BANGLADESH WATER DEVELOPMENT BOARD
THE PEOPLE'S REPUBLIC OF BANGLADESH

THE PROJECT FOR CAPACITY DEVELOPMENT OF MANAGEMENT FOR SUSTAINABLE WATER RELATED INFRASTRUCTURE IN THE PEOPLE'S REPUBLIC OF BANGLADESH

FINAL REPORT
PROJECT COMPLETION REPORT

SEPTEMBER 2017

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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INGEROSEC Corporation
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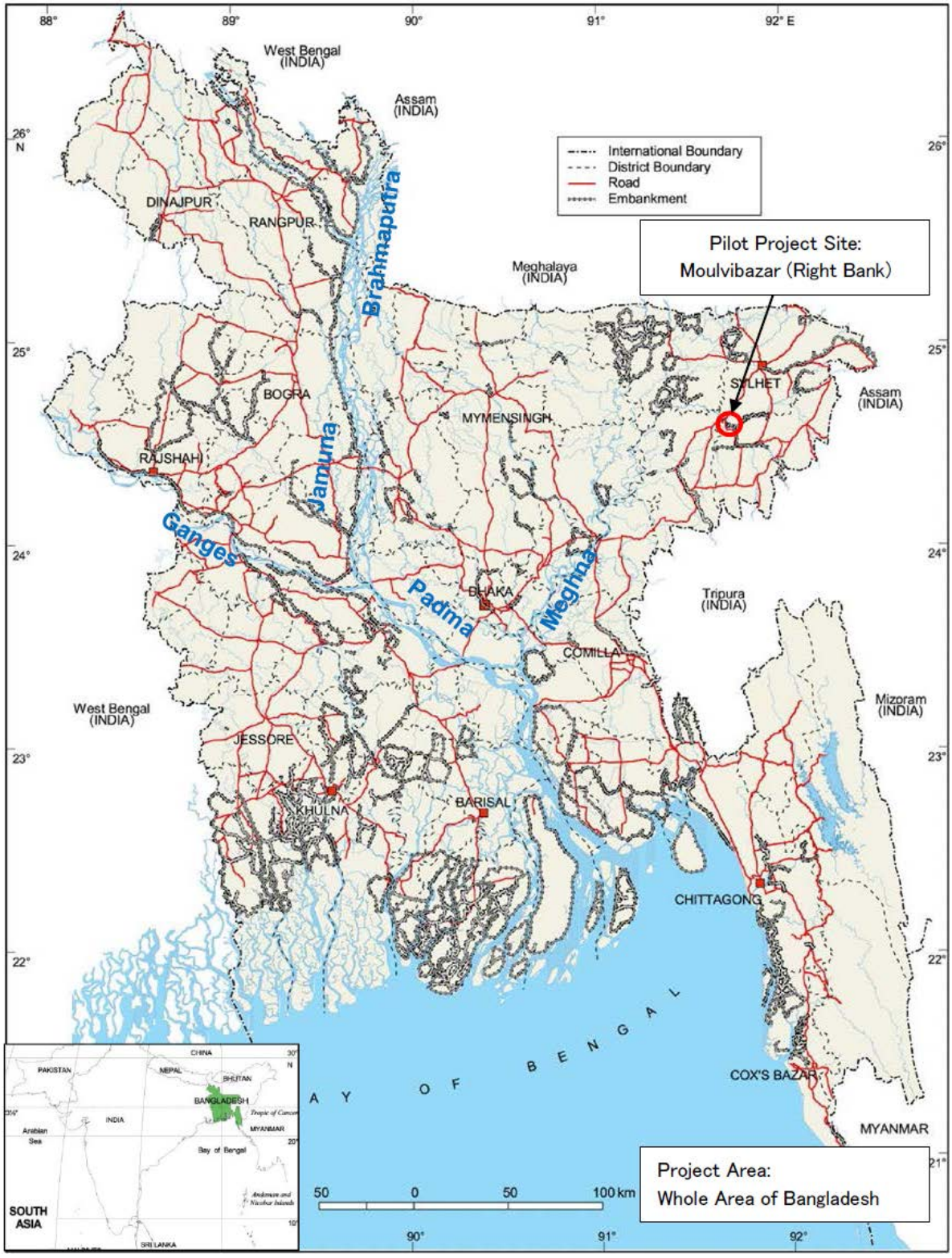

LOCATION MAP OF THE PROJECT

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ABBREVIATIONS

ADB	:	Asian Development Bank
BMD	:	Bangladesh Meteorological Department
BWDB	:	Bangladesh Water Development Board
CEGIS	:	Center for Environmental and Geographic Information Services
CEIP	:	Coastal Embankment Improvement Project
C/P	:	Counterpart
DDM	:	Department of Disaster Management
DOE	:	Department of Environment
ECA	:	Environmental Conservation Act
ECC	:	Environmental Compliance Certificate
ECP	:	Environmentally Critical Project
ECR		Environmental Conservation Rule
EIA	:	Environmental Impact Assessment
EMP	:	Environmental Management Plan
F/S	:	Feasibility Study
FCD	:	Flood Control Drainage
FCDI	:	Flood Control, Drainage and Irrigation
GOB	:	Government of Bangladesh
IEE	:	Initial Environmental Examination
IPCC	:	Intergovernmental Panel on Climate Change
IPSWAM	:	Integrated Planning for Sustainable Water Management
IWM	:	Institute of Water Modeling
JCC	:	Joint Coordination Committee
JICA	:	Japan International Cooperation Agency
LGED	:	Local Government Engineering Department
MOEF	:	Ministry of Environment and Forests
MOWR	:	Ministry of Water Resources
NWMP	:	National Water Management Plan
NWPo	:	National Water Policy
NWRC	:	National Water Resources Council
O&M	:	Operation and Maintenance
PRW	:	Pilot Repair Works
RRI	:	River Research Institute
SAIWRPMP	:	Southwest Area Integrated Water Resources Planning and Management Project
SOB	:	Survey of Bangladesh
TWG	:	Technical Working Group
WARPO	:	Water Resources Planning Organization
WB	:	World Bank
WMIP	:	Water Management Improvement Project
WMO	:	Water Management Organizations

1. OUTLINE OF THE PROJECT

1.1 Background of the Project

Bangladesh is located in one of the largest deltas in the world with three mighty rivers, namely the Ganges, the Brahmaputra and the Meghna. These cause 112 billion m^3 surface water flow in wet season (July to September), 3.7 billion m^3 in dry season (January to March) and 1 to 1.5 billion tons of sediments carried annually. In addition to this geographical condition, hydrological and meteorological issues such as floods, flash floods, tides, intense and continuous rainfall, cyclones, etc. are responsible for the damage of embankment.

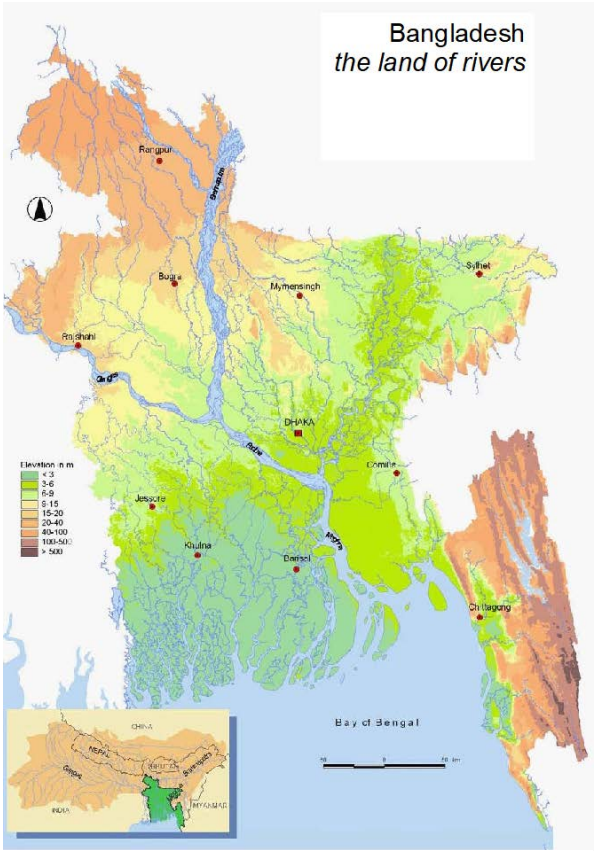


Figure 1.1 Topography of Bangladesh
Source: Water Resources Planning Organization, National Water Management Plan, March 2001

As a result, 22% of the country's area is affected by floods annually and 60% of the country experiences a massive flood in almost every 10 year. About 11,000 km of embankments provide flood protection and support livelihoods and communication development. Embankments are vital to protect the peoples and their assets from flood disasters. Around 15 to 20% of the total embankments are damaged annually which is equivalent to around BDT 2 billion.

The construction of earthen embankment in Bangladesh has been conducted in the less expensive form to protect properties from flood water in rainy season. However, the constructed earthen embankment failed every year in many places. Frequent repair and renovation are required and they need a huge amount of cost annually.

Concerning the above situation, the Government of the People's Republic of Bangladesh (hereinafter referred to as "GOB") requested the Government of Japan (hereinafter referred to as "GOJ") to provide the technical cooperation on the "Capacity Development on Management for Sustainable Water Related Infrastructure" in 2011.

In response to the request, the GOJ approved the implementation of the Project in 2012 and JICA dispatched a detailed planning survey team to clarify the framework of the technical cooperation for the Project. JICA and the authorities concerned of the GOB concluded the Minutes of Meeting (hereinafter referred to as "M/M") in October 2012 and the Record of Discussions (hereinafter referred to as "R/D" in March 2013 on the Project.

1.2 Objectives of the Project

The objectives of the Project are to improve the standards for design, construction of river embankment and operation and maintenance (hereinafter referred to as "O&M) of hydraulic structures through the analysis on present status and issues in the fields of design, construction and

operation and maintenance of water-related infrastructure in Bangladesh, and implementation of a pilot project and model O&M activities in the selected field offices of BWDB, and to enhance the capacity of BWDB officers in the said fields through the Project.

1.3. Project Period

The Project was commenced in August 2013 with three (3) years period. However, the activities were constrained and delayed due to the continuous general strikes called as "hartals" and transport blockades called as "oborot" related to the General Election in January 2014 and the pilot project could not implemented in scheduled period in the dry season of 2014/2015. In this context, JICA and BWDB concluded the M/M dated December 22, 2014 as the amendment of R/D in March 2013, and the project period was extended to four (4) years. After calming down of the continuous general strikes and transport blockades, the project activities were again constrained and delayed due to continuous general strikes and transport blockades during the first anniversary of the general election from December 2014 to May 2015 and the sporadic terror incidents from September 2015. In response to this condition, JICA and BWDB again concluded the M/M in September, 2017 as the amendment of R/D, and the project period was again extended to four (4) years and three (3) months. Therefore, the Project was completed in October 2017.

1.4 Target and Expected Outputs of the Project

General features of the Project are presented below.

Title of the Project:

Title of the Project is "The Project for Capacity Development of Management for Sustainable Water Related Infrastructure in the People's Republic of Bangladesh".

Expected Goals which will be attained after the Project Completion

(1) Goal of the Proposed Plan
To improve the capacities of BWDB on embankment engineering in terms of Design, Construction and Operation & Maintenance methods

(2) Goal which will be attained by utilizing the Proposed Plan
To achieve water-related disaster risk reduction through proper management of the infrastructures

Outputs

(1) Design for sustainable river embankment is introduced
(2) Construction method and procedure of river embankment is improved
(3) Operation and Maintenance (hereinafter referred to as "O&M") system for the river infrastructures is ensured

Project Sites and Beneficiaries

Project sites are Dhaka and sites for the pilot project and the trial run of the recommended O&M activities at Moulvibazar. The direct beneficiaries of the Project will be the officers and staffs of BWDB.

Implementing Agency

Bangladesh Water Development Board (BWDB), assistance by JICA

Relevant Organizations

(1) Ministry of Water Resources (MoWR)
(2) River Research Institute (RRI)

(3) Institute of Water Modeling (IWM)
(4) Center for Environmental and Geographic Information Services (CEGIS)
(5) Department of Disaster Management (DDM)
(6) Bangladesh Meteorological Department (BMD)

1.5 Project Design Matrix (PDM)

The Project Design Matrix (PDM) Version 1.0 was agreed upon in the M/M between BWDB and JICA in October 2012, in order to monitor the project progress periodically. The PDM was supposed to be revised as the occasion demands.

The PDM had been revised with the following background:

(1) The project period was extended to four (4) years for deferring the pilot project implementation to the dry season of 2015/2016 due to the delay of project activities caused by the unrest related to the General Election. JICA and BWDB concluded the M/M dated December 22, 2014 as the amendment of R/D in March 2013.
(2) The Objectively Verifiable Indicators of the Project are planned to be determined through the mutual discussion between JICA and BWDB during the Project period. During this reporting period, the indicators were set through due discussions.

The PDM Version 2.0 are shown in Table 1.1,

Table 1.1 Project Design Matrix (PDM) Version 2.0

Project Title: The Project for Capacity Development of Management for Sustainable Water Related Infrastructure
Implementing Organization: Bangladesh Water Development Board (BWDB)
Period: 2013 - 2017 (4 years)
Date : May 2016
Project Area: Dhaka and sites for Pilot project and model O&M activities

VER: 2.0 (May. 2016)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Overall Goal (Goal which will be attained by utilizing the Proposed Plan) To achieve water-related disaster risk reduction through proper management of the infrastructures	1. Infrastructures damaged by floods are reduced.	1. Record of damaged infrastructures managed with the developed manuals. 2 Record of damaged infrastructures before application of the developed manuals.	No drastic change of hydrological condition. Budget of management of infrastructures in the Implementation Agency is secured.
Project Purpose (Goal of the Proposed Plan) To improve the capacities of BWDB on Embankment Engineering in terms of Design, Construction and Operation & Maintenance methods	1. Manuals are approved by DG to apply to the actual practices of BWDB. 2. Action Plan for dissemination and revision of the manuals is prepared. 3. Seminars/workshops on the manuals lectured by C/Ps are held for the officials of BWDB.	1. Office Order By DG for the Manuals 2. Action Plan for dissemination and revision of the manuals. 3. Number of participants in seminars/workshops	No drastic policy change in the Implementing Agency. Budget of the action plan in the implementing Agency is secured.
Output 1: Design for sustainable river embankment is introduced 2: Construction method and supervision of river embankment is improved 3: Operation and Maintenance system for the river infrastructures is ensured	1. The design manual is developed in BWDB as a revision of embankment design of the Standard Design Manual of BWDB. 2. The construction manual is developed in BWDB. 3-1. The O&M manual is developed in BWDB. 3-2. GIS database of damage and maintenance records is established as a model of GIS database in field.	1. The design manual of river embankment 2. The construction manual of river embankment 3-1. The O&M manual for hydraulic structures 3-2. Model GIS database	Concern about the Project is maintained in the Inplementing Agency. No drastic personnel change in the Implementing Agency.
Activities 1-1 : To review the design condition of river embankment such as design water level, tide level, characteristics of soil materials, etc. 1-2 : To review the existing design methods and criteria 1-3 : To examine various design methods for river embankment and specify availability 1-4 : To draft the design manual for river embankment 1-5 : To conduct the design of the pilot project 2-1 : To review the existing construction methods for river embankment 2-2 : To conduct soil tests of obtainable construction materials to find out the characteristics, and examine the optimum method of water content, compactness and stabilization 2-3 : To draft the construction manual for river embankment including monitoring works 2-4 : To select pilot project site for design and construction 2-5 : To conduct the pilot project at the selected site to evaluate design and construction methods for river embankment 2-6 : To revise the prepared manuals (1-4 and 2-3) based on the lessons of the pilot project (2-5) 3-1 : To review the present Operation and Maintenance (O&M) activities for river infrastructures 3-2 : To draft the O&M manual for river infrastructures 3-3 : To select the O&M division office for the model O&M 3-4 : To conduct the model O&M activities at the selected division office by using the prepared O&M manual (3-2) 3-5 : To revise the prepared manual (3-2) based on the lessons of the model O&M activities (3-4) 3-6 : To prepare the GIS database of damage and maintenance records at the selected division office for the model O&M activities 4-1 : To hold the technical seminar/workshop on design, construction and O&M method for river infrastructures 4-2 : To hold the related training courses in Japan for the BWDB personnel engaged in the Project 4-3 : To prepare the action plan for dissemination and effective use of the Manuals	Input <u>Input by JICA</u> - Dispatch of Experts: Team Leader/River management Design Construction Cost estimate Operation and Maintenance GIS database - Training Related training(s) in Japan <u>Input by BWDB</u> (a) Services of BWDB's counterpart personnel and administrative personnel (b) Suitable office space with necessary equipment; (c) Information as well as support in obtaining medical service; (d) Credentials or identification cards; (e) Available data (including maps and photographs) and information related to the Project; (f) Running expenses necessary for the implementation of the Project; and (g) Necessary facilities to members of the JICA missions for the remittance as well as utilization of the funds introduced into the People's Republic of Bangladesh from Japan in connection with the implementation of the Project		No drastic change of the policies on management of water related infrastrucures and implementing organization.

1.6 Project Activity Flow

The project activities consist of the following four components:

- Activities for improvement of design for sustainable river embankment,
- Activities for improvement of construction method for sustainable river embankment,
- Activities for improvement of operation and maintenance for sustainable river structures,
- Common Activities (local seminars/workshops, training in Japan, preparation of action plan for dissemination and effective use of the prepared manuals, and reporting),

The project activity flow is shown in Figure 1.2 below.

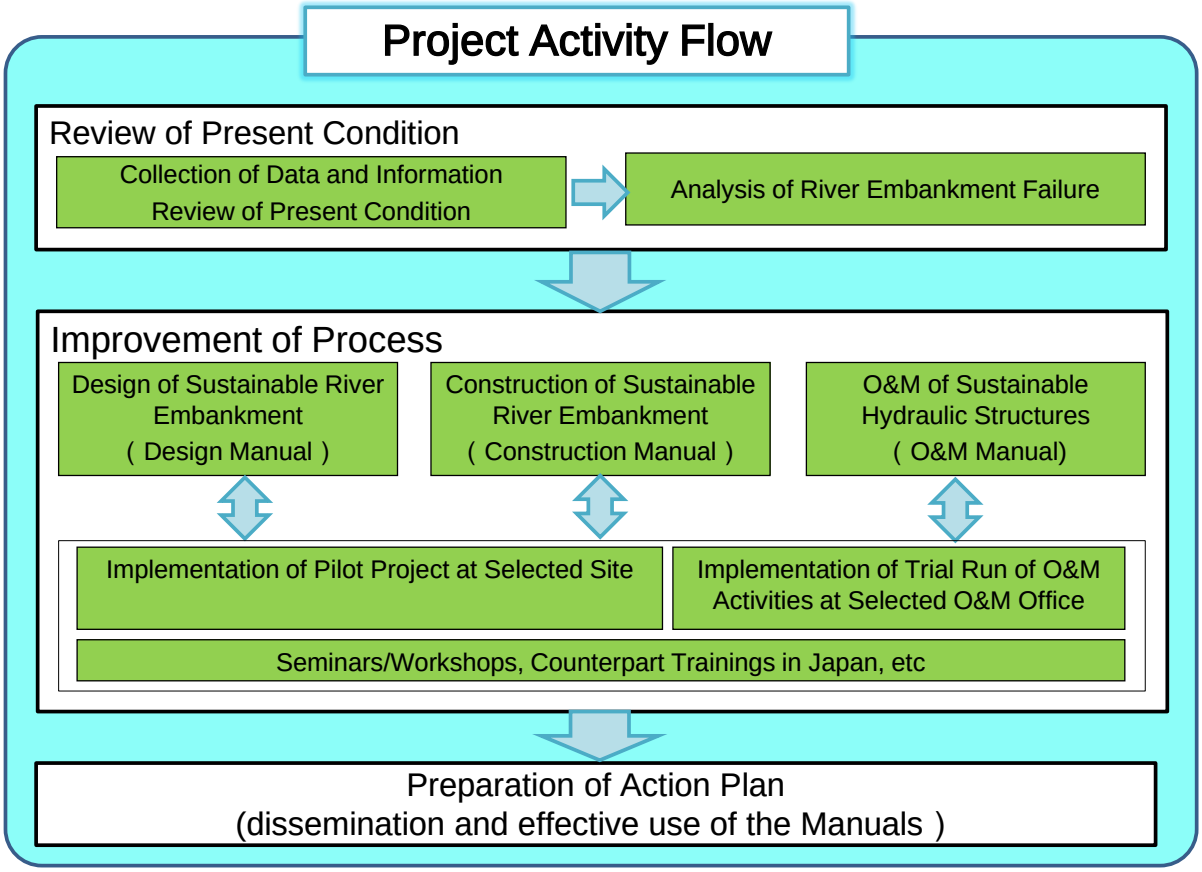
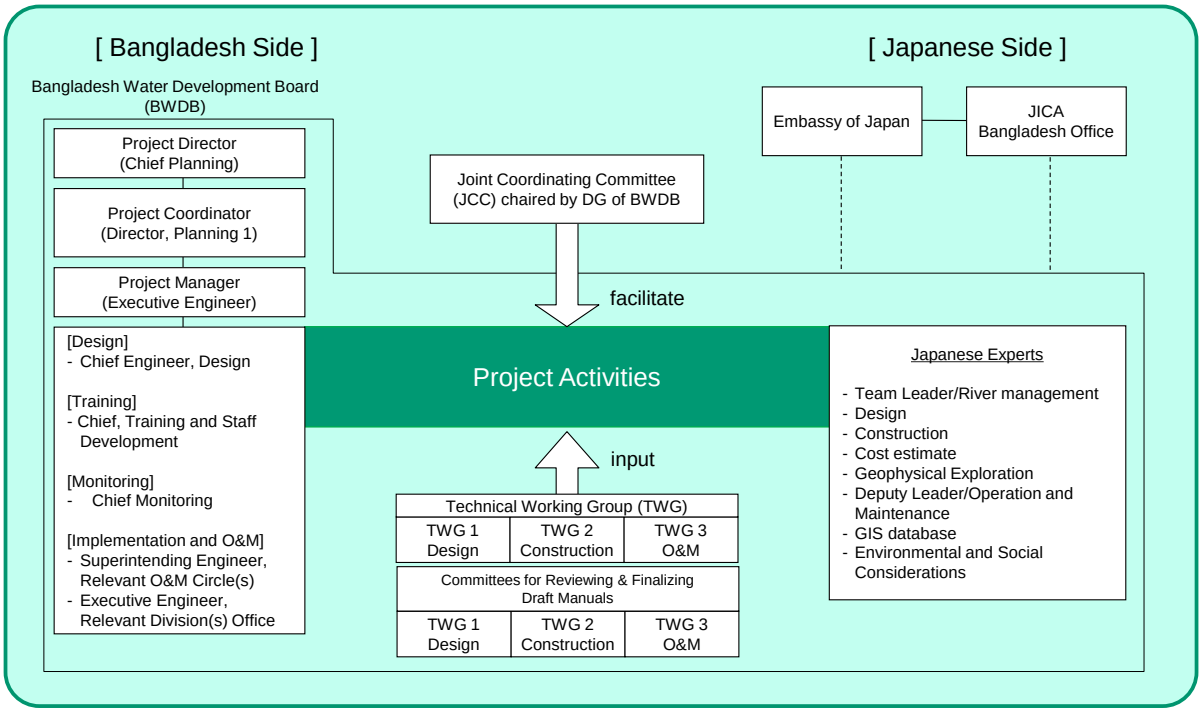


Figure 1.2 Project Activity Flow

1.7 Project Implementation Structure

The project implementation structure is shown in Figure 1.3 below. BWDB is an implementing agency of the Project.



Source: Figure in R/D of the Project dated March 25, 2013, is arranged by the JICA Expert Team.

Figure 1.3 Project Implementation Structure

Actual inputs by Bangladesh side and Japanese side are summarized in Appendix-5 of this report.

In order to facilitate inter-organizational coordination on implementation of the Project, the .Joint Coordination Committee (hereinafter referred to as "JCC") was established. The list of members of JCC is shown in Table 1.2.

Table 1.2 Lists of Proposed Members of Joint Coordination Committee

Proposed Member		Remarks
1. Bangladesh side (BWDB)		
(1)	Director General of BWDB	Chairperson
(2)	Additional Director General (Planning)	Co-Chairperson
(3)	Chief, Planning (Project Director)	
(4)	Chief, Monitoring (C/P)	
(5)	Chief Engineer, Design (C/P)	
(6)	Chief Engineer, Hydrology	
(7)	Chief Training & Staff Development (C/P)	
(8)	Chief Engineer, Relevant O&M Zone	
(9)	Chief, Water Management	
(10)	Director, Planning 1 (Project Coordinator)	Secretariat of JCC
(11)	Project Manager	
2. Bangladesh side (Organizations concerned)		
(12)	Representative of Ministry of Water Resources (MOWR)	
(13)	Representative of River Research Institute (RRI)	

Proposed Member		Remarks
(14)	Representative of Institute of Water Modeling (IWM)	
(15)	Representative of Center for Environmental and Geographic Information Services (CEGIS)	
(16)	Representative of Department of Disaster Management (DDM)	
(17)	Representative of Bangladesh Meteorological Department (BMD)	
3. Japanese side		
(18)	JICA Experts	
(19)	Representative of JICA Bangladesh Office	
4. Others		
(20)	Other personnel appointed by the Chairperson	

Source: ANNEX-2, R/D dated 25th Mar, 2013.

During the project period, the meetings of the JCC were held four (4) times. Outlines of the JCC Meeting are shown in Table 1.3 and the minutes of meetings of JCC are shown in Appendix-8 of this report, respectively.

Table 1.3 Outlines of JCC Meetings

No.	Date	Venue/ Agenda/ Number of Participants
1	O2 September, 2013	Venue: Conference Room of Director General, BWDB Agenda: Explanation/discussion on Inception Report (draft); Discussion on procedure of the Project. Participants: 27 (BWDB, agencies concerned: 19, JICA Head Office, JICA Bangladesh Office and JICA Expert Team: 8)
2	13 July, 2014	Venue: Conference Room, Head Office, BWDB Agenda: Explanation/discussion on Progress Report; Especially, discussion on delay of the Project due to political unrest and how to accelerate the Project activities. Participants: 29 (BWDB, agencies concerned: 21, JICA Bangladesh Office and JICA Expert Team: 8)
3	27 July, 2015	Conference Room, Head Office, BWDB Agenda: Explanation/discussion on Progress Report 2 (draft); Review result of present condition, design of the pilot project, basic concept of preparation of manuals, etc. Participants: 33 (BWDB, agencies concerned: 28, JICA Bangladesh Office and JICA Expert Team: 5)
4	17 July 2017	Conference Room, Head Office, BWDB Agenda: Explanation/discussion on Draft Final Report; Design manual for river embankment, Construction manual for river embankment, O&M manual for hydraulic structures, action plan for dissemination and effective use of manuals, extension of project period, etc. Participants: 33 (BWDB, agencies concerned: 28, JICA Bangladesh Office and JICA Expert Team: 5)

1.8 Plan and Actual Operation

Overall schedule of the project implementation was planned originally at the initial stage of the Project. The Project was scheduled to be implemented for around three (3) years, commenced in August 2013 and scheduled to complete in August 2016. However, the work schedule had been revised several times through the discussions with the concerned agencies and findings in the field, and due to the followings:

After the commencement of the project activities in the field, the frequent general strikes and

transport blockades had been carried out by political parties especially in the period from October 2013 to January 2014 for the general election of January 2014. Under these conditions, the project activities had been restricted and delayed. So that, the pilot repair works (hereinafter referred to as "PRW" of the pilot project were postponed from the dry season of 2014/2015 to that of 2015/2016, and the project period was extended to four (4) years.

After calming the continuous general strikes and transport blockades for the general election of January, the continuous general strikes and transport blockades for the first anniversary of the general election had been carried out from December 2014 to May 2015. The project activities had been restricted and delayed again.

In addition, the terrorism events had happened intermittently from September 2015. Therefore, the experts' activities had been restricted with the safety measures, such as, restriction of international travel for the Japanese experts from July 2016, restriction of national trip, enhancement of security measures for the project activities, etc. The international and internal travel bans of the Japanese experts were loosened from December 2016. However, the international and internal travels of the Japanese experts had been limited and adjusted by JICA depending on the security risks. The project activities were restricted and delayed again.

On the other hand, the construction works of the PRW, which were commenced for the November 2015, were affected by the unusual weather condition, such as a big flood of February and continuously higher water level of the Manu River from the end of March, 2016. As the result, the river side works of the PRW were suspended till the dry season of 2016/2017. The PRW was finally finished in May 2017.

Original plan of operation and actual result of the project activities are shown in Appendix-2 of this report, and major changes in the schedule are summarized as follows:

- Delay of implementation of field reconnaissance due to the frequent general strikes and transport blockades in the period from October 2013 to January 2014.
- Delay of deciding typical sites for conducting soil investigation and topographic survey due to delay of above activities.
- Delay of implementation of soil investigation and topographic survey due to the above and difficulties of the soil tests in Bangladesh.
- Delay of analysis of river embankment failure due to delay of the above activities
- Delay of preparation of draft manuals due to delay of the above activities
- Due to the findings that the characteristics of local conditions for river embankment construction are quite different depending on the locations in Bangladesh, the scope of manuals needed to be revised and accordingly the time schedule of preparation of manuals needed to be changed.
- Delay of selection of pilot project site due to the lack of typical site of river embankment failure that satisfies the conditions as a pilot project site. The conditions as a pilot project site were;
  1) where river embankment failure is due to inadequate design, construction and O&M,
  2) where the pilot project could be implemented without any serious social and environmental issues,
  3) the pilot project site should be at a location where the visit to the site could be done within one day from Dhaka.
- Delay of selection of the O&M Division Office for model O&M activities due to the delay of field reconnaissance and analysis of river embankment failures.
- Delay of commencement of the design of the PRW, in addition delay of the design activities due to delay of selection of the pilot project site, and delay of soil mechanic investigation and topographic survey of the selected site.
- Postponement of the construction works of the PRW from the dry season of 2014/2015 to that in

2015/2016, due to delay of preparation of the design.

- Suspension of the river side works of PRW due to continuous higher water level of the Manu River at the PRW site, that is, arrival of one (1) month early rainy season.
- Supplement of the temporary prevention works for the river side works of PRW against flood during 2016/2017 rainy season due to the above suspension.
- Extension of construction period of the PRW to the dry season in 2016/2017 due to above suspension.
- Delay of the model O&M activities in the selected division office including preparation of the GIS database of damage and maintenance records at the office, due to delay of selection of the office, the continuous general strikes and transport blockades during a period from December 2014 to May 2015, and strengthening of security measures against the intermittent terrorism events from September 2015.
- The training courses in Japan were initially planned to be conducted thrice in 2013, 2014 and 2015. However, the training courses were changed to be conducted twice in 2014 and 2015 due to difficulties of selection of participants in early stage of the Project.

1.9 Plan and Actual Assignment of JICA Experts

In order to conduct the project activities, the Japanese experts corroborated with the counterpart members of BWDB in Bangladesh and also in Japan. During the project period, the assignment schedule of the Japanese experts was revised several times in accordance with the revision of the plan of operation. Planed and actual assignment of the Japanese experts are summarized as shown in Appendix-2 of this report.

2. SUMMARY OF MANUALS AND ACTION PLAN

JICA Expert Team prepared "Design Manual of River Embankment", "Construction Manual of River Embankment", "O&M Manual for Hydraulic Structures", and "Action Plan for Dissemination and Effective Use of Manuals" through the project activities. These manuals and the action plan are summarized below.

2.1 Summary of Design Manual of River Embankment

The Design Manual of River Embankment was prepared as shown in the following procedure. The purpose of the manual is that BWD staff can design sustainable and low-cost river embankment by themselves.

Dec/2013 -	The JICA Expert Team studied and discussed with the Design Circles (DCs) regarding preparation of the manual.
Feb/2015	The JICA Expert Team submitted the manual (draft-1) to DCs and discussed with it.
May/2015	The JICA Expert Team submitted the manual (draft-2) to DCs and discussed with each design section respectively.
Dec/2015	Working committee for reviewing and finalizing draft manual was established.
Feb/2016	The JICA Expert Team revised the manual reflecting the comments for draft-2 from BWDB.
Apr/2016	The Director General of BWDB gave approval of the manual.
Sep/2017	The JICA Expert Team added the lesson-learned from the pilot project into the manual

Based on the result of discussion with C/P as below, the configuration of table of content was prepared:

1) Because design manual of slope protection works and foot protection works are described in the Guideline for River Bank Protection prepared by BWDB in 2010, design of those pertaining to erosion countermeasures should be based on that. Therefore those are excluded in this manual.
2) A series of items pertaining to embankment design are described in Chapter 7 and in a part of Chapter 10 in the Standard Design Manual. All items pertaining to design of river embankment are classified to the following categories in this manual for easily understanding referring to Japan's manual.
    a. Basics of Embankment Design
    b. Design specification
    c. Verification of Embankment Safety
3) Verification of embankment safety with respect to seepage, erosion and earthquake are described in the category of Verification of Embankment Safety in Japan's manual. On the other hand, verification of embankment safety with respect to seepage is only described in the Standard Design Manual. Verification of embankment safety with respect to not only seepage, but also erosion, earthquake and bearing capacity of foundation ground are described.
4) Whether verification of embankment safety with respect to earthquake should be described in the manual was discussed with BWDB on the following reasons. Earthquake doesn't occurs much in comparison with in Japan, costly measure against erosion must be conducted prior to measure against earthquake, water level of the Big Rivers at the time of the flood is kept to be high for a long time.

5) Verification of embankment safety with respect to bearing capacity of foundation ground is not described in Japan's manual, but described in this manual because there are many palaces with soft ground in Bangladesh.

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2.2 Summary of Construction Manual of River Embankment

The Construction Manual of River Embankment was prepared as shown in the following procedure. The purpose of the manual is to improve capability of construction of river embankment.

Dec/2013 -	The JICA Expert Team studied the construction manual.
Jul/2015	The JICA Expert Team submitted the manual in JCC.
Dec/2015	Working committee for reviewing and finalizing draft manual was established.
Jun/2016 -	The JICA Expert Team revised the manual reflecting the comments from BWDB.
Oct/2016	The JICA Expert Team submitted manual to BWDB.
May/2017	The JICA Expert Team revised the manual adding dealing work extension, field density test, trial production of mortal gunny bags, safety event, temporary protection works, etc.
Jul/2017	The JICA Expert Team submitted the manual in JCC.
Sep/2017	The JICA Expert Team added land acquisition, confirmation of right of way, latest survey equipment from the lesson-learned from the pilot project into the manual

As a document stipulating the construction works of the embankment of BWDB, there are two (2) documents, namely Technical Specification for Civil Work (TS of BWDB) and Standard Schedule of Rates Manual (SSoRM). For practical aspect, TS of BWDB is a part of the contract documents of the civil works of BWDB and SSoRM is utilized for cost estimation including drafting bill of quantities for tendering and contracting of the civil works. SSoRM is published at appropriate interval as per each district by BWDB.

On the TS of BWDB and SSoRM, necessary work items and specifications are described including requirements of qualities of the works for river embankment/revetment works. But the details of the frequencies and procedures for quality control methods and tests are not drafted in the both Standards. Draft of Construction Manual is applied as a supplemental document for TS of BWDB and SSoRM. The manual is intended to mainly script the method of construction plan including prior necessary investigations for planning, detailed procedure/method of quality control, and safety measurements including the prevention for third parties damages. Those are not described in the both Standards.

The manual would be used among the personnel who are engaged with river embankment construction, not only staff of BWDB but also the contractors' engineers engaged in the execution of the works as their engineers. In order for the target users to understand it, the draft manual had been prepared in collaboration with BWDB staffs in respect of technical terms and the content of the manual.

The contents of Draft of Construction Manual are as follows;

2.3 Summary of O&M Manual for Hydraulic Structures

The Construction Manual of River Embankment was prepared as shown in the following procedure. The purpose of the manual is to improve capability of construction of river embankment.

Nov/2013 -	The JICA Expert Team studied the O&M manual.
Nov/2015	The JICA Expert Team submitted and explained the manual to BWDB.
Dec/2015	Working committee for reviewing and finalizing draft manual was established.
Jun/2016	The JICA Expert Team revised the manual reflecting the comments regarding updated information about structures from BWDB.
May/2017	The JICA Expert Team revised the manual adding structures' functions, damage mechanism and GIS database and submitted to BWDB
Jul/2017	Director General of BWDB approved the manual.

Basic concepts for preparation of the O&M Manual are as follows:

- The O&M Manual is a technical document in accordance with the frameworks and procedures stipulated in the BWDB O&M Guidelines.
- The O&M Manuals a technical and administrative reference for the O&M of the hydraulic structures managed by BWDB, except the structures managed by the Water Management Organizations (WMOs) and other organizations.
- The O&M Manual is prepared for the officials of BWDB as main users, especially sub-divisional engineers and sectional officers, who are the main acting forces of the O&M activities of BWDB in the field level offices. The O&M activities in the field level are shared with WMOs. Therefore, mandate of the field level official of BWDB includes the coordination and technical and administrative assistance of WMOs and other organizations. The administrative assistance of the WMOs and other organizations shall be conducted in accordance with the "Guidelines for Participatory Water Management" prepared by MoWR.
- The structures of the O&M Manual cover the whole structures related to the rivers, such as river channels, embankment, slope protection works, foot protection works, sluices/regulators, barrages, pump stations, etc.
- The O&M Manual includes all the areas with specific characteristics in topographical, geological and hydrological features.
- The O&M Manual shall be revised based on the information from the BWDB officials and the lessons learned from the model O&M activities in the field and experience from the pilot project works.

Based on the above concepts, the O&M Manual were prepared in accordance with the table of contents mentioned below.

Table 2.1 Composition of O&M Manual

Chapter	Contents
1) Introduction	Scope and application of the draft manual and definition of water related infrastructures.
2) Concept of O/M	Scope, present situation, four pillars concepts of O&M.
3) Basic Scheme Data	Preparation of basic scheme data of O&M
4) Operational Manual:	Planning and actual work of operation
5) Maintenance Manual:	Planning and actual work of maintenance
6) Budget of O&M:	Budget planning of O&M works

7) Implementation and Monitoring of O&M:	Implementation and monitoring of O&M including the organizations.
8) Flood Fighting:	Flood fighting during floods as important part of operation works.
Annexes	Reference material: 1) Terms of reference on inventory survey of managed structures (sample), 2) proposed GIS database as a tool of O&M activities, and 3) technical guidance of flood countermeasures.

2.4 Summary of Action Plan for Dissemination and Effective Use of Manuals

The Action Plan was prepared through the discussions in BWDB and outline of the Action Plan was shown below:

Table 2.2 Outline of Action Plan

Item	Design Manual	Construction Manual	O&M Manual
Planning Period	10 years	10 years	10 years
Person in Charge	Chief Engineer, Design, in association with Chief Planning, Chief Engineer, Hydrology, Chief Training and Staff Development, and Zonal Chief Engineers.	Chief Monitoring in association with Chief Planning, Chief Engineer, Design, Chief Engineer, Hydrology, Chief Training and Staff Development, and Zonal Chief Engineers.	Chief Engineer, Design, in association with Chief Monitoring, Chief Engineer, O&M, Chief Engineer, Hydrology, Chief Training and Staff Development, and Zonal Chief Engineers.
Target Officials	・Main: Technical staff in Design Directorate ・Sub: All tech staffs excluding staff of Design Directorate	・Main: Technical staff in field ・Sub: Technical staff in the head office including Design Directorate	・Main: Technical staff in field ・Sub: Technical staff in the head office including Design Directorate
Dissemination	・Dissemination through the circulars of BWDB, training courses, on-line, etc. ・Stepwise trial run starts with reasonable scale and it'll be applied for all projects in the future.		
Application of Manuals	・Trial runs on application of manuals in all of the design works of BWDB, except the works with the development partners. ・During the trial run period, respective trial run results should be reviewed by respective officials. ・Duration of trial run period shall be 3 years at least. ・Duration of trial run period shall be determined based on feedback from previous trial runs. ・Surveys of representative cased of the new embankment failures should be conducted annually and the manual should be verified through those surveys.	・Stepwise trial run on application of manuals in the representative projects, without special fund and exclusive staffs ・During the trial run period, each O&M offices shall have at least a trial run. ・During the trial run period, respective trial run results should be reviewed by respective officials. ・During the trial run period, trial run results should be reviewed by respective design engineers. ・In case of a project/O&M Circle/year, trial run period become 3 years. ・Duration of trial run period shall be determined based on feedback from previous trial runs.	・Stepwise trial run in a certain area, without special fund and exclusive staffs. Trial run will be as follows: (1) inventory surveys of managed structures in a certain area, (2) preparation of GIS database if the resources allows, (3) long-term and medium-term O&M planning, (4) trial run of O&M, and return to (1). Cycle up to whole jurisdictional area of each office. ・In case of 20 % of the jurisdictional area yearly, duration of trial run period will be 5 years. ・Trial run should be expand to all of the jurisdictional area. ・During the trial run period, respective trial run results should be reviewed by respective officials.
Effective use of Manual	・During the trial run period, pros and cons of trial runs should be compiled and shared among relevant staff of BWDB as the supplemental explanation and information of the manuals, through the BWDB circular, regular training courses, and on-line.		
Update of Action Plan	・As appropriate based on the yearly review results of trial runs.		
Update of Manual	・Manual update based on the supplemental explanation and information, finding through the surveys of embankment failures (every 5 years or 10 years, depend on the accumulation of information and findings.)	・Manual and technical specification update based on the accumulated explanation and information and new construction methods (once 10 years)	・Manual update based on the accumulated explanation and information (once 10 years)

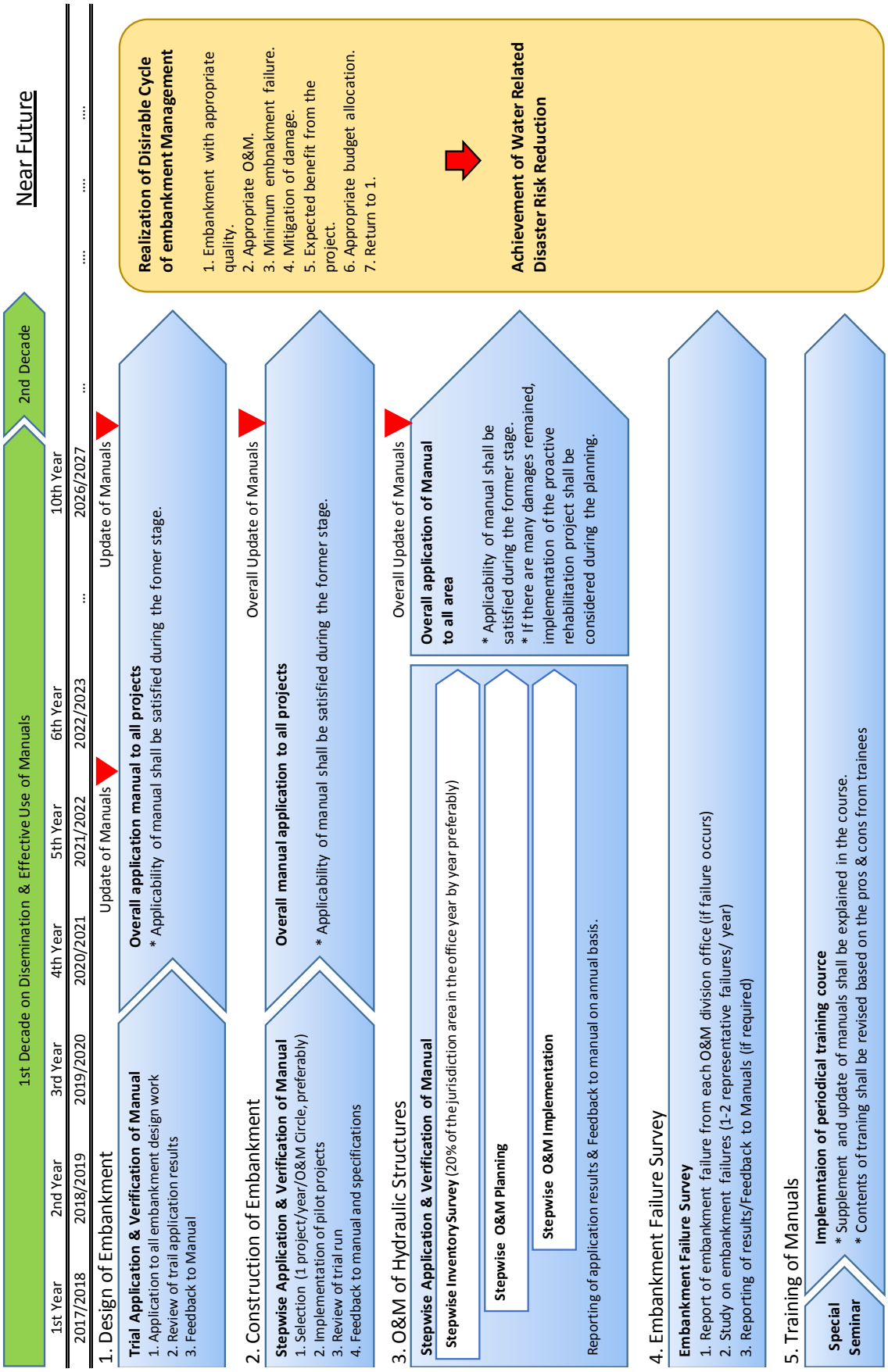


Figure 2.1 Road Map for Realization of Dissemination and Effective Use of Manuals

Table 2.3 Implementation Schedule of Action Plan

Engineering Aspect/Activities	Fiscal Year								Desirable Future
	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023	:::	2026/2027	
	1st	2nd	3rd	4th	5th	6th	:::	10th	
1. Embankment Design									
(1) Trial application and verification of manual: 3 fiscal years									No damage due to design. Appropriate budget of the works. New research can be conducted.
1) Application to all embankment design works									
2) Review of trial application									
3) Feedback to manual (supplementary explanation and information)									
(2) Overall application of manual to all projects									
(3) Overall revision of manual									
2. Embankment Construction									
(1) Step-wise application and verification of manual (3 fiscal years)									No damage due to construction. Appropriate budget of construction.
1) Selection of Pilot Project (1 pilot project/year/O&M circle preferably)									
2) Implementation of pilot projects									
3) Review of trial run									
4) Feedback to manual/specifications (supplemental explanation and information of manual/ specifications)									
(2) Overall application of manual to all projects									
(3) Overall revision of manual									
3. O&M of Hydraulic Structures									
(1) Step-wise application and verification of manual (6 years)									No damage due to O&M. Decrease of emergency works. Demand-base budget of O&M, including those of offices, tools and equipment.
1) Selection of pilot area (20% of the area of each O&M div. office, preferably)									
2) Inventory survey and compilation of inventory sheets									
3) Step-wise planning (5 years)									
4) Step-wise implementation (5 years)									
5) Review of trial run (annual basis)									
6) Feedback to manual (supplementary explanation and information)									
(2) Overall application of manual to O&M									
(3) Overall revision of manual									
4. Embankment Failure Survey (Every fiscal year)									
(1) Embankment failure/damage report (O&M division office: if occur)									
(2) Study on cause of embankment failure (1-2 failures/year)									
(3) Feedback to manual (supplementary explanation and information)									
5. Training of Manuals									
(1) Special seminar/workshop (by the Project)	▲								
(2) Trainings in BWDB's regular training courses									No information gap among the head office and field offices.

3. PROJECT ACTIVITIES

3.1 Transfer of Knowledge

The project activity flow is shown in Figure 3.1 below.

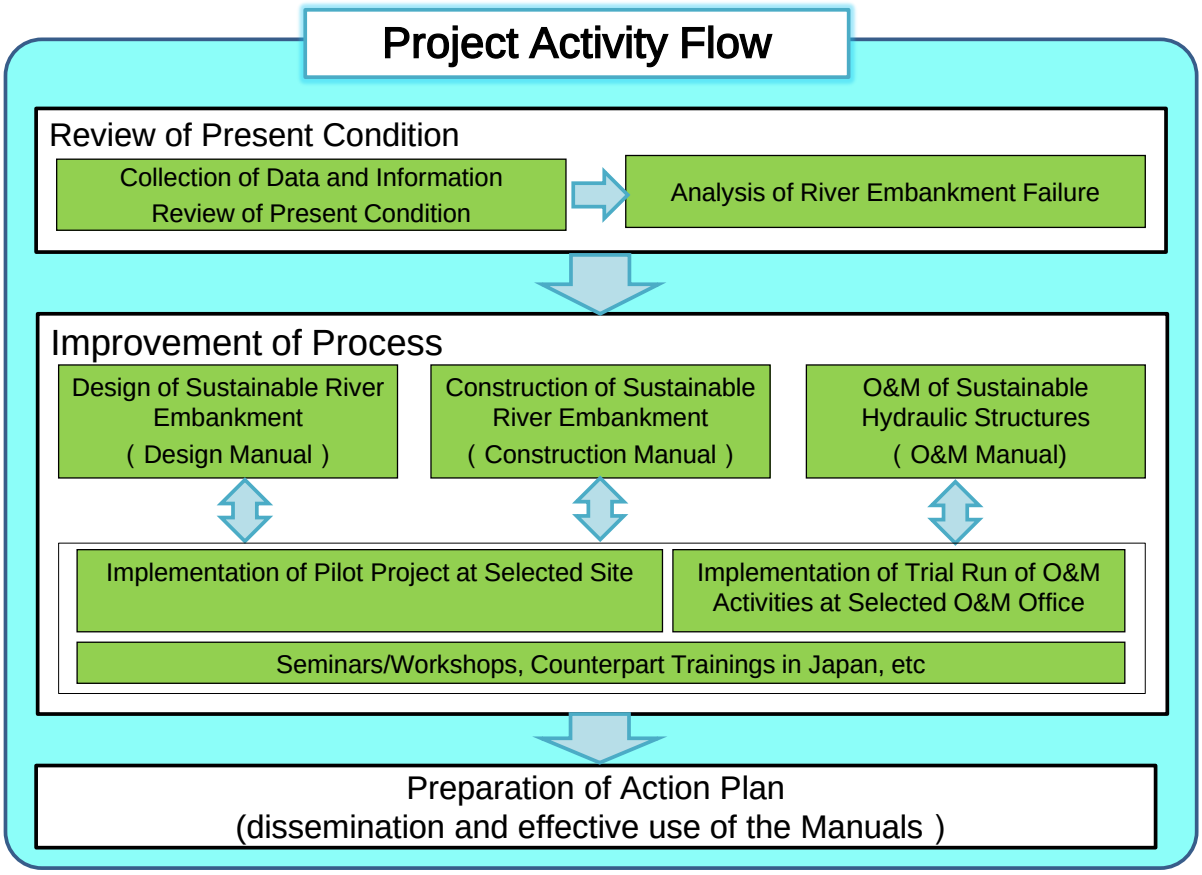


Figure 3.1 Project Activity Flow

3.2 Present State Analysis

1) Review of the Present Condition of River Embankment and River Structures
Review of the present condition was conducted through collection of the data and information from the head office and field offices of BWDB, and the field inspections of the embankment failure sites and the construction fields of embankments.

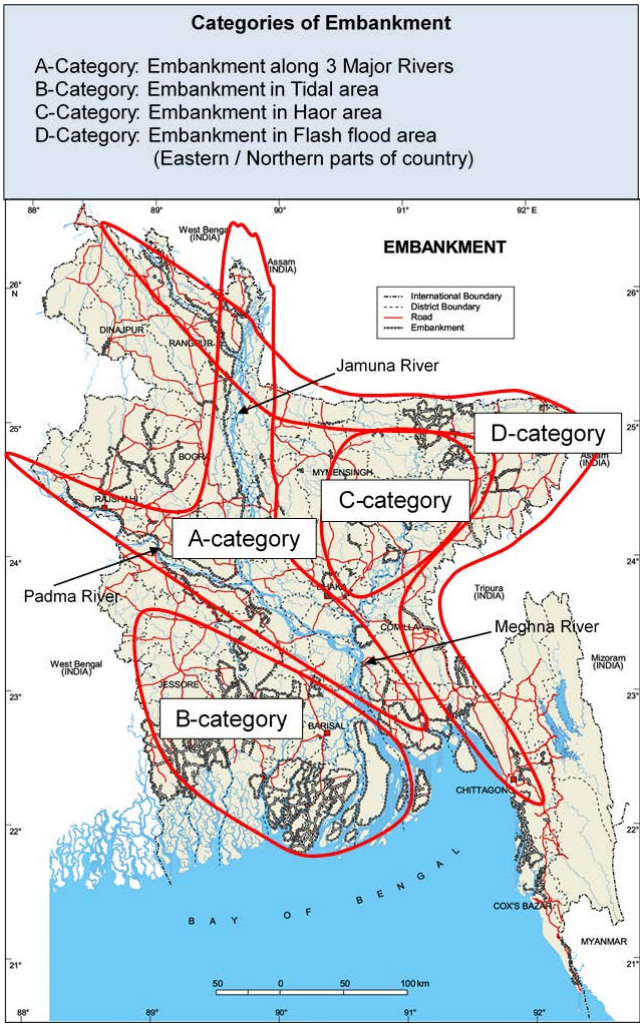
- According to the results of field inspection, most of the embankment failures are caused by bank erosion, not by seepage of embankment. The grain size distributions of embankment materials are uniform, such as sand, silt and clay. Therefore, it is difficult to compact the soil materials thoroughly to meet with the design quality.
- In the case of construction of embankment along the major rivers, construction machineries are used. However, repair works of existing damaged embankment and the embankment works along the internal rivers are almost carried out by manpower without using the construction machineries. In addition, there are many cases without protection works of the toe and slope of embankment against erosion.

- The river structures along the major rivers are well operated and maintained and in good condition. In addition, materials of the repair works have been reserved along the embankment. However, along the internal rivers, there are many infrastructures left damaged without repair.

Photograph-1: Embankment failure (Sirajganj)

Photograph-2: Reconstruction of Embankment (Netrokona)

2) Study on Causes and Mechanism of Embankment Failure
Based on the results of the field inspections and flood situation in Bangladesh, the embankments in Bangladesh are classified into the following 4 typical categories:



Locations of the Categories of Embankment

A-Category: Embankment along Major Rivers

Floods of the major rivers have quite long duration and large scale bank erosions occur. Due to huge amount of required materials, especially in the case of retired embankment, the embankments are mostly constructed by sand dredged from the river-bed in the vicinity. Therefore, the embankments have possibility of piping during floods. The embankments are generally covered with clayey soil against permeability in such cases.

B-Category: Embankment in Tidal Area

The embankment failures are not only caused by overflowing and erosion due to rainfall, storm surge and wind wave of cyclone, but also by erosion due to recurrent river flows caused by tidal fluctuation of the Bay of Bengal.

C-Category: Embankment in Haor Area

Rivers flowing from India in the northeast area with high rainfall and large upstream catchment forms a low-lying basin in Bangladesh so called "Haor". The embankment in the area is totally submerged in flood season. Material of the embankment consists of cohesive clayey silt and accordingly the embankment is strong to a certain degree against overflow. However, many embankment failures have taken place due to not only overflow but also the public cut.

D-Category: Embankment in Flash Flood Area (East and North-eastern Areas)

Upper basins of the rivers in the east and north-east area are occupied with the steep mountains in India (that exceeds the altitude of 1,000 m in cases). After flowing into Bangladesh, the rivers begin to meander greatly since altitude becomes low and the slopes of rivers are gentle. Therefore, rapid rising of river water level occurs during the flood and these areas are facing risks of embankment breach by frequent overflow. In addition, local scours at most river bends occur along the outer-banks.

Photograph-3: Damaged Embankment (Moulvibazar: D-category)

In order to verify causes and mechanism of existing embankment failures, a preliminary study on the stability of representative cases in the above embankment categories, consisting of the topographic surveys, the geotechnical investigations, and the seepage and circular slip analysis, was conducted and the following results have been obtained:

- Most of the representative embankments secure the stability against circular sliding during the flood with the appropriate setback.
- Some of the representative embankments have the possibility of piping at the toes of the embankments in the case with less clay condition.
- Embankment stability against circular sliding is degraded depending on expansion of bank erosion, because of low bearing capacity of the foundation ground.

3.3 Preparation of the Manuals

1) Design Manual on River Embankment
Design criteria on embankment are prescribed in "Standard Design Manual (SDM)" formulated by BWDB in 1996. The SDM has not been revised after its formulation. Necessity of revision of the SDM has been recognized among the officials of BWDB. The Design Manual is a revision of embankment design of the SDM. Based on the detailed review of the SDM through the study on present conditions of embankment and comparison between the SDM and the Japanese technical standards, the Design Manual was prepared under the following concepts;

- Prescribed shape method and verification of safety are applied to the method of design of embankment in the Design Manual, the same as the SDM and the Japanese technical standards.
- The Design Manual shall consist of 1) Basics of Embankment Design, 2) Structural Specifications and 3) Verification of Safety of Embankment. In addition, the substantial ideas on the embankment design shall be included in the Design Manual in order to facilitate not only design but also construction, operation and maintenance of embankment.
- Items of the Basics of Embankment Design in the Design Manual shall be selected from those in the SDM and the Japanese Standards in consideration of the present conditions of embankment.

- Structural specifications of slope protection work, leakage protection work and foot protection work, which are appurtenant facilities of embankment, are described in the Design Manual, except those prescribed in "Guideline for River Bank Protection" prepared by BWDB in 2010. Specifications prescribed in the Guideline are applied in the design of the appurtenant facilities.
- The SDM prescribes the verification of embankment safety only to seepage. In addition to the verification of embankment safety to seepage, the Design Manual prescribes the verification of embankment safety to erosion, earthquake and bearing capacity of foundation ground. Furthermore, the verification of embankment safety in the Draft Manual shall be the kind that uses the soil constants possible to be obtained by basic soil tests, not by advanced soil tests, in consideration of the existing conditions of test equipment in Bangladesh.

2) Construction Manual on River Embankment

"Technical Specification for Civil Works of BWDB (TS of BWDB)" and "Standard Schedule of Rates Manual (SSoRM)" is generally used as standard specifications for the river embankment projects implemented by BWDB. TS of BWDB and SSoRM cover all necessary descriptions of work items and criteria/specifications of the work items in the river training and embankment works. However, those do not cover all the technical aspects on embankment works from planning to completion. Accordingly the Construction Manual has been prepared under the following concepts;

- The Construction Manual shall be a systematic technical reference for embankment works on all stages of construction works including management aspects.
- The Construction Manual shall include the preparation methods of construction plan including the plans for preliminary survey and investigation, quality control, and safety control not only for those people who are engaged in the works but also for those people of the third parties. Those are not described in TS of BWDB and also in SSoRM.
- The Construction Manual shall be prepared so that it can be easily understood by the BWDB officials who are presently engaged in the embankment works in the field.

3) O&M Manual for Hydraulic Structures

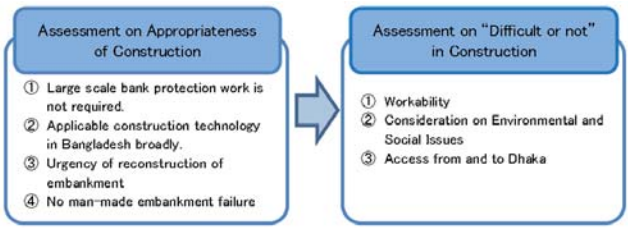
There are several O&M manuals prepared for the past several projects in BWDB. In addition, the "Guidelines for Operation and Maintenance of Permanent Structures of BWDB" (BWDB O&M Guidelines) was prepared by BWDB and approved by Ministry of Water Resources in 2010. According to the officials of BWDB in the field, however, those manuals/guidelines are basically not disseminated and therefore are not applied in the field. After detailed review of the previous manuals and guidelines, the O&M manual for the river structures was prepared through the discussions with C/Ps. The following concepts were applied to prepare the O&M Manual;

- The O&M Manual is a technical and administrative document within the framework of integrated O&M in BWDB, which includes four (4) pillars, i.e. "Basic Scheme Data", "Budget Procedure", Planning Procedure" and "Monitoring and Supervision".
- The O&M Manual is prepared so that it can be easily understood by the BWDB officials who are the main acting forces of the O&M activities in the field.
- The objective structures of the O&M Manual covers the whole structures related to the rivers, such as river channels, embankment, slope protection works, foot protection works, sluices/regulators, barrages, pump stations, etc.

3.4 Implementation of Pilot Project for Embankment

In order to verify the draft manuals prepared, a pilot project of construction of embankment is being conducted. The pilot project site was selected from 14 investigation sites of the embankment failures. Selection was conducted through the following screening, under the precondition of the

avoidance of duplication with other donors (WB, ADB and others).



Selection of Pilot Project Site

As a result, the embankment failure site at the right bank of the Manu River in Moulvibazar District was selected as the pilot project site.

After the topographic survey and soil investigation of the selected pilot project site, the detailed design of the pilot repair works (the PRW) of embankment was conducted with the following improvement features:

Feature 1:
CC block with projection as the slope covering works in order to decelerate flow along the protection work and to limit generation of secondary flow along the protection work.

Feature 2:
Embankment in situ with the bank protection work in order to avoid the setback with a large scale land acquisition and house relocation.

Feature 3:
Foundation at the toe of bank slope to support the slope covering work.

Feature 4:
Embankment of mortal gunny bags and geotextile sheet under the low water level to avoid soil compaction in water and leakage of soil materials.

The PRW was conducted with an implementation scheme of JICA Bangladesh Office as a Procurement Entity and an Employer, a joint venture consortium of local construction companies as a Contractor, and a Construction Supervision Team organized by the members of Moulvibazar O&M Division Office and the JICA Expert Team.

Selection of the Contractor was commenced from September 2015 through the electronic government procuring system and the Contract Agreement of the PRW was concluded between JICA Bangladesh Office and the selected Contractor on 16 November 2015.

Photograph-4: Pilot Repair Works (as of 23/Jan/2016)

The works of PRW commenced from 25 November 2015 to aim for completion within the 2015/2016 dry season. However, the works of PRW were affected by the unusual weather condition in February and March 2016. As a result, the river side works of PRW were forced to be suspended till next dry season. The PRW was resumed from December 2016 and completed in May 2017.

The construction supervision was conducted in accordance with the draft construction manual. In order to share the information with others, the daily reports of PRW were delivered to the related personnel, and the documents, reference materials, findings in the PRW were introduced to the officials of BWDB in the workshops at the site in January and April 2016, March, April and May 2017.

Photograph-5: Field Density Test (as of 02/Apr/2016)

Environmental and social management during the PRW was monitored in accordance with the Environmental Management and Monitoring Plan prepared during design stage. Through monitoring, it was confirmed that environmental and social management was carried out appropriately.

3.5 Trial Run of O&M Activities

In accordance with the prepared Draft O&M Manual, the O&M activities including GIS database of damage and maintenance records are being conducted as a trial run at a selected O&M division office. The O&M division office for the model O&M activities was selected from the recommended offices

by BWDB in consideration of managed facilities of the jurisdictional area of office, access from and to Dhaka, condition of GIS database and the pilot project for embankment. As a result, Moulvibazar O&M division office was selected as the office for the model O&M activities.

Prior to the model O&M activities, review of the present condition of O&M in the Moulvibazar office was conducted. As a result, it revealed that there were few basic data and information of the managed structures shared in the office. It is difficult to prepare the long-term and short-term O&M plans in order to manage the structures in the office efficiently. Therefore, inventory survey of the structures managed by the office and patrol/inspection of managed structures and repair work sites were conducted as the first step of the O&M activities.

The GIS database of the office was developed to manage the hydraulic structure information in an efficient manner as a trial activity in the office, having the compatibility with the previous database for the selected projects by Water Management Improvement Project (WMIP). Technical transfer to the officials in the office for the GIS database were conducted through the seminar and on-the-job training.

Based on the above results, the maintenance plan will be reviewed/ prepared for the further O&M activities by the office.

Photograph-6: Seminar in Moulvibazar O&M Office

3.6 Revision of Manuals

In order to review and finalize the prepared draft manuals, the working committees for reviewing and finalizing respective draft manuals were constituted on December 2015.

The draft manual for design of embankment was revised after in-depth reviewing based on the comments from the working committee, and the revised manual was submitted to BWDB in April 2016. After scrutiny and approval of the revised manual by the Working Committee, DG of BWDB has approved the revised manual as the Design Manual in June 2016. The manual was formally applied to the design works of embankment.

The draft manuals for construction of embankment was revised based on information and lessons learned through the construction works of the Pilot Project. The revised manual was submitted to the Working Committee in July 2017.

The draft O&M manual of hydraulic structures was revised based on the information and lessons learned through the trial run of the O&M activities in the selected O&M division office and the revised manual was submitted to the Working Committee in May 2017. After the approval by the Working Committee, the revised manual was approved by DG of BWDB as the O&M Manual in July 2017.

3.7 Preparation of Action Plan

In order to attain and sustain the expected goals after the project completion, it is indispensable for BWDB to disseminate the manuals, to use the manuals effectively, and to update the manuals timely. Therefore, the action plan for dissemination and effective use of the manuals will be prepared through the discussions with CPs.

In addition to preparation of the action plan, the activities such as translation of the prepared manuals to Bengali, workshops on the prepared manuals, etc. will be also conducted in order to facilitate implementation of the action plan.

4. TECHNOLOGY TRANSFER

4.1 Seminar / Workshop

The workshops during the project period are summarized as shown in Table 4.1.

Table 4.1 Workshops during the Project Period

No.	Date	Venue/Contents/Participants/Purpose
1	26/Oct/2015	Venue: Ground & Conference room, Design Circle Campus, BWDB Contents: Explanation and demonstration on geophysical exploration of embankment (2D-resistivity exploration and surface wave exploration) Participants: 35 (Design Circle & Planning: 31, JICA Expert Team: 4) Purpose: Targeting the Design Circle Staff, who are mainly in charge of the design with the following purposes: - To build an awareness of importance of survey of the present embankment, - To introduce benefits of the geophysical exploration at a stage prior to the boring test. Summary of the geophysical exploration are shown in Appendix-3 of this report.
2	16/Nov/2015	Venue: Conference Room, Head Office, BWDB Contents: Assessment of current status of embankment, outlines and basic consideration of draft manuals (embankment design, construction of embankment, O&M of hydraulic structures), outline of pilot project design and ESIA, report of 2nd training in Japan Participants: 63 (MOWR/BWDB: 55, JICA and Team: 8) Purpose: - To share the result of review of present condition of river embankment and study on causes and mechanism of embankment failures, - To explain the outlines and basic considerations of the draft manuals and to discuss the draft manuals. - To introduce the next project activities and to request participation to the project activities.
3	23/Jan/2016	Venue: Pilot repair works site & conference room of Hotel Rest Inn, Moulvibazar Contents: Inspection of the pilot repair works, safety management, quality management (trial fabrication of mortal gunny bags, construction of foot protection work) Participants: 35 (BWDB including the field offices: 27, JICA and team: 8) + 5 (PR company) Purpose: Targeting the officials in charge of planning, design and construction supervision with the following purposes: - To introduce the safety and quality management of the pilot repair works (trial fabrication of mortal gunny bags, construction of foot protection work). - To Introduce above (especially safety management) in Japan, - To discuss about above among the participants

No.	Date	Venue/Contents/Participants/Purpose
4	02/Apr/2016	Venue: Pilot repair works site & conference room of Hotel Kairan, Moulvibazar Contents: Inspection of the pilot repair works, quality management (selection of embankment material, trial fabrication of armor block, trail compaction, field density test) Participants: 31 (BWDB including the field offices and contractor: 23, JICA and team: 8) Purpose: Targeting the officials in charge of planning, design and construction supervision with the following purposes: - To introduce the quality management of the pilot repair works (selection of embankment material, trial fabrication of armor block, trail compaction, field density test) - To Introduce above in Japan, - To discuss about above among the participants
5	12/Mar/2017	Venue: Pilot repair works site & conference room of Hotel Rest Inn, Moulvibazar Contents: Intermediate inspection for lower part of the embankment works Participants: 23 (BWDB including the field offices and contractor: 18, JICA and team: 5) Purpose: Targeting the officials in charge of planning, design and construction supervision with the following purposes: - To introduce the joint intermediate inspection as a part of the final inspection, - To reconfirm importance of the quality and progress management, and - To discuss about above among the participants.
6	27/Apr/2017	Venue: Pilot repair works site Contents: Joint inspection before completion of the pilot repair works. Participants: 13 (BWDB including the field offices and contractor: 8, JICA and team: 5) Purpose: Targeting the officials in charge of planning, design and construction supervision with the following purposes: - To introduce importance of the joint inspection before the completion of the works, - To reconfirm importance of the quality and progress management, and. - To discuss about above among the participants.
7	20/May/2017	Venue: Pilot repair works site & & conference room of Hotel Rest Inn, Moulvibazar Contents: Joint final inspection of the pilot repair works, and explanation of the final draft of the construction manual. Participants: 20 (BWDB including the field offices and contractor: 14, JICA and team: 6) Purpose: Targeting the officials in charge of planning, design and construction supervision with the following purposes: - To introduce importance of the joint final inspection, - To reconfirm importance of the quality and progress management, - To determine the completion date of the works, - To explain the revised manual based on the experience and information through implementation of the pilot works, and - To discuss about above matters among the participants, including how to disseminate and use the manual effectively.
8	13/Jul/2017	Venue: Conference Room, Head Office, BWDB Contents: Explanation of the manuals of design, construction and O&M, and the Action Plan for dissemination and effective use of manuals. Participants: 70 (BWDB including the field offices:53, JICA and team: 7) Purpose: Targeting the officials in charge of planning, design and construction supervision with the following purposes: - To explain the manuals of design, construction and O&M, - To explain the Action Plan for dissemination and effective use of the manuals, - To prepare the explanation material of the manuals for the future training courses in BWDB, and - To discuss about above matters.

4.2 On-the-job Training

Discussions between BWDB officers and the JICA Expert Team had been conducted through the activities in the field including the PRW and the managed structures in the offices of BWDB on technical issues on design, construction and O&M. Major topics of the OJT related to the activities are summarized as follows:

(1) OJT related to Design of River Embankment

Although the additional study, discussion and recommendation related to the damaged embankment could hardly be conducted due to the adverse influence of strengthening of security against intermittent terrorism events, the Design Circles (DCs) of BWDB and the JICA Expert Team conducted preparing, reviewing and finalizing of the design manual and revision of the design of PRW, collaboratively.

(2) OJT related to Construction of River Embankment

The OJT related to construction of river embankment had been conducted through the implementation of the PRW from the announcement of tender to construction supervision.
The JICA Expert Team had collaborated with Directorate of Contract and Procurement Cell, BWDB during the procurement of PRW, and the Moulvibazar O&M Division Office during construction supervision.
The construction supervision had been conducted in accordance with the draft construction manual. The JICA Expert Team had prepared and explained the documents and reference materials to the related counterpart personnel. In addition, the daily reports of the PRW had been delivered to the related personnel for the information sharing. The documents and reference materials prepared in the PRW had been presented in the workshops in the field to the participants and had been incorporated in the revised Construction Manual.

(3) OJT related to O&M of Hydraulic Structures

Although the field activities were limited because of the adverse influence of strengthening of security against the intermittent terrorism events, the trial run of the model O&M activities and use of the GIS database in the selected office, Moulvibazar O&M division office, had been conducted.
During the model O&M activities, the draft O&M manual had been delivered and explained to the related officials in the office. In addition, the patrols/inspections of the structures had been conducted based on the inventory survey result, in order to discuss the present condition and necessity and priority of repair of the structures.
During preparation of the model GIS database, the model GIS database had been built with the staffs in the office, and the staffs had been trained as a GIS database operators. The model GIS database in the office can be operated and maintained in the office alone. In addition, small scale seminars had been held for the key engineering officials, to disseminate the function of GIS database and to accumulate their demand and expectations to the GIS database in the office.

4.3 Training Course in Japan

The training course in Japan was initially planned to be held thrice in 2013, 2014 and 2015 separately. But due to the necessary time to decide the members of the participants and the continuous blockades and hartals caused by political unrest, it was decided to hold the combined training for the first and the second training courses in October 2014 as a first training program. Therefore, the training courses in Japan became twice as shown in Table 4.2.

Table 4.2 Training Courses in Japan

No.	Name of Training Course	Training Period (arrival at Japan – departure from Japan)	Actual Participants	Remarks
1	Training 2014	19/Oct/2014 – 01/Nov/2014	12 persons	Schedule number: 15
2	Training 2015	04/Oct/2015 – 17/Oct/2015	12 persons	Schedule number: 12

Overall goal and expected goals of the training courses, process of training program preparation and training programs are shown below, respectively. The detailed programs and participant lists of the above training courses are shown Appendix-5 of this report, respectively.

(1) Overall Goal of Training Courses

Participants conduct the river management and disaster prevention activities with reinforced manners employing the extensive knowledge, broad information and improved network acquired through the training in Japan.

(2) Expected Goals of Training Courses

Goal 1: To acquire extensive knowledge on river management and disaster prevention through watching, hearing and experiencing the efforts in Japan, and compare and consider with the existing conditions of river management and disaster prevention in Bangladesh, in order to address improvement of river management and disaster prevention activities.

Goal 2: To exchange knowledge and information with the people in charge of river management and disaster prevention in central and local authorities and independent administrative agency through dialogs and exchange of opinions, in order to enrich understanding of concerned activities of the partner country and to create an opportunity for operational improvement.

Goal 3: To share information among the training participants through exchange of opinions and to improve network of personal contacts, and facilitate necessary collaboration.

Goal 4: To prepare action plan of each group utilizing acquired knowledge through training in Japan.

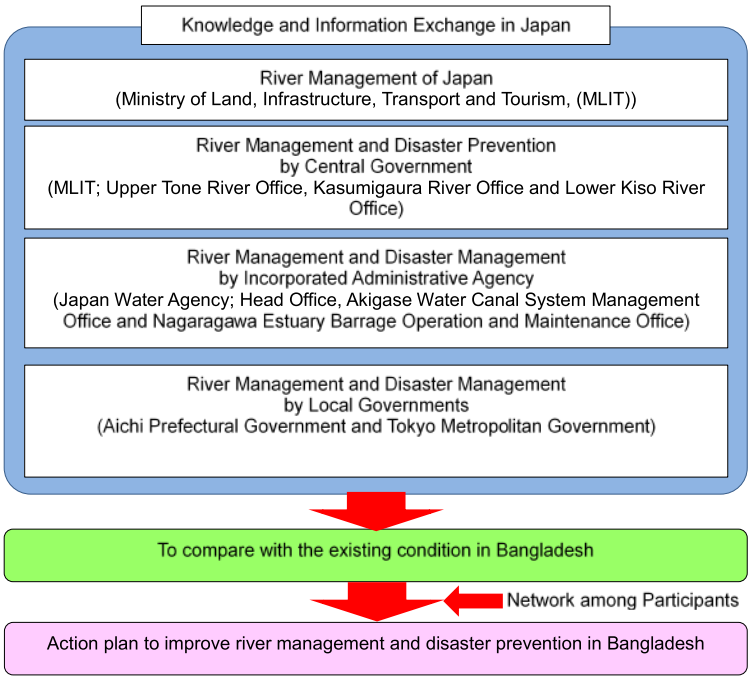


Figure 4.1 Expected Goals of Training Courses
(Note: Offices and Sites in Training 2015)

(3) Training Program Preparation

The training programs were prepared in the following procedure:

a. Preparation of draft training program: The JICA Expert Team in cooperation with the JICA Long-term Expert to BWDB was prepared the draft program including inspections of river/coastal embankment sites and water management structures in low-lying area, in consideration of the responsibilities of BWDB and the river condition in Bangladesh.

b. Preliminary arrangement with the candidate recipient offices: The JICA Expert was preliminarily discussed with the candidate recipient offices (Ministry of Land, Infrastructure,

Transport and Tourism, prefectural governments, and Japan Water Agency) about the contents of training course, and candidate sites/structures, and got the internal approval from those offices.

c. Determination of training program: Arranged training program was approved by JICA and the official request letters to the recipient office were issued.

(4) Training Programs

Programs of the training 2014 and 2015 are shown below:

1) Training 2014

Table 4.3 Program of Training 2014

	Date		Schedule	Objectives
1	19 Oct. Sunday		Arrival in Japan	
2	20 Oct. Monday	10:00-12:30	JICA Tokyo International Center (TIC) Briefing Orientation	Opening guidance and training orientation
		14:00-16:00	Cabinet Office, Government Of Japan (1) Lecture on Japanese government's disaster management and disaster response scheme	To learn about Japanese government's measures on disaster management and disaster response scheme, role of national, prefectural authorities and concerned agencies, and integrated disaster information system.
3	21 Oct. Tuesday	09:30-12:00 13:30-15:30	Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Water and Disaster Management Bureau: (1) Lecture on river management administration of Japan (2) Lecture on outline of technical standards of Japan	To learn river management in Japan; organization, legal framework, flood management, water utilization, environment considerations, disaster prevention and technical management. To learn about the technical standards, outline of the guidelines for river management in Japan, and to learn about the system how the technical standards and guidelines are maintained, revised and disseminated.
4	22 Oct. Wednesday	10:00-12:00	Japan Water Agency: Head Office (1) Lecture on outline of the agency's operation	To learn about outline of operation the agency, technical standards, guidelines, technical management system, and to learn about advanced operation & maintenance practices.
		13:00-16:00	Japan Water Agency: Tone Water Transfer Canal System Reconstruction and Management Office: (1) Short field trip by chartered bus to the facilities of Tone Water Transfer Canal System Reconstruction and Management Office.	To learn about operation and maintenance of water canal and related facilities by observation, explanations and exchange of opinions.

	Date		Schedule	Objectives
5	23 Oct. Thursday	10:00-12:00	MLIT: Upper Tone River Office, Kanto Regional Development Bureau (1) Lecture on flood control measures in the Tone River basin	To learn about history of flood control projects, outline of flood control measures, construction methods of flood control embankments, construction supervision, works at water colliding sections and operation and management of embankments and river structures of the river which is directly controlled by the central government.
		13:00-16:00	MLIT: Upper Tone River Office, Kanto Regional Development Bureau (1) Short field trip by chartered bus to embankment of the Tone River	To learn about water colliding section of the embankment by observation and explanation as reference knowledge for planning, designing, construction supervision and maintenance.
6	24 Oct. Friday	10:00-12:00	Saitama Prefectural Government River and Sediment Management Division (1) Lecture on flood control measures in Saitama Prefecture Saitama Prefecture locates on the north adjacent to the Tokyo Capital City and it is a part of greater Tokyo metropolitan area.	To learn about history of flood control projects, outline of flood control measures, construction methods of flood control embankments, construction supervision, works at water colliding sections, and operation and maintenance of embankments and river structures of the rivers which are controlled by the local government.
		13:00-16:00	Saitama Prefectural Government River and Sediment Management Division (1) Short field trip by chartered bus to embankment in Saitama Prefecture.	To observe works at water colliding sections of embankment and make use of this experience and knowledge as reference material for planning, designing, construction supervision and maintenance.
7	25 Oct. Saturday	AM	Move from Tokyo to Nagoya, (approx.. 2 hours by super express train)	
		13:30-15:30	Nagoya Municipal Minato Disaster Prevention Center Experiential activity: Visiting a disaster prevention experiential facility.	To observe and experience in order to bolster awareness of disaster prevention and importance of preparedness against disaster. * The center is a facility to learn how to protect citizens by themselves by understanding actual disaster and also the facility has role as a base facility of emergency center in time of disaster.
8	26 Oct. Sunday		Holiday (Self-study)	
9	27 Oct.	AM	(Self-study)	

	Date		Schedule	Objectives
	Monday	13:00-16:00	MLIT: Lower Kiso River Office, Chubu Regional Development Bureau, (1) Lecture on flood control measures of the Kiso River basin (2) Short filed trip by chartered bus to the river facilities of the three rivers in the lower Kiso River basin	To learn about history of flood control projects in the lower Kiso-Three Rivers basin, outline of countermeasures, method of construction, supervision of construction, works at water colliding sections, and operation and maintenance of rivers flowing through low lying areas controlled by the local government. The rivers flow in to the bay of Ise (Pacific ocean). Morphological feature of the area has similarity to that of Bangladesh. To observe and learn about embankments of the Kiso-Three Rivers, works at water colliding sections and krippen groin to provide a reference for planning, designing, and operation and maintenance.
10	28 Oct. Tuesday	10:00-12:00	Japan Water Agency: Nagara River Estuary Barrage Management Office: (1) Short field trip by chartered bus to the Nagara River Estuary Barrage	To learn about purpose, function and maintenance of huge barrage by observation and explanation. Also learn how the facility has been designed, constructed and maintained, and how environmental and social impacts were mitigated.
		13:00-16:00	Aichi Prefectural Government: River Department: (1) Short field trip by chartered bus to the construction site of the Nikko River (2) Lecture on countermeasures of tidal wave and high tide in the area	To observe the construction site in low lying area and learn how structure and facilities are designed and constructed. To learn about history of countermeasures of high tide in the area, outline of disaster response projects, design, construction method, construction supervision and maintenance of the coastal embankments. The area was severely damaged by the catastrophic powerful typhoon named “Ise-wan typhoon” in 1959. Since after this disaster, Aichi Prefectural Government has started its efforts to fortify the countermeasure facilities against high tide.
11	29 Oct. Wednesday	9:30-12:00	Aichi Prefectural Government: River Department (1) Boat tour in the Nagoya port to observe the coastal embankments.	To observe the coastal embank in order to provide a reference for planning, designing and maintenance in Bangladesh.
		PM	Move from Nagoya to Tokyo (approx.. 2 hours by super express train)	

	Date		Schedule	Objectives
12	30 Oct. Thursday	9:30-12:00	JICA Tokyo International Center (TIC) Review of training	Presentation and information sharing session: Each participant will deliver lessons learned and applicable particular items obtained in the course of training to his operation and services in Bangladesh.
		13:30-16:00	JICA Tokyo International Center (TIC) Preparation of Action Plan	Objectives of Action Plan: (1) Action Plan shall be prepared for short, middle and long term. (2) The plan shall address how to make the most use of lessons learned and training experience for river & disaster management services in Bangladesh, how to disseminate those knowledge and information, and how to consolidate coordination mechanism with concerned organizations in Bangladesh.
13	31 Oct. Friday	AM	JICA Tokyo International Center (TIC) Preparation of Action Plan	
		PM	JICA Tokyo International Center (TIC) Presentation of Action Plan, evaluation, closing ceremony	
14	01 Nov. Saturday		Departure from Japan	

2) Training 2015

The program and arrangement of the training 2015 had been improved based on the suggestions and recommendations shared through discussion between BWDB and JICA Expert Team after the training 2014. As a good result, the training 2015 had been highly appreciated by the training participants. The clarified requests from BWDB after the training 2014 and the countermeasures in order to improve the training 2015 are shown in Table 4.4 and the program of training 2015 are shown in Table 4.5:

Table 4.4 Requests and Countermeasures for Training 2015

No.	Requests from BWDB after Training 2014	Countermeasures taken by JICA Expert Team for Training 2015
1	Training schedule should not be too tight in order to reduce excess burden of participants.	No lecture programs on the domestic travel days were set. Duration of each lecture and field tour was adjusted appropriately.
2	Climate (low temperature) in the late October was not comfortable for participants. The training schedule should be adjusted accordingly.	The training schedule was set in the first half of October. During the training period, fine sunny days continued and all the participants were in good health condition.
3	In order to secure an appropriate flight connection, training participants should be decided as soon as possible.	Discussion to prepare the program with BWDB was initiated as early as in February 2015, and the flight arrangement went better than the previous training. There was no tiresome domestic transfer connection.
4	In order to secure JICA Centers as accommodation, training participants should be decided as soon as possible.	As a result of early preparation in February 2015, all accommodation facilities became the JICA Centers.

No.	Requests from BWDB after Training 2014	Countermeasures taken by JICA Expert Team for Training 2015
5	The basic information of Japan should be provided in the orientation immediately after arrival in Japan.	In the program orientation on the first day, printed facts sheets presenting basic information of Japan were delivered to the participants. Also a half day tour to the Edo-Tokyo Museum was provided in the programs in order for the participants to touch Japanese history and culture.
6	The pivotal mission of BWDB is disaster management. The training program should correspond to it.	The role of BWDB was scrutinized in order to adjust the training program properly.

Table 4.5 Program of Training 2015

	Date		Schedule	Objective
1	04 Oct. Sunday	***	Arrival in Japan	
2	05 Oct. Monday	AM	JICA Tokyo International Center (TIC) Briefing of the training (JICA)	Opening guidance of the training
		PM	JICA Tokyo International Center (TIC) Program Orientation	Briefing of the training course program, training schedule, and basic information of Japan.
3	06 Oct. Tuesday	AM	Water and Disaster Management Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Japan (1) Lecture on river management administration of Japan	To learn about river management in Japan; organization, legal framework, flood management, water utilization, environment considerations, disaster prevention, etc.
		PM	(2) Lecture on outline of operation & maintenance of flood control facilities	To learn about the operation and management of flood control facilities in Japan: laws and regulations, necessity of O&M, damage records, activities of O&M, activities, challenges for future, etc.
4	07 Oct. Wednesday	AM	MLIT: Upper Tone River Office, Kanto Regional Development Bureau (1) Lecture on flood control measures in the Tone River basin	To learn about history of flood control projects, outline of flood control measures, construction methods of flood control embankments, construction supervision, operation, management and flood fighting activities of embankments and river structures of the river which is directly managed by the central government.
		PM	(2) Inspection of disaster management operation center and river facilities	To learn about flood countermeasures and flood fighting activities by observation and explanation as reference knowledge for planning, designing, construction supervision, maintenance, and flood fighting activities.
5	08 Oct. Thursday	AM	Head Office, Japan Water Agency (JWA) Lecture on outline of the agency's operation	To learn about outline of operation of the agency, technical standards, guidelines, technical management system, and to learn about advanced operation & maintenance practices.

	Date		Schedule	Objective
		PM	Akigase Barrage; Tone Canal Project, Akigase Barrage Management Office, JWA Inspection of the Akigase Barrage and related facilities.	To learn about operation and maintenance of diversion/intake weir by observation, explanations and exchange of opinions.
6	09 Oct. Friday	AM	MLIT: Kasumigaura River Office, Kanto Regional Development Bureau (1) Lecture on river and flood management in the area by the office.	To learn about history of flood control projects, outline of flood control measures, construction methods of flood control embankments, operation & maintenance and flood fighting activities.
		PM	(2) Inspection of embankment, barrage and disaster management center	To observe the river management and disaster mitigation structures, facilities and system and to make use of this experience and knowledge as reference material for planning, designing, construction supervision, operation and maintenance, and flood fighting activities.
7	10 Oct. Saturday	AM	Honjo Life Safety Learning Center, Tokyo Fire Department, Tokyo Metropolitan Government The center is a facility to learn how to protect citizens by themselves by understanding actual disaster and also the facility has role as a base facility of emergency center in time of disaster.	To observe and experience virtual disasters such as rain-storm, earthquake and fire in order to bolster awareness of disaster prevention and share the importance of preparedness against disasters.
		PM	Tokyo Metropolitan "Edo-Tokyo Museum"	To learn about general history and culture of Japan by visiting "Edo-Tokyo Museum" The museum opened in 1993 as a space to reflect on the history and culture of Edo-Tokyo and envision the city and life of the future. Housed in a unique building modeled after an elevated-floor type warehouse, the museum has been a landmark and popular tourist attraction in Tokyo.
8	11 Oct. Sunday	AM-PM	Holiday (Self-study)	
9	12 Oct. Monday	AM	Move from Tokyo to Nagoya, (approx.. 2 hours by super express train)	
		PM	Holiday (Self-study)	

	Date		Schedule	Objective
10	13 Oct. Tuesday	AM	MLIT: Lower Kiso River Office, Chubu Regional Development Bureau, (1) Lecture on flood control measures of the Kiso River basin (2) Inspection of the river facilities of the three rivers in the lower Kiso River basin	To learn about history of flood control projects in the lower Kiso-Three Rivers basin, outline of countermeasures, method of construction, supervision of construction, works at water colliding sections, and operation and maintenance of rivers flowing through low lying areas controlled by the central government. The rivers flow in to the Bay of Ise (Pacific ocean). Morphological feature of the area has similarity to that of Bangladesh. To observe and learn about embankments of the Kiso-Three Rivers, works at water colliding sections and Krippen groin to provide a reference for planning, designing, and operation and maintenance.
		PM	Japan Water Agency: Nagaragawa Estuary Barrage Operation and Maintenance Office: Inspection of the Nagaragawa Estuary Barrage	To learn about purpose, function and maintenance of huge barrage by observation and explanation. Also learn how the facility has been designed, constructed and maintained, and how environmental and social impacts were mitigated.
11	14 Oct. Wednesday	AM	Aichi Prefectural Government: River Division, Construction Department (1) Lecture on countermeasures of flood and high tide in the area. Field inspection of construction site of renovation works for the river lock gate.	To learn about history of countermeasures of flood and high tide in the area, outline of disaster response projects, design, construction method, construction supervision, maintenance and flood fighting activities of the river and coastal embankments. The area was severely damaged by the catastrophic powerful typhoon named "Ise-wan (bay) typhoon" in 1959. Since after this disaster, Aichi Prefectural Government has started its efforts to fortify the countermeasure facilities against flood and high tide.
		PM	(2) Lecturer on coastal embankment in Aichi Prefecture. Field Inspection of the disaster management facilities of Nagoya port by a ship.	To observe Nagoya port breakwater structures and other disaster management facilities by a chartered ship.
12	15 Oct. Thursday	AM	Move from Nagoya to Tokyo (approx.. 2 hours by super express train)	
		PM	JICA Tokyo International Center (TIC) Brief meeting to review the training	Presentation and information sharing session: Each participant will briefly deliver lessons learned and applicable particular items obtained in the course of training to his operation and services in Bangladesh.

	Date		Schedule	Objective
13	16 Oct. Friday	AM	JICA Headquarters Preparation of Action Plan	Objectives of Action Plan: (3) Action Plan shall be prepared for short, middle and long term. (4) The plan shall address how to make the most use of lessons learned and training experience for river & disaster management services in Bangladesh, how to disseminate those knowledge and information, and how to consolidate coordination mechanism with concerned organizations in Bangladesh. (5) Participants will be grouped in 3 groups. Each group will make a presentation in the afternoon session.
		PM	JICA Headquarters Presentation of Action Plan by each group (3 groups), evaluation of training and closing ceremony	To share Action Plans and evaluation of training. JICA certificate will be handed to each participant.
14	17 Oct. Saturday		Departure from Japan	

After the training 2015, all the training participants had attended the workshop held at BWDB on November 16, 2015, and two participants had made a presentation on embankment construction in Japan based on the knowledge obtained in the training and they had mentioned possible adaptation to embankment in Bangladesh.

5. Ideas and Lessons Learned on Project Implementation

5.1 Basic ideas on Project Implementation

All of the project activities were conducted with the following basic ideas:

(1) Project Activities related to All Phases of Lifecycle of Water Related Infrastructures

Issue: BWDB is responsible for development and effective management of water resources with command area above 1,000 ha, and is an implementing agency conducting all of phases of water resources development, such as survey, plan, design, construction/supervision, operation and maintenance. There are many divisions related to water resources in BWDB. Therefore, interdivisional cooperation is a key of the services of BWDB.
Idea: The project activities were conducted not only for one division, but also divisions related to all phases of the water resources management. Especially, the pilot project was implemented in collaboration of the Planning, Design and Procurement Directorates of BWDB, the field office of BWDB and the JICA Expert Team, in order to promote the interdivisional cooperation of BWDB. During the construction period, the periodical construction workshops for the technical staffs in the head office of BWDB and the field offices were held in the work site, in order to promote the information sharing and interdivisional cooperation, in addition to dissemination and discussion of the construction manual
Result/lesson learned: During the project activities, the interdivisional cooperation of BWDB was able to be secured. As a result of the experience of C/P during the Project, it is expected that information sharing and interdivision cooperation are developed in BWDB.

(2) Preparation of Manuals in View of Country Circumstances

Issue: In order to prepare the manuals, it is important to grasp the causes and mechanism embankment failures, the present condition of the managed hydraulic structures, etc. However, there are few surveys and studies conducted by BWDB.
Idea: The manuals of design, construction and O&M were prepared in view of the specific country circumstances with the social and environmental viewpoints, under the following considerations;

- The results of study on the present conditions of embankment and embankment failures, including the verification of embankment failures by use of seepage and circular slip analysis, were reflected to the manuals. In addition, the geophysical exploration survey was introduced as a method to identify weakness of embankment effectively and at low cost.
- The manuals were prepared for the improvement of hydraulic structures with available materials and equipment in the field. In addition, the manuals were revised based on the information and lessons learned through the implementation of the Pilot Project and the model O&M activities.
- User-friendly manuals were prepared with tables and figures for easy understanding and usage for future dissemination.

Result/lesson learned: The design manual and construction manual for the river embankment and the O&M manual for the hydraulic structures were prepared based on the results of study on the present condition of embankment and structures.

(3) Promotion of Total Cost Consciousness

Issue: At present, it is said that the budget and staff of BWDB are not enough for mitigation of recurring flood damage. Consequently, the negative spiral of construction of embankment is taking place, that is, a spiral of a) providing the embankment within a limited budget and inappropriate quality, b) insufficient O&M for keeping the function of embankment, c) recurrence embankment failures, d) recurrent damages in the project area and usage of the limited budget for repairs, e)

underperforming benefit from the projects, f) less budget allocation to the embankment management by the financial authorities, and return to a).
Accordingly it is considered necessary to change the spiral to the flow, that is, of a) providing the embankment of appropriate quality even with high cost, b) appropriate O&M for keeping the functions of the river embankment, c) no or few damage to embankment and the project area, d) mitigation of flood damage and reduction of unnecessary repair cost, e) expected benefit from the project, f) appropriate budget allocation by the financial authorities, and return to a).
That is to say the present spiral should be changed to "reduction of total cost/life cycle cost of water-related infrastructure".
Idea: It was tried to promote total cost/life cycle cost consciousness through the project activities, including the meetings, discussions, seminars/workshops, etc.
Result/lesson learned: Through the repeated promotion, the idea of total cost/life cycle cost consciousness was being understood within BWDB. It is expected that the idea of total cost/life cycle cost consciousness in addition to the basic data and skills obtained through the project activities will contribute to capacity enhancement to manage the water related infrastructures and also to secure budget.

(4) Preparation of Action Plan for dissemination and effective use of Manual

Issue: In order to attain and sustain the expected goals after the project completion, it is indispensable for BWDB to disseminate the manuals, to apply the manuals to the actual activities effectively, and to update the manuals timely. However, it is difficult to apply the manuals to all activities at the same time, due to the limited resources of BWDB.
Idea: The Action Plan to disseminate the manual and to apply the manuals to the actual activities in a stepwise manner and within reasonable scope with current mechanism and resources of BWDB were prepared as a project activity in collaboration with the counterparts.
Result/lesson learned: The Action Plan was able to be prepared within the existing resources and organization structure of BWDB. Therefore, it is expected that the Action Plan will be implemented surely.

5.2 Ideas and Lessons Learned on Implementation of Activities by Fields

Ideas and lessons learned on implementation of respective activities related to embankment design, embankment construction and O&M of the river structures are summarized below;

5.2.1 Ideas and Lessons Learned in Activities related to Embankment Design

(1) Examination of Causes and Mechanism of Past Embankment Failures

Issues: In order to prepare the design manual of river embankment, it is important to grasp the causes and mechanism of the past embankment failures in Bangladesh. However, there are few data and studies for the past embankment failures in Bangladesh.
Idea: Field reconnaissance at 14 representative sites of embankment failures, which occurred in recent years, was conducted to examine the causes of embankment failures.
Based on the results of the field reconnaissance and review of the present condition, it was found that the river embankments in Bangladesh were categorized into the following 4 types;
A-category: Embankment along 3 Major Rivers (Padma, Meghna, Jamuna)
B-category: Embankment in Tidal area
C-category: Embankment in Haor
D-category; Embankment in Flash flood area
In addition, it was also found that the past embankment failures in Bangladesh are mostly caused by

river bank erosion. It means whether river embankments are stable against flood in case without bank erosion could not be clarified through field reconnaissance. Therefore, numerical simulation of the "unsteady flow permeability analysis and slope stability analysis in utilization of the finite element method was conducted on the representative embankment failures cases in respective embankment categories, to clarify whether the embankment was stable against flood when bank erosion was protected.
Circular slip analyses of the past embankment failure sites were conducted to investigate how much bank erosion advanced when circular slip takes place (Safety Factor of circular slip $\leqq 1.0$).
As the results of the analyses, it was found that the simulated cross section profile of embankment failures showed fairly good consistency with the current damaged cross section profile.
Result/lesson learned: Findings about the river bank erosion and the mechanism of the embankment failure were of great use in understanding the present embankments in Bangladesh.

(2) Manual in View of Country Circumstances

Issue: Almost the entire national land of Bangladesh is spread out over the downstream floodplains of three major rivers, and the topographical gradient is extremely gentle and there are few slopes or mountains. Therefore, there are few projects with the design methods required the sophisticated soil test results, such as seepage analysis, circular slip analysis, etc. As the results, only a few limited agencies have the capability to implement sophisticated soil tests. It is not practical to apply the design procedures required the result sophisticated soil tests to the ordinary embankments.
Idea: In preparing the design manual, design procedures required the result of sophisticated soil tests were avoided as much as possible. But the verification based on the basic soil test was incorporated in the manual. This verification method can be sufficiently applied to embankment design by devising the design conditions.
Result/lesson learned: The Design manual was prepared in view of country circumstances. Therefore, the manual was applicable to the actual design works without difficulty. It is expected that the manual will be applied to the actual design works through the trial run in order to design the safer and high quality embankment.

(3) Correct Understanding of River Embankment to Technical Staffs in Field

Issue: The design manual for river embankment was prepared and revised through the discussions in the Design Directorate of BWDB. The Design Directorate is in charge of all design works of BWDB. On the other hand, construction and O&M of the structures of BWDB are conducted by the technical staffs in the field offices. In addition, proposal and restoration works of the embankment failures are conducted by the technical staffs in the field offices. Therefore, the technical staffs in the field offices are required to understand the river embankment correctly, such as function of embankment, mechanism of embankment failure, basic design concepts of embankment, etc.
Idea: In this context, "Textbook for correct understanding of River Embankment" was prepared as a reference material of the design manual.
Result/Lesson learned: In order to prevent the flood damage of embankment, not only the technical staffs of the Design Circle but also the technical staffs in the field offices are required to understand the river embankment correctly, such as function of embankment, mechanism of embankment failure, basic design concepts of embankment, etc. This material is expected to help disseminate the design manual after the Project.

5.2.2 Ideas and Lessons Learned in Activities related to Embankment Construction

(1) Review of Present Condition

Issues: Prior to preparation of the construction manual of river embankment, review of present

condition of structures including embankment of BWDB. As the results, the following issues were found out;

- Construction works of embankment in the field offices of BWDB, except the large scale projects, are conducted mainly by man power without heavy construction equipment. It is considered that the construction capacities of the contractors for those works are low and the guidance and instruction through the construction supervision by the technical staffs of BWDB are important for those works.
- There are two document of the construction works of the embankment of BWDB, namely "Technical Specification for Civil Work" and "Standard Schedule of Rates Manual (SSoRM)". However, the details of the frequencies and procedures for quality control methods and tests are not drafted in the both documents. In addition, there is no reference material that systematically explained the construction of embankment. Therefore, the construction quality of the works are depend on the capacities of the technical staffs in the field offices in the BWDB and the contractors of the works.

Idea: In consideration of the above issues, the construction manual was prepared as a supplemental document of the above 2 documents. The manual was intended to mainly script the method of construction plan including prior necessary investigations for planning, detailed procedure/method of quality control, and safety measurements including the prevention for third parties damages, which were not described in both documents.
The manual would be used among the personnel who were engaged with river embankment construction, not only staff of BWDB but also the contractors' engineers engaged in the execution of the works as their engineers. In order for the target users to understand it, the manual had been prepared in collaboration with BWDB staffs in respect of technical terms and the content of the manual.
Result/lesson learned: Based on the review results of the existing condition of the construction works, the construction manual was prepared easy to understand as a supplemental material of the documents related to the embankment construction of BWDB.

(2) Verification of Manual through Implementation of the Pilot Project

Issue: Although the construction manual was prepared based on the review result of the present condition, there is no actual construction works applying the prepared manual.
Idea: In order to evaluate design and construction methods for river embankment proposed in the manuals for design and construction of embankment, the Pilot Project was conducted in the Project.
During construction of the Pilot Project, transfer of knowledge to the technical staffs of the field office and engineers of the contractor was conducted as the on-the job-training on a daily basis. In addition, the periodical construction workshops for the technical staffs in the head office of BWDB and the field offices were held in the work site in order to disseminate and discuss the manual.
The construction manual was finalized by use of the documents and photographs in the pilot project, based on the information and lessons learned through implementation of the pilot project, discussions in the workshops.
Result/lesson learned: Through implementation of the Pilot Project, it was proved that the construction manual was sufficiently applicable to the actual construction works. In addition, the dissemination of the construction manual was commenced and the manual was able to be revised based on information and lessons learned on implementation of the Pilot Project. It is expected that application of the construction manual to the actual construction works will be expanded step by step within reasonable scope with current resources, referring the construction works of the Pilot Project..

(3) Defect Liability Period of the Construction Works of the Pilot Project

Issue: The construction works of the Pilot Project had commenced on 25 November 2015, with a

schedule to complete within the dry season of 2015/2016. However, the works had been forced to be suspended before the end of dry season of 2015/2016, because of continuous higher river water level due to unusual weather condition. The works had resumed on 21 December 2016 and completed on 23 May 2017. The defect liability period of the works is one year, up to 22 May 2017. On the other hand, the project period is up to October 2017. Therefore, the management of the works in the defect liability period after the Project became a problem.

Idea: The construction works of the Pilot Project was conducted in the jurisdictional area of Moulvibazar O&M division office and the contractor of the works was a local contractor in the jurisdictional area of the office. In addition, Executive Engineer of the office was a member of the construction supervision team of the works. Therefore, it was proposed to delegate the Project Manager during the defect liability period to Executive Engineer of the office.

After the completion of the construction works, the members of the office including Executive Engineer, members of the contractor and the JICA experts conducted the joint inspection of the repaired embankment, in or der to prepare the delegation of the Project Manager to the Executive Engineer of the office. During the joint inspection, minor defects of the works were found and instructed repair to the contractor.

Result/lessons learned: Because the Executive Engineer was major member of the construction supervision team, delegation of the Project Manager to the Executive Engineer of the office was proposed and approved smoothly.

5.2.3 Ideas and Lessons Learned in Activities related to O&M of Hydraulic Structures

(1) Activities of O&M of Hydraulic Structures

1) Review of Present Condition of O&M

Issues: As the results of review of the present condition of O&M of hydraulic structures, the following major issues were found out;

- Inadequate number of staffs in the field offices
- Insufficient budget for O&M compared with the demand.
- Inadequate data management for the completed projects (especially no inventory of hydraulic structures).
- Inadequate planning on O&M (especially no O&M plan)
- Insufficient understanding to the function of structures for the staffs in the field offices

As the above result, there are many structures damaged and without repair. In addition, there are many defects in the structures without any treatment. Those defects are the causes of the serious damages of the structures during floods.

Idea: The O&M Manual was prepared as a technical document including the function and O&M methods of respective structures in accordance with the frameworks and procedures in BWDB.

Result/lesson learned: Based on the review result, the O&M manual was prepared to improve the actual O&M of structures.

2) Finalization of Manual based on the lessons learned through the Model O&M Activities

Issue: After preparation of the O&M manual, the model O&M activities, such as the inventory survey of the managed structures, patrol/inspection and discussion of the damaged structures, etc. were conducted in the selected model field office.

As the results, it was found that the technical staffs in the field offices were required to understand the function of hydraulic structures and the causes and mechanism of structure damages sufficiently. Appropriate inspection and prompt repair of the structures cannot be

conducted without understanding to the causes and mechanism of damages of structures. In addition, priority of repairs of structures cannot be determined without understanding to the function of respective structures.

Idea: Based on the above information and lessons learned, the O&M manual was finalized adding detailed explanation including the function of structures and the causes and mechanisms of damages of structures. In addition, the JICA Expert Team tried to explain the causes and mechanism of damages of structures in an easy-to-understand manner during the model activities and the workshops.

Result/lessons learned: Through the model O&M activities, the O&M manual was finalized according to the ability of C/Ps, and prepared for application to the actual activities. It was expected to disseminate the O&M manual and to apply the manual to the actual activities of BWDB step by step within the reasonable scope.

(2) Activities related to GIS Database for O&M

1) Development of GIS Database for O&M

Issue: How to develop the GIS database for O&M of hydraulic structures managed in the selected field office, as a model activity, in order to implement the O&M activities of managed structures by the staffs efficiently.

Idea 1: Development in collaboration with the Staffs in the Field Office

The model GIS database for O&M of structures was developed by use of QGIS software. The QGIS is the open source software, available to all staffs without special knowledge about the computers.

In order to enhance the technical staffs' skill for database and to make full use of the model GIS database to the O&M activities after the Project, development of the model GIS database was conducted in collaboration with the technical staffs in charge of O&M from the data input phase to completion.

Idea2: Improvement of Model GIS Database with technical staffs

The model GIS database manages the information of the structures on the map. However, the staffs had few custom to locate the structures on the map and information other than the locations of structures on the map were required for the staffs to locate the structures on the map. Based on the discussions with the staffs, the GIS database was improved adding the locations of growth centers and the rural markets as key places/landmarks on the base map, and including the kilometer post (chainage) of river embankment in the database

The model GIS database was developed based on the inventory data of the structures by contracted survey of the Project. There was no inventory data of the structures in the model field office and only staffs in charge of the O&M were in a situation of grasping the information of structures.

Therefore, the inventory data of the structures were confirmed by the staffs in charge of O&M and inspection with those staffs. Those activities were indispensable to make full use of the model GIS database to the O&M activities after the Project.

Result/lesson learned: It was reconfirmed that joint development and improvement with the technical staff in the field office was important for the development of GIS Database that was useful for the actual activities.

2) Usage of GIS Database in BWDB

Issue: Development of the GIS database in selected office was conducted as a model activity. However, it is desirable for BWDB to develop the GIS databases in the other field offices as the standard activity for the O&M of the managed structures in BWDB.

Idea: In this context, it is indispensable to manage the GIS databases in cooperation among the head offices and the field offices, in consideration of information sharing of the databases, common data format of the database and technical support for the defects of databases. Technical transfer activities related to the GIS database was also conducted in the head office of

BWDB as the small seminars. However, there was no section related to the GIS database in BWDB. Therefore, the necessity of setting up a section in charge and allocation of personnel wad discussed between the planning directorate of BWDB and the JICA Expert Team.

Results/lessons learned: It was expected to allocate personnel in charge of the database in the head office of BWDB. It was reaffirmed that publicity is indispensable for disseminating new technologies like the GIS database.

6. Recommendation for Future Project Implementation

As mentioned in the section 2.4 of this report, "the Action Plan for Dissemination and Effective Use of Manuals" had been prepared in collaboration with BWDB, in order to attain and sustain the expected goals of the Project

In the Action Plan, dissemination of manuals and application of manuals to the actual works of BWDB will be proceeded in stepwise manner and within reasonable scope with current mechanism and resources of BWDB. The Action plan also includes the mechanism for update of the manuals and the Action Plan itself.

The Action Plan will be conducted by BWDB within reasonable scope with current mechanism and resources of BWDB. The periodic monitoring by BWDB is also recommended for ensuring the implementation of Action Plan.

LIST OF APPENDICES

Appendix-1: Project Activity Flow

The project activities consist of the following four components:

- Activities for improvement of design for sustainable river embankment,
- Activities for improvement of construction method for sustainable river embankment,
- Activities for improvement of operation and maintenance for sustainable river structures,
- Common Activities (local seminars/workshops, training in Japan, preparation of action plan for dissemination and effective use of the prepared manuals, and reporting),

The project activity flow is shown in the below figure.

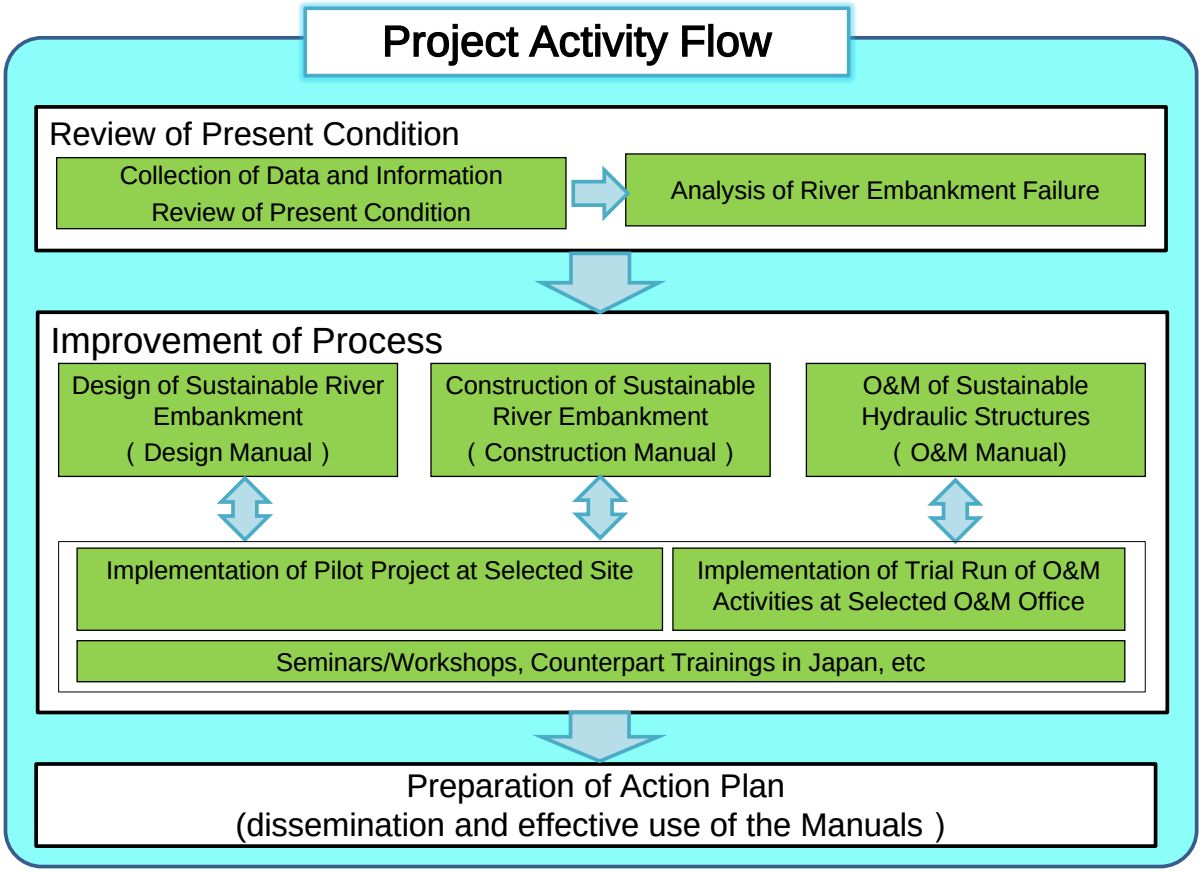


Figure: Project Activity Flow

Appendix-2: Planned and Actual Assignment of JICA Experts

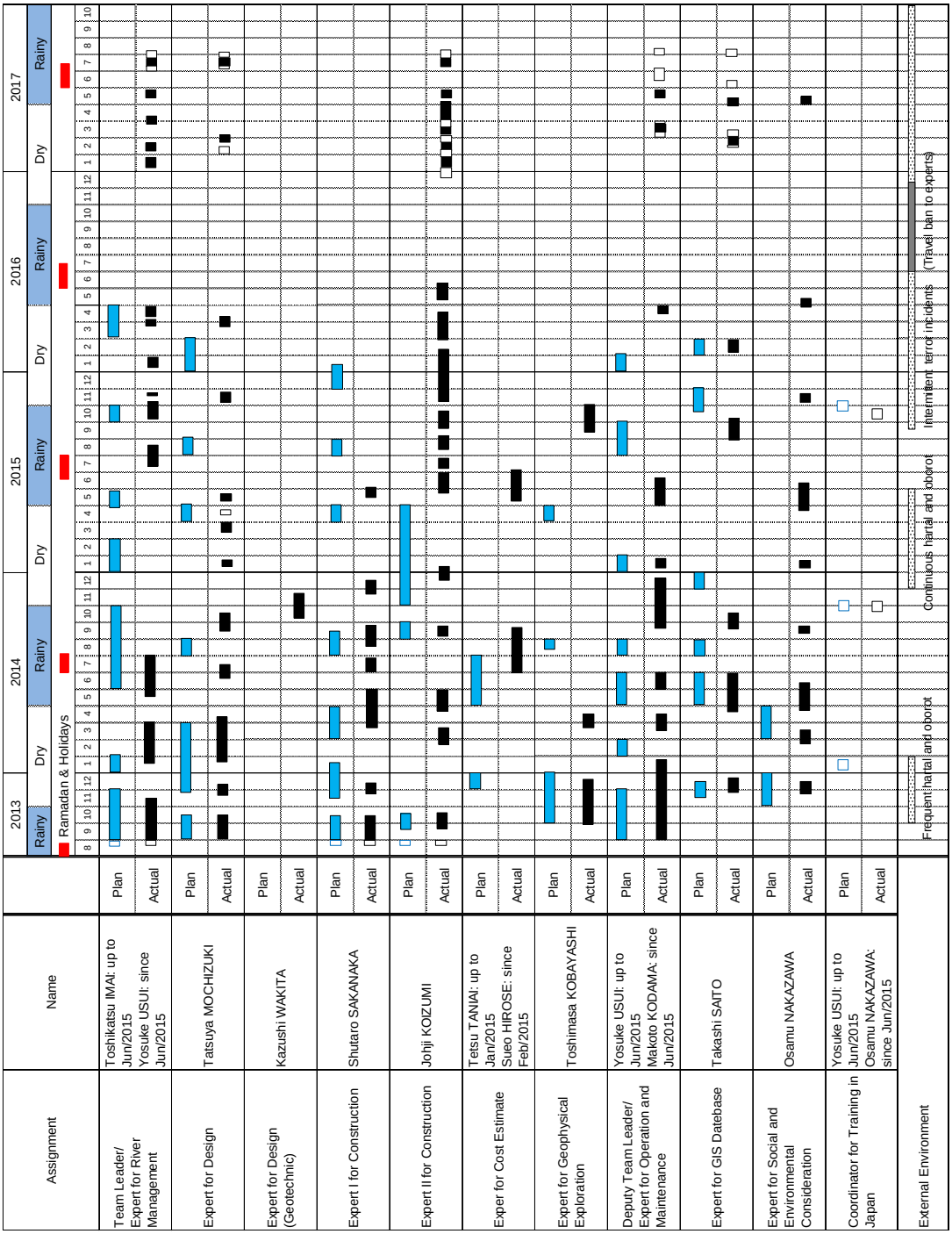


Figure : Planned and Actual Assignment of JICA Expert

Appendix-3: List of Outputs of the Project

Major outputs of the Project are as follows:

1. Design Manual for River Embankment
2. Construction Manual for River Embankment
3. Operation and Maintenance Manual for Hydraulic Structures
4. Action Plan for Dissemination and Effective Use of Manuals

In addition to above outputs, "User's' Manual for O&M GIS Database" was also prepared. Those outputs are compiled in ANNEXES of the FINAL REPORT.

Appendix-4: Planned and Actual Operation of the Project Activities

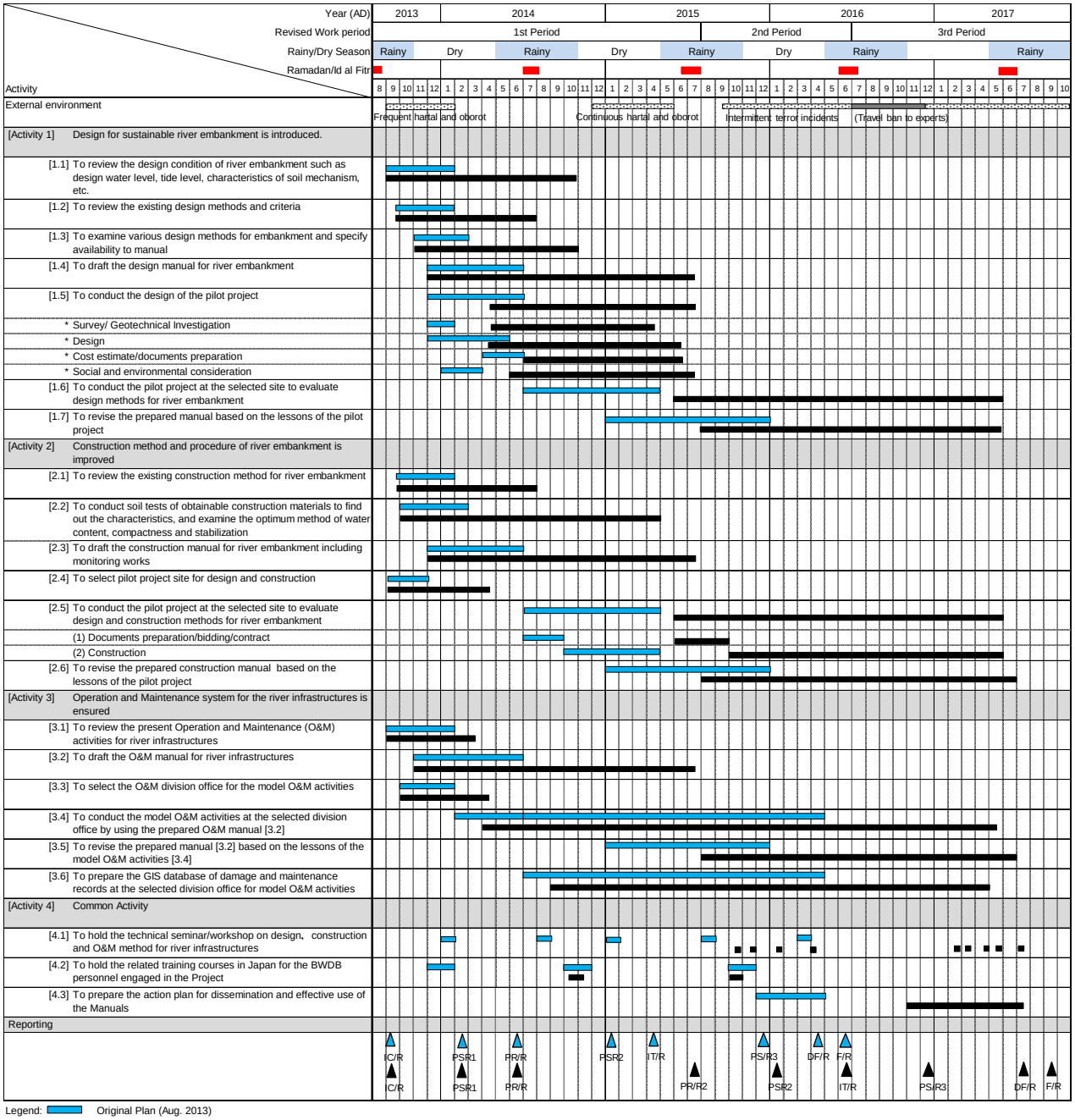


Figure: Planned and Actual Operation of the Project Activities

Appendix-5: Actual Input

1. Input by Bangladesh Side

(1) Counterpart Personnel

Table: Counterpart Personnel of BWDB

No.	Assignment	Name/Position of BWDB
1	Project Director	Mr. Zahirul Islam, Chief Planning - up to January 2014 Mr. Gopal Chandra Sutradhar, Chief Planning - February 2014 - June 2015 Mr. Mahfuzur Rahman, Chief Planning - June 2015 – February 2016 Mr. Kh. Khalequzzaman, Chief Planning - March 2016 – June 2017 Mr. A.M.Aminul Haque, Chief Planning - since June 2017
2	Project Coordinator	Mr. Md. Abdur Rahman Akhanda, Director, Planning-1 - up to June 2015 Mr. Fazlur Rashid, Director, Planning-1 - June 2015 – October 2015 Mr. Md. Abdul Hye, Director, Planning-1 - October 2015 – January 2016 Mr. Md. Amirul Hossain, Director, Planning-1 - January 2016 – March 2016 Mr. Fazlur Rashid, Director, Planning-1 - since March 2016
3	Project Manager	Mr. Naba Kumar Chowdhury, Executive Engineer, Project Management Unit – Estuary Study Pilot Project - up to February 2014 Dr. Shamal Chandra Das, Executive Engineer, Office of Chief Planning - since March 2014
4	C/P	
4.1	C/P (Design)	Chief Engineer, Design
4.2	C/P (Training)	Chief, Training and Staff Development
4.3	C/P (Monitoring)	Chief, Monitoring
4.4	C/Ps (Implementation. and O&M)	Superintending Engineer in relevant O&M Circle(s)
4.5	C/Ps (Implementation. and O&M)	Executive Engineer in relevant Division office

Joint Coordination Committee (hereinafter referred to as "JCC") was established in order to facilitate inter-organizational coordination. The meetings of the JCC were held whenever deemed necessary. The list of members of JCC is shown in Table below;

Table: Lists of Proposed Members of Joint Coordination Committee

Proposed Member		Remarks
1. Bangladesh side (BWDB)		
(1)	Director General of BWDB	Chairperson
(2)	Additional Director General (Planning)	Co-Chairperson
(3)	Chief, Planning (Project Director)	
(4)	Chief, Monitoring (C/P)	

(5)	Chief Engineer, Design (C/P)	
(6)	Chief Engineer, Hydrology	
(7)	Chief Training & Staff Development (C/P)	
(8)	Chief Engineer, Relevant O&M Zone	
(9)	Chief, Water Management	
(10)	Director, Planning 1 (Project Coordinator)	Secretariat of JCC
(11)	Project Manager	
2. Bangladesh side (Organizations concerned)		
(12)	Representative of Ministry of Water Resources (MoWR)	
(13)	Representative of River Research Institute (RRI)	
(14)	Representative of Institute of Water Modeling (IWM)	
(15)	Representative of Center for Environmental and Geographic Information Services (CEGIS)	
(16)	Representative of Department of Disaster Management (DDM)	
(17)	Representative of Bangladesh Meteorological Department (BMD)	
3. Japanese side		
(18)	JICA Experts	
(19)	Representative of JICA Bangladesh Office	
4. Others		
(20)	Other personnel appointed by the Chairperson	

Source: ANNEX-2, R/D dated 25th Mar, 2013.

Technical Working Group (hereinafter referred to as "TWG") was supposed to be reflected, and to be established, in order to provide the information and consideration on the local conditions for the effective dissemination of the design, construction and O&M manuals prepared by the Project. The list of the members of each TWG was proposed in the M/M in October 2012 on the Project as shown in Table below:

Table: List of Members of Technical Working Groups (TWGs)

Technical Working Group 1: Design	Technical Working Group 2: Construction	Technical Working Group 3: O&M
Chief Engineer, Office of Chief Engineer, Design Representative of Design Circle 1 Representative of Design Circle 2 Representative of Design Circle 3 Representative of Design Circle 4 Representative of Design Circle 5 Representative of Design Circle 6 Representative of River Research Institute Representative of other organizations concerned	Chief Monitoring Director of Program Superintending Engineer, O&M Circle of the pilot project site for construction Representative of Central Zone, Dhaka Representative of Eastern Zone, Comilla Representative of North Eastern Zone, Sylhet Representative of South Eastern Zone, Chittagong Representative of South Western Zone, Khulna Representative of Mid-Western Zone, Faridpur Representative of North Western Zone, Rashahi Representative of Southern Zone, Barisal Representative of Northern Zone, Rangpur Representative of other organizations concerned.	Chief Monitoring Director of O&M Superintending Engineer, O&M Circle selected for the O&M activity Representative of Central Zone, Dhaka Representative of Eastern Zone, Comilla Representative of North Eastern Zone, Sylhet Representative of South Eastern Zone, Chittagong Representative of South Western Zone, Khulna Representative of Mid-Western Zone, Faridpur Representative of North Western Zone, Rashahi Representative of Southern Zone, Barisal Representative of Northern Zone, Rangpur Representative of other organizations concerned.

Source: M/M in October 2012 on the Project, arranged by the JICA expert team

In addition, three (3) working committees (WCs) for reviewing and finalizing of the draft manuals

were established in December 2015, in response to the recommendation in the workshop on November 16, 2015. The members of the WCs are as follows:

Table: List of Members of Working Committees (WCs)

1. Committee for reviewing & finalizing the Draft Design Manual for embankment

No.	Name of Member	Designation	Position
1	Brozo Mohan Nath (up to Jan/2016) Md. Harun Ur Rasheed (since Jan/2016)	Superintending Engineer Design Circle -V, BWDB, Dhaka. Superintending Engineer, Design Circle -1, BWDB, Dhaka.	Convener
2	Kazi Tofail Hossain (up to Jan/2016) Yasmin Begum (since Jan/2016)	Superintending Engineer Design Circle -II, BWDB, Dhaka. Superintending Engineer (Attached) Design Circle-I, BWDB, Dhaka.	Member
3	Md. Rafiqul Alam	Executive Engineer Directorate of Programme, BWDB, Dhaka.	Member
4	Shamal Chandra Das	Executive Engineer Office of the Chief Planning, BWDB, Dhaka.	Member
5	Md. Harun Ur Rasheed (up to 16 January 2016) Dr. Jibon Kumar Sarker (since 27 January 2016)	Superintending Engineer, Design Circle -1, BWDB, Dhaka. Executive Engineer, Design Circle-IV, BWDB, Dhaka.	Member-Secretary

2. Committee for reviewing & finalizing the Draft Construction Manual

No.	Name of Member	Designation	Position
1	Motahar Hossain	Superintending Engineer, Design Circle-VI, BWDB, Dhaka	Convener
2	Md. Abdul Matin Sarkar	Executive Engineer, Dhaka O & M Division-II, BWDB, Dhaka.	Member
3	Md. Enayet Ullah	Executive Engineer, Directorate of Planning-I, BWDB, Dhaka.	Member
4	Tarik Abdullah Al Faiz	Executive Engineer, PMU-ESPP, BWDB, Dhaka.	Member
5	Md. Rafius Sazzad	Executive Engineer, IMIP, BWDB, Dhaka.	Member-Secretary

3. Committee for reviewing & finalizing the Draft O & M Manual

No.	Name of Member	Designation	Position
1	Mohammad Ali	Director, O & M, BWDB, Dhaka.	Convener
2	Md. Mahbur Rahman	Director, Directorate of Program, BWDB, Dhaka.	Member
3	Rezaul Mostofa Asafadullah	Executive Engineer, Dhaka O & M Division-I, BWDB, Dhaka.	Member
4	Md. Asaduzzaman	Executive Engineer, Directorate of Planning-I, BWDB, Dhaka.	Member
5	Md. Abdus Salam	Executive Engineer, O & M, BWDB, Dhaka.	Member-Secretary

Source: Office Memorandums (Memo No. BWDB/P-I/815 on December 15, 2015, and Memo No. BWDB/P-I/904 on January 27, 2016.)

(2) Office Space of the Project

Office space of the Project in the head office of BWDB was provided from the commencement of the Project.

2. Input by JICA

The input by JICA were as follows:

1) Dispatch of expert team consisting the Japanese experts and the local supporting staffs
2) Direct expense of the project activities, including those of seminars/workshops, office, etc.
3) Procurement of the construction works for the pilot project
4) Related trainings in Japan

Appendix-6: Records of Counterpart Training Courses in Japan

The training courses in Japan had been conducted twice as shown in Table below:.

Table: Training Courses in Japan

No.	Name of Training Course	Training Period (arrival at Japan – departure from Japan)	Actual Participants	Remarks
1	Training 2014	19/Oct/2014 – 01/Nov/2014	12 persons	Schedule number: 15
2	Training 2015	04/Oct/2015 – 17/Oct/2015	12 persons	Schedule number: 12

The programs and participant lists of respective training courses are shown below:

Program of Training Course in Japan (19 October 2014 – 01 November 2014)

Date		Time	Type	Contents	Lecturer/Instructor		Language	Venue	Accommodation
					Name	Company／Agency Name			
10/19	Sun	～		Arrival					Akihabara Washington Hotel
10/20	Mon	9:30 10:00		Program Orientation	O. Nakazawa	IDEA Consultants, Inc. Overseas Division	E	JICATokyo	Akihabara Washington Hotel
		10:00 ～ 12:30		Briefing	O. Nakazawa	IDEA Consultants, Inc. Overseas Division	E	JICATokyo	
		14:00 16:00 ～	L	Japanese system for disaster	M.Hasegawa	Cabinet Office, under Director-General for Policy Planning, International disaster prevention cooperation expert	J	Cabinet Office	
10/21	Tue	9:30 ～ 11:30	L	River Management of Japan	A. Shimasaki	Ministry of Land, Infrastructure and Transport, Water and Disaster Management Bureau,River plan section	J	MLIT	Akihabara Washington Hotel
		13:30 ～ 15:30	L	Maintenance of Flood Control Facilities in Japan	N.Osanai	Ministry of Land, Infrastructure and Transport, Water and Disaster Management Bureau, River maintenance planning office	J		
10/22	Wed	10:00 12:00 ～	L	Project Outline of Japan Water Agency (JWA)	H.Noguchi	JWA,Comprehensive Technology Center, international group	E	JWA HQ	Akihabara Washington Hotel
		13:00 16:00 ～	O	Visit to Tone Water-conveyance facilities	T.Kuroki	Tone Water-conveyance general office, Management section	J	JWA	
10/23	Thu	10:00 ～ 12:00	L	River improvement measures in the Tonegawa basin	M.Okado	Ministry of Land, Infrastructure and Transport Kanto Regional Development Bureau, Tonegawa upper reaches river office	J	Upper Tone River Office, Kanto Regional Development Bureau, MLIT	Akihabara Washington Hotel
		13:00 ～ 16:00	O	Tonegawa river structure visit	K.Nakajima	Ministry of Land, Infrastructure and Transport Kanto Regional Development Bureau, Tonegawa upper reaches river office	J	Disater Prevention Center and facilities	
10/24	Fri	10:00 ～ 12:00	L	River improvement/flood control measures in Saitama	M.Okada	River and Erosion Control Division, Department of Land Development, Saitama Prefectural Government	J	Office of River and Erosion Control Division	Akihabara Washington Hotel
		13:00 ～ 16:00	O	Flood management measureas (retarding basin, Koshigaya Lake town) in Saitama	M.Okada	River and Erosion Control Division, Department of Land Development, Saitama Prefectural Government	J	Retarding basins, etc.	
10/25	Sat	9:00 ～ 12:00		Travel (by Shinkansen:Tokyo – Nagoya)					JICA Chubu
		13:30 ～ 15:30	O	Visit to experience-based disaster prevention learning facilities	T.Yoshimura	Nagoya Port Disaster Prevention Center	J	Nagoya Port Disaster Prevention Center	
10/26	Sun	10:00 ～ 12:00		Document rearranging, self-study	O.Nakazawa	IDEA Consultants, Inc. overseas division	E	JICA Chubu	JICA Chubu
		～							
10/27	Mon	10:00 ～ 12:00		Document rearranging, self-study	O.Nakazawa	IDEA Consultants, Inc. overseas division	E	Via Inn Hotel	Via Inn Hotel, Nagoya
		13:00 ～ 16:00	L/O	Lecture: River Improvement/Flood Control Measures of the Kiso River, the Nagara river and the Ibi River/visit to several on going construction sites	T.Murata	Lower Kiso River Office, Chubu Regional Development Bureau, MLIT	J	Several on on going construction sites, Lower Kiso River Office	
10/28	Tue	10:00 ～ 12:00	O	Visit to Nagara River Estuary Barrage	K. Murao	Nagara River Estuary Barrage Operation & Maintenance Office, Japan Water Agency	J	Nagara River Estuary Barrage Operation & Maintenance Office and the barrage	Via Inn Hotel, Nagoya
		13:00 16:00 ～	L/O	Visit to Nikko River construction site / lecture: measures against tsunami and storm surge in low-lying area in coastal area of Aichi prefecture	C. Kato/N. Furuhashi	Maintenance Group, Pumping Station Management Division, Kaifu Construction Office, Aichi Prefectural Government	J	Nikko River Branch Office, Aichi Kaifu Construction Office, Aichi Prefectural Government	
10/29	Wed	9:30 ～ 12:00	O	Visits (by ship) to the Nagoya port storm surge breakwater facilities improvement work site	M. Kuroyanagi/A. Jindou	Nagoya Port Office, Chubu Regional Development Bureau, MLIT/Nagoya Port Authority/Aichi Prefectural Government/Nagoya Port Management Union	J	Nagoya Port, Aichi Prefecture	Ochanomizu Hotel Juraku
		13:30 ～ 16:30		Move(by Shinkansen:Nagoya – Tokyo)					
10/30	Thu	9:30 ～ 12:00	P	Summarization of Training	O.Nakazawa	IDEA Consultants, Inc. overseas division	E	Hotel Meeting Rm	Ochanomizu Hotel Juraku
		13:30 ～		Action plan preparations	O.Nakazawa	IDEA Consultants, Inc. overseas division	E	Hotel Meeting Rm	
10/31	Fri	～		Action plan preparations	O.Nakazawa	IDEA Consultants, Inc. overseas division	E	Hotel Meeting Rm	Ochanomizu Hotel Juraku
		～	P	Action plan presentation, evaluation meeting, closing ceremony				Hotel Meeting Rm	
11/1	Sat	～		Departure					

L: Lecture O: Observation P: presentation

List of Participants of Training Course in Japan (19 October 2014 – 01 November 2014)

No.	Name	Position
1	Mr. PRAMANIK Akm Aftab Hossain	Deputy Secretary, Economic Relations Division, Ministry of Finance
2	Mr. HOSSAIN Kazi Sakhawat	Deputy Secretary, Development Wing, Ministry of Water Resources
3	Mr. RASAL Abu Usuf Mohammad	Assistant Chief, Planning Wing, Ministry of Water Resources
4	Mr. KUNDU Jati Das	Chief Engineer (Design), Design Department, BWDB
5	Mr. AKHANDA Md. Abdur Rahman	Director, Directorate of Planning-1, (Project Coordinator), BWDB
6	Mr. ABEDIN Md. Fakhrul	Superintending Engineer, Office of the Chief Planning, BWDB
7	Dr. DAS Shamal Chandra	Executive Engineer/Project Manager, Office of the Chief Planning, (Project Manager), BWDB
8	Mr. KABIR K. M. Humayun	Director, Directorate of Processing, BWDB
9	Mr. SIRAJ Mohammad Shajahan	Executive Engineer, Office of the Chief Planning, BWDB
10	Mr. AHMED Golam Faruque	Deputy Chief, Planning, BWDB
11	Mr. KHAN Kamruzzaman	Sub-Divisional Engineer, Directorate of Planning-III, BWDB
12	Mr. HOSSAIN Mohammad Akbar	Research Officer, Directorate of Planning-1, BWDB

Program of Training Course in Japan (04 October 2015 – 17 October, 2015)

Date		Time Table			Program	Person in Charge/Lecturer		Venue	Accommodation
						Name	Organization		
4 October	Sunday				Arrival in Japan				Tokyo International
5 October	Monday	10:00	～	12:30	JICA Guidance Briefing	Osamu NAKAZAWA	IDEA Consultants, Inc.	TIC, JICA	Tokyo International Center
		14:00	～	16:00	Program Orientation	Osamu NAKAZAWA	IDEA Consultants, Inc.	TIC, JICA	
6 October	Tuesday	10:30	～	12:00	Lecturer on River Management Administration of Japan	Takafumi NAKUI	International Affairs Office, Water and Disaster Management Bureau, MLIT	Headquarters of Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Tokyo, Japan	Tokyo International Center
		13:00	～	16:00	Lecture on Operation& Maintenance of Flood Control Facilities in Japan	Tadashi FUJITA	River Maintenance Planning Office, River Environmental Division, Water and Disaster Management Bureau, MLT		
7 October	Wednesday	9:50	～	10:00	Outline of day's training program	M. MORITA	Deputy Manager,Upper Tone River Office, Kanto Regional Development Bureau, MLIT	Upper Tone river Office, Kanto Regional Development Bureau, MLIT, Saitama	Tokyo International Center
		10:00	～	12:00	Outline of Tone River Basin and Flood Management Measures	Mr. KOMIYAMA	Director, Planning Division,Upper Tone River Office, Kanto Regional Development Bureau, MLIT		
		13:00	～	14:00	Hydrological Observation and Data Utilization	Mr. MOCHIMARU	Director, Survey Division,Upper Tone River Office, Kanto Regional Development Bureau, MLIT		
		14:00	～	15:00	Organaization and Function of Disaster Management Center	Mr. SHINDOU	Director, Disaster Management Division,Upper Tone River Office, Kanto Regional Development Bureau, MLIT		
		15:30	～	16:00	Field inspection of didaster management station and construction site of embankment reinforcement	Mr. SHINDOU	Director, Disaster Management Division,Upper Tone River Office, Kanto Regional Development Bureau, MLIT		
		16:15	～	16:30	Questions and Answers	Ms. Akiko YOGI	Expert, Planning Division, Upper Tone River Office, Kanto Regional Development Bureau, MLIT		
8 October	Thursday	10:00	～	10:10	Outline of Japan Water Agency	Mr. Michio OTA	Manager, International Affiars Division, Water Resources Engineering Department, Japan Water Agency (JWA)	Headquarters of Japan Water Agency, Saitama	Tokyo International Center
		10:10	～		Duties of General Engineering Affairs Department	Mr. Takami SASAKI	Chief, Engineering Affairs Division, General Engineering Affairs Department JWA		
			～		Consturction and Management Technology of JWA				
			～	12:00	Accident Countermeasures for Dam Construction Works				
		13:00	～	16:00	Lecture and Field Inspection of Akigase Barrage, Tone Water Canal Project, JWA	Mr. Satoshi OJIMA	Deputy Director, Akigase Operation and Mintenance Office, Tone Cana; project, JWA	Akigase Operation and Maintenance Office, Tone Canal Project, JWA, Saitama	
9 October	Friday	10:00	～	12:00	Lecturer on River Management and Disaster Mitigation Measures in the Low-lying Area	Tatsuaki ICHIMURA	Chief, Survey Division, Kasumigaura River Office, Kanto Regional Development Bureau, MLIT	Kasumigaura River Office, Kanto Regional Development Bureau, MLIT, Ibaragi	Tokyo International Center
		13:30	～	16:30	Field Inspection of Embankments and Estuary Barrage				
10 October	Saturday	10:30	～	12:20	Disaster Management Learning Center	A guide of the center	Honjo Center for Disaster Management (Life Safety Learning Center), Tokyo Fire Department, Tokyo Metropolitan Government	Honjo Center for Disaster Management , Tokyo	Tokyo International Center
		14:00	～	15:30	Learn about general history and culture of Japan at "Edo-Tokyo Museum"	Guides of the museum	Tokyo Metropolitan Edo-Tokyo Museum	Edo-Tokyo Museum, Sumida-ku, Tokyo	
11 October	Sunday				(Self-study)	Osamu NAKAZAWA	IDEA Consultants, Inc.	TIC	Tokyo International Center
12 October	Monday				Move from Tokyo to Nagoya by super express train	Osamu NAKAZAWA	IDEA Consultants, Inc.		JICA Chubu International Center, Nagoya
					(Self-study)	Osamu NAKAZAWA	IDEA Consultants, Inc.	JICA Chubu International Center	
13 October	Tuesday	9:00	～	12:00	Lecture and Field Inspection of Flood Control Measures in the lower Kiso River Basin (construction site for embankment reinforment works, drainage pumping house, consrtuction site for gate, etc.)	Nobutaka IWATA	Lower Kiso River Office, Chubu Regional Development Bureau, MLIT	Lower Kiso River Office, Chubu Regional Development Bureau, MLIT, Mie	JICA Chubu International Center, Nagoya
		14:00	～	16:00	Lecturer and field inspection of Nagaragawa Estuary Barrage	Mr. Hiryoyuki HANADA	Director, Management Division, Nagaragawa Estuary Barrage Operation & Maintenance Office, JWA	Nagaragawa Estuary Barrage Operation and Maintenance Office, JWA, Mie	
14 October	Wednesday	10:00	～	12:00	Lecture on Countermeasures of Flood and High Tide in the area	Kaoru NISHIMURA	River Division, Construction Department, Aichi Prefectural Government	River Division, Construction Department, Aichi Prefectural Government, Nagoya	JICA Chubu International Center, Nagoya
		13:30	～	16:00	Field Inspection of Disaster Mitigation Facilities of Nagoya Port	Kaoru NISHIMURA			
15 October	Thursday				Move from Nagoya to Tokyo by super express train	Osamu NAKAZAWA	IDEA Consultants, Inc.		Tokyo International Center
		14:00	～	16:00	Preparation of Action Plan, Presentation of Impression of Training by each participant	Osamu NAKAZAWA	IDEA Consultants, Inc.	JICA Headquarters, Tokyo	
16 October	Friday	9:00	～	12:00	Preparation of Action Plan	Osamu NAKAZAWA	IDEA Consultants, Inc.	JICA Headquarters, Tokyo	Tokyo International Center
		14:00	～	16:30	Presentation of Action Plan, Evaluation of Training and Closing Ceremony	Osamu NAKAZAWA	IDEA Consultants, Inc.		
17 October	Saturday				Departure from Japan				

List of Participants of Training Course in Japan (04 October 2015 – 17 October, 2015)

No.	Nominees	Designation	Organization/Address
1	Mrs. Hamida Chowdhury	Deputy Secretary	Development-4 Branch Development Wing Ministry of Water Resources Bangladesh Secretariate Dhaka-1000
2	Mr. Muhammad Hiruzzaman	Deputy Secretary	Audit Branch Audit Wing Ministry of Water Resources Bangladesh Secretariate Dhaka-1000
3	Mr. Khondaker Khalequzzaman	Chief Monitoring	Office of the Monitoring Engineeer Hydrology, BWDB, Dhaka
4	Mr. A. K. Manzur Hasan	Superintending Engineer	Surface Water Hydrology Circle, BWDB, Dhaka
5	Mr. Kazi Tofael Hossain	Superintending Engineer	Office of the Superintending Engineer Design Circle-2 BWDB, Dhaka
6	Mr. Fazlur Rashid	Superintending Engineer/ Director	Planning Directorate-1 BWDB, Dhaka
7	Mr. Harun Ur Rasheed	Superintending Engineer	Office of the Superintending Engineer Design Circle-1 BWDB, Dhaka
8	Mr. Mohammad Enayet Ullah	Executive Engineer	Office of the Planning Directorate-1 BWDB, Dhaka-1000
9	Mr. Faizur Rob Chowdhury	Sub-Divisional Engineer & Executive Engineer (Additional Charge)	Office of the Executive Engineer Moulvibazar O & M Division BWDB, Moulvibazar
10	Mr. Md. Fahad Hasan	Assistant Engineer	Office of the Director Processing Section BWDB, Dhaka
11	Mr. M. L. Shaikat	Assistant Engineer	Office of the Chief Planning BWDB, Dhaka
12	Mrs. Mosammat Shamsad Mahmuda Fatima	Assistant Engineer	Office of the Planning Directorate-1 BWDB, Dhaka-1000

Appendix-7: Deliverables of the Project

Deliverables of the Project are listed below:

Table: List of Deliverables and Timing of Submittal

Report		
	Original Plan	Actual Condition
1. Inception Report	August 2013	August 2013
2. Project Status Report (No.1)	February 2014	February 2014
3. Progress Report	June 2014	June 2014
4. Progress Report (2)	-	July 2015
5. Project Status Report (No. 2)	January 2015	January 2016
6. Interim Report	April 2015	September 2016
7. Project Status Report (No. 3)	December 2015	December 2016
8. Draft Final Report	April 2016	July 2017
9. Final Report	July 2016	September 2017

Due to delay of the activities caused by the continuous hartals and transport blockades, sporadic terror incidents and the time extension of the PRW, the preparation and submittal of reports in the Project is forced to change.

Appendix-8: Minutes of Meetings of Joint Coordination Committee

The 1st Meeting of JCC: O2 September, 2013

BWDB

THE PROJECT FOR CAPACITY DEVELOPMENT OF MANAGEMENT FOR SUSTAINABLE WATER RELATED INFRASTRUCTURE

JICA

MINUTES OF MEETING
BETWEEN
BANGLADESH WATER DEVELOPMENT BOARD
AND
TECHNICAL COOPERATION TEAM
ON
THE PROJECT FOR CAPACITY DEVELOPMENT OF MANAGEMENT FOR SUSTAINABLE WATER RELATED INFRASTRUCTURE

The Technical Cooperation Team (hereinafter referred to as "the JICA Expert Team") dispatched by the Japan International Cooperation Agency (hereinafter referred to as "JICA") has hold a meeting on the Project for Capacity Development of Management for Sustainable Water Related Infrastructure (hereinafter referred to as "the Project"), on the Inception Report of the Project with Bangladesh Water Development Board (hereinafter referred to as "BWDB). As a result of the meeting, BWDB and the JICA Expert Team have agreed with the matters referred to in the document attached hereto.

Dhaka, Bangladesh, September 2nd, 2013

Mr. Md. Azizul Haque
Director General,
BWDB,
Dhaka

Mr. Toshikatsu Imai
Team Leader,
JICA Expert Team,
Japan

Attachments

1. Implementation Structure

   a) Joint Coordination Committee for the Project will be established headed by the Director General of BWDB for the purpose of facilitation of inter-organizational coordination;

   b) The Technical Working Groups will be established for the purpose to reflect the area circumstances to the manuals of design, construction and O&M and to disseminate the manuals.

2. Assignment of Counterpart Personnel

   Counterpart Personnel for the Project will be mobilized from BWDB as indicated in Appendix-1.

3. Project Office

   Project office will be set up in BWDB Head Office in Dhaka for office work of the JICA Expert Team, Counterpart Personnel and TWG.

4. Design and Construction Manuals

4-1 The design and construction manuals to be prepared by the Project cover the river embankment. The design and construction related to the coastal embankment shall be conducted based on the result of CEIP (Coastal Embankment Improvement Project) which has been being implemented by the World Bank targeting the embankment along the Bay of Bengal, because the CEIP has already conducted the detailed study in terms of the design and construction. The Project needs to coordinate closely with CEIP in order to enhance the outcome of both projects.

4-2 In the process of drafting of design and construction manuals of river embankment, the Project will refer to the outcome of the projects

implemented/planned by ADB, for the measures against the serious erosion of the main rivers with dynamic river movement.

4-3 JICA requested BWDB to take a responsibility to avoid the duplication of the activities implemented/planned by the other organizations including government organizations, donors and NGOs for better coordination with them. BWDB agreed to it.

5. Operation and Maintenance Manual

The operation and maintenance manual to be prepared by the Project will target river infrastructures such as river embankment, revetment, spur and sluice gate.

6. Revise of the Design and Construction Manuals

Revise of the Manuals would be conducted through the discussion with BWDB based on the actual works by BWDB.
Revise of the Manuals through the feedback from the pilot project would be also conducted.

7. Pilot Project Site

The pilot project site should be a representative river embankment site in Bangladesh with no particular impact on social and environmental aspects. The selection of the pilot project site should be completed by the middle of November, 2013.

8. Finalization of the Inception Report

BWDB will review the Inception Report (Draft). Based on the review results, the JICA Expert Team and the Counterpart Personnel of BWDB will soon finalize the Inception Report jointly.

End

Appendix-1

BWDB Counterpart Personnel

No.	Duty	Position	Name
1	Project Director	Chief Planning	Mr. Zahirul Islam
2	Project Coordinator	Director Planning 1	Mr. Md. Abdur Rahman Akhanda
3	Project Manager	Executive Engineer	Mr. Naba Kumar Chowdhury
4	Counterparts (C/P)		
4.1	C/P (design)	Chief Engineer, Design	Mr. Jati Das Kundu
4.2	C/P (training)	Chief, Training and Staff Development	Mr. Md. Salim Bhuiyen
4.3	C/P (monitoring)	Chief, Monitoring	Mr. K. M. Nazmul Haque
4.4	C/P (construction/O&M)1	Superintending Engineer in Relevant O&M Circles	To be named
4.5	C/P (construction/O&M)2	Executive Engineer in Relevant Division(s) office	To be named

Participants List of Inception Meeting

02 September, 2013

The Project for Capacity Development of Management for Sustainable Water Related Infrastructure

No.	Name	Title/Organization	Phone No. & E-mail Address	Signature
1	Md. Abdul Mannan	ADG (Planning) / BWDB		
2	Md. Afzalhossain	ADG (WRM), BWDB		
3	Zahirul Islam.	Chief planning. BWDB		
4	Md. Salim Bhuiyan	Chief Training & staff. Development BWDB		
5	K. M. Nazmul Haque	Chief Monitoring BWDB		
6	Md. Sarafat Hossain Khan	Project Co-ordinator CEIP, BWDB		
7	Md. Abdur Rahman Akhanda	Director, Planning-1 BWDB		
8	Md. Abdul Qudus	PD. JMPEMP. BWDB		
9	Michio OTA	JICA Expert		
10	Musa Nurur Rahman	XEN. Planning-1 BWDB		
11	Amanullah	Executive Engineer, BWDB Office of the Chief Planning		
12	Dr. M. K. Eusufzai	Senior Scientific officer River Research Institute (RRI)		
13	Jati Das Kundu	Chief Engr. Design BWDB		
14	Fazlur Rashid	Executive Engineer Planning-1		
15	TANJIR SAIF AHMED	Asst. Engr. Pl-1 BWDB		
16	S.M. Shahidul Haque	CSO to the DG BWDB		

No.	Name	Title/Organization	Phone No. & E-mail Address	Signature
17	PRODIP KR. BISWAS	PI-1, BWDB		
18	S.M. Shahidul Islam	XEN/Satkhira O&M Division-2		
19	Anisuzzaman Chowdhury	Sr. program officer JICA		
20	Naoki Matsumura	JICA Bangladesh office		
21	Yosuke. USUI	DT Leader / O&M JICA Expert Team		
22	Sakanaka	JICA Exppert Team		
23	Tatsuya Mochiduki	JICA expert team		
24	Koichi Kitamura	JICA HQ		
25	Naba Kumar Chowdhury	EE/BWDB		
26	Kazi Sakhawat Hossain	D.S. MoWR		
27	TOSHIKATSU IMAI	Team Leader/River Manageut JICA Expert Team		
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The 2nd Meeting of JCC : 13 July 2014

BWDB

THE PROJECT FOR CAPACITY DEVELOPMENT OF MANAGEMENT FOR SUSTAINABLE WATER RELATED INFRASTRUCTURE

MINUTES OF MEETING
BETWEEN
THE BANGLADESH WATER DEVELOPMENT BOARD
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY
ON
THE PROJECT FOR CAPACITY DEVELOPMENT OF MANAGEMENT FOR SUSTAINABLE WATER RELATED INFRASTRUCTURE

The 2nd Meeting of Joint Coordination Committee (hereinafter referred to as "the JCC") of the Project for Capacity Development of Management for Sustainable Water Related Infrastructure (hereinafter referred to as "the Project") was held on July 13th, 2014 on the Progress Report with the attendance of the concerned officials of Bangladesh Water Development Board (hereinafter referred to as "BWDB"), other authorities concerned of the Project, the concerned officials of the Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Technical Cooperation Team (hereinafter referred to as "the JICA Expert Team") dispatched by JICA. The meeting was chaired by the Director General of BWDB. The attendance list is attached hereto.
As a result of the meeting, the JCC has agreed with the matters referred to in the document attached hereto.

Dhaka, Bangladesh, July 24th, 2014

Md. Shahidur Rahman
Director General, BWDB,
Dhaka

Toshikatsu IMAI
Team Leader,
JICA Expert Team,
Japan

Decisions of the JCC Meeting

1. Delay of the project activities

   The JICA Expert Team explained the delay of the project activities due to the continuous hartal and blockades. The JCC understood the present situation and agreed the assistance to the project activities to catch up on the original schedule.

2. Pilot Project and Model O&M Activities

   The JICA Expert Team explained that the pilot project site was selected from 14 investigation sites of the embankment failure, and the pilot project and the model O&M activities will be implemented at Moulvibazar.
   The JCC agreed the implementation of the pilot project and model O&M activities at the Moulvibazar.

3. Pilot Project and Draft Manuals for Design and Construction of Embankment

   The JICA Expert Team explained that preparation of the manuals for design and construction of embankment will be conducted in parallel with preparation of detailed design of the pilot project works, because of the delay of the project activities due to the continuous hartals and blockades. However, both activities will be conducted based on the discussion between the Counterpart of BWDB and the JICA Expert Team. The JCC understood the situation.

4. Objectively Verifiable Indicators of the Project Design Matrix of the Project

   The JICA Expert Team requested to determine the objectively verifiable indicators of the Project Design Matrix of the Project. The JCC agreed that the indicators shall be determined in the Technical Working Groups of the Project during the early stage of the next period.

5. Seminar/Workshop

   The JICA Expert Team proposed that the first seminar will be held after the analysis of the on-going soil investigation. The JCC agreed the proposal.

6. Finalization of the Progress Report

   BWDB and the authorities concerned to the Project will review the Progress Report (Draft). Based on the review results, the JICA Expert Team and the Counterpart Personnel of BWDB will soon finalize the Progress Report jointly.

7. Other Matters Discussed: as shown in the following pages; Discussions in the JCC Meeting on July 13, 2014.

End

Discussions in the JCC Meeting on July 13, 2014

1. Mr. Maqbul Hossain, Director Planning-2, BWDB:

   - In table 6.2 it is mentioned that SWAIWRPMP project is completed but actually the project is not completed, it is now on-going. It should be corrected.
   - In page 50 it is mentioned that local people agreed to donate land for embankment verbally, but verbal agreement is not sufficient, written consent needs to be taken.
   - Both were noted by JICA Expert Team.

2. Mr. Md. Giash Uddin Ahmed, ADG, Eastern Region, BWDB:

   - The soil on coastal area is very different from that of the other area of the country. He proposes to implement another pilot project in coastal region.
   - JICA Expert Team answered that it is not possible because the scope of the Project is limited. The pilot project could be implemented only at one site.

3. Mr. G. C Sutradhar, Chief Planning, BWDB:

   - It is proposed to consider one pilot project site for each type of embankment category.
   - JICA Expert Team answered that it is not possible because the scope of the Project is limited. The pilot project could be implemented only at one site.

4. Mr. Md. Amirul Hossain, Executive Engineer, Flood Forecasting and Warning Center, BWDB :

   - Tidal area water level data collection is very difficult. In Bhola and Chandpur, Water level is being collected by them with sensor, which can be used by the project. He proposes to include hydrology personnel in technical working group. He proposes to fix an auto gauge at pilot site under this project. He informed that 19 non tidal and 10 tidal auto gauge are planned to be installed under WMIP project all over the country.
   - JICA Expert Team took note of the proposal.

5. Mr. Ahmed Arif Rashid, Sr. Mechanical engineer, Bangladesh Meteorological Department (BMD):

   - The meeting is informed that JICA project completed in BMD have been very helpful for people and the commitment is made to cooperate with the study team with any data required.
   - JICA Expert Team welcomes the proposal.

6. Mr. M. R. Sazzad, Executive Engineer, Design , BWDB:

   - The subject is very technical in nature and should be reviewed attentively. For improvement of O&M manual, O&M manual prepared by WMIP should be used.
   - JICA Expert Team agreed to review the proposal.

7. Mr. Netai Dey Sarker, Asst. Director, Department of Disaster Management (DDM):

   - Risk element in embankment should be attended and included in manual. Earthquake zoning map is available and should be used. Flood level mapping with different return period is going on in DDM project. It should be used in this project.
   - JICA Expert Team thanks the provision of the information. JICA Expert Team will review the information.

8. Mr. Shamal Chandra Das, Project Manager, Chief planning office, BWDB:

   - It is proposed to provide stability analysis of four types of embankment as described in the report in the light of type of soil.
   - JICA Expert Team plans to conduct the stability analysis for 3 categories except Haor area, but the test cases are 4 since the test for A-category will be conducted for 2 cases for 2 types of sand sizes.

   - The subject on Geophysical Exploration conducted in Comilla and Moulvibazar was not reported in the presentation. This is very new information for Bangladesh. Next time this issue should be reported in the presentation.
   - JICA Expert Team agreed with the proposal.

9. Mr. Jahangir Kabir, Superintending Engineer , Design circle1, BWDB:

   - It is mentioned that design office is exchanging views with the consultant from time to time. To update the present manual, it is necessary to consider the extreme climate change and the present hydrological and environmental situation. Earthquake also needs to be considered for design of embankment including other environmental and social issues.
   - JICA Expert Team noted the proposal.

Participant List of JCC Meeting

July 13, 2014

The Project for Capacity Development of Management for Sustainable Water Related Infrastructure

No.	Name	Title/Organization	Phone № & Email Address	Signature
1	MD. ANSARALI MIAN	ADG (Planning)		
2	Md. Ismail Hossain	Chief Engineer BWDB		
3	G.C. Sutradhar	Chief planning BWDB		
4	Md. Abdur Rahman Akhanda	Director/Planning-1 BWDB		
5	MD. MAQBUL HUSSAIN	Director/Planning-2 BWDB		
6	Md Fakhrul Abedin	SE, office of the chief planning, project Director, Hor.		
7	Md. Mahfuzur Rahman	project coordination Director, CDSP-IV BWDB		
8	Engr. M. R. Sajjad, Peng.	Executive Engineer design, BWDB		
9	Md. Shahjahan Siraj	Executive Engineer office of chief planning		
10	Kazi Rezaul Karim	Principal Scientific Officer, River Morphology Institute		
11	Dr. Shamal Ch. Das	E. E. / BWDB		
12	Md. Akbar Hossain	Research officer Planning-1, BWDB		
13	Netai Dey Sarker	AD(GIS), DDM		
14	Md. Amjazul Hossain	E.E., FFWC BWDB		
15	Md. Akmal Hossain	ACE, BWDB CRGSP.		
16	Md. Mahbur Rahman	EE/ Chief Monitoring Off.		
17	Md. Jahangir Kabir	SP/ Design cirkle-1		
18	Md. Mutahar Hussain	SE, Monitoring BWDB		
19	Ginga Nakadai	JICA		
20	Naoki Matsumura	JICA Bangladesh office		
21	A.Q. Md Ali	JICA Study Team Sr. Expert		

No.	Name	Title/Organization	Phone No. & Email Address	Signature
22	Shutaro Sakanaka	JICA Expert		
23	Toshitsu TANIAI	JICA Expert		
24	Tatsuya Mochizuki	JICA expert		
25	Md. Giash uddin Ahmed	ADG (E.R) BWDA		
26	Mr. R. A. Khan	SE - Ganges Barrage study Pro.		
27	AHMED ARIF RASHID	Snr. Mech. Engr. BMD		
28	Toshikatsu Imai	JICA Expert		
29	Muntasir Ibn Mohsin	Administrator JICA Expert Team		
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The 3rd Meeting of JCC: 27 July 2017

MINUTES OF MEETING
BETWEEN
THE BANGLADESH WATER DEVELOPMENT BOARD
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY
ON
THE PROJECT FOR CAPACITY DEVELOPMENT OF MANAGEMENT FOR SUSTAINABLE WATER RELATED INFRASTRUCTURE

The 3rd Joint Coordination Committee (hereinafter referred to as "the 3rd JCC") of the Project for Capacity Development of Management for Sustainable Water Related Infrastructure (hereinafter referred to as "the Project") was held on July 27th, 2015 on the Progress Report (2) with the attendance of the Bangladesh Water Development Board (hereinafter referred to as "BWDB), other authorities concerned of the Project, the Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Technical Expert Team (hereinafter referred to as "the JICA Expert Team") dispatched by JICA.

As a result of the meeting, the 3rd JCC has agreed with the matters referred to in the document attached hereto.

Dhaka, Bangladesh, July , 2015

05.8.2015

Md. Ismail Hossain
Director General,
BWDB

05.08.2015

Yosuke Usui
Team Leader,
JICA Expert Team

Discussions in the 3rd JCC Meeting

The 3rd JCC Meeting was held on July 27th, 2015 in BWDB conference room to discuss and review the Draft Progress Report(2) (PR(2)) of the Project for Capacity Development of Management of Sustainable Water related Infrastructure. The meeting was presided over by Mr.Md.Ismail Hossain,DG/BWDB.The list of the participants attending the meeting are attached in Annexure-1

At the outset, DG, BWDB welcomes everybody attending the meeting. Then Mr. Md. Mahfuzur Rahman, Chief Planning gave a brief resume of the project and stated that this is the 3rd meeting of JCC to review the Draft PR(2) submitted by JICA Expert Team. He then requested DG/BWDB to conduct the meeting.

At that stage DG, BWDB requested Mr. Usui,Team Leader of the JICA Expert Team to present the report. Mr. Usui made a short but informative power point presentation of the report which includes Background of the project,Outline,Contents of the Draft Progress Report(2),Progress of major topics and Activity Plan from August/15 to May2016. He spoke about the embankment failures in BWDB at different places and explained the reason of failure with analysis done by the Project. He also mentioned about the status of preparation of Draft Design Manual, Draft Construction Manual, Draft O&M Manual of Hydraulic Structure GIS data base etc. those will be prepared under the under the study in his deliberations.

DG, BWDB then gave thanks to Mr. Usui for his presentation and declares the floor open for discussion and comments.

In all 5(five) officials took part in discussion and comments which are narrated below.

Mr. Fazlur Rashid, Director, Planning-1 and PC(Project Coordinator).

He said that written comments will be handed over to the consultant and he mentioned the following points:

Photograph related to chaos during tender opening may not be included in the report.

The statement made that "every year BWDB rate schedule is revised" in the report is not always true rather it is revised as and when required as per market situation.

Whether Hydraulic structures of all BWDB areas considered or not.
Experience from the pilot project may be applied in other cases.

05.8.2015

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05.08.2015

Mr. Md. Harunur Rasheed, SE, Design Circle-1

He has given written comments but he mentioned certain points as below:

Information provided in different documents such as Draft Design Manual, and its attachments. The Drat PR(2)has got small anomalies which should be corrected. In page 80-82 of the Draft PR(2) calculation for alpha has been done considering 1:2 slope only but calculation for any other slope may also be given. Also value of alpha is different in different documents which may be corrected.

Only coefficient of roughness for C.C. Blocks has been mentioned. Coefficients for hard rock, geo-bag, etc. may be provided in the draft manual.

In page 15 A1/S3 the term RE used may be explained.
In the calculation of free board the value of constant q may be provided.

Mr.Shamal Chandra Das, XEN, Chief Planning office and Project Manager.
He said that he will hand over some written comments but he mentioned some of the points.

In one page the project duration has been mentioned as 3 years but it is actually now 4 years which may be corrected.

It is mentioned in the report that BWDB has 8 Zones but actually it will be 9 zones.

It is observed that in updating the Design Manual only BWDB standard Design Manual has been reviewed.

But there are other guide line and Manual also.It should be clarified whether those has been considered or not.

Function of the projected block may be explained in detail.

Mr. Md. Abdur Rahman Ahkanda, Chief Training.

He wanted to know that whether new phenomenon of design will be tested in the Pilot Project or not.

DG, BWDB

He raised certain points as follows:

In the presentation and report compaction scenario for one type of embankment has been given but what about other type of embankment compaction criterion?

05.8.2015

05.08.2015

The soil of Bangladesh is different than Japanese soil. So from Bangladesh context the compaction scenario may be explained in more detail manner i. e. degree of compaction scenario may be explained and stated whether it can be attainable.

In the draft design manual what is meant by fundamental idea behind design should be explained.

Avoidance of sophisticated soil test should also be explained.

Earthquake has been considered but climate change should also be considered.

MrUsui replied some of the points in short and confirmed that appropriate answer and information will be given in the final version of the PR(2).

After thread bare discussion the following decision were made:

1. **The JICA Expert Team will incorporate all written suggestions /comments made and also suggestions/comments raised in the meeting and submit the final Progress Report (2) in due time.**
2. **Subject to incorporation of all suggestions/comments the PR-2 is accepted**
3. **The project should be completed within the extended time of 4 years by August, 2017.**

The meeting ended with thanks from the chair.

5.8.2015

05.08.2015

Participant List of JCC Meeting

July 27, 2015

The Project for Capacity Development of Management for Sustainable Water Related Infrastructure

No.	Name	Title/Organization	Phone No. & Email Address	Signature
1				
2				
3	Fazlur Rashid	Director, PI-I BWDB		
4	Md. Harun ur Rashid	SE, Design Circle-1 BWDB		
5	Sujoy Chakma	Director, Planning-III BWDB.		
6	Saeda Nazneen	Chief Engineer O&M, BWDB		
7	Provati Mukherjee	Chief Engineer Hydrology, BWDB		
8	Md. Abdur Rahman Akhanda	Chief Training & SD BWDB		
9	Khondaker Khalequzzaman	Chief Monitoring BWDB.		
10	Abul Kalam Azad	CE/Central Zone BWDB, Dhaka		
11	Md. Shamsuddoha	PD/PMU-BPP BWDB, Dhaka		

No.	Name	Title/Organization	Phone No. & Email Address	Signature
12	Md. Fazlul Karim	Chief Soil & Agriculture Survey officer CWM, BWDB Dhaka		
13	Nasrin Jahan	JICA Project officer		
14	Kazi Rezaul Karim CSO, RRI, Faridpur	chief scientific Officer, Riv Research Inst		
15	M. Nazmul Islam	AE, Directorate of Planning - I, BWDB		
16	Ashutosh Barmen	AE, office of the chief planning, BWDB.		
17	Mostafizur Rahman	Programmer, BWDB		
18	Md. Zahedur Rahman	SDE, Chief planning BWDB		
19	Liton Kumer Sarker	SDE, Chief Planning BWDB		
20	Shamsad Mahmuda Fatima	AE, planning-1, BWDB, Dhaka		
21	M. L. Shaikat	AE, office of the chief planning BWDB Dhaka		
22	M. Abdur Rakib	AE, office of the chief planning, BWDB, Dhaka		
23	TANJIR SAIF AHMED	Asst. Engr. Plan-1 BWDB		

No.	Name	Title/Organization	Phone No. & Email Address	Signature
24	Md. Amirul Hossain	Executive Engr. FFWC, BWDB		
25	Dhirendra Nath Sarker.	S.E/BWDB. Moulvibazar.		
26	Dr. Shamal Chandra Das	Executive Engr. Office of the C/P. BWDB.		
27	Md Fakhrul Abedin Project Director Haor Flood Management & Livelihood Improvement Project	Project Director HFM&LIP BWDB. Dhaka		
28	Md. Mahfuzur Rahman	chief planning BWDB		
29	Md. Abdul Basit	Executive Engr; BWDB Design-6		
30	Saleh Ahmed	Executive Engineer BWDB, planning		
31	Koichi Kitamura	JICA		
32	Kazumitsu MURAOKA	JICA Expert to BWDB		
33	Rathindra Nath Roy	Assistant chief. MoWR.		
34	Hasan Zubair	Senior Local Expert JICA		
35	Yosuke USUI	JICA Expert Team		

The 4th Meeting of JCC: 17 July, 2017

MINUTES OF THE REVIEW MEETING

BETWEEN

BANGLADESH WATER DEVELOPMENT BOARD (BWDB)
AND
JAPAN INTERNATIONAL CO-OPERATION AGENCY (JICA)

ON

THE PROJECT FOR CAPACITY DEVELOPMENT OF MANAGEMENT FOR SUSTAINABLE WATER RELATED INFRASTRUCTURE

The 4th Joint Coordination Committee (hereinafter referred to as "the 4th JCC") meeting on the Draft Final Report (hereinafter referred to as "DFR") of the Project for Capacity Development of Management for Sustainable Water Related Infrastructure (hereinafter referred to as "the Project") was held on July 17, 2017. Participants from Bangladesh Water Development Board (hereinafter referred to as "BWDB"), other authorities concerned with the Project, Japan International Cooperation Agency (hereinafter referred to as "JICA") and the Technical Expert Team (hereinafter referred to as "the JICA Expert Team") dispatched by JICA attended the meeting.

In line with the fruitful discussion between the parties present there, the 4th JCC has agreed with the matters as meeting outputs inked in the document attached hereto.

Dhaka, Bangladesh, July 20, 2017

20.07.2017

Md. Mahfuzur Rahman
Director General,
BWDB

20/Jul/2017

Yosuke USUI
Team Leader/River management,
JICA Expert Team

Discussion in the 4th JCC Meeting

The 4th JCC Meeting was held on July 17, 2017 at BWDB conference room, 3rd floor, WAPDA Building, motijheel C/A, Dhaka-1229 to review the Draft Final Report (DFR) of the Project for Capacity Development of Management for Sustainable Water related Infrastructure. Mr. Md. Mahfuzur Rahman, Director General, BWDB presided over the meeting. The list of the participants attending the meeting is attached in Annexure-1.

At the outset, in response to the offer from the chair, all the participants present gave self-introduction. Then recitation from the Holy Quran was made.

Discussion started with opening remarks from Mr. Hitoshi Ara, senior representative of JICA Bangladesh office. He invited concerned personnel from BWDB and other organizations to keenly look into the contents, outputs and recommendations of the DFR and make valuable comments, if needed. The JICA Expert Team would address the comments and reflect necessary compliances in the Final Report, he said. He exclaimed the status of the on-going work as the final stage of the Project. JICA Experts would describe the DFR, activities so far done relating to preparation of manuals, the pilot repair work, model O&M activities, GIS database establishment and other associated activities done under this Project. He appreciated all-out cooperation from BWDB.

Mr. A.M. Aminul Haque, Chief Planning, BWDB, Dhaka expressed hope on enhancing capacity of BWDB in managing water related infrastructures through practice of the prepared manuals and upgrading of those on situational demand time to time.

Mr. Md. Mahfuzur Rahman, Director General, BWDB reminisced his impression on the Project during his tenure as Chief Planning, BWDB, Dhaka and expressed gratitude to JICA and The Expert Team for successfully completing the tasks taken up under the Project. Sharing the memories of his visit to the pilot repair works site, he admired introduction of sophisticated quality of works as pilot structures. Moreover, he invited JICA to think of picking up other water resources fields of interests like the major rivers & coastal areas in joint collaboration with BWDB. He pointed out Jamalpur and

1

Sirajganj as specific districts facing severe river bank erosion problems leading to loss of valuable lands every year. He intensified on customization of the achievements from the present work for construction of embankments along the banks of Jamuna River. He expressed interest on extended research and sharing of experiences to manage major rivers better way. He suggested commencement of O & M practices one by one from Moulvibazar district following the prepared O & M manual. Customization of the manuals for flush type rivers and then major rivers with joint collaboration between BWDB and JICA would be highly appreciated, he said. He shared his experiences of Japanese protection from coastal erosion as well as introduction of super levees along important locations for safety of mega cities from flood during his visit to Japan and envisaged appreciable improvements in coastal embankments with JICA cooperation in Bangladesh.

With the speech of the Director General, BWDB, the first session of the JCC meeting came to an end. After the tea break, the second session was commenced under the chairmanship of Mr. Md. Abdur Rahman Akhanda, Additional Director General (Planning), BWDB, Dhaka.

The Chair of the second session welcomed all the participants and offered JICA Expert Team to present the DFR. In response to him, Mr. Yosuke Usui, Team Leader/River management, JICA Expert Team presented DFR. He mentioned outline of the project, the goals and outputs, background and necessity of extension of the project period, short brief on the manuals and the action plan for dissemination & effective use of the prepared manuals for convenience of BWDB. After his presentation, the floor was open for discussion.

Mr. S M Shahidul Islam, Superintending Engineer, Moulvibazar O & M Circle, BWDB, Moulvibazar expressed his satisfaction on the over-all activities conducted by JICA Expert Team under the Project. However, he expressed his concern on the high expenditure of such construction and capacity of BWDB as well as GoB to make such expenditure in O & M purposes. The chair asked if there was scope to improve our existing practices of O & M. Such initiative might need extra expenditure, Superintending Engineer, Moulvibazar O & M Circle, BWDB, Moulvibazar replied.

Mr. Fazlur Rashid, Director, Planning I, BWDB, Dhaka picked a portion of presentaion and asked the reason why the Expert Team faced difficulty in soil test.

Mr. Yosuke Usui, Team Leader/River management, JICA Expert Team shared difficulty in soil type investigation due to lack of local facilities. In response to him, the chair replied that BWDB has already taken up initiatives for establishing its own laboratories at zonal level. He opined that after commissioning of the laboratories, the problems relating to material investigation through laboratory experiments might be solved.

Mr. Md. Harunur Rasheed, Superintending Engineer, Design Circle 2, BWDB, Dhaka shared point shooting learning from the Project. His speech covered three major points of improvement. He appreciated completion of sequential dumping first leading to slope placing works. BWDB conventional practice of partially dumping, then partial placing again returning to the rest of the dumping works should be changed to completion of dumping and then placing, he opined. About following procedure of time extension, he said that this pilot work was scheduled up to Apr/2016. However it could not be completed due to early flood and deteriorated weather condition. The Expert Team, JICA and BWDB discussed the matter and extended time up to May 2017. Accordingly the works were completed maintaining formalities. He recommended BWDB colleagues to maintain formalities of time extension, if required following necessary procedure in time. He also iterated good practices of compaction during the Pilot repair works. 230 mm depth of every layer was maintained during compaction. He felt necessity to take care while conducting compaction works during embankment construction under BWDB supervision.

Mr. A.M. Aminul Haque, Chief Planning, BWDB, Dhaka discussed presence of multiple types of soil particles during construction of embankments. Performance of soil particles might vary with inter-molecular combination, he added. He shared on-going test of performance of different composition of embankment materials in terms of seepage, sliding of embankment, and characteristics of soil using physical model. He suggested devising scopes for incorporation of mathematical modeling software for determining composition of soil particles for construction of earthen embankment. He also suggested discussing any new improvement in the prepared manuals.

Dr. Md. Lutfar Rahman, Director General, River Research Institute (RRI) offered his manpower to run BWDB laboratories, if required. In reply, the chair said BWDB would run the laboratories using their own manpower. He saw no scope to utilize RRI

manpower in this regard. However, RRI could train up BWDB's manpower if required, he opined.

Mr. Koichi Kitamura from JICA told the house that learning starts through this project. He suggested practicing the prepared guidelines and then learning by doing would be attained. He suggested that any O & M works should be based on good inventory survey, O & M plan, etc. Such proper documentation is necessary to convince the authority to place O & M fund. So BWDB should work to improve the inventory survey and make good O & M plan and prepare appropriate priority list to convince the authority for O & M fund.

Mr. Hitoshi Ara, Senior Representative, JICA Bangladesh Office suggested that the Executive summary would be reframed including the presentation contents as well as the project outputs. He wanted to know whether thi manuals are standard manuals and could be used at all zones of BWDB. Mr. Mochizuki, Expert for Design, JICA Expert Team the manuals as standard manual and could be used in all of zones with certain modifications. In response to a query of the Chair, the manuals were prepared for the embankment part only.

Mr. Md. Abdus Salam, Director O&M, BWDB, asked if there was any scope to assist GoB in terms of O & M Budget. Mr. Hitoshi Ara replied that the budget of Bangladesh increased and BWDB budget also would increase. BWDB should handle O & M by their own budget.

Mr. Sajal Kumar Roy, Assistant Engineer, Office of Chief Monitoring, BWDB, Dhaka asked to take care of the dynamic flow condition and homogeneity of soil particles while designing the embankments. He was later instructed to give written comments in details following proper official channel to Director, Planning-1, BWDB, Dhaka for review and incorporation in the Final Report.

Mr. Mahfuz Ahamad, Chief Water Management, BWDB, Dhaka mentioned that in the manual the role of stakeholders could be accommodated and recommendations should be mentioned about plantation plan on embankment and the agreement with the Department of Forests.

The Chair instructed all the participants to submit written comments on the DFR within 31st July, 2017 to the Directorate of Planning-1, BWDB, Dhaka.

Dr. Shamal Chandra Das, Executive Engineer, Office of Chief Planning, BWDB, Dhaka

and Project Manager sought attention regarding formation of sub-committee for implementation of the Action plan specially related to O & M activities. The Chair termed it as BWDB's internal issue and it would be looked into after completion of the Project.

Mr. A.K. Manzur Hasan, Chief Engineer, Hydrology, BWDB, Dhaka offered JICA to extend such type of activities in the coastal region and Haor areas.

Mr. Fazlur Rashid, Director, Planning-1, BWDB, Dhaka gave thanks giving speech to JICA for taking such praise-worthy initiative. He welcomed introducing the projected blocks in pilot project with a view to reducing the velocity and attract silt deposition.

Mr. Kazumitsu Muraoka, JICA Expert to BWDB said thanks to the experts and BWDB for such cooperative approach and expressed hope for long-term JICA-BWDB collaborative activities in future.

After thread bare discussion, the following conclusions were made:

1. The project period should be extended up to 31st October, 2017 and the project duration would be 4 years and 3 months.
2. BWDB would submit the comments on DFR, if found within 31st July, 2017.
3. All suggestions/comments would be incorporated and the Final Report including action plan for utilization of manuals. The Final Report would be approved by competent authority by the completion of the Project.

The meeting ended with vote of thanks from the Chair.

Annexure-1

Participant List
for
Joint Coordination Committee (JCC) Meeting

The Project for Capacity Development of Management for Sustainable Water Related Infrastructure

Date: July 17, 2017

Time: 09:30 am – 13:03 pm

Venue: Conference Room, the 3rd Floor, WAPDA Building, Motijheel, BWDB

No	Name	Title/Organization	Phone No Email Address	Signature
1	Md. Abdur Rahman Khanda	ADG(P) BWDB		
2	Hitoshi AIKA	Senior Representative JICA Bangladesh Office		
3	Mohammad Shahabuddin	Chief Engr. Training and staff Div.		
4	Saeeda Nazneen	Chief Engineer Design, BWDB		
5	A.K. Manzur Hasan	Addl. Chief Engr. Hydrology, BWDB.		
6	Md. Harun ur Rashid	Superintending Engineer Design Circle-2 BWDB		
7	A.M. Aminul Haque	Chief Planning BWDB		
8	Koichi Kitamura	JICA		

Annexure-1

No	Name	Title/Organization	Phone No Email Address	Signature
9	Md Fakhrul Abedin Addl. chief Engr/PD HFMLIP, BWDB	BWDB		
10	Mahfuz Ahamad Chief Water Manage-ment, BWDB	BWDB		
11	Md. Shamsuddoha Project Co-ordinating Director CDSP-IV, BWDB	BWDB		
12	Tariq A. Al Fayyaz Executive Engineer CDSP-IV, BWDB	BWDB		
13	Md. Abdus Salam	Director, O&M BWDB		
14	Fazlur Rashid	Director Planning-1 BWDB, Dhaka		
15	Md. Enamul Islam	CSO to DG		
16	Mohammad Harun Ar Rashid Deputy Secretary	Deputy-Director MIM, Department of Disaster Management		
17				
18				

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Annexure-1

No	Name	Title/Organization	Phone No Email Address	Signature
19	Dr. Engr. Md. Lutfor Rahmen	Director General River Research Institute		
20	Tatsuya Mochizuki	JICA expert Team. Member		
21	Yosuke Usui	JICA Expert Team T/L		
22	Md. Hasan Zubair	JICA Senior Expert		
23	Johji KOIZUMI	JICA Expert Team, construction		
24	Kazumitsu Muraoka	JICA Expert to BWDB		
25	S. M. SHAHIDUL ISLAM	Superintending Engineer, Moulvibazar Circle. BWDB		
26	Dr. Shamal Chandra Das	Executive Engr Office of The C/P BWDB		
27	TANJIR SAIF AHMED	SDE, A-1, BWDB		
28	Nasreen Islam Mukti	AE (Civil), P1-1, BWDB		

Annexure-1

No	Name	Title/Organization	Phone No Email Address	Signature
29	Tasnia Hoque	Assistant Engineer, Planning-1 BWDB, Dhaka.		
30	Ashutosh Barman	Sub-Divisional Engineer, Office of the Chief Planning, BWDB, Dhaka.		
31	Sajal Kumar Roy AE, Chief Monitoring BWDB	BWDB		
32	Md. Sumon Miah	SDE, planning-1 BWDB.		
33				
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Appnedix-9: Record of Other Activities related to the Project

In order to facilitate implementation of the model activities and development of the model GIS database in the selected field office of BWDB, the inventory survey of the structures managed by the selected field office (Moulvibazar O&M division office) had been conducted.
There are 19 water development schemes/projects completed in the jurisdictional area of the Moulvibazar O&M division office, with the purposes of flood control, drainage improvement, irrigation development, town protection and bank protection, and there are many structures managed by the office. The locations of the structures managed by the office are grasped by the officials in the fields. However, there no location map and no ledger of managed structures shared in the office. In addition, the reports related to the completed projects were scattered and lost.
Considering the above situation and staff shortage in the office, the inventory survey of the managed structures of the office has been conducted as the first step of the model activities by committing to the local consultant's firm. Outline of survey are as shown in table below:

Table: Outline of Inventory Survey of Hydraulic Structure of Model O&M Division

Name of Survey	Inventory Survey of Hydraulic Structures of Water Resources Development Schemes in Moulvibazar O&M Division, BWDB
Owner of Contract	JICA Bangladesh Office (JICA long-term expert to BWDB)
Survey Period	Sep/2015 to Mar/2016
Objective of Survey	To clarify the locations, major specifications and present conditions of hydraulic structures constructed and managed by the Moulvibazar O&M Division Office.
Scope of Survey	a. To clarify the approximate locations of all hydraulic structures constructed and managed by the Moulvibazar O&M Division Office, through interviews with the officials of the O&M office and with local people. b. To conduct the field investigation of the hydraulic structures in the jurisdictional area of the O&M office along the Manu River, in order to clarify the precise location, basic specifications and existing condition of the structures. c. To summarize the field data and records and to provide report.
Objective Structure	- River channel - Drainage channel - Irrigation canal - Appurtenant Structure Embankment, Bank and foot protection work, groin/ spur dike, road, bridge/culvert, - Water Control Structures Barrage/large regulator, sluice/escape, aqueduct, siphon, pump station

This survey had been conducted with the financial support by JICA long-term expert to BWDB, also as a pilot activity for dissemination of the inventory survey and the GIS database to all O&M division office of BWDB. In addition to this survey, a similar survey was conducted in the Cox's Bazar O&M Division.
During the early stage of the inventory survey, an expert of the JICA Expert Team joined the inventory survey team through collection of data and information with the interviews from the staff in the office and inhabitants in the field and inspections at the sites. The survey result was compiled as the hydraulic structures inventory. After the project, O&M division office should conduct the survey themselves or instruct the local consultant to survey. The JICA Expert gave C/P guidance on preparation of hydraulic structures inventory. Main points of it are as follows:

- Hydraulic structures inventory is prepared in order to be utilized for O&M.
- Therefore, the inventory should provide the information required for O&M.
- Items to be described are structure's type, urgency of repair, dimension, damaged situation, influence by damage, etc.