

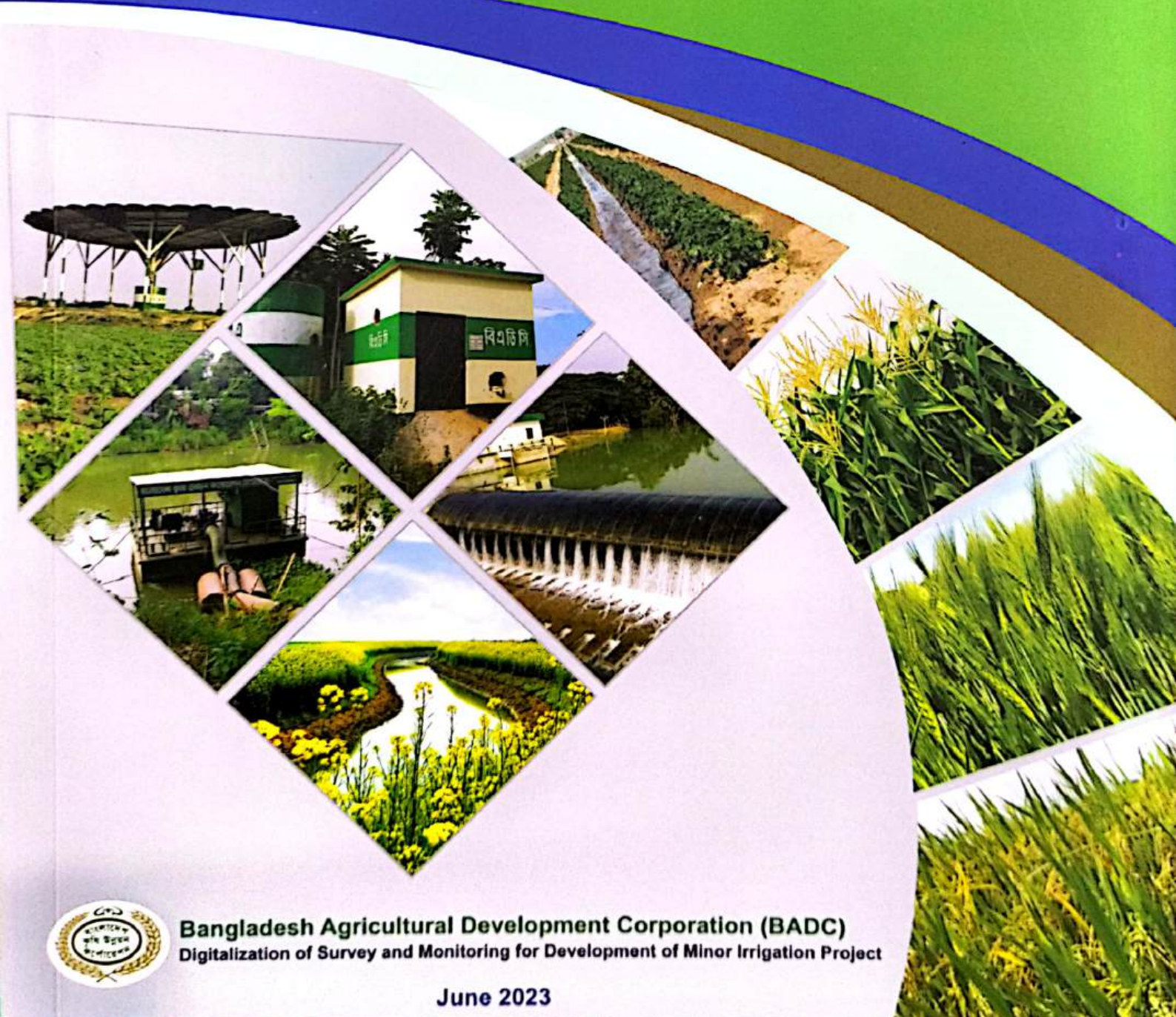
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Government of the People's Republic of Bangladesh  
Ministry of Agriculture



# Minor Irrigation Survey Report 2022-2023



**Bangladesh Agricultural Development Corporation (BADC)**  
Digitalization of Survey and Monitoring for Development of Minor Irrigation Project

June 2023



**Government of the People's Republic of Bangladesh**  
**Ministry of Agriculture**

# **Minor Irrigation Survey Report 2022-2023** **(Rabi Season)**

## **Survey Conducted by**

Bangladesh Agricultural Development Corporation (BADC)  
Department of Agriculture Extension (DAE)  
Barind Multipurpose Development Authority (BMDA)  
Centre for Environmental and Geographic Information Services (CEGIS)

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**June 2023**

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House # 06, Rd. No. 23/C, Gulshan-1, Dhaka 1212
- Copy Right** : Additional Chief Engineer (MI), Western, BADC,  
Shech Bhaban, 22 Manik Mia Avenue, Sher-e-Bangla  
Nagar, Dhaka.
- Publisher** : Additional Chief Engineer (MI), Western, BADC,  
Shech Bhaban, 22 Manik Mia Avenue, Sher-e-Bangla  
Nagar, Dhaka.
- Date of Publication** : June 2023
- Price** : Tk. 2000.00 Only.

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## FOREWORD



Irrigation development in Bangladesh has played a significant role in the country's agricultural advancement and food security. Bangladesh Agricultural Development Corporation (BADC) has been successfully performing on development of minor irrigation, collecting and monitoring the irrigation-related data since 1961. I am pleased to share that the BADC will publish an informative report on minor irrigation equipment survey 2022-2023, under the Digitalization of Survey and Monitoring for Development of Minor Irrigation Project of BADC. The report will provide yearly and time series data about irrigated areas, the number of irrigation equipment, and the power source of irrigation equipment that has benefited farmers.

I would expect that the report to provide basic information on minor irrigation by low lift pumps, deep tube wells, shallow tube wells, rubber dams, solar pumps, dug wells, artesian wells, manually operated pumps, traditional and gravity flow irrigation systems as well as agency wise minor irrigation status of the country.

I believe the findings of the report will help the Government to formulate policy and make decisions for the effective minor irrigation sub-sector which will play a key role in the production of agri-produces. I also hope that this report will furnish necessary irrigation-related data for the planners, researchers and administrators for effective and smart irrigation planning.

I like to extend my thanks to my colleagues at the Minor Irrigation Wing of BADC, BMDA, DAE and CEGIS who contributed to the preparation and publication of the report.

Abdullah Sazzad ndc  
Chairman (Grade-1), BADC.



## PREFACE



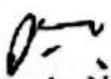
Bangladesh Agricultural Development Corporation (BADC) has been playing a pioneering role in introducing, developing and expanding minor irrigation in the country since 1961. About 95% of the irrigated land of the country is covered by minor irrigation. It is playing a significant role in increasing food production in the Rabi season. It is a great pleasure that the Digitalization of Survey and Monitoring for Development of Minor Irrigation Project (closed) is going to publish "Minor Irrigation Survey Report 2022-2023". This report presents data on irrigation equipment, irrigated area, groundwater withdrawal status, mode of irrigation, power consumption and farmers who benefited during the 2022-23 Rabi season.

At present, the dependency on groundwater for minor irrigation development is a major concern. Abstraction of groundwater by DTW and STW in the Rabi season increases in the northern part of the country. Moreover, saline water intrusion increased in the southern part. So BADC has implemented irrigation water management tools like AWD, construction of buried pipelines, installation of dug-well, drip and sprinkler method of irrigation, excavation of canal and construction of rubber dam.

Between the years 2004-05 and 2022-23, the Bangladesh Agricultural Development Corporation (BADC), Barind Multipurpose Development Authority (BMDA), and the Department of Agricultural Extension (DAE) conducted several minor irrigation surveys as the part of their routine work. These surveys aimed to assess the current status of irrigation facilities and identify areas that need improvement. However, beyond the regular outlook of these surveys, for an indepth data analysis and a comprehensive report, BADC assigned the Centre for Environmental and Geographic Information Services (CEGIS) to prepare a detailed report on minor irrigation survey.

This report reflected that the country's total irrigation coverage in the Rabi season is about 5.75 million hectares of which 4.15 million ha (72.20%) through utilization of groundwater and 1.60 million ha (27.80%) through utilization of surface water. I believe that the findings of the report will help the government formulate policy decisions for effective irrigation planning. I also hope that this report will furnish the planners, policymakers, researchers, academics and administrators with necessary irrigation-related data.

I would like to express my sincerest gratitude to the officials of CEGIS, BADC, BMDA, and DAE for their committed engagement in preparing and publishing the report.

  
Engr. Shibendra Narayan Gope  
Chief Engineer (Minor Irrigation)  
BADC, Dhaka



## PREFACE



Digitalization of Survey and Monitoring for Development of Minor Irrigation Project (closed) involves collecting data on groundwater monitoring, surveying irrigation equipment, irrigated area, benefitted farmers, groundwater level, irrigation water quality, irrigation costs etc. The main objective of this report is to generate reliable and adequate statistical data about minor irrigation development. The Survey and Monitoring Project aims to modernize and strengthen the existing monitoring system by providing technical support and cooperation to users.

The Centre for Environmental and Geographic Information Services (CEGIS), a public trust under the Ministry of Water Resources, has conducted the survey. Through field surveys, CEGIS has collected minor irrigation data for Rabi 2022-23 and the report has been finalized after consulting BADC, BMDA, and DAE.

I believe that the report findings will assist the government in formulating decisions for effective irrigation planning. I also hope that this report will furnish the planners, researchers and administrators with necessary irrigation-related data to enable effective planning in the minor irrigation sub-sector.

I would like to extend my sincere thanks to the CEGIS authority, and all my colleagues both in the field and at the project office for their efforts to publish the report. I am especially grateful to Dr. Md. Monirul Islam, Deputy Director, DAE, Md. Jahangir Alam Khan, Additional Chief Engineer, BMDA for their sincere efforts in composing this report.

I am indeed grateful to the Chief Engineers of the Irrigation Wing, and the Member Director (MI), BADC for their valuable suggestions and insightful guidance in preparing and publishing this report.

I am very much grateful to Mr. Abdullah Sazzad, NDC, Chairman of Bangladesh Agricultural Development Corporation, for his constant support and valuable suggestions in completing the survey. I would also like to express my gratitude to Mr. Badal Chandra Biswas, Director General of DAE, and Md. Abdur Rashid, Executive Director of BMDA, for their contributions.

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## LIST OF ACRONYMS

Agri	Agricultural
ATIA	Assisting Transformation to Irrigated Agriculture
AWD	Alternate Wetting and Drying
BADC	Bangladesh Agricultural Development Corporation
BIESM	Bangladesh Irrigation Equipment Survey and Monitoring System
BMDA	Barind Multipurpose Development Authority
BPDB	Bangladesh Power Development Board
BRDB	Bangladesh Rural Development Board
BWDB	Bangladesh Water Development Board
CEGIS	Center for Environmental and Geographic Information Services
DAE	Department of Agriculture Extension
DTW	Deep Tube Well
FY	Financial Year
GIS	Geographical Information System
GWT	Ground Water Table
HYV	High Yielding Variety
IDA	International Development Agency
LGED	Local Government Engineering Department
LLP	Low Lift Pump
MoA	Ministry of Agriculture
NCA	Net Cultivated Area
PVC	Polyvinyl Chloride
REB	Rural Electrification Board
STW	Shallow Tube Well

## Executive Summary

Over the last sixty years, Bangladesh Agricultural Development Corporation (BADC) become a popular organization to the farmer, has been pioneer in expansion of irrigation area, fielding of irrigation equipment and technology, best use of surface water, judicious use of groundwater, increasing irrigation efficiency along with production, preservation & supply of high yielding variety of seed as well as quality fertilizers. BADC is involved with minor irrigation activities, including water use through LLP, rubber dam, floating pump, solar pump, dug well, DTW, STW and gravity flow system etc. Minor irrigation survey report 2022-23 as a part of regular work of BADC irrigation wing. It has been being performed by three organizations i.e. BADC, BMDA and DAE since 2004-05 till 2022-23. By this time, BADC developed Bangladesh Irrigation Equipment Survey & Monitoring (BIESM) software with a technical assistance by Centre for Environmental & Geographic Information Services (CEGIS), a Public Trust under the Ministry of Water Resources. CEGIS prepared 2022-23 minor irrigation survey report as assigned by BADC.

The report includes the country's agency-wise yearly irrigation coverage and time series of the irrigation area, operated irrigation equipment, power sources for irrigation equipment, farmers' involvement in irrigation activities, and the trend of surface and ground water use.

The main objectives of this report are to update database of BIESM software & prepare minor irrigation survey report of 2022-23 Rabi Season. Report has been prepared by field survey, field visit, GPS Survey, and consulting with stake holder organization BADC, DAE, BMDA. In 2022-23 irrigation season country's irrigation coverage is about 5.75 million ha of which 4.15 million ha (72.20% of total area) are through utilization of ground water and 1.60 million ha (27.80% of total area) through utilization of surface water. Net Cultivated Area (NCA) in Bangladesh is about 8.08 million ha (BBS 2023) where total irrigated area 5.75 million ha which is about 71.12% of NCA.

The survey has been conducted on Boro, Wheat, Potato, Maize, Spices and Vegetables which has been irrigated through minor irrigation equipment, structures and gravity flow system.

The findings of the report will help the Government to formulate policy decisions for effective minor irrigation planning which would play a key role in the production of food grains double by 2030. This report will furnish the planner, policy makers, researchers and administrators necessary irrigation related information and data for an effective planning in minor irrigation subsectors.

## Key Messages from BIESM 2022-23

- According to BIESM 2022–23 Rabi season data, about 5.75 million hectares (71.12% of NCA) of crop land were under irrigation, of which 1.60 million hectares (27.80%) were irrigated with surface water, and 4.15 million hectares (72.20 %) with ground water.
- Approximately 28.88% (2.33 million ha) of the country, comprising mostly hilly, coastal, and char regions, currently lacks facilities for irrigation.
- Surface water irrigation was performed by LLP, Solar pump, Floating pump, Rubber dam, gravity flow method and traditional methods.
- Ground water irrigation was performed by DTW, STW, Solar pump, Dug well, Artesian well and manual methods.
- About 17,21,834 irrigation equipment were used in Rabi 2022-23 of which 12,43,467 (about 72.22 %) operated by diesel engines, 4,74,503 (about 27.56%) operated by electricity and 3,864 (0.22%) is operated by solar energy.
- Solar operated irrigated pumps are now being popular to the farmers due to low operating cost.
- A total of 33,968 DTWs, 14,77,454 STWs, 2,06,548 LLPs, 73 Rubber dam, 3,008 Solar pumps, 856 solar Dug wells were operated.
- Farmers are using buried pipe and fita pipe to regulate the irrigation water. They are also adapting AWD to demonstrate the effectiveness of their irrigation practices.
- Irrigation by STW is still popular to the farmers due to its low price, ease of operation and mobility within small fragmented land.
- There is a shortage of surface water in the North-West and North-Central hydrological regions, ground water irrigation is used for crop production.
- Surface water resources are abundant in the hydrological regions of the North East, South Central, and South West; where, farmers are using surface water for agriculture production.
- Irrigation efficiency can be increased by installing buried pipe line in water conveyance system, drip and sprinkler irrigation system. Farmers can improve this efficiency by implementing AWD and receiving water management training.
- Government adapted Integrated Minor Irrigation Policy 2017, Water Act 2018, Ground Water Management Act 2018, NAP 2022 and Delta Plan 2100. An integrated approach to irrigation water management may be better option for the sustainable management of surface and groundwater resources.
- Area irrigated by STW and DTW is increased. Many DTWs installed in the decade of seventy with eighty feet housing pipe. Some of those were found technically unfit for operation due to lowering of GWT, clogging of strainer, sand pumping, non-electrification etc.
- Irrigated area covered by a single DTW, STW, LLP are found 30.78 ha, 2.09 ha and 6.43 ha respectively. It indicates poor irrigation efficiency at scheme level.
- Around 50% of water is wasted in the conveyance system since the majority of privately-owned irrigation schemes distribute water via earthen canals.

## Objectives of the Survey

Bangladesh is one of the world's biggest deltaic countries. Compared to its population, it has a small amount of arable land. When it comes to irrigation, there is an abundance of water throughout the wet season (June to September), but a scarcity during the Rabi season (January to April). The primary tool for raising production from agriculture is irrigation. In Bangladesh, small-scale irrigation is essential for increasing the irrigated area, producing more food, and contributing to the nation's food security. For the formulation of economic policy and plan for agricultural development, adequate and reliable statistical data about the number and types of irrigation equipment (both diesel and electric), irrigated area, irrigation cost and benefiting farmers are very much essential.

The survey and Monitoring Project of BADC has been carrying out survey of irrigation equipment since its inception in the year 2000. Five survey reports in five consecutive years 2000 to 2004 have been prepared and published by this project alone. But as per direction of MOA the survey is being carried out by BADC, DAE & BMDA jointly from 2005 and now on.

This report's main goals are to inventory and keep an eye on the minor irrigation systems that run by electricity and diesel, irrigated area both surface and groundwater, and number of benefited farmers throughout the Rabi season 2022-23.

The primary objectives of the 2022–2023 minor irrigation survey are to learn more about minor irrigation facilities and to verify the state, historical development, and current trend of minor irrigation systems across the country.

The detailed objectives of the minor irrigation survey 2022-23 are outlined as follows:

- To assess the historical development, present trend and status of minor irrigation system;
- To assess the present status of diesel & electric-driven irrigation equipment such as Deep Tube Well (DTW), Shallow Tube Well (STW), Low Lift Pump (LLP), Solar pump and Dug-well in terms of number, type and area irrigated;
- To assess the irrigated area by using groundwater and surface water, as well as the irrigated area in accordance with equipment;
- To determine the incremental utilization of irrigation facility, irrigated area and benefited farmers;
- To provide irrigation-related data to planners, researchers, and administrators;
- Assisting the government in making judgements about efficient minor irrigation planning, which ultimately contributes to national food security;

## Introduction

Irrigation water is a vital resource for agricultural development. Every season, more and more information on irrigation is required for demand-based planning in the irrigation subsector to enhance the irrigated area and ensure the country's sustainable food grain production. A database, GIS maps, reports, and pertinent information on irrigation systems must be prepared for future use.

A minor irrigation system is made up of non-mechanized, semi-mechanized, and mechanized irrigation systems. The non-mechanized irrigation systems include conventional systems like swing baskets and doans. The category of semi-mechanized irrigation systems includes gravity flow systems and manually operated pumps like hand tube wells, treadle pumps, artesian wells, etc.; mechanized irrigation systems include low lift pumps, shallow and deep tube wells, solar pumps, and rubber dams. Mechanized systems mostly used solar, electricity, or diesel power for irrigation equipment.

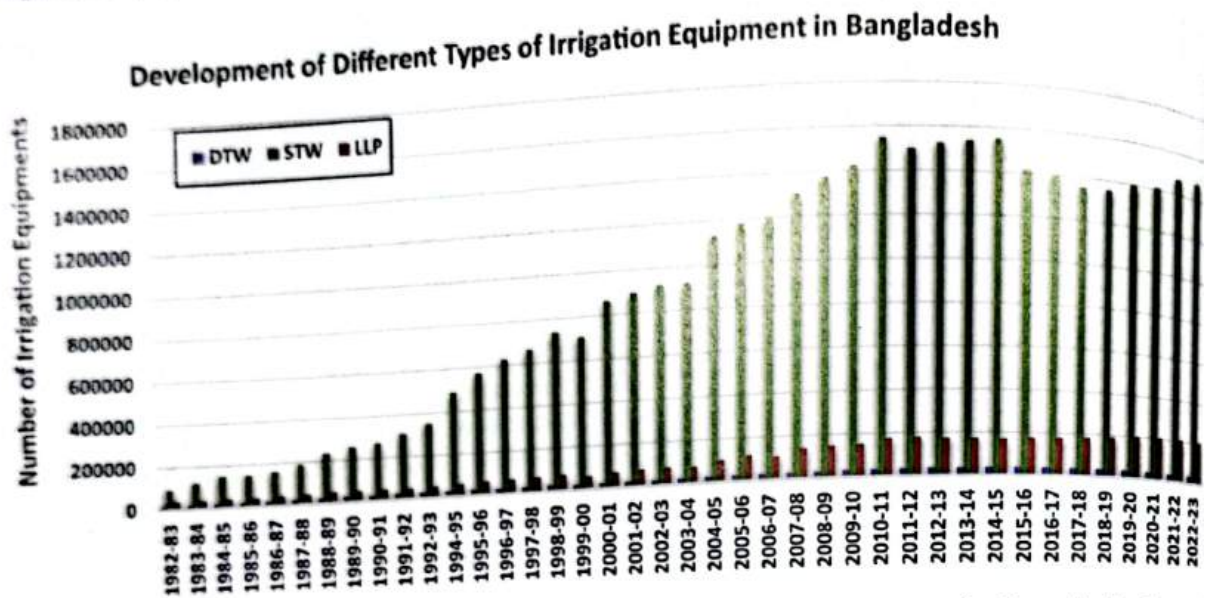
In 1961, BADC began its irrigation operations, fielding 1555 Low Lift Pumps. Deep tube wells were later installed in 1967–1968 for irrigation in areas with scarce surface water. Similar installations were made for the same reasons in shallow tube wells in 1973–1974, floating pumps in 1987–1988, rubber dam and solar pumps in 2011–2012, and dug wells in 2015–2016. In addition to these techniques, irrigation work is carried out in some parts of the country using gravity flow, conventional methods, manual pumps, and artesian wells. Table 1 summarizes irrigation using various methods of surface and groundwater utilization.

**Table 1: Summary of Surface and Ground water Irrigation by Different Modes during Rabi 2022-23**

SL	Mode of Irrigation	No of Equipment	Area Irrigated (ha)	% of Surface Water	% of Total Irrigated Area	Area Irrigated per equipment (ha)
<b>A</b>	<b>Surface water irrigation by</b>					
1	Low Lift pump	206548	1327972	83.10	23.11	6.43
2	Gravity flow		253996	15.90	4.42	
3	Traditional method		5414	0.34	0.09	
4	Solar pump	868	10562	0.66	0.18	12.17
	<b>Sub Total</b>	<b>207416</b>	<b>1597944</b>	<b>100.00</b>	<b>27.80</b>	
<b>B</b>	<b>Ground water irrigation by</b>			<b>% of Ground Water</b>		
1	Deep tube well	33968	1045582	25.20	18.19	30.78
2	Shallow tube well	1477454	3081813	74.25	53.60	2.09
3	Manual & Artesian Well		6332	0.15	0.11	
4	Solar Pump	2140	15844	0.38	0.28	7.40
5	Dug Well	856	1019	0.02	0.02	1.19
	<b>Sub Total</b>	<b>1514418</b>	<b>4150590</b>	<b>100.00</b>	<b>72.20</b>	
	<b>Grand Total</b>	<b>1721834</b>	<b>5748534</b>		<b>100.00</b>	

From Table 1, it is revealed that during the Rabi 2022-23, total 17,21,834 numbers of irrigation equipment's are used for irrigation in the country which is 0.54% higher than that of 2021-22 Rabi season in which 17,12,515 nos. of irrigation equipment were operated. On the other hand, irrigated area was 5.75 million ha in Rabi 2022-23 which is also 1.04 % higher than that of 2021-2022 Rabi season irrigated area was 5.69 million hectares. Out of total 5.75 million hectares irrigated area, 5.46 million ha irrigated by DTW, STW & LLP and 0.29 million ha

irrigated by Manual and Artesian well, traditional method, gravity flow, solar pump and deep tube well. Out of total 5.75 million ha Irrigated area 4.15 million ha through the utilization of groundwater i.e. 72.20% of total Irrigated area and 1.60 million ha through utilization of surface water i.e. 27.80% of total Irrigated area. The historical development of different types of irrigation equipment in Bangladesh is shown in Figure 1.



**Figure 1: Development of Different Types of Irrigation Equipment in Bangladesh**

With the development of high-yielding rice varieties ideal for Boro rice in Bangladesh during the 1980s and 1990s, these rice types responded well to fertilizer and irrigation. The focus was shifted to the development of groundwater resources because the Teesta, Brahmaputra-Jamuna, and Ganges River floodplains all have favorable aquifer conditions. Deep tube well (DTW) construction began in the late 1960s, but it picked up steam in the late 1980s. BADC installed over 25,500 DTWs across the country up to 1992. Presently, 33,968 DTWs are working in Bangladesh to provide water for irrigation purposes. Those are installed by BADC, BMDA and private sectors. Discharge capacity of DTWs is 28-56 lit/sec mostly. Considering the climate change issues and environmental condition of Bangladesh, government discouraged ground water used for irrigation and approved Ground Water Management Act -2018 in parliament, because in some area of Bangladesh excessive groundwater withdrawal is found. Now the installation of new DTW by the government fund is suspended.

Following the growth of DTWs, shallow tube wells (STWs) with discharge capacities ranging from 10 to 21 lit/sec were developed. However, limitations on tube well spacing and an embargo on the import of all diesel engines prevented STWs from being implemented initially, despite the obvious advantages of groundwater irrigation. Following the destructive 1988 floods and the cyclones that followed in the early 1990s, it became clear that agricultural machinery was necessary to get farming economics back on track. Since Irrigation by STW is totally driven by private sector.

The government lifted all restrictions and embargos on the import of irrigation equipment. Consequently, local markets were flooded with inexpensive and easy to operate irrigation pumps and small engines (<12 HP), mainly imported from India and China.

The groundwater and surface water irrigated area are shown in Figure 2.

Source wise Irrigated Area (ha) in the year 2022-23

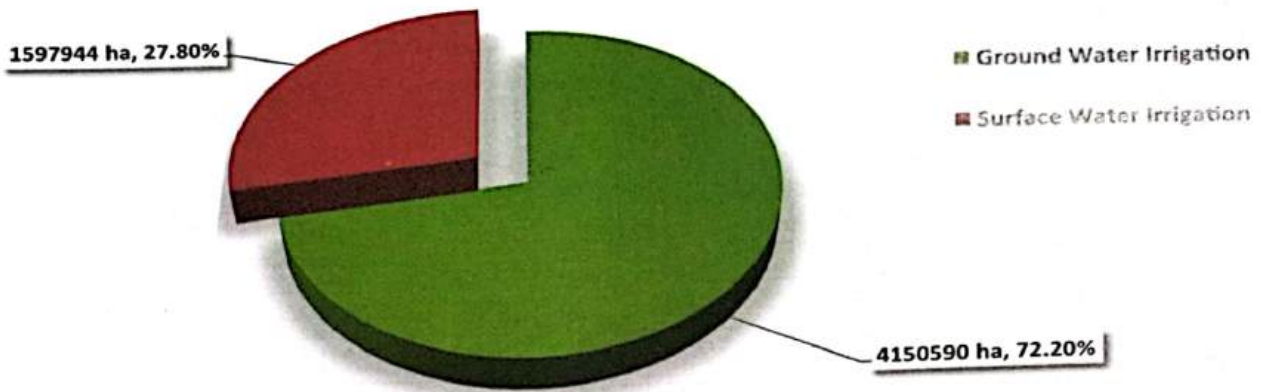


Figure 2: Irrigated Area (ha) of Surface and Groundwater in Rabi 2022-23

Distribution of irrigated area during the Rabi 2022-23 are shown in the Table 2 and graphical presentation shown in Figure 3.

Table 2: Total Area (ha) Covered by Different Irrigation Mode in Rabi 2022-23

Different Modes of Irrigation	Irrigated Area (ha)	% of total area
Deep tube well	1045582	18.19
Shallow tube well	3081813	53.61
Low lift pump	1327972	23.10
Gravity flow	253996	4.42
Solar pump	26406	0.46
Manual & Artesian well	6332	0.11
Traditional method	5414	0.09
Dug Well	1019	0.02
<b>Total</b>	<b>5748534</b>	<b>100.00</b>

Area Covered by Different Irrigation Mode in Rabi 2022-23

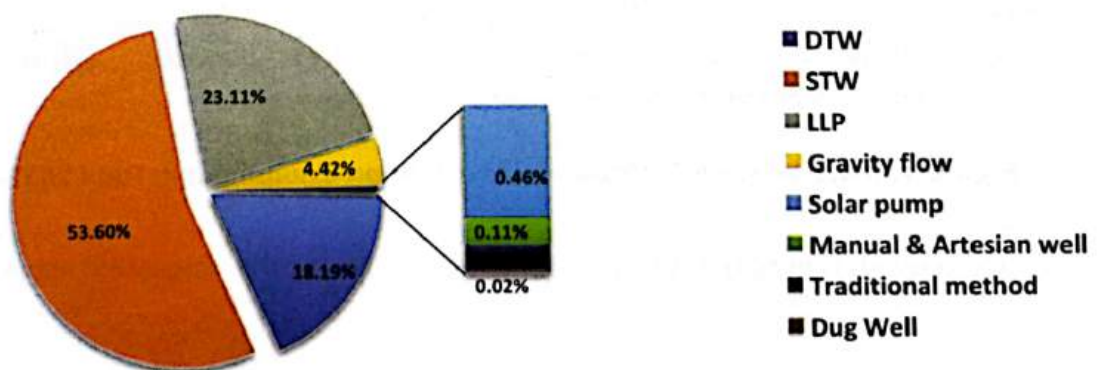


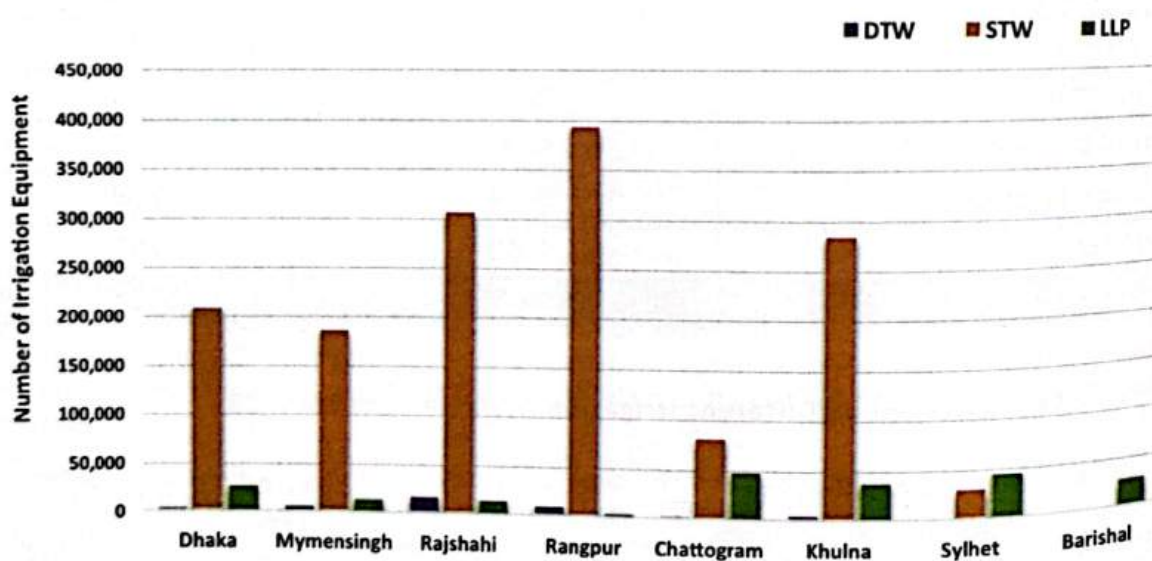
Figure 3: Total Area Covered by Different Irrigation Mode in Rabi 2022-23

Distribution of irrigation equipment's used during Rabi 2022-23 are shown in bellows

**Table 3: Division-wise distribution of irrigation equipment used in Rabi 2022-23**

Name of Division	Nos. of Irrigation equipment in the Year 2022-23					Total
	DTW	STW	LLP	Solar	Dug Well	
Dhaka	2127	206691	25183	99	20	234120
Mymensingh	4117	183913	12396	55	45	200526
Rajshahi	14998	305011	12956	541	594	334100
Rangpur	7883	391645	2564	1366	76	403534
Chattogram	1561	79590	47007	205	21	128384
Khulna	3113	282205	36288	622	82	322310
Sylhet	169	28240	43610	47	4	72070
Barishal	-	159	26544	73	14	26790
<b>Total</b>	<b>33968</b>	<b>1477454</b>	<b>206548</b>	<b>3008</b>	<b>856</b>	<b>1721834</b>

**Division Wise Distribution of Irrigation Equipment in the Rabi 2022-23**

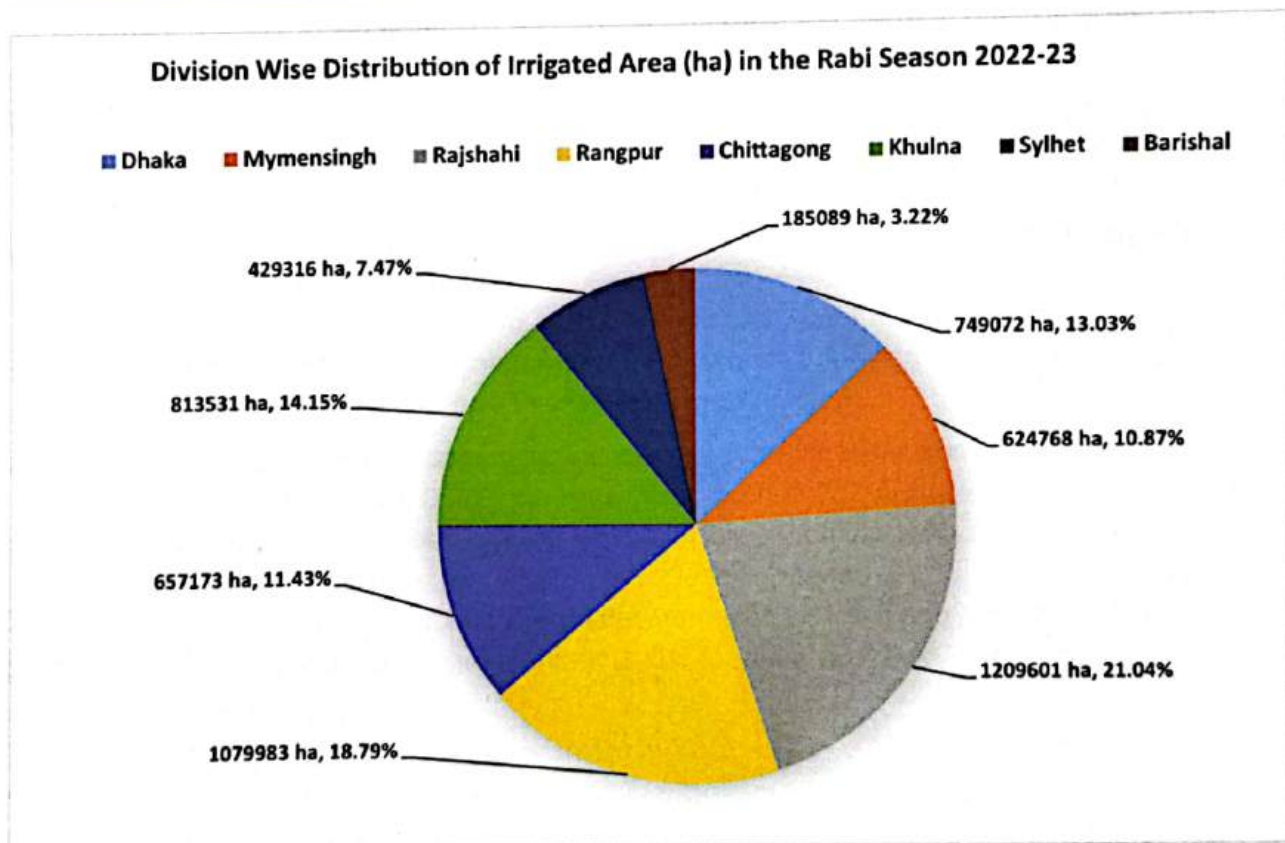


**Figure 4: Division wise Distribution of Irrigation Equipment in Rabi 2022-23**

Distribution of irrigation area during Rabi 2022-23 are shown bellows

**Table 4: Division wise distribution of Total Irrigated Area (ha) in Rabi 2022-23.**

Division	Irrigation Year 2022-23	
	Irrigated Area (ha)	% of Total Area
Dhaka	749072	13.03
Mymensingh	624768	10.87
Rajshahi	1209601	21.04
Rangpur	1079983	18.79
Chattogram	657173	11.43
Khulna	813531	14.15
Sylhet	429316	7.47
Barishal	185089	3.22
<b>Total</b>	<b>5748534</b>	<b>100.00</b>



**Figure 5: Division wise Distribution of Irrigated Area (ha) In Rabi 2022-23**

## Ground Water Irrigation

Bangladesh's shallow (unconfined) and deep (confined, semi-confined) aquifers are the country's sources of groundwater. There is medium sand to gravel in these aquifers. The hydraulic conductivity and storage capacity are sufficient for groundwater withdrawal. Wells sinking to a depth of 30 to 180 metres. The Rajshahi Division has the highest concentration of deep tube wells (44.15%), followed by Rangpur, Mymensingh, Khulna, and Dhaka Division. Rangpur Division has the highest concentration of STW, followed by Rajshahi, Khulna, Dhaka, and Mymensingh Divisions. About 73.86% of the total groundwater is used in four divisions in the North-Central and North-Western hydrological zones i.e. Dhaka, Mymensingh, Rajshahi and Rangpur division. It is probable that groundwater irrigation in the North-West will persist until land limitations or sustainable groundwater withdrawals are accomplished. A sufficient recharge during the five-month monsoon period is necessary for groundwater irrigation during the seven-month dry period. Over the course of the year, irrigation will accelerate groundwater depletion and cause an unsustainable fall in water levels if recharge is not greater than or at least equal to discharge. However, due to increasing groundwater extraction in the former zones, it is discovered that groundwater recharge is higher in the North-West than in the South and North-East, respectively. These regions' farmers have already begun to transition to less water-intensive and more profitable crops including vegetables, wheat, and maize.

In Bangladesh, diesel engines power almost 72.22% of the pumps. Most of the STW operated by diesel engine, the remaining 27.56% use electricity and 0.22% solar energy. Electric pumps are typically less expensive than diesel ones. However, in certain instances, farmers favour diesel pumps over other types because of their lower initial costs and ease of mobility in tiny, dispersed farmlands, even in the face of power cuts. Farmers' preferences for diesel pumps may also be influenced by the prevalence of power cuts and the generally poor electricity network in many rural locations. The owners of STWs irrigate not just their own land but also those of their neighbors for a set seasonal charge that can be paid in cash or by growing crops.

Groundwater irrigation requires large amounts of energy to lift water from underlying aquifers. In the Rabi 2022-23 about 33206 DTWs are electrified; the rest 762 are diesel operated. Out of the 1.48 million STWs in Bangladesh, only 0.42 million are electrified whereas the remaining 1.06 million are diesel operated. In the North-west, diesel operated STWs are used primarily for irrigating Boro rice, and partially for supplementary irrigation to Aman and Aus rice and other crops. Since there is little genetic and agronomic potential to boost rice yield, rising irrigation costs will lower farmers' net profits.

## Deep Tubewell

Well with electricity or diesel driven pump lifts water from aquifer. Deep Tubewells (DTW) are of large well diameter (15.24-20.32 cm) and pumped water by a submersible turbine pump having capacity 28-56 L/sec mostly. DTWs are called deep wells not because of large depth but because of the type of pump (force mode) used, the capacity of the well and position of groundwater table (>7.0 m).

Total 33968 number of Deep Tubewells are operated in 2022-23 Rabi season for irrigation in agricultural land. About 1.05 million ha of land is irrigated by Deep Tubewell, which is 25.20 percent of ground water irrigation and 18.19 percent of total irrigated area of Bangladesh. The average irrigated area coverage of DTW is 30.78 ha. Irrigation by deep tubewells decreasing because many DTWs are installed in the decade of seventy-eighty with 80' housing pipe. Those became technically unfit for lift water due to depletion of groundwater level. Details of irrigated area of Deep Tubewells are presented in Table 5 and Figure 23.



**Figure 6: BADC DTW in Dhanbari Upazila, Tangail**



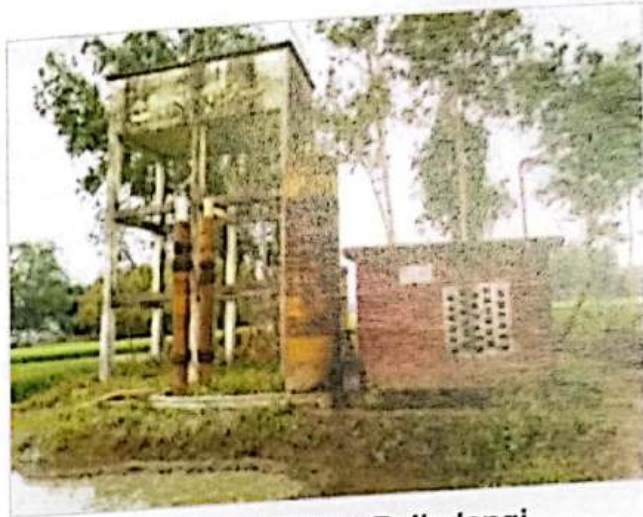
**Figure 7: BADC Deep Tubewell at Kashiani Upazila, Gopalganj**



**Figure 8: BADC Solar Deep Tubewell at Sadar Upazila, Sylhet**



**Figure 9: BADC Deep Tubewell at Lakhai Upazila, Habiganj**



**Figure 10: BMDA DTW in Baliadangi Upazila, Thakurgaon**



**Figure 11: BMDA DTW at Naldanga Upazila, Nator**



**Figure 12: Private DTW at Ghatail Upazila, Tangail**



**Figure 13: BADC Solar DTW at Gowainghat Upazila, Sylhet**



**Figure 14: Solar DTW at Birganj Upazila, Dinajpur**

## Shallow Tubewell

Shallow tubewell (STW), mostly used for irrigation have 5.08-10.16 cm well diameter with a capacity of 10-21 liter/sec and abstract water from aquifer with the help of land based electrical/ diesel driven centrifuged pump when groundwater table lies within 7.0 m from ground surface. A total of 1.48 million shallow tubewells are operated in rabi season of 2022-2023. The irrigated area of shallow tubewell was about 3.08 million ha with 2.09 ha average per STW. About 74.25 percent of ground water irrigation is covered with Shallow Tubewells, which is 53.60 percent of total irrigated area of Bangladesh. Division-wise irrigated area coverage of STW is presented in Table 5 and Figure 23.



Figure 15: Shallow Tubewell at Basail Upazila, Tangail



Figure 16: Shallow Tubewell at Baghmara Upazila, Rajshahi



Figure 17: Shallow Tubewell (pit) at Baghmara Upazila, Rajshahi



Figure 18: Electrified Shallow Tubewell Chirirbandar Upazila, Dinajpur



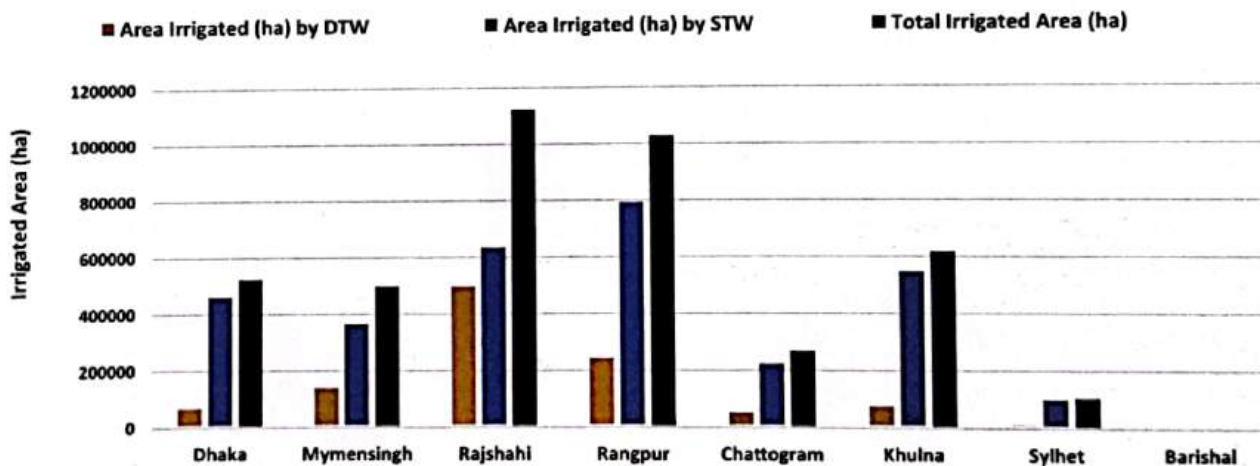
Figure 19: Portable Solar system for STW operated by BADC at Kaunia Upazila, Rangpur

During the Rabi 2022-23, DTWs and STWs covered throughout the country were 1.05 million ha and 3.08 million ha. In the previous Rabi season 2021-2022, total 1.50 million DTWs and STWs were in operation and 4.11 million ha land were irrigated. Deep Tube Well contributed 18.19% and Shallow Tube Well is contributed 53.61% of the total area irrigated during Rabi 2022-23. Division-wise Irrigation by DTWs & STWs is shown in Table 5 along with graphical representation in Figure 23.

**Table 5: Area Irrigated by DTWs and STWs in Eight Divisions of Bangladesh, 2022-23**

Division	Irrigation Year 2022-23		
	Area Irrigated (ha) by DTW	Area Irrigated (ha) by STW	Total Irrigated Area (ha)
Dhaka	62911	455238	518149
Mymensingh	133744	359556	493300
Rajshahi	491010	627448	1118458
Rangpur	237056	787204	1024260
Chattogram	46089	215862	261951
Khulna	69603	541881	611484
Sylhet	5169	94200	99369
Barishal	-	424	424
<b>Total</b>	<b>1045582</b>	<b>3081813</b>	<b>4127395</b>

**Area Irrigated by DTW and STW in comparison with Total Irrigated Area in the Year 2022-23**



**Figure 20: Area irrigated by DTWs and STWs in Comparison with Total Irrigated Area in Rabi, 2022-23**

## Dug well

Dug well is a well for lift water, constructed by excavating a large-diameter (mostly 122-132 cm) and installing a casing with opening. Water pumped from the well by an electrically operated submersible pump. Rain water is harvested and stored in dug well by a funnel-type structure with solar panel placed on the upper face of the structure. In recent years, dug well irrigation is becoming popular adoptive options in the water-scarce areas especially in Barind Tract, hilly and vegetable growing areas.



Figure 21: BADC Solar operated Dug well at Madhupur Upazila, Tangail



Figure 22: BADC Solar operated Dug well at Chhagalnaiya Upazila, Feni.



Figure 23: BADC Solar operated Dug well at Daulatpur, Kustia.



Figure 24: BMDA Solar operated Dug well at Badarganj Upazila, Rangpur



## Manually Operated Pump in Well

Manual irrigation systems are easy to handle, require no technical equipment and are therefore generally cheap. But these types of pumps need high labor inputs. A common and very simple technique for manual irrigation is Treadle pump, Diaphragm Pump, and Hand Pump etc. for groundwater-based irrigation. These types of pump mainly used for low water demand crops in small farm land.



Figure 25: Diaphragm Pump



Figure 26: Treadle Pump

## Artesian Well

A water table higher than the well ensures water pressure will consistently force water from an artesian aquifer. An artesian aquifer is an underground layer which holds groundwater under pressure. This causes the water level in the well to rise to a point where the pressure is equal to the weight of water putting it under pressure. Water may even reach the ground surface if the natural pressure is high enough, in which case the well is called a flowing artesian well. An aquifer is a geologic layer which can hold water such as sand and gravel, limestone, or sandstone, through which water flows and is stored. An artesian aquifer is trapped between rocks or clay which causes pressure. Water returns to the aquifers when the water table at its recharge zone is at a higher elevation than the head of the well.



Figure 27: Artesian well, BADC



Figure 28: Artesian well, Private

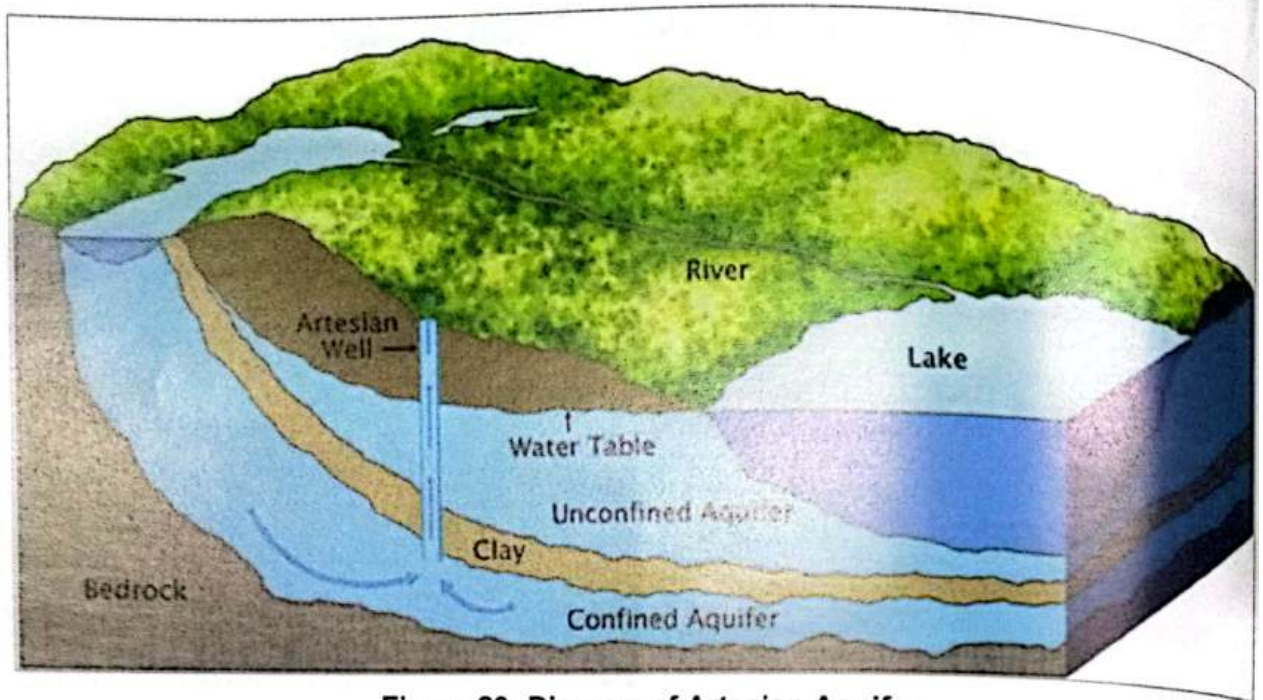


Figure 29: Diagram of Artesian Aquifer

Division wise irrigated area by Manual and Artesian well in Rabi 2022-23 is shown in Table 6.

Table 6: Irrigated Area by Manual Method and Artesian Well in Rabi 2022-23.

SI No	Division	Irrigated Area (Hectare)	% of Total
1	Dhaka	1119	17.67
2	Mymensingh	305	4.82
3	Rajshahi	208	3.28
4	Rangpur	187	2.95
5	Chattogram	756	11.94
6	Khulna	708	11.18
7	Sylhet	2338	36.92
8	Barishal	711	11.23
<b>Total</b>		<b>6332</b>	<b>100.00</b>

## Surface Water Irrigation

One of the main sources of irrigation water is surface water in Bangladesh. Perennial rivers, streams, canals, khals, beels, ponds, and other man-made or natural reservoirs are the major sources of surface water. There is a paucity of surface water during the dry season, but it is abundant during the rainy season. In order to increase surface water, BADC, BMDA, and other organizations have implemented a number of projects, such as canal digging, river dredging and the construction of rubber dams. Although the farmers of Bangladesh mostly use groundwater for irrigation purpose, but surface water irrigation still contributes 27.80% of total irrigated land during Rabi season. Surface water is mainly used in South-central, South-east and North-east hydrological regions of Bangladesh which is mainly fallen under three administrative Divisions of the country, i.e. Barishal, Chattogram and Sylhet. The outfall of GBM basin is mainly flown through Barishal and part of the Chattogram division. As a result, most of the rivers of these two divisions have fresh water for irrigation during Rabi season. Rivers and estuary with Eastern hill hydrological zones also have enough fresh surface water to support irrigation. Despite some water salinity issues being observed in recent years due to upstream water withdrawal, climate change, and sea level rise, farmers still rely on surface water irrigation.

Surface water irrigation is less expensive and crop friendly than groundwater. Currently, diesel engine is used for operation of 89.36% of LLPs. BADC and BMDA fielded 2-5 cusec LLP to farmers for surface water irrigation. Moreover, floating irrigation pump is also supplied by BADC to double-lifting irrigation schemes. Seventy-three numbers Rubber dam/ Hydraulic elevator dam are constructed by BADC, BMDA, BWDB, LGED in perennial rivers and creeks to make available surface water for irrigation. Besides this excavation/ re-excavation of canal is done by the government to increase surface water availability. By increasing the availability of electricity, this cost might be further reduced. Diesel pumps usually have higher costs and lower water extraction capacity than electric. But despite subsidies on electricity, some cases diesel pumps are preferred by farmers due to low capital costs and mobility ease within small and fragmented farm lands.

Surface water irrigation requires less amounts of energy than ground water. In the Rabi season 2022-23 about 184572 LLPs are diesel operated; the rest 21976 are electrically operated. In the South-central and North-east, diesel operated LLPs are used primarily for irrigating Boro rice, and partially for supplementary irrigation to T. Aman, Aus and other crops.



**Figure 30: Re-excavated Khal at Narsingdi**



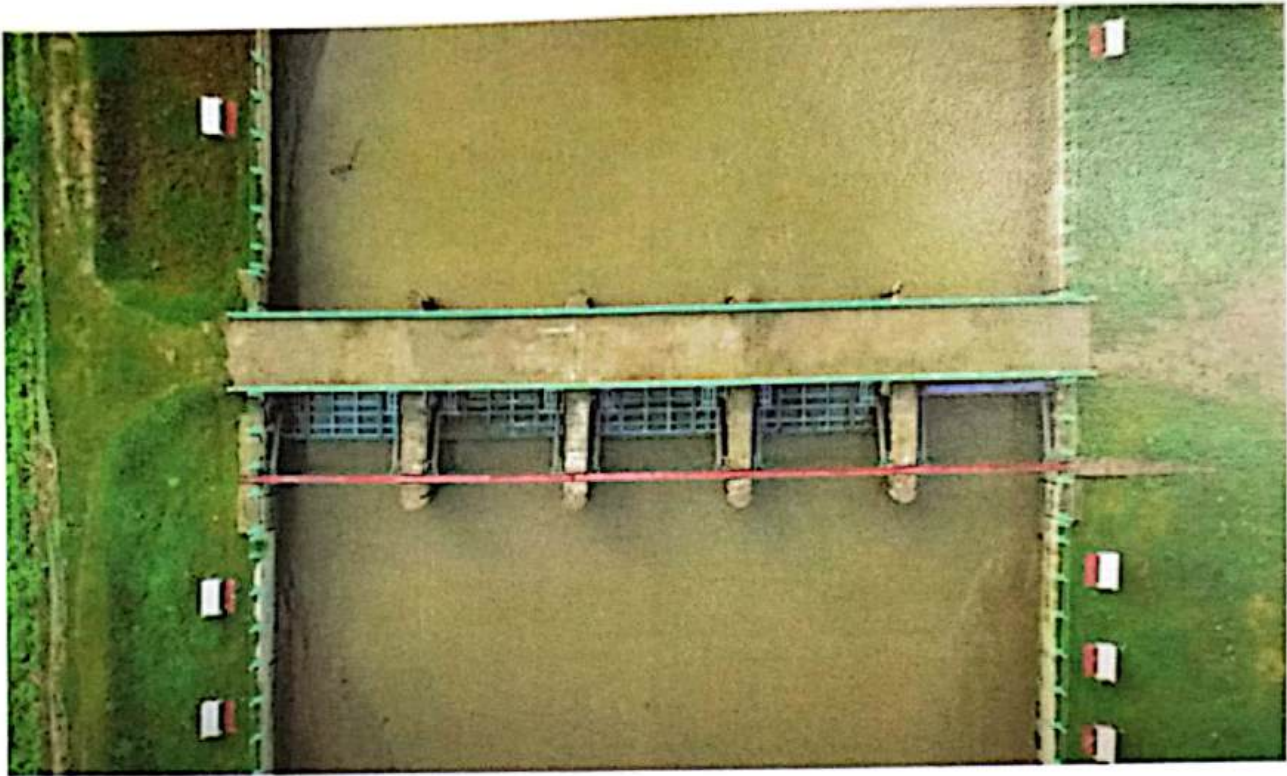
**Figure 31: Re-excavation of Khal at Kishoreganj**



**Figure 32: Submerged Weir at Ashuganj-Palash Agro Irrigation Project by BADC**



**Figure 33: Intake point of Regulator at Ashuganj-Palash Agro Irrigation Project by BADC**



**Figure 34: Hydraulic Elevated Dam at Anwara, Chattogram by BADC**



**Figure 35: Rubber Dam at Kalmakanda Upazila, Netrokona District by BADC**

## Low Lift Pumps (LLP)

A Low Lift Pump (LLP) is one in which water is lifted between two open water surfaces through a pump total head up to about 10m. Pump is coupled with an electrical or diesel-driven power source. Mostly centrifugal pump is used for LLP with a capacity of 14-140 L/sec. In 2022-23, about 206548 nos. of LLP were operated for irrigation purpose and 1.33 million ha irrigated which is 23.10% of total irrigated area. Out of 206548 LLPs, BADC operated 9311 nos. of LLPs under various projects through which 232207 ha of land was irrigated. Division wise no. of LLPs and irrigated areas in Rabi 2022-23 are shown in Table 7.



Figure 36: LLP with Buried Pipe, Nangalkot Upazila, Cumilla by BADC



Figure 37: 1.0 Cusec solar LLP at Kasiani Upazila, Gopalganj by BADC



Figure 38: 0.5 Cusec Solar LLP at Brahmanpara Upazila, Cumilla



Figure 39: 2.0 cusec LLP at Rajshahi by BMDA



Figure 40: 25 Cusec Floating Pump at Netrokona by BADC



Figure 41: BADC



Figure 42: Barge Mounted Floating LLP at Rajshahi by BMDA



Figure 43: by BA



Figure 44: Boat Mounted Floating Solar LLP at T



Figure 40: 25 Cusec Floating Pump at Netrokona by BADC



Figure 41: 10 Cusec Floating Pump at Cumilla by BADC



Figure 42: Barge Mounted Floating LLP at Rajshahi by BMDA



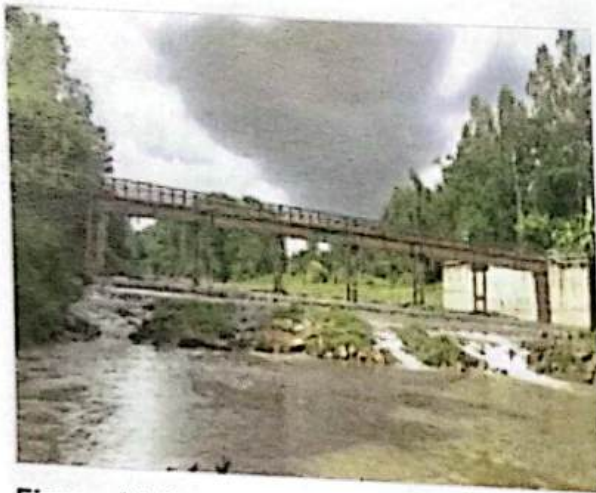
Figure 43: Portable Solar Irrigation System by BADC at Char area Rangpur



Figure 44: Boat Mounted Floating Solar LLP at Tista River, Kaunia, Rangpur by BADC

## Rubber Dam

Rubber Dam is a hydraulic structure usually built to river/creeks perpendicular to flow direction and store surface water for irrigation/ recharge/ salinity control/ recreation/ flood control purpose. Total 73 Rubber Dam is constructed in Bangladesh. Rubber Dam are constructed by LGED, BADC, BWDB and BMDA.



**Figure 45: Ichamati Rubber Dam at Rangunia, Chattogram by BADC**



**Figure 46: Chillakhali Nodi Rubber Dam at Nalitabari, Sharpur by BADC**



**Figure 47: Zinziram Nodi Rubber Dam at Raumari upazila, Kurigram by LGED.**



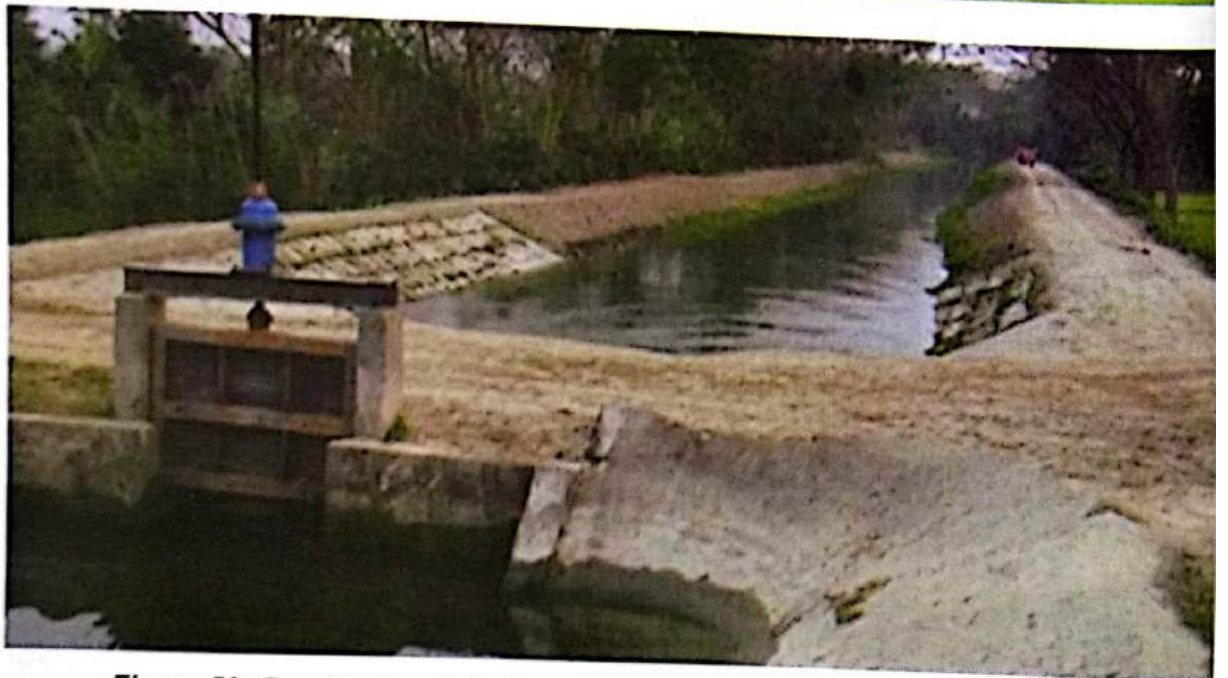
**Figure 48: Mohamaya Rubber Dam at Mirsharai Upazila, Chattogram by BWDB.**

## Gravitational Flow

Surface water is the main source of gravity flow irrigation system. In some part of the country, irrigation carried out by gravity flow through major irrigation projects. This type of irrigation projects mainly implemented and operated by BWDB. Some of the irrigated areas under gravity flow are also covered by BADC, LGED and private sector. It has been observed that during 2022-23 irrigation seasons, 253996 ha of land were irrigated by gravity flow method. Division wise irrigated area (ha) by Gravity Flow is shown in Table 7.



Figure 49: Gravity flow irrigation at Ashuganj-Polash agro-irrigation project by BADC



**Figure 50: Gravity Flow Irrigation at Tista Barrage at Nilphamari by BWDB**

## Traditional Irrigation Equipment

Bangladesh was dependent on traditional means of irrigation, up to 1960s, when irrigation was applied by swing basket, shewty, doan etc. Swing basket or shewty is capable of lifting water up to 3 feet approximately and doans up to 5 feet. After introduction of modern irrigation technology, the use of traditional method irrigation is decreasing day by day. During Rabi 2022-23, 5414 ha of land has been irrigated by traditional method. Division-wise irrigated area (ha) by Traditional Method in the Boro Season is shown in the Table 7.



Figure 51: Doan



Figure 52: Swing Basket

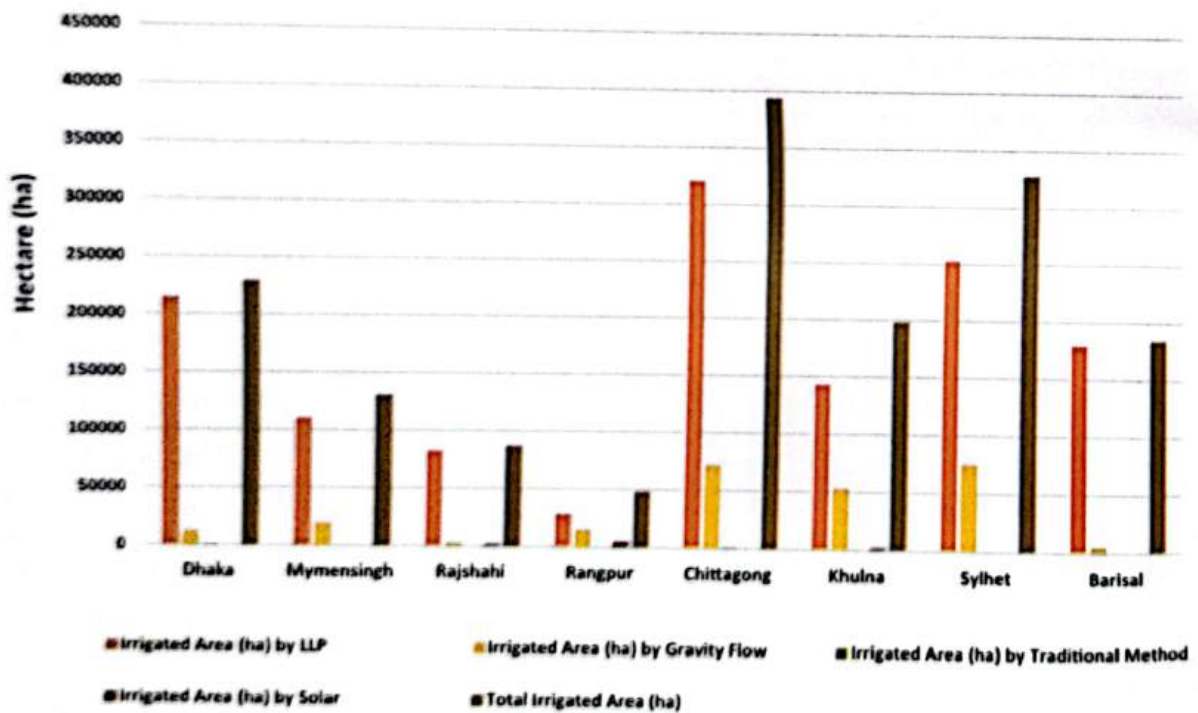


Figure 53: Different Types of Traditional Irrigation Methods

**Table 7: Area irrigated by Surface water in eight divisions of Bangladesh, Rabi 2022-23**

Name of Division	Irrigated Area (ha) by LLP	Irrigated Area (ha) by Traditional Method	Irrigated Area (ha) by Gravity Flow	Irrigated Area (ha) by Solar	Total Irrigated Area (ha)
Dhaka	214811	1379	12675	366	229231
Mymensingh	110343	497	19782	195	130817
Rajshahi	82348	75	2902	1961	87286
Rangpur	27948	233	15059	4984	48224
Chittagong	319796	1467	71632	517	393412
Khulna	142779	698	52536	2091	198104
Sylhet	251656	701	74785	185	327327
Barishal	178291	364	4625	263	183543
<b>Total</b>	<b>1327972</b>	<b>5414</b>	<b>253996</b>	<b>10562</b>	<b>1597944</b>

**Area Irrigated by Surface Water Irrigation in Rabi Season 2022-23**



**Figure 54: Division wise Area Irrigated by Surface Water In Rabi 2022-23**

## Trend of Minor Irrigation

### A. Operational Equipment and Irrigated Area

The trend of operational irrigation equipment and irrigated area from 1961-62 to 2022-23 is shown in Table 8 and Table 9.

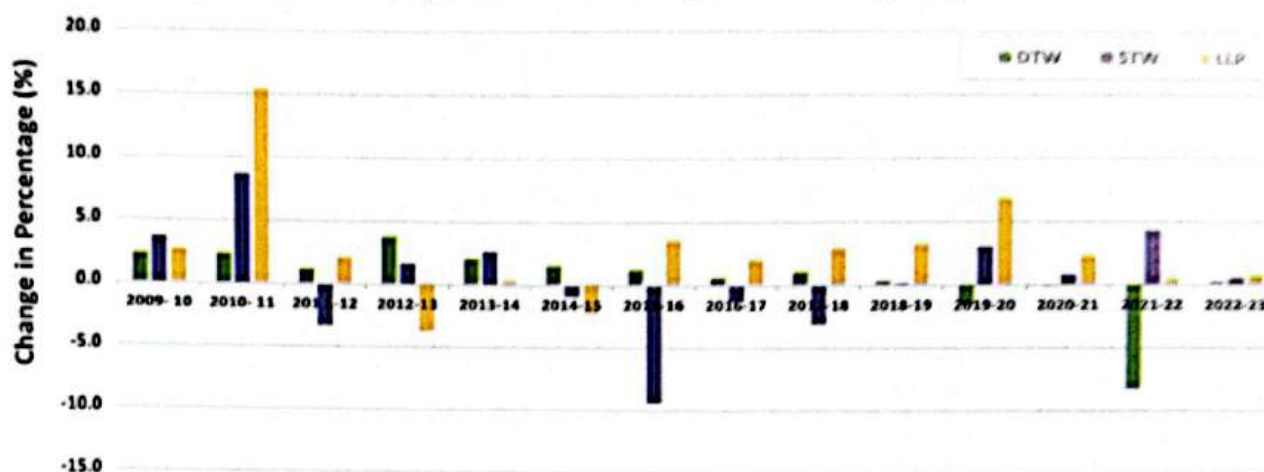
**Table 8: Trend of Minor Irrigation Equipment 1961-62 to 2022-23**

Boro/Rabi Season	Annual Operating (Nos.)			Annual Change in Percentage (%)		
	DTW	STW	LLP	DTW	STW	LLP
1961-62			1555			0.00
1962-63			2024			30.16
1963-64			2477			22.38
1964-65			2239			-9.61
1965-66			3420			52.75
1966-67			3990			16.67
1967-68	102		6558	0.00		64.36
1968-69	380		10852	272.55		65.48
1969-70	980		17846	157.89		64.45
1970-71	796		24483	-18.78		37.19
1971-72	906		24243	13.82		-0.98
1972-73	1237		32917	36.53		35.78
1973-74	1494	998	35243	20.78	0.00	7.07
1974-75	2699	1029	35534	80.66	3.11	0.83
1975-76	3828	2162	36382	41.83	110.11	2.39
1976-77	4461	3045	28361	16.54	40.84	-22.05
1977-78	7453	6447	36730	67.07	111.72	29.51
1978-79	9329	8379	35895	25.17	29.97	-2.27
1979-80	9795	11280	37389	5.00	34.62	4.16
1980-81	10131	20931	35951	3.43	85.56	-3.85
1981-82	11491	42955	41153	13.42	105.22	14.47
1982-83	13800	93100	35500	20.09	116.74	-13.74
1983-84	15500	120300	36000	12.32	29.22	1.41
1984-85	16900	147000	37000	9.03	22.19	2.78
1985-86	17900	146900	37500	5.92	-0.07	1.35
1986-87	18700	160300	40600	4.47	9.12	8.27
1987-88	20300	188700	42300	8.56	17.72	4.19
1988-89	22400	235900	50800	10.34	25.01	20.09
1989-90	22600	260000	51000	0.89	10.22	0.39
1990-91	21500	270300	51600	-4.87	3.96	1.18
1991-92	25500	309300	50300	18.60	14.43	-2.52
1992-93	25700	348900	52200	0.78	12.80	3.78
1993-94	24500	359200	52600	-4.67	2.95	0.77
1994-95	26700	488900	57100	8.98	36.11	8.56
1995-96	27300	571200	60600	2.25	16.83	6.13
1996-97	25200	629800	62900	-7.69	10.26	3.80

Boro/Rabi Season	Annual Operating (Nos.)			Annual Change in Percentage (%)		
	DTW	STW	LLP	DTW	STW	LLP
1997-98	25300	664700	66300	0.40	5.54	5.41
1998-99	26700	736100	72900	5.53	10.74	9.95
1999-00	23530	707570	58050	-11.87	-3.88	-20.37
2000-01	23180	865210	71310	-1.49	22.28	22.84
2001-02	23000	893360	77000	-0.78	3.25	7.98
2002-03	23430	924020	79870	1.87	3.43	3.73
2003-04	24720	925150	77790	5.51	0.12	-2.60
2004-05	27180	1128990	99250	9.95	22.03	27.59
2005-06	28280	1182520	119130	4.05	4.74	20.03
2006-07	29170	1202720	107290	3.15	1.71	-9.94
2007-08	31300	1304970	138630	7.30	8.50	29.21
2008-09	32170	1374580	146790	2.78	5.33	5.89
2009-10	32910	1425140	150610	2.30	3.68	2.60
2010-11	33670	1549150	173670	2.31	8.70	15.31
2011-12	34050	1498390	177220	1.13	-3.28	2.04
2012-13	35320	1523610	170570	3.73	1.68	-3.75
2013-14	36034	1563791	171041	2.02	2.64	0.28
2014-15	36566	1549711	167175	1.48	-0.90	-2.26
2015-16	36979	1417008	173179	1.16	-9.36	3.46
2016-17	37175	1398960	176478	0.53	-1.27	1.90
2017-18	37538	1355852	181469	0.98	-3.08	2.83
2018-19	37634	1357532	187188	0.26	0.12	3.15
2019-20	37007	1398706	199914	-1.67	3.03	6.80
2020-21	36955	1409689	204391	-0.14	0.79	2.24
2021-22	33896	1469980	205212	-8.28	4.28	0.40
2022-23	33968	1477454	206548	0.21	0.51	0.65

*Note: Data from 1961-62 to 1981-82 Taken from Year wise Progress Report of BADC, data from 1982-83 to 1999-2000 taken from Census of Irrigation in Bangladesh by ATIA Project and data from 2000-01 to 2022-23 taken from Minor Irrigation Survey Report of BADC.*

**Irrigation Equipment Annual Change in Percentage (%)**



**Figure 55: Trend of Minor Irrigation Equipment Change in last Fourteen Rabi season (2009-10 to 22-2023)**

**Table 9: Trend of Irrigated Area by Different Minor Irrigation Mode (1961-62 to 2022-23)**

Irrigation Season	DTW	STW	LLP	Manual & Artesian Well	Traditiona I Method	Gravity Flow Method	Solar Pump	Dug Well	Total
1961-62			29928						
1962-63			53864						
1963-64			63462						
1964-65			53547						
1965-66			70248						
1966-67			91136						
1967-68	1667		130373						
1968-69	6510		180620						
1969-70	13004		273227						
1970-71	12984		373230						
1971-72	11874		369745						
1972-73	15287		508715						
1973-74	24881	1806	565477						
1974-75	47716	2726	576963						
1975-76	62246	5220	603425						
1976-77	66477	7168	519479						
1977-78	137034	27929	708959						
1978-79	204186	35827	820470						
1979-80	235748	55400	894775						
1980-81	259557	99029	912099						
1981-82	323152	202180	1089873						
1982-83	234000	371000	337000	16000	405000	160000			1523000
1983-84	263000	480000	342000	16000	372000	136000			1610000
1984-85	287000	586000	351000	16000	384000	147000			1772000
1985-86	304000	586000	356000	16000	314000	163000			1739000
1986-87	318000	639000	386000	16000	326000	155000			1840000

Irrigation Season	DTW	STW	LLP	Manual & Artesian Well	Traditional Method	Gravity Flow Method	Solar Pump	Dug Well	Total
1987-88	345000	753000	402000	16000	433000	115000			2064000
1988-89	380000	941000	482000	16000	391000	170000			2380000
1989-90	384000	1037000	484000	16000	478000	176000			2575000
1990-91	365000	1078000	513000	18000	498000	316000			2645000
1991-92	434000	1234000	500000	19000	316000	251000			2674000
1992-93	437000	1392000	496000	22000	323000	291000			2829000
1993-94	389000	1388000	458000	29000	348000	326000			2767000
1994-95	502000	1638000	538000	25000	250000	352000			3107000
1995-96	540000	2004000	568000	51000	207000	355000			3752000
1996-97	475000	2159000	570000	38000	186000	333000			3762000
1997-98	465000	2182000	622000	64000	201000	285000			3833000
1998-99	507000	2522000	628000	101000	232000	358000			4349000
1999-00	529640	2122510	581800	18650	76520	227400			3556520
2000-01	538260	2295660	603280	6530	71730	250850			3766310
2001-02	530290	2355030	628750	7460	36900	286010			3849770
2002-03	587930	2409410	664020	11710	32510	309650			4018240
2003-04	589490	2429130	630670	13340	25570	355670			4043860
2004-05	654190	3159900	838380	1250	24250	109380			4787340
2005-06	700660	3120610	803170	2110	26130	107040			4759720
2006-07	725260	3196120	810020	2250	12150	137060			4882870
2007-08	785680	3197180	903870	5210	19040	138800			5049780
2008-09	790115	3245143	957035	15448	43965	75145			5126851
2009-10	773323	3336652	964902	17412	40186	85151			5217626
2010-11	719206	3505287	1009981	6381	3814	19071			5263740
2011-12	758963	3418147	1084594	11858	28326	20447			5322335
2012-13	934342	3242440	1035736	34560	28320	97707			5373105
2013-14	876803	3278838	1083535	33778	28318	101060			5402332
2014-15	962039	3235184	1106705	27718	20232	96274			5448152
2015-16	1194177	2954949	1164603	29718	18336	128564			5490347
2016-17	1063486	3079001	1187823	27518	14553	154885			5527266
2017-18	1072539	2981646	1220879	26856	12769	241925			5556614
2018-19	1076141	2994466	1248616	8780	8065	238871	11960	583	5587482
2019-20	1084245	3001120	1269661	7852	6825	242356	14524	1015	5627598
2020-21	1085431	3006076	1287013	6752	6124	245136	16524	1735	5654791
2021-22	1038113	3070155	1310917	6552	5824	247636	9939	444	5689580
2022-23	1045582	3081813	1327972	6332	5414	253996	26406	1019	5748534

Note: Data from 1961-62 to 1981-82 Taken from Year wise Progress Report of BADC, data from 1982-83 to 1999-2000 taken from Census of Irrigation in Bangladesh by ATIA Project and data from 2000-01 to 2022-23 taken from Irrigation Equipment Survey Report of BADC.

## B. Comparative Study of Area Coverage (ha) per Equipment (DTW, STW, LLP)

A comparative study of area coverage (ha) per equipment (DTW, STW & LLP) is given below in the Table 10.

Table 10: Comparative Study of Area Coverage Hectare per Equipment (DTW, STW & LLP)

Irrigation season	Irrigated Area ('000 ha)			Operational Equipment ('000 No.)			Area Coverage per		
	DTW	STW	LLP	DTW	STW	LLP	DTW	STW	LLP
1982-83	234	371	337	13.8	93.1	35.5	16.96	3.98	9.49
1983-84	263	480	342	15.5	120.3	36	16.97	3.99	9.5
1984-85	287	586	351	16.9	147	37	16.98	3.99	9.49
1985-86	304	586	356	17.9	146.9	37.5	16.98	3.99	9.49
1986-87	318	639	386	18.7	160.3	40.6	17.01	3.99	9.51
1987-88	345	753	402	20.3	188.7	42.3	17	3.99	9.5
1988-89	380	941	482	22.4	235.9	50.8	16.96	3.99	9.49
1989-90	384	1037	484	22.6	260	51	16.99	3.99	9.49
1990-91	365	1078	513	21.5	270.3	51.6	16.98	3.99	9.94
1991-92	434	1234	500	25.5	309.3	50.3	17.02	3.99	9.94
1992-93	437	1392	496	25.7	348.9	52.2	17	3.99	9.5
1994-95	502	1638	538	26.7	488.9	57.1	18.8	3.35	9.42
1995-96	540	2004	568	27.3	571.2	60.6	19.78	3.51	9.37
1996-97	475	2159	570	25.2	629.8	62.9	18.85	3.43	9.06
1997-98	465	2182	622	25.3	664.7	66.3	18.38	3.28	9.38
1998-99	507	2522	628	26.7	736.1	72.9	18.99	3.43	8.61
1999-00	529.64	2122.51	581.8	23.53	707.57	58.05	22.51	3	10.02
2000-01	538.26	2295.66	603.28	23.18	865.21	71.31	23.22	2.65	8.46
2001-02	530.29	2355.03	628.75	23	893.36	77	23.06	2.64	8.17
2002-03	587.93	2409.41	664.02	23.43	924.02	79.87	25.09	2.61	8.31
2003-04	589.49	2429.13	630.67	24.72	925.15	77.79	23.85	2.63	8.11
2004-05	654.19	3159.9	838.38	27.18	1128.99	99.25	24.07	2.8	8.45
2005-06	700.66	3120.61	803.17	28.28	1182.52	119.13	24.78	2.64	6.74
2006-07	725.26	3196.12	810.02	29.17	1202.72	107.29	24.86	2.66	7.55
2007-08	785.68	3197.18	903.87	31.3	1304.97	138.63	25.1	2.45	6.52
2008-09	790.12	3245.14	957.04	32.17	1374.55	146.79	24.56	2.36	6.52
2009-10	773.323	3336.65	964.9	32.91	1425.14	150.61	23.5	2.34	6.41
2010-11	719.206	3505.287	1009.981	33.67	1549.149	173.669	21.36	2.26	5.82
2011-12	758.963	3418.147	1084.594	34.045	1498.386	177.216	22.23	2.28	6.12
2012-13	934.342	3242.44	1035.736	35.322	1523.609	170.569	26.45	2.13	6.07
2013-14	876.803	3278.838	1083.535	36.034	1536.791	171.041	24.33	2.1	6.33
2014-15	962.039	3235.184	1106.705	36.566	1549.711	167.175	26.3	2.08	6.62
2015-16	1194.177	2954.949	1164.603	36.979	1417.008	173.179	32.29	2.08	6.72
2016-17	1063.486	3079.001	1187.823	37.175	1398.96	176.478	28.6	2.2	6.73
2017-18	1072.539	2981.646	1220.879	37.538	1355.852	181.469	28.57	2.19	6.72
2018-19	1076.141	2994.466	1248.616	37.634	1357.532	187.188	28.59	2.21	6.67
2019-20	1084.245	3001.12	1269.661	37.007	1398.706	199.914	29.3	2.15	6.35
2020-21	1085.431	3006.074	1287.013	36.955	1409.649	204.391	29.37	2.13	6.29
2021-22	1038.113	3070.155	1310.917	33.896	1469.98	205.212	30.63	2.09	6.39
2022-23	1045.582	3081.813	1327.972	33.968	1477.454	206.548	30.78	2.09	6.43

### Area (Hectare) Coverage Per Equipment

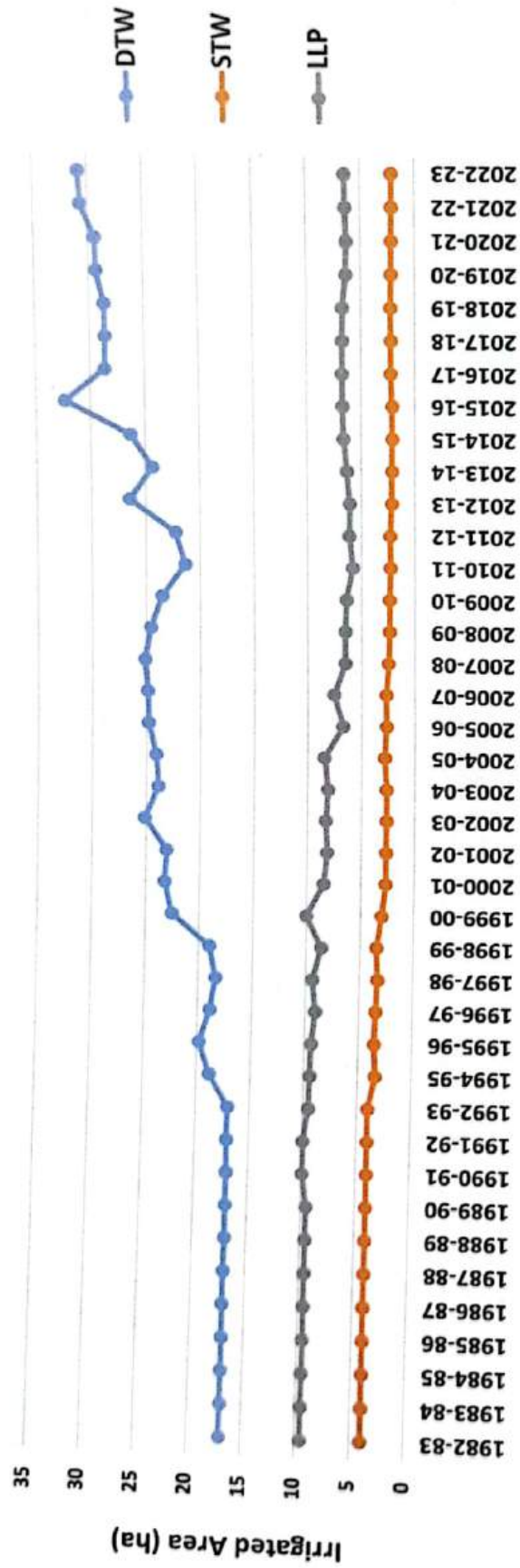


Figure 56: Area Coverage per Irrigation Equipment during Rabi 1982-83 to 2022-2023

### Trend of Irrigated area (Hectare) by Different Minor Irrigation Mode from 1982-83 to 2022-23

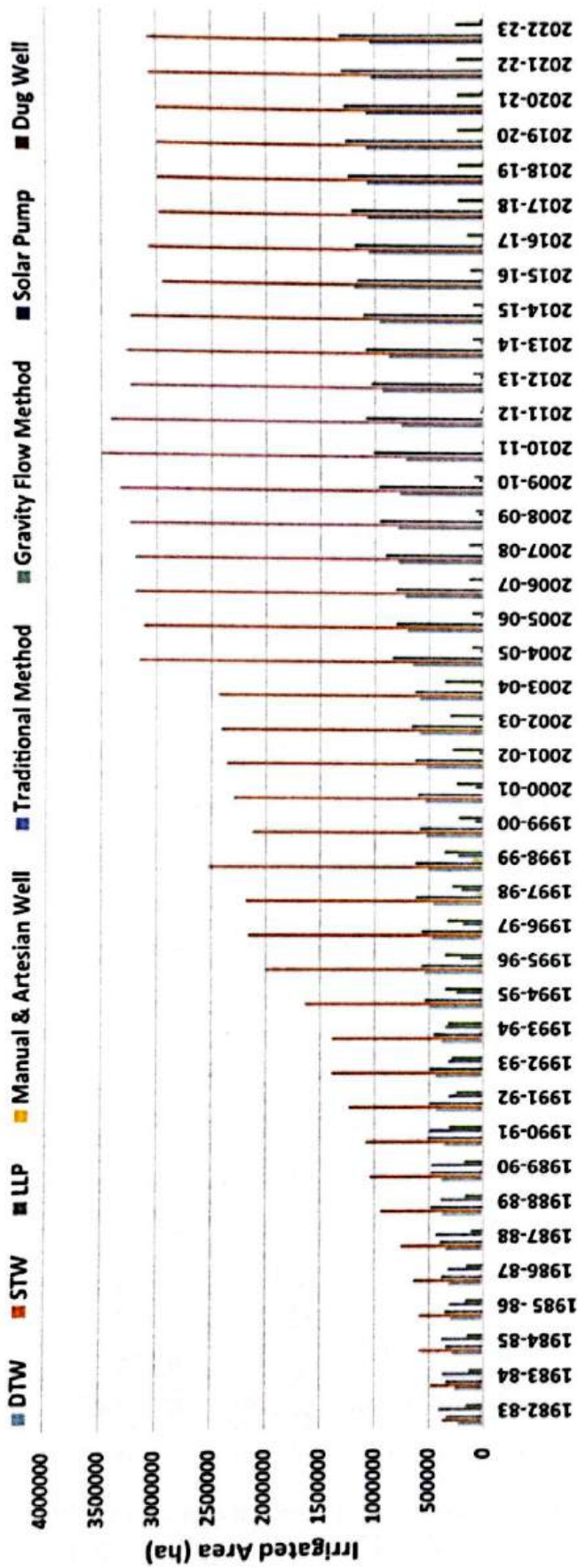


Figure 57: Trend of Irrigated Area (ha) during Rabi 1982-83 to 2022-2023

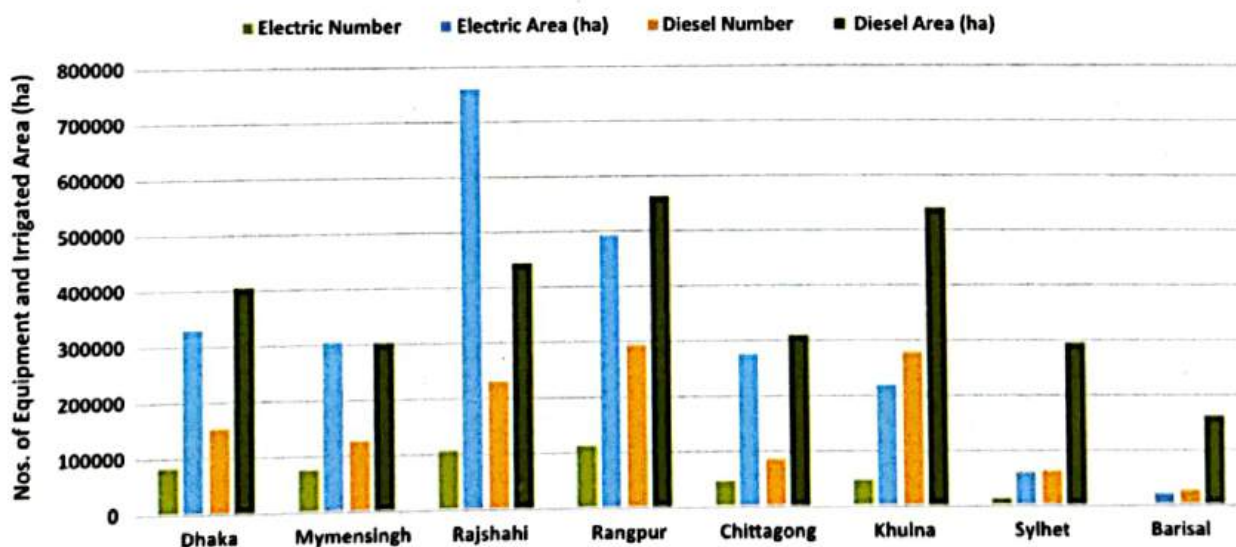
## Power Source in Irrigation Equipment

During the 2022-23 Rabi season, 1717970 number of power operated irrigation equipment are used all over the country. Power-operated equipment's are operated either by diesel or electricity. Recently solar energy is used to generate electricity to operate the small capacity irrigation pumps. A total of 3864 solar-powered equipment was found, including Dug-well 856. The survey has been made to determine number of diesel or electricity-operated various types of equipment's used all over the country. Different modes of irrigation equipment based on Power Source are shown in Table 11 and graphical presentation in Figure 58

**Table 11: Division Wise Distribution of Irrigation Equipment based on Power Source**

Division	Electric		Diesel		Total	
	Number	Area (ha)	Number	Area (ha)	Number	Area (ha)
Dhaka	82,078	329,156	151,923	403,804	234,001	732,960
Mymensingh	74,644	303,353	125,782	300,290	200,426	603,643
Rajshahi	104,371	759,315	228,594	441,491	332,965	1,200,806
Rangpur	110,505	491,252	291,587	560,956	402,092	1,052,208
Chittagong	44,832	274,275	83,326	307,472	128,158	581,747
Khulna	45,810	217,121	275,796	537,142	321,606	754,263
Sylhet	10,756	59,168	61,263	291,857	72,019	351,025
Barishal	1,507	19,258	25,196	159,457	26,703	178,715
<b>Total</b>	<b>474,503</b>	<b>2,452,897</b>	<b>1,243,467</b>	<b>3,002,470</b>	<b>1,717,970</b>	<b>5,455,367</b>

**Division wise Irrigation Equipment and Irrigated Area (ha) on the Basis of Power Source**



**Figure 58: Bar Diagram showing Number of Electrical and Diesel Operated Equipments and Irrigated Area (ha) in Rabi 2022-23**

# **GIS Map on Irrigation Survey**







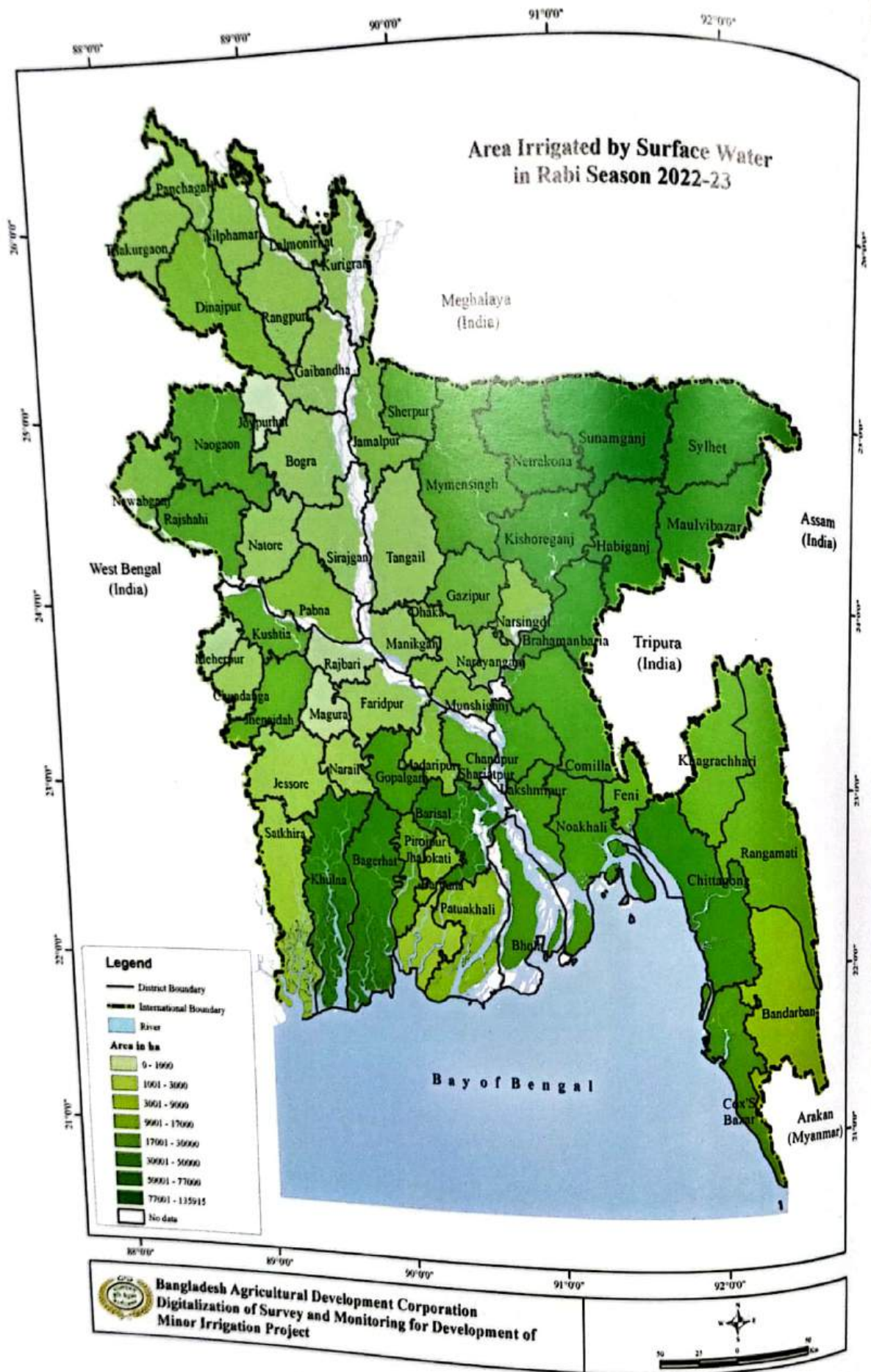


Figure 62: Irrigated Area by Surface Water



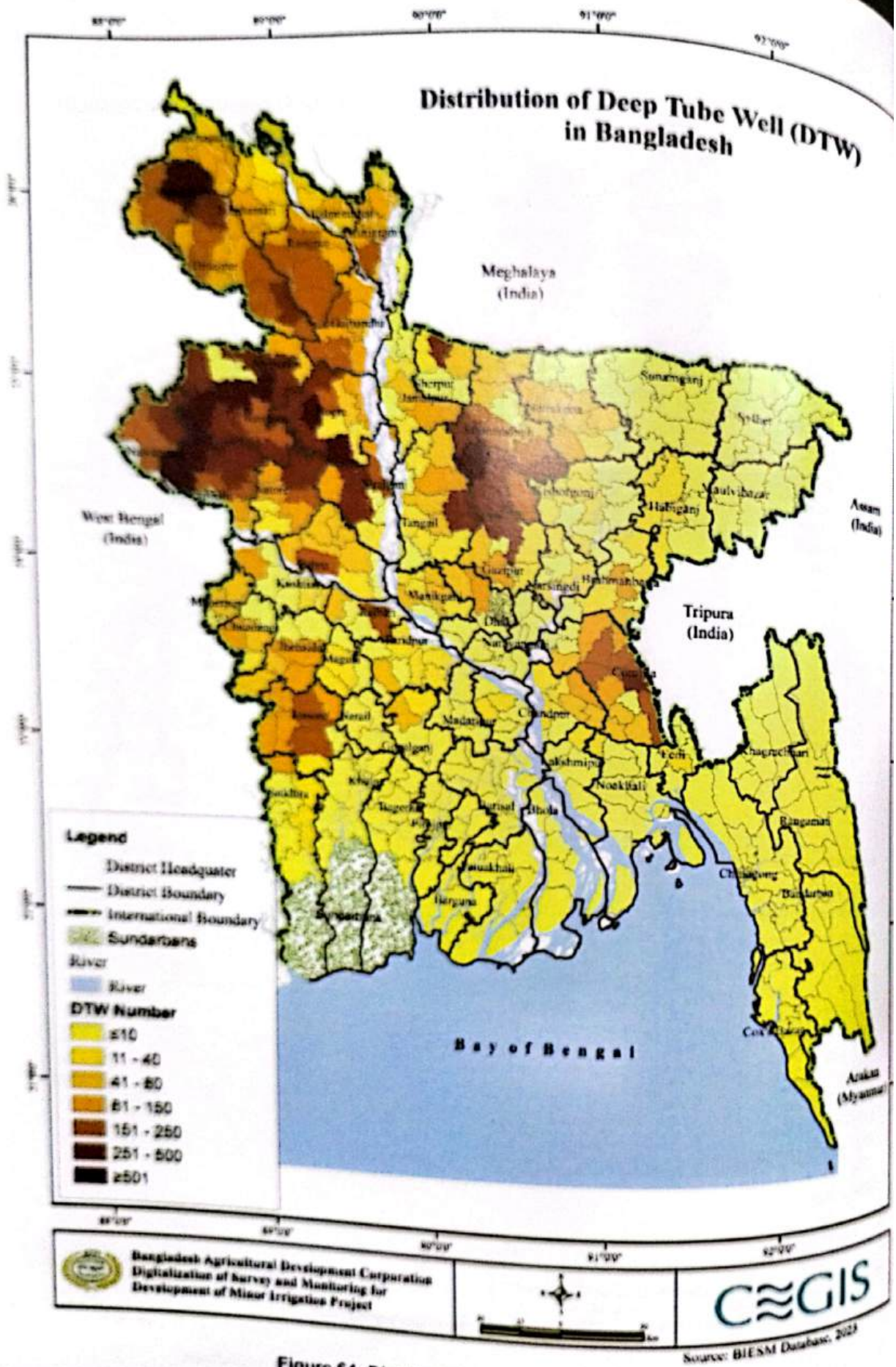
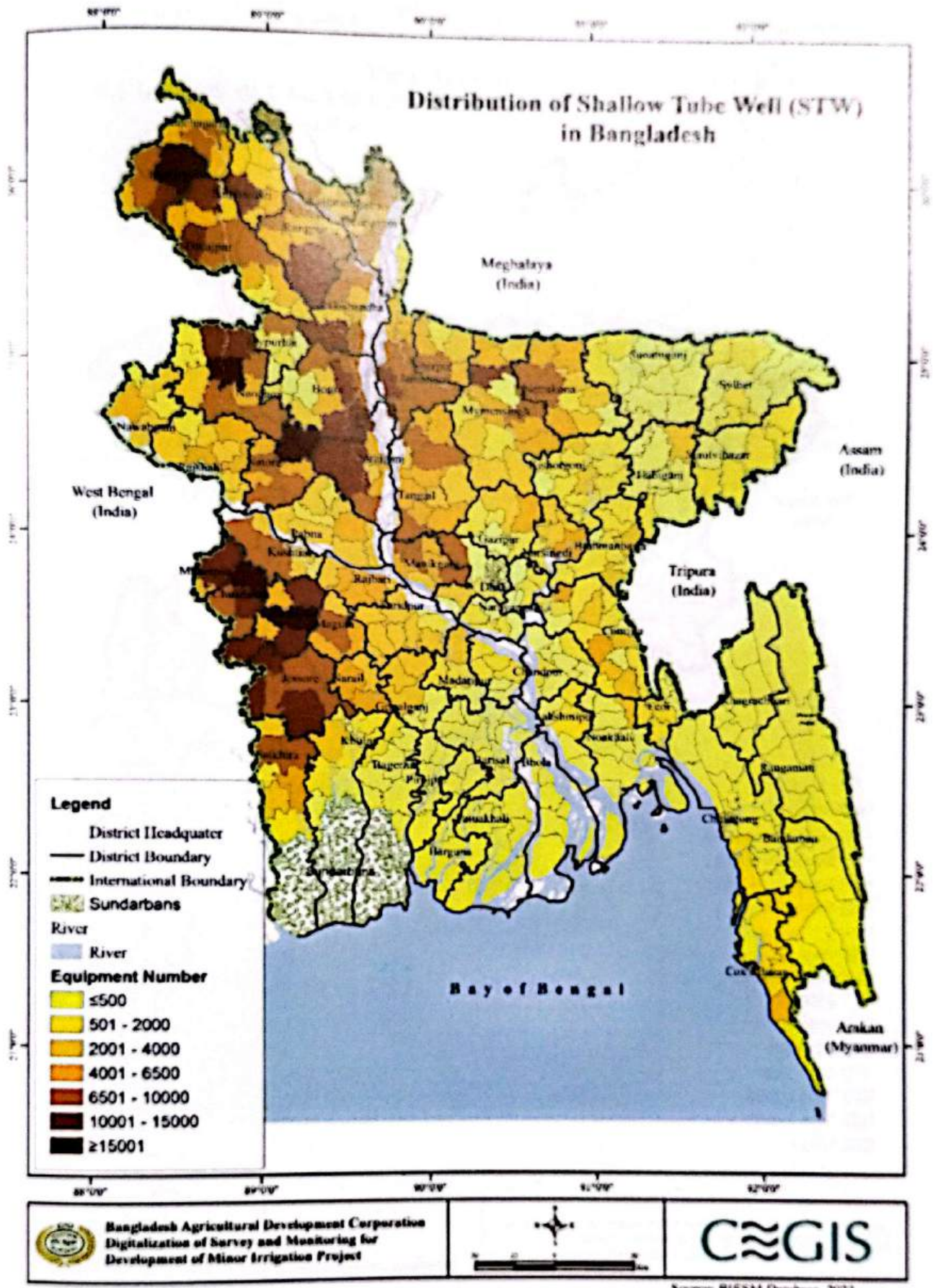


Figure 64: Distribution of DTW in Bangladesh



**Figure 65: Distribution of STW in Bangladesh**

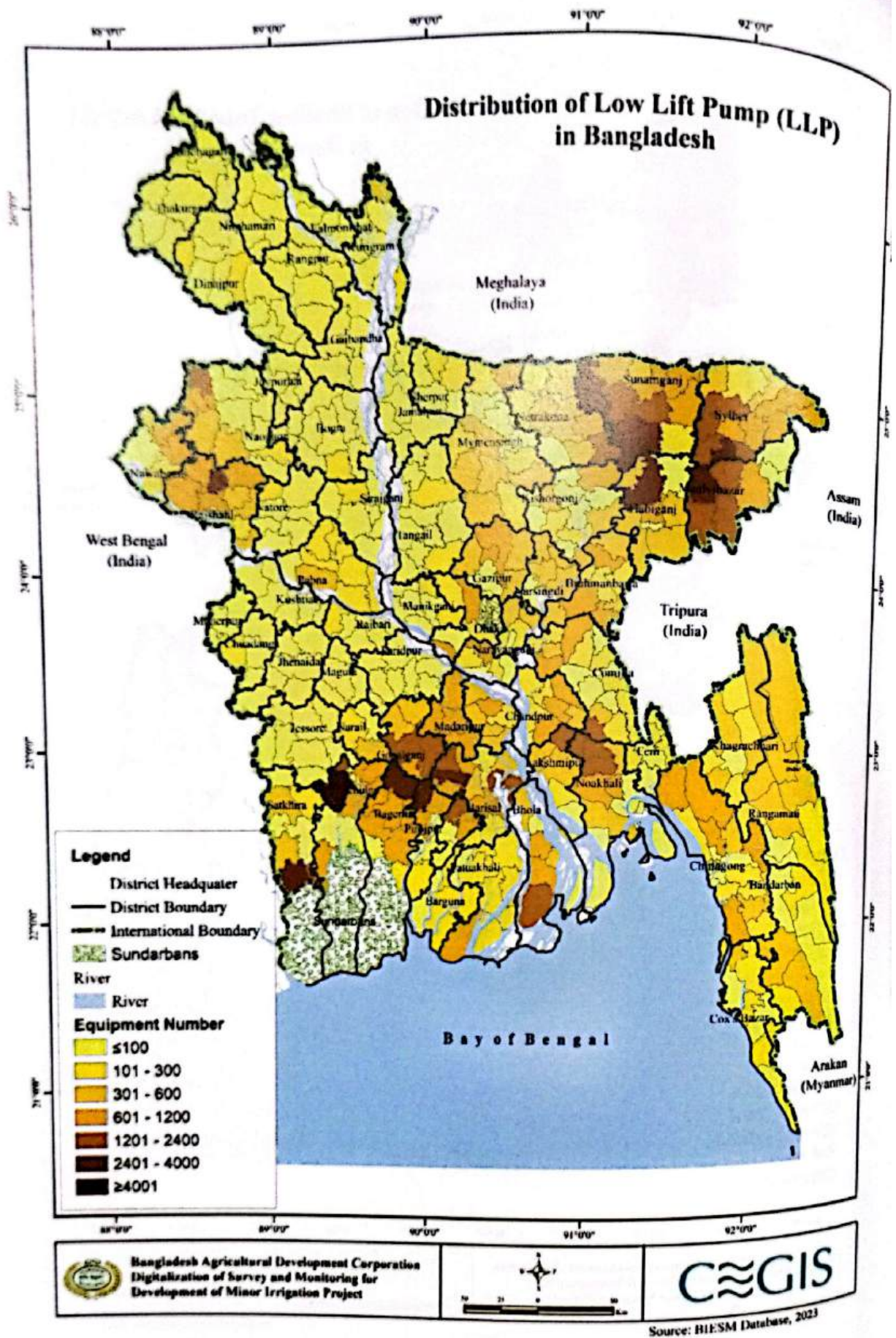


Figure 66: Distribution of LLP In Bangladesh

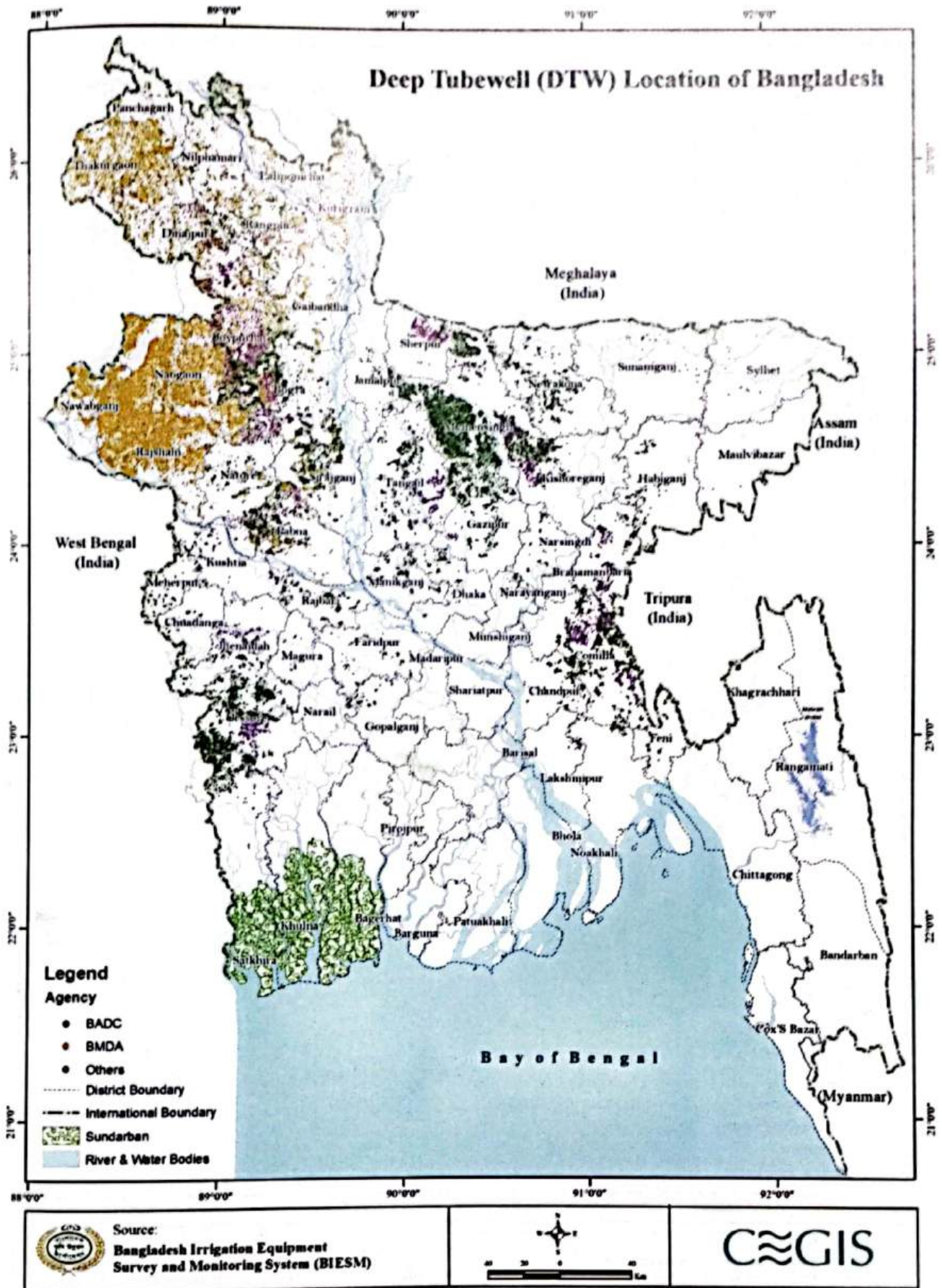


Figure 67: Location of Deep Tubewell

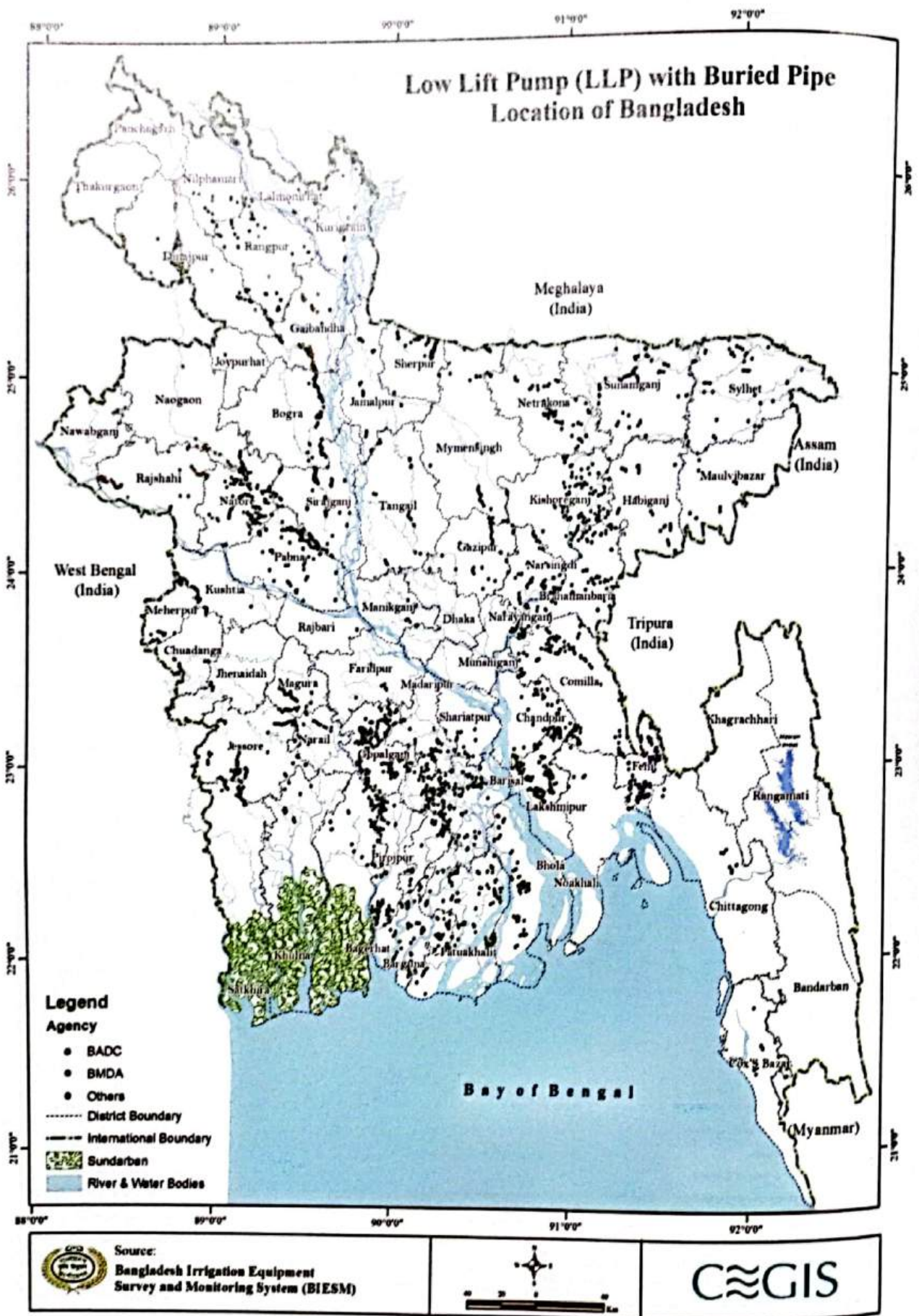


Figure 68: Location of LLP with Buried Pipe

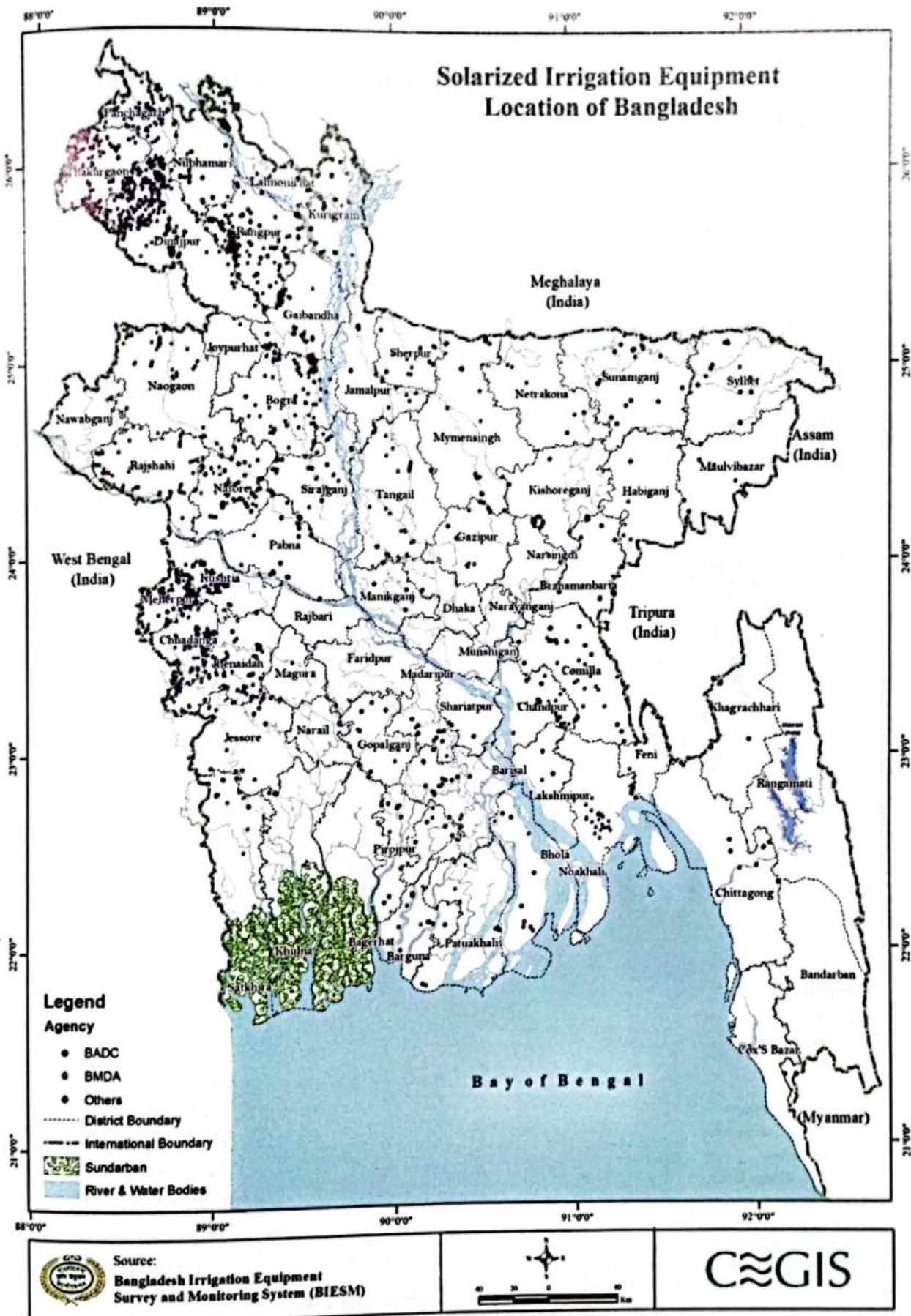


Figure 69: Location of Solar Irrigation Equipment

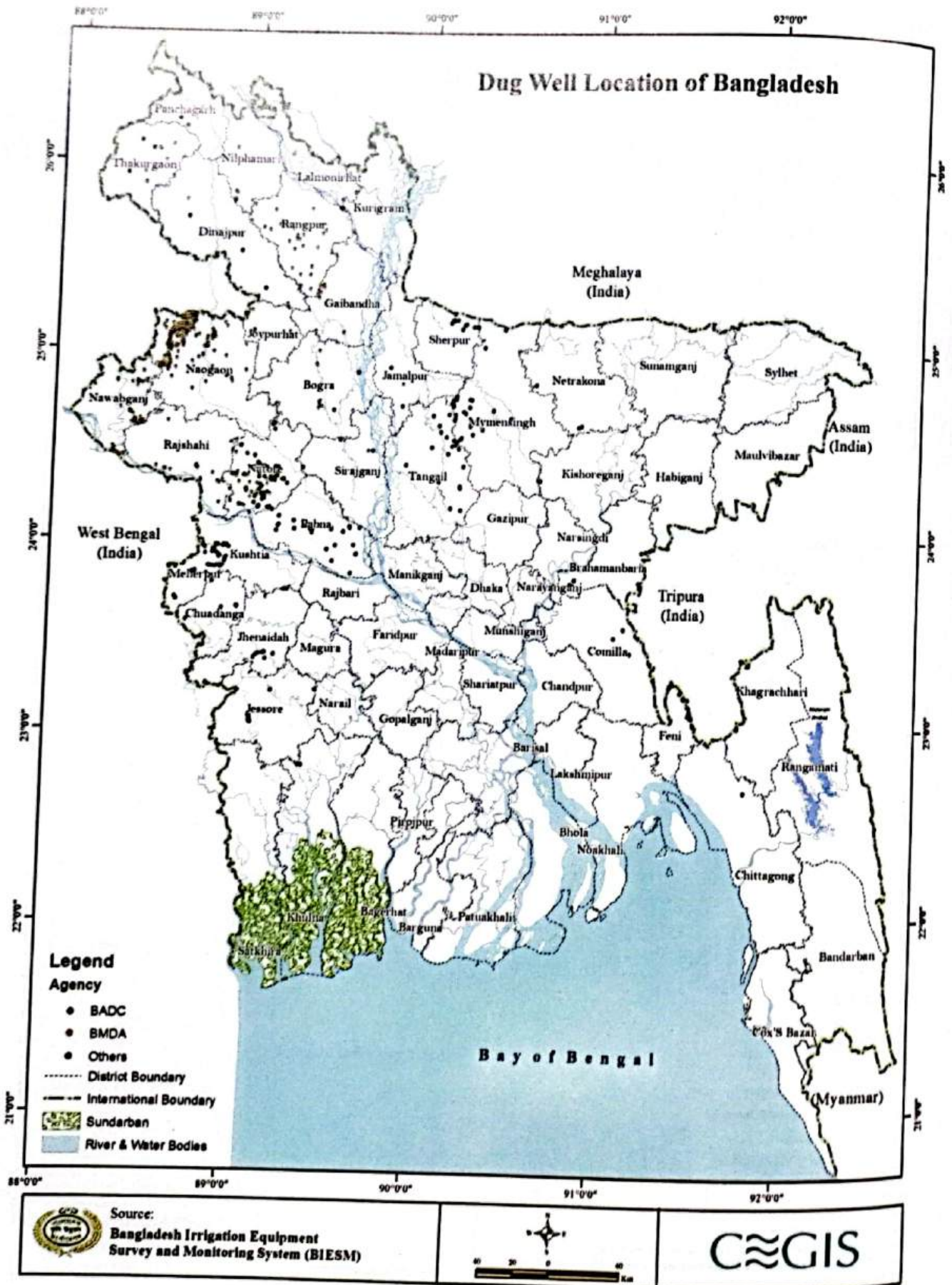


Figure 70: Location of Dug Well

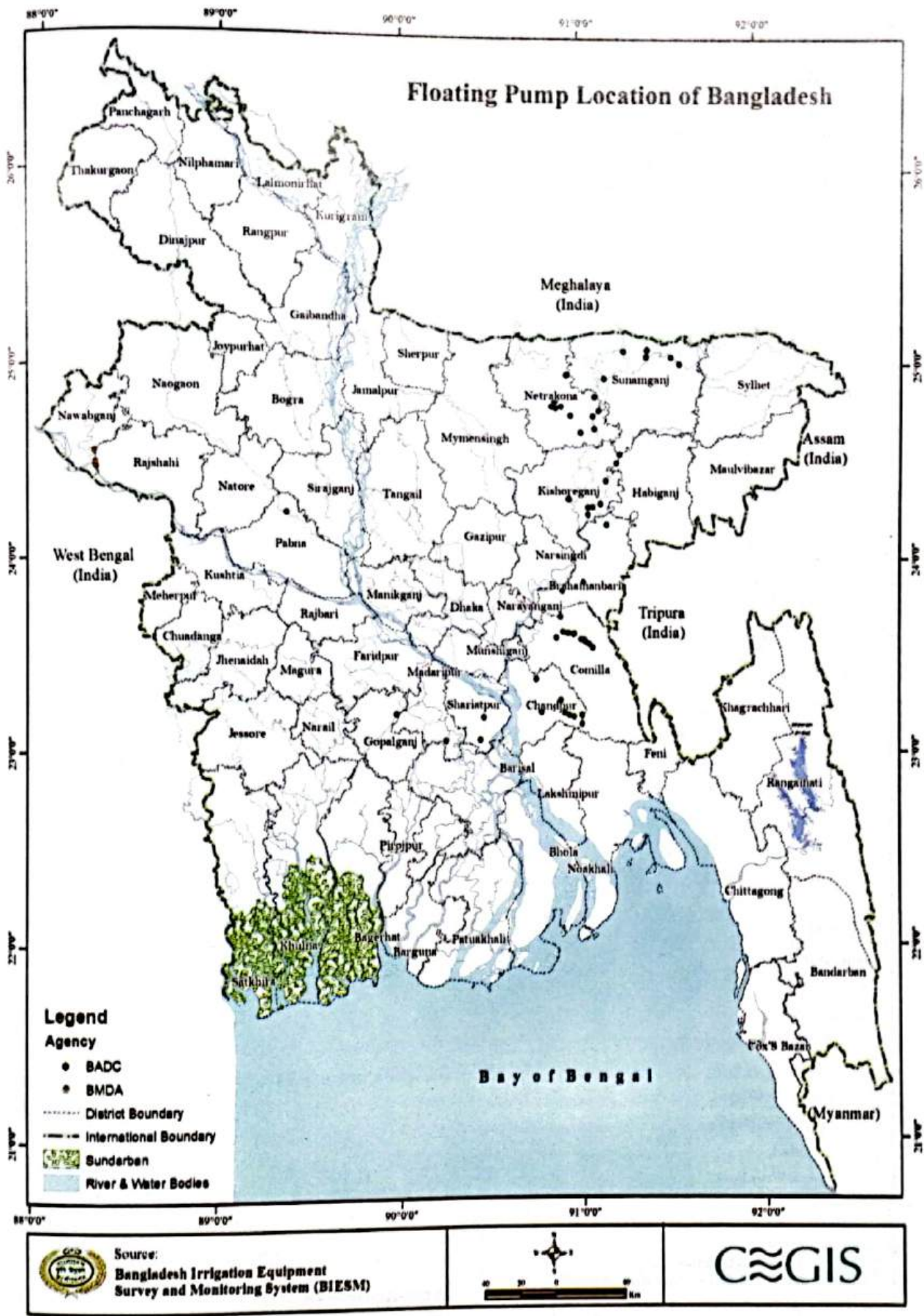


Figure 71: Location of Floating Pump

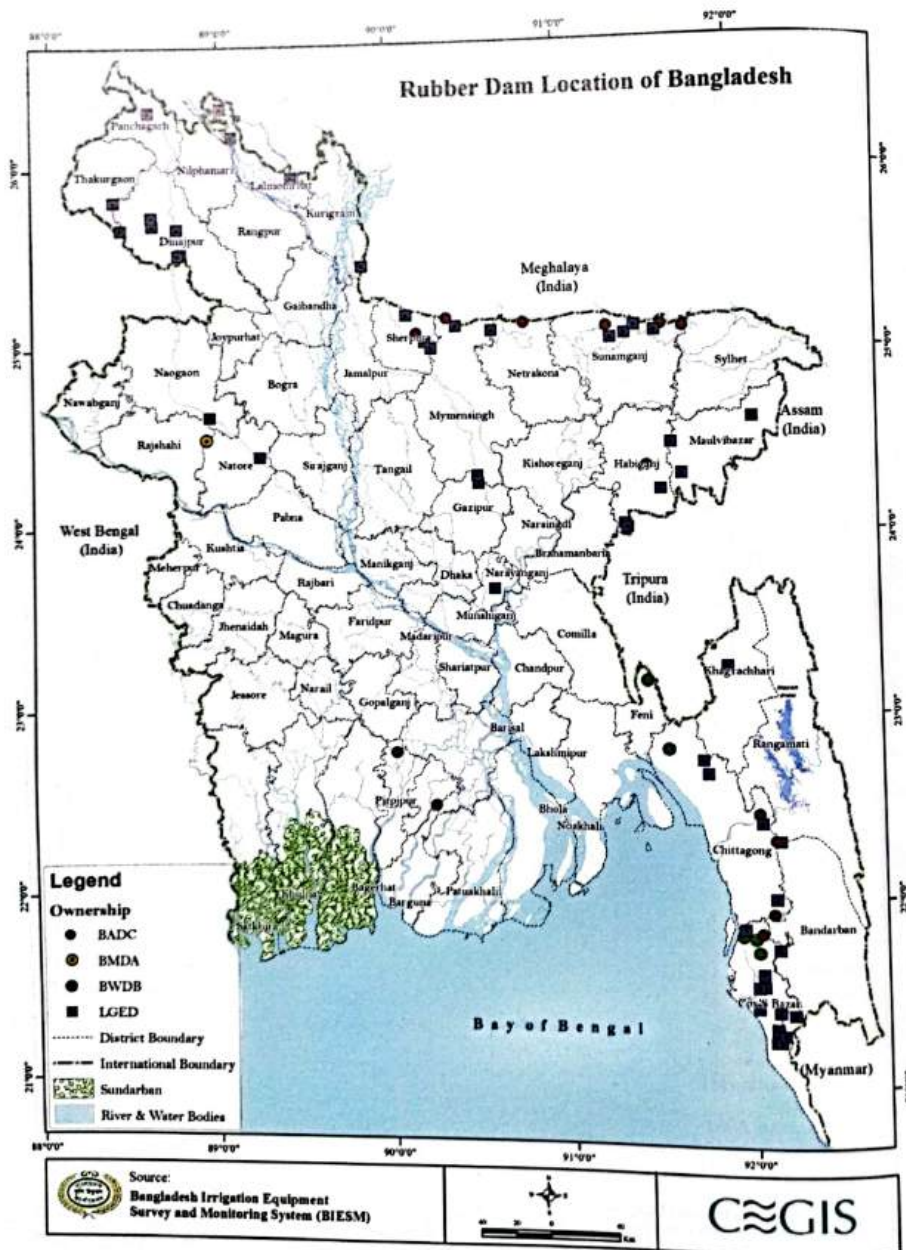


Figure 72: Location of Rubber Dam

## Study on Survey of Minor Irrigation Preparation of Data Base and

Since 1999, BADC has conducted surveys in the agricultural sector, including pump capacity, irrigation equipment, and benefits to farmers. BADC and DAE were appointed in order to carry out the surveys. BADC received technical support and recommendations from DAE for minor irrigation policies through the publications gathered over the past 22 years.

The preparation of a GIS database, which includes water and ground water sources of irrigation, preserving, or storing the aforementioned data in a web-based software development and data monitoring minor irrigation activities. Primary databases are required for updating databases.

Digitalization of Survey & Monitoring for Data Base has been taken a program named Irrigation Equipment Survey & Monitoring System (BIESM) a database on about 1.72 million irrigation equipment with 49 columns needful information's and also queries about irrigation. Under this program, the Bangladesh Water Resources Ministry as a consulting firm, the database and Bangladesh Irrigation Equipment Survey and Monitoring System (BIESM) software were prepared. Although it still needs some attention in terms of data updating has been carried out to strengthen the database. In 2021-2022, The Bangladesh Irrigation Equipment Survey and Monitoring System software were update with all DTW, rubber dam location data. The Suggestion of expert software.

During 2022-2023, the BIESM software is being line installed, rubber dam, solar pump location data as per ToR. With this location data of minor irrigation equipment, the BIESM software will be updated in 2022-2023. The searching option of software will be added. Except this the year wise finding out by this BIESM software. The reporting system of software will be generate all kind of irrigation data related to the software. The updated software has all the data

## **Study on Survey of Minor Irrigation Equipment, Area, Preparation of Data Base and Updating of BIESM Software**

Since 1999, BADC has conducted surveys and monitored several aspects of the country's agricultural sector, including pump capacity, source of power, irrigation mode, irrigated area, irrigation equipment, and benefits to farmers. Enumerators and field staff from BADC, BMDA, and DAE were appointed in order to carry out the survey. The government and legislators have received technical support and recommendations for the development and implementation of minor irrigation policies through the publication of Annual Survey Reports based on the data gathered over the past 22 years.

The preparation of a GIS database, which includes maps and 3D geometrical maps for surface water and ground water sources of irrigation, is crucial in the age of digitization for processing, preserving, or storing the aforementioned collected information and data. Additionally, web-based software development and database creation are essential for surveying and monitoring minor irrigation activities. Primary information such as tables, graphs, maps, and GIS databases are required for updating database.

Digitalization of Survey & Monitoring for Development of Minor Irrigation Project under BADC has been taken a program named Irrigation Equipment Survey & Monitoring System to establish a database on about 1.72 million irrigation equipment through questionnaire incorporated with 49 columns needful information's and also develop a web base software to meet necessary queries about irrigation. Under this program, BADC appointed CEGIS a trusty board of the Water Resources Ministry as a consulting firm to accomplish the above assignment. Under this task, the database and Bangladesh Irrigation Equipment Survey and Monitoring System (BIESM) software were prepared. Although the database has a compact and unique dataset but it still needs some attention interims of data consistency. Moreover, a few more features have been suggested by experts and stakeholders during the disclosure meeting. Therefore, an updating has been carried out to strengthen the database as well as the BIESM software.

In 2021-2022, The Bangladesh Irrigation Equipment Survey and Monitoring System (BIESM) software were update with all DTW, rubber dam, solar pump (DTW, STW, LLP) and dug-well location data. The Suggestion of experts and BADC officials were also incorporated in the software.

During 2022-2023, the BIESM software is updated with all low lift pump those where buried pipe line installed, rubber dam, solar pump (DTW, STW, LLP), floating pump and dug-well location data as per ToR. With this location data BIESM software also updated with collected details data of minor irrigation equipment, which is required to publish as Minor Irrigation Report 2022-2023. The searching option of software is updated. The region office of BADC is added in the searching option. Except this the yearly data was also separated and past year data can be finding out by this BIESM software. The report is also updated with new picture, graph, map and arrangement. The reporting system of BIESM is also updated in this phase. Now user can generate all kind of irrigation data related pie chart, graph, table up to union or mouza level.

The updated software has all the datasets to meet any queries about irrigation. It has also had

the ability to analyze data and present it to the audience. The homepage is presented in Figure 73. Each user must have a password and user ID in order to log in to this software Figure 74. The database has four major modules that are presented in Figure 75. As mentioned earlier, a number of data and information will be available for any user which is ranging from equipment type and location to benefited farmer and labor level data (Figure 76). Data was collected by 49 columns questionnaire to gather all the information related to irrigation and every specific equipment (Figure 77). A glimpse of the analysis capacity of the software is presented in Figure 78. Some unique features are added to this software. These are- i) irrigation equipment data could be visible with its picture and brief information (Figure 79), ii) Overall irrigation equipment and related information could be viewed even at union level (Figure 80), iii) distance between the equipment is being measured (Figure 81).

In this year 2022-2023, database is update with some new features. These are- i) to monitor user level information, a user log-in system is introduced, ii) Administrative data is updated as per present administrative unit, iii) Those LLP scheme where buried pipe line installed, iv) Solar and Dug well scheme of BADC, BMDA, SREDA and other agencies, v) Location of Floating pumps and Rubber dam is also updated etc.

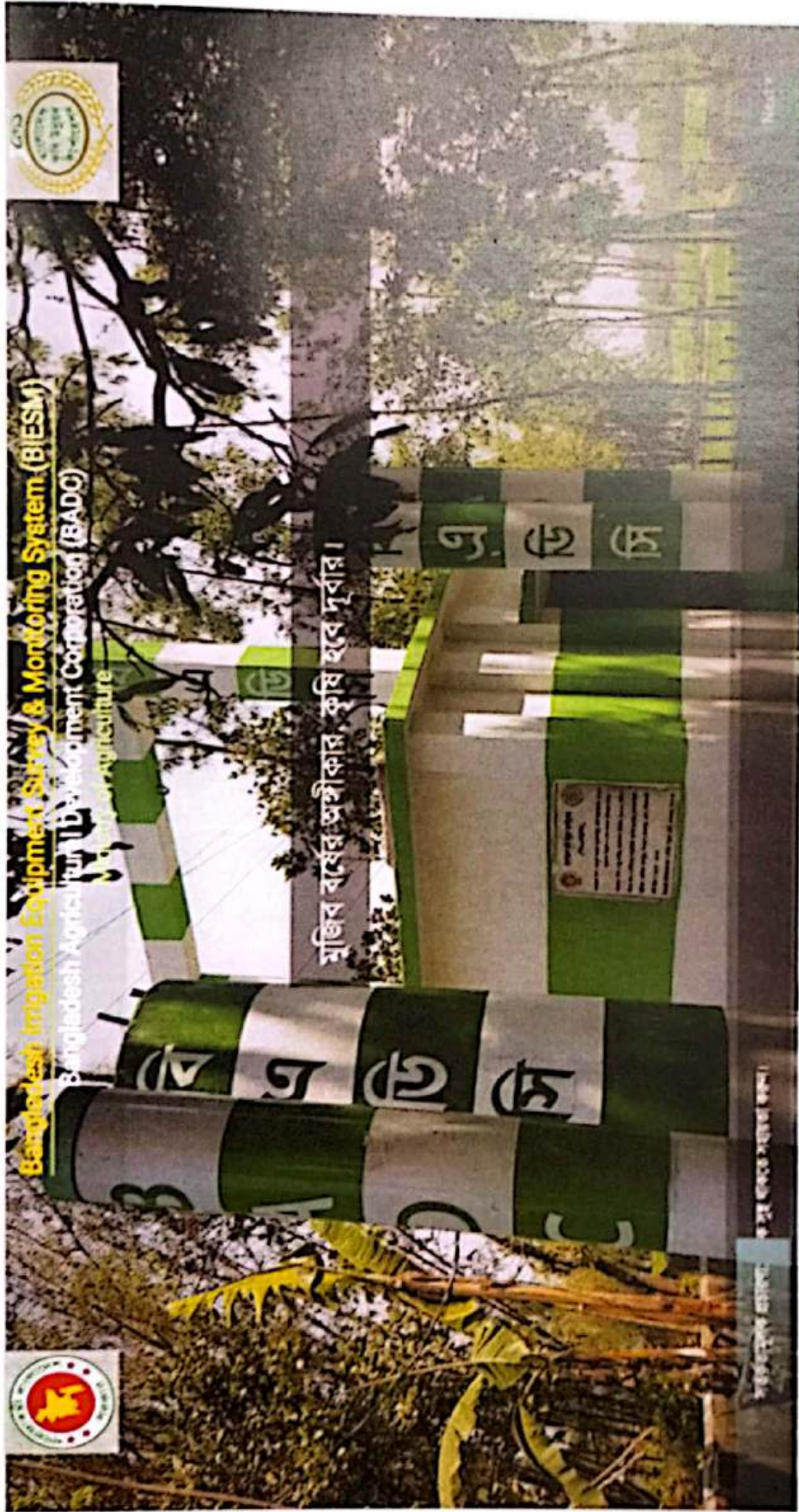


Figure 73: Homepage of BIESM software



Figure 74: User Login page of BIESM software



Figure 75: Modules of the BIESM software

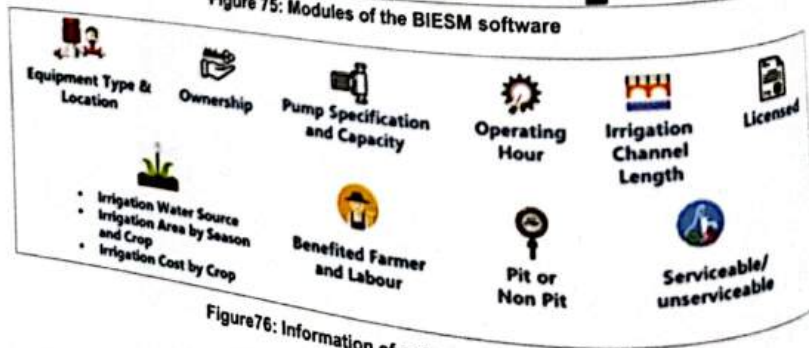


Figure 76: Information of software at a glance



Figure 77: Data entry form for BIESM software

### Add Low Lift Pump (LLP) Survey Information

Equipment: **Low Lift Pump (LLP)** | Data Year: **2023**

Division: <b>Dhaka</b>	J/L No.	Name of Scheme	Source of Energy: <b>01-Diesel</b>
District: <b>— Select —</b>	Plot No.	Name of Owner/Manager	Make & Model
Upazila:	Latitude	Owner/Manager Mobile No.	HP
Union:	Longitude	Name of Agency: <b>01-BADC</b>	Make & Model
Mauza:	Elevation	<input type="checkbox"/> Is Licensed?	KW
Mauza:	Survey Date: <b>DD-MM-YYYY</b>	<input type="checkbox"/> Is Serviceable?	Source of Power: <b>01-BPDB</b>

Pump Capacity (Cusec): | Source of Surface Water: **01-River**

Irrigation Channel Length (m)			
Parca	Buried Pipe	Fla Pipe	Karka

Equipment Image:  |

Use in Rabi Season?

Total Operating Hours (hr)	Irrigated Area (Acres)							Irrigation Cost (Tk./Acres)				
	Boro	Wheat	Potato	Maise	Veg (R)	Mustard	Others	Boro	Wheat	Potato	Maise	Veg (R)

Use in Kharif-1 Season?

Total Operating Hours (hr)	Irrigated Area (Acres)				Irrigation Cost (Tk./Acres)				Benefited Farmer		Benefited Agriculture Labour	
	Ass	June	Veg (S)	Others	Ass	June	Veg (S)	Others	Male	Female	Male	Female

Use in Kharif-2 Season?

Total Operating Hours (hr)	Irrigated Area (Acres)		Irrigation Cost (Tk./Acres)		Benefited Farmer		Benefited Agriculture Labour	
	T Aman	Others	T Aman	Others	Male	Female	Male	Female

|

Figure 77: Data entry form for BIESM software



Figure 78: Brief Data analysis capacity of BIESM software



Figure 79: Location information extracted from BIESM software

All Union Wise Survey Information data source

01. Division : Rajshahi  
 02. District : Rajshahi  
 03. Upazila : Godagarl  
 04. Union : Gogram  
 05. Rivers Name : Ganges  
 06. Rivers Length(Km) : 2.10 (Km)  
 07. Waterbodies Name : Falikhoia Beel  
 08. Waterbodies Area(ha) : 1.12 (ha)

Equipment Name	Equipment (Count)	Irrigated Area (Acre)							Irrigation Cost (Tk/Acre)						Benefit Farm (Cous)	
		Boro	Wheat	Potato	Maize	Mustard	Veg (W)	Other <sup>d</sup>	Total	Boro	Wheat	Potato	Maize	Veg (W)		Other <sup>d</sup>
Deep Tubewell (DTW)	75	2,538.20	725.20	1,159.20	323.40	0.00	472.85	182.00	5,400.85	5,976.55	0.00	0.00	0.00	0.00	0.00	3.
Shallow Tubewell (STW)	420	300.64	87.35	138.35	37.20	14.00	55.72	22.26	655.52	11,056.06	2,064.94	2,665.22	1,959.31	2,239.66	2,564.80	2.
Low Lift Pump (LLP)	151	531.89	153.00	242.21	65.24	0.00	101.05	39.26	1,132.65	11,476.98	1,924.10	2,510.26	1,981.76	2,111.96	2,101.34	1.
<b>All Equipments</b>	<b>646</b>	<b>3,376.73</b>	<b>965.55</b>	<b>1,539.76</b>	<b>425.84</b>	<b>14.00</b>	<b>629.62</b>	<b>243.52</b>	<b>7,189.02</b>	<b>7,297.55</b>	<b>491.70</b>	<b>634.35</b>	<b>474.77</b>	<b>537.16</b>	<b>573.22</b>	<b>?</b>

Close

Figure 80: Union level data extracted from BIESM software

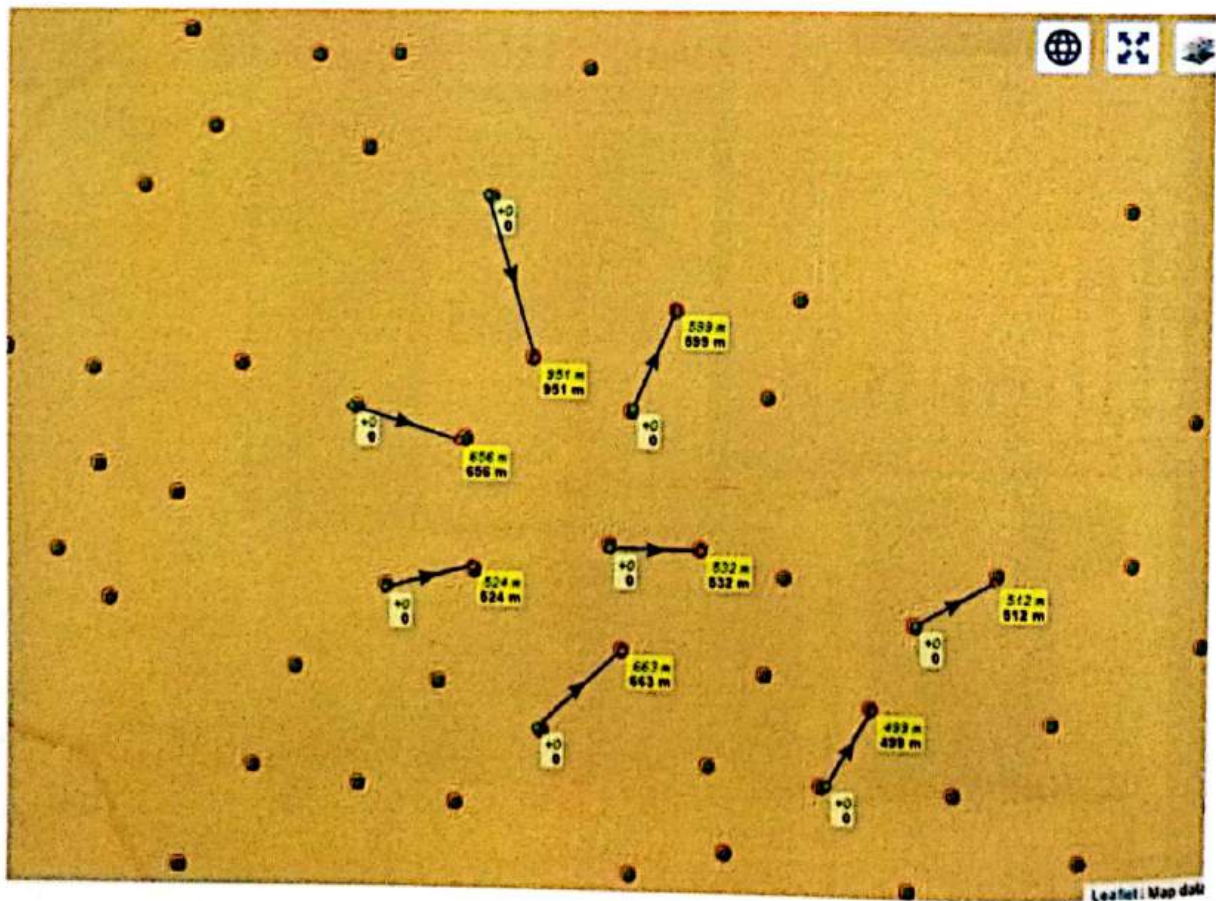


Figure 81: Distance measurement between irrigation equipment from BIESM software

## Findings of the Survey

This survey's primary goal was to determine the number of different irrigation equipment in use, the area that was irrigated, and the beneficiaries. BADC, DAE, BMDA and CEGIS-appointed field staffs are collected the information. We are aware that the lack of a set technique for calculating the area made it very difficult to determine the area accurately. Thus, information was gathered by interviewing with farmers who might benefit from the equipment and by the owners' statements. It is claimed that the amount of land that is irrigated per piece of equipment can differ depending on the equipment capacity, conveyance system, the location as well as type of irrigated crop.

The main findings of this survey report are:

- In the 2022-23 Rabi season, total irrigated area was 5.75 million ha, of which groundwater irrigation covered 4.15 million ha (72.20% of the total irrigated area); while surface water irrigation covered 1.60 million ha (27.80% of total irrigated area). To compare with the previous year, groundwater used for irrigation is decreased in the Rabi season.
- During the Rabi season 2022–2023, there was a noticeable increase in the use of low lift pumps (0.65%), shallow tube wells (0.51%), and deep tube wells (0.21%) in comparison to the previous year.
- The irrigated area increased by 1.04% in Rabi 2022–2023 over the previous year. The areas under DTW, STW, and LLP rising by 0.72%, 0.38%, and 1.30%, respectively.
- It is found that about 97.76% (33,206) DTWs were operated by electric motors and 2.24% (762) DTWs were operated by diesel engines. In case of shallow tube wells, 28.38% (419,321) STWs were operated by electric motors and 71.62% (1,058,133) STWs were operated by diesel engines.
- Low Lift Pumps were mainly operated by diesel engines, which is 89.36% (184,572) and the rest were operated by electric motors, which is only 10.64% (21,976).
- The average area under irrigation for each low lift pump was 6.43 hectares, 2.09 hectares for STW, and 30.78 hectares for DTW. The minor irrigation plan may include on-farm water management, as seen by the limited irrigation coverage per unit of water discharge.
- The price of paddy significantly impacts future investment in Boro cultivation. The producer/farmers will be encouraged to invest in irrigation sector if the Boro paddy price goes up.

**Organization Wise Summary of Irrigation Equipment Used, Area Irrigated and Benefited Farmers  
Rabi Crops (Boro, Wheat, Potato, Maize, Onion and Vegetables) 2022-23**

Type of Equipment	Name of organization	Operated by Electricity						Operated by Diesel			Total	
		Unit			Irrigated Area (ha)	Benefitted Farmers	Unit	Irrigated Area (ha)	Benefitted Farmers	Unit	Irrigated Area (ha)	Benefitted Farmers
		PDB	REB	TOTAL								
DTW	BADC	620	10606	11226	335096	1216399	302	8365	24427	11528	343461	1240826
	BMDA	905	14632	15537	514275	1074834	0	0	0	15537	514275	1074834
	Others	310	6133	6443	178278	681021	460	9568	43794	6903	187846	724815
	<b>Total</b>	<b>1835</b>	<b>31371</b>	<b>33206</b>	<b>1027649</b>	<b>2972254</b>	<b>762</b>	<b>17933</b>	<b>68221</b>	<b>33968</b>	<b>1045582</b>	<b>3040475</b>

STW	BADC	15	171	186	786	2624	11	62	321	197	848	2945
	BMDA	0	0	0	0	0	0	0	0	0	0	0
	Others	33781	385229	419135	1115977	3666699	1058122	1964988	9371127	1477257	3080965	13037826
	<b>Total</b>	<b>33796</b>	<b>385400</b>	<b>419321</b>	<b>1116763</b>	<b>3669323</b>	<b>1058133</b>	<b>1965050</b>	<b>9371448</b>	<b>1477454</b>	<b>3081813</b>	<b>13040771</b>

LLP	BADC	278	3406	3684	103472	237537	5627	128736	250855	9311	232207	488392
	BMDA	54	524	578	14869	38522	10	155	750	588	15024	39272
	Others	3189	14525	17714	190145	601370	178935	890596	2565725	196649	1080741	3167095
	<b>Total</b>	<b>3521</b>	<b>18455</b>	<b>21976</b>	<b>308486</b>	<b>877429</b>	<b>184572</b>	<b>1019487</b>	<b>2817330</b>	<b>206548</b>	<b>1327972</b>	<b>3694759</b>

DTW +STW +LLP	39152	435226	474503	2452897	7519006	1243467	3002470	12256999	1717970	5455367	19776005
Manual & Artesian Well	0	0	0	0	0	0	0	0	0	6332	27782
Traditional Method	0	0	0	0	0	0	0	0	0	5414	20472
Gravity Flow	0	0	0	0	0	0	0	0	0	253996	293733
Solar Pump	0	0	0	0	0	0	0	0	3008	26406	46736
Dug Well	0	0	0	0	0	0	0	0	856	1019	3635
<b>COUNTRY TOTAL</b>	<b>39152</b>	<b>435226</b>	<b>474503</b>	<b>2452897</b>	<b>7519006</b>	<b>1243467</b>	<b>3002470</b>	<b>12256999</b>	<b>1721834</b>	<b>5748534</b>	<b>20168363</b>

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# **ANNEXURE-A**

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**DIVISION WISE DATA ON IRRIGATION SURVEY-2022-23**

**DIVISION WISE IRRIGATION EQUIPMENT USED AND TOTAL AREA IRRIGATED**  
( Including Solar Pump, Dug Well, Gravity flow, Artesian Wells, Manual, & Traditional Methods )

SI No	Division	Total Area (ha)	Net Cultivated Area (ha)	Deep Tube Well			Shallow Tube Well			Low Lift Pump			Total Area Irrigated By DTM, STW & LLP (8+12+16)		Solar Pump		Dug Well		Area Irrigated by Manual Artesian well	Area Irrigated by Traditional Method (ha)	Area Irrigated by gravity flow (ha)	Area Irrigated by all Methods (ha) (17+19+21+22+23+24)		
				Elec	Diesel	Total	Area Irrigated (ha)	Elec	Diesel	Total	Area Irrigated (ha)	Elec	Diesel	Total	No	Area Irrigated (ha)	No	Area Irrigated (ha)						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Dhaka	2050545	1199490	2054	73	2127	62911	75936	130753	206691	455236	4086	21097	25183	214811	732960	99	915	20	24	1119	1379	12675	749072
2	Mymensingh	1066753	726008	3875	242	4117	133744	68929	114984	183913	359556	1840	10556	12396	110343	603643	55	487	45	54	305	497	19782	624768
3	Rajshahi	1815424	1312399	14804	194	14998	491010	86214	218797	305011	627448	3353	9603	12956	82348	1200806	541	4903	594	707	206	75	2902	1209601
4	Rangpur	1618340	1229032	7858	25	7883	237056	101649	289996	391645	787204	998	1566	2564	27948	1052208	1366	12206	76	90	187	233	15059	1079933
5	Chittagong	3390666	1081322	1506	55	1561	46069	35823	43767	79590	215862	7503	39504	47007	319796	581747	205	1546	21	25	756	1467	71632	657173
6	Khulna	2228607	1060279	2959	154	3113	69603	41543	240662	282205	541881	1306	34980	36288	142779	754263	622	5228	82	96	708	696	52530	813531
7	Sylhet	1263431	728840	150	19	169	5169	9061	19149	28240	94200	1515	42095	43610	251656	351025	47	462	4	5	2338	701	74785	429316
8	Barisal	1322919	745028	0	0	0	0	134	25	159	424	1373	25171	26544	178291	178715	73	658	14	16	711	364	4625	185089
<b>Country Total</b>		<b>14758885</b>	<b>8082398</b>	<b>33206</b>	<b>762</b>	<b>33968</b>	<b>1045582</b>	<b>419321</b>	<b>1058133</b>	<b>1477454</b>	<b>3081813</b>	<b>21976</b>	<b>184572</b>	<b>206548</b>	<b>1327972</b>	<b>5455367</b>	<b>3008</b>	<b>26406</b>	<b>856</b>	<b>1019</b>	<b>6332</b>	<b>5414</b>	<b>253996</b>	<b>5748534</b>



## Division Wise Irrigation Equipment used, Area Irrigated and Benefitted Farmer

(Area in Hectare)

**DTW**

SL NO	DIVISION	Organization	DEEP TUBEWELL OPERATED BY ELECTRICITY AND DIESEL											
			DTW Operated by Electricity				DTW Operated by Diesel				Total			
			PDB	REB	Total	Area	Farmers	Unit	Area	Farmers	Unit	Area	Farmers	Farmers
1	Dhaka	BADC	73	1403	1476	45205	169151	2	41	190	1478	45246	169341	
		Others	67	511	578	15996	63267	71	1669	9125	649	17665	72392	
		<b>Total</b>	<b>140</b>	<b>1914</b>	<b>2054</b>	<b>61201</b>	<b>232418</b>	<b>73</b>	<b>1710</b>	<b>9315</b>	<b>2127</b>	<b>62911</b>	<b>241733</b>	
2	Mymensingh	BADC	274	3076	3350	113354	429857	161	4460	12504	3511	117814	442361	
		Others	56	469	525	13924	60975	81	2006	10040	606	15930	71015	
		<b>Total</b>	<b>330</b>	<b>3545</b>	<b>3875</b>	<b>127278</b>	<b>490832</b>	<b>242</b>	<b>6466</b>	<b>22544</b>	<b>4117</b>	<b>133744</b>	<b>513376</b>	
3	Rajshahi	BADC	121	2033	2154	65831	231324	0	0	0	2154	65831	231324	
		BMDA	522	9332	9854	338896	698032	0	0	0	9854	338896	698032	
		Others	124	2672	2796	82482	313183	194	3801	16471	2990	86283	329654	
<b>Total</b>	<b>767</b>	<b>14037</b>	<b>14804</b>	<b>487209</b>	<b>1242539</b>	<b>194</b>	<b>3801</b>	<b>16471</b>	<b>14998</b>	<b>491010</b>	<b>1259010</b>			
4	Rangpur	BADC	78	950	1028	29364	95328	3	56	220	1031	29420	95548	
		BMDA	383	5300	5683	175379	376802	0	0	0	5683	175379	376802	
		Others	38	1109	1147	31857	123536	22	400	1548	1169	32257	125084	
<b>Total</b>	<b>499</b>	<b>7359</b>	<b>7858</b>	<b>236600</b>	<b>595666</b>	<b>25</b>	<b>456</b>	<b>1768</b>	<b>7883</b>	<b>237056</b>	<b>597434</b>			
5	Chittagong	BADC	32	991	1023	32350	127119	28	720	2131	1051	33070	129250	
		Others	8	475	483	12521	46737	27	498	2030	510	13019	48767	
		<b>Total</b>	<b>40</b>	<b>1466</b>	<b>1506</b>	<b>44871</b>	<b>173856</b>	<b>55</b>	<b>1218</b>	<b>4161</b>	<b>1561</b>	<b>46089</b>	<b>178017</b>	
6	Khulna	BADC	38	2029	2067	44995	150122	101	2875	8512	2168	47870	158634	
		Other	17	875	892	20837	70837	53	896	3578	945	21733	74415	
		<b>Total</b>	<b>55</b>	<b>2904</b>	<b>2959</b>	<b>65832</b>	<b>220959</b>	<b>154</b>	<b>3771</b>	<b>12090</b>	<b>3113</b>	<b>69603</b>	<b>233049</b>	
7	Syhet	BADC	4	124	128	3997	13498	7	213	870	135	4210	14368	
		Others	0	22	22	661	2486	12	298	1002	34	959	3488	
		<b>Total</b>	<b>4</b>	<b>146</b>	<b>150</b>	<b>4658</b>	<b>15984</b>	<b>19</b>	<b>511</b>	<b>1872</b>	<b>169</b>	<b>5169</b>	<b>17856</b>	
8	Barisal	BADC	0	0	0	0	0	0	0	0	0	0	0	
		Others	0	0	0	0	0	0	0	0	0	0	0	
		<b>Total</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	
<b>Country Total</b>		BADC	620	10606	11226	335096	1216399	302	8365	24427	11528	343461	1240826	
		BMDA	905	14632	15537	514275	1074834	0	0	0	15537	514275	1074834	
		Others	310	6133	6443	178278	681021	460	9568	43794	6903	187846	724815	
<b>Total</b>	<b>1835</b>	<b>31371</b>	<b>33206</b>	<b>1027649</b>	<b>2972254</b>	<b>762</b>	<b>17933</b>	<b>68221</b>	<b>33968</b>	<b>1045582</b>	<b>3040475</b>			

## Division Wise Irrigation Equipment used, Area Irrigated and Benefitted Farmer

(Area in Hectare) **STW**

SL No	DIVISION	Organization	SHALLOW TUBEWELL OPERATED BY ELECTRICITY AND DIESEL												
			STW Operated by Electricity					STW Operated by Diesel					Total		
			PDB	REB	Total	Area	Farmers	Unit	Area	Farmers	Unit	Area	Farmers		
1	Dhaka	BADC	0	0	0	0	0	0	0	0	0	0	0	0	0
		Others	6525	69413	75938	199811	671732	130753	255427	906560	206691	455238	1578292	1578292	1578292
		<b>Total</b>	<b>6525</b>	<b>69413</b>	<b>75938</b>	<b>199811</b>	<b>671732</b>	<b>130753</b>	<b>255427</b>	<b>906560</b>	<b>206691</b>	<b>455238</b>	<b>1578292</b>	<b>1578292</b>	<b>1578292</b>
2	Mymensingh	BADC	2	0	2	12	25	0	0	0	2	12	25	25	25
		Others	6153	62774	68927	150752	496293	114984	208792	1105599	183911	359544	1601892	1601892	
		<b>Total</b>	<b>6155</b>	<b>62774</b>	<b>68929</b>	<b>150764</b>	<b>496293</b>	<b>114984</b>	<b>208792</b>	<b>1105599</b>	<b>183913</b>	<b>359556</b>	<b>1601892</b>	<b>1601892</b>	
3	Rajshahi	BADC	2	1	3	15	34	1	5	10	4	20	44	44	
		BMDA	0	0	0	0	0	0	0	0	0	0	0	0	
		Others	2021	84190	86211	237297	728152	218796	390131	2007184	305007	627428	2735336	2735336	
4	Rangpur	<b>Total</b>	<b>2023</b>	<b>84191</b>	<b>86214</b>	<b>237312</b>	<b>728186</b>	<b>218797</b>	<b>390136</b>	<b>2007194</b>	<b>305011</b>	<b>627448</b>	<b>2735380</b>	<b>2735380</b>	
		BADC	11	164	175	724	2487	10	57	311	185	781	2798	2798	
		BMDA	0	0	0	0	0	0	0	0	0	0	0	0	
5	Chittagong	Others	16848	84501	101474	236345	827097	289986	550078	2569456	391460	786423	3396553	3396553	
		<b>Total</b>	<b>16859</b>	<b>84665</b>	<b>101649</b>	<b>237069</b>	<b>829584</b>	<b>289996</b>	<b>550135</b>	<b>2569767</b>	<b>391645</b>	<b>787204</b>	<b>3399351</b>	<b>3399351</b>	
		BADC	0	2	2	8	15	0	0	0	0	2	8	15	
6	Khulna	Others	206	35615	35821	125198	388564	43767	90656	404989	79588	215854	793553	793553	
		<b>Total</b>	<b>206</b>	<b>35617</b>	<b>35823</b>	<b>125206</b>	<b>388579</b>	<b>43767</b>	<b>90656</b>	<b>404989</b>	<b>79590</b>	<b>215862</b>	<b>793568</b>	<b>793568</b>	
		BADC	0	2	2	13	30	0	0	0	0	2	13	30	
7	Sylhet	Others	1306	40235	41541	132918	439346	240662	408950	2139326	282203	541868	2578672	2578672	
		<b>Total</b>	<b>1306</b>	<b>40237</b>	<b>41543</b>	<b>132931</b>	<b>439376</b>	<b>240662</b>	<b>408950</b>	<b>2139326</b>	<b>282205</b>	<b>541881</b>	<b>2578702</b>	<b>2578702</b>	
		BADC	0	2	2	14	33	0	0	0	0	2	14	33	
8	Barisal	Others	691	8398	9089	33317	114458	19149	60869	237424	28238	94186	351882	351882	
		<b>Total</b>	<b>691</b>	<b>8400</b>	<b>9091</b>	<b>33331</b>	<b>114491</b>	<b>19149</b>	<b>60869</b>	<b>237424</b>	<b>28240</b>	<b>94200</b>	<b>351915</b>	<b>351915</b>	
		BADC	0	0	0	0	0	0	0	0	0	0	0	0	
Country Total		Others	31	103	134	339	1057	25	85	589	159	424	1646	1646	
		<b>Total</b>	<b>31</b>	<b>103</b>	<b>134</b>	<b>339</b>	<b>1057</b>	<b>25</b>	<b>85</b>	<b>589</b>	<b>159</b>	<b>424</b>	<b>1646</b>	<b>1646</b>	
		BADC	13	171	184	774	2599	11	62	321	195	836	2920	2920	
Country Total		BMDA	0	0	0	0	0	0	0	0	0	0	0	0	
		Others	33781	385229	419135	1115977	3666699	1058122	1964988	9371127	1477257	3080965	13037826	13037826	
		<b>Total</b>	<b>33794</b>	<b>385400</b>	<b>419319</b>	<b>1116751</b>	<b>3669298</b>	<b>1058133</b>	<b>1965050</b>	<b>9371448</b>	<b>1477452</b>	<b>3081801</b>	<b>13040771</b>	<b>13040771</b>	

**Division Wise Irrigation Equipment used, Area Irrigated and Benefitted Farmer**

(Area in Hectare)

**LLP**

SL NO	DIVISION	LOW LIFT PUMP OPERATED BY ELECTRICITY AND DIESEL												Total	
		LLP Operated by Electricity			LLP Operated by Diesel			LLP Operated by Electricity			LLP Operated by Diesel			Unit	Area
	Organization	PDB	REB	Total	Area	Farmers	Unit	Area	Farmers	Unit	Area	Farmers	Unit	Area	Farmers
1	BADC	65	856	921	30517	65578	1469	34722	66638	2390	65239	132216	2390	65239	132216
	Others	617	2548	3165	37627	124244	19628	111945	359432	22793	149572	483676	22793	149572	483676
	<b>Total</b>	<b>682</b>	<b>3404</b>	<b>4086</b>	<b>68144</b>	<b>189822</b>	<b>21097</b>	<b>146667</b>	<b>426070</b>	<b>25183</b>	<b>214811</b>	<b>615892</b>	<b>25183</b>	<b>214811</b>	<b>615892</b>
2	BADC	66	229	295	9632	22311	911	20181	48412	1206	29813	70723	1206	29813	70723
	Others	343	1202	1545	15679	48634	9645	64851	202696	11190	80530	251330	11190	80530	251330
	<b>Total</b>	<b>409</b>	<b>1431</b>	<b>1840</b>	<b>25311</b>	<b>70945</b>	<b>10556</b>	<b>85032</b>	<b>251108</b>	<b>12396</b>	<b>110343</b>	<b>322053</b>	<b>12396</b>	<b>110343</b>	<b>322053</b>
3	BADC	0	608	608	10050	24028	29	564	1407	637	10614	25435	637	10614	25435
	BMDA	30	259	289	6579	22630	10	155	750	299	6734	23380	299	6734	23380
	Others	159	2297	2456	18165	53845	9564	46835	115098	12020	65000	168943	12020	65000	168943
<b>Total</b>	<b>189</b>	<b>3164</b>	<b>3353</b>	<b>34794</b>	<b>100503</b>	<b>9603</b>	<b>47554</b>	<b>117255</b>	<b>117255</b>	<b>12956</b>	<b>82348</b>	<b>217758</b>	<b>12956</b>	<b>82348</b>	<b>217758</b>
4	BADC	17	211	228	5020	11189	94	1386	2873	322	6406	14062	322	6406	14062
	BMDA	24	265	289	8290	15892	0	0	0	289	8290	15892	289	8290	15892
	Others	110	371	481	4273	13172	1472	8979	22669	1953	13252	35841	1953	13252	35841
<b>Total</b>	<b>151</b>	<b>847</b>	<b>998</b>	<b>17583</b>	<b>40253</b>	<b>1566</b>	<b>10365</b>	<b>25542</b>	<b>25542</b>	<b>2564</b>	<b>27948</b>	<b>65795</b>	<b>2564</b>	<b>27948</b>	<b>65795</b>
5	BADC	11	609	620	21710.818	50274	1615	37114	69989	2235	58825	120263	2235	58825	120263
	Others	903	5980	6883	82487	265943	37889	178484	760050	44772	260971	1025993	44772	260971	1025993
	<b>Total</b>	<b>914</b>	<b>6589</b>	<b>7503</b>	<b>104197.82</b>	<b>316217</b>	<b>39504</b>	<b>215598</b>	<b>830039</b>	<b>47007</b>	<b>319796</b>	<b>1146256</b>	<b>47007</b>	<b>319796</b>	<b>1146256</b>
6	BADC	36	466	502	10319.761	24462	160	1772.3603	3625	662	12092	28087	662	12092	28087
	Others	248	558	806	8038	24826	34820	122649	276940	35626	130687	301766	35626	130687	301766
	<b>Total</b>	<b>284</b>	<b>1024</b>	<b>1308</b>	<b>18357.761</b>	<b>49288</b>	<b>34980</b>	<b>124421.36</b>	<b>280565</b>	<b>36288</b>	<b>142779</b>	<b>329853</b>	<b>36288</b>	<b>142779</b>	<b>329853</b>
7	BADC	31	178	209	7159	17248	578	16925	29659	787	24084	46907	787	24084	46907
	Others	214	1092	1306	14020	41746	41517	213552	469418	42823	227572	511164	42823	227572	511164
	<b>Total</b>	<b>245</b>	<b>1270</b>	<b>1515</b>	<b>21179</b>	<b>58994</b>	<b>42095</b>	<b>230477</b>	<b>499077</b>	<b>43610</b>	<b>251656</b>	<b>558071</b>	<b>43610</b>	<b>251656</b>	<b>558071</b>
8	BADC	52	249	301	9063	22447	771	16071	28252	1072	25134	50699	1072	25134	50699
	Others	595	477	1072	9856	28960	24400	143301	359422	25472	153157	388382	25472	153157	388382
	<b>Total</b>	<b>647</b>	<b>726</b>	<b>1373</b>	<b>18919</b>	<b>51407</b>	<b>25171</b>	<b>159372</b>	<b>387674</b>	<b>26544</b>	<b>178291</b>	<b>439081</b>	<b>26544</b>	<b>178291</b>	<b>439081</b>
<b>Country Total</b>	BADC	278	3406	3684	103472	237537	5627	128736	250855	9311	232207	488392	9311	232207	488392
	BMDA	54	524	578	14869	38522	10	155	750	588	15024	39272	588	15024	39272
	Others	3189	14525	17714	190145	601370	178935	890596	2565725	196649	1080741	3167095	196649	1080741	3167095
<b>Total</b>	<b>3521</b>	<b>18455</b>	<b>21976</b>	<b>308486</b>	<b>877429</b>	<b>184572</b>	<b>1019487</b>	<b>2817330</b>	<b>206548</b>	<b>1327972</b>	<b>3694759</b>	<b>206548</b>	<b>1327972</b>	<b>3694759</b>	