4	.7	.7	13.5
4.00	499	86.5	86.5	100.0
Security				
1.00	6	1.0	1.0	1.0
2.00	0	0.0	0.0	1.0
3.00	19	3.3	3.3	4.3
4.00	552	95.7	95.7	100.0

APPENDIX-D3: Scale Wise Distribution in Satkhira (Accessibility)

Scale wise Distribution of households under different indicators of Accessibility for Satkhira District

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
Distance				
1.00	78	31.3	31.3	31.3
2.00	47	18.9	18.9	50.2
3.00	30	12.0	12.0	62.2
4.00	94	37.8	37.8	100.0
Mode of Transport				
1.00	0	0.0	0.0	0.0
2.00	54	21.7	21.7	21.7
3.00	149	59.8	59.8	81.5
4.00	46	18.5	18.5	100.0
Condition of Road				
1.00	151	60.6	60.6	60.6
2.00	80	32.1	32.1	92.8
3.00	18	7.2	7.2	100.0
4.00	0	0.0	0.0	100.0
Travel Time				
1.00	86	34.5	34.5	34.5
2.00	12	4.8	4.8	39.4
3.00	41	16.5	16.5	55.8
4.00	110	44.2	44.2	100.0
Queuing Time				
1.00	0	0.0	0.0	0.0
2.00	3	1.2	1.2	1.2
3.00	4	1.6	1.6	2.8
4.00	242	97.2	97.2	100.0
Cost-Income Ratio				
1.00	3	1.2	1.2	1.2
2.00	29	11.6	11.6	12.9
3.00	39	15.7	15.7	28.5
4.00	178	71.5	71.5	100.0
Equality				
1.00	1	0.4	0.4	0.4
2.00	0	0.0	0.0	0.4
3.00	0	0.0	0.0	0.4
4.00	248	99.6	99.6	100.0
Safety				
1.00	17	6.8	6.8	6.8
2.00	64	25.7	25.7	32.5
3.00	1	0.4	0.4	32.9
4.00	167	67.1	67.1	100.0
Security				
1.00	1	0.4	0.4	0.4
2.00	0	0.0	0.0	0.4
3.00	11	4.4	4.4	4.8
4.00	237	95.2	95.2	100.0

APPENDIX-E: Scale Wise Distribution (Accessibility)

Scale wise distribution of all households under different indicators of Accessibility

Scale	Frequency	Percent	Valid Percent	Cumulative Percent
Distance				
1.00	532	45.5	45.5	45.5
2.00	205	17.6	17.6	63.1
3.00	112	9.6	9.6	72.7
4.00	319	27.3	27.3	100.0
Mode of Transport				
1.00	30	2.6	2.6	2.6
2.00	217	18.6	18.6	21.1
3.00	647	55.4	55.4	76.5
4.00	274	23.5	23.5	100.0
Condition of Road				
1.00	583	49.9	49.9	49.9
2.00	321	27.5	27.5	77.4
3.00	244	20.9	20.9	98.3
4.00	20	1.7	1.7	100.0
Travel Time				
1.00	591	50.6	50.6	50.6
2.00	103	8.8	8.8	59.4
3.00	161	13.8	13.8	73.2
4.00	313	26.8	26.8	100.0
Queuing Time				
1.00	47	4.0	4.0	4.0
2.00	34	2.9	2.9	6.9
3.00	67	5.7	5.7	12.7
4.00	1020	87.3	87.3	100.0
Cost-Income Ratio				
1.00	49	4.2	4.2	4.2
2.00	114	9.8	9.8	14.0
3.00	146	12.5	12.5	26.5
4.00	859	73.5	73.5	100.0
Equality				
1.00	14	1.2	1.2	1.2
2.00	26	2.2	2.2	3.4
3.00	2	0.2	0.2	3.6
4.00	1126	96.4	96.4	100.0
Safety				
1.00	71	6.1	6.1	6.1
2.00	218	18.7	18.7	24.7
3.00	9	0.8	0.8	25.5
4.00	870	74.5	74.5	100.0
Security				
1.00	28	2.4	2.4	2.4
2.00	4	0.3	0.3	2.7
3.00	45	3.9	3.9	6.6
4.00	1091	93.4	93.4	100.0

APPENDIX-F: User Manual of Android Mobile Application-WATapp

Application Overview:

The application is designed as a decision making tool that will provide an instant overview of the water security situation of Khulna, Satkhira and Bagerhat Districts of south-western Bangladesh.

Organization of the Manual:

The user manual consists of the following four sections

- General information
- System Summary
- How to download the application
- User-Privileges

General Information:

General information section explains in general terms the application overview and the sections of the user manual.

Systemsummary:

This section explains about the hardware and software requirements for accessing WATAPP application and user access levels.

How to download the application:

This section explains the options available to download the WATAPP Android application on your mobile.

Using the Application:

This section provides a detailed description of the functionalities of the WATAPP application

System Summary:

System summary section explains about the hardware and software requirements for accessing WATAPP application and user access levels.

Hardware and Software Requirements:

Requires a smart phone with Android operating system (OS). The minimum Android version should be 6.0.3 and up to avail all the features in the application. To download and use the functionalities of WATAPP mobile app, you require an Internet connection in your mobile.

User Access Levels:

Any user can access and uses the WATAPP application without registering in the application and any kind of hassle.

How to download the application:

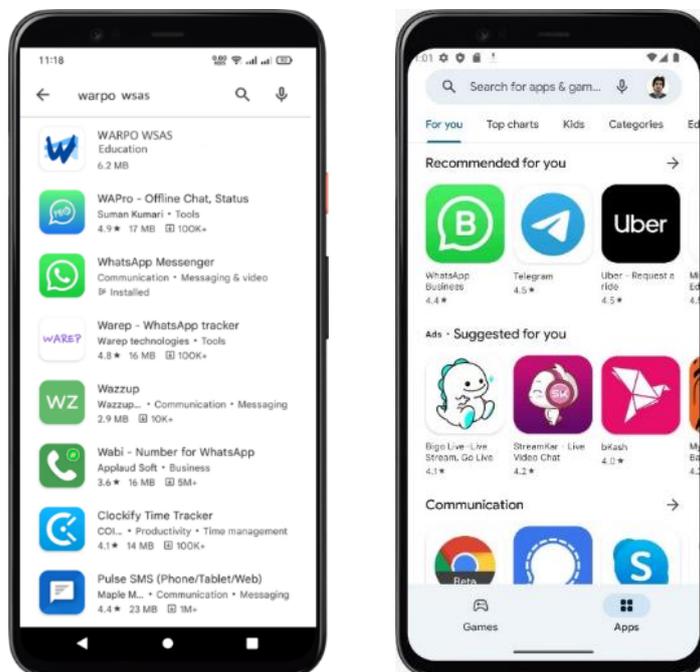
WATAPP application can be downloaded through the following way

Google PlayStore



Google Play Store:

Open Play Store application on your mobile by clicking on the Play Store icon as shown in the image below.



Click on the Google Play text at the top and enter the text "WATapp" in the search bar. Click on the WATapp application icon from the search result. Now below page will open which asks to install the application. Click on the "INSTALL" button to install the application.

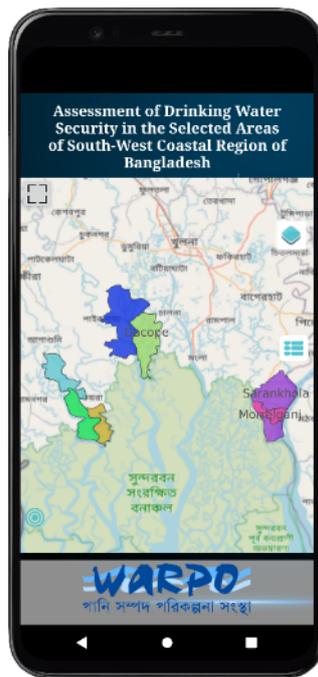
**User-PRIVILEGES:**

- Following features can be availed by the user.
- Home Screen Overview
- Full Screen Button
- Layer Switcher
- Legend
- Area Selection
- Basic Information
- Map Information & Result
- Current

Location

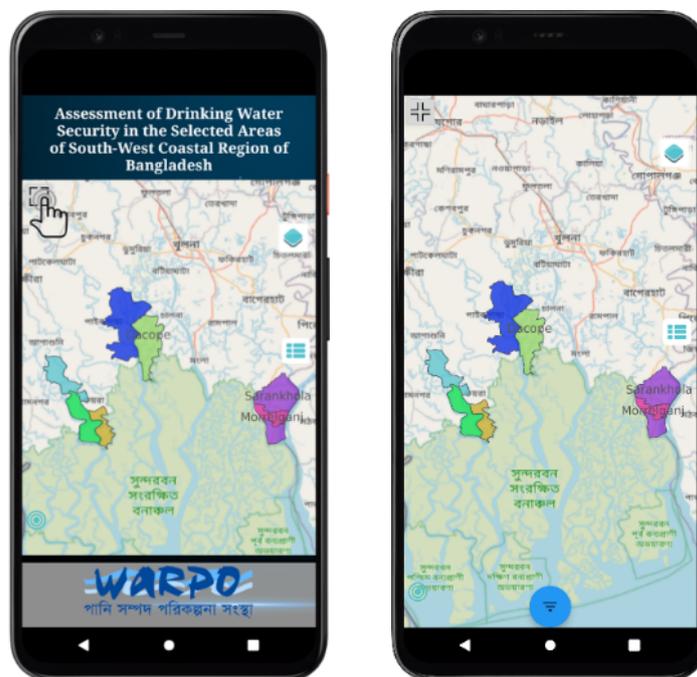
Home Screen Overview:

Launch the application by clicking on the WATAPP icon on your mobile as shown in the image below. As soon as WATAPP application is launched, homepage will be displayed which shows the main window of the application as shown in the image. There are three components to this window. A title portion is at the top, and a logo section is at the bottom. And the heart of our app is in the center. This is the section for the map. There are a few action buttons in the map area.



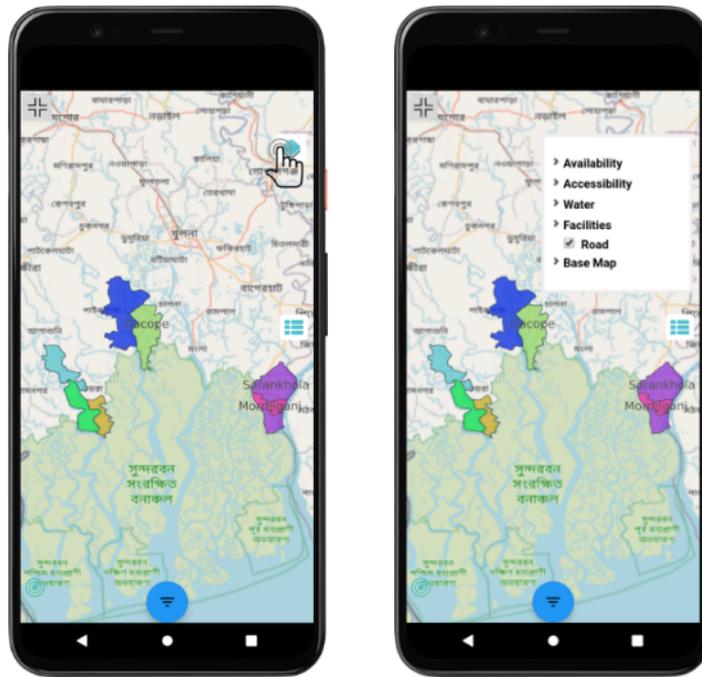
Full Screen Button:

The full-screen button is found in the upper-left corner of the map area. When user click on it, the map will expand to fill the entire screen. And then another button will appear at the bottom.

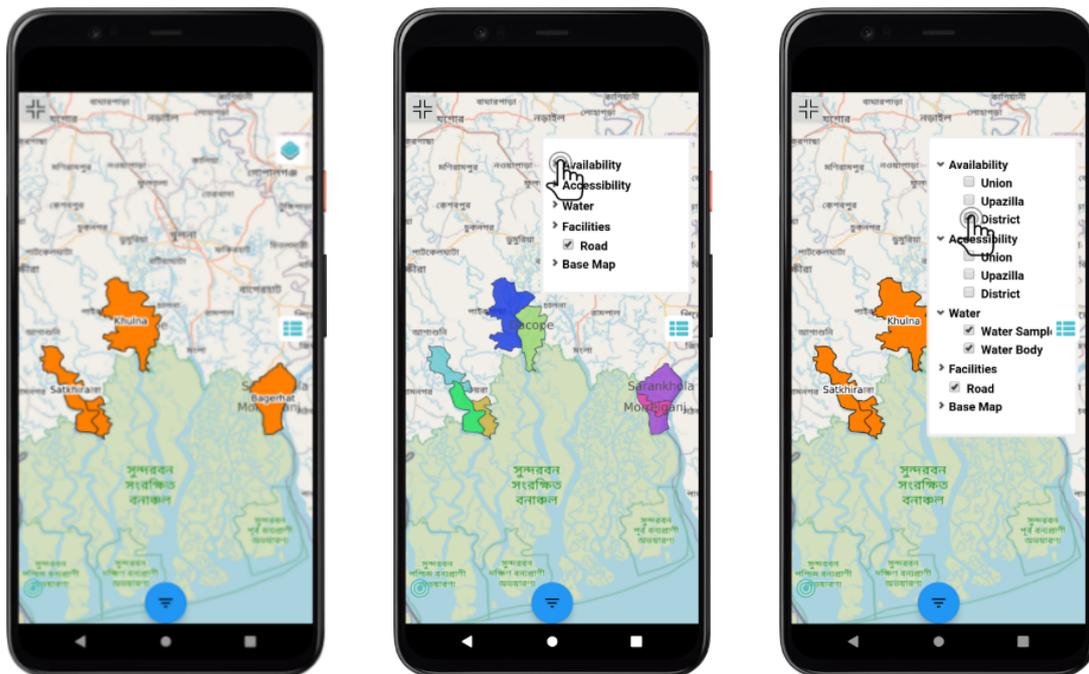


Layer Switcher:

The layer switcher button is positioned in the upper right corner of the map. When you click on it, a panel appears that displays all layers of the map, for example water availability, accessibility, and quality.

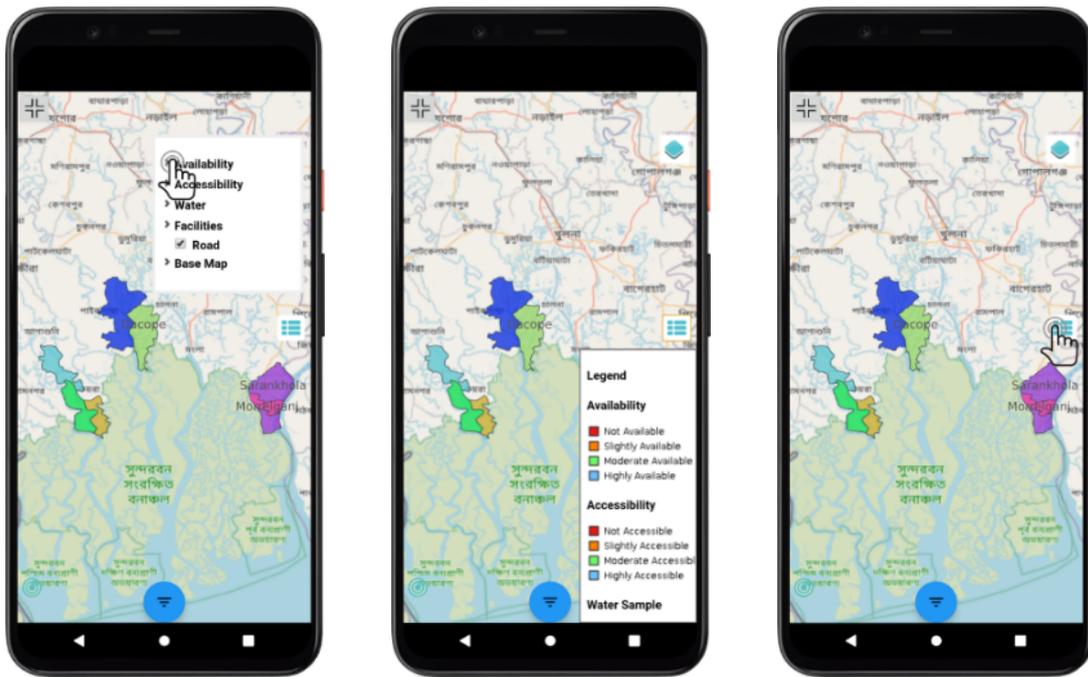


When a user clicks on one of the layers, it expands. And display several types of that layer. If the user chooses one of these, the map will be colored accordingly. The legend explains the significance of the colors.



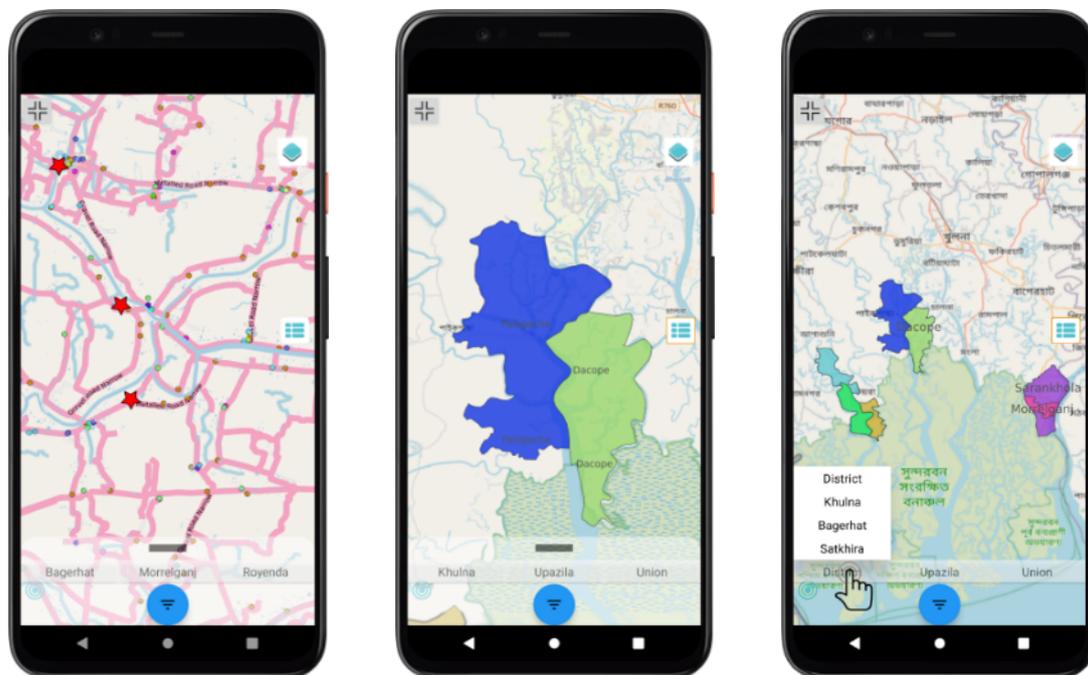
Legend:

When we look at the map, we can see a button in the right-middle of the map. Which is the legend button. And clicking on it will bring up a panel. This panel displays the legend for all of the layers on the map.



Area Selection

The search button / area selection button is located at the bottom of the map. Users may simply choose a district, then an upazila within that district, and finally a union inside that upazila. When he picks a spot, the map zooms in on that specific region. The detailed data will then be visualized.

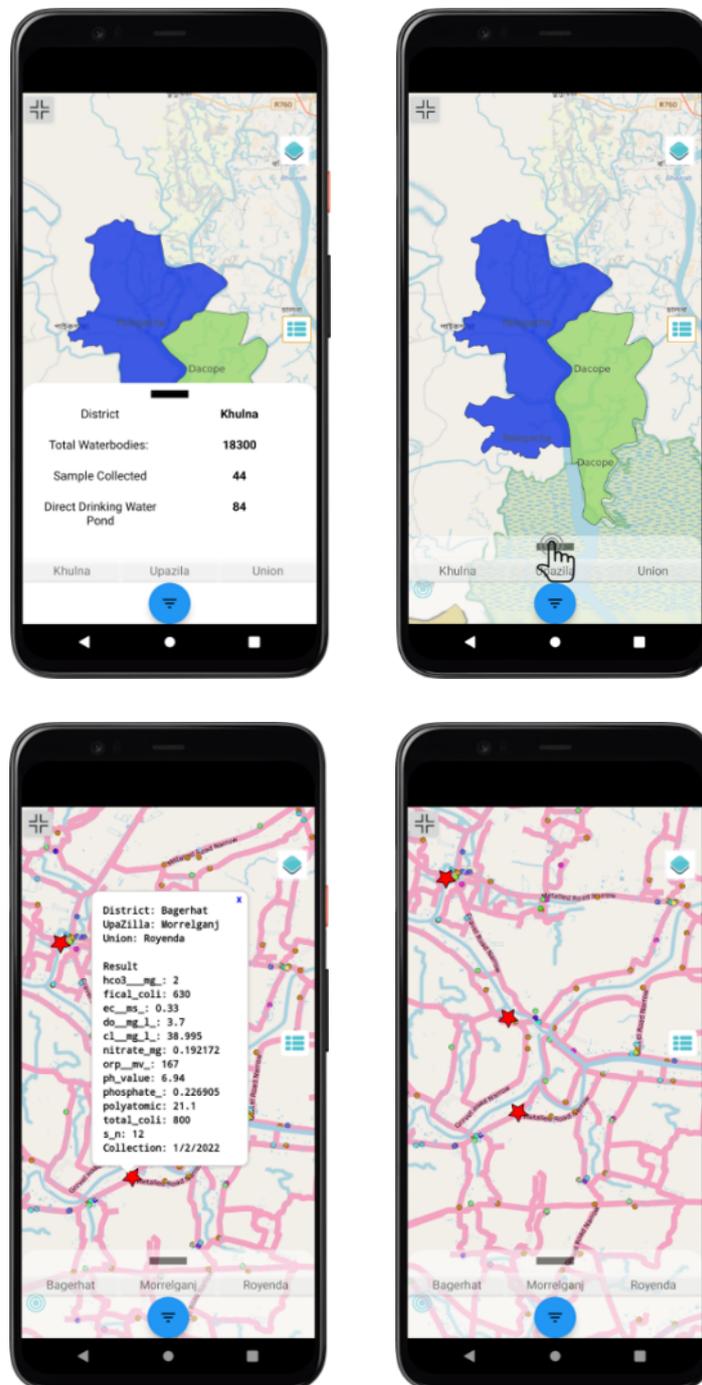


Basic Information

The essential information for each selected location can also be seen in numerical figures. As shown in the images.

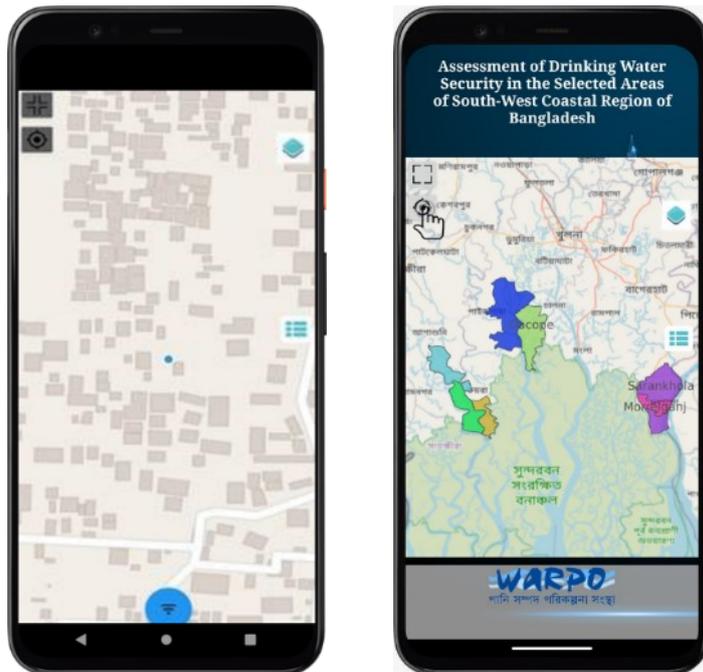
Map Information & Result:

Detail information will be shown at the final zoom scale. A user may view all of the layers of that place, including the road layer, building layer, waterbodies layer, and other utilities. All colors and symbols are explained in the Legend section. The waterbodies highlighted with a star are where water samples were collected and analyzed in the lab. If user click on it, they will view the laboratory findings.



Current Location:

When a user selects the Current Location button, the application zooms in on its current location. Then he'll be able to observe the circumstances around him on the map.



APPENDIX-G: Name of the Project Team Members and Enumerators

S/N	Name	Profession	Institute
1.	S. M. Tariqul Islam	Teacher	IDM, KUET
2.	Md. Hasibul Hasan	Teacher	IDM, KUET
3.	Anjum Tasnuva	Teacher	IDM, KUET
4.	Swarna Binte Kadir	Teacher	IDM, KUET
5.	Md. Shofiqul Islam	Teacher	IDM, KUET
6.	Md. Riad Hossain	Teacher	IDM, KUET
7.	Esraz-Ul_Zannat	Teacher	URP, KUET
8.	Meherab Hossain	Research Assistant	IDM, KUET
9.	Md. Rabiul Islam	Research Assistant	KUET
10.	Ripa Das	Research Assistant	Khulna University
11.	Rukia Siddika Moume	MSc in Sanitation	KUET
12.	Arman Ali Shanto	MSc in Sanitation	KUET
13.	Mustakim Anu	MSc in Sanitation	KUET
14.	Sakina Afroz Bithi	MSc in Sanitation	KUET
15.	Sohel Gazi	Student	KUET
16.	Brojen Mandal	MSc in Sanitation	KUET
17.	Amir Hamza Nirjhor	BURP	KUET
18.	Jinnurain Sharier	BURP	KUET
19.	Yasir Arafat	BSc in Environmental Science	Khulna University
20.	Abdullah HaqAbir	BSc in Environmental Science	Khulna University
21.	Tamjidul Ridwan	BURP	KUET
22.	Md. Sanaul	BURP	KUET
23.	Masuma Akhtar	BSc in Environmental Science	Khulna University
24.	S.K. Reason	BSc in Environmental Science	Khulna University
25.	Md. Shuvo	BSc in Environmental Science	Khulna University
26.	Bulbul Hasan	MSc in Civil Engineering	KUET
27.	Md. Mahin	BSc in Environmental Science	Khulna University

APPENDIX-H: Field Memories



Existing drinking water infrastructure which is not in service at Southkhali, Bagerhat



Existing PSF which is not in service Southkhali, Bagerhat



Drinking water collection by children in the study area



Drinking water collection by woman from long distance in the study area



Drinking water collection by women and children in the study area



Challenges of drinking water collection (kacha road)



KUET team in the field for data collection



Questionnaire survey



Drinking Water sample collection and some parameter analysis



Field data collection by WARPO team



Visit of WARPO team in the laboratory during drinking water sample analysis



Training provided by KUET team to the WARPO members on WATapp software



Consultation meeting in KUET on the findings of the project



Discussion on the research findings with Senior Secretary of WRM, DG WARPO



Final workshop group photo

APPENDIX-I: Action Plan and Research Work

Table: Action plan versus completion of research work

Activities	Months																		Comment	% of Completion
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Approval of the Project	█																		Done	100%
Staff and Expert recruitment	█																		Done	100%
Staff orientation and deployment		█																	Done	100%
Inception meeting		█																	Done	100%
Reconnaissance survey		█	█																Done	100%
Activities # 01																				
Types and numbers of sources, ownership of the source, and continuity of services				█	█								█	█					Done	100%
Fixing the drinking water source location				█	█								█	█					Done	100%
Developing source location map						█	█								█	█			Done	100%
Developing availability index map							█	█							█				Done	100%
Activities # 02																				
Develop Indicators							█												Done	100%
Questionnaire Survey				█	█	█	█	█	█										Done	100%
Focus Group Discussion				█	█	█	█	█											Done	100%
Key Informant Interview					█	█	█	█											Done	100%
Collection of Secondary Data			█	█	█	█													Done	100%
Activities # 03																				
Selection of sources for water sampling				█	█	█	█												Done	100%
Water sample collection							█							█					Done	100%
Water quality analysis							█	█						█	█				Done	100%
Water quality mapping									█	█					█	█			Done	100%
Spatial distribution of water quality parameters									█	█	█	█	█	█	█	█	█		Done	100%

Activities	Months																		Comment	% of Completion
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
Development of water quality index model																			Done	100%
Data Analysis																			Done	100%
Mobile App Preparation																			Done	100%
Report Writing																			Done	100%
Dissemination and Reporting																				
Initial Workshop in Khulna																			Done	100%
Yearly progress report																			Done	100%
Final Project Report																			Done	100%
Final Workshop in Dhaka																			Done	100%

APPENDIX J: List of respondents for the Study

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Bagerhat	Sarankhola	Southkhali	Uttar Southkhali	Abdul Mazid	Latitude: 22.2529, Longitude: 89.831
Bagerhat	Sarankhola	Roynda	South Kadamtala	Billal	Latitude: 22.2913, Longitude: 89.842
Bagerhat	Sarankhola	Roynda	South Kadamtala	Billal	Latitude: 22.2913, Longitude: 89.842
Bagerhat	Sarankhola	Roynda	South Kadamtala	Billal	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Rajoir	Asma	Latitude: 3254, Longitude: 8584
Bagerhat	Sarankhola	Southkhali	Bakultala	Abdul Ahad Abdul Hakim Sikder	Latitude: 22.2527, Longitude: 89.8265 Latitude: 22.1836.63, Longitude: 89.5117.42
Bagerhat	Sarankhola	Roynda	South Kadontola	Kamal Uddin	Latitude: 22.2528, Longitude: 89.8247
Bagerhat	Sarankhola	Roynda	Lakurtala	Bimal Das	Latitude: 22.2769, Longitude: 89.8292
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Khontakata	Abdul mojid	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Khontakata	Abdul mojid	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	Uttar Kadamtali	Abdul Aziz	Latitude: 22.313, Longitude: 89.8546
Bagerhat	Sarankhola	Southkhali		Jalaluddin	Latitude: 22.2567, Longitude: 89.827
Bagerhat	Sarankhola	Southkhali	Uttar Southkhali	Kalimuddin	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Uttar Southkhali	Kalimuddin	Latitude: 22.253, Longitude: 89.8306
Bagerhat	Sarankhola	Southkhali	Uttar Southkhali	Ab. Karim	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	South Kadamtala	Shahjahan	Latitude: 22.2899, Longitude: 89.8423
Bagerhat	Sarankhola	Roynda	South Kadamtala	Shahjahan	Latitude: 22.2899, Longitude: 89.8423
Bagerhat	Sarankhola	Roynda	Uttar Kadamtali	Nur Mia	Latitude: 22.312, Longitude: 89.8551
Bagerhat	Sarankhola	Southkhali		Sha alam	Latitude: 22.2531, Longitude: 89.8239
Bagerhat	Sarankhola	Roynda	South Kadamtala	Mostafa	Latitude: 22.2906, Longitude: 89.843
Bagerhat	Sarankhola	Roynda	South Kadamtala	Mostafa	Latitude: 22.2906, Longitude: 89.843
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Masud	Latitude: 22.3911, Longitude: 89.8335
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Masud	Latitude: 22.3911, Longitude: 89.8335
Bagerhat	Sarankhola	Southkhali	South Southkhali	Abul Haoladar	Latitude: 22.25, Longitude: 89.833
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Ibrahim Fakir	Latitude: 22.3884, Longitude: 89.8358
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Ibrahim Fakir	Latitude: 22.3884, Longitude: 89.8358
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Ibrahim Fakir	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Bakultola	Merina Akter	Latitude: 22.2557, Longitude: 89.8279
Bagerhat	Sarankhola	Southkhali	Rayenda	Masum	Latitude: 22.255, Longitude: 89.899
Bagerhat	Sarankhola	Southkhali	Rayenda	Dalim	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Rayenda	Jahid	Latitude: 22.234, Longitude: 89.832 Latitude: 22.35391, Longitude: 89.867786
Bagerhat	Sarankhola	Khontakata	4 no. Ward	Rahima Begum	Latitude: 22.3545, Longitude: 89.8676
Bagerhat	Sarankhola	Khontakata	4 no. Ward	Nazina Begum	Latitude: 22.3545, Longitude: 89.8676
Bagerhat	Sarankhola	Roynda	Ward 6	Abdul Mannan	Latitude: 22.3048, Longitude: 89.8499
Bagerhat	Sarankhola	Southkhali	Bakultola	Jamal Hossain	Latitude: 22.2532, Longitude: 89.8249
Bagerhat	Sarankhola	Roynda	Uttar Kadamtali	Monowar	Latitude: 22.3127, Longitude: 89.8553
Bagerhat	Sarankhola	Southkhali	Bakultala	Rais Hawlader	Latitude: 22.2537, Longitude: 89.8239
Bagerhat	Sarankhola	Southkhali	Rayenda	Jahid	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	6 no. Ward, moterpara	Nasir	Latitude: 22.33555, Longitude: 89.8549
Bagerhat	Sarankhola	Khontakata	6 no. Ward, moterpara	Nasir	Latitude: 22.33555, Longitude: 89.8549
Bagerhat	Sarankhola	Southkhali	Bakultola	Halim	Latitude: 89.2523, Longitude: 89.8266
Bagerhat	Sarankhola	Southkhali	Bakultala	Abdul Hai	Latitude: 22.2538, Longitude: 89.8235
Bagerhat	Sarankhola	Roynda	South Kadamtala	Altaf	Latitude: 22.2933, Longitude: 89.8412
Bagerhat	Sarankhola	Roynda	South Kadamtala	Altaf	Latitude: 22.2933, Longitude: 89.8412

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Bagerhat	Sarankhola	Roynda		Joinob Begum	Latitude: 22.3048, Longitude: 89.8508
Bagerhat	Sarankhola	Southkhali	Ta	Kamrul Islam	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	Lakurtala	Wahida Md. Riyadul Islam	Latitude: 22.2756, Longitude: 89.8294
Bagerhat	Sarankhola	Southkhali			Latitude: 22.234, Longitude: 89.831
Bagerhat	Sarankhola	Roynda	Uttar Kadamtali	Abdur Razzak	Latitude: 22.273, Longitude: 89.858
Bagerhat	Sarankhola	Khontakata	Ward 7	Lamia	Latitude: 22.3261, Longitude: 89.8597
Bagerhat	Sarankhola	Roynda	Ward 9	Dabir Akon	Latitude: 22.3057, Longitude: 89.8498
Bagerhat	Sarankhola	Dhansgar	Ward no 7	Beauty	Latitude: 22.3363, Longitude: 89.768
Bagerhat	Sarankhola	Southkhali	Bokultala	Sha Alam	Latitude: 22.2536, Longitude: 89.8273
Bagerhat	Sarankhola	Dhansgar	6 no. Ward	Rabeya Begum	Latitude: 22.3367, Longitude: 89.7673
Bagerhat	Sarankhola	Roynda	Lakurtala	Goni	Latitude: 22.2755, Longitude: 89.8292
Bagerhat	Sarankhola	Khontakata	Ward 4	Ali	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Ward 5	Forida	Latitude: 22.3454, Longitude: 89.8681
Bagerhat	Sarankhola	Roynda	Lakurtala	Jotin Sarker	Latitude: 22.2774, Longitude: 89.8283
Bagerhat	Sarankhola	Roynda	Uttar Kadamtali	Nikhil	Latitude: 22.3131, Longitude: 89.8544
Bagerhat	Sarankhola	Southkhali	Tafalbari	Edward Babul	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda		Sokhina khatun	Latitude: 22.3062, Longitude: 89.8506
Bagerhat	Sarankhola	Roynda	Ward 9	Abul Miah Md. Abu jafor Kazi	Latitude: 22.3053, Longitude: 89.8505
Bagerhat	Sarankhola	Southkhali	Rayenda		Latitude: 22.259, Longitude: 89.836
Bagerhat	Sarankhola	Southkhali	Bokultala	Fatema	Latitude: 22.2535, Longitude: 89.8236
Bagerhat	Sarankhola	Khontakata	Ward 3	Rakhi Jahangir Hossain	Latitude: 22.3426, Longitude: 89.8525
Bagerhat	Sarankhola	Southkhali	Bokultala		Latitude: 22.2528, Longitude: 89.8234
Bagerhat	Sarankhola	Southkhali	Tafal bari	Tanbin Jahan	Latitude: , Longitude:
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Abdur Rashid	Latitude: 22.3884, Longitude: 89.8358
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Abdur Rashid	Latitude: 22.3884, Longitude: 89.8358
Bagerhat	Sarankhola	Roynda	Zilbunia	Mizan	Latitude: 22.3056, Longitude: 89.8525
Bagerhat	Sarankhola	Roynda	Zilbunia	Mizan	Latitude: 22.3056, Longitude: 89.8525
Bagerhat	Sarankhola	Roynda	Zilbunia	Mizan	Latitude: 22.3057, Longitude: 89.8504
Bagerhat	Sarankhola	Roynda	Zilbunia	Halim	Latitude: 22.3057, Longitude: 89.8504
Bagerhat	Sarankhola	Roynda	Zilbunia	Halim	Latitude: 22.3057, Longitude: 89.8504
Bagerhat	Sarankhola	Roynda	Zilbunia	Mizan	Latitude: 22.3057, Longitude: 89.8504
Bagerhat	Sarankhola	Khontakata	Choumuhoni	Iliyas	Latitude: 22.3479, Longitude: 89.8534
Bagerhat	Sarankhola	Southkhali	South southkhali	Anwoara	Latitude: 22.253, Longitude: 89.83
Bagerhat	Sarankhola	Roynda	Lakurtola	Ranjan Kumar	Latitude: 22.277, Longitude: 89.8282
Bagerhat	Sarankhola	Khuoia	Boropuri	Rekha	Latitude: 22.3895, Longitude: 89.8292
Bagerhat	Sarankhola	Khuoia	Boropuri	Rekha	Latitude: 22.3895, Longitude: 89.8292
Bagerhat	Sarankhola	Southkhali	Bakultala	Abdul Malek Nasir uddid haoladar	Latitude: 22.2531, Longitude: 89.8252
Bagerhat	Sarankhola	Dhansgar	6 no ward		Latitude: 22.3734, Longitude: 89.7735
Bagerhat	Sarankhola	Khontakata	West khontakata	Habib Khan	Latitude: 22.3449, Longitude: 89.8529
Bagerhat	Sarankhola	Khontakata	West khontakata	Habib Khan	Latitude: 22.3449, Longitude: 89.8529
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Sobhan Mollah	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Sobhan Mollah	Latitude: , Longitude: Latitude: 221833.62, Longitude: 895113.15
Bagerhat	Sarankhola	Roynda	Uttar Kadamtola	Saikat Hasan	
Bagerhat	Sarankhola	Roynda	Lakurtala	Sadek	Latitude: 22.2768, Longitude: 89.8293
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Moterpara	Riadul	Latitude: 22.3337, Longitude: 89.85514
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Moterpara	Riadul	Latitude: 22.3337, Longitude: 89.85514
Bagerhat	Sarankhola	Khontakata	5 no ward	Rashid Ahmed	Latitude: 22.3422, Longitude: 89.8662

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Bagerhat	Sarankhola	Khontakata	5 no ward	Rashid Ahmed	Latitude: 22.3422, Longitude: 89.8662
Bagerhat	Sarankhola	Khontakata	Choumuhoni	Rahima	Latitude: 22.3462, Longitude: 89.8533
Bagerhat	Sarankhola	Khontakata	Choumuhoni	Rahima	Latitude: 22.3462, Longitude: 89.8533
Bagerhat	Sarankhola	Khuoia	5 no. Ward, Boropuri	Obaidul Munshi	Latitude: 22.3902, Longitude: 89.8297
Bagerhat	Sarankhola	Khuoia	5 no. Ward, Boropuri	Obaidul Munshi	Latitude: 22.3902, Longitude: 89.8297
Bagerhat	Sarankhola	Khontakata	Rajoir	Rexona Begum	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Rajoir	Rexona Begum	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Rajoir	Rexona Begum	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Bokultala	Sha Alam	Latitude: 22.2535, Longitude: 89.8242
Bagerhat	Sarankhola	Khontakata	6 no. Ward,Moterpara	Sobur Hawladar	Latitude: 22.3324, Longitude: 89.8552
Bagerhat	Sarankhola	Khontakata	6 no. Ward,Moterpara	Sobur Hawladar	Latitude: 22.3324, Longitude: 89.8552
Bagerhat	Sarankhola	Khontakata	Rajoir	Mahabub Hawladar	Latitude: 22.3251, Longitude: 89.8582
Bagerhat	Sarankhola	Khontakata	Moddom khontakata	Abdullah Gazi	Latitude: 22.3405, Longitude: 89.8634
Bagerhat	Sarankhola	Roynda	Zilbunia	Abdur Rajjak	Latitude: 22.3061, Longitude: 89.8525
Bagerhat	Sarankhola	Roynda	Zilbunia	Abdur Rajjak	Latitude: 22.3061, Longitude: 89.8525
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Hawa Begum	Latitude: 22.3868, Longitude: 89.8357
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Hawa Begum	Latitude: 22.3868, Longitude: 89.8357
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Ruhul Amin	Latitude: 22.3877, Longitude: 89.8358
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Ruhul Amin	Latitude: 22.3877, Longitude: 89.8358
Bagerhat	Sarankhola	Khontakata	6no. Ward	Jahanara Begum	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	No. 1 Dhansagar	Abdullah	Latitude: 22.3699, Longitude: 89.7735
Bagerhat	Sarankhola	Khontakata	Moddom Khontakata	Khalek Hawladar	Latitude: 22.34062, Longitude: 89.864105
Bagerhat	Sarankhola	Roynda	Ward 9	Din Islam	Latitude: 22.3051, Longitude: 89.8502
Bagerhat	Sarankhola	Roynda	5 no. ward, north kodomtola	lipi khan	Latitude: 22.3126, Longitude: 89.8554
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Selim	Latitude: 22.3863, Longitude: 89.8353
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Selim	Latitude: 22.3863, Longitude: 89.8353
Bagerhat	Sarankhola	Southkhali	Tafal bari	Ali Ahamad	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	No. 1 Dhansagar	Gias Hawlader	Latitude: 22.3685, Longitude: 89.7743
Bagerhat	Sarankhola	Roynda	5 NO. WARD, KODOMTOLA	KOMLA	Latitude: 22.3231, Longitude: 89.8542
Bagerhat	Sarankhola	Khuoia	5 no. Ward, boropuri	Md. Mosharraf Hossain	Latitude: 22.3909, Longitude: 89.8308
Bagerhat	Sarankhola	Khuoia	5 no. Ward, boropuri	Md. Mosharraf Hossain	Latitude: 22.3909, Longitude: 89.8308
Bagerhat	Sarankhola	Khuoia	6 no. Ward,east chipa baroikhali	Abdul Khalek	Latitude: , Longitude:
Bagerhat	Sarankhola	Khuoia	6 no. Ward,east chipa baroikhali	Abdul Khalek	Latitude: 22.3955, Longitude: 89.8376
Bagerhat	Sarankhola	Khuoia	6 no. Ward,east chipa baroikhali	Abdul Khalek	Latitude: 22.3955, Longitude: 89.8376
Bagerhat	Sarankhola	Khuoia	6 no. Ward,east chipa baroikhali	Abdul Karim	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Al-amin	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Md. Ibrahim	Latitude: 22.3427, Longitude: 89.854
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Md. Ibrahim	Latitude: 22.3427, Longitude: 89.854
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Arif	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Md. Ibrahim	Latitude: , Longitude:
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Jalil	Latitude: 22.3922, Longitude: 89.8325
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Jalil	Latitude: 22.3922, Longitude: 89.8325
Bagerhat	Sarankhola	Southkhali	Rayenda	Md. Masum Hawlader	Latitude: 22.2341, Longitude: 89.8327
Bagerhat	Sarankhola	Khontakata	Moddho Khontakata	Shan Alam	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Moddho Khontakata	Shan Alam	Latitude: , Longitude:

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Bagerhat	Sarankhola	Southkhali	Tafalbari	Jossim Uddin Abdur Rahman	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Moddom khontakata	Gazi	Latitude: 22.3408, Longitude: 89.8639
Bagerhat	Sarankhola	Khontakata	Choumuhoni	Sarowar	Latitude: 22.3484, Longitude: 89.8585
Bagerhat	Sarankhola	Khontakata	Choumuhoni	Sarowar	Latitude: 22.3484, Longitude: 89.8585
Bagerhat	Sarankhola	Khontakata	4no. Ward, Uttar Khontakata	Rashida	Latitude: 22.3552, Longitude: 89.8684
Bagerhat	Sarankhola	Khontakata	4no. Ward, Uttar Khontakata	Rashida	Latitude: 22.3552, Longitude: 89.8684
Bagerhat	Sarankhola	Southkhali	Rayenda	Mahmuda	Latitude: 22.254, Longitude: 89.834
Bagerhat	Sarankhola	Southkhali	Tafalbari #4	Ripa Khanam	Latitude: , Longitude:
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Khokon	Latitude: 22.392, Longitude: 89.8324
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Khokon	Latitude: 22.392, Longitude: 89.8324
Bagerhat	Sarankhola	Khuoia	Chalitabunia, Ward 2	Md Sohorab Hossain	Latitude: 22.3994, Longitude: 89.8403
Bagerhat	Sarankhola	Roynda	5NO. WARD, KODOMTOLA	MORJINA	Latitude: 22.3125, Longitude: 89.8538
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Md. Easin Khan	Latitude: 22.3431, Longitude: 89.8547
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Md. Easin Khan	Latitude: 22.3431, Longitude: 89.8547
Bagerhat	Sarankhola	Khontakata	5 no ward,west khontakata	Hosneara	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no ward,west khontakata	Hosneara	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no. ward	Asma Begum	Latitude: 22.3435, Longitude: 89.8539
Bagerhat	Sarankhola	Khontakata	5 no. ward	Asma Begum	Latitude: 22.3435, Longitude: 89.8539
Bagerhat	Sarankhola	Khontakata	4 no. ward	Poli khatun	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	6no. Ward		Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	6no. Ward		Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	Fakir Bari	Salman Khan	Latitude: 22.359, Longitude: 89.7675
Bagerhat	Sarankhola	Roynda	Ward 9	Altaf Hossain	Latitude: 22.3047, Longitude: 89.8499
Bagerhat	Sarankhola	Roynda	Ward 9	Helal Uddin	Latitude: 22.3052, Longitude: 89.8504
Bagerhat	Sarankhola	Southkhali	Rayenda	Hamid Sarder	Latitude: 22.235, Longitude: 89.832
Bagerhat	Sarankhola	Khuoia	Ward 2	Abdul Hai	Latitude: 22.4006, Longitude: 89.8392
Bagerhat	Sarankhola	Khuoia		Md.Mojid Siddik	Latitude: , Longitude:
	Morrelganj	Khuoia	No.4 Khaulia	Rasel	Latitude: 22.3891, Longitude: 89.8351
	Morrelganj	Khuoia	No.4 Khaulia	Rasel	Latitude: 22.3891, Longitude: 89.8351
Bagerhat	Sarankhola	Roynda	Lakurtala	Bharti Rani	Latitude: 22.2767, Longitude: 89.8295
Bagerhat	Morrelganj	Khuoia	No. 4 Khaulia	Hashem	Latitude: 22.392, Longitude: 89.8326
Bagerhat	Morrelganj	Khuoia	No. 4 Khaulia	Hashem	Latitude: 22.392, Longitude: 89.8326
Bagerhat	Sarankhola	Roynda		Hafiza Banu	Latitude: 22.3055, Longitude: 89.8506
Bagerhat	Sarankhola	Khontakata	5 no. ward	Khalek Hawlader	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no. ward	Khalek Hawlader	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Tafalbari	Panna Mia	Latitude: 22.261, Longitude: 89.828
Bagerhat	Sarankhola	Roynda		Firoz Sheik	Latitude: 22.3995, Longitude: 89.8404
Bagerhat	Sarankhola	Roynda		Firoz Sheik Ab. Rahim	Latitude: 22.3995, Longitude: 89.8404
Bagerhat	Sarankhola	Khuoia		Bapary	Latitude: , Longitude:
Bagerhat	Sarankhola	Khuoia		Hafiz Ali	Latitude: 22.3992, Longitude: 89.8402
Bagerhat	Sarankhola	Khuoia		Hafiz Ali	Latitude: 22.3992, Longitude: 89.8402
Bagerhat	Sarankhola	Khuoia		Hafiz Ali	Latitude: , Longitude:
Bagerhat	Sarankhola	Khuoia		Hafiz	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda		Jorina Banu	Latitude: 22.3063, Longitude: 89.8504
Bagerhat	Sarankhola	Dhansgar	No. 1 Ward Dhansagar	Jahidul Sheikh	Latitude: 22.3721, Longitude: 89.7728
Bagerhat	Sarankhola	Khontakata	Ward 5	Rina	Latitude: 22.3449, Longitude: 89.8676
Bagerhat	Sarankhola	Southkhali		Yousus Ali	Latitude: 22.2569, Longitude: 89.8284

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Bagerhat	Sarankhola	Dhansgar	Bhola Nodir Chor	Yunus Khan	Latitude: 22.371, Longitude: 89.771
Bagerhat	Sarankhola	Southkhali	Uttor Southkhali	Soliman	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Uttar Southkhali	Delwar	Latitude: 22.2521, Longitude: 89.8325
Bagerhat	Sarankhola	Dhansgar	1 NO. WARD	SIRAJUL	Latitude: 22.3714, Longitude: 89.7733
Bagerhat	Sarankhola	Dhansgar			Latitude: 45464, Longitude: 4464
Bagerhat	Sarankhola	Southkhali	Bakultola	Abdur Razzak	Latitude: 22.2525, Longitude: 89.8267
Bagerhat	Sarankhola	Roynda	Zilbunia	Azim	Latitude: 22.3061, Longitude: 89.8525
Bagerhat	Sarankhola	Roynda	Zilbunia	Azim	Latitude: 22.3061, Longitude: 89.8525
Bagerhat	Sarankhola	Khontakata	Ward 6	Shah Alam	Latitude: 22.3305, Longitude: 89.8548
Bagerhat	Sarankhola	Khontakata	ward 3	Sobur	Latitude: 22.3435, Longitude: 89.851
Bagerhat	Sarankhola	Khuoia		Selika Khatun	Latitude: 22.3992, Longitude: 89.8402
Bagerhat	Sarankhola	Khontakata	Ward 7	Nurunnahar	Latitude: 22.3271, Longitude: 89.8618
Bagerhat	Sarankhola	Khuoia	East Chipa Baroikhali	Shahidul Islam	Latitude: 22.3969, Longitude: 89.839
Bagerhat	Sarankhola	Khuoia	East Chipa Baroikhali	Shahidul Islam	Latitude: 22.3969, Longitude: 89.839
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Varanipara	Piyara Begum	Latitude: 22.34133, Longitude: 89.8534
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Varanipara	Piyara Begum	Latitude: 22.34133, Longitude: 89.8534
Bagerhat	Sarankhola	Khontakata	Choumuhoni	Iliyas	Latitude: 22.3479, Longitude: 89.8534
Bagerhat	Sarankhola	Khontakata	Ward 5	Fokhrul	Latitude: 22.3455, Longitude: 89.8659
Bagerhat	Sarankhola	Dhansgar	1 no. Ward	Rashida Begum	Latitude: 22.3732, Longitude: 89.7755
Bagerhat	Sarankhola	Khuoia	5 no. Ward, Boropuri	Mojid	Latitude: 22.3967, Longitude: 89.8285
Bagerhat	Sarankhola	Khuoia	5 no. Ward, Boropuri	Mojid	Latitude: 22.3967, Longitude: 89.8285
Bagerhat	Sarankhola	Khontakata	Rajoir-7	Rina	Latitude: 22.3264, Longitude: 89.8589
Bagerhat	Sarankhola	Dhansgar	Amragachi	Motiuir Rahman Talukder	Latitude: 22.3726, Longitude: 89.7735
Bagerhat	Sarankhola	Dhansgar	6 no. Ward	Rekha	Latitude: 22.3595, Longitude: 89.7633
Bagerhat	Sarankhola	Khontakata	Ward 3	Kobir	Latitude: 22.3438, Longitude: 89.8517
Bagerhat	Sarankhola	Khontakata	Ward 3	Jamirul	Latitude: 22.3438, Longitude: 89.8504
Bagerhat	Sarankhola	Khontakata	Ward 4	Hafiza	Latitude: 22.3559, Longitude: 89.8678
Bagerhat	Sarankhola	Khontakata	Ward 6	Abbas	Latitude: 22.3408, Longitude: 89.8537
Bagerhat	Sarankhola	Khontakata	West Khontakata	Rehana	Latitude: 22.34484, Longitude: 89.85324
Bagerhat	Sarankhola	Khontakata	West Khontakata	Rehana	Latitude: 22.34484, Longitude: 89.85324
Bagerhat	Sarankhola	Southkhali	Chalitabuniya	Apurba Halder	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	Uttar Kadamtola	Md. Mujibur Rahman	Latitude: 221827.92, Longitude: 895111.97
Bagerhat	Sarankhola	Roynda	Uttar Kadamtola	Md. Mujibur Rahman	Latitude: , Longitude:
Bagerhat	Sarankhola	Khuoia	Nishanbaria	Siam khan	Latitude: 22.4044, Longitude: 89.8313
Bagerhat	Sarankhola	Roynda		Marjina khatun	Latitude: 22.3053, Longitude: 89.8505
Bagerhat	Sarankhola	Roynda		Hasina Begum	Latitude: 22.3047, Longitude: 89.8508
Bagerhat	Sarankhola	Roynda	South Kadamtala	Sohel	Latitude: 22.2908, Longitude: 89.84
Bagerhat	Sarankhola	Roynda	South Kadamtala	Sohel	Latitude: 22.2908, Longitude: 89.84
Bagerhat	Sarankhola	Dhansgar	6 no. ward	Abdul Jalil Munshi	Latitude: 22.378968, Longitude: 89.763557
Bagerhat	Sarankhola	Dhansgar	Bhola Nodir Chor	Abdul Awal	Latitude: 22.3711, Longitude: 89.7712
Bagerhat	Sarankhola	Dhansgar	Bhola Nodir Chor	Abdul Awal	Latitude: , Longitude:
Bagerhat	Sarankhola	Khuoia	Nishanbaria	Saleha Begum	Latitude: 22.4049, Longitude: 89.83
Bagerhat	Sarankhola	Southkhali	Rayenda	Abdul Jalil	Latitude: , Longitude: ; Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	Ward 9	Babul Ahned	Latitude: 22.3055, Longitude: 89.849
Bagerhat	Sarankhola	Southkhali	Tafalbari	Dr. Pijush Kanti Roy	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	No. 6 Dhansagar	Bahadur Molla	Latitude: 22.3594, Longitude: 89.7649
Bagerhat	Sarankhola	Dhansgar		Saiful Islam	Latitude: 22.3696, Longitude: 89.1742

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Bagerhat	Sarankhola	Southkhali	Rayenda	Nazma Begum	Latitude: 22.253, Longitude: 83.83
Bagerhat	Sarankhola	Southkhali	RAYENDA	Doli BEGUM	Latitude: 22.257, Longitude: 89.835
Bagerhat	Sarankhola	Dhansgar	Dhansagor	Kohinur Begum	Latitude: 22.3733, Longitude: 89.7749
Bagerhat	Sarankhola	Khontakata	Rajoir	Md. Miraj Hossain	Latitude: 22.3341, Longitude: 89.8114
Bagerhat	Sarankhola	Southkhali	Rayenda	Amena	Latitude: 22.255, Longitude: 89.829
Bagerhat	Sarankhola	Southkhali	Rayenda	Abul Kalam	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	Ward 9	Bulbul Khan	Latitude: 22.3058, Longitude: 89.8499
Bagerhat	Sarankhola	Khontakata	6no. Ward	Jahanara Begum	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	Lakurtala	Rafikul Halder	Latitude: 22.2754, Longitude: 89.8272
Bagerhat	Sarankhola	Roynda	Lakurtala	Indu Rani	Latitude: 22.2769, Longitude: 89.8276
Bagerhat	Sarankhola	Khontakata	Ward 6	Kajol rekha	Latitude: 22.3303, Longitude: 89.854
Bagerhat	Sarankhola	Roynda	9 NO. WARD	KARIMA	Latitude: 22.3065, Longitude: 89.8505
Bagerhat	Sarankhola	Khontakata	Ward 6	Faruk	Latitude: 22.3301, Longitude: 89.8546
Bagerhat	Sarankhola	Khontakata	Ward 6	Alamin	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Ward 6	Yousuf	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Ward 6	Siddik	Latitude: 22.3303, Longitude: 89.8554
Bagerhat	Sarankhola	Khontakata	Ward 6	Siddik	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Ward 6	Nur miya	Latitude: 22.3303, Longitude: 89.8532
Bagerhat	Sarankhola	Roynda	9 NO. WARD	NURUNNAHAR	Latitude: 22.3062, Longitude: 89.8502
Bagerhat	Sarankhola	Khontakata	Ward 4	Kulsum	Latitude: 22.3554, Longitude: 89.867
Bagerhat	Sarankhola	Roynda	9 NO. WARD	BOKUL	Latitude: 22.306, Longitude: 89.26
Bagerhat	Sarankhola	Khontakata	Moddho Khontakata	Monir Akon	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Moddho Khontakata	Monir Akon	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Rajoir	Kobir Hossain	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	Rajoir	Kobir Hossain	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	8 NO. WARD	SHAHIDA	Latitude: 22.2753, Longitude: 89.8292
Bagerhat	Sarankhola	Roynda	9 NO. WARD	SHAILA	Latitude: 22.3063, Longitude: 89.8522
Bagerhat	Sarankhola	Khuoia	6 no. Ward,East chipa baroikhali	Shafiqul Hawlader	Latitude: 22.3945, Longitude: 89.836
Bagerhat	Sarankhola	Khuoia	6 no. Ward,East chipa baroikhali	Shafiqul Hawlader	Latitude: 22.3945, Longitude: 89.836
Bagerhat	Sarankhola	Khuoia	5no. Ward, Boropuri	Nazrul Islam	Latitude: 22.3902, Longitude: 89.8318
Bagerhat	Sarankhola	Khuoia	5no. Ward, Boropuri	Nazrul Islam	Latitude: 22.3902, Longitude: 89.8318
Bagerhat	Sarankhola	Roynda	8 NO. WARD	LIMA	Latitude: 22.2769, Longitude: 89.2895
Bagerhat	Sarankhola	Dhansgar	7 no ward	Rexona	Latitude: 22.86777, Longitude: 89.76221
Bagerhat	Sarankhola	Roynda	6 NO. WARD, KODOMTOLA	FATIMA	Latitude: 22.2913, Longitude: 89.8426
Bagerhat	Sarankhola	Khuoia	6 no. Ward, East Chipa Baroikhali	Rashida	Latitude: 22.3972, Longitude: 89.8383
Bagerhat	Sarankhola	Khuoia	6 no. Ward, East Chipa Baroikhali	Rashida	Latitude: 22.3972, Longitude: 89.8383
Bagerhat	Sarankhola	Khontakata	6 no. ward, Moterpara	Md. Sumon	Latitude: 22.3338, Longitude: 89.85556
Bagerhat	Sarankhola	Khontakata	6 no. ward, Moterpara	Md. Sumon	Latitude: 22.3338, Longitude: 89.85556
Bagerhat	Sarankhola	Southkhali	Rayenda	Sefali Begum	Latitude: 22.2551, Longitude: 89.829
Bagerhat	Sarankhola	Roynda	6 NO. WARD, MODDHO KODOMTOLA	FARUK HOWLADAR	Latitude: 22.293, Longitude: 89.8412
Bagerhat	Sarankhola	Roynda	9NO. WARD	LUCKY	Latitude: 22.3062, Longitude: 89.8528
Bagerhat	Sarankhola	Dhansgar			Latitude: , Longitude:
Bagerhat	Sarankhola	Khuoia	Nishanbaria	Babul Hawlader	Latitude: 22.4027, Longitude: 89.8247
Bagerhat	Sarankhola	Dhansgar	Bhola Nodir Chor	Alauddin Talukder	Latitude: 22.371, Longitude: 89.771
Bagerhat	Sarankhola	Roynda	Uttar Kadamtola ward# 5	Emdadul Haque	Latitude: 221833.62, Longitude: 895111.05

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Bagerhat	Sarankhola	Roynda	Chalitabunia W 2	Helal Uddin	Latitude: 22.401, Longitude: 89.8389
Bagerhat	Sarankhola	Roynda	Uttar Kadamtola	Dulal	Latitude: 221833.73, Longitude: 895109.77
Bagerhat	Sarankhola	Dhansgar		Shabbir Sheikh	Latitude: 22.359, Longitude: 89.7675
Bagerhat	Sarankhola	Roynda	Ward 2	Nuruzzaman	Latitude: 22.4008, Longitude: 89.8395
Bagerhat	Sarankhola	Roynda	Uttar Kadamtola	Kabir Ahmed	Latitude: 221833.73, Longitude: 895109.78
Bagerhat	Sarankhola	Dhansgar	Fakir Bari	Mosarraf Sheikh	Latitude: 22.359, Longitude: 89.7675
Bagerhat	Sarankhola	Khontakata	6 no ward	Md. Tousir Hawlader	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	6 no ward	Md. Tousir Hawlader	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	Fakir Bari	Redoy Fakir	Latitude: 22.359, Longitude: 89.7675
Bagerhat	Sarankhola	Roynda	Uttar Kadamtola	Selim Ahmed	Latitude: 22.3102, Longitude: 89.8546
Bagerhat	Sarankhola	Khuoia	Nishanbaria	Nurul Islam	Latitude: 22.4034, Longitude: 89.826
Bagerhat	Sarankhola	Roynda	8 NO. WARD	MONOAWARA	Latitude: 22.275, Longitude: 89.829
Bagerhat	Sarankhola	Roynda	5no. ward, kodomtola	fozila begum	Latitude: 22.3119, Longitude: 89.8553
Bagerhat	Sarankhola	Southkhali	Rayenda	Yousuf Ali	Latitude: 22.2584667, Longitude: 898288999
Bagerhat	Sarankhola	Khontakata	4 no. ward	Hajra Begum	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	4 no. ward	Hajra Begum	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	4 no. ward	Poli khatun	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda		Afsana Begum	Latitude: 22.3049, Longitude: 89.8502
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Moterpara.	Md. Badsha	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Moterpara.	Md. Badsha	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	No. 6 Dhansagar	Rahman Fakir	Latitude: 22.3605, Longitude: 89.7649
Bagerhat	Sarankhola	Khontakata	4 no. Ward	Nurul Hawlader	Latitude: 22.3503, Longitude: 89.8662
Bagerhat	Sarankhola	Khontakata	4 no. Ward	Nurul Hawlader	Latitude: 22.3503, Longitude: 89.8662
Bagerhat	Sarankhola	Roynda	5 no. ward, kodomtola	shahida	Latitude: 22.313, Longitude: 89.8554
Bagerhat	Sarankhola	Roynda	8 NO. WARD	KANIJ FATIMA	Latitude: 22.2759, Longitude: 89.8292
Bagerhat	Sarankhola	Roynda	Lakurtala	Latifa khatun	Latitude: 22.274, Longitude: 89.826
Bagerhat	Sarankhola	Southkhali	Tafalbari	Abdul Subhan	Latitude: 22.261, Longitude: 89.829
Bagerhat	Sarankhola	Southkhali	South Southkhali	khodeza	Latitude: 22.254, Longitude: 89.83
Bagerhat	Sarankhola	Roynda	8 NO. WARD	MAHMUDA	Latitude: 22.2754, Longitude: 89.8292
Bagerhat	Sarankhola	Roynda	Lakurtala	Saleha Begum	Latitude: 22.2756, Longitude: 89.8271
Bagerhat	Sarankhola	Southkhali	Tafalbari	Abdul Jalil	Latitude: 22.261, Longitude: 89.828
Bagerhat	Sarankhola	Khontakata	Ward 5	Safia	Latitude: 22.3448, Longitude: 89.8676
Bagerhat	Sarankhola	Khuoia	Ward 2	Faruk Hossain	Latitude: 22.4007, Longitude: 89.8392
Bagerhat	Sarankhola	Dhansgar	Fakir Bari	Altaf Hawlader	Latitude: 22.359, Longitude: 89.7675
Bagerhat	Sarankhola	Roynda		Taffel Hossain	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	Fakir Bari	Babu Munshi	Latitude: 22.359, Longitude: 89.7675
Bagerhat	Sarankhola	Dhansgar	No. 1 Dhansagar	Hosne Ara	Latitude: 22.3722, Longitude: 89.7724
Bagerhat	Sarankhola	Southkhali	Rayenda	Nurul Islam	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	8 NO. WARD	ANOWARA	Latitude: 22.2755, Longitude: 89.8294
Bagerhat	Sarankhola	Roynda	8 NO. WARD	NASIMA	Latitude: 22.2766, Longitude: 89.289
Bagerhat	Sarankhola	Khuoia		Raza Miah	Latitude: 22.3993, Longitude: 89.841
Bagerhat	Sarankhola	Southkhali	Tafalbari	Amena Begum	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	No. 1 Dhansagar	Jahanara	Latitude: 22.3718, Longitude: 89.7732
Bagerhat	Sarankhola	Khontakata	5 no. ward	Ismail	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no. ward	Ismail	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	South Southkhali	Firoza	Latitude: 22.25498, Longitude: 89.83
Bagerhat	Sarankhola	Dhansgar	Amragachi	Piyara Begum	Latitude: 22.3737, Longitude: 89.775
Bagerhat	Sarankhola	Khontakata	Ward 4	Abul Halim	Latitude: 22.3566, Longitude: 89.8686

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Bagerhat	Sarankhola	Roynda	6 NO. WARD , MODDHO KODOMTOLA	SALEHA BEGUM	Latitude: 22.3022, Longitude: 89.834
Bagerhat	Sarankhola	Southkhali	Rayenda	Sahera	Latitude: 22.255, Longitude: 83.83
Bagerhat	Sarankhola	Roynda	5 no. ward , kodomtola	shilpi rani	Latitude: 22.323, Longitude: 89.854
Bagerhat	Sarankhola	Roynda	5 NO. WARD, KODOMTOLA	FATIMA	Latitude: 22.3128, Longitude: 89.8537
Bagerhat	Sarankhola	Roynda	6 NO, WARD, MODDHO KODOMTOLA	HIRA BEGUM	Latitude: 22.3021, Longitude: 89.8341
Bagerhat	Sarankhola	Roynda	8 NO. WARD	RINA	Latitude: 22.2768, Longitude: 89.2995
Bagerhat	Sarankhola	Roynda	6 NO. WARD, MODDHO KODOMTOLA	SALMA BEGUM	Latitude: 22.293, Longitude: 89.8414
Bagerhat	Sarankhola	Dhansgar	Bhola Nodir Chor	Kabir Sheikh	Latitude: 22.371, Longitude: 89.771
Bagerhat	Sarankhola	Southkhali	Tafalbari	Rafiqul Islam	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Uttor Southkhali	Soliman	Latitude: 22.2533, Longitude: 89.8315
Bagerhat	Sarankhola	Southkhali	Uttor Southkhali	Salman Kazi	Latitude: , Longitude:
Bagerhat	Sarankhola	Dakshin Khali	Uttar Southkhali	Shah Md Delowar	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	6 NO. WARD	NIPA	Latitude: 22.3602, Longitude: 89.7653
Bagerhat	Sarankhola	Khuoia		Mofifullah	Latitude: 22.4032, Longitude: 89.8262
Bagerhat	Sarankhola	Dhansgar	No. 1 Dhansagar	Lipi	Latitude: 22.3715, Longitude: 89.7731
Bagerhat	Sarankhola	Southkhali	Rayabda	Abdul Khalek	Latitude: , Longitude:
Satkhira	Shyamnagar	Gabura		8 Md. Omar Ali	22.247026
Satkhira	Shyamnagar	Gabura		5 Md. Solimon Sarder	
Satkhira	Shyamnagar	Gabura		5 Md. Sahanu Islam	
Satkhira	Shyamnagar	Gabura		5 Md. Abdul Alim	
Satkhira	Shyamnagar	Gabura		9 Sofikul Islam	
Satkhira	Shyamnagar	Gabura		5 Robiul Islam Dalim	
Satkhira	Shyamnagar	Gabura		7 Kobir Uddin Md. Mukarram Billah	22.243235
Satkhira	Shyamnagar	Gabura		5 Md. Abdul Mannan	
Satkhira	Shyamnagar	Gabura		4 Abul kashem	
Satkhira	Shyamnagar	Gabura		8 Md. Osman ali	22.249153
Satkhira	Shyamnagar	Gabura		6 Golam Mostofa Md.Masidul Islam	22.267083
Satkhira	Shyamnagar	Gabura		6 Aksed ali	22.22596
Satkhira	Shyamnagar	Gabura		6 Abu Musa Abdul khaled sordar	22.22653
Satkhira	Shyamnagar	Gabura		6 Anisur	22.242584
Satkhira	Shyamnagar	Gabura		9 Md.Ruhul Kuddus	22.22656
Satkhira	Shyamnagar	Gabura		9 Sirajul Sheikh	22.22693
Satkhira	Shyamnagar	Gabura		4 Abdus Samad Gail	
Satkhira	Shyamnagar	Gabura		6 Md Mohasin	
Satkhira	Shyamnagar	Gabura		4 Rasel Sardar Alhaz Md. Johurul Islam	22.244265
Satkhira	Shyamnagar	Gabura		7 Gazi	22.3265
Satkhira	Shyamnagar	Gabura		4 Maksu Gay	
Satkhira	Shyamnagar	Gabura		6 Ahmad ali Sheikh	
Satkhira	Shyamnagar	Gabura		8 Md.khosrur Rahman	
Satkhira	Shyamnagar	Gabura		6 Mst.Hafiza Khatun	
Satkhira	Shyamnagar	Gabura		6 Mst.Munjira	22.145801

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
				Khatun	
Satkhira	Shyamnagar	Gabura	7	Kaheenur khaton	
Satkhira	Shyamnagar	Gabura	5	Robul Islam	
Satkhira	Shyamnagar	Gabura	8	Karim	22.9865635
Satkhira	Shyamnagar	Padma Pukur		ashikur rahman	22.2964
Satkhira	Shyamnagar	Padma Pukur		rasel ahmed	22.299244
Satkhira	Shyamnagar	Padma Pukur	1006		22.3038
Satkhira	Shyamnagar	Padma Pukur		sadaman mondol	22.3046
Satkhira	Shyamnagar	Padma Pukur		debasish ratan	22.3052
Satkhira	Shyamnagar	Padma Pukur		kama;l gazi	22.3103
Satkhira	Shyamnagar	Padma Pukur		rakib howlader	22.3305
Satkhira	Shyamnagar	Padma Pukur		rubel mondol	22.3276
Khulna		Padma Pukur		ratan seikh	22.4676
Satkhira	Assasuni	Pratap Nagar		abu abdullah	22.4009
Satkhira	Assasuni	Pratap Nagar		sabur ali gazi	22.4042
Satkhira	Assasuni	Pratap Nagar		mujahid sarder	22.5757
Satkhira		Pratap Nagar		kazi sojol	22.3938
Satkhira	Assasuni	Pratap Nagar		kazi rafiqul islam	22.4575
Satkhira	Assasuni	Pratap Nagar		kazi shahdat	22.3998
Satkhira	Assasuni	Pratap Nagar		kalipodo sarker	22.4264
Satkhira	Assasuni	Pratap Nagar		masudur rahman	22.4046
Satkhira	Assasuni	Pratap Nagar		rasel sarder	
Satkhira	Assasuni	Pratap Nagar		kamal gazi	22.3936
Satkhira	Assasuni	Sreeula		bijoy sarker	22.4275
Satkhira	Assasuni	Sreeula		md rana	22.4275
Satkhira	Assasuni	Sreeula		rana sarder	22.4236
Satkhira	Assasuni	Sreeula		ilius gazi	22.4236
Satkhira	Assasuni	Pratap Nagar		golam hossain	22.4145
Satkhira	Assasuni	Pratap Nagar		sanower hossain	22.3936
Satkhira	Assasuni	Pratap Nagar		kamal seikh	22.3918
Satkhira	Assasuni	Pratap Nagar		ratul sarder	22.3968
Satkhira	Assasuni	Sreeula		rahim sarder	22.4221
Satkhira	Assasuni	Sreeula		jamal hossain	22.4243
Satkhira		Sreeula		rohomot ali	22.4238
Satkhira	Assasuni	Sreeula		imran ali	22.4461
Satkhira	Assasuni	Sreeula		selim molla	22.4596
Satkhira	Assasuni	Sreeula		kabir ali	22.4076
Satkhira	Assasuni	Sreeula		dobir seikh	22.3982
Satkhira	Assasuni	Sreeula		hridoy rahman	22.4113
Satkhira		Sreeula		samsul hoq	22.41
Satkhira	Assasuni	Sreeula		masud rana	22.4141
Satkhira	Assasuni	Sreeula		amanat gazi	22.4105
Satkhira	Assasuni	Sreeula		mannan molla	22.4275
Satkhira	Assasuni	Sreeula		mannan mohammad	22.4288
Satkhira	Shyamnagar	Padma Pukur		Mujahidul Islam	22.2931
Satkhira	Shyamnagar	Padma Pukur		Sudharno Barman	22.2937
Satkhira	Shyamnagar	Padma Pukur		Jamal Uddin	22.2954
Satkhira	Shyamnagar	Padma Pukur		Mita Rani	22.2936
Satkhira	Shyamnagar	Padma Pukur		Subroto MD.	22.2934
Satkhira	Shyamnagar	Padma Pukur		Mukhtaruzzaman	22.2963

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Satkhira	Shyamnagar	Padma Pukur		Md. Afzal Hossain	22.2967
Satkhira	Shyamnagar	Padma Pukur		Rafiquzzaman	22.2978
Satkhira	Shyamnagar	Padma Pukur		Tanvir	22.2985
Satkhira	Shyamnagar	Padma Pukur		Jashim	22.3003
Satkhira	Shyamnagar	Padma Pukur		Supada Dutta	22.3048
Satkhira	Shyamnagar	Padma Pukur		Paritosh Ratan	22.3046
Satkhira	Shyamnagar	Padma Pukur		Akash	22.3046
Satkhira	Shyamnagar	Padma Pukur		Sushmita	22.3041
Satkhira	Shyamnagar	Padma Pukur		Sudipta	22.3039
Satkhira	Assasuni	Pratap Nagar		Azizur Rahman	22.4011
Satkhira	Assasuni	Pratap Nagar		Hafizur Rahman	22.4004
Satkhira	Assasuni	Pratap Nagar		Ramjan	22.4027
Satkhira	Assasuni	Pratap Nagar		Pallab	22.4015
Satkhira	Assasuni	Pratap Nagar		Azam	22.4006
Satkhira	Assasuni	Pratap Nagar		Masud	22.4006
Satkhira	Assasuni	Pratap Nagar		Kazi Kaium	22.4006
Satkhira	Assasuni	Pratap Nagar		Golam Rabbani	22.4006
Satkhira	Assasuni	Pratap Nagar		Biplob	22.3925
Satkhira	Assasuni	Pratap Nagar		Zakir	22.3922
Satkhira	Assasuni	Pratap Nagar		Abdus Salam	22.4146
Satkhira	Assasuni	Pratap Nagar		Abdullah Karigor	22.4146
Satkhira	Assasuni	Pratap Nagar		Amzad Hossain	22.415
Satkhira	Assasuni	Pratap Nagar		Hossain	22.4151
Satkhira	Assasuni	Pratap Nagar		Mujahid	22.4153
Satkhira	Assasuni	Sreeula	6	Altaf Hossain	22.4276
Satkhira	Assasuni	Sreeula	6	Ajit Sarker	22.42769
Satkhira	Assasuni	Sreeula	6	Tarek	22.4283
Satkhira	Assasuni	Sreeula	6	Nimai Sarkar	22.4289
Satkhira	Assasuni	Sreeula	6	Monirul	22.4298
Satkhira	Assasuni	Sreeula		Aziz	22.4461
Satkhira	Assasuni	Sreeula		Gias	22.4749
Satkhira	Assasuni	Sreeula		Laily	22.4308
Satkhira	Assasuni	Sreeula		Bipul	22.4366
Satkhira	Assasuni	Sreeula		Badiar	22.4315
Satkhira	Assasuni	Sreeula		Partho	22.4427
Satkhira	Assasuni	Sreeula		Mustafa	22.4049
Satkhira	Assasuni	Sreeula		Mazed	22.5057
Satkhira	Assasuni	Sreeula		Farukh	22.4342
Satkhira	Assasuni	Sreeula		Shojib	22.4436
Khulna	Koyra	Dakhin Bedkashi	Golkhali	Rowshonwara	Latitude: 22.2, Longitude: 89.32
Khulna	Koyra	Dakhin Bedkashi	Golkhali	Md. Yousuf karikar	Latitude: 22.2, Longitude: 89.32
Khulna	Koyra	Dakhin Bedkashi	Shakbaria	Bokul chandra mondol	Latitude: 22.2923, Longitude: 89.3155
Khulna	Koyra	Dakhin Bedkashi	Mativanga	Romesh chandra sarkar	Latitude: 22.21, Longitude: 89.31
Khulna	Koyra	Dakhin Bedkashi	Mativanga	Joyonto Sarkar	Latitude: 22.22, Longitude: 89.31
Khulna	Koyra	Dakhin Bedkashi	Shakbaria	Shahanara	Latitude: 22.3044, Longitude: 89.2998
Khulna	Koyra	Dakhin Bedkashi	Shakbaria	Al-Amin	Latitude: 22.2872, Longitude: 89.3283
Khulna	Koyra	Dakhin Bedkashi	Shakbaria	Rowshanara	Latitude: 22.2872, Longitude: 89.3283

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Khulna	Koyra	Dakhin Bedkashi	Golkhali	Rehana	Latitude: 22.21, Longitude: 89.32
Khulna	Koira	Dakhin Bedkashi	Binapani	Ab: Alim	Latitude: 22.26442, Longitude: 89.324688
Khulna	Koyra	Dakhin Bedkashi	Mativanga	Bikash chandra	Latitude: 22.22, Longitude: 89.3
Khulna	Koyra	Dakhin Bedkashi	Mativanga	Am-amin	Latitude: 22.21, Longitude: 89.31
Khulna	Koyra	Dakhin Bedkashi	Golkhali	Rabindranath	Latitude: 22.21, Longitude: 89.32
Khulna	Koyra	Dakhin Bedkashi	Golkhali	Shekhor	Latitude: 22.21, Longitude: 89.32
Khulna	Koyra	Dakhin Bedkashi	Ward 5	Gonesh	Latitude: , Longitude:
Khulna	Koyra	Dakhin Bedkashi	Shakbaria	Komolesh	Latitude: 22.2872, Longitude: 89.3283
Khulna	Koyra	Dakhin Bedkashi	Ward 4	Nitai	Latitude: , Longitude:
Khulna	Koyra	Dakhin Bedkashi	Golkhali	Md. Khairul Dhali	Latitude: 22.21, Longitude: 89.31
Khulna	Koira	Dakhin Bedkashi	Ward 8	Md.Shajan Gazi	Latitude: 22.2379, Longitude: 89.3318
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Md. Robiul Mollah	Latitude: 22.3699, Longitude: 89.5556
Khulna	Koyra	Dakhin Bedkashi	Ward 6	Ayub Ali Gazi	Latitude: , Longitude:
Khulna	Koyra	Dakhin Bedkashi	Golkhali	Osman Gazi	Latitude: 22.21, Longitude: 89.31
Khulna	Koyra	Dakhin Bedkashi	Ward 5	Md. Israfil Sardar	Latitude: , Longitude:
Khulna	Koyra	Dakhin Bedkashi	Mativanga	Joyonti	Latitude: 22.21, Longitude: 89.3
Khulna	Koyra	Dakhin Bedkashi	Dakshin Bedkashi	Chandra kanta mandal	Latitude: 22.2494, Longitude: 89.3129
Khulna	Koira	Dakhin Bedkashi	gorshina	Md. Abdul Ohab Morol	Latitude: 22.24444, Longitude: 89.340018
Khulna	Koira	Dakhin Bedkashi	Ward 6	Md. Rafiqul Islam	Latitude: 22.237, Longitude: 89.3286
Khulna	Koyra	Dakhin Bedkashi	Ward 9	Mojibor Rahman	Latitude: , Longitude:
Khulna	Koira	Dakhin Bedkashi	binapani	Abul bashar	Latitude: 22.25827, Longitude: 89.33008
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Md. Robiul Islam	Latitude: 22.3705, Longitude: 89.5569
Khulna	Koyra	Dakhin Bedkashi	Golkhali	Md. Abdullah Gazi	Latitude: 22.21, Longitude: 89.31
Khulna	Koyra	Dakhin Bedkashi	8no. Ward, choramukha	Md. Sirajul Islam	Latitude: , Longitude:
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Md. Rayhan Dhali	Latitude: 22.2681, Longitude: 89.322
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Apu mandal	Latitude: 22.3725, Longitude: 89.557
Khulna	Koyra	Dakhin Bedkashi	Dakshin Bedkashi	Utpal Halder	Latitude: 22.2494, Longitude: 89.3129
Khulna	Dacope	Dakhin Bedkashi	Dakshin Bedkashi	Alamgir kha	Latitude: 22.2494, Longitude: 89.3129
Bagerhat	Koyra	Dakhin Bedkashi	Uttar Kadamtola, Rayenda, Shorokhola	Mohesh Mandal	Latitude: 22.1838.28, Longitude: 89.5113.53
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Dipankar Mandal	Latitude: 22.3681, Longitude: 89.5521
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Azad Gazi	Latitude: 22.3691, Longitude: 89.5531
Khulna	Koyra	Dakhin Bedkashi	Mativanga	Rabbani	Latitude: 22.21, Longitude: 89.31
Khulna	Koyra	Dakhin Bedkashi	Dakshin Bedkashi	Karim	Latitude: 22.2453, Longitude: 89.3141
Khulna	Koyra	Dakhin Bedkashi	Ward 7	Siadur Rahman	Latitude: , Longitude:
Khulna	Koira	Dakhin Bedkashi	Ward 7	Salam	Latitude: 22.236, Longitude: 89.3266
Khulna	Koyra	Dakhin	Dakshin bedkashi	Anjuara	Latitude: 22.2494, Longitude: 39.3129

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
		Bedkashi			
Khulna	Koira	Dakhin Bedkashi	binapani	Bishi shardar	Latitude: 22.25607, Longitude: 89.33525
Khulna	Koira	Dakhin Bedkashi	binapani	Abul Hasan	Latitude: 22.25806, Longitude: 89.33133
Khulna	Koira	Dakhin Bedkashi	Joshing	akbar	Latitude: 22.24285, Longitude: 89.34333
Khulna	Koira	Dakhin Bedkashi	Joshing	salma	Latitude: 22.24808, Longitude: 89.34333
Khulna	Koira	Dakhin Bedkashi	Joshing	aktha	Latitude: 22.24763, Longitude: 89.34475
Khulna	Koyra	Dakhin Bedkashi	Dakshin Bedkashi	aktar	Latitude: 22.2494, Longitude: 89.3129
Khulna	Koyra	Dakhin Bedkashi	Chormukha	aka	Latitude: 22.26396, Longitude: 89.32332
Khulna	Koyra	Dakhin Bedkashi	9 no. Ward	hasan	Latitude: 22.258177, Longitude: 89.3324
Khulna	Koyra	Dakhin Bedkashi	5 no. Ward, jorshing	rekha	Latitude: 22.240244, Longitude: 89.343167
Khulna	Koyra	Dakhin Bedkashi	9 no ward	Yunus	Latitude: 22.260685, Longitude: 89.327826
Khulna	Koyra	Dakhin Bedkashi	9 no ward	Tarikul	Latitude: 22.2561, Longitude: 89.33393
Khulna	Koyra	Dakhin Bedkashi	5 no ward, jarsing	Latkfa	Latitude: 22.245516, Longitude: 89.344683
Khulna	Koyra	Dakhin Bedkashi	Shakbaria	Jolil	Latitude: 22.2871, Longitude: 89.3282
Khulna	Koyra	Dakhin Bedkashi	Meder char	Hamid	Latitude: , Longitude:
Khulna	Koyra	Dakhin Bedkashi	Choramukha	Jahangir	Latitude: , Longitude:
Khulna	Koyra	Dakhin Bedkashi	Choramokha	Mizanur	Latitude: , Longitude:
Khulna	Koyra	Dakhin Bedkashi	7no ward	Mizanur	Latitude: , Longitude:
Khulna	Koira	Dakhin Bedkashi	Ward 6	Anupom	Latitude: 22.2153, Longitude: 89.3279
Khulna	Koira	Dakhin Bedkashi	Ward 7	Mohon Ali Gazi	Latitude: 22.2153, Longitude: 89.3279
Khulna	Koira	Dakhin Bedkashi	Ward 5	Samsur Gazi	Latitude: 22.235, Longitude: 89.3302
Khulna	Koyra	Dakhin Bedkashi	Ward 7	Nittanando Mondol	Latitude: , Longitude:
Khulna	Paikgacha	Dakhin Bedkashi	8no. Ward, hani	obokumar sorkar	Latitude: , Longitude:
Khulna	Koira	Dakhin Bedkashi	Ward 8	dipongkor sorkar	Latitude: 22.2354, Longitude: 89.3279
Khulna	Koira	Dakhin Bedkashi	Ward 7	choyon sarkar	Latitude: 22.2379, Longitude: 89.3317
Khulna	Koyra	Dakhin Bedkashi	9 no. Ward, hani	irani	Latitude: , Longitude:
Khulna	Paikgacha	Deluti	Ward 5	Bahadur Mollah	Latitude: 22.5827, Longitude: 89.4017
Khulna	Paikgacha	Deluti	Ward 5	Badiar	Latitude: 22.5827, Longitude: 89.4017
Khulna	Paikgacha	Deluti	Hatbari	Mita	Latitude: 22.6255, Longitude: 89.4471
Khulna	Paikgacha	Deluti	Ward 7	Meri Rani Biswas	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 7	Shimul Tikadar	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Fulbari	Biporno Biswas	Latitude: 22.6438, Longitude: 89.4314
Khulna	Paikgacha	Deluti	Ward 5	Pabitra Kumar Mondal	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 6	Jahangir Biswas	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 6	Debala Rani Ghosh	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 3	Ranjan Sarkar	Latitude: Longitude:
Khulna	Paikgacha	Deluti	No.4 Deluti	Harun Sheikh	Latitude: 22.6204, Longitude: 89.4105
Khulna	Paikgacha	Deluti	Hatbari	Shyama Prosad Halder	Latitude: 22.6302, Longitude: 89.4398

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Khulna	Paikgacha	Deluti	Telikhali	Diganta Sardar	Latitude: 22.6261, Longitude: 89.4462
Khulna	Paikgacha	Deluti	Telikhali	Madhusudan Mallick	Latitude: 22.6266, Longitude: 89.4588
Khulna	Paikgacha	Deluti	No. 4 Deluti	Nitai Mondal	Latitude: 22.5817, Longitude: 89.401
Khulna	Paikgacha	Deluti	No. 4 Deluti	Ujjal	Latitude: 22.5823, Longitude: 89.4004
Khulna	Paikgacha	Deluti	No. 4 Deluti	Hedayet	Latitude: 22.5964, Longitude: 89.4064
Khulna	Paikgacha	Deluti	Hatbari	Mustafa	Latitude: 22.6324, Longitude: 89.4408
Khulna	Paikgacha	Deluti	Ward 3	Pallab	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 5	Mazed	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Hatbari	Zakir	Latitude: 22.6256, Longitude: 89.4472
Khulna	Paikgacha	Deluti	Ward 6	bodir	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 5	ahmed	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 5	bodir	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 2	ahmed	Latitude: Longitude:
Khulna	Paikgacha	Deluti	No. 4 Deluti	majed	Latitude: 22.6088, Longitude: 89.4128
Khulna	Paikgacha	Deluti	No. 4 Deluti	Ghouropodo roy	Latitude: 22.5832, Longitude: 89.3907
Khulna	Paikgacha	Deluti	No. 4 Deluti	Ajay Ray	Latitude: 22.5966, Longitude: 89.4064
Khulna	Paikgacha	Deluti	Ward 7	Nironjon shana	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 6	Mithun Roy	Latitude: Longitude:
Khulna	Paikgacha	Deluti	No.4 Deluti	soshan mondol	Latitude: 22.6205, Longitude: 89.4108
Khulna	Paikgacha	Deluti	Ward 6	salm	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Fulbari	Anup Kumar Roy	Latitude: 22.6439, Longitude: 89.4313
Khulna	Paikgacha	Deluti	Telikhali	Md.Owahed sheikh	Latitude: 22.6293, Longitude: 89.4439
Khulna	Paikgacha	Deluti	Ward 5	barik	Latitude: 22.5729, Longitude: 89.4026
Khulna	Paikgacha	Deluti	Ward 6	rana	Latitude: 22.5729, Longitude: 89.4026
Khulna	Paikgacha	Deluti	Ward 7	Chinmoy Mondol	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 6	taslima	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 5	Md Lutfor gazi	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 7	Khan Bahadur sana	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Telikhali	Bithika Mondol	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Telikhali	Babor ali sana	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Telikhali	Kobita Vawali	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 9	Ishwari Vawali	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Telikhali	khukumoni Mondol	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 6	Urmila Kaowali	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 6	lokkhi kawali	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 5	tulshi majhi	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 5	abdul gazi	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Trlikhali	Salma	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Telikhali	Bithi	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Fulbari	Faruk	Latitude: 22.6424, Longitude: 89.4351
Khulna	Paikgacha	Deluti	Ward 6	Rumki	Latitude: 22.5758, Longitude: 89.4126
Khulna	Paikgacha	Deluti	Ward 7	Rupa	Latitude: 22.5758, Longitude: 89.4126
Khulna	Paikgacha	Deluti	No. 4 Deluti	Silu	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 1	Taslim	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Telikhali	Moni	Latitude: Longitude:
Khulna	Paikgacha	Deluti	No. 4 Deluti	Mohon	Latitude: Longitude:
Khulna	Paikgacha	Deluti	No. 4 Deluti	Puja	Latitude: Longitude:
Khulna	Paikgacha	Deluti	Ward 4	Nuru	Latitude: Longitude:

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Khulna	Paikgacha	Deluti	Ward 8	Nuru	Latitude: Longitude:
Khulna	Paikgacha	Deluti	No.4 Deluti	borun	Latitude: 22.6316, Longitude: 89.4158
Khulna	Paikgacha	Deluti	Fulbari	Nirmola Dofadar	Latitude: 22.6415, Longitude: 89.4372
Khulna	Paikgacha	Deluti	Trlikhali	Proshanto Kumar Bahar	Latitude: 22.6262, Longitude: 89.4587
Khulna	Paikgacha	Garuikhali	3	Trishna biswas	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	5	Newton Mistri	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	5	Sushan mondol	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Narayon mondol	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	4	Aser ali	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	5	Niranjon mondol	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Pobitro mondol	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	5	Lavlu	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	8	Bishajit	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	komolesh	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Bapi	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	8	Rabin	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	8	Gonesh	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	8	Sanjit bala	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Emran Haolader	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	5	Newton	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Bisnu mistri	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Malik	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Sumon Sarkar	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Shashanko Sarkar	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Nobiron	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Somiron Rani	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Golapi	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Naraon	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Santos	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	4	Sheuli	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Md. Ripon Sana	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	4	Oliar Rahman	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	4	Md. Ajjul Biswas	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Rajbollav Mondal	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Pushpa Rani sarkar	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Baccu Sana	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Raju Sana	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Shahanara Begum	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	8	Md. Salam Sana	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	8	Zafarul Sheikh	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Binoy Krishna Biswas	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Bijoli Sarkar	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	5	Md. Nasir Sana	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Afjal Gazi	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Paritosh Mondal	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Tushar Mondal	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Binoy Kanti Mondal	Latitude: , Longitude:

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Khulna	Paikgacha	Garuikhali	3	Dijwen Sarkar	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Md. Khokon Gazi	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	8	Bidhan Mondal	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	9	Arafat Hossain	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	gopal dofadar	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	rina parvin	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	taposh kumar	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	sabitry	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	sukriti	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	khokon	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	hafiza	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Podma rani	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Ponchanon	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Abdur Rahman	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Monirul Islam	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Al Mamun	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Jhorna Rani Gain	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Jamirul	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	3	Abul Hosen	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	9	Fozlur Ali	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	4	Chandona	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	7	Bkash chandro mondal	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	5	Puspa	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	5	Lucky	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Nimai	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	2	Rabeya	Latitude: , Longitude:
Khulna	Paikgacha	Garuikhali	9	Rajjak	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	W5	Halima	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	Ward 6	Rekha	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	W9	Sujan kumar Gain	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	Ward 8	Shofiqul	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	W1	Gobindalal Mandal	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W1	Nirun Das	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	kamarkhola	Barik Gzi	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	W	Jasmin	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	Ward 8	Momtaz	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Ward 7	Atiur Rahman	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Ward 6	Kobirul Islam	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	shivnagar	Amir Hossain Gazi	Latitude: 22.5353, Longitude: 89.4682
Khulna	Dacope	Kamarkhola	kamarkhola	Rakib Hossain	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Ward 8	Afajuddin gaji	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	kalinagar	Nasima begum	Latitude: 22.5681, Longitude: 89.4781
Khulna	Dacope	Kamarkhola	W	Soleman soddar	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	Joynagar	Abdur Rashid	Latitude: 22.5353, Longitude: 89.4682
Khulna	Dacope	Kamarkhola	Joynagar	Shahjahan soddar	Latitude: 22.5353, Longitude: 89.4682
Khulna	Dacope	Kamarkhola	JOYNAGARA	Sukumar gan	Latitude: 22.5353, Longitude: 89.4682
Khulna	Dacope	Kamarkhola	Joynagar	Gobinda	Latitude: 22.5353, Longitude: 89.4682

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Khulna	Dacope	Kamarkhola	Joynagar	Pankaj Ray	Latitude: 22.5344, Longitude: 89.4641
Khulna	Dacope	Kamarkhola	kamarkhola	Md. Tuhin Sana	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	kamarkhola	Jamal faruk gazi	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Ward 5	Asaduzzaman Gazi	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Ward 8	Moin Ali	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Ward 7	Halima	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Ward 6	Abucl youfuf	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Ward 8	Nazim uddin mollik	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	kamarkhola	Washim Biswas	Latitude: 22.5601, Longitude: 89.4663
Khulna	Dacope	Kamarkhola	kamarkhola	Kashem	Latitude: 22.5681, Longitude: 89.4781
Khulna	Dacope	Kamarkhola	W1	Atiar Gazi	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	kamarkhola	Enamul sarder	Latitude: 22.5615, Longitude: 89.4704
Khulna	Dacope	Kamarkhola	W5	Irshadul gazi	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	kalinagar	Md.Abdar ali fokir	Latitude: 22.5262, Longitude: 89.4752
Khulna	Dacope	Kamarkhola	shivbagar	Altaf hossain	Latitude: 22.5353, Longitude: 89.4682
Khulna	Dacope	Kamarkhola	joynagar	Monirul islam	Latitude: 22.5353, Longitude: 89.4682
Khulna	Dacope	Kamarkhola	joynagar	Babul gazi	Latitude: 22.5353, Longitude: 89.4682
Khulna	Dacope	Kamarkhola	W9	Md Dobiruddin gazi	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W9	Abdul mistree	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W9	Shyamaprosad Mondal	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W1	Sumita Roy	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W5	Prashanta Baidya	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W8	Fazlu Sana	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	Ward 6	Abdul Bariq Gazi	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	kalinagar	Md. Mokbul Hossain	Latitude: 22.5262, Longitude: 89.4752
Khulna	Dacope	Kamarkhola	W	Rafiqul Islam	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	Ward 6	Parimal Halder	Latitude: , Longitude:
Khulna	Dacope	Kamarkhola	Kamarkhola	Md. Ziaur Rahman	Latitude: 22.5692, Longitude: 89.479
Khulna	Dacope	Kamarkhola	W1	Krishnapada Mondal	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W5	Jay Prakash dey	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W	majid	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W	Nasima	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W5	Sanjit Sardar	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W2	Srikanto Bala	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W9	Pravash Chandra Gain	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W8	Abu Sattar Sans	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W2	Jinarul Sana	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	kamarkhola	Md. Nasim Mollah	Latitude: 22.5601, Longitude: 89.4663
Khulna	Dacope	Kamarkhola	kamarkhola	Sushanta Bairagi	Latitude: 22.5467, Longitude: 89.4738
Khulna	Dacope	Kamarkhola	W2	Pronab Goldar	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	W1	Abdul Hamid Sana	Latitude:Longitude:
Khulna	Dacope	Kamarkhola	kamarkhola	Bablu Sheikh	Latitude: 22.5601, Longitude: 89.4663
Khulna	Dacope	Kamarkhola	W5	Shyamal Bachar	Latitude:Longitude:
Khulna	Paikgacha	Lata	Lata	Billal Hossain	Latitude: 22.6408, Longitude: 89.3689

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Khulna	Paikgacha	Lata	Putrakhali	Md. Islam	Latitude: 22.643514, Longitude: 89.306236
Khulna	Koira	Lata	Putlakhali	Goutam Gharami	Latitude: 22.6151, Longitude: 89.36581
Khulna	Paikgacha	Lata	Haria	Shailendranath Bachar	Latitude: 22.61567, Longitude: 89.34719
Khulna	Paikgacha	Lata	Tetultala	Poritosh kumar sardar	Latitude: 22.6453, Longitude: 89.3444
Khulna	Paikgacha	Lata	Godardanga	Tipu gazi	Latitude:Longitude:
Khulna	Paikgacha	Lata	Tetul Tala	Mamunur Rashid	Latitude: 22.6453, Longitude: 89.3444
Khulna	Paikgacha	Lata	Kathmari	Saeed vai	Latitude:Longitude:
Khulna	Paikgacha	Lata	Lata	Abdul morol	Latitude: 22.6408, Longitude: 89.3689
Khulna	Paikgacha	Lata	Pana	Ain uddin gazi	Latitude: 22.6556, Longitude: 89.341
Khulna	Paikgacha	Lata	Godardanga	Mohon torofdar	Latitude:Longitude:
Khulna	Paikgacha	Lata	Tetultola	Nita Rani Sardar	Latitude: 22.6452, Longitude: 89.3444
Khulna	Paikgacha	Lata	Ward 2 Haria	Arpona Roy	Latitude: 22.62691, Longitude: 89.34897
Khulna	Paikgacha	Lata	Putimari	Sonia Begum	Latitude: 22.6691, Longitude: 89.3567
Khulna	Paikgacha	Lata	Pana	Hamida Akter	Latitude: 22.6556, Longitude: 89.341
Khulna	Paikgacha	Lata	Pana	Momin Gazi	Latitude: 22.6482, Longitude: 89.3372
Khulna	Paikgacha	Lata	Tetultala	Ibrahim Khalil	Latitude:Longitude:
Khulna	Paikgacha	Lata	Godardanga	Dipayan Golder	Latitude: 22.6769, Longitude: 89.3691
Khulna	Paikgacha	Lata	Lata	Md. Enamul Sheikh	Latitude:Longitude:
Khulna	Paikgacha	Lata	Shonkordana	Mahbubul Alam	Latitude: 22.6294, Longitude: 89.349267
Khulna	Paikgacha	Lata	Putimari	Halima bibi	Latitude: 22.67, Longitude: 89.3567
Khulna	Paikgacha	Lata	Godardanga	Anowara	Latitude: 22.6731, Longitude: 89.3656
Khulna	Paikgacha	Lata	Godardanga	Jamuna bani ghosh	Latitude: 22.6681, Longitude: 89.3736
Khulna	Paikgacha	Lata	Godardanga	Sraboni Adhikari	Latitude: 22.6768, Longitude: 89.3691
Khulna	Paikgacha	Lata	Godardanga	Ram munda	Latitude:Longitude:
Khulna	Paikgacha	Lata	Pana	Robiul	Latitude: 22.651, Longitude: 89.3495
Khulna	Paikgacha	Lata	Dholai	Kamal	Latitude:Longitude:
Khulna	Koira	Lata	Ward 8	Sabirali	Latitude: 22.62782, Longitude: 89.35651
Khulna	Paikgacha	Lata	Godardanga	Ponkoj	Latitude:Longitude:
Khulna	Paikgacha	Lata	Godardanga	Robiul	Latitude:Longitude:
Khulna	Paikgacha	Lata	Kathamari	Abdul Gazi	Latitude: 22.6403, Longitude: 83.3379
Khulna	Paikgacha	Lata	Pana	Hashem	Latitude:Longitude:
Khulna	Paikgacha	Lata	Haria	Arun munda	Latitude:Longitude:
Khulna	Paikgacha	Lata	Pana	Md. Mahfuz Uddin	Latitude: 22.654, Longitude: 89.3401
Khulna	Paikgacha	Lata	Shamukpota	Masura	Latitude: 22.6648, Longitude: 89.3419
Khulna	Paikgacha	Lata	Tetul Tala	Maksudul Gazi	Latitude:Longitude:
Khulna	Paikgacha	Lata	Shamukpota	Nasima khatun	Latitude: 22.6665, Longitude: 89.3447
Khulna	Paikgacha	Lata	Shamukpota	Babulal Munda	Latitude: 22.665, Longitude: 89.3429
Khulna	Paikgacha	Lata	8 no. Ward, hani	Masum Billah	Latitude:Longitude:
Khulna	Paikgacha	Lata	Lata	Monirul Islam	Latitude:Longitude:
Khulna	Paikgacha	Lata	Pana	Fajila Begum	Latitude:Longitude:
Khulna	Paikgacha	Lata	Godardanga	Rajab Ali Sheikh	Latitude: 22.6715, Longitude: 89.3618
Khulna	Paikgacha	Lata	Putimari	Nosher Mollah	Latitude: 22.6711, Longitude: 89.3593
Khulna	Koira	Lata	Adharmanik	Nitto Nando	Latitude: 22.62386, Longitude: 89.35546
Khulna	Paikgacha	Lata	Shamukpota	tania	Latitude: 22.6696, Longitude: 89.359
Khulna	Paikgacha	Lata	8no. Ward	asa	Latitude:Longitude:

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Khulna	Paikgacha	Lata	Putimari (Govt. Housing Project)	asash	Latitude: 22.6657, Longitude: 89.3436
Khulna	Paikgacha	Lata	Putimari	emran	Latitude: 22.6681, Longitude: 89.3509
Khulna	Paikgacha	Lata	Putimari	titu	Latitude: 22.6676, Longitude: 89.3508
Khulna	Paikgacha	Lata	Shamukpota		Latitude: 22.6668, Longitude: 89.3448
Khulna	Paikgacha	Lata	Putimari	atik	Latitude: 22.6675, Longitude: 89.3503
Khulna	Paikgacha	Lata	Godardanga	Prokash audhikari	Latitude: 22.6712, Longitude: 89.3611
Khulna	Paikgacha	Lata	Godardanga	Indrany	Latitude:Longitude:
Khulna	Paikgacha	Lata	Lata	Parboty	Latitude:Longitude:
Khulna	Paikgacha	Lata	8 no. Ward, hani	Sundor mondol	Latitude:Longitude:
Khulna	Paikgacha	Lata	8 no. Ward		Latitude:Longitude:
Khulna	Paikgacha	Lata	Tetul Tala		Latitude:Longitude:
Khulna	Paikgacha	Lata	Putimari (Govt. Housing Project)		Latitude: 22.6637, Longitude: 89.3417
Khulna	Paikgacha	Lata	Pana		Latitude:Longitude:
Khulna	Koyra	Lata	3no. Ward,Adharmanik		Latitude: 22.585755, Longitude: 89.3866965
Khulna	Paikgacha	Lata	Gabgunia	samsul hoq	Latitude: 22.2923, Longitude: 89.3155
Khulna	Paikgacha	Lata	Pana	masud rana	Latitude:Longitude:
Khulna	Paikgacha	Lata	Putrakhali	amanat gazi	Latitude:Longitude:
Khulna	Paikgacha	Lata	Godardanga	mannan molla	Latitude:Longitude:
Khulna	Paikgacha	Lata	Tetul Tala	mannan mohammad	Latitude: 22.6474, Longitude: 89.3461
Khulna	Paikgacha	Lata	Godardanga	Mujahidul Islam Sudharno Barman	Latitude: 22.6706, Longitude: 89.3608
Khulna	Koira	Lata	Sankudana		Latitude: 22.62941, Longitude: 89.34717
Khulna	Paikgacha	Lata	Kathmari	Jamal Uddin	Latitude: 22.647, Longitude: 89.3674
Khulna	Koira	Lata	haria	Mita Rani	Latitude: 22.62058, Longitude: 89.34609
Khulna	Koira	Lata	haria	Subroto	Latitude: 22.61231, Longitude: 89.3473
Khulna	Koira	Lata	Dholai	MD. Mukhtaruzzaman	Latitude: 22.61008, Longitude: 89.33278
Khulna	Paikgacha	Lata	Putimari	Md. Afzal Hossain	Latitude: 22.6742, Longitude: 89.3678
Khulna	Koira	Lata	Sochiar bondo	Rafiquzzaman	Latitude: 22.62867, Longitude: 89.3516
Khulna	Koira	Lata	Sankudana	Tanvir	Latitude: 22.62722, Longitude: 89.34888
Khulna	Paikgacha	Lata	Dholai	Jashim	Latitude: 22.609227, Longitude: 89.362077
Khulna	Paikgacha	Lata	Kathamari	Supada Dutta	Latitude:Longitude:
Khulna	Paikgacha	Lata	Shonkordana	Paritosh Ratan	Latitude:Longitude:
Khulna	Paikgacha	Lata	Shonkordana	Akash	Latitude:Longitude:
Khulna	Paikgacha	Lata	Ward 3 Shochiarbondondo	Sushmita	Latitude:Longitude:
Khulna	Paikgacha	Lata	Ward 3 adharmanik	Sudipta	Latitude: 22.62517, Longitude: 89.35547
Khulna	Paikgacha	Lata	Tetultola	Azizur Rahman	Latitude:Longitude:
Khulna	Paikgacha	Lata	Gabgunia	Hafizur Rahman	Latitude:Longitude:
Khulna	Paikgacha	Lata	Pana	Ramjan	Latitude:Longitude:
Khulna	Paikgacha	Lata	Ward 3 Shochiarbondondo	Pallab	Latitude: 22.598474, Longitude: 89.31465
Khulna	Paikgacha	Lata	8 no. Ward, hani	Azam	Latitude: , Longitude:
Khulna	Paikgacha	Lata	8 no. Ward	Masud	Latitude: , Longitude:
Khulna	Paikgacha	Lata	8 no. Ward, hani		Latitude: , Longitude:
Khulna	Paikgacha	Lata	8no. Ward		Latitude: , Longitude:
Khulna	Paikgacha	Lata	Ward 2 Haria		Latitude:Longitude:
Khulna	Paikgacha	Lata	Shonkordana		Latitude: 22.62902, Longitude:

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					89.349005
Khulna	Paikgacha	Lata	Lata		Latitude: 22.63317, Longitude: 89.3688
Khulna	Paikgacha	Sholadana	Khaumari		Latitude: 22.5594, Longitude: 89.3657
Khulna	Paikgacha	Sholadana	Khatuamari		Latitude: 22.5205, Longitude: 89.3977
Khulna	Paikgacha	Sholadana	Betbunia		Latitude: 22.5216, Longitude: 89.399
Khulna	Paikgacha	Sholadana	5		Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	7no. Ward, West vetkimari		Latitude: 22.529929, Longitude: 89.39504639
Khulna	Paikgacha	Sholadana	4no. Ward		Latitude: 22.521643, Longitude: 89.39885
Khulna	Paikgacha	Sholadana	W2		Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W7		Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	Ghatuamari		Latitude: 22.5236, Longitude: 89.3813
Khulna	Paikgacha	Sholadana	6	MD. Mukhtaruzzaman	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	5 no. Ward, Betbunia	Md. Afzal Hossain	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W9	Rafiquzzaman	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	Khaumari	Tanvir	Latitude: 22.5208, Longitude: 89.3854
Khulna	Paikgacha	Sholadana	7no. Ward, Betbunia	Jashim	Latitude: 22.5300324, Longitude: 89.3943705
Khulna	Paikgacha	Sholadana	9 no. Ward, Betbunia	Supada Dutta	Latitude: 22.5467, Longitude: 89.3966
Khulna	Paikgacha	Sholadana	W1	Paritosh Ratan	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W1	Dulal	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	6	Shabbir Sheikh	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W2	Nuruzzaman	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	9 no. Ward, Betbunia	Kabir Ahmed	Latitude: 22.5487, Longitude: 89.3986
Khulna	Paikgacha	Sholadana	Sonakhali	Mosarraf Sheikh	Latitude: 22.5269, Longitude: 89.368
Khulna	Paikgacha	Sholadana	7 no. Ward, Betbunia	Md. Tousir Hawlader	Latitude: 22.5396, Longitude: 89.3959
Khulna	Paikgacha	Sholadana	Ghatuamari	Md. Tousir Hawlader	Latitude: 22.5238, Longitude: 89.3811
Khulna	Paikgacha	Sholadana	W9	Redoy Fakir	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	Vakotmari	Selim Ahmed	Latitude: 22.5283, Longitude: 89.4027
Khulna	Paikgacha	Sholadana	Khaumari	Nurul Islam	Latitude: 22.5204, Longitude: 89.3852
Khulna	Paikgacha	Sholadana	Khaumari	MONOAWARA	Latitude: 22.5272, Longitude: 89.3678
Khulna	Paikgacha	Sholadana	W9	fozila begum	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W1	Yousuf Ali	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W1	Hajra Begum	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W7	Hajra Begum	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W2	Poli khatun	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	5 no. Ward, Khatuamari	Afsana Begum	Latitude: 22.5223048, Longitude: 89.3837698
Khulna	Paikgacha	Sholadana	5 no. Ward, Khatuamari	Md. Badsha	Latitude: 22.522728, Longitude: 89.38278155
Khulna	Paikgacha	Sholadana	W7	Md. Badsha	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	Betbunia	Rahman Fakir	Latitude: 22.5214, Longitude: 89.3987
Khulna	Paikgacha	Sholadana	Ghatuamari	Nurul Hawlader	Latitude: 22.5269, Longitude: 89.368
Khulna	Paikgacha	Sholadana	Khatua mari	Nurul Hawlader	Latitude: 22.5207, Longitude: 89.3848
Khulna	Paikgacha	Sholadana	W9	shahida	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W2	KANIJ FATIMA	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W9	Latifa khatun	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	6 no. Ward, Betbunia	Abdul Subhan	Latitude: 22.5393, Longitude: 89.3957
Khulna	Paikgacha	Sholadana	W1	khodeza	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W7	MAHMUDA	Latitude: , Longitude:

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Khulna	Paikgacha	Sholadana	4 no. Ward, Betbunia	Saleha Begum	Latitude: 22.52163917, Longitude: 89.398568
Khulna	Paikgacha	Sholadana	9no. Ward, boyarjhapa	Abdul Jalil	Latitude: 22.5799922, Longitude: 89.38532816
Khulna	Paikgacha	Sholadana	W1	Safia	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W2	Faruk Hossain	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	9 no. Ward, Betbunia	Altaf Hawlader	Latitude: 22.5455, Longitude: 89.3953
Khulna	Paikgacha	Sholadana	8 no. Ward, Boyarjhapa	Taffel Hossain	Latitude: 22.551967, Longitude: 89.39783266
Khulna	Paikgacha	Sholadana	8 no. Ward, Boyarjhapa	Babu Munshi	Latitude: 22.552684, Longitude: 89.3976876
Khulna	Paikgacha	Sholadana	W9		Latitude: , Longitude:
Khulna	Paikgacha	Sholadana		3 hasan	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	5 no. Ward, Khatuamari	jou	Latitude: 22.527132, Longitude: 89.367646
Khulna	Paikgacha	Sholadana	W2	jsa	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	Purbo Bakotmari	KARIMA	Latitude: 22.3142, Longitude: 89.241
Khulna	Paikgacha	Sholadana	9no. Ward, Tangramari		Latitude: 22.5635331, Longitude: 89.38728294
Khulna	Paikgacha	Sholadana	W2	rahij	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	8 no. Ward, Betbunia		Latitude: 22.5637332, Longitude: 89.387847
Khulna	Paikgacha	Sholadana	5 no. Ward, Khatuamari	Selim	Latitude: 22.521817, Longitude: 89.38499
Khulna	Paikgacha	Sholadana	9 no. Ward, Betbunia	Selim	Latitude: 22.544, Longitude: 89.3939
Khulna	Paikgacha	Sholadana	W9	Ali Ahamad	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W9	Gias Hawlader	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W7	KOMLA	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	W2	Md. Mosharraf Hossain	Latitude: , Longitude:
Khulna	Dacope	Sutarkhali	Kalabogi	Md. Mosharraf Hossain	Latitude: 22.42948, Longitude: 89.4507899
Khulna	Dacope	Sutarkhali	W2	Abdul Khalek	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W9	Abdul Khalek	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	5no. Ward, kasaripara,nalian	Abdul Khalek	Latitude: 22.470424, Longitude: 89.444377
Khulna	Dacope	Sutarkhali	8no. Ward, Kalabogi-sutarkhali	Abdul Karim	Latitude: 22.44185, Longitude: 89.45322
Khulna	Dacope	Sutarkhali	kalabagisutarkhali	Al-amin	Latitude: 22.4656, Longitude: 89.4579
Khulna	Dacope	Sutarkhali	9no. Ward, kalabogi	Md. Ibrahim	Latitude: 22.435511, Longitude: 89.4526686
Khulna	Dacope	Sutarkhali	W5	Md. Ibrahim	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	2no. Ward, Gonary-moddopara/forest para	Arif	Latitude: 22.46443, Longitude: 89.4365
Khulna	Dacope	Sutarkhali	Sutarkhali Purbapara	Md. Ibrahim	Latitude: 22.47, Longitude: 89.46
Khulna	Dacope	Sutarkhali	W	Jalil	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W8	Jalil	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Nolyan	Md. Masum Hawlader	Latitude: 22.48, Longitude: 89.43
Khulna	Dacope	Sutarkhali	W5	Shan Alam	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Sutarkhali Dakshinpara	Shan Alam	Latitude: 22.47, Longitude: 89.46
Khulna	Dacope	Sutarkhali	W	Jossim Uddin	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Dakhsin Gunari	Abdur Rahman Gazi	Latitude: 22.47, Longitude: 89.43
Khulna	Dacope	Sutarkhali	W2	Sarowar	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W8	Sarowar	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Dakhsin Gunari	Rashida	Latitude: 22.47, Longitude: 89.44
Khulna	Dacope	Sutarkhali	Sutarkhali Dakshinpara	Rashida	Latitude: 22.47, Longitude: 89.46

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Khulna	Dacope	Sutarkhali	W1	Mahmuda	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W2	Ripa Khanam	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W8	Khokon	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Sutarkhali purbapara	Khokon	Latitude: 22.48, Longitude: 89.46
Khulna	Dacope	Sutarkhali	Sutarkhali Purbapara	Md Sohorab Hossain	Latitude: 22.49, Longitude: 89.47
Khulna	Dacope	Sutarkhali	W	MORJINA	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W2	Md. Easin Khan	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W	Md. Easin Khan	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Sutarkhali Purbapara	Hosneara	Latitude: 22.49, Longitude: 89.47
Khulna	Dacope	Sutarkhali	W2	Hosneara	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W5	Asma Begum	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Dakhsin Gunari	Asma Begum	Latitude: 22.47, Longitude: 89.43
Khulna	Dacope	Sutarkhali	W9	Poli khatun	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W		Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W5		Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W1	Salman Khan	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W2	Altaf Hossain	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W9	Helal Uddin	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Kalabagi	Hamid Sarder	Latitude: 22.4557, Longitude: 89.4562
Khulna	Dacope	Sutarkhali	Kalabagi	Abdul Hai	Latitude: 22.4526, Longitude: 89.4558
Khulna	Dacope	Sutarkhali	W8	Md.Mojid Siddik	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W	Rasel	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Kalabagi	Rasel	Latitude: 22.4568, Longitude: 89.4452
Khulna	Dacope	Sutarkhali	Kalabogi	Bharti Rani	Latitude: 22.436694, Longitude: 89.4447195
Khulna	Dacope	Sutarkhali	W1	Hashem	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	kalabagisutarkhali	Hashem	Latitude: 22.4617, Longitude: 89.4659
Khulna	Dacope	Sutarkhali	W8	Hafiza Banu	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Nolian village	Khalek Hawlader	Latitude: 22.4566, Longitude: 89.4447
Khulna	Dacope	Sutarkhali	W1	Khalek Hawlader	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	kalabagisutarkhali	Panna Mia	Latitude: 22.4617, Longitude: 89.4659
Khulna	Dacope	Sutarkhali	W5	Firoz Sheik	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W9	Firoz Sheik	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	kalabagisutarkhali	Ab. Rahim Bapary	Latitude: 22.4617, Longitude: 89.4659
Khulna	Dacope	Sutarkhali	W5	Hafiz Ali	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Nalian	Hafiz Ali	Latitude: 22.46528, Longitude: 89.4379628
Khulna	Dacope	Sutarkhali	Nalian	Hafiz Ali	Latitude: 22.46211, Longitude: 89.43523
Khulna	Dacope	Sutarkhali	Nolian village	Hafiz	Latitude: 22.4566, Longitude: 89.4447
Khulna	Dacope	Sutarkhali	8no. Ward, kalabogi	Jorina Banu	Latitude: 22.436641, Longitude: 89.44801
Khulna	Dacope	Sutarkhali	W2	Jahidul Sheikh	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	Kalabagi	Rina	Latitude: 22.4526, Longitude: 89.4558
Khulna	Dacope	Sutarkhali	W8	Yousus Ali	Latitude:Longitude:
Khulna	Dacope	Sutarkhali	W1	Yunus Khan	Latitude:Longitude:
Khulna	Dacope	Tildanga	Kakrabunia	Soliman	Latitude: 22.5768, Longitude: 89.42999
Khulna	Koyra	Tildanga	Kakrabunia	Delwar	Latitude: 22.572477, Longitude: 89.4314574
Khulna	Dacope	Tildanga	Laxmikhola	SIRAJUL	Latitude: 22.62, Longitude: 89.44
Khulna	Dacope	Tildanga	Naldanga		Latitude:Longitude

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Khulna	Dacope	Tildanga	Kakrabunia	Abdur Razzak	Latitude:Longitude
Khulna	Dacope	Tildanga	Kakrabunia	Azim	Latitude:Longitude
Khulna	Dacope	Tildanga	Kakrabunia	Azim	Latitude: 22.57, Longitude: 89.43
Khulna	Dacope	Tildanga	Batbunia	Shah Alam	Latitude:Longitude
Khulna	Dacope	Tildanga	Gorkhali	Sobur	Latitude:Longitude
Khulna	Dacope	Tildanga	Khona	Selika Khatun	Latitude: , Longitude:
Khulna	Dacope	Tildanga	Batbunia	Nurunnahar	Latitude: , Longitude:
Khulna	Dacope	Tildanga	Laxmikhola	Shahidul Islam	Latitude: 22.62, Longitude: 89.45
Khulna	Dacope	Tildanga	Botbunia	Shahidul Islam	Latitude:Longitude
Khulna	Dacope	Tildanga	Tildanga Kacharibari	Piyara Begum	Latitude: 22.59, Longitude: 89.46
Khulna	Dacope	Tildanga	Kakrabunia	Piyara Begum	Latitude: 22.57, Longitude: 89.42
Khulna	Dacope	Tildanga	Naldanga	Iliyas	Latitude: 22.58, Longitude: 89.44
Khulna	Dacope	Tildanga	Gharkhali	Fokhrul	Latitude:Longitude
Khulna	Dacope	Tildanga	Naldanga	Rashida Begum	Latitude:Longitude
Khulna	Dacope	Tildanga	6no. Ward, Kaminibasias	Mojid	Latitude: 22.56311, Longitude: 89.43281
Khulna	Dacope	Tildanga	Kakrabunia	Mojid	Latitude:Longitude
Khulna	Dacope	Tildanga	Botbunia	Rina	Latitude: 22.5719, Longitude: 89.4586
Khulna	Dacope	Tildanga	Kakrabunia	Motuir Rahman Talukder	Latitude:Longitude
Khulna	Dacope	Tildanga	Kakrabunia	Rekha	Latitude:Longitude
Khulna	Dacope	Tildanga	Gharkhali	Kobir	Latitude:Longitude
Khulna	Dacope	Tildanga	Batbunia	Jamirul	Latitude:Longitude
Khulna	Dacope	Tildanga	Botbunia	Hafiza	Latitude: 22.576229, Longitude: 89.45198
Khulna	Dacope	Tildanga	Botbunia	Abbas	Latitude: 22.57486, Longitude: 89.45151
Khulna	Dacope	Tildanga	Khona	Rehana	Latitude: , Longitude:
Khulna	Dacope	Tildanga	Batbunia	Rehana	Latitude: , Longitude:
Khulna	Dacope	Tildanga	Gorkhali	Apurba Halder	Latitude:Longitude
Khulna	Dacope	Tildanga	Khona	Md. Mujibur Rahman	Latitude: 22.59, Longitude: 89.46
Khulna	Dacope	Tildanga	Gharkhali	Md. Mujibur Rahman	Latitude:Longitude
Khulna	Dacope	Tildanga	Gorkhali	Siam khan	Latitude: 22.569125, Longitude: 89.430786
Khulna	Dacope	Tildanga	Gharkhali	Marjina khatun	Latitude: , Longitude:
Khulna	Dacope	Tildanga	Botbunia	Hasina Begum	Latitude:Longitude
Khulna	Dacope	Tildanga	Gharkhali	Sohel	Latitude:Longitude
Khulna	Dacope	Tildanga	Batbunia	Sohel	Latitude:Longitude
Khulna	Dacope	Tildanga	Naldanga	Abdul Jalil Munshi	Latitude: 22.58, Longitude: 89.44
Khulna	Dacope	Tildanga	Batbunia	Abdul Awal	Latitude:Longitude
Khulna	Dacope	Tildanga	Kakrabunia	Abdul Awal	Latitude:Longitude
Khulna	Dacope	Tildanga	Botbunia	Saleha Begum	Latitude: 22.5722, Longitude: 89.45724
Khulna	Dacope	Tildanga	Kakrabunia	Abdul Jalil	Latitude:Longitude
Khulna	Dacope	Tildanga	Kakrabunia	Babul Ahned	Latitude:Longitude
Khulna	Dacope	Tildanga	Kakrabunia	Dr. Pijush Kanti Roy	Latitude:Longitude
Khulna	Dacope	Tildanga	Botbunia	Bahadur Molla	Latitude: 22.57, Longitude: 89.46398
Khulna	Dacope	Tildanga	Tildanga Kacharibari	Saiful Islam	Latitude: 22.59, Longitude: 89.46
Khulna	Dacope	Tildanga	Gorkhali	Nazma Begum	Latitude: 22.56575, Longitude: 89.430613
Khulna	Dacope	Tildanga	Kakrabunia	Doli BEGUM	Latitude: 22.574812, Longitude: 89.42996
Khulna	Dacope	Tildanga	Kakrabunia	Kohinur Begum	Latitude: 22.57423, Longitude:

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					89.42985
Khulna	Dacope	Tildanga	Mojamnagar	Md. Miraj Hossain	Latitude: 22.562518, Longitude: 89.42377
Khulna	Dacope	Tildanga	Gharkhali	Amena	Latitude: , Longitude:
Khulna	Dacope	Tildanga	kalabagisutarkhali	Abul Kalam	Latitude: , Longitude:
Khulna	Koyra	Tildanga	Kakrabunia	Bulbul Khan	Latitude: 22.5789, Longitude: 89.4275
Khulna	Dacope	Tildanga	Gorkhali	Jahanara Begum	Latitude: 22.56453, Longitude: 89.42873
Khulna	Dacope	Tildanga	Botbunia	Rafikul Halder	Latitude: 22.5738, Longitude: 89.45563
Khulna	Dacope	Tildanga	Mojamnagar	Indu Rani	Latitude: 22.563758, Longitude: 89.431723
Khulna	Koyra	Uttar Bedkashi	6 no. Ward, Pathorkhali	Kajol rekha	Latitude: , Longitude:
Khulna	Koyra	Uttar Bedkashi	6no. Pathorkhali	KARIMA	Latitude: , Longitude:
Khulna	Koyra	Uttar Bedkashi	Ward 5	Faruk	Latitude: , Longitude:
Khulna	Koyra	Uttar Bedkashi	Ward 9	Alamin	Latitude: , Longitude:
Khulna	Koira	Uttar Bedkashi	Shek Sarkar para	Yousuf	Latitude: 22.30719, Longitude: 89.304129
Khulna	Koyra	Uttar Bedkashi	Ward 7	Siddik	Latitude: , Longitude:
Khulna	Koyra	Uttar Bedkashi	Shakbaria	Siddik	Latitude: 22.304, Longitude: 89.3013
Khulna	Koyra	Uttar Bedkashi	Shakbaria	Nur miya	Latitude: 22.304, Longitude: 89.3013
Khulna	Koyra	Uttar Bedkashi	Shakbaria	NURUNNAHAR	Latitude: 22.3041, Longitude: 89.3014
Khulna	Koyra	Uttar Bedkashi	Ward 8	Kulsum	Latitude: , Longitude:
Khulna	Koyra	Uttar Bedkashi	Botul Bazar	BOKUL	Latitude: 22.3152, Longitude: 89.3214
Khulna	Koyra	Uttar Bedkashi	Ward 7	Monir Akon	Latitude: , Longitude:
Khulna	Koyra	Uttar Bedkashi	6no. Pathorkhali	Monir Akon	Latitude: 22.3034, Longitude: 89.3271
Khulna	Koyra	Uttar Bedkashi	Pathorkhali	Kobir Hossain	Latitude: 22.3034, Longitude: 89.3214
Khulna	Koyra	Uttar Bedkashi	Pathorkhali	Kobir Hossain	Latitude: 22.3034, Longitude: 89.3214
Khulna	Koyra	Uttar Bedkashi	Padmapukur	SHAHIDA	Latitude: 22.2644, Longitude: 89.3296
Khulna	Koyra	Uttar Bedkashi	Botul Bazar	SHAILA	Latitude: 22.3205, Longitude: 89.9198
Khulna	Koyra	Uttar Bedkashi	Botul Bazar	Shafiqul Hawlader	Latitude: 22.3148, Longitude: 89.319
Khulna	Koyra	Uttar Bedkashi	Botul Bazar	Shafiqul Hawlader	Latitude: 22.3144, Longitude: 89.3184
Khulna	Koyra	Uttar Bedkashi	Botul Bazar	Nazrul Islam	Latitude: 22.3117, Longitude: 89.3256
Khulna	Koyra	Uttar Bedkashi	Borobariya	Nazrul Islam	Latitude: 22.30314, Longitude: 89.30826
Khulna	Koyra	Uttar Bedkashi	Ward 8	LIMA	Latitude: , Longitude:
Khulna	Koyra	Uttar Bedkashi	Ward 9	Rexona	Latitude: , Longitude:
Khulna	Koyra	Uttar Bedkashi	Botul Bazar	FATIMA	Latitude: 22.3156, Longitude: 89.3203
Khulna	Koyra	Uttar Bedkashi	3 no ward	Rashida	Latitude: 22.307666, Longitude: 89.363603
Khulna	Koyra	Uttar Bedkashi	5 no ward, jorsing	Rashida	Latitude: 22.2479, Longitude: 89.342679
Khulna	Koira	Uttar Bedkashi	Shekh sarker para	Md. Sumon	Latitude: 22.30643, Longitude: 89.30267
Khulna	Koira	Uttar Bedkashi	Shekh sarker para	Md. Sumon	Latitude: 22.3053, Longitude: 89.302551
Khulna	Koyra	Uttar Bedkashi	6 no. Pathorkhali	Sefali Begum	Latitude: , Longitude:

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Khulna	Koyra	Uttar Bedkashi	6 no. Pathorkhali	FARUK HOWLADAR	Latitude: 22.3032, Longitude: 89.3242
Khulna	Koyra	Uttar Bedkashi	3 no. Ward, Shekh Sardar para	LUCKY	Latitude: 22.30404, Longitude: 89.303153
Khulna	Koyra	Uttar Bedkashi	Botul Bazar		Latitude: 22.3117, Longitude: 89.3256
Khulna	Koyra	Uttar Bedkashi	8 no. Choramukha	Babul Hawlader	Latitude: , Longitude:
Khulna	Koira	Uttar Bedkashi	Shek sarker Para	Alauddin Talukder	Latitude: 22.307237, Longitude: 89.305031
Khulna	Koyra	Uttar Bedkashi	5 no ward	Emdadul Haque	Latitude: 22.24494, Longitude: 89.33714
Khulna	Koyra	Uttar Bedkashi	3 no ward, Botulabazar	Helal Uddin	Latitude: 22.303538, Longitude: 89.303657
Satkhira	Assasuni	Sreeula		3 Md.Mojid Siddik	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		7 Rasel	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		6 Rasel	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		6 Bharti Rani	Latitude22.145801Longitude89.1695
Satkhira	Assasuni	Pratap Nagar		Hashem	Latitude22.4153Longitude89.2264
Satkhira	Assasuni	Sreeula		Hashem	Latitude22.4461Longitude89.1762
Satkhira	Assasuni	Sreeula		3 Hafiza Banu	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		4 Khalek Hawlader	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		5 Khalek Hawlader	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		9 Panna Mia	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		4 Firoz Sheik	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		2 Firoz Sheik	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		3 Ab. Rahim Bapary	Latitude,;Longitude::
Satkhira	Assasuni	Pratap Nagar		Hafiz Ali	Latitude22.4151Longitude89.2281
Satkhira	Shyamnagar	Gabura		4 Hafsa	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		7 Nimai Sarkar	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		9 Monirul	Latitude22.22656Longitude89.269626
Satkhira	Shyamnagar	Padma Pukur		Aziz	Latitude22.2964Longitude89.2741
Satkhira	Assasuni	Sreeula		2 Gias	Latitude,;Longitude::
Satkhira	Assasuni	Pratap Nagar		Laily	Latitude22.4015Longitude89.2133
Satkhira	Assasuni	Sreeula		5 Bipul	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		3 Badiar	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		9 Partho	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		3 Mustafa	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		Mazed	Latitude22.294547Longitude89.27131
Satkhira	Assasuni	Sreeula		7 Farukh	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		5 Shojib	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		6 Rowshonwara	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		Md. Yousuf karikar	Latitude22.2936Longitude89.2502
Satkhira	Assasuni	Sreeula		Bokul chandra mondol	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		3 Romesh chandra sarkar	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		3 Joyonto Sarkar	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		2 Shahanara	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		1 Al-Amin	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		4 Rowshanara	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		2 Rehana	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		Ab: Alim	Latitude22.4436Longitude89.1385
Satkhira	Shyamnagar	Pratap Nagar		3 Bikash chandra	Latitude,;Longitude::

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Satkhira	Shyamnagar	Pratap Nagar	3	Am-amin	Latitude,;Longitude::
Satkhira	Assasuni	Pratap Nagar		Rabindranath	Latitude22.3922Longitude89.2303
Satkhira	Assasuni	Sreeula		Shekhor	Latitude22.5057Longitude89.1472
Satkhira	Assasuni	Pratap Nagar		Gonesh	Latitude22.4146Longitude89.2297
Satkhira	Assasuni	Sreeula		Komolesh	Latitude22.4049Longitude89.1721
Satkhira	Assasuni	Pratap Nagar		Nitai	Latitude22.3925Longitude89.2297
Satkhira	Assasuni	Sreeula		Md. Khairul Dhali	Latitude22.4366Longitude89.167
Satkhira	Shyamnagar	Gabura	2	Md.Shajan Gazi	Latitude,;Longitude::
Satkhira		Pratap Nagar	3	Md. Robiul Mollah	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Ayub Ali Gazi	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Osman Gazi	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	7	Md. Israfil Sardar	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	6	Joyonti	Latitude22.4298Longitude89.1868
Satkhira	Assasuni	Sreeula		Chandra kanta mandal	Latitude22.4749Longitude89.1519
Satkhira	Shyamnagar	Gabura	9	Md. Abdul Ohab Morol	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Md. Rafiqul Islam	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	5	Mojibor Rahman	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	3	Abul bashar	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Md. Robiul Islam	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	1	Md. Abdullah Gazi	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	3	Md. Sirajul Islam	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	7	Md. Rayhan Dhali	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	9	Apu mandal	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	6	Utpal Halder	Latitude22.4289Longitude89.1867
Satkhira	Shyamnagar	Padma Pukur	6	Alamgir kha	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	8	Mohesh Mandal	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	4	Dipankar Mandal	Latitude22.267083Longitude89.274782
Satkhira	Shyamnagar	Gabura	2	Azad Gazi	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Gias Hawlader	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	9	KOMLA	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	6	Md. Mosharraf Hossain	Latitude22.4283Longitude89.1916
Satkhira	Assasuni	Pratap Nagar		Md. Mosharraf Hossain	Latitude22.3936Longitude89.224
Satkhira	Assasuni	Pratap Nagar		Abdul Khalek	Latitude22.4042Longitude89.2586
Satkhira	Assasuni	Pratap Nagar		Abdul Khalek	Latitude22.4006Longitude89.2143
Satkhira	Assasuni	Pratap Nagar		Abdul Khalek	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Abdul Karim	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Al-amin	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	3	Md. Ibrahim	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	2	Md. Ibrahim	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	3	Arif	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	2	Md. Ibrahim	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	2	Jalil	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	1	Jalil	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	3	Md. Masum Hawlader	Latitude,;Longitude::
Satkhira	Assasuni	Pratap Nagar	5	Shan Alam	Latitude,;Longitude::

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Satkhira	Shyamnagar	Gabura	4	Shan Alam	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	3	Jossim Uddin	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		Abdur Rahman Gazi	Latitude22.3052Longitude89.2377
Satkhira	Shyamnagar	Gabura	4	Sarowar	Latitude22.3265Longitude89.3095
Satkhira	Shyamnagar	Gabura	1	Sarowar	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Rashida	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	8	Rashida	Latitude22.9865635Longitude89.23136
Satkhira	Shyamnagar	Padma Pukur		Mahmuda	Latitude22.3046Longitude89.2366
Satkhira	Assasuni	Sreeula		Ripa Khanam	Latitude22.4288Longitude89.1941
Satkhira	Shyamnagar	Padma Pukur		Khokon	Latitude22.3038Longitude89.2682
Satkhira	Assasuni	Sreeula		Khokon	Latitude22.4236Longitude89.1871
Satkhira	Assasuni	Sreeula		Md Sohorab Hossain	Latitude22.4275Longitude89.1935
Satkhira	Assasuni	Sreeula		MORJINA	Latitude22.4275Longitude89.1935
Satkhira	Shyamnagar	Padma Pukur		Md. Easin Khan	Latitude22.2954Longitude89.2493
Satkhira	Shyamnagar	Padma Pukur	6	Md. Easin Khan	Latitude,;Longitude::
Satkhira	Assasuni	Pratap Nagar		Hosneara	Latitude22.4009Longitude89.214
Satkhira	Shyamnagar	Padma Pukur		Hosneara	Latitude22.2931Longitude89.2509
Satkhira	Assasuni	Pratap Nagar		Asma Begum	Latitude22.4046Longitude89.2404
Satkhira	Shyamnagar	Gabura	6	Asma Begum	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		Poli khatun	Latitude22.299244Longitude89.270377
Satkhira	Shyamnagar	Padma Pukur			Latitude22.2978Longitude89.2735
Satkhira	Shyamnagar	Gabura	3		Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	1	Salman Khan	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	2	Altaf Hossain	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	3	Helal Uddin	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	1	Hamid Sarder	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	3	Abdul Hai	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	5	Md.Mojid Siddik	Latitude,;Longitude::
Satkhira	Assasuni	Pratap Nagar		Rasel	Latitude22.5757Longitude89.34
Satkhira	Assasuni	Sreeula	3	Rasel	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	7	Bharti Rani	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	3	Hashem	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		Hashem	Latitude22.3103Longitude89.2673
Satkhira	Assasuni	Sreeula		Hafiza Banu	Latitude22.4461Longitude89.1527
Satkhira	Assasuni	Sreeula		Khalek Hawlader	Latitude22.4275Longitude89.1935
Satkhira	Assasuni	Sreeula	3	Khalek Hawlader	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	3	Panna Mia	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		Firoz Sheik	Latitude22.3305Longitude89.2845
Khulna		Padma Pukur		Firoz Sheik Ab. Rahim	Latitude22.4676Longitude89.5453
Satkhira	Shyamnagar	Padma Pukur		Bapary	Latitude22.2967Longitude89.2733
Satkhira	Shyamnagar	Padma Pukur		Hafiz Ali	Latitude22.3276Longitude89.2843
Satkhira	Shyamnagar	Gabura	3	Hafiz Ali	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	3	Hafiz Ali	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	7	Hafiz	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		Jorina Banu	Latitude22.2934Longitude89.25
Satkhira	Assasuni	Sreeula	3	Jahidul Sheikh	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		Rina	Latitude22.4427Longitude89.1585
Satkhira	Assasuni	Sreeula		Yousus Ali	Latitude22.3982Longitude89.1471
Satkhira	Shyamnagar	Gabura	9	Yunus Khan	Latitude22.22653Longitude89.269524

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Satkhira	Assasuni	Sreeula		Soliman	Latitude22.4236Longitude89.1918
Satkhira		Sreeula		Delwar	Latitude22.4238Longitude89.1644
Satkhira	Assasuni	Sreeula	3	SIRAJUL	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula			Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	3	Abdur Razzak	Latitude,;Longitude::
Satkhira	Assasuni	Pratap Nagar		Azim	Latitude22.415Longitude89.2305
Satkhira	Shyamnagar	Padma Pukur		Azim	Latitude22.298Longitude89.2697
Satkhira	Assasuni	Sreeula		Shah Alam	Latitude22.4596Longitude89.1544
Satkhira	Assasuni	Sreeula		Sobur	Latitude22.4113Longitude89.1407
Satkhira		Sreeula		Selika Khatun	Latitude22.41Longitude89.1899
Satkhira	Shyamnagar	Padma Pukur		Nurunnahar	Latitude22.2937Longitude89.2505
Satkhira	Shyamnagar	Padma Pukur	6	Shahidul Islam	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	2	Shahidul Islam	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	7	Piyara Begum	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		Piyara Begum	Latitude22.4308Longitude89.1775
Satkhira	Assasuni	Sreeula	6	Iliyas	Latitude22.42769Longitude89.1931
Satkhira	Assasuni	Pratap Nagar		Fokhrul	Latitude22.4027Longitude89.2121
Satkhira	Assasuni	Pratap Nagar		Rashida Begum	Latitude22.4146Longitude89.2302
Satkhira	Assasuni	Pratap Nagar		Mojid	Latitude22.4575Longitude89.2285
Satkhira	Assasuni	Sreeula		Mojid	Latitude22.4315Longitude89.1782
Satkhira		Pratap Nagar		Rina	Latitude22.3938Longitude89.228
Satkhira	Assasuni	Pratap Nagar		Motiur Rahman Talukder	Latitude22.4264Longitude89.5367
Satkhira	Assasuni	Sreeula		Rekha	Latitude22.4342Longitude89.1584
Satkhira	Assasuni	Pratap Nagar		Kobir	Latitude22.3998,Longitude89.2339,
Satkhira	Assasuni	Pratap Nagar		Jamirul	Latitude22.4145Longitude89.2298
Satkhira	Assasuni	Sreeula		Hafiza	Latitude22.4105Longitude89.1831
Satkhira	Assasuni	Sreeula		Abbas	Latitude22.4221Longitude89.1528
Satkhira	Assasuni	Pratap Nagar		Rehana	Latitude22.4004Longitude89.2157
Satkhira	Assasuni	Pratap Nagar		Rehana	Latitude22.4011Longitude89.2137
Satkhira	Shyamnagar	Padma Pukur		Apurba Halder	Latitude22.3039Longitude89.238
Satkhira	Shyamnagar	Padma Pukur		Md. Mujibur Rahman	Latitude22.2963Longitude89.2735
Satkhira	Shyamnagar	Padma Pukur		Md. Mujibur Rahman	Latitude22.3041Longitude89.2378
Satkhira	Shyamnagar	Padma Pukur		Siam khan	Latitude22.3046Longitude89.2366
Satkhira	Assasuni	Pratap Nagar		Marjina khatun	Latitude22.4006Longitude89.2143
Satkhira	Shyamnagar	Padma Pukur		Hasina Begum	Latitude22.2931Longitude89.2509
Satkhira	Assasuni	Sreeula	6	Sohel	Latitude22.4276Longitude89.1935
Satkhira	Assasuni	Pratap Nagar		Sohel	Latitude22.4006Longitude89.2143
Satkhira	Assasuni	Pratap Nagar		Abdul Jalil Munshi	Latitude22.4006Longitude89.2136
Satkhira	Shyamnagar	Gabura	8	Abdul Awal	Latitude22.249153Longitude89.250116
Satkhira	Shyamnagar	Padma Pukur	6	Abdul Awal	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura	6	Saleha Begum	Latitude22.22596Longitude89.269445
Satkhira	Assasuni	Sreeula	1	Abdul Jalil	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	1	Babul Ahned	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula	1	Dr. Pijush Kanti Roy	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur	7	Bahadur Molla	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur	7	Saiful Islam	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur	7	Nazma Begum	Latitude,;Longitude::

District	Upazila	Union	Village Name / Ward No.	Name of the respondent	Location
Satkhira	Assasuni	Sreeula		5 Doli BEGUM	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		5 Kohinur Begum	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		9 Md. Miraj Hossain	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		1 Amena	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		1 Abul Kalam	Latitude,;Longitude::
Satkhira		Sreeula		3 Bulbul Khan	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		9 Jahanara Begum	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		5 Rafikul Halder	Latitude,;Longitude::
Satkhira	Assasuni	Pratap Nagar		7 Indu Rani	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		6 Kajol rekha	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		6 KARIMA	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		9 Faruk	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		1 Alamin	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		1 Yousuf	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		1 Siddik	Latitude,;Longitude::
Satkhira	Shyamnagar	Gabura		6 Siddik	Latitude22.242584Longitude89.268786
Satkhira	Shyamnagar	Gabura		7 Nur miya	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		6 NURUNNAHAR	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		9 Kulsum	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		1 BOKUL	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		1 Monir Akon	Latitude,;Longitude::
Satkhira	Shyamnagar	Padma Pukur		1 Monir Akon	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		1 Kobir Hossain	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		1 Kobir Hossain	Latitude,;Longitude::
Satkhira	Assasuni	Sreeula		1 SHAHIDA	Latitude,;Longitude::

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District	Upazila	Union	Village Name	Name of the respondent ;	Location
Khulna	Dacope	Sutarkhali	Kalabogi	Md. Tuhin Sana	Latitude: 22.42948 Longitude: 89.4507899
Khulna	Dacope	Sutarkhali	9no. Ward, kalabogi	Jamal faruk gazi	Latitude: 22.435511 Longitude: 89.4526686
Khulna	Dacope	Sutarkhali	8no. Ward, kalabogi	Asaduzzaman Gazi	Latitude: 22.436641 Longitude: 89.44801
Khulna	Dacope	Sutarkhali	Kalabogi	Moin Ali	Latitude: 22.436694 Longitude: 89.4447195
Khulna	Dacope	Sutarkhali	Nalian	Halima	Latitude: 22.46528 Longitude: 89.4379628
Khulna	Dacope	Sutarkhali	Nalian	Abucl youfuf	Latitude: 22.46211 Longitude: 89.43523
Khulna	Dacope	Sutarkhali	kalabagisutarkhali	Nazim uddin mollik	Latitude: 22.4656 Longitude: 89.4579
Khulna	Dacope	Sutarkhali	kalabagisutarkhali	Irshadul gazi	Latitude: 22.4617 Longitude: 89.4659
Khulna	Dacope	Sutarkhali	Nolian village	Md.Abdar ali fokir	Latitude: 22.4566 Longitude: 89.4447
Khulna	Dacope	Sutarkhali	Nolian village	Altaf hossain	Latitude: 22.4566 Longitude: 89.4447
Khulna	Dacope	Sutarkhali	Kalabagi	Monirul islam	Latitude: 22.4568 Longitude: 89.4452
Khulna	Dacope	Sutarkhali	Kalabagi	Babul gazi	Latitude: 22.4557 Longitude: 89.4562
Khulna	Dacope	Sutarkhali	Kalabagi	Md Dobiruddin gazi	Latitude: 22.4526 Longitude: 89.4558
Khulna	Dacope	Sutarkhali	Kalabagi	Abdul mistree	Latitude: 22.4526 Longitude: 89.4558

Khulna	Dacope	Kamarkhola	kamarkhola	soshan mondol	Latitude: 22.5601 Longitude: 89.4663
Khulna	Dacope	Tildanga	6no. Ward, Kaminibasias	Pravash Chandra Gain	Latitude: 22.56311 Longitude: 89.43281
Khulna	Dacope	Tildanga	Mojamnagar	Abu Sattar Sans	Latitude: 22.563758 Longitude: 89.431723
Khulna	Dacope	Tildanga	Mojamnagar	Jinarul Sana	Latitude: 22.562518 Longitude: 89.42377
Khulna	Dacope	Kamarkhola	kamarkhola	salm	Latitude: Longitude:
Khulna	Dacope	Kamarkhola	kamarkhola	Anup Kumar Roy	Latitude: 22.5601 Longitude: 89.4663
Khulna	Dacope	Kamarkhola	kamarkhola	Md.Owahed sheikh	Latitude: 22.5601 Longitude: 89.4663
Khulna	Dacope	Tildanga	Khona	Md. Nasim Mollah	Latitude: Longitude:
Khulna	Dacope	Kamarkhola	Joynagar	Bithika Mondol	Latitude: 22.5353 Longitude: 89.4682
Khulna	Dacope	Tildanga	Khona	Sushanta Bairagi	Latitude: Longitude:
Khulna	Dacope	Kamarkhola	Joynagar	Babor ali sana	Latitude: 22.5344 Longitude: 89.4641
Khulna	Dacope	Tildanga	Tildanga Kacharibari	Pronab Goldar	Latitude: 22.59 Longitude: 89.46
Khulna	Dacope	Tildanga	Gorkhali	Abdul Hamid Sana	Latitude: 22.56453 Longitude: 89.42873
Khulna	Koyra	Dakhin Bedkashi	Dakshin bedkashi	Rowshonwara	Latitude: 22.2494 Longitude: 39.3129
Khulna	Koyra	Dakhin Bedkashi	Chormukha	Md. Yousuf karikar	Latitude: 22.26396 Longitude: 89.32332
Khulna	Koyra	Dakhin Bedkashi	9 no ward	Bokul chandra mondol	Latitude: 22.260685 Longitude: 89.327826
Khulna	Koyra	Dakhin Bedkashi	Kakrabunia	Tipu gazi	Latitude: 22.572477 Longitude: 89.4314574
Khulna	Koyra	Dakhin Bedkashi	9 no. Ward	Romesh chandra sarkar	Latitude: 22.258177 Longitude: 89.3324
Khulna	Koyra	Lata	3no. Ward,Adharmanik	Nirmola Dofadar	Latitude: 22.585755 Longitude: 89.3866965
Khulna	Paikgacha	Lata	Ward 3 adharmanik	Proshanto Kumar Bahar	Latitude: 22.62517 Longitude: 89.35547
Khulna	Paikgacha	Lata	Ward 3 Shochiarbondoo	Trishna biswas	Latitude: 22.598474 Longitude: 89.31465
Khulna	Paikgacha	Lata	Shonkordana	Newton Mistri	Latitude: 22.6294 Longitude: 89.349267
Khulna	Paikgacha	Lata	Shonkordana	Sushan mondol	Latitude: 22.62902 Longitude: 89.349005
Khulna	Paikgacha	Lata	Ward 2 Haria	Narayon mondol	Latitude: 22.62691 Longitude: 89.34897
Khulna	Dacope	Kamarkhola	Joynagar	khukumoni Mondol	Latitude: 22.5353 Longitude: 89.4682
Khulna	Dacope	Kamarkhola	Joynagar	Urmila Kaowali	Latitude: 22.5353 Longitude: 89.4682
Khulna	Dacope	Kamarkhola	joynagar	lokkhi kawali	Latitude: 22.5353 Longitude: 89.4682
Khulna	Dacope	Kamarkhola	shivnagar	tulshi majhi	Latitude: 22.5353 Longitude: 89.4682
Khulna	Dacope	Kamarkhola	shivbagar	abdul gazi	Latitude: 22.5353 Longitude: 89.4682
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Rabbani	Latitude: 22.2681 Longitude: 89.322
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Karim	Latitude: 22.3681 Longitude: 89.5521
Bagerhat	Koyra	Dakhin Bedkashi	Uttar Kadamtola, Rayenda, Shorokhola	Siadur Rahman	Latitude: 221838.28 Longitude: 895113.53
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Salam	Latitude: 22.3691 Longitude: 89.5531
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Anjuara	Latitude: 22.3699 Longitude: 89.5556
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Bishi shardar	Latitude: 22.3705 Longitude: 89.5569
Khulna	Koyra	Dakhin Bedkashi	Patakhali	Abul Hasan	Latitude: 22.3725 Longitude: 89.557
Khulna	Paikgacha	Lata	Godardanga	Md. Ripon Sana	Latitude: 22.6706 Longitude: 89.3608
Khulna	Paikgacha	Lata	Godardanga	Oliar Rahman	Latitude: 22.6731 Longitude: 89.3656
Khulna	Paikgacha	Lata	Godardanga	Md. Ajjul Biswas	Latitude: 22.6681 Longitude: 89.3736
Khulna	Paikgacha	Lata	Godardanga	Rajbollav Mondal	Latitude: 22.6768 Longitude: 89.3691
Khulna	Paikgacha	Lata	Godardanga	Pushpa Rani sarkar	Latitude: 22.6769 Longitude: 89.3691
Khulna	Paikgacha	Lata	Godardanga	Baccu Sana	Latitude: 22.6712 Longitude: 89.3611

Khulna	Paikgacha	Lata	Godardanga	Raju Sana	Latitude: 22.6715 Longitude: 89.3618
Khulna	Paikgacha	Sholadana	5 no. Ward, Khatuamari	Jhorna Rani Gain	Latitude: 22.527132, Longitude: 89.367646
Khulna	Paikgacha	Sholadana	4 no. Ward, Betbunia	Jamirul	Latitude: 22.52163917, Longitude: 89.398568
Khulna	Paikgacha	Sholadana	5 no. Ward, Betbunia	Abul Hosen	Latitude: , Longitude:
Khulna	Paikgacha	Sholadana	6 no. Ward, Betbunia	Fozlur Ali	Latitude: 22.5393, Longitude: 89.3957
Khulna	Paikgacha	Sholadana	7 no. Ward, Betbunia	Chandona	Latitude: 22.5396, Longitude: 89.3959
Khulna	Paikgacha	Sholadana	8 no. Ward, Betbunia	Bkash chandro mondal	Latitude: 22.5637332, Longitude: 89.387847
Khulna	Paikgacha	Sholadana	9 no. Ward, Betbunia	Puspa	Latitude: 22.5487, Longitude: 89.3986
Khulna	Paikgacha	Sholadana	9 no. Ward, Betbunia	Lucky	Latitude: 22.5467, Longitude: 89.3966
Khulna	Paikgacha	Deluti	Fulbari	Shimul Tikadar	Latitude: 22.6439, Longitude: 89.4313
Khulna	Paikgacha	Deluti	Fulbari	Biporno Biswas	Latitude: 22.6424, Longitude: 89.4351
Khulna	Paikgacha	Deluti	Fulbari	Pabitra Kumar Mondal	Latitude: 22.6415, Longitude: 89.4372
Khulna	Paikgacha	Deluti	Hatbari	Jahangir Biswas	Latitude: 22.6324, Longitude: 89.4408
Khulna	Paikgacha	Deluti	Hatbari	Debala Rani Ghosh	Latitude: 22.6302, Longitude: 89.4398
Khulna	Paikgacha	Deluti	Hatbari	Ranjan Sarkar	Latitude: 22.6256, Longitude: 89.4472
Khulna	Paikgacha	Deluti	Hatbari	Harun Sheikh	Latitude: 22.6255, Longitude: 89.4471
Khulna	Paikgacha	Deluti	Telikhali	Shyama Prosad Halder	Latitude: 22.6261, Longitude: 89.4462
Khulna	Paikgacha	Lata	Putimari	Zafarul Sheikh	Latitude: 22.67, Longitude: 89.3567
Khulna	Paikgacha	Lata	Putimari	Binoy Krishna Biswas	Latitude: 22.6691, Longitude: 89.3567
Khulna	Paikgacha	Lata	Putimari	Bijoli Sarkar	Latitude: 22.6681, Longitude: 89.3509
Khulna	Paikgacha	Lata	Putimari	Md. Nasir Sana	Latitude: 22.6676, Longitude: 89.3508
Khulna	Paikgacha	Lata	Putimari	Afjal Gazi	Latitude: 22.6675, Longitude: 89.3503
Bagerhat	Sarankhola	Southkhali		Jalaluddin	Latitude: 22.2567, Longitude: 89.827
Bagerhat	Sarankhola	Southkhali	Uttar Southkhali	Kalimuddin	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Uttar Southkhali	Kalimuddin	Latitude: 22.253, Longitude: 89.8306
Bagerhat	Sarankhola	Southkhali	Uttar Southkhali	Ab. Karim	Latitude: , Longitude:
Bagerhat	Sarankhola	Roynda	Zilbunia	Mizan	Latitude: 22.3056, Longitude: 89.8525
Bagerhat	Sarankhola	Roynda	Zilbunia	Mizan	Latitude: 22.3056, Longitude: 89.8525
Bagerhat	Sarankhola	Roynda	Zilbunia	Mizan	Latitude: 22.3057, Longitude: 89.8504
Bagerhat	Sarankhola	Roynda	Zilbunia	Halim	Latitude: 22.3057, Longitude: 89.8504
Bagerhat	Sarankhola	Roynda	Zilbunia	Halim	Latitude: 22.3057, Longitude: 89.8504
Bagerhat	Sarankhola	Roynda	Zilbunia	Mizan	Latitude: 22.3057, Longitude: 89.8504
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Moterpara	Riadul	Latitude: 22.3337, Longitude: 89.85514
Bagerhat	Sarankhola	Khontakata	6 no. Ward, Moterpara	Riadul	Latitude: 22.3337, Longitude: 89.85514
Bagerhat	Sarankhola	Khontakata	5 no ward	Rashid Ahmed	Latitude: 22.3422, Longitude: 89.8662
Bagerhat	Sarankhola	Khontakata	5 no ward	Rashid Ahmed	Latitude: 22.3422, Longitude: 89.8662
Bagerhat	Sarankhola	Khontakata	Choumuhoni	Rahima	Latitude: 22.3462, Longitude: 89.8533
Bagerhat	Sarankhola	Khontakata	Choumuhoni	Rahima	Latitude: 22.3462, Longitude: 89.8533
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Hawa Begum	Latitude: 22.3868, Longitude: 89.8357
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Hawa Begum	Latitude: 22.3868, Longitude: 89.8357
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Ruhul Amin	Latitude: 22.3877, Longitude: 89.8358
Bagerhat	Morrelganj	Khuoia	No.4 Khaulia	Ruhul Amin	Latitude: 22.3877, Longitude: 89.8358
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Md. Easin Khan	Latitude: 22.3431, Longitude: 89.8547
Bagerhat	Sarankhola	Khontakata	5 no ward, west khontakata	Md. Easin Khan	Latitude: 22.3431, Longitude: 89.8547
Bagerhat	Sarankhola	Khontakata	5 no ward,west	Hosneara	Latitude: , Longitude:

			khontakata		
Bagerhat	Sarankhola	Khontakata	5 no ward,west khontakata	Hosneara	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no. ward	Asma Begum	Latitude: 22.3435, Longitude: 89.8539
Bagerhat	Sarankhola	Khontakata	5 no. ward	Asma Begum	Latitude: 22.3435, Longitude: 89.8539
Bagerhat	Morrelganj	Khuoia	No. 4 Khaulia	Hashem	Latitude: 22.392, Longitude: 89.8326
Bagerhat	Morrelganj	Khuoia	No. 4 Khaulia	Hashem	Latitude: 22.392, Longitude: 89.8326
Bagerhat	Sarankhola	Roynda		Hafiza Banu	Latitude: 22.3055, Longitude: 89.8506
Bagerhat	Sarankhola	Khontakata	5 no. ward	Khalek Hawlader	Latitude: , Longitude:
Bagerhat	Sarankhola	Khontakata	5 no. ward	Khalek Hawlader	Latitude: , Longitude:
Bagerhat	Sarankhola	Southkhali	Tafalbari	Panna Mia	Latitude: 22.261, Longitude: 89.828
Bagerhat	Sarankhola	Roynda		Firoz Sheik	Latitude: 22.3995, Longitude: 89.8404
Bagerhat	Sarankhola	Roynda		Firoz Sheik	Latitude: 22.3995, Longitude: 89.8404
Bagerhat	Sarankhola	Roynda	Ward 9	Babul Ahned	Latitude: 22.3055, Longitude: 89.849
Bagerhat	Sarankhola	Southkhali	Tafalbari	Dr. Pijush Kanti Roy	Latitude: , Longitude:
Bagerhat	Sarankhola	Dhansgar	No. 6 Dhansagar	Bahadur Molla	Latitude: 22.3594, Longitude: 89.7649
Bagerhat	Sarankhola	Dhansgar		Saiful Islam	Latitude: 22.3696, Longitude: 89.1742
Bagerhat	Sarankhola	Southkhali	Rayenda	Nazma Begum	Latitude: 22.253, Longitude: 83.83
Bagerhat	Sarankhola	Southkhali	RAYENDA	Doli BEGUM	Latitude: 22.257, Longitude: 89.835
Bagerhat	Sarankhola	Dhansgar	Dhansagor	Kohinur Begum	Latitude: 22.3733, Longitude: 89.7749
Bagerhat	Sarankhola	Khontakata	Rajoir	Md. Miraj Hossain	Latitude: 22.3341, Longitude: 89.8114
Satkhira	Shyamnagar	Gabura	7	Kobir Uddin	
Satkhira	Shyamnagar	Gabura	7	Md. Mukarram Billah	22.2432 89.2502
Satkhira	Shyamnagar	Gabura	5	Md. Abdul Mannan	
Satkhira	Shyamnagar	Gabura	4	Abul kashem	
Satkhira	Shyamnagar	Gabura	8	Md. Osman ali	22.2492 89.2501
Satkhira	Shyamnagar	Gabura	6	Golam Mostofa	
Satkhira	Shyamnagar	Gabura	4	Md.Masidul Islam	22.2671 89.2748
Satkhira	Shyamnagar	Padma Pukur		rasel ahmed	22.2992 89.2704
Satkhira	Shyamnagar	Padma Pukur		1006	22.3038 89.2682
Satkhira	Shyamnagar	Padma Pukur		sadaman mondol	22.3046 89.2366
Satkhira	Shyamnagar	Padma Pukur		debasish ratan	22.3052 89.2377
Satkhira	Shyamnagar	Padma Pukur		kama;l gazi	22.3103 89.2673
Satkhira	Shyamnagar	Padma Pukur		rakib howlader	22.3305 89.2845
Satkhira	Shyamnagar	Padma Pukur		rubel mondol	22.3276 89.2843
Satkhira		Pratap Nagar		kazi sojol	22.3938 89.228
Satkhira	Assasuni	Pratap Nagar		kazi rafiqul islam	22.4575 89.2285
Satkhira	Assasuni	Pratap Nagar		kazi shahdat	22.3998 89.2339
Satkhira	Assasuni	Pratap Nagar		kalipodo sarker	22.4264 89.5367
Satkhira	Assasuni	Pratap Nagar		masudur rahman	22.4046 89.2404
Satkhira	Assasuni	Pratap Nagar		rasel sarder	
Satkhira	Assasuni	Pratap Nagar		kamal gazi	22.3936 89.224
Satkhira	Assasuni	Sreeula		bijoy sarker	22.4275 89.1935
Satkhira	Assasuni	Sreeula		md rana	22.4275 89.1935
Satkhira	Assasuni	Sreeula		rana sarder	22.4236 89.1918
Satkhira	Assasuni	Sreeula		ilius gazi	22.4236 89.1871
Satkhira	Assasuni	Pratap Nagar		golam hossain	22.4145 89.2298
Satkhira	Assasuni	Pratap Nagar		sanower hossain	22.3936 89.2269
Satkhira	Assasuni	Pratap Nagar		kamal seikh	22.3918 89.2383
Satkhira	Assasuni	Pratap Nagar		ratul sarder	22.3968 89.2078
Satkhira	Assasuni	Sreeula		rahim sarder	22.4221 89.1528

Satkhira	Assasuni	Sreeula		jamal hossain	22.4243	89.1527
Satkhira	Shyamnagar	Padma Pukur		Md. Afzal Hossain	22.2967	89.2733
Satkhira	Shyamnagar	Padma Pukur		Rafiquzzaman	22.2978	89.2735
Satkhira	Shyamnagar	Padma Pukur		Tanvir	22.2985	89.2735
Satkhira	Shyamnagar	Padma Pukur		Jashim	22.3003	89.2735
Satkhira	Shyamnagar	Padma Pukur		Supada Dutta	22.3048	89.2366
Satkhira	Shyamnagar	Padma Pukur		Paritosh Ratan	22.3046	89.237
Satkhira	Shyamnagar	Padma Pukur		Akash	22.3046	89.2366
Satkhira	Shyamnagar	Padma Pukur		Sushmita	22.3041	89.2378
Satkhira	Assasuni	Sreeula	6	Nimai Sarkar	22.4289	89.1867
Satkhira	Assasuni	Sreeula	6	Monirul	22.4298	89.1868
Satkhira	Assasuni	Sreeula		Aziz	22.4461	89.1762
Satkhira	Assasuni	Sreeula		Gias	22.4749	89.1519
Satkhira	Assasuni	Sreeula		Laily	22.4308	89.1775
Satkhira	Assasuni	Sreeula		Bipul	22.4366	89.167
Satkhira	Assasuni	Sreeula		Badiar	22.4315	89.1782