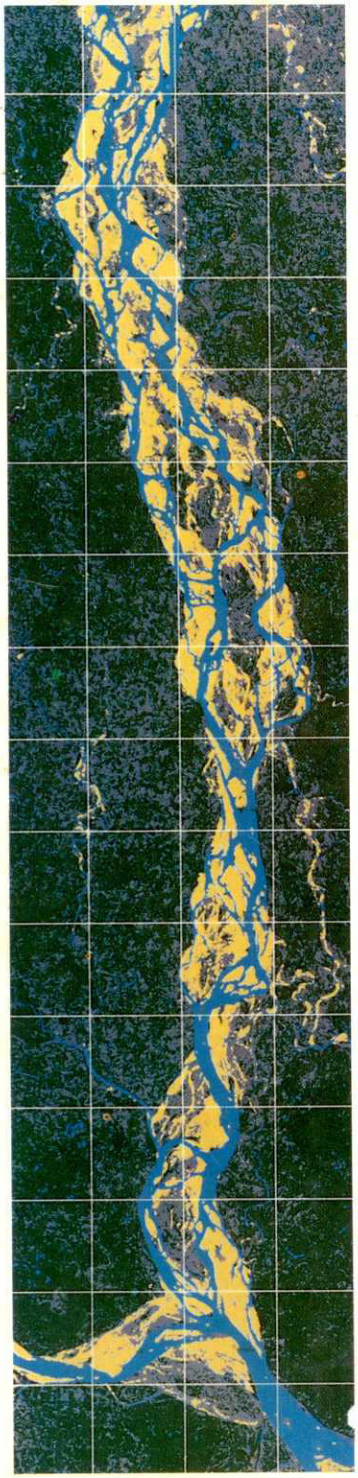
GOVERNMENT OF PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF WATER RESOURCES
WATER RESOURCES PLANNING ORGANIZATION

FEDERAL REPUBLIC OF GERMANY

KREDITANSTALT FÜR
WIEDERAUFBAU (KfW)

FRENCH REPUBLIC

CAISSE FRANCAISE DE
DEVELOPPEMENT (CFD)



BANK PROTECTION AND RIVER TRAINING (AFPM) PILOT PROJECT FAP 21/22

TEST AND IMPLEMENTATION PHASE

PROGRESS REPORT NO. 30

OCTOBER TO DECEMBER 2000

JAMUNA TEST WORKS CONSULTANTS, JOINT VENTURE
CONSULTING CONSORTIUM FAP 21/22

RHEIN-RUHR ING.-GES.MBH, DORTMUND/GERMANY

COMPAGNIE NATIONALE DU RHONE, LYON/FRANCE
PROF.DR. LACKNER & PARTNERS, BREMEN/GERMANY
DELFT HYDRAULICS, DELFT/NETHERLANDS

In association with:

BANGLADESH ENGINEERING &
TECHNOLOGICAL SERVICES LTD. (BETS)
DESH UPODESH LIMITED (DUL)

BANK PROTECTION AND RIVER TRAINING
(AFPM) PILOT PROJECT
FAP 21/22

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FAP 21/22

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1 GENERAL

1.1 THE PROJECT

The Project FAP 21/22 consisting of the two components

- Bank Protection Pilot Project (FAP 21) and
- River Training and Active Flood Plain Management Pilot Project (FAP 22)

was awarded by the Flood Plan Coordination Organization (FPCO) represented by the Kreditanstalt für Wiederaufbau (KfW) to the joint venture Rhein-Ruhr Ingenieur-Gesellschaft mbH as lead partner, Compagnie Nationale du Rhône, Prof. Dr. Lackner & Partners and Delft Hydraulics in association with Bangladesh Engineering and Technological Services Ltd. (BETS) and Desh Upodesh Ltd. (DUL).

As per Terms of Reference the Consultancy Services are to be performed in two phases, a Planning Study Phase (Phase I) followed by a Test and Implementation Phase (Phase II) for the FAP 21 component.

The Consultancy Agreement was signed on October 14, 1991. The date of commencement was fixed on December 01, 1991.

The Inception Report was issued on March 21, 1992 and the Interim Report on July 16, 1992. The Draft Final Planning Study Report for the FAP 22 component was presented on December 19, 1992 and that for the FAP 21 component on January 18, 1993.

A joint mission of KfW and Caisse Française de Developpement (CFD) carried out from January 26 to February 07, 1993 the Project appraisal of Phase II. The Mission together with FPCO agreed with the overall concept for the Test and Implementation Phase of the FAP 21 component, which started on June 01, 1993 after the "Letter to Proceed" had been issued by FPCO on May 15, 1993.

After a meeting held on June 21, 1993 the FAP Review Committee of the Ministry of Irrigation, Water Development and Flood Control recommended the Draft Final Planning Study Report of both the components for approval by the Technical Committee.

The Final Planning Study Report FAP 21/22 was presented on June 30, 1993 and approved by the FAP Technical Committee of the Ministry of Irrigation, Water Development & Flood Control on August 09, 1994.

With effect of January 01, 1996 the responsibilities of the client passed to the Water Resources Planning Organization (WARPO) of the in 1995 renamed Ministry of Water Resources.

The Bank Protection Pilot Project (FAP 21) consists of the construction of a Groyne Test Structure and a Revetment Test Structure at different test sites. The subcontract for the Groyne Test Structure at Kamarjani Test Site was awarded to the Consortium: The Engineers Limited and Corolla Corporation (BD) Ltd. on September 07, 1994. The actual construction works started on October 01, 1994 and were substantially completed end of April 1995. The groyne field was tested and permanently monitored by the Consultant for a period of 5 years and handed over to Bangladesh Water Development Board (BWDB) on April 15, 2000.

The subcontract for the construction of the Revetment Test Structure at Bahadurabad Test Site was awarded to the Joint Venture The Engineers Ltd.-Corolla Corporation (BD) Ltd. and Monico Ltd.-Boskalis International on September 30, 1995. The execution of works started in December 1995 but

had to be suspended in January 1996 for various reasons. The construction works were resumed in November 1996 and substantially completed end of May 1997.

With reference to the suspension of works on the Revetment Test Structure early 1996 and the incomplete adaptation / repair works at the Groyne Test Structure, the Consultant recommended in July 1996 an extension of the monitoring period of the FAP 21 component by one year up to end of 1999, which was approved by the Ministry of Water Resources in March 1997. Hence, work plan and staffing schedule were adapted accordingly up to December 31, 1999.

During the review mission of KfW and AFD (new name of the French donor agency with effect from April 1998) it was agreed between the donors, WARPO and BWDB in July 1998 to implement a third FAP 21 test site at Ghutail about 4 km downstream from Test Site II. Based on the Consultant's technical and financial proposal of December 1998 and its modification of May 1999 a subcontract was awarded to the Consortium: The Engineers Limited and Corolla Corporation (BD) Ltd. on June 23, 1999 for the construction of another Revetment Test Structure. The order to commence was issued the same day. The actual construction works started on December 17, 1999 and were completed end of May 2000. The structure was inaugurated by GoB on July 01, 2000. Necessary extension of Consultant's contract was approved by the Client and the Donors, and work plan and staffing schedule were adapted up to December 31, 2000.

After a test and monitoring period of four years the revetment structure at Bahadurabad was handed over to BWDB on December 14, 2000 together with the third test structure at Ghutail which, however, was tested only during the monsoon season 2000.

In September 2000 a proposal was submitted for remaining services in 2001 including mathematical model investigations, further monitoring of the test structures and training of BWDB staff for monitoring of bank protection and river training structures.

The River Training and Active Flood Plain Management Pilot Project (FAP 22) was formally finalized by holding an international experts discussion from November 02 to 04, 1993 on the new concepts presented in the Final Planning Study Report. Based on the recommendations of the Experts a combination of two different recurrent measures was built in the dry season 1996/97 at Katlamari Test Site and monitored during the flood season 1997. Early January 1998, however, it emerged that the investigations at Katlamari could not be continued due to the morphological development in the test site area. Therefore, a new test site had to be selected, which was finally found at Kundarapara, about 5 km east of Kamarjani Test Site. However, all activities, in particular the development and investigation of floating elements, had to be stopped in March and June 1998 respectively due to permanent problems with the local population in that area

1.2 THE REPORT

As per Section 12.01 and Appendix 1 of the Consulting Agreement as well as according to the Work Plan of the Test and Implementation Phase (Table 1 of Attachment 1 to "Letter to Proceed") a Progress Report is due at the end of December 2000. This report is the Progress Report as indicated above and spells out the work progress of Consulting Services and Construction Works in the period from October to December 2000.

This report presents for the two components of the pilot project a description in brief of the activities performed during this period.

1.3 PERSONNEL DEPLOYMENT

After issue of the "Letter to Proceed" the expatriate Consultants and their local counterparts took up their assignment. The personnel deployment during the period under review is shown in Table 1.1-1, 1.1-2 and 1.1-3 for the FAP 21 component and in Table 2.1-1 and 2.1-2 for FAP 22.

1.4 IMPORTANT DATES AND EVENTS

15.05.1993	Letter to Proceed
01.06.1993	Start of Test and Implementation Phase
12.06.1993	Subcontract for the construction and installation of the Filter Test Rig
21.06.1993	Meeting of FAP Review Committee on Draft Final Study Report FAP 21/22
30.06.1993	Submission of Final Study Report FAP 21/22
14.07.1993	Subcontract for Physical Model Tests
23.07.1993	Collapse of Manos Regulator at Kamarjani Test Site
08. to 12.08.1993	Visit of Members of the German Parliament
18.09.1993	Submission of Final Invoice Phase I
28.09.1993	Subcontract for topographic and hydrographic survey at Kamarjani Test Site
31.10.1993	Subcontract for subsoil investigations at Kamarjani Test Site
02. to 04.11.1993	Experts Discussion FAP 22
10.02.1994	Coordination meeting for Kamarjani Test Site with FPCO and BWDB
23.02.1994	Issue of Tender Documents for Kamarjani Test Site
28.02.1994	Submission of Experts Recommendations FAP 22
20.03.1994	Pre-bid meeting for Test Site I
17.04.1994	Tender opening for Kamarjani Test Site
08. to 20.06.1994	Technical Assessment of Procurement Arrangements of the Consultant
14. to 20.06.1994	Review Mission of KfW/CFD
18.06.1994	Consultants Report on the results of the Experts Discussion FAP 22
09.08.1994	Approval of Consultants Final Study Report by the FAP Technical Committee
04.09.1994	Order to Commence construction works at Kamarjani Test Site
07.09.1994	Subcontract signed for construction works at Kamarjani Test Site
22.09.1994	Submission of Tech. Report No.1 on Physical Model Tests
22.09.1994	Submission of Tech. Report No.2 on Morphological Prediction for Test Areas
26.09.1994	Coordination meeting for Kamarjani Test Site with FPCO and BWDB
28. to 03.10.1994	KfW mission for definition of Kamarjani Test Site location
01.10.1994	Start of Construction Works at Kamarjani Test Site.
12. to 17.02.1995	Review Mission of KfW/CFD
26.02.1995	Submission of Technical Report No. 3 on Filter Stability Investigation
16.04.1995	Issue of Tender Documents for Test Site II
18.04.1995	Submission of Technical Report No. 4 on Falling Apron Investigation
15.05.1995	Pre-bid meeting for Test Site II
20. to 25.05.1995	Audit of the Project (Test Site I at Kamarjani)
30.05.1995	Completion of construction works at Kamarjani Test Site
11.06.1995	Tender opening for Test Site II
31.08.1995	Order to Commence construction works at Bahadurabad Test Site
10.09.1995	Coordination meeting for Bahadurabad Test Site with FPCO
20. to 26.09.1995	KfW mission for definition of Bahadurabad Test Site location
30.09.1995	Subcontract signed for construction works at Bahadurabad Test Site
01.12.1995	Start of construction Works at Bahadurabad Test Site

01.02.1996	Suspension of Construction Works at Bahadurabad Test Site
12.03.1996	Submission of Technical Report No. 5 on Additional Model Tests
20.03.1996	Submission of letters of FORCE MAJEURE to WARPO for both Test Sites
22.04.1996	Proposal for Final Implementation of Revetment Test Structure at Test Site II
26.06 to 03.07.1996	Review Mission of KfW/CFD
18.07.1996	Proposal for Modification of Consulting Services
05.09.1996	Submission of Report on Extended Studies on Recurrent Measures (FAP 22)
30.09.1996	Submission of Report on Monitoring and Adaptation 1995 at Test Site I
29.10.1996	Proposal for location of FAP 22 Test Site (Katlamari)
13. to 17.11.1996	Technical Review Mission of KfW/CFD
26.11.1996	Resumption of construction works at Bahadurabad Test Site
24.12.1996	Start of construction works at Katlamari Test Site (FAP 22)
02.03.1997	Approval of extension of the monitoring period up to December 31, 1999
20.03.1997	Completion of construction works at Katlamari Test Site (FAP 22)
31.05.1997	Completion of construction works at Bahadurabad Test Site
20. to 29.06.1997	Technical Assessment of Procurement Arrangements of the Consultant
11. to 19.07.1997	Audit of the Project (Test Site I and II)
14. to 21.07.1997	Technical Review Mission of KfW/CFD
14.09.1997	Submission of Technical and Financial Proposal for Consultancy Services and Construction of Low Cost and Recurrent Measures (FAP 22)
06.01.1998	Approval of modified Proposal of September 1997 for Consultancy Services and Construction of Low Cost and Recurrent Measures (FAP 22)
07.02.1998	Start of construction works at Kundarapara Test Site
05.05.1998	Submission of Technical Report No. 6 on Additional Model Tests
14. to 23.07.1998	Technical Review Mission of KfW/AFD
09.09.1998	Submission of Report on Monitoring and Adaptation 1996 at Test Site I
23.12.1998	Proposal for modification of Consulting Services for Test Site III
01. to 07.03.1999	Technical Review Mission of KfW/AFD
23.03.1999	Submission of Report on Monitoring and Adaptation 1997 at Test Site I
23.03.1999	Submission of Report on Monitoring and Adaptation 1997 at Test Site II
31.05.1999	Proposal for modification of Consulting Services for Test Site III (Revision 1)
23.06.1999	Subcontract signed for construction works at Test Site III
23.06.1999	Order to commence construction works at Ghutail Test Site
17.12.1999	Start of construction works at Ghutail Test Site
23.12.1999	Approval of extension of the construction and monitoring period up to December 31, 2000
05.02.2000	Submission of Report on Monitoring and Adaptation 1998 at Test Site I
05.02.2000	Submission of Report on Monitoring and Adaptation 1998 at Test Site II
26.02. to 06.03.2000	Technical Review Mission of KfW
15.04.2000	Handing over of the Groyne Test Structure at Kamarjani to BWDB
25.05.2000	Completion of construction works at Ghutail Test Site
01.07.2000	Inauguration of Ghutail Test Structure by GoB
29.08. to 07.09.2000	Technical Assessment of Procurement Arrangements of the Consultant for Test Site III
12.09. to 19.09.2000	Audit of the Project (Test Site III)
14.12.2000	Handing over of the Revetment Test Structures at Bahadurabad and Ghutail to BWDB

2 BANK PROTECTION COMPONENT (FAP 21)

2.1 PRELIMINARY REMARK

The Consultant's services of the Test and Implementation Phase (Phase II) comprise all engineering and management tasks relating to the planning and execution of test structures, their monitoring, adaptation, repair measures during subsequent years and handing over to the Client at the end of the contract period.

After submission of the Draft Final Planning Study Report a joint mission of KfW and CFD has carried out the project appraisal to proceed into Phase II of the Project. The Mission agreed to the overall concept of Phase II proposed by the Consultant the essence of which was the construction of permeable groynes and of various types of revetments at two different test sites in two successive seasons.

However, the remaining lead time of the programme as presented in the Draft Final Planning Study Report for additional studies, final design, procurement, subcontracting and preparation of construction was found to be too short in view of the administrative and technical difficulties identified by the Consultant and the Mission. There seemed to be unacceptable risks that the construction of the test works at the first test site could not be completed successfully during the dry season 1993/94, which in turn would have led to major cost increases and endangered the achievement of meaningful test results.

A mutual understanding between all parties concerned had been reached on a postponement of the start of the construction period and of the end of the Project by one year. Moreover, it was decided to reduce the magnitude of the test works on the two selected test sites in order to reserve funds for further improvement of the test structures or, if necessary and possible, for the construction of new structures. Since in July 1998 remaining funds of about DM 8.4 million were estimated taking into account costs for monitoring and maintenance of the first two test structures until the end of the Project, all parties concerned came on request of the client to an agreement to utilise the contract amount up to 100 % and to implement a third test site.

Table 1.2-1.1 is showing the Work Plan and Table 1.2-3.1 the Staffing Schedule of the Test and Implementation Phase as per "Letter to Proceed" of May 15, 1993. Table 1.2-1.2 and 1.2-1.3 present revisions of the Work Plan of September 1996 and May 1999 respectively. Necessary modifications of the Staffing Schedule adjusted to the revised Work Plans and approved by the client and the donors are shown in Table 1.2-3.2 to 1.2-3.4. Table 1.2-2 is indicating the actual progress of works and Table 1.2-4 and Table 1.2-5 the actual deployment of the expatriate and local professional staff respectively during the period under review.

2.2 TEST SITE I AT KAMARJANI

2.2.1 General

Initially, the test structure comprised 6 groynes, each of them a combination of an impermeable and a permeable section with increasing permeability towards the river of which 3 groynes (G-1 to G-3) were partly constructed off-shore and on-shore while the other ones G-B1, G-B2 and G-A were built on the flood plain. All six structures launch from and were built against an embankment constructed under the authority of BWDB.

The main components of the groyne test field are the groynes G-1 to G-3, whereas G-B1, G-B2 and G-A, which were built upstream and downstream respectively from the main groynes, are intended to supplement the functioning and effects of the latter.

The "Order to Commence" the construction works was issued on September 04, 1994 and the works were substantially completed in April 1995.

The structure was "tested" by the river for the first time during the flood season 1995 which was marked by five flood peaks of which three represent events with more than 10 years re-occurrence and a maximum water level on July 10, 1995 corresponding to a situation of about 25 years re-occurrence.

The first four flood peaks contributed to three major damage events within the test site area:

- destruction of the impermeable groyne head of groyne G-2 and loss of piles of the permeable section;
- breach of the main embankment about 80 m downstream from groyne G-2, and
- collapsing of the impermeable part of groyne G-3 at the downstream side and destruction of the impermeable groyne head.

The initial findings of damage causes and the results of additional physical model tests performed in November/December 1995 at the River Research Institute at Faridpur had identified improvement and adaptation measures, which had to fulfil mainly the following conditions:

- to substantially reduce the magnitude of return currents and vortices within the groyne field, in particular along the main embankment, and
- to improve the transition between the permeable and impermeable part of the groynes with the aim to further limit the development of severe return currents, turbulences and vortices.

For the design of adaptation and repair measures, the design parameters as per original design of the groyne structure were being maintained. Only the downstream part of the impermeable groyne heads received substantially increased launching aprons.

Since the main river attack during the monsoon season 1996 was expected downstream from groyne G-A threatening the main embankment near the Manos river estuary, a new supplementary groyne G-A/2 was built 200 m downstream from G-A. However, the execution of the adaptation and repair works was hampered by the political situation in the country in 1995 and the first quarter 1996 with the result that the works could not be completed in time due to the rising water level. Especially, groyne G-2 remained incomplete because the gap between the remaining pile structure built in 1995 and the relocated main embankment could not be closed by driving further piles as per design.

During the flood season 1996 the river banks in the area of Kamarjani continued to be eroded and also the Groyne Test Structure came under attack again due to the attraction of the flow by the scour hole in front of the groynes. However, due to the adaptation of the structure and the morphological development in the test site area no damages to the structure occurred during the monsoon season 1996 except to the main embankment, which was slightly damaged by wave erosion in those areas where the upper part was only protected by grass sods. Repair works were carried out in November 1996 and the grass sod protection was replaced by brick mattressing. Further repair works of the pile structure of groyne G-2 were carried out by driving 23 Nos. steel piles ϕ 711 mm and 32 m length. Early 1998 twelve Nos. reinforced in-situ concrete piles were constructed between the toe of the relocated main embankment and the pile structure left over and intact after the monsoon 1995.

From September 1997 to end of January 1998 ten additional physical model tests were performed in the River Research Institute in Faridpur, the objective of which was

(1) to investigate the causes of damages observed in 1995 and

(2) to gain more information/knowledge of the behaviour of the groynes/groyne field

in order to be in a position to formulate design rules at the end of the Project in 1999 and to work out guidelines and manuals for their application.

During the monsoon seasons 1997 and 1998 no damages to the test structure occurred. Hence, no adaptation and repair works were necessary in the dry season 1998/99.

Also during the monsoon season 1999 no damages have been observed. Only more or less slow bank erosion continued downstream from the test structure in the area from Rasulpur to Balashi ghat as well as severe erosion at Kamarjani Bazar, about 4 km upstream from the groyne field. No adaptation and repair works were required.

In the course of the Technical Review Mission of KfW in February/March 2000 it was decided in agreement with all parties concerned to hand over the test structure to BWDB, which actually was done on April 15, 2000.

The general layout of the test structure after the execution of adaptation and repair works is shown in Fig. 1.

CONTROL POINT SCHEDULE

Location	ID - No. of Control Point	Co-ordinates BTM (FAP 24) Easting	Northing	Elevation (m PWD)
Near Comp	FAP 21 05	461,479 517	802,817 795	+ 21 920
G-4/2	No 24 33	(to be established)		
G-A	No 24 31	461,763 470	803,328 440	+ 23 335
G-3	No 24 29	461,922 160	803,595 130	+ 23 258
G-2	No 24 26	462,003 780	803,684 190	+ 23 446
G-1	No 24 24	462,071 690	804,125 130	+ 23 390
G-B/1	No 24 22	462,106 970	804,374 750	+ 23 404
G-B/2	No 24 20	462,142 470	804,626 130	+ 23 954

LEGEND

Homestead
Borrow pit
Bankline
Control points

NOTES

1 All measurements in meters
2 Levels refer to ± 0.00 m PWD
3 Reference Drawings

AD MA 002 Cross Sections of Main Embankment
AD MA 003 Main Embankment Centre of Revetment
AD MA 010 Groyne G-1, General Layout Plan
AD MA 020 Groyne G-2, General Layout Plan
AD MA 030 Groyne G-3, General Layout Plan
AD MA 040 Groyne G-A, General Layout Plan
AD MA 050 Groyne G-A/2, General Layout Plan

Scale 1:2000

REVISION	DATE	NAME	DESCRIPTION	DESIGNED
3	27.1.97	ANOWAR	As BUILT DRAWING (Adaptation works)	
2	8.8.96	ANOWAR	AS BUILT DRAWING	
1	28.05.96	ANOWAR	Revetment near G-4/2	

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF IRRIGATION WATER DEVELOPMENT & FLOOD CONTROL
FLOOD PLAN COORDINATION ORGANIZATION (FPCO)

BANK PROTECTION PILOT PROJECT FAP - 21

BANK TEST WORKS CONSULTANTS JOINT VENTURE

CONSULTING CONSORTIUM FOR BPP

TEST SITE I - KAMARJANI
- ADAPTATION WORKS -
ADAPTATION OF TEST STRUCTURES
GENERAL PROJECT LAYOUT

	NAME	DATE
DRAWN	ANOWAR	10-01-96
CHECKED		15-01-96
APPROVED		

SCALE 1 : 2000

FIGURE NO. 1

REVISION 3

2.2.2 Monitoring of the Test Structures

Since the final objective of the bank protection pilot project is to develop and optimise design criteria, cost-effective construction and maintenance methods, which will serve as future standards appropriate for the prevailing conditions at the Jamuna and other rivers of Bangladesh, regular monitoring, preventive maintenance and adaptation of the works is a must after installation of the test structure. Hence, monitoring started immediately after completion of the works in 1995 and were continued even after handing over the structure to BWDB in April 2000, however, on a considerably reduced scale.

During the period under review only bathymetric surveys from October 18 to 21, float track measurements on October 21 and charline survey on October 22 were performed.

All the surveys were finally processed in the office in Dhaka and the results of the bathymetric surveys are shown in contour charts together with flow lines in Annex B.

2.3 TEST SITE II AT BAHADURABAD

2.3.1 Introduction

The construction of the Revetment Test Structure was originally planned about 4 km south of Bahadurabad Ghat based on the investigations during the Study Phase. Since, however, no substantial erosion occurred at the pre-selected test site, this area was abandoned and a more suitable one was selected in September/October 1995 at Kulkandi-village just downstream from Bahadurabad Ghat. The decision on the final location of the test structure was taken on October 11, 1995. However, end November 1995 it emerged that the Subcontractor could not mobilise the main construction equipment for dredging and underwater works in time. After he had admitted his inability to do so, the Consultant informed the Subcontractor on December 05, 1995 of his failure to comply with the contractual obligations in accordance with Sub-Clause 63.1 (b) of the Conditions of Contract. On January 20, 1996 the Subcontractor was notified in accordance with Sub-Clause 46.1 of the Conditions of Contract that the rate of progress of works was too slow to comply with the contractual Time of Completion and finally it was decided on January 31, 1996 to defer the final completion of the test structure until the dry season 1996/97.

Based on the experience in 1995 and January 1996, and after identification of the main constraints preventing the completion of Works as per original schedule, a proposal for the final implementation of the Revetment Test Structure during the dry season 1996/97 was submitted in April 1996 taking into account the morphological analysis of the test area in March and May 1996 and the expected morphological development during the monsoon season 1996.

However, in August 1996 a deep channel shifted towards the bank of the selected test site and over the full length of the planned structure with severe erosion of the river bank resulting in a complete loss of the unprotected structure of 1995/96. Hence, another location of the Revetment Test Structure had to be determined and the design of the structure to be adapted accordingly. A proposal was presented to WARPO on October 19, 1996 which was discussed with the client and the donors during a review mission of the latter from November 13 to 17, 1996 with the final decision in favour of the location as shown in Fig. 2.

The start and the implementation of works was strongly affected by the land acquisition problem and the progress of works was already behind schedule at the end of 1996, because the subcontractor could only start the actual works on November 20, 1996 and concentrated till the end of the year mainly on earth works. Even after the client and the donors had decided during their meeting in

November 1996 to proceed with the construction works, the concerned authorities of the Government of Bangladesh took almost another month for compensation payment to the local population after the donors had agreed to advance necessary funds.

Due to the above mentioned circumstances the delay of the actual construction works accumulated to almost 2.5 months. However, the Consultant and his Subcontractor made every effort to make up for lost time and on June 12, 1997 the Revetment Test Structure was complete in all respects.

During the construction phase the structure was protected by a natural earth dam. This was important for the completion of the falling aprons. It remained intact for a longer period than expected and was finally washed away only in the last week of June 1997. Hence, the test structure was subjected to flow and wave attack and the falling aprons started to function. During the monsoon 1997 the structure was strongly attacked by the river and severe erosion downstream from the structure was observed. In July flow velocities up to 3.9 m/s were measured and a scour hole developed in front of Section D and E the deepest level of which was at –7.0 m+PWD. The river attack continued also in August and September just as the severe erosion downstream from the test structure, which was about 100 m in September in an area about 1 km downstream from the structure.

Though the flow velocity decreased considerably in September, the depth of the scour hole in front of the structure increased and shifted to Section G and H. The deepest level was recorded at –14 m+PWD. In October 1997 a mid channel char continued to grow in front of the Railway ferry ghat. This resulted in a reduction of width and depth of the channel near the bank upstream from the Revetment Test Structure, whereas the western channel developed further and attacked the riverbank just downstream from the structure. Considerable erosion of some 50 m were recorded in October and this process continued till the end of the year. However, no damage to the structure was observed, the falling aprons functioned as expected and at the end of the year sedimentation in the area of the falling aprons of Section G and H and in the channel occurred. Hence, no adaptation and repair works were required. Only some rain-cuts, which had developed under the revetment of the main embankment in Section E, had to be filled.

Also during the first quarter of 1998 erosion has been observed downstream from the structure up to Ghutail Bazar. When the water level started to rise at about mid March, the test structure came under attack again, but the falling aprons continued to function as expected. In June and July sedimentation occurred in front of the structure with maximum deposition of about 17.5 m along Section H-2. In August, however, fresh erosion gave way to the sedimentation process and continued along the structure till end of the year affected in the last quarter by the formation of a new char in front of the structure. During the whole year 1998 no damages to the structure caused by the river were observed and no adaptation and repair works were to be done.

At the beginning of 1999 a number of chars had developed in the vicinity of the test structure and a channel aimed at an angle of about 40° at Section B and C of the structure. After moderate changes of the river bed in front of the revetments and falling aprons during the first 5 months of the year, the erosion process started to increase in June and resulted in deep scour holes up to about –5 m+PWD in the downstream area. In July the oblique channel shifted further downstream and the parallel channel in front of the revetment structure started to silt up. During the last quarter of the year when the water level continued to fall a strip of land gradually surfaced, which had a width of about 100 m in front of the structure and which the local population started to cultivate. Their activities continued during the dry season 2000, when the water level further went down and no erosion occurred in front of the revetment structure.

During the monsoon season 2000 no damages to the structure were observed and thus no adaptation and repair works had to be executed.

29

CONTROL POINT SCHEDULE			
No. of Control Points	Co-ordinates BTM		Elevation (m PWD)
	Easting	Northing	
FAP 21-B	471,548.482	778,800.937	+ 20.246
*) GPS FM 764	471,086.185	778,478.880	—
FAP 21.28	471,330.663	777,813.399	+ 20.139
FAP 770	471,067.515	778,073.154	+ 20.248
FAP 21-X	471,293.485	778,654.360	—
FAP 21-Y	471,149.095	777,975.060	—

*) not existent anymore

To Schools
(Primary, Secondary, Madrasha)

FAP 21.B

LAND ACQUISITION
PHASE I (1995-96)

EC-MB Camp

pond

FAP 21-X

A-2

B

Village North-south connection

Consultants camp

LAND ACQUISITION
PHASE II (Site Survey 17.10.96)

FAP 21.28

SEE DETAIL
DRG. R-A-315

Market

C

D

E

F

G

H-1

H-2

FAP 21-Y

Pond

FAP 770

GPS FM 784

BANKLINE ON
15TH MAY '97

BANKLINE ON
15TH OCTOBER '96

179.40

224.40

45.0

JAMUNA RIVER

175.48

470.08

503.82

DRAWING PHOTOREDUCED BY 50%

0 50 100 200 m
SCALE 1 2000

LEGEND

Embankment
Road Pucca, Kacha, Footpath
High River Bank
House Pucca, Kacha & Tinshed
Traverse Station & Pillar
Home stead
Mosque

NOTES

1. The topography shown on this drawing is based on J.T.W.C.'s survey of Oct '96 combined with topographical maps of Survey of Bangladesh
2. Levels refer to ± 0.00 m PWD
3. Bank line and bathymetric survey as on 09/10/96
4. Reference Drawing
   R A 302 Detailed Layout of Test Structure

REV	DATE	NAME	DESCRIPTION	APPROVED
1	01.6.97	Anwar	AS BUILT DRAWING	

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF WATER RESOURCES
WATER RESOURCES PLANNING ORGANISATION (WARPO)

BANK PROTECTION PILOT PROJECT FAP-21

JAMUNA TEST WORKS CONSULTANTS, JOINT VENTURE

TEST SITE II - BAHADURABAD

GENERAL LAYOUT OF TEST STRUCTURE
(1996/97)

	NAME	DATE	SCALE : 1 : 2,000
DRAWN	ANWAR	03-11-96	
CHECKED		03-11-96	
APPROVED			FIGURE NO. 2 — REVISION 1

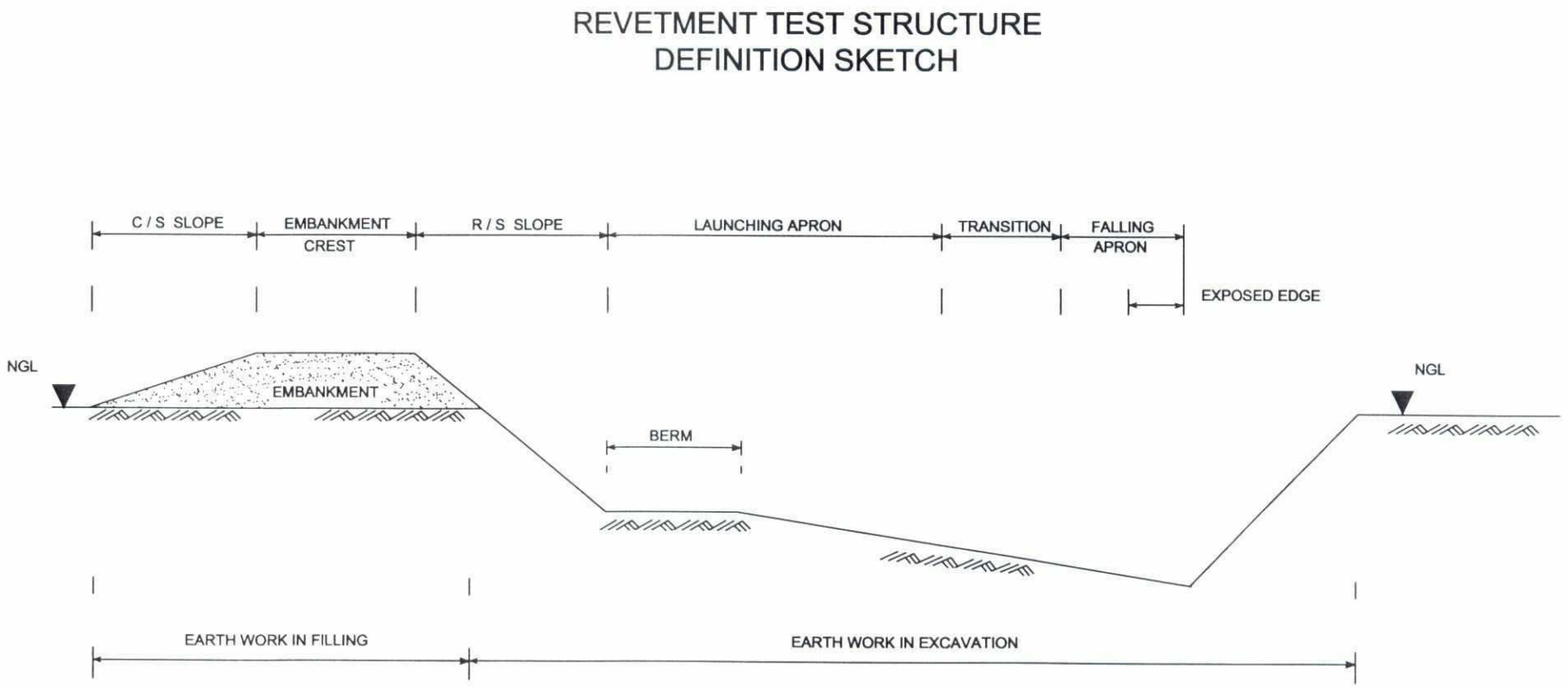


Fig. 3: Definition sketch of the Revetment Test Structure

DETAILS OF REVETMENT COMPOSITION

A. COVER LAYER

Test Structure		A - end	A - 1	A - 2	B	C	D	E		F	G	H-1	H-2	H-2(end)	
Land - sided slope		Brick mattress d = 15cm	In all sections durba grass sods laid on Geo-jute soil saver							Detail on top of Embankment Drg. No. R-A-314					
River side	Approximate length along toe of upper slope (at berm level)	87.40	74.70	74.70	99.10	93.20	88.0	90		88.0	100.0	82.75	97.60	20.0	30.0
	Revetment above berm level (+15.3m to +22.0m PWD)	Brick mattress d = 15cm	Brick mattress d = 15cm	Wiremesh mattress d = 23/36cm with stone fill Grade B (D_{50} = 15 cm)	Wiremesh mattress d = 23cm with stone fill Grade B (D_{50}= 15cm) on intermediate rubble layer (d = 25cm)	CC-blocks D_n = 35cm hand-laid in single, diagonal lines	CC-blocks D_n = 35cm hand-laid in single, parallel lines	Inter Locking CC-slabs (ship-lap TYPE)		wiremesh mattress d=36m with brick fill	Interlocking CC-slabs (tongue-groove type) on intermediate layer	Rip-rap Grade C (D_{50}= 20cm) Top 20cm with stone pitching(d =50cm)	Rip-rap Grade C (D_{50}= 20cm) Top 20cm with stone pitching(d =40cm)	As H-2	Rip-rap E+F 80cm on 20cm
	Launching Apron at and below berm level (+14.5m to +22.0m PWD)		Dumped CC-blocks D_n= 30cm	Dumped CC-blocks D_n = 35cm	Dumped CC-blocks Edge us:D_n = 50cm Center :D_n = 35cm Edge ds:D_n = 40cm	Articulated RENO-mattress d = 23/36cm;stone fill Grade B,C,D (D =25cm) with inter-connecting steel wires ropes and anchor pipes at berm level	Articulated CC-blocks mattress with inter-connecting steel wire ropes and anchor pipes at berm level	FORESHORE-mattress (Collapsible block mattress with cement grout fill)		PROFIX-mattress (tubular fabric mattress with sand and sand-bitumen fill)	INCOMAT-sandflex mattress (collapsible block mattress with sand fill)	Rip-rap Grade F (D_n=25-35-45cm)	CC-blocks, D_n=30cm D_n=35cm (mixed)		
	Transition between launching Apron and falling Apron		CC-blocks D_n= 30cm		CC-blocks D_n = 35cm					Rip-rap,Grade E CC-blocks,(D_n=30cm)* 1	CC-blocks, D_n=35cm *2				
	Falling Apron (Level +14.5m PWD)	Dumped CC-blocks D_n = 30cm	Dumped CC-blocks D_n = 35cm D_n= 40cm (mixed)	Rip-rap,Grade E (D_{50} = 30 cm)	Geo-sand-container Type C (180Kg/No.)	Geo-sand-container Type E (900Kg/No.)	CC-blocks D_n= 40cm		Geo-sand -container D	CC-blocks D_n=40/45cm (mixed)	CC-blocks D_n=35/40cm (mixed)				
	Transition between launching Apron and falling Apron			Rip-rap, Grade F (D_n = 25/35/45cm)	Geo-sand-container Type C(250Kg/No.)		CC-blocks D_n= 45cm	CC-blocks D_n=40cm	Geo-sand -container E	Gabion sacks with stone fill Grade B (D_{50}=15cm)(1300kg/No)	CC-blocks D_n=40cm	Selected boulders D_n= 35 - 45cm			

us = Upstream
ds = Downstream

*1 Mixed CC-blocks 30cm + boulder Grade E in evelope of double layer chain link fence

*2 Mixed CC-blocks 35cm + boulder Grade F in evelope of double layer chain link fence

B. FILTER LAYER

Test Structure			A - end	A - 1	A - 2	B	C		D	E		F	G	H-1	H-2	H-2(end)	
Land - sided slope			GF - 1	In all sections geo-jute Soil saver								Detail on top of Embankment Drg. No. R- A -314			Village Road		
River side	Approximate length along toe of upper slope (at berm level)		87.40	74.70	74.70	99.10	93.20		88.0	90		88.0	100.0	82.75	97.60	20.0	30.0
	Geotextile filter mats above berm level	Spec. type	GF-1/-5	GF - 1	GF - 5	GF - 2	Filter III on Filter II	Khoa on Filter II	GF - 2	GF - 1	GF - 5	GF - 1	GF - 1	GF - 4	GF - 4	As H-2	GF - 2
		Brand Name	BIDIM HaTe O 2214	BIDIM b 7	HaTe O 2214	BIDIM S 550			BIDIM S 550	DATEX AD 1300	HaTe J 9014	BIDIM S 390	DATEX AD 1300	BIDIM S 700	HaTe E 650 /K 251		HaTe E 650
	Geotextile filter mats at and below berm level	Spec. type	GF-1/-5	GF - 2	GF - 2	GF - 4	GF - 2		GF - 4	FORESHORE-mattress (collapsible fabric black mattress with cement grout fill)		PROFIX-mattress (tubular fabric mattress with cement grout fill)	GF -1 (sub-layer to INCOMAT-sand flex mattress)	GF - 1	GF - 1	—	—
		Brand Name	BIDIM HaTe O 2214	BIDIM S 550	BIDIM S 550	HaTe K 251	DATEX AD 1600		BIDIM S 700				BIDIM b 700	BIDIM S 390	BIDIM S 390	—	—

Table 1: Details of Revetment Composition

2.3.2 Monitoring of the Test Structures

Monitoring of the Revetment Test Structure started already during the construction phase in January 1997. During the period under report only bathymetric surveys from October 26 to 28, float track measurements on October 29 as well as bankline survey from Harindhara to Ghutail on October 27 were performed.

All the surveys were finally processed in the office in Dhaka. The results of the bathymetric surveys are shown in contour charts together with flow lines in Annex F as well as a differential model in Annex G.

2.4 TEST SITE III AT GHUTAIL

2.4.1 General

During the monsoon season 1997 and the following dry season severe erosion occurred further downstream from the Revetment Test Structure at Bahadurabad. Following the demand of the local population for suitable protection of their land and homesteads, WARPO requested the donors KfW and AFD during their review mission in July 1998 to agree to the implementation of a third test site at Ghutail, about 4 km downstream from the Revetment Test Structure. Since the test structures at Kamarjani and Bahadurabad had been implemented within the available budget and taking into account a cost estimate for their monitoring and maintenance until the completion of the Project by the end of December 1999, remaining funds of about DM 8.4 million were estimated. Taking further into account the intention to utilise the contract amount up to 100 %, it was agreed between the donors, WARPO and BWDB in July 1998 to implement a third FAP 21 test site at Ghutail.

Immediately after the decision had been taken in favour of a third test site, the Consultant started necessary investigations and surveys and arrived finally at the conviction that any test structure at any suitable test site on the Jamuna could not be completed before the monsoon season 1999. It was therefore suggested to the donors and the client on November 01, 1998 to start the actual construction of the third test structure after the monsoon season 1999 only.

In December 1998 a technical and financial proposal for the implementation of a third test structure along with a proposal for necessary modification of consulting services was submitted by the Consultant because the existing Contract was scheduled up to the end of 1999 only. The client and the donors approved the extension of the Contract up to end of 2000, but asked for some modifications of the financial proposal taking into account also the discussions and findings of the donors' review mission of March 1999. A revised proposal was submitted in May 1999, which was finally approved by the donors and the client as well.

Based on the local situation and the investigations/observations since July 1998, when the general decision was taken to implement a third test site, it was decided to build another Revetment Test Structure taking into account the experience of Bahadurabad Test Site. A preliminary design was submitted with the "Proposal for Modification of Consulting Services for Test Site III" in May 1999, which had to be adapted to the actual situation on site at mid November of that year.

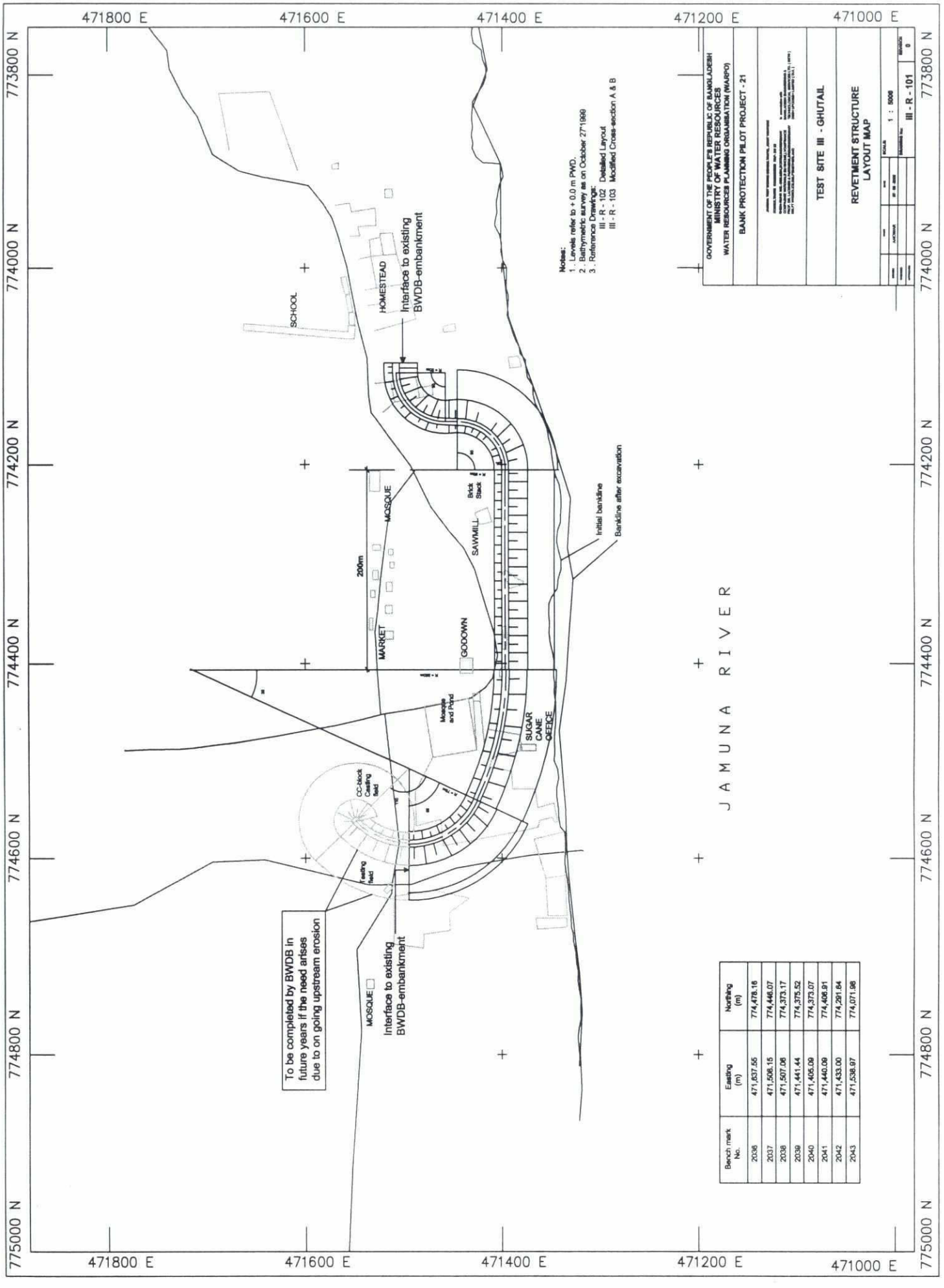
The revetment, the final general layout of which is shown in Fig. 4, consists of an embankment and 2 different sections of launching/falling aprons. The crest of the embankment is at 21.50 m+PWD and the launching/falling aprons are built in the dry at 15.0 m+PWD, i.e. above Standard Low Water Level, which is at about 12.85 m+PWD. The total length of the aprons is 31 m in Section A and 28 m in Section B. They are designed to cope with scouring up to about –5 m+PWD. The 16 m long

launching aprons are constructed of articulated RENO-mattresses with rubble-fill placed on geotextile filter. For the falling apron cc-blocks are used, the size of which is 40 and 45 cm in Section A and 35 and 40 cm in Section B. The water side slope of the embankment is protected by brick mattressing on geotextile filter. For details see Annex K of this report.

The actual construction works started on December 18, 1999 because of temporary problems with the local population in connection with compensation for crops and shifting of houses and were completed on May 25, 2000.

2.4.2 Monitoring of the Test Structures

After the decision had been taken to build a third test structure, the Consultant started necessary investigations, bathymetric surveys and flow measurements, in particular in the area of Ghutail Bazar. These activities were continued during the construction phase and after completion of the test structure. Since June 1998 the survey area in front of the Revetment Test Structure at Bahadurabad was extended to the south and the area in front of Ghutail Bazar included. Hence, during the period under report the monitoring activities were the same as for the Revetment Test Structure at Bahadurabad. As to the results, reference is made to Annex F and G. No substantial changes occurred in the test site area at Ghutail. The average flow velocity in front of the structure was 0.8 m/s only.



Bench mark No.	Easting (m)	Northing (m)
2036	471,637.55	774,478.16
2037	471,506.15	774,446.07
2038	471,507.06	774,373.17
2039	471,441.44	774,375.52
2040	471,405.09	774,373.07
2041	471,440.09	774,406.91
2042	471,433.00	774,291.84
2043	471,538.97	774,071.98

2.5 REPORTING

2.5.1 Introduction

In accordance with the Terms of Reference and the Consulting Agreement the Consultant has critically to assess the results of the test programme at the end of the Project and present a

Final Technical, Financial and Economical Project Evaluation Report

together with

Guidelines and Manuals for Planning, Design and Implementation of River Training and Bank Protection Works.

The latter are to be prepared on the basis of all available know-how and experience gained during the Project and should be applicable to more or less standard solutions for rivers in Bangladesh, in particular the Brahmaputra/Jamuna River.

On the occasion of the donors' review mission in July 1998 the Consultant presented in a work shop on July 20, 1998 his concept for the above mentioned reports. Tables of Content were elaborated and discussed with the donors and engineers of BWDB and WARPO. Finally, a time schedule was agreed upon in the workshop for the presentation of the Guidelines and Manuals. Since however, the project period was extended until end of 2000 due to the implementation of third test site, the schedule for elaborating the Guidelines and Manuals as well as the Final Project Evaluation Report needed to be modified. The programme of July 1998 was discussed with all parties concerned and updated during the donors' review missions of March 1999 and February/March 2000. The following updated programme was jointly agreed upon:

Date	Task	Action
December 1998	Determination of participants and composition of BWDB/WARPO working group; Definition of general concept and degree of Detailing	Finalized
December 1998	Determination of Table of Contents	Approved
January to March 2000	Submission and presentation of draft chapters of the Guidelines	Consultant
July 2000	Submission of consolidated comments and suggestions of modification to draft Guidelines and Manual	BWDB / WARPO
October 2000	Inclusion of additional experiences from the monsoon 2000 season, if any	Consultant
December 2000	Submission of Final Document	Consultant

2.5.2 Status of Works

(a) Final Project Evaluation Report

All information, experience and data gathered at the test sites with the different systems during the construction and monitoring period respectively have to be analysed in order to define the most suitable solutions for bank protection structures in Bangladesh with regard to their design, construction materials and construction methods. Hence, the results of and the experience with the test structures will be compiled for each of the structures in reports on

- design;
- procurement and construction;
- monitoring, and
- evaluation of hydraulic loads and river response

together with a report on the morphological behaviour of the river in the test site areas and relevant investigations respectively.

These reports will be presented as annexes to the technical part of the evaluation report. The latter will contain summaries of the annexes in a form as condensed as possible together with the conclusions and lessons learned.

This concept holds also for the other part of the final report viz. the financial and economical evaluation. The following annexes are under preparation:

Annex 1	Morphological Investigations
Annex 2	Socio-economic Investigations
Annex 3	Ecological Assessment
Annex 4	The Groyne Test Structure Design Report
Annex 5	The Groyne Test Structure Procurement and Construction Report
Annex 6	The Groyne Test Structure Monitoring Report
Annex 7	The Groyne Test Structure Evaluation of Hydraulic Loads and River Response
Annex 8	The Revetment Test Structure Design Report
Annex 9	The Revetment Test Structure Procurement and Construction Report
Annex 10	The Revetment Test Structure Monitoring Report
Annex 11	The Revetment Test Structure Evaluation of Hydraulic Loads and River Response
Annex 12	Financial and Economic Evaluation

(b) Guidelines and Manuals

The main topics of the Guidelines are **Planning, Design** and **Implementation** of river training and bank protection works. The structure of the documents has been discussed in the workshop in July 1998 and takes into account the existing guidelines and manuals of BWDB. In the course of preparation slight modifications of the Tables of Content were required, but the focal points of the documents are still:

- identification of priority protection sites;
- preparatory investigations and studies;
- general planning requirements;
- design principles for the individual bank protection and river training works;
- construction (materials, methods, equipment and implementation), and
- monitoring and maintenance.

On January 30, 2000 a meeting was held with the working group of BWDB. As discussed and agreed upon during the meeting, the Consultant did not submit the Guidelines as a whole but in sections. The individual chapters were submitted to WARPO and BWDB as follows, each time with the request for comments and suggestions of modification:

Chapter 1 to 3	February 06, 2000
Chapter 4 to 7	March 06, 2000
Chapter 8 and 10	May 09, 2000
Chapter 14 to 19	May 31, 2000
Chapter 21 and 22	May 31, 2000.

It is mentioned that Chapter 9, 12 and 13 dealing with design principles for cross bars, guide bunds and training walls is not covered by the Consultant, but kept free for the experience of BWDB. In the meeting on January 30 and the letter of May 31, 2000 it was stressed, however, that the Consultant is prepared for discussions with BWDB engineers in this regard.

Comments on Chapter 8 to 19 were received on July 20, 2000 from the office of the Chief Engineer, Design of BWDB.

The first draft of the Guidelines was submitted to KfW in September 2000. After the comments of the latter were received on November 07, a meeting was held in the office of KfW on December 08, 2000. The remaining programme was discussed and it was agreed upon to submit the final document by end June 2001.

The first draft of the Design Manual, which was started during the third quarter of 2000, was complete by about 95 % at the end of period under report.

3 RIVER TRAINING (AFPM) COMPONENT (FAP 22)

3.1 PRELIMINARY REMARK

After the activities under FAP 22 had been suspended in 1995, the Consultant was requested by WARPO on March 06, 1996 to take up recurrent measure activities. Therefore, the project works were resumed at the beginning of April 1996 and concentrated mainly on the completion of the desk study and a report on the activities in 1995/96, which was submitted on September 05, 1996 along with a proposal and work plan for the project continuation for the implementation of recurrent measures during the lean season 1996/97. The work plan covered the selection of suitable test sites as well as the design, implementation and testing of appropriate recurrent measures as Low Water Bandals, Improved Bandals and Sills.

Immediately after the positive comments of KfW on the Consultants programme of investigations in 1996/97 were received in September 1996, a suitable test site had been selected in the outflanking Katlamari channel just upstream from Fulchari where a combination of two measures viz. a 210 m long bandal structure and an earth dam about 600 m downstream from the bandals was built. Design

and construction works started in the last quarter of 1996 and were completed mid March 1997. These measures were tested by the Jamuna river and monitored by the Consultants during the monsoon season 1997. It was intended to supplement/modify the test structures based on the experience of the first test season and to continue the investigations during the monsoon season 1998. A technical and financial proposal for further investigations was submitted to the client and the donors in the last quarter of 1997, but at the end of the flood season 1997 it emerged that the overall morphological development in the test site area and the Fulchari channel did not allow the continuation of the tests at Katlamari Test Site. Therefore, at the beginning of January 1998 a new test site was selected for testing of recurrent measures during the monsoon season 1998 which was located about 5 km east of the Groyne Test Structure of FAP 21 at Kamarjani. Unfortunately, the investigations had to be stopped because of the opposition of the population in that area.

Table 2.2-1 and Table 2.2-3 are showing the Work Plan as per proposal of August 1996 and December 1997 respectively whereas Table 2.2-5 the Staffing Schedule for the study period 1996 till 1998 including that one of the modified proposal of December 1997. Table 2.2-2 and 2.2-4 are showing the actual activities up to the end of 1997 and 1998 respectively and Table 2.2-6 and 2.2-7 the actual input of the expatriate and the local professional staff fielded up to end of June 2000.

3.2 TEST SITE I AT KATLAMARI

3.2.1 The Test Structures

Two different structures were built at Katlamari:

(a) improved bandals with a total length of 210 m and consisting of 4 main components at the off-take of the Katlamari channel with the aim to deflect the flow and to encourage siltation behind the structure;
(b) an earth dam 600 meters downstream from the bandal structure with the aim to close the Katlamari channel at the beginning of the flood season.

The idea behind these measures was to deflect the flow into the Fulchari channel, to decrease the size of the Katlamari channel and thus concentrate more flow in the Fulchari channel, to deepen the latter and to improve the ferry operations to Fulchari Ghat. In parallel it was expected that the size of the Katlamari channel would decrease, that bank erosion would diminish and agradable land could be won.

Both the structures were designed to support the effectiveness of each other and thus to increase their overall efficiency.

3.2.2 Monitoring of the Test Structures

After the Fulchari channel started to move westwards and finally washed away Section E of the bandal structure, it was decided to abandon this test site. In January/February 1998 dismantling of the remaining sections of the structure except Section A was started and the dismantled material of the bandal structure was transported to the new test site at Kundarapara and partly used for the construction of low water bandals. After the monsoon season also Section A was given up.

Hence, no monitoring activities are to be reported from the period under review.

3.3 TEST SITE II AT KUNDARAPARA

3.3.1 The Test Structures

In order to reduce the severe erosion in the outer bend of the Kamarjani channel between Syedpur and Balashi Ghat it was planned to promote the development of the Kundarapara cut-off channel. The following recurrent measures were planned to be constructed and investigated:

(a) Low Water Bandals
Low water bamboo bandals were installed in February / March 1998 at the entrance of the Kamarjani bypass channel in order to increase the inflow into the Kundarapara channel and at the same time to reduce the inflow into the Kamarjani bypass channel. The bandals were removed end of March 1998 when the water level started to rise.

(b) Improved Bandals with adjustable Screens
After permanent problems with the local population, it was decided on March 10, 1998 to stop the construction of the improved bandals when it became obvious that they could not be completed in time before the flood season 1998

(c) Floating Screens
In the course of positioning and anchoring of the elements, local people sabotaged the activities so that the Consultant had no choice but to stop the investigations with floating screens for the flood season 1998.

3.3.2 Monitoring of the Test Structures

During the period under report bathymetric surveys and flow measurements were continued in the Kundarapara channel the results of which are presented in Annex B and C (FAP 21, Test Site I). However, testing of the floating elements remained suspended, since the morphological situation and channel configuration at the third FAP 21 test site did not allow any tests with floating screens.

3.4 REPORTING

Valuable results of the tests with recurrent measures gained at Katlamari and Kundarapara Test Sites will be included in the Guidelines for river training and bank protection works, which are under preparation (Section 2.5).

Table 1.1-1

BANK PROTECTION TEST STRUCTURES - FAP 21
EXPATRIATE PROFESSIONAL STAFF
Activities during the period of 10/2000 to 12/2000

VERSION : 01.02.01

Sl. No.	Function	Person	Code	Company	Period		Remarks
					From	To	
1.1	Project Director	Dr. D. Neuhaus / Dr. H. Kramer	DN / HK	RRI	01/10	31/12	Part time in Europe
1.2	Home Office Support						
1.3.1	Project Manager	C. Netzeband	CN	RRI	01/10 23/10	22/10 31/12	Home Office Work & Leave
1.4	Chief Hydraulic Design Engineer	Dr. H. Kramer	HK	L&P	01/10	31/12	Part time in Europe
2.1.1	Hydraulic Design Engineer	M. Schwarz	MS	L&P	01/10	31/12	Part time in Europe
2.2	Structural Engineer	-	-	-	-	-	
2.3	Mechanical Engineer	-	-	-	-	-	
2.4	Procurement Expert	-	-	-	-	-	
2.5.1	Subsoil Expert	H. Wessling	HW	L&P	-	-	
3.1.	Chief Supervising Engineer	-	-	-	-	-	
3.2.1	Supervising Engineer	K. Oberhagemann	KO	RRI	-	-	
3.4.1	Surveyor	J. Heise	JH	RRI	-	-	
3.5.1	Administrator	B. Thomas	BT	CNR	-	-	
3.6.1	Monitoring Expert	T. Döscher	TD	RRI	-	-	
4.1.1	Morphologist	Dr. E. Mosselman	EM	DELFT	01/12	31/12	Part time in Europe
4.2.1	Modelling Expert	M. v. d. Wal	MvdW	DELFT			
		D. Carrion	DC	CNR	-	-	
		E. Divet	ED	CNR	-	-	
4.3.1	Environmental Expert	C. Bertrand	CB	CNR	-	-	
4.5.1	Economist	--	-	-	-	-	
4.6.1	Unallocated	--	-	-	-	-	

Table 1.1-2

BANK PROTECTION TEST STRUCTURES - FAP 21
LOCAL PROFESSIONAL STAFF
Activities during the period of 10/2000 to 12/2000

VERSION : 01.02.01

Sl. No.	Function	Person	Code	Company	Period		Remarks
					From	To	
1.2	Home Office Support	NN					
1.3.2	Deputy Project Manager	S. M. Mansur	SM	BETS	01/10	31/12	
2.1.2	Hydraulic Design Engineer 2	A. Q. Mohammed Ali	MA	BETS	-	-	
2.3.2	Mechanical Engineer 2	Masih-ur-Rahman	MR	DUL	-	-	
2.4.2	Procurement Expert 2	Masih-ur-Rahman	MR	DUL	-	-	
3.2.2	Supervising Engineer 2	Fazlur Rahman /	FR	BETS	-	-	
		Sk. Golam Kader	SGK	BETS	01/10	31/12	
3.3	Quantity Surveyor	Faizur Rahman Khan	FRK	DUL	-	-	
3.4.2	Surveyor 2	-	-	-	-	-	
3.6.2/3/4	Monitoring Expert 2	A.B.M. Anwar Haider	AH	BETS	-	-	
	Jr. Monitoring Expert	Pankaj K. Maitra	PKM	BETS	01/10	31/12	
	Monitoring Data Processor	Yasmin Khayer	YK	FL	-	-	
4.1.2	Morphologist 2	M. H. Sarker	MHS	FL	-	-	
4.2.2	Modelling Expert 2	Monjur Kader	MoK	BETS	-	-	
4.3.2	Environmental Expert 2	Dr. A.K.M. Nazrul Islam	NI	BETS	-	-	
4.4	Socio-Economist	Tauhidun Nabi	TN	BETS	-	-	
4.5.2	Economist 2	Dr. Lutfor Rahman	LR	BETS	-	-	
4.6.2	Unallocated 2		-	-	-	-	

Table 1.1-3

BANK PROTECTION TEST STRUCTURES - FAP 21

LOCAL SUPPORT STAFF

Activities during the period of 10/2000 to 12/2000

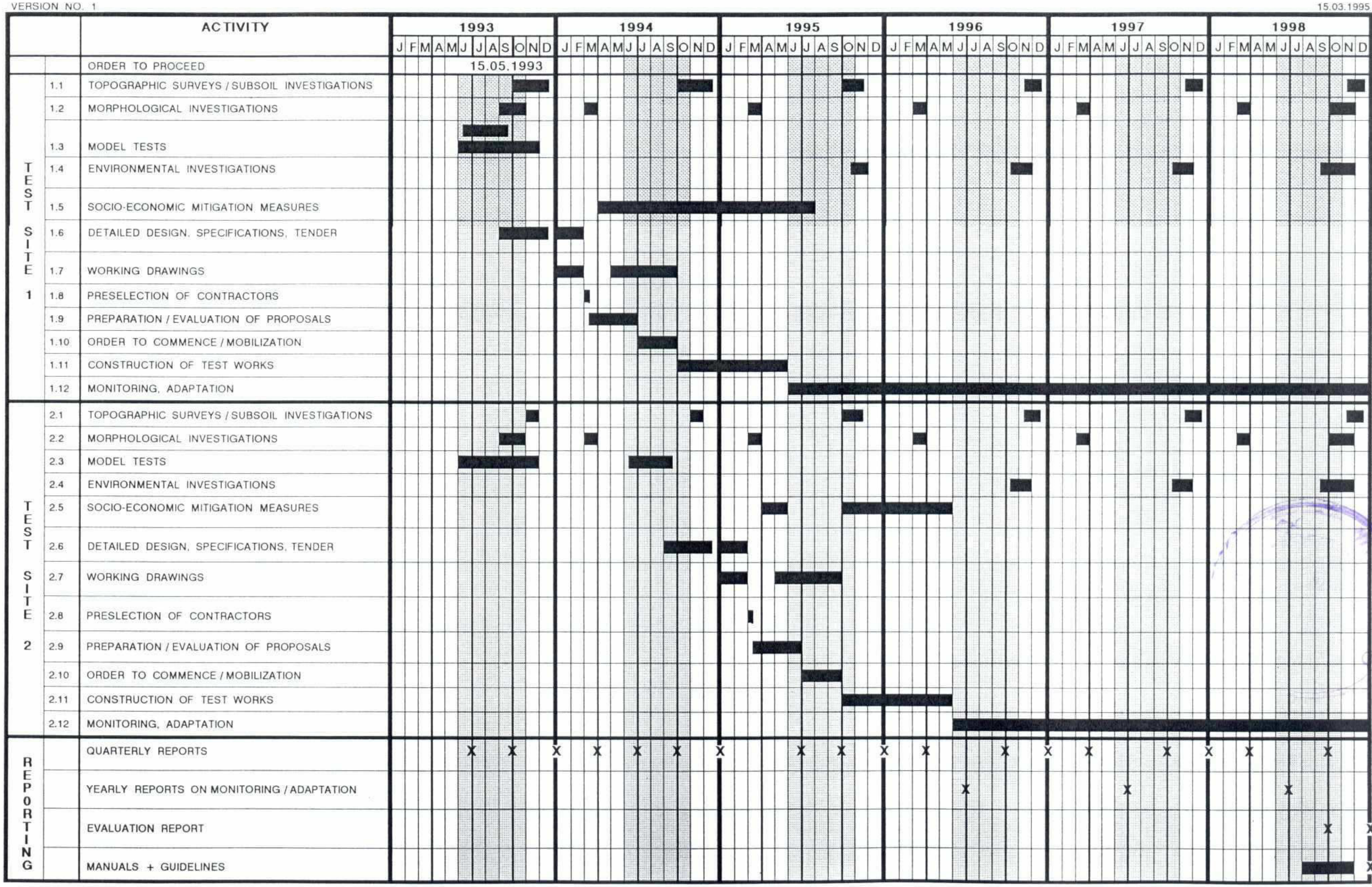
VERSION : 01.02.01

Sl. No.	Function	Person	Company	Period		Remarks
				From	To	
1	Bilingual Secretary	Sk. Zakirul Islam	BETS	01/10	31/12	
2	Receptionist	Md. Razaul Karim	BETS	01/10	31/12	
3	Operator / Data Input	Md. Khorshed Alam	BETS	01/10	31/12	
5	Draftsman	Md. Fazle Hossain Bhuiyan	BETS	01/10	31/12	
6	Photocopy Operator	Md. Q M Hussain (Babu)	BETS	01/10	31/12	
7	Accountant	A.B.M Bazlur Rashid	BETS	01/10	31/12	
8	Asstt. Acct. Purchase	Md. Shafiuddin	BETS	01/10	31/12	
9	Messenger	Md. Aziz	BETS	01/10	31/12	
10	Peon	Md. Habibur Rahman Hawladar	BETS	01/10	31/12	
11	Guards (8 hours shift)	Md. Farid Sikder /	BETS	01/10	31/12	
		Md. Moqbul Hossain /	BETS	01/10	31/12	
		Md. Shakawat Hossain	BETS	01/10	31/12	
12-15	Drivers	Four Drivers	L&S	01/10	31/12	

TABLE 1 . 2 - 1 . 1

BANK PROTECTION TEST STRUCTURES FAP 21

WORK PLAN *)

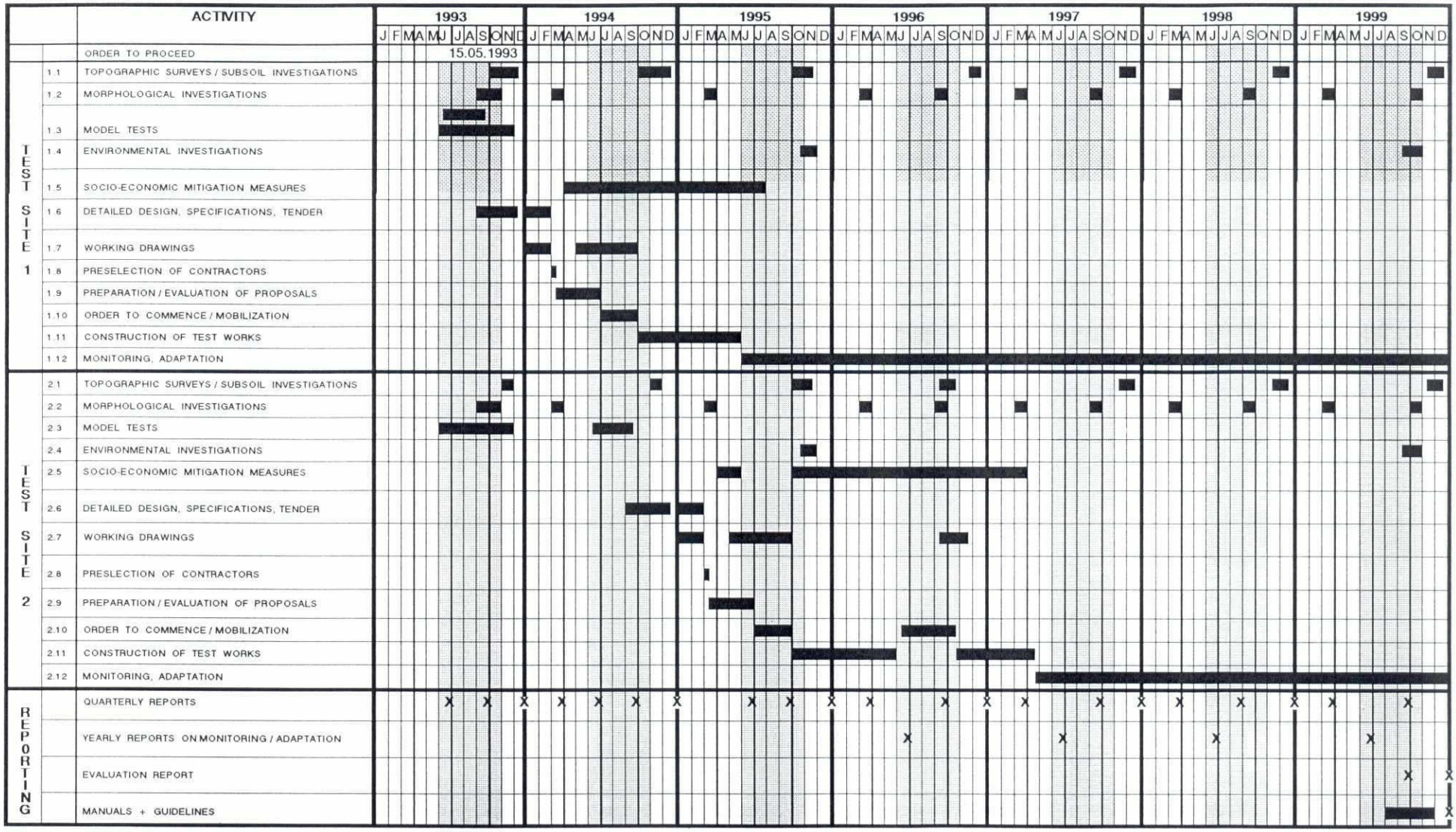


*) AS PER LETTER TO PROCEED OF MAY 1993

MONSOON

TABLE 1.2-1.2

BANK PROTECTION TEST STRUCTURES FAP 21
WORK PLAN
REVISION NO. 1 *)



*) AS PER PROPOSAL OF SEPTEMBER 1996

MONSOON

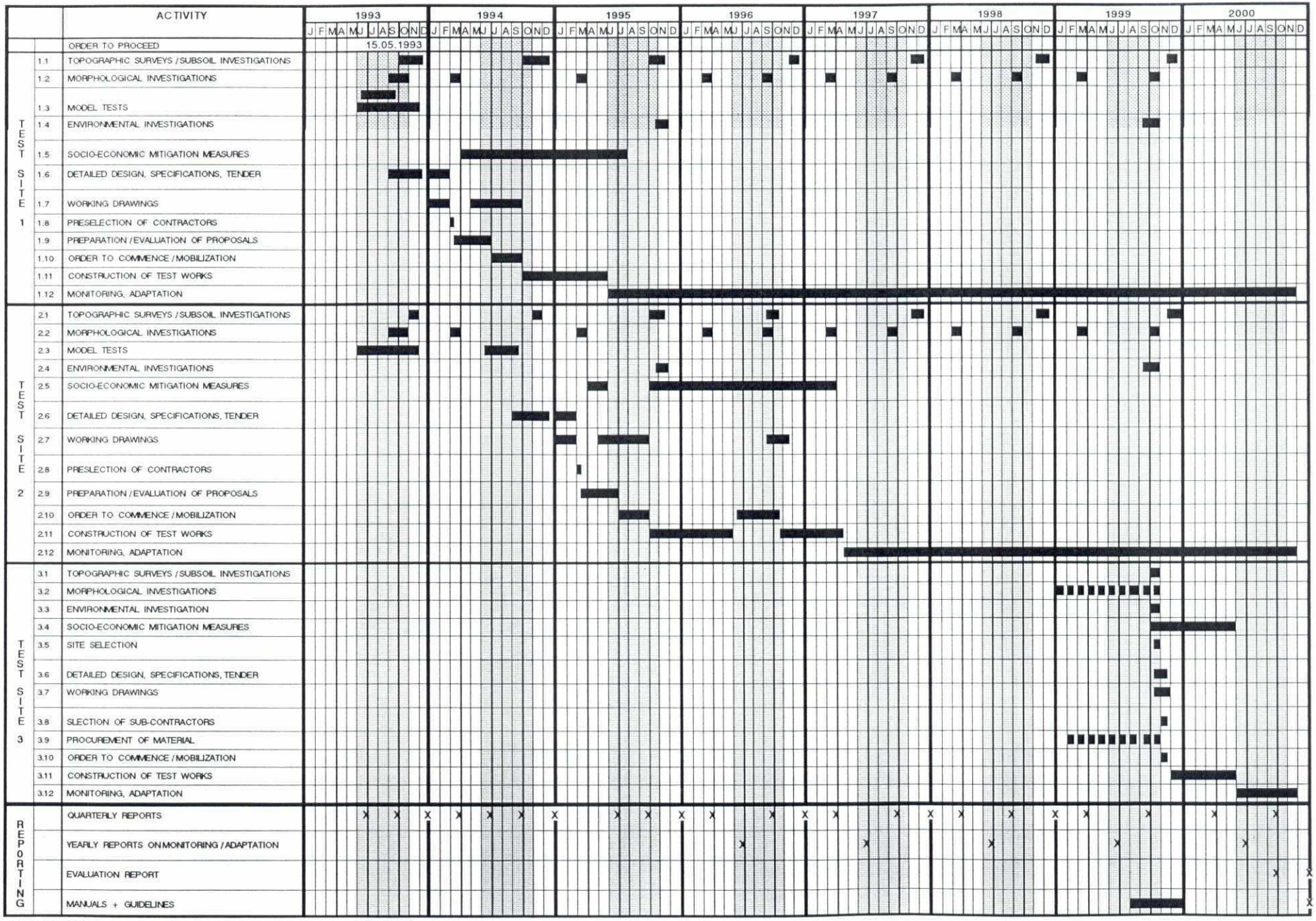
G 2

TABLE 1.2-1.3

BANK PROTECTION TEST STRUCTURES FAP 21

WORK PLAN

REVISION NO. 2 *)



*) AS PER PROPOSAL OF MAY 1999

MONSOON

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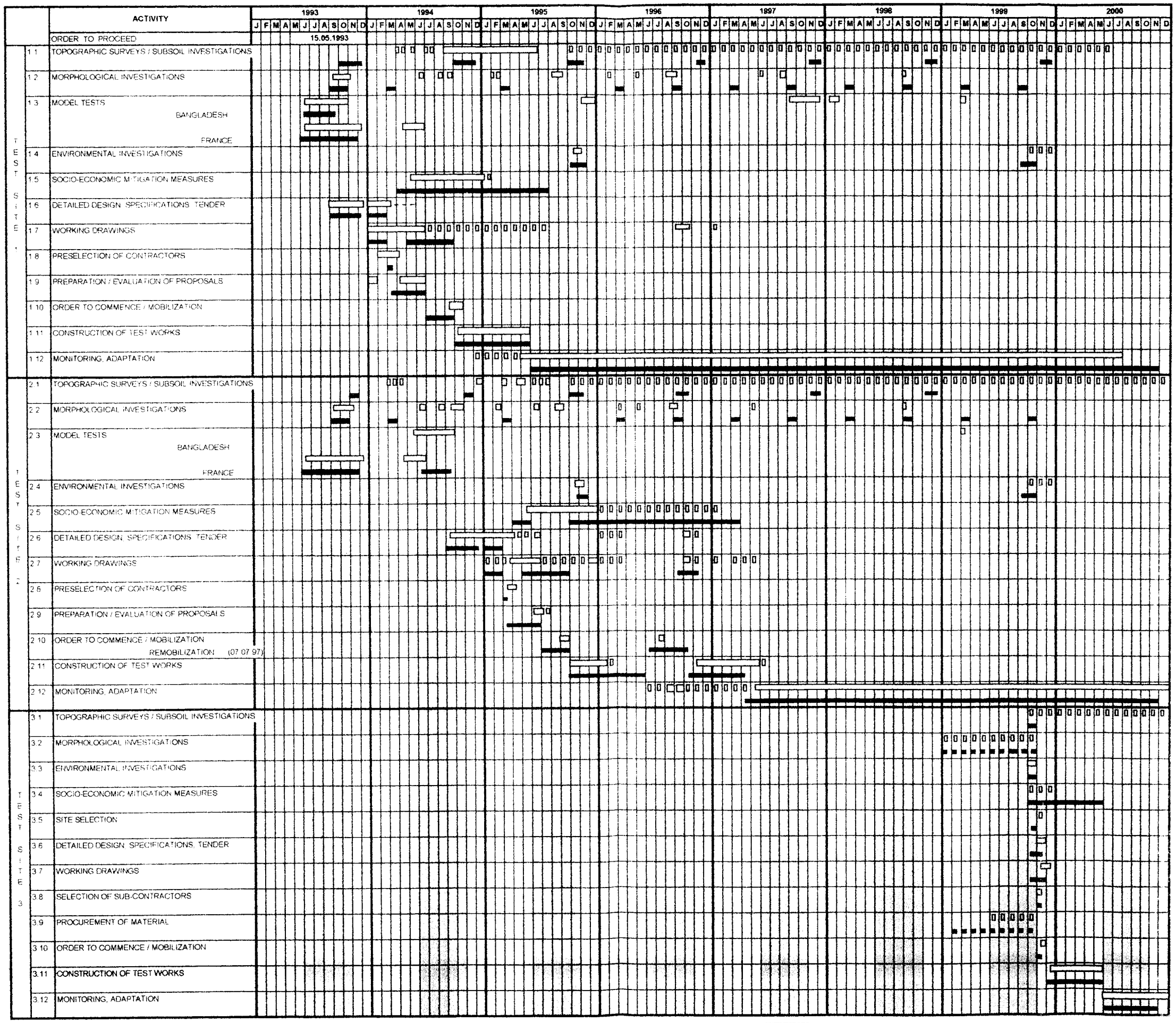
TABLE 1.2-2

BANK PROTECTION TEST STRUCTURES FAP 21
REVISION NO. 2 *)
WORK PLAN - FIELDED UP TO DECEMBER 31, 2000



*) AS PER PROPOSAL OF MAY 1999

TABLE 1.2-3.1

BANK PROTECTION TEST STRUCTURES - FAP 21

STAFFING SCHEDULE *)

VERSION NO.1

15.03.1993

		FUNCTION	1993	1994	1995	1996	1997	1998	MAN-MONTHS EXPATRIATES BD	EU	LOCAL	
			J F MA MJ J A S O N D	J F MA MJ J A S O N D	J F MA MJ J A S O N D	J F MA MJ J A S O N D	J F MA MJ J A S O N D	J F MA MJ J A S O N D				
	1.1	PROJECT DIRECTOR							3	8		8
	1.2	HOME OFFICE SUPPORT								10	7	
	1.3.1/2	PROJECT MANAGER / DEPUTY PROJECT MANAGER							58	3	67	17
	1.4	CHIEF HYDRAULIC DESIGN ENGINEER							16	2		8
								SUB-TOTAL	77	23	74	33
	2.1.1/2	HYDRAULIC DESIGN ENGINEER 1 + 2							13		35	5
	2.2	STRUCTURAL ENGINEER							2			1
	2.3.1/2	MECHANICAL ENGINEER 1 + 2							2	1	3	2
	2.4.1/2	PROCUREMENT EXPERT 1 + 2							1	3	1	1
	2.5.1/2	SUBSOIL ENGINEER 1 + 2							2	2	6	2
								SUB-TOTAL	20	6	45	11
	3.1	CHIEF SUPERVISING ENGINEER							20			2
	3.2.1/2	SUPERVISING ENGINEER 1 + 2							20		53	2
	3.3	QUANTITY SURVEYORS									90	
	3.4.1/2	SURVERYOR 1 + 2							8		62	6
	3.5	ADMINISTRATOR							26			4
								SUB-TOTAL	74	0	205	14
	4.1.1/2	MORPHOLOGIST 1 + 2							8		9	7
	4.2.1/2	MODELLING EXPERT 1 + 2 + 3							7		16	2
	4.3.1/2	ENVIRONMENTAL EXPERT 1 + 2							4		7	4
	4.4	SOCIO-ECONOMIST									25	
	4.5.1/2	ECONOMIST 1 + 2							3		4	2
	4.6.1/2	UNALLOCATED 1 + 2							10		10	12
								SUB-TOTAL	32	0	71	27
		QUARTERLY REPORTS	X X X X X X X X X X X X X X X X X X X X X X X X									
		YEARLY REPORTS ON MONITORING / ADAPTATION										
		EVALUATION REPORT										
		MANUALS + GUIDELINES										
								TOTAL	203	29	395	85

*) AS PER LETTER TO PROCEED OF MAY 1993

MONSOON IN BANGLADESH OUTSIDE BANGLADESH LOCAL

TABLE 1.2-3.2

BANK PROTECTION TEST STRUCTURES - FAP 21

STAFFING SCHEDULE

REVISION NO. 1 *)

01.06.1995

	FUNCTION	1993	1994	1995	1996	1997	1998	MAN-MONTHS EXPATRIATES BD	EU	LOCAL	FLIGHTS
		J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D				
1.1	PROJECT DIRECTOR							3	8		8
1.2	HOME OFFICE SUPPORT								10	7	
1.3.1/2	PROJECT MANAGER / DEPUTY PROJECT MANAGER							58	3	67	17
1.4	CHIEF HYDRAULIC DESIGN ENGINEER							17	3		10
							SUB-TOTAL	78	24	74	35
2.1.1/2	HYDRAULIC DESIGN ENGINEER 1 + 2							18		35	6
2.2	STRUCTURAL ENGINEER							2			1
2.3.1/2	MECHANICAL ENGINEER 1 + 2							2	1	3	2
2.4.1/2	PROCUREMENT EXPERT 1 + 2							1	3	1	1
2.5.1/2	SUBSOIL ENGINEER 1 + 2							2	2	6	2
							SUB-TOTAL	25	6	45	12
3.1	CHIEF SUPERVISING ENGINEER							20			2
3.2.1/2	SUPERVISING ENGINEER 1 + 2							20		53	2
3.3	QUANTITY SURVEYORS									90	
3.4.1/2	SURVERYOR 1 + 2							8		52	6
3.5	ADMINISTRATOR							26			4
3.6.1/2/3	MONITORING EXPERT 1 + 2 + 3							6		61	2
							SUB-TOTAL	80	0	266	16
4.1.1/2	MORPHOLOGIST 1 + 2							9		9	10
4.2.1/2/3	MODELLING EXPERT 1 + 2 + 3							9		18	4
4.3.1/2	ENVIRONMENTAL EXPERT 1 + 2							4		7	4
4.4	SOCIO-ECONOMIST									25	
4.5.1/2	ECONOMIST 1 + 2							3		4	2
4.6.1/2	UNALLOCATED 1 + 2							2		2	3
							SUB-TOTAL	27	0	65	23
	QUARTERLY REPORTS	X X X X X X X X	X X X X X X X X	X X X X X X X X	X X X X X X X X	X X X X X X X X	X X X X X X X X				
	YEARLY REPORTS ON MONITORING / ADAPTATION				X	X	X				
	EVALUATION REPORT						X				
	MANUALS + GUIDELINES						X				
							TOTAL	210	30	450	86

*) AS PER PROPOSAL OF 1995

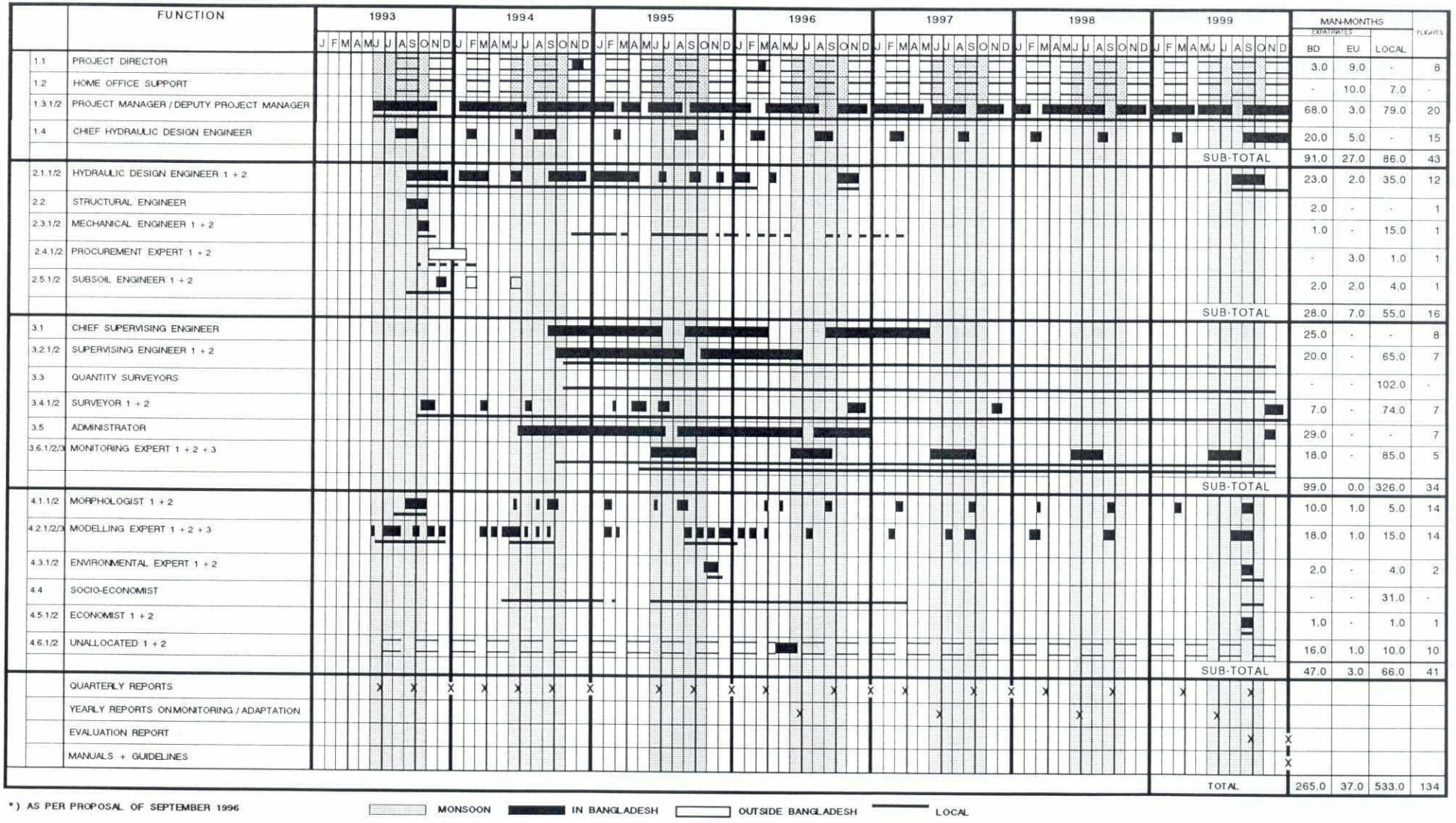
MONSOON IN BANGLADESH OUTSIDE BANGLADESH LOCAL

TABLE 1.2-3.3

BANK PROTECTION TEST STRUCTURES - FAP 21

STAFFING SCHEDULE

REVISION NO. 2 *)



*) AS PER PROPOSAL OF SEPTEMBER 1996

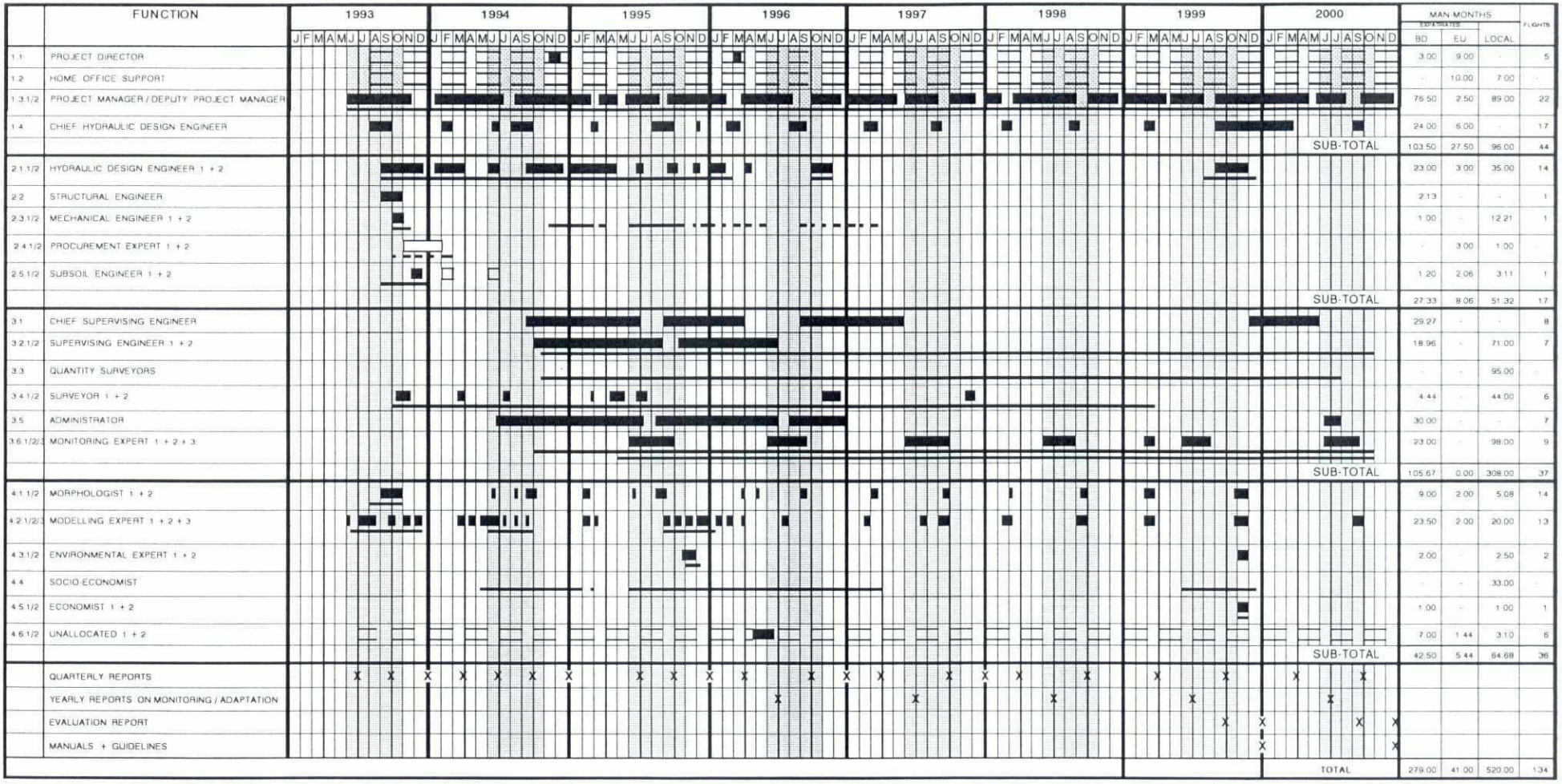
MONSOON IN BANGLADESH OUTSIDE BANGLADESH LOCAL

TABLE 1.2-3.4

BANK PROTECTION TEST STRUCTURES - FAP 21

STAFFING SCHEDULE

REVISION NO. 3 *)



	FUNCTION	MAN-MONTHS ESTIMATES BD	EU	LOCAL	FLIGHTS
1.1	PROJECT DIRECTOR	3.00	9.00	-	5
1.2	HOME OFFICE SUPPORT	-	10.00	7.00	-
1.3.1/2	PROJECT MANAGER / DEPUTY PROJECT MANAGER	76.50	2.50	89.00	22
1.4	CHIEF HYDRAULIC DESIGN ENGINEER	24.00	6.00	-	17
	SUB-TOTAL	103.50	27.50	96.00	44
2.1.1/2	HYDRAULIC DESIGN ENGINEER 1 + 2	23.00	3.00	35.00	14
2.2	STRUCTURAL ENGINEER	2.13	-	-	1
2.3.1/2	MECHANICAL ENGINEER 1 + 2	1.00	-	12.21	1
2.4.1/2	PROCUREMENT EXPERT 1 + 2	-	3.00	1.00	-
2.5.1/2	SUBSOIL ENGINEER 1 + 2	1.20	2.06	3.11	1
	SUB-TOTAL	27.33	8.06	51.32	17
3.1	CHIEF SUPERVISING ENGINEER	29.27	-	-	8
3.2.1/2	SUPERVISING ENGINEER 1 + 2	18.96	-	71.00	7
3.3	QUANTITY SURVEYORS	-	-	95.00	-
3.4.1/2	SURVEYOR 1 + 2	4.44	-	44.00	6
3.5	ADMINISTRATOR	30.00	-	-	7
3.6.1/2/3	MONITORING EXPERT 1 + 2 + 3	23.00	-	98.00	9
	SUB-TOTAL	105.67	0.00	308.00	37
4.1.1/2	MORPHOLOGIST 1 + 2	9.00	2.00	5.08	14
4.2.1/2/3	MODELLING EXPERT 1 + 2 + 3	23.50	2.00	20.00	13
4.3.1/2	ENVIRONMENTAL EXPERT 1 + 2	2.00	-	2.50	2
4.4	SOCIO-ECONOMIST	-	-	33.00	-
4.5.1/2	ECONOMIST 1 + 2	1.00	-	1.00	1
4.6.1/2	UNALLOCATED 1 + 2	7.00	1.44	3.10	6
	SUB-TOTAL	42.50	5.44	64.68	36
	QUARTERLY REPORTS				
	YEARLY REPORTS ON MONITORING / ADAPTATION				
	EVALUATION REPORT				
	MANUALS + GUIDELINES				
	TOTAL	279.00	41.00	520.00	134

*) AS PER PROPOSAL OF MAY 1999

MONSOON IN BANGLADESH OUTSIDE BANGLADESH LOCAL

GK

TABLE 1.2-4

BANK PROTECTION TEST STRUCTURES - FAP 21

REVISION NO. 3 *)

STAFFING SCHEDULE - EXPATRIATE PROFESSIONAL STAFF; FIELDED UP TO DECEMBER 31, 2000

	FUNCTION	1993	1994	1995	1996	1997	1998	1999	2000
		J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D	J F M A M J J A S O N D
11	PROJECT DIRECTOR								
12	HOME OFFICE SUPPORT								
131	PROJECT MANAGER								
14	CHIEF HYDRAULIC DESIGN ENGINEER								
211	HYDRAULIC DESIGN ENGINEER								
22	STRUCTURAL ENGINEER								
231	MECHANICAL ENGINEER 1								
241	PROCUREMENT EXPERT 1								
251	SUBSOIL ENGINEER 1								
31	CHIEF SUPERVISING ENGINEER								
321	SUPERVISING ENGINEER 1								
341	SURVEYOR 1								
35	ADMINISTRATOR								
361	MONITORING EXPERT 1								
411	MORPHOLOGIST 1								
421	MODELLING EXPERT 1								
432	ENVIRONMENTAL EXPERT 1								
451	ECONOMIST 1								
461	UNALLOCATED 1								
	QUARTERLY REPORTS	X X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X
	YEARLY REPORTS ON MONITORING / ADAPTATION		X		X		X	X	X
	EVALUATION REPORT							X X	X
	MANUALS + GUIDELINES								X

*) as per proposal of May 1999

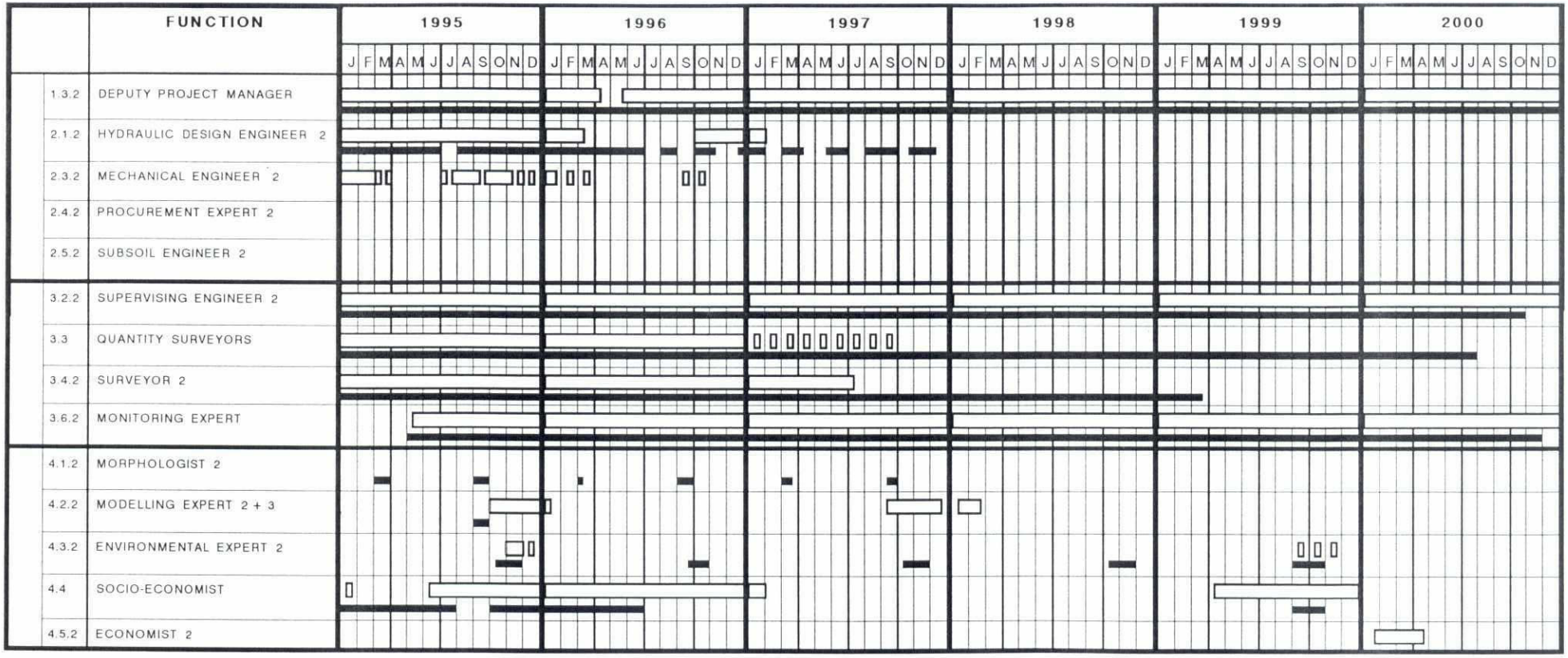
MONSOON — IN BANGLADESH — OUTSIDE BANGLADESH — REALIZATION

TABLE 1.2-5

BANK PROTECTION TEST STRUCTURES - FAP 21

REVISION NO. 3 *)

STAFFING SCHEDULE - LOCAL PROFESSIONAL STAFF - FIELDED UP TO DECEMBER 31, 2000



*) AS PER PROPOSAL OF SEPTEMBER 1996

SCHEDULE REALIZATION

FAP 21/22, MONTHLY REPORT

TABLE 2.1-1

STUDIES ON RECURRENT MEASURES - FAP 22
EXPATRIATE PROFESSIONAL STAFF
Activities during the period of 10/2000 to 12/2000

VERSION : 01.02.01

Sl. No.	Function	Person	Code	Company	Period		Remarks
					From	To	
1.1	Project Director	Dr. D. Neuhaus	DN	RRI	-	-	
		Dr. H. Kramer	HK		-	-	
1.2	Home Office Support						
1.3.1	Project Manager	C. Netzeband	CN	RRI	-	-	
1.4	Chief Hydraulic Design Engineer	Dr. H. Kramer	HK	L&P	-	-	
5.2	Hydraulic Design Engineer	M. Schwarz	MS	L&P	-	-	
5.3.1	Surveyor	-	-	-	-	-	
5.4.1	Morphologist	Dr. E. Mosselman	EM	DELFT	-	-	
5.5	System Analyst	R. H. Buijsrogge	RHB	DELFT	-	-	
5.6	Programmer	M. Witteveen	MW	DELFT	-	-	
5.6.A	Programmer / Modeller	J. I. Crebas	JIC	DELFT	-	-	
5.7	GIS Specialist	G.K.F.M.Hesselmans	GMH	DELFT	-	-	
5.8.1	Supervising Engineer	K. Oberhagemann	KO	RRI	-	-	
5.9.1	Monitoring Expert	T. Döscher	TD	L&P	-	-	
5.10	Economist	-	-	-	-	-	

TABLE 2.1-2

STUDIES ON RECURRENT MEASURES - FAP 22
LOCAL PROFESSIONAL STAFF
Activities during the period of 10/2000 to 12/2000

VERSION : 01.02.01

Sl. No.	Function	Person	Code	Company	Period		Remarks
					From	To	
1.2	Home Office Support	NN	-	-			
1.3.2	Deputy Project Manager	S. M. Mansur	SM	BETS	-	-	
5.1.2	River Engineer 2	S. R. Khan	SRK	BETS	-	-	
5.3.2	Surveyor 2	--	-	-	-	-	
5.4.2	Morphologist 2	Salahuddin Khan	SK	BETS	-	-	
5.9.2/3/4	Monitoring Expert 2	A.B.M. Anwar Haider	AH	BETS	-	-	
	Jr. Monitoring Expert	Pankaj K. Maitra	PKM	BETS	-	-	
	Monitoring Data Processor	Yasmin Khayer	YK	FL	-	-	
5.10.2	Economist 2	Dr. Lutfor Rahman	LR	BETS	-	-	

TABLE 2.2-1

STUDIES ON RECURRENT MEASURES - FAP 22

WORK PLAN AS PER PROPOSAL OF AUGUST 1996

SL. NO.	ACTIVITY	1996				1997											
		Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	PRE-SELECTION	■	■														
2	VERIFICATION SURVEY	■															
3	FIELD CHECKS		■	■	■	■											
4	FIELD SELECTION		■	*	*	*											
5	DETAILED SURVEY		■	■													
6	FINAL DESIGN		■	■	■	■											
7	TENDERING			■	■												
8	CONSTRUCTION				■	■	■	■									
9	OPERATION AND MAINTENANCE							■	■	■	■	■	■	▮	▮	▮	▮
10	MONITORING AND EVALUATION							■	■	■	■	■	■	▮	▮	▮	▮

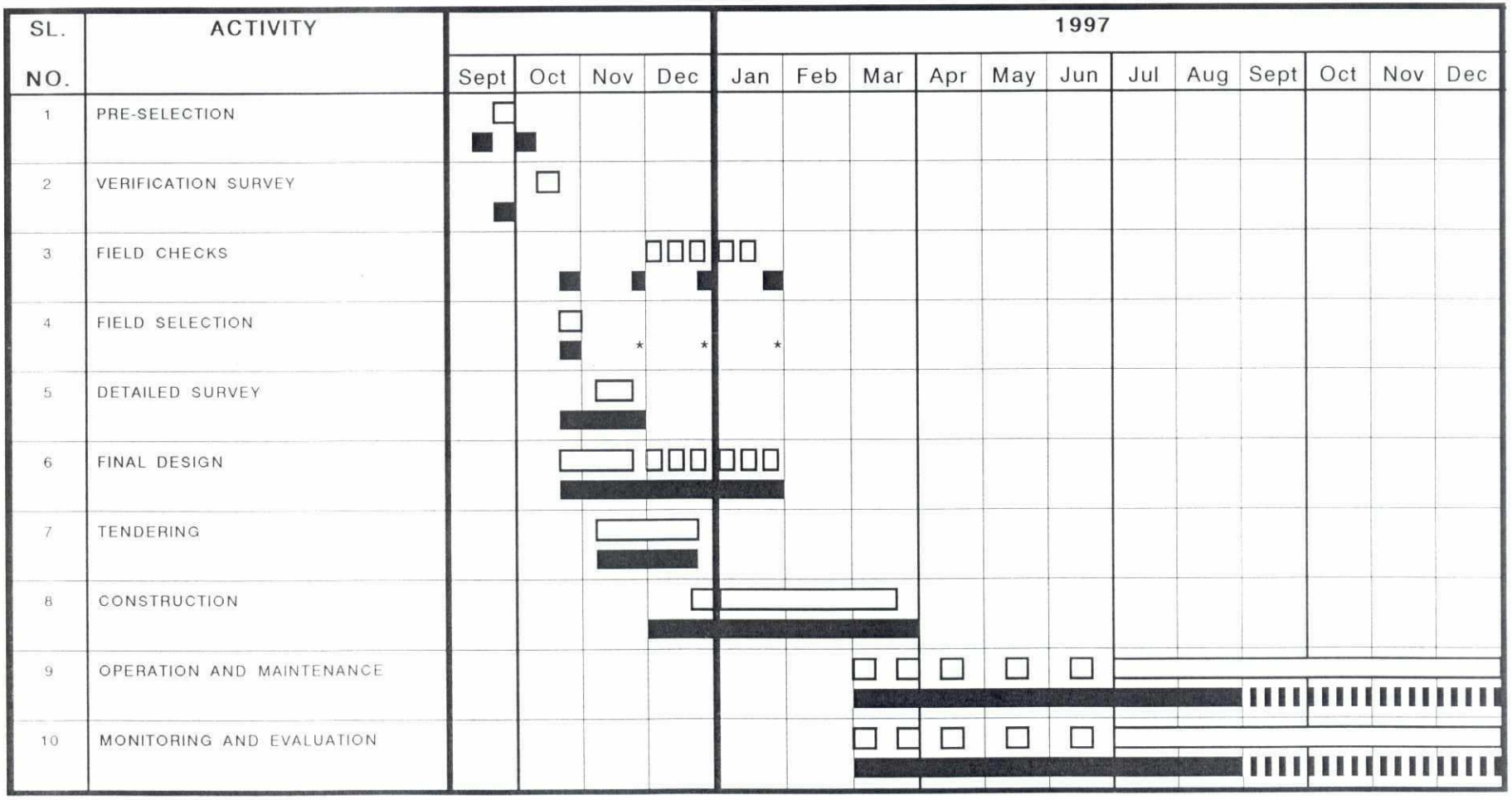
NOTE: * DENOTES REVIEW OF FINAL SELECTION

TABLE 2.2-2

STUDIES ON RECURRENT MEASURES - FAP 22

WORK PLAN AS PER PROPOSAL OF AUGUST 1996

ACTIVITIES FIELDED UP TO DECEMBER 31, 1997



NOTE: * DENOTES REVIEW OF FINAL SELECTION

TABLE 2.2-3

STUDIES ON RECURRENT MEASURES - FAP 22

WORK PLAN AS PER PROPOSAL OF DECEMBER 1997

SL. NO.	ACTIVITY	1997				1998											
		Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	PRE-SELECTION OF SITE																
2	VERIFICATION SURVEY / FIELD CHECK																
3	MAINTENANCE/ADAPTATION OF EXISTING BANDALS																
4	ELONGATION OF IMPROVED BANDALS																
5	DESIGN OF FLOATING SCREEN ELEMENTS																
6	CONSTRUCTION OF FLOATING SCREEN ELEMENTS																
7	FINAL SITE SELECTION																
8	DETAILED SURVEY																
9	POSITIONING AT TEST SITE																
10	OPERATION AND MAINTENANCE																
11	MONITORING																
12	EVALUATION																

TABLE 2.2-4

STUDIES ON RECURRENT MEASURES - FAP 22

WORK PLAN AS PER PROPOSAL OF DECEMBER 1997

FIELDED UP TO DECEMBER 31, 1998

SL. NO.	ACTIVITY	1997				1998											
		Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	PRE-SELECTION OF SITE																
2	VERIFICATION SURVEY / FIELD CHECK																
3	MAINTENANCE/ADAPTATION OF EXISTING BANDALS																
4	ELONGATION OF IMPROVED BANDALS																
5	DESIGN OF FLOATING SCREEN ELEMENTS																
6	CONSTRUCTION OF FLOATING SCREEN ELEMENTS																
7	FINAL SITE SELECTION																
8	DETAILED SURVEY																
9	POSITIONING AT TEST SITE																
10	OPERATION AND MAINTENANCE																
11	MONITORING																
12	EVALUATION																

TABLE 2.2-5

STUDIES ON RECURRENT MEASURES - FAP 22

STAFFING SCHEDULE *)

	FUNCTION	NAME	1996 J F M A M J J A S O N D	1997 J F M A M J J A S O N D	1998 J F M A M J J A S O N D	Man-Months EXPATRIATES BD	EU	LOCAL	FLIGHTS
1.1	PROJECT DIRECTOR	Dr. D. Neuhaus / Dr. H. Kramer							
1.2	HOME OFFICE SUPPORT						1.5		
1.3.1	PROJECT MANAGER *	C. Netzeband							
1.3.2	DEPUTY PROJECT MANAGER *	S. M. Mansur							
1.4	CHIEF HYDRAULIC DESIGN ENGINEER	Dr. H. Kramer				1.5	1.0		2
					SUB-TOTAL	1.5	2.5		2
5.1.1	RIVER ENGINEER 1	Pieter van Groen				5.5			6
5.1.2	RIVER ENGINEER 2	S. R. Khan						12.0	
5.2	HYDRAULIC DESIGN ENGINEER	M. Schwarz				1.0	0.75		1
5.4.1	MORPHOLOGIST 1 *	Dr. E. Mosselman				2.0			1
5.4.2	MORPHOLOGIST 2	M. H. Sarker / NN						17.0	
5.6.1	PROGRAMMER / MODELLING ENGINEER 1	J. Crebas				1.0			
5.8.1	SUPERVISING ENGINEER 1	K. Oberhagemann				8.0	0.5		3
5.8.2	SUPERVISING ENGINEER 2	F. R. Khan						14.0	
5.9.1	MONITORING EXPERT 1	T. Döscher				2.0			2
5.9.2	MONITORING EXPERT 2	A. Haider / P.K. Maitra						14.0	
5.11.1	UNALLOCATED 1					3.0			3
5.11.2	UNALLOCATED 2							2.0	
					SUB-TOTAL	22.5	1.25	59.0	16
	QUARTERLY REPORTS		X	X	X X X X				
	DRAFT EVALUATION REPORT				X				
	FINAL EVALUATION REPORT				X				
					TOTAL	24.0	3.75	59.0	18

NOTE: * Some of the working time of the Professionals will be charged to FAP 21 project

*) AS PER PROPOSAL OF AUGUST 1996 AND DECEMBER 1997 — MONSOON — EXPATRIATE — LOCAL — FAP 21

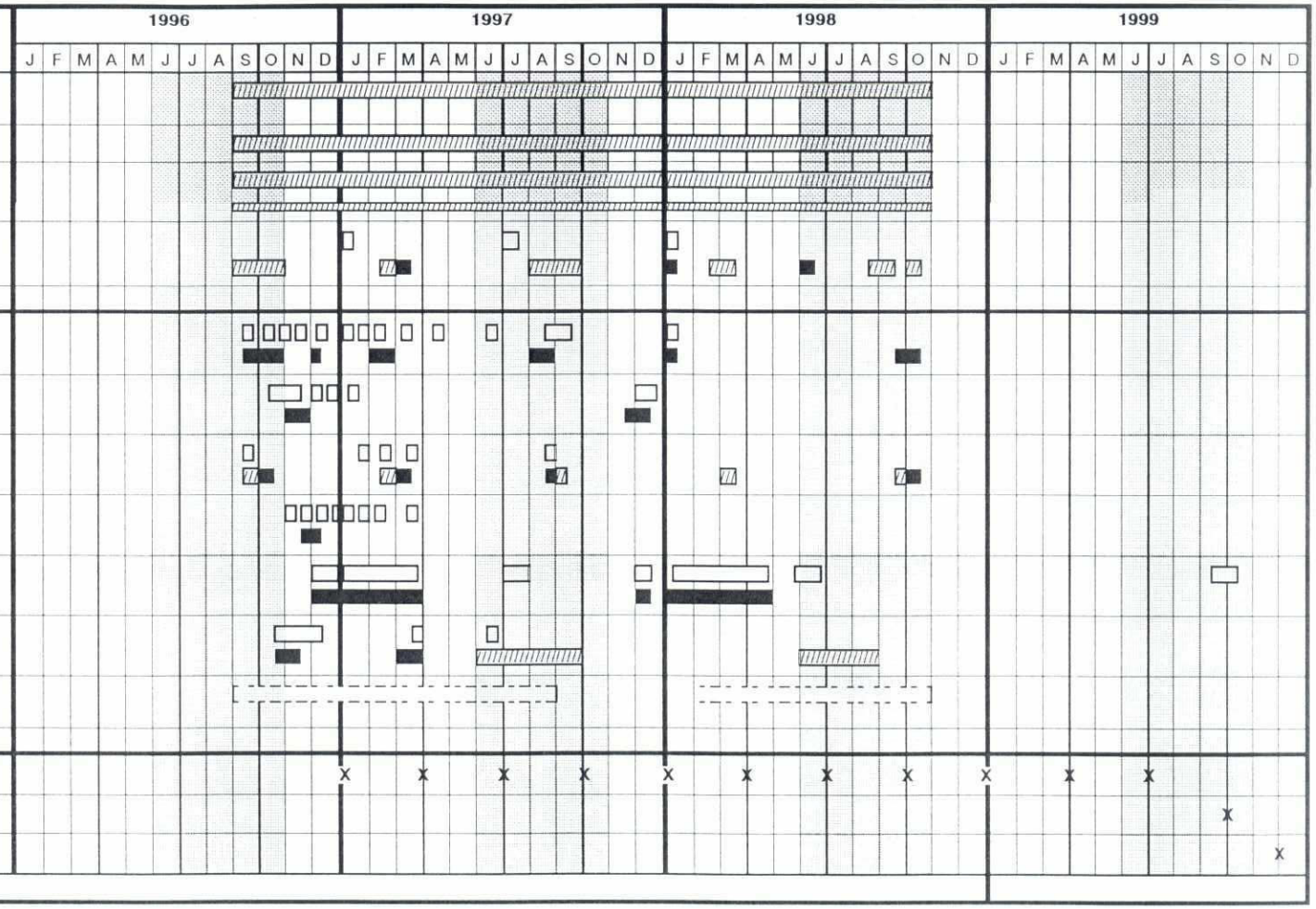
TABLE 2.2-6

STUDIES ON RECURRENT MEASURES - FAP 22

STAFFING SCHEDULE *)

EXPATRIATE PROFESSIONAL STAFF - FIELDED UP TO JUNE 30, 2000

	FUNCTION	NAME
1.1	PROJECT DIRECTOR	Dr. D. Neuhaus / Dr. H. Kramer
1.2	HOME OFFICE SUPPORT	
1.3.1	PROJECT MANAGER *	C. Netzeband
1.4	CHIEF HYDRAULIC DESIGN ENGINEER *	Dr. H. Kramer
5.1.1	RIVER ENGINEER 1	Pieter van Groen
5.2	HYDRAULIC DESIGN ENGINEER	M. Schwarz
5.4.1	MORPHOLOGIST 1 *	Dr. E. Mosselman
5.6.1	PROGRAMMER / MODELLING ENGINEER 1	J. Crebas
5.8.1	SUPERVISING ENGINEER 1	K. Oberhagemann
5.9.1	MONITORING EXPERT 1	T. Doscher
5.11.1	UNALLOCATED 1	
	QUARTERLY REPORTS	
	DRAFT EVALUATION REPORT	
	FINAL EVALUATION REPORT	



NOTE : * Some of the working time of the Professionals will be charged to FAP 21 project

*) AS PER PROPOSAL OF AUGUST 1996 AND DECEMBER 1997

MONSOON EXPATRIATE FAP 21 RELIAZATION

TABLE 2.2-7

STUDIES ON RECURRENT MEASURES - FAP 22

STAFFING SCHEDULE *)

LOCAL PROFESSIONAL STAFF - FIELDED UP TO DECEMBER 31, 1999

	FUNCTION	NAME	1996												1997												1998												1999											
			J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1.3.2	DEPUTY PROJECT MANAGER *	S. M. Mansur																																															
5.1.2	RIVER ENGINEER 2	S. R. Khan																																															
5.4.2	MORPHOLOGIST 2	S. KHAN																																															
5.8.2	SUPERVISING ENGINEER 2	F. R. Khan																																															
5.9.2	MONITORING EXPERT 2	A. Haider / P.K. Maitra/ Masumdar																																															
5.11.2	UNALLOCATED 2																																																
	QUARTERLY REPORTS														X			X			X			X			X			X			X			X			X			X			X				
	DRAFT EVALUATION REPORT																																														X		
	FINAL EVALUATION REPORT																																															X	

NOTE: * Some of the working time of the Professionals will be charged to FAP 21 project

*) AS PER PROPOSAL OF AUGUST 1996 AND DECEMBER 1997

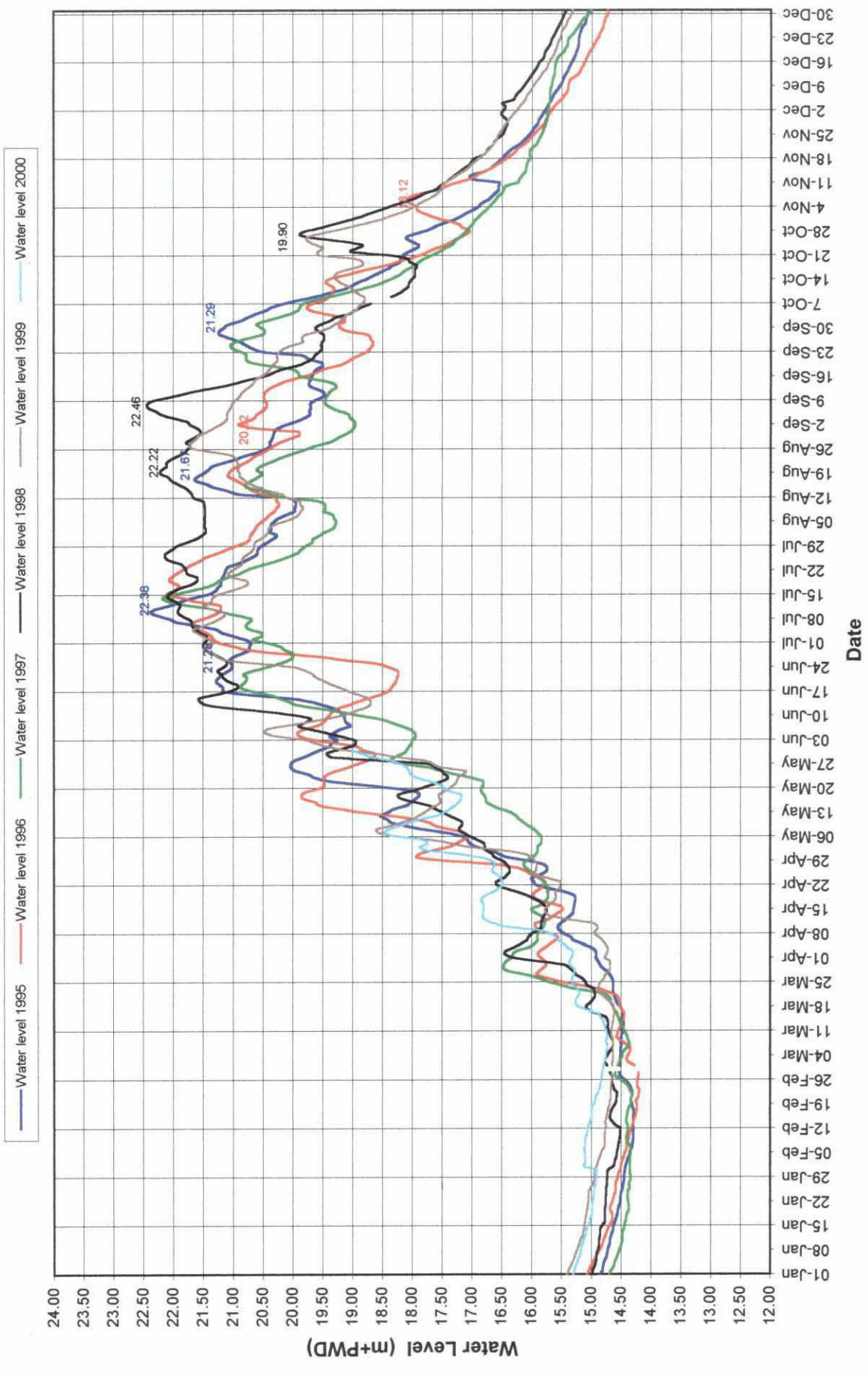
MONSOON FAP 21 LOCAL RELIAZATION

ANNEX A

FAP 21 / Test Site I

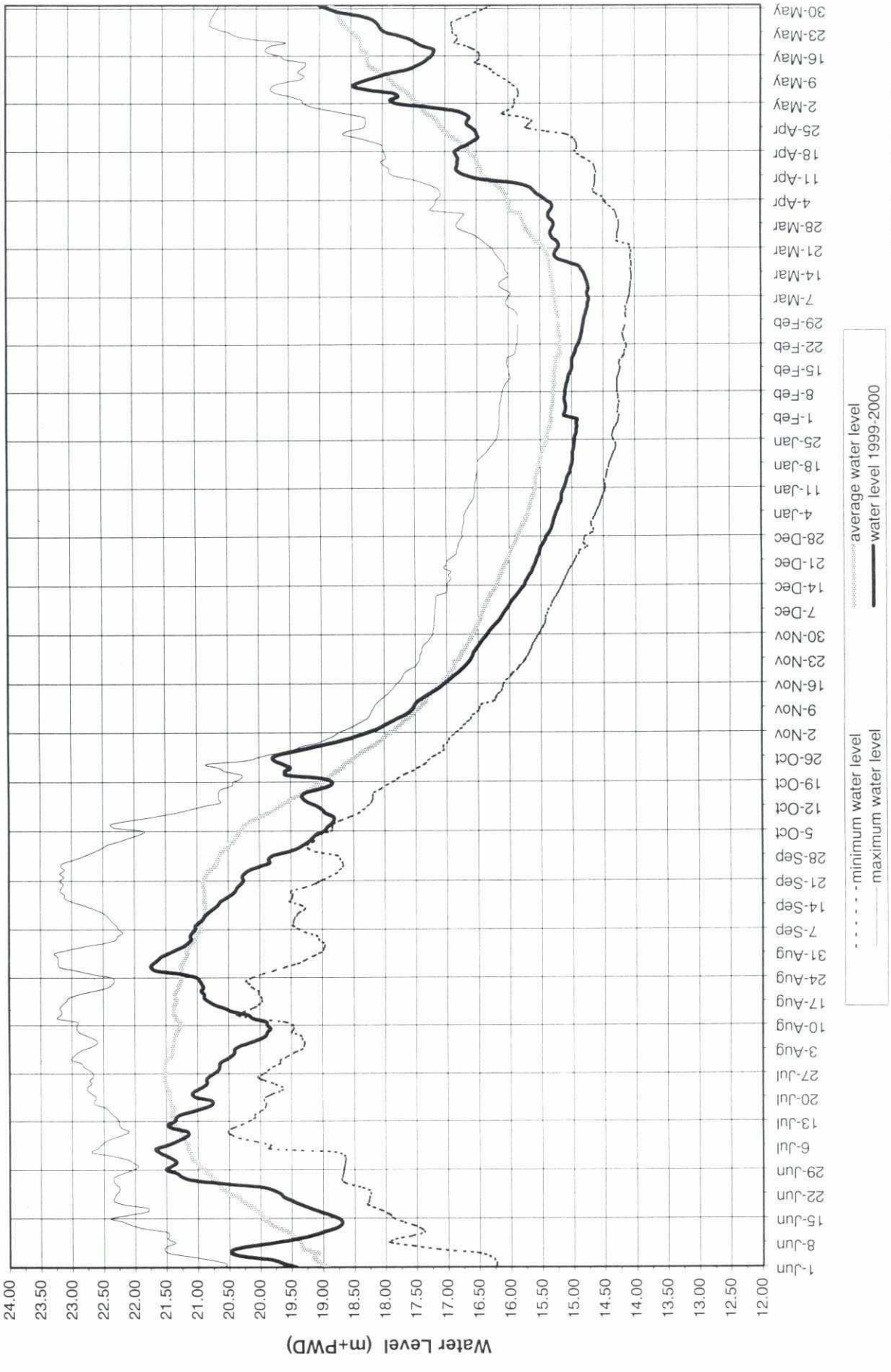
- Water Level

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT KAMARJANI TEST SITE
(January to December)



BANK PROTECTION TEST STRUCTURES - FAP 21

BWDB WATER LEVEL FREQUENCY CURVES VERSUS ACTUAL FAP 21 WATER LEVEL AT KAMARJANI TEST SITE UP TO MAY 2000

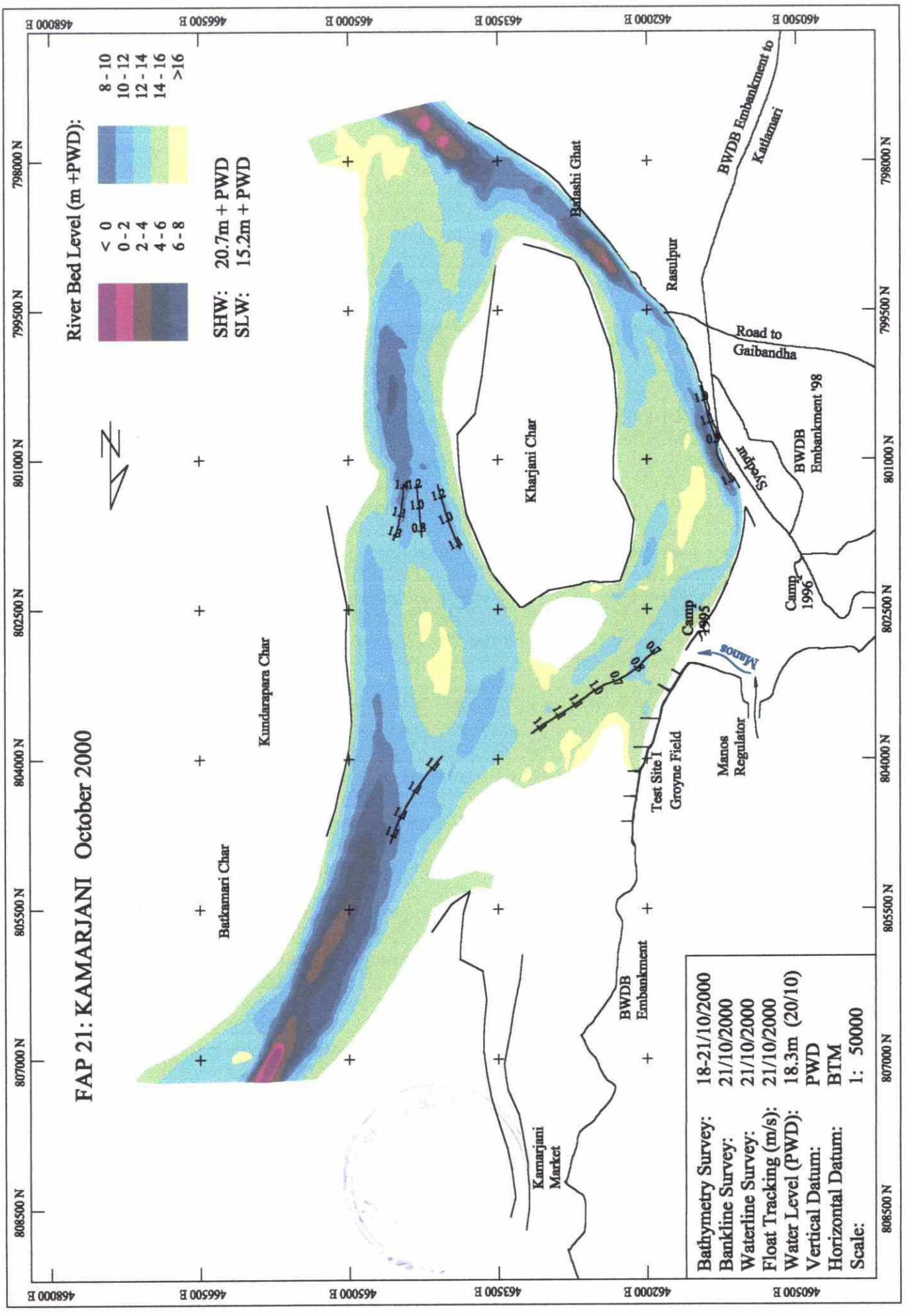


BWDB Data: Period of Record 1957 - 1997

ANNEX B

FAP 21 / Test Site I

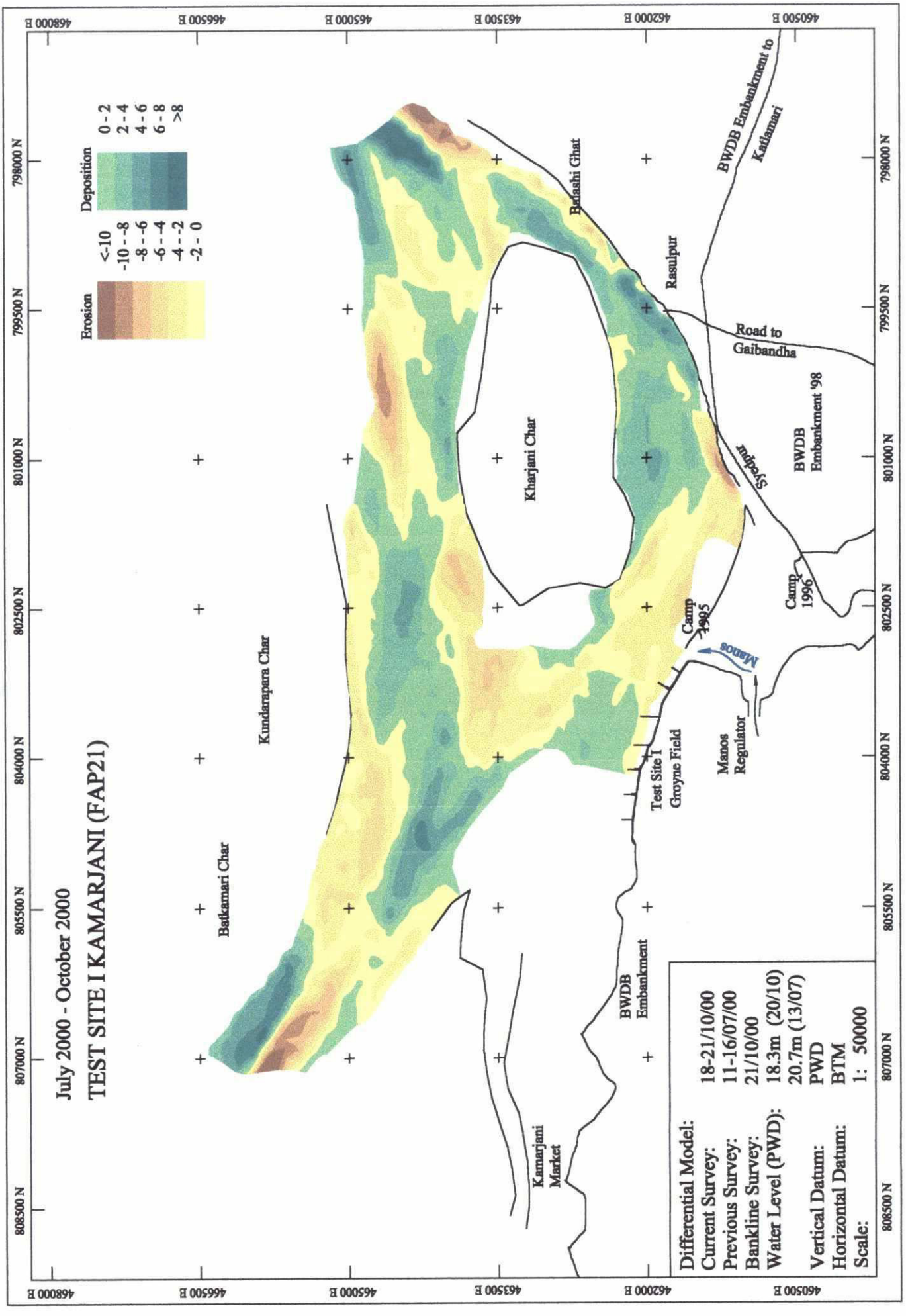
- Bathymetric Survey and Flow Velocities


FAP 21: KAMARJANI October 2000
River Bed Level (m +PWD):
< 0
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
14 - 16
>16
SHW: 20.7m + PWD
SLW: 15.2m + PWD
Batkamari Char
Kundarapara Char
Kharjani Char
Badashi Ghat
Rasulpur
BWDB Embankment to Katlamari
Road to Gaibandha
BWDB Embankment '98
Sapahar
Camp 1995
Camp 1996
Manos
Manos Regulator
Test Site I
Groyne Field
BWDB Embankment
Kamarjani Market
Bathymetry Survey: 18-21/10/2000
Bankline Survey: 21/10/2000
Waterline Survey: 21/10/2000
Float Tracking (m/s): 21/10/2000
Water Level (PWD): 18.3m (20/10)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 50000

ANNEX C

FAP 21 / Test Site I

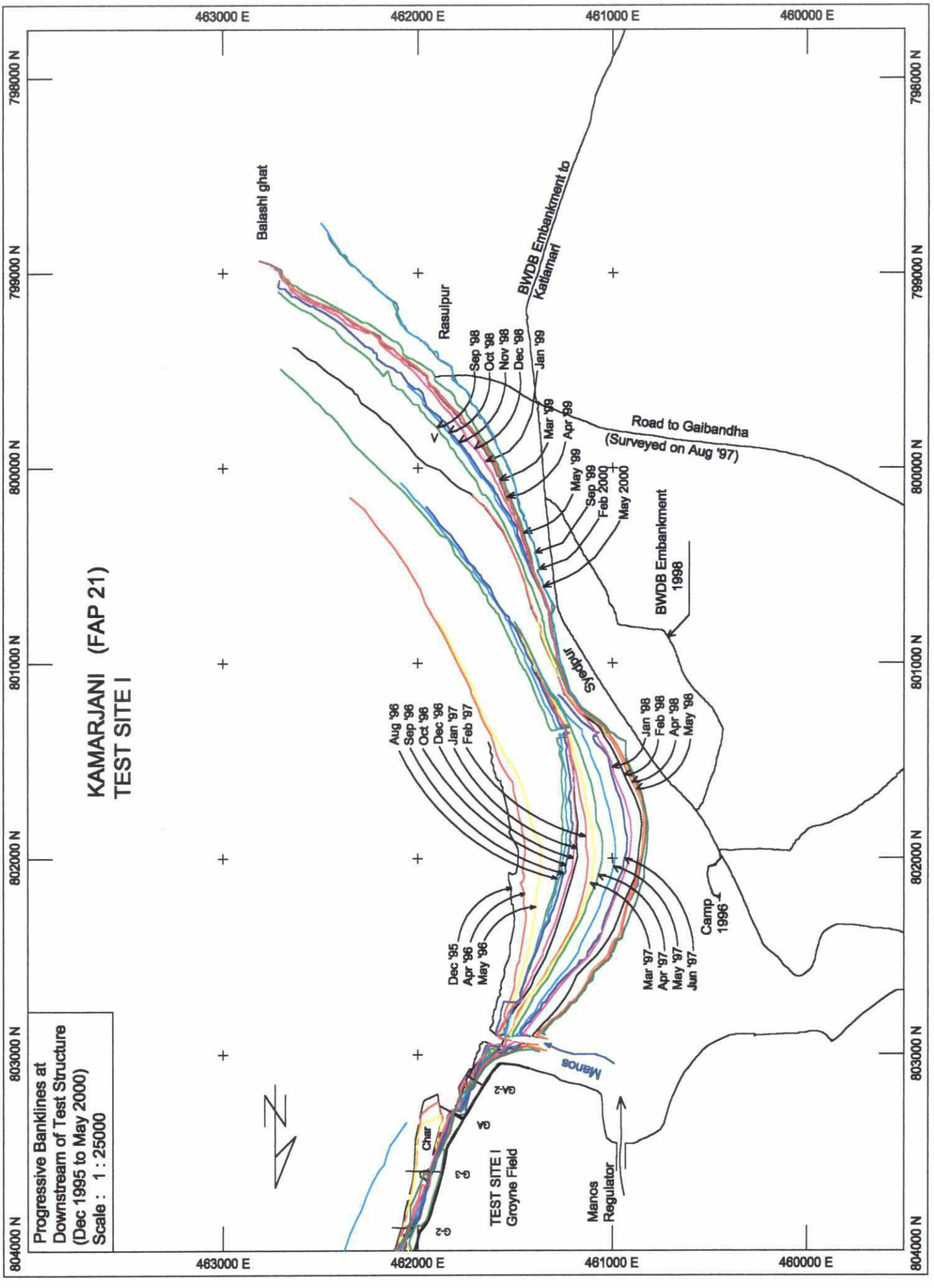
- Differential Models


July 2000 - October 2000
TEST SITE I KAMARJANI (FAP21)
Erosion
<-10
-10 - -8
-8 - -6
-6 - -4
-4 - -2
-2 - 0
Deposition
0 - 2
2 - 4
4 - 6
6 - 8
>8
Batkamari Char
Kundarapara Char
Kharjani Char
Bafashi Ghat
Rasulpur
BWDB Embankment to Katlamari
Road to Gaibandha
BWDB Embankment '98
Manos
Camp 1995
Camp 1996
Test Site I Groyne Field
Manos Regulator
BWDB Embankment
Kamarjani Market
Differential Model:
Current Survey: 18-21/10/00
Previous Survey: 11-16/07/00
Bankline Survey: 21/10/00
Water Level (PWD): 18.3m (20/10)
20.7m (13/07)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 50000
808500 N
807000 N
805500 N
804000 N
802500 N
801000 N
799500 N
798000 N
460500 E
462000 E
463500 E
465000 E
466500 E
468000 E

ANNEX D

FAP 21 / Test Site I

- Change of Bankline


KAMARJANI (FAP 21)
TEST SITE I
Progressive Banklines at Downstream of Test Structure (Dec 1995 to May 2000)
Scale : 1 : 25000
463000 E
462000 E
461000 E
460000 E
798000 N
799000 N
800000 N
801000 N
802000 N
803000 N
804000 N
Balashi ghat
Rasulpur
BWDB Embankment to Katlamari
Road to Gaibandha (Surveyed on Aug '97)
BWDB Embankment 1998
Sheikpur
Camp 1996
Manos
Manos Regulator
TEST SITE I Groyne Field
Char
G-2
G-3
G-4
GA-2
Sep '98
Oct '98
Nov '98
Dec '98
Jan '99
Mar '99
Apr '99
May '99
Sep '98
Feb 2000
May 2000
Aug '96
Sep '96
Oct '96
Dec '96
Jan '97
Feb '97
Jan '98
Feb '98
Apr '98
May '98
Dec '95
Apr '96
May '96
Mar '97
Apr '97
May '97
Jun '97

ANNEX E

FAP 21 / Test Site II

- Water Level

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
MONTH : OCTOBER 2000

DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	18.470	18.450	18.430	
2	18.380	18.360	18.360	
3	18.150	18.160	18.110	
4	17.990	17.970	17.950	
5	17.910	17.860	17.840	
6	17.740	17.690	17.650	
7	17.610	17.550	17.510	
8	17.480	17.420	17.400	
9	17.390	17.330	17.230	
10	17.160	17.140	17.120	
11	17.060	17.020	17.000	
12	16.940	16.920	16.900	
13	16.870	16.860	16.860	
14	16.820	16.810	16.810	
15	16.780	16.770	16.770	
16	16.760	16.750	16.740	
17	16.650	16.650	16.650	
18	16.600	16.530	16.510	
19	16.490	16.440	16.420	
20	16.390	16.370	16.350	
21	16.310	16.240	16.210	
22	16.140	16.130	16.120	
23	16.050	16.040	16.030	
24	15.990	15.970	15.970	
25	15.920	15.910	15.910	
26	15.870	15.870	15.860	
27	15.840	15.830	15.820	
28	15.800	15.800	15.800	
29	15.740	15.730	15.730	
30	15.710	15.690	15.690	
31	15.690	15.680	15.670	

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
MONTH : NOVEMBER 2000

DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	15.660	15.650	15.640	
2	15.640	15.640	15.630	
3	15.620	15.610	15.600	
4	15.580	15.560	15.540	
5	15.530	15.510	15.490	
6	15.450	15.420	15.400	
7	15.380	15.360	15.350	
8	15.330	15.310	15.280	
9	15.260	15.250	15.240	
10	15.200	15.180	15.160	
11	15.150	15.150	15.150	
12	15.120	15.110	15.100	
13	15.080	15.070	15.060	
14	15.050	15.040	15.030	
15	15.020	15.010	14.000	
16	14.990	14.980	14.970	
17	14.950	14.940	14.930	
18	14.920	14.920	14.920	
19	14.900	14.880	14.870	
20	14.850	14.840	14.840	
21	14.830	14.830	14.830	
22	14.830	14.830	14.830	
23	14.820	14.820	14.820	
24	14.810	14.800	14.800	
25	14.800	14.790	14.790	
26	14.770	14.760	14.740	
27	14.720	14.720	14.720	
28	14.710	14.710	14.710	
29	14.700	14.700	14.680	
30	14.670	14.650	14.620	

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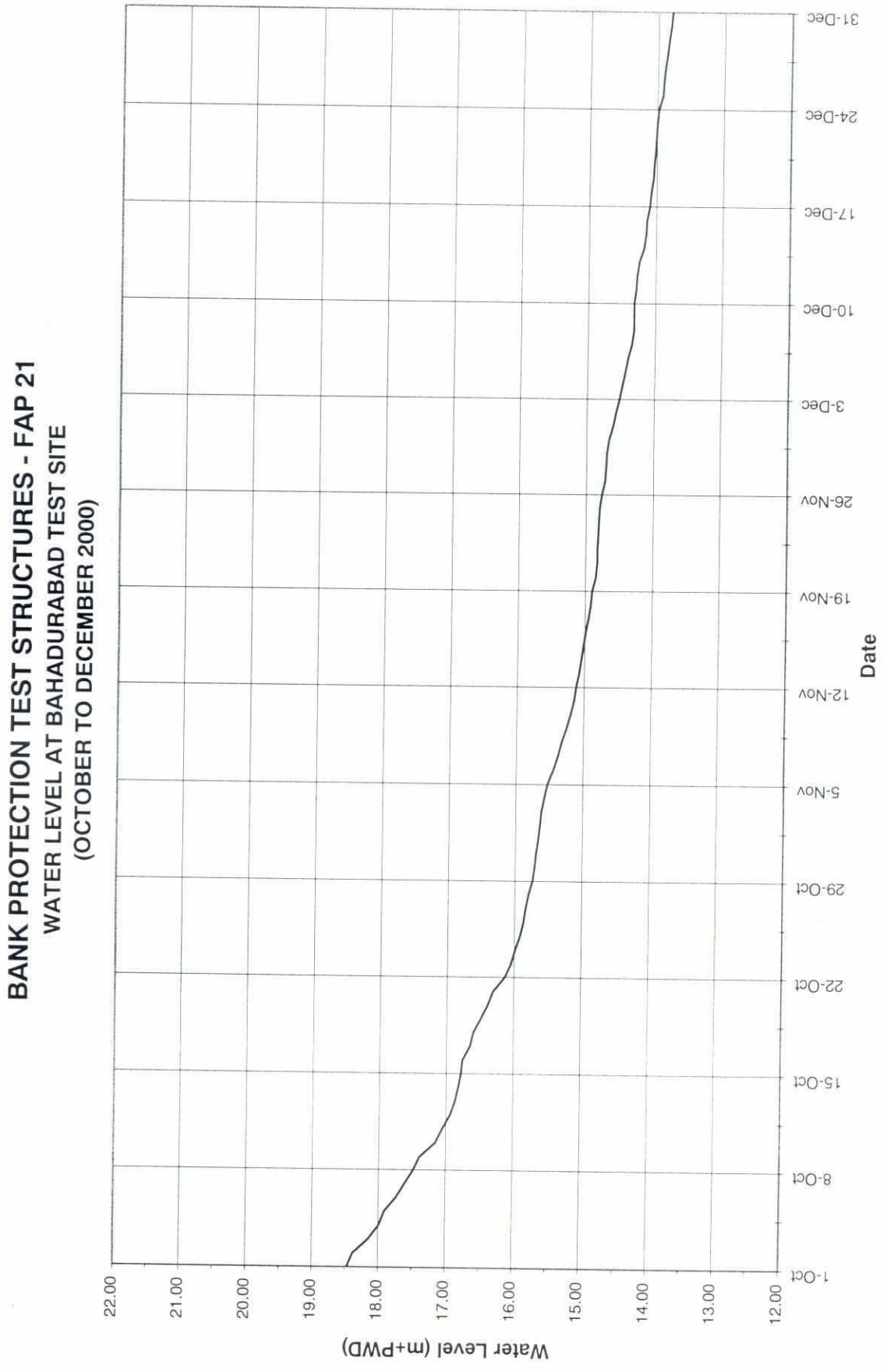
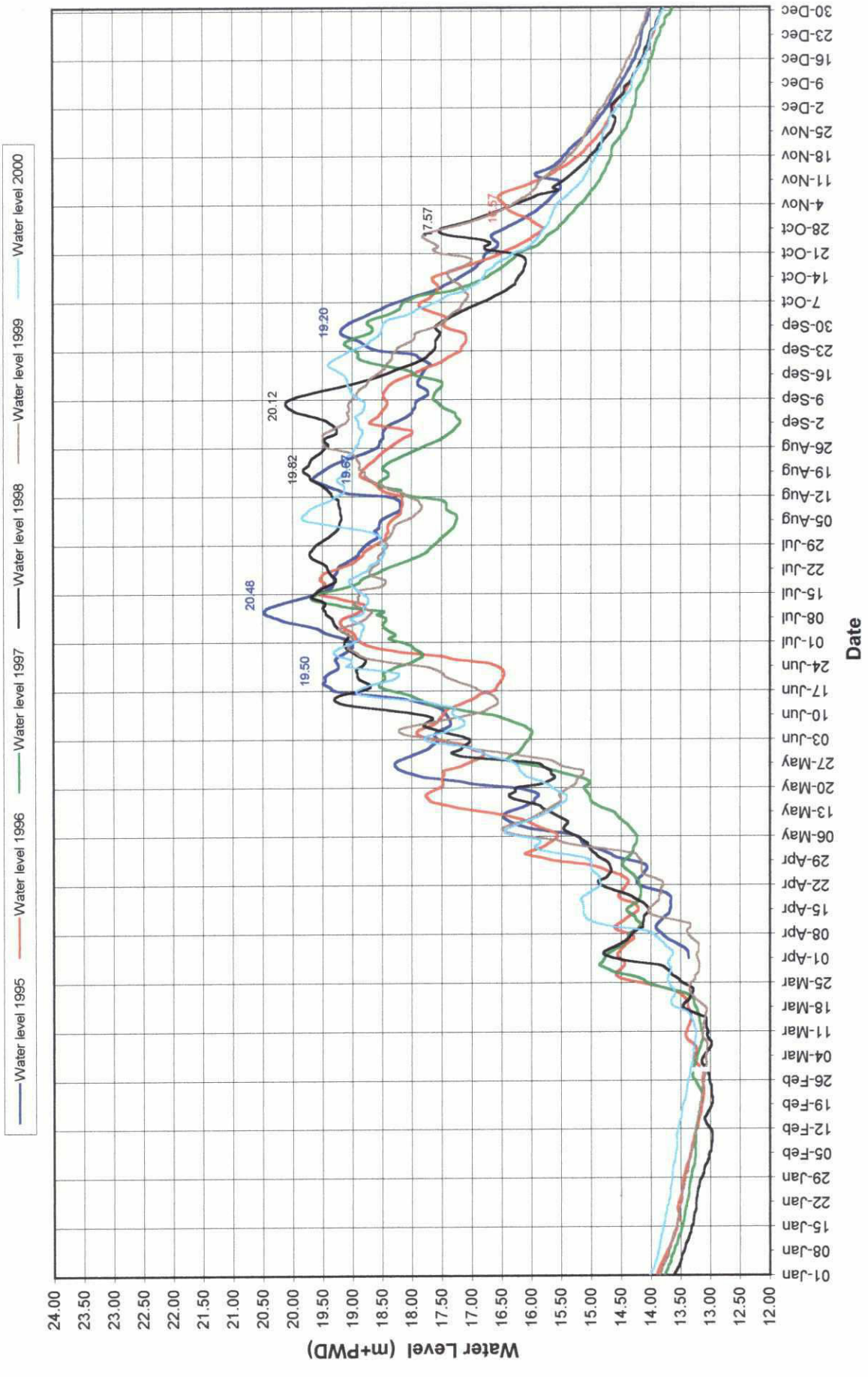
BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
MONTH : DECEMBER 2000

DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	14.610	14.600	14.590	
2	14.570	14.550	14.540	
3	14.520	14.510	14.500	
4	14.480	14.470	14.460	
5	14.440	14.430	14.420	
6	14.400	14.380	14.370	
7	14.350	14.350	14.340	
8	14.320	14.320	14.320	
9	14.320	14.320	14.320	
10	14.320	14.310	14.300	
11	14.290	14.290	14.290	
12	14.280	14.270	14.260	
13	14.250	14.230	14.210	
14	14.180	14.170	14.160	
15	14.150	14.150	14.150	
16	14.140	14.130	14.130	
17	14.100	14.100	14.100	
18	14.080	14.070	14.070	
19	14.050	14.050	14.050	
20	14.040	14.040	14.040	
21	14.020	14.020	14.020	
22	14.010	14.010	14.010	
23	14.000	13.990	13.990	
24	13.980	13.960	13.950	
25	13.920	13.920	13.920	
26	13.910	13.910	13.910	
27	13.890	13.890	13.880	
28	13.860	13.860	13.850	
29	13.840	13.830	13.820	
30	13.810	13.810	13.810	
31	13.790	13.780	13.780	

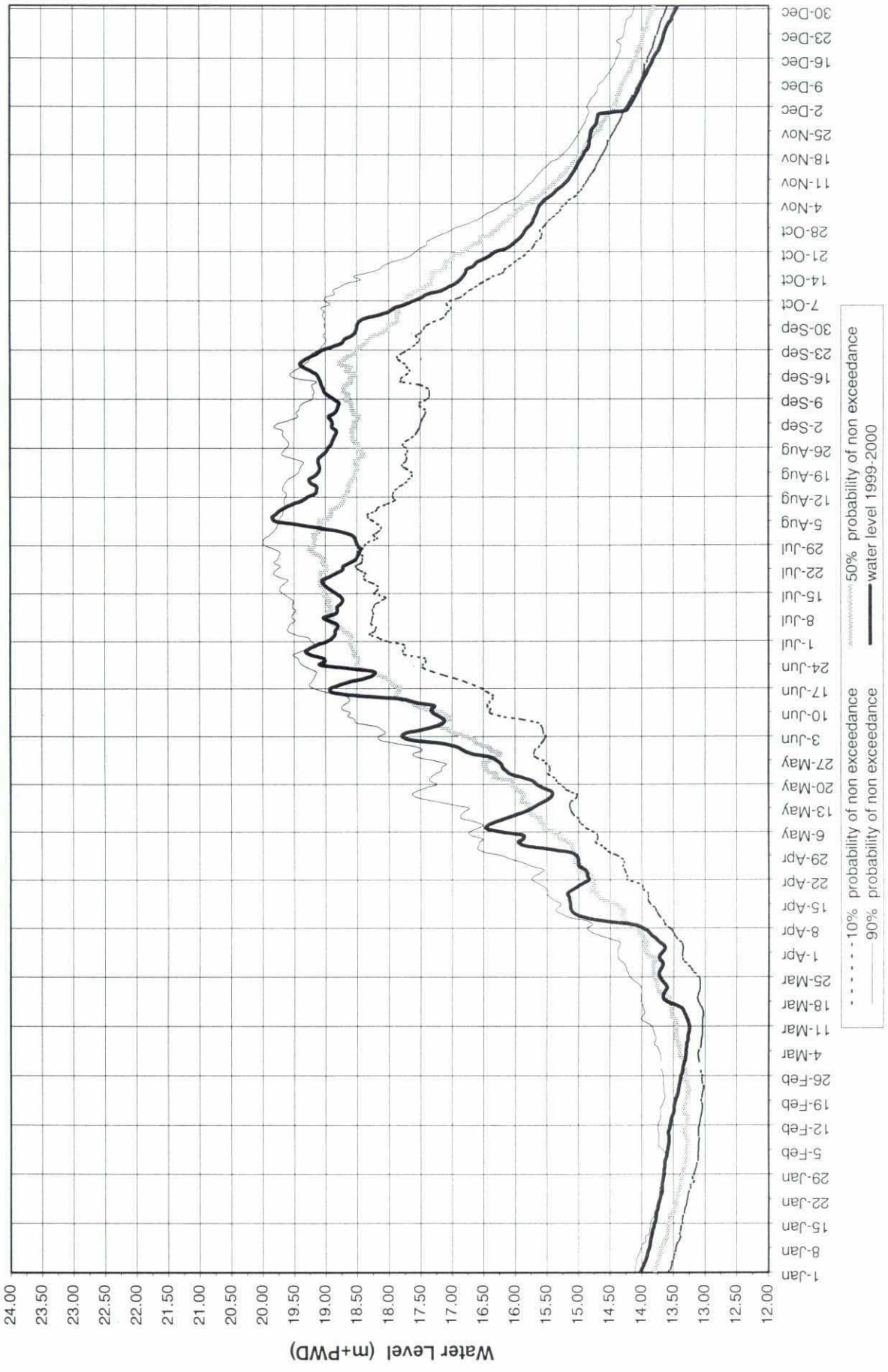

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
(OCTOBER TO DECEMBER 2000)
Water Level (m+PWD)
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
Date
1-Oct
8-Oct
15-Oct
22-Oct
29-Oct
5-Nov
12-Nov
19-Nov
26-Nov
3-Dec
10-Dec
17-Dec
24-Dec
31-Dec

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
(January to December)



BANK PROTECTION TEST STRUCTURES - FAP 21

BWDB WATER LEVEL FREQUENCY CURVES VERSES ACTUAL FAP 21 WATER LEVEL AT BAHADURABAD TEST SITE UP TO DECEMBER 2000

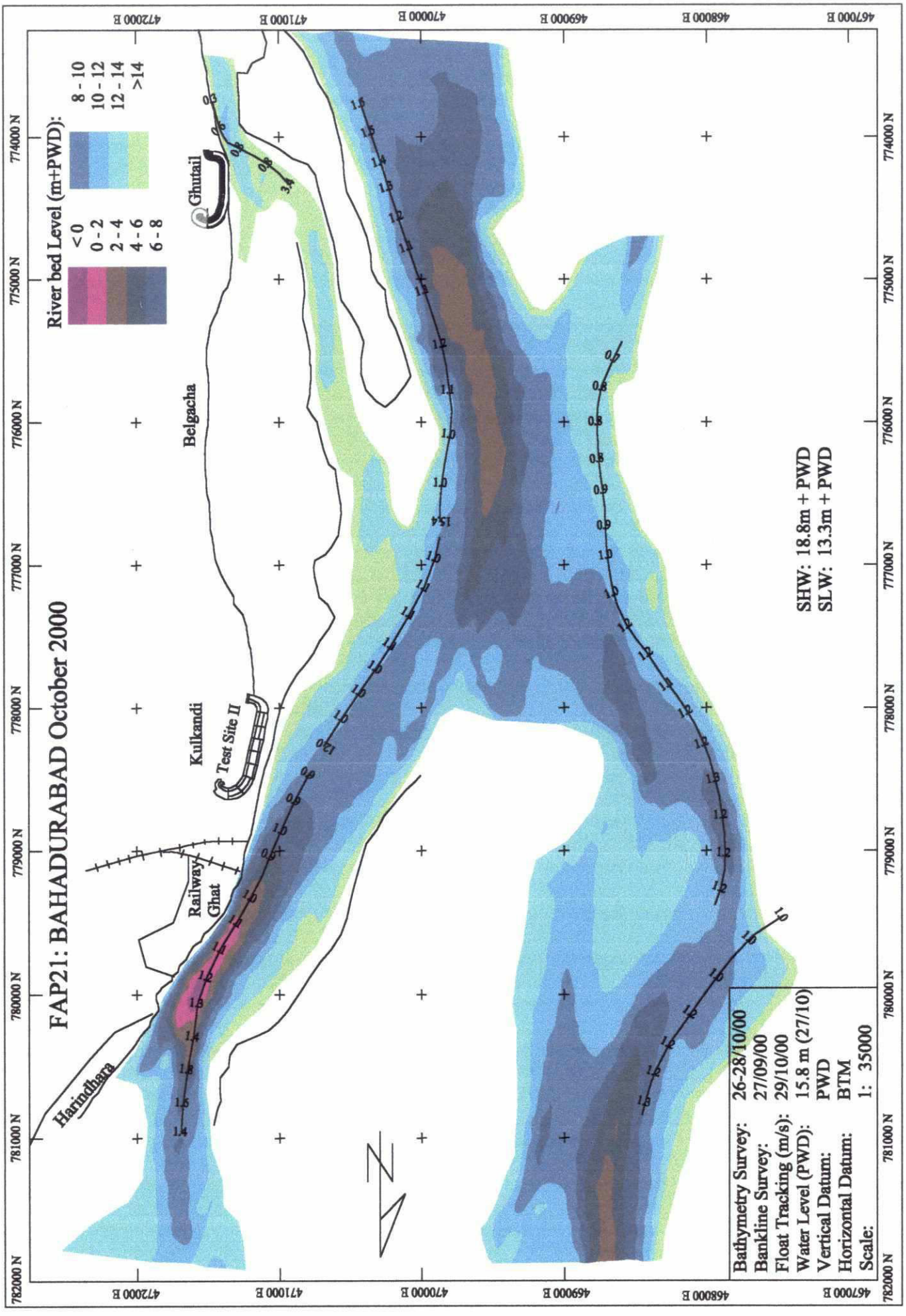


BWDB Data: Period of Record 1962 - 1994

ANNEX F

FAP 21 / Test Site II

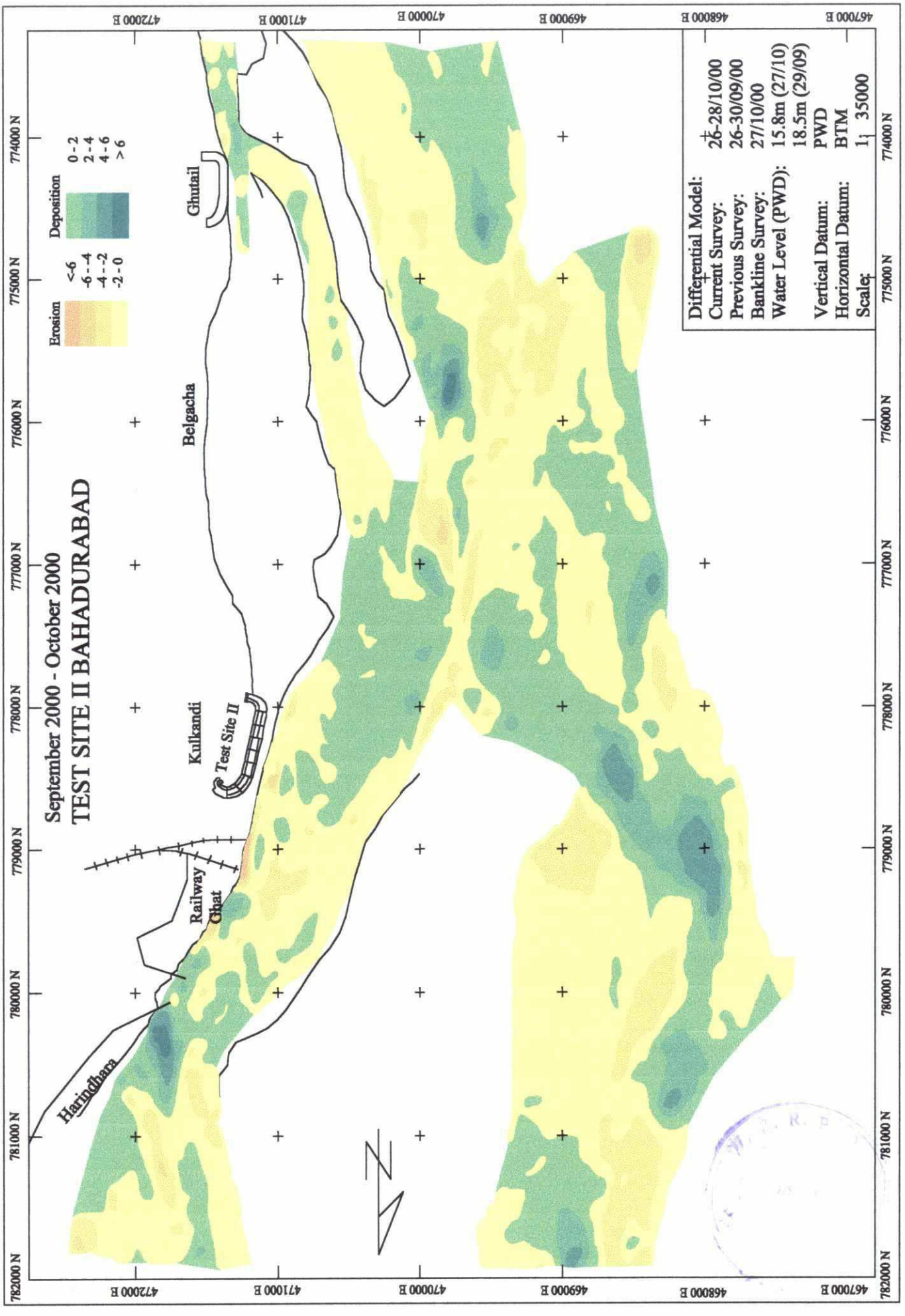
- Bathymetric Survey and Flow Velocities


FAP21: BAHADURABAD October 2000
River bed Level (m+PWD):
<0
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
>14
Ghutail
Belgacha
Kulkandi
Test Site II
Railway Ghat
Harindhara
SHW: 18.8m + PWD
SLW: 13.3m + PWD
Bathymetry Survey: 26-28/10/00
Bankline Survey: 27/09/00
Float Tracking (m/s): 29/10/00
Water Level (PWD): 15.8 m (27/10)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 35000
782000 N
781000 N
780000 N
779000 N
778000 N
777000 N
776000 N
775000 N
774000 N
472000 E
471000 E
470000 E
469000 E
468000 E
467000 E

ANNEX G

FAP 21 / Test Site II

- Differential Models

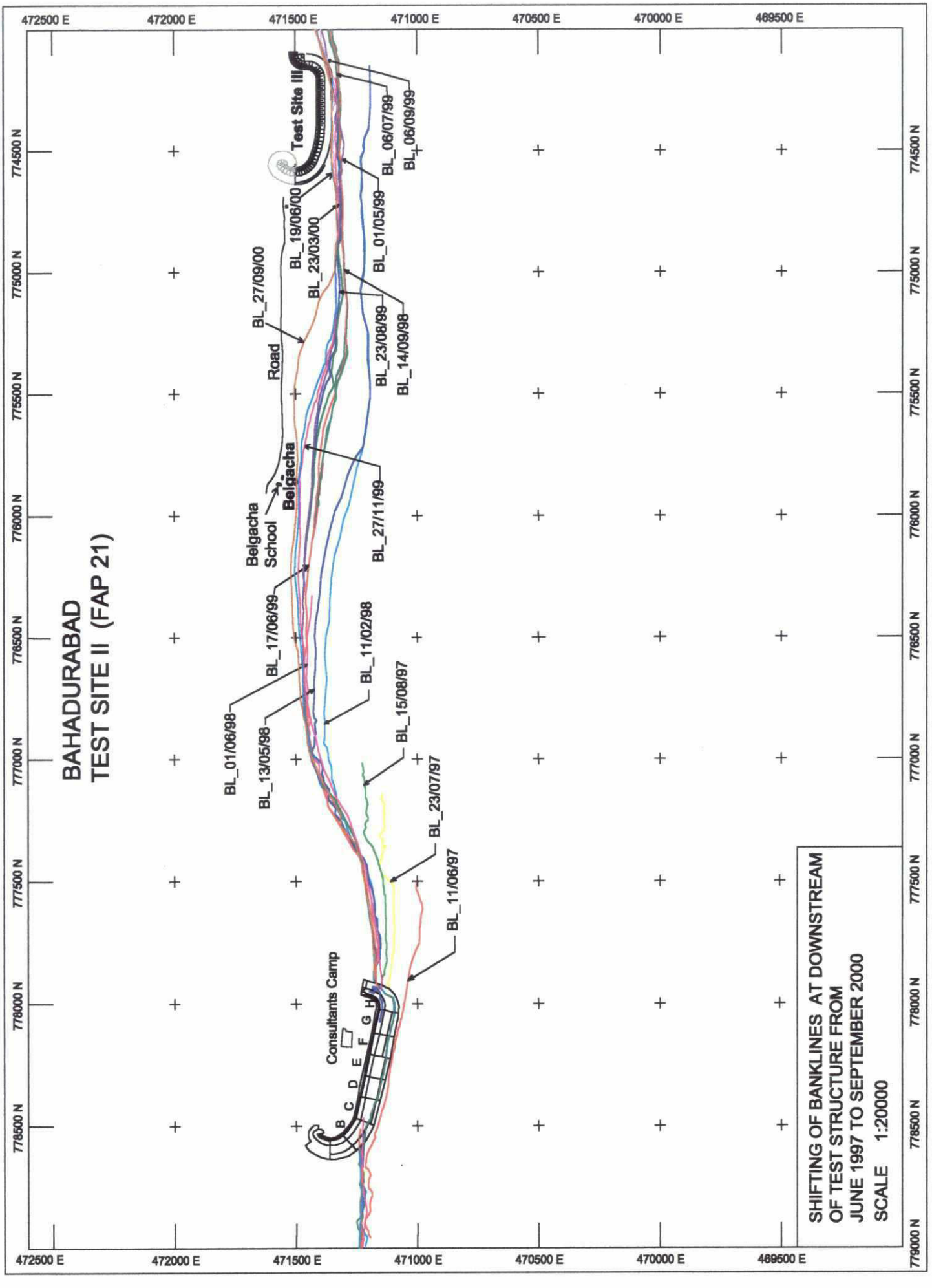

September 2000 - October 2000
TEST SITE II BAHADURABAD
Erosion
<-6
-6 - -4
-4 - -2
-2 - 0
Deposition
0 - 2
2 - 4
4 - 6
> 6
Differential Model:
Current Survey: 26-28/10/00
Previous Survey: 26-30/09/00
Bankline Survey: 27/10/00
Water Level (PWD): 15.8m (27/10)
18.5m (29/09)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 35000
Ghutail
Belgacha
Kulkandi
Test Site II
Railway Ghat
Harindhara
N
472000 E
471000 E
470000 E
469000 E
468000 E
467000 E
774000 N
775000 N
776000 N
777000 N
778000 N
779000 N
780000 N
781000 N
782000 N

ANNEX H

FAP 21 / Test Site II

- Change of Bankline

92


BAHADURABAD
TEST SITE II (FAP 21)
Test Site III
Belgacha
Belgacha School
Road
Consultants Camp
BL_27/09/00
BL_19/06/00
BL_23/03/00
BL_06/07/99
BL_06/09/99
BL_01/05/99
BL_23/08/99
BL_14/09/98
BL_27/11/99
BL_17/06/99
BL_01/06/98
BL_13/05/98
BL_11/02/98
BL_15/08/97
BL_23/07/97
BL_11/06/97
SHIFTING OF BANKLINES AT DOWNSTREAM
OF TEST STRUCTURE FROM
JUNE 1997 TO SEPTEMBER 2000
SCALE 1:20000
472500 E
472000 E
471500 E
471000 E
470500 E
470000 E
469500 E
774500 N
775000 N
775500 N
776000 N
776500 N
777000 N
777500 N
778000 N
778500 N
779000 N

ANNEX I

FAP 21 / Test Site III

- Water Level

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BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT GHUTAIL TEST SITE
MONTH : OCTOBER 2000

DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	18.470	18.450	18.430	
2	18.380	18.360	18.360	
3	18.150	18.160	18.110	
4	17.990	17.970	17.950	
5	17.910	17.860	17.840	
6	17.740	17.690	17.650	
7	17.610	17.550	17.510	
8	17.480	17.420	17.400	
9	17.390	17.330	17.230	
10	17.160	17.140	17.120	
11	17.060	17.020	17.000	
12	16.940	16.920	16.900	
13	16.870	16.860	16.860	
14	16.820	16.810	16.810	
15	16.780	16.770	16.770	
16	16.760	16.750	16.740	
17	16.650	16.650	16.650	
18	16.600	16.530	16.510	
19	16.490	16.440	16.420	
20	16.390	16.370	16.350	
21	16.310	16.240	16.210	
22	16.140	16.130	16.120	
23	16.050	16.040	16.030	
24	15.990	15.970	15.970	
25	15.920	15.910	15.910	
26	15.870	15.870	15.860	
27	15.840	15.830	15.820	
28	15.800	15.800	15.800	
29	15.740	15.730	15.730	
30	15.710	15.690	15.690	
31	15.690	15.680	15.670	

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BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT GHUTAIL TEST SITE
MONTH : NOVEMBER 2000

DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	15.340	15.340	15.330	
2	15.310	15.310	15.310	
3	15.300	15.300	15.300	
4	15.260	15.250	15.240	
5	15.200	15.190	15.170	
6	15.130	15.120	15.100	
7	15.060	15.050	15.040	
8	15.010	14.990	14.970	
9	14.950	14.950	14.940	
10	14.850	14.850	14.840	
11	14.850	14.850	14.840	
12	14.800	14.800	14.790	
13	14.760	14.750	14.750	
14	14.730	14.720	14.720	
15	14.670	14.670	14.670	
16	14.660	14.660	14.650	
17	14.630	14.630	14.620	
18	14.580	14.570	14.570	
19	14.560	14.560	14.560	
20	14.550	14.550	14.540	
21	14.520	14.520	14.520	
22	14.510	14.510	14.510	
23	14.490	14.490	14.490	
24	14.470	14.470	14.460	
25	14.450	14.450	14.450	
26	14.440	14.440	14.400	
27	14.430	14.430	14.420	
28	14.390	14.390	14.380	
29	14.340	14.340	14.330	
30	14.300	14.300	14.300	

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BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT GHUTAIL TEST SITE
MONTH : DECEMBER 2000

DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	14.250	14.250	14.240	
2	14.210	14.200	14.200	
3	14.170	14.170	14.160	
4	14.140	14.140	14.140	
5	14.110	14.100	14.100	
6	14.080	14.080	14.080	
7	14.050	14.050	14.050	
8	14.040	14.040	14.030	
9	14.010	14.010	14.010	
10	13.980	13.980	13.980	
11	13.950	13.950	13.940	
12	13.920	13.920	13.920	
13	13.900	13.890	13.890	
14	13.870	13.860	13.860	
15	13.840	13.840	13.840	
16	13.820	13.810	13.810	
17	13.790	13.780	13.780	
18	13.750	13.740	13.740	
19	13.720	13.720	13.720	
20	13.700	13.690	13.690	
21	13.680	13.680	13.670	
22	13.660	13.660	13.660	
23	13.650	13.650	13.640	
24	13.630	13.630	13.630	
25	13.610	13.600	13.600	
26	13.580	13.580	13.570	
27	13.540	13.540	13.540	
28	13.520	13.582	13.510	
29	13.490	13.490	13.480	
30	13.460	13.460	13.450	
31	13.440	13.440	13.440	

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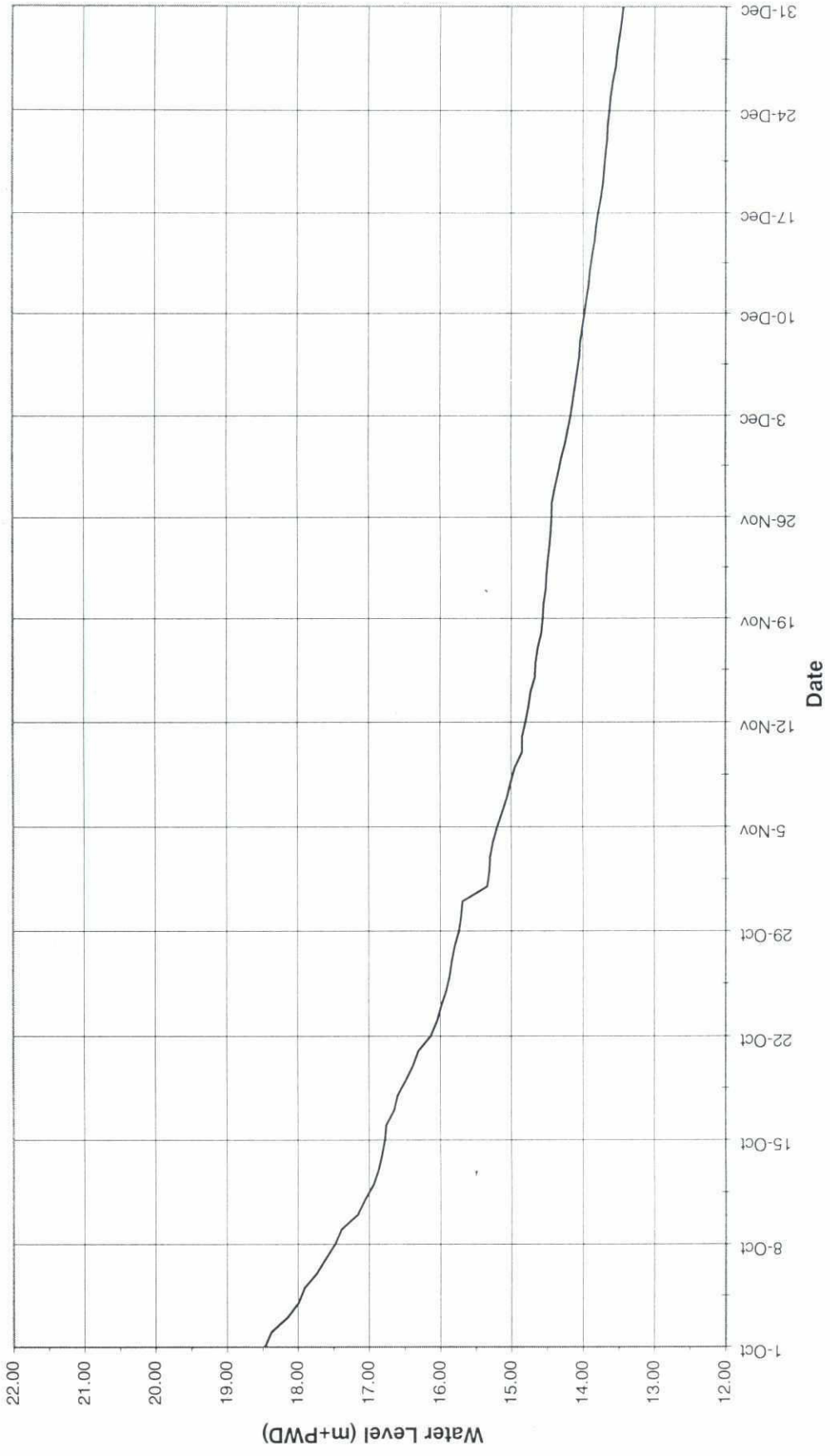
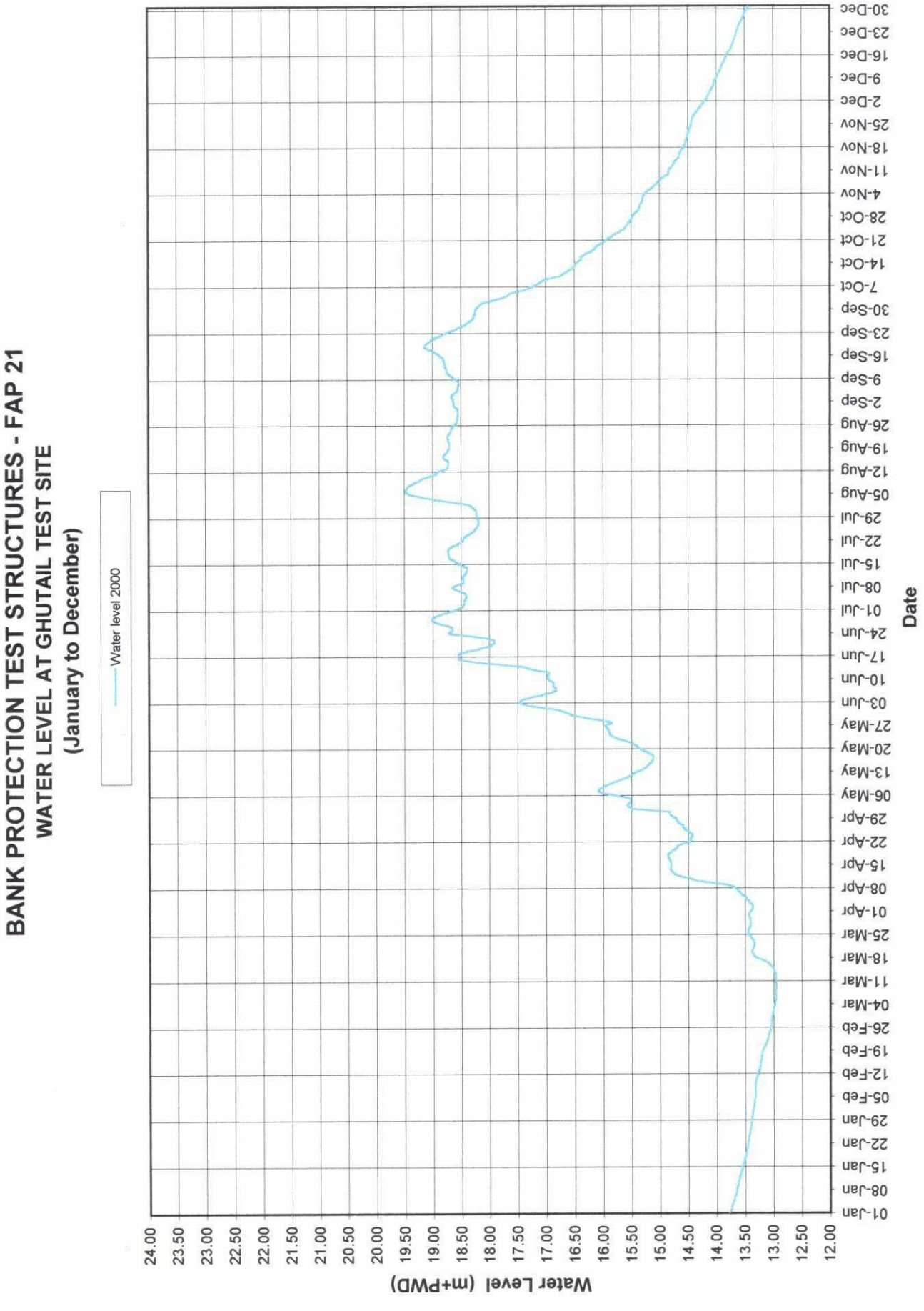
BANK PROTECTION TEST STRUCTURES - FAP 21

WATER LEVEL AT GHUTAIL TEST SITE

(OCTOBER TO DECEMBER 2000)

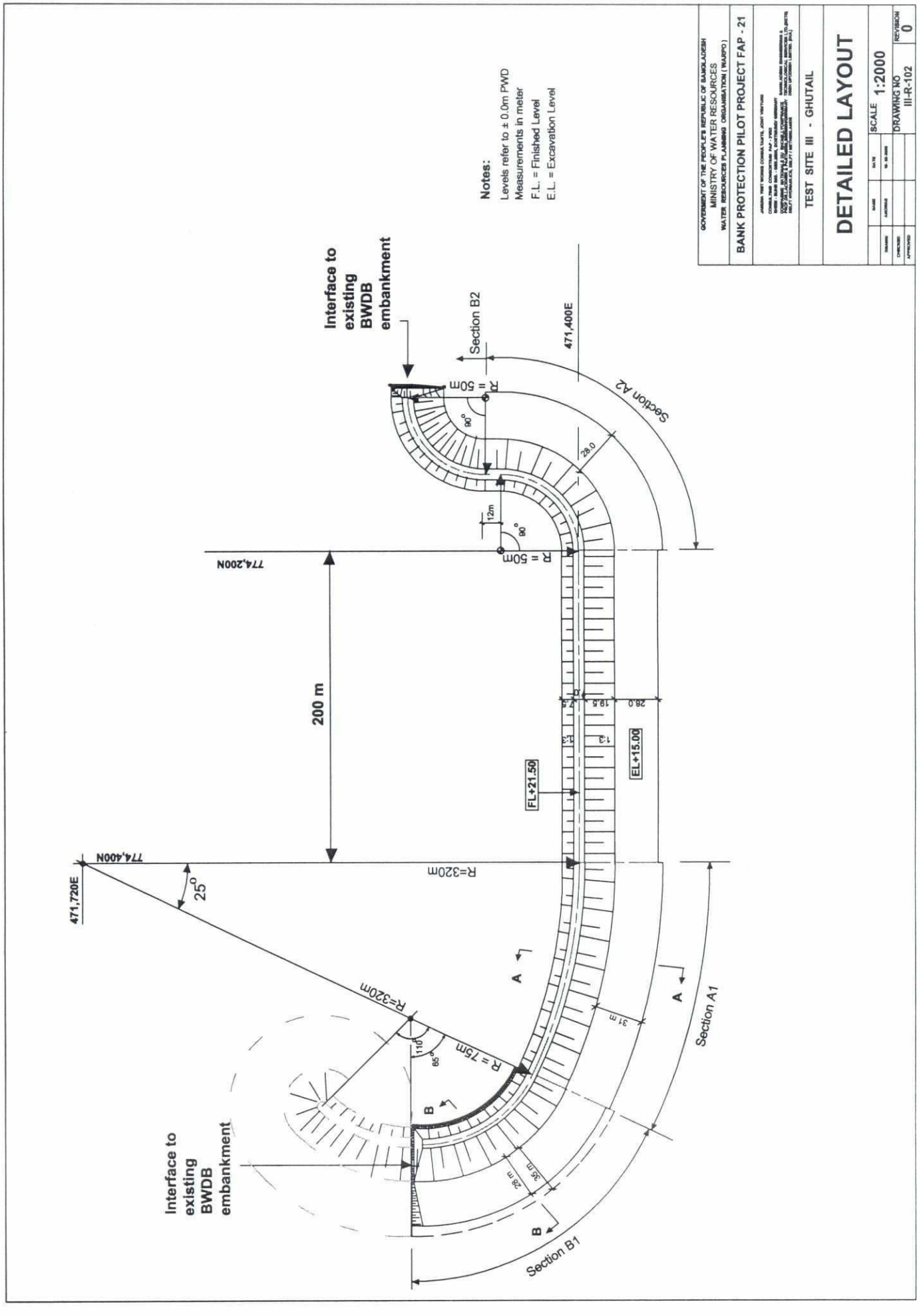


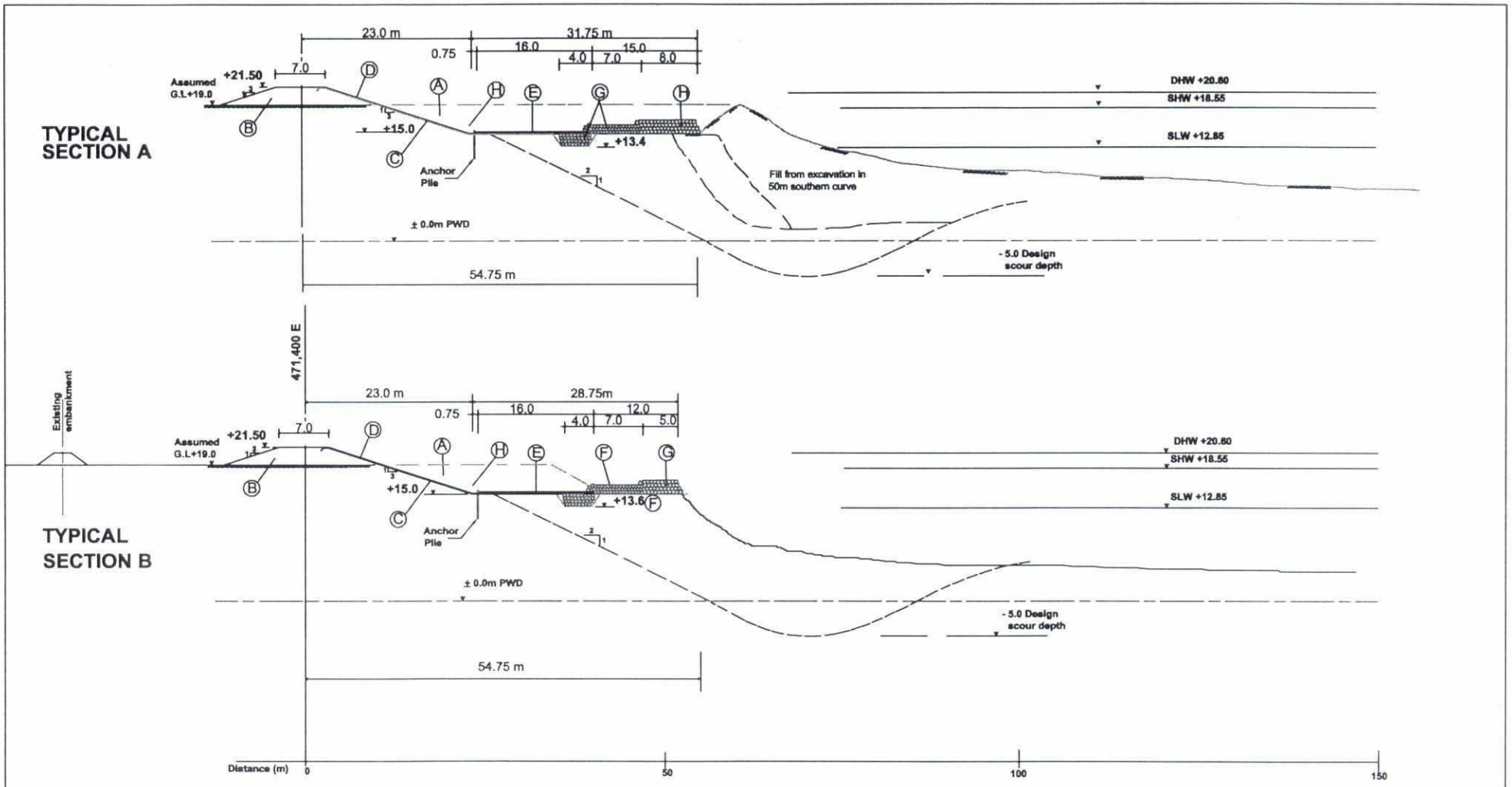

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT GHUTAIL TEST SITE
(January to December)
Water level 2000
Water Level (m+PWD)
24.00
23.50
23.00
22.50
22.00
21.50
21.00
20.50
20.00
19.50
19.00
18.50
18.00
17.50
17.00
16.50
16.00
15.50
15.00
14.50
14.00
13.50
13.00
12.50
12.00
Date
01-Jan
08-Jan
15-Jan
22-Jan
29-Jan
05-Feb
12-Feb
19-Feb
26-Feb
04-Mar
11-Mar
18-Mar
25-Mar
01-Apr
08-Apr
15-Apr
22-Apr
29-Apr
06-May
13-May
20-May
27-May
03-Jun
10-Jun
17-Jun
24-Jun
01-Jul
08-Jul
15-Jul
22-Jul
29-Jul
05-Aug
12-Aug
19-Aug
26-Aug
2-Sep
9-Sep
16-Sep
23-Sep
30-Sep
7-Oct
14-Oct
21-Oct
28-Oct
4-Nov
11-Nov
18-Nov
25-Nov
2-Dec
9-Dec
16-Dec
23-Dec
30-Dec

ANNEX K

FAP 21 / Test Site III

- Detailed Layout and Cross-Section


GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF WATER RESOURCES
WATER RESOURCES PLANNING ORGANISATION (WARPO)
BANK PROTECTION PILOT PROJECT FAP - 21
TEST SITE III - GHUTAIL
DETAILED LAYOUT
SCALE 1:2000
DRAWING NO III-R-102
REVISION 0
Notes:
Levels refer to ± 0.0m PWD
Measurements in meter
F.L. = Finished Level
E.L. = Excavation Level
Interface to existing BWDB embankment
Section B2
471,400E
Section A2
R = 50m
28.0
12m
774,200N
200 m
FL+21.50
EL+15.00
774,400N
471,720E
25°
R=320m
R = 75m
110°
65°
31 m
Section A1
28 m
35 m
Section B1
Interface to existing BWDB embankment



Ⓐ Excavation
Ⓑ Fill, Compact + Profile
Ⓒ Geotextile filter POLYFELT TS-70
Ⓓ Brick mattressing (d=15cm)
Ⓔ Articulated RENO-mattresses
d-30cm,rubble-fill Grade B/C
(D_{50} =15/20cm)
Geotextile filter BIDIM S-82
Ⓕ CC-Blocks 35° (45 Nos/m²)
Ⓖ CC-Blocks 40° (32 Nos/m²)
Ⓗ CC-Blocks 45° (25 Nos/m)

Notes:

1. All measurements in meter.
2. Levels refer to ± 0.0 m PWD.
3. SLW = Standard Low Water
   SHW = Standard High Water
   DHW = Design High Water

GOVERMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
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BANK PROTECTION PILOT PROJECT FAP - 21

TEST SITE III - GHUTAIL

MODIFIED CROSS-SECTION A & B

	NAME	DATE	SCALE
DRAWN	ANOWAR	07-05-2000	1:500
CHECKED			DRAWING NO III-R-103
APPROVED			REVISION 0