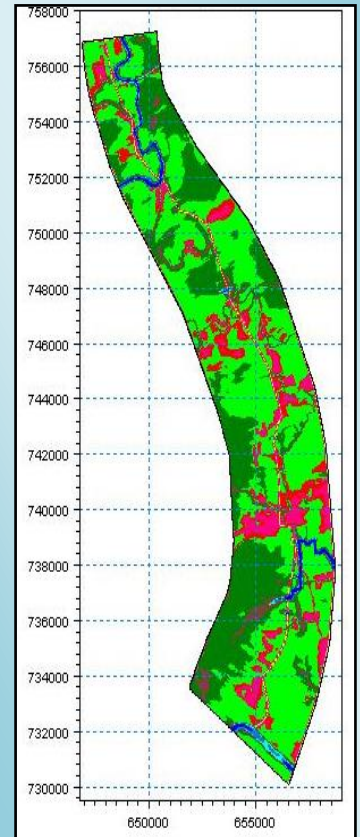


# Annual Report



**2015 –2016**

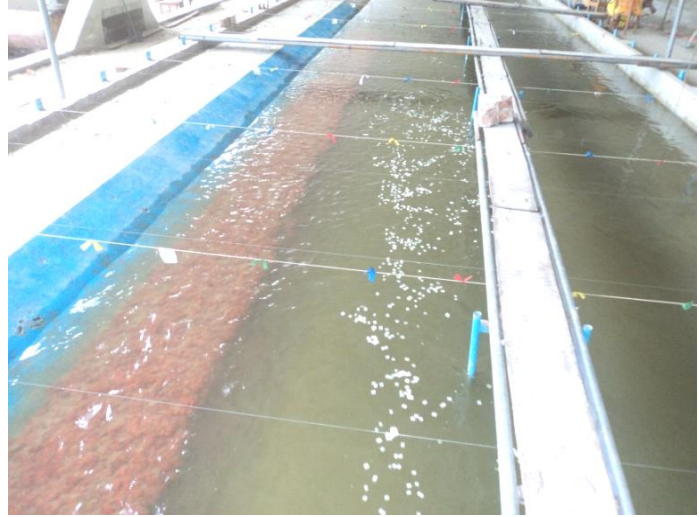
**Serial No. 43/15-16**



**J U L Y 2015 - J U N E 2016**



**RIVER RESEARCH INSTITUTE, FARIDPUR**  
**Ministry of Water Resources**  
**Government of the People's Republic of Bangladesh**



# Annual Report

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**Serial No. 43/15-16**

**JULY 2015 - JUNE 2016**

**Published in February 2017**

**RIVER RESEARCH INSTITUTE**  
**Faridpur, Bangladesh**

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RRI, Faridpur.

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**Faridpur, Bangladesh.**

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RRI, Faridpur.

**Advisor**

**RIVER RESEARCH INSTITUTE**  
**Faridpur, Bangladesh.**

## Editorial Note

The annual report is a reflection of all activities of a financial year of an institute or organization. This reflection is focused on every fiscal year in River Research Institute (RRI) as a report through Editorial Committee. The Editorial Committee prepared of this report based on the annual activities carried out by different directorates of River Research Institute during the fiscal year 2015-16 and presented briefly in this report. It includes the findings of physical and mathematical model studies, testing of various engineering properties of soil, concrete, water quality, sediment samples etc. This report also contains the research and development activities, staff development, financial management, projects with revenue received, future trend etc. which will assist to provide information available to the organization and individuals working in the water sector.

The Editorial Committee desires to express the pleasant thanks to Chief Advisor Dr. Engr. Md. Lutfor Rahman, Director General (in-charge) of RRI for his valuable direction, suggestion, assistance and back-up in publishing this annual report.

The committee earnestly recognizes the guidance made by the advisors Mr. Arun Chandra Mahottam, Director, Administration & Finance, Mr. Engr. Swapan Kumar Das, Director, (Add. charge), Geotechnical Research and Mr. Pintu Kanungoe, Chief Scientific Officer for the editing and improvement of this annual report.

The committee is also grateful to the relevant personnel who extended their efforts and co-operation in preparing & publishing this report in time. Any valuable comments and suggestions regarding improvement of this report from concerned person will be highly acknowledged.

**Uma Saha**  
Convener  
&  
Principal Scientific Officer  
RRI, Faridpur.

**Engr. Md. Alauddin Hossain**  
Executive Editor  
&  
Principal Scientific Officer  
RRI, Faridpur.



## Message from the Director General

River Research Institute (RRI) is a statutory public organization. It is working under the Ministry of Water Resources, Government of the People's Republic of Bangladesh. It keeps its efforts with necessary support through finding out design parameters of different hydraulic structures in water resources and other sectors. During 2015-2016, the activities of RRI were as usual as physical & mathematical model studies, determination of soil parameters, testing & quality control of construction materials, analysis of water, suspended sediment & bed material, completion of research & development project and other scheduled works.

A numerical model study entitled "Hydrological and Morphological Study for construction of Rajapur bridge over the River Monu at 14<sup>th</sup> K.M of Kulaura- Prithimpasha-Hazipur- Sharifpur Road (Road No. Z-2822) under Road Division, Moulvibazar" is carried out during this fiscal year at RRI by Hydraulic Research directorate. Various tests are conducted on engineering properties of soil, sediment analysis of different rivers, and water quality & quality control of construction materials by Geotechnical Research Directorate of RRI.

Two important researches are carried out at RRI funded by GoB during this fiscal year at RRI. One is "Investigation on launching characteristics of different material to find out the cost-effective and sustainable solution of river bank protection" and the other is "Assessment of river pollution around Dhaka and find out the ways to alleviate pollution". At present, two important researches are being carried out at RRI funded by GoB. One is "Investigation of Hydro-morphological and Environmental status of the Karnaphuli river" which is started from 2015-16 and other is "Hydro-morphological study of the Mahananda river in Bangladesh with focus on problems and probable solutions of dry season flow scarcity".

The main activities of Administration & Finance Directorate comprise of the overall administration of RRI, accounts & audit, estate, library, public relation & photography and establishment. In addition, the activities such as operation & maintenance of official and residential buildings, water supply system & sewerage, roads, power distribution system including power generator and other activities of physical facilities are being routinely done. The revenue earned from model studies, various tests and government grant met the annual expenditures of this institute during the financial year 2015-16.

Finally, sincere and pleasurable thanks are extended to all concerned personnel, especially to the Editorial Committee who has important contribution for the publication of this annual report.

**Dr. Engr. Md. Lutfor Rahman**  
Director General (in-charge)

# BOARD OF GOVERNORS OF RRI

## (As on February 2017)

<p><b>1. Hon'ble Minister</b> Ministry of Water Resources Government of the People's Republic of Bangladesh.</p>	<p style="text-align: center;"><b>Anisul Islam Mahmud</b></p>	<p style="text-align: center;"><b>Chairman</b></p>
<p><b>2. Chairman</b> Zilla Parishad, Faridpur.</p>	<p style="text-align: center;">-</p>	<p style="text-align: center;"><b>Member</b></p>
<p><b>3. Hon'ble Member of Parliament</b> Nominated by the Government.</p>	<p style="text-align: center;"><b>Md. Abdur Rahman, MP</b> Faridpur-1.</p>	<p style="text-align: center;"><b>Member</b></p>
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<p><b>10. Director General (in-charge)</b> River Research Institute Faridpur.</p>	<p style="text-align: center;"><b>Dr. Engr. Md. Lutfor Rahman</b></p>	<p style="text-align: center;"><b>Member-Secretary</b></p>



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## 1 INTRODUCTION

### 1.1 GENERAL

River Research Institute (RRI) is a national organization in Bangladesh. It is working as a statutory public authority under the Ministry of Water Resources (MoWR), Government of the People's Republic of Bangladesh. The activities of RRI are conducted by three directorates namely, Hydraulic Research, Geotechnical Research, and Administration & Finance.

RRI is set up with a view to devising plans and actions to develop water resources in a sustainable manner to meet the development needs of Bangladesh. Since its establishment RRI has been conducting multi-disciplinary and problem oriented tests and researches in the field of River Hydraulics, Hydraulics of Structure and Irrigation, Coastal Hydraulics, Soil Mechanics, Material Testing & Quality Control, Sediment Technology, Hydro-chemistry, Geo-chemistry and Instrumentation. The results of such tests and research are playing a vital role in providing information and recommendations regarding different water resources development plans and interventions.

RRI has been conducting physical modelling in the field of water resources since its establishment. Recently RRI is also involved in mathematical modelling. Physical and mathematical modelling tools are complementary to each other. Both physical and mathematical model have been proved to be very essential for sound engineering judgments to find out solutions for different water resources development projects. In view of this RRI has adopted hybrid modelling approach by using physical as well as mathematical modelling to improve the understanding of different water systems which may lead to safe and less expensive solutions for engineering problems. RRI has the mandate for conducting hydrodynamic and morphological study of the river mainly to derive and verify the design parameters of any hydraulic structures, bank protection and river training works.

During fiscal year 2015-16, the following four studies were carried out at RRI, which first three studies has been completed and last study is going on at present fiscal year.

- **Hydrological and Morphological study for construction of Rajapur bridge over the River Monu at 14th K.M of Kulaura- Prithimpasha-Hazipur-Sharifpur Road (Road No. Z-2822) under Road Division, Moulvibazar.**
- **Investigation on launching characteristics of different materials to find out the cost-effective and sustainable solution of river bank protection.**
- **Assessment of river pollution around Dhaka and find out the ways to alleviate pollution.**
- **Investigation of Hydro-morphological and Environmental status of the Karnaphuli river**



A view of a meeting attended Mr. Anisul Islam Mahmud, Hon'ble Minister, Ministry of Water Resources and Chairman of the Board of Governors (BoG) of RRI including Senior Secretary, MoWR and DG, RRI.



A view of monthly coordination meeting showing newly appointed DG (in charge) Dr. Engr. Md. Lutfor Rahman and Administration & Finance Director Arun Chandra Mahottam (Deputy Secretary).

As per requirements of different clients, some proposals have been submitted for model studies and correspondence with the relevant organization is going on. In addition, the operation & maintenance activities of office and residential buildings, roads, rest house, vehicles, water supply system, sewerage system, power distribution system including power generator etc. are routinely done.

RRI has a Board of Governors (BoG) comprising ten members chaired by the Hon'ble Minister, MoWR, Government of the People's Republic of Bangladesh which reviews and evaluates the activities of RRI and approves important proposals so that it can run with all its activities properly. Director General is the Chief Executive of the institute and responsible for implementation of the decisions approved by the BoG.

A large number of soil, water, sediment and construction material samples are received from different projects of Bangladesh Water Development Board (BWDB) and other organizations. These samples are tested in the sophisticated laboratories of RRI as routine works of Geo-technical Research Directorate. The results and findings are sent to the concerned project authorities.

RRI has also been publishing journal named 'Technical Journal' yearly since 1991. RRI's technical journal got recognition in 2000 by ISSN - International Centre, 20, rue Bachaumont, 75002 Paris - France and its serial has been registered as ISSN 1606-9277 with key- title: Technical journal - River Research Institute, abbreviated key – title: Tech. J. - River Res. Inst. Multidisciplinary research activities and case studies of different water resources projects are published in the journal.

Qualified and trained personnel are very much essential to meet the objectives of RRI and to maintain its standard to the international level. For this purpose a number of officials have already been completed their higher studies and obtained training in the related fields at home and abroad. Many others are expected to be trained in the near future.

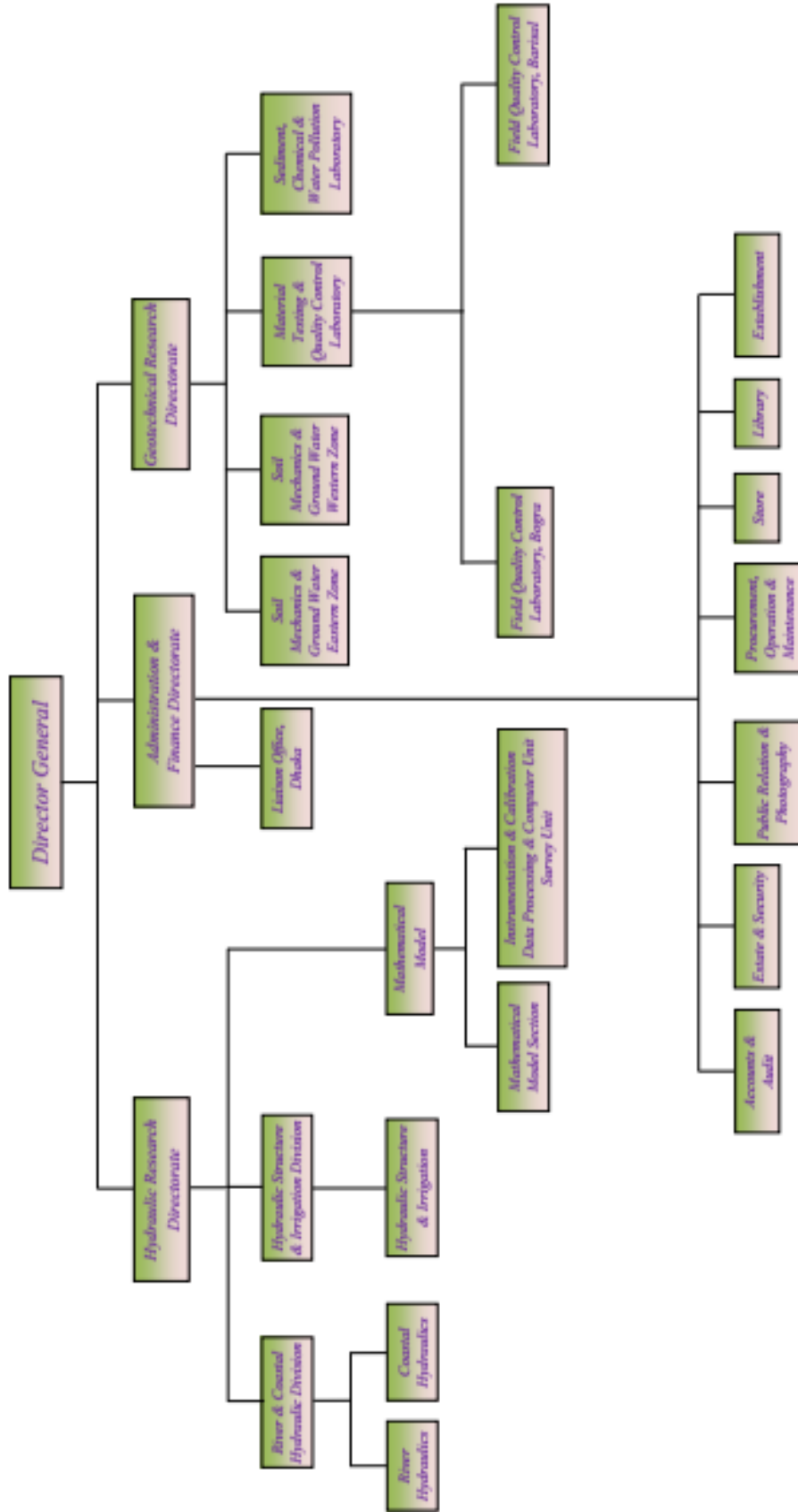
RRI has well experienced manpower in the field of hydraulic, geotechnical and environmental engineering. Detailed list of existing administrators, scientists, supporting and managerial officers is shown in Annex-I.



Mr. Md. Azam Khan, Ex-Director General (in-charge) inaugurated the Advanced Training Course on Mathematical Modelling organized by ICT Cell at RRI.



# Administrative Structure of River Research Institute



## 2 ACTIVITIES OF THE INSTITUTE

The Directorates of Hydraulic Research and Geo-technical Research execute the research activities of this institute. The Administration & Finance Directorate is accountable for the overall Administration and Financial activities of RRI and works for its development. The activities of different directorates are briefly described below:

### 2.1 HYDRAULIC RESEARCH DIRECTORATE

The Hydraulic Research Directorate has three divisions such as (i) River & Coastal Hydraulics (ii) Hydraulic Structure & Irrigation and (iii) Mathematical Model. These three divisions carry out studies and research work in the field of flood control and drainage, river training and bank protection, coastal engineering, hydraulic structure and irrigation etc. by means of physical and mathematical modelling along with other laboratory testing and studies. This directorate is well equipped with physical and mathematical modelling facilities.



#### Physical Modelling

Physical modelling is an authentic tool, which can be used confidently to verify the effectiveness of any structural intervention in the river by reproducing the natural phenomena of river hydro-morphology at a reduced scale. The causes of any river engineering problems are identified and its mitigation measures are investigated. Local scour, 3-dimensional flow phenomena like eddy and vortex, morphological processes and developments etc. are possible to reproduce well in physical model.

The important design parameters such as local scour around the structure, flow field, maximum velocity, appropriate length, spacing, location, orientation etc. of any hydraulic structures can also be obtained by physical modelling. The physical process/phenomena, which are not possible to describe well by empirical formula and mathematical expression, can be easily reproduced precisely in physical modelling. Moreover, the real phenomena that are happening in the field are only possible to visualize by physical modelling.

#### Necessity of Physical Modelling

River models are important for the prediction of future developments in river morphology and the management of the natural processes in an integrated way to the benefit of the people. Physical modelling technique is used for the solution of the problems that may occur during the ongoing construction of bridges, river training works and other hydraulic structures and also for the future maintenance of the same against the critical hydrodynamic and morphological conditions. Physical models are necessary for the following specific reasons.

- To understand the prevailing river condition
- To determine the most suitable option for river training
- To determine the effects of hydraulic structures on existing flow pattern and river morphology
- To determine the effectiveness of the proposed works
- To find out the most suitable design parameters for hydraulic structures
- To predict future changes in the river morphology
- To ensure sustainable development of water resources through detailed investigations.

### Applicable areas of Physical Modelling

- |                                     |                     |
|-------------------------------------|---------------------|
| □ River training                    | □ Bridge hydraulics |
| □ Bank protection and stabilization | □ River morphology  |
| □ Flood control                     | □ Shore protection  |
| □ Irrigation and drainage           |                     |
| □ Navigation                        |                     |

### Physical Modelling facilities at RRI

#### Indoor model Area

Dimension	:	100mx30m (effective space 70mx23m)
Pump capacity	:	800 l/s (maximum)
Sand depth in the covered shed model bed	:	0.7-0.8 m
D50 of sand	:	0.10mm

#### Outdoor model Area

Dimension	:	125mx40m (Three beds)
Tilting flume	:	23.98mx0.76m
Pumping capacity	:	800 l/s (maximum)
Sand depth in the open air model bed	:	0.5 -0.6 m
D50 of sand	:	0.15-0.18mm

Other available facilities include various measuring instruments, tide generator, wave generator, sediment feeder, power generator, workshop etc.

### Important Physical model studies conducted at RRI and achievement in the past

So far, more than two hundreds of Physical model studies of different projects have been conducted by Hydraulic Research Directorate since 1948. Some of the important Physical model studies carried out at RRI is as follows:

Name of the project	Year of completion	Objectives of the Physical modelling
Ganges barrage project	2013	To finalize the location, effectiveness and design parameters of the proposed barrage
Padma multipurpose Bridge project	2013	To check the efficacy of river training structure
3 <sup>rd</sup> Karnaphully bridge project	2006	To decide the effectiveness and design parameters of bridge piers
Gorai river restoration project	2001	To find out the suitable options for sustainable measures
Bangabandhu multipurpose bridge project	2000	To find out the efficacy of river training structure and to solve instantly arising any difficulties during the period of erection.
Paksey roadway bridge project	1996	To verify the efficacy of river training structure
Silt trap model for Teesta barrage project	1994	To finalize the effectiveness and design parameters of the barrage component

### Mathematical Modelling

At the present time, mathematical modelling tool is being widely used all over the world for research and studies in the field of water resources engineering. It has become an important tool for decision support in planning and management of water resources and sustainable water infrastructure development. In many cases mathematical modeling is complementary to physical modeling to arrive at sound engineering judgment as to planning, design and implementation of water infrastructure projects. In view of this fact, the GoB has equipped RRI with mathematical modeling facilities (MIKE Series) to enhance its quality of works. It is expected that RRI will play a vital role in water sector as well as in other related sectors to make the water resources development cost effective and sustainable. It can be mentioned here that RRI has already completed a number of mathematical model studies from 2009 to till. Recently RRI has conducted Rajapur Bridge Project over the Monu river under Moulvibazar Road Division. At present, another two mathematical model studies entitled "Topographical, Hydrological and Morphological Study using mathematical model for the proposed new Sachna-Golakpur Road under Sunamganj Road Division during the year 2015-16" and "Hydrological and Morphological Study for proposed Sonahat Bridge over the river Dudhkumar at 5th km of Bhurungamari-Sonahat-Mothergonj-Bhitorband-Nageshwari Road (Z-5624) under Kurigram Road Division" are going on at RRI as per agreement signed between RRI and RHD (Roads and Highways Department).

### Important Mathematical model studies conducted at RRI

- Detail Engineering Design of Kurigram Irrigation Project (South Unit),
- Wazed Miah Bridge project on Karatowa River



- Proposed Road Bridge of Mymensingh-Goffargaon-Toke Road in Mymensingh District
- Proposed Bridge on Kalni River under Habiganj Road Division.
- Proposed Boga Bridge project over the river Lohalia under Patuakhali Road Division.
- Pagla-Jagannathpur-Raniganj-Aushkandi Road alignment project under Sunamganj Road Division.
- Proposed Nalua-Baherchar bridge over the river Pandab-Paira under Patuakhali Road Division.

### 2.1.1 Mathematical Model Studies Conducted by Hydraulic Research Directorate

- a) **Hydrological and Morphological study for construction of Rajapur bridge over the River Monu at 14th K.M of Kulaura- Prithimpasha-Hazipur-Sharifpur Road (Road No. Z-2822) under Road Division, Moulvibazar.**

Moulvibazar Road Division is planned to construct Kulaura-Prithimpasha-Hazipur-Sharifpur road. The road is not yet constructed due to barrier of the Monu River. At present there is road connection from Kulaura to Brindaranir Dighipar Bazar to the west side of the Monu river. This road is not much away from the likely bridge location. There is also road network to the east of the proposed bridge location. Therefore, construction of a bridge over the Monu river at a suitable location will facilitate to establish uninterrupted road communication from Kulaura to Sharifpur. Establishment of this road link will be of much benefit to the people who live in the southeast part of the Kulaura upazila. The objective of this bridge is to establish a direct and shorter roadway connection of northern part of Kulaura with southern part of Kulaura. In addition, it also help to establish an easy and shorter communication of Kulaura, Juri, Barolekha, Beanibazar upazila and Sutarkandi land port with land port Chatlapur.



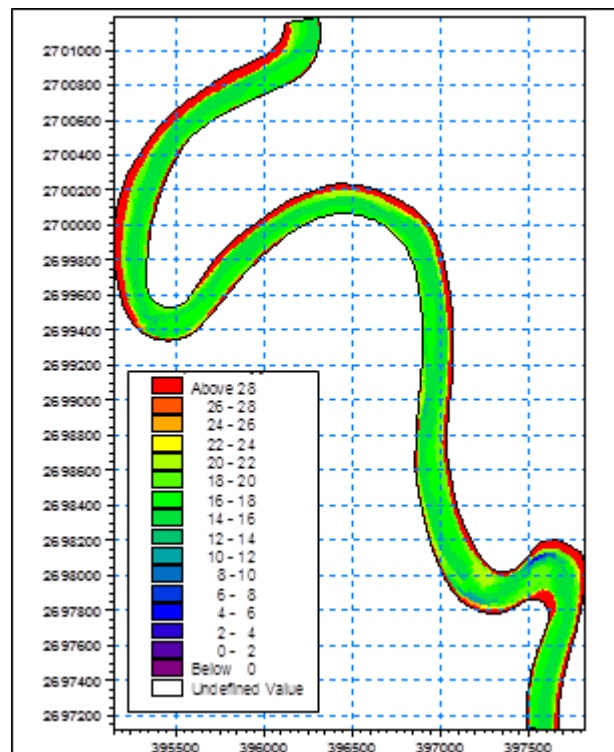
Students crossing the Monu River at Rajapur Kheya ghat

Under above situations, Roads and Highways Department commissioned River Research Institute (RRI), Faridpur to carry out study undertaken by the Road Division, RHD, Moulvibazar. Necessary hydrological, hydrographic and sediment data have been

collected through a field survey campaign. Historical hydrological data of the rivers and satellite images of the study area have been collected from WARPO, Dhaka and CEGIS, Dhaka respectively. The collected data have been processed and analyzed to the extent of deriving necessary inputs for the MIKE21C model that has been developed for hydraulic analysis of bridge and other information relevant to the proposed bridge.

The overall objective of the proposed study is to determine the suitable location of sustainable road alignment along with structures (bridges) and to provide the hydraulic design variables including the river training and protective work from hydrological and morphological considerations.

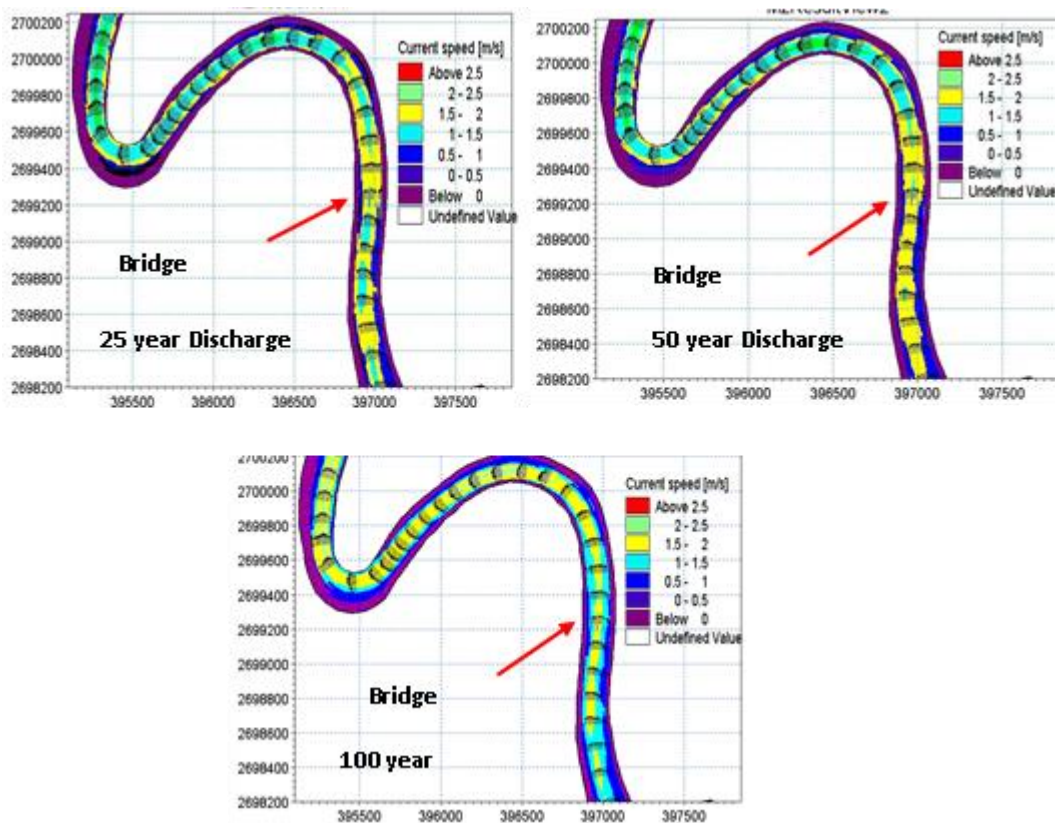
In order to conduct the study necessary hydrological data of the Monuriver, satellite image of the study area and other relevant information have been collected. A field survey campaign has been conducted to collect the recent bathymetric and bank line data and approach and access road alignment. The collected data includes historical hydrological data of the river, satellite images of the study area, sediment data, river cross-section, bank lines, topographic data of the surrounding area, water level and discharge etc. The data have been processed and analyzed to the extent of gaining understanding of the present physical conditions of the river at the bridge location and deriving information to use as model inputs. A two-dimensional model of the Monu river including the likely bridge location and river training structure have been developed using modelling software MIKE21C. The initial bathymetry of the model is formed by use of the recently surveyed bathymetric data. The initial bathymetry of the model is shown in Figure 2.1.



**Figure 2.1: Initial bathymetry of the model**

It appears from the model results that due to meandering pattern of the river, velocity distribution along the cross-section varies throughout the study reach. However, at the

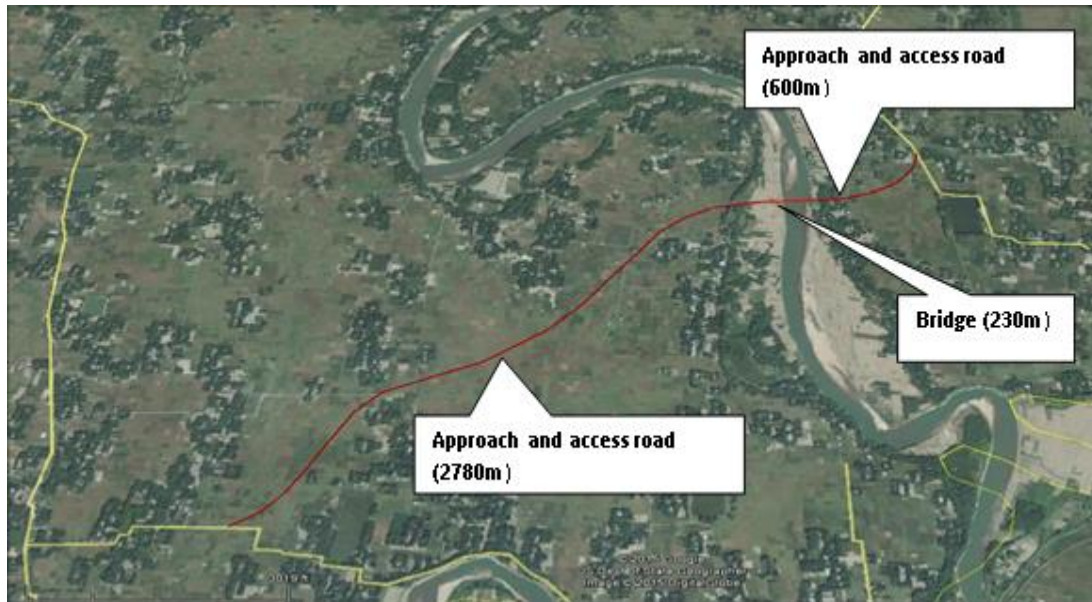
crossing location the velocity distribution along the cross-section is almost symmetrical with maximum velocity being in the middle of the river. The flow field in the study reach is shown in Figure 2.2. On the other hand, skew in the velocity distribution along the cross-section is observed at the bend locations. It means that the bend locations are more vulnerable to bank erosion compared to the crossing locations. It is to be mentioned here that the bank materials of the Monu river at the study reach do offer some resistance to bank erosion but still slow and steady bank erosion is still possible. It is very difficult to apply model simulated bank erosion in such cases to real life condition. However, fair idea of bank migration rate can be obtained by superimposing time series very fine resolution satellite images. In case of Monu river the rates of bank erosion vary widely along the river course. In the study reach, the rate of bank erosion is in the order of a few meters. At Rajapur there is a crossing between two consecutive meander bends where difference in the bed level along the cross-section is very less. River bed degradation potential at this location is also very less. Moreover, the river banks are fairly stable at this crossing.



**Figure 2.2: Velocity fields at and around the bridge for different return period discharges.**

For the above reasons and taking other relevant issues in view into account the bridge location is selected at the inflection point of two consecutive meander bends. Based on the model simulation results the design discharge for the bridge has been estimated and appropriate length of the bridge has been determined. It is found that the bridge length could be 230m. From overall considerations the minimum length of the bridge (230m) is suggested.

The bridge is then introduced in the model considering five spans and four piers. The model simulation results with different discharges show that the bridge constriction caused by the piers does not have any noticeable influence on the upstream water level compared to the base condition. The bridge also does not noticeably influence the flow pattern at the bridge location compared to the base condition. However, relatively high local velocities may occur around the piers. The bridge and approach road are shown in Figure 2.3.



**Figure 2.3: Location of approach road and access road alignments**

The river bends in the immediate upstream and downstream of the suggested bridge location is facing outer bank migration at a slow pace. There are bank protection works at some stretches. If this bend migration is prevented completely by implementing RTWs it will add to the safety of the bridge. Therefore, the bend migration situation there should be monitored closely and if necessary, the government organization concerned may be requested to take erosion protection measure at this location.

It appears from the study results that the both banks at the proposed bridge location are fairly stable. Lateral instability at the bridge location may occur only if any large scale morphological developments take place in the upstream of the bridge location (such as chute cut-off) either for natural or man-made reasons. In order to counteract bank erosion arisen out of such likely lateral instability of river the bridge should be protected by implementing bank revetment on both banks of the river. For the left and right banks the length of such protection works is 100m (75m upstream and 25m downstream of the bridge axis). There should be terminations at both ends of the bank revetment.

The abutments and slopes of the approach embankments should be protected from erosion caused by the high flow velocity during an extreme event. The length of the approach embankment to be protected from erosion is 20m.

### 2.1.2 Ongoing Model Study at RRI

#### A) Topographical, Hydrological and Morphological Study using mathematical model for the proposed new Sachna-Golakpur Road under Sunamganj Road Division

The overall objectives of the proposed study is to determine the suitable location of sustainable road alignment along with structures (bridges and culverts) and to provide the hydraulic design variables including the river training and protective work from hydrological and morphological considerations.

#### B) Hydrological and Morphological Study for proposed Sonahat Bridge over the river Dudhkumar at 5th km of Bhurungamari-Sonahat-Mothergonj-Bhitorband-Nageshwari Road (Z-5624) under Kurigram Road Division

The overall objective of the proposed study is to determine the suitable location of bridge along with alignment of approach road and to provide the hydraulic design of bridge and approach road including the river training works, if required from hydrological and morphological considerations.

#### C) Laboratory Based Study using Physical modeling on River Bank Erosion Control using Concrete Block Mats and Placed Concrete Blocks with Filter on the Arial Khan River Bank at Madaripur District

The overall objective of the study is to evaluate and determine the performance of the proposed bank protection measures compared to conventional steps.

#### D) Physical Model Investigation for the Protection of Paira Bridge over the Paira River under Patuakhali District

The objectives of the study are to evaluate and determine the performance of the sustainability of proposed Paira bridge as well as bank protection measures. Detailed analysis for the flow characteristics near Paira Bridge through upstream and downstream condition and considering hydraulic similarity in real scale model. Evaluate the scour effect and flow characteristics near the Piers and the River Training Works during construction stages as well as during the operation & maintenance phases by conducting fixed bed and mobile bed hydraulic experiments and give necessary recommendations for stability of the Piers & the River Training Works.

### 2.1.3 Proposals for Model Study

- **Hydrological and Morphological Study for Improvement of Nikli – Soharmul - Karimganj Road & Gunnodhor GC -Mojlishpure GC Road (10.46km) under Rural Infrastructures Development Project of Kishorgonj District under Local Government Engineering Department**

- ❑ **Hydrological and Morphological study for proposed Kaharol Road (Z-5007) under Dinajpur Road Division**
- ❑ **Physical model investigation for the protection of right bank of the Jamuna River from Kurnibari to Chandanbaisha at Sariakandi upazilla in Bogra District.**



Figure 2.4: A view of meeting in connection with contract agreement of Physical Model Investigation for the Protection of Right Bank of the Jamuna River from Kurnibari to Chandanbaisha at Sariakandi Upazila in Bogra District

## 2.2 GEO-TECHNICAL RESEARCH DIRECTORATE

Geo-technical Research Directorate comprises of three divisions. These are Soil Mechanics and Groundwater Eastern & Western Zone division, Material Testing & Quality Control division and Sediment, Chemical & Water pollution division. The scope of works and facilities available in each division are described in the following sections.



### 2.2.1 Soil Mechanics and Ground Water Eastern & Western Zone

Soil Mechanics & Groundwater Eastern and Western Zone of Geo-technical Research Directorate is an utmost important wing of RRI. It has been conducting tests and research work for the determination of different physical parameters of soils which are required for planning and design of the infrastructures of flood control, irrigation, drainage, water development and other water development projects. Ground Water Circle (GWC) of BWDB and other organizations explore site and complete their boring and collect soil samples from different project sites in connection with construction of hydraulic structures like bridges, dams, barrages, regulators, weirs, flood control and river training works and other relevant works. Site investigation and boring logs are prepared by them and sent to RRI with collecting samples. RRI has developed sufficient laboratory facilities for testing of soil samples received from those clients. The soil samples are tested in these zones with great care through the scientists and trained / skilled soil technicians. Finally, the reports of the tested soil samples are prepared based on field investigation and laboratory analysis data by relevant recognize conventional and formulas. The reports focus the engineering characteristics of the soil samples according to the foundation needs. Then the approved report is sent to the respective clients along with bill. The works executed in connection with soil testing, analysis and publication of reports during 2015-16 have been discussed briefly in this section.

#### Receiving Procedure of Soil Samples

The disturbed soil samples were collected in polythene bags and undisturbed soil samples in the Shelby tubes by the clients and sent to the Soil Mechanics and Groundwater Eastern & Western Zone laboratories of Geo-technical Research Directorate of RRI. The zones received in total 4571 no. of samples from GWC of BWDB and other organizations within the fiscal year 2015-16. Among them, 4565 no. of disturbed and 6 no. of undisturbed soil samples tested and reports sent to the respective clients in the fiscal year 2015-16.

#### Testing of Soil Samples

At first all the soil samples are visually inspected in the laboratory and representative samples are selected for necessary testing. Generally, tests are conducted for determining Natural Moisture Content (NMC), Grain Size Distribution, Atterberg Limits, Density ( $\gamma$ ), Void Ratio ( $e$ ), Compression Index ( $C_c$ ), Unconfined Compressive Strength ( $q_u$ ), Shear

Strength (cohesion  $c$  and angle of internal friction  $\Phi$ ), by Direct Shear, Tri-axial Shear with or without pore pressure, California Bearing Ratio (CBR) value and Permeability value etc. As per planned schedule, different tests are performed simultaneously in order to work out all necessary parameters quickly within the shortest possible time. Other necessary soil parameters are also tested according to client's requirements. Some laboratory facilities are illustrated below.



Consolidation Test Apparatus



Equipment for Hydrometer Analysis



Triaxial Shear Test Apparatus



Direct Shear Test Apparatus

### Preparation of Reports

The soil testing reports normally contain the mode of field exploration, laboratory investigation, summary of test results, range of test values, results of the different tests along with tables, curves, charts and figures which are essential part of the report. The reports are prepared, published and sent to the clients with a copy to the design office of BWDB. A copy of the report is also sent to the library of RRI for record. A total 30 no. of soil testing reports are published and sent to the respective clients during the fiscal year 2015-16. The detailed information has been tabulated in Table 2.2.1.



**Table 2.2.1: List of samples received and tested (project-wise) and billed amount executed during 2015-16 in Soil Mechanics & Ground Water Division.**

Sl. No.	Report No.	Name of Division	Name of Project	No. of Sample Received & Tested		Billed amount Taka
				5 D	6 U	
1	2	3	4	5	6	7
1	02 (2015-16)	Executive Engineer, O&M Division, BWDB, Pirojpur .	Construction of sluice at nadmula khal under CCTF Project , Pirojpur .	70	00	105580
2	03(2015-16)	Director General Bangladesh Haor development Board .	Construction of Regional office building of Haor development Board,Netrakona .	70	00	116371
3	04(2015-16)	Executive Engineer, O&M Division -1, BWDB, Chittagong.	Construction of sluice at brahmana chari Khal ,Ctg .	84	00	131803
4	05(2015-16)	Executive Engineer, O&M Division , BWDB, PatuaKhali .	Construction of sluice at Mosuri Khati Under polder no-43/2B Patua khali .	140	00	69255
5	06(2015-16)	Executive Engineer, O&M Division , BWDB, PatuaKhali .	Construction of Sluice at km.7.780 in polder no-55/2d under ECRRP,Patuakhali .	98	00	131998
6	07(2015-16)	Executive Engineer, O&M Division -1, BWDB, Chittagong.	Construction of cross regulator at km. 3.110 north supply canel ,Project. Ctg .	56	00	127280
7	08(2015-16)	Director General Bangladesh Haor development Board .	Borni Baor Project,Gopalgonj .	210	00	360898
8	09(2015-16)	Director General Bangladesh Haor development Board .	Borni Baor Project,Gopalgonj .	126	00	194128
9	10(2015-16)	Director General Bangladesh Haor development Board .	Borni Baor Project,Gopalgonj .	126	00	166611
10	11(2015-16)	Executive Engineer, O&M Division , BWDB, PatuaKhali .	Construction of Sluice at Nondi para under polder no-43/2A ,Patuakhali .	70	00	119599
11	12(2015-16)	Executive Engineer, O&M Division , BWDB, Dhaka .	Construction of Director General,s Banglo at Banani BWDB Officers Quarter.	84	00	126759
12	13(2015-16)	Executive Engineer, Bera O&M Division, BWDB, Bera,Pabna.	Soil boring for the Construction of Office Building at Bera O & M Division .Bera, Pabna.	120	00	262517
13	14(2015-16)	Executive Engineer, WD Division , BWDB, Manikgonj .	Construction of rest house at Manikgonj W D Division.Manikgonj .	70	00	113275
14	15(2015-16)	Executive Engineer, WD Division , BWDB, Manikgonj .	Construction of Bridge cum regulator at Goshbari Khal ,Manikgonj .	70	00	70577
15	16(2015-16)	Executive Engineer, Sylhet O&M Division, BWDB, Sylhet.	Construction of Regulator under Gilka Haor sub project,Sylhet.	80	00	168044
16	17(2015-16)	Executive Engineer, Sylhet O&M Division, BWDB, Sylhet.	Construction of Regulator under Gilka Haor sub project,Sylhet.	80	00	168935
17	18(2015-16)	Executive Engineer, WD Division , BWDB, PatuaKhali	Kuakata Seabeach protection & Development Project,patuaKhali .	04	00	5340
18	19(2015-16)	Executive Engineer, Sylhet O&M Division, BWDB, Sylhet.	Construction of Regulator under FCD project at haor Area,Sylhet.	84	00	215335
19	20(2015-16)	Executive Engineer, O&M Division , BWDB, PatuaKhali .	Construction of sluice at 4.00 km.under Blue gold Project ,Patuakhali .	126	00	213442

Sl. No.	Report No.	Name of Division	Name of Project	No. of Sample Received & Tested		Billed amount Taka
				5 D	6 U	
1	2	3	4	5	6	7
20	21(2015-16)	Executive Engineer, O&M Division , BWDB, PatuaKhali .	Construction of sluice atkm.30.80 under ECRRP project ,Patuakhali .	126	00	255318
21	22(2015-16)	Project manager Jica, WAPDA Bhabon, Dhaka .	The pilot Repair works of manu river flood control embankment in moulobi Bazar .	06	00	102148
22	23(2015-16)	Executive Engineer, Bera O&M Division, BWDB, Bera,Pabna.	Dredging irrigation development & Fishing of gajnarbill Pabna .	150	00	274776
23	24(2015-16)	Executive Engineer, O&M Division -2, BWDB, Chittagong.	Regulator construction to flood control bank protection & Drainage for BEZA ctg .	332	00	530320
24	25(2015-16)	Executive Engineer, O&M Division -1, BWDB, Chittagong.	Soil boring for the Construction of drainage outletat km.0.385 at maliara Bakkain FCDI project ,Ctg.	82	00	115460
25	26(2015-16)	Executive Engineer, O&M Division , BWDB, Cox,s Bazar .	Construction of regulator under the proposed shelter project -2,Cox'sBazar .	84	00	151430
26	27(2015-16)	Executive Engineer, O&M Division -2, BWDB, Chittagong.	Construction of sluice under the Rehabilitation & Drainage project in Chittagong .	84	00	131803
27	28(2015-16)	Executive Engineer, O&M Division , BWDB, Cox,s Bazar .	Construction of regulator under the Rehabilitation project in Cox'sBazar .	84	00	184965
28	29(2015-16)	Executive Engineer, O&M Division , BWDB, Gopalgonj .	Tarail pachuria FCDI Project,Gopalgonj .	70	00	124421
29	30(2015-16)	Executive Engineer, W D Division , BWDB,kalapara, Patuakhali .	Construction of Drainage cum flashing sluice in polder no-49 Patuakhali..	238	00	105469
30	31(2015-16)	Executive Engineer, WD Division , BWDB,kalapara, Patuakhali .	Construction of Drainage cum flashing sluice in polder no-46 Patuakhali	266	00	500259
Total				4565	06	5344116

D- Disturbed

U- Undisturbed

### Field Services

To assist the quality control of earth works of different projects, RRI sends experienced technicians on deputation to the field in response to the request from the project authority mainly from BWDB and different organizations of Bangladesh. During the deputation period, technicians are involved in conducting in-situ tests for the ongoing projects. During the year 2015-16, three trained soil technicians were posted in the different working sites. Technicians are deputed in the field for several quality control works such as Field Compaction, Relative Density, Grain Size, Limit, Natural Moisture Content, Hydrometer, Field Quality Control, Loss-on-ignition etc. at different projects.

## Revenue

A total of Tk. 53.44 lakh has been billed during the fiscal year 2015-16 from soil tests (For detail see Table 2.2.1) and 10% overhead charge on basic pay for last fiscal year has been earned from the deputed soil technicians for quality control works from project sites. In total Tk. 65.19 lakh has been received during the fiscal year 2015-16. A total of Tk. 21.36 Lakh is remaining unpaid up to June 2016 to different clients of BWDB.

**Table 2.2.2: List of soil Technicians deputed in the field for Quality Control Work**

Sl. No.	Name & designation of deputed technicians	Name of division	Working period
1	2	3	4
1.	Md. Golam Mostafa S.T.-B	Cox's Bazar O&M Division, BWDB, Cox's Bazar.	01.07.15 - 30.06.16
2	Md. Nuruzzaman S.T.-B	Patuakhali O&M Division, BWDB, Kalapara, Patuakhali.	01.07.15 - 30.06.16
3	Md. Abdul Mannan S.T.-A	Bera O & M Division, BWDB, Bera, Pabna.	01.07.15 - 30.06.16

### 2.2.2 Material Testing and Quality Control

The Material Testing and Quality Control discipline of Geo-technical Research Directorate deals with the determination of physical and engineering properties of concrete and concrete materials normally used for different types of river training works, hydraulic structures and other infrastructures. It also involves 'Laboratory Trial Mix' and computation of concrete mix design to attend particular design strength with materials to be used in the construction works. At present this discipline has two types of working facilities viz. laboratory oriented testing & research facilities and the other is monitoring & evaluation of construction works by conducting field tests and investigations for quality control of concrete to the ongoing projects.

#### Laboratory Activities

During the fiscal year 2015-16, a total of 153 number samples/specimens of cement, sand, shingles/stone chips, bricks, concrete cylinders, MS Rod were received from the different ongoing projects under the different divisions of BWDB and other Govt. and Non-Govt. organizations for conducting tests as specified by the clients. There is a very useful and sophisticated instrument named "The Universal Testing Machine (UTM)" used in the concrete laboratory for testing of MS rod, flat bar, concrete cylinder, block etc.

Category-wise list of samples received from different BWDB Divisions and other organizations during this fiscal year have been given in Table 2.2.3. The Division-wise list of sample tested with project name, their billed amount and the recovery amount of the different BWDB Divisions during the fiscal year 2015-16 are shown in Table 2.2.3.

**Table 2.2.3: Category-wise list of samples received from different BWDB Divisions and other organizations during the fiscal year 2015-16.**

Sl. No.	Name of division/Other organization/Field laboratory	Cement	Sand	Stone/ Kho	Concrete cylinder/Cube	M.S rod	Brick	Total sample
1	2	3	4	5	6	7	8	9
1	Faridpur O&M Division, BWDB, Faridpur.	02	05	-	-	-	-	7
2	Gopalganj O&M Division, BWDB, Gopalganj.	7	14	23	27	-	-	71
3	Madaripur O&M Division, BWDB, Madaripur.	-	-	02	06	08	-	16
4	Magura O&M Division, BWDB, Magura.	04	09	04	06	-	-	23
5	Kushtia O&M Division, BWDB, Kushtia.	-	01	-	03	-	-	04
6	Amla O&M Division, BWDB, Amla.	-	01	-	06	-	-	07
7	Barisal Field Laboratory, Barisal.	03	14	02	06	-	-	25
Total		16	44	31	54	08	-	153

**Table 2.2.4: Name of the Projects, total no. of samples received and billed amount & recovery amount of different BWDB Divisions and other organization during the fiscal year 2015-16**

Sl. No.	Name of division/Other organization/ Field laboratory	Name of project	Total nos. of sample tested	Billed amount (in Taka)	Recovery (in Taka)
1	2	3	4	5	6
1	Faridpur O&M Division, BWDB, Faridpur.	<ul style="list-style-type: none"> <li>Faridpur town protection project</li> </ul>	7	24150	24150
2	Gopalganj O&M Division, BWDB, Gopalganj.	<ul style="list-style-type: none"> <li>Protective work of Modhumati River</li> <li>Madaripur Beel Rute Canal.</li> </ul>	71	155675	155675
3	Madaripur O&M Division, BWDB, Madaripur	<ul style="list-style-type: none"> <li>River Bank protection work.</li> </ul>	16	8400	8400
4	Magura O&M Division, BWDB, Magura.	<ul style="list-style-type: none"> <li>River Bank Protection work of Gorai River.</li> </ul>	23	66075	66075
5	Kushtia O&M Division, BWDB, Kushtia.	<ul style="list-style-type: none"> <li>River Bank Protection work of Bhairab River.</li> </ul>	04	3375	3375

Sl. No.	Name of division/Other organization/ Field laboratory	Name of project	Total nos. of sample tested	Billed amount (in Taka)	Recovery (in Taka)
1	2	3	4	5	6
6	Amla O&M Division, BWDB, Amla.	<ul style="list-style-type: none"> <li>River Bank Protection work of Bhairab River.</li> </ul>	07	5550	5550
7	Barisal Field Laboratory, Barisal.	<ul style="list-style-type: none"> <li>Different Project under Barisal O&amp;M Division, Barisal, Patuakhali, O&amp;M Division, Patuakhali, Borguna O&amp;M Division, Borguna, Bholo O&amp;M Division, Bholo etc.</li> </ul>	25	61125	61125
Total			153	324350	324350



Universal testing machine used for testing of MS rod, flat bar, concrete cylinder, block etc.



Compressive strength testing machine used for testing of concrete cylinder, block etc.

### Field Services

For quality control of works, a few numbers of trained technicians were deputed in the field in response to the request from the project authority. During the fiscal year 2015-16, 02 (two) number of technicians were deputed in the different work sites of BWDB. List of the concrete technicians deputed in the field for quality control works at different projects have been presented in [Table 2.2.5](#).

### Revenue

In the fiscal year 2015-16, a total of Tk. 324350.00 has been billed for testing of different types of materials. A total of Tk. 324350.00 was received during the fiscal year 2015-16.

**Table 2.2.5: List of Concrete Technicians deputed in the field for Quality Control Work in the fiscal year 2015-16**

Sl. No.	Name & designation of deputed technicians	Name of division	Working period
1	2	3	4
1	Md. Shariful Islam ST-A/CT-A (in charge)	Cox's bazar O&M Division, BWDB, Cox's bazar.	01.07.15 to 30.06.16
2	Md. Rezaul Karim MT-B/CT-B(in charge)	Pabna O&M Division, BWDB, Pabna.	01.07.15 to 30.06.16

### 2.2.3 Sediment, Chemical and Water Pollution

Sediment, Chemical and Water Pollution discipline is one of the testing and research discipline of Geo-technical Research Directorate of RRI. There are two laboratories under this discipline, namely Sediment Technology laboratory and Chemical and Water Pollution laboratory. Test and analysis of various kinds of sediment samples of different rivers of Bangladesh are being carried out in the Sediment Technology laboratory. The test results are used for planning and designing of hydraulic structures like barrages, drainage channels, irrigation canals, flashing sluices, closures etc. Sediment testing results are also used in physical and mathematical model studies. In the chemical and water pollution laboratory, samples of surface and ground water are being analyzed for using water in different purposes.

#### Testing Facilities in Sediment Technology Laboratory

The sediment technology laboratory has the following testing facilities:

- Determination of sediment concentration by evaporation and filtration method.
- Determination of sediment concentration with soluble salt correction.
- Determination of specific gravity.
- Determination of viscosity.
- Grain size analysis by
  - Wet and dry sieving method
  - Hydrometer method
  - Pipette method
  - Sieve and pipette combined method
  - Sieve and hydrometer combined method

#### Activities of Sediment Technology Laboratory

A total number of **360** of general suspended sediment, bulk suspended sediment and river bed soil samples were received and tested in the sediment technology laboratory during the fiscal year 2015-16. The samples were collected by the field personnel of 3 (three) measurement divisions under the Surface Water Hydrology Circle-I of BWDB and other institutions. The samples were collected as a routine work by the Surface Water Hydrology Circle-I of BWDB.

The name of clients and category-wise list of samples tested during the fiscal year 2015-16 has been shown in Table 2.2.6.

**Table 2.2.6: Category-wise list of samples with the clients**

Sl. No.	Name of client	Category of samples	Nos. of samples received & tested
1	Surface Water Hydrology Circle-1 of BWDB	General suspended sediment samples	255
2	Surface Water Hydrology Circle-1 of BWDB	Bulk suspended sediment samples	96
3	DUCT & MH JUTE MILLS	General suspended sediment and Water Sample	9

### Description of Samples of Surface Water Hydrology Circle-I of BWDB

The samples of Surface Water Hydrology-I of BWDB collected as a nature of routine work consisted of suspended sediment samples only. The suspended sediment samples can again be sub-divided into the following 2 (two) categories:

- General suspended sediment samples.
- Bulk suspended sediment samples.

The difference between general suspended sediment samples and bulk suspended sediment samples is that the former represents the true picture of a stream in respect of its total suspended sediment content while the later represents the average characteristics of a stream in respect of its fine sediment content only since its coarse fraction is removed in the field.

### General Suspended Sediment Samples

The general suspended sediment samples of Surface Water Hydrology Circle-I were collected from the 11 (Eleven) gauging stations spread over 10 (Ten) important rivers of Bangladesh. The samples were sent to the sediment technology laboratory of RRI for determining their sediment concentrations. The results obtained in the tests were expressed in parts-per-million (PPM) by weight. The results of analysis of general suspended sediment samples are published in the form of Annual Report.



**Figure 2.5:** Dr. Sultan Ahmed (Joint secretary), Director, Natural Resource Management & Research, Department of Environment, Bangladesh and Howlader Zakir Hossain, Deputy Secretary, Ministry of Water Resources visited the Chemical Lab of Geo-technical Research directorate at RRI.

### Bulk Suspended Sediment Samples

The bulk suspended sediment samples were collected by the field personnel of the Surface Water Hydrology Circle-I of BWDB from the rivers: the Ganges at Baruria and Mawa; the Gorai-Madhumati at Kamarkhali and the Brahmaputra at Bahadurabad.

In the Sediment Technology laboratory, all the bulk suspended sediment samples were analyzed for determining their fine sediment concentration only. The results obtained in concentration studies were expressed in parts-per-million (PPM) by weight. The fine sediment discharges were also calculated using the values of fine sediment concentration. The data of coarse sediment discharges were received from the concerned field personnel of the Surface Water Hydrology Circle-I of BWDB.

### Activities of Chemical and Water Pollution Laboratory

Chemical and Water Pollution laboratory is well equipped laboratory with modern instruments including Gas Chromatography-Mass Spectroscopy, Atomic Absorption Spectrometer, Spectrophotometer, Portable spectrophotometer, portable multi-parameter meter, Aquaculture testing kit etc. These equipments are designed with cutting-edge technology and are ideal for a wide range of applications including: environmental, materials, geological, food safety, clinical and petrochemicals.

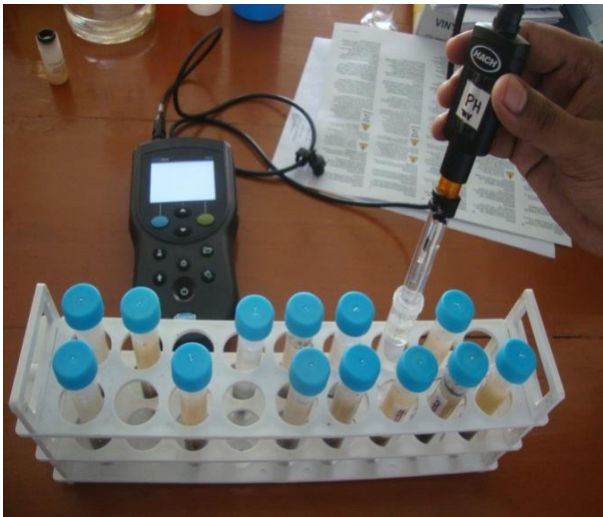




Heavy metals of soil samples detected by Atomic Absorption Spectrometer.



Gas Chromatography-Mass Spectroscopy to detect volatile organic compound in soil and water.



pH measurement of Sediment samples using HACH 30QD multiparameter in chemical Lab.



Incubator used to maintain required temperature of reagents and samples.

'Gas Chromatography Mass Spectroscopy' is used in Chemical and Water Pollution Laboratory for detecting volatile organic compounds, pesticide, insecticide etc. in soil, sediment and water samples. 'Atomic Absorption Spectrometer' is used in this laboratory for determining metals like Na, K, Ca, Cr, Ni, Cu, Mn, Mg, Si, Ba, Fe, Zn, Co, Bi, Cd, Pb, As, Pt, Ag, Al, Sb, Se, Hg, B, Sn, Be, Mo etc. in soil, sediment and water. Hach Spectrophotometer is used to detect substances such as Al, Ba, B, Cd, Cr, Mg, Fe, Cl, C, Ni, Fl, SO<sub>4</sub> etc. in soil, sediment and water samples. Hach portable spectro-photometer is used to detect substances in the field as Hach spectrometer does in the laboratory. Portable Multimeter meter is used to determine pH, EC, TDS, Salinity etc. from the river. Aqua-culture kit is used to measure Amonia, Cl<sup>-</sup>, CO<sub>2</sub>, Hardness etc. Digital Turbidity meter can be used in this Laboratory to detect turbidity of water samples. Conductivity meter is also available to measure conductivity, total dissolved solid (TDS), salinity of soil and water sample.

The following facilities also exist in the Chemical and Water Pollution laboratory:

- Determination of p<sup>H</sup>, electrical conductivity, turbidity, free carbon di-oxide, bi-carbonate, sulphate, chloride, nitrate, sodium chloride, total solid content, hardness, calcium, magnesium, iron, silica, total dissolved solid, dissolved oxygen etc.
- Determination of arsenic.
- Determination of salinity.

#### Revenue earned during the fiscal year 2015-16

A total of Tk. 1.89 lakh has been billed during the fiscal year 2015-16 for testing of sediment samples. In total Tk. 2.60 lakh has been received in this fiscal year 2015-16 and a total of Tk. 3.25 lakh is remaining unpaid up to June 2016 to different clients of BWDB and other organisation.

## 2.3 ADMINISTRATION & FINANCE DIRECTORATE

This Directorate consists of several sections namely, i. Establishment, ii. Accounts & Audit, iii. Public Relation & Photography, iv. Library, v. Estate & Security and vi. Store. The other activities include procurement, operation & maintenance of physical facilities.



### 2.3.1 Activities of Administration & Finance Directorate

The activities of Administration & Finance Directorate include overall administration of RRI, establishment, human resources development, financial management, photography, public relations, internal security, storing of materials, plantation, arrangement of different kinds of training, publications of annual reports, journal, newsletters etc. The approved and existing manpower working in this institute is 257 and 200 respectively. The details of manpower are given in the following table as shown below:

**Table 2.3.1: Class-wise approved and existing manpower in RRI**

Sl. No.	Class	Approved manpower	Existing manpower
1	1 <sup>st</sup> Class	68	34
2	2 <sup>nd</sup> Class	03	01
3	3 <sup>rd</sup> Class	122	95
4	4 <sup>th</sup> Class	64	70
Total		257	200

This directorate also collects a number of books both from home and abroad, journals, research reports, newsletter and many other publications every year for library. Many researchers, students and teachers from different institutions use this library for their necessary documents. The total number of reading materials (including books, journal, newsletter reports and publications) is mentioned in Table2.3.2.

**Table2.3.2: Total collection of items in the Library**

Sl.No	Description	Collection in 2015-16	Total
1	Books	47	1882
2	Journal	5	2643
3	Reports	45	5326
4	Other publications	7	5116
Total		104	14967

The total expenditure under this directorate during the fiscal year 2015-16 is shown in Table2.3.3.

**Table2.3.3: Total expenditure in establishment**

Sl. No.	Description	Amount (Tk. in lakh)
1	Officers salary	189.07
2	Staff salary	294.65
3	Allowances	353.37
4	Supply and services	171.47
5	Repair & maintenance	37.94
6	Capital expenditure	24.82
7	Establishment cost by own fund	18.34
	<b>Total</b>	<b>1089.66</b>



**A view of Advanced Training Course on Mathematical Modelling organized by ICT Cell at RRI.**

### 2.3.2 Other Activities

In addition to the above activities, this directorate also provides technical support services to the other directorates and divisions. This directorate is also responsible for procurement, operation & maintenance, and mechanical & electrical works of physical

facilities. The work completed by operation and maintenance, and mechanical and electrical section during the fiscal year 2015-16 is outlined below.

### Works executed by Operation and Maintenance (Civil Engineering)

- Repair and maintenance of different offices as well as residential buildings. The repair and maintenance works include stripping of old plaster and replacing by new plaster works, white washing, plastic painting, synthetic enamel painting to window gratings, door polishing, wood work in door frames and replacing of glass panes in window shatters and replacing of doors under establishment budget.
- Purchase & replacing of plumbing materials of different buildings with new ones.
- Purchase of stationery, plumbing, hardware and construction materials for general use as well as model use.
- Cleaning of water tank in all office and residential buildings.
- Cleaning and maintenance of surface drain of RRI campus.

### Works executed by Mechanical and Electrical Section

#### 1) Mechanical Section

- Installation, repair & maintenance of pump, motors, tailgates, gate valves, foot valves, model bridges etc.
- Repair and maintenance of mechanical tools.
- Repair, fitting & fixing of grill, window etc at residential and office buildings.
- Repair and maintenance of all the vehicles of RRI.
- Purchase of raw materials for mechanical workshop of RRI.
- Repair and maintenance of photocopy machines, air cooler and refrigerators.

#### 2) Electrical Section

- Purchase of fuel & batteries for generator.
- Routine maintenance of computer, printers, UPS, IPS and other electronic equipments.
- Purchase of computer accessories, electrical materials.
- Purchase of electric wires of different sizes.
- Electrification of model.

### 3 RESEARCH AND DEVELOPMENT ACTIVITIES

The two directorates of RRI, namely Hydraulic Research and Geo-technical Research conduct research and development activities in their respective fields. These activities are briefly described in this chapter.

#### 3.1 Research and Development Work

Research plays a significant role to improve the quality of lives of the people and also the socio-economic development of the country. Quick and effective decision making by proper use of information contributes for uplift of the society. Researches in the field of hydraulics, geo-technical and environmental engineering carry great importance for the development of water resources of the country.

Considering the above facts, RRI has conducted three research works in 2015-2016 fiscal year. One is “Investigation on launching characteristics of different materials to find out the cost-effective and sustainable solution of river bank protection” under Hydraulic Research Directorate and another two are “Assessment of river pollution around Dhaka and find out the ways to alleviate pollution” and “Investigation of Hydro-morphological and Environmental status of the Karnaphuli river” under Geotechnical Research Directorate. The first two research projects mentioned in above has been completed in 2015-2016 fiscal year. RRI has been undertaken a research work entitled “Hydro-morphological study of the Mahananda river in Bangladesh with focus on problems and probable solutions of dry season flow scarcity” for the 2016-2017. The short descriptions about the above mentioned research works are described in the following sections.

#### 3.2 Name of the Research Work

##### **(a) Investigation on launching characteristics of different materials to find out the cost-effective and sustainable solution of river bank protection.**

Bangladesh is a land of rivers having an agro based economy. It is the greatest delta in the world. From ancient time to the present days, rivers have been playing a dominant role in human activities. Rivers provide waterways to transport the agricultural and other commodities from one place to another, water for drinking, irrigation and act as reservoir for fish culture. Rivers also help in the generation of electric power. But occasional heavy flood has caused flooding of lands and caving of the banks, thereby causing heavy destruction to the cities and other important engineering constructions.

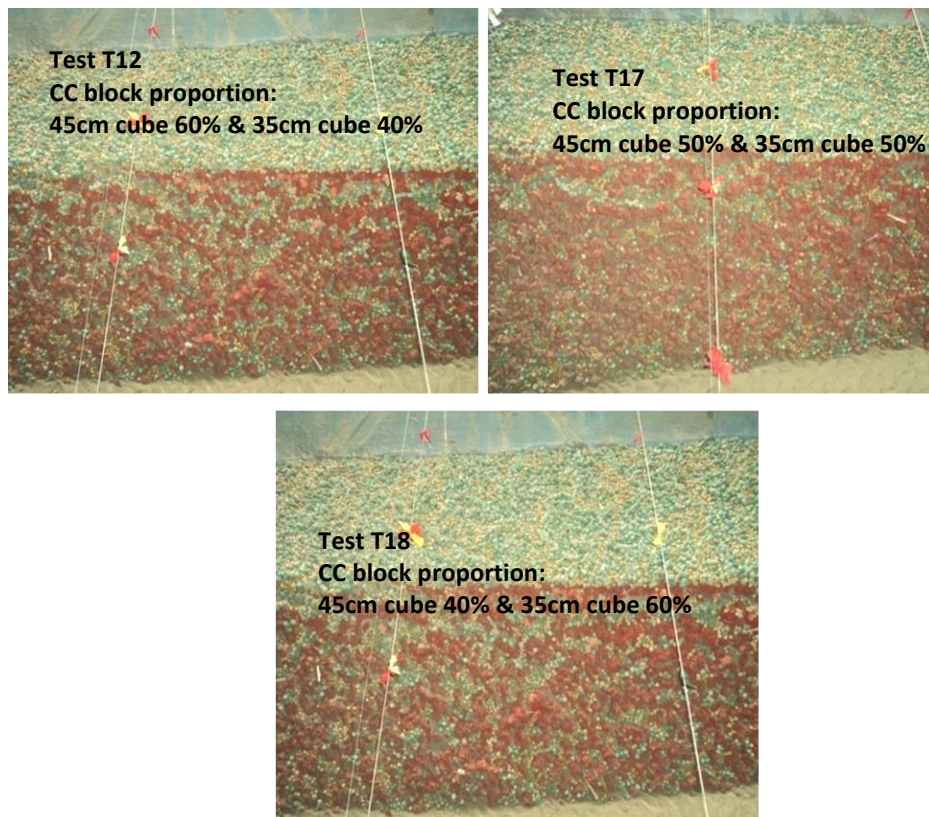
Protection of riverbanks from erosion is a part and parcel of river training works. A lot of important installations like towns, industries, different institutions, Hat-bazar, agricultural lands etc. adjacent to the river bank require effective bank protection or training works to save area from the bank erosion by flood flow even in lean flow. In this respect, RRI has taken the aforementioned research work.

The overall objectives of the study were to investigate the launching behavior of stone chips, cement concrete (CC) blocks and geo-bags, to observe the velocity and scour in the vicinity of bank protective structures, to compare the performance of stone chips, CC

blocks & geo-bags under oblique flow (60-degree) condition and to find out the cost-effective materials for launching apron to protect river bank.

The model was a Froude model and studied over a generalized bathymetry. The investigation was being carried out to determine the local scour and velocity field at and around the revetments under different likely approach flow conditions. It had been constructed to an undistorted scale, and designed to fulfil both flow and sediment transport criteria simultaneously. It means the model velocity was higher than the critical flow velocity for the initiation of sediment motion. Any velocities higher than the critical, scour dimensions are only function of flow direction and structure geometry. The model therefore, reproduced the scour holes correctly. The investigation was being done on a mobile bed model. The hydraulic similarity was established in the model to an undistorted scale. A closed shed has been selected for model development. It provides all kinds of facilities related to model study. The preliminary layout of model is given by grid system.

After setting reference grid points in the model, channel plan form is given and bed & bank levels are fixed up by levelling instrument as per bathymetry using Rise & Fall method. This requires some cutting and filling of sand. In this physical model, various types of instrument and facilities are needed such as, a sharp-crested weir, point gauges, 3-D current meter, high resolution camera, stopwatch, floats etc.



**Figure 3.1: Launching behavior of composite materials for different CC block proportion.**

There is active bank erosion almost in all major rivers in the country causing damage to valuable land, properties and infrastructures from year to year. Because of high density of

population along the river banks, a great numbers of people are also displaced due to this continuous bank erosion process. These poor displaced people migrate to nearby towns and cities and live sub-human life in the slump areas. This has created a great natural and social problem in the country. Bank protection work is one of the prime necessities for poverty alleviation and national growth. The issue is the safety of lives, land & sustainability of the infrastructures against the forces acting in the rivers.

Launching Apron (LA) is an important part of river training structures. Without LA of appropriate launching materials, revetment and spurs cannot be stable and may collapse. Therefore, a research work has been undertaken at RRI to combat river bank erosion effectively. Through the research work, the performance of launching materials for river bank protection has been assessed to determine their efficacy and to find out the cost-effective material.

All test runs (100%) have been completed and Final Report has been submitted. A seminar on this research was held at RRI on 20 June, 2016.



Figure 3.2: A Seminar on “Investigation on launching characteristics of different material to find out the cost-effective and sustainable solution for river bank protection” held at RRI on 20.06.2016 where Mrs. Saeeda Nazneen, Chief Engineer (Design), BWDB was present as chief guest.





**Figure 3.3: Mrs. Saeeda Nazneen, Chief Engineer (Design), BWDB and Md. Motaher Hossain, SE, Design Circle-6, BWDB observing the research model at RRI on 20.06.2016.**

**(b) Assessment of river pollution around Dhaka and find out the ways to alleviate pollution.**

With a population over 15 million Dhaka is one of the most congested city of the world. This rapidly growing city is surrounded by many rivers and khals namely the Buriganga, the Turag, the Balu, the Bongshi, the Kornatoli, the Shitalakhya, the Pungly, the Tongi Khal and others. The rivers surrounding Dhaka are an advantage to it and essential for the survival of the mega city as these provide drainage system, drinking water, different kinds of fishes and waterways for traveling. However, over the last couple of decades major industrialization and urbanization has been observed in Dhaka. Violating the environment law, tons and tons of untreated industrial effluents are being dumped into these rivers. The rivers have become a dumping ground of all kinds of solid, liquid and other chemical waste. Moreover, encroachment on rivers is a common practice in Dhaka and most of the natural drainages disappeared or are in way to due to illegal encroachment. Under these circumstances this research has been taken started from the fiscal year 2014-15 and has been completed in the fiscal year 2015-16.

The main aims of the research were i) to assess spatial and temporal variation of water quality parameters including the toxic/heavy metal (T/HM) concentrations around Dhaka ii) to find out ways to alleviate river pollution iii) to draw the implication and to recommend for policy approaches to reduce contamination and to improve food security in Bangladesh. In this research, an integrated approach is followed to understand and solve key problems addressing river pollution involving Physical, Chemical, Biological and Socio-Economic components. It is carried out based on the samples collection from river,

in-situ and laboratory investigations of samples, some questionnaire survey from the river bank community surrounding Dhaka city. Around Dhaka 40 study points along the rivers namely Bongshi, Buriganga, Karnatoli, Turag, Balu & Shitalakha were selected for this research work.



Heavy metals such as Zn, Al, Pb, B, Cd, Cr, Mg, Fe, As, Hg etc. of water samples are being detected by Atomic Absorption



A view of questionnaire survey along the Bangshi river

Investigation reveals that the Buriganga, Bongshi, Turag, Shitalakha, Balu and Karnatoli rivers are under severe pollution threat in dry season. Water quality parameters are beyond the tolerable limit of DoE in dry season. In post rainy season water quality better than dry season. However, T/HM concentration has greater than standard limit specially Cd and Cr in post rainy season. T/H metal exists in our Food chain as considerable amount of toxic metals like Pb, Cr, Cd, Ni and Cu have found in fish, tomato and red spinach. Moreover, considerable amount of T/H metals found in different types of fishes in all rivers. River pollution intensity will be decreased the entire rivers around Dhaka in dry season if water flow can be increased in the Bongshi river. As T/H metals are present in post rainy season too, effluent treatment plant (ETP) should be used to all the dyeing and chemical industries before dispose to the rivers.

A seminar was held at RRI on 29<sup>th</sup> June, 2016 to share the research findings to the respected audience including environment specialist. Final report has been submitted.



A view of seminar on research study where Dr. Sultan Ahmed (Joint secretary), Director, Natural Resource Management & Research, Department of Environment, Bangladesh was the chief guest and Howlader Zakir Hossain, Deputy Secretary, Ministry of Water Resources was the special guest.



Principal Investigator Dr. Engr. Fatima Rukshana, Senior Scientific Officer is presenting her research findings to the audience in a seminar held at RRI organized by Geo-technical Research Directorate..

### **(c) Investigation of Hydro-morphological and Environmental status of the Karnaphuli river**

The Karnaphuli River is the largest and most important river in Chittagong and Chittagong Hill tracts. Originating from Lushai hills of the Indian state of Mizoram, the river enters into Bangladesh through the north-east border of the country. Immeasurable streams are joining it carrying water from a catchment of approximately 11,000 sq.km. Almost all the headstreams of the Karnaphuli river lie on the western margin of Mizoram. The important ones among them are Phairang, Tuichong, Thega, Doh and Tuiliangpui. They meet one another at Demagiri and flows south-east to Bangladesh in the name of Karnaphuli. The total length of the river is about 274km and within the Bangladesh territory the length is about 160km. The river is perennial and flow of the river is less from the month of February to April. The river is joined by the river Halda at Kalurghat Bridge and the combined flow finally discharges into the Bay of Bengal. In the early sixties Kaptai dam was constructed as part of the Karnaphuli Multipurpose Project and it is the only dam of Bangladesh that is used to generate hydro-electric power. The dam is also vital as a flood management installation for the areas downstream. Due to construction of this dam on the river, a vast lake of water has formed the reservoir for the Karnaphuli power plant project. As a result, the riverine eco-system of the river both upstream and downstream of the dam was highly affected and flow and sediment transport regime have undergone significant changes. It is to be noted here that since time immemorial the terrestrial eco-system on both sides of the river have been sustained by this river. The effects of the human interventions in the form of dam, bridge etc. on this rich eco-system is yet to be ascertained. In the recent past, the flow of the river is reported to have declined and sedimentation problem is observed at its outfall. As a result both inland and maritime navigation have been hampered to the great worry of the Chittagong Port Authority. Numerous attempts have been made to cope with the sedimentation problem which is related to the morphological changes of the river especially in the upstream.

The port of Chittagong is situated on the banks of the Karnaphuli. Due to numerous past and ongoing developments in the river and river fronts the Karnaphuli has affected the lives and livelihoods dependent on it to a large extent. Some of the developments had severe impacts on hilly and coastal floodplain environments as well as on lives of indigenous people living in the Chittagong Hill Tracts. Considering all these issues a comprehensive study on the Karnaphuli river has been undertaken by the Director General of Prime Minister's office as first initiative under the program "Nadi o Jibaner Sandane" to develop understanding of this river system and riverine environment and assess the impacts of development activities on natural environment and lives and livelihoods of this river dependent people.

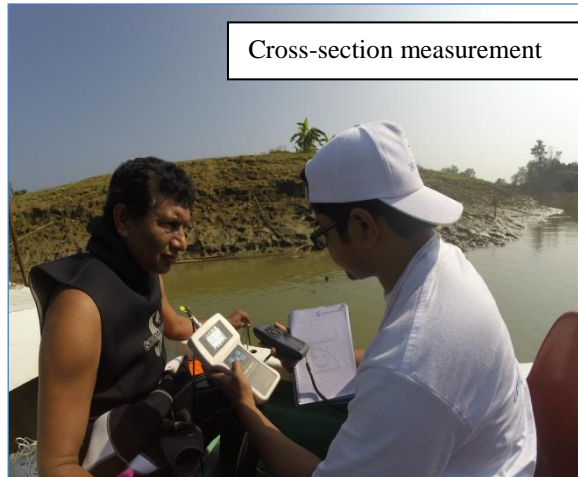
As a national institute entrusted with conducting study and research on the rivers of Bangladesh to assist in different water resources development of the country, River Research Institute (RRI) has taken up the study "Investigation of Hydro-morphological and Environmental status of the Karnaphuli river" in support of this program undertaken by the Prime Minister's Office.

The overall objective of the study is to assess the hydro-morphological and environmental status of the Karnaphuli river to develop understanding as to how the river responded to the natural changes and human interventions and also likely trend in the future hydro-morphological development. The study involves collection, processing and analysis of available primary and secondary data. The primary data have been collected through a field survey campaign organized by Prime Minister's Office whereas the secondary data have been collected from available sources.



Water quality measurement

The scope of work includes assessment of historical planform development of the river, present flow and sediment transport regime, assessment of effects of dam and other human interventions on flow and sediment transport and determination of physiochemical and biochemical parameters of the water and bed/bank materials.



Cross-section measurement

The study was undertaken in the year 2015-16 and a short report on the completed works has already been submitted in June 2016. In the mean time, more works have been completed in terms of data analysis and interpretation. The RRI authority has extended the study duration up to the June 2017. Laboratory tests and field data analysis together with report writing are going on. A second report of the study will be submitted shortly. The river has a hilly part and a coastal part with distinct characteristics. Also the downstream part of the river is tidally affected. The study will focus on these issues to come up with important outcomes in terms of a database of the river, historical plan form development, enhanced understanding of hydro-morphological behavior of the river, present status of water and soil quality, anthropogenic effects on riverine ecosystem etc. The sedimentation problem at the outfall of the river will also be addressed to assist in devising solutions of the same. Effective communication will be established with the Chittagong Port Authority to collect the available bathymetry data to this end.



A view of research team including RRI Officials meeting at Prime Minister's Office

**(d) Hydro-morphological study of the Mahananda river in Bangladesh with focus on problems and probable solutions of dry season flow scarcity**



Mahananda river, a trans-boundary stream originating from Himalayas and spills through the southern parts of Rajshahi, Chapai Nawabganj as well as Natore district. The river has a catchment area of about 1300 sq. km. It is revealed from the recorded discharge during monsoon and lean period that the monsoon discharge is almost same in every year,

whereas the lean period discharge is declined drastically from year to year. Uses of river water in various purposes have been limiting gradually due to the shortage of normal flow in the river. Mahananda is a flashy river along the edge of Tentulia Barrage in India diverts much of its normal flow towards Bihar. The river erodes its banks during monsoon, in the Chapai Nawabganj district after re-entering Bangladesh. Its length inside Bangladesh is about 85 km.

The major towns on the bank of Mahananda are Tentulia, Bholahat, Gomastapur, and Chapai Nawabganj. There is a water level measuring station at Gomastapur and a discharge measuring station at Chapai Nawabganj (Haque, M. Inamul 2008). Entering back into Bangladesh at Gomostapur upazila under Chapai Nawabganj district the Mahananda river travels 36 km through three upazilas namely Gomostapur, Shibganj, Chapai Nawabganj Sadar. The river ultimately falls into the Ganges river at Godagari upazila under Rajshahi district. The 36 km river reach is very important in terms of agriculture, fishery, groundwater withdrawal for irrigation and drinking purpose, transportation of different goods etc. However, due to acute shortage of dry season flow agriculture, fishery, ground water use and navigation have been drastically affected with dire consequences on livelihoods and environment. Depletion of groundwater table due to over withdrawal of ground water, arsenic contamination of groundwater and inadequate recharge are some of the conceivable problems. The other problems are lack of year round navigation facility, decreasing fish population, bank erosion and drought. All these problems are believed to be directly related to the dry season flow scarcity of the Mahananda river.

Under the above mentioned circumstance and its negative social, environmental and economic impacts the honorable Member of Parliament of 44 Chapai-Nawabganj has requested River Research Institute to take up a comprehensive study on the Mahananda river to address the issues and to find out sustainable solutions of the problem through his letter on 25 March 2016. River Research Institute is mandated to take up studies to address river related problems and find out solutions of the same through physical and numerical model investigations as well as through field data collection and analysis. It is therefore, decided to take up a comprehensive hydro-morphological study of the Mahananda river to identify the issues that are hindering the development and devise feasible options to address these issues.

The main objective of this study is to develop understanding of the hydro-morphological processes of the river Mahananda from historical perspective and to assess the impacts of changes in flow and sediment transport regime on riverine and floodplain ecosystem, agriculture, fishery, navigation, flooding and bank erosion. The main objective also includes identification of issues that are hindering development and development of likely options to address these issues.

The research investigation has been undertaken by RRI for the 2016-2017 fiscal year. At present available literature is being reviewed and assessment is being made for data requirements. Side by side initiatives are being taken to procure available data and materials needed for the study.

### 3.3 Proposals for New Research Project

- ❑ Construction of protective experimental work by using bamboo bandalling structure to protect the Dewanganj in Bakshiganj Upazilla from river bank erosion of Jhinai, Old Brahmaputra, Jinjiram and Dashani River and to protect the Sherpur Sadar Upazilla from bank erosion of Old Brahmaputra
- ❑ Construction of protective experimental work by using bamboo bandalling structure to protect the Islampur Upazilla from river bank erosion of Old Brahmaputra and Dashani river and to safeguard Melandaha and Jamalpur Sadar Upazilla of Jamalpur district from bank erosion of Old Brahmaputra



A view of bamboo bandalling for the protection of river bank



## 4 HUMAN RESOURCES DEVELOPMENT

### 4.1 Introduction

Special emphasis has been given to develop the manpower of RRI since its establishment, as required to achieve its goal. At present there are a number of scientists and engineers working at RRI whose efforts are being put with a view to reach the research standard through innovation of new technologies and ideas in the related fields of activity. RRI is a new organisation of this kind of research in the country. As the technologies of the discipline concerned are fast developing, so the necessity of higher studies and advanced on the job training of the research personnel in the academic and research institution of similar activities abroad (especially in developed countries) has strongly been pronounced in order that they can keep them abreast of the latest development in the related fields of research. Some of the RRI personnel attended higher studies and training program both at home and abroad. Besides, the training on computer literacy and English language has been given to RRI staff of different categories on group basis.

The name of the persons took part in seminar, conference, workshop and training during the year 2015-2016 are mentioned below.

**Table 4.1: Persons attended in higher studies, seminar, conference, workshop and training in the fiscal year 2015-16**

SL. No.	Name & Designation	Name of Course/Seminar/ Workshop	Course Period (Date)
1	Dr. Engr. Md. Lutfor Rahman Director General	Urban adaptation Planning and Design, DUET, Gazipur.  Participated in a project research meeting at Kyoto University, Japan	04.09.15-06.09.15  19.05.16-29.05.16
2	Engr. A. K. M. Ashrafuzzaman Principal Scientific Officer	Advanced Training Course on Mathematical Modelling organized by Information Communication Technology (ICT) Cell, River Research Institute (RRI) held at RRI, Faridpur.	24.04.16-28.04.16
3	Engr. Md. Abul Ala Moududi Principal Scientific Officer	Advanced Training Course on Mathematical Modelling organized by Information Communication Technology (ICT) Cell, River Research Institute (RRI) held at RRI, Faridpur.	24.04.16-28.04.16

SL. No.	Name & Designation	Name of Course/Seminar/ Workshop	Course Period (Date)
4	Engr. Md. Azizul Haque Podder Principal Scientific Officer	ICT and e-Government Management Course	31.01.16- 11.02.16
		Advanced Training Course on Mathematical Modelling organized by Information Communication Technology (ICT) Cell, River Research Institute (RRI) held at RRI, Faridpur.	24.04.16-28.04.16
5	Engr. Syed Md. Anwaruzzaman, Principal Scientific Officer	Modern Office Management Course	06.09.15-17.09.15
6	Engr. Md. Alauddin Hossain Principal Scientific Officer	National Seminar on Excellence in Engineering for Sustainable Development organized by Institution of Engineers, Bangladesh (IEB) held at IEB HQ, Ramana, Dhaka.	04.02.16-07.02.16
		Advanced Training Course on Mathematical Modelling organized by Information Communication Technology (ICT) Cell, River Research Institute (RRI) held at RRI, Faridpur.	24.04.16-28.04.16
7	Engr. Md. Johurul Islam Senior Scientific Officer	Advanced Training Course on Mathematical Modelling organized by Information Communication Technology (ICT) Cell, River Research Institute (RRI) held at RRI, Faridpur.	24.04.16-28.04.16
8	Nasima Khatun PS to DG	Workshop on Women and Child Right.	20.12.15
9	Md. Jahangir Alam Account Officer	Seminar on Medium Term Budget Framework	25.02.16
10	Engr. Mohammad Mehedi Hasan Scientific Officer	Conduct & Discipline Course	23.08.15- 27.08.15
		Planning & Project Management Course	11.10.15- 29.10.15

SL. No.	Name & Designation	Name of Course/Seminar/ Workshop	Course Period (Date)
11	Md. Moniruzzaman Scientific Officer	ICT and e-Governance management Course	24.03.16-05.05.16
12	Engr. Omar Al Maimun Scientific Officer	Conduct & Discipline Course	11.10.15- 15.10.15
13	Md. Zakir Hossain Khan Estimator	Communicative English Course	20.12.15- 31.12.15
14	Md. Enayetur Rahman Data Entry Operator	Basic Office Management Course	09.08.15- 27.08.15
	Md. Hafizul Islam, Computer Operator	Computer Application & English Language Course	18.10.15-05.11.15
15	Md. Motaher Hossain Computer Operator	Basic Office Management Course	15.11.15-03.12.15
16	Rasel Kabir Computer Operator	Basic Conduct and Discipline Course	26.07.15-30.07.15
17	Md. Manik Khan Account Assistant	Basic Office Management Course, RPATC, Dhaka.	03.04.16-21.04.16
18	Md. Abdus Samad ST-C	Basic Financial Management Course	13.09.15-17.09.15
19	Md. Anwar Hossain Security Guard	Computer Literacy Course	04.10.15-08.10.15
20	Owasi Uddin MLSS	Computer Literacy Course	20.03.16-24.03.16
21	Md. Jamal Uddin MLSS	Staff Development Course	05.06.16-09.06.016
22	Hasina Begum Messenger	Staff Development Course	29.11.15-03.12.15

## 5 FINANCIAL MANAGEMENT

### 5.1 Introduction

River Research Institute is a national organization having mandate of a statutory Public Authority under the Ministry of Water Resources, Government of the People's Republic of Bangladesh. The annual expenses are being borne by its own income & some grant from the Government revenue budget. The main sources of RRI's own income are revenue received from physical and mathematical model studies, and testing of soil, concrete, water and sediment. Salient features of RRI's income, expenditure and closing balance in recent years are given below in Table 5.1, Table 5.2 and Table 5.3 respectively.

**Table 5.1: Income statement**

Sl. No	Sources of income	Total (Tk. in lakh)				
		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
1	Model study & geo-technical testing fee	115.24	85.50	191.25	116.92	77.33
2	Govt. grant	640.54	655.00	700.61	840.00	1071.32
3	Others	11.7	8.39	10.97	10.98	22.11
	<b>Total</b>	<b>767.48</b>	<b>748.89</b>	<b>902.83</b>	<b>967.90</b>	<b>1164.76</b>

The above income statement is also presented below as pie chart.

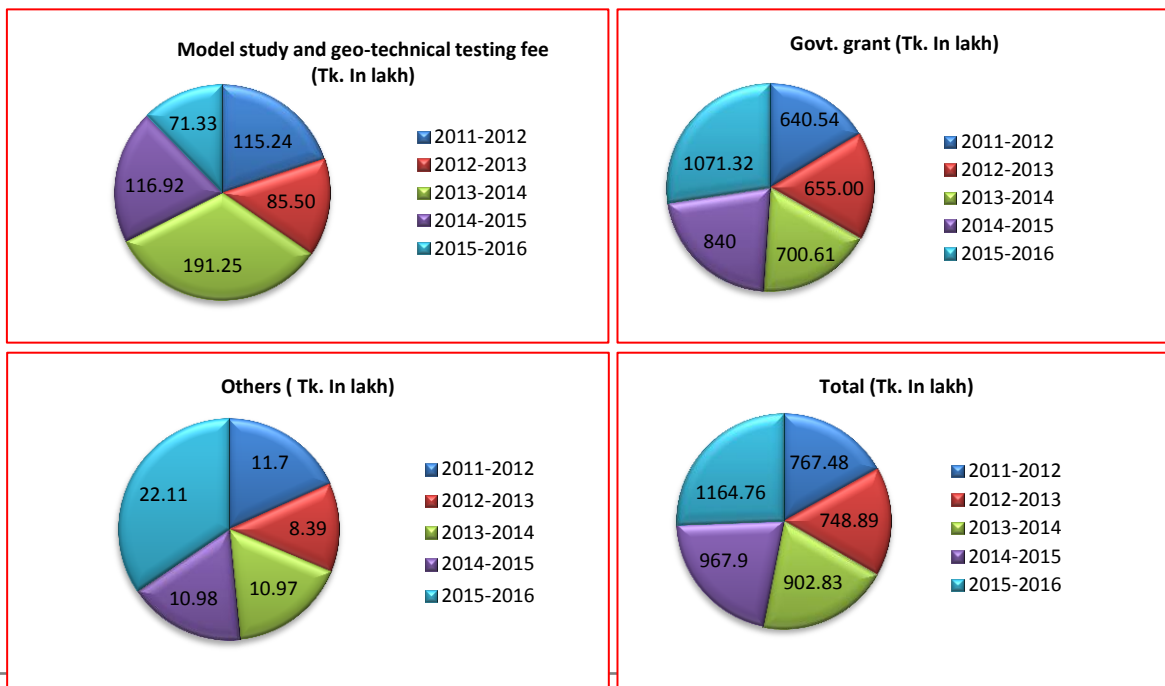


Figure: Income statement chart

Table5.2: Expenditure statement

Sl. No.	Description	Total (Tk. in lakh)				
		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
1	Model study and Geo-technical testing.	81.08	44.07	124.81	67.53	40.08
2	Establishment	644.17	673.24	730.42	835.27	1089.66
3	Refund of non-expended money	-	-	-	4.73	-
	Total	725.25	717.31	855.23	907.53	1129.74

The above expenditure statement is also presented below as pie chart:

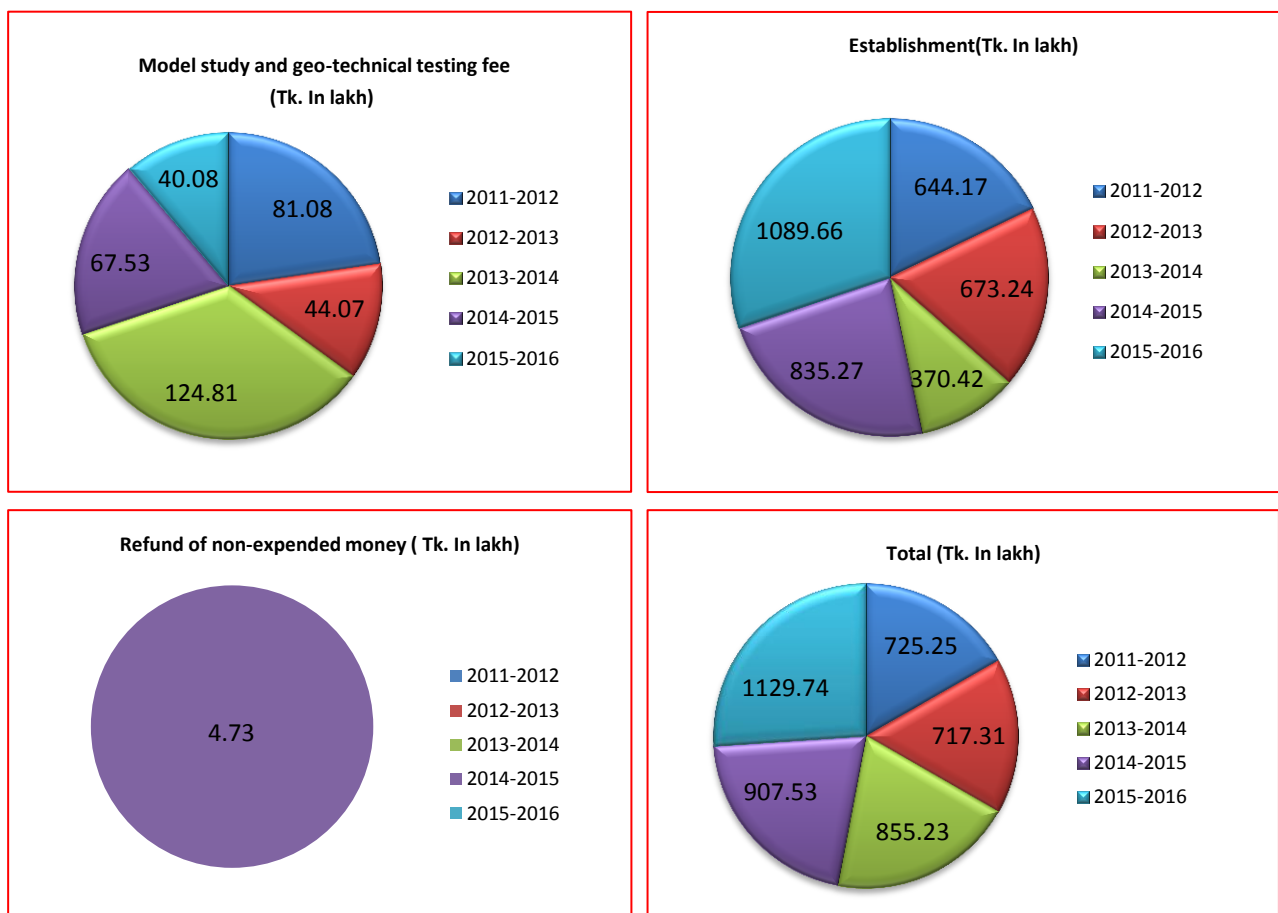


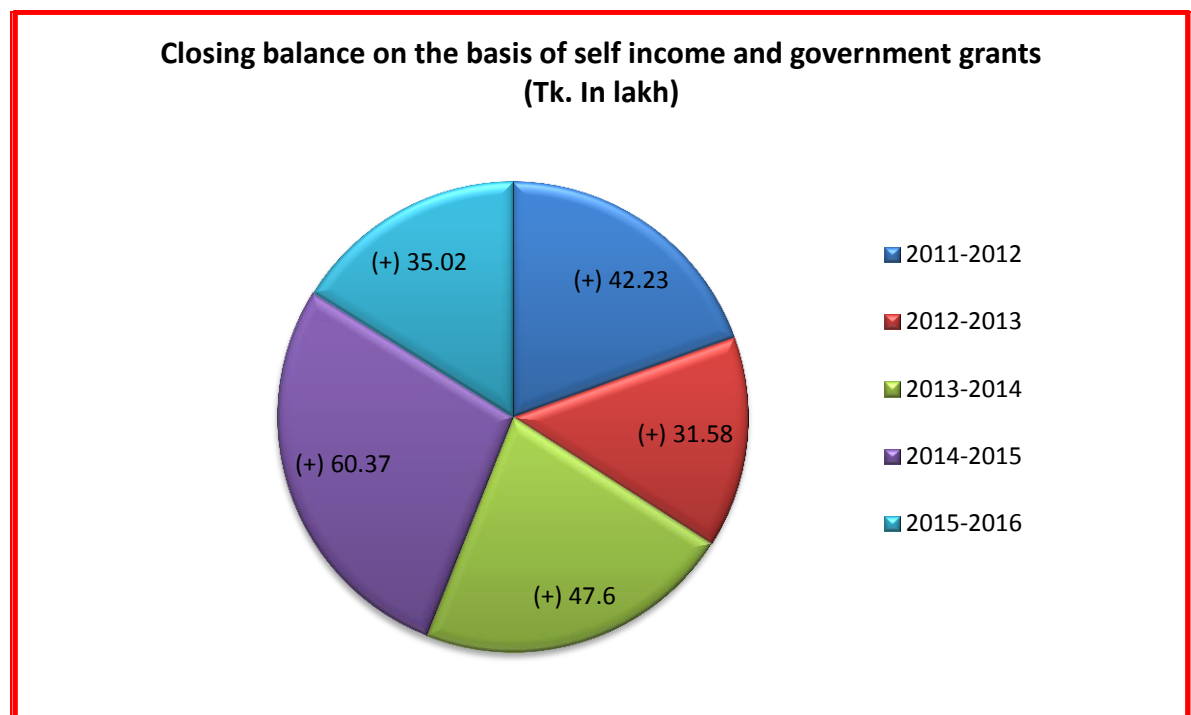
Figure: Expenditure statement chart

**Table 5.3: Closing balance**

Sl. No.	Description	Total (Tk. in lakh)				
		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
1	Closing balance on the basis of self income and govt. grant	(+) 42.23	(+) 31.58	(+) 47.60	(+) 60.37	(+) 35.02

NB: (+) indicates surplus.

The above closing balance is also presented below as pie chart.

**Figure: Closing balance chart**

Detailed budgetary information is given in Annex-II.

## 6 INVENTORY OF PROJECTS WITH REVENUE RECEIVED

Here the revenue earned from the model studies completed by Hydraulic Research Directorate and revenue earned from the test conducted by Geotechnical Research Directorate are described in the following section.

### 6.1 Hydraulic Research Directorate

In the fiscal year 2015-16, Hydraulic Research Directorate has received revenue from Hydrological and Morphological study for construction of Rajapur bridge over the River Monu at 14th K.M of Kulaura- Prithimpasha-Hazipur-Sharifpur Road (Road No. Z-2822) under Road Division, Moulvibazar. The name of the models with estimated cost and money received is shown in Table 6.1.

**Table 6.1: Name of the models with estimated cost and money received**

Sl. No.	Name of the model	Total estimated cost (Tk in lakh)	Money received during 2015-16 (Tk in lakh)	Remarks
1	Hydrological and Morphological study for construction of Rajapur bridge over the River Monu at 14th K.M of Kulaura- Prithimpasha-Hazipur-Sharifpur Road (Road No. Z-2822) under Road Division, Moulvibazar.	12.20	10.56	Completed
Total		12.20	10.56	

### 6.2 Geotechnical Research Directorate

During the fiscal year 2015-16, volume of works done and revenue earned by Geotechnical Research Directorate have been shown in Table 6.2.

**Table 6.2: Volume of works done and revenue earned during the fiscal year 2015-16**

Sl. No.	Name of the discipline	Total nos. of samples tested	Total billed (Tk. in lakh)	Money received (Tk. in lakh)
1	Soil Mechanics & Ground Water Eastern & Western Zone.	Disturbed-4565 Undisturbed-06	53.44	65.19
2	Material Testing and Quality Control.	153	3.24	3.24
3	Sediment, Chemical and Water Pollution.	360	1.89	2.60
Total		5084	58.57	71.03

## 7 FUTURE TREND AND CONCLUSIONS

RRI is a national organization working under the Ministry of Water Resources, Government of the people's republic of Bangladesh. It consists of three directorates namely Hydraulic Research, Geo-technical Research and Administration & Finance. In Hydraulic Research, different types of tests, studies, applied researches etc. are conducted for river training, bank protection and stabilization, flood control and drainage, and different types of hydraulics structure by means of physical modelling as well as mathematical modelling. In Geo-technical Research, various tests, studies, applied researches etc are conducted on sub-surface soil, sediment content and sediment size of different rivers of Bangladesh, water quality and quality control of construction materials used for the construction of different types of hydraulic structures and other constructions by its existing manpower. The Administration & Finance directorate is associated with overall administration of RRI, estate, library, public relation & photography, operation & maintenance of physical facilities, establishment etc.

### 7.1 Trend and Conclusions

To fulfil the objectives of RRI and to cope with the increasing demand of the age in the competitive market, institutional development, instrumentation, sustainable technology development and highly trained manpower are very essential to raise the standard of service in international level. From this point of view the following trend and conclusions are important as mentioned below:

- Now-a-days, Information Technology (IT) has become a very useful tool for research and studies, sound management and transparent administration in the world. RRI has to encounter with the new challenge of the world in the field of water sector.
- RRI has already established a network system by connecting all the activities of this institute. For this RRI has completed all the installations and collected software, hardware and networking components required. By this time, LAN is working at RRI. It will be required a complete wing (manpower & logistics) to govern the IT sector in RRI.
- Two Material Testing and Quality Control field laboratories at Bogra and Barisal have already been established. A liaison office is situated at 72, Green Road, Dhaka. In the liaison office soil, building materials, sediment & water samples are being received from BWDB and other Govt, Semi-Govt, NGOs and consulting firms.
- RRI carries these samples from Dhaka to Faridpur by its own transport to complete the test in due time. The connecting reports have been sent to the client to execute the work of the projects in national level in scheduled time.



- RRI has already established well-equipped Math Model LAB with internet facilities and uninterrupted power supply required to support mathematical modelling.
- RRI successfully completed the physical model studies of some biggest projects of Bangladesh namely Bangabandhu Bridge Project, Padma Multipurpose Bridge Project, Ganges Barrage Project, Gorai River Restoration Project, Arial Khan Roadway Bridge Project, 3<sup>rd</sup> Karnafully Roadway Bridge Project, Kushtia Town Protection Project etc.
- RRI has also been publishing technical journal named as RRI Technical Journal yearly since 1991. Multidisciplinary research activities and case studies of different projects are included in the journal. RRI Technical Journal has already got recognition in 2000 by ISSN - International Centre, 20, rue Bachaumont, 75002 Paris - France and its serial has been registered as "ISSN 1606-9277 with key- title: Technical journal - River Research Institute, abbreviated key – title: Tech. J. - River Res".
- RRI may act as a focal institution of its peripheral region to investigate regional water resources problems. A monitoring cell may be established at RRI to monitor the natural hazards like flood, draught, bank erosion, earthquake etc. As a focal institution, RRI may provide consultancy services to the Government, Local Authority of any organizations or may directly advise the beneficiaries to take precautionary measures against those hazards.
- RRI is working in collaboration with BUET and is willing to work with similar foreign institutions like CWPRS (India), DHI (Denmark), Delft Hydraulics (The Netherlands), HR Wallingford (UK), NHC (Canada), SMEC (Australia), LHI (Sri Lanka) etc. Efforts are being made by RRI to start joint venture/bi-lateral study/research projects with these similar international institutions.
- More opportunities should be extended for RRI research personnel for imparting higher studies leading to MS/Ph D degree and other advanced on-job training. There should also have enough scope for RRI officials to participate in the national/international seminar, symposium, congress, workshop etc.
- RRI has completed two research work titled "Investigation on launching characteristics of different materials to find out the cost-effective and sustainable solution of river bank protection" and "Assessment of river pollution around Dhaka and find out the ways to alleviate pollution".
- RRI has undertaken a new research project entitled "Hydro-morphological study of the Mahananda river in Bangladesh with focus on problems and probable solutions of dry season flow scarcity"
- It can be mentioned here that though RRI is primarily catering the needs for national agencies, with the gradual development of manpower and technology, the institute will fulfil the demands for international bodies and organizations in future.

**Annex I****PERSONNEL OF RRI**

**List of the Existing Scientific, Administrative and Supporting Managerial Personnel of RRI**  
(As on February 2017).

Sl. No.	Name of Officer	Designation	Qualification	E-mail
1	Dr. Engr. Md. Lutfor Rahman	Director General (In charge)	B.Sc.Engg. (Civil), BUET, PGD (Env. Water) in UK, M.Engg. (WRE), BUET, Ph. D, DUET; Life F-IEB, M-BCS, M-BAAS, Life M-NOAA,	mdlutforrahman10@yahoo.com
2	Arun Chandra Mahottam (Deputy Secretary)	Director (Admin & Finance)	M.S.S. (Social Welfare), ISWR, DU, Dhaka	<a href="mailto:mahottam@yahoo.com">mahottam@yahoo.com</a>
3	Engr. Swapan Kumar Das	Director (In charge)	B.Sc.Engg. (Civil), Engineering College, Khulna, M.Engg. (WRE), BUET; PGT in IHE, Delft, The Netherlands, India & Canada; F-IEB.	swapan89@yahoo.com
4	Engr. Pintu Kanungoe	Chief Scientific Officer	B.Sc. Engg. (Civil), BUET, M.Engg. (Hydraulic Engg.), IHE, Delft, The Netherlands; PGT in Nepal & The Netherlands; F-IEB.	pintu_kanungoe@yahoo.com
5	Engr. Kazi Rezaul Karim	Chief Scientific Officer	B.Sc. Engg. (Civil), BUET, PGD (Hydrology), Belgium.	razu6511@yahoo.com
6	Uma Saha	Principal Scientific Officer	B.Sc. (Hons), M.Sc. (Physics), JU, MBA (MIS), PU; PGT in The Netherlands, Malaysia & India; LM-BPS.	umasaha_65@yahoo.com
7	Sheela Rani Chowdhury	Principal Scientific Officer	B.Sc. (Hons), M.Sc. (Physics), RU; PGT in The Netherlands & India; LM-BPS.	sheela_chowdhury@yahoo.com
8	Engr. A. K. M. Ashrafuzzaman	Principal Scientific Officer	B.Sc. Engg. (Civil), BUET, M. Engg. (Water Resources), BUET; M. Sc. (Hydrology & Water Resources), UNESCO-IHE, Delft, The Netherlands; PGT in IIT, Roorkee, India, Trained in BPATC; F-IEB.	ashrafuzzaman_89@ymail.com
9	Engr. Md. Abul Ala Moududi	Principal Scientific Officer	B.Sc. Engg. (Agril), BAU, Mymensingh, M. Engg. (WRE), BUET; PGT in IHE, Delft, The Netherlands, Trained in BUET; F-IEB.	moududi80@yahoo.com moududi78@gmail.com
10	Engr. Md. Azizul Haque Podder	Principal Scientific Officer	B.Sc. Engg. (Agril), BAU, M.Sc. (WRS), ITC, The Netherlands; F-IEB.	mdazizul66@yahoo.com
11	Engr. Syed Md. Anwaruzzaman	Principal Scientific Officer	B.Sc. Engg. (Agril), Gold Medalist, BAU, M. Engg. (WRE), BUET; Trained in IEB, BPATC, RPATC & BIM; F-IEB, M-KIB & MBSAE.	<a href="mailto:anwaruzzaman1968@gmail.com">anwaruzzaman1968@gmail.com</a>

Sl. No.	Name of Officer	Designation	Qualification	E-mail
12	Engr. Md. Matiar Rahman Mondol	Principal Scientific Officer	B.Sc. Engg. (Civil), BUET, M.Sc. Engg. (Civil & Environmental Engg.), BUET, Trained in RPATC; F-IEB.	<a href="mailto:mrmondol@yahoo.com">mrmondol@yahoo.com</a>
13	Engr. Md. Alauddin Hossain	Principal Scientific Officer	B.Sc. Engg. (Agril), BAU, Mymensingh; M. Engg. (WRM), UNESCO-IHE, Delft, The Netherlands; PGD in India and Nepal (Groundwater Governance in Asia), PGT in China (IRBM), Nepal (Building Flood Disaster Resilience of Cities) & Vietnam (River Delta Planning); Trained in BPATC, NAPD; Life F-IEB, M-KIB, M-BSAE.	<a href="mailto:alauddin_1968@yahoo.co.uk">alauddin_1968@yahoo.co.uk</a> <a href="mailto:babulala68@gmail.com">babulala68@gmail.com</a>
14	Engr. Gias Uddin Ahmed	Senior Scientific Officer	B.Sc.Engg. (Agril), BAU, Mymensingh; Trained in BPATC.	
15	Dr.Engr. Moniruzzaman Khan Eusufzai	Senior Scientific Officer	B.Sc. Engg. (Agril), M.S (IWM), BAU, PhD (Environmental Science), Japan; Post doc (Climate Change), Japan; F-IEB	<a href="mailto:mzk1973_82@hotmail.com">mzk1973_82@hotmail.com</a>
16	Dr. Engr. Fatima Rukshana	Senior Scientific Officer	B. Sc. Engg.(Agril), M.S ( FPM), BAU; PhD (Soil and Environmental Sci.), LTU, Australia; PGT (GIS and Remote Sensing for Water Sector), UNESCO-IHE, The Netherlands; F-IEB, M-ASSI, M-IUSS.	<a href="mailto:frukshana11@gmail.com">frukshana11@gmail.com</a>
17	Engr. Shailen Kumer Ghosh	Senior Scientific Officer	B.Sc. Engg. (Mechanical) BIT, Dhaka; Trained in BPATC; M-IEB.	<a href="mailto:shailen67@gmail.com">shailen67@gmail.com</a>
18	Engr. Md. Johurul Islam	Senior Scientific Officer	B.Sc. Engg. (Civil), BUET, Trained in BUET & RPATC; M-IEB.	<a href="mailto:johurul1999@yahoo.com">johurul1999@yahoo.com</a>
19	Md. Abul Ehsan Mian	Photographer/ PRO/DD (In-charge)	B.S.S RU, Trained in Photography, BPI, Dhaka.	<a href="mailto:ehsanrubel68@gmail.com">ehsanrubel68@gmail.com</a>
20	Md. Abu Zafar	Assistant Director	M.A (NU), LLB, Trained in RPATC.	
21	Md. Azmal Hossain Fakir	Librarian	B.A (Hons), M.A (Geography); PGD in Library & Information Science, RU; PGT in New Delhi, India; Trained in RPATC.	<a href="mailto:azmal1966@gmail.com">azmal1966@gmail.com</a>
22	Nasima Khatun	Private Secretary to Director General	B.A, NU, Diploma in Computer Science; Trained in RPATC.	<a href="mailto:rribd@yahoo.com">rribd@yahoo.com</a>
23	Engr. Mohammad Mehedi Hasan	Scientific Officer	B.Sc. Engg. (Agril), BAU, Mymensingh; M.Sc. (Environmental Engg.), BUET; M.Sc.Engg. (WRE), KULeuven, Belgium;Trained in RPATC, NAPD; M-IEB.	<a href="mailto:mhsn.rri.bd@gmail.com">mhsn.rri.bd@gmail.com</a>
24	Md. Dulal Bawali	Scientific Officer	B.Sc. (Hons), M.Sc.in Applied Physics Electronics and Communication Engineering, Islamic University, Kustia.	<a href="mailto:dulal.bawali@gmail.com">dulal.bawali@gmail.com</a>
25	Engr. Md. Zubayerul Islam	Scientific Officer	B.Sc. Engg. (Agril), M.S in Farm Structure, BAU, Mymensingh; M-IEB.	<a href="mailto:zubi_ageng@yahoo.com">zubi_ageng@yahoo.com</a>
26	Md. Jahangir Alam	Accounts Officer	B.Com, DU; Trained in RPATC.	<a href="mailto:Jahangir_rri@yahoo.com">Jahangir_rri@yahoo.com</a>

Sl. No.	Name of Officer	Designation	Qualification	E-mail
27	Engr. Md. Tofiqzaman	Scientific Officer	B.Sc. Engg. (Civil), DUET, Gazipur.	<a href="mailto:tofiqri@gmail.com">tofiqri@gmail.com</a>
28	Nayan Chandra Ghosh	Scientific Officer	B.Sc. (Hons), M.Sc. (Physics), Jagannath University, M.Phil (Physics), BUET, Dhaka; LM-BPS.	<a href="mailto:nayan.ghs@gmail.com">nayan.ghs@gmail.com</a>
29	Md. Moniruzzaman	Scientific Officer	B.Sc. (Hons), M.Sc. (Physics), RU, Rajshahi.	<a href="mailto:mmpdpru@gmail.com">mmpdpru@gmail.com</a>
30	Engr. Md. Shahabuddin	Scientific Officer	B.Sc. Engg. (Civil), DUET, Gazipur.	shahabuddin_61@yahoo.com
31	Engr. Abdullah Al Imran	Scientific Officer	B.Sc. Engg. (Civil), KUET, Khulna.	<a href="mailto:imran_0301086@yahoo.com">imran_0301086@yahoo.com</a>
32	Engr. KhondokerRajib Ahmed	Scientific Officer	B.Sc. Engg. (Civil), BUET, Dhaka.	<a href="mailto:krahmed147@gmail.com">krahmed147@gmail.com</a>
33	Engr. Sajia Afrin	Scientific Officer	B.Sc. Engg. (Civil), CUET, Chittagong.	<a href="mailto:shithi_cecuet02@yahoo.com">shithi_cecuet02@yahoo.com</a>
34	Engr. Omar Al Maimun	Scientific Officer	B.Sc. Engg. (Civil), DUET, Gazipur.	<a href="mailto:maimunduet@gmail.com">maimunduet@gmail.com</a>
35	Goswami Bilwa Mongal	Sub-Assistant Engineer	Dip. in Civil Engg., Trained in RPATC.	-

**Annex II****FINANCE AND ACCOUNTS****Income and expenditure account for the fiscal year 2015-2016**

For the year ended June 30, 2016

Income		Expenditure	
Items	Taka (Lakh)	Items (Lakh)	Taka (Lakh)
Govt. grant	1071.32	Establishment: • Officers salary 189.07 • Staff salary 294.65 • Allowances 353.37 • Supply and services 171.47 • Repair & maintenance 37.94 • Capital expenditure 24.82 • Estab. cost by own fund 18.34	1089.66
Model study	10.56	Model study	9.55
Geotechnical testing fee	60.77	Geotechnical testing	30.53
Others	22.11	Refund of non-expended money	-
Total	1164.76	Surplus (+)	35.02
		Total	1164.76

**Income and expenditure account for the fiscal year 2014-2015**

For the year ended June 30, 2015

Income		Expenditure	
Items	Taka (Lakh)	Items (Lakh)	Taka (Lakh)
Govt. grant	840.00	Establishment • Officers salary 114.62 • Staff salary 186.36 • Allowances 314.72 • Supply and services 148.02 • Repair & maintenance 30.75 • Capital expenditure 40.80	835.27
Model study	34.43	Model study	28.50

Geotechnical testing fee	82.49	Geotechnical testing fee	39.03
Others	10.98	Refund of non-expended money	4.73
Total	967.90	Surplus (+)	60.37
		Total	967.90

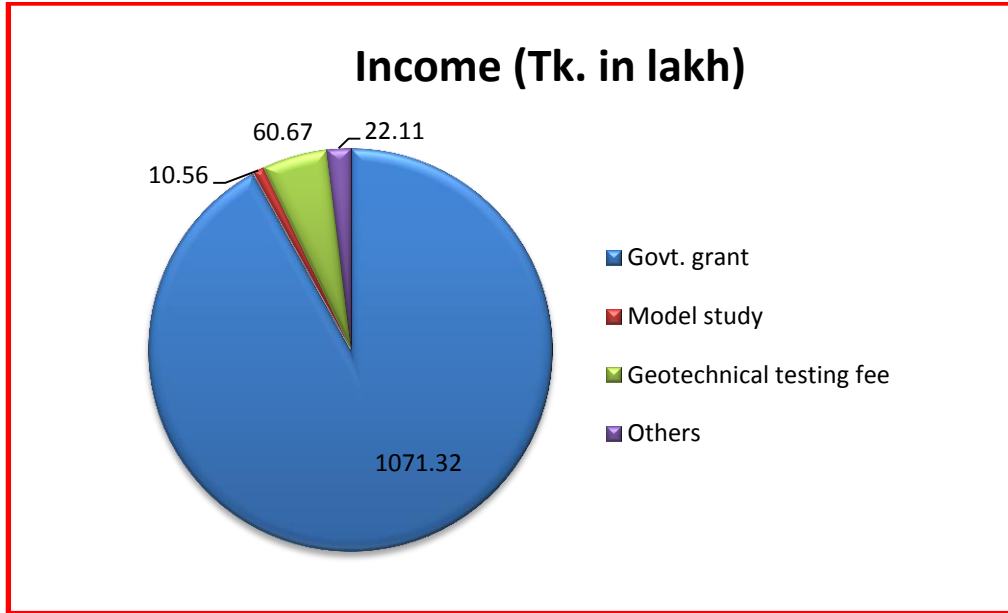


Figure: Income chart for the year ended on June 30, 2016

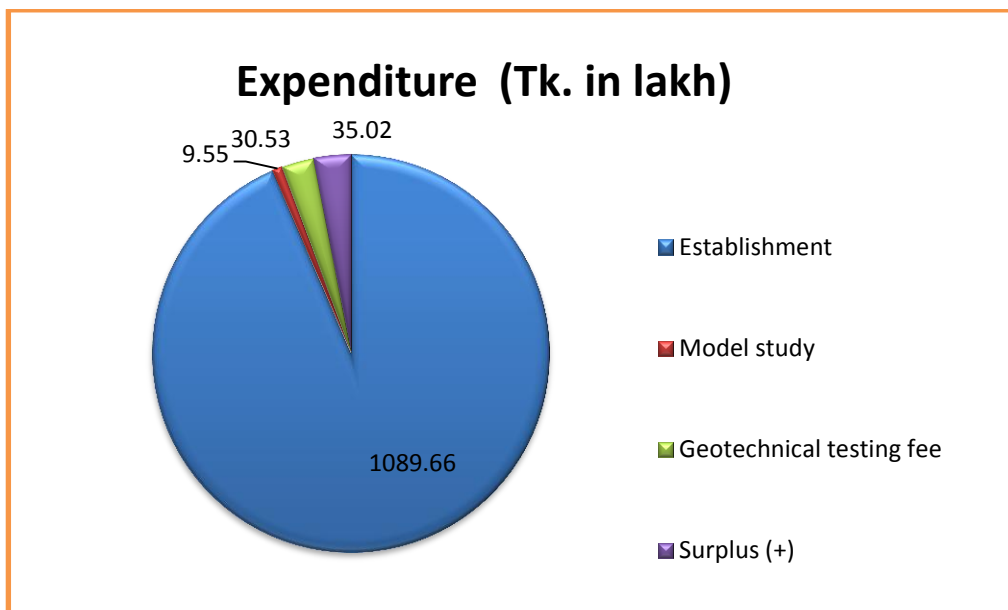


Figure: Expenditure chart for the year ended on June 30, 2016

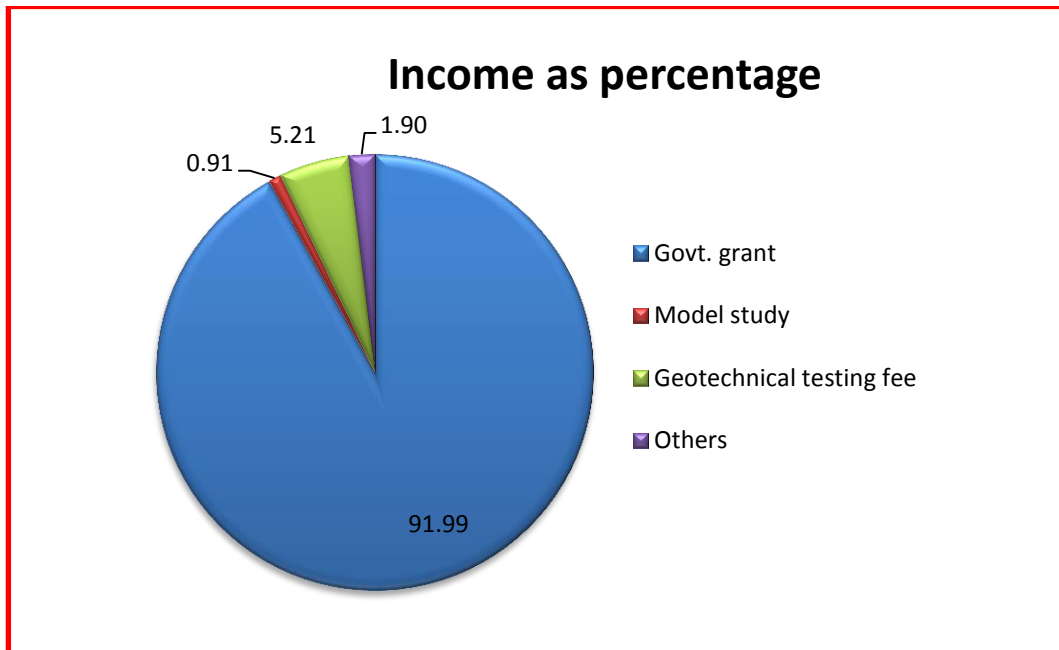


Figure: Chart showing percentage of total income for the year ended on June 30, 2016

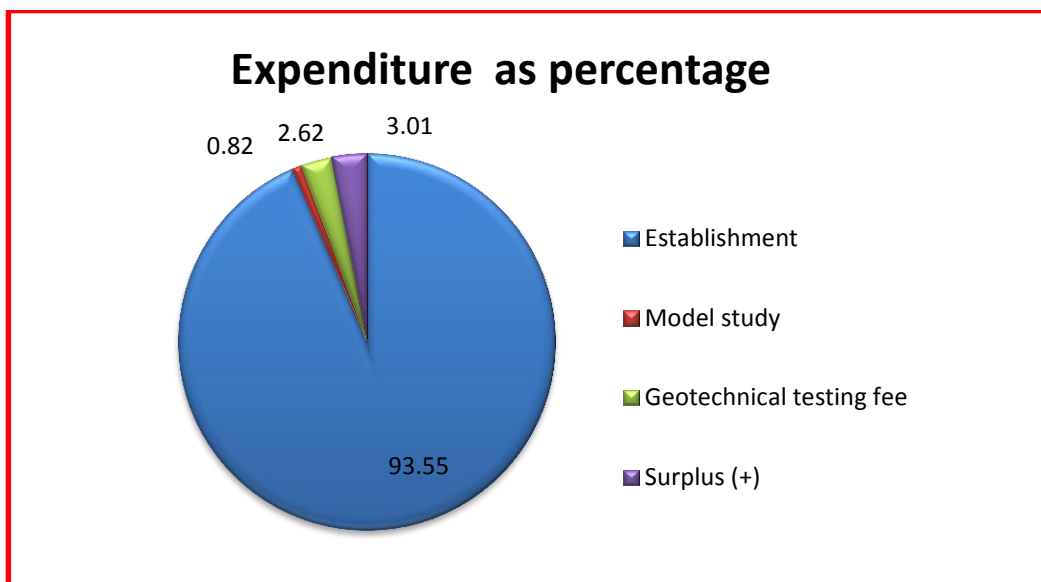


Figure: Chart showing percentage of total expenditure for the year ended June 30, 2016

The income and expenditure account for the fiscal year 2014-2015 are also presented below as pie chart:

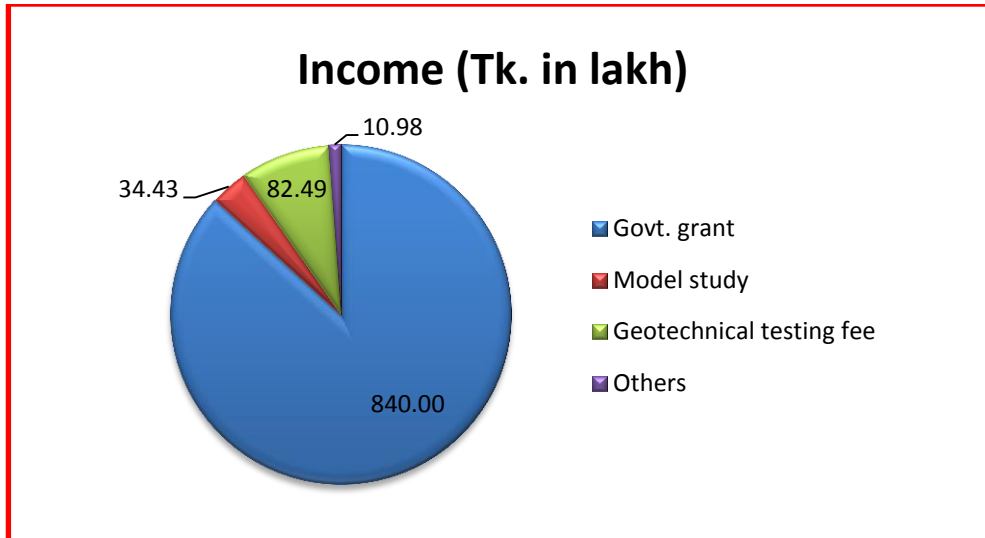


Figure: Income chart for the year ended on June 30, 2015

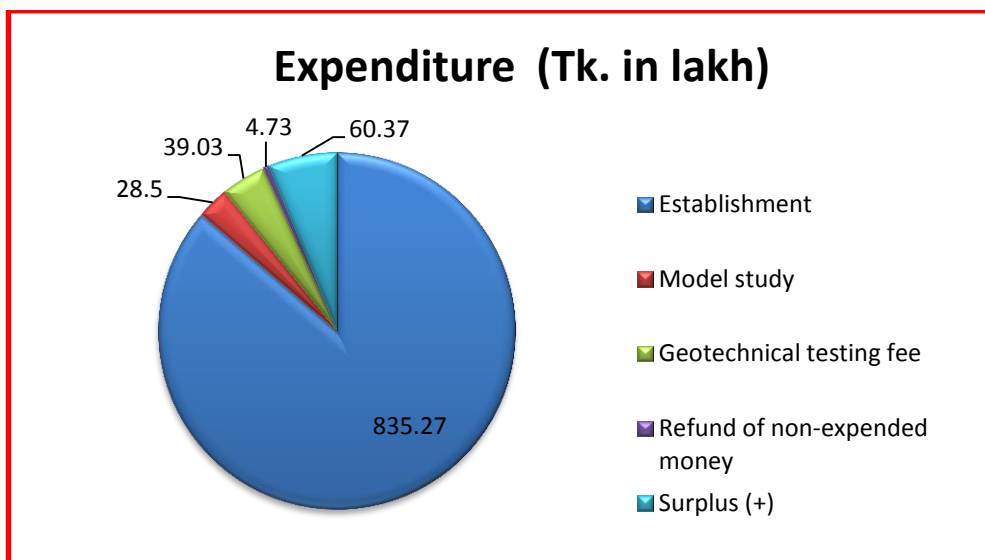


Figure: Expenditure chart for the year ended on June 30, 2015



The above figures can be expressed as percentage of total income and total expenditure in pie chart as the following page:

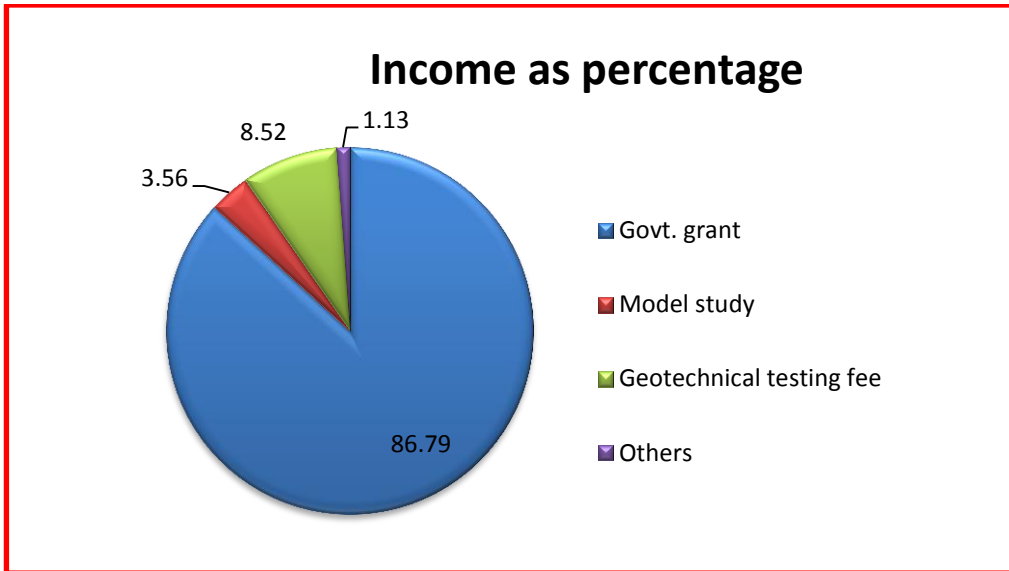


Figure: Chart showing percentage of total Income for the year ended June 30, 2015

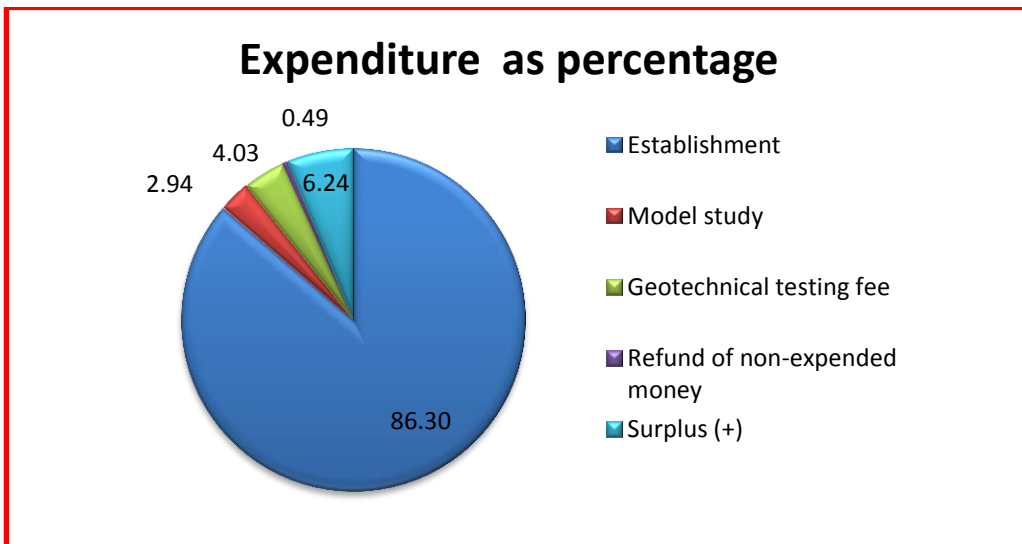


Figure: Chart showing percentage of total expenditure for the year ended June 30, 2015

Annex III**LIST OF ABBREVIATIONS**

AD	Assistant Director
ADB	Asian Development Bank
AFPM	Active Flood Plan Management
A & F	Administration and Finance
A & FD	Administration and Finance Directorate
AIT	Asian Institute of Technology
ASTM	American Society for Testing Materials
ASO	Assistant Scientific Officer
ASSSI	Australian Society of Soil Science Inc.
B.A	Bachelor of Arts
BAU	Bangladesh Agricultural University
BCL	Bangladesh Consultant Limited
BCSIR	Bangladesh Council of Scientific and Industrial Research
BIAM	Bangladesh Institute for Administrative Management
BIM	Bangladesh Institute of Management
BIT	Bangladesh Institute of Technology
BIWTA	Bangladesh Inland Water Transport Authority
BIWTC	Bangladesh Inland Water Transport Corporation
BoG	Board of Governors
BPATC	Bangladesh Public Administration Training Centre
BPI	Bangladesh Photographic Institute
BPS	Bangladesh Physical Society
BRRP	Buriganga River Restoration Project
BUET	Bangladesh University of Engineering & Technology
BWDB	Bangladesh Water Development Board
CBR	California Bearing Ratio
CC	Certificate Course
CERP	Coastal Embankment Rehabilitation Project
CEGIS	Centre of Environmental and Geographic Information Services
CPT	Cone Penetration Test
CPU	Central Processing Unit
CPTU	Central Procurement Training Unit
CSO	Chief Scientific Officer
CT	Concrete Technician
CUET	Chittagong University of Engineering & Technology
CWPRS	Central Water and Power Research Station
CZEM	Coastal Zone Engineering and Management
DDC	Design Development Consultants Limited
DD	Deputy Director
DG	Director General
DHI	Danish Hydraulic Institute
DIFPP	Dhaka Integrated Flood Protection Project
Dip.	Diploma
DIFPP	Dhaka Integrated Flood Protection Project

DPP	Development Project Proforma
D/S	Downstream
DU	Dhaka University
DUET	Dhaka University of Engineering & Technology
EC	Electrical Conductivity
EEE	Electrical & Electronics Engineering
EGIS	Environmental and Geographic Information Service
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESIA	Environmental impact statement
ENGG.	Engineering
FAP	Flood Action Plan
FCDI	Flood Control, Drainage & Irrigation
F-IEB	Fellow of the Institution of Engineers, Bangladesh
FM	Fineness Modulus
FPM	Farm Power and Machinery
GBSP	Ganges Barrage Study Project
GDP	Gross Development Profit
GHH	Ground Water Hydrology
GIS	Geographic Information System
GO	Government Order
GoB	Government of Bangladesh
GR	Geotechnical Research
GRD	Geotechnical Research Directorate
GRRP	Gorai River Restoration Project
GWC	Ground Water Circle
Hons	Honours
HP	Horse Power
HR	Hydraulic Research
HRD	Hydraulic Research Directorate
HRL	Hydraulic Research Laboratory
IAD	Integrated Agricultural Development
IBAIS	International Business Administration and Information System
ICDDR	International Centre for Diarrheal Disease Research and Rehabilitation, Bangladesh
IDCB	Institutional Development and Capacity Building
IEB	Institution of Engineers, Bangladesh
IHE	International Institute for Infrastructural, Hydraulic and Environmental Engineering
IIT	Indian Institute of Technology
IMED	Implementation, Monitoring and Evaluation Department
IRD	Integrated Rural Development
ITC	International Institute for Aerospace Survey and Earth Sciences
IUSS	International Union of Soil Science
IWFM	Institute of Water and Flood Modelling
IWM	Institute of Water Modelling / Irrigation and Water Management
IWRM	Integrated Water Resources Management

JOCL	Japan Overseas Consultants Limited.
JU	Jahangirnagar University
KUET	Khulna University of Engineering & Technology
KUL	Katholic University of Leuven
KVA	Kilo Volt Ampere
LA	Laboratory Attendant
LAB	Laboratory
LGB	Left Guide Bund
LHI	Lanka Hydraulic Institute
LLB	Bachelor of Law
LM	Life Member
LOI	Letter of Intent
LT	Laboratory Technician
LTU	La Trobe University
M.A	Master of Arts
M-ASCE	Member of American Society of Civil Engineer
M-BAAS	Member of Bangladesh Association for Advancement of Science
MBA	Master of Business Administration
M-BCS	Member of Bangladesh Computer Society
M-BES	Member of Bangladesh Environmental Society
MC	Main Consultant/Moisture Content
M-IEB	Member of the Institution of Engineers, Bangladesh
MIS	Management Information System
M-JSCE	Member of Japan Society of Civil Engineers
MLSS	Member of the Lower Class Subordinate
M-NOAMI	Member of National Oceanographic and Maritime Institute
MoU	Memorandum of Understanding
MoWR	Ministry of Water Resources
MP	Member of the Parliament
MPA	Mongla Port Authority
MS	Mild Steel
M.S/M.Sc.	Master of Science
M. Phil	Master of Philosophy
NHC	North Hydraulic Consultants Limited
NMC	Natural Moisture Content
NU	National University
NAHRIM	National Hydraulic Research Institute Malaysia
O & M	Operation & Maintenance
OTM	Open Tendering Method
PABX	Public Automatic Branch Exchange
PATC	Public Administration Training Centre
PC	Personal Computer
PD	Project Director
PGD	Post Graduate Diploma
PGT	Post Graduate Training
PhD	Doctor of Philosophy
PLOI	Provisional Letter of Intent

PPM	Parts per Million
PS	Private Secretary
PSO	Principal Scientific Officer
PU	Prime University
PWD	Public Works Department
RAC	Regional Accounts Centre
RDPP	Revised Development Project Proforma
REBRFM	Research on the Effect of Bandalling on River Flow and Morphology
RFQ	Request for Quotation
RGB	Right Guide Bund
RHD	Roads & Highways Department
RPATC	Regional Public Administration Training Centre
RRI	River Research Institute
RTW	River Training Work
RU	Rajshahi University
RUET	Rajshahi University of Engineering & Technology
SAE	Sub-Assistant Engineer
SICT	Support to Information and Communication Technology
SMEC	Snowy Mountain Engineering Corporation
SO	Scientific Officer
SRNDP	Southwest Road Network Development Project
SSD	Submerged Soil Density
SSO	Senior Scientific Officer
SSFCDI	Small Scale Flood Control, Drainage & Irrigation
ST	Soil Technician
SWH	Surface Water Hydrology
SWMC	Surface Water Modelling Centre
TDS	Total Dissolved Solids
ToR	Terms of Reference
TU	Technical University
UGC	University Grant Commission
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPM	Universiti Putra Malaysia
U/S	Upstream
USA	United States of America
UTM	Universal Testing Machine
WR	Water Resources
WRDP	Water Resources Development Project
WRE	Water Resources Engineering
WRM	Water Resources Management
WR	Water Resources Survey

Annex IV

**IMPORTANT MOMENT**









## OBJECTIVES OF RIVER RESEARCH INSTITUTE

The activities of RRI as per Act 53 of 1990 are directed towards the achievements of the following objectives:

- \* To carry out studies for design supports in river training, river bank protection, flood control, irrigation & drainage works and to conduct research in river engineering, sediment control, estuary and tidal effects by means of physical model.
- \* To conduct mathematical model studies on river flow & regional flow network, hydrology, surface & ground water utilization and environmental issues with special attention to salinity intrusion & water quality with a view to develop the water resources.
- \* To perform tests on construction materials required for river training, river bank protection, flood control, irrigation & drainage structures and to inspect & evaluate the quality of the construction works thereof.
- \* To conduct training program on the above mentioned subjects and to publish reports & periodicals related to technical aspects.
- \* To advise the Government, Local Authority or any organizations regarding the problems and best approach towards the solution on the above mentioned subjects.
- \* To co-operate & conduct joint ventured research work with other similar local or foreign organizations.
- \* To take any necessary steps for performing the above mentioned works.

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