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

Minor Irrigation Survey Report 2021-2022

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

June 2022

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

Minor Irrigation Survey Report 2021-2022
(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)

Report Prepared by

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FOREWORD

Bangladesh Agricultural Development Corporation (BADC) has been successfully working on collecting and monitoring the irrigation and water related data since its inception. It is a great pleasure that Digitalization of Survey and Monitoring for Development of Minor Irrigation Project of BADC is going to publish an informative report on irrigation equipment survey 2021-22. Primary data about irrigated area, number of irrigation equipment, power source of irrigation equipment, irrigation cost and benefited farmers could be found from this report.

I expect the report would meet the requirement of some basic information on minor irrigation which covered low lift pumps, deep tube wells, shallow tube wells, rubber dams, solar pumps, artesian wells, manually operated pumps, traditional and by gravity flow irrigation system.

I believe, the findings of the report will help the Government in formulation of policy and taking decisions for 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 planning.

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

AFM Hayatullah
Chairman (Grade-1), BADC.

PREFACE

Digitalization of Survey and Monitoring for Development of Minor Irrigation Project (closed) is directly involved with collection of data regarding groundwater monitoring, survey of irrigation equipment, irrigated area, benefited farmers, groundwater level, irrigation water quality, irrigation costs etc. Main objective of this report is to generate reliable and adequate statistical data about minor irrigation development. Survey and Monitoring Project has been introduced to make the prevailing monitoring system more widened, consolidated, stronger and modernized as well as to provide technical support and cooperation to the users.

Minor irrigation survey has been being performed by the Centre for Environmental and Geographic Information Services (CEGIS) a public trust under the ministry of water resources. Minor irrigation data of Rabi 2021-22 has been collected by CEGIS through field survey and finalized the report consulting with three organization BADC, BMDA and DAE.

I believe that the findings of the report will help the government in formulation of decisions for effective irrigation planning. I also hope that this report will furnish the planners, researchers and administrators necessary irrigation related data for effective planning in minor irrigation sub-sector.

I would like to extend my sincere thanks to CEGIS authority, all my colleagues both in the field and at project office for their efforts to publish the report. I am especially grateful to Kbd. Mohammad Jakir Hasnat, Deputy Director, DAE, Md. Jahangir Alam Khan, Superintending engineer, BMDA for their sincere efforts in composing this report.

I am very much grateful to Chief Engineers of irrigation wing and also Member Director (MI), BADC for their valuable suggestions for preparing and publication of this report.

Special thanks to AFM Hayatullah, Chairman, BADC, Md. Benojir Alam, Director General, DAE and Md. Abdur Rashid, Executive Director, BMDA for their participation and valuable suggestions to make this effort successful.

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and
Project Director
Digitalization of Survey and Monitoring for Development
of Minor Irrigation Project, BADC

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
PVC	Polyvinyl Chloride
NCA	Net Cultivated Area
REB	Rural Electrification Board
STW	Shallow Tube well

Executive Summary

Bangladesh Agricultural Development Corporation (BADC) a renowned and popular organization for farmer, has been working to achieve increasing irrigation area, irrigation technology development, best use of surface water, judicial use of groundwater, increasing irrigation efficiency along with production, Preservation & supply of high yielding variety of seed as well as quality fertilizers since 1961. BADC is involved with minor irrigation activities, including water use through LLP, rubber dam, floating pump, solar pump, dug well, DTW and STW etc. Minor irrigation survey report 2021-22 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 2020-21. By this time, BADC developed Bangladesh Irrigation Equipment Survey & Monitoring (BIESM) software with a technical assistance by Centre for Environmental & Geographical Information Services (CEGIS), a Public Trust under the Ministry of Water Resources. CEGIS prepared 2021-22 minor irrigation Survey report as assigned by BADC.

The report comprises irrigation area, operated irrigation equipment, farmers' involvement in irrigation activities trend of surface and ground water use, power required for irrigation etc.

The main objectives of this report are to update database of BIESM software & prepare minor irrigation survey 2021-22 Rabi Season. Report has been prepared by field survey, field visit, GPS survey, and consulting with stake holder organization BADC, DAE, BMDA. In 2021-22 irrigation season country's irrigation coverage is about 5.69 million ha of which 4.11 million ha are through utilization of ground water and 1.57 million ha through utilization of surface water. Net Cultivated Area (NCA) in Bangladesh is about 8.12 million ha where total irrigated area 5.69 million ha which is about 70% of NCA.

The survey has been conducted on Boro, Wheat, Potato, Maize, Fruits and vegetables which has been irrigated by minor irrigation equipment.

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.

Messages from BIESM 2021-22

- In 2021-22 Rabi season about 5.69 million ha crop land was under irrigation out of which 1.57 million ha (about 27.5%) by surface water and 4.12 million ha (about 72.5 %) by ground water.
- 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 17,12,515 irrigation equipment are used in Rabi season of which 12,45,758 (about 73 %) operated by diesel engines, 4,66,201 (about 27%) operated by electricity and a very small number (3,427) is operated by solar energy. Solar operated irrigated pumps are now being popular to the farmers due to low operating cost. Electrical pumps are preferred by the farmers due to low power cost and subsidy provided by the government.
- A total of 33,896 DTWs, 14,69,980 STWs, 2,05,212 LLPs, 68 Rubber dam, 2,872 Solar pumps, 555 solar Dug wells were operated in Bangladesh.
- Farmers are adopting and practicing AWD, lined Canal, buried pipe, fita pipe, drip sprinkler, mulching for improving irrigation efficiency and reducing irrigation cost.
- Irrigation by STW is increasing, popular to the farmers due to its low price, ease of operation and mobility within small fragmented land.
- In North-West and North-Central hydrological region, irrigation activity and crop production are performed by ground water due to scarcity of surface water.
- North-East, South-Central and South-West hydrological region is rich with surface water, Government intervention is required to use surface water for irrigation.
- Ground water use for irrigation can be minimized by installing buried pipe line, drip and sprinkler system, AWD, water management, lining Canal, training to farmers and choosing low water demand and high value crops for cultivation.
- Government introduced Integrated Minor Irrigation Policy 2017, Water Act 2018, Ground Water Management Act 2018 and Delta Plan 2100. For sustainable surface and ground water resources management integrated water resources management approach to be adopted.
- At present Irrigation charge paid through crop sharing, area, or other local methods to be replaced by installing prepaid meter system. Irrigation charge should be fixed by the upazila irrigation committee prior to every irrigation season as per government instructions.
- Area irrigated by STW is increased while area irrigated by DTW decreased. Some DTW area occupied by STW where GWT within suction limit. Many DTWs installed in the decade of seventy with eighty feet housing pipe. Some of those are 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 30.63 ha, 2.09 ha and 6.39 ha respectively.
- Distance between irrigation equipment can be calculated by BIESM software.
- Direction of GW flow can also be measured from BIESM software along with other basic information at scheme level.

Objectives of the Survey

Bangladesh is one of the largest deltaic countries in the world. It has limited fertile agricultural land in relation to its population. There is abundant water in rainy season (June to September) but limited water in Rabi season (January to April) when plenty of water is needed for irrigation purpose. Irrigation is the main input for increasing agricultural production. In Bangladesh, minor irrigation plays a vital role to expand irrigated area, increasing food production and thereby to help ensuring food security of the country. 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.

The main objectives of this report are to survey and monitor the minor irrigation equipment operated for irrigation by utilizing diesel and electricity, area of land is irrigated through the utilization of surface water & groundwater and farmers are benefited in the Rabi season.

The primary objective of the minor irrigation survey 2021-22 is to gather a better knowledge about minor irrigation facilities and to know the present trend and status of minor irrigation system all over the country.

The detailed objectives of the minor irrigation survey 2021-22 are outlined as follows:

- ❒ To assess the present trend and status of minor irrigation system;
- ❒ To assess the present status of diesel & electric-driven minor irrigation equipment such as Deep Tube Well (DTW), Shallow Tube Well (STW) and Low Lift Pump (LLP) in terms of number, type and thereby to help estimating the future requirement of diesel and electricity during the next Rabi Season;
- ❒ To assess the irrigated area through utilization of surface water and groundwater and the irrigated area (command area) per equipment;
- ❒ To find out the incremental utilization of irrigation facility; irrigated area and benefited farmers;
- ❒ To furnish the planner, researchers and administrators with necessary irrigation related data for effective planning in irrigation sub-sector;
- ❒ To help the Government in formulation of decisions for effective minor irrigation planning, which plays a key role in the production of food grains and thereby to help ensuring the food security of the country;
- ❒ To develop skill of BADC officials through training on irrigation survey, preparing survey procedures and methodologies to collect adequate and accurate data on minor irrigation.

Introduction

Irrigation water is a valuable resource for crop production, it is necessary to collect related information regarding irrigation systems from the field, prepare database, GIS maps and report for future use. Necessity of irrigation-related information increases day by day for demand-based planning in irrigation sub-sector to enhance irrigated area to ensure sustainable food grain production in the country.

Minor irrigation consists of mechanized, semi-mechanized and non-mechanized systems of irrigation. Low lift pumps, shallow tube wells and deep tube wells, solar pump and rubber dams are under mechanized irrigation system; manually operated pumps such as hand tube wells, treadle pumps, artesian wells etc, and gravity flow systems are under semi-mechanized irrigation system. Traditional systems such as doans, swing baskets etc come under non-mechanized irrigation systems. Mechanized system used diesel, electricity or solar power mainly in irrigation equipment.

BADC started irrigation activities by utilizing 1555 nos. of Low lift pumps in 1961. Later on in 1967-68, Deep Tube Wells were installed for irrigation purposes where surface water was not available. Similarly, Shallow Tube wells in 1973-74, Floating Pumps in 1987-88, Rubber Dam and Solar Pumps in 2011-12 and Dug wells in 2015-16 were installed for the same purposes. Besides these methods, irrigation activities in some areas of the country are performed through manual pump and artesian well, traditional method, and gravity flow method. The summary of irrigation through utilization of surface and groundwater by different modes is shown in Table 1.

Table 1: Summary of Surface water and Ground water Irrigation by Different Modes during Robi Season 2021-22

Sl. No.	Mode of Irrigation	No of Equipment	Area Irrigated (ha)	% of Surface Water	% of Total Irrigated Area (ha)	Area Irrigated per Equipment (ha)
A.	Surface Water Irrigation by:					
1	Low lift pump	205,212	1,310,917	83.66	23.04	6.39
2	Gravity flow		247,636	15.80	4.35	
3	Traditional method		5,824	0.37	0.10	
4	Solar pump	739	2,557	0.16	0.04	3.46
Sub Total		**205,951**	**1,566,934**	**100.00**	**27.54**	
B.	Ground water irrigation by:			% of ground water		
1	Deep tube well	33,896	1,038,113	25.18	18.25	30.63
2	Shallow tube well	1,469,980	3,070,155	74.47	53.96	2.09
3	Manual & Artesian wel		6,552	0.16	0.12	
4	Solar Pump	2,133	7,382	0.18	0.13	3.46
5	Dug Well	555	444	0.01	0.01	0.80
Sub Total		**1,506,564**	**4,122,646**	**100.00**	**72.46**	
GRAND TOTAL		**1,712,515**	**5,689,580**		**100.00**	

From Table 1, it is revealed that during the Rabi 2021-22, total 17,12,515 numbers of irrigation equipment's are used for irrigation in the country which is 3.41% higher than that of 2020-21 Rabi season in which 1,656,113 nos. of irrigation equipment were operated. On the other hand, irrigated area was 5.69 million ha in Rabi season 2021-22 which is also 0.64 % higher than that of 2020-2021 Rabi season irrigated area was 5.65 million hectares. Out of total 5.69 million hectares irrigated area, 5.43 million ha irrigated by DTW, STW & LLP and 0.26 million ha irrigated by Manual and Artesian well, traditional method, gravity flow, solar pump and dug well. Out of total 5.69 million ha Irrigated area 4.12 million ha through the utilization of groundwater i.e. 72.5% of total Irrigated area and 1.57 million ha through utilization of surface water i.e. 27.5% of total Irrigated area. The historical development of different types of irrigation equipment in Bangladesh is shown in Figure 1.

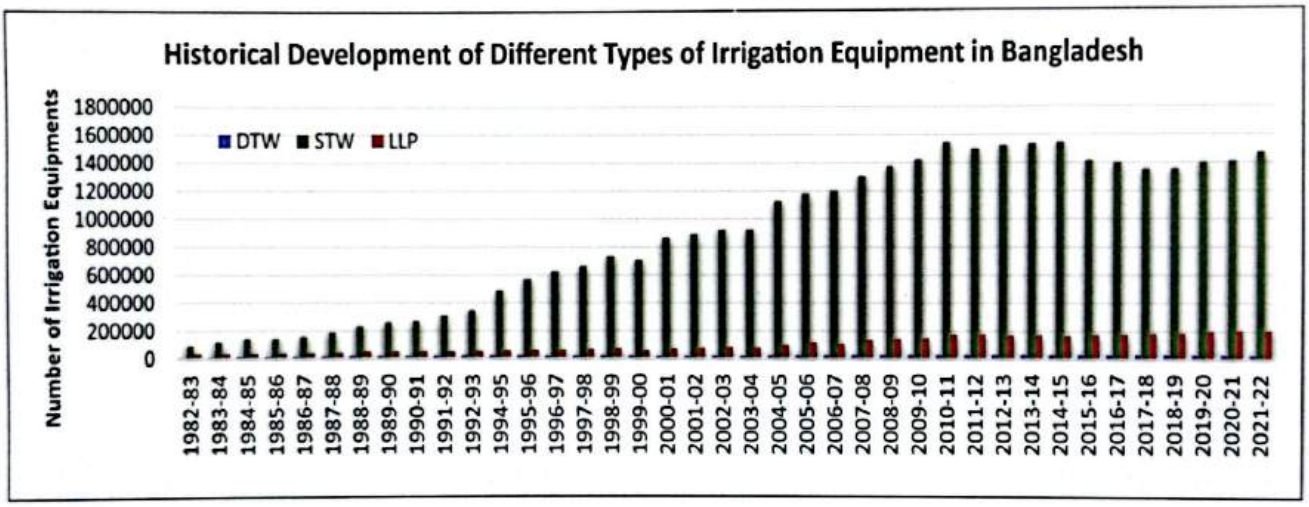


Figure 1: Historical Development of Different Types of Irrigation Equipment in Bangladesh

In Bangladesh, with the introduction of high-yielding rice varieties in 1980-90s that responded favorably to irrigation and fertilizer, and which are suitable for boro rice. Since aquifer conditions were favorable in most parts of the Teesta, Brahmaputra-Jamuna and Ganges River floodplain, the attention was diverted to the development of groundwater resources. The installation of deep tube wells (DTWs) started in. the late 1960s, but gained momentum in late 1980s. Within 1992, about 25,500 DTWs were installed throughout the country by BADC. Currently, 33,896 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.

The expansion of DTWs was followed by the development of Shallow Tube Wells (STWs) with discharge capacities of 7-21 lit/sec. However, despite visible benefits of groundwater irrigation, STWs were not initially adopted due to restrictions on tube well spacing and embargo on the

import of all types of diesel engines. After devastating floods of 1988 and subsequent cyclones in the early 1990s, it is realized that the need for agricultural machinery to kick-off farming economics back into action. 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.

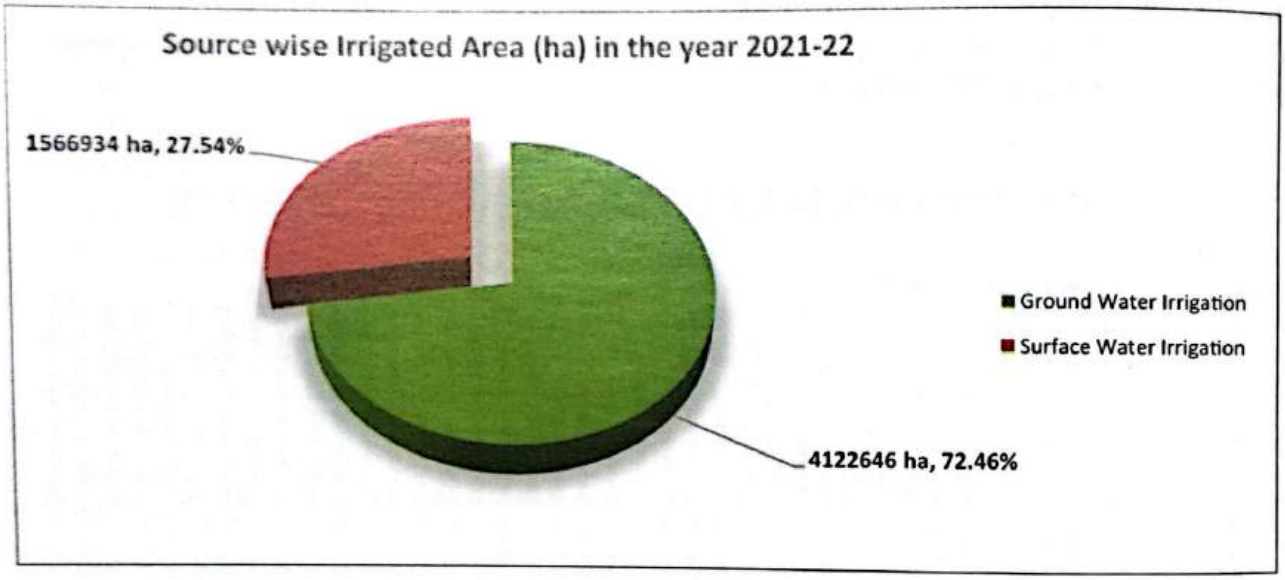


Figure 2: Irrigated Area (ha) of Surface water and Groundwater during Rabi Season 2021-22

Distribution of irrigated area during the Rabi season 2021-22 are shown in the Table 2 and graphical presentation shown in Figure 3.

Table 2: Total Area (ha) Covered by Different Irrigation Mode during Rabi Season 2021-22

Different Modes of Irrigation	Irrigated Area (ha)	% of total area
Deep tube well	1,038,113	18.25
Shallow tube well	3,070,155	53.96
Low lift pump	1,310,917	23.04
Gravity flow	247,636	4.35
Solar pump	9,939	0.17
Manual & Artesian well	6,552	0.12
Traditional method	5,824	0.10
Dug Well	444	0.01
Total	**5,689,580**	**100.00**

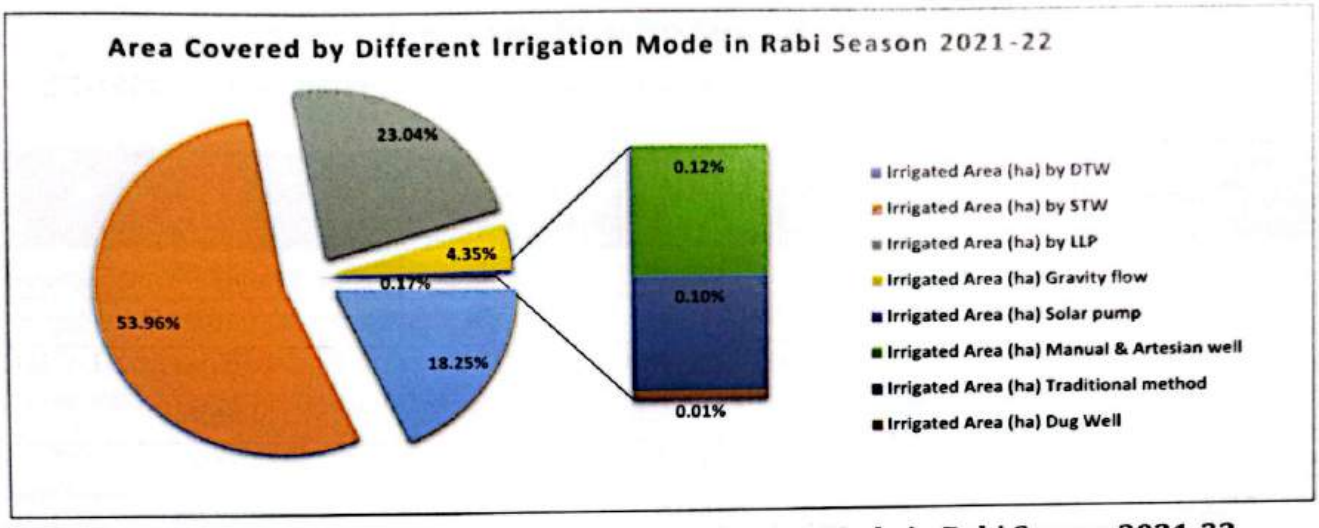


Figure 3: Total Area Covered by Different Irrigation Mode in Rabi Season 2021-22

Distribution of irrigation equipment's used during Rabi season 2021-22 are shown in bellows

Table 3: Division-wise distribution of irrigation equipment's used during Rabi Season 2021-22

Name of Division	Nos. of Irrigation equipment in the Year 2021-22					
	DTW	STW	LLP	Solar	Dug Well	Total
Dhaka	2,134	195501	25,806	53	15	223,509
Mymensingh	4,153	183,213	12,333	30	38	199,767
Rajshahi	15,355	309,766	12,326	914	340	338,701
Rangpur	7,463	393,427	2,301	1,234	85	404,510
Chattogram	1,749	78,210	46,592	78	28	126,657
Khulna	2,869	281,605	35,981	502	15	320,972
Sylhet	173	28,099	43,617	20	14	71,923
Barishal	-	159	26,256	41	20	26,476
Total	**33,896**	**1,469,980**	**205,212**	**2,872**	**555**	**1,712,515**

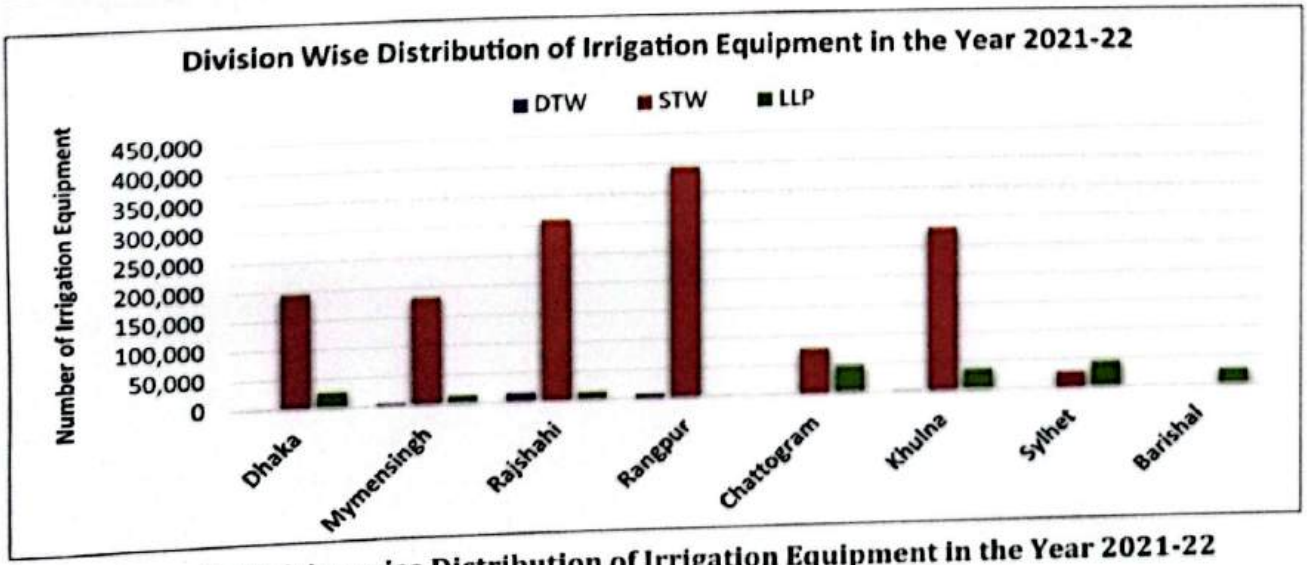


Figure 4: Division wise Distribution of Irrigation Equipment in the Year 2021-22

Distribution of irrigation area during Rabi season 2021-22 are shown in bellows

Table 4:Division wise distribution of Total Irrigated Area (ha) During **Rabi Season** 2021-22.

Division	Irrigation Year 2021-22	
	Irrigated Area (ha)	% of Total Area
Dhaka	719,844	12.65
Mymensingh	622,955	10.95
Rajshahi	1,219,834	21.44
Rangpur	1,066,126	18.74
Chattogram	650,843	11.44
Khulna	801,704	14.09
Sylhet	428,186	7.53
Barishal	180,087	3.17
Total	5,689,580	100.00

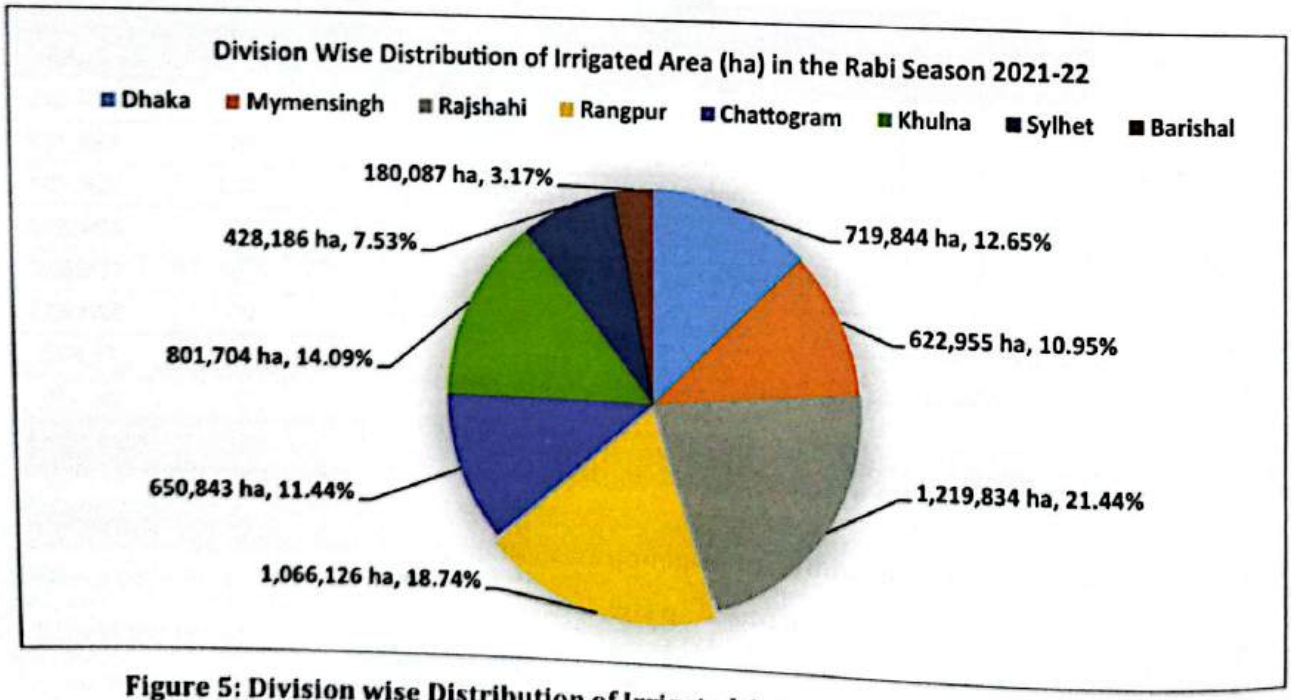


Figure 5: Division wise Distribution of Irrigated Area (ha) in Rabi Season 2021-22

Ground Water Irrigation

In Bangladesh, sources of groundwater were shallow (unconfined) and deep (confined, semi confined) aquifer. These aquifers consist of medium sand to gravels. Storage capacity and hydraulic conductivity is good enough for withdrawal of ground water. Sinking of wells depth between 30m – 180m. Concentration of deep tube well is highest in Rajshahi Division (43.3%) followed by Rangpur, Mymensingh, Khulna and Dhaka Division. Highest concentration of STW is found in Rangpur Division followed by Rajshahi, Khulna, Dhaka and Mymensingh Divisions. About 85.87% 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. In the North-West, groundwater irrigation is likely to continue until the limits of land or sustainable groundwater withdrawals are reached. Groundwater irrigation in dry season over a seven-month period depends on adequate recharge in the five-month monsoon period. If recharge is not more or at least equivalent to discharge, around the year Irrigation will accelerate groundwater depletion resulting in an excessive decline in water levels. On the other hand, it is found that groundwater recharge is higher in the North-west than the South and North-east, respectively, a function of increased groundwater extraction in the former zones.

Farmers of these regions have already started switching to more profitable and less water-intensive crops such as maize, wheat, vegetables etc. About 73% of the pumps within Bangladesh are run by diesel engines. The remaining 27% use electricity. Diesel pumps usually have higher costs 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 farmlands. Increasing power cuts and the generally poor electricity network in many rural areas comprise other potential reasons for farmers' diesel pump preferences. In addition to irrigate their own lands, the owners of STWs also provide irrigation services to their neighbors for a fixed seasonal fee in cash or through payment by producing crops.

Groundwater irrigation requires large amounts of energy to lift water from underlying aquifers. In the Rabi season 2021-22 about 33,092 DTWs are electrified; the rest 804 are diesel operated. Out of the 1.47 million STWs in Bangladesh, only 0.41 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.

As the genetic and agronomic scope for yield increase in rice is limited, increasing irrigation costs will reduce farmers' net incomes, further threatening the economic foundations upon which boro rice production is based. The following are pictures of some deep tube wells and shallow tube wells:

Deep Tubewell

Well with electricity or diesel driven pump lifts water from aquifer. Deep Tubewells (DTW) are of large diameter (15.24-20.32 cm) and pumped water by a submersible turbine pump having capacity 20-56 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 33,896 number of Deep Tubewells are operated in 2021-22 Rabi season for irrigation in agricultural land. About 1.04 million ha of land is irrigated by Deep Tubewell, which is 25.18 percent of ground water irrigation and 18.24 percent of total irrigated area of Bangladesh. The average irrigated area coverage of DTW is 30.63 ha. Irrigation by deep tubewells decreeing 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 Deep Tubewell at Kutubdia Upazila, Cox's Bazar

Figure 7: BADC Deep Tubewell at Kosba Upazila, Brahmanbaria

Figure 8: BADC Solar Deep Tubewell at Subarnochar Upazila, Noakhali

Figure 9: BADC DTW in Kalaroa Upazila, Satkhira

Figure 10: BMDA DTW in Sherpur Upazila, Bogura

Figure 11: BMDA DTW in Sadar Upazila, Nilphamari

Figure 12: Private DTW at Monirampur Upazila, Jashore

Figure 13: BADC Solar DTW at Sadar Upazila, Jashore

Figure 14: Solar DTW at Bochaganj Upazila, Dinajpur

Shallow Tubewell

Shallow tubewell (STW), mostly used for irrigation have 5.08-10.16 cm diameter with a capacity of 7-21 liter/sec and abstract water from aquifer with the help of land based centrifugal pump when groundwater table lies within 7.0 m from ground surface. A total of 1.47 million shallow tubewells are operated in rabi season of 2021-2022. The irrigated area of shallow tubewell was about 3.07 million ha with 2.09 ha average per STW. About 74.82 percent of ground water irrigation is covered with Shallow Tubewells, which is 53.95 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 Phulbari Upazila, Dinajpur

Figure 16: Shallow Tubewell at Karimganj Upazila, Kishoreganj

Figure 17: Shallow Tubewell (pit) at Manda Upazila, Naogaon

Figure 18: Shallow Tubewell at Khetlal Upazila, Joypurhat

During the Rabi season 2021-22, DTWs and STWs covered throughout the country were 1.04 million ha and 3.07 million ha. In the previous Rabi season 2020-2021, total 1.45 million DTWs and STWs were in operation and 4.09 million ha land were irrigated. Deep Tube Well contributed 18.24% and Shallow Tube Well is contributed 53.95% of the total area irrigated during Rabi season 2021-22. 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, 2021-22

Division	Irrigation Year 2021-22		
	Area Irrigated (ha) by DTW	Area Irrigated (ha) by STW	Total Irrigated Area (ha)
Dhaka	54,809	428,064	482,873
Mymensingh	136,295	358,156	494,451
Rajshahi	496,845	641,532	1,138,377
Rangpur	228,506	793,378	1,021,884
Chattogram	47,830	213,121	260,951
Khulna	68,665	541,581	610,246
Sylhet	5,163	93,899	99,062
Barishal	-	424	424
Total	**1,038,113**	**3,070,155**	**4,108,268**

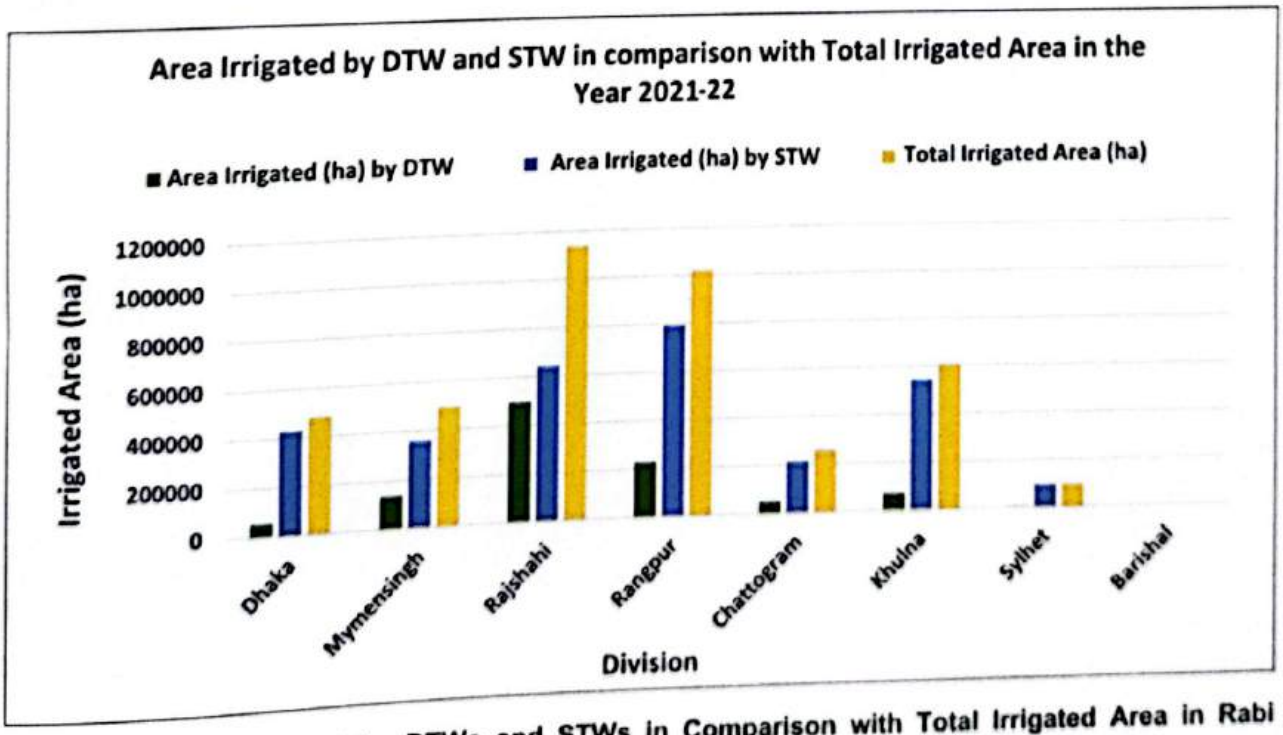


Figure 19: Area irrigated by DTWs and STWs in Comparison with Total Irrigated Area in Rabi Season, 2021-22

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 and hilly areas.

Figure 20: BADC Solar operated Dug well in Nalitabari Upazila, Sherpur District.

Figure 21: BMDA Solar operated Dug well in Saidpur Upazila, Nilphamari District.

Figure 22: BADC Solar operated Dug well in Mujibnagar, Meherpur District.

Figure 23: BADC Solar operated Dug well in Porshuram Upazila, Feni District.

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 24: Diaphragm Pump

Figure 25: 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 26: Artesian well, BADC

Figure 27: Artesian well, Private

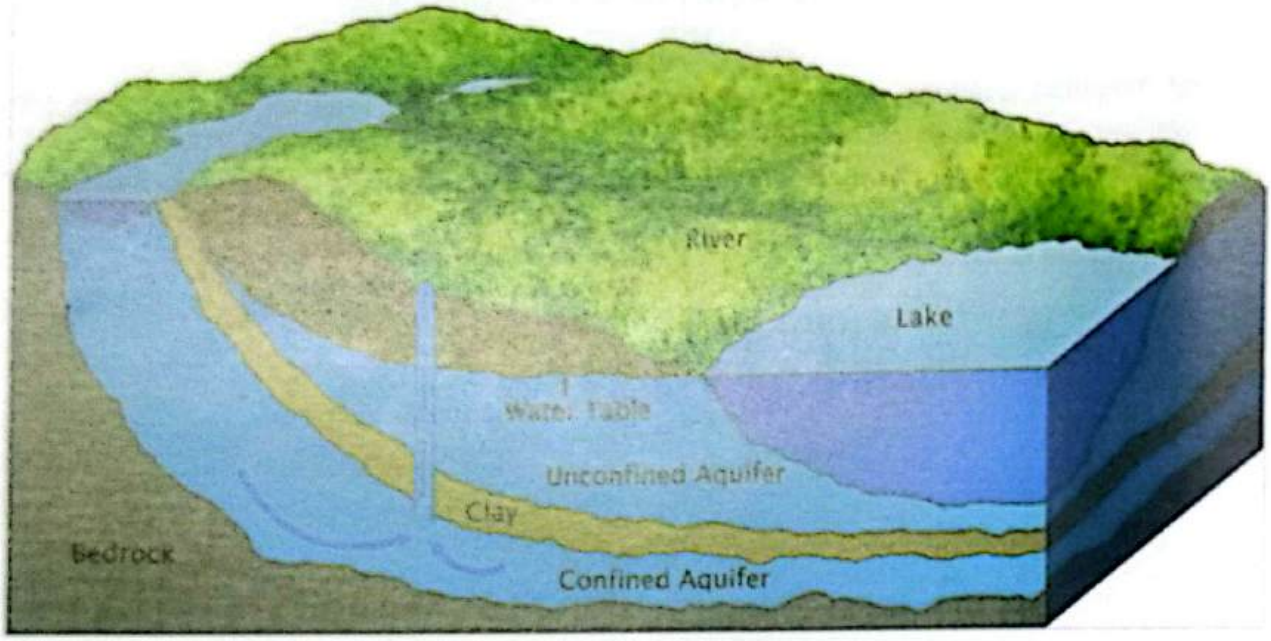


Figure 28: An Artesian Well Diagram of Artesian Aquifer

Division wise irrigated area by Manual and Artesian well method in Rabi season 2021-22 are shown in Table 6.

Table 6: Irrigated Area by Manual Method & Artesian Well in 2021-22.

Sl No	Division	Irrigated Area (Hectare)	% of Total
1	Dhaka	1,119	17.08
2	Mymensingh	305	4.66
3	Rajshahi	230	3.51
4	Rangpur	200	3.05
5	Chattogram	810	12.36
6	Khulna	753	11.49
7	Sylhet	2,432	37.12
8	Barishal	703	10.73
Total		**6,552**	**100.00**

Surface Water Irrigation

Surface water is one of the major sources of irrigation. Main sources of surface water are perennial rivers, creeks, canals, khals, beels, ponds and other natural or artificial reservoirs. Surface water is abundant in rainy season while in dry season scarcity of surface water is found. BADC, BMDA and other organizations have taken many programs i.e. canal digging, river dredging, and rubber dam construction to augment surface water. Although the farmers of Bangladesh mostly use groundwater for irrigation purpose, but surface water irrigation still contributes 27.5% 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 is used for operation of around 90% 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. Sixty-eight 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 2021-22 about 1,84,429 LLPs are diesel operated; the rest 20,783 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 29: Re-excavated Khal at Burichang Upazila, Cumilla

Figure 30: Re-excavated Khal at Khaliajhuri Upazila, Netrokona

Figure 31: Submerged Weir at Ashuganj-Palash Agro Irrigation Project

Figure 32: Intake point of Regulator at Ashuganj-Palash Agro Irrigation Project

Figure 33: Hydraulic Elevated Dam at Anwara, Chattogram by BADC

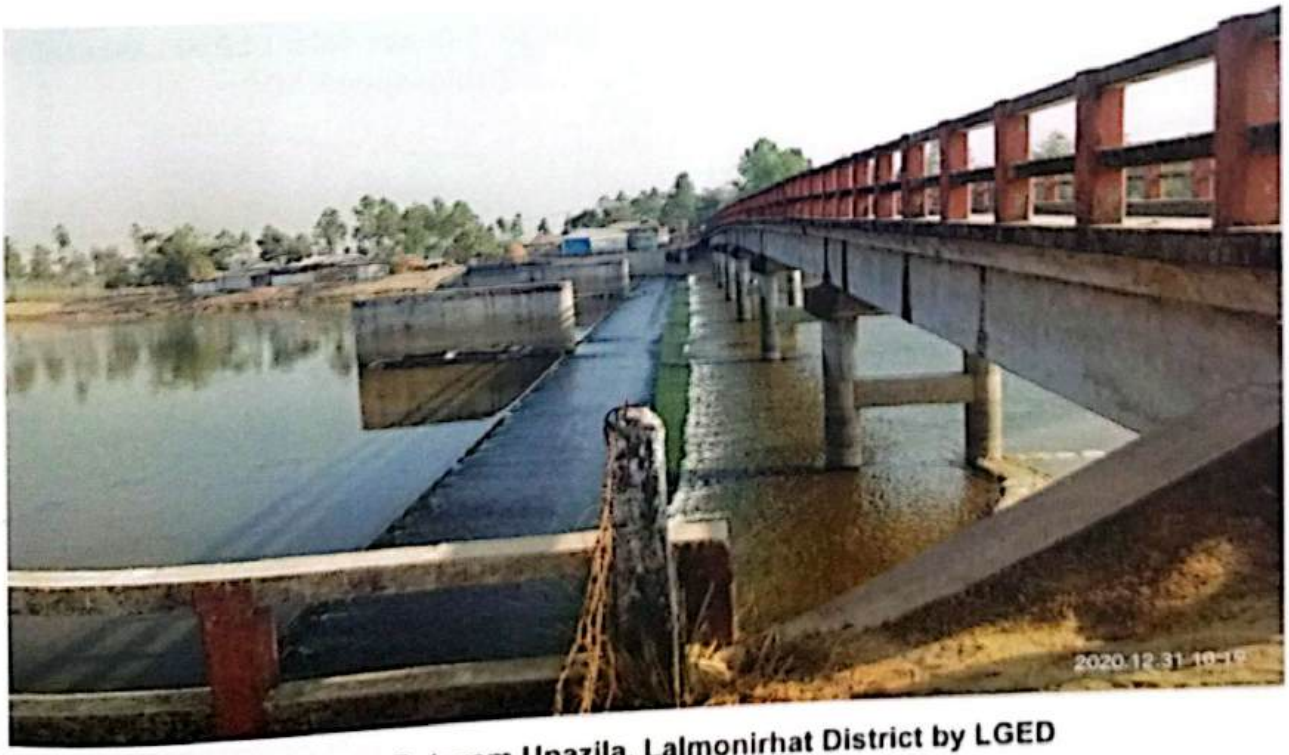


Figure 34: Rubber Dam at Patgram Upazila, Lalmonirhat District by LGED

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 2021-22, about 205,212 nos. of LLP were operated for irrigation purpose and 1.31 million ha irrigated which is 23.02% of total irrigated area. Out of 205,212 LLPs, BADC operated 8,831 nos. of LLPs under various projects through which 222,147 ha of land was irrigated. Division wise no. of LLPs and irrigated areas in Rabi season 2021-22 are shown in Table 7.

Figure 35: 5 Cusec Solar LLP at Sadar Upazila, Sunamganj by BADC

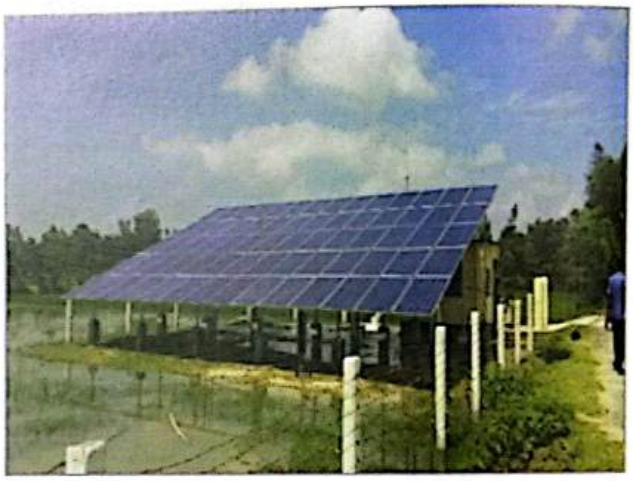


Figure 36: 5 Cusec solar LLP at Lakhai Upazila, Habiganj by BADC

Figure 37: 0.5 Cusec Solar LLP at Kolaroa Upazila, Satkhira

Figure 38: 12.5 cusec FP at Karimganj Upazila, Kishoreganj

Figure 39: 12.5 Cusec Floating Pump, Chandpur

Figure 40: 12.5 Cusec Floating Pump, Netrokona

Figure 41: 12.5 Cusec Floating Pump, Sunamganj

Figure 42: Portable water Distribution System at Char area Rangpur

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 68 Rubber Dam is constructed in Bangladesh. Rubber Dam are constructed by LGED, BADC, BWDB and BMDA.

Figure 43: Menogchora Rubber Dam at Haluaghat, Mymensingh by BADC

Figure 44: Rubber Dam at Kamlakanda, Netrakona by BADC

Figure 45: Rubber Dam on Atrai river at Mohonpur upazila, Dinajpur by LGED.

Figure 46: Netai River Rubber Dam at Dhobaura Upazila, Mymensingh by LGED.

Gravitational Flow

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 2021-22 irrigation seasons, 247,636 ha of land were irrigated by gravity flow method. Division wise irrigated area (ha) by Gravity Flow is shown in Table 7.

Figure 47: Gravity flow irrigation at Ashuganj-Polash agro-irrigation project (APAIP) by BADC

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 Season 2021-22, 5,824 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 48: Doan

Figure 49: Swing Basket

Figure 50: Different Types of Traditional Irrigation Methods

Table 7: Area irrigated by Surface water in eight divisions of Bangladesh, Rabi Season 2021-22

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	218175	1,492	15,989	184	235,840
Mymensingh	107705	580	19,782	102	128,169
Rajshahi	75806	80	2,047	3,022	80,955
Rangpur	24636	250	14,770	4,318	43,974
Chittagong	318622	1,535	68,632	271	389,060
Khulna	138812	737	49,356	1,788	190,693
Sylhet	251026	760	74,785	110	326,681
Barisal	176135	390	2,275	144	178,944
Total	**1,310,917**	**5824**	**247,636**	**9,939**	**1,574,316**

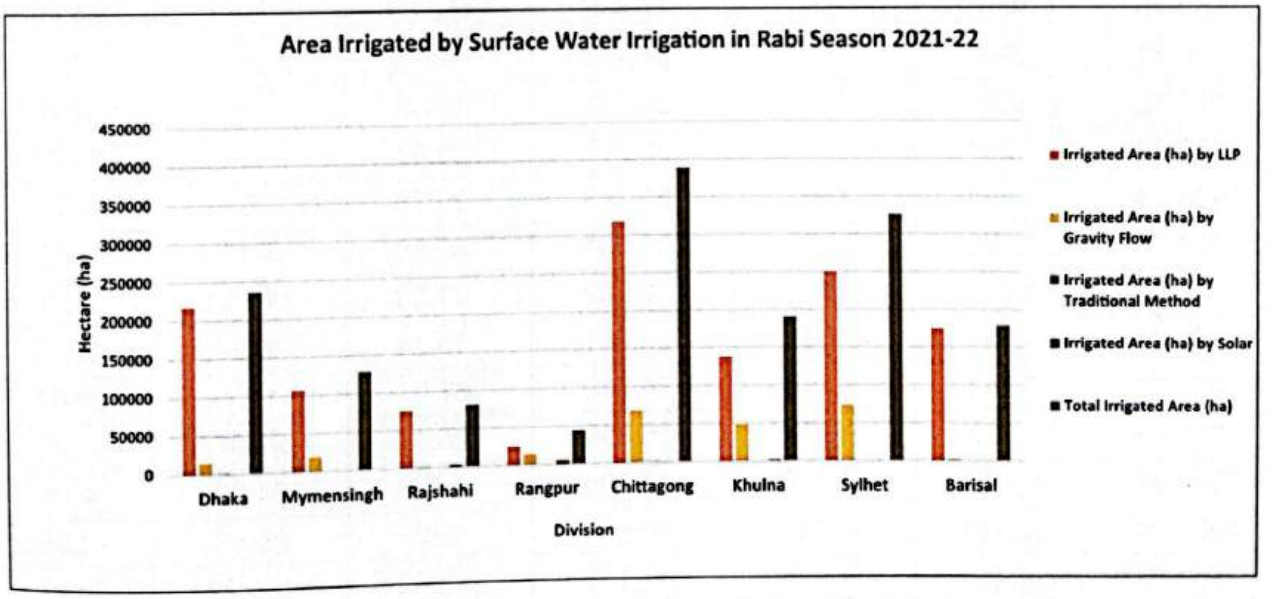


Figure 51: Division wise Area Irrigated by Surface Water during Boro 2021-22

Trend in Minor Irrigation

A. Operational Equipment and Irrigated Area

The trend of operational irrigation equipment and irrigated area from 1961-62 to 2021-22 is shown in Table 8 and Table 9.

Table 8: Trend of Minor Irrigation Equipment 1961-62 to 2021-22

Boro Season	Boro Season Annual Operating (Nos.)			Equipment Annual Change in Percentage (%)		
	DTW	STW	LLP	DTW	STW	LLP
1961-62			1,555			0
1962-63			2,024			30.16
1963-64			2,477			22.38
1964-65			2,239			-9.61
1965-66			3,420			52.75
1966-67			3,990			16.67
1967-68	102		6,558	0		64.36
1968-69	380		10,852	272.55		65.48
1969-70	980		17,846	157.89		64.45
1970-71	796		24,483	-18.78		37.19
1971-72	906		24,243	13.82		-0.98
1972-73	1,237		32,917	36.53		35.78
1973-74	1,494	998	35,243	20.78	0	7.07
1974-75	2,699	1,029	35,534	80.66	3.11	0.83
1975-76	3,828	2,162	36,382	41.83	110.11	2.39
1976-77	4,461	3,045	28,361	16.54	40.84	-22.05
1977-78	7,453	6,447	36,730	67.07	111.72	29.51
1978-79	9,329	8,379	35,895	25.17	29.97	-2.27
1979-80	9,795	11,280	37,389	5	34.62	4.16
1980-81	10,131	20,931	35,951	3.43	85.56	-3.85
1981-82	11,491	42,955	41,153	13.42	105.22	14.47
1982-83	13,800	93,100	35,500	20.09	116.74	-13.74
1983-84	15,500	120,300	36,000	12.32	29.22	1.41
1984-85	16,900	147,000	37,000	9.03	22.19	2.78
1985-86	17,900	146,900	37,500	5.92	-0.07	1.35
1986-87	18,700	160,300	40,600	4.47	9.12	8.27
1987-88	20,300	188,700	42,300	8.56	17.72	4.19
1988-89	22,400	235,900	50,800	10.34	25.01	20.09

Boro Season	Boro Season Annual Operating (Nos.)			Equipment Annual Change in Percentage (%)		
	DTW	STW	LLP	DTW	STW	LLP
1989-90	22,600	260,000	51,000	0.89	10.22	0.39
1990-91	21,500	270,300	51,600	-4.87	3.96	1.18
1991-92	25,500	309,300	50,300	18.6	14.43	-2.52
1992-93	25,700	348,900	52,200	0.78	12.8	3.78
1993-94	24,500	359,200	52,600	-4.67	2.95	0.77
1994-95	26,700	488,900	57,100	8.98	36.11	8.56
1995-96	27,300	571,200	60,600	2.25	16.83	6.13
1996-97	25,200	629,800	62,900	-7.69	10.26	3.8
1997-98	25,300	664,700	66,300	0.4	5.54	5.41
1998-99	26,700	736,100	72,900	5.53	10.74	9.95
1999-00	23,530	707,570	58,050	-11.87	-3.88	-20.37
2000-01	23,180	865,210	71,310	-1.49	22.28	22.84
2001-02	23,000	893,360	77,000	-0.78	3.25	7.98
2002-03	23,430	924,020	79,870	1.87	3.43	3.73
2003-04	24,720	925,150	77,790	5.51	0.12	-2.6
2004-05	27,180	1,128,990	99,250	9.95	22.03	27.59
2005-06	28,280	1,182,520	119,130	4.05	4.74	20.03
2006-07	29,170	1,202,720	107,290	3.15	1.71	-9.94
2007-08	31,300	1,304,970	138,630	7.3	8.5	29.21
2008-09	32,170	1,374,580	146,790	2.78	5.33	5.89
2009- 10	32,910	1,425,140	150,610	2.3	3.68	2.6
2010- 11	33,670	1,549,150	173,670	2.31	8.7	15.31
201 1-12	34,050	1,498,390	177,220	1.13	-3.28	2.04
2012-13	35,320	1,523,610	170,570	3.73	1.68	-3.75
2013-14	36,034	1,563,791	171,041	2.02	2.64	0.28
2014-15	36,566	1,549,711	167,175	1.48	-0.9	-2.26
2015-16	36,979	1,417,008	173,179	1.16	-9.36	3.46
2016-17	37,175	1,398,960	176,478	0.53	-1.27	1.9
2017-18	37,538	1,355,852	181,469	0.98	-3.08	2.83
2018-19	37,634	1,357,532	187,188	0.26	0.12	3.15
2019-20	37,007	1,398,706	199,914	-1.67	3.03	6.80
2020-21	36,955	1,409,689	204,391	-0.14	0.79	2.24
2021-22	33,896	1,469,980	205,212	-8.28	4.28	0.40

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 2021-22 taken from Minor Irrigation Survey Report of BADC.

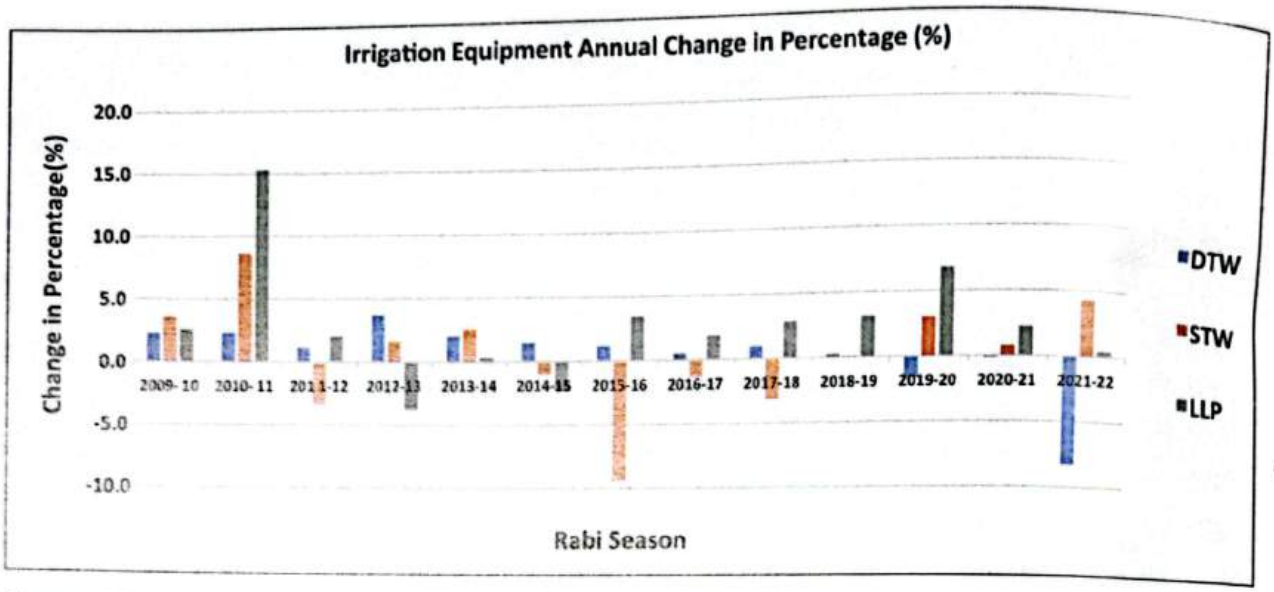


Figure 52: Trend of Minor Irrigation Equipment Change in Percentage of last Thirteen Rabi Seasons (2009-10 to 21-2022)

Table 9: Trend of Irrigated Area by Different Minor Irrigation Mode (1961-62 to 2021-22)

Irrigation Season	DTW	STW	LLP	Manual & Artesian Well	Traditional Method	Gravity Flow Method	Solar Pump	Dug Well	Total
1961-62			29927.9						
1962-63			53863.6						
1963-64			63461.9						
1964-65			53547.4						
1965-66			70247.8						
1966-67			91135.6						
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

Irrigation Season	DTW	STW	LLP	Manual & Artesian Well	Traditional Method	Gravity Flow Method	Solar Pump	Dug Well	Total
1985 -86	304000	586000	356000	16000	314000	163000			1739000
1986-87	318000	639000	386000	16000	326000	155000			1840000
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

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 2021-22 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 ha per equipment (DTW, STW & LLP)

Irrigation season	Irrigated Area ('000 ha)			Operational Equipment ('000No.)			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

Figure 53: Area Coverage per Irrigation Equipment in Last Twenty Rabi Seasons (2001-2021)

Figure 54: Trend of Irrigated Area (ha) during Rabi Season 1982-83 to 2021-2022

Power Source in Irrigation Equipment

During the 2021-22 Rabi season, 1711980 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. 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 55

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	80,415	309,394	143,079	391,838	223,494	701,232
Mymensingh	74,114	304,290	125,615	297,968	199,729	602,258
Rajshahi	103,907	762,480	234,454	454,725	338,361	1,217,205
Rangpur	107,477	475,133	296,948	575,705	404,425	1,050,838
Chittagong	43,701	265,632	82,928	314,212	126,629	579,844
Khulna	44,277	209,176	276,680	541,670	320,957	750,846
Sylhet	10,881	62,936	61,028	287,262	71,909	350,198
Barisal	1,430	19,847	25,026	156,856	26,456	176,703
Total	**466,202**	**2,408,888**	**1,245,758**	**3,020,236**	**1,711,960**	**5,429,124**

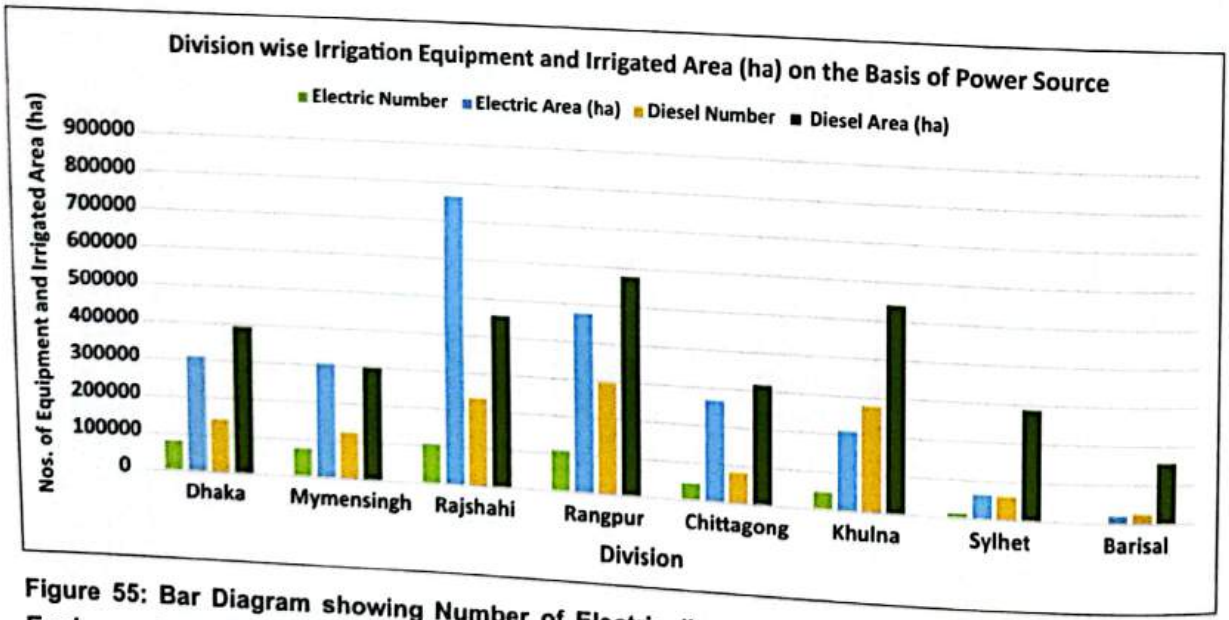


Figure 55: Bar Diagram showing Number of Electrically and Diesel Operated Different types of Equipment's and Irrigated Area (ha) during Rabi Season 2021-22

GIS Map on Irrigation Survey

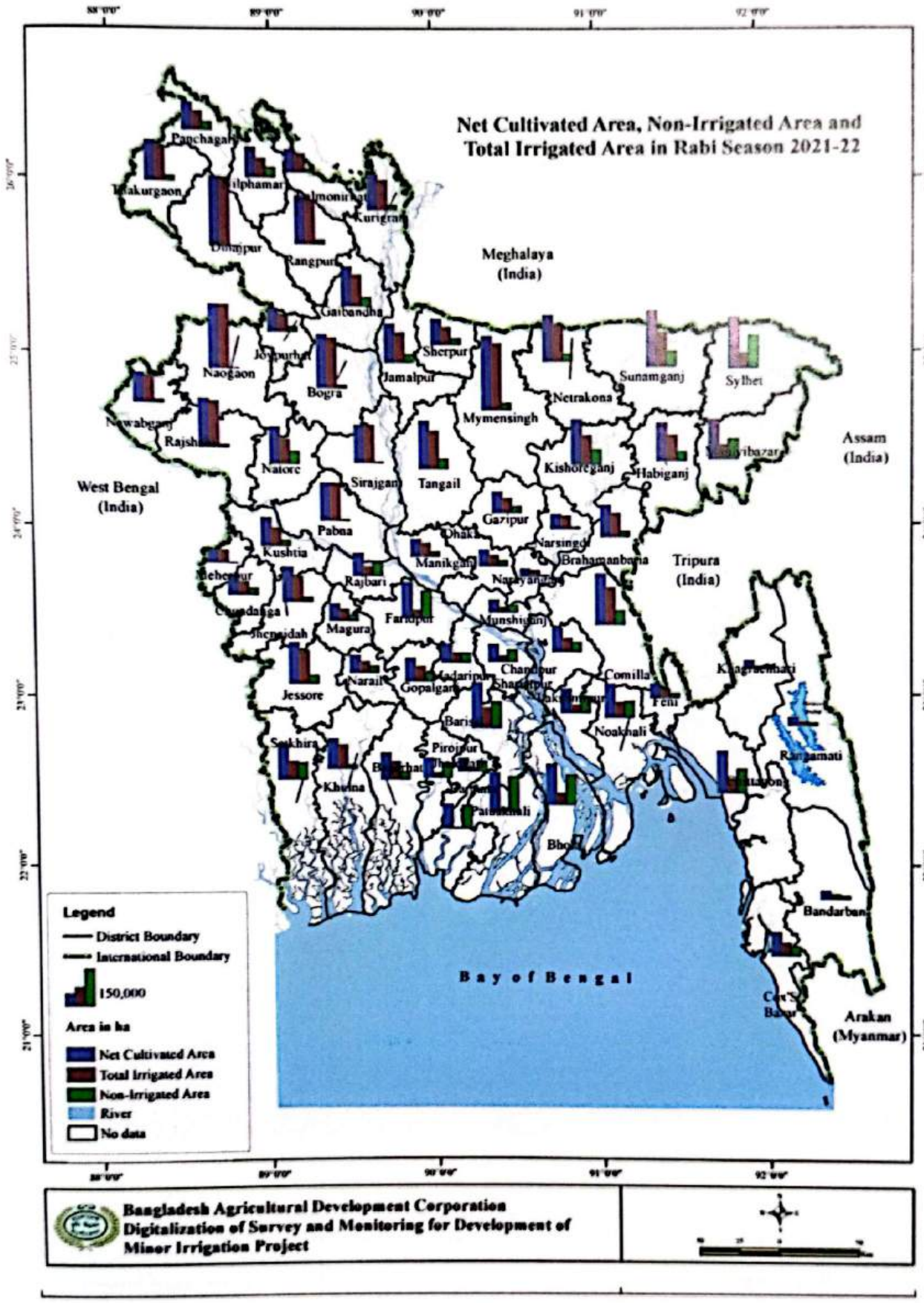


Figure 56: Net Cultivated Area, Non-Irrigated Area and Total Irrigated Area

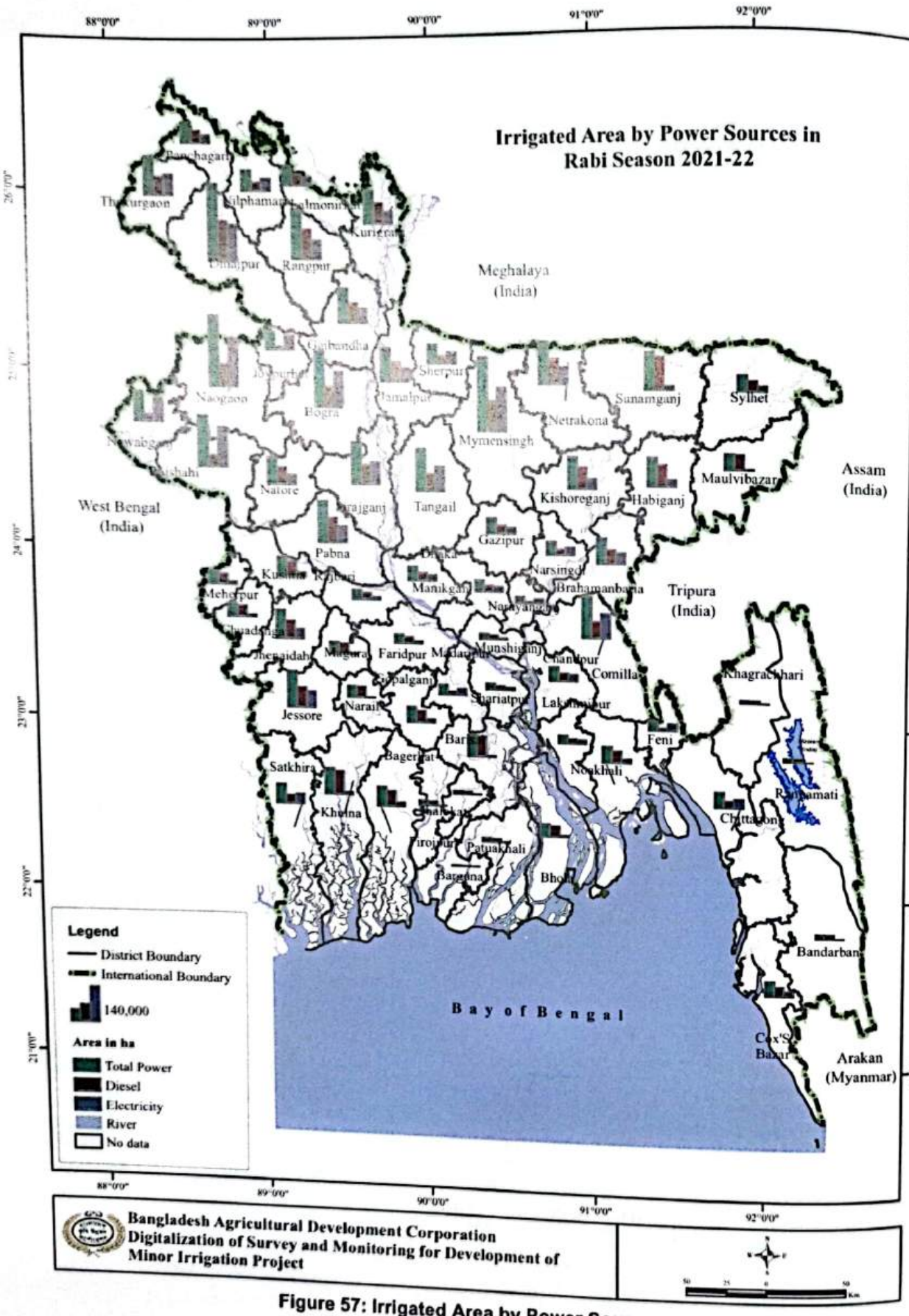


Figure 57: Irrigated Area by Power Sources

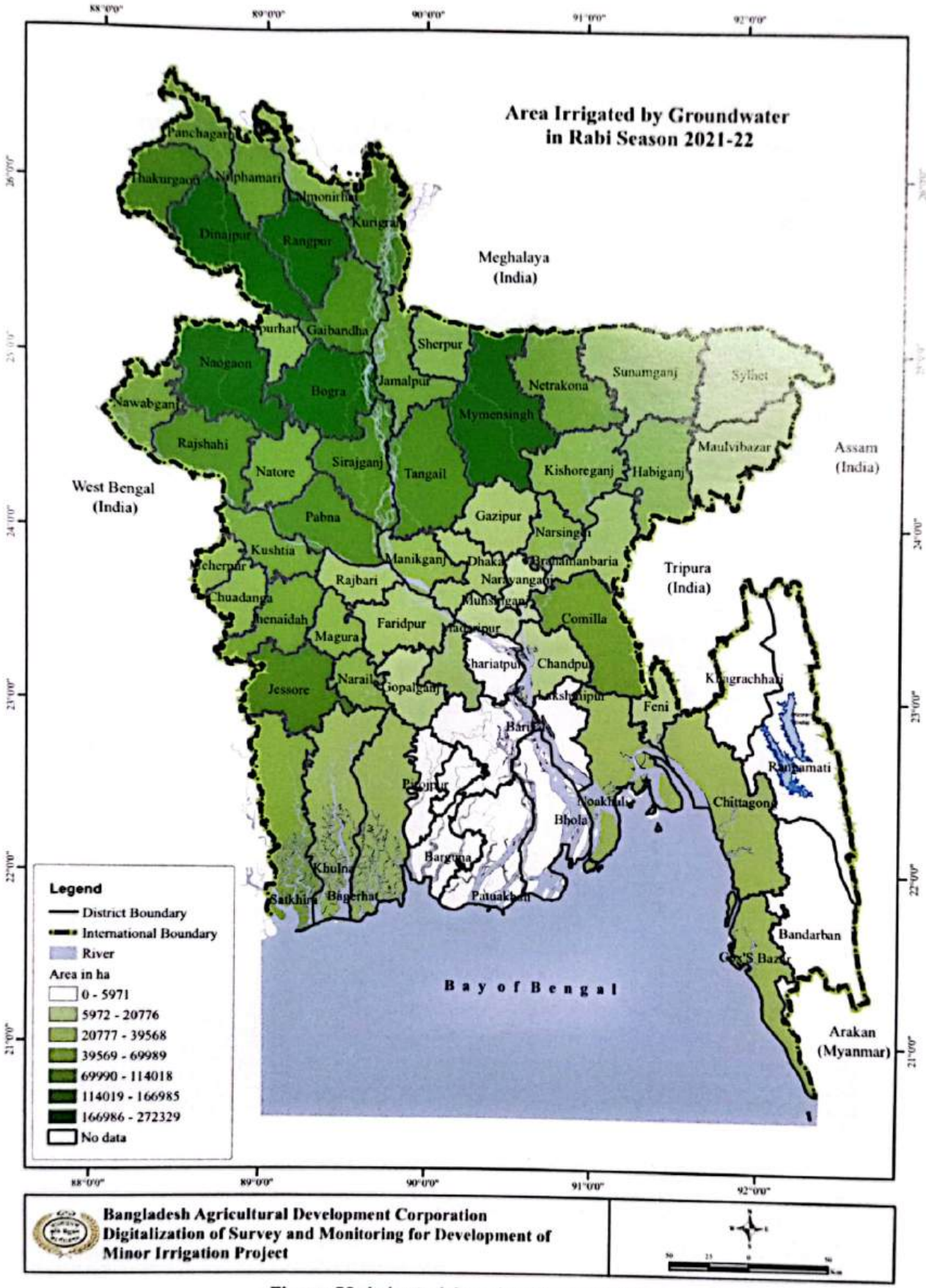


Figure 58: Irrigated Area by Groundwater

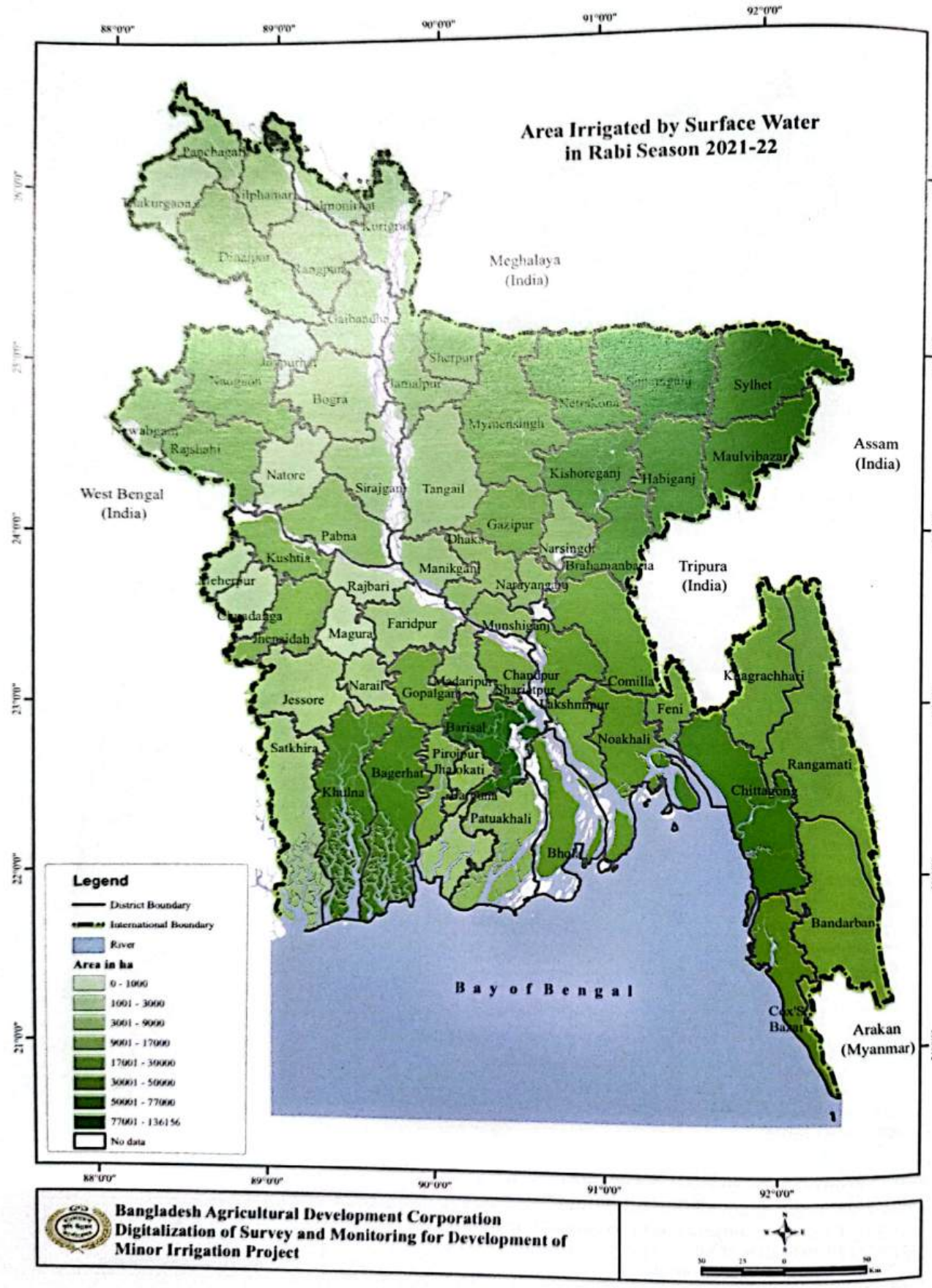


Figure 59: Irrigated Area by Surface Water

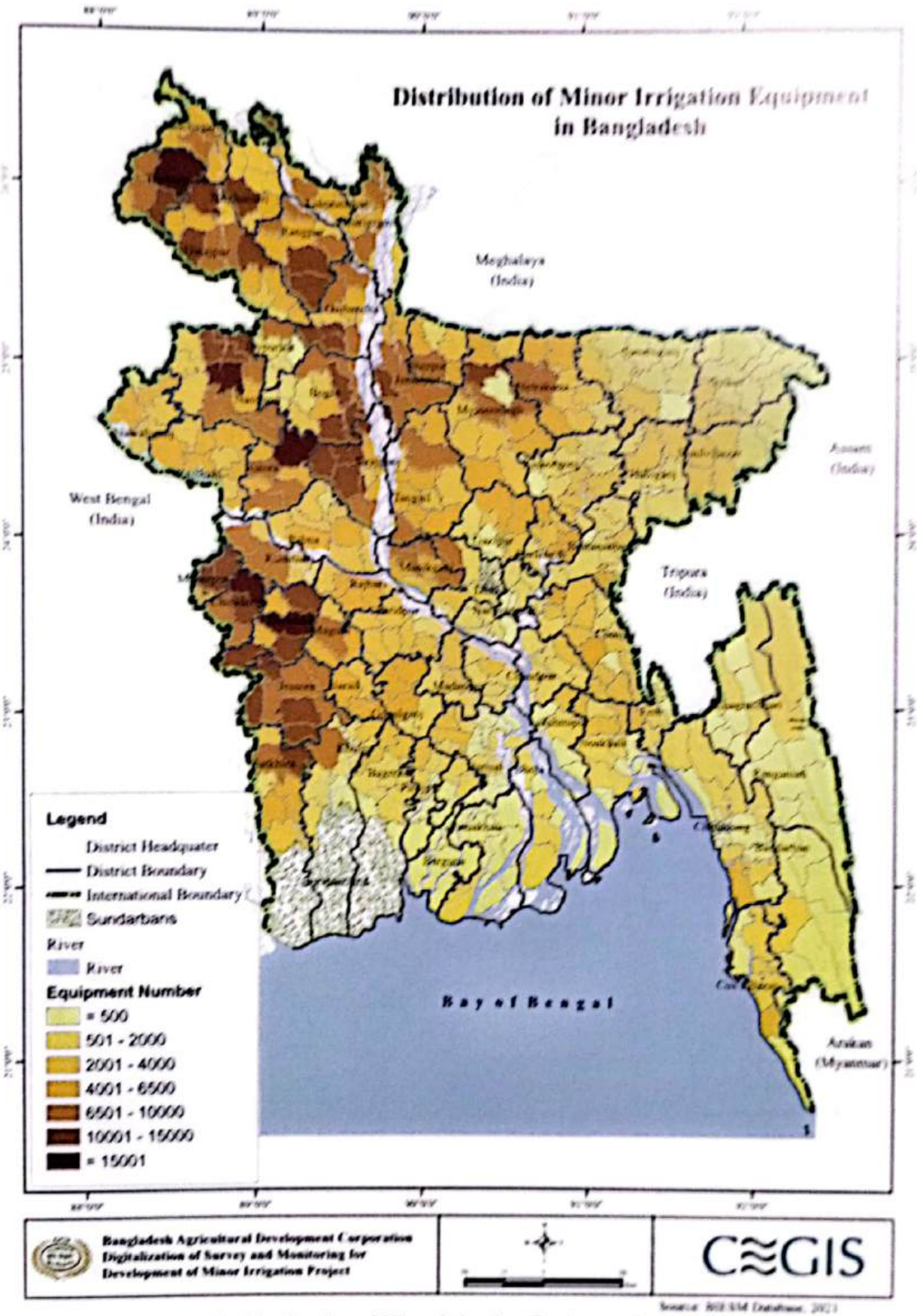
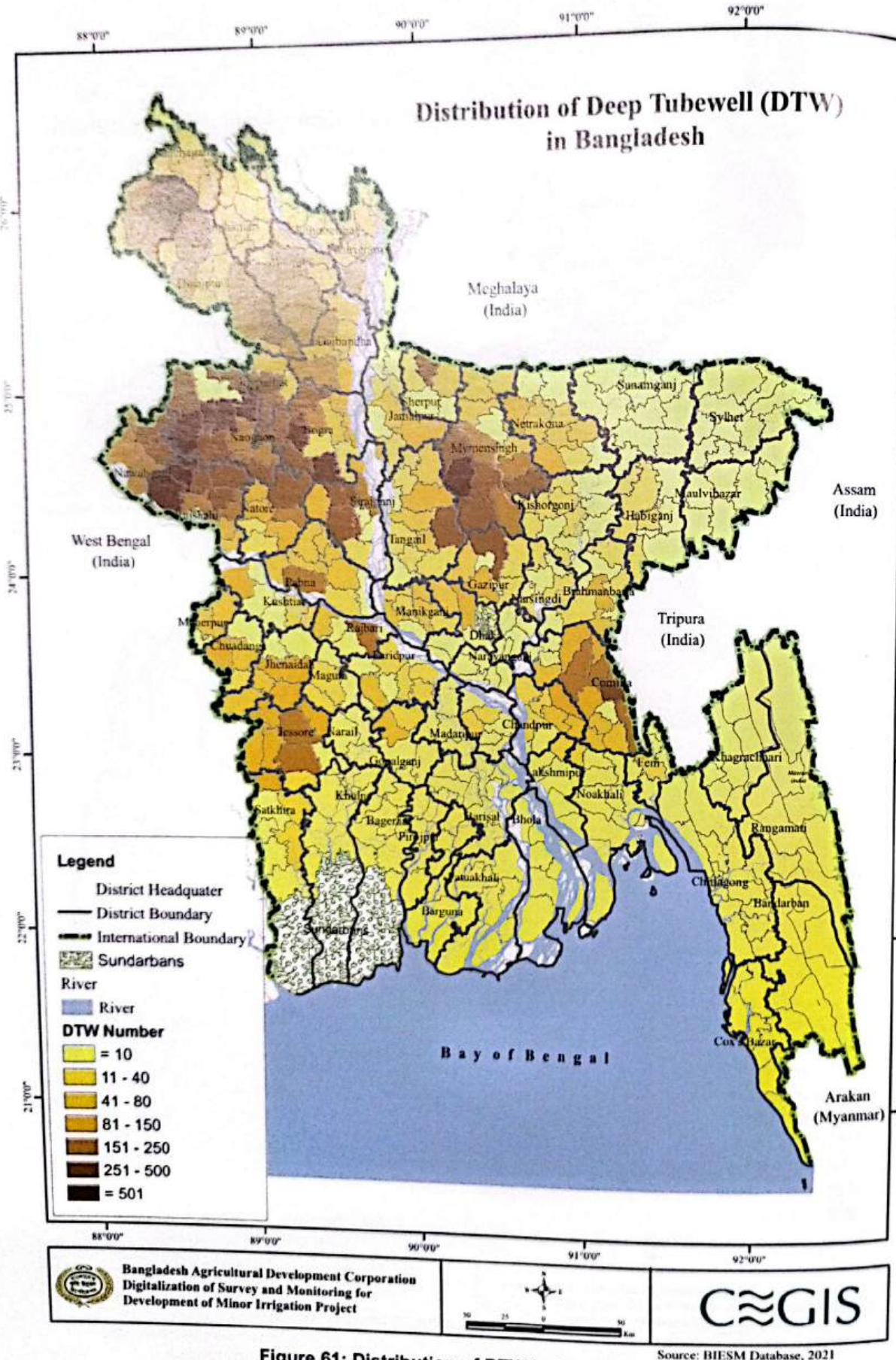
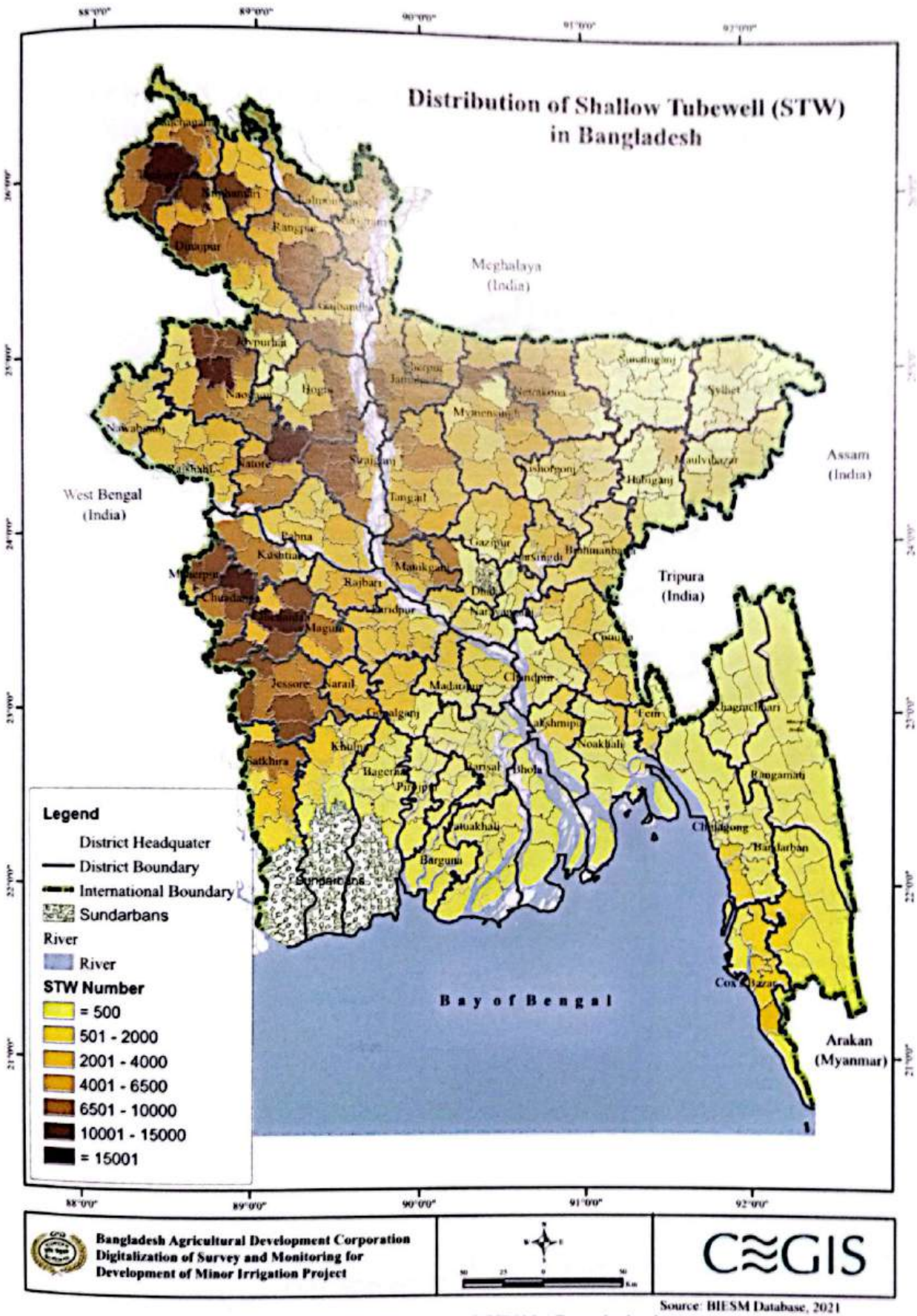


Figure 60: Distribution of Minor Irrigation Equipment in Bangladesh



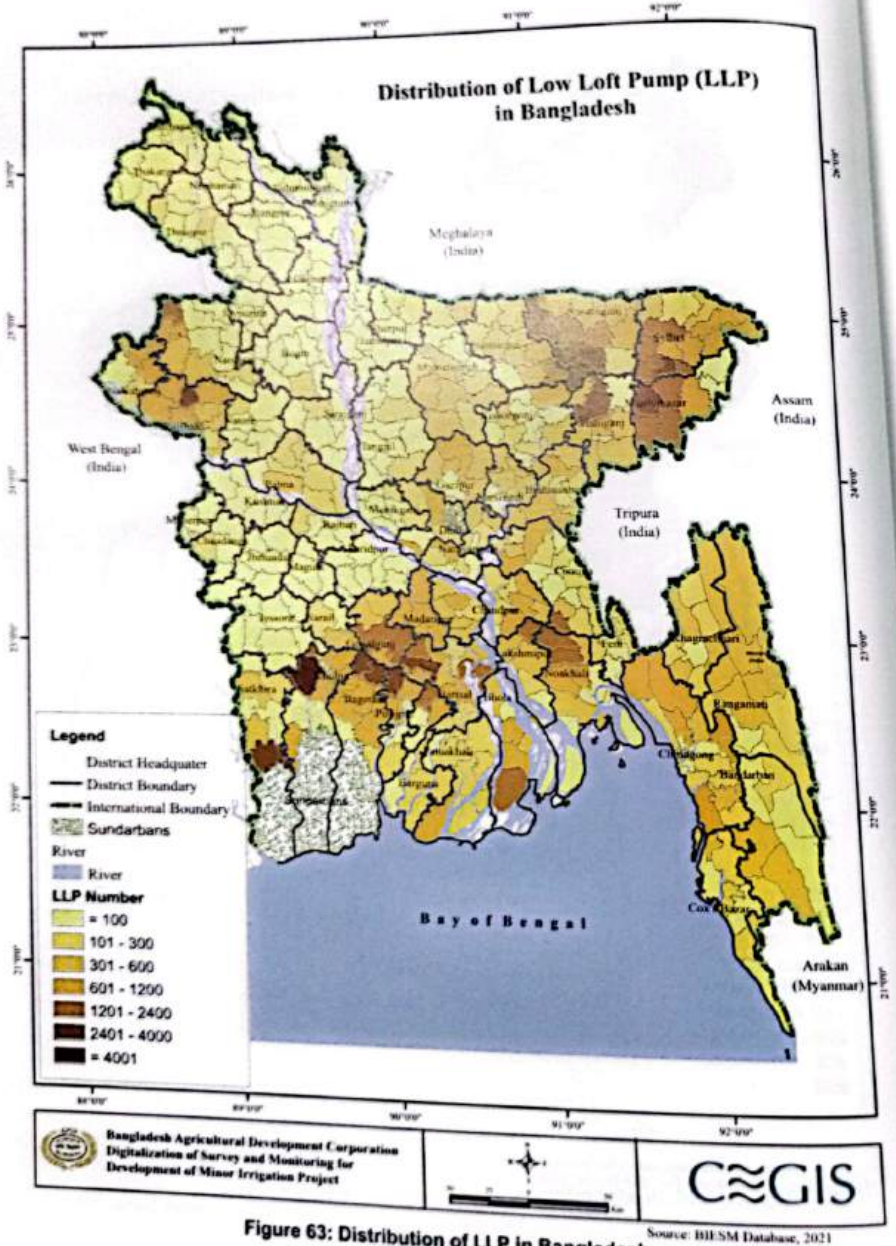
Source: BIESM Database, 2021

Figure 61: Distribution of DTW in Bangladesh



Source: BIESM Database, 2021

Figure 62: Distribution of STW in Bangladesh



Source: BIESM Database, 2021

Figure 63: Distribution of LLP in Bangladesh

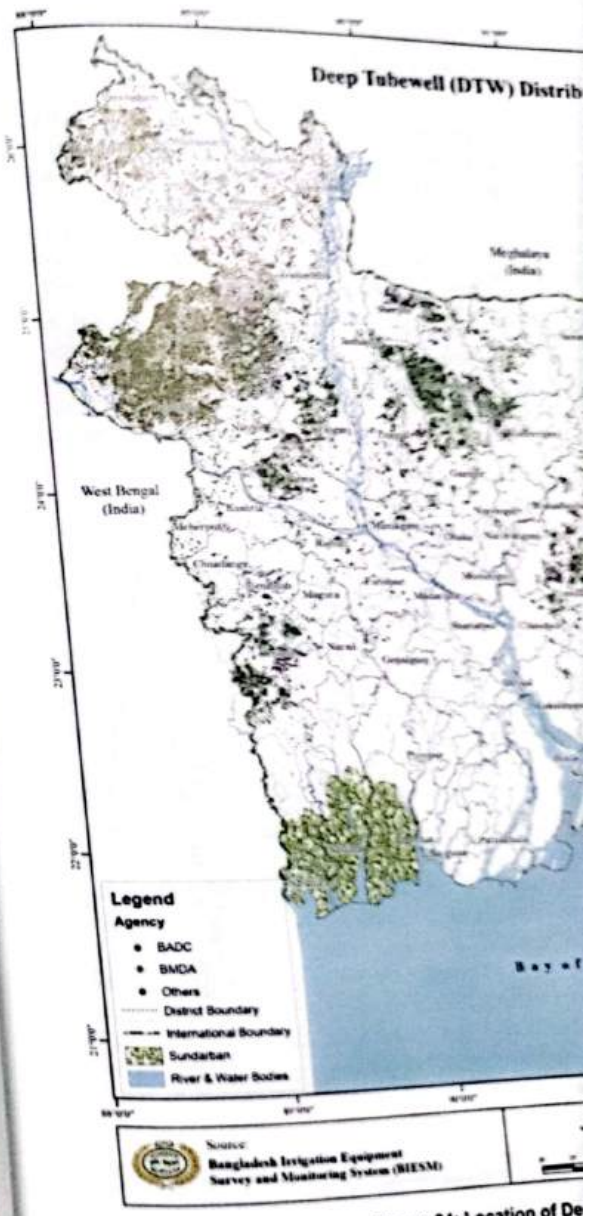
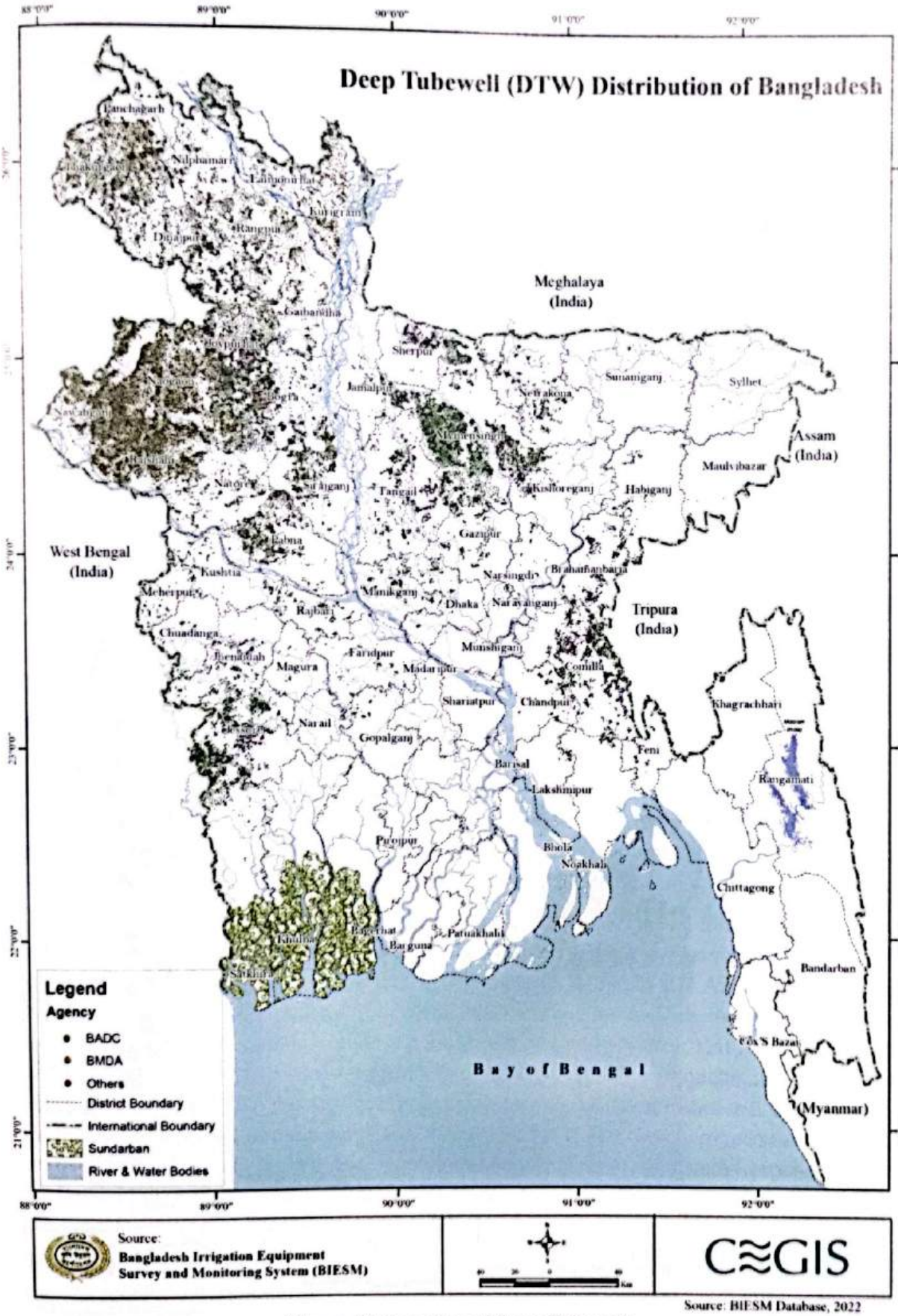


Figure 64: Location of De



Source: BIESM Database, 2022

Figure 64: Location of Deep Tubewell

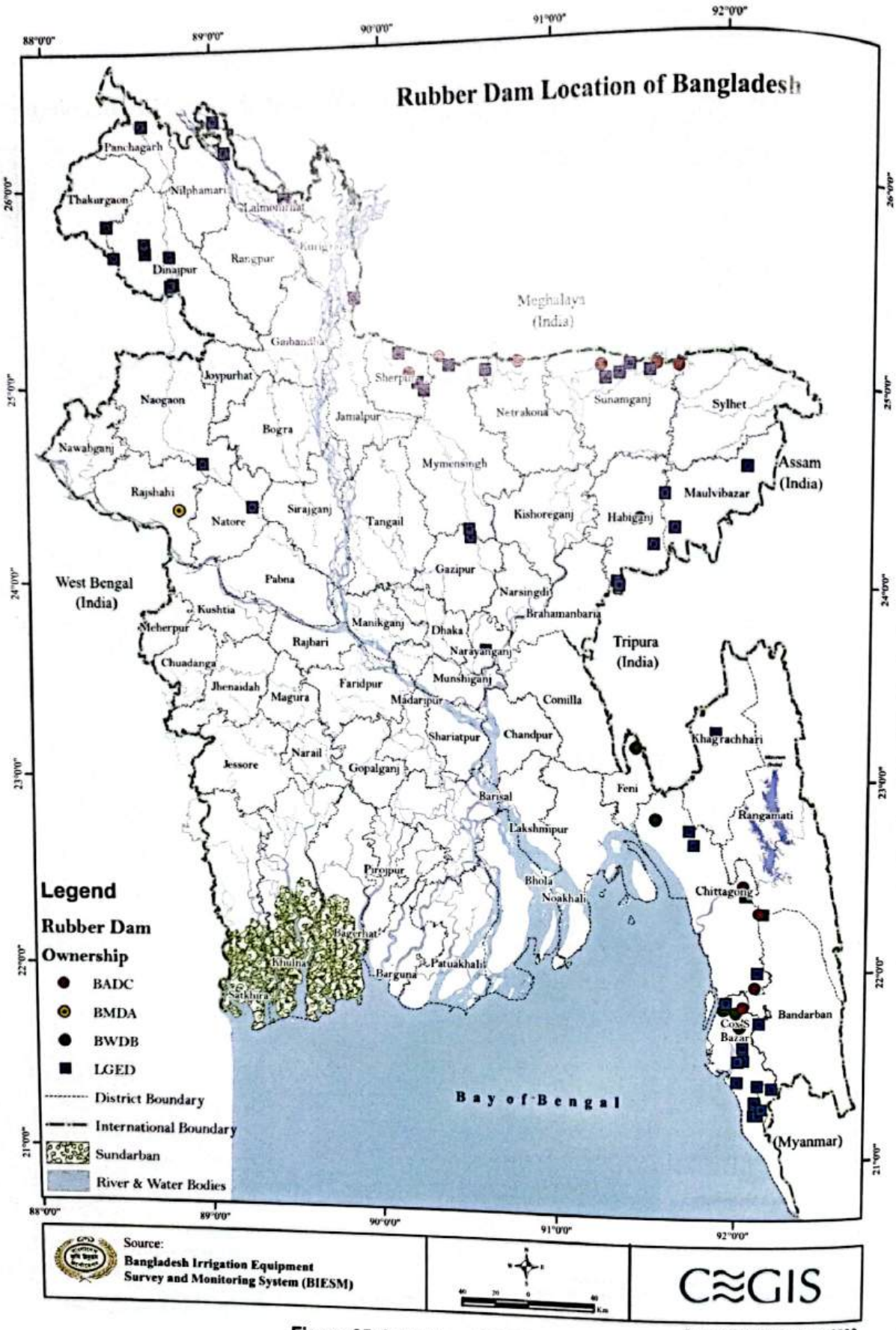


Figure 65: Location of Rubber Dam

Source: BIESM Database, 2022

Study on Survey of Minor Irrigation Equipment, Area, Preparation of Data Base and Development of Software

BADC has been implementing survey and monitoring activities such as irrigation equipment, irrigated area, irrigation cost and crop production cost, source of power, pump capacity, benefitted farmers etc. in all over the country since 1999. The Survey was conducted through appointing enumerators and field employees of BADC, BMDA and DAE. Based on these collected data Annual Survey Report has been published during last two decades to provide technical assistance and suggestions to the government and policymakers for formulation of Minor Irrigation Policy.

In the era of Digitalization in processing and preserving or storing the above collected information's/data, it is essential to create a database and to develop a web base software for survey and monitoring of Minor Irrigation activities, cardinal information are needed like Table, Graphs, Maps, GIS database etc. so it is important to prepare GIS database including Maps and 3D geometrical Maps for surface water and ground water too.

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 16 lac 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.

In first phase, 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 (e.g. some remote area DTW data was not been added). 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.

The 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 66. The database has four major modules that are presented in Figure 67. 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 68). Data was collected by 49 columns questionnaire to gather all the information related to irrigation and every specific equipment (Figure 69). A glimpse of the analysis capacity of the software is presented in Figure 70. Some unique features are added to this software. These are- i) irrigation equipment data could be visible with its picture and brief information (Figure 71), ii) Overall irrigation equipment and related information could be viewed even at union level (Figure 72), iii) distance between the equipment is being measured (Figure 73).

From this year's database update some new features have been introduced. 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) remote area's DTW information is incorporated etc.

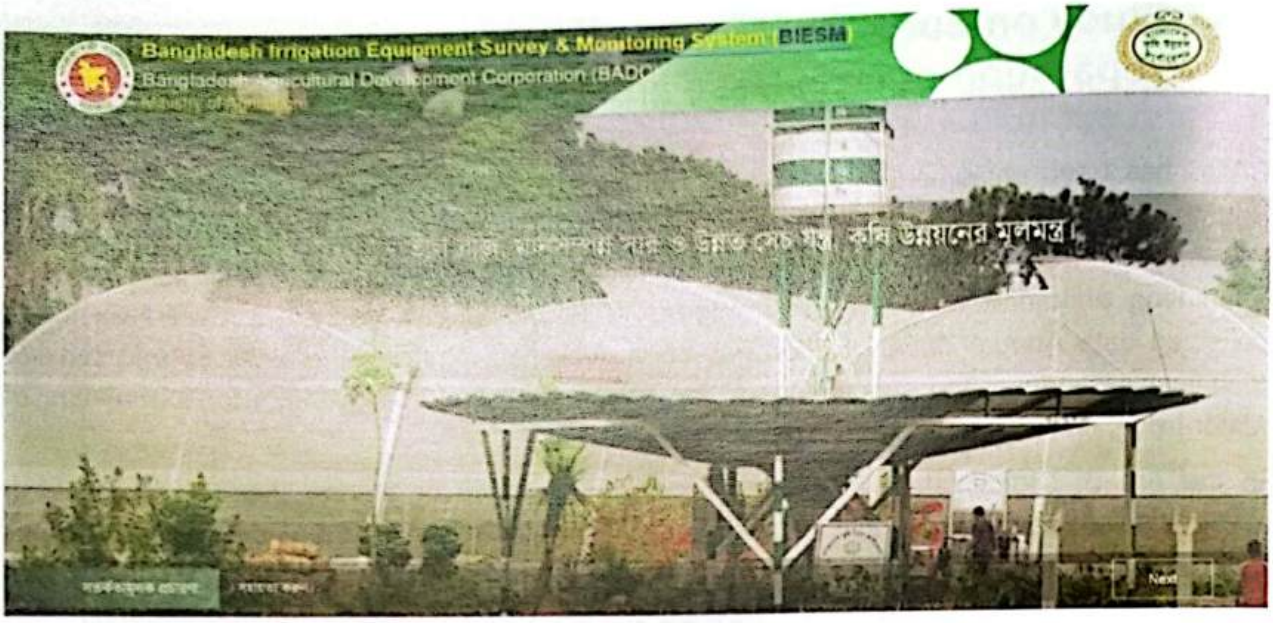


Figure 66: Homepage of BIESM software

Figure 67: Modules of the BIESM software

Figure 68: Information of software at a glance

Figure 69: Data entry form for BIESM software

Figure 70: Brief Data analysis capacity of BIESM software

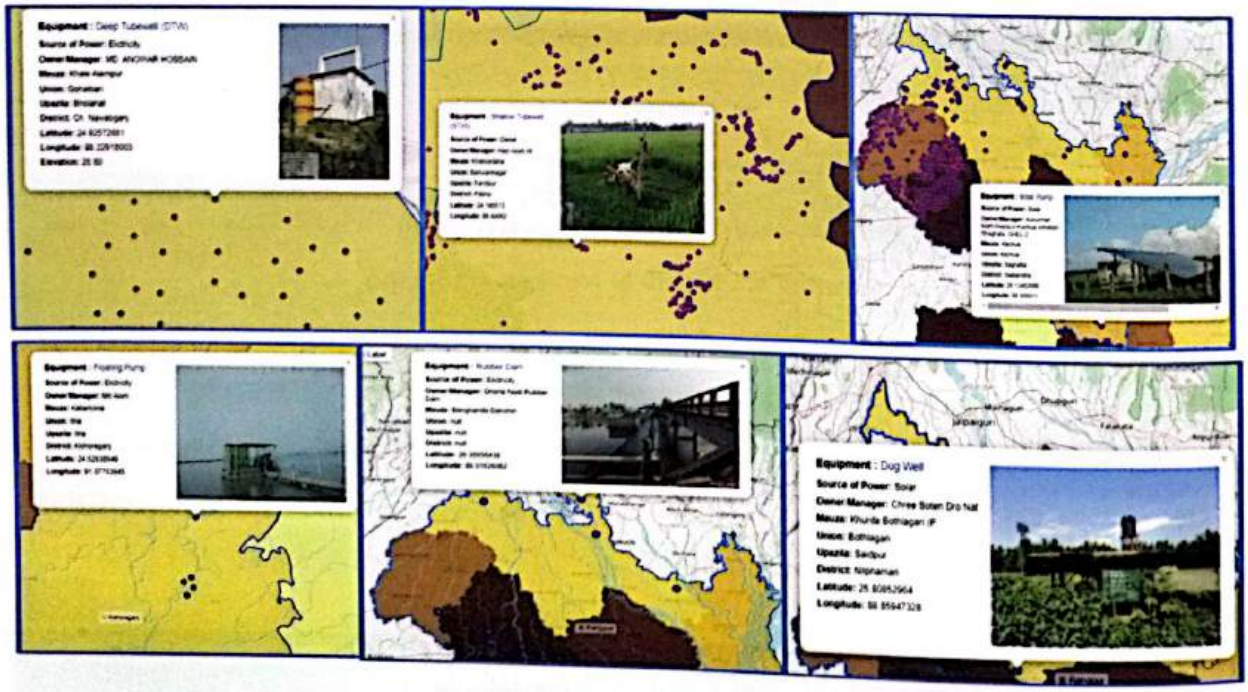


Figure 71: Location information extracted from BIESM software

Union Wise Survey Information

data source

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

Equipment Name	Equipment (Count)	Irrigated Area (Acre)								Irrigation Cost (Tk/Acre)						Benefi Farm (Cou
		Boro	Wheat	Potato	Maize	Mustard	Veg (W)	Other[4]	Total	Boro	Wheat	Potato	Maize	Veg (W)	Other[4]	
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.
All Equipments	646	3,370.73	965.55	1,539.76	425.84	14.00	629.62	243.52	7,189.02	7,297.55	491.70	634.35	474.77	537.16	573.22	7,

Close

Figure 72: Union level data extracted from BIESM software

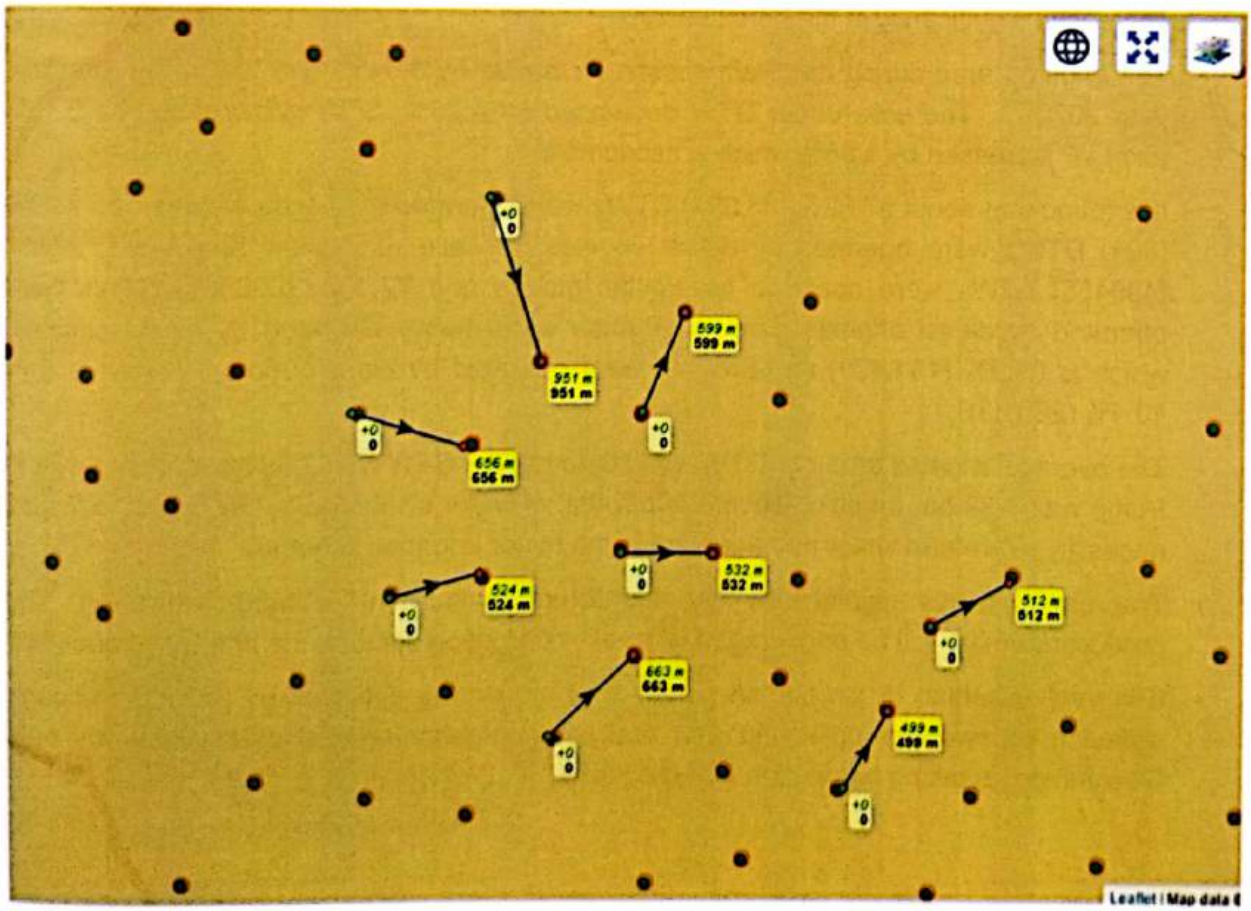


Figure 73: Distance measurement between irrigation equipment from BIESM software

Findings of the Survey

The main objective of this survey was to find out the number of operated different irrigation equipment, area irrigated and beneficiaries. BADC, DAE, BMDA and CEGIS-appointed field staffs are collected the above irrigation equipment information. We know that, the accurate area calculation was quite difficult, because there was no specific method to calculate the area. So, the information was collected from the statement of the equipment's owners and consultation with beneficiary farmers. It is mentioned that the irrigated area per equipment may vary from location to location as well as farmer to farmer.

The main findings of this survey report are:

- During the irrigation season 2021-22, the operation of deep tube wells decreased by 8.28%, shallow tube wells increased by 4.28 % and low lift pumps increased by 0.40% which is very significant in comparison with the previous year.
- In the 2021-22 Rabi season, total irrigated area was 5.69 million ha, of which groundwater irrigation covered 4.12 million ha, 72.5% of the total irrigated area; while surface water irrigation covered 1.57 million ha and 27.5% of total irrigated area. To compare with the previous year which is indicates that using of groundwater in irrigation activities is decreased significantly in the boro season.
- The irrigated area during this Rabi season increased by 0.64% than that of the previous year 2020-21. The area under DTW decreased by 4.36%, STW is increased by 2.13% and LLP increased by 1.86% which is acceptable.
- It is found that about 97.62% (33,092) DTWs were operated by electric motors and 2.38% (804) DTWs were operated by diesel engines. In case of shallow tube wells, 27.9% (409455) STWs were operated by electric motors and 72.1% (1060525) STWs were operated by diesel engines. Low Lift Pumps were mainly operated by diesel engines, which is 89.9% (184,429) and the rest were operated by electric motors, which is only 10.1% (20,783).
- The average irrigated area per DTW was 30.63 ha, per STW was 2.09 ha and per Low Lift Pump was 6.39 ha. Irrigation coverage per unit of water discharge is low, which indicates necessity of on-farm water management in the minor irrigation scheme.
- The price of rice significantly impacts future investment in boro cultivation. The producer/farmers will be encouraged to invest in irrigation sector if the boro price goes up.
- It is very essential to strengthen survey and monitoring activities by providing enough skilled manpower for collecting and analyzing irrigation-related data which will help Government in taking future plan and program.

Organization Wise Summary of Irrigation Equipment Used, Area Irrigated and Benefited Farmers
Rabi Crops (Boro, Wheat, Potato, Maize, Onion and Vegetables) 2021-22

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	629	10517	11146	330099	1198842	342	9477	27105	11488	339576	1225947
	BMDA	907	14589	15496	510748	1062456	0	0	0	15496	510748	1062456
	Others	315	6125	6440	178208	679610	462	9581	43794	6912	187789	723404
	Total	1851	31231	33082	1019055	2940908	804	19058	70899	33896	1038113	3011807
STW	BADC	15	171	186	776	2524	11	55	296	197	831	2820
	BMDA	0	0	0	0	0	0	0	0	0	0	0
	Others	33821	375448	409269	1093284	3612636	1060514	1976040	9394453	1469783	3069324	13007089
	Total	33836	375619	409455	1094060	3615160	1060525	1976095	9394749	1469980	3070155	13009909
LLP	BADC	288	2949	3237	79306	195806	5794	143941	263807	9031	223247	459613
	BMDA	29	578	607	18324	46859	0	0	0	607	18324	46859
	Others	3214	13725	16939	188204	581044	178635	881142	2547051	195574	1069346	3128095
	Total	3531	17252	20783	285834	823709	184429	1025083	2810858	205212	1310917	3634567
DTW +STW +LLP		39218	424102	463320	2398949	7379777	1245758	3020236	12276506	1709088	5419185	19656283
Manual & Artesian Well		0	0	0	0	0	0	0	0	0	6552	28582
Traditional Method		0	0	0	0	0	0	0	0	0	5824	21672
Gravity Flow		0	0	0	0	0	0	0	0	0	247636	275733
Solar Pump		0	0	0	0	0	0	0	0	2872	9939	45236
Dug Well		0	0	0	0	0	0	0	0	555	444	2135
COUNTRY TOTAL		39218	424102	463320	2398949	7379777	1245758	3020236	12276506	1712515	5689580	20029641

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ANNEXURE-A

DIVISION WISE DATA ON IRRIGATION SURVEY-2021-22

DIVISION WISE IRRIGATION EQUIPMENT USED AND TOTAL AREA IRRIGATED

(IncludingSolar Pump, Dug Well, Gravity flow, Artisian Wells, Manual, & Traditional Methods)

Sl No.	Division	Total Area (ha)	Net Cultivated Area (ha)	Deep Tube Well				Shallow Tube Well				Low Lift Pump				Total Area irrigated by DTW, STW & LLP (8+12+16)	Solar Pump		Dug Well		Area irrigated by Manual Artisian 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)
				Nos			Area irrigated (ha)	Nos			Area irrigated (ha)	Nos			Area irrigated (ha)		Nos	Area Irrigated (ha)	Nos	Area Irrigated (ha)				
				Elec	Diesel	Total		Elec	Diesel	Total		Elec	Diesel	Total										
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	1203535	2032	102	2134	54809	74277	121224	195501	428064	4053	21753	25806	218175	701048	53	184	15	12	1119	1492	15989	719844
2	Mymensingh	1066753	734912	3921	232	4153	136295	68229	114984	183213	358156	1934	10399	12333	107705	602156	30	102	38	30	305	580	19782	622955
3	Rajshahi	1815424	1319278	15156	199	15355	496845	85569	224197	309766	641532	2268	10058	12326	75806	1214183	914	3022	340	272	230	80	2047	1219834
4	Rangpur	1618340	1233888	7438	25	7463	228506	97817	295610	393427	793378	988	1313	2301	24636	1046520	1234	4318	85	68	200	250	14770	1066126
5	Chittagong	3390866	1086988	1696	53	1749	47830	34443	43767	78210	213121	7484	39108	46592	318622	579573	78	271	28	22	810	1535	68632	650843
6	Khulna	2228607	1067562	2695	174	2869	68665	40043	241562	281605	541581	1037	34944	35981	138812	749058	502	1788	15	12	753	737	49356	801704
7	Sylhet	1263431	732481	154	19	173	5163	8943	19156	28099	93899	1764	41853	43617	251026	350088	20	110	14	11	2432	760	74785	428186
8	Barisal	1322919	747860	0	0	0	0	134	25	159	424	1255	25001	26256	176135	176559	41	144	20	16	703	390	2275	180087
Country Total		**14756885**	**8126504**	**33092**	**804**	**33896**	**1038113**	**409455**	**1060525**	**1469980**	**3070155**	**20783**	**184429**	**205212**	**1310917**	**5419185**	**2872**	**9939**	**555**	**444**	**6552**	**5824**	**247636**	**5689580**

DIVISION WISE IRRIGATION EQUIPMENT USED AND TOTAL AREA IRRIGATED

Sl No.	Division	Deep Tube Well						Shallow Tube Well						Low Lift Pump						Solar Pump		DTW+STW+LLP+Solar Pump					
		Elec		Diesel		Total		Elec		Diesel		Total		Elec		Diesel		Total		Total		Elect. Total		Diesel Total		Grand Total	
		Nos	Area	Nos	Area	Nos	Area	Nos	Area	Nos	Area	Nos	Area	Nos	Area	Nos	Area	Nos	Area	Nos	Area	Elec. Nos	Elec. Area	Dies. Nos	Dies. Area	Total Nos	Total Area
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	26	27	28
1	Dhaka	2032	52436	102	2373	2134	54809	74277	195171	121224	232893	195501	428064	4053	61603	21753	156572	25806	218175	53	184	80415	309394	143079	391838	223494	701232
2	Mymensingh	3921	129973	232	6322	4153	136295	68229	149364	114984	208792	183213	358156	1934	24851	10399	82854	12333	107705	30	102	74114	304290	125615	297968	199729	602258
3	Rajshahi	15156	492782	199	4063	15355	496845	85569	236996	224197	404536	309766	641532	2268	29680	10058	46126	12326	75806	914	3022	103907	762480	234454	454725	338361	1217205
4	Rangpur	7438	228050	25	456	7463	228506	97817	226761	295610	566617	393427	793378	988	16004	1313	8632	2301	24636	1234	4318	107477	475133	296948	575705	404425	1050838
5	Chittagong	1696	46769	53	1061	1749	47830	34443	122465	43767	90656	78210	213121	7484	96127	39108	222495	46592	318622	78	271	43701	265632	82928	314212	126629	579844
6	Khulna	2695	64407	174	4258	2869	68665	40043	129931	241562	411650	281605	541581	1037	13050	34944	125762	35981	138812	502	1788	44277	209176	276680	541670	320957	750846
7	Sylhet	154	4638	19	525	173	5163	8943	33033	19156	60866	28099	93899	1764	25155	41853	225871	43617	251026	20	110	10881	62936	61028	287262	71909	350198
8	Barisal	0	0	0	0	0	0	134	339	25	85	159	424	1255	19364	25001	156771	26256	176135	41	144	1430	19847	25026	156856	26456	176703
Country Total		33092	1019055	804	19058	33896	1038113	409455	1094060	1060525	1976095	1469980	3070155	20783	285834	184429	1025083	205212	1310917	2872	9939	466202	2408888	1245758	3020236	1711960	5429124

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
1	Dhaka	BADC	73	1396	1469	37953	143413	31	674	2390	1500	38627	145803
		Others	98	465	563	14483	73098	71	1699	8600	634	16182	81698
		Total	**171**	**1861**	**2032**	**52436**	**216511**	**102**	**2373**	**10990**	**2134**	**54809**	**227501**
2	Mymensingh	BADC	276	3155	3431	117180	435957	154	4486	11853	3585	121666	447810
		Others	56	434	490	12793	58035	78	1836	6960	568	14629	64995
		Total	**332**	**3589**	**3921**	**129973**	**493992**	**232**	**6322**	**18813**	**4153**	**136295**	**512805**
3	Rajshahi	BADC	128	2247	2375	72329	245612	0	0	0	2375	72329	245612
		BMDA	528	9400	9928	332180	684620	0	0	0	9928	332180	684620
		Others	98	2745	2853	88273	305381	199	4063	22442	3052	92336	327823
		Total	**754**	**14392**	**15156**	**492782**	**1235613**	**199**	**4063**	**22442**	**15355**	**496845**	**1258055**
4	Rangpur	BADC	78	645	723	18540	61009	3	56	220	726	18596	61229
		BMDA	379	5189	5568	178568	377836	0	0	0	5568	178568	377836
		Others	38	1109	1147	30942	115136	22	400	1148	1169	31342	116284
		Total	**495**	**6943**	**7438**	**228050**	**553981**	**25**	**456**	**1368**	**7463**	**228506**	**555349**
5	Chittagong	BADC	32	1181	1213	34562	140335	26	658	2331	1239	35220	142666
		Others	8	475	483	12207	59937	27	403	1092	510	12610	61029
		Total	**40**	**1656**	**1696**	**46769**	**200272**	**53**	**1061**	**3423**	**1749**	**47830**	**203695**
6	Khulna	BADC	38	1765	1803	45578	158018	121	3376	9441	1924	48954	167459
		Other	17	875	892	18829	65137	53	882	2812	945	19711	67949
		Total	**55**	**2640**	**2695**	**64407**	**223155**	**174**	**4258**	**12253**	**2869**	**68665**	**235408**
7	Sylhet	BADC	4	128	132	3957	14498	7	227	870	139	4184	15368
		Others	0	22	22	681	2886	12	298	740	34	979	3626
		Total	**4**	**150**	**154**	**4638**	**17384**	**19**	**525**	**1610**	**173**	**5163**	**18994**
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
		Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Country Total		BADC	**629**	**10517**	**11146**	**330099**	**1198842**	**342**	**9477**	**27105**	**11488**	**339576**	**1225947**
		BMDA	**907**	**14589**	**15496**	**510748**	**1062456**	**0**	**0**	**0**	**15496**	**510748**	**1062456**
		Others	**315**	**6125**	**6450**	**178208**	**679610**	**462**	**9581**	**43794**	**6912**	**187789**	**723404**
		Total	**1851**	**31231**	**33092**	**1019055**	**2940908**	**804**	**19058**	**70899**	**33896**	**1038113**	**3011807**

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	
		Others	6549	67728	74277	195171	660264	121224	232893	830353	195501	428064	1490617	
		Total	**6549**	**67728**	**74277**	**195171**	**660264**	**121224**	**232893**	**830353**	**195501**	**428064**	**1490617**	
2	Mymensingh	BADC	2	0	2	12	0	0	0	0	2	12	0	
		Others	6153	62074	68227	149352	490293	114984	208792	1105599	183211	358144	1595892	
		Total	**6155**	**62074**	**68229**	**149364**	**490293**	**114984**	**208792**	**1105599**	**183213**	**358156**	**1595892**	
3	Rajshahi	BADC	2	1	3	15	34	1	5	10	4	20	44	
		BMDA	0	0	0	0	0	0	0	0	0	0	0	
		Others	2021	83545	85566	236981	728152	224196	404531	2055784	309762	641512	2783936	
		Total	**2023**	**83546**	**85569**	**236996**	**728186**	**224197**	**404536**	**2055794**	**309766**	**641532**	**2783980**	
4	Rangpur	BADC	11	164	175	714	2387	10	50	286	185	764	2673	
		BMDA	0	0	0	0	0	0	0	0	0	0	0	
		Others	16862	80780	97642	226047	809157	295600	566567	2612289	393242	792614	3421446	
		Total	**16873**	**80944**	**97817**	**226761**	**811544**	**295610**	**566617**	**2612575**	**393427**	**793378**	**3424119**	
5	Chittagong	BADC	0	2	2	8	15	0	0	0	2	8	15	
		Others	206	34235	34441	122457	382109	43767	90656	404989	78208	213113	787098	
		Total	**206**	**34237**	**34443**	**122465**	**382124**	**43767**	**90656**	**404989**	**78210**	**213121**	**787113**	
6	Khulna	BADC	0	2	2	13	30	0	0	0	2	13	30	
		Others	1306	38735	40041	129918	427746	241562	411650	2147426	281603	541568	2575172	
		Total	**1306**	**38737**	**40043**	**129931**	**427776**	**241562**	**411650**	**2147426**	**281605**	**541581**	**2575202**	
7	Sylhet	BADC	0	2	2	14	33	0	0	0	2	14	33	
		Others	693	8248	8941	33019	113858	19156	60866	237424	28097	93885	351282	
		Total	**693**	**8250**	**8943**	**33033**	**113891**	**19156**	**60866**	**237424**	**28099**	**93899**	**351315**	
8	Barisal	BADC	0	0	0	0	0	0	0	0	0	0	0	
		Others	31	103	134	339	1057	25	85	589	159	424	1646	
		Total	**31**	**103**	**134**	**339**	**1057**	**25**	**85**	**589**	**159**	**424**	**1646**	
Country Total		BADC	**13**	**171**	**184**	**764**	**2499**	**11**	**55**	**296**	**195**	**819**	**2795**	
		BMDA	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
		Others	**33821**	**375448**	**409269**	**1093284**	**3612636**	**1060514**	**1976040**	**9394453**	**1469783**	**3069324**	**13007089**	
		Total	**33834**	**375619**	**409453**	**1094048**	**3615135**	**1060525**	**1976095**	**9394749**	**1469978**	**3070143**	**13009884**	

Division Wise Irrigation Equipment used, Area Irrigated and Benefitted Farmer

(Area in Hectare)

LLP

SL NO	DIVISION	Organization	LOW LIFT PUMP OPERATED BY ELECTRICITY AND DIESEL											
			LLP Operated by Electricity					LLPOperated by Diesel			Total			
			PDB	REB	Total	Area	Farmers	Unit	Area	Farmers	Unit	Area	Farmers	
1	Dhaka	BADC	85	935	1020	25784	64834	1914	47672	99804	2934	73456	164638	
		Others	518	2515	3033	35819	112304	19839	108900	350480	22872	144719	462784	
		Total	**603**	**3450**	**4053**	**61603**	**177138**	**21753**	**156572**	**450284**	**25806**	**218175**	**627422**	
2	Mymensingh	BADC	32	378	410	9594	22294	1195	22744	49149	1605	32338	71443	
		Others	343	1181	1524	15257	47259	9204	60110	192501	10728	75367	239760	
		Total	**375**	**1559**	**1934**	**24851**	**69553**	**10399**	**82854**	**241650**	**12333**	**107705**	**311203**	
3	Rajshahi	BADC	0	80	80	1844	4976	30	353	1034	110	2197	6010	
		BMDA	14	370	384	11350	26602	0	0	0	384	11350	26602	
		Others	379	1425	1804	16486	48959	10028	45773	119140	11832	62259	168099	
		Total	**393**	**1875**	**2268**	**29680**	**80537**	**10058**	**46126**	**120174**	**12326**	**75806**	**200711**	
4	Rangpur	BADC	44	80	124	3058	7442	106	1378	3021	230	4436	10463	
		BMDA	15	208	223	6974	20257	0	0	0	223	6974	20257	
		Others	165	476	641	5972	16031	1207	7254	16723	1848	13226	32754	
		Total	**224**	**764**	**988**	**16004**	**43730**	**1313**	**8632**	**19744**	**2301**	**24636**	**63474**	
5	Chittagong	BADC	11	563	574	12840	32444	1473	42948	69623	2047	55788	102067	
		Others	852	6058	6910	83287	264077	37635	179547	761600	44545	262834	1025677	
		Total	**863**	**6621**	**7484**	**96127**	**296521**	**39108**	**222495**	**831223**	**46592**	**318622**	**1127744**	
6	Khulna	BADC	33	198	231	5012	11551	124	3113	4470	355	8125	16021	
		Others	248	558	806	8038	24526	34820	122649	276940	35626	130687	301466	
		Total	**281**	**756**	**1037**	**13050**	**36077**	**34944**	**125762**	**281410**	**35981**	**138812**	**317487**	
7	Sylhet	BADC	31	427	458	10738	26406	351	12349	18101	809	23087	44507	
		Others	214	1092	1306	14417	41946	41502	213522	469418	42808	227939	511364	
		Total	**245**	**1519**	**1764**	**25155**	**68352**	**41853**	**225871**	**487519**	**43617**	**251026**	**555871**	
8	Barisal	BADC	52	288	340	10436	25859	601	13384	18605	941	23820	44464	
		Others	495	420	915	8928	25942	24400	143387	360249	25315	152315	386191	
		Total	**547**	**708**	**1255**	**19364**	**51801**	**25001**	**156771**	**378854**	**26256**	**176135**	**430655**	
Country Total		BADC	**288**	**2949**	**3237**	**79306**	**195806**	**5794**	**143941**	**263807**	**9031**	**223247**	**459613**	
		BMDA	**29**	**578**	**607**	**18324**	**46859**	**0**	**0**	**0**	**607**	**18324**	**46859**	
		Others	**3214**	**13725**	**16939**	**188204**	**581044**	**178635**	**881142**	**2547051**	**195574**	**1069346**	**3128095**	
		Total	**3531**	**17252**	**20783**	**285834**	**823709**	**184429**	**1025083**	**2810858**	**205212**	**1310917**	**3634567**	