2020-21

Government of the People's Republic of Bangladesh
Ministry of Water Resources

Bangladesh Water Development Board

PROJECT COMPLETION REPORT : IMED 04/2003 (Revised)

for

Feasibility Study for Re-excavation of Shuvadya Khal along with Development and Protection of its both Banks at Keraniganj Upazila in Dhaka District

August, 2021

Government of the People's Republic of Bangladesh
Ministry of Planning
Implementation Monitoring and Evaluation Division

PROJECT COMPLETION REPORT : IMED 04/2003 (Revised)

A. PROJECT DESCRIPTION :

01.	**Name of the Project**	:	Feasibility Study for Re-excavation of Shuvadya Khal along with Development and Protection of its both Banks at Keraniganj Upazila in Dhaka District **(Project code-222010600)**
02.	**Administrative Ministry/Division**	:	Ministry of Water Resources (MoWR)
03.	**Executing Agency**	:	Bangladesh Water Development Board (BWDB)
04.	**Location of the Project**	:	Keraniganj, Dhaka

05. Objective of the Project:

The main objective of the study is to assess the feasibility of the envisaged re-excavation of Shuvadya khal from technical point of view and find out suitable option for development and protection of both banks of Shuvadya khal as well as improvement of navigability in the study area considering technical, financial, social and environmental aspects.
The specific objectives of the study are:

Technical:

- To assess water retention capacity and availability of surface water resources of Shuvadya khal;
- To identify the obstacles and encroachments along both banks of Shuvadya Khal and recommendations to uproot all the impediments to ensuring flow through the khal.
- To improve drainage situation and navigation facilities of the project area.
- To identify the most effective improvement and protection measures for both banks of Shuvadya khal and find suitable option for several public amenities, pathways, recreational and communication facilities.
- To assess the feasibility of infrastructures (Walkway, Cantilever walkway/causeway, cantilever deck, floating deck, viaduct, sewerage treatment plant, solar power plant, street furniture, watch tower foot over bridge, road bridge, replacement/ renovation of existing bridge) construction for the development and maintenance of Shuvadya Khal.
- To provide detail design of excavation/ re-excavation of khal/ canal and all types of proposed interventions / infrastructures;
- To prepare afforestation plan considering classification of trees.
- To prepare dredged material management plan.

Environmental and Social:

- To prepare an Environmental and Social Impact Assessment (ESIA) study.
- Preparation of biodiversity conservation plan.
- To prepare Environmental Monitoring and Management Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.

06. Estimated Cost :

(In lakh Taka)

	Original	Latest Revised
(a) Total	322.50	-
(b) Taka	322.50	-
(c) Foreign Currency	-	-
(d) Project Aid	-	-
(e) RPA	-	-

07.	Date of Approval	:	PCP/PFS	PP
(a) Original		:	22.07.2020	
(b) Latest Revised		:	-	
(c) No Cost Time Extension		:	05.01.2021	

08. Implementation Period :

	Date of Commencement	Date of Completion
(a) Original	July 2020	January 2021
(b) Latest Revised	-	-
(c) Actual	July 2020	June 2021

09. Financing Arrangement (Source-wise):

9.1 Status of Loan/Grant

a) Foreign Financing : *Not Applicable*

Source (s)	Currency as per Agreement	Amount in US $ (Million)	Nature (Loan/Grant/ supplier's/ credit)	Date of Agreement	Date of Effective-ness	Date of Closing	
						Original	Revised
1	2	3	4	5	6	7	8

b) GOB:

(In lakh Taka)

Total amount	Loan	Grant	Cash Foreign Exchange
1	2	3	4
322.50	-	322.50	-

9.2 Utilization of Project Aid: *Not Applicable*

(In million)

Source (s)	Total Amount		Actual Expenditure		Unutilized Amount	
	In US $	In Local Currency	In US $	In Local Currency	In US $	In Local Currency
1	2	3	4	5	6	7

9.3 Re-imbursible Project Aid (RPA): *Not Applicable*

(In lakh Taka)

R P A Amount		Amount Spent	Amount Claimed	Amount Re-imbursed	Remarks
As per PP	As per Agreement				
1	2	3	4	5	6

B. IMPLEMENTATION POSITION

01. Implementation Period :

Implementation Period as per PP		Actual Implementation period	Time Over-run (% of original implementation period)	Remarks
Original	Latest Revised			
1	2	3	4	5
July,2020-January, 2021 (07 Months)	July, 2020-June, 2021(12 Months)	July, 2020-June, 2021(12 Months)	71.43 %	Due to covid -19 situation

02. Cost of the Project :

(In lakh Taka)

Description	Estimated Cost		Actual expenditure	Cost over-run (% of original cost)	Remarks
	Original	Latest revised			
1	2	3	4	5	6
TOTAL	322.50	-	297.73	-	The actual contract with the consultant was less than the estimated cost.
TAKA	322.50	-	297.73	-	
PA	-	-	-	-	

03. Project Personnel:

Sanctioned strength as per PP	Manpower employed during execution	Status of the existing manpower			Manpower Employed	
		Manpower requirement for O&M as per pp	Existing manpower for O & M	Others		
1	2	3	4	5	Male	Female
Officer (s)	11	-	-	-	10	1
Staff(s)	14	-	-	-	8	6
Total :	25	Existing Manpower of Directorate of Planning-1, BWDB			18	7

04. Training of Project Personnel (Foreign/Local): No provision of training in this project.

Field of Training /Study tour/workshop/Seminer etc.	Provision as per PP		Actual		Remarks
	Number of person	Man - months	Number of person	Man - months	
1	2	3	4	5	6
a. Foreign	N/A	N/A	N/A	N/A	
b. Local	N/A	N/A	N/A	N/A	

05. Component-wise Progress (As per latest approved PFS) :
(In lakh Taka)

Items of work (as per PFS)	Unit	Target (as per PFS)		Actual Progress		Reasons for deviation (±)
		Physical	Financial	Physical (%)	Financial	
1	2	3	4	5	6	7
A. Revenue						
1. Consultancy (55 m.m)	Man-Month	55	315.32	55	293.58	
2. Other stationarie	LS	100%	1.38	100%	1.36	
3. Honorarium/Fees/Renuneration		100%	3.00	60.53%	1.82	
4. Travel Expense	LS	100%	0.80	0.0%	0.0	
5. Entertainment Expense	LS	100%	1.00	10.0%	0.0	
Sub-total (Revenue):			**321.50**	**99.10%**	**296.76**	
B. Capital						
1. Computer and accessories	LS	100%	1.00	100%	0.97	
Sub-total (Capital):			**1.00**	**100%**	**0.97**	
Grand-Total		**100%**	**322.50**	**99.11%**	**297.73**	

06. Information regarding Project Director (s):

Name & Designation with pay Scale.	Full time	Part time	Responsible for more than one project	Date of		Remarks
				Joining	Transfer	
1	2	3	4	5	6	7
Dr. Shamal Chandra Das Superintending Engineer Grade-4; 50,000-71,200	Full time	-	Yes	13.08.2020	Till Date	

07. Procurement of Transport (in Nos.): *Not Applicable*

Type of transport	Number as per P.P.	Procured with date	Transferred to Transport Pool with date	Transferred to O & M with date	Condemned/ damaged with date	Remarks
1	2	3	4	5	6	7
Car	-	-	-	-	-	
Jeep	-	-	-	-	-	
Microbus	-	-	-	-	-	
Minibus	-	-	-	-	-	
Bus	-	-	-	-	-	
Pick-up	-	-	-	-	-	
Truck	-	-	-	-	-	
Motor Cycle	-	-	-	-	-	
By-cycle	-	-	-	-	-	
Speed Boat	-	-	-	-	-	
Launch	-	-	-	-	-	
Others with name	-	-	-	-	-	

08. Procurement of Goods, Works and Consultancy Services:

08.1 Goods & Works of the Project costing above Tk. 200.00 lakh. and Consultancy above Tk. 100.00 lakh :

Description of procurement (goods/works /consultancy) as per bid document	Tender/Bid/Proposal Cost (in lakh Taka)		Tender/Bid/Proposal		Date of completion of works/services and supply of goods	
	As per PFS	Contracted value	Invitation date	Contract signing/ L.C opening date	As per contract	Actual
1	2	3	4	5	6	7
Consultancy Services for "Feasibility Study for Re-excavation of Shuvadya Khal along with Development and Protection of its both Banks at Keraniganj Upazila in Dhaka District"	315.32	312.82	26.07.2020	03.09.2020	02.02.2021 As per 1st Revision: 04.03.2021 As per 2nd Revision: 30/06/2021	30.06.2021

8.2 Use of Project Consultant (s) (Foreign/Local):

Name of the Field	Approved man month		Actual man month utilised	Remarks
	As per PP	As per contract		
1	2	3	4	5
a) Foreign :	-	-	-	
b) Local	55	55	55	

09. Construction/Erection/Installation Tools & Equipment: *Not Applicable*

Description of items	Quantity (as per PP)	Quantity procured with date	Transferred to O & M with date	Disposed off as per rule with date	Balance	Remarks
1	2	3	4	5	6	7

C. FINANCIAL AND PHYSICAL PROGRAMME :

01. (a) Original and revised schedule as per PFS :

(In lakh Taka)

Financial Year	Financial provision & physical target as per original PP				Financial provision & physical target as per latest revised PP			
	Total	Taka	P.A.	Physical %	Total	Taka	P.A.	Physical %
1	2	3	4	5	6	7	8	9
2020-21	322.50	322.50	-	100%	-	-	-	-
Total	**322.50**	**322.50**	-	**100%**	-	-	-	-

01. (b) Revised ADP allocation and progress :

(In lakh Taka)

Financial Year	Revised Allocation & target				Taka release	Expenditure & physical progress			
	Total	Taka	P.A.	Physical %		Total	Taka	P.A.	Physical %
1	2	3	4	5	6	7	8	9	10
-	-	-	-	-	-	-	-	-	-
2020-21	322.50	322.50	-	100%	320.00	297.73	297.73	-	100%
Total	**322.50**	**322.50**	-	**100%**	**320.00**	**297.73**	**297.73**	-	**99.11%**

D. ACHIEVEMENT OF OBJECTIVES OF THE PROJECT:

Objectives as per PP/PFS	Actual achievement	Reasons for shortfall, if any
Technical Feasibility Study		
• To assess water retention capacity and availability of surface water resources of Shuvadya khal;	• Variation water level and flow throughout the year are determined. • Reaches are identified based one flow direction in the Volume-1, chapter-4	
• To identify the obstacles and encroachments along both banks of Shuvadya Khal and recommendations to uproot all the	• Obstacles and illegal encroachment has been identified and addressed in	

Objectives as per PP/PFS	Actual achievement	Reasons for shortfall, if any
impediments to ensuring flow through the khal	the Land Acquisition Plan Report. • The plot schedule characterized by plot number, category of land as per record, total area of land, area to be acquired, owner name and address etc. also described at Land Acquisition Plan (LAP) Report. • Types of encroachment and types of encroached structures has been identified and demarcate din the study reports, map etc.	
• To improve drainage situation and navigation facilities of the project area.	Present situation of khal and possible measure are identified in the chapter-4 in the Volume-1	
• To identify the most effective improvement and protection measures for both banks of Shuvadya khal and find suitable option for several public amenities, pathways, recreational and communication facilities.	• Study identified the most effective bank protection measures which is suitable for the project site. As a result, study proposed 4 (four) types of bank protection measure for the both bank of the Khal depending on the site characteristics, surrounding land use and environment • Study identified the Shuvadya Khal not only a water navigational channel but also a passive recreational activity for the inhabitants of the KeraniganjUpazila. As a result, different types of public amenities pathways, recreational and communication facilities such as public toilet, children's play area, watch tower, walkway, floating deck, boat ghat has been proposed.	
• To assess the feasibility of infrastructures	• Feasibility basement of different types of	

Objectives as per PP/PFS	Actual achievement	Reasons for shortfall, if any
(Walkway, Cantilever walkway/causeway, cantilever deck, floating deck, viaduct, sewerage treatment plant, solar power plant, street furniture, watch tower foot over bridge, road bridge, replacement/ renovation of existing bridge) construction for the development and maintenance of Shuvadya Khal.	infrastructures associated with the study has been made intensively trough different types of survey and public participations such as questionnaire survey, Focus Group Discussion (FGD), Workshop etc. • Walkway, cantilever walkway/causeway, cantilever deck, floating deck, viaduct, Solar Aquatic Treatment Plant (SATP), Sewerage Diversion line, Sewerage Treatment Plant (STP), street furniture, Trash-bin, watch tower, foot over bridge, road bridge, replacement/ renovation of existing bridge has been proposed along with design, drawings and cost estimation. • Again, Operation and Maintenance Guidelines for Sustainable Management of Shuvadya Khal has been developed and described at Feasibility Study Report (chapter- 6, Volume-I)	
• To provide detail design of excavation/ re-excavation of khal/ canal and all types of proposed interventions / infrastructures;	• All the designs of protective measures and interventions proposed for excavation/ re-excavation of khal/ canal along with cost estimation has been described with design drawing in the Feasibility Study Report (Volume II- Design Report and Volume V- Cost Estimation) • Design and cost estimation of proposed interventions/ infrastructures such as Bridges, Cause-way, bank protections/ embankmentalso been addressed.	
• To prepare afforestation plan considering classification of trees.	• Existing number and types of trees has been identified through forest baseline survey. • Afforestation plan has	

Objectives as per PP/PFS	Actual achievement	Reasons for shortfall, if any
	been proposed at masterplan based on classification of trees. • Landscape plan also been prepared.	
• To prepare dredged material management plan.	• Dredged materials plans have been prepared according to the categories of dredged materials classifications such as soil, debris, sludge. • Volume and types of sediments to be dredged has been calculated. • Suitable location for disposal of dredged materials has been identified and described at the study report (chapter- 6, Volume-I). • Maintenance of Khal dredging also addressed in the study.	
Environmental & Social Study		
• To prepare an Environmental and Social Impact Assessment (ESIA) study.	• Extensive baseline survey & study has been conducted on Environmental & Social Impact Assessment (ESIA) • Separate report on ESIA has been submitted. • Identification & analysis of key environmental issues, Potential socio-environmental impacts bases on the pre-construction phase, construction phase and post-construction phase, stakeholder analysis and public consultation has been described in the ESIA study. • ESIA Study also follow the prescribed table of contents & terms of references approved by Department of Environment (DoE)	
• Preparation of biodiversity conservation plan.	• Environmental Enhancement and Conservation Plan has been added under the Biodiversity Conservation Plan at the Feasibility Study Report (Volume-I).	

Objectives as per PP/PFS	Actual achievement	Reasons for shortfall, if any
	• The plan includes existing biodiversity status along with biodiversity conservation target and enhancement plan. • Detail impact avoidance and mitigation measures also described in the plan.	
• To prepare Environmental Monitoring and Management Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.	• Environmental Monitoring and Management Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc. described in the ESIA study report. • EMMP also includes institutional arrangements, budget and action plan for implementing the mitigation measures. • Grievance Redress Mechanism of the study has been addressed in this section.	

E. BENEFIT ANALYSIS

01. Annual Out-put: ***Not Applicable*** **for the Study Project.**

Items of out-put	Unit	Estimated quantity expected at full capacity	Actual quantity of out-put during the 1st year of operation at full capacity (or during, real production for newly completed project).

02. Cost / Benefit: ***Not Applicable*** **(It is not an investment project, hence** ***not applicable*****)**

Item	Estimated	Actual
(1) Benefit cost ratio of the project **(i) Financial** **(ii) Economic** **(2) Internal Rate of Return** **(i) Financial** **(ii) Economic**		

03. Please give reasons for shortfall, if any, between the estimated and actual benefit:
Not Applicable

F. MONITORING AND AUDITING

Monitoring: *Not Applicable*

Name & designation of the inspecting official	Date of Inspection	Identified Problems	Recommendations
1	2	3	4

(a) Ministry / Agency:

(b) IMED :

(c) Others: (Please specify)

0.2. Auditing during and after Implementation:

2.1. Internal Audit: *No audit conducted yet.*

Period of Audit	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4

2.2. External Audit: *No audit conducted yet.*

Audit period	Date of submission of Audit Report	Major findings/ objections	Whether objections resolved or not.
1	2	3	4

G. DESCRIPTIVE REPORT

1. General Observations/Remarks of the Project on:

1.1 Background

In Keraniganj near Dhaka, most of the khals which once had link with Buriganga and Dhaleshwari rivers are filled up either totally or partially due to continuous encroachment, misuse and dumping of solid wastes, discharge sewer and waste water.

According to Bangladesh Water Development Board (BWDB) there were over six khals in Keraniganj namely Shuvadya khal, Mirerbagh khal, Hazaribagh khal, Pangaon khal, Karim Khali Khal (khal) and Manurbagh Khal. Shuvadya khal originates from the Buriganga River. It flows through Keraniganj. It finally falls into the Dhaleshwari rivers. Besides, Baghoir khal, a tributary of Shuvadya Khal, is also in danger due to illegal encroachment and lack of proper excavation including sludge removal. Government agencies, local public representatives, traders and influential land grabbers are allegedly setting up illegal establishments to grab the Subhadhya khal, a major khal of Keraniganj upazila. The Shuvadya khal had been recognized as a compelling water channel for the commercial success of that area, and now the khal is on its deathbed and become dry, highly polluted and lost its natural flow due to rampant waste dumping. Various shops and markets were illegally set up on the khal embankments, while pillars were erected on the khal for encroachment. Many mosques have been built in the khal. Discharges from the drain and sewage comprising domestic and industrial liquid waste are causing water pollution in the khal.

With this backdrop it has been decided to take project on Shuvadya khal to recover the former glory of the khal by creating a landmark eco-island, which is first of its kind in Bangladesh, based on the state of the art features of public amenities and facilities including implementation of shore protection system and ecosystem restoration activities. A development project proposal (DPP) has been prepared in connection with re-excavation of Shuvadya Khal and development and protection of both bank of Shuvadya Khal at Keraniganj Upazila in Dhaka District. A PEC (Project Evaluation Committee) meeting on the prepared DPP was held in Planning Commission on 19-12-2019. According to the decision of the PEC (Project Evaluation Committee) meeting, a detailed feasibility study has to be completed to approve the DPP.
In this circumstance, Bangladesh Water Development Board (BWDB) intends to a detailed feasibility and design development project for Shuvadya khal and shore protection system through national engineering and architectural consulting firm.
Hence, for the re-excavation of Shuvadya khal, it is solely necessary to carry out a detailed feasibility study with detailed survey for the preparation of DPP. Under this circumstances, this PFS has been prepared to engage national Consultants to carry out the envisaged feasibility study.

1.2 Justification/Adequacy

Water bodies mainly rivers with its tributaries and khals are the lifeblood of economy and social life of Bangladesh. Its cultural life is also profoundly related to rivers and water. Once the mighty river Buriganga, the central trade and communication route of ancient Bangla, had a primary khal named "Shuvadya" which flowed through the Keraniganj Upazila of Dhaka District. The Shuvadya khal had been recognized as a compelling water channel for the commercial success of that area, and now the khal is on its deathbed and become dry, highly polluted and lost its natural flow due to rampant waste dumping.
At this situation it has been decided to take project on Shuvadya khal to recover the former glory of the khal by creating a landmark eco-island, which is first of its kind in Bangladesh, based on the state of the art features of public amenities and facilities including implementation of shore protection system and ecosystem restoration activities. Under this circumstances, a comprehensive study is required on Shuvadya Khal with detailed design for the preparation of DPP.
To meet Sustainable Development Goals, it is essential to protect and restore water related ecosystems such as wetlands and rivers. Urgent action must be taken to reduce the loss of natural habitats and biodiversity which are part of our common heritage. Besides, National Water Policy (NWPo-1999) indicates priorities for different multi-sectoral needs to be

ensured in planning & development of water management projects. Re-excavating of Shuvadya Khal is required to improve water retention capacity, preserving natural habitats of fishes and other aquatic life thereby improving socio-economic and environmental condition of the country.

Linkage With Bangladesh Delta Plan (BDP), 2100

- The Project will contribute to the implementation of the Bangladesh Delta Plan 2100 from technical aspect.
- The concept of the project is in line with BDP2100. Particularly, the Project contributes to the following strategies and sub-strategies:

Strategy at National Level

- Strategy FR 1: Protecting Economic Strongholds and Critical Infrastructure.
- Strategy FR 2: Equipping the FMD Schemes for the Future
- Sub-strategy FR 2.5: River management, excavation and smart dredging preceded by appropriate feasibility study
- Strategy FR 3: Safeguarding Livelihoods of Vulnerable Communities
- Sub-strategy FR 3.7: River management as well as improved flood management, drainage, O&M and flow management

Hotspot Specific Strategies

5) River Systems and Estuaries

- Improvement of the conveyance capacity as well as stabilize the rivers
- Strategy for sediment management including a strong capital dredging and maintenance programme.

At this circumstances, a holistic approach is required to complete the study on Shuvadya Khal so that the goal of Bangladesh Delta Plan can be achieved.

1.3 Objectives

The main objective of the study is to assess the feasibility of the envisaged re-excavation of Shuvadya khal from technical point of view and find out suitable option for development and protection of both banks of Shuvadya khal as well as improvement of navigability in the study area considering technical, financial, social and environmental aspects.

The specific objectives of the study are:

Technical:

- To assess water retention capacity and availability of surface water resources of Shuvadya khal;
- To identify the obstacles and encroachments along both banks of Shuvadya Khal and recommendations to uproot all the impediments to ensuring flow through the khal.
- To improve drainage situation and navigation facilities of the project area.
- To identify the most effective improvement and protection measures for both banks of Shuvadya khal and find suitable option for several public amenities, pathways, recreational and communication facilities.
- To assess the feasibility of infrastructures (Walkway, Cantilever walkway/causeway, cantilever deck, floating deck, viaduct, sewerage treatment plant, solar power plant, street furniture, watch tower foot over bridge, road bridge, replacement/ renovation of existing bridge) construction for the development and maintenance of Shuvadya Khal.
- To provide detail design of excavation/ re-excavation of khal/ canal and all types of proposed interventions / infrastructures;
- To prepare afforestation plan considering classification of trees.

- To prepare dredged material management plan.

Environmental and Social:

- To prepare an Environmental and Social Impact Assessment (ESIA) study.
- Preparation of biodiversity conservation plan.
- To prepare Environmental Monitoring and Management Plan (EMMP) for conservation of aquatic resources, fisheries resources, bird sanctuaries etc.

1.4 Project revision with reasons: Not Applicable

2. Rationale of the project in respect of Concept, Design, Location and Timing.

Shuvadya khal is one of the most important khals of Keraniganj Upazila because it connects Buriganga River to Dhaleshwari River, passes through a big commercial strip and more number of settlements on both side of the khal than any other khals of Keraniganj. As Shuvadya had long lost its purity and width due to waste and sewage dumped by local people and garment factories. This study was aimed to restore Shuvadya khal and its bank line, save it from encroachment, ensuring navigability of the khal, increasing accessibility and connectivity through bridges and better roads, and make the khal and its surroundings aesthetically pleasing.

A development project proposal (DPP) has been prepared by Dhaka O&M Division-2, BWDB, Dhaka in connection with re-excavation of Shuvadya Khal and development and protection of both bank of Shuvadya Khal at Keraniganj Upazila in Dhaka District. A PEC (Project Evaluation Committee) meeting on the prepared DPP was held in Planning Commission on 19-12-2019. According to the decision of the PEC (Project Evaluation Committee) meeting, a detailed feasibility study has to be completed to approve the DPP In this circumstance, Bangladesh Water Development Board (BWDB) intends to a detailed feasibility and design development project for Shuvadya khal and bank protection system through national engineering and architectural consulting firm.

3. Brief description on planning and financing of the project and its applicability.

- **Project Identification**

Shuvadya Khal is one of the most important khals of Keraniganj Upazila because it connects Buriganga River to Dhaleshwari River, passes through a big commercial strip and more number of settlements on both side of the khal than any other khals of Keraniganj. As Shuvadya had long lost its purity and width due to wastes and sewage dumped by local people and garment factories. While field survey, it has been observed that household wastes, industrial and chemical discharge from factories and markets along with municipal wastes are being dumped into the Shuvadya Khal. It has now become an urgent appeal of Keraniganj to save Shuvadya before it is lost forever. In this circumstance, Bangladesh Water Development Board (BWDB) intends has carried out a feasibility and design development project for Shuvadya Khal. This study is aimed to restore Shuvadya Khaland its bank line, save it from encroachment, ensuring navigability of the khal, increasing accessibility and connectivity through bridges and better roads, and make the khal and its surroundings aesthetically pleasing. It has been decided to take up the project on Shuvadya khal to recover the former glory of the khal, which is first of its kind in Bangladesh, based on the state of the art features of public amenities and facilities including implementation of bank protection system and ecosystem restoration activities.

- **Project Preparation**

In Keraniganj Upazila near Dhaka, most of the Canals or 'Khals' which once had link with Buriganga and Dhaleshwari rivers are filled up either totally or partially due to continuous illegal encroachment, misuse and dumping of solid wastes, discharge sewer and waste water. The study area includes the Shuvadya Khal located in the North Central Region of Bangladesh.The Shuvadya Khal originates from Buriganga River near the area of Shuvadya union,KeraniganjUpazila in Dhaka District and flows south under the Dhaka-Mawa highway and falls into the Dhaleswari River. The Basin area of the Shuvadya Khal is around 50 sq.km. The Khal is on its deathbed and become dry, highly polluted and lost its natural flow due to rampant waste dumping and active in monsoon season due to local rainfall and some accumulative flows coming from Buriganga River. Besides, Baghoir Khal, a tributary of Shuvadya Khal, is also in danger due to illegal encroachment and lack of proper periodic excavation including sludge removal. The length of the Khal is about 13 km and the width vary from around 9 m to 100 m. Various shops, markets and even mosques were illegally set up on the Khal's embankment and legal right of way, while many erected with floating slabs over the Khal for encroachment. Discharges from the drain and sewage comprising domestic and industrial liquid waste are causing water pollution in the Khal. With this backdrop it has been decided to take up the project on Shuvadya Khal to recover the former glory of the Khal, which is first of its kind in Bangladesh, based on the state of the art features of public amenities and facilities including implementation of bank protection system and ecosystem restoration activities.

Appraisal

DPEC Meeting Date: 12.07.2021

- **Credit Negotiation**
- **Credit Agreement**
- **Credit Effectiveness**
- **Loan Disbursement**
- **Loan Conditionalities**
- **Project Approval.**
- **Others (if any).**

Applicable for Investment Project

The project was approved by the Honorable State Minister, MoWR on 22.07.2021

4. <u>Analysis of the Post-Implementation situation and result of the project</u>: *Not Applicable*

4.1 Whether the beneficiaries of the project have clear knowledge about the Target/ Objectives of the project.

4.2 Programme for use of created-facilities of the project

4.3 O & M programme of the project.

4.4 Impact of the project -

4.4.1 Direct

4.4.2 Indirect

4.5 Transfer of Technology and Institutional Building through the project

4.6 Employment generation through the project.

4.7 **Possibility of Self employment**

4.8 **Possibility of women-employment opportunity**

4.9 **Women's participation in development**

4.10 **Probable Impact on Socio-Economic activity.**

4.11 **Impact on environment**

4.12 **Sustainability of the project**

4.13 **Contribution to poverty alleviation/reduction**

4.14 **Opinion of the public representatives, local elite, local administration, teachers, religious leaders, women's representatives etc.**

4.15 **Contribution of Micro-credit programmes and Comments on overlapping with any NGO activities.**

5. ***Problems encountered during Implementation (with duration & steps taken to remove those)***

5.1	**Project Management**	5.12	**Project aid disbursement and re-imbursment**
5.2	**Project Director**		
5.3	**Land Acquisition**	5.13	**Mission of the development partners.**
5.4	**Procurement**	5.14	**Time & Cost Over-run**
5.5	**Consultancy**	5.15	**Project Supervision/Inspection**
5.6	**Contractor**	5.16	**Delay in Decision**
5.7	**Manpower**	5.17	**Transport**
5.8	**law & Order**	5.18	**Training**
5.9	**Natural clamity**	5.19	**Approval**
5.10	**Project financing, allocation and release.**	5.20	**Others.**
5.11	**Design formulation/approval**		

It is a contract base consultancy project. The above problems don't occur

6. **Remarks & Recommendations of the Project Director:**

"Feasibility Study for Re-excavation of Shuvadya Khal along with Development and Protection of its both Banks at Keraniganj Upazila in Dhaka District" was sanctioned in administrative approval from Ministry of Water Resources given vide memo no-42.00.0000.040.014.009.2020-186 dated:22/07/2022. Due to covid-19 pandemic situation the duration of the study was revised by Ministry of Water Resources . Project has been completed on 30/06/2021 successfully.

The prime objective of the study is to assess the feasibility of the envisaged re-excavation of Shuvadya khal from technical point of view and find out suitable option for development and protection of both banks of Shuvadya khal as well as improvement of navigability in the study area considering technical, financial, social and environmental aspects.

Significant plans, proposals, act, policies and strategies of documents relevant to the current study are incorporated in this study which can help to develop proper guidelines for plan preparation. The study reports include plans, relevant national legislation, regulatory and policy instrument of Govt. and other agencies. As the proponent of the project will conduct its infrastructural and operational activities in compliance with applicable Bangladeshi legislation and policies, a comprehensive review of the legal and institutional framework within which the hydrology, environmental and social assessment is carried out for this study specially National Land Use Policy, 2001; Draft Dhaka Structure Plan (2016-2035); National Water Policy, 1999; Water Act 2013; National Environmental Policy 1992; National Environmental Management Action Plan (NEMAP), 1995; Environmental Conservation Act (ECA), 1995; Environment Conservation Rules, 1997 (Amended in 2002); Playfield, Open Space, Park and Natural Water Reservoir Conservation Act, 2000; National Waste Management Strategy, 2002; The Acquisition and Requisition of Immovable Property Ordinance, 1982; Bangladesh Biodiversity Act (2017); Bangladesh Delta Plan, 2100 etc.

The Basin area of the Shuvadya Khal is around 50 sq.km. The Khal is on its deathbed and become dry, highly polluted and lost its natural flow due to rampant waste dumping and active in monsoon season due to local rainfall and some accumulative flows coming from Buriganga River. Besides, Baghoir Khal, a tributary of Shuvadya Khal, is also in danger due to illegal encroachment and lack of proper periodic excavation including sludge removal. The length of the Khal is about 13 km and the width vary from around 9 m to 100 m. Various shops, markets and even mosques were illegally set up on the Khal's embankment and legal right of way, while many erected with floating slabs over the Khal for encroachment. Discharges from the drain and sewage comprising domestic and industrial liquid waste are causing water pollution in the Khal.

The main target is to restore the Suvadya Khal and transform the urban fabric of Keraniganj by making the khal as the front rather than the backyard drain. Creation of public spaces in specific areas will foster the necessary change that is required for the khal to be transformed into a neighborhood front water body. Specific goals have been set and strategies have been formed. Based on the objectives for achieving the specific goals different areas have been designed. Environmental Management Plan (EMP), Re-excavation methodology of Shuvadya khal, Dredge Material Management Plan, Maintenance of Khal Dredging, Maintenance of Bank protection, Operation and Maintenance Guidelines for Sustainable Management Acquisition and resettlement plan has been developed and design approach has been set. Main design components of the master plan for Shuvadya Khal are following: Entry Point, Memorial Plaza, Ghat, Solar Acquatic Treatment Plant (SATP), Amenity Building, Playground, Eco Island, Mollar Bazar, Khal Embankment, Walkway, Waste Disposal Bins, Public Toilet, Bridges, Sewarage Diversion Network, Sewerage Treatment Plant (STP), Tree Plantation plan. Estimated cost for the study is BDT 159302.16 Lac where Economic IRR is 13.27%, Economic NPV is BDT 3,440.24 crore and Economic BCR is 2.64. As, Economic BCR is greater than 1, thus considering it the project is economically feasible to implement.

All the major activities has been accomplished under the project. The design, cost estimate and ESIA have been prepared through this study based on which the DPP of the investment project would be finalized.

29.08.2021

Date:.....

Signature and seal of the Project Director

... ohamal Chand...
Superintending Engineer (Civil)
Directorate of Planning-1
BWDB, Dhaka.

7. Remarks/Comments of Agency Head

BWDB is planning to take an implementation project on Shuvadya khal to recover the former glory of the khal by creating a landmark eco-island, which is first of its kind in Bangladesh, based on the state of the art features of public amenities and facilities including implementation of bank protection system and ecosystem restoration activities, Environmental Management Plan (EMP),Re-excavation methodology of Shuvadya khal, Dredge Material Management Plan, Maintenance of Khal Dredging, Maintenance of Bank protection, Operation and Maintenance Guidelines for Sustainable Management. The most effective bank protection measures has been identified through this study. All the designs of protective measures and interventions proposed for excavation/ re-excavation of khal/ canal along with cost estimation has been described with design drawing. With the concent from MOWR BWDB will soon take necessary steps to approve the DPP for the implementation project

27/02/2020
(FAZLUR RASHID)
Director General
BWDB, Dhaka.

Date : .....

Signature and Seal

8. Remarks/Comments of the officer in- charge of the Ministry/Division

Date :

Signature and Seal

FINAL REPORT
(Volume I- Main Report)

APPROVED

30.6.2021

(A K M Wahed Uddin Chowdhury)
Director General
BWDB, Dhaka.

FINAL REPORT APPROVED BY DG, BWDB
Vide U.O. No...৬২৯৫.....-DG
Dated: ২০/৬/২০২১

Submitted By:

Water Environment & Climate

In association with

VITTI Sthapati Brindo LTD

JUNE. 2021

FINAL REPORT APPROVED BY DG, BWDB
.....-DG

EXECUTIVE SUMMARY

Background

Shuvadya Khal is one of the most important khals of Keraniganj Upazila because it connects Buriganga River to Dhaleshwari River, passes through a big commercial strip and more number of settlements on both side of the khal than any other khals of Keraniganj. As Shuvadya had long lost its purity and width due to wastes and sewage dumped by local people and garment factories. While field survey, it has been observed that household wastes, industrial and chemical discharge from factories and markets along with municipal wastes are being dumped into the Shuvadya Khal. It has now become an urgent appeal of Keraniganj to save Shuvadya before it is lost forever. In this circumstance, Bangladesh Water Development Board (BWDB) ~~intends~~ has carried out a feasibility and design development project for Shuvadya Khal. This study is aimed to restore Shuvadya Khal and its bank line, save it from encroachment, ensuring navigability of the khal, increasing accessibility and connectivity through bridges and better roads, and make the khal and its surroundings aesthetically pleasing. It has been decided to take up the project on Shuvadya khal to recover the former glory of the khal, which is first of its kind in Bangladesh, based on the state of the art features of public amenities and facilities including implementation of bank protection system and ecosystem restoration activities.

The main objective of the study is to assess the feasibility of the envisaged re-excavation & redevelopment of Shuvadya Khal from a technical point of view and find out suitable option for development and protection of both banks of Shuvadya Khal as well as improvement of navigability in the study area considering technical, economic, social and environmental aspects.

Existing Scenario

Shuvadya Khal enters Keraniganj Upazila as a tributary of Buriganga River near Paar Gendaria through Shuvadya Union. Another small tributary of Buriganga joins it near Kaliganj Bazar in Aganagar Union. Then it flows through Aganagar Union, Shuvaddya Union, Tegharia Union and then finally joins Dhaleshwari River at Konda Union. Hence, Shuvadya Khal starts geographically from 23°42' (N) and 90°24' (E); and ends at 23°38' (N) and 90°25' (E). Shuvadya Khal's water flow is disconnected at some locations due to the accumulation of debris and sludge. For example, at Kaliganj Jora Bridge and Chunkutia Thotkata Khal area the Khal bed is covered in years of wastes so badly that it can be hardly recognized as a water body. Shuvadya Khal, along with its two tributaries: from Char Kaliganj to Char Par Gendaria; and Kaliganj Area, is approximately 13 km long and between 9 m to around 100 m wide at different sections. The khal width is the narrowest after Chairman Maath and it is the widest after Mollar Hat bazar.

The land use pattern of the study area mainly urban settlements followed by agriculture and aquaculture zone. It was observed that 1 crops are being cultivated at the agricultural land parcel throughout the year. The physiography of the study area falls Young Brahmaputra-Jamuna Floodplain zone which comprises the area of Brahmaputra sediments. It has a complex relief of broad and narrow ridges, inter- ridge depressions, partially in filled cut-off channels and basin. This area is occupied by permeable silt loam to silty clay loam soils on the ridges and impermeable clays in the basins, neutral to slightly acid in reaction. General soil types include predominantly grey floodplain soils. Organic matter content is low in ridges and moderate in basins. Soils are deficient in N, P, and S but the status of K and Zn are reasonable (Banglapedia). Keraniganj Upazila area covers four distinct soil types; they are non-calcareous alluvium soil, non-calcareous grey floodplain soil, non-calcareous dark grey floodplain soil, and miscellaneous soil. The major soil type of Keraniganj Upazila is non-calcareous grey floodplain soil (46.73%) (BARC, 2020). Topography the study area has a level difference of 5 m (approx.) with a gentle slope towards Dhaleshwari River. Once an important

waterway, the Shuvadya Khal on the outskirts of the capital loses in dry season navigability due to siltation and dumping of solid waste (The Daily Star, 2016). Though, navigation in downstream part of Shuvadya Khal up to Rajendrapur is still alive round the year, navigation facility exists not at all near Kaliganj point where Shuvadya Khal meets the Buriganga River (people say offtake of Shuvadya Khal) due to dumping solid waste, siltation and illegal encroachment. In monsoon period, Shuvadya Khal is active when water enters in the Shuvadya Khal from both direction (from Buriganga and Dhaleswari) at high tide and goes out at ebb tide but water depth does not reach at the level enough for navigation in the upper part of the khal. During dry months, water enters and goes out in the khal only from the Dhaleswari River.

The study area is located in the floodplain between the Buriganga River (North side of the project area) and Dhaleshwari River (South side of the project area). Average annual high flood level in the project area is 4.75 m MSL. It appears that more than 50% area is lying below 4.74 m MSL. These low lying areas go under water almost every year. From flood inundation maps prepared using model simulated flood level, it is observed that significant area remains under flood water during an average year flood. Moreover, most of the study area (more than 90%) goes under water during an extreme flood like flood of 100 year return period. The average year flood where it's indicating that approximately 50% of the project area is flooded in an average flood year, and analysis shows that among the last 103 years, the annual high flood level has crossed the estimated average flood level (4.75 m MSL) in around 59 years. So that flood is common phenomenon in the study area.

Relevant Plans and Documents

Significant plans, proposals, act, policies and strategies of documents relevant to the current study are incorporated in this chapter which can help to develop proper guidelines for plan preparation. These documents include plans, relevant national legislation, regulatory and policy instrument of Govt. and other agencies. As the proponent of the project will conduct its infrastructural and operational activities in compliance with applicable Bangladeshi legislation and policies, a comprehensive review of the legal and institutional framework within which the hydrology, environmental and social assessment is carried out for this study specially National Land Use Policy, 2001; Draft Dhaka Structure Plan (2016-2035); National Water Policy, 1999; Water Act 2013; National Environmental Policy 1992; National Environmental Management Action Plan (NEMAP), 1995; Environmental Conservation Act (ECA), 1995; Environment Conservation Rules, 1997 (Amended in 2002); The Forest Act (1927) and the Forest (Amendment) Act (2000); Playfield, Open Space, Park and Natural Water Reservoir Conservation Act, 2000; National Waste Management Strategy, 2002; The Acquisition and Requisition of Immovable Property Ordinance, 1982; Bangladesh Biodiversity Act (2017); Bangladesh Delta Plan, 2100 etc.

Hydro- Morphological Assessment

For this study, IWM has carried out cross-sections survey by level flying technique and using sounding technique depending on the field condition. Reduced level of the cross-section data has been estimated from known reference benchmarks of Survey of Bangladesh (SoB BM 6038) by benchmark flying. Water level observation plan has been taken in the Shuvadya Khal and the Buriganga River from September 2020 to December 2020. The observations have been carried out by using water level gauge and high-frequency pressure sensor with the reference of Public Works Department (PWD). The water level measurement interval is 3 hrs. for manual gauge and 10-minute interval for pressure sensor.

Discharge measurement has been conducted to observe the water availability in the khal at three locations: at offtake, at outfall and in the middle of the Shuvadya Khal for calibration and validate of the model. There is also no regular water quality monitoring station in the Shuvadya Khal system. Surface water sample has been collected and tested for 17 different parameters in a total of three locations: Buriganga River (upstream of Shuvadya Khal), Rajendrapur and near outfall of the

Shuvadya Khal (Mollarhat/Bakterchar). Hydro-meteorological data include both meteorological (rainfall, evaporation, temperature, humidity, wind speed, wind direction, sunshine etc.) and hydrological data (water level, groundwater, and discharge, etc.). Available hydro-meteorological data have been collected mostly from secondary sources: Bangladesh Water Development Board (BWDB), Bangladesh Meteorological Department (BMD), Bangladesh Inland Water Transport Authority (BIWTA), and Institute of Water Modelling (IWM). BWDB maintains rainfall station (7 Nos.), water level station (3 Nos.), Groundwater station (2 Nos.) and discharge station (1 No.) in and around the study area has been checked for consistency, processed and analyzed.

There are several structures with different opening sizes constructed on the Shuvadya Khal for communication purpose. Detail information of existing hydraulic structures like bridges, culverts, etc. on the khal have been taken. Structure inventory includes the information of geo-position, number of span, length, opening information (height/ width), deck/soffit /sill level etc. of bridges in the study area. Approximately 17 nos. of different types of structures has been surveyed by IWM during the field survey.

As described earlier, the Shuvadya Khal is a tidal channel, and the tidal water enters into the khal both from Buriganga River and Dhaleswari River. Presently, there is a tidal meeting point in the khal, located at about 10 km (Bagunbari) inside from the Dhaleaswari River in the dry season and 7.8 km (Shanshan ghat) in the wet season. Besides, the people are living close to both banks, disposes of waste water directly to the khal including significant amount of solid waste. Due to have a tidal meeting point as well as receive waste water, there is significant deposition in some reach of the khal. The banks of the khal is mostly occupied and developed for building construction. There are many unspecified bridges so far constructed over the khal. It creates obstruction to the flow and accelerates deposition. The deposited reach dries out during dry months and even in wet months, the water remains almost stagnant because of excessive debris.

Hydro- Morphological Analysis of Data

Consistency checking of rainfall data has been carried out according to the standard procedures described in IWM Data Processing Manual[1]. The consistency check includes visual observation of rainfall records through on-screen plots, estimation of yearly mean values, double mass analysis and comparison of monthly values with the selected base station group. There are 7 rainfall stations found inside and around the study area and historical rainfall data at said stations has been collected which are maintained by BWDB. This data was necessitated for the update of the existing NCRM model. Collected data has been checked through double mass analysis. From the analysis it has been observed that six stations out of 7 found have consistent and reliable data. Rainfall records found outside the accepted range are considered to be inconsistent. Extremely inconsistent data has been discarded.

There are seven rainfall stations maintained by BWDB in and around the project area which are Dhaka (CL009), Nawabganj (CL412), Shimrail (CL519), Manikganj (CL020), Munshiganj (CL365) and Bhagyakul (CL402). Among them Dhaka (CL009) and Nawabganj (CL412) are located near around the project area River basin. Historical records of daily rainfall at these stations are found to be available of around 40 years (1980-2019). Among 7 stations, Dhaka and Nawabganj stations are the nearest rainfall station from the project area thus more representative for the study area which are consistent and reliable in comparison to peripheral other stations. Annual maximum rainfall of 1-day, 3-day and 5-day accumulation has been analyzed for the above mentioned both stations from 1961 to 2019 and it is observed that there is decreasing trend for 1-day, 3-day and 5-day accumulated rainfall for both stations.

[1]SWMC Handbook, March 1997

Annual high flood of 2-year, 5-year, 10-year, 20-year, and 100-year return period are necessary for analyzing of different flood scenarios. The model has been simulated for a real hydrological year which best represent the specific return period. Annual high flood levels of different return period as stated at a key hydrological measurement station have been compared against actual records of some flood events. It is observed that flood of 2008, 2007, 1980, 2004 and 1998 are very close to return floods of 2-year, 5-year, 10-year, 20-year, and 100-year respectively.

In connection of this study, NCRM hydro-dynamic model has been updated incorporating Shuvadya Khal and it's all tributaries with the field surveyed and DEM extracted cross-sections. All new river/khal alignment and their cross-sections are surveyed by IWM. 70 nos. cross-sections of Shuvadya Khal, 24 nos. cross-section of Dhaleswari-Branch, and 47 nos. cross-section of different connecting khals have been incorporated in this model. The output of HD model is water level and flow (discharge) at any un-gauged location. The MIKE11 modelling system provides the facility for assessing surface water resources from historical model simulation and for the decision making through several options simulations.

1D hydro-dynamic flow is showing that tidal water enters and goes out in Shuvadya Khal from both the ends. Water enters from Dhaleswari to Shuvadya Khal and it goes up to Golam Bazar bridge (Near Begunbari), from Buriganga to Shuvadya Khal up to 1.5 Km from the offtake. Water velocity at Golam Bazar is almost zero and dead zone is created by both side flows. Water level in the Shuvadya Khal shows a wide variation throughout the year. From historical analysis of water levels, it is observed that monthly average minimum water level falls as low as (-) 0.46 m MSL at Milbarak of the Buriganga River during February, and during wet months it rises as high as 6.54 m MSL. An intermediate reach of the khals (close to Km 10.0) dries out during dry months due to high bed elevation. The khal gets tide both from offtake (with Buriganga River) and outfall (with Dhaleswari River). It receives local catchment runoff and flood spill flow during wet season only. Waste water (domestic/industrial) generated in the adjoining areas is also added in the flow of khal round the year. Thus, the main sources of water of the khal are the Buriganga River and the Dhaleswari River. The Shuvadya Khal is a flowing water body, and practically there is no self-water retention capacity of the khal other than the augmentation from two connecting rivers.

Flow regime of Shuvadya Khal is dominated by the flow coming from the Buriganga River and the Dhaleshwari River. Contribution of local inflow coming from adjoining catchments of the khal as well as addition of domestic and industrial waste water is quite insignificant. The khal experiences tidal influences coming from both the Buriganga River and the Dhaleswari River. During dry months, some middle reach of the khal dries out and tide water coming from the Buriganga River reaches up to Km 10.0 of the khal at Begunbari in the dry season. The remaining reach of the khal experience tides coming from the Dhaleswari River. The scenario is bit different during wet months when tides coming from both the rivers meets at Km 7.80 of the khal at Shuvadya Shanshan Ghat. The scenario stated later also prevails round the year when the khal is re-excavated in project condition. It is observed that the net flow of Shuvadya Khal received from the Buriganga River and drained toward the Dhaleswari River is quite insignificant. As iterated earlier that the Shuvadya Khal experiences flow in both directions resulted from prevailing tide both in the Buriganga River and Dhaleswari River. Discharges in the khal gradually increases while it progresses from offtake towards outfall. It is observed that annual high flood levels in the khal are 4.75 m MSL in average year and 5.8 m MSL in the 20-year return period. In an average hydrological year, flow at offtake of the Shuvadya Khal is around 1.5 m^3/s, gradually increasing towards the downstream along the khal it is raised to around 91 m^3/s at outfall. In a flood of 20-year return period, flow at Offtake of the Shuvadya Khal is around 4.3 m^3/s which is gradually raised to around 100 m^3/s at outfall of the khal. Maximum section average velocity in the khal are 0.51 m/s and 0.46 m/s respectively in an average year and 20-year flood event.

The Shuvadya Khal is quite narrow at the offtake (Buriganga river side, Km 11.1), and its width increases while it progresses towards the outfall (Dhaleswari river side, Km 0.00). As of field survey,

top width of the khal near the offtake is around 20 meter, increasing towards the downstream, the top width becomes around 100 meter near the outfall. At the reach of the khal from Km 9.0 to Km 11.0, the entire top width is not open rather partially occupied by local people by constructing of high-rise buildings. The building foundation is on either raised over column or embedded column. In this project planning, top width of the khal has been compromised depending on extend of possible demolition of existing installation of the khal. As of planning, top width of the khal near the offtake is around 20 meter which has gradually been increased towards the downstream. The bed level of the khal is proposed to be (-) 1.16 m MSL near the offtake with a downward longitudinal slope of 10 cm/kilometer towards the downstream. The bed level of the khal at offtake has been decided considering 1.5 meter depth compared to historical monthly average Low Water Level (LLW) which is estimated to be 0.34 m MSL.

The Shuvadya Khal is 13 km long and top width of the khal varies from 09 meter to 100 meters. The existing bed slope of the khal is 20 cm per km downwards towards the Dhaleswari River. The bed level of the khal ranges from (-) 1.27 m MSL to 2.44 m MSL. The khal is relatively deeper at offtake and outfall where the bed levels are (+) 0.64 m MSL and (-) 1.27 m MSL respectively. Left bank (LB) levels of the khal varies from 0.64 m MSL to 6.05 m MSL where the right bank (RB) level varies from 0.74 m MSL to 6.14 m MSL. Longitudinal profiles of left bank, right bank and bed are given in the Appendix. The khal is encroached at many places through construction of buildings using raised pillars/piles. The development of the khals has been planned with least intervention or demolition of existing installations but with optimum beauty, environment, hydraulic connectivity and above all lifelines of the khal. Considering the existing topography of the khal and for the ease of planning, the whole length is conceptually divided into three segments: Segment-1 covers the length from Km 9.0 to Km 11.0, Segment-2 covers the length from Km 5.50 to Km 9.0 and Segment-3 covers the remaining length of 5.6 km from Km 0.0 to Km 5.50.

Top width of the khal is very less near the two offtake (Km 9.1 to Km 11.1, planned top width less than 20 meter) which is too insufficient to accommodate minimum depth, bed width and required side slope. Thus, rectangular section with hard side protection (Shore Pile) in both left and right side have been planned for re-excavation of the khal. The next reach i.e. Km 5.6 to Km 9.1 planned top width is bit more but again not enough to maintain an optimum natural section. So, hard slope protection with side slope of 1 vertical: 1.5 horizontal have been proposed up to 1.5 meter above the design bed level. The lower part of the section is planned to be rectangular in shape with supported by vertical gravity brick wall in both sides. Up to Km 5.6 the khal is wide and there is sufficient space to accommodate a natural section without any hard protection or intervention. In this reach of the khal re-excavation is proposed with side slope of 1 vertical: 2 horizontal and bed width is 15 meters. The bed level of the khal is planned to be (-) 1.16 m MSL at offtake with Buriganga River, and the khals is proposed to be re-excavated with longitudinal slope of 10 cm per km. Estimated volume of earthwork for re-excavation of Shuvadya Khal is around 367,290 cubic meter.

Master Plan Design and Design Components

The main target is to restore the Suvadya Khal and transform the urban fabric of Keraniganj by making the khal as the front rather than the backyard drain. Creation of public spaces in specific areas will foster the necessary change that is required for the khal to be transformed into a neighborhood front water body. Specific goals have been set and strategies have been formed. Based on the objectives for achieving the specific goals different areas have been designed. Acquisition and resettlement plan has been developed and design approach has been set. Main design components of the master plan for Shuvadya Khal are following: Entry Point, Memorial Plaza, Ghat, Solar Acquatic Treatment Plant (SATP), Amenity Building, Playground, Eco Island, Mollar Bazar, Khal Embankment, Walkway, Waste Disposal Bins, Public Toilet, Bridges, Sewarage Diversion Network, Sewerage Treatment Plant (STP), Tree Plantation plan.

Cost Estimation and Economic Analysis

Estimated cost for the study is BDT 159302.16 Lac where Economic IRR is 13.27%, Economic NPV is BDT 3,440.24 crore and Economic BCR is 2.64. As, Economic BCR is greater than 1, thus considering it the project is economically feasible to implement. It would be better if the estimated cost is presented in a figure of Lac like

Environmental and Social Impact Assessment (ESIA)

The Environmental and Social Impact Assessment (ESIA) has been prepared by identifying the potential impacts, assessing them, and recommending possible mitigating and enhancing measures for negative and positive impacts, respectively. The assessment process included a site visit, site surveys for impact assessment, baseline environmental and social condition survey, stakeholder consultation, analysis of the possible project intervention, and finally experts identified and evaluated potential environmental and social impact associated with all aspects of the proposed project.

Environmental and Social Management Plan (ESMP) has been prepared for pre-construction, construction, and post-construction phases by assigned responsibilities to the supervision personnel as well as implementing contractors. The Keraniganj Upazila Parishad (KUP) as the executing agency is responsible for environmental and social management. However, Government officials may not be sufficient to handle environmental and social considerations. So, additional Manpower may be needed to look after the issues. The ESMP has shown the responsibilities of relevant entities at respective phases of different restoration work. The Executive Engineer (XEN) of the Keraniganj Upazila Parishad office bears the main responsibility for environmental and social issues. The project will involve some land acquisition so environmental monitoring required may need specific personnel to be deputed. The Sub Divisional Engineer (SDE), Keraniganj in particular, shall also be responsible for the supervision of contractors to ensure compliance with the ESIA and other associated works. Complaints from residents should also be received by the SDE and transferred to the XEN responsible for supervising overall activities related to environmental and social issues.

Environmental monitoring on key environmental parameters, including noise, water, sediments, location, and sampling frequency has been prepared. There is the likelihood of minor impacts but these will have to be properly recorded. The indicators will include air quality (visual and individual observation), noise level, water quality, sediment at re- excavation reaches. One Community Monitoring Officer will work for the implementation period for social and environmental monitoring. An amount of BDT 1.55 million will be required for meeting the environmental monitoring cost.

Land Acquisition Plan (LAP)

This LAP has been produced following different Resettlement Policy Frameworks (RPF) developed by the Bangladesh Water Development Board (BWDB) for similar projects. A total of 401 installations will be affected including 565 pieces (mouza plot) of land will be acquired for the implementation of the project. From the study, the minimum affected land and structure area is about 18 sq. ft. whereas the maximum is 2880 sq. ft. The mean value of land and structure area are 148.83 sq. ft. and 144.07 sq. ft. respectively. The standard deviation of land area is 226.30 sq. ft. and the structure area are 224.44 sq. ft. The Land Acquisition Plan (LAP) contains budget for private land acquisition which is prepared based on the replacement value and quantity of land by category which is estimated BDT 32352.74 Lac for both land acquisition and structural compensations.

Public Consultation

According to the ToR, public consultation is an integral part. To fulfill these requirements consultation meetings with the BWDB officials on inception and interim study and Focus Group Discussion (FGD), KII with the local inhabitants, Union Parishad Chairman, project affected people and business group has been held. During the study period 5 FGD meeting has been already done which consists of local

business group, union chairman, local inhabitants and potential affected group. Brief description of the study and proposed project has been given to these groups and the opinions, observations and suggestions are noted down along with the KII from upazila government officials of different department.

During the public consultation meetings, local people were informed of various potential environmental and social hazards such as noise disturbance, dust and air pollution, temporary and permanent occupation of lands, and deployment of the labor force, part of which they were already aware of. They stated that such negative impacts would not cause significant harm to their livelihoods. They also expected that the authority concerned would take proper measures to minimize or mitigate the adverse effects. Local people demonstrated positive responses to the proposed khal restoration, irrespective of the rich and poor, young and old, and male and female. According to the local people, the proposal for khal re-excavation and restoration of navigability is a long-standing issue in the area, but it has never been materialized, resulting in a big disappointment among them.

Participants also believed that the importance of the area would be elevated and various economic activities would be started in the area after the khal development. They expected that opportunities for income generation will increase and the economic activities around the area would be accelerated. Moreover, local people also showed strong expectations for the increased opportunities for employment for physically unskilled or semi-skilled labor in the construction work. According to the local people, the banks of the Shuvadya Khal have been stable, and the khal has not shifted for a long time. Thus, the risk of erosion caused by the water flow is very less. It has been mentioned that the Shuvadya Khal is 'normal' in nature and the banks never went underwater for a considerable period. According to FGDs, during the high flood of 1988, surrounding homesteads were flooded up to 3 to 7 feet. Since the movement of larger size boat, having a height of 1.5-1.8 meter, for purchasing agricultural products from the village areas to nearby markets is quite a common practice in the area, the local people requested a reasonable canal restoration height so that the boat movement under the khal re-excavation could continue even during the high flood season.

Conclusion

The Shuvadya Khal had been recognized as a compelling water channel for the commercial success of that area, and now the khal is on its deathbed and become dry, highly polluted and lost its natural flow due to uncontrolled waste dumping and filling up by the encroachers. The proposed study is a magnificent attempt to recover the former glory of the khal by creating some landmark along with re-excavation, development and protection of the both bank of the khal, based on state of the art features of public amenities and facilities including implementation of bank protection system and ecosystem restoration activities.

Shuvadya Khal's length, its numerous sections, variation of land uses along its both bank, and most importantly connectivity to Buriganga River makes it the most challenging to this khal to restore. Identifying the illegal settlements that have sprouted along its edges along with some settlements that needs to be evicted that need concerned authority's empathetic actions. Most importantly, protecting the Shuvadya Khal and giving people the access to enjoy this khal has to be done concurrently. By using the appropriate technology and data driven projection, this study will have expected to outcome the best option to ensure Shuvadya Khal gets saved!