WARPO
পানি সম্পদ পরিকল্পনা সংস্থা

Water Resources Planning Organization

Draft Final Report

Study on Online Processing and Tracking of Water Resources Project Clearance and No Objection Certificates for Groundwater Abstraction

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Acronyms and Abbreviation

CC	Clearance Certificates
CDSP	Char Development and Settlement Project
CEGIS	Centre for Environmental and Geographic Information Services
CERP	Coastal Embankment Rehabilitation Project
CSS	Cascading Style Sheet
DFD	Data Flow Diagram
DFR	Draft Final Report
HTML	Hypertext Markup Language
IWRM	Integrated Water Resources Management
MIS	Management Information System
MoU	Memorandum of Understanding
NOC	No objection certificate
NWMP	National Water Management Plan
NWRD	National Water Resources Database
OTA	Operational Acceptance Testing
RFP	Request For Proposal
SQL	Structured Query Language
ToR	Terms of Reference
UAT	User Acceptance Testing
WARPO	Water Resources Planning Organization

Chapter 1 : Introduction

1.1 Project Appreciation

1.1.1 Background

Water Resources Planning Organization (WARPO) was established under the Water Resources Planning Act 1992 and mandated by the National Water Policy 1999 and the Bangladesh Water Act 2013 and its 2018 Rules which require it to act as not only as a strategic planning agency but also as a water resources management and regulatory agency. The recently gazette Bangladesh Water Rules 2018 place a wide range of new regulatory responsibilities on WARPO which will progressively implement by WARPO as it expands its staffing and establishes regional offices. To this end, it is essential to implement two of the highest priority measures in the 2018 Rules, those for water resources project clearance and force-mode groundwater abstraction, and also to ensure that the necessary information to apply these rules can be disseminated to those responsible for their implementation.

A particular feature of Sub-rule 47(6) under the Bangladesh Water Rules-2018 empowers WARPO to introduce digital processes where it deems appropriate. Thus, for new regulatory processes, this allows WARPO to leapfrog over paper-based systems to create an operating environment that is easier, quicker and cheaper to run and adds the immense benefits of greater transparency and accountability. This principle will demonstrate good governance by WARPO which benefits both public and private sectors and society at large through contributing to greater protection and more effective use of water resources.

The National Water Management Plan (NWMP, 2001), provides a framework to implement National Water Policy (1999) and Bangladesh Water Act 2013. This act significantly extends the mandate of WARPO into being a regulatory as well as planning organization, and requires a major expansion of its staffing and structure to achieve this. The new regulatory role is spelled out in the Bangladesh Water Rules 2018. Because implementation of all rules at all administrative levels will take a period of years, it is better to implement the Rules in parallel with increased resources in WARPO. Hence, Water Resources Project Clearance and No Objection Certificates for force-mode deep tube wells and data dissemination have been selected as priority areas for action, and where operation will be supported by consultancy implants until WARPO has sufficient trained staff in place.

1.1.2 Objectives

The main objective of the project is to commence implementation of priority components of the Bangladesh Water Rules 2018, specifically for water sector project clearance and No objection certificate of groundwater abstraction under force mode. In support of these measures, the project has improved access to the information in the National Water Resources Database (NWRD) that is needed to support in decision making. This has been contributing to the development of water resources in a more holistic and integrated way so as to help in finding the optimum compromise between the economic benefits across all sectors and conserving and protecting the water-related environment. The specific objectives of the consultancy service are listed below:

- Development of a web-based system for applying, processing and tracking Clearance Certificates as specified in Chapter 8 of the Bangladesh Water Rules, 2018.
- Development of a web-based system for applying, processing and tracking No Objection Certificates for Ground water under force-mode as specified in Chapter 10 of the Bangladesh water Rules 2018. For IT development purposes, there will be much synergy with clearance process, and as above, there will be listings of all applications and their status, and summary reporting thereof.
- Development of an on-line systems for dissemination of existing data of NWRD, ICRD and other sub-sets of NWRD for processing information to those who need information for the above measures and to other, previously approved users with established rights of, and procedures for, access to data. Within the established rules and restrictions, this will give easy access to water resources data (e.g. hydrological, environmental, social, economic, climate, fisheries etc.) that will facilitate implementation of integrated water resources management (IWRM) processes.
- Post und update a schedule of all regulatory measures under the Bangladesh Water Rules 2018 indicating the dates, by region and by sector, when they will come into effect so that all water users can be clear as to their obligations under the Bangladesh Water Act, 20l3.

1.1.3 Scope of Work

The overall scope of the project is to design and develop web based application for Clearance Certificates and No Objection Certificates as specified in Bangladesh Water Rules, 2018 and on-line Data Dissemination Tool. Operation and maintenance support for evaluating and issuing certificates is also required for the remainder of the project period. The detail scope of works as understood from the ToR are described below:

a) System analysis, design, development and implementation of a web-based portal for the water sector Project Clearance Certification process described in Chapter 8 of the Bangladesh Water Rules 2018 with reference to implementing this for projects that exceed the financial threshold for determination by WARPO.

b) System analysis, design, development and implementation of a web-based portal for issuing of No objection certificate (NOC) by WARPO for the abstraction of ground water by force-mode deep tube wells as specified in Rule 30(3) of Chapter 10 under the Bangladesh Water Rules 2018.

c) System analysis, design, development and implementation of a web based Data Dissemination Tool to disseminate existing data of NWRD to line agencies, Government and private agencies, and registered researchers and students. The data will be limited to those themes that are included in the NWRD at the time of bid submission plus additional data items to the existing structure of these themes.

d) Update Desktop computer with advance ArcGIS and Remote sensing Software (license software) needs for data analyzing, quality checking, processing and storing the requirements for (a), (b) and (c).

e) Test application (a) with the DoE, prior to making the system fully operational.

f) Operate and maintain the on-line systems (a), (b) and (c) in compliance with the Conditions of the Bangladesh Water Rules 2018 for the remainder of the project.

g) WARPO will provide the list of individuals and/or organization that will have access to the NWRD via password system.

h) Establishing the protocols (signing MoU etc.) among different collaborative agencies for effective data storage, sharing and exchange through the NWRD web portal.

i) Update the Data Management Guideline of the NWRD web portal which includes, maintenance and operation of NWRD web portal, data collection and processing, data Layer preparation, data quality checking, data storage and archiving, data categorization, Database development and management, principle of data sharing and dissemination, data Backup, data purging, maintaining standard in all aspects, roles and responsibilities of respective entities and other activities necessary for the best performance and efficiency of NWRD.

j) Prepare/ update an online data inventory of data, database and remote sensing images of different organization. Moreover, data collection, processing, metadata, data sharing, status, data policy, backup system, software, and other data/database related activities.

k) Upgrade existing offline tools of NWRD and ICRD (Data Quality Tool, Data availability Tool, Data Upload Tool etc.

l) Development of online help and guidelines for the systems described in (a), (b) and (c) and establishment the linkages of the systems described in (a), (b) and (c) with the National Web Portal and WARPO website for easy accessibility of these systems to all stakeholders including district and upazila offices.

m) Development of online Mapping Tool and Reporting Tool in accordance with the requirement of (a) (b) and (c).

n) Linkage with P-MIS (Project and Program MIS of NWRP/NWMP) with Clearing House Tools of WARPO.

1.2 Deliverables

The deliverables of this project are as follows:

A. Comprehensive on-line processing and reporting tool for water sector project Clearance Certificates (CC).

B. Comprehensive on-line processing and reporting tool for No Objection Certificates (NOC) for Ground Water Abstraction under force-mode deep tube wells.

C. Online 'Data Export/Dissemination Tool' for data dissemination from NWRD, ICRD and other subsets of NWRD to a specified group of users.

D. Upgrade and update of all existing Desktop application tools of NWRD and ICRD with advance features

   i. Data Quality Tools for validation and verification of collected data

   ii. Data Processing Tools for converting collected data from various organizations and agencies to National Water Resources Database (NWRD) format.

   iii. Statistical Analysis tools for generating reports and graphs.

iv. Metadata editor for creating, editing, updating and deleting of NWRD Meta data. Add features, so that WARPO professionals can create, update and delete new data layer, sub-layer and can import data directly to data layer and/or data sub-layer.

E. Guidelines Policies

i. Updated NWRD 'Database Management Guideline' including the roles and responsibilities of all collaborating agencies for central database maintenance, operation, data collection, processing, quality, standardization, data policies, backup, standardization and all other activities necessary for proper management and efficiency of the database.

ii. Guidelines for overall water resources data collection plans containing review sect oral data collection responsibilities, up-gradation of data collection etc.

iii. Updated Data quality Methodologies to maintain the quality of data in all steps including Data collection, processing, storing and dissemination.

iv. Updated Guideline of Data Quality Check, Assessment and Improvements and Policies for Data import, data export.

1.3 Resource Mobilization

A multi-disciplinary team of CEGIS has been mobilized from September 26, 2019 to conduct “Online Processing and Tracking of Water Resources Project Clearance and No Objection Certificates for Groundwater Abstraction”. The team includes the following professionals:

1 Malik Fida A Khan, Team Leader (Water Resources Engineer)

2 Abul Kashem Md. Hasan , Deputy Team Leader (Data base specialist)

3 Md. Shafiqul Islam, Data Analyst

4 Md. Mostafizur Rahman, GIS Expert

5 Mohammad Shahidul Islam , Remote Sensing Expert

6 Badal Mohammad Faruque , System Analyst

7 Md Anisur Rahman , Computer Programmer

8 Md. Abdul Hadi , Computer Programmer

9 Tanvir Ahmed, Hydrologist

10 Ahmmed Zulfiqar Rahaman, Hydrogeologist

1.4 Activities performed during inception stage

1.4.1 Contract Signing

The contract was signed between WARPO and CEGIS on September 26, 2019. The contract signing ceremony was arranged in the conference room of WARPO. Director General of WARPO presided over the contract signing ceremony. All officials of WARPO including the Directors, Principal Scientific Officers were present on the ocassion. Fahmida Akhtar, Project Director and Principal Scientific Officer (Senior System Analyst), Water Resources Planning Organization (WARPO) and Mr. Malik Fida A Khan, Executive Director, CEGIS signed the contract on behalf of WARPO and CEGIS respectively (Picture 1.1).

Figure 1.1: Contact Signing Ceremony of the Project

1.4.2 Meetings

The project has started through an excellent participatory kick-off meeting attended by a number of senior officials both from the WARPO and Consultant Team from CEGIS. The meeting was held on September 30, 2019 at WARPO chaired by Fahmida Akhtar, Project Director and Principal Scientific Officer (Senior System Analyst), WARPO. Md. Ekram Ullah, Principal Scientific Officer (Agriculture); Md. Masud Alam, Principal Scientific Officer (Monitoring and Evaluation); AKM Khusrul Amin, Senior Scientific Officer(Fisheries); Md. Hasan Shahariar, Senior Scientific Officer (Environment); Md. Jahid Hossain, Senior Scientific Officer (Ground Water); Krishna Chandra Bhadra, (Senior Scientific Officer) (Programmer); Md. Tariqul Islam, Scientific Officer (Agriculture); Abul Kashem Md. Hasan, Director, Database, ICT and System Management Division , CEGIS, Mr. Md. Shafiqul Islam, CEGIS, Md Anisur Rahman (Senior Programmer), CEGIS Tanvir Ahmed (Hydrologist), CEGIS were presented in the meeting.

In the meeting, the process and procedure of issuing clearance certificate for water resources development projects was discussed in the light of Bangladesh Water Rules 2018. Twelve

application forms for clearance certificate for different water resources related projects as described in Bangladesh Water Rules 2018 were discussed in the meeting. It was also suggested to prepare the user guidelines for submitting these forms. Guidelines for different committee and WARPO for evaluating these forms has also been prepared. Application forms of web application for clearance certificate will be prepared as per Bangladesh Water Rules 2018.

Another 3 meetings were held on October 28, 2019 at WARPO on Data Dissemination Tool, Data Management Guideline/Policy, and Upgradation of desktop tools with relevant committees of WARPO. In the meetings, officials were discussed about the desktop tools such as TS tools, Statistical Analysis tool, Data processing tools. This tools will need to be functional as per requirement of WARPO. In the meeting they also discussed about the online Data Dissemination Tools and the payment procedure of the application process. Meetings on Updating of Data Management Guideline/Policy and necessary activities, e.g. Updating of Data Catalogues, Data Pricing, Data Policy were discussed.

Four meetings were held on Water Resources Project Clearance with the relevant committee of WARPO from 30 September 2019 to 03 December 2019 to finalize the application forms for project clearance with required documents, data and information. A list of the meetings ig given below:

SN	Meeting Group	Date	Discussion
1	WARPO and Consultant Team from CEGIS	September 30, 2019	Kick-off meeting of the Project
2	WARPO and Consultant Team from CEGIS	October 28, 2019	Process and Procedure of issuing clearance certificate
3	WARPO and Consultant Team from CEGIS	November 30 2019	Data Dissemination Tool, Data Management Guideline/Policy, and Upgradation of Desktop tools
4	WARPO and Consultant Team from CEGIS	03 December 2019	Project Clearance with the relevant committee of WARPO
5	WARPO and Consultant Team from CEGIS	11 March 2020	Comments from PIC members and WARPO Officials have been included in the Design Report, Testing and Operational Plan Report, Interim Report.
6	WARPO and Consultant Team from CEGIS	17 August 2020	WARPO Committee comments about Clearance Certificate (CC) in Zoom meeting.

7	WARPO and Consultant Team from CEGIS	25 August 2020	WARPO Committee comments about Clearance Certificate (CC) in Google meeting.

Table 1.1: Project Meetings

Chapter 2 : Approach and Methodology

In order to prepare an efficient approach and methodology to carry out the activities of the proposed project successfully, a thorough investigation has been done on the RFP/ToR and an initial examination has been carried out on the existing information available with the WARPO. In the software development lifecycle Agile/Iterative models have been followed. Based on the investigations a comprehensive approach and methodology has been developed and presented in Figure 2.1. A description of the different steps of the methodology is given in the subsequent sections.

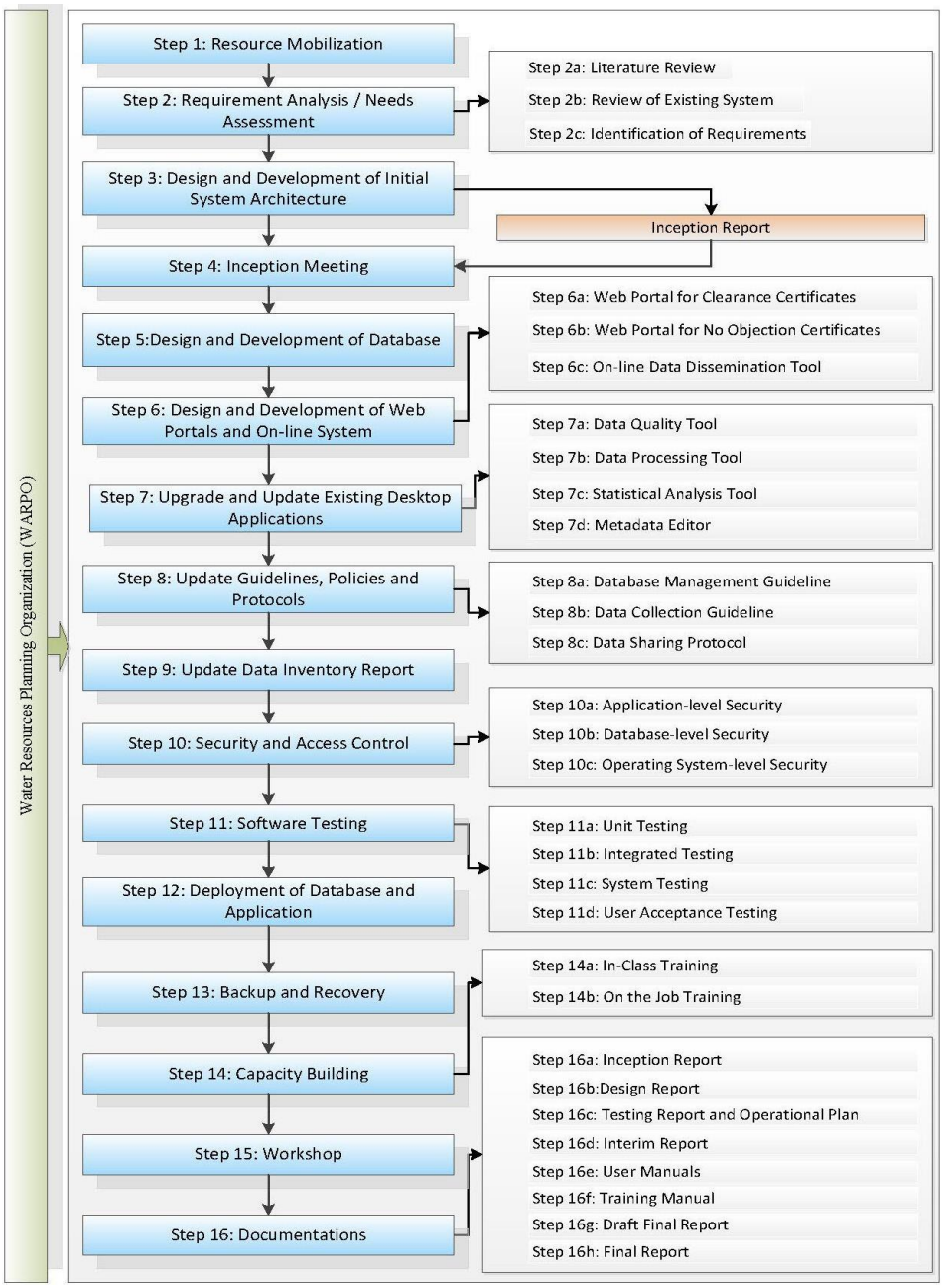


Figure 2.1: Flow Diagram of Methodology

2.1 Requirement Analysis/Needs Assessment

An initial discussion meeting has been organized with relevant officials of WARPO to understand the details of requirements of the project such as design of the web portals and on-line system, design diagram of database, data and information need, expected outputs/outcomes of the project, features and functionalities of the web portals and on-line systems and running environment of the proposed system etc. The needs assessment task was accomplished by performing the following sub-activities.

2.1.1 Literature Review

Relevant reports, documents and information has been collected and reviewed in the project period. Extensive literature review has been made at this stage to accumulate the necessary information to finalize the approach and methodology and also for clear understanding. Existing documents such as Bangladesh Water Act 2013, Bangladesh Water Rules 2018, National Water Management Plan 2001, National Water Policy 1999, Data Dissemination Policy of WARPO, Time Series Data Quality Control Guideline, Spatial Data Quality Guideline, Final Report on Maintenance, Updating and Dissemination of National Water Resources Database, Data Inventory Report of NWRD and ICRD and other reports prepared under previous phases of development and update of NWRD and ICRD is being reviewed to understand project's objectives, activities and implementation mechanism.

2.1.2 Review of Existing System

The consultant team has examined the existing web applications and databases of NWRD and ICRD, web portal of PMIS, desktop based Data Dissemination Tool, Data Quality Tool, Data Analysis Tool, Metadata Editor, NWRD Data Availability Tool, available data and corresponding attribute information. The technical documents and user manual of the existing systems and database structures, Databases Design and Construction Details including Metadata and other documents on existing system has also been reviewed to get a clear idea of the different components and framework of the system. Beyond this existing computerized system, consultant team has investigated the relevant physical/manual system to assess the potential improvement area for computerization that fit within the scope of work.

2.1.3 Identification of Requirements

The features and functionalities of the existing systems (Data Dissemination Tool, Data Quality Tool, Data Analysis Tool, Metadata Editor, and NWRD Data Availability Too) identified in the previous sub-activities section was analysed and have shared with WARPO officials. Required number of meetings with WARPO officials have arranged to determine the requirements of the proposed systems (web portal for water sector project Clearance Certificates and No Objection Certificates for Ground Water Abstraction, On-line Data Dissemination Tool) at its required level of details. These meetings have also identified the design and development platform of the database, framework of intended web portal. Consultant team has then analysed the findings and finalized the features and functionalities of existing as well as new systems. Then it has been consulted with the relevant WARPO officials for their review and suggestions. The consultant team has established and documented the business requirements of the system. A requirement has been traceable back-ward to requirements and the stakeholders that motivated it.

2.2 Design and Development of Initial System Architecture

Depending on the requirement as identified in the RFP/ToR and the functionalities determined in the needs assessment, a logical model or framework (Figure 2.2) of the new system has been developed. The system has been designed and developed using the standard four-tier architecture of software development. It consists of the following layers:

- Presentation (user-interface)
- Web server
- Application server
- Data server

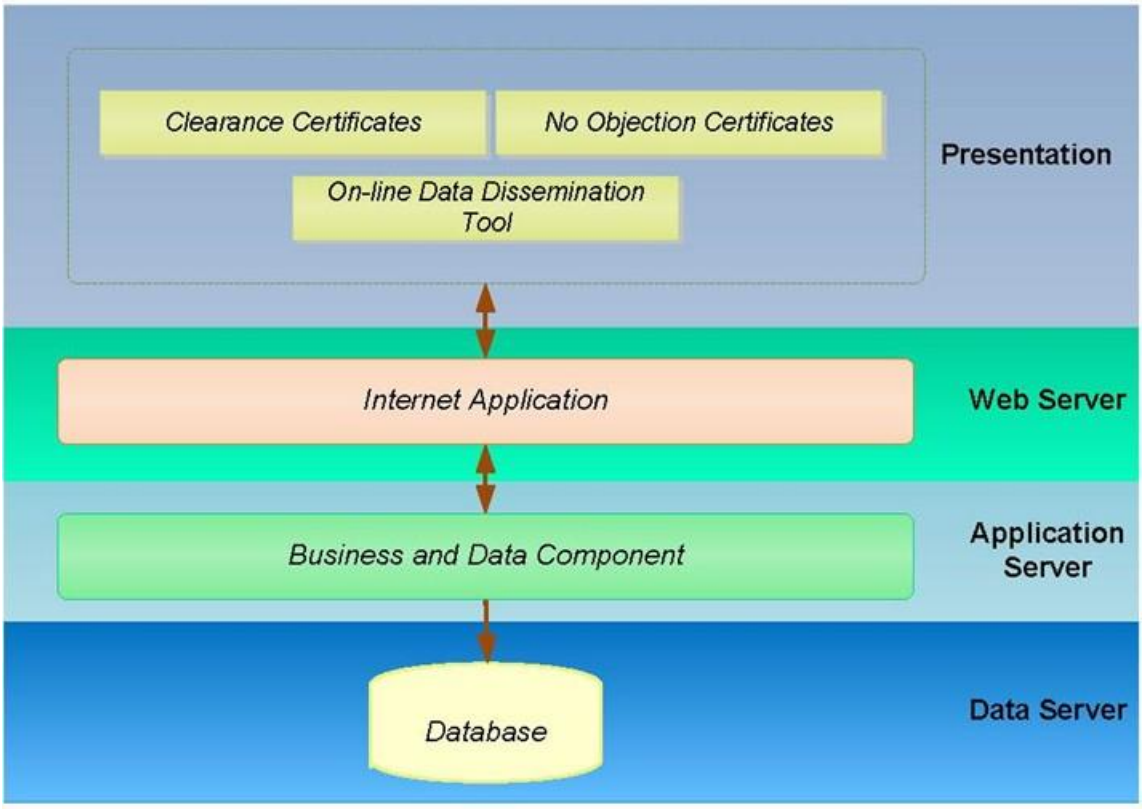


Figure 2.2: System Architecture of Application Software

2.2.1 Presentation Layer

The presentation layer is a user-interface that a user uses to interact with the application. It has been developed using ASP .Net core, Javascript, HTML5, CSS3, jQuery and Ajax. The Model-View-Controller (MVC) approach has been used in this development. A Standard and dynamic web layout has been used to develop the user interface which has been made simple and user-friendly in consultation with the officials of WARPO.

2.2.2 Web server

The main component for a web-enabled application is the web server. It is a program that manages and delivers web pages and allows users to communicate with the server for data service through the Internet or the intranet. The web server has been configured using Internet Information Services 7 or higher.

2.2.3 Application Server

The application layer consists of business and data components. The business component is used to impose different business rules and logic. The data component is responsible for retrieving data from the server. The application layer has been developed using ASP .Net core.

2.2.4 Data Server

The data server contains data, views, triggers and stored-procedure which executes SQL statements, views, triggers and stored-procedure for data manipulation. A relational database management system Oracle 11g (x64) has been used for storing, retrieving and managing data as WARPO already has a license of it.

2.3 Coding Standard

ASP.Net core (MVC) programming language has been used to develop the system in order to meet the documented requirements of the system. Code indentation has been used for better readability. A maximum line length for comments and code has been established to avoid horizontal scrolling of editor window. Spaces has been used after each comma, operators, values and arguments. Large or complex sections of code has been broken into smaller comprehensible modules/ functions. Source code has been arranged and separated between different files. The standard naming convention has been used for each section. Elusive names that are open to subjective interpretation have been avoided. Class names have been not included in the name of class properties. For naming routines, the verb-noun method has been used. Computation qualifiers (Avg, Sum, Min, Max, Index) have been appended to the end of a variable name where appropriate. Customary opposite pairs (such as min/max, begin/end, and open/close) in variable names have been be used. Mixed-case formatting has been used to simplify reading. Boolean variable names have contained 'Is' which implies Yes/No or True/False values such as fileIsFound. Using terms such as Flag when naming status variables have been avoided which differ from Boolean variables in that they may have more than two possible values. For example, instead of document Flag, a more descriptive name such as document Format Type has been used. Meaningful name has been used even for a short-lived variable that may appear in only a few lines of code. Single-letter variable names, such as i or j has been used for short-loop indexes only. A list of standard prefixes has been developed for the project to help developers consistently name variables. For variable names, notation that indicates the scope of the variable have been included. Constants are all uppercase with underscores between words. Built-in functions and third-party library functions with our own wrapper functions are wrapped. Error message and recover or fail are reported gracefully and useful error messages are provided. When modifying code, the up to date are always kept with the comments around it. At the beginning of every routine, standard, boilerplate comments, indicating the routine's purpose, assumptions, and limitations are provided as it is very much helpful to understand. Adding comments at the end of a line of code are avoided. To conserve resources, the development team are selective in the choice of data type to ensure the size of a variable is not excessively large. The scope of variables is kept as small as possible to avoid confusion and to ensure maintainability. When writing classes, the use of public variables is avoided. Instead, procedures to provide a layer of encapsulation and also to allow an opportunity to validate value changes are used. Data connections are not opened using a specific user's credentials. Connections that are opened

using such credentials are not pooled and reused, thus losing the benefits of connection pooling.

2.4 Inception Workshop

At the end of the needs assessment, a draft inception report has been prepared mentioning the details of the approach, methodology, work plan, technology transfer, System Requirement Specification and reporting. This report has been submitted to Project Management Unit of WARPO in 20 copies at the end of 2 months from signing of contract. An inception workshop has been arranged by WARPO on the Draft Inception Report within one week from submission of the Report discussing with the Project Director. All officials concerned of WARPO and other stakeholders have been invited in the meeting by WARPO. The approach and methodology of the project implementation have been presented and finalized through this meeting. The comments of the participants have been incorporated in the final version of the inception report and has been submitted to WARPO for approval. Henceforth, the approved inception report has been the final guiding document to carry out the project activities.

2.5 Interim Workshop

At the end February 2021 an interim workshop was conducted to share the Clearance certificate system, NoC system, Data dissemination tools with other relevant systems with the stakeholders, higher officials of government and others. An interim report has been submitted after that workshop. This report has been submitted to Project Management Unit of WARPO. All officials concerned of WARPO and other stakeholders have been invited in the worshop by WARPO. The Clearance certificate system, NoC system, Data dissemination tools have been presented and finalized through this meeting. The comments of the participants have been incorporated in the final version of the interim report and has been submitted to WARPO.

2.6 Design and Development of Database

Database have been designed and developed based on NWRD and the initial system architecture of the overall system. Actually, new tables required for two web portals and on-line system have been included into NWRD database. In order to develop these tables, the requirements identified in the ToR as well as in the needs assessment have been converted into Data Flow Diagram (DFD). Depending on the DFD a logical model has been developed to produce an ER diagram. This ER diagram have been presented to relevant officials of the WARPO for approval. Depending on the approved logical model (ER Diagram), the physical tables have been designed. To avoid data redundancy and inconsistency, the tables have been normalized. Master-child relationship has been implemented between tables to maintain data relationships and the referential integrity. The referential integrity has ensured that, no data could be entered in the child tables without entering corresponding data in the master table. Each table has maintained a primary key, which has been uniquely identify each record in the table to reduce the chances of data duplication.

The database consists of two types of data: Tabular or attribute data and GIS data. Tabular data contain detail information of different components. GIS data contains location of these components as well as different administrative boundaries.

2.6.1 Attribute Data

The Database contains a big number of tables. All these tables have been categorized into three types: data definition tables, lookup tables and data tables. The data definition tables contain hierarchical information of different data and serve as the application-oriented link among those data. Lookup tables contain predefined values of different columns of the actual data. Data tables are the actual tables which contain different types of data relevant to project clearance certificate system, No Objection Certificate (NOC) system and Online Data Dissemination Tool. These tables may store information relevant to flood control management, excavation and re-excavation of Khal projects and river bank protection projects, ground water and deep tube wells. Data tables have ID fields (such as geo-code) which are used to link with GIS Data.

2.6.2 GIS Data

GIS data contains location or spatial information. During the submission of application for clearance certificate, NOC and data dissemination the user has enter the latitude and longitude of a project location. This information has been processed and converted into GIS files. District, upazila, union have been used as GIS data. These GIS data have been included into the geo-spatial database. Attribute table of GIS data has a field to link with the Data Tables.

2.6.3 Views and Stored Procedures

A number of stored procedures has been written to implement the business logic and to extract the consistent data into a more secured way. A number of views has also be written to present consistent data from multiple tables to the developer hiding complex relation among the tables.

2.6.4 Data Flow Diagram

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modelling its process aspects. A DFD shows what kinds of information are input to and output from the system, where the data are come from and go to, and where the data are stored. A context-level data flow diagram shows the interaction between the system and external agents which act as data sources and data sinks. A level-0 DFD of Web Portal for Clearance Certificate is given below.

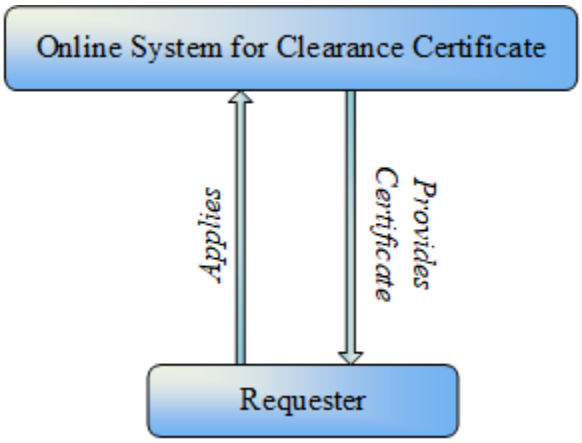


Figure 2.3: Level-0 Data Flow Diagram for Clearance Certificate System

A level-0 DFD of Web Portal for No Objection Certificate is given below.

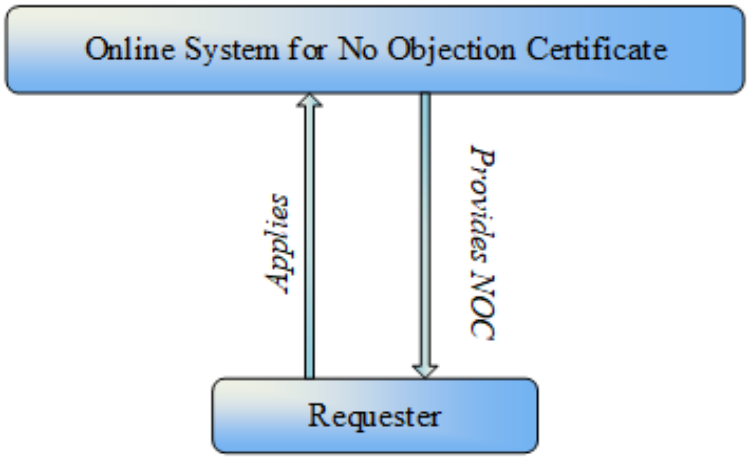


Figure 2.4: Level-0 Data Flow Diagram for NOC System

A level-0 DFD of Online Data Dissemination Tool is given below.

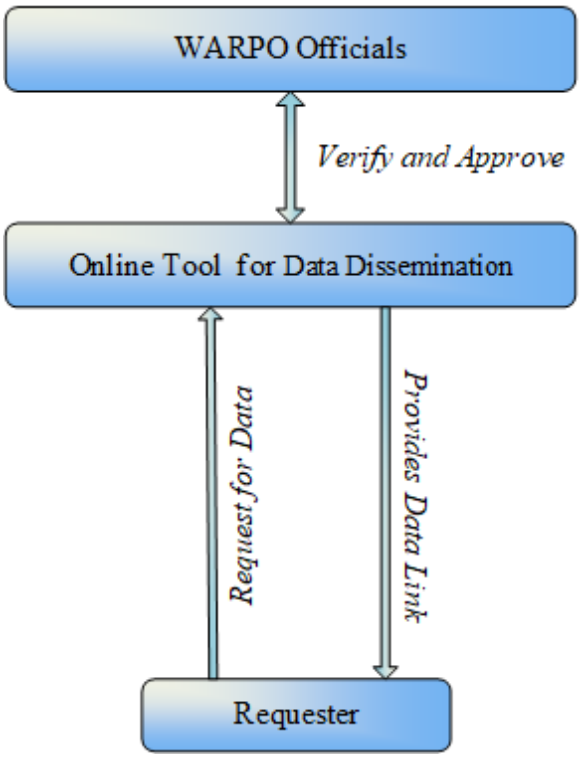


Figure 2.5: Level-0 Data Flow Diagram for Online Data Dissemination Tool

Based on the level-0 diagram a level-1 data flow diagram for Clearance Certificate is drawn.

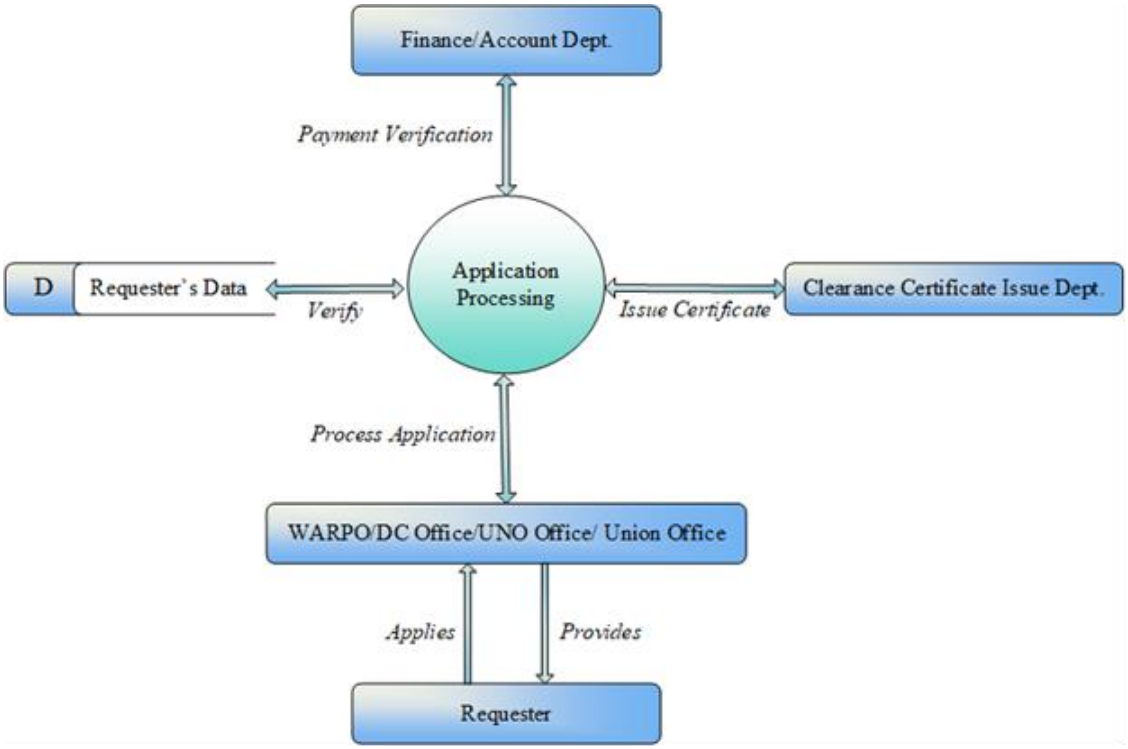


Figure 2.6: Level-1 Data Flow Diagram (DFD) for Clearance Certificate

Based on the level-0 diagram a level-1 data flow diagram for NOC System is drawn.

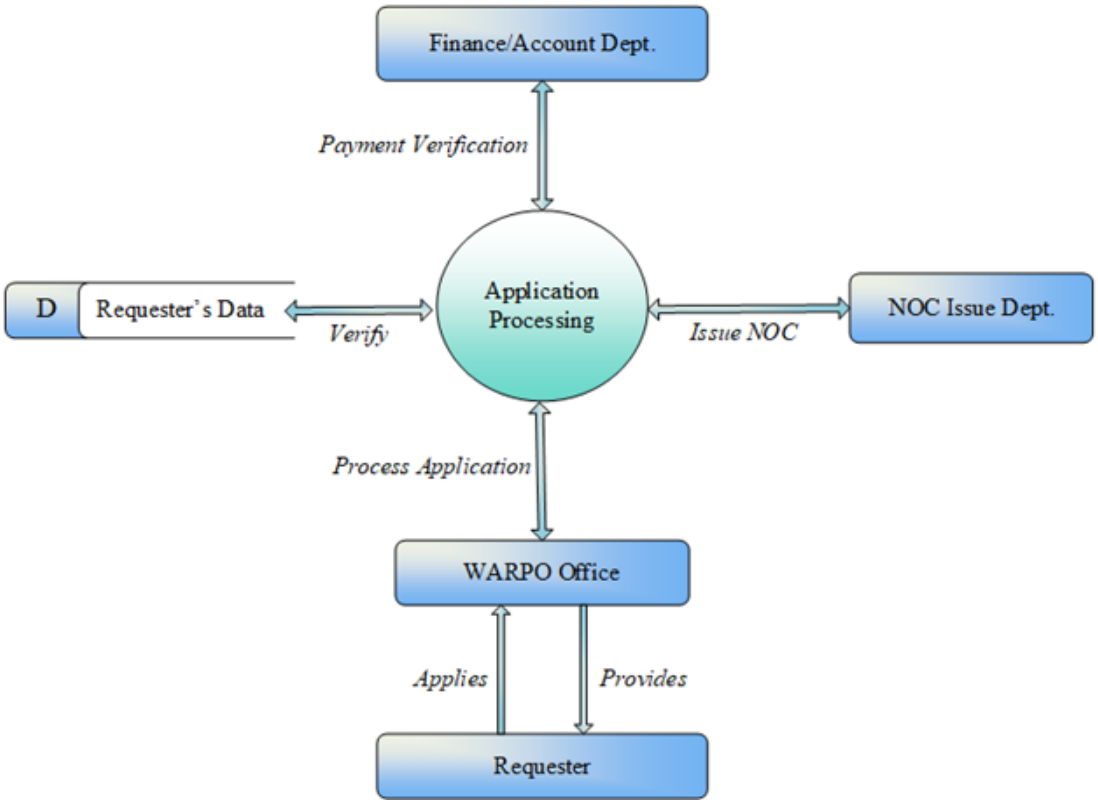


Figure 2.7: Level-1 Data Flow Diagram (DFD) for NOC System

Based on the level-0 diagram a level-1 data flow diagram for Data Dissemination Tool is drawn.

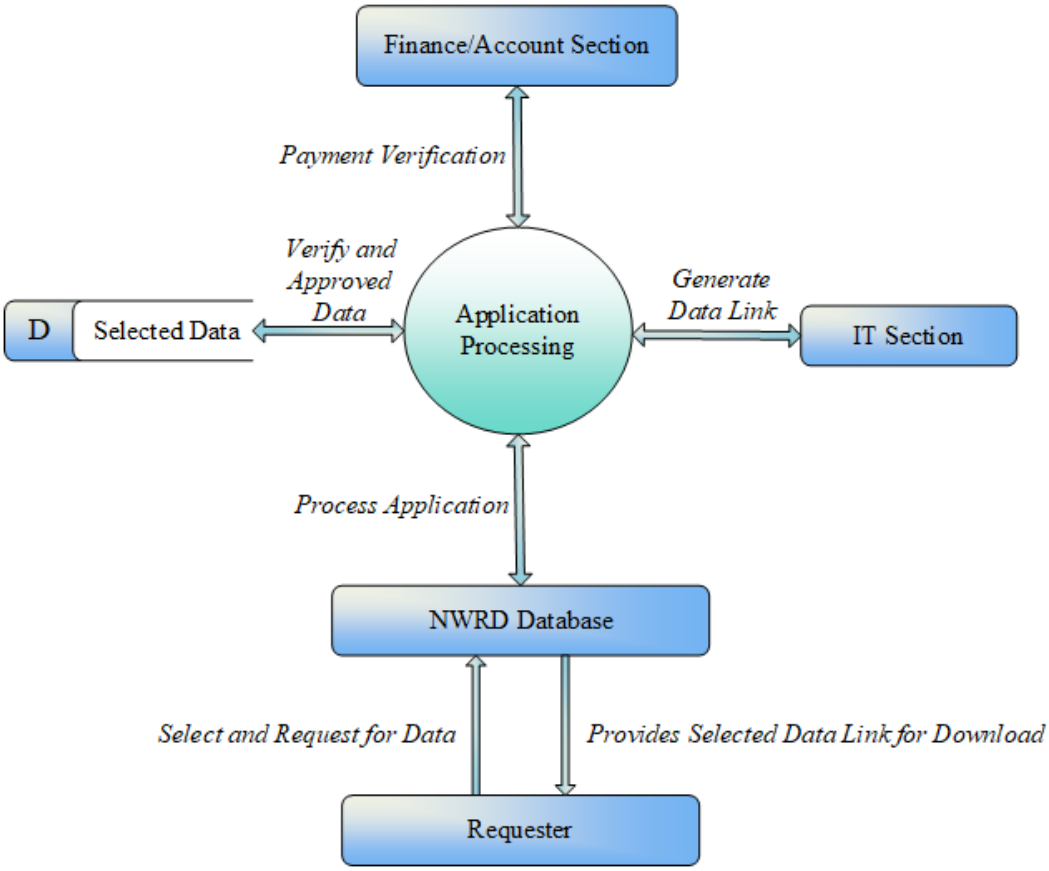


Figure 2.8: Level-1 Data Flow Diagram (DFD) for Data Dissemination Tool

2.7 Design and Development of Web Portals and On-line System

Based on the requirements identified in the ToR as well as in the needs assessment and the initial system architecture, two web portals and one on-line system have been developed.

2.7.1 Web Portal for Clearance Certificates

According to Bangladesh Water Rules 2018, it has been made mandatory to get Clearance Certificate from respective Committee based on the estimated cost for an individual or organization who wants to initiate a project from a group of water resources related development projects. For the projects with the estimated cost less than 10 lacs, have to be taken a Clearance Certificate from Integrated Water Resources Management Committee of Union by an individual or an organization. If the estimated cost of the projects is in between 10 Lac and 20 Lac, it has been made mandatory to get Clearance Certificate from Integrated Water Resources Management Committee of Upazila. Clearance Certificate from Integrated Water Resources Management Committee of District has to be taken if project cost becomes more than 20 lacs but less than 50 lacs. Clearance Certificate from WARPO has to be required if project cost exceed 50 lacs. Again, if a project covers more than one union, then the Clearance has to be taken from Integrated Water Resources Management Committee of

Upazila. If the catchment area of a project is located in multiple Upazilas, then Clearance from Integrated Water Resources Management Committee of District has to be required. If a project is located in multiple districts, then Clearance from WARPO has to be taken. A web based interactive system has been developed for applying, processing and tracking these water sector Project Clearance Certificates. The portal has been allowed users to make and register applications, track progress and get certificates. It has been allowed WARPO to process and evaluate application with respect to predefined criteria and provide certificate. The guidelines of Clearing House have been developed as per requirements following Bangladesh Water Rules as well as acts, rules, policy, plan and strategy of WARPO. Based on this guideline, the portal has been developed. This portal has the linkage with the NWMP, NWP, Delta Plan 2100, SDG Goals, etc. In this portal, a schedule of all regulatory measures under the Bangladesh Water Rules 2018 have been updated indicating the dates, by region and by sector, when they have been come into effect. It has been helping all water users to be clear as to their obligations under the Bangladesh Water Act, 2013.

As per Bangladesh Water Rules 2018, there are 13 types of application forms to apply for the clearance certificate on different projects such as Flood Control Management, Excavation and re-excavation of Khal projects and river bank protection projects etc. Besides, all forms of the Tafseel (Form1 to Form 19) of Bangladesh Water Rules 2018 related to the Water Resources Project Clearance have been properly included in the web-portals.

This web-based application for Clearance and No Objection certificate includes user registration, application status monitoring panel, higher authority approval section, online Clearance or No Objection Certificate and some other relevant features.

The screenshots of user login and user registration is displayed in Figure 2.9.

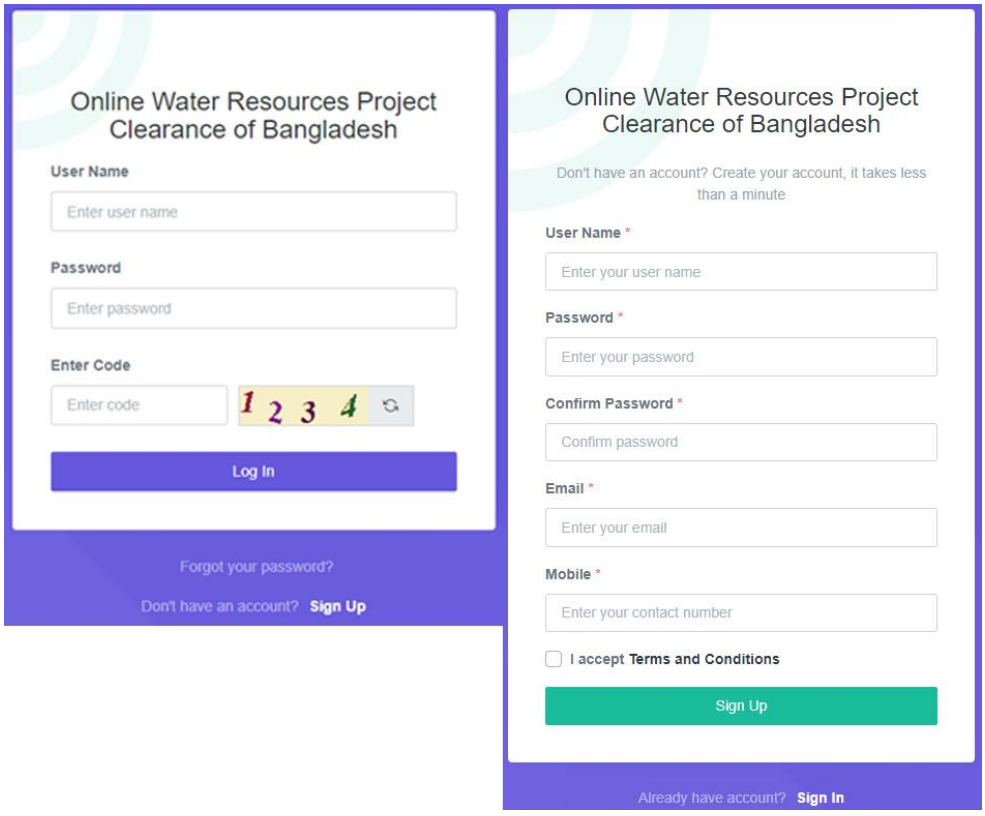


Figure 2.9: User Login & Registration for Clearance Certificate Tool

The portal has following 9 modules:

1) **Dashboard:** The Dashboard provides an overview of the web portal. It displays the overall status of the application for Clearance Certificate, sector wise application status, year wise application submitted, and year wise certificate issued. The screenshot of **Dashboard** is displayed in Figure 2.10.

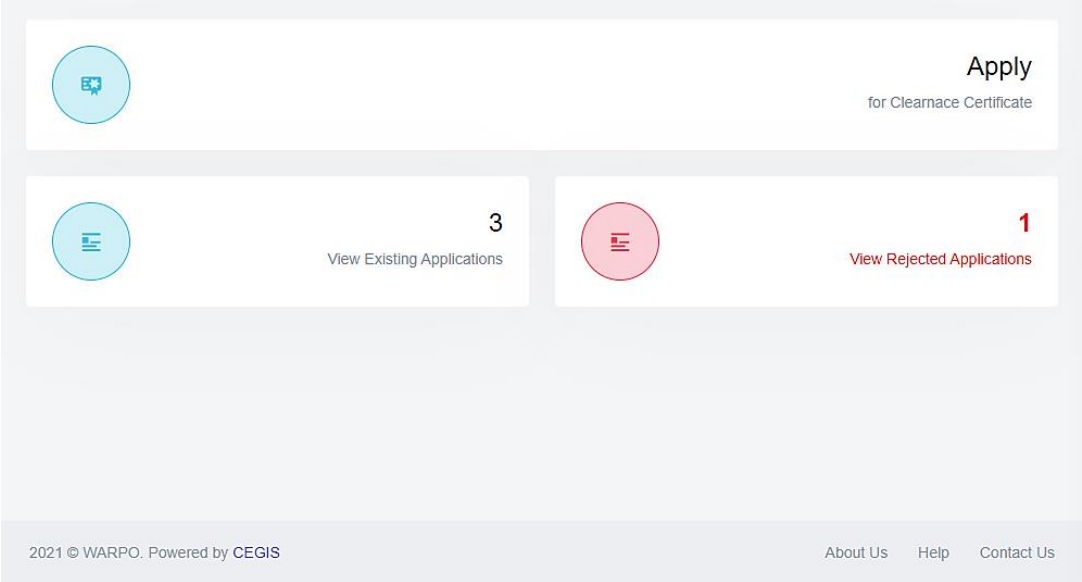


Figure 2.10: Dashboard of Clearance Certificate

2) **Application Module:** This module has been developed to submit application for clearance certificate through online. This is the main module of the application where each form was developed according to the Bangladesh Water Rules 2018 Application Form 3.1 - 3.13. A user has to be authenticated by logging into the system after completing registration to use the application module. Each form has four sections e.g. General Section, Technical Information, Deed Obligatory and Administrative Section respectively and sample screenshot is displayed in Figure 2.11 to 2.14 consecutively.

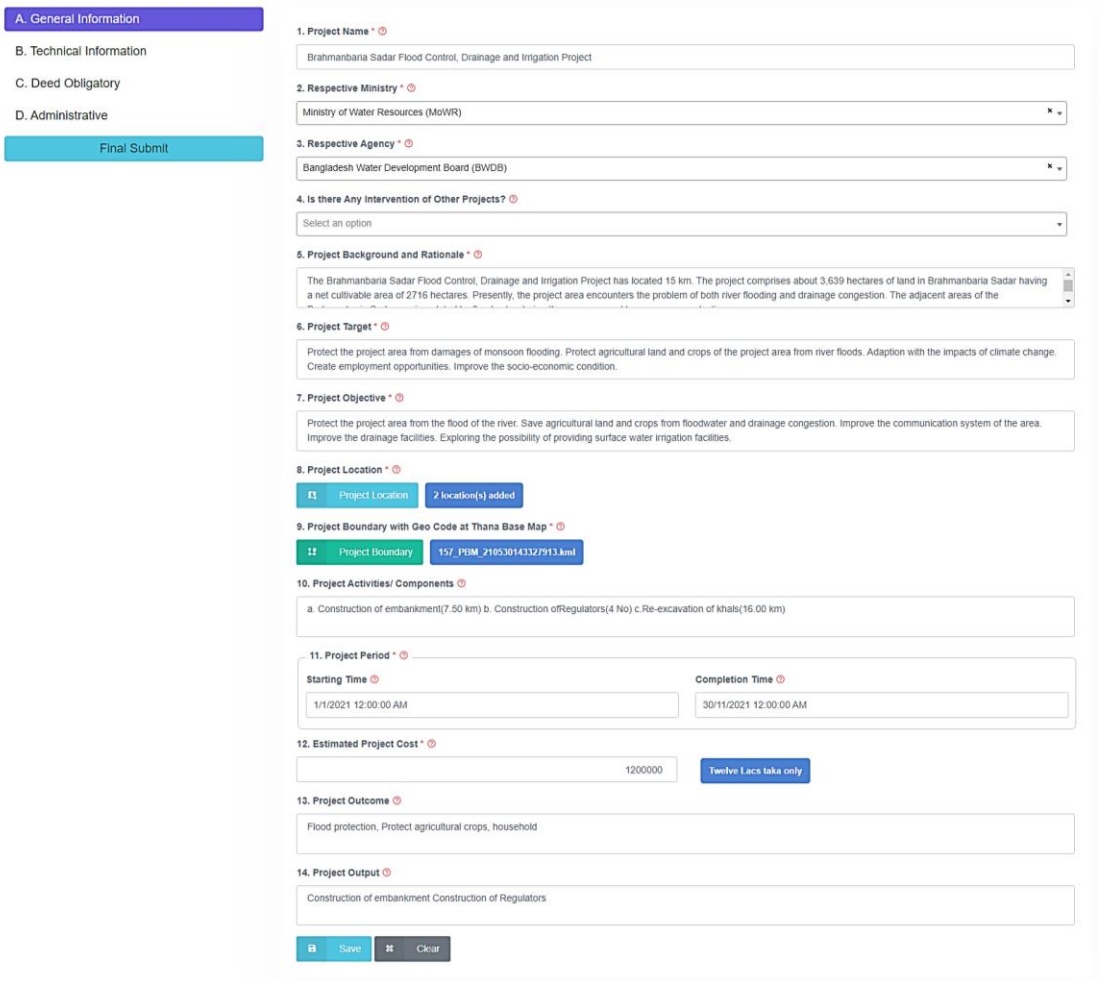


Figure 2.11: General Section

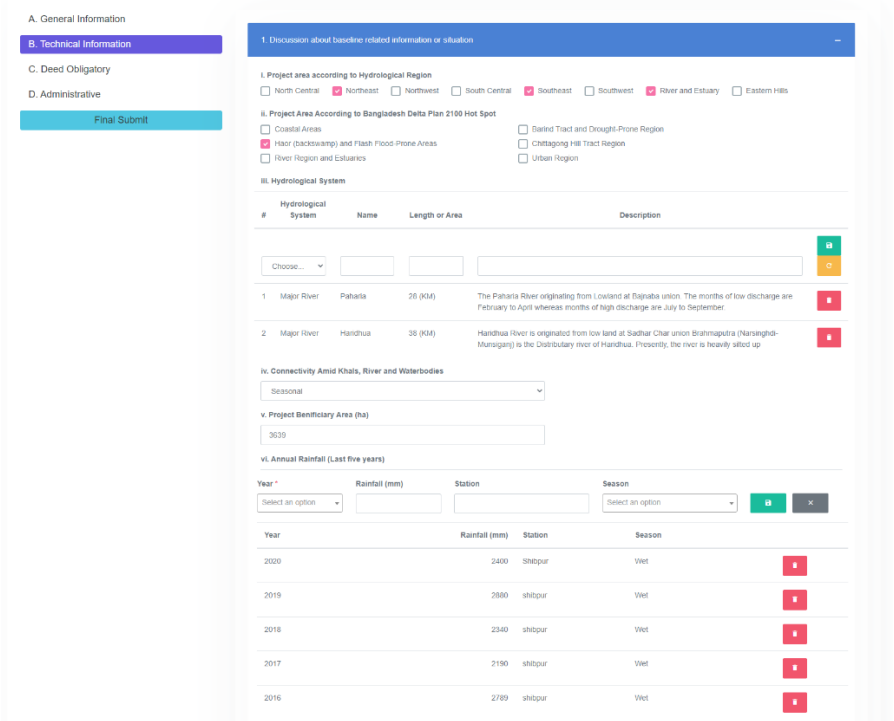


Figure 2.12: Technical Information

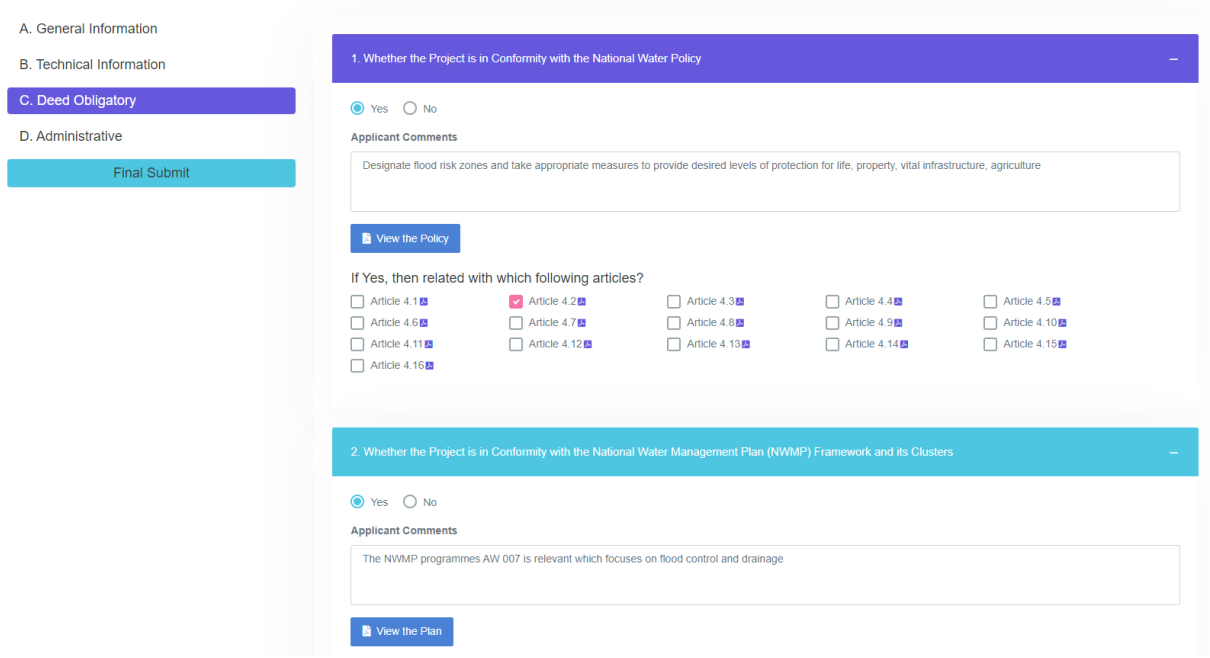


Figure 2.13: Deed Obligatory

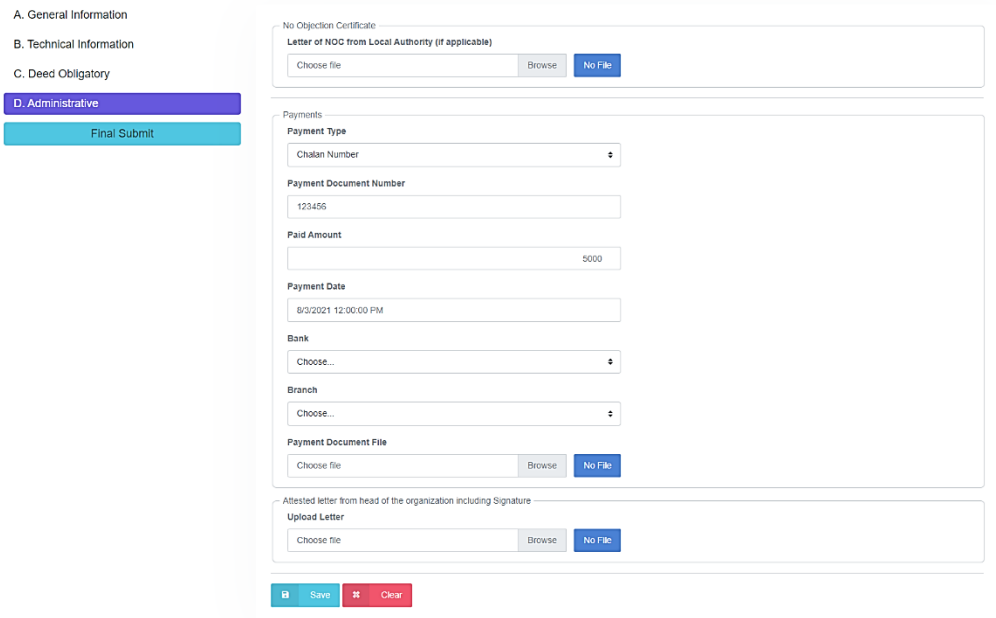


Figure 2.14: Administrative Section

3) **Tracking Module:** Tracking module has been developed to keep track of the application along with its reviews and forwards to appropriate authority based on information provided by the application. Only the authorized members of Integrated Water Resources Management Committee of Union, Integrated Water Resources Management Committee of Upazila, Integrated Water Resources Management Committee of District and WARPO can use this module. To make the application robust in case of failure of sufficient submission of information the application can request applicant to provide the missing ones. The module has functionality to incorporate information obtained through field visit from inspection team. More

importantly it creates an eligible list of applicants for Clearance Certificate and sends a notification message via email informing the applicants about application status. The screenshot of application **Tracking** is displayed in Figure 2.15.

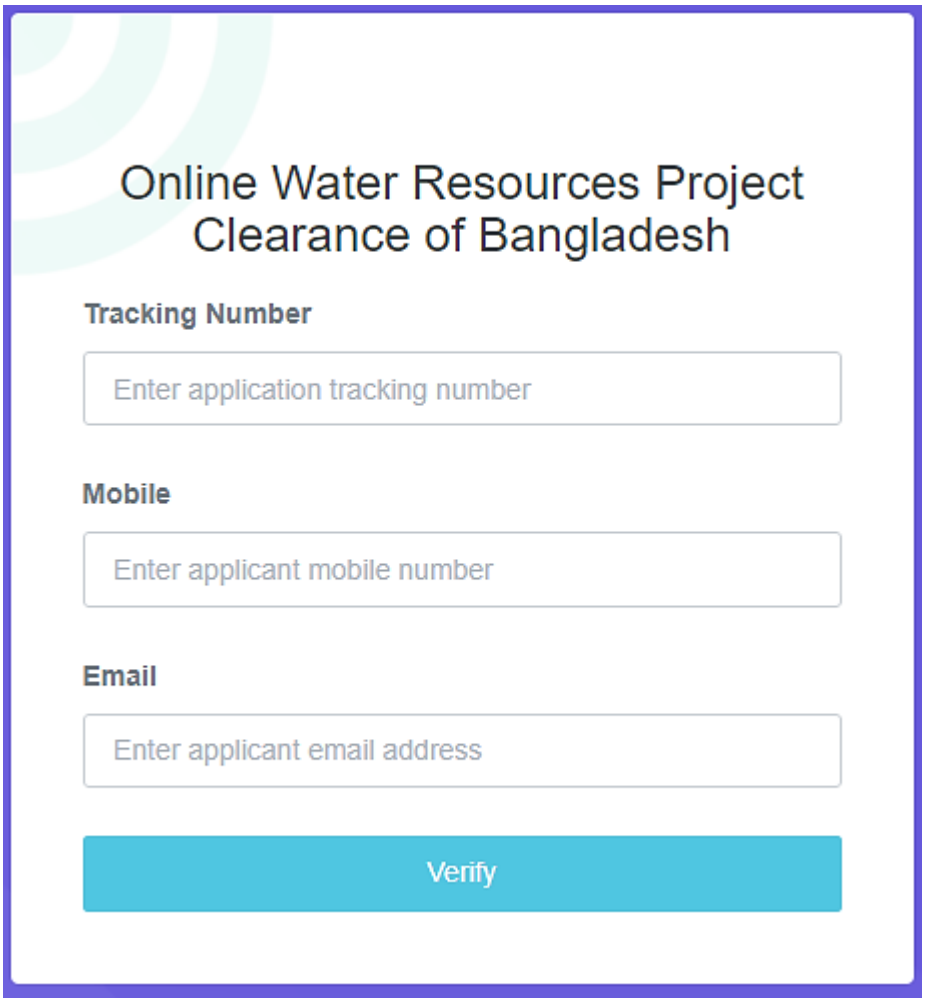


Figure 2.15: Application Tracking

4) **Certification Module:** By using this module the applicants of approved applications can download their Clearance Certificate as pdf file. The screenshot of certificate module is displayed in Figure 2.16 to 2.19.

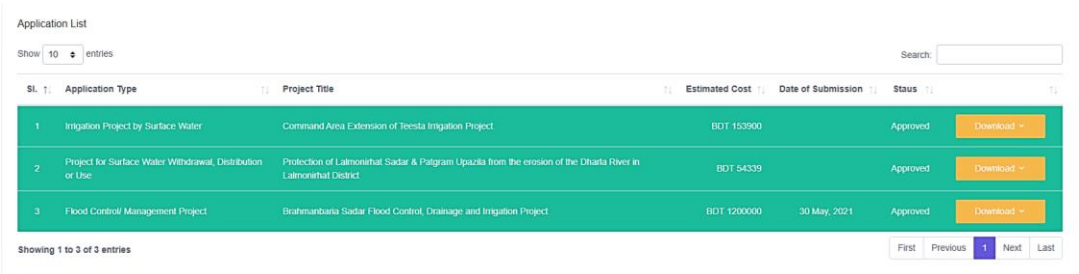
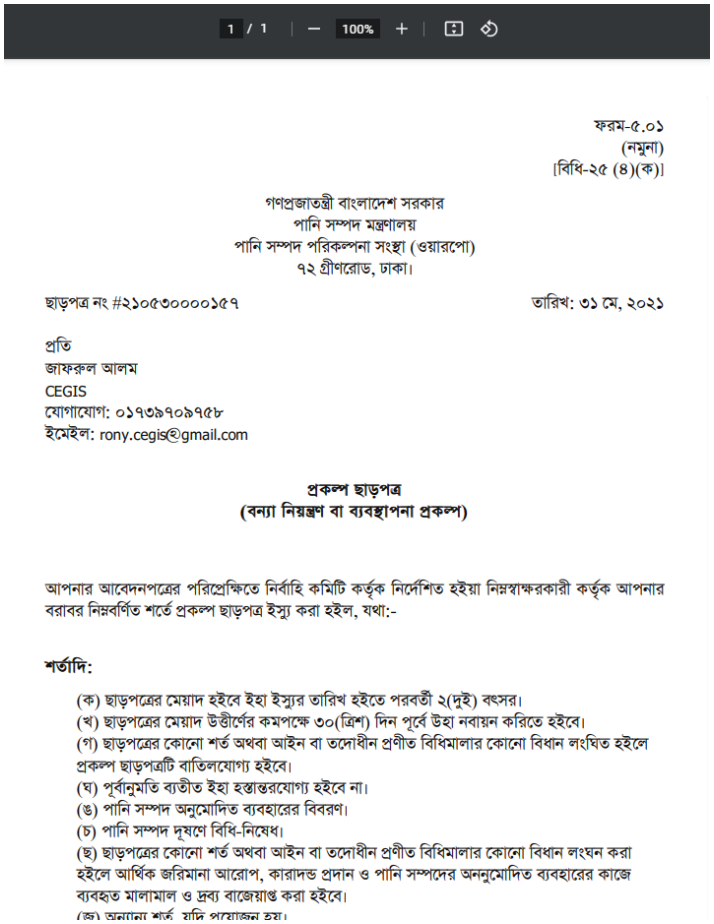


Figure 2.16: Certificate Download Module



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ফরম-৫.০১
(নমুনা)
[বিধি-২৫ (৪)(ক)]

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পানি সম্পদ মন্ত্রণালয়
পানি সম্পদ পরিকল্পনা সংস্থা (ওয়ারপো)
৭২ গ্রীণরোড, ঢাকা।

ছাড়পত্র নং #২১০৫৩০০০০১৫৭ তারিখ: ৩১ মে, ২০২১

প্রতি
জাফরুল আলম
CEGIS
যোগাযোগ: ০১৭৩৯৭০৯৭৫৮
ইমেইল: rony.cegis@gmail.com

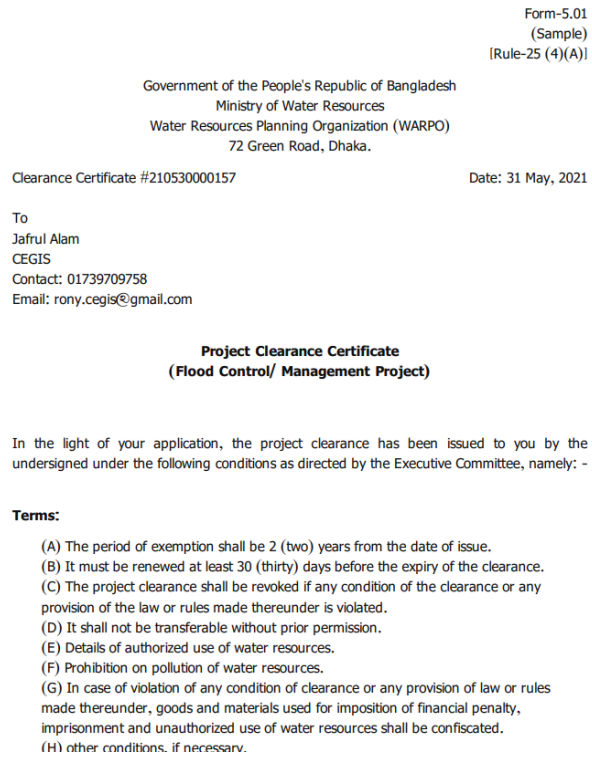
প্রকল্প ছাড়পত্র
(বন্যা নিয়ন্ত্রণ বা ব্যবস্থাপনা প্রকল্প)

আপনার আবেদনপত্রের পরিপ্রেক্ষিতে নির্বাহি কমিটি কর্তৃক নির্দেশিত হইয়া নিম্নস্বাক্ষরকারী কর্তৃক আপনার বরাবর নিম্নবর্ণিত শর্তে প্রকল্প ছাড়পত্র ইস্যু করা হইল, যথা:-

শর্তাদি:

(ক) ছাড়পত্রের মেয়াদ হইবে ইহা ইস্যুর তারিখ হইতে পরবর্তী ২(দুই) বৎসর।
(খ) ছাড়পত্রের মেয়াদ উত্তীর্ণের কমপক্ষে ৩০(ত্রিশ) দিন পূর্বে উহা নবায়ন করিতে হইবে।
(গ) ছাড়পত্রের কোনো শর্ত অথবা আইন বা তদোধীন প্রণীত বিধিমালার কোনো বিধান লংঘিত হইলে প্রকল্প ছাড়পত্রটি বাতিলযোগ্য হইবে।
(ঘ) পূর্বানুমতি ব্যতীত ইহা হস্তান্তরযোগ্য হইবে না।
(ঙ) পানি সম্পদ অনুমোদিত ব্যবহারের বিবরণ।
(চ) পানি সম্পদ দূষণে বিধি-নিষেধ।
(ছ) ছাড়পত্রের কোনো শর্ত অথবা আইন বা তদোধীন প্রণীত বিধিমালার কোনো বিধান লংঘন করা হইলে আর্থিক জরিমানা আরোপ, কারাদন্ড প্রদান ও পানি সম্পদের অননুমোদিত ব্যবহারের কাজে ব্যবহৃত মালামাল ও দ্রব্য বাজেয়াপ্ত করা হইবে।
(জ) অন্যান্য শর্ত, যদি প্রয়োজন হয়।

Figure 2.17: Bengali Formatted Certificate



Form-5.01
(Sample)
[Rule-25 (4)(A)]

Government of the People's Republic of Bangladesh
Ministry of Water Resources
Water Resources Planning Organization (WARPO)
72 Green Road, Dhaka.

Clearance Certificate #210530000157 Date: 31 May, 2021

To
Jafrul Alam
CEGIS
Contact: 01739709758
Email: rony.cegis@gmail.com

Project Clearance Certificate
(Flood Control/ Management Project)

In the light of your application, the project clearance has been issued to you by the undersigned under the following conditions as directed by the Executive Committee, namely: -

Terms:

(A) The period of exemption shall be 2 (two) years from the date of issue.
(B) It must be renewed at least 30 (thirty) days before the expiry of the clearance.
(C) The project clearance shall be revoked if any condition of the clearance or any provision of the law or rules made thereunder is violated.
(D) It shall not be transferable without prior permission.
(E) Details of authorized use of water resources.
(F) Prohibition on pollution of water resources.
(G) In case of violation of any condition of clearance or any provision of law or rules made thereunder, goods and materials used for imposition of financial penalty, imprisonment and unauthorized use of water resources shall be confiscated.
(H) other conditions, if necessary.

Figure 2.18: English Formatted Certificate

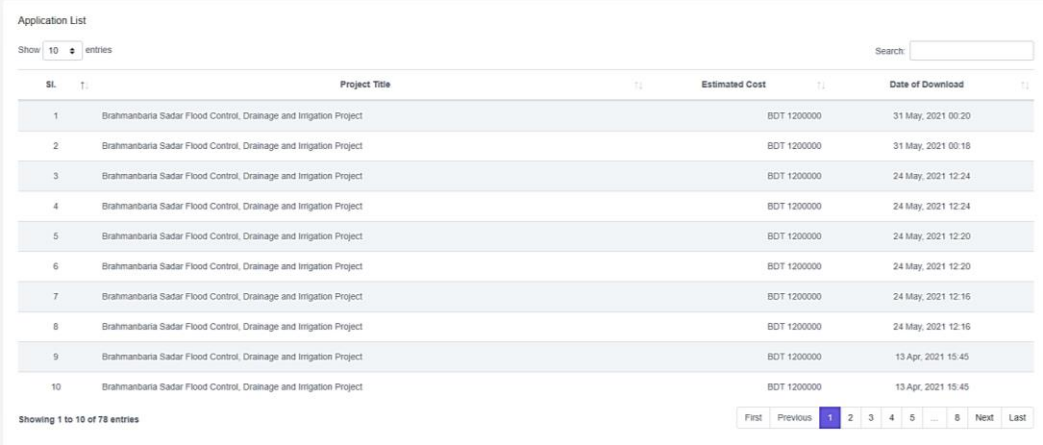


Figure 2.19: Certificate Download History

5) **Monitoring and Reporting Module:** This module consists of monitoring and reporting tool for both applicant and higher authorities. In monitoring tool applicant can see their application status in pending, referred, rejected or approved state. The higher authority can also view the same status with more specific information about the application. In both case, information can be displayed as table shown in Table 2.1.

Table 2.1: Status of Applications for Clearance Certificate

SN	Project Type	Project Name	Estimated Cost	Date of Submission	Status
1	FCMP	FCMP-3	BDT 12,00,000	22 Jan, 2021	Pending
2	FCMP	FCMP-2	BDT 19,00,000	18 Jan, 2021	Approved
3	IPSW	IPSW-2	BDT 21,00,000	15 Jan, 2021	Approved
4	IPSW	IPSW -1	BDT 25,00,000	15 Jan, 2021	Rejected
5	FCMP	FCMP-1	BDT 9,00,000	10 Jan, 2021	Approved

Reporting module also allows WARPO to view the summarized information of different activities of different committees such as total number of applications, total number of rejected or approved projects. The module allows authorized users to search or query information based on region, sector, type, applicant name or applicant status and generate customized reports such as list of approved applications, list of rejected application for a particular project type, number of approved, rejected or referred applications for different type of projects. Finally, the reports is shown in form of chart or tabular data. Generated reports can be printed or exported in XLSX, XLS, CSV etc. formats.

Besides, Monitoring and Reporting Modules has been included with indicators in the web portal so that WARPO and relevant committees can monitor whether the Water Resources Project Clearance Certificates have been provided following the Bangladesh Water Rules 2018. A screenshot of reporting module is displayed in Figure 2.20.

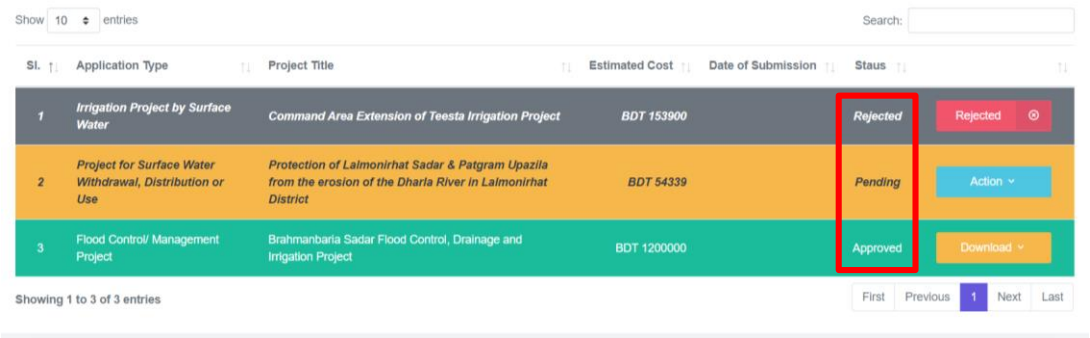


Figure 2.20: Status of Applications for Clearance Certificate

6) **Data Availability Module:** Data availability module has been developed to calculate the volume of surface water and groundwater availability. They would also monitor water usage of project locations. Information like surface water level, discharge, water bodies, groundwater level from other water sources can be displayed by this module. Finally, the total usage of water can be calculated using this module's available information. Screenshot of data availability module is displayed in Figure 2.21.

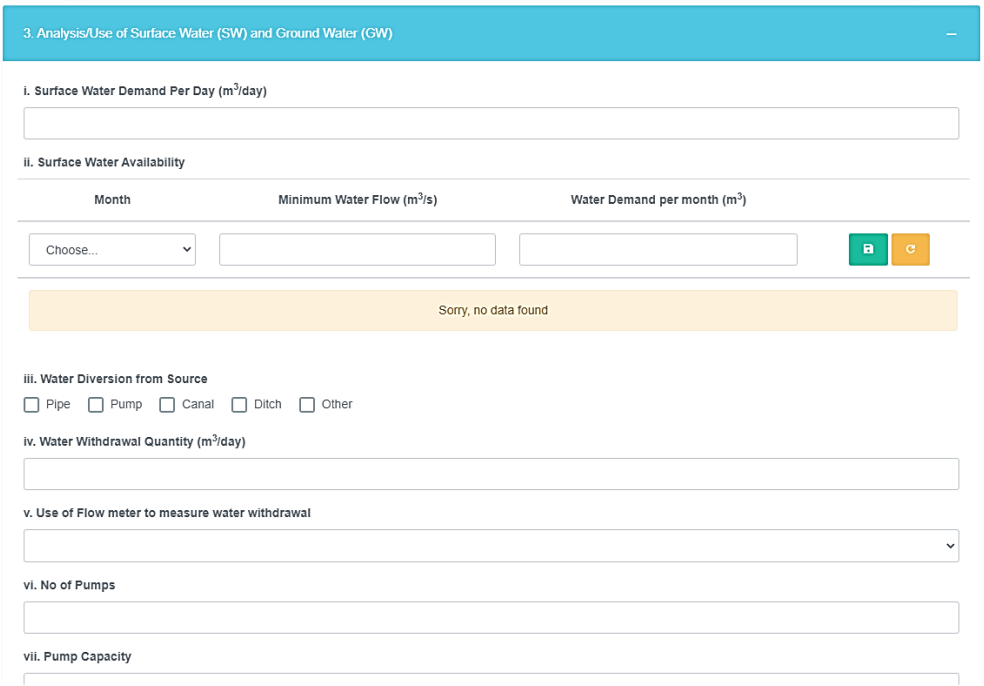


Figure 2.21: Status of Applications for Clearance Certificate

7) **Project Information Module:** This module is open for all users. Using this module, user can see list of projects, their status and action-dates. This module provides facilities to generate summary report on the progress of clearance activities by region, sector and agency wise. A screenshot of project information is displayed in Figure 2.22.

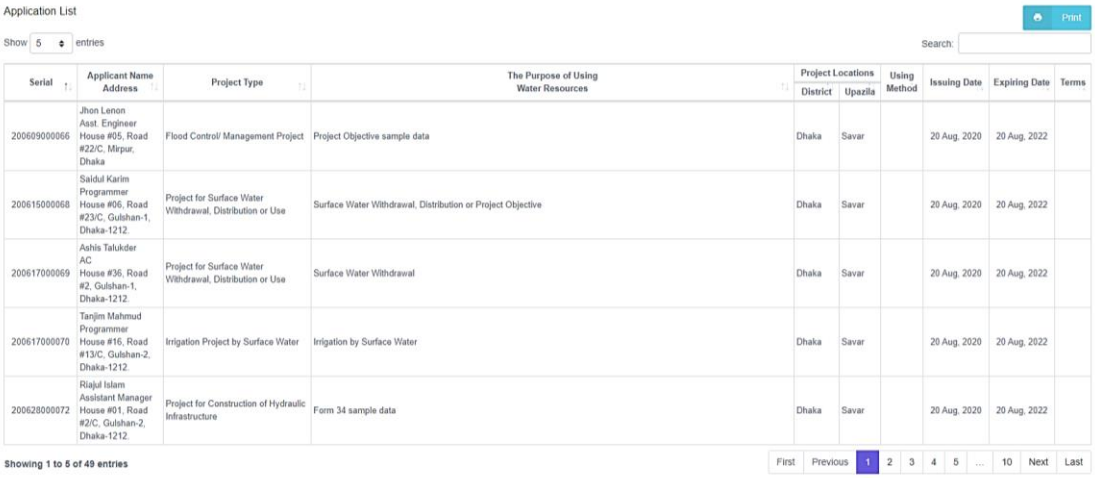


Figure 2.22: Project Information

8) **Administration Module:** This module allows administrator to add new data layer and assign new user rights. Screenshots of administrative module is displayed in Figure 2.23 to 2.24.

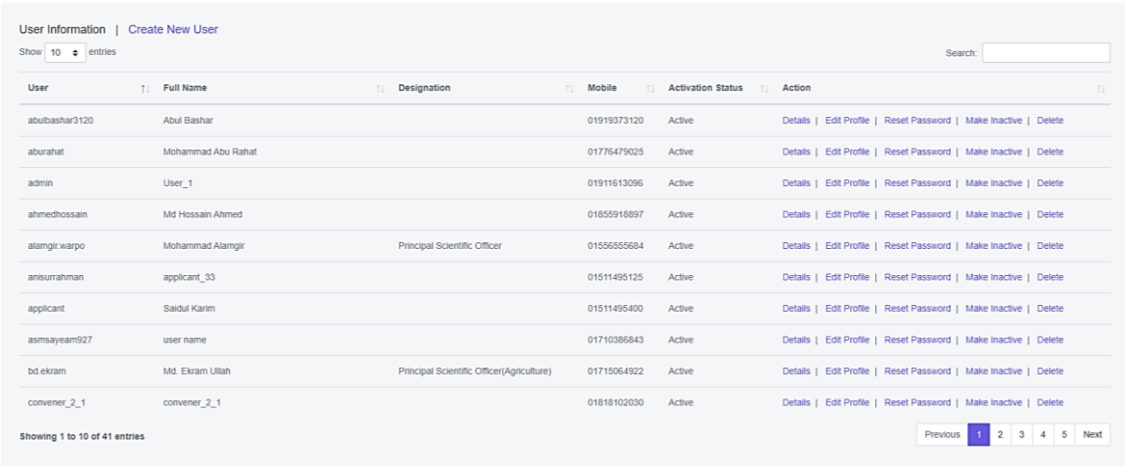


Figure 2.23: User Creation Panel

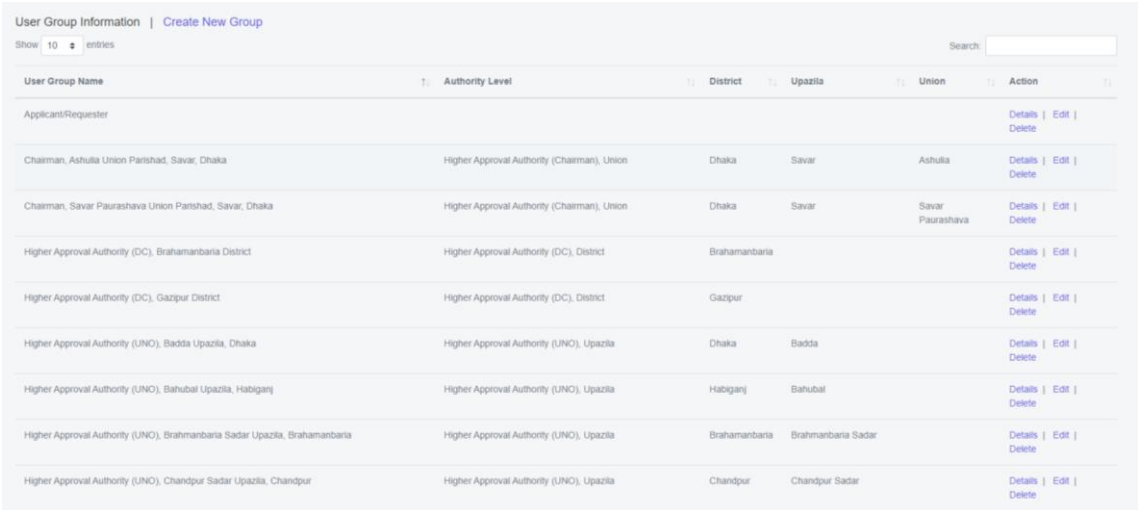


Figure 2.24: User Group Creation Panel

9) **Help and Guideline Module:** This module is responsible for the new users to assist and guide on how to interact with different modules and portals. A detail user manual in PDF format can also be found in this section. Screenshots of help and guideline module is displayed in Figure 2.25 to 2.26.

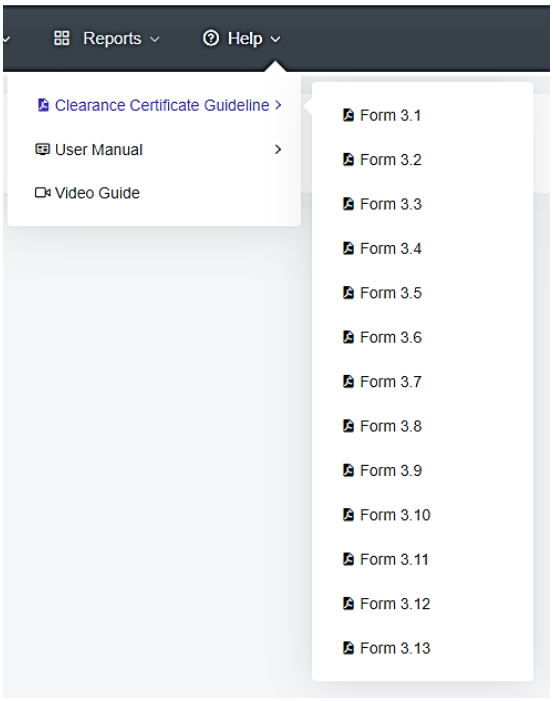


Figure 2.25: Help and Guideline Module

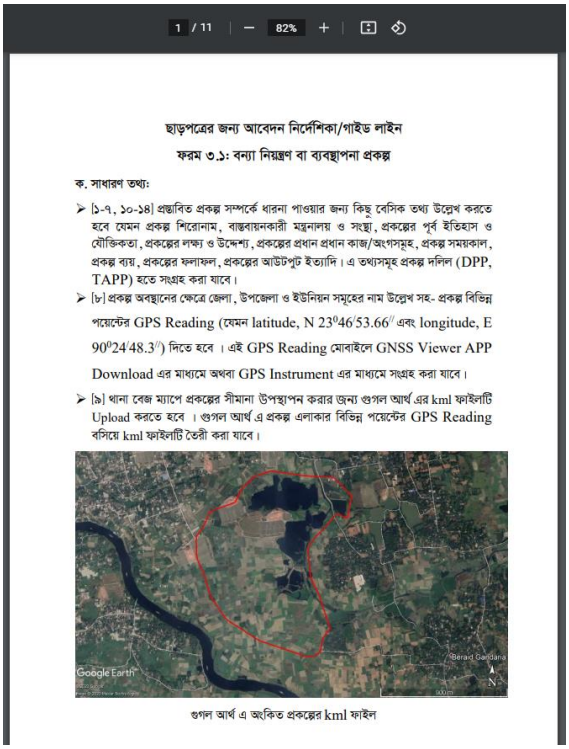


Figure 2.26: Guideline View in PDF Mode

The flow diagram of the clearance certificate is shown in Figure 2.27.

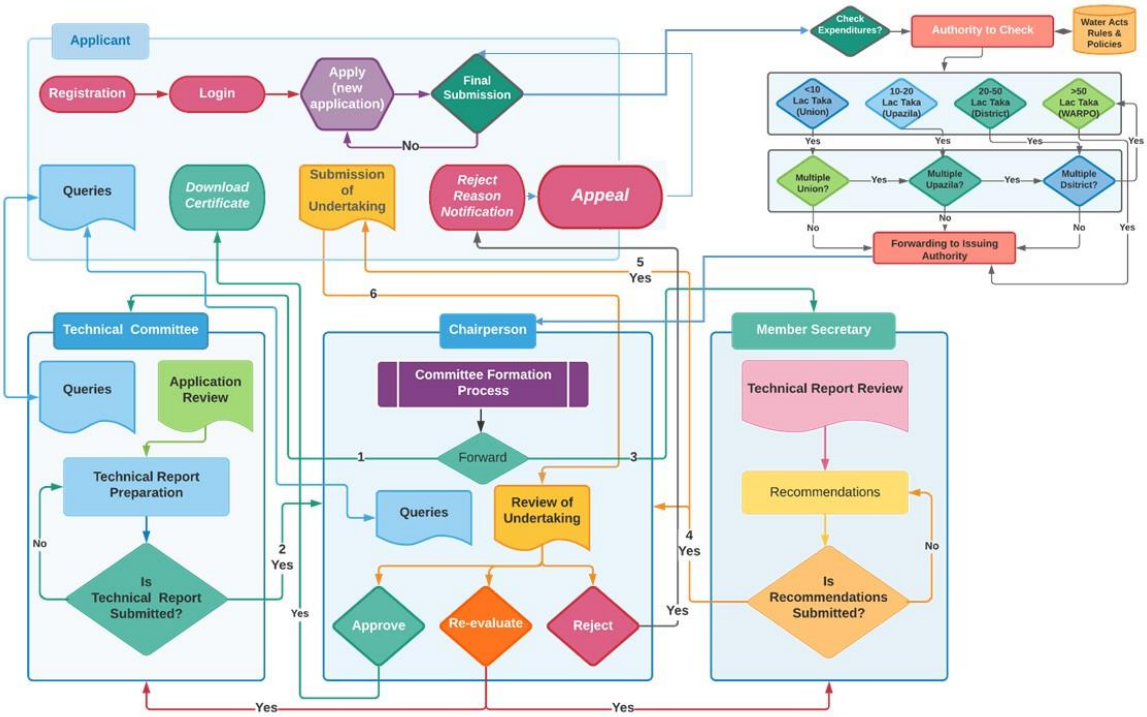


Figure 2.27: Flow Diagram of Clearance Certificate

2.7.2 Web Portal for No Objection Certificates

According to Bangladesh Water Rules 2018, all water resources development related projects involved in abstraction of ground water by force-mode deep tube wells need to get No Objection Certificate (NOC) from WARPO. A web based interactive system has been developed for applying, processing and tracking these No Objection Certificates as described in Chapter 10 of Bangladesh Water Rules 2018. The portal allows users to make and register applications, track progress and get NOC. It allows WARPO to process and evaluate application with respect to predefined criteria and provide NOC. Besides, the forms of the Tafseel of Bangladesh Water Rules 2018 related to the No Objection Certificates for Groundwater Abstraction activities has been properly included in the web-portal which has focused on the application forms, no objection certificates, monitoring, registration, and other relevant information. A guideline of NOC has been prepared as per the requirements following Bangladesh Water Rules as well as acts, rules, policy, plan and strategy of WARPO. Based on this guideline, the portal has been developed. In the home of this portal, a schedule of all regulatory measures under the Bangladesh Water Rules 2018 have been updated indicating the dates, by region and by sector, when they came into effect. It helps all water users to be clear as to their obligations under the Bangladesh Water Act, 2013. Login and Registration of No Objection Certificate portal is shown in Figure 2.28.

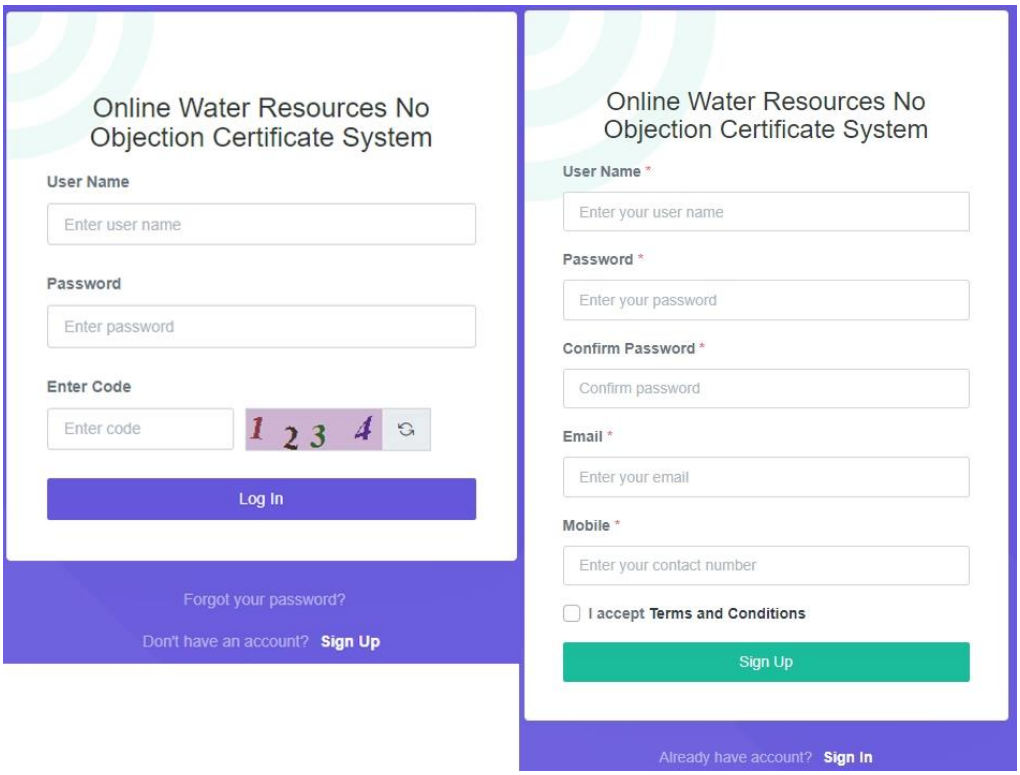


Figure 2.28: Login and Registration of No Objection Certificate Web Portal

The portal has following 9 modules:

1) **Dashboard**: Provides an overview of web portal. Displays the overall status of application for No Objection Certificate, sector wise application status, year wise application submitted, and year wise certificate issued. A Screenshot of Dashboard is displayed in Figure 2.29.

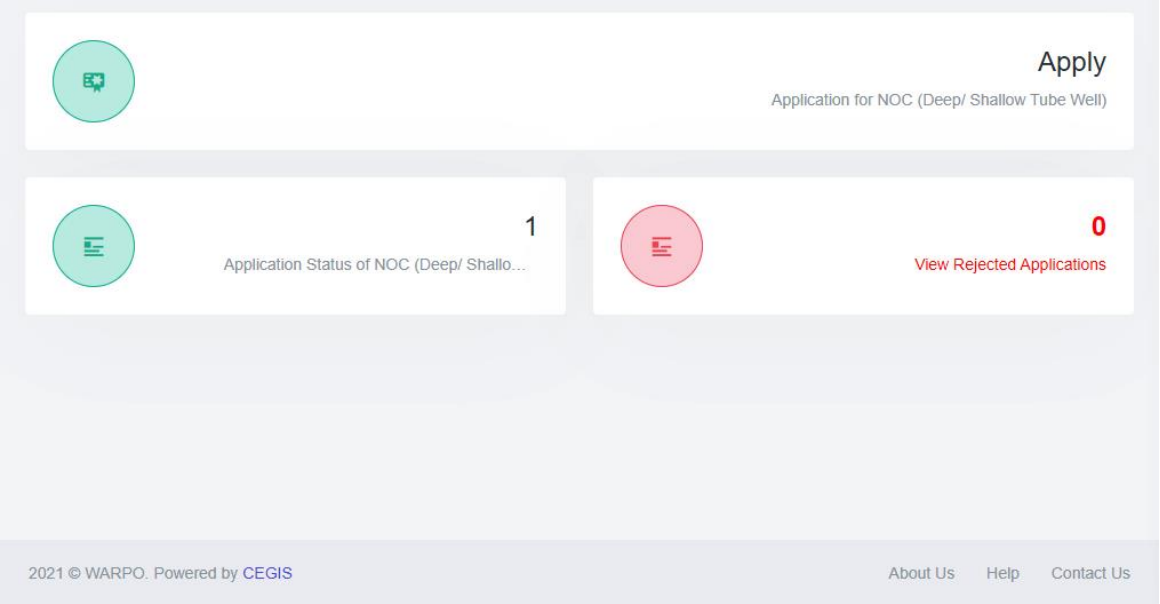


Figure 2.29: Dashboard of NOC

2) **Application Module**: This is the main module of the application where each form was developed according to the Bangladesh Water Rules 2018 Application Form 7. A user has to be authenticated by logging into the system after completing registration to use the application module. Each form has four sections e.g. General Section, Technical Information, Deed Obligatory and Administrative Section respectively and sample screenshot is displayed in Figure 2.30 to 2.33 consecutively.

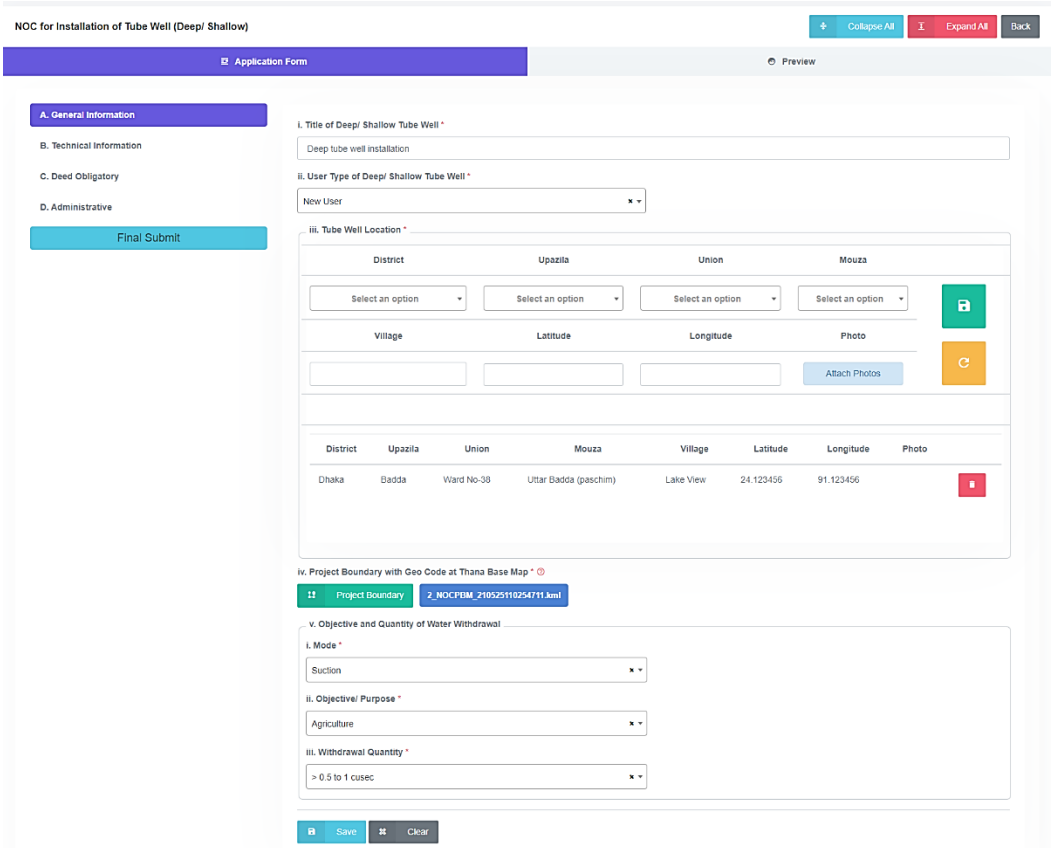


Figure 2.30: General Section

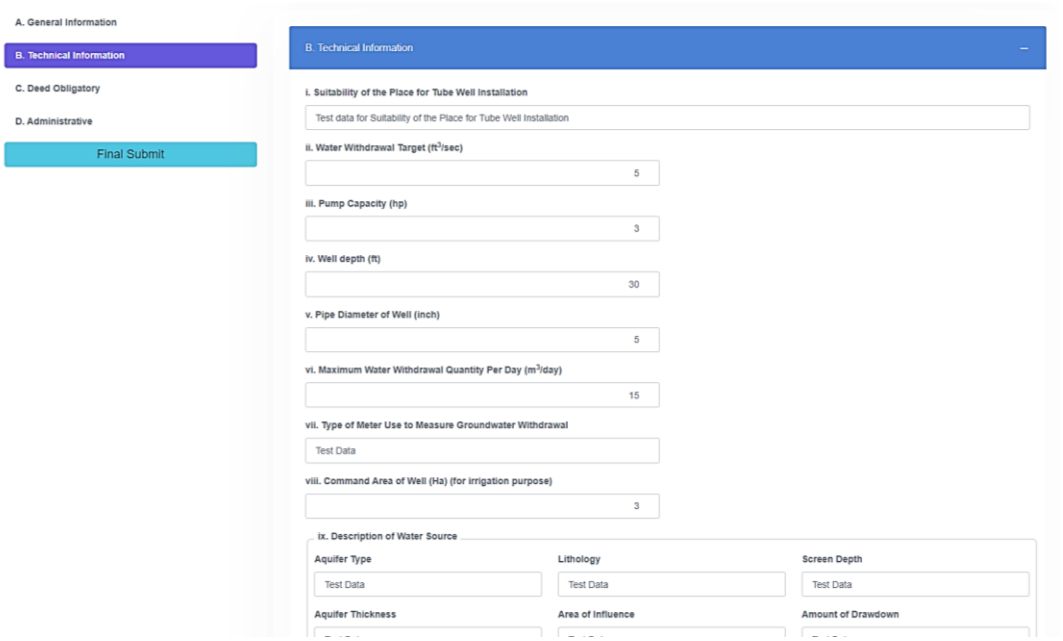


Figure 2.31: Technical Information

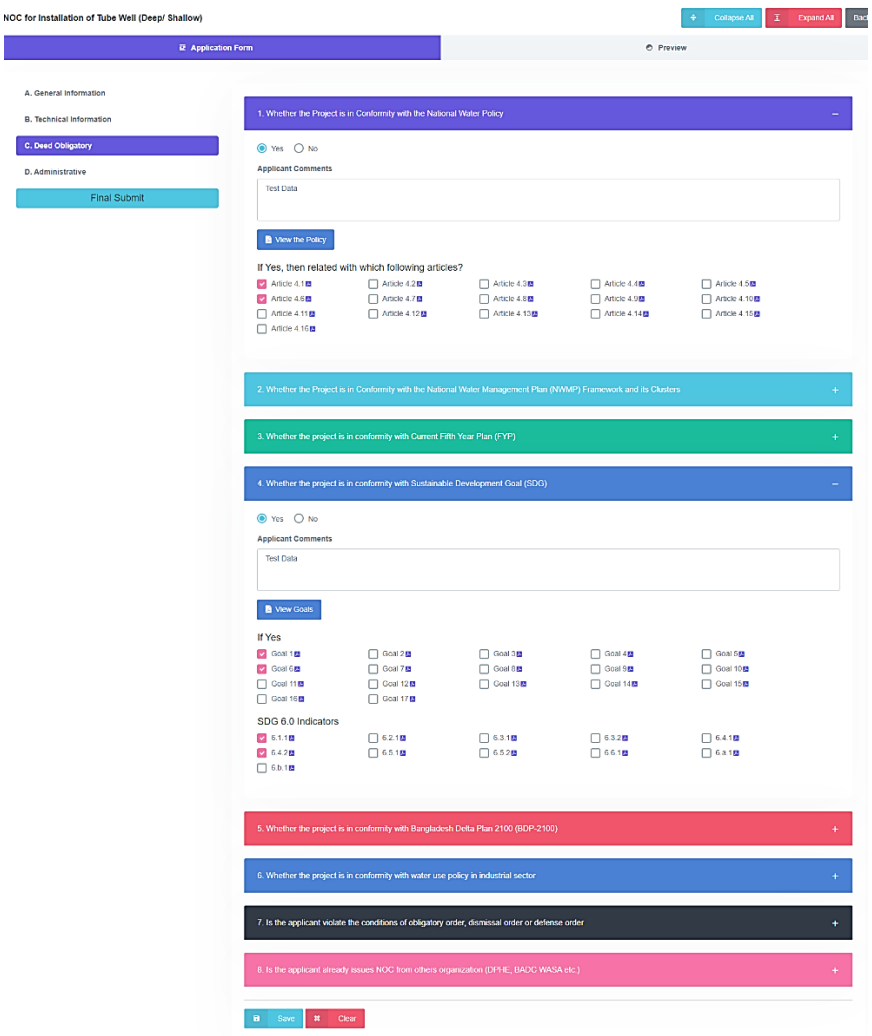


Figure 2.32: Deed Obligatory

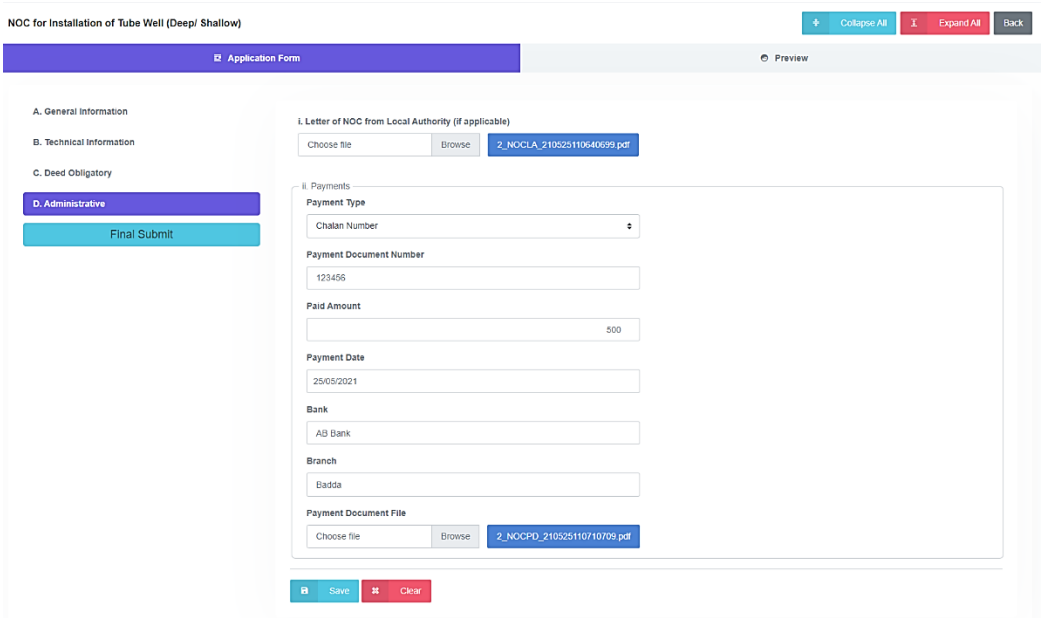


Figure 2.33: Administrative

3) **Tracking Module:** Only the authorized members of WARPO officials can use this module. It keeps track of the application along with its reviews and forwards to appropriate authority based on information provided by the application. To make the application robust in case of failure of sufficient submission of information the system can request applicant to provide the missing ones even after 15 days of application submission. The module has functionality to incorporate information obtained through field visit from inspection team. The system evaluates each application based on some criteria defined according to Rule 31(4) and 31(5) of Chapter 10 of Bangladesh Water Rules 2018 and creates an eligible list of applicants for No Objection Certificate. Finally, it sends a notification message via email informing the applicants about application status.

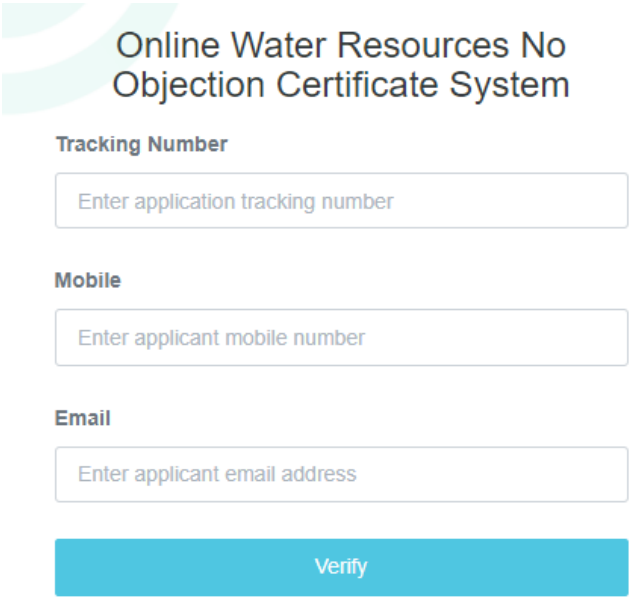


Figure 2.34: Application Tracking

4) This module is used by WARPO officials. It helps to track, review and analyze the applications based on the information provided by the applicant. If information provided by applicant is not sufficient, then the module can send a request to applicant for additional information within 15 days after getting application. The module also allows WARPO user to incorporate information obtained through field visit. The system evaluates each application based on some criteria defined according to Rule 31(4) and 31(5) of Chapter 10 of Bangladesh Water Rules 2018 and generate a list of eligible applicants for NOC and make their status enable to get the NOC form the system. A notification through email is also sent automatically to the applicants to inform the status of the application.

5) **Certification Module:** This module allows qualified applicants to get NOC from the portal as pdf file or printed copy. The module also has option to appeal for reconsideration when an agency gets notification for temporary suspension.

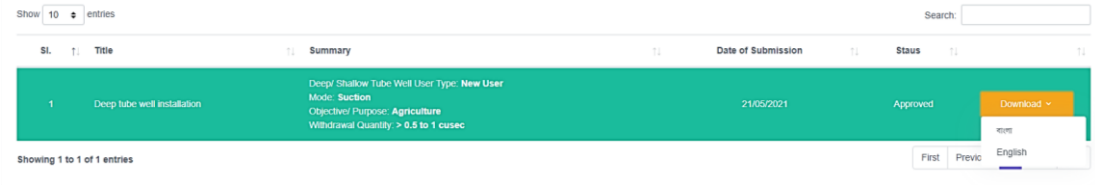
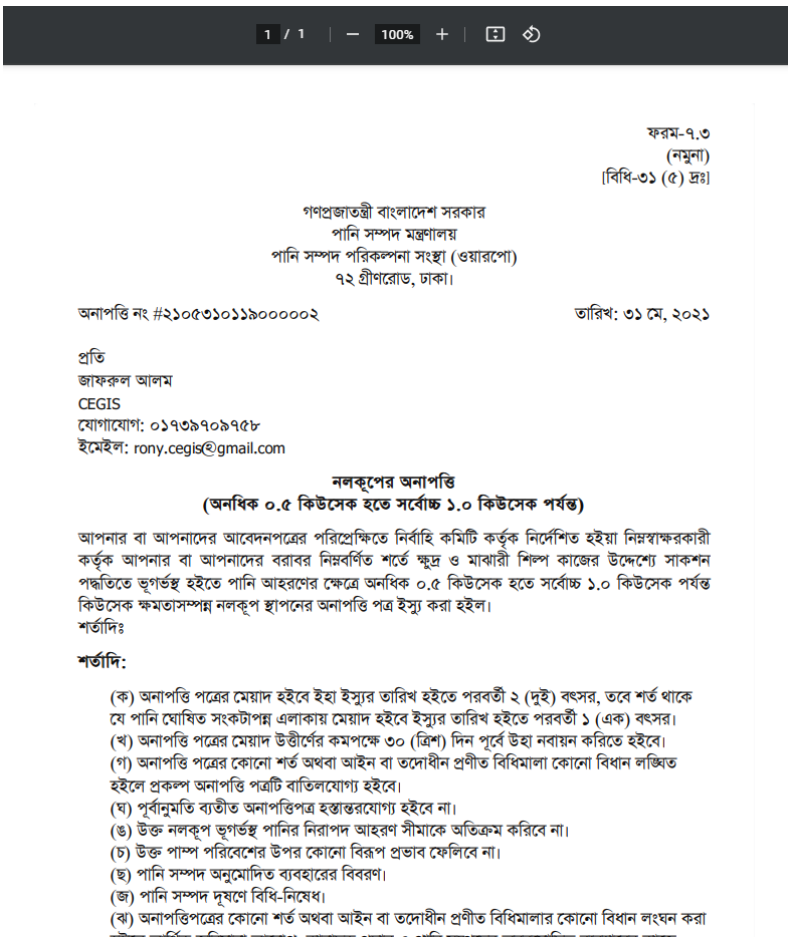


Figure 2.34: Certificate Module



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ফরম-৭.৩
(নমুনা)
[বিধি-৩১ (৫) দ্রঃ]

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পানি সম্পদ মন্ত্রণালয়
পানি সম্পদ পরিকল্পনা সংস্থা (ওয়ারপো)
৭২ গ্রীণরোড, ঢাকা।

অনাপত্তি নং #২১০৫৩১০১১৯০০০০০২ তারিখ: ৩১ মে, ২০২১

প্রতি
জাফরুল আলম
CEGIS
যোগাযোগ: ০১৭৩৯৭০৯৭৫৮
ইমেইল: rony.cegis@gmail.com

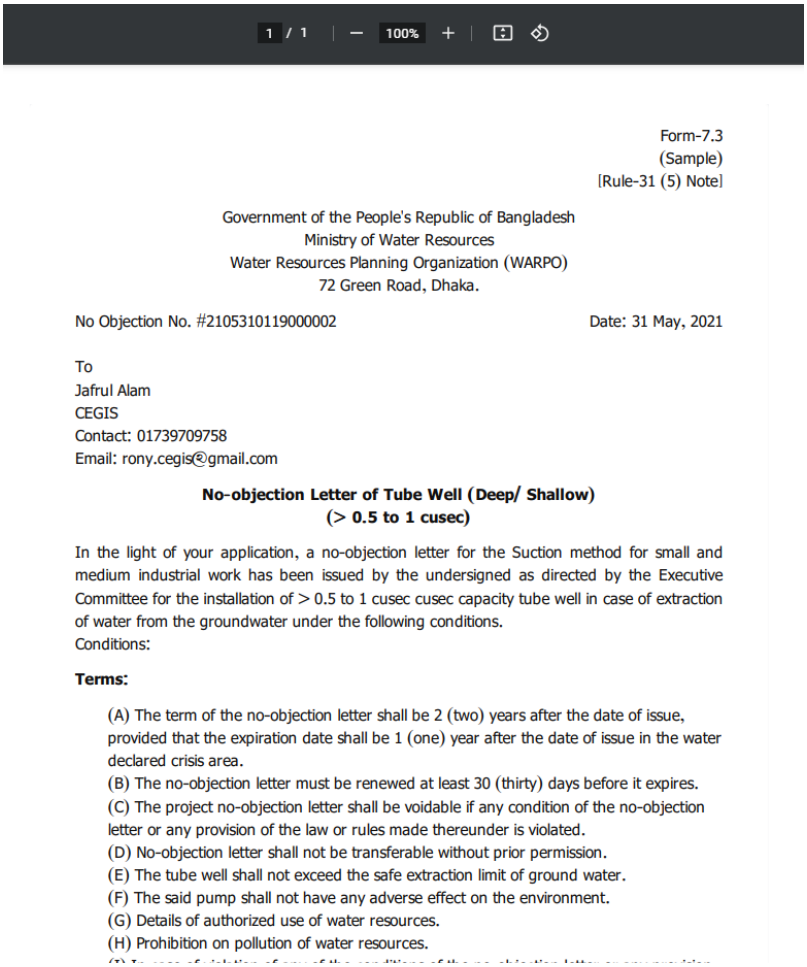
নলকূপের অনাপত্তি
(অনধিক ০.৫ কিউসেক হতে সর্বোচ্চ ১.০ কিউসেক পর্যন্ত)

আপনার বা আপনাদের আবেদনপত্রের পরিপ্রেক্ষিতে নির্বাহি কমিটি কর্তৃক নির্দেশিত হইয়া নিম্নস্বাক্ষরকারী কর্তৃক আপনার বা আপনাদের বরাবর নিম্নবর্ণিত শর্তে ক্ষুদ্র ও মাঝারী শিল্প কাজের উদ্দেশ্যে সাকশন পদ্ধতিতে ভূগর্ভস্থ হইতে পানি আহরণের ক্ষেত্রে অনধিক ০.৫ কিউসেক হতে সর্বোচ্চ ১.০ কিউসেক পর্যন্ত কিউসেক ক্ষমতাসম্পন্ন নলকূপ স্থাপনের অনাপত্তি পত্র ইস্যু করা হইল।
শর্তাদিঃ

শর্তাদি:

(ক) অনাপত্তি পত্রের মেয়াদ হইবে ইহা ইস্যুর তারিখ হইতে পরবর্তী ২ (দুই) বৎসর, তবে শর্ত থাকে যে পানি ঘোষিত সংকটাপন্ন এলাকায় মেয়াদ হইবে ইস্যুর তারিখ হইতে পরবর্তী ১ (এক) বৎসর।
(খ) অনাপত্তি পত্রের মেয়াদ উত্তীর্ণের কমপক্ষে ৩০ (ত্রিশ) দিন পূর্বে উহা নবায়ন করিতে হইবে।
(গ) অনাপত্তি পত্রের কোনো শর্ত অথবা আইন বা তদোধীন প্রণীত বিধিমালা কোনো বিধান লঙ্ঘিত হইলে প্রকল্প অনাপত্তি পত্রটি বাতিলযোগ্য হইবে।
(ঘ) পূর্বানুমতি ব্যতীত অনাপত্তিপত্র হস্তান্তরযোগ্য হইবে না।
(ঙ) উক্ত নলকূপ ভূগর্ভস্থ পানির নিরাপদ আহরণ সীমাকে অতিক্রম করিবে না।
(চ) উক্ত পাম্প পরিবেশের উপর কোনো বিরূপ প্রভাব ফেলিবে না।
(ছ) পানি সম্পদ অনুমোদিত ব্যবহারের বিবরণ।
(জ) পানি সম্পদ দূষণে বিধি-নিষেধ।
(ঝ) অনাপত্তিপত্রের কোনো শর্ত অথবা আইন বা তদোধীন প্রণীত বিধিমালার কোনো বিধান লংঘন করা

Figure 2.35: Bengali Formatted NOC Certificate



Form-7.3
(Sample)
[Rule-31 (5) Note]

Government of the People's Republic of Bangladesh
Ministry of Water Resources
Water Resources Planning Organization (WARPO)
72 Green Road, Dhaka.

No Objection No. #2105310119000002 Date: 31 May, 2021

To
Jafrul Alam
CEGIS
Contact: 01739709758
Email: rony.cegis@gmail.com

No-objection Letter of Tube Well (Deep/ Shallow)
(> 0.5 to 1 cusec)

In the light of your application, a no-objection letter for the Suction method for small and medium industrial work has been issued by the undersigned as directed by the Executive Committee for the installation of > 0.5 to 1 cusec cusec capacity tube well in case of extraction of water from the groundwater under the following conditions.
Conditions:

Terms:

(A) The term of the no-objection letter shall be 2 (two) years after the date of issue, provided that the expiration date shall be 1 (one) year after the date of issue in the water declared crisis area.
(B) The no-objection letter must be renewed at least 30 (thirty) days before it expires.
(C) The project no-objection letter shall be voidable if any condition of the no-objection letter or any provision of the law or rules made thereunder is violated.
(D) No-objection letter shall not be transferable without prior permission.
(E) The tube well shall not exceed the safe extraction limit of ground water.
(F) The said pump shall not have any adverse effect on the environment.
(G) Details of authorized use of water resources.
(H) Prohibition on pollution of water resources.

Figure 2.36: English Formatted NOC Certificate

6) **Monitoring and Reporting Module:** This module has two interface. One interface is used by the applicants to see the status of their applications. The status may be registered, referred, rejected, suspended or approved. Other interface is used by WARPO to view the status of all applications. In both case, information can be displayed as table shown in Table 2.2.

Table 2.2: Status of Applications for NOC

SN	Project Name	User Type	Mode	Quantity	Status
1	Deep Tube Installation for Drinking Water	New User	Suction	> 0.5 to 1 cusec	Approved
2	Tube Installation for Drinking Water	Existing User	Force mode	> 1 to 3 cusec	Approved
3	Shallow Tube Installation for Drinking Water	New User	Suction	> 0.5 to 1 cusec	Approved
4	Deep Tube Installation for Drinking Water	Existing User	Force mode	> 1 to 3 cusec	Rejected
5	Tube Installation for Drinking Water	New User	Suction	> 0.5 to 1 cusec	Approved

The module provides facilities to search or query information based on region, sector, type, applicant name or applicant status and generate customized reports such as list of approved applications, list of rejected application for a particular project type,

number of approved, rejected or referred applications for different type of projects. Generated reports may be printed or exported in PDF, Excel or other desired format.

After providing NOC to applicants (agencies), WARPO can regularly monitor them to ensure that they are maintaining the conditions required for NOC. If any agency fails to maintain the conditions, then using this module, WARPO can suspend the NOC of that agency temporarily. A notification through email will be automatically sent to the agency mentioning the reasons of suspension and asking to come for a hearing. If the explanation of the agency in the hearing satisfy WARPO technical committee, then suspension will be withdrawing. Otherwise, NOC of the agency will be suspended permanently.

Besides, Monitoring and Reporting Modules has been included with indicators in the web portals so that WARPO and relevant committees can monitor whether the No Objection Certificates for Groundwater Abstraction have been provided following the Bangladesh Water Rules 2018.

7) **Data Availability Module:** This module quantifies the volume of groundwater availability and monitor water usage of project locations. Groundwater level, borehole locations of BWDB, Aquifer Properties has been used by this module. This information has been analyzed and total usage of water has been calculated.

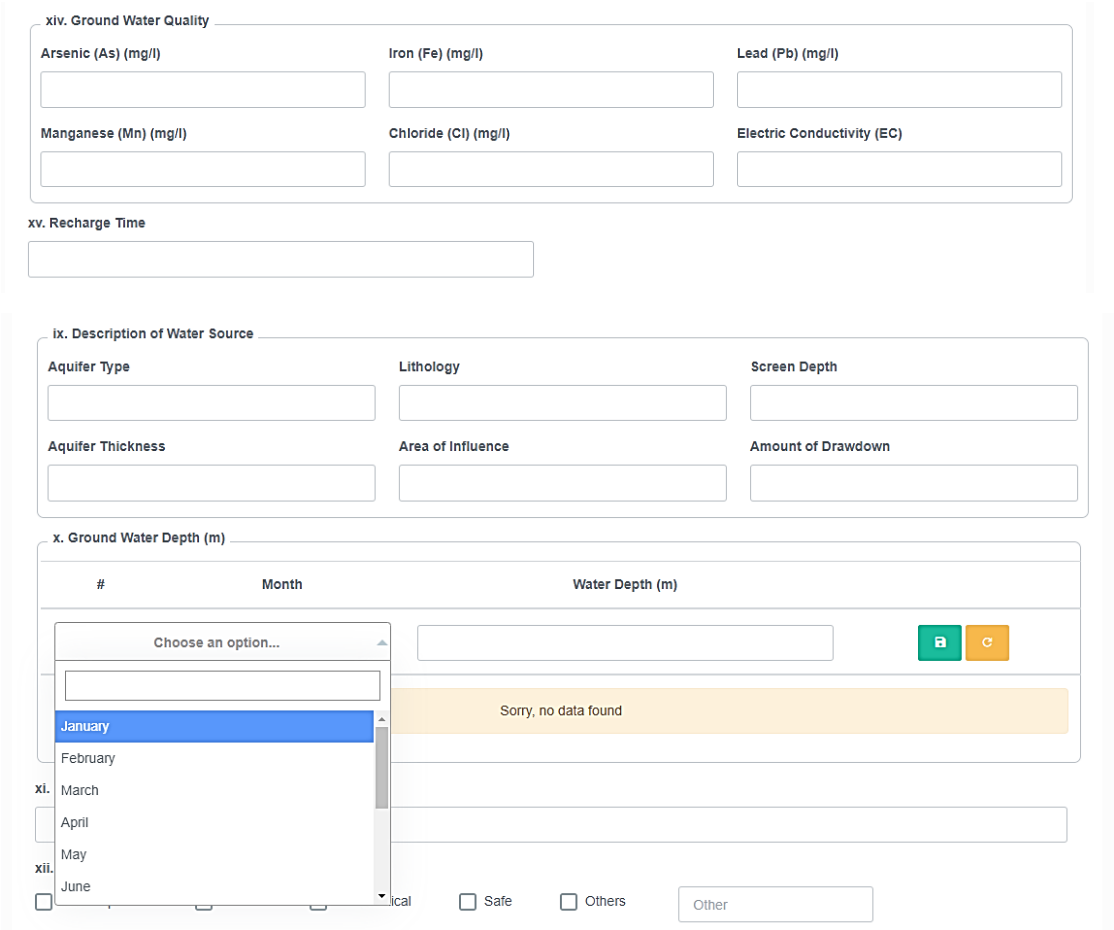


Figure 2.37: Data Availability Module

8) **Project Information Module:** This module has been open for all users. Using this module, user can see list of projects involved in abstraction of ground water by force-mode deep tube wells, their status and action-dates and act where appropriate. This module also provides facilities to generate summary report on the progress of NOC activities by region, sector and agency wise.

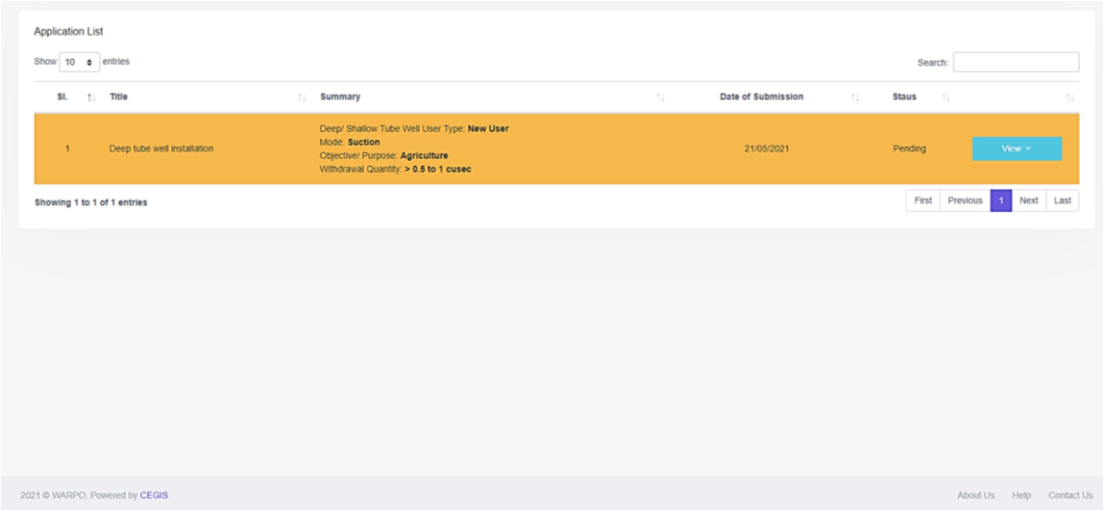


Figure 2.38: Project Information Module

9) **Administration Module:** This module is used by Administrator to do some administrative works. It allows Administrator to add new data layers, assign right to users Screenshots of administrative module is displayed in Figure 2.39 to 2.40.

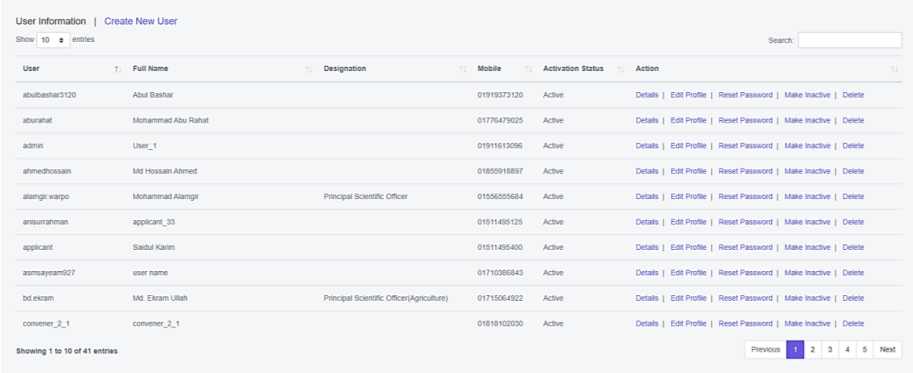


Figure 2.39: User Creation Panel

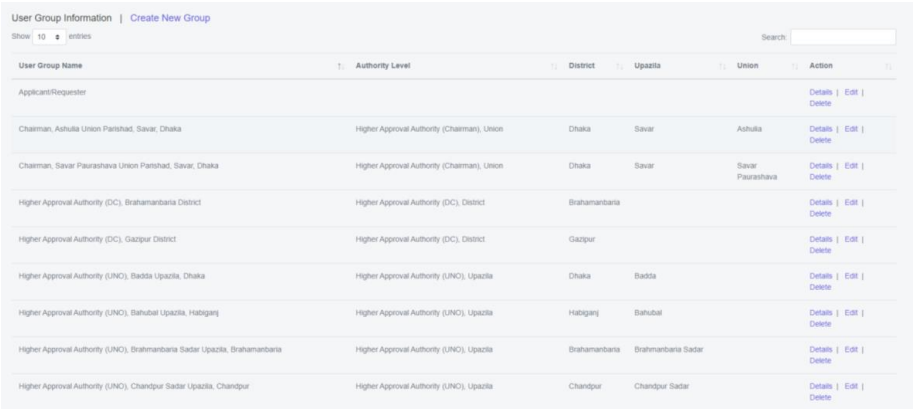


Figure 2.40: User Group Creation Panel

9) **Help and Guideline Module:** This module has an interactive interface to assist and guide the users to use different module of the portal. A detail user manual in PDF format is also available here.

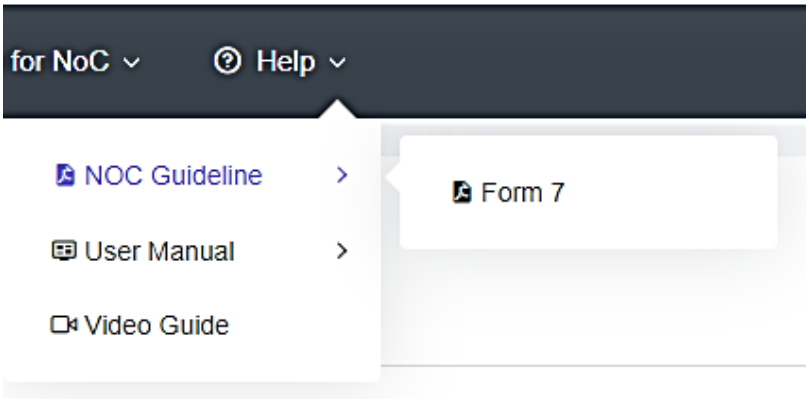


Figure 2.41: Help and Guideline Module Menu

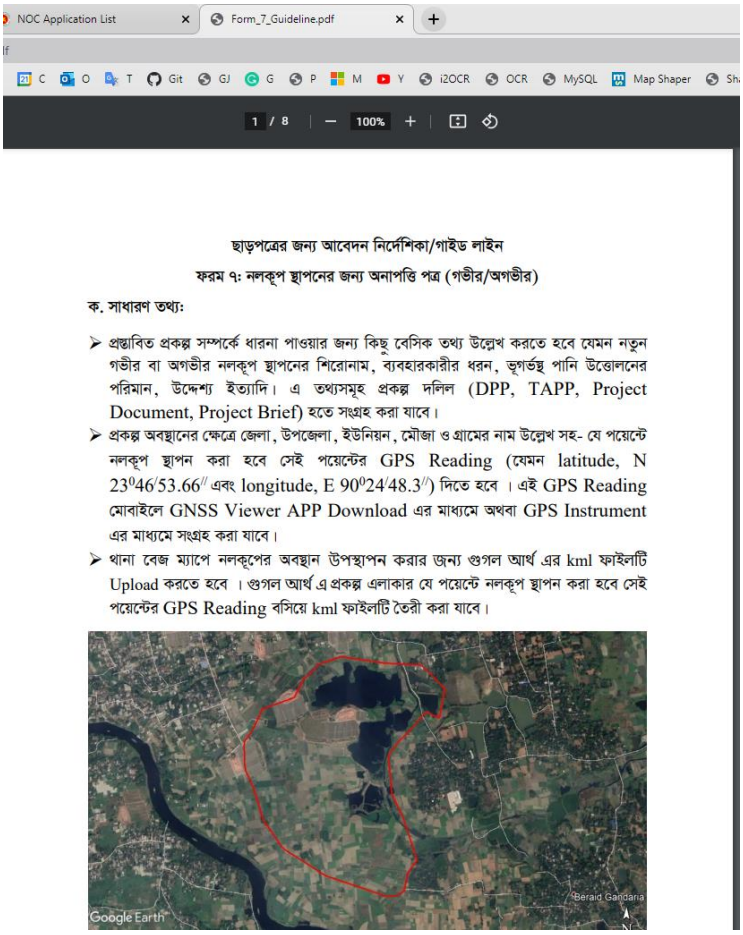


Figure 2.42: Guideline Module in PDF Mode

The flow diagram of No Objection certificate is shown in Figure 2.43.

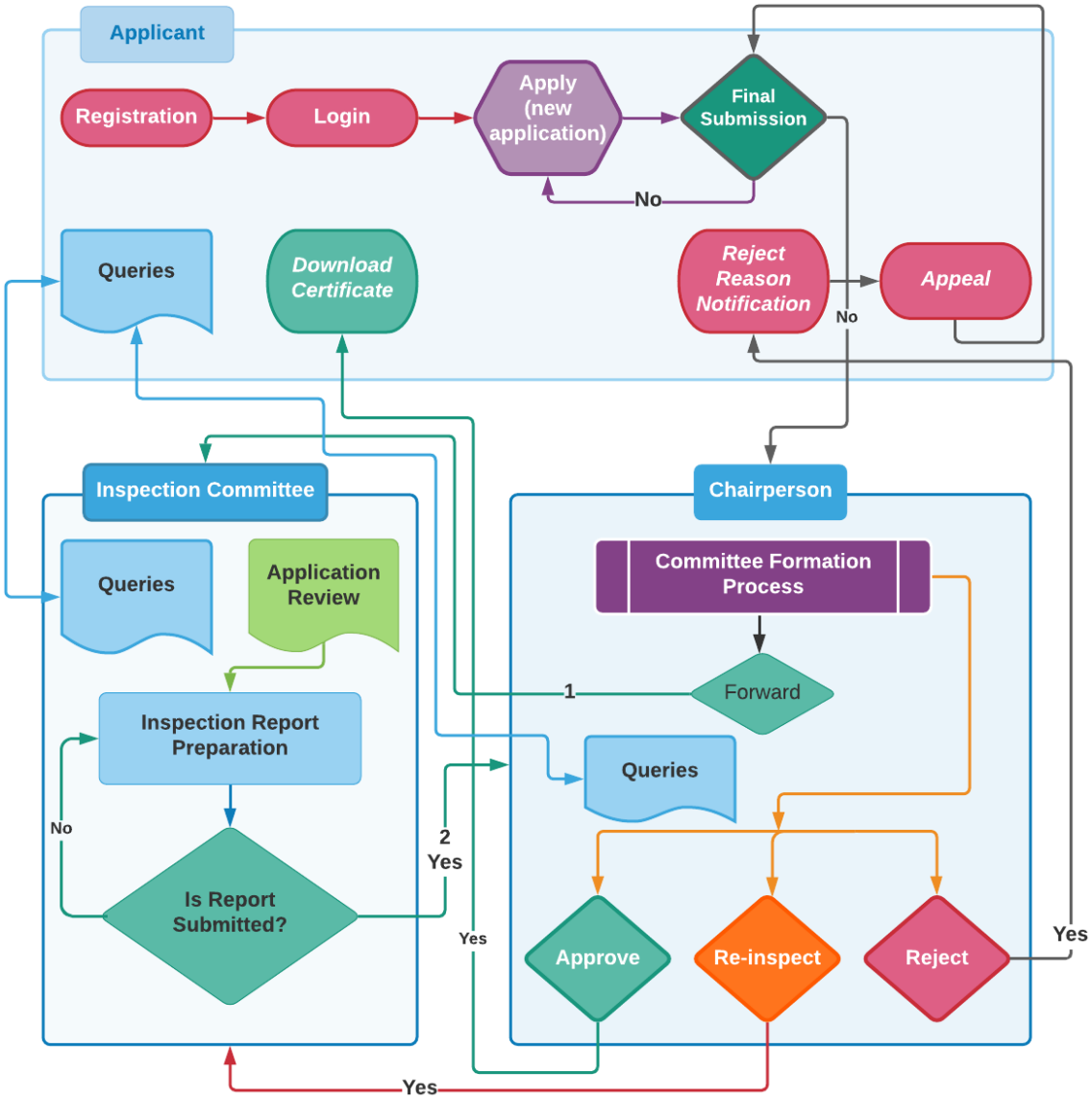


Figure 2.43: Flow Diagram of No Objection Certificate

2.7.3 On-line Data Dissemination Tool

WARPO has developed a desktop based Data Dissemination Tool (Figure 2.13) with the assistance of CEGIS and has been using it to dissemination data from NWRD and ICRD for a long time. It is a very interactive tool. The major functions of this tool are to display and prepare the data availability, data estimation cost, invoice, data receiving form for client, and finally data export for CD writing. This tool is very flexible to select time series data on user requirement. User can select time series data for particular stations and for particular years or hydrological years. It can retrieve data and price from the server. During exporting data for dissemination a readme text file is created which contains the details explanation of each data layers for user.

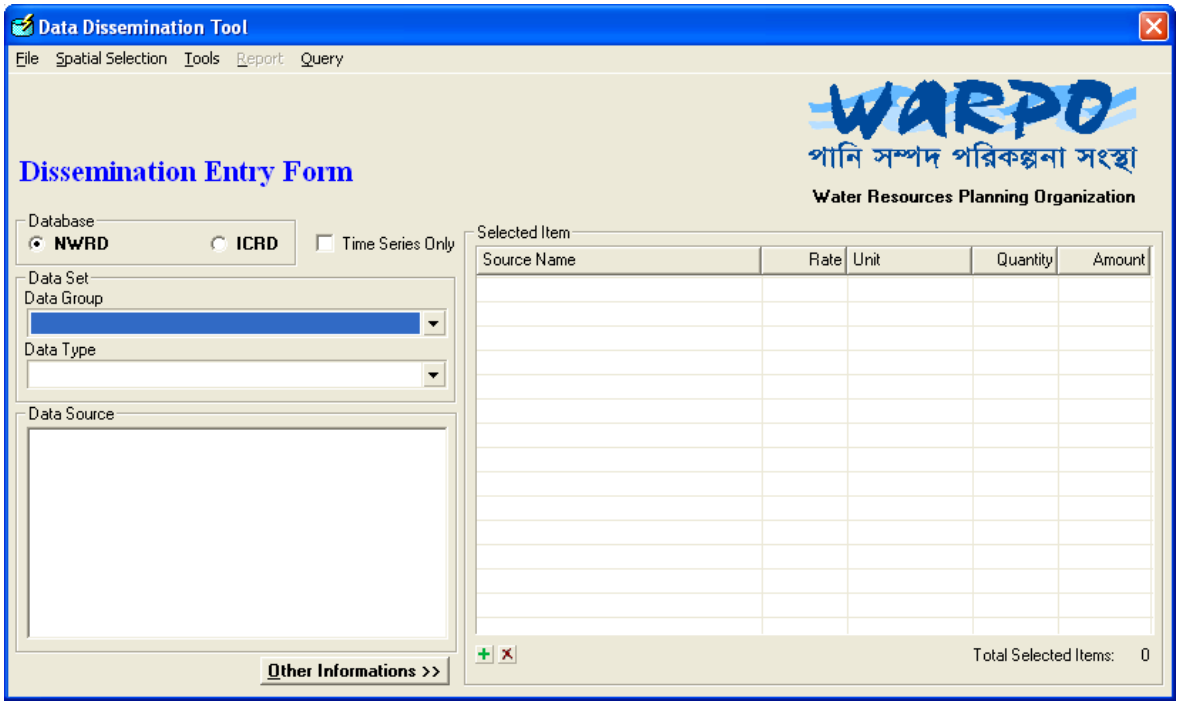


Figure 2.13: Desktop based Data Dissemination Tool

This tool also provides facilities to

- Update data price.
- Update exchange rate.
- Update wet and dry period definition.
- Search data layers.
- Save selected information for later use.

Existing Data Dissemination Tool is desktop based. It needs to install in a client machine (PC). Outside users cannot access to this tool. When a user requests for data, WARPO needs to select the desired layers and prepare estimation for the users. If a web based tool is developed, then all these tasks (data selection, prepare estimation etc.) related to data dissemination can be done by users through internet. After getting request for data, WARPO can either accept or reject the request using this tool. If the request is accepted, then after getting payment, WARPO can send a temporary user ID and password to the user for downloading data.

On-line Data Dissemination Tool has been developed to disseminate existing data from NWRD, ICRD, and other sub-sets of NWRD such as Char Development and Settlement Project (CDSP), Coastal Embankment Rehabilitation Project (CERP) and others to line agencies, Government and private agencies, and registered researchers and students. These data are required for issuing Project Clearance Certificate or No Objection Certificate, implementing Integrated Water Resources Management (IWRM) process or water sector related study/research. The system disseminates data following the Data Dissemination Policy of WARPO. Home page of On-line Data Dissemination Tool is shown in Figure 2.14.

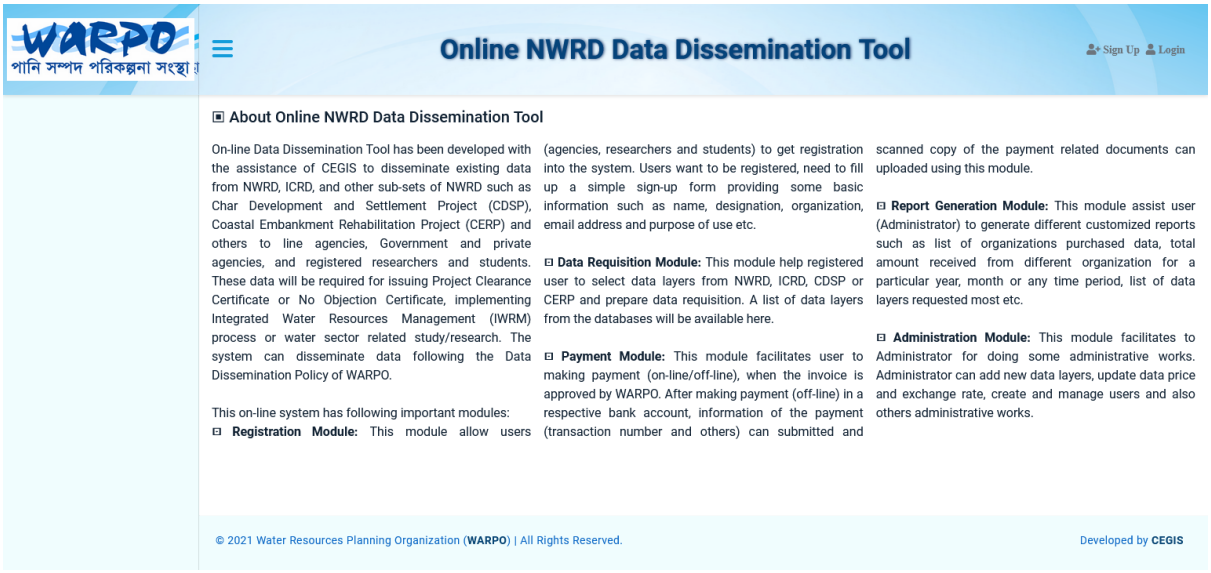


Figure 2.14: Home Page of online Data Dissemination Tool

This on-line system has following 8 major modules:

1) **Dashboard**: It gives an overview and summary information of the on-line system. The dashboard displays the overall status of data dissemination, organization wise data dissemination status both in tabular and chart format. Dashboard of the system is shown in Figure 2.15.

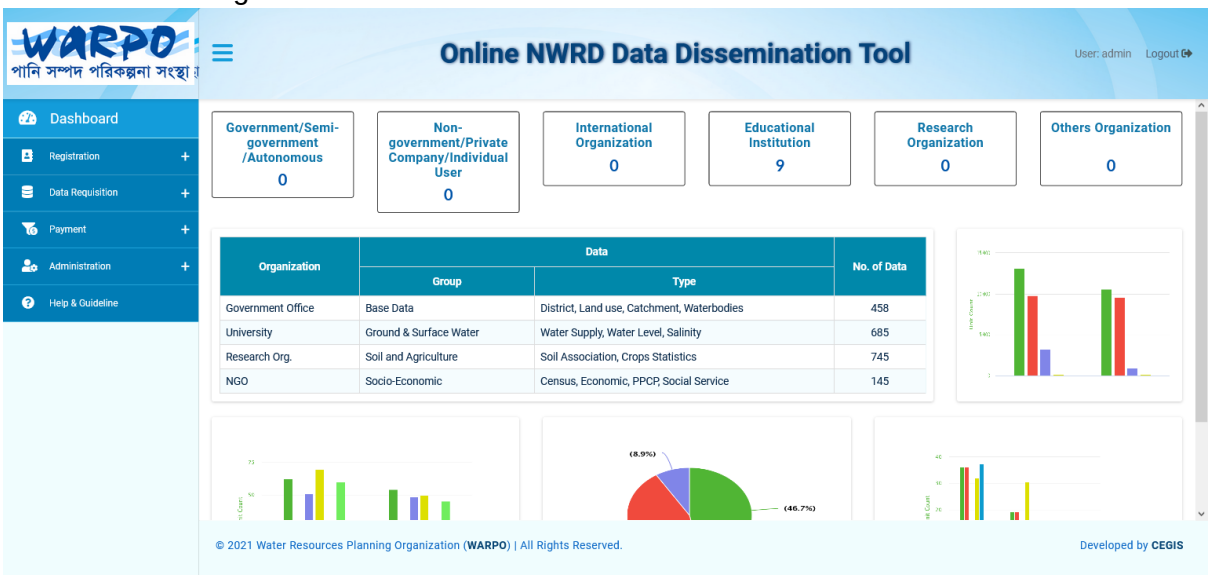


Figure 2.15: Dashboard of online Data Dissemination Tool

2) **User Registration Module:** This module allows users (agencies, researchers and students) to get registration into the system. Users want to be registered, need to fill up a simple request form (Figure 2.16) providing some basic information such as name, designation, organization, email address and purpose of registration and submit it. Administrator can review and analyze the submitted information and if agree to accept the request then an automated generated User ID and Password will be sent to the email address of the user.

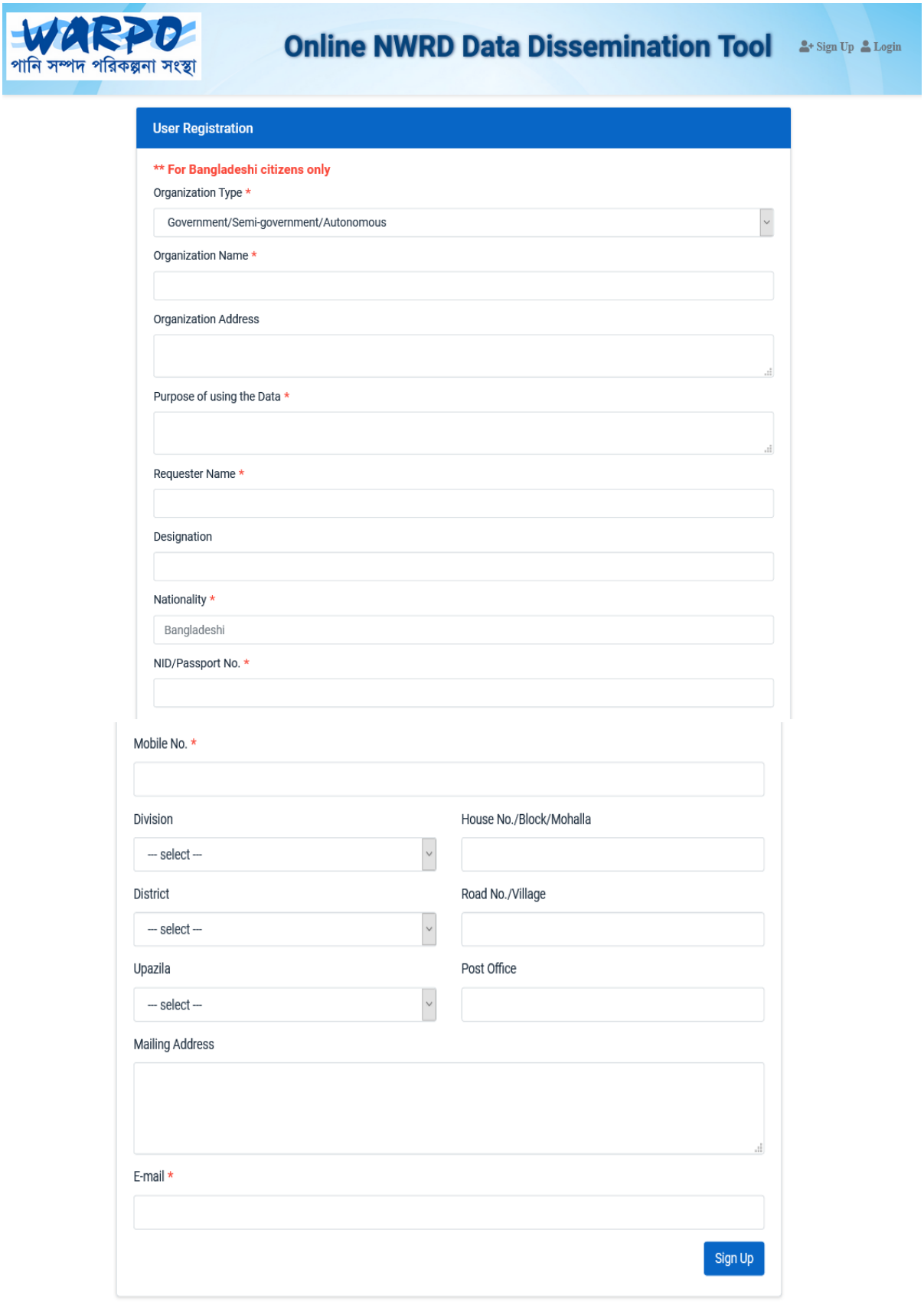


Figure 2.16: Registration Form of online Data Dissemination Tool

3) **Data Requisition Module:** This module helps the registered Data requester to select the desired data layers from NWRD and ICRD and prepare data estimation. A list of data layers from the databases available here. An advance filtering engine assist user to search data layers based on different criteria (data source, group, and type).The system also incorporates a Time Series data selection panel. Data requester can select the desired Time Series data layers using this Time Series data selection panel. Before preparing a data estimation, the data requester has to submit a form by filing some basic information, such as the type of data requester and the purpose of the data using. Data Requisition Form is shown in Figure 2.17.

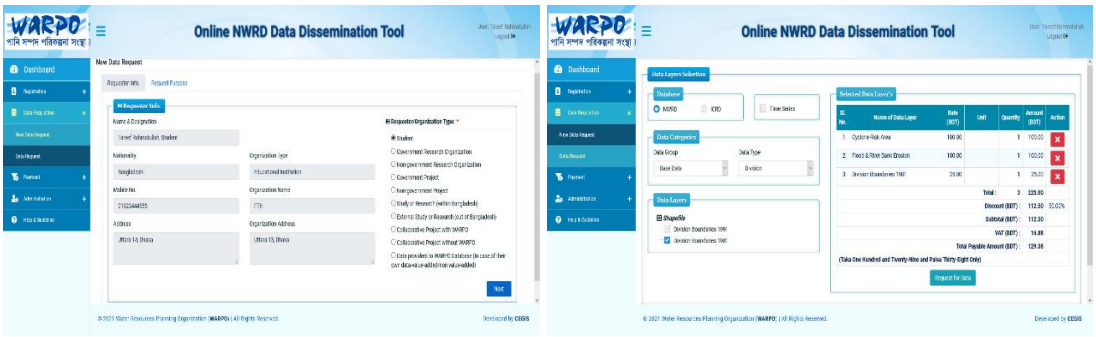


Figure 2.17: Data Requisition Form of online Data Dissemination Tool

4) **Request Processing Module**:

This process is completed in 4 steps

- ✓ Create an Invoice by Scientific Officer (SO) based on data requester requirement.
- ✓ Recommend the Invoice by Senior Scientific Officer (SSO), Principal Scientific Officer (PSO) and Director (DIR).
- ✓ Finally Approve the Invoice by the Director General (DG)
- ✓ Send an email requesting payment after approval of the Director General (DG).

5) **Payment Module**: This module facilitates user to making payment (on-line/off-line), when the invoice is approved by Administrator. After making payment (off-line) in a respective bank account, information of the payment (transaction number and others) can submitted and scanned copy of the payment related documents can uploaded using this module. Simultaneously, a notification message will be sent to Administrator and users.

6) **Data Downloading Module**: This module allows user to download requested data. User gets a link for downloading. Clicking on this link downloads the data into the local computer. A log history is also maintained to keep track of each download activity.

7) **Report Generation Module:** This module assists user (Administrator) to generate different customized reports such as list of organizations purchased data, total amount received from different organization for a particular year, month or any time period, list of data layers requested most etc.

8) **Administration Module:** This module allows system administrators to perform some administrative tasks. Administrator can update data price and exchange rate, create and manage users and also others administrative works.

The flow diagram of the Online Data Dissemination Tool is shown in Figure 2.18.

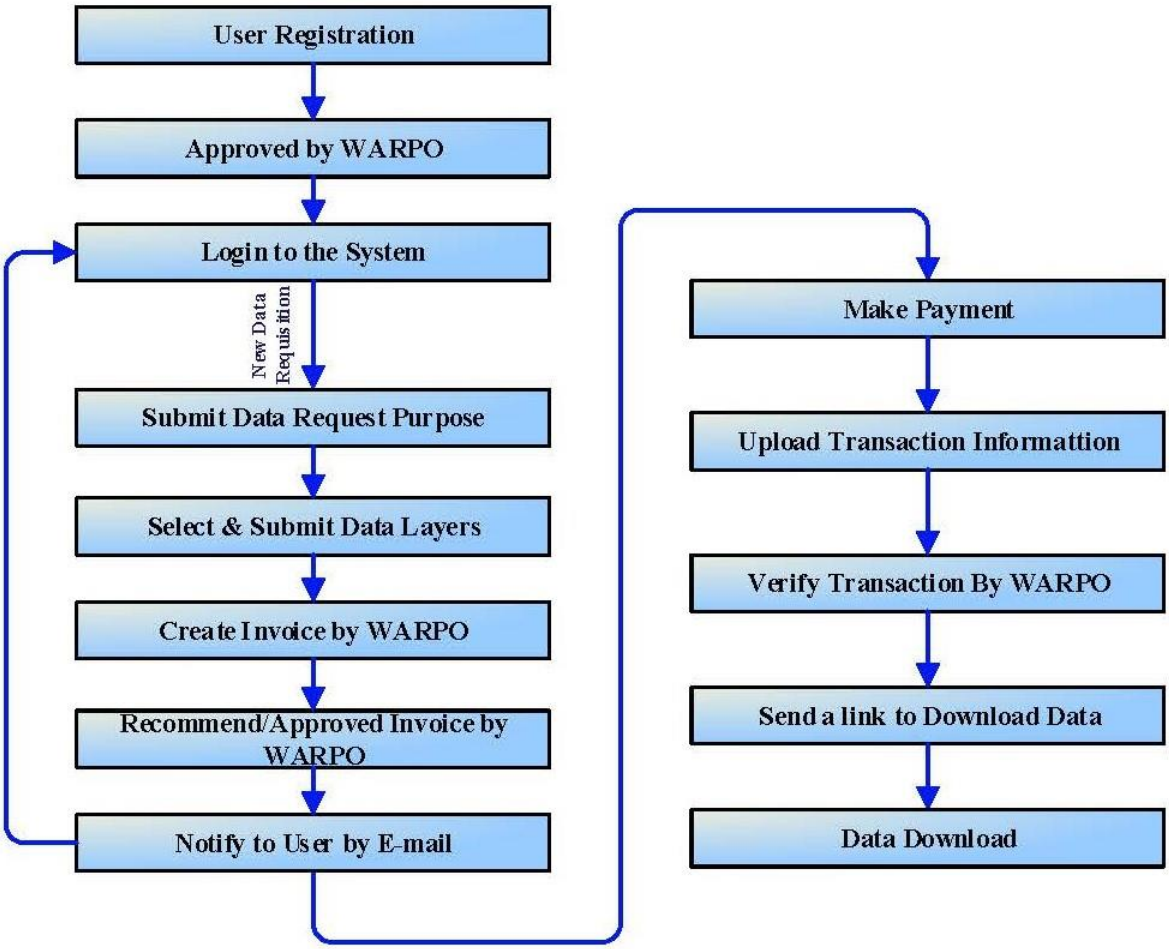


Figure 2.18: Flow Diagram of Online Data Dissemination Tool

2.8 Upgrade and Update Existing Desktop Applications

A number of desktop application has been developed under previous phases of NWRD to assist the activities related to database (NWRD, ICRD, CDSP and CERP) updating. These applications has been upgraded and updated with recent tools and technologies.

2.8.1 Data Quality Tool

Hydro-meteorological data are an important component for the planning process as the country's land and water resource systems need continuous planning and management. Quality assurance for hydro-meteorological data are important particularly for WARPO, because WARPO is maintaining different national (NWRD) and regional level (ICRD) databases which contain a large number of temporal (hydro- meteorological) data. A tool for Data Quality Control and Assessment shown in Figure 2.19 has been developed to check and improve the quality of temporal data. It helps to check overshoot and undershoot and ensure quality of temporal data following the quality control guideline of NWRD. This tool facilitates for comparison & visual plotting of data to check the quality using different analytical method. This tool has been updated as for functionality for WARPO requirements.

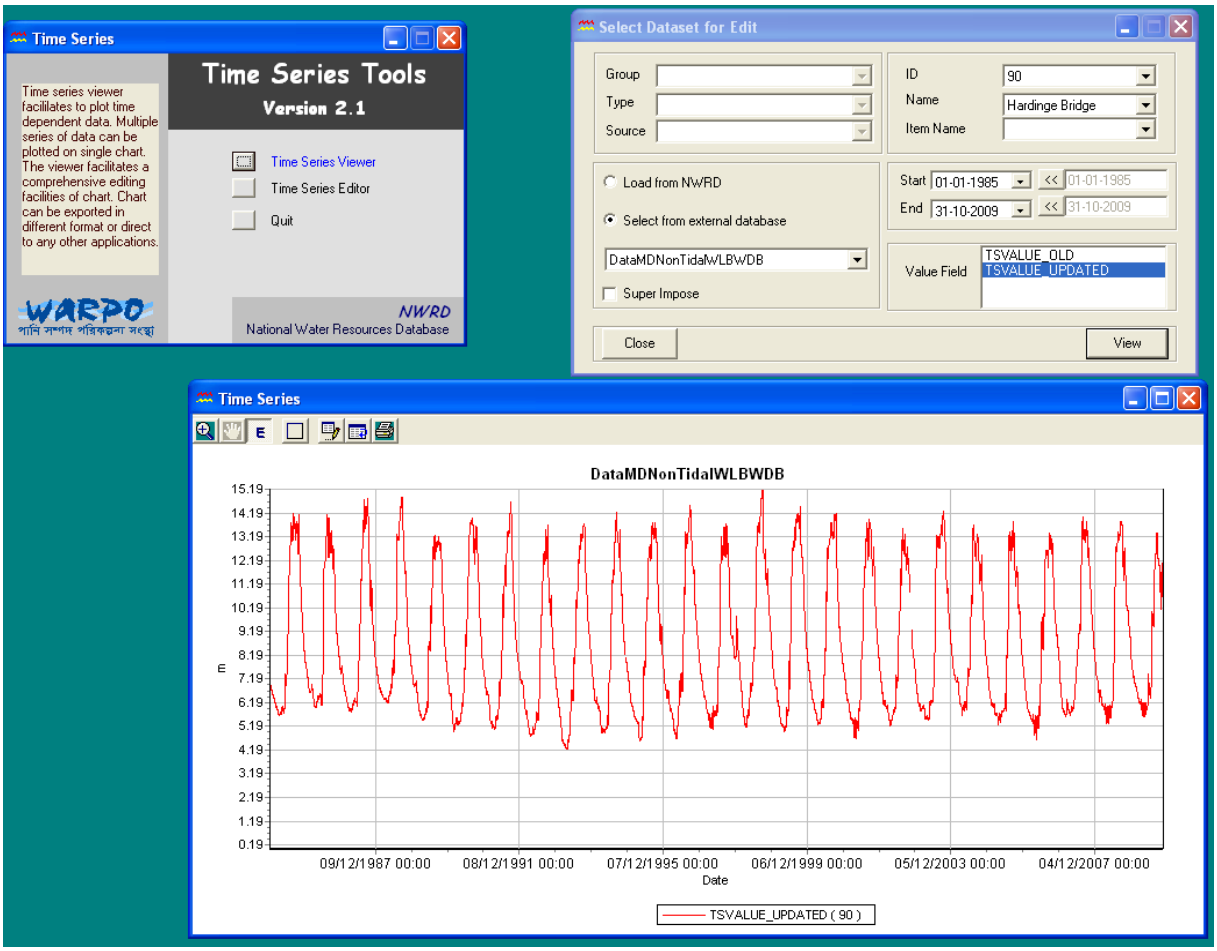


Figure 2.19: Data Quality Tool Developed for NWRD

2.8.2 Data Processing Tool

Temporal and attribute data that has been collected from different Data Providing Agencies are in different format. An Online Data Processing Tool has been developed to convert collected data into a format compatible to NWRD and ICRD databases. This tool has been upgraded to web base (Figure 2.20) in this Project. This tool has been updated in web to make it more generic.

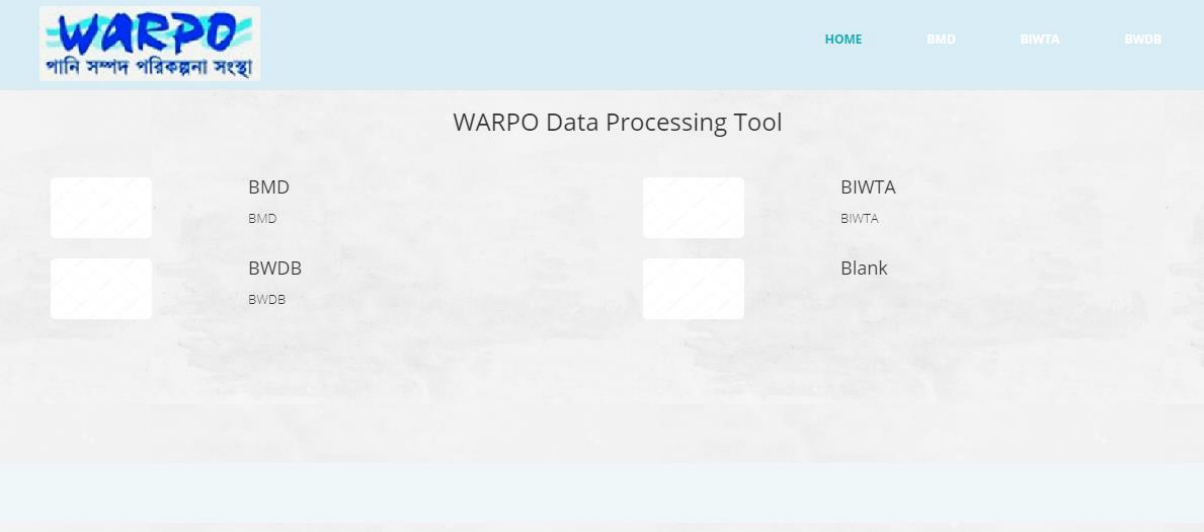


Figure 2.20: Online Data Processing Tool

2.8.3 Statistical Analysis Tool

A desktop base Statistical Analysis Tool was developed to analyze time dependent data. This tool has been upgraded to web base (Figure 2.21) in the previous phase. The main function of this tool is to support the user to analyze Time Series data using simple statistical calculation, display calculated data either in chart or tabular format and export calculated data to user format. This tool can also help user to retrieve time series data in hydrological year wise and separately either in dry or wet period wise. The simple statistical analysis is available to calculate the sum, max, min, average, count and standard deviation of different time series data. Different type of Frequency Analysis, Dependable Analysis is also incorporated in this tool. The calculated results can be viewed and exported. This tool has been functional as per requirement of WARPO.

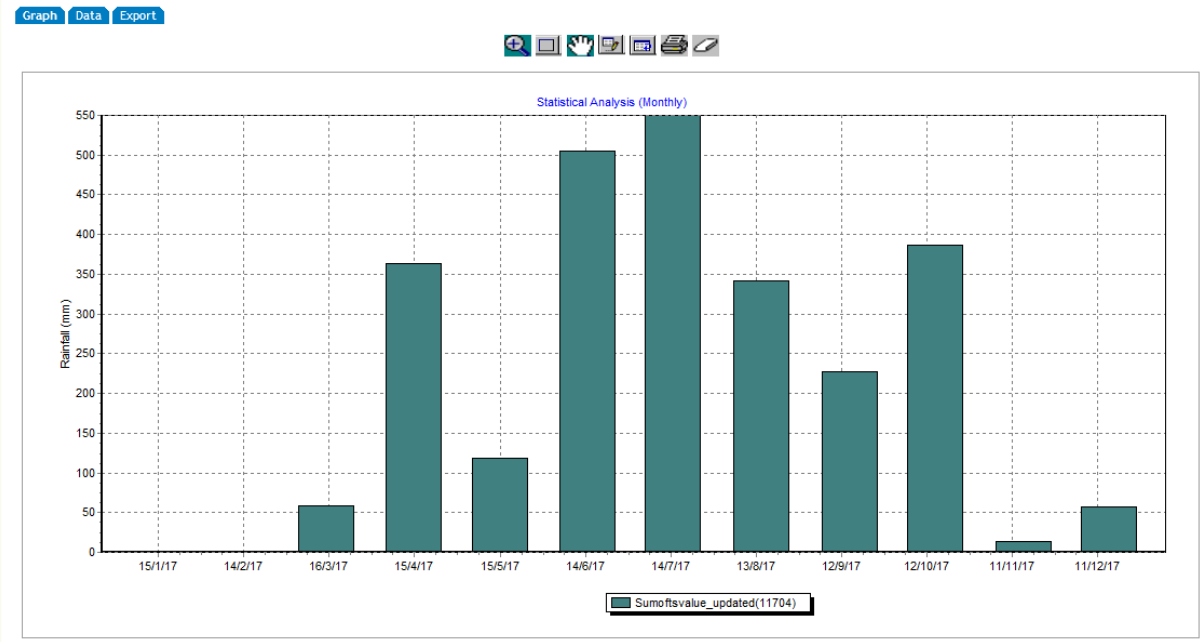


Figure 2.21: Statistical Analysis Tool Developed for NWRD

2.8.4 Metadata Editor

Metadata is "data about data". It is the background information of the data. Each data layer of NWRD contains metadata. A tool has been developed to add, edit or delete metadata for a particular data layer easily and efficiently. This tool (Figure 2.22) also helps to update Data Definition Tables (defines group and type of a layer) and bundle information (description of tables/attribute tables). This tool has been updated so that data layers can be directly imported form NWRD database. The Metadata Editor system functionally updated as per requirement of WARPO. It has been updated for other databases (ICRD, CDSP and CERP) also.

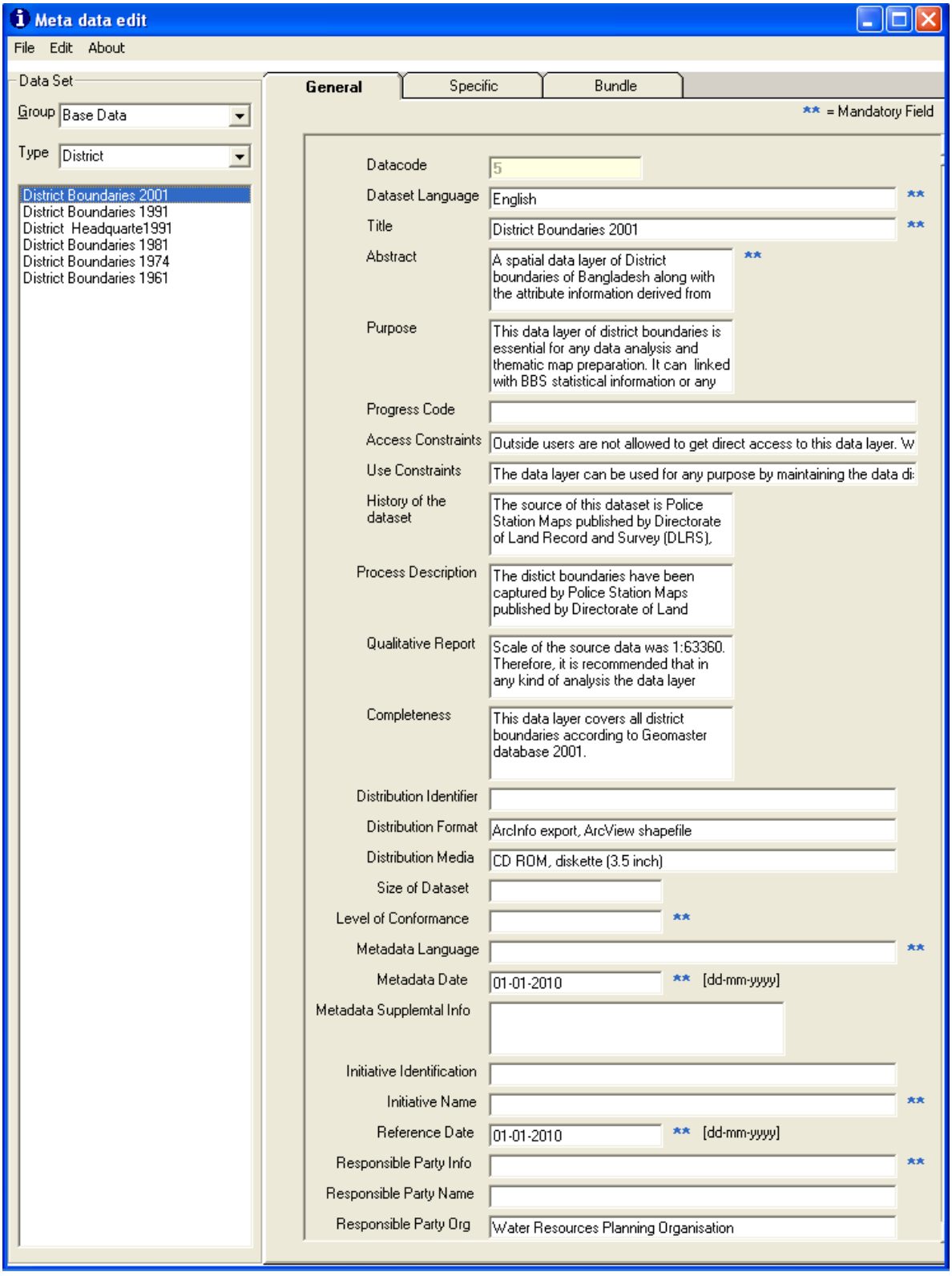


Figure 2.22: Meta Data Editor Developed for NWRD

2.9 Update Guidelines, Policies and Protocols

A number of guidelines and policies has been developed to manage data, plan data collection, check data quality and disseminate data. These guidelines and policies has been updated as per requirement of WARPO. Some new guidelines has also been developed.

2.9.1 Data Dissemination Policy and Pricing

A data dissemination policy and pricing guideline had been developed which contain the collected water resources data dissemination and pricing guidelines. This guideline has been updated with the context of time to disseminate the data for the stakeholder with reasonable time and pricing.

2.9.2 Database Management Guideline

A Database Management Guideline has been prepared describing database, metadatabase, data definition tables, data type (temporal, attribute and spatial), hierarchical structure of spatial data, views and stored procedures of NWRD. This guideline helps to manage and update the database. This guideline will be updated to include maintenance and operation of NWRD web portal, data collection and processing, data Layer preparation, data quality checking, data storage and archiving, data categorization, database development and management, principle of data sharing and dissemination, data Backup, data purging, maintaining standard in all aspects, roles and responsibilities of respective entities and other activities necessary for the best performance and efficiency of NWRD. XML Schemas 1.0 or above will be used to manage and overall Enterprise Schema. Metadata Object Facility (MOF) will be used to define, manipulate and integrate metadata and data in a platform independent manner. Data Archiving will be performed in such a way that it can support integrity checking through hashing, audit logging and regulatory compliance.

2.9.3 Data Collection Guideline

A data collection guideline has been developed which contains plan for water resources data collection, review of sectoral data collection responsibilities and upgrade method of data collection. This guideline helps to update data quality methodologies to maintain the quality of data in all steps including data collection, processing, quality checking, storing and dissemination.

2.9.4 Data Sharing Protocol

A framework of communication infrastructure needs to be introduced to connect NWRD with other national level databases outside WARPO like BWDB, BBS, DoF, BARC, SoB, BBS etc. and to share data and information among these agencies. In order to develop this framework, several workshops and dialogues have been held at WARPO with these line agencies in previous phase of NWRD. A guideline named “Co-operative Inter-agency Networking towards Improved Database Management” has been developed and disseminated among the prime data providing agencies. In this guideline, WARPO has proposed to form an inter-agency network committee and offered to develop a framework for communication infrastructure. In this connection MoUs needs to be signed among different collaborative agencies such as BADC, BMD, UDD, DPHE, DoE, SPARRSO, BMDA, BIWTA, DWASA, DBHWD, DAE, SRDI and BBS. It is to be noted here that, MoUs with some agencies has already been signed such as DBHWD. MoUs with remaining agencies have been signed under this project.

2.10 Update Data Inventory Report

A comprehensive data inventory report comprising data availability in 24 organizations was prepared during the development of NWRD under WARPO with assistance of EGIS-II project. It's a live document and need to keep update in regular basis. The inventory report has been further updated in the previous phase of NWRD based on the open discussion held at the launching meeting of the project and in consultation with the planners at WARPO and other potential users. The report contains the name and number of the database available in different organizations and their needs necessary for the future plan to create, update and redundancy of data sets. This report has been further updated under this project.

2.11 Security and Access Control

Security and access control is a major issue in designing and developing web-based application. The proposed systems supports application based, database level and operating system based authentication for control. Following are the steps of the control measures for possible exposed threats.

2.11.1 Application-level Security

For a web-based application, application-level security is a major concern. This can be implemented, by introducing a firewall between the web server and the network. For intranet, application-level security canl be implemented by assigning a unique ID and password to each user. Using this ID and password, the user can access the application. This security feature for which user can access the web-based systems, has been specified at database-level.

2.11.2 Database-level Security

To implement database-level security and to protect data from unauthorized access and the database cannot be accessible directly from external network (non-government network). Strict security policies have been established for archived data to prevent unauthorised access and data loss. RDBMS has been used with security controls to ensure aggregation (value of disclosed data) and inference (confidentiality). Four user groups can be created and different levels of access rights can be assigned to each group. Each user has been assigned to a particular user group.

The four levels of security access that could be implemented for this project are as follows:

1) **Level 1:** This level canl be assigned to registered users (agencies, researchers and students) of web-based systems. Each of the following system can have its own registered users.
    a. Web Portal for Clearance Certificates: submit application, print certificate.
    b. Web Portal for No Objection Certificates: submit application, print certificate.
    c. On-line Data Dissemination Tool: make data requisition, download data.
2) **Level 2:** This level can be assigned to Administrator. Each of the following system can have its own administrator.
    a. Web Portal for Clearance Certificates: create user, assign rights.
    b. Web Portal for No Objection Certificates: create user, assign rights.

c. On-line Data Dissemination Tool: create user, assign rights, process data requests, and generate customized reports.

3) **Level 3:** This can be assigned to a Group of WARPO officials for web portals of Clearance Certificates and No Objection Certificates. Using this role, he/she can track, review and analyze application, monitor application status, generate customized reports.

4) **Level 4:** It can be assigned to high officials of WARPO to see different customized reports.

The security levels has been finalized after discussing with WARPO officials.

2.11.3 Operating System-level Security

Operating system-level security means the limitation of physical access to a machine and would require an additional login in order to gain access.

The operating system restricts unauthorized users from logging on or opening the computer and database itself, securing database to deleting or adding any data from unauthorized users. Operating system–level security has been implemented by assigning a user ID and password to each user. Each user has been then assigned to a particular user group.

2.12 Software Testing

After developing the software, different levels testing need to be performed to ensure software quality. In this project the following tests will be performed in sequence as shown in Figure 2.23.

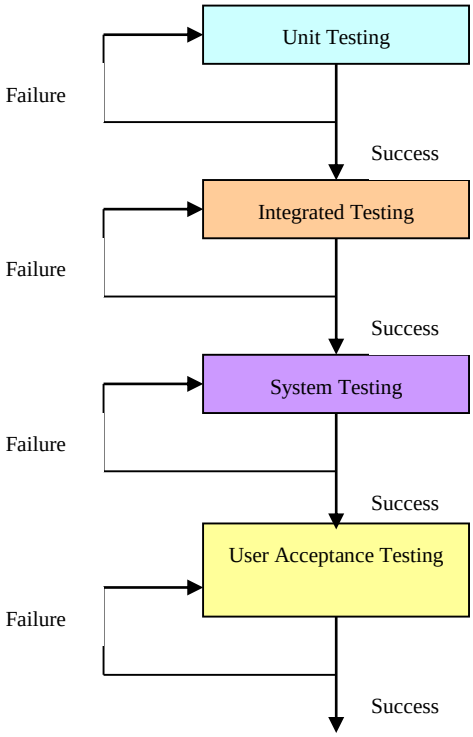


Figure 2.23: Software Testing

2.12.1 Unit Testing

It is a procedure used to validate that a particular module of source code is working properly. The procedure is to write test cases for all functions and methods so that whenever a change causes a regression, it can be quickly identified and fixed. This type of testing is mostly done by the developers. In this project every module of the system will be tested separately by using separate test data sets. Unit test for the Report module is shown in Figure 2.24.

Test Data Set: Spatial and attribute data.

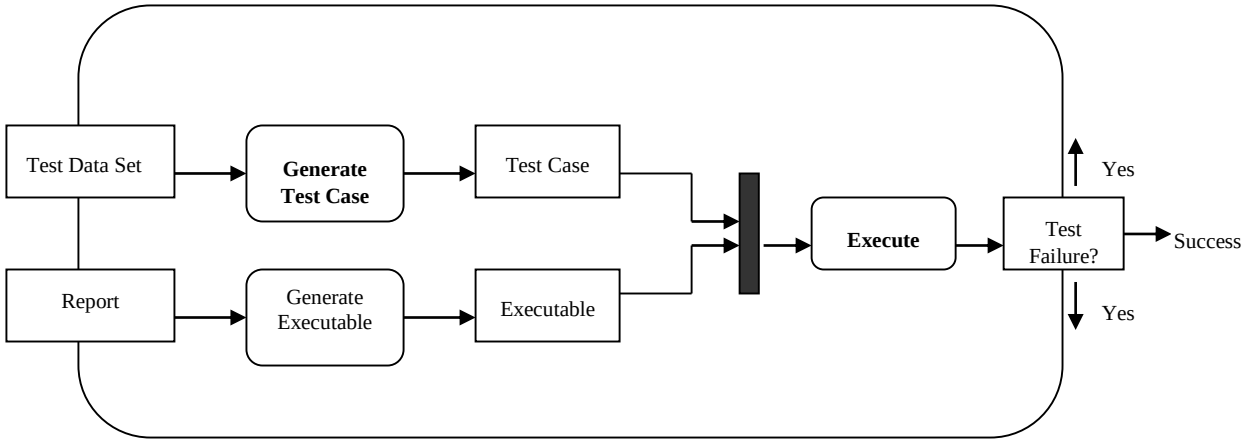


Figure 2.24: Unit Testing of Report Module

Separate test data set will be selected and separate unit test will be performed for each module of the System.

2.12.2 Integrated Testing

It is the phase of software testing in which individual software modules are combined and tested as a group. After performing unit test, all modules will be combined to develop the overall system. The integrated system will be tested to validate those multiple parts of the system interact according to the system design. The same test data sets used in unit test for different modules will be applied to the integrated system. If the system responses according to the system design, the test has been successful. Otherwise, the system will be modified and tested again. The integrated testing of the Data Dissemination Tool (DDT) is shown in Figure 2.25.

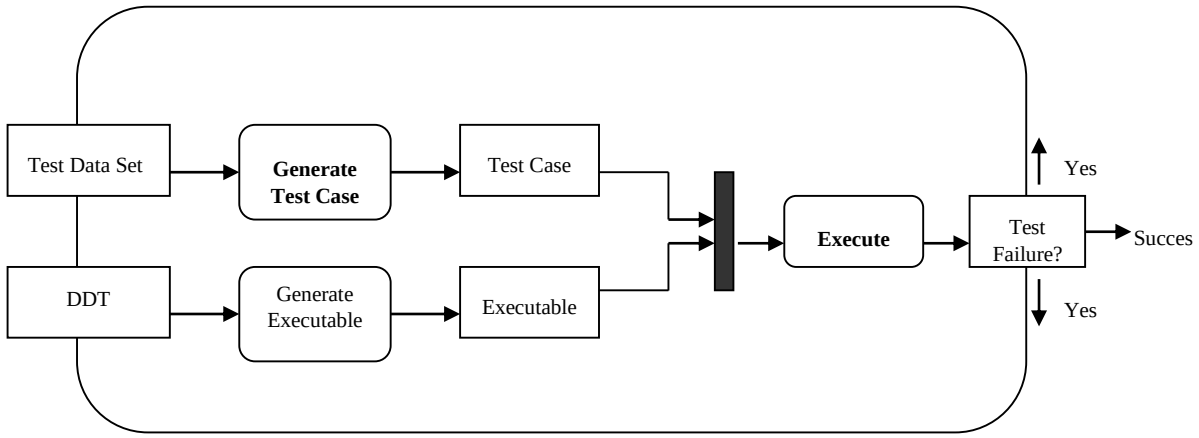


Figure 2.25: Integrated testing of Data Dissemination Tool

2.12.3 System Testing

System testing is conducted on a complete, integrated system to evaluate the system's compliance with its specified requirements. System testing falls within the scope of Black Box testing, and as such, should require no knowledge of the inner design of the code or logic. Before performing this testing, network, data server, web server and web applications will be installed and configured. The same test data sets used in unit test will be applied to the overall system. If any problem is encountered during testing, developers will investigate the problem and try to find out the actual reason of the problem. Problems may arise from network, data server or web server. After identifying the problem, it will be fixed and system test will be performed again. Developers will perform this test. Figure 2.26 shows the system testing of the Application Systems of WARPO.

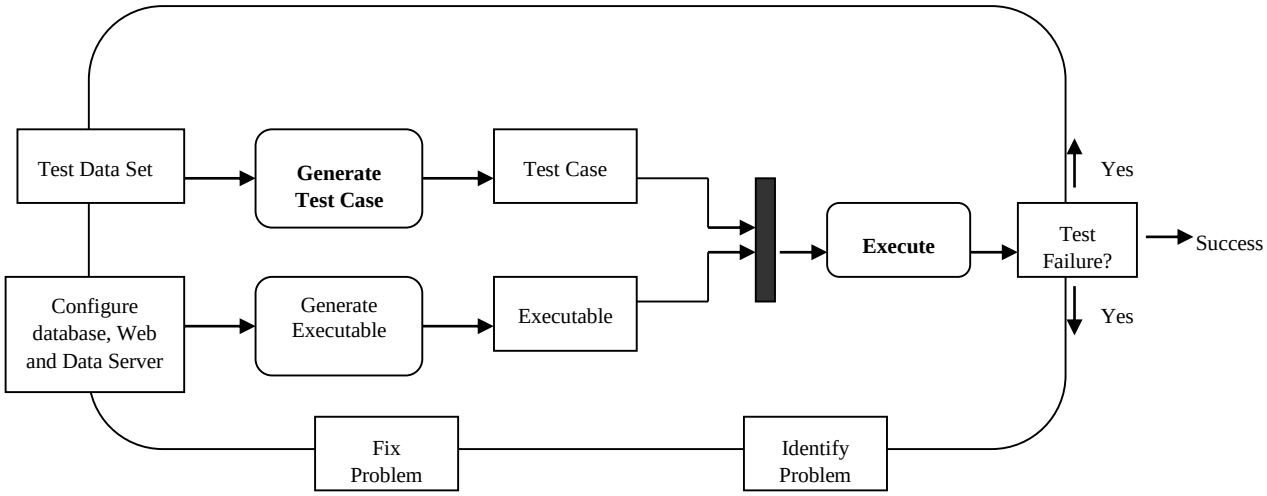


Figure 2.26: System testing of the Web Application

2.12.4 User Acceptance Testing

User Acceptance Testing (UAT) is a process for obtaining confirmation by the owner or client of the system under test, through trial or review, that the modification or addition meets mutually agreed-upon requirements. In software development, UAT is one of the final stages of a project and will often occur before a client or customer accepts a new system. After developing the overall system and performing the system test, the responsible official of WARPO will be invited to test the system.

2.13 Deployment of Database and Application

The database has been installed, created and configured at the server of WARPO. All checked and tested information has been transferred from the test database to the production (central) database. The web applications has been installed and configured into the central web server.

2.14 Backup and Recovery

As data can be lost or database can be corrupted due to hardware failure or software crash, the system will provide facilities to take regular backup of the database. In order to reduce backup space and time a multilevel incremental backup procedure will be used.

An incremental level *x* backup will copy all changed blocks since previous incremental level *y* backup where *x*>=*y*, *y*>=0 and *x*>=0.

An example of multilevel incremental backup strategy is shown in Figure 2.27.

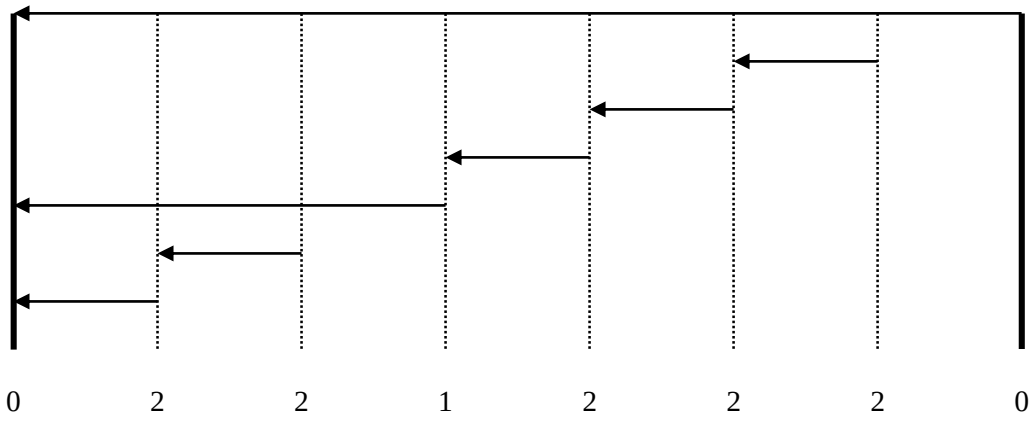


Figure 2.27: Incremental Backup

Chapter 3 : Capacity Building

Transfer of knowledge and technology is an important issue required for smooth operation and management of the project. The objective of technology transfer could be achieved through selecting suitable training programs and involving implementing officials. Both in-class training and on-the-job training has been provided to the officials of WARPO. However, a training needs assessment has been made through discussion with WARPO officials.

3.1 In-Class Training

The training schedule, contents of the training program and number of participants have been finalized after discussing with WARPO officials. It is to be noted here that Consultant provided technical support and assistance to organize the training programs. 24 days of training have been completed out of 25 days.

3.1.1 On the Job Training

A team of client part worked with the project team. On the job training has been provided to the client team during the development of database and application, installing and configuring the database and web server, trouble shooting and fixing different problems, taking backup and tuning of database within the project period.

3.2 Workshop

Consultant has provided to technical support and assistance to WARPO to organize three (03) workshops. The first workshop was a launching workshop, organized after submission of the Inception Report. The workshops was open to the Government Officials, NGO's and professionals working in water resources sector. The main target of the workshop was to share the approach and methodology has been followed in the project.

The second workshop was organized after submission of the Interim Report. The main target of the workshop is to share the progress and activities of the running project. The Final Workshop will be organized after submission of Draft Final Report (DFR). The objective of the workshop would be to disseminate the findings and incorporate valuable suggestions from different experts on water resources planning and management. In between there will be seminars to disseminate the study outcome to have responses and feedbacks.

3.3 Documentations

In addition of Inception report, following four types of documents have been prepared and delivered to the WARPO during the different time periods of the project.

1. Design Report
2. Testing Report and Operational Plan
3. Interim Report
4. User Manual
5. Training Manual
6. Draft Final Report

7. Final Report

3.3.1 Design Report

At the end of the 3 (three) months of the commencement of the services, the CEGIS submitted 20 copies of the Design Report. This report has been included database design, procurement requirements and the installation and testing plan.

3.3.2 Interim Report

At the end of the 5 (five) months of the commencement of the services, the consultant prepared and submitted 20 copies of Interim Report. The report contains progress of the project activities.

3.3.3 Testing Report and Operational Plan

At the end of the 5 (five) months of the commencement of the services, the consultant prepared and submitted 20 copies of Testing Report and Operational Plan.

3.3.4 Draft Final Report

The consultant is preparing and will submit 30 copies of Draft Final Report. WARPO and other relevant organizations will give comments on the draft within 15 days after receiving the draft final report. The report will be finalized incorporating comments from WARPO and other organizations and will be submitted to WARPO within 15 days after receiving comments. The final of the Draft Final Report need to be approved by Director General of WARPO.

3.3.5 User Manual

Detail user manuals for 1) Web Portal for Clearance Certificates, 2) Web Portal for No Objection Certificate and 3) On-line Data Dissemination Tool have been prepared furnishing the following items:

- Purpose and scope of the project
- Definitions, acronyms, and abbreviations
- List of references
- Detail description of user interface
- Navigation details of web-based applications
- List of probable error messages and error handling procedure
- Detailed description of backup and recovery procedure

The report has been submitted in 5 (five) copies at the end of 8 (Eight) months of the commencement of the services.

3.3.6 Training Manual

High quality training manuals have been prepared and supplied to WARPO wherever required. Furthermore, presentation slides and other audio-visual methods implied in the training made available to the users. The report was submitted in 5 (five) copies at the end of 9 (nine) months of the commencement of the services.

3.3.7 Final Report

At the end of the 9 (nine) months of the commencement of the services, the consultant shall prepare and submit 30 copies of Final Report along with all digital copy, and other documents relevant to the project to the Project Director after incorporating necessary observations/comments from different organizations.

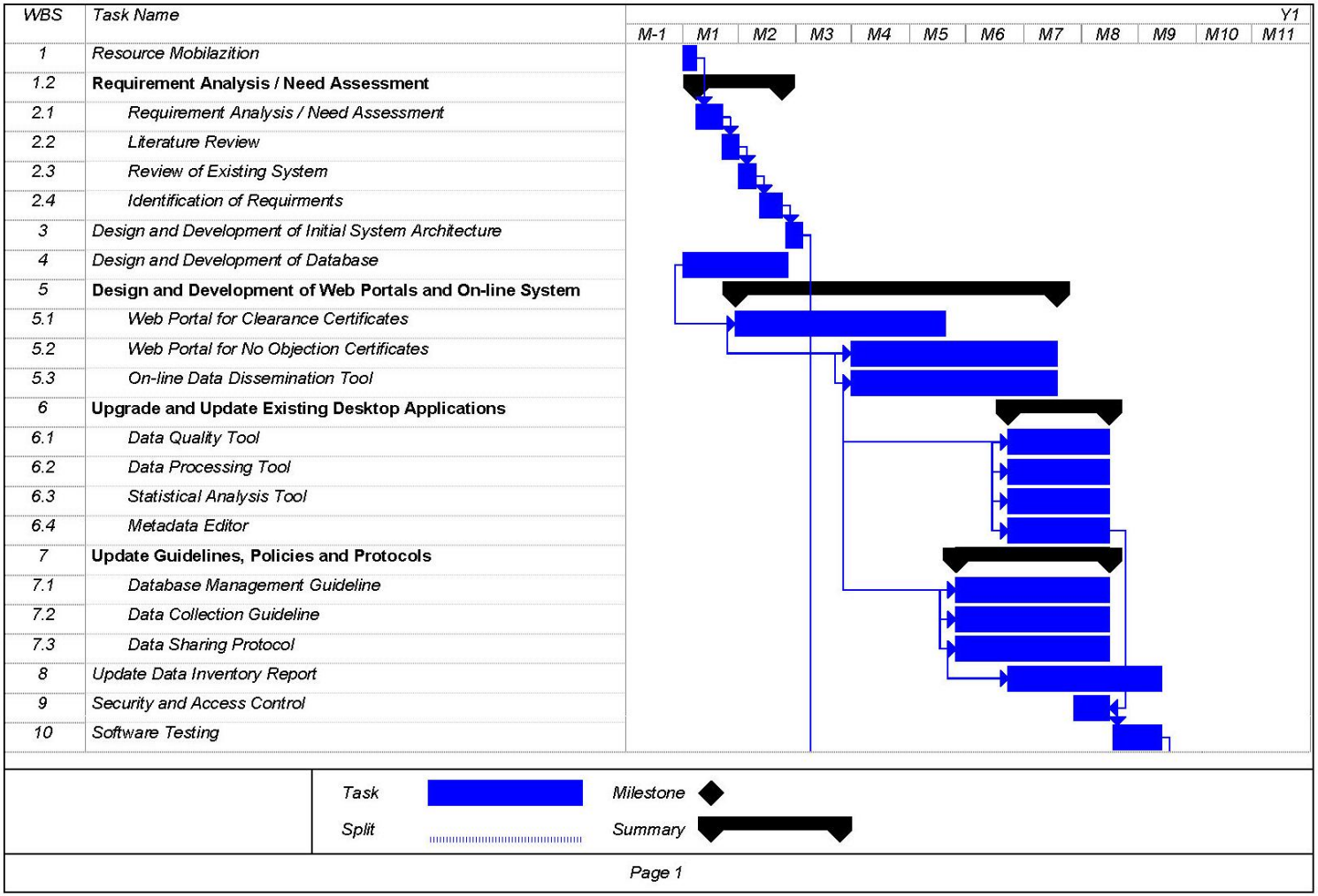
Chapter 4 : Work Plan, Organization and Staffing

4.1 General

The Work Plan set out for this project is proposed to be an innovative and interactive approach for guiding the development of database and web enabled application tools. Timely and efficient implementation of activities through proficient management of key experts and resources to drive sustainable development is the first and foremost intent of this project. In this regard, a well-prepared implementation plan has been developed for this project considering the workload, technical considerations and availability of resources.

4.2 Work Schedule

Tentative work schedule of the project is given Figure 4.1.



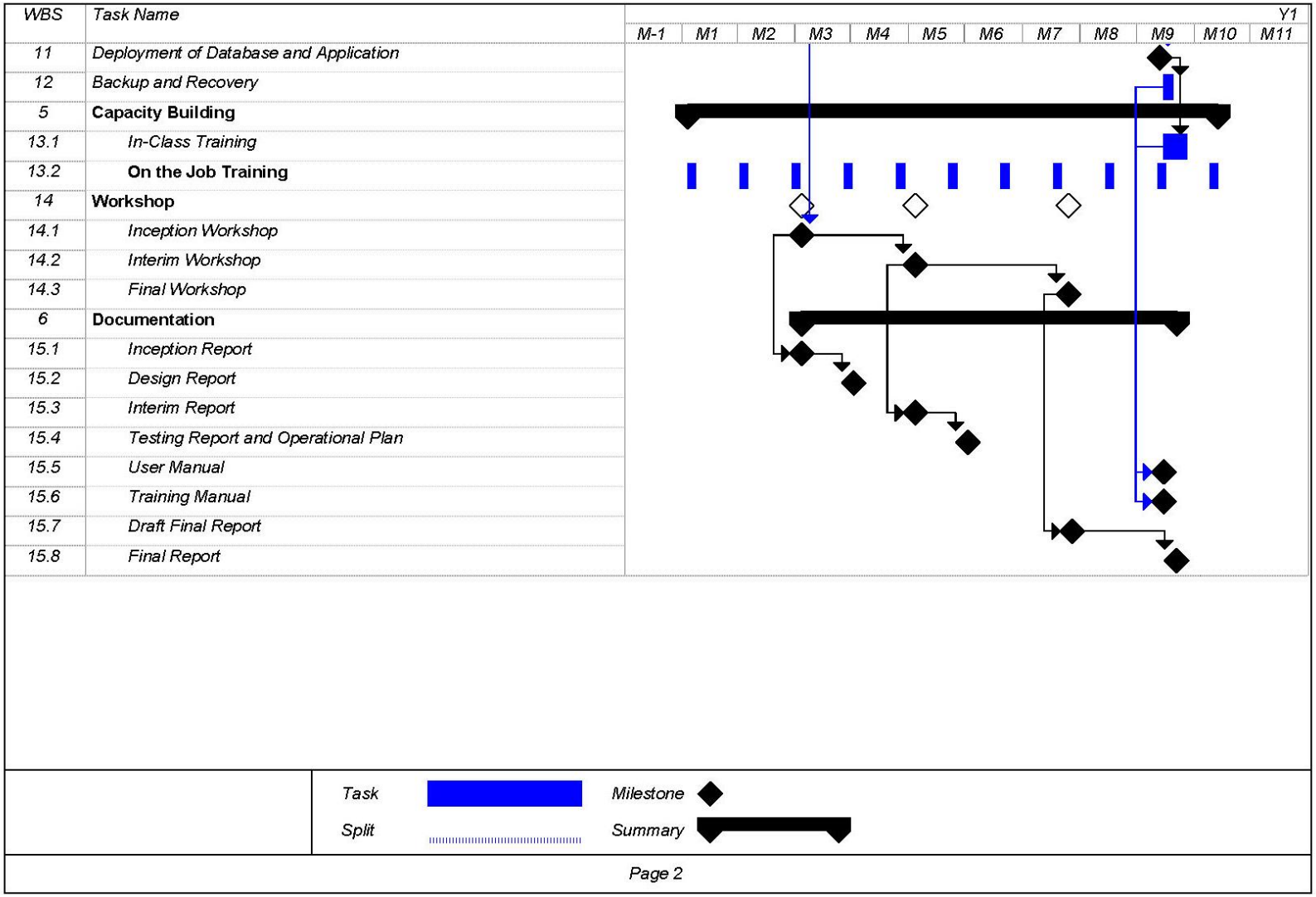


Figure 4.1: Tentative Work Schedule of the Project

Chapter 5 : Conclusion and Recommendations

5.1 Recommendations

The consultant team has some recommendations to make the developed systems sustainable and to ensure the proper utilization of the systems. The following activities and actions are recommended:

- Proper dissemination of the three softwares that have been prepared is badly needed by conducting more workshop, seminar and national level programs;
- Technical sessions on specific subject matters can be conducted on demand basis;
- More and more route level training for NOC and CC should be conducted;
- The refresher training for NOC and CC can also be conducted;
- Regular backup of the software and database should be taken in the backup server and monitor these accordingly.
- Regular update of the software and policy should be taken into consideration;
- Technological enhancement should be considered time to time basis as per the priority given in the national level policies, rules or acts.
- Data pricing in the dissemination tool need to be updated in regular basis;
- To keep functioning the online tools, internal capacity building is required. An in-house support team can be appointed who will try and test every features of all of the systems and coordinate with the other relevant teams;
- For data collection, a digital platform is required beside MoU;
- NWRD has to be made available to NOC and CC users;
- Regular updating of NWRD and ICRD must be ensured;
- Standard practices and security precautions can be followed to ensure Intellectual Property Rights (IPRs) and data breach does not happen.
- .7x24 hours support services can be provided for the applicants, authority and other relevant stakeholders of the software.
- Strategic planning and decisions should be taken to reduce time, cost and human efforts.
- The data center of WARPO should be made capable of handling the load on online systems.

5.2 Conclusion

As the main objective of the project is to commence implementation of priority components of the Bangladesh Water Rules 2018, specifically for water sector project clearance and No objection certificate of groundwater abstraction under force mode, the consultant team has completed the development of the web based CC, NOC and data dissemination systems along

with other relevant software updating tasks. All of the required training programmes mentioned in the ToR have been conducted. More than one workshops have been conducted as well. In this report, some recommendations have also been given to make the the web based systems sustainable. It is expected that, the web based systems will assist the water sector projects in a more holistic and integrated way which will fulfill the requirement of Bangladesh government as well as the stakeholders of the sector in more flexible, efficient and reliable way.