

BANGLADESH WATER DEVELOPMENT BOARD

Consultancy Services for Management, Design, Supervision and other Related Services
of Haor Flood Management and Livelihood Improvement Project (BWD Project)

DETAIL DRAWINGS OF TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERIBLE EMBANKMENT UNDER HAOR FLOOD MANAGEMENT AND LIVELIHOOD PROJECT

Approved
B.O. 2020
A.K.M. Shariful Alam
Project Director, Awdi Chittagong
Haor Flood Management Project
BWD, Directorate General of Engineering
Liveshood Improvement Project

DECEMBER, 2019

General Notes:

- The damage of submersible embankment is due to flash flood is a common phenomenon in the haor region. It mainly occurs due to wave action/Afjal (local name, locally generated post monsoon windstorm which generates relatively high velocity with associated waves) and flood varying degree of damage during the flood of 2017, 2018 and 2019. Submersible embankment is one of the main physical components of the haor sub-projects and protection of the submersible embankment is the main objective to rich the goal of this project.
- During the preparation of this project the factors for the damage of the side slope as well as the submersible embankment were not considered. For this region during the implementation period a study for assessing the damage, identifying the causes of damage and advising the protection measures of the submersible embankment during the flood of 2017, 2018 and 2019 is done by IWM. They finalize the report in June 2019.
- According to the report of IWM, current practices for slope protection of BWDB and as per suggestion of JICA Advisor to BWDB Mr. Akhiro Maeda, four broad types of protection (Type-A, Type-B, Type-C and Type-D) has been designed for this project.
- Submersible embankment in the Haor region remains under water for about 5-6 months during the monsoon season in each year. This repeated alternating drying and wetting coupled with other factors such as height and spacing of embankment, fetch length, size of peripheral river, soil properties and presence of clay content, wind speed/Afjal (local name), water flow velocity etc. causing damage of the embankment. As per severity of wave and current attack of the submersible embankment at different locations of some haors, different types of protection measure have been prepared on the basis of "Embankment Damage Assessment Report" under HMLIP, dated June 2019.
5. Tentative Location and name of haor with Type of Protection measure is shown in sheet no 02/19. Actual type of protection and exact location will be finalized after finalization.
6. This design is made as per previous discussion with Project Director (P.D). HMLIP arr different dates/times to protect the slope protection of the submersible embankment under this project. According to the decision, a letter if P.D. is issued to prepare this design, vide his office memo no. PMO/HMLIP/2019-20/C-1(f)/70B, Date: 19-12-2019

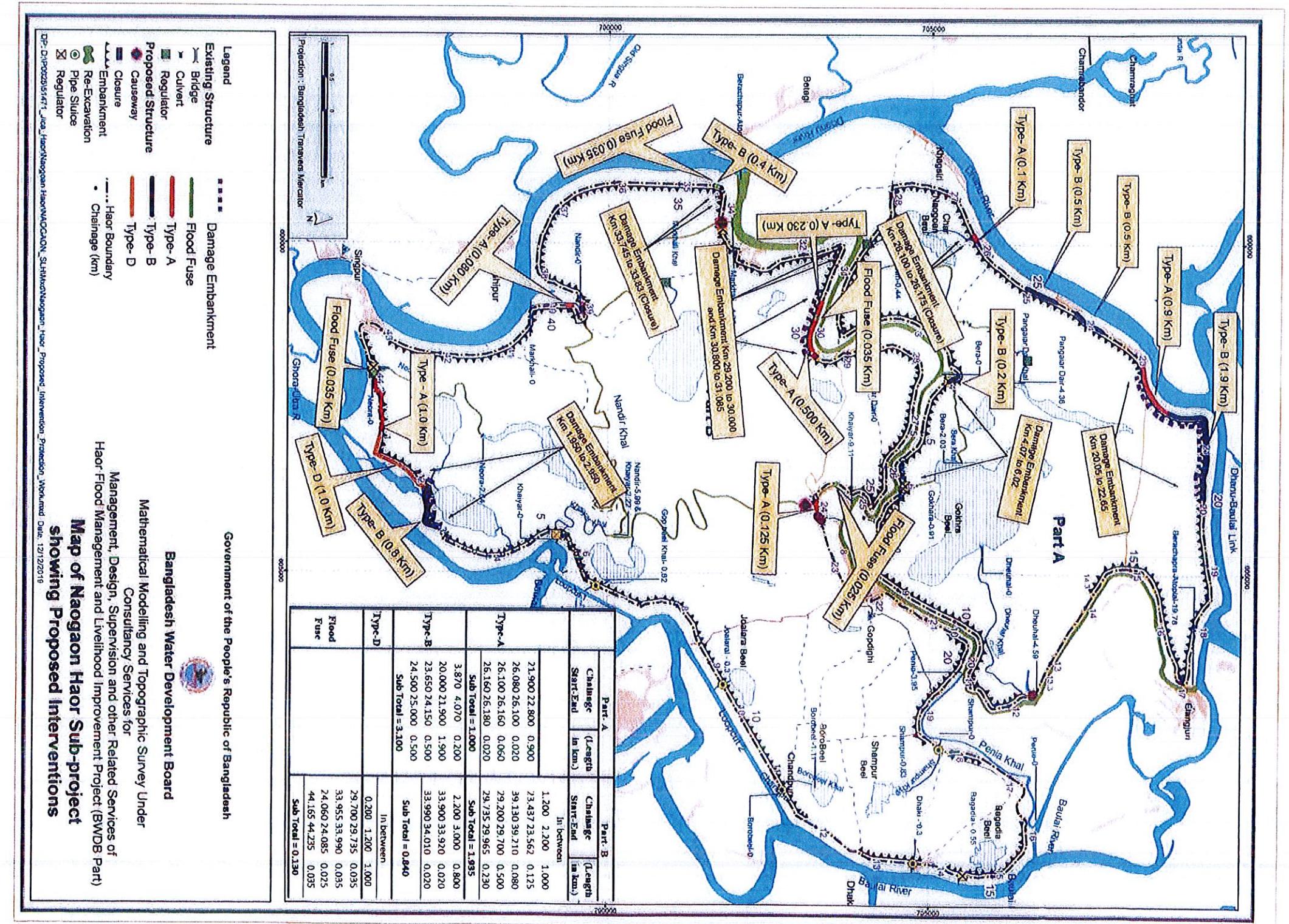
BANGLADESH WATER DEVELOPMENT BOARD		CONSULTANTS: Nippon Kei Co. Ltd (Nk), Joint Venture with BETS-CNRs		GENERAL NOTES	
DRAWN BY: DESIGNED BY: CHECKED BY: RECOMMENDED BY:		CHECKED BY: RECOMMENDED BY: APPROVED BY:			
Kusum Aker Kazir Mithma Basar		Jai Das Kundu A.Q. Mithma Md. Abdur Baset		Md. Abdur Baset Mother Hassan	
Fazlara Afreen		Fazlara Afreen		23.12.2019	
W.M.		W.M.		W.M.	
Scale: As shown					
TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERSIBLE EMBANKMENT					
of Haor Flood Management and Levee/Leakage Improvement Project (BWDB Part)					
Consultancy Services for Management, Design, Supervision and other Related Services					
23.12.2019					
Dwg. No. TYP SLOPE PROT TYPE. HMLP2237 Sheet. 01/19 23.12.2019					

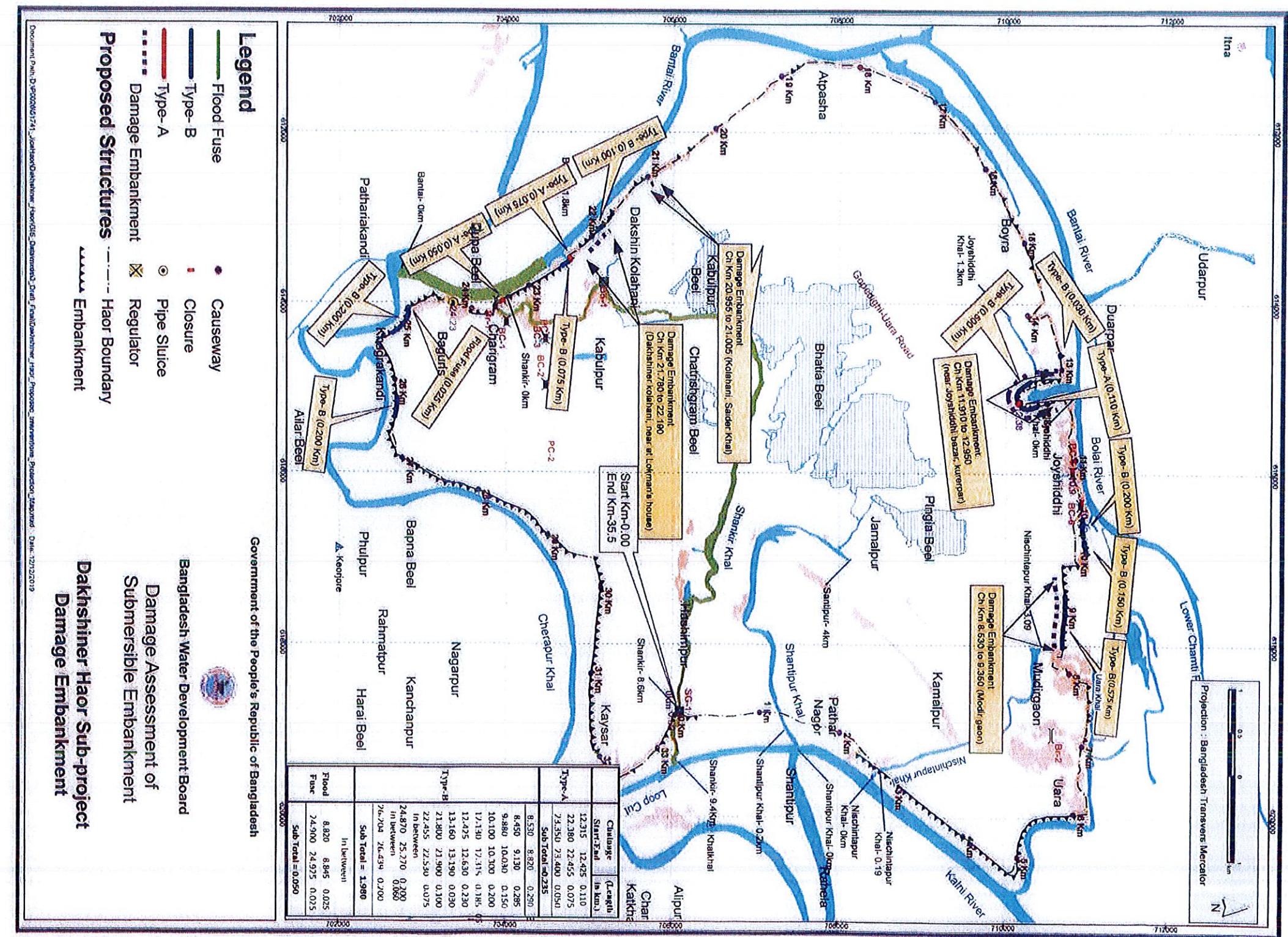
Table of Protection Measures at Different Haors

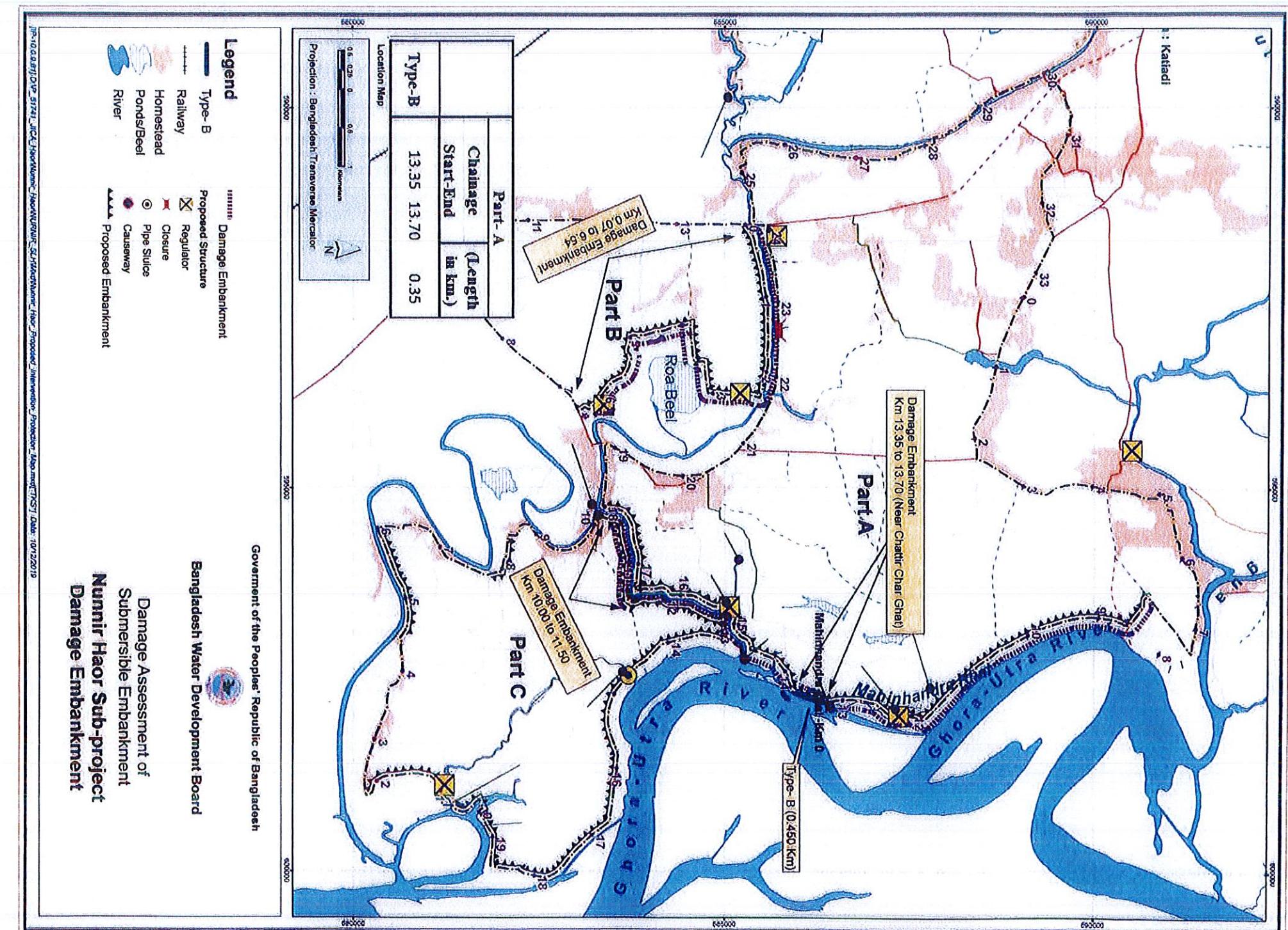
Name of Haor	Protection Measure														
	Type - A	Type - B	Type - C	Type - D	From (km)	to (km.)	Total (km)	From (km)	to (km.)	Total (km)	From (km)	to (km.)	Total (km)	Grand Total (KM)	
Naogaon Haor Part - A	21.900	22.800	0.900	3.870	4.070	0.200	4.070	0.200	2.200	3.000	0.800	0.200	1.200	1.000	4.100
Naogaon Haor Part - B	23.437	23.562	0.125	0.125	0.110	0.290	0.820	8.530	0.110	0.235	0.235	0.200	2.215	2.215	2.215
Dakshiner Haor	22.380	22.455	0.075	8.845	9.130	0.285	9.130	0.030	9.880	10.030	0.150	0.100	13.160	0.030	Naopara Haor
Noapara Haor	12.130	12.315	0.185	12.130	12.315	0.185	12.130	0.200	10.100	10.300	0.200	0.100	21.800	0.030	Nunnir Haor
Nunnir Haor	13.160	13.190	0.030	13.160	13.190	0.030	13.160	0.030	13.190	16.050	0.450	0.450	13.350	0.350	Dharmapasha Rubibeej
Dharmapasha Rubibeej	23.350	23.400	0.050	9.880	10.030	0.150	9.880	0.150	23.350	23.400	0.050	0.400	1.100	0.700	Sub- Project
Sub- Project	0.400	1.100	0.700	1.100	2.650	1.550	1.100	0.700	0.700	0.700	2.800	3.500	3.500	3.500	TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERGIBLE EMBANKMENT
LOCATIONAL TABLE OF PROTECTION MEASURES															Consultancy Services for Management, Design, Supervision and other Related Services of Haro Flood Management and Levee/Leak Protection Project (WBDB Part)
CONSULTANT'S NAME: Nippon Kei Co., Ltd (NK), Joint Venture with BETS-CNRs															CHEKED BY: RECOMMENDED BY: APPROVED BY:
DRAWN BY: DESIGNED BY: CHECKED BY: RECOMMENDED BY:															Scale: As shown
CONTRACT NO.: DWG NO.: TYPE SLOPE PROT TYPE: HFM3LIP2227 SHEET 02/19 DATE: 12/2019															Auto CAD OPERATOR: JUNIOR ENGINEER: STRUCTURAL ENGINEER-2: CO-TEAM LEADER: DWG NO.: TYPE SLOPE PROT TYPE: HFM3LIP2227 SHEET 02/19 DATE: 12/2019
DESIGNER: Kazi Md. Abul Basit: SE DESIGNER: Md. Abdul Basit: CE DESIGN: Mother Hassan															Fazlana Afreen: Md. Abdul Basit: CE DESIGN: Mother Hassan

BANGLADESH WATER DEVELOPMENT BOARD	LOCATION TABLE OF PROTECTION MEASURES											
TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERGIBLE EMBANKMENT												
CONSULTANCY SERVICES FOR MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES OF HARO FLOOD MANAGEMENT AND LEVEE/LEAK PROTECTION PROJECT (WBDB PART)												
CONSULTANT'S NAME: Nippon Kei Co., Ltd (NK), Joint Venture with BETS-CNRs												
CHEKED BY: RECOMMENDED BY: APPROVED BY:												
DRAWN BY: DESIGNED BY: CHECKED BY: RECOMMENDED BY:												
CONTRACT NO.: DWG NO.: TYPE SLOPE PROT TYPE: HFM3LIP2227 SHEET 02/19 DATE: 12/2019												
Kulsum Akter: Kazi Md. Abul Basit: SE DESIGNER: Md. Abdul Basit: CE DESIGN: Mother Hassan	Fazlana Afreen: Md. Abdul Basit: CE DESIGN: Mother Hassan											
DESIGNER: Kazi Md. Abul Basit: SE DESIGNER: Md. Abdul Basit: CE DESIGN: Mother Hassan												
AUTO CAD OPERATOR: JUNIOR ENGINEER: STRUCTURAL ENGINEER-2: CO-TEAM LEADER: DWG NO.: TYPE SLOPE PROT TYPE: HFM3LIP2227 SHEET 02/19 DATE: 12/2019												

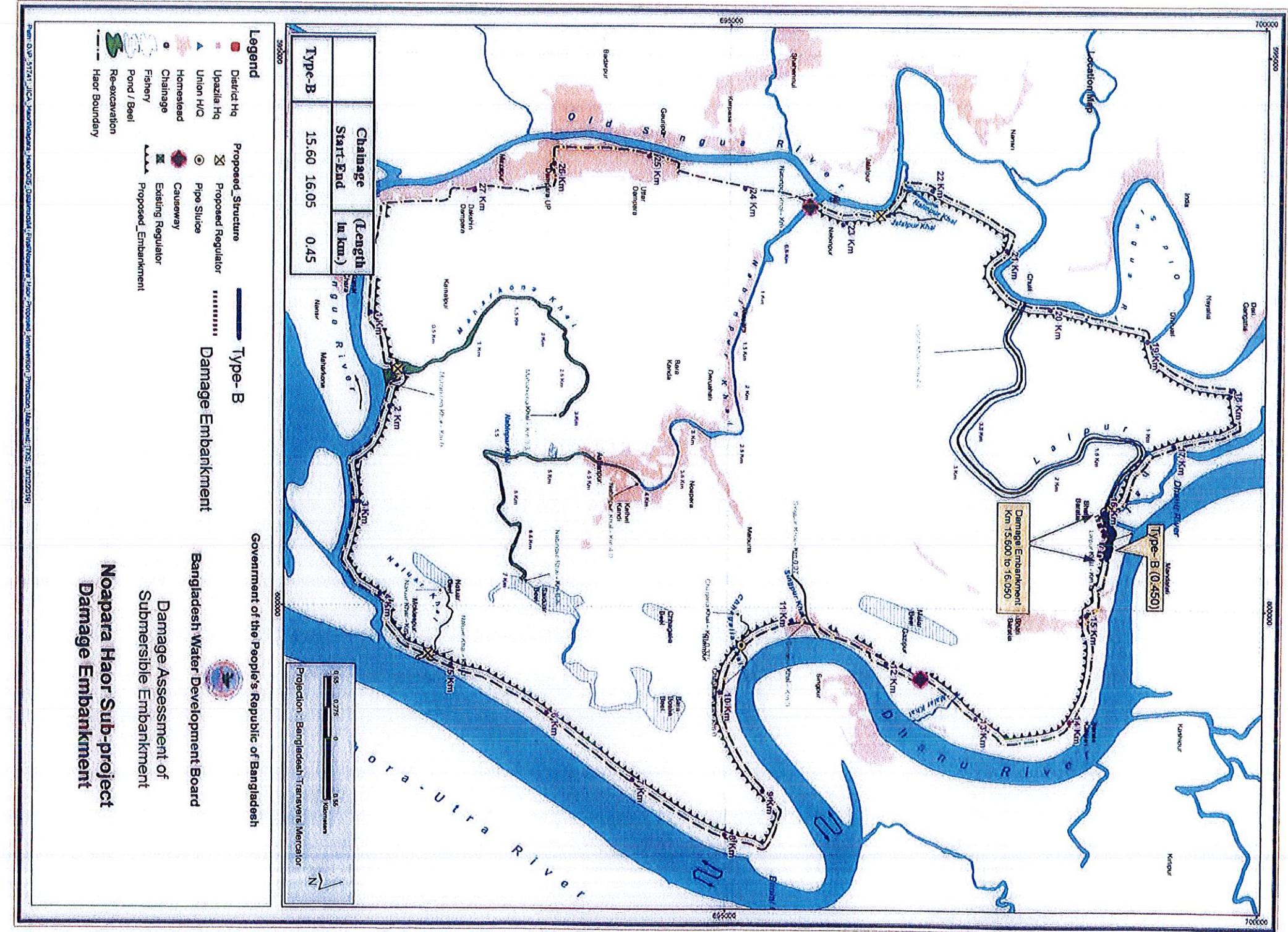
BANGLADESH WATER DEVELOPMENT BOARD					
Counselancy Services for Management, Design, Supervision and other Related Services of Har-Food Management and Livelihood Improvement Project (WDB Part)					
TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERGIBLE ENDABANKMENT					
LOCATION MAP OF PROTECTION MEASURES (NOAGAON HAR PART-A&B)					
CONSULTANTS: Nippon Kei Co. Ltd (NKK), Joint Venture with BETS-CNRs					
CHECKED BY: RECOMMENDED BY: APPROVED BY:					
DRAWN BY:	DESIGNED BY:	CHEKED BY:	RECOMMENDED BY:		
<i>Md. Md. Abu Basher</i>	<i>Md. Md. Abu Basher</i>	<i>Md. Md. Abu Basher</i>	<i>Md. Md. Abu Basher</i>	<i>23.12.19.</i>	
Kusum Akter	Kazi Muhammad Basheer	Jui Das Kudus	AD. Team Leader	AUTO CAD OPERATOR	
Fazlana Afreen	<i>Md. Md. Abu Basher</i>	<i>Md. Md. Abu Basher</i>	EE. DESIGN CIRCLE-1	STRUCTURAL ENGINEER	
Kusum Akter	Kazi Muhammad Basheer	Jui Das Kudus	AD. Team Leader	JUNIOR ENGINEER	
SHEET 03-19 / 2019					



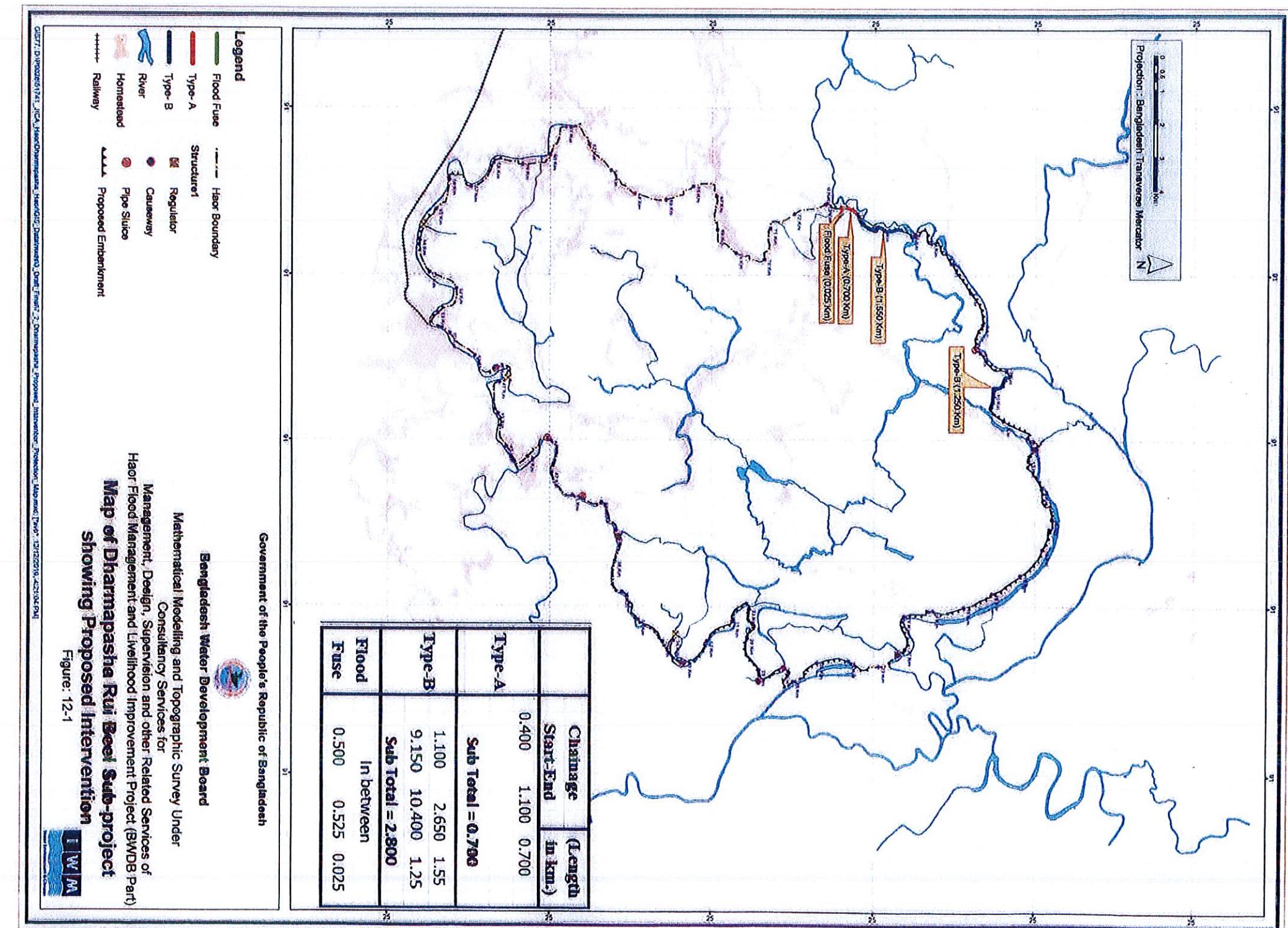




CONSULTANTS: Nippon Koei Co., Ltd (NKK), Joint Venture with BETS-CNRs						
DRAWN BY: DESIGNER BY: CHECKED BY: RECOMMENDED BY:						
AUTO CAD OPERATOR: JUNIOR ENGINEER: STRUCTURAL ENGINEER-2: CO-FAMILY FADER: WGS NO TYP SLOPE PROT TYPE: HMBUP-2237 SHEET: 05/19 23-12-2019						
DESIGNER SIGNATURE: Junior Desh Kumar A.O. Dhammada Ali E DESIGN CYCLE: 1 SE DESIGN CYCLE: 1 CE DESIGN						
Ku sum Akter Kal Mithumoni Basheer Md. Abdul Basit Mother Hassan						
Fazlana Afreen Md. Abdul Basit Mother Hassan						
Date: 23.12.19						
APPROVED BY: RECOMMENDED BY: APPROVED BY:						
LOCATION MAP OF PROTECTION MEASURES (NOAPARA HAOR)						
GEOMETRICAL DESIGN OF SLICE PROTECTION OF SUBMERGIBLE EMERGENCY						
of Haor Flood Management and Livelihood Improvement Project (GWDB Part)						
Consultancy Services for Management, Design, Supervision and other Related Services						
BANGLADESH WATER DEVELOPMENT BOARD						

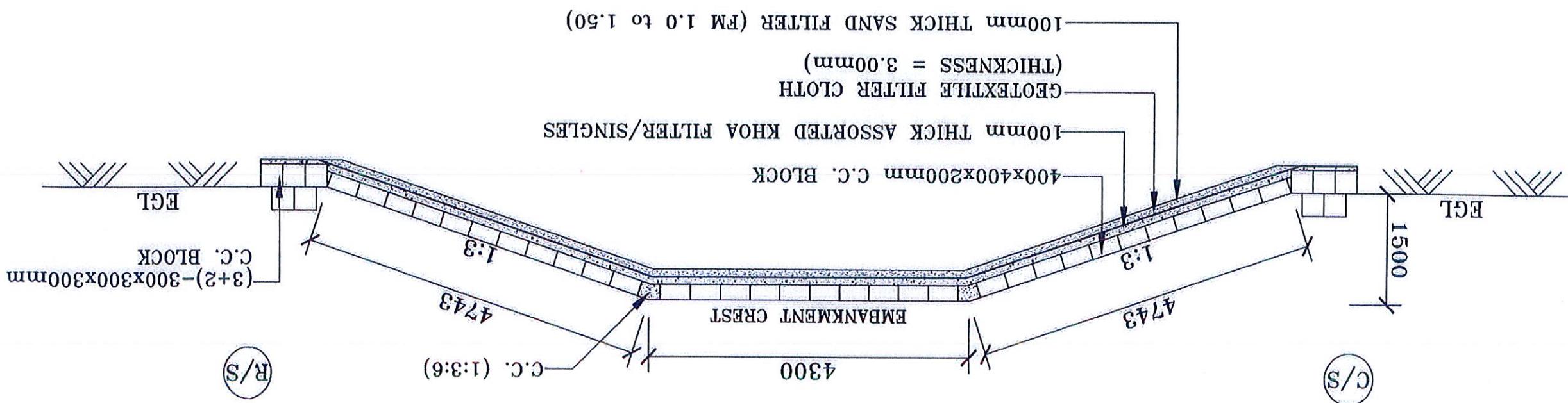


BANGLADESH WATER DEVELOPMENT BOARD		CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES OF HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)	
CONSULTANT: Nippon Koei Co. Ltd (NKL), Joint Venture with BETS-CNRs		LOCATION MAP OF PROTECTION MEASURES (DHRMAPASHRIBEEL)	
CONSULTANTS: Nippon Koei Co. Ltd (NKL), Joint Venture with BETS-CNRs		TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERISBLE EMBANKMENT	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		APPROVED BY:	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		RECOMMENDED BY:	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		CHECKED BY:	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		DRAWN BY:	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		CHECKED BY:	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		DESIGNED BY:	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		STRUCTURAL ENGINEER-2	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		STRUCTURAL ENGINEER-1	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		DESIGN CIRCLE-1	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		GE DESIGN	
CONSULTANCY SERVICES FOR HAOR FLOOD MANAGEMENT, DESIGN, SUPERVISION AND OTHER RELATED SERVICES (DHRMAPASHRIBEEL)		WFG NO TYP SLOPE PROT TYPE: MFLP-2237 SHEET 07/19 23.12.19	



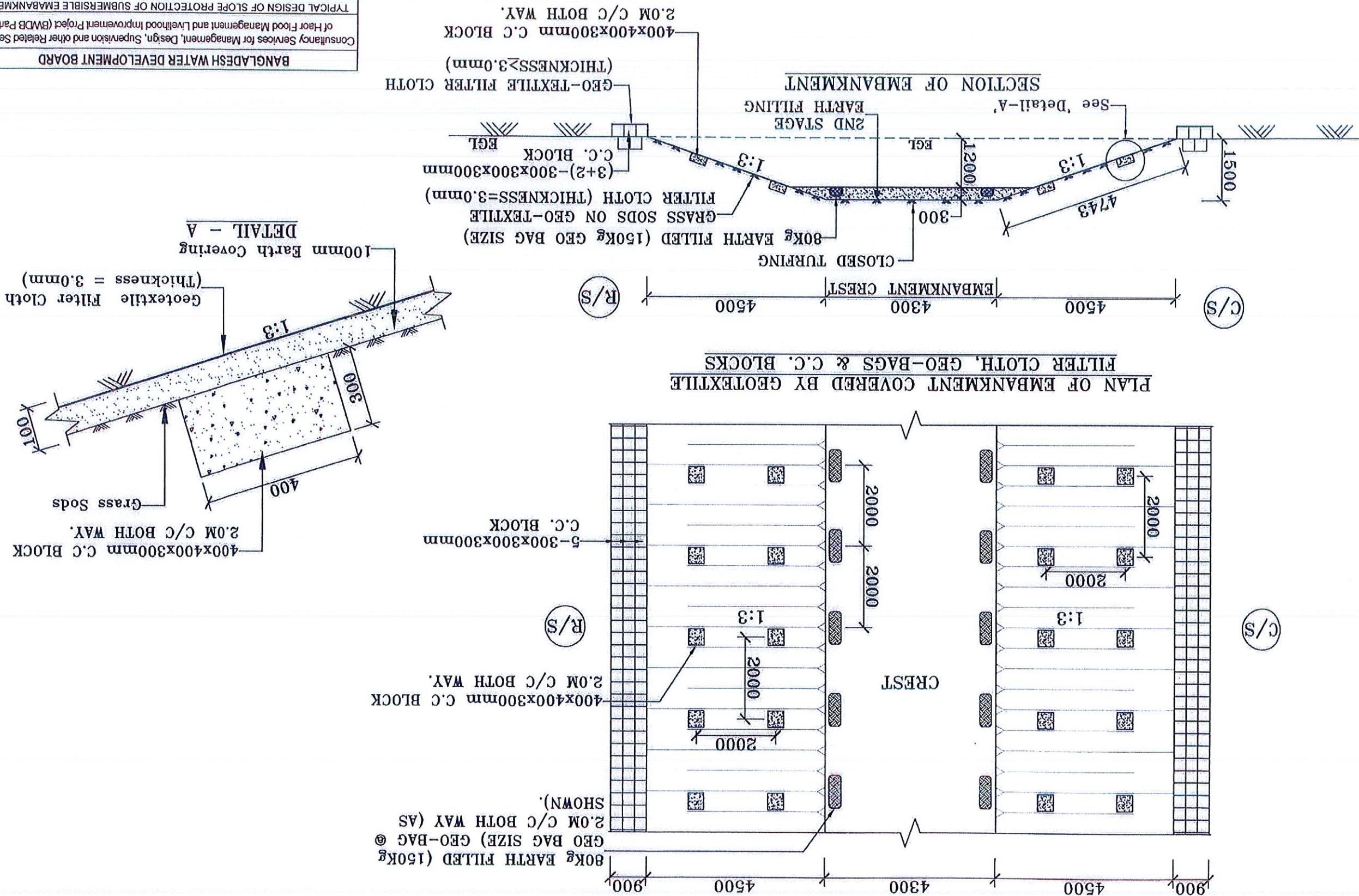
TYPE-A PROTECTION

SECTION OF SUBMERGIBLE EMBANKMENT WITH SLOPE PROTECTION



CONSULTANTS: Nippon Kei Co., Ltd (NK), Joint Venture with BETS-CNRs					
DRAWN BY:	DESIGNED BY:	CHECKED BY:	RECOMMENDED BY:	APPROVED BY:	
Kulsum Akter	Kazi Mahamud Basheer	Jalil Das Kundu	A. M. Monamad Ali	Fazlana Afreen	Md. Abdul Basit
TYPE-A					
TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERGIBLE EMBANKMENT					
of Harf Flood Management and Leveeboard Improvement Project (BMDP Part)					
Consultancy Services for Management, Design, Supervision and other Related Services					
BANGLADESH WATER DEVELOPMENT BOARD					
Scale: As shown					
DRAFT NO TYPE REPORT/TYPEA/HFSLP-227 SHEET 08/19 23-12-2019					

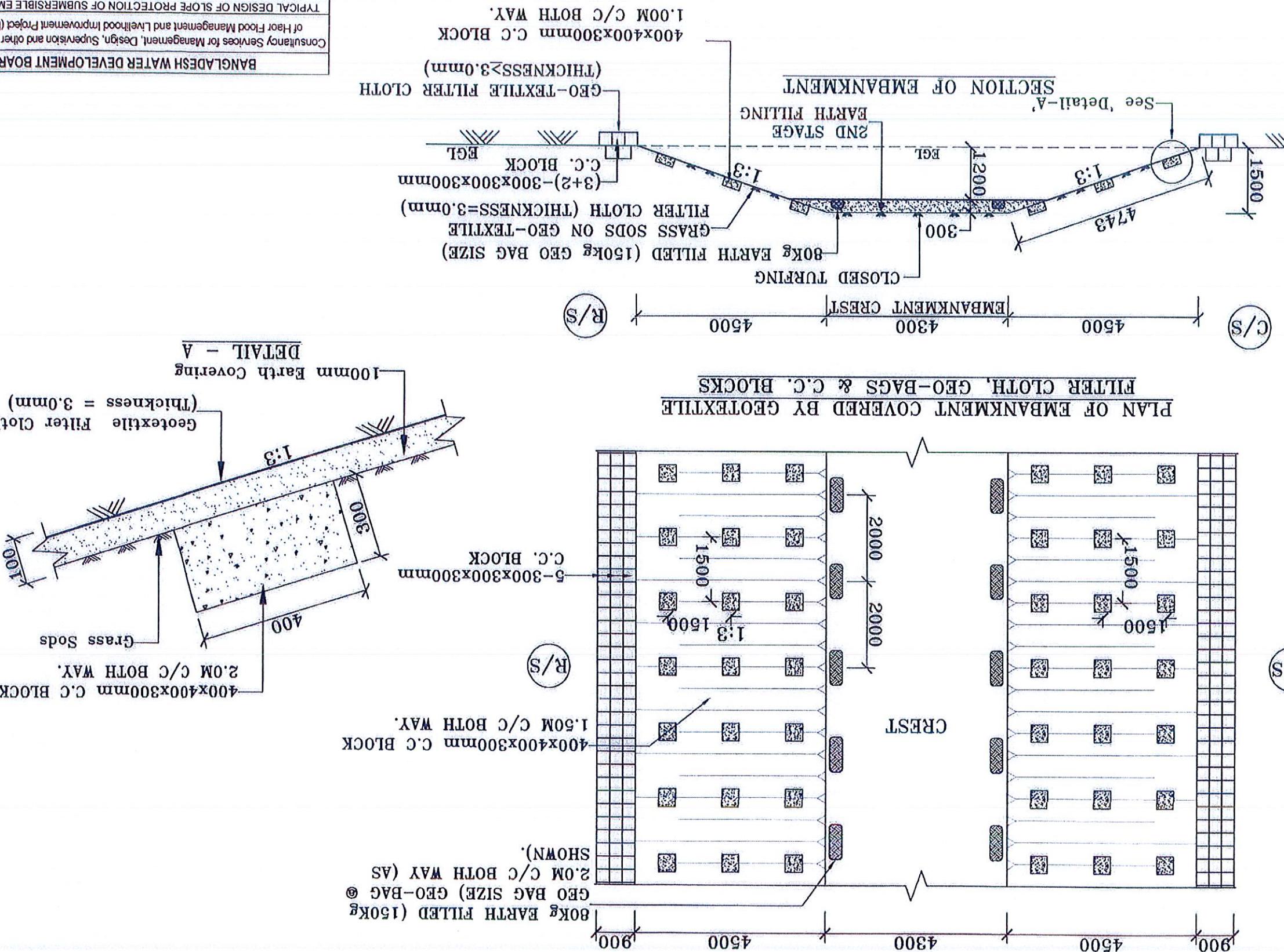
TYPE-B1 PROTECTION



Scale: As shown

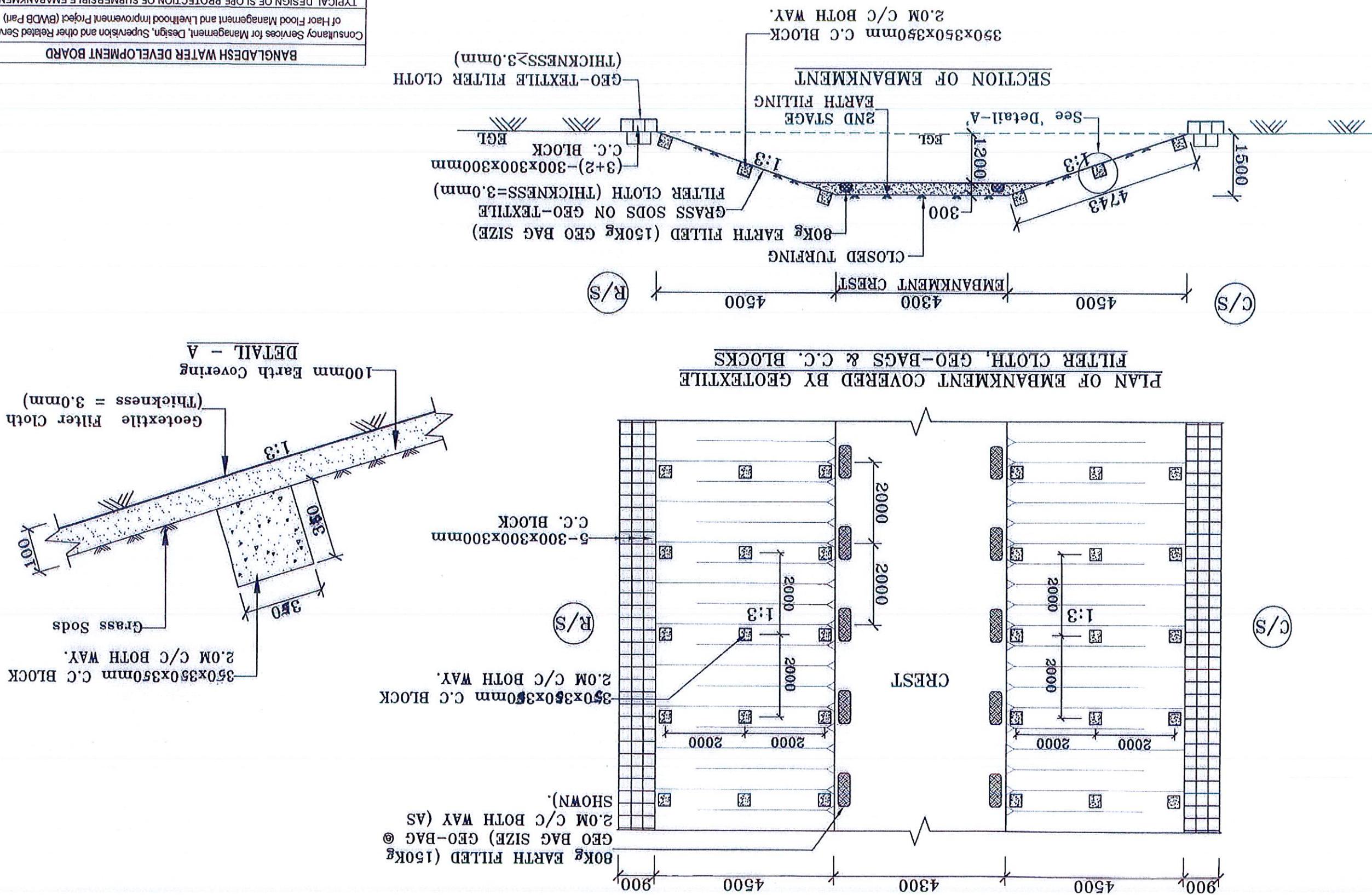
BANGLADESH WATER DEVELOPMENT BOARD		(THICKNESS 3.0mm)		400x400mm C.C. BLOCK		2.0M C/C BOTH WAY.	
Consultancy Services for Management, Design, Supervision and other Related Services of Haror Food Management and Livelihood Improvement Project (BWDBP)		TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERSEIBLE EMABANKMENT		Nippon Kei Co., Ltd (NK), Joint Venture with BETS-CNRs		CONSULTANTS:	
CHECKED BY:	RECOMMENDED BY:	APPROVED BY:	RECOMMENDED BY:	APPROVED BY:	RECOMMENDED BY:	APPROVED BY:	DRAWN BY:
TYPE-B1		Nippon Kei Co., Ltd (NK), Joint Venture with BETS-CNRs		Nippon Kei Co., Ltd (NK), Joint Venture with BETS-CNRs		Nippon Kei Co., Ltd (NK), Joint Venture with BETS-CNRs	
KUSSUM Akter		Fazlana Afreen		Md. Abdur Basir		Md. Md. Hossain	
kazi Muhammad Beshar		EE, DESIGN CHIEF - 1		SE DESIGN CHIEF - 1		CE DESIGN	
Jalil Das Ruhdu		A.Q. Shahmara Ali		CO-TEAM LEADER		DWG. NO. TYP. SLOPE PROT. TYPE-B HMWB/P-227	
						SHEET 09/19	
						23-12-2019	

TYPE-B2 PROTECTION



scale: As shown

TYPE-B3 PROTECTION



SCALE: AS SHOWN

TYPE-B4 PROTECTION

TYPE-B5 PROTECTION

OKg EARTH FILLED (150kg
EO BAG SIZE) G-E0-BAG @
.0M C/C BOTH WAY (AS
HOWN).

PLAN OF EMBANKMENT COVERED BY GEOTEXTILE

FILTER CLOTH, GEO-BAGS & C.C. BLOCKS

Geotextile Filter Cloth
(Thickness = 3.0m)

1:3

100

Grass Seeds

R/S

2000 2000

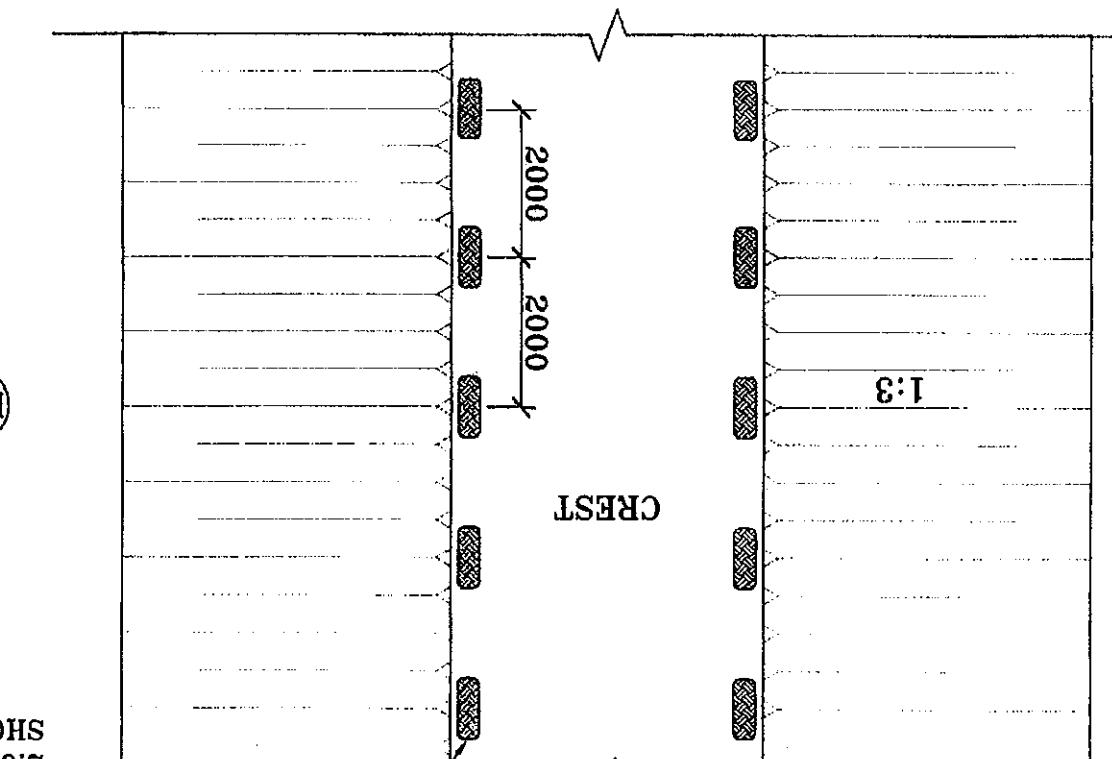
CREST

1:3

4500 4300 4500

80kg EARTH FILLED (150kg
GEO BAG SIZE) GEO-BAG @
2.0M C/C BOTH WAY (AS
SHOWN).

C/S DETAIL - A 4500 4300 4500 R/S

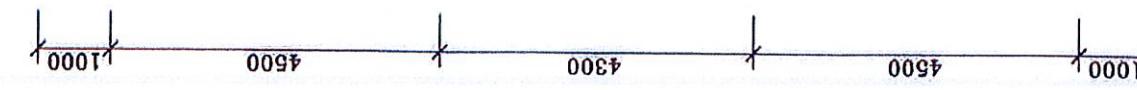


PLAN OF EMBARKMENT COVERED BY GEOFLEXITE FILTER CLOTH, GEO-BAGS & C.C. BLOCKS

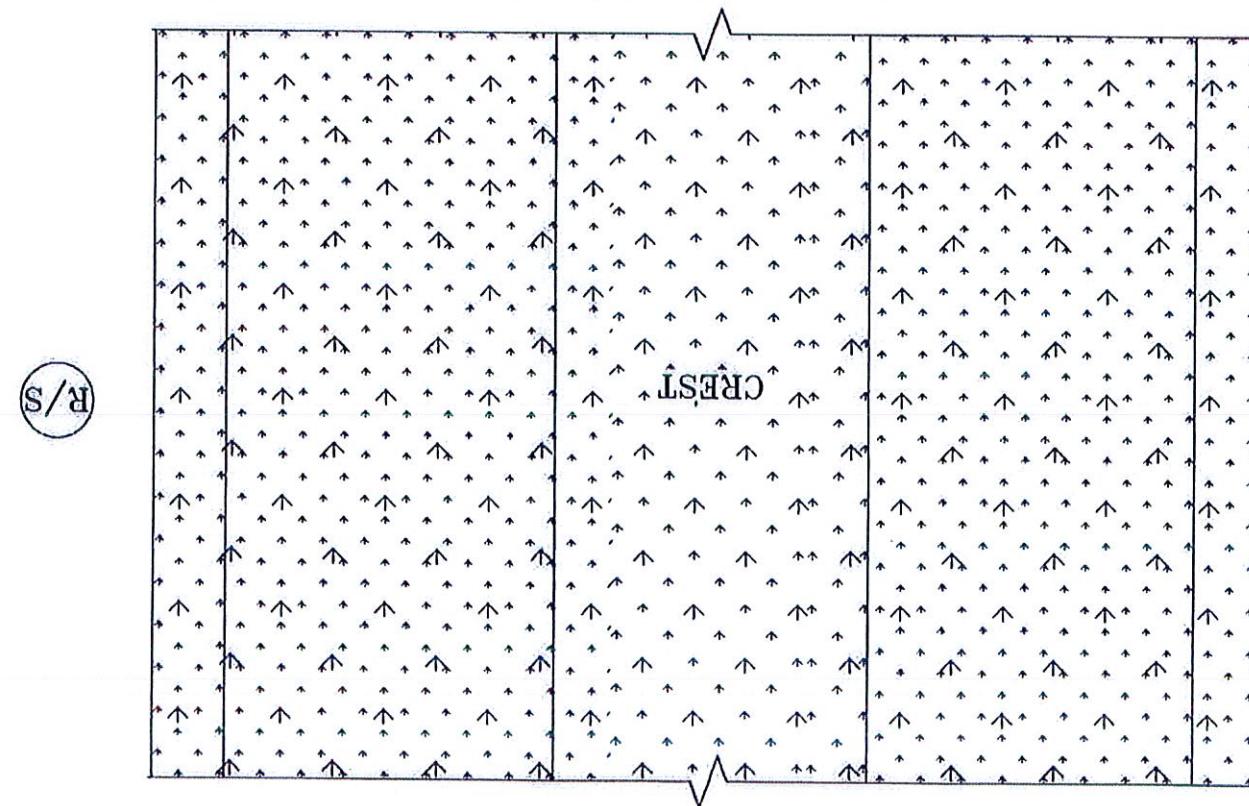
The diagram illustrates the cross-section of an embankment crest. It features a base layer of 'CLOSED TURFING' (100 mm thick) followed by a 'GROWING EARTH FILLED' (300 mm thick) and a 'GRASS SOIL FILTER' (300 mm thick). Above these is a 'GRASS' layer (100 mm thick). The top surface has a slope of 1:3. A vertical dashed line labeled 'SND STAGE EARTH FILLING' extends from the top surface down to the 'CLOSED TURFING'. A circular detail labeled 'See "Detail-A"' shows a cross-section of the slope with a slope of 1:3 and a height of 1.00 m. The total height of the embankment is indicated as 1.500 m. The diagram also includes a horizontal dimension line of 1500 m and a vertical dimension line of 1.000 m.

Scale: As shown

TYPE-C2 BIOLOGICAL PROTECTION

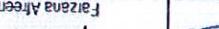


PLAN OF BIOLOGICAL PROTECTION ON BOTH SIDE VERTRIEVER PLANT & GRASS SDS

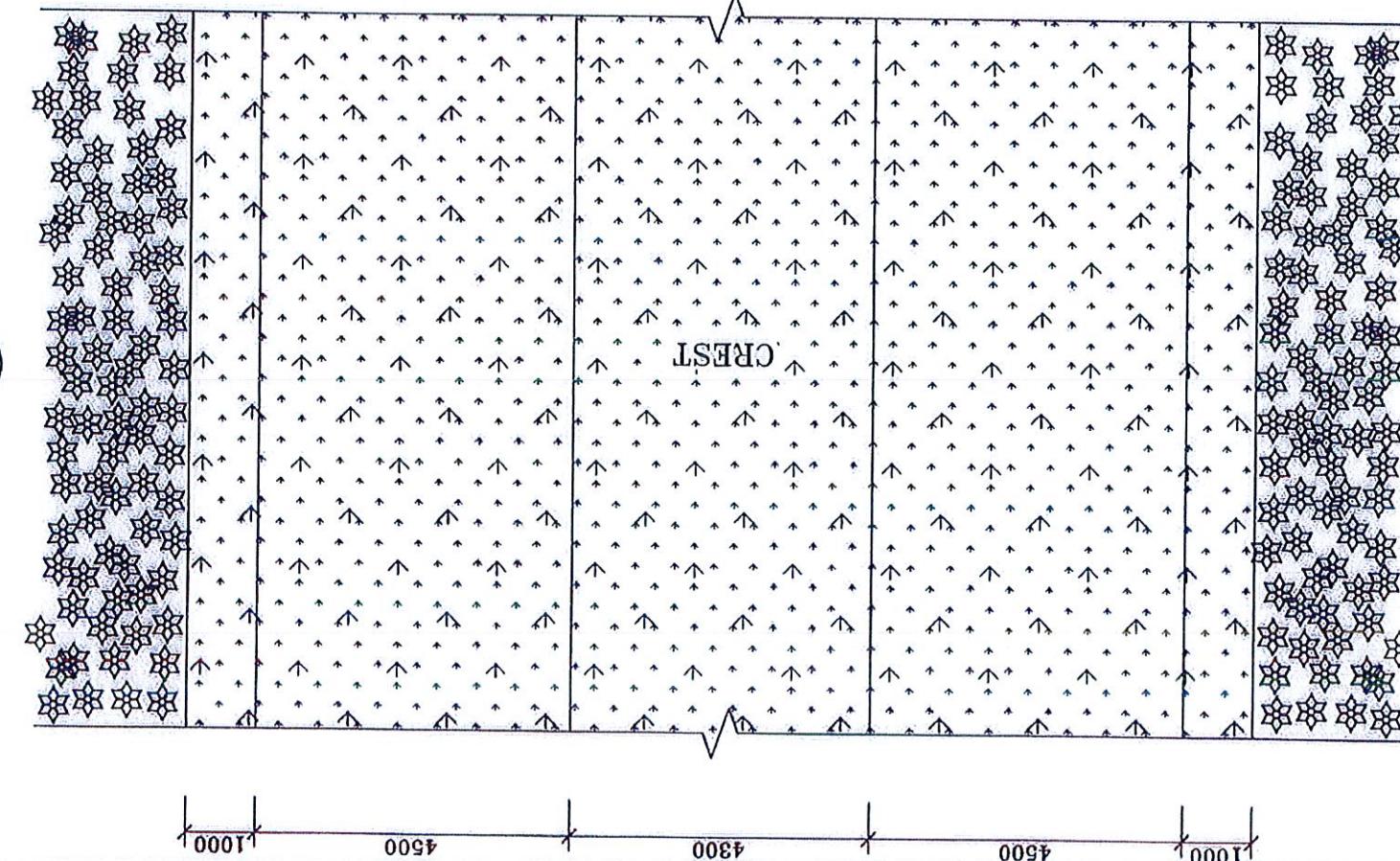


SECTION OF VEGETATIVE FILTER PLANT & GRASS SODS

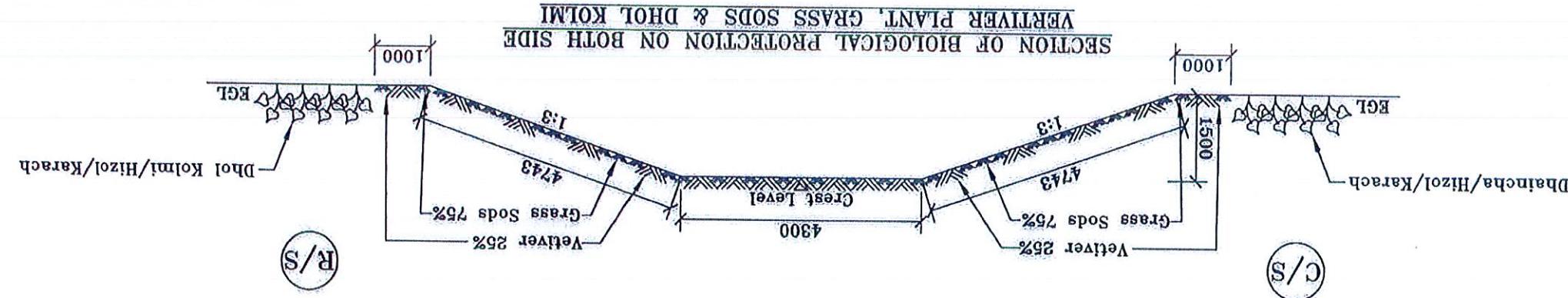
The diagram illustrates a cross-section of a vegetative filter plant. The top horizontal line represents the ground surface (G.L.). On the left, a vertical wall is labeled '1000' at the top. A slope on the left side is labeled 'Vetiver 25%' and 'Grass Sods 75%'. The crest level is marked as '4300'. The right side shows another slope with 'Vetiver 25%' and 'Grass Sods 75%' protection, also reaching a crest level of '4300'. Vertical dimensions on the right indicate a height of '500' from the base to the top of the right slope, and a total height of '1500' from the base to the top of the left wall. The bottom horizontal line is labeled 'E.G.L.'.

BANGLADESH WATER DEVELOPMENT BOARD					
Consultancy Services for Management, Design, Supervision and other Related Services of Harpal Management Project, Subdivision and other Related Services TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERSEABLE EMERGENCY					
CONSULTANTS: Nippon Koei Co., Ltd (NKK), Joint Venture with BETS-CNRs CHECKED BY: RECOMMENDED BY: APPROVED BY:					
DRAWN BY: 	DESIGNED BY: 	CHECKED BY: 	RECOMMENDED BY: 	APPROVED BY: 	TYPE-C2
Scale: As shown					
AUTO CAD OPERATOR: Md. Abu Bari	JUNIOR ENGINEER: Md. Abu Bari	STRUCTURAL ENGINEER: Md. Abu Bari	CO-TEAM LEADER: Md. Abu Bari	DWG. NO.: TYP SLOPE PROT TYPE-CHEM&LIP-2237	SHEET: 15/19 23-12-2019
Kusum Akter	Kazi Muhammad Beshar	Jalil Das Khondi	A.Q. Mohammad Ali	EE, DESIGN CIRCLE - 1	SE, DESIGN CIRCLE - 1
Fazlana Afreen	Md. Abu Bari			Md. Abu Bari	Mother Hassan
					23-12-19.

TYPE-C4 BIOLOGICAL PROTECTION



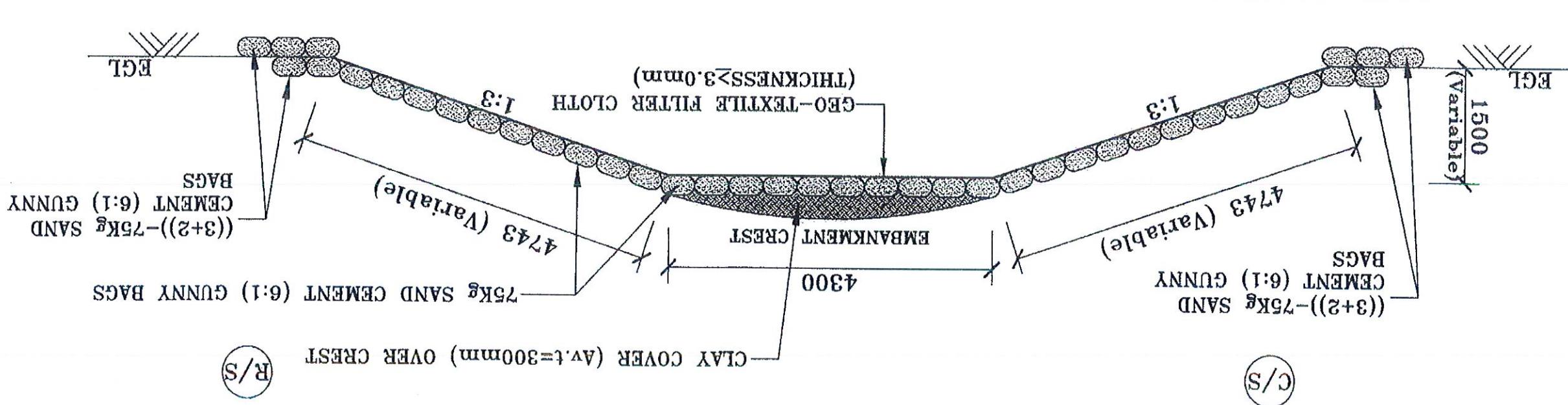
PLAN OF BIOLOGICAL PROTECTION ON BOTH SIDE
VERTEVER PLANT, GRASS SODS & DHOOL KOLMI



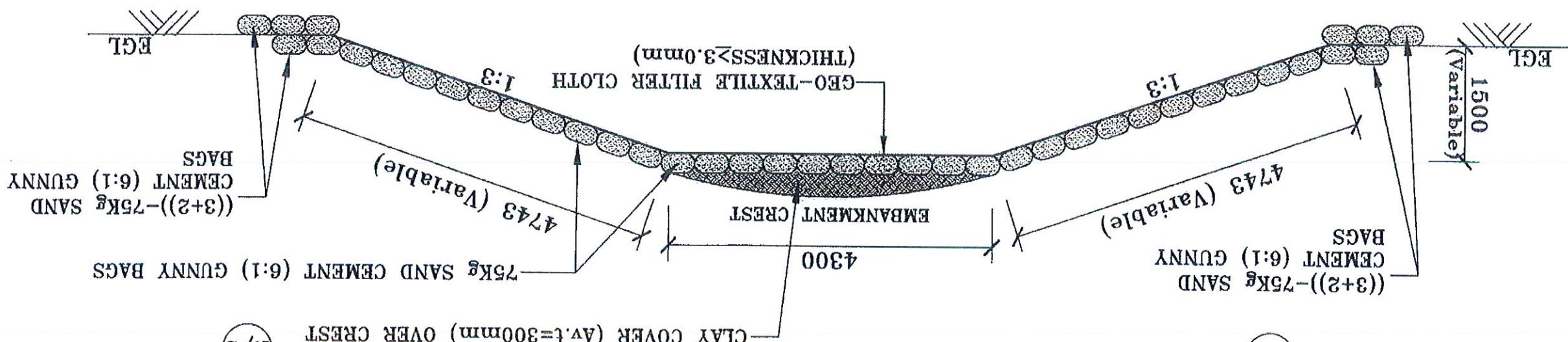
VERTRIEBER PFLANT, GRASS SODS & DHOI KOLMI
SECTION OF BIOLOGICAL PROTECTION ON BOTH SIDE

BANGLADESH WATER DEVELOPMENT BOARD		Consultancy Services for Management, Design, Supervision and other Related Services of Haror Flood Management and Levee/Leak Improvement Project (BDP)		TYPICAL DESIGN OF SLOPE PROTECTION OF SUBMERSEABLE EMBANKMENT TYPE-C4	
CONSULTANTS: Nippon Kei Co. Ltd (NKK), Joint Venture with BETS-CNRs		CHECKED BY: RECOMMENDED BY:		APPROVED BY:	
DRAWN BY:	DESIGNED BY:	CHEKED BY:	RECOMMENDED BY:	APPROVED BY:	
KUUSUM Akter Autodesk CAD OPERATOR		Kazi Muhammad Basher JUNIOR ENGINEER		STRUCTURAL ENGINEER-2 CD TEAM LEADER	
Fazlana Afreen A.Q. Noorunnisa Ali		Jahidul Khydri FE DESIGNER		DWG NO. TYP SLOPE PROT TYPE-C4/HMLP227 SHEET 1719 23.12.2019 CE, DESIGN Mother Hassan	
Scale: As shown					

TYPE-D PROTECTION



SECTION OF SUBMERGIBLE EMBANKMENT WITH SLOPE PROTECTION BY SAND CEMENT GUNNY BAGS



Scale: As shown