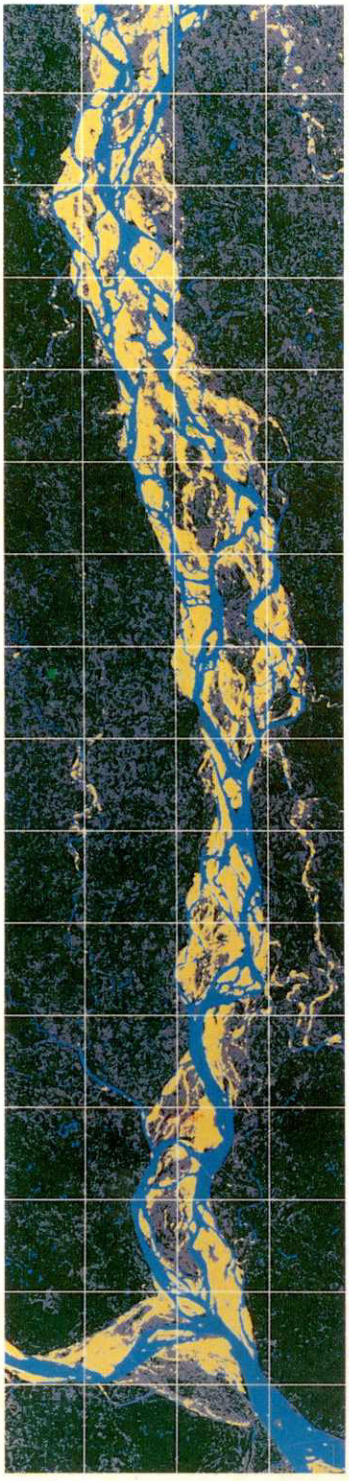
GOVERNMENT OF PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF WATER RESOURCES
WATER RESOURCES PLANNING ORGANIZATION

FEDERAL REPUBLIC OF GERMANY

KREDITANSTALT FÜR
WIEDERAUFBAU (KfW)

FRENCH REPUBLIC

CAISSE FRANCAISE DE
DEVELOPPEMENT (CFD)



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

TEST AND IMPLEMENTATION PHASE

PROGRESS REPORT NO. 25

JULY TO SEPTEMBER 1999

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

PROGRESS REPORT NO. 24

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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) had 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 on site started on October 01, 1994 and were substantially completed end of April 1995. 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. In December 1998 the Consultant submitted a technical and financial proposal relating to this decision along with a proposal for necessary modification of Consulting Services. On the basis of this the client and the donors approved an extension of the Contract up to the end of 2000.

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 had to be stopped in March and June 1998 respectively due to permanent problems with the local population in that area. Finally, it was decided to resume the tests under FAP 22 in connection with the implementation of the third FAP 21 test site.

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 September 1999. 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 July to September 1999.

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 by Dr. Friedrich von Raumer on behalf of FPCO/KfW/CFD
14. to 20.06.1994	Review Mission of KfW/CFD
18.06.1994	Submission of 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 and discussions on import of geotextile material
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 03.07.96	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 by Dr. Friedrich von Raumer on behalf of WARPO/KfW/CFD
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
23.12.1998	Proposal for modification of Consulting Services for Test Site III
01. to 07.03.1999	Technical Review Mission of KfW/AFD
31.05.1999	Proposal for modification of Consulting Services for Test Site III (Revision 1)
23.06.1999	Subcontract signed for construction works at Third Test Site
23.06.1999	Order to commence with fabrication of cc-blocks for Third Test Site

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 at two test sites, 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 is 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.

The 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 1.2-3.2 presents the revised Staffing Schedule submitted along with the Progress Report No. 6 and adapted to the donors' comments, whereas Table 1.2-1.2 and Table 1.2-3.3 are showing the Work Plan and the Staffing Schedule as per proposal of July 1996, approved in March 1997. 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 of 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 the Bangladesh Water Development Board (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.

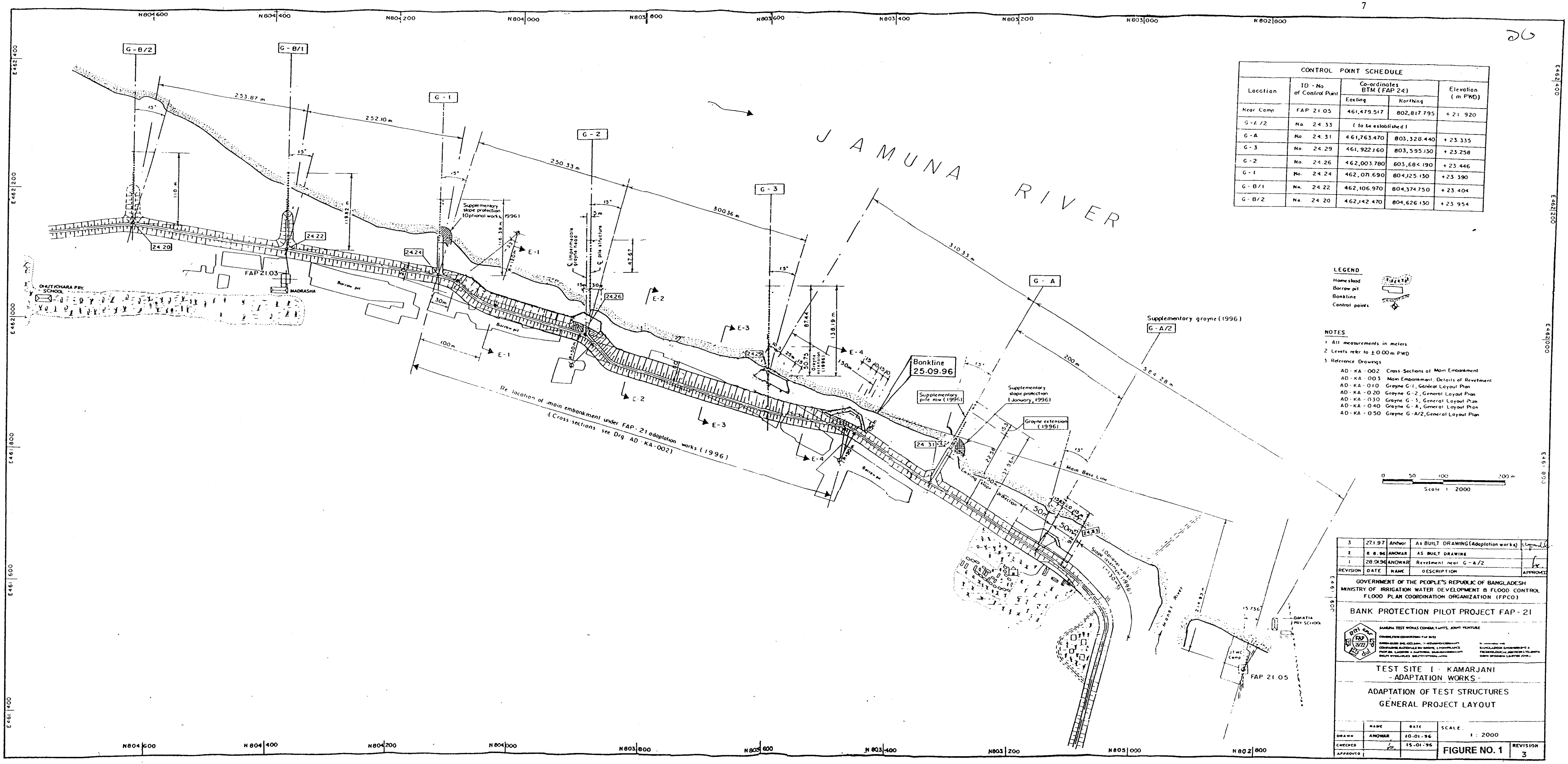
During the flood season 1996 the river banks in the area of Kamarjani continued to be eroded and also the Groyne Test Structure came under attack again due to the attraction of the flow by the scour hole in front of the groynes. However, due to the adaptation of the structure and the morphological development 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 was carried out by driving 23 Nos. steel piles ϕ 711 mm and 32 m length as well as by construction of 12 Nos. of reinforced in-situ concrete piles 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 season 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 current monsoon season 1999 no damages have been observed till the end of period under report. 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.

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)		Elevation (m PWD)
		Easting	Northing	
Near Comp	FAP 21.05	461,479.517	802,817.795	+ 21.920
G-A/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-KA-002 Cross Sections of Main Embankment
AD-KA-003 Main Embankment, Details of Revetment
AD-KA-010 Groyne G-1, General Layout Plan
AD-KA-020 Groyne G-2, General Layout Plan
AD-KA-030 Groyne G-3, General Layout Plan
AD-KA-040 Groyne G-A, General Layout Plan
AD-KA-050 Groyne G-A/2, General Layout Plan

0 50 100 200 m
Scale 1 : 2000

REVISION	DATE	NAME	DESCRIPTION	APPROVED
3	27.1.97	Anwar	As BUILT DRAWING (Adaptation works)	
2	8.8.96	ANOWAR	AS BUILT DRAWING	
1	28.01.96	ANOWAR	Revetment near G-A/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

JAMUNA TEST WORKS CONSULTANTS, JOINT VENTURE

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. The following activities have been performed during the period under review:

(1) Bathymetry

Bathymetry surveys were done to detect and record planform and riverbed changes and their influence on the stability of the test structure. The activities during the months of July to September 1999 are shown in Table 1. All the surveys were finally processed in the office in Dhaka and the results are shown in contour charts.

The results of the main surveys during the period under review are given in Annex B.

Date	Survey Area		
	July 1999	August 1999	September 1999
01	main survey		
02	main survey		
03	main survey		
04	main survey		
05	main survey		
06	main survey		
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18		main survey	
19		main survey	
20		main survey	
21		main survey	
22		main survey	
23		main survey	main survey
24			main survey
25			main survey
26			main survey
27			main survey
28			main survey
29			
30			
31			

Table 1: Bathymetry surveys at Kamarjani Test Site from July to September 1999

(2) Topographic Measurements

The topographic measurements were done by using Electronic Distance Measurement (EDM) equipment & levelling instrument. During the period under review the following works were performed:

17/07	water level gauge at G-A shifted and zero value measured at 19.41 m+PWD
20/07	water level gauge at groyne G-A shifted and zero value measured at 20.15 m+PWD
24-28/07	installation of new benchmarks at Kamarjani Bazar, Rasulpur and Kundarapara char
29/09	bankline from groyne G-3 to Syedpur, char survey in front of mouth of Manos river
30/09	bankline from Syedpur to Balashi ghat

(3) Measurement by the Monitoring System

The monitoring system is located at groyne G-2 and recording water level information, wave heights and periods, test pile inclination and acceleration, wind speed and direction as well as other meteorological data like temperature, precipitation and relative humidity. Data are shown in the monthly reports on monitoring of the test structures.

(4) Measurement of Flow Velocity and Direction

Float track measurements were continued as well as measurements with the Valeport currentmeter in the Kamarjani main channel and Kundarapara cut-off channel. Results are presented in the monthly reports on monitoring of the test structures and in Annex B.

(5) Observations

The first peak water level of the current year was measured on July 05 at 21.67 m+PWD. Thereafter the water level dropped for more than one month and the minimum was recorded on August 09 at 19.83 m+PWD, which was close to the minimum of the frequency curve for the period 1957 to 1997. The second peak of the 1999 monsoon flood was observed on August 27 at 21.74 m+PWD and at the end of the period under report the water level was at 19.40 m+PWD, again close to the minimum curve for the above mentioned period.

Severe erosion at Kamarjani Bazar, about 4 km upstream from the groyne field continued, which has started during the monsoon season 1998. The same holds for the area downstream from the test structure up to Balashi Ghat, but no significant flow was measured at the groyne field.

In August the Kundarapara channel shifted to the west and conveyed about 52% of the total discharge, whereas about 48% ran along the Kamarjani channel.

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 under water 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 next dry season.

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 15 the Client had been informed that the Revetment Test Structure was complete in all respects on June 12, 1997.

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 became 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.

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.

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, 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. Finally, the river bed level was recorded at about 16 m+PWD and remained stable till the end of the period under report, when slight erosion started again, however, in an area about 100 m in front of the test structure.

CONTROL POINT SCHEDULE			
No. of Control Points	Co-ordinates BTM		Elevation (m PWD)
	Easting	Northing	
FAP21-B	471,548.482	778,800.937	+20.246
*) GPS FM764	471,086.185	778,478.880	—
FAP21.28	471,330.663	777,813.399	+20.139
FAP770	471,067.515	778,073.154	+20.248
FAP21-X	471,293.485	778,654.360	—
FAP21-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

FAP 21-X

Village North-south connection

Consultants camp

LAND ACQUISITION
PHASE II (Site Survey 17.10-96)

FAP 21.28

SEE DETAIL
DRG. R-A-315

FAP-770

GPS FM 764

BANKLINE ON
15TH MAY '97

BANKLINE ON
15TH.OCTOBER'96

179.40
224.40
45.0
175.48
470.08
503.82

J A M U N A R I V E R

E 471600
E 471400
E 471200
E 471000
E 470800
E 470600

N778 800
N778 600
N778 400
N778 200
N778 000
N777 800
N777 600
N777 400

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. Bankline and bathymetric survey as on 09/10/96.
4. Reference Drawing:
   R-A-302 Detailed Layout of Test Structure

DRAWING PHOTOREDUCED BY 50%

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	ANOWAR	03-11-96	
CHECKED		03-11-96	
APPROVED			FIGURE NO. 2 — REVISION 1

REVETMENT TEST STRUCTURE
DEFINITION SKETCH

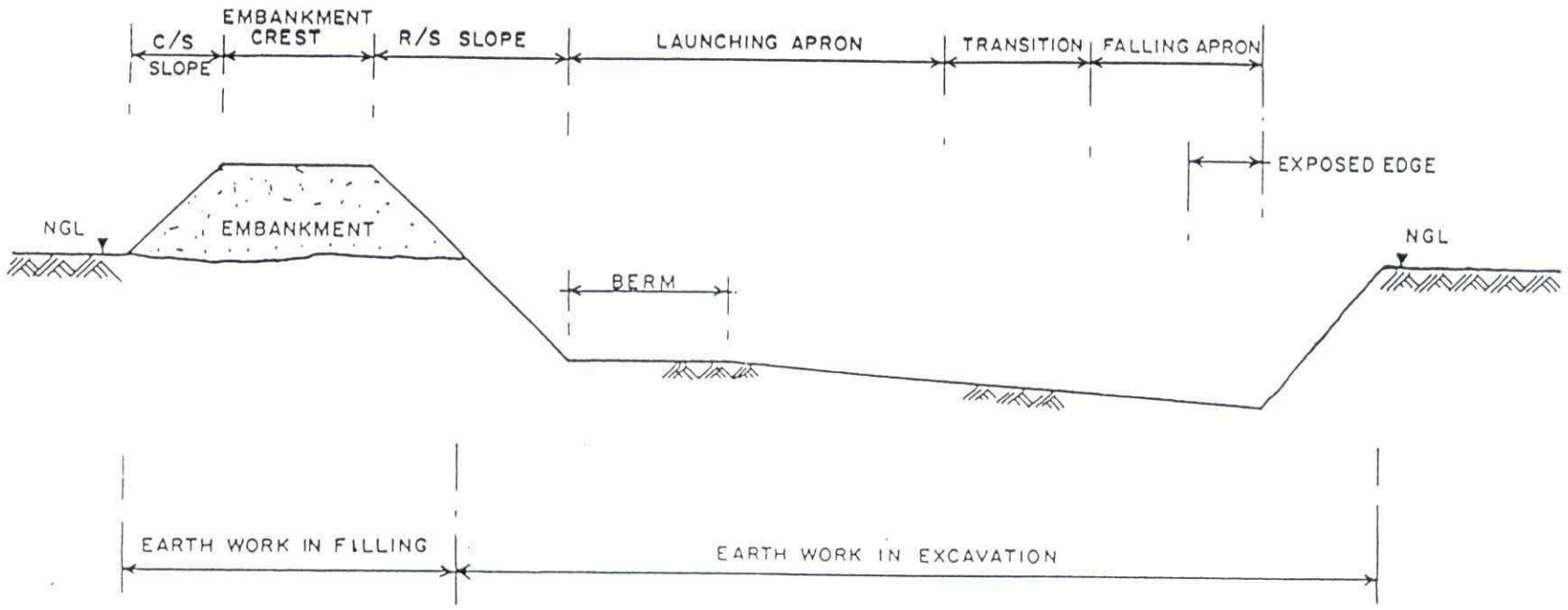


Figure 3: Definition Sketch of the Revetment Test Structure

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
Land-sided slope		Brick mattress d = 15 cm	In all sections Durba grass sods laid on Geo-jute soil saver									
River side	Approximate length along toe of upper slope (at berm level)	~ 87.40	~ 74.70	~ 74.70	~ 99.10	~ 93.20	88.0	90.0	88.0	100.0	~ 82.75	~ 97.60
	Revetment above berm level (+15.3m to +22.0m PWD)	Brick mattress d = 15 cm	Brick mattress d = 15 cm	Wiremesh mattress d = 23/36 cm with stone fill Grade B (D_{50} = 15 cm)	Wiremesh mattress d = 23 cm with stone fill Grade B (D_{50} = 15 cm) on intermediate rubble layer (d = 25 cm)	CC-blocks D_n = 30 cm hand-laid in single, diagonal lines	CC-blocks D_n = 30 cm hand-laid in single, parallel lines	Interlocking CC-slabs (ship-lap type)	Wiremesh mattress d = 36 cm with brick fill	Interlocking CC-slabs (tongue-groove type) on intermediate layer	Rip-rap Grade C (D_{50} = 20 cm) Top 20 cm with stone pitching (d = 50 cm)	Rip-rap Grade C (D_{50} = 20 cm) Top 20 cm with stone pitching (d = 40 cm)
	Launching Apron at and below berm level (+14.5 m to +15.3 m PWD)		Dumped CC-blocks D_n = 30 cm	Dumped CC-blocks D_n = 35 cm	Dumped CC-blocks Edge us: D_n = 50 cm Center: D_n = 35 cm Edge ds: D_n = 40 cm	Articulated Rano-mattress d = 23/36 cm; stone fill grade B, C, D (D_{50} = 25 cm) with inter-connecting steel wire ropes and anchor piles at berm level	Articulated CC-block 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 = 25-35-45 cm)	CC-blocks D_n = 30 cm D_n = 35 cm (mixed)
	Transition between launching apron and falling apron		CC-blocks D_n = 30 cm	CC-blocks D_n = 30 cm	CC-blocks D_n = 35 cm				Rip-rap Grade E CC-blocks, D_n = 30 cm *1	CC-blocks D_n = 35 cm *2		
	Falling Apron (level +14.5 m PWD)	Dumped CC-blocks D_n = 30 cm	Dumped CC-blocks D_n = 35 cm D_n = 40 cm (mixed)	Rip-rap, Grade E (D_{50} = 30 cm)	Geo-sand-container Type C (180 kg/No.)	Geo-sand-container Type E (900 kg/No.)	CC-blocks D_n = 40 cm	CC-blocks D_n = 40 cm / Geo-sand container D	CC-blocks D_n = 40/45 cm (mixed)	CC-blocks D_n = 35/40 cm (mixed)		
	Exposed edge of falling apron			Rip-rap, Grade F (D_n = 25/35/45 cm)	Geo-sand-container Type D (250 kg/No.)		CC-blocks D_n = 45 cm	CC-blocks D_n = 45 cm / Geo-sand container E	Gabion socks with stone fill Grade B (D_{50} = 15 cm) (1,300 kg/No.)	CC-blocks D_n = 40 cm	Selected boulders D_n = 35-45 cm	

us : upstream
ds : downstream

B. FILTER LAYER

Test Structure			A - end	A - 1	A - 2	B	C		D	E		F	G	H - 1	H - 2
Land-sided slope			GF - 1	In all sections Geo-jute Soil Saver											
River Side	Approximate length along toe of upper slope (at berm level)		~ 87.40	~ 74.70	~ 74.70	~ 99.10	~ 93.20		88.0	90.0		88.0	100.0	~ 82.75	~ 97.60
	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/-2
		Brand Name	BIDIM b7 HaTe 02214	BIDIM b7	HaTe 0 2214	BIDIM S 550			BIDIM S 550	DATEX AD1300	Hate J 9014	BIDIM S 390	DATEX AD1300	BIDIM S 700	HaTe E650/K251
	Geotextile filter mats at and below berm level	Spec Type	GF-1/-5	GF-2	GF-2	GF-4	GF-2		GF-4	FORESHORE-mattres (collapsible fabric block mattress with cement grout fill)		PROFIX-mattress (tubular fabric mattress with sand and sand-bitumen fill)	GF-1 (sub-layer to INCOMAT-sand flex mattress)	GF-1	GF-1
		Brand Name	BIDIM b7 HaTe 02214	BIDIM S 550	BIDIM S 550	HaTe K 251	DATEX AD 1600		BIDIM S 700				BIDIM b 7	BIDIM S 390	BIDIM S 390

Table 2: 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 the following activities have been performed:

(1) Bathymetry

Bathymetry surveys are mainly done to record riverbed changes in front of the test structure and to detect their influence on the stability of the structure, in particular to find out the behaviour / functioning of the falling aprons and launching aprons, since this is decisive for the overall stability of the test structure.

The activities during the months of July to September 1999 are shown in Table 3. All the surveys were finally processed in the office in Dhaka and the results are shown in contour charts as well as differential models (see Annex G and H).

Date	Survey Area		
	July 1999	August 1999	September 1999
01			
02		u/s of Harindhara to Ghat	
03			
04			
05			
06			
07			
08			
09	main survey		
10	main survey		
11	main survey	main survey	main survey
12	main survey	main survey	main survey
13	main survey	main survey	main survey
14	Harindhara	main survey	main survey
15		main survey	main survey
16		main survey	
17			
18			
19			
20	u/s of Harindhara to Ghat		
21	u/s of Harindhara to Ghat		
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

Table 3: Bathymetry surveys at Bahadurabad Test Site from July to September 1999

Moreover, measurements have been carried out regularly in the individual sections of the structure. The aim of these activities is to get more information on erosion and sedimentation in the channel in front of the structure, in the area of the falling aprons and on the functioning of the falling/launching aprons. The results of these measurements are given as cross-sections in Annex I.

(2) Topographic Measurements

During the period under review the following works were performed:

05-06/07	bankline from the test structure to 3.0 km downstream from Ghutail bazar
21/07	bankline from the railway ghat to 2.0 km upstream from Harindhara school
27/07	survey at boundaries of embankment at upstream from the railway ghat by single GPS
02/08	bankline from the railway ghat to 300 m upstream from Harindhara school
19/08	bankline from the test structure to Belgacha
21/08	waterline in front of the test structure
23-24/08	bankline from the test structure to 1.0 km downstream from Ghutail bazar
29/08	6 nos. cross-sections taken at Ghutail Bazar along with bathymetry
06/09	bankline from the test structure to 2.5 km downstream from Ghutail bazar
11/09	bankline from the railway ghat to Harindhara
19/09	bankline along Belgacha

(3) Measurement of Flow Velocity and Direction

Float track measurements were continued as well as measurements with the Valeport currentmeter. Results of flow measurements are presented in the monthly reports on monitoring and in Annex G.

(4) Observations

Peak water levels during the third quarter of 1999 were recorded at 19.22 m+PWD on July 05 and at 19.50 m+PWD on August 29. At the end of the period under report the water level was measured at 17.61 m+PWD.

In July, the channel which aimed during the first five months of the year at an angle of about 40° at Section B and C of the test structure, shifted further downstream and the parallel channel in front of the falling aprons started to silt up to a level of about 16 m+PWD. Deposition of about 19 m were recorded in a time period less than one month. This sudden change from scouring to a deposition process happened in the same way as last year and can be studied in the cross-sections of Annex I. Only end September slight erosion started again, however, in an area about 100 m in front of the test structure.

Another severe bank erosion started in the area of Harindhara upstream from Bahadurabad Ghat. A new channel from north-west at an angle of about 40° caused bank erosion, which continued till the end of the period under review. A deep scour hole developed about 2 km upstream from the Revetment Test Structure and moved downstream in south-west direction. Mid September its location was only about 700 m away from the test structure and its depth was below PWD.

2.4 TEST SITE III

2.4.1 Introduction

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 in letter No. CC/F21-22/WARPO-KfW/L/98-332 of 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.

2.4.2 Selection of Test Sites

The technical proposal of December 1998 was based on the morphological situation during and immediately after the monsoon 1998 in that area. Since this location was proposed by the client during the flood season, it was stressed by the Consultant in his proposal in accordance with the conditions mentioned in the Minutes of Meeting of the donors' review mission of July 1998 that its suitability as a test site could only be estimated after a detailed investigation of the effects of the tremendous flood 1998 on the river morphology. Site visits, morphological investigations on site in February/March 1999 and the study of a satellite image of January 23, 1999 which became available only in the second half of February 1999, revealed considerable morphological changes in the area of Ghutail and further upstream. Based on the results of all investigations including the morphological development to be expected during the monsoon season 1999, the proposed location seemed to be only partly suitable for the construction of another test structure, especially of a groyne field. Hence, the Consultant concentrated on the investigation of alternative locations suitable for the construction of groynes and revetments as well.

Within the feasible reach of the present test sites, namely Kamarjani and Bahadurabad, six locations have been investigated and assessed with regard to their suitability for a third test structure. Basis of the analysis of the pre-selected sites were the site selection criteria already defined in the Final Planning Study Report FAP 21. Finally, Ghutail and the consolidation of the Revetment Test Structure at Test Site II were assessed to be most suitable for the implementation of a third test structure. Details of the assessment were presented in a revision of the "Proposal for Modification of Consulting Services for Test Site III" in May 1999.

Since small erosion in front of Ghutail continued during the period under report, it was decided to build the third test structure after the monsoon season in this area. The final location will be determined at the beginning of November.

2.4.3 Type of Structure

Since the investigations of February and March 1999 revealed that the changed conditions at Ghutail may prohibit the construction of a groyne field within the available budget, it was recommended in the revised proposal of May 1999 to prepare for the implementation of a revetment test structure at Ghutail.

As to details of layout and design principles reference is made to Progress Report No. 23. The final design of the structure will be prepared in the first half of November immediately after the decision has been taken on the final location and alignment of the structure.

2.4.4 Work Plan

A suitable work plan for planning and implementation of the third test structure was presented in the proposal of December 1998. This program has been slightly adapted taking into account the donors' comments of January 1999 on the proposal of December 1998 and the discussions held during the donors' review mission of March 1999. However, it is stressed again that the Government of Bangladesh has to make sure that the Consultant and the Contractors will have access to the finally selected site beginning of November 1999 at the latest. This was discussed with BWDB and WARPO during the donors' review missions in July 1998 and March 1999, and is mentioned in the relevant minutes of meeting.

The offer for the construction works for the Third Test Site received from the Consortium: Engineers Ltd. and Corolla Corporation (BD) Ltd. was accepted by the Consultant with letter No. CC/F21/CONS/L/99-132, dated June 22, 1999 and the Subcontract for the execution of works signed on June 23, 1999.

The order to commence the works, limited to the fabrication of cc-blocks was also issued on June 23, 1999.

Other important, dates, which have to be observed, are:

November 01, 1999:	final decision on the location of the test site;
November 01, 1999:	access to the site for Consultant and Contractors;
mid November 1999:	order to commence and mobilisation;
December 01, 1999:	start of actual construction works, and
May 31, 2000:	termination of construction works.

The Consultant would appreciate very much the active participation of BWDB and WARPO in the final selection process of the actual location of the test site.

2.5 REPORTING

In accordance with the Terms of Reference and the Consulting Agreement the Consultant will critically assess the results of the test programme at the end of the Project for the Final Evaluation Report. In addition to that report the Consultant will submit on the basis of all available know-how and experience gained during the Project guidelines and manuals for the design and implementation of river training and bank protection works for more or less standard solutions for the rivers in Bangladesh, in particular the Jamuna River.

On the occasion of the donors' review mission in July 19998 the Consultant presented in a work shop on July 20, 1998 his concept for the Final Project Evaluation Report, Guidelines and Manuals. Tables of Content (see Annex P) were elaborated and discussed with the donors and engineers of BWDB and WARPO. Finally, a time schedule was agreed upon in the work shop for the presentation of the guidelines and manuals for planning, design and implementation of river training and bank protection works.

Since the project period was extended until end of 2000 due to the implementation of a third test site, the schedule for elaborating the guidelines and manuals needed to be modified. After a discussion of

all parties concerned during the donors' review mission of March 1999, the programme of July 1998 was reviewed and 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
December 1999	Submission and presentation of draft Guidelines and Manuals	Consultant
May 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

The Consultant's experts continued to review and assess the test results available so far and to draft the Final Project Evaluation Report. During the period under report a group of engineers which are involved in the test programme viz. The Chief Hydraulic Design Engineer, the Design Engineer and the Modelling Expert met in Dhaka for the elaboration of the draft guidelines and manuals, which will be submitted end of this year. They were supported by their home offices, the Morphologist, the Monitoring Expert and made considerable progress also on the evaluation of events at both the test sites and the Final Project Evaluation 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 is located about 5 km east of the Groyne Test Structure of FAP 21 at Kamarjani.

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 the period under report 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 1999.

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 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.

In the course of the donors' review mission of March 1999 it was agreed upon by all parties involved to execute the next phase of the investigations with floating elements in connection with and at the location of the third test site at Ghutail or, alternatively, at Bahadurabad.

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.

3.4 REPORTING

Valuable results of the tests with recurrent measures gained at Katlamari and Kundarapara Test Sites will be included in the guidelines and manuals detailed in Section 2.5 of this Progress Report and in Annex P, to which Consultants Supervising Engineer of FAP 22 contributed during his stay in Dhaka during the period under report.

Table 1.1-1

BANK PROTECTION TEST STRUCTURES - FAP 21
EXPATRIATE PROFESSIONAL STAFF
Activities during the period of 07/99 to 09/99

VERSION : 01.10.99

Sl. No.	Function	Person	Code	Company	Period		Remarks
					From	To	
1.1	Project Director	Dr. D. Neuhaus / Dr. H. Kramer	DN / HK	RRI	01/07	30/09	Part time in Europe
1.2	Home Office Support						
1.3.1	Project Manager	C. Netzeband	CN	RRI	01/07	12/08	
					01/09	30/09	
1.4	Chief Hydraulic Design Engineer	Dr. H. Kramer	HK	L&P	01/07	16/08	Part time in Europe
					18/08	30/09	In Bangladesh
2.1.1	Hydraulic Design Engineer	M. Schwarz	MS	L&P	18/08	07/09	
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	-	-	-	-	-	
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	01/07	02/08	
4.1.1	Morphologist	Dr. E. Mosselman	EM	DELFT	01/07	30/09	Part time in Europe
4.2.1	Modelling Expert	M. v. d. Wal	MvdW	DELFT	01/07	31/08	Part time in Europe
					05/09	09/09	In Bangladesh
					18/09	30/09	In Bangladesh
		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 07/99 to 09/99

VERSION : 01.10.99

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	01/07	30/09	
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	-	-	
2.5.2	Subsoil Expert 2	-	-	-	-	-	
3.2.2	Supervising Engineer 2	Fazlur Rahman /	FR	BETS	-	-	
		Sk. Golam Kader	SGK	BETS	01/07	30/09	
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	01/07	30/09	
	Jr. Monitoring Expert	Pankaj K. Maitra	PKM	BETS	01/07	30/09	
	Monitoring Data Processor	Yasmin Khayer	YK	FL	01/07	30/09	
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	01/07	30/09	
4.5.2	Economist 2	NN	-	-	-	-	
4.6.2	Unallocated 2		-	-	-	-	

Table 1.1-3

BANK PROTECTION TEST STRUCTURES - FAP 21
LOCAL SUPPORT STAFF
Activities during the period of 07/99 to 09/99

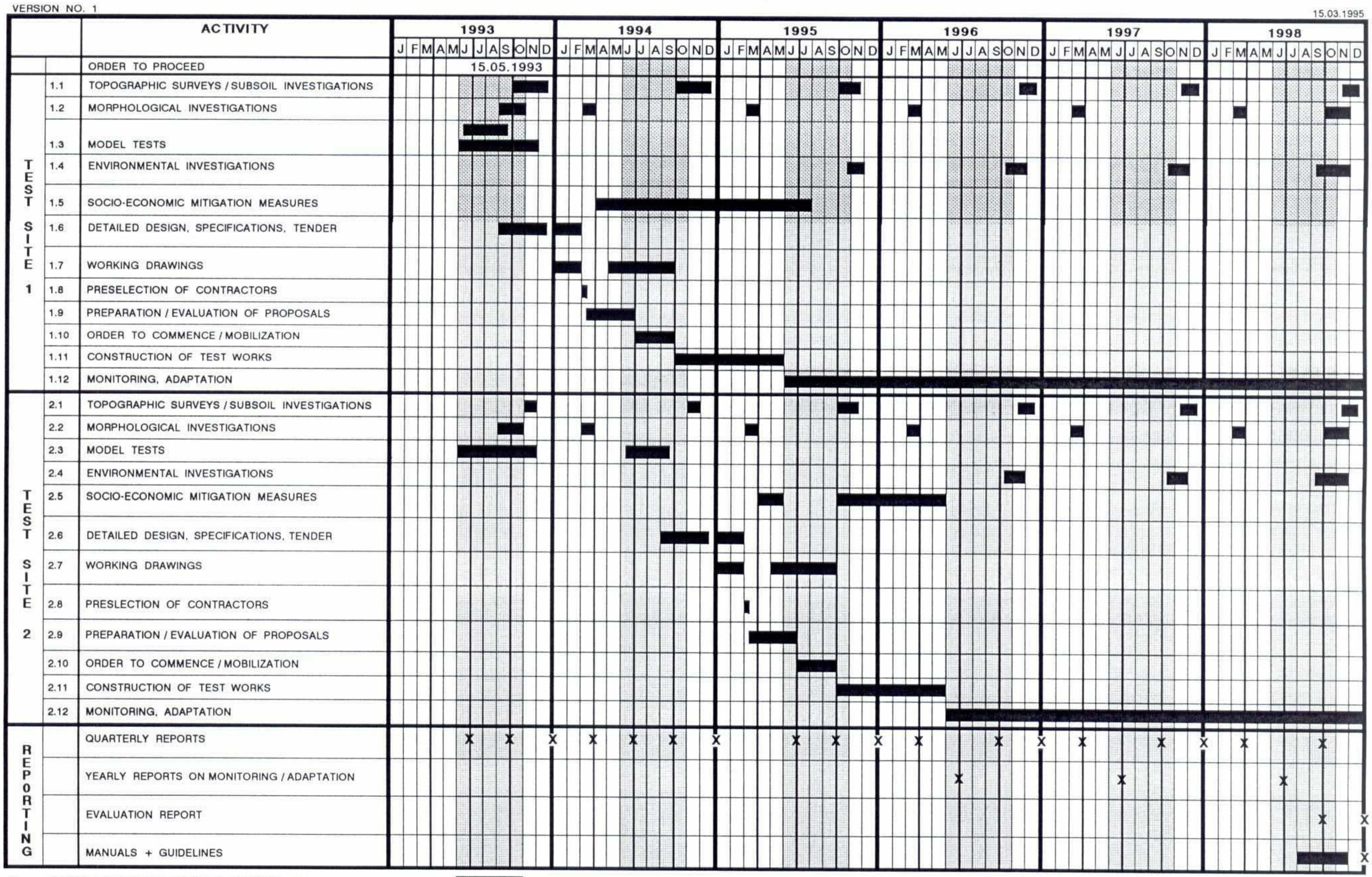
VERSION : 01.10.99

Sl. No.	Function	Person	Company	Period		Remarks
				From	To	
1	Bilingual Secretary	Sk. Zakirul Islam	BETS	01/07	30/09	
2	Receptionist	Md. Razaul Karim	BETS	01/07	30/09	
3	Operator / Data Input	Md. Khorshed Alam	BETS	01/07	30/09	
4	Senior Draftsman	Anowarul Alam	BETS	01/07	30/09	
5	Draftsman	Md. Fazle Hossain Bhuiyan	BETS	01/07	30/09	
6	Photocopy Operator	Md. Q M Hussain (Babu)	BETS	01/07	30/09	
7	Accountant	A.B.M Bazlur Rashid	BETS	01/07	30/09	
8	Asstt. Acct. Purchase	Md. Shafiuddin	BETS	01/07	30/09	
9	Messenger	Md. Aziz	BETS	01/07	30/09	
10	Peon	Md. Habibur Rahman Hawladar	BETS	01/07	30/09	
11	Guards (8 hours shift)	Md. Farid Sikder /	BETS	01/07	30/09	
		Md. Moqbul Hossain /	BETS	01/07	30/09	
		Md. Shakawat Hossain	BETS	01/07	30/09	
12-19	Drivers	Eight Drivers	L&S	01/07	30/09	

TABLE 1.2-1.1

BANK PROTECTION TEST STRUCTURES FAP 21

WORK PLAN *)

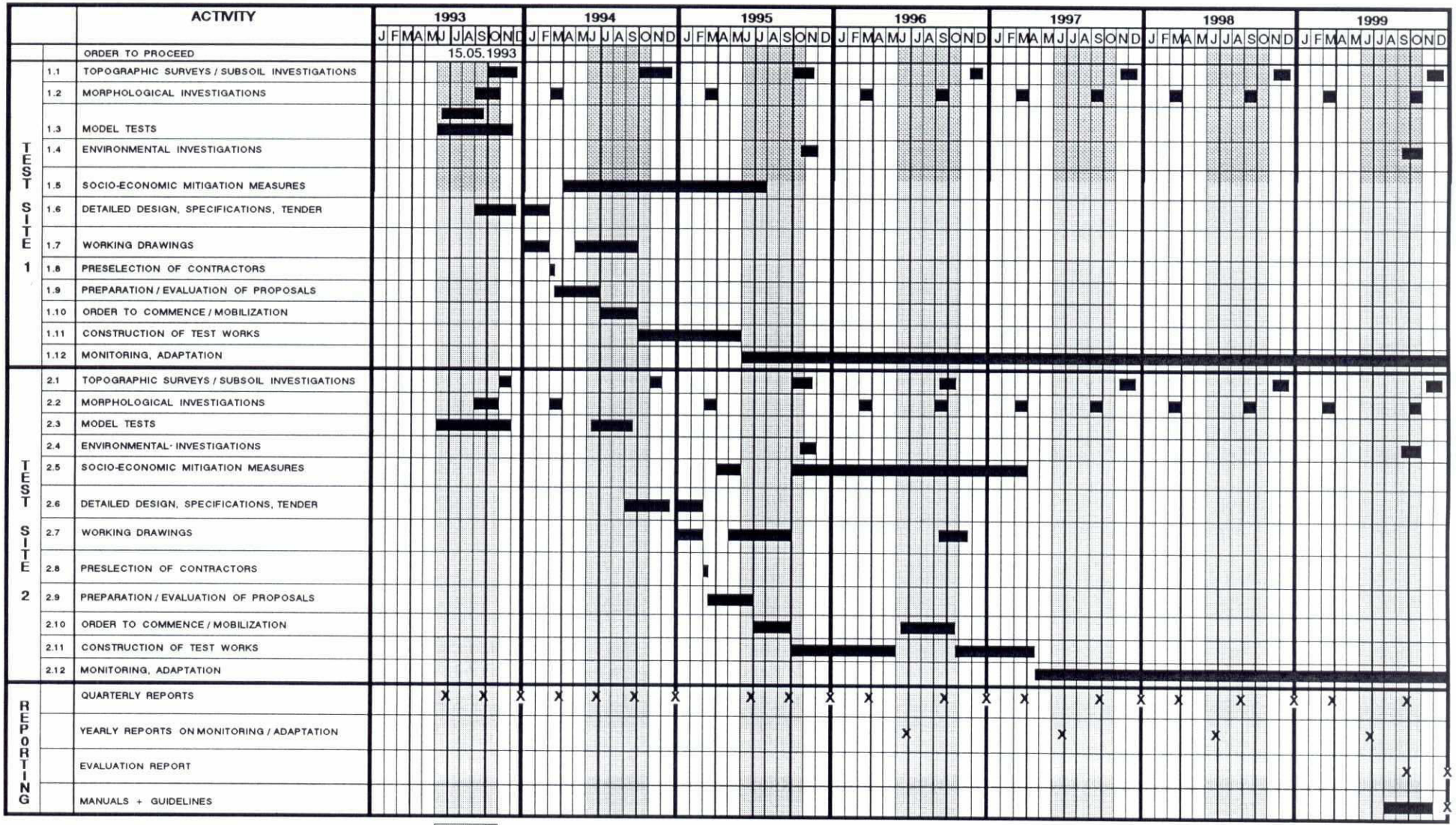


*) AS PER LETTER TO PROCEED OF MAY 1993

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 1.2-2

BANK PROTECTION TEST STRUCTURES FAP 21

REVISION NO. 1 *)

WORK PLAN - FIELDED UP TO SEPTEMBER 30, 1999

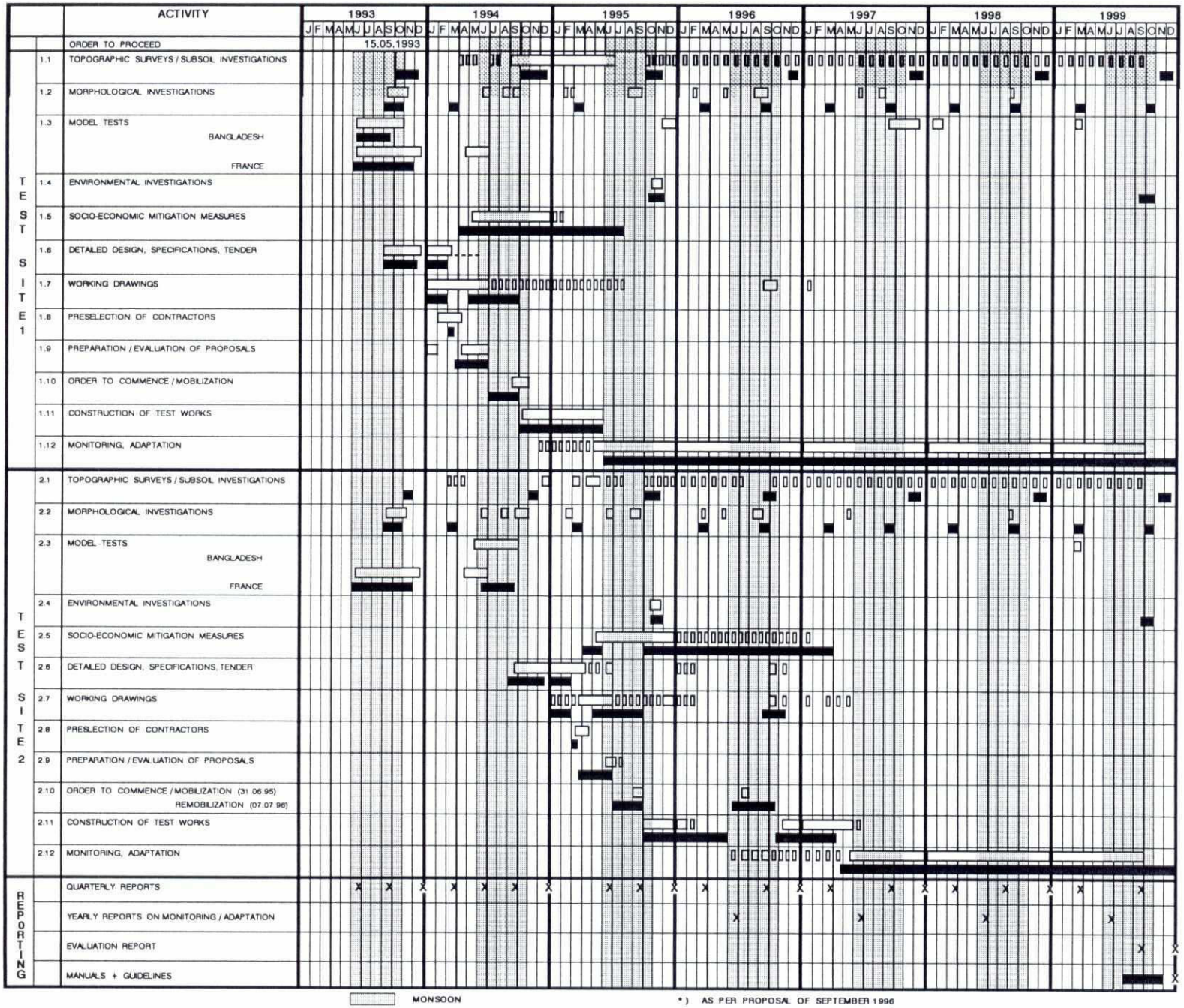


TABLE 1.2-3.1

BANK PROTECTION TEST STRUCTURES - FAP 21

STAFFING SCHEDULE *)

VERSION NO.1 — 15.03.1993

		FUNCTION	1993 J F M A M J J A S O N D	1994 J F M A M J J A S O N D	1995 J F M A M J J A S O N D	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	EXPATRIATES EU	LOCAL	
	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	X X X									
		EVALUATION REPORT	X									
		MANUALS + GUIDELINES	X									
								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
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		62	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

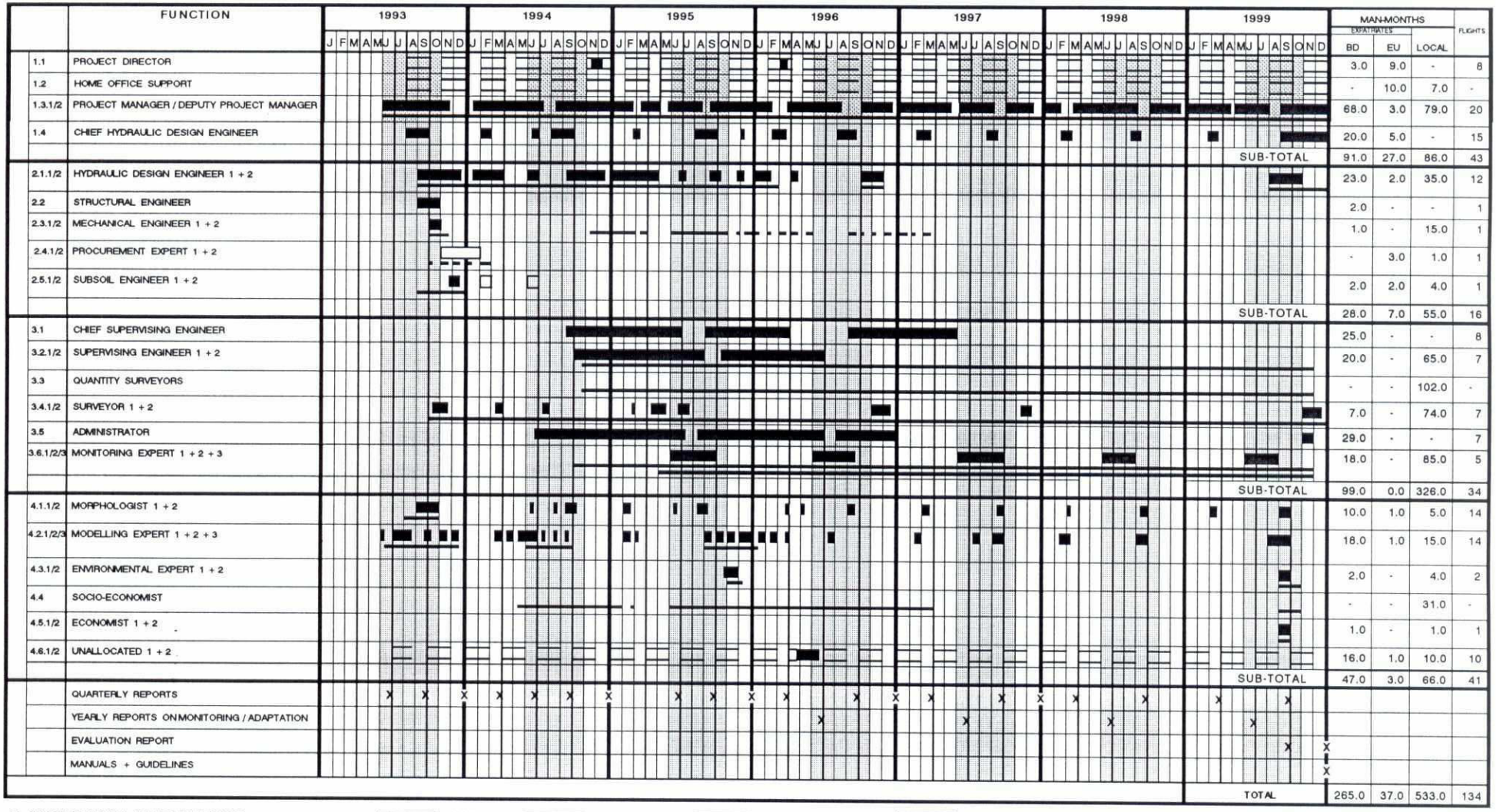
MONSOON IN BANGLADESH OUTSIDE BANGLADESH LOCAL

TABLE 1.2-3.3

BANK PROTECTION TEST STRUCTURES - FAP 21

STAFFING SCHEDULE

REVISION NO. 2 *)



	FUNCTION	MAN-MONTHS EXPATRIATES BD	MAN-MONTHS EXPATRIATES EU	MAN-MONTHS LOCAL	FLIGHTS
1.1	PROJECT DIRECTOR	3.0	9.0	-	8
1.2	HOME OFFICE SUPPORT	-	10.0	7.0	-
1.3.1/2	PROJECT MANAGER / DEPUTY PROJECT MANAGER	68.0	3.0	79.0	20
1.4	CHIEF HYDRAULIC DESIGN ENGINEER	20.0	5.0	-	15
	SUB-TOTAL	91.0	27.0	86.0	43
2.1.1/2	HYDRAULIC DESIGN ENGINEER 1 + 2	23.0	2.0	35.0	12
2.2	STRUCTURAL ENGINEER	2.0	-	-	1
2.3.1/2	MECHANICAL ENGINEER 1 + 2	1.0	-	15.0	1
2.4.1/2	PROCUREMENT EXPERT 1 + 2	-	3.0	1.0	1
2.5.1/2	SUBSOIL ENGINEER 1 + 2	2.0	2.0	4.0	1
	SUB-TOTAL	28.0	7.0	55.0	16
3.1	CHIEF SUPERVISING ENGINEER	25.0	-	-	8
3.2.1/2	SUPERVISING ENGINEER 1 + 2	20.0	-	65.0	7
3.3	QUANTITY SURVEYORS	-	-	102.0	-
3.4.1/2	SURVEYOR 1 + 2	7.0	-	74.0	7
3.5	ADMINISTRATOR	29.0	-	-	7
3.6.1/2/3	MONITORING EXPERT 1 + 2 + 3	18.0	-	85.0	5
	SUB-TOTAL	99.0	0.0	326.0	34
4.1.1/2	MORPHOLOGIST 1 + 2	10.0	1.0	5.0	14
4.2.1/2/3	MODELLING EXPERT 1 + 2 + 3	18.0	1.0	15.0	14
4.3.1/2	ENVIRONMENTAL EXPERT 1 + 2	2.0	-	4.0	2
4.4	SOCIO-ECONOMIST	-	-	31.0	-
4.5.1/2	ECONOMIST 1 + 2	1.0	-	1.0	1
4.6.1/2	UNALLOCATED 1 + 2	16.0	1.0	10.0	10
	SUB-TOTAL	47.0	3.0	66.0	41
	QUARTERLY REPORTS				
	YEARLY REPORTS ON MONITORING / ADAPTATION				
	EVALUATION REPORT				
	MANUALS + GUIDELINES				
	TOTAL	265.0	37.0	533.0	134

*) AS PER PROPOSAL OF SEPTEMBER 1996

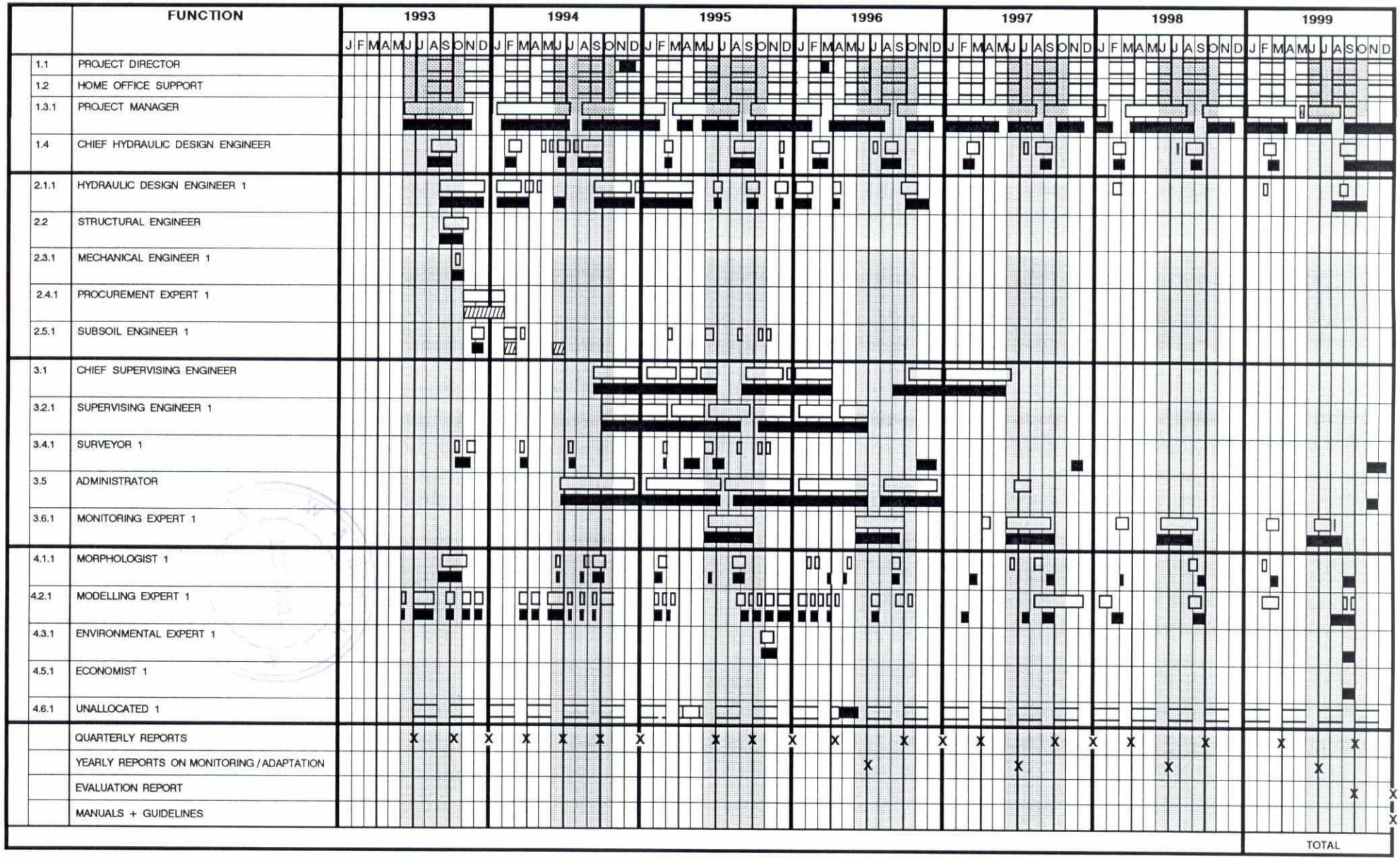
MONSOON IN BANGLADESH OUTSIDE BANGLADESH LOCAL

TABLE 1.2-4

BANK PROTECTION TEST STRUCTURES - FAP 21

REVISION NO. 2 *)

STAFFING SCHEDULE - EXPATRIATE PROFESSIONAL STAFF; FIELDED UP TO SEPTEMBER 30, 1999



*) AS PER PROPOSAL OF SEPTEMBER 1996

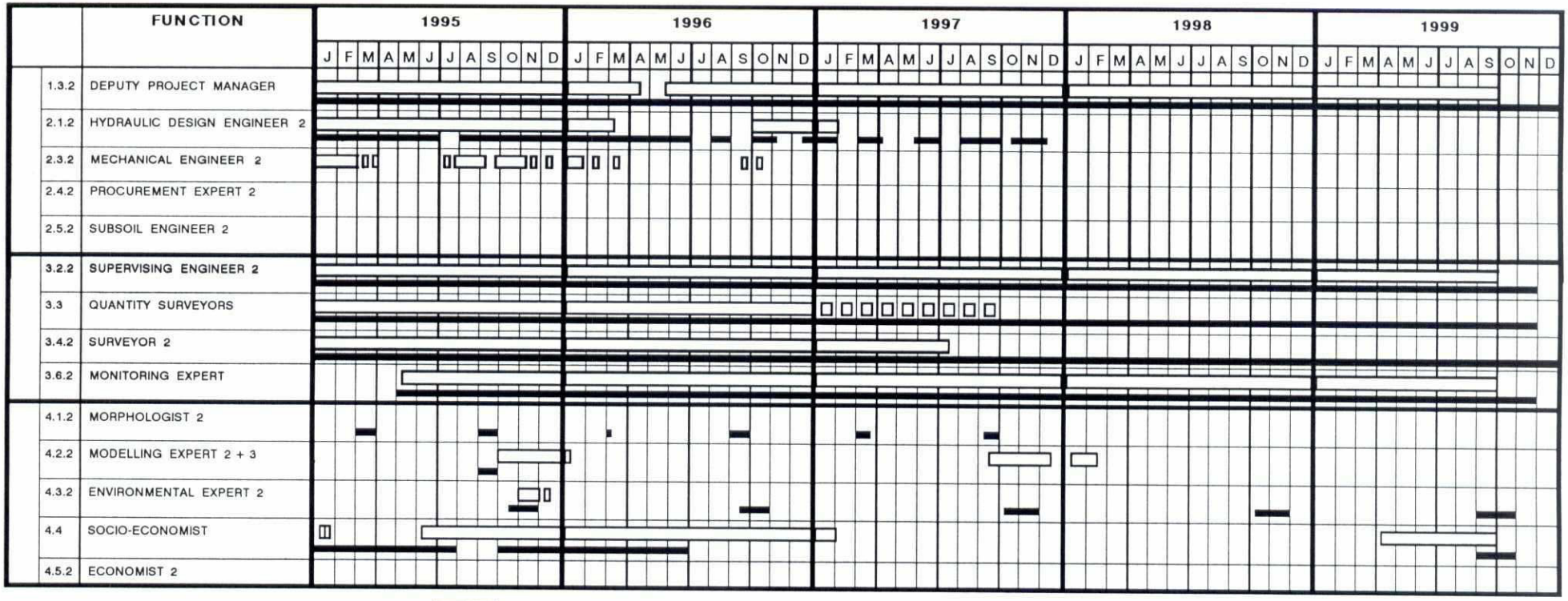
MONSOON | IN BANGLADESH | OUTSIDE BANGLADESH | LOCAL | PART TIME

TABLE 1.2-5

BANK PROTECTION TEST STRUCTURES - FAP 21

REVISION NO. 2 *)

STAFFING SCHEDULE - LOCAL PROFESSIONAL STAFF - FIELDED UP TO SEPTEMBER 30, 1999



*) AS PER PROPOSAL OF SEPTEMBER 1996

SCHEDULE REALIZATION

TABLE 1.2-6

BANK PROTECTION TEST STRUCTURES - FAP 21

TEST SITE - III

WORK PLAN *

VERSION 05.1999

	ACTIVITY	1999												2000											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
3.1	MORPHOLOGICAL INVESTIGATIONS																								
3.2	PROCUREMENT OF MATERIAL																								
3.3	SITE SELECTION																								
3.4	TOPOGRAPHIC SURVEY																								
3.5	ENVIRONMENTAL INVESTIGATIONS																								
3.6	SOCIO-ECONOMIC MITIGATION MEASURES																								
3.7	DETAILED DESIGN, SPECIFICATIONS, TENDER																								
3.8	WORKING DRAWINGS																								
3.9	SELECTION OF SUB-CONTRACTOR																								
3.10	ORDER TO COMMENCE/MOBILIZATION																								
3.11	CONSTRUCTION OF TEST WORKS																								
3.12	MONITORING																								
3.13	WORKSHOPS																								

*) as per proposal of May 1999

-8 80

80

TABLE 1.2-7

BANK PROTECTION TEST STRUCTURES - FAP 21

STAFFING SCHEDULE

REVISION NO. 3 *

	FUNCTION	EXPATRIATE BD	EXPATRIATE EU	LOCAL	FLIGHT
1.1	PROJECT DIRECTOR	3.00	9.00	0.00	5
1.2	HOME OFF. SUPPORT	0.00	10.00	7.00	0
1.3.1	PROJECT MANAGER	76.50	2.50	0.00	22
1.3.2	Dy. PROJ. MANAGER	0.00	0.00	89.00	0
1.4	CHIEF HYD. DES. ENG.	24.00	6.00	0.00	17
	SUB-TOTAL	103.50	27.50	96.00	44
2.1.1	HYD. DES. ENG.	23.00	3.00	0.00	14
2.1.2	HYD. DES. ENG.	0.00	0.00	35.00	0
2.2	STRUCTURAL ENG.	2.13	0.00	0.00	1
2.3.1	MECH. ENG. 1	1.00	0.00	0.00	1
2.3.2	MECH. ENG. 2	0.00	0.00	12.21	0
2.4.1	PROC. EXP. 1	0.00	3.00	0.00	0
2.4.2	PROC. EXP. 2	0.00	0.00	1.00	0
2.5.1	SUBSOIL ENG. 1	1.20	2.06	0.00	1
2.5.2	SUBSOIL ENG. 2	0.00	0.00	3.11	0
	SUB-TOTAL	27.33	8.06	51.32	17
3.1	CHIEF SUP. ENG.	29.27	0.00	0.00	8
3.2.1	SUP. ENG. 1	18.96	0.00	0.00	7
3.2.2	SUP. ENG. 2	0.00	0.00	71.00	0
3.3	QUANT. SURVEYOR	0.00	0.00	95.00	0
3.4.1	SURVEYOR 1	4.44	0.00	0.00	6
3.4.2	SURVEYOR 2	0.00	0.00	44.00	0
3.5	ADMINISTRATOR	30.00	0.00	0.00	7
3.6.1	MONIT. EXP. 1	23.00	0.00	0.00	9
3.6.2	MONIT. EXP. 2	0.00	0.00	54.00	0
3.6.3	MONIT. EXP. 3	0.00	0.00	44.00	0
	SUB-TOTAL	105.67	0.00	308.00	37
4.1.1	MORPHOLOGIST 1	9.00	2.00	0.00	14
4.1.2	MORPHOLOGIST 2	0.00	0.00	5.08	0
4.2.1	MODELLING EXP. 1	23.50	2.00	0.00	13
4.2.2	MODELLING EXP. 2+3	0.00	0.00	20.00	0
4.3.2	ENVIRONM. EXP. 1	2.00	0.00	0.00	2
4.3.2	ENVIRONM. EXP. 2	0.00	0.00	2.50	0
4.4	SOCIO-ECONOMIST	0.00	0.00	33.00	0
4.5.1	ECONOMIST 1	1.00	0.00	0.00	1
4.5.2	ECONOMIST 2	0.00	0.00	1.00	0
4.6.1	UNALLOCATED 1	7.00	1.44	0.00	6
4.6.2	UNALLOCATED 2			3.10	0
	SUB-TOTAL	42.50	5.44	64.68	36
	QUART. REPORTS				
	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

TABLE 2.1-1

STUDIES ON RECURRENT MEASURES - FAP 22
EXPATRIATE PROFESSIONAL STAFF
Activities during the period of 07/99 to 09/99

VERSION : 01.10.99

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	-	-	
5.1.1	River Engineer	P. van Groen	PvG	DELFT	-	-	
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	14/09	30/09	
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 07/99 to 09/99

VERSION : 01.10.99

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	20/09	30//09	
5.8.2	Supervising Engineer 2	F. R. Khan	FRK	DUL	-	-	
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	--	-	-	-	-	

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							■	■	■	■	■	■	▮	▮	▮	▮

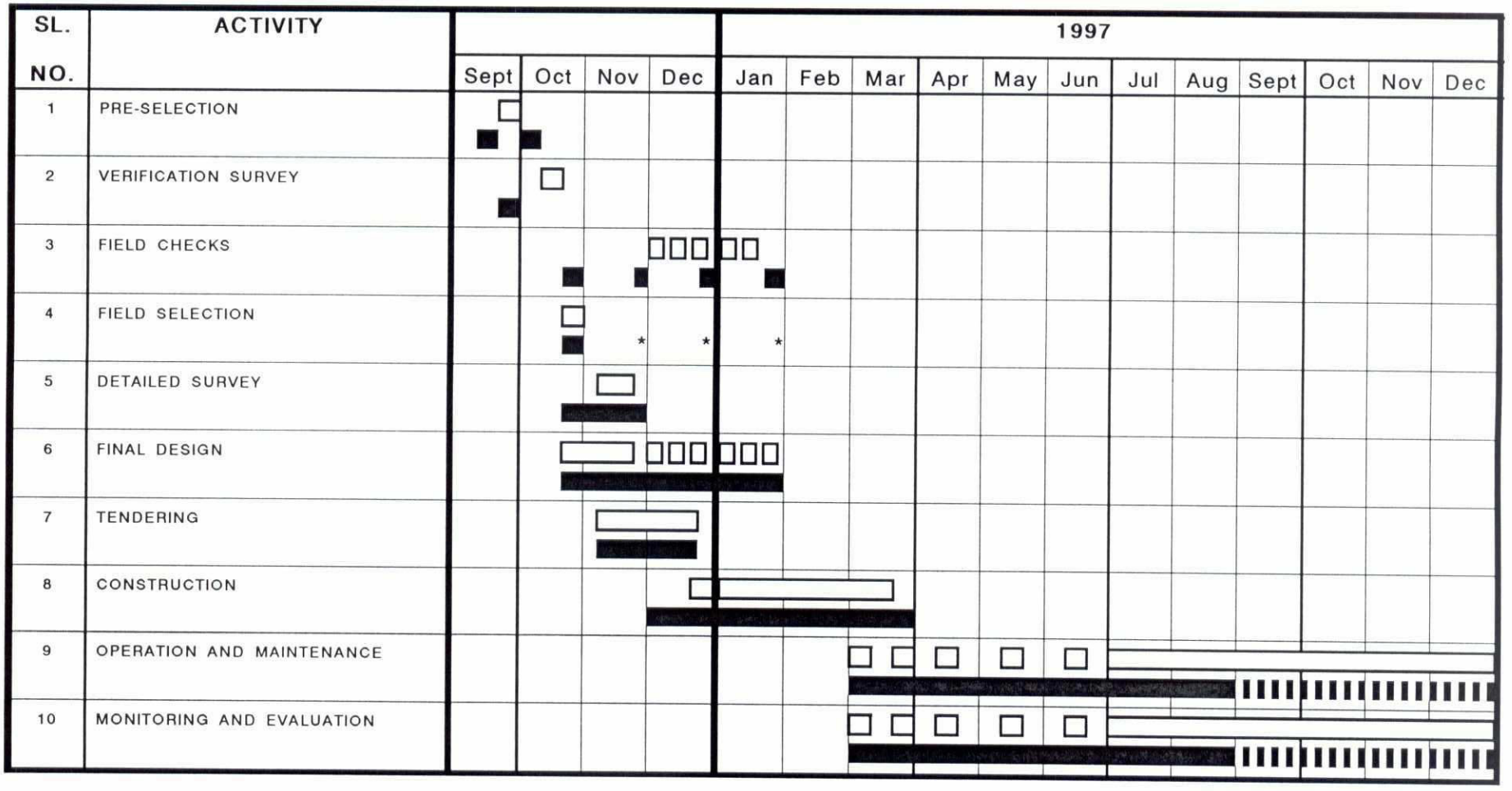
NOTE: * DENOTES REVIEW OF FINAL SELECTION

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
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

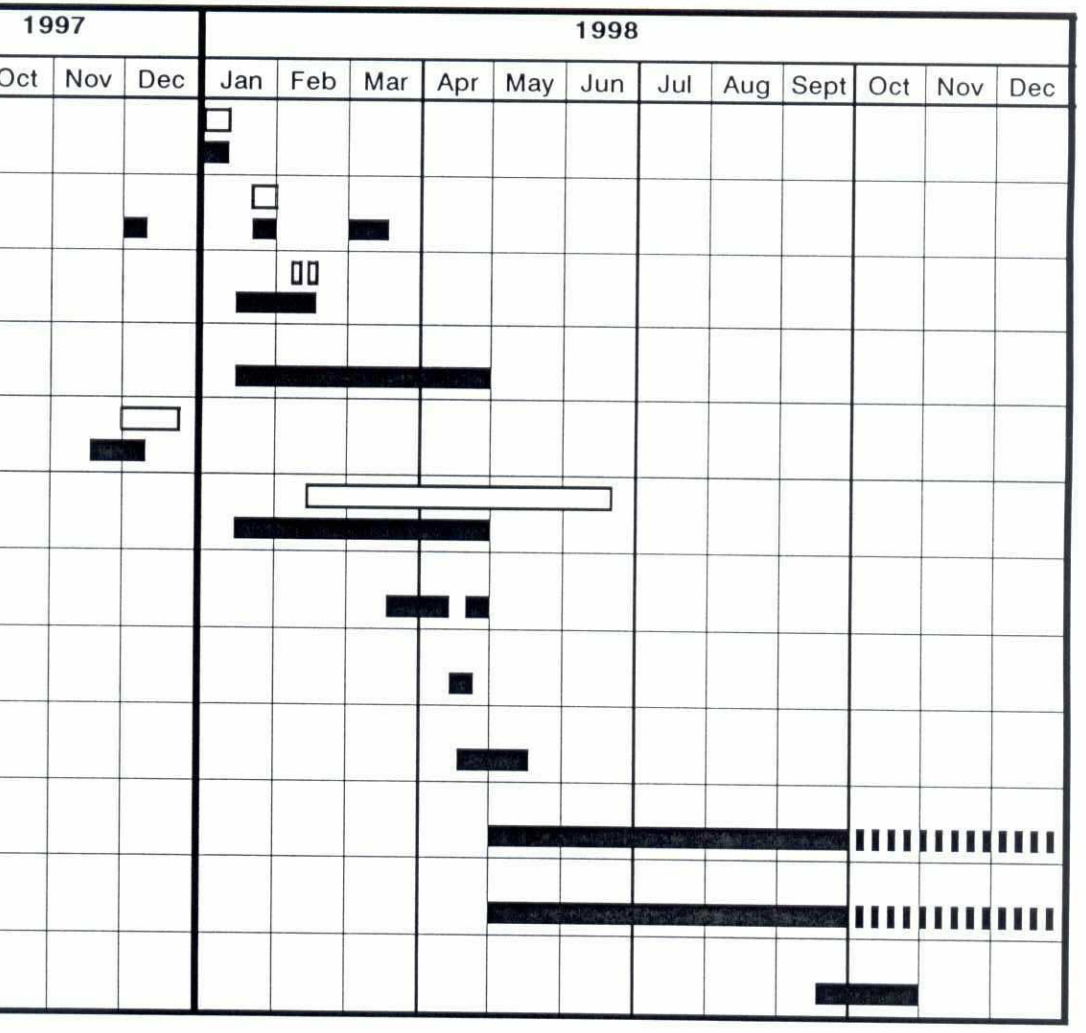


TABLE 2.2-5

STUDIES ON RECURRENT MEASURES - FAP 22

STAFFING SCHEDULE *)

	FUNCTION	NAME	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		12.0	6
5.1.2	RIVER ENGINEER 2	S. R. Khan				
5.2	HYDRAULIC DESIGN ENGINEER	M. Schwarz	1.0	0.75		1
5.4.1	MORPHOLOGIST 1 *	Dr. E. Mosselman	2.0		17.0	1
5.4.2	MORPHOLOGIST 2	M. H. Sarker / NN				
5.6.1	PROGRAMMER / MODELLING ENGINEER 1	J. Crebas	1.0			
5.8.1	SUPERVISING ENGINEER 1	K. Oberhagemann	8.0	0.5	14.0	3
5.8.2	SUPERVISING ENGINEER 2	F. R. Khan				
5.9.1	MONITORING EXPERT 1	T. Döscher	2.0		14.0	2
5.9.2	MONITORING EXPERT 2	A. Haider / P.K. Maitra				
5.11.1	UNALLOCATED 1		3.0		2.0	3
5.11.2	UNALLOCATED 2					
		SUB-TOTAL	22.5	1.25	59.0	16
	QUARTERLY REPORTS					
	DRAFT EVALUATION REPORT					
	FINAL EVALUATION REPORT					
		TOTAL	24.0	3.75	59.0	18

1996 | 1997 | 1998 — J F M A M J J A S O N D

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

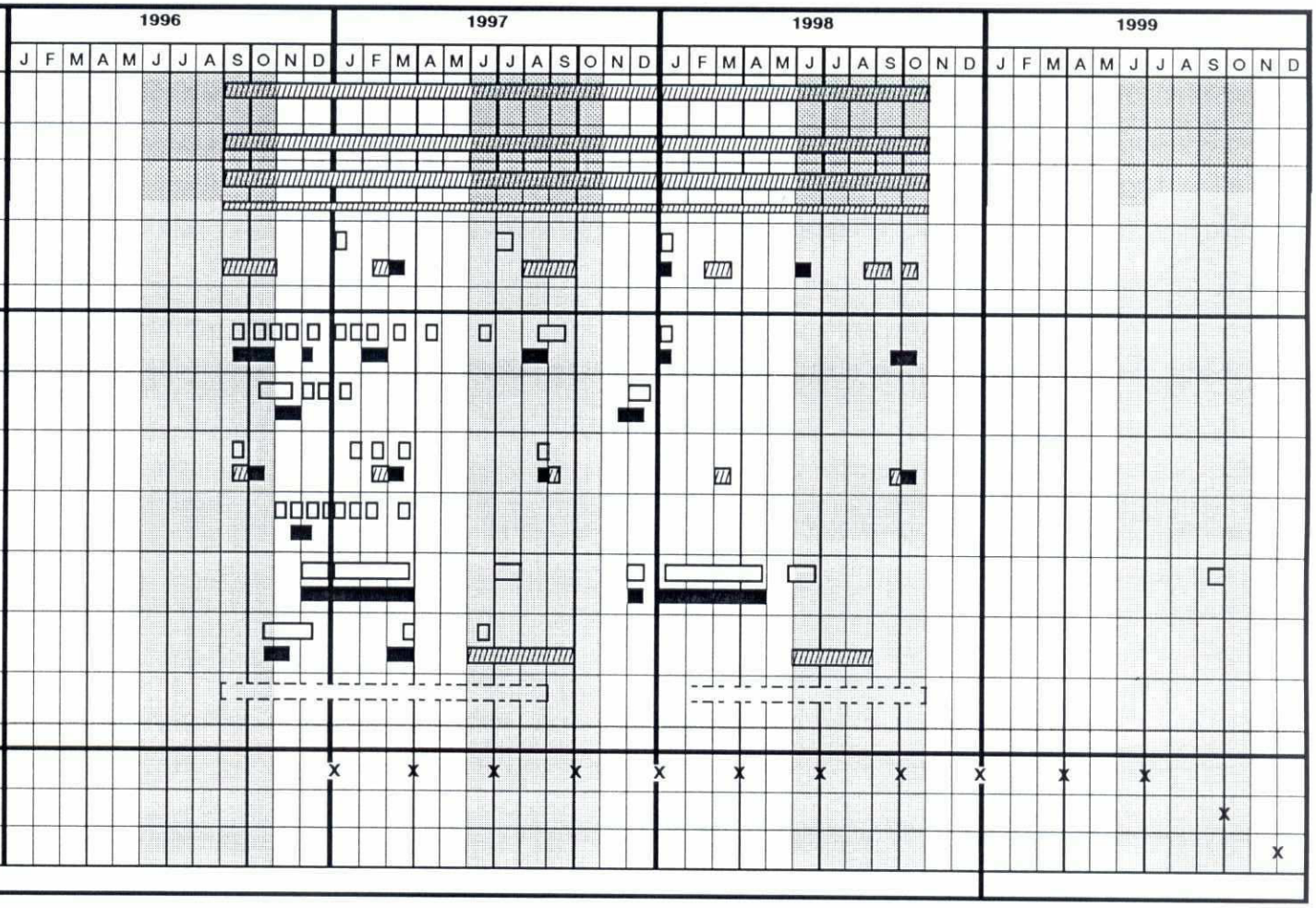
TABLE 2.2-6

STUDIES ON RECURRENT MEASURES - FAP 22

STAFFING SCHEDULE *)

EXPATRIATE PROFESSIONAL STAFF - FIELDED UP TO SEPTEMBER 30, 1999

	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. Döscher
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

EXPATRIATE FAP 21 RELIAZATION

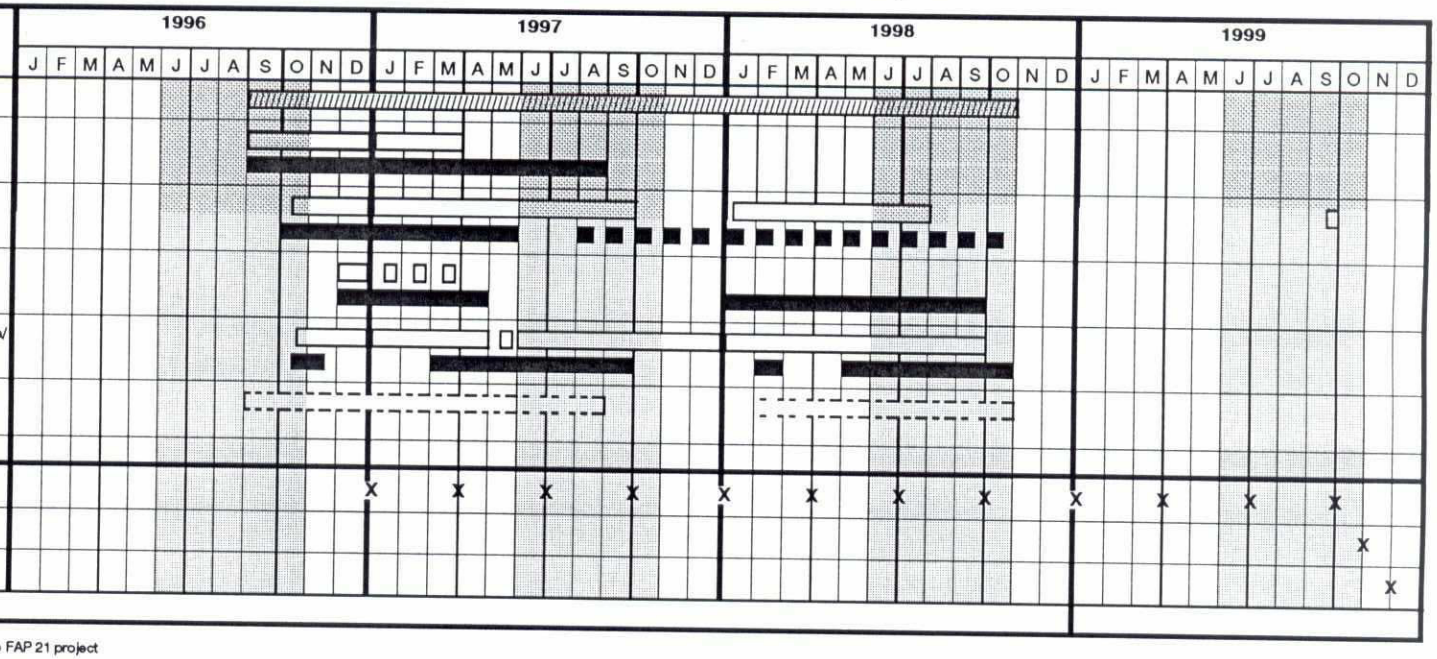
TABLE 2.2-7

STUDIES ON RECURRENT MEASURES - FAP 22

STAFFING SCHEDULE *)

LOCAL PROFESSIONAL STAFF - FIELDED UP TO SEPTEMBER 30, 1999

	FUNCTION	NAME
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	
	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

CD

ANNEX A

FAP 21 / Test Site I

- Water Level

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT KAMARJANI TEST SITE
MONTH : JULY 1999

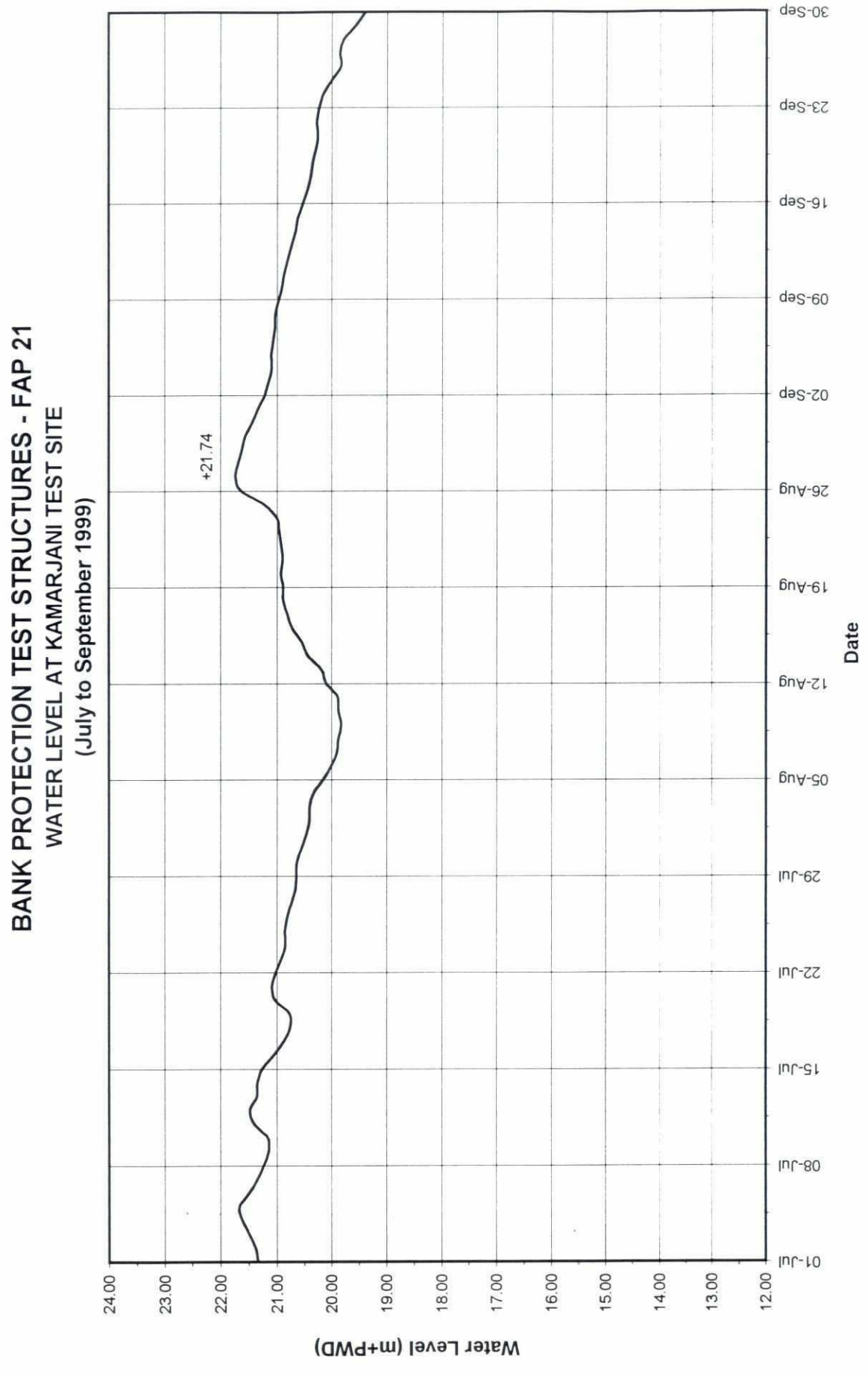
DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	21.340	21.360	21.390	
2	21.390	21.400	21.420	
3	21.500	21.530	21.550	
4	21.620	21.590	21.710	
5	21.670	21.640	21.600	
6	21.500	21.470	21.440	
7	21.350	21.320	21.290	
8	21.240	21.220	21.220	
9	21.150	21.150	21.150	
10	21.170	21.190	21.210	
11	21.410	21.470	21.510	
12	21.480	21.440	21.430	
13	21.360	21.360	21.350	
14	21.350	21.360	21.360	
15	21.270	21.250	21.220	
16	21.060	21.030	21.000	
17	20.880	20.840	20.810	
18	20.760	20.760	20.750	
19	20.780	20.860	20.880	
20	21.040	21.050	21.080	
21	21.090	21.090	21.090	
22	21.020	21.000	20.980	
23	20.920	20.900	20.880	
24	20.850	20.850	20.860	
25	20.860	20.850	20.850	
26	20.820	20.810	20.800	
27	20.740	20.730	20.710	
28	20.670	20.670	20.660	
29	20.650	20.650	20.650	
30	20.640	20.630	20.620	
31	20.560	20.540	20.530	

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT KAMARJANI TEST SITE
MONTH : AUGUST 1999

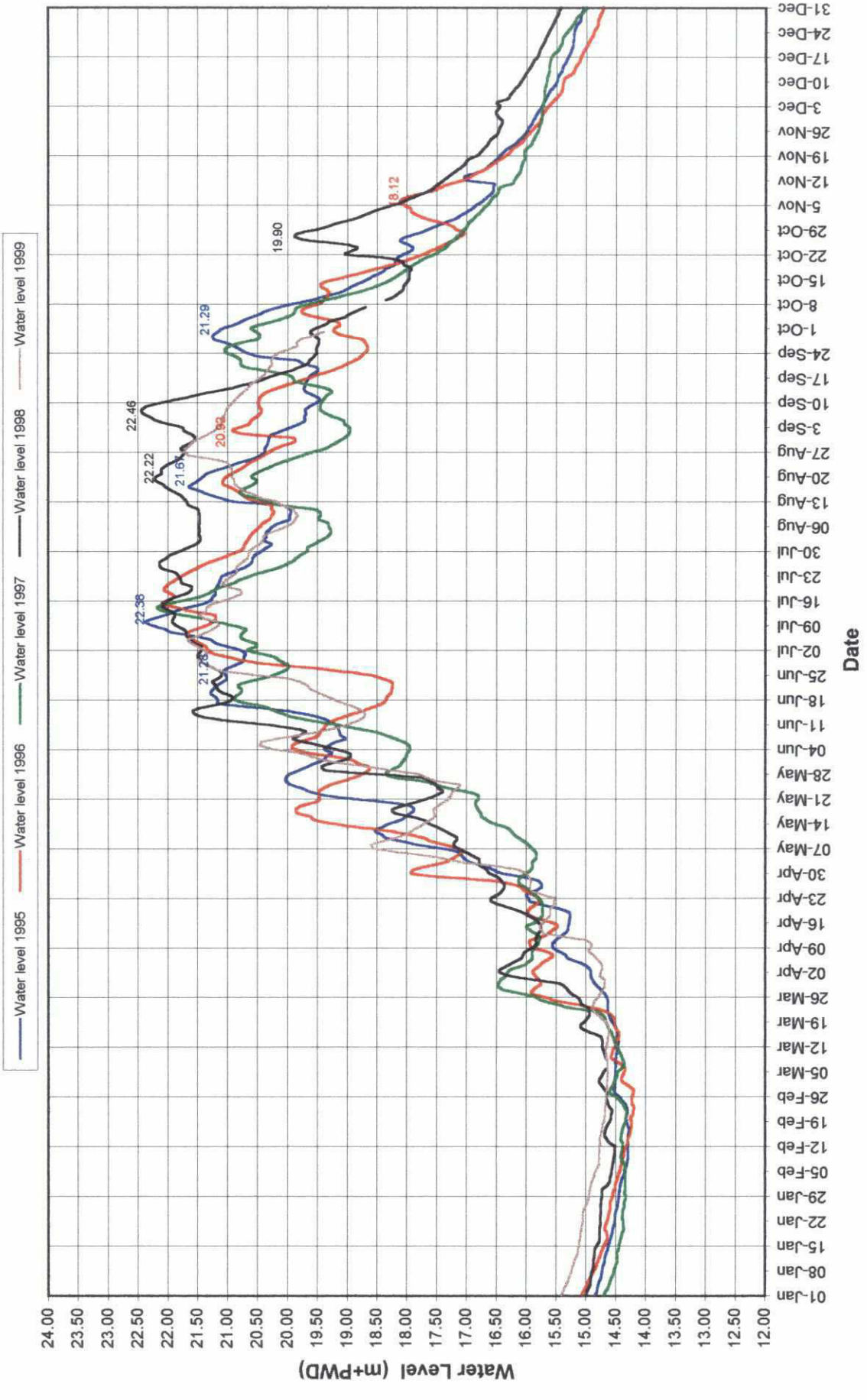
DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	20.470	20.460	20.450	
2	20.410	20.410	20.410	
3	20.410	20.400	20.390	
4	20.330	20.310	20.280	
5	20.160	20.120	20.100	
6	20.010	19.990	19.970	
7	19.910	19.910	19.900	
8	19.880	19.870	19.860	
9	19.830	19.830	19.830	
10	19.880	19.890	19.890	
11	19.900	19.960	20.000	
12	20.110	20.140	20.150	
13	20.190	20.230	20.270	
14	20.440	20.490	20.520	
15	20.560	20.580	20.610	
16	20.730	20.740	20.760	
17	20.820	20.850	20.870	
18	20.890	20.890	20.890	
19	20.890	20.910	20.920	
20	20.940	20.950	20.950	
21	20.900	20.890	20.880	
22	20.930	20.950	20.960	
23	20.960	20.980	20.990	
24	21.010	21.020	21.030	
25	21.240	21.310	21.410	
26	21.650	21.680	21.680	
27	21.740	21.750	21.740	
28	21.700	21.670	21.650	
29	21.630	21.640	21.640	
30	21.570	21.560	21.540	
31	21.450	21.420	21.400	

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT KAMARJANI TEST SITE
MONTH : SEPTEMBER 1999

DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	21.340	21.320	21.290	
2	21.220	21.210	21.190	
3	21.150	21.130	21.120	
4	21.100	21.100	21.100	
5	21.110	21.110	21.120	
6	21.080	21.070	21.060	
7	21.040	21.040	21.040	
8	21.030	21.030	21.010	
9	20.970	20.960	20.950	
10	20.910	20.900	20.890	
11	20.870	20.860	20.850	
12	20.810	20.810	20.800	
13	20.740	20.720	20.700	
14	20.670	20.670	20.660	
15	20.630	20.620	20.600	
16	20.540	20.520	20.510	
17	20.450	20.420	20.400	
18	20.390	20.390	20.380	
19	20.360	20.360	20.340	
20	20.300	20.280	20.280	
21	20.260	20.250	20.270	
22	20.280	20.270	20.270	
23	20.240	20.240	20.240	
24	20.160	20.130	20.100	
25	20.000	19.960	19.920	
26	19.840	19.810	19.800	
27	19.860	19.870	19.880	
28	19.790	19.740	19.700	
29	19.570	19.530	19.490	
30	19.400	19.360	19.350	

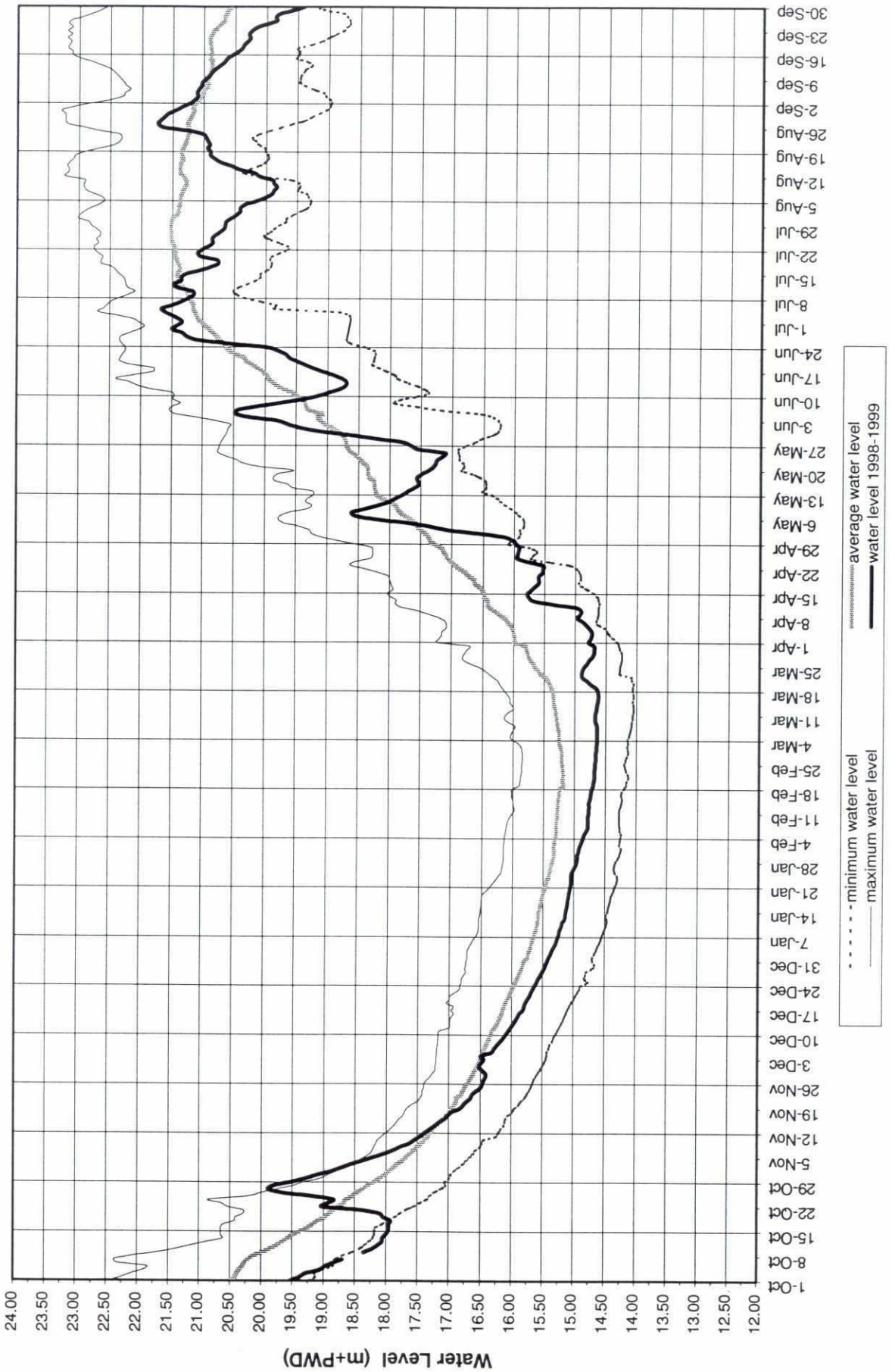

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT KAMARJANI TEST SITE
(July to September 1999)
+21.74
Water Level (m+PWD)
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
Date
01-Jul
08-Jul
15-Jul
22-Jul
29-Jul
05-Aug
12-Aug
19-Aug
26-Aug
02-Sep
09-Sep
16-Sep
23-Sep
30-Sep

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 SEPTEMBER '99

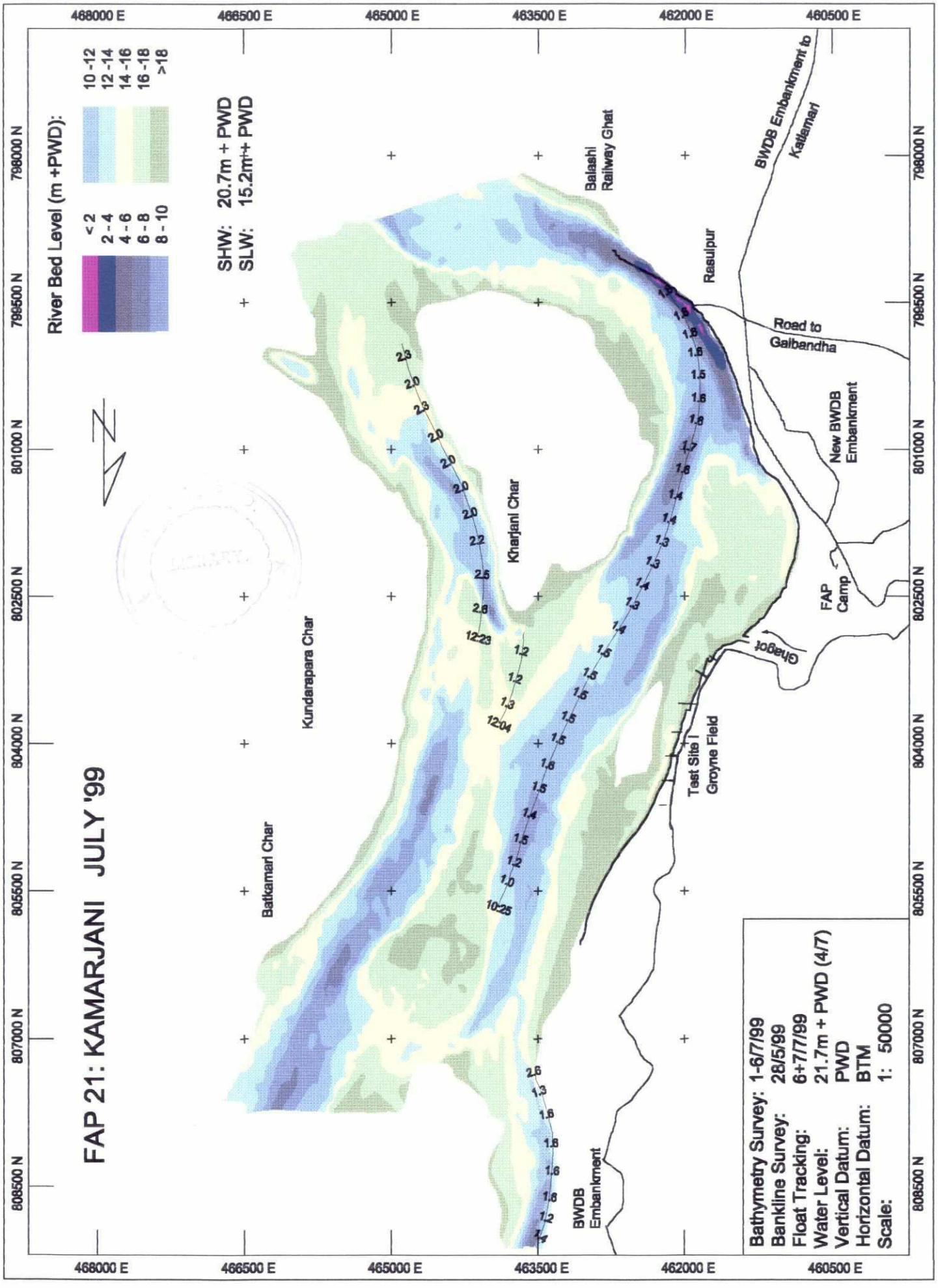


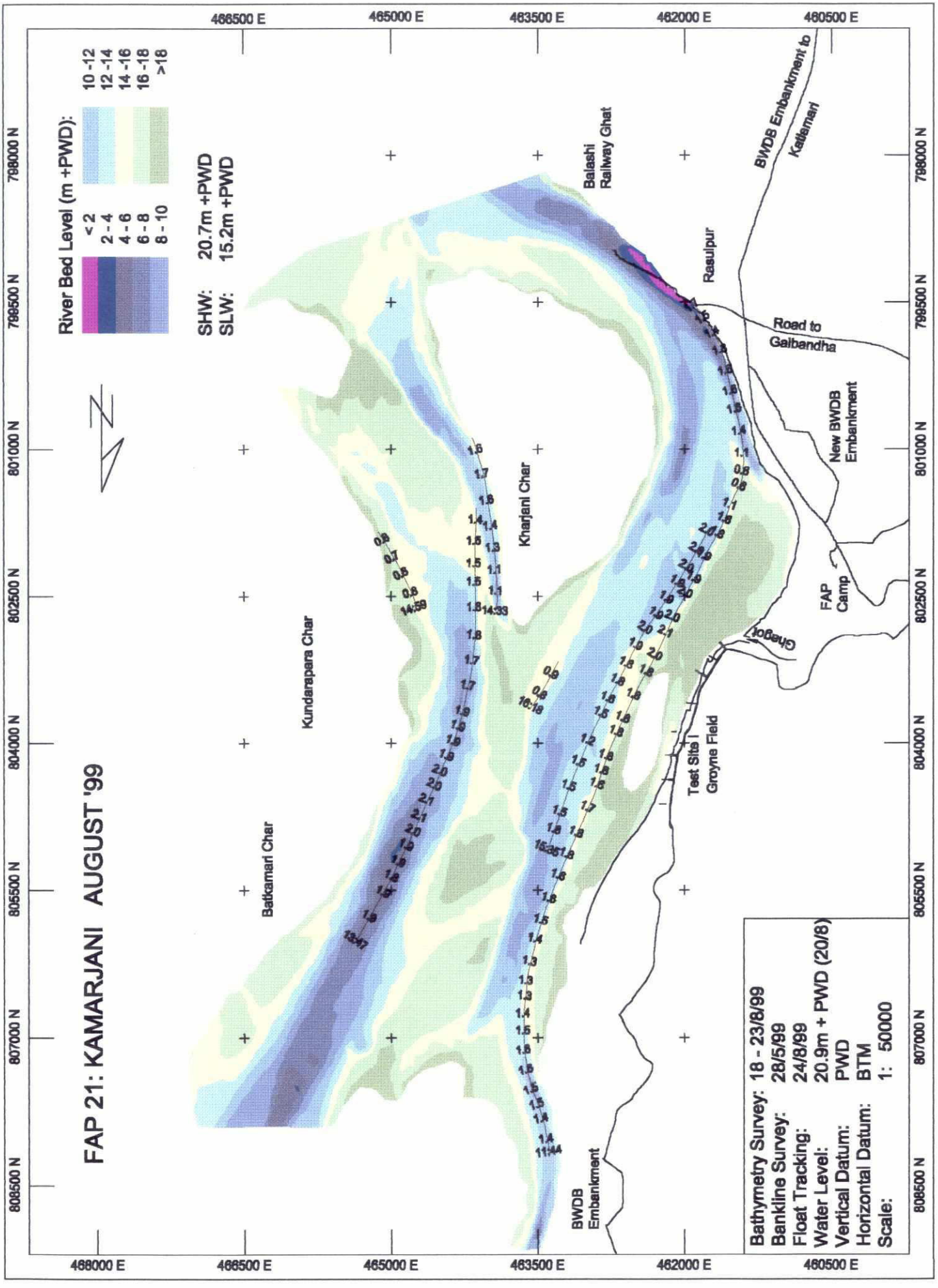
BWDB Data: Period of Record 1957 ~ 1997

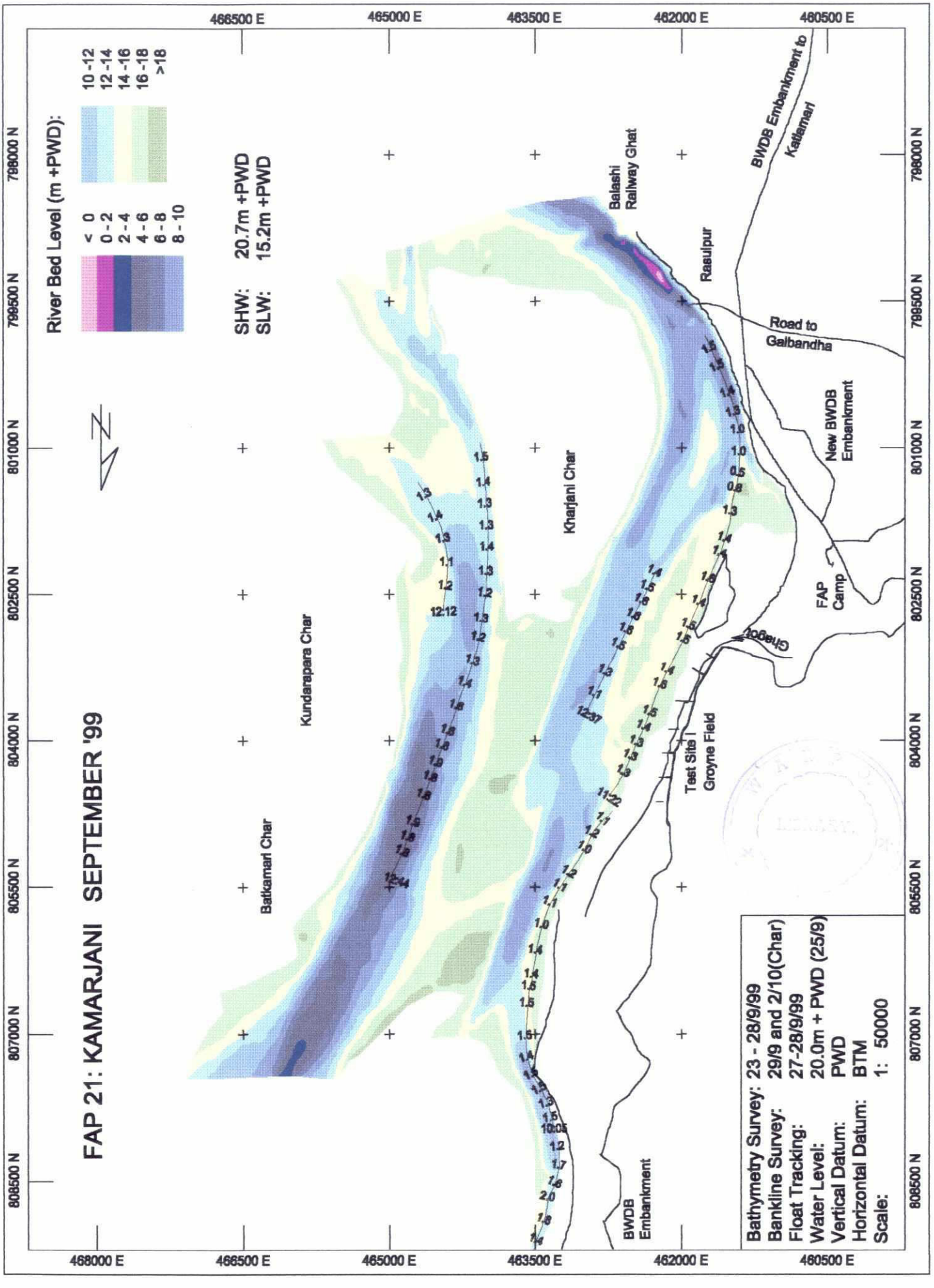
ANNEX B

FAP 21 / Test Site I

- Bathymetric Survey and
  Flow Velocities


FAP 21: KAMARJANI JULY '99
River Bed Level (m +PWD):
< 2
2 - 4
4 - 6
6 - 8
8 - 10
10 -12
12 -14
14 -16
16 -18
>18
SHW: 20.7m + PWD
SLW: 15.2m++ PWD
Kharjani Char
Kundarapara Char
Batkamari Char
Balashi Railway Ghat
Rasulpur
BWDB Embankment to Katlamari
Road to Gaibandha
New BWDB Embankment
FAP Camp
Ghagot
Test Site I Groyne Field
BWDB Embankment
Bathymetry Survey: 1-6/7/99
Bankline Survey: 28/5/99
Float Tracking: 6+7/7/99
Water Level: 21.7m + PWD (4/7)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 50000
468000 E
466500 E
465000 E
463500 E
462000 E
460500 E
798000 N
799500 N
801000 N
802500 N
804000 N
805500 N
807000 N
808500 N

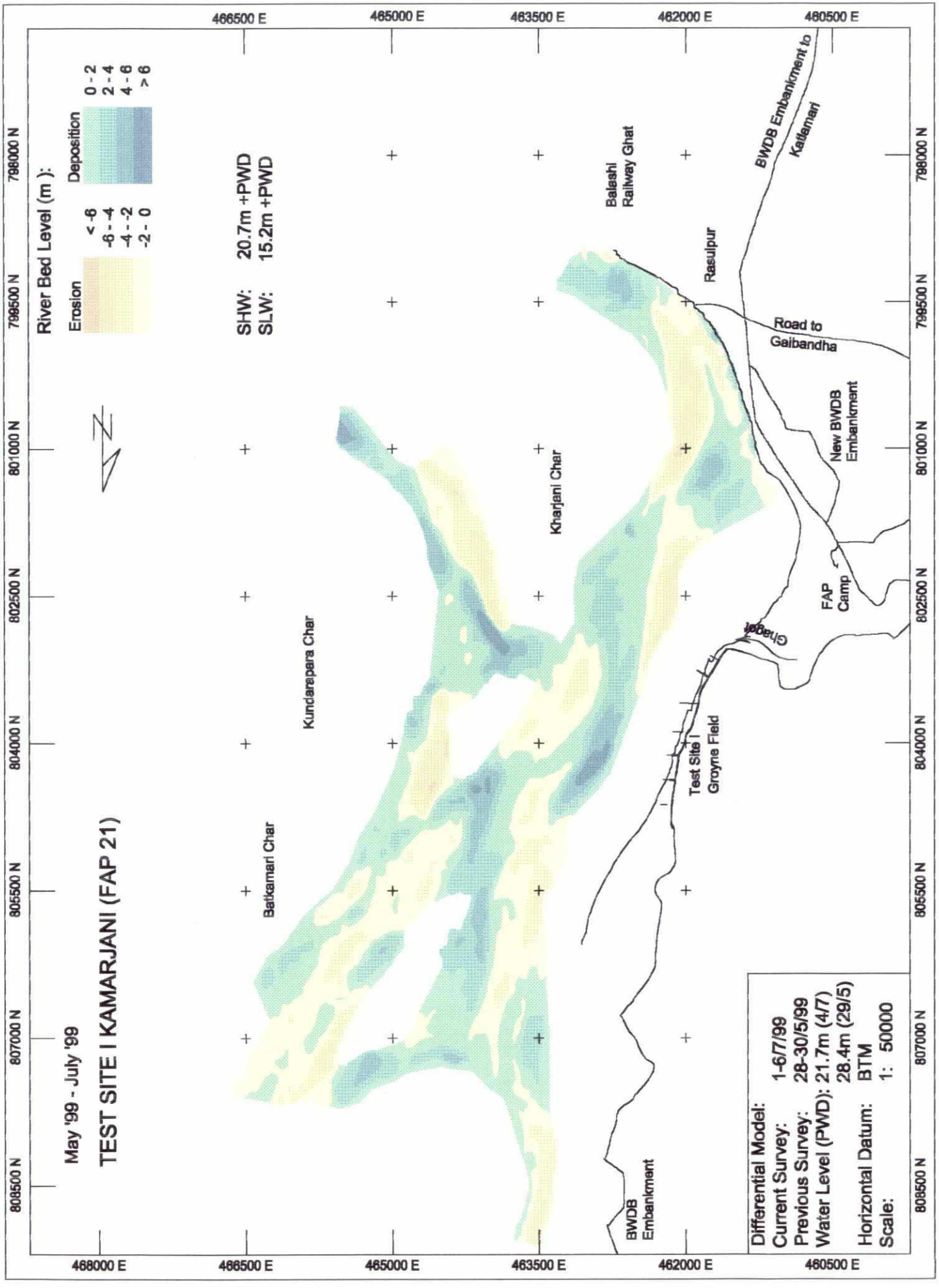

FAP 21: KAMARJANI AUGUST '99
River Bed Level (m +PWD):
< 2
2 - 4
4 - 6
6 - 8
8 - 10
10 -12
12 -14
14 -16
16 -18
>18
SHW: 20.7m +PWD
SLW: 15.2m +PWD
N
Batkamari Char
Kundarapara Char
Kharjani Char
Balashi Railway Ghat
Rasulpur
BWDB Embankment to Kattlemari
Road to Galbandha
New BWDB Embankment
FAP Camp
Ghegor
Test Sits I Groyne Field
BWDB Embankment
Bathymetry Survey: 18 - 23/8/99
Bankline Survey: 28/5/99
Float Tracking: 24/8/99
Water Level: 20.9m + PWD (20/8)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 50000
466500 E
465000 E
463500 E
462000 E
460500 E
468000 E
798000 N
799500 N
801000 N
802500 N
804000 N
805500 N
807000 N
808500 N

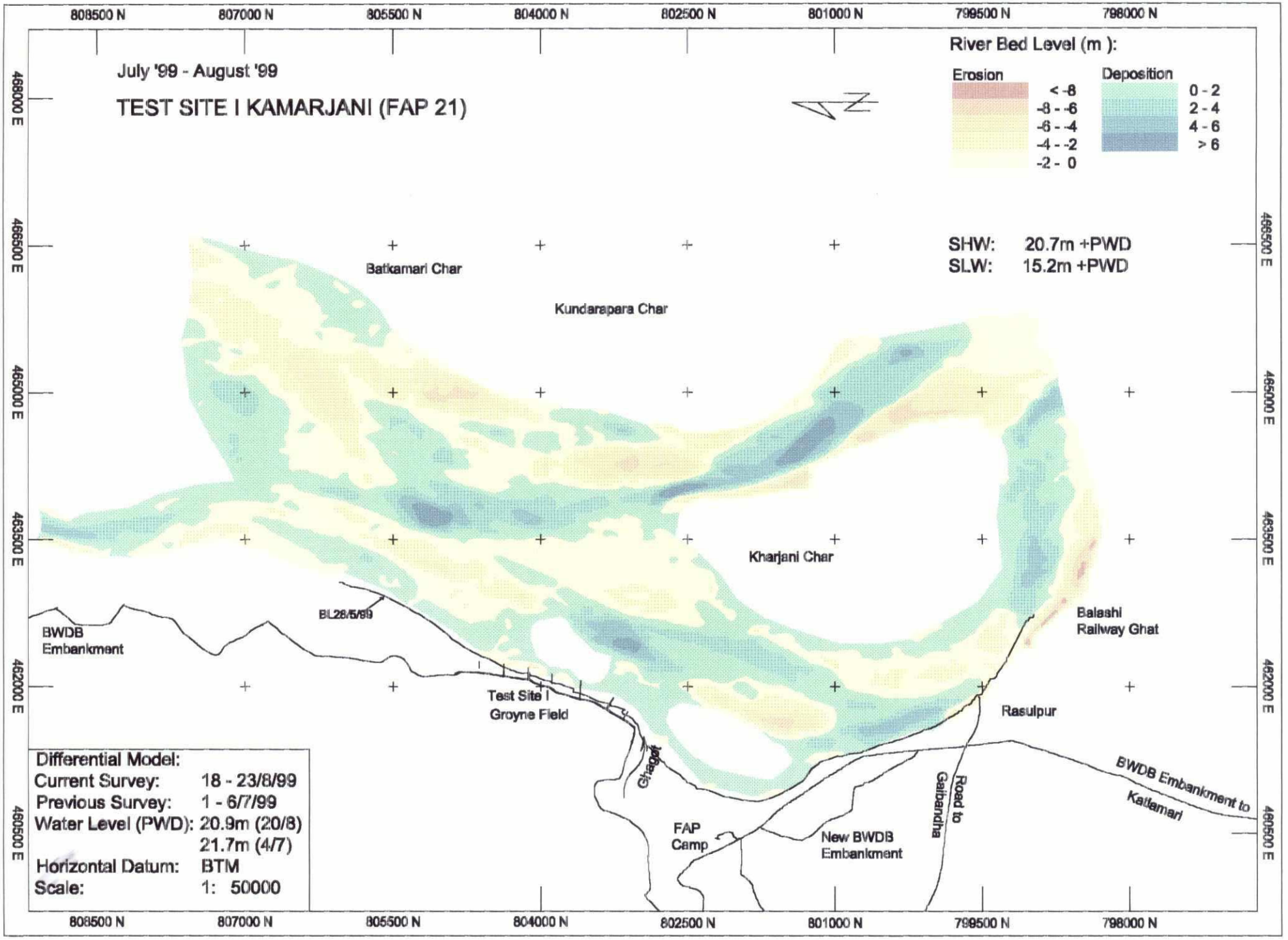

FAP 21: KAMARJANI SEPTEMBER '99
River Bed Level (m +PWD):
< 0
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 -12
12 -14
14 -16
16 -18
>18
SHW: 20.7m +PWD
SLW: 15.2m +PWD
Batkamari Char
Kundarapara Char
Kharjani Char
Balashi Railway Ghat
Rasulpur
BWDB Embankment to Katlamari
Road to Galbandha
New BWDB Embankment
FAP Camp
Test Site I
Groyne Field
BWDB Embankment
Bathymetry Survey: 23 - 28/9/99
Bankline Survey: 29/9 and 2/10(Char)
Float Tracking: 27-28/9/99
Water Level: 20.0m + PWD (25/9)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 50000
468000 E
466500 E
465000 E
463500 E
462000 E
460500 E
808500 N
807000 N
805500 N
804000 N
802500 N
801000 N
799500 N
798000 N

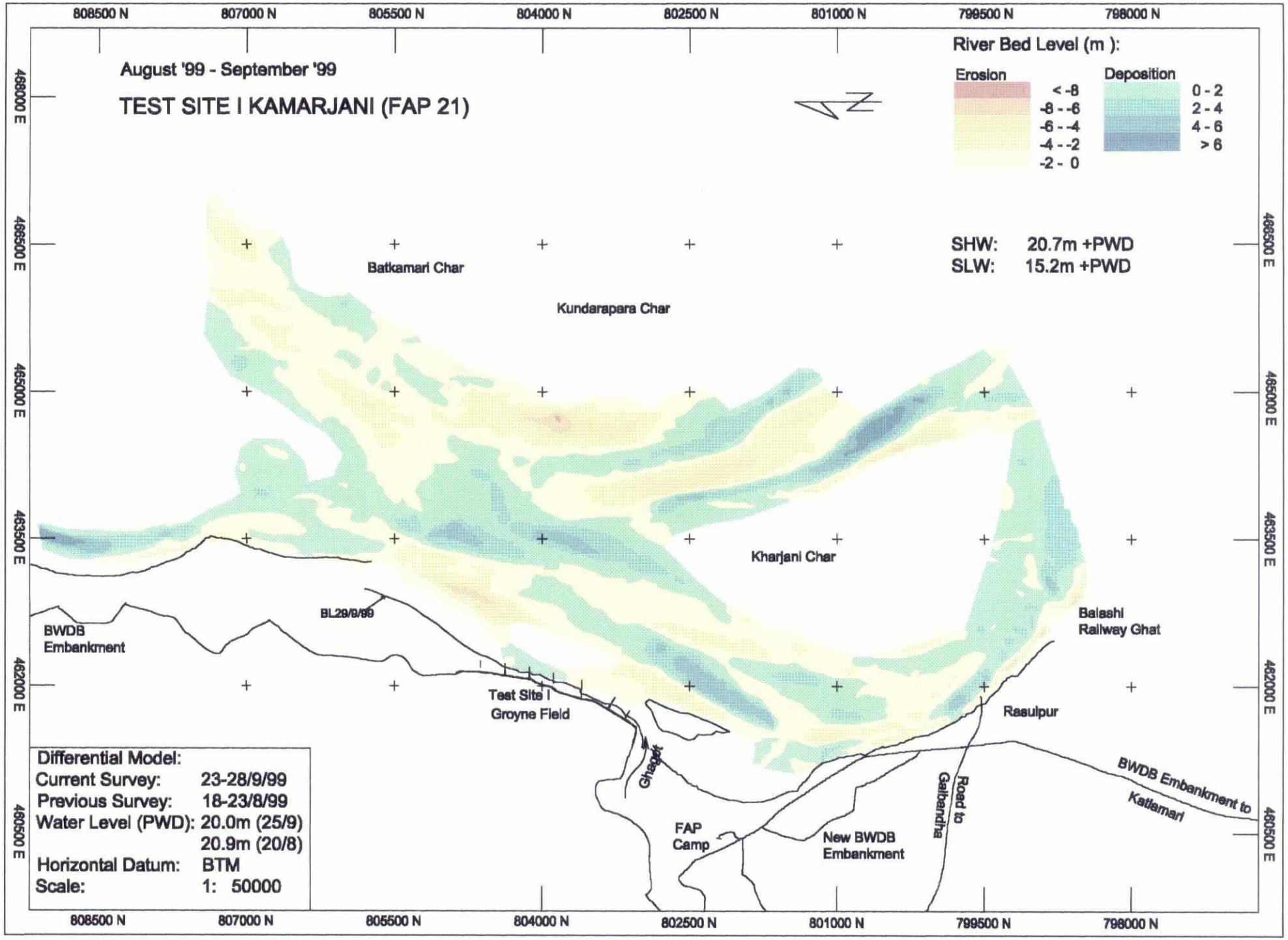
ANNEX C

FAP 21 / Test Site I

- Differential Models


TEST SITE I KAMARJANI (FAP 21)
May '99 - July '99
River Bed Level (m):
Erosion
< -6
-6 - -4
-4 - -2
-2 - 0
Deposition
0 - 2
2 - 4
4 - 6
> 6
SHW: 20.7m +PWD
SLW: 15.2m +PWD
Differential Model:
Current Survey: 1-6/7/99
Previous Survey: 28-30/5/99
Water Level (PWD): 21.7m (4/7)
28.4m (29/5)
Horizontal Datum: BTM
Scale: 1: 50000
Batkamari Char
Kundarapara Char
Kharjani Char
Balashi Railway Ghat
Rasulpur
BWDB Embankment to Katlamari
Road to Gaibandha
New BWDB Embankment
FAP Camp
Test Site I Groyne Field
BWDB Embankment
466500 E
465000 E
463500 E
462000 E
460500 E
468000 E
808500 N
807000 N
805500 N
804000 N
802500 N
801000 N
799500 N
798000 N

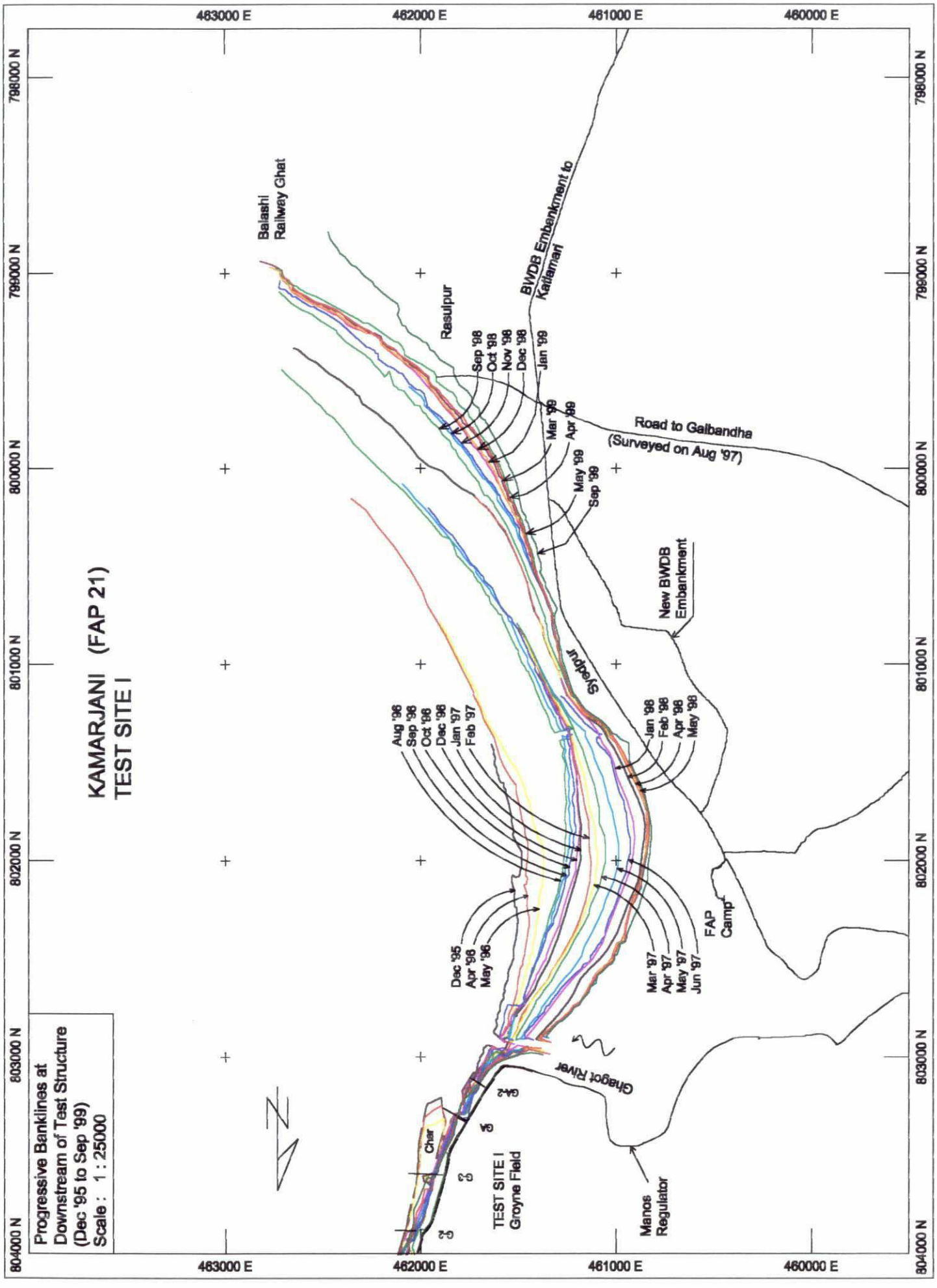

808500 N
807000 N
805500 N
804000 N
802500 N
801000 N
799500 N
798000 N
468000 E
466500 E
465000 E
463500 E
462000 E
460500 E
July '99 - August '99
TEST SITE I KAMARJANI (FAP 21)
River Bed Level (m):
Erosion
< -8
-8 - -6
-6 - -4
-4 - -2
-2 - 0
Deposition
0 - 2
2 - 4
4 - 6
> 6
SHW: 20.7m +PWD
SLW: 15.2m +PWD
Batkamari Char
Kundarapara Char
Kharjani Char
BWDB
Embankment
BL28/5/99
Test Site I
Groyne Field
Ghagot
Balashi
Railway Ghat
Rasulpur
BWDB Embankment to
Kaitamari
Road to
Gaibandha
FAP
Camp
New BWDB
Embankment
Differential Model:
Current Survey: 18 - 23/8/99
Previous Survey: 1 - 6/7/99
Water Level (PWD): 20.9m (20/8)
21.7m (4/7)
Horizontal Datum: BTM
Scale: 1: 50000


August '99 - September '99
TEST SITE I KAMARJANI (FAP 21)
River Bed Level (m):
Erosion
< -8
-8 - -6
-6 - -4
-4 - -2
-2 - 0
Deposition
0 - 2
2 - 4
4 - 6
> 6
SHW: 20.7m +PWD
SLW: 15.2m +PWD
808500 N
807000 N
805500 N
804000 N
802500 N
801000 N
799500 N
798000 N
468000 E
466500 E
465000 E
463500 E
462000 E
460500 E
Batkamari Char
Kundarapara Char
Kharjani Char
BWDB Embankment
BL29/8/99
Test Site I
Groyne Field
Ghagat
FAP Camp
New BWDB Embankment
Road to Gaibandha
Rasulpur
Balashi Railway Ghat
BWDB Embankment to Katlamari
Differential Model:
Current Survey: 23-28/9/99
Previous Survey: 18-23/8/99
Water Level (PWD): 20.0m (25/9)
20.9m (20/8)
Horizontal Datum: BTM
Scale: 1: 50000

ANNEX D

FAP 21 / Test Site I

- Change of Bankline


KAMARJANI (FAP 21)
TEST SITE I
Progressive Banklines at Downstream of Test Structure (Dec '95 to Sep '99)
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 Railway Ghat
Rasulpur
BWDB Embankment to Kaliamari
Sep '98
Oct '98
Nov '98
Dec '98
Jan '99
Mar '99
Apr '99
May '99
Sep '99
Road to Gaibandha (Surveyed on Aug '97)
New BWDB Embankment
Sreepur
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
FAP Camp
Ghagot River
Char
G-1
G-2
G-3
G-4
G-4-2
TEST SITE I
Groyne Field
Manos Regulator

ANNEX E

FAP 21 / Test Site I

- Photographs

There was not further development at the test site during the period under review.

Therefore, there are no photographs.

ANNEX F

FAP 21 / Test Site II

- Water Level

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
MONTH : JULY 1999

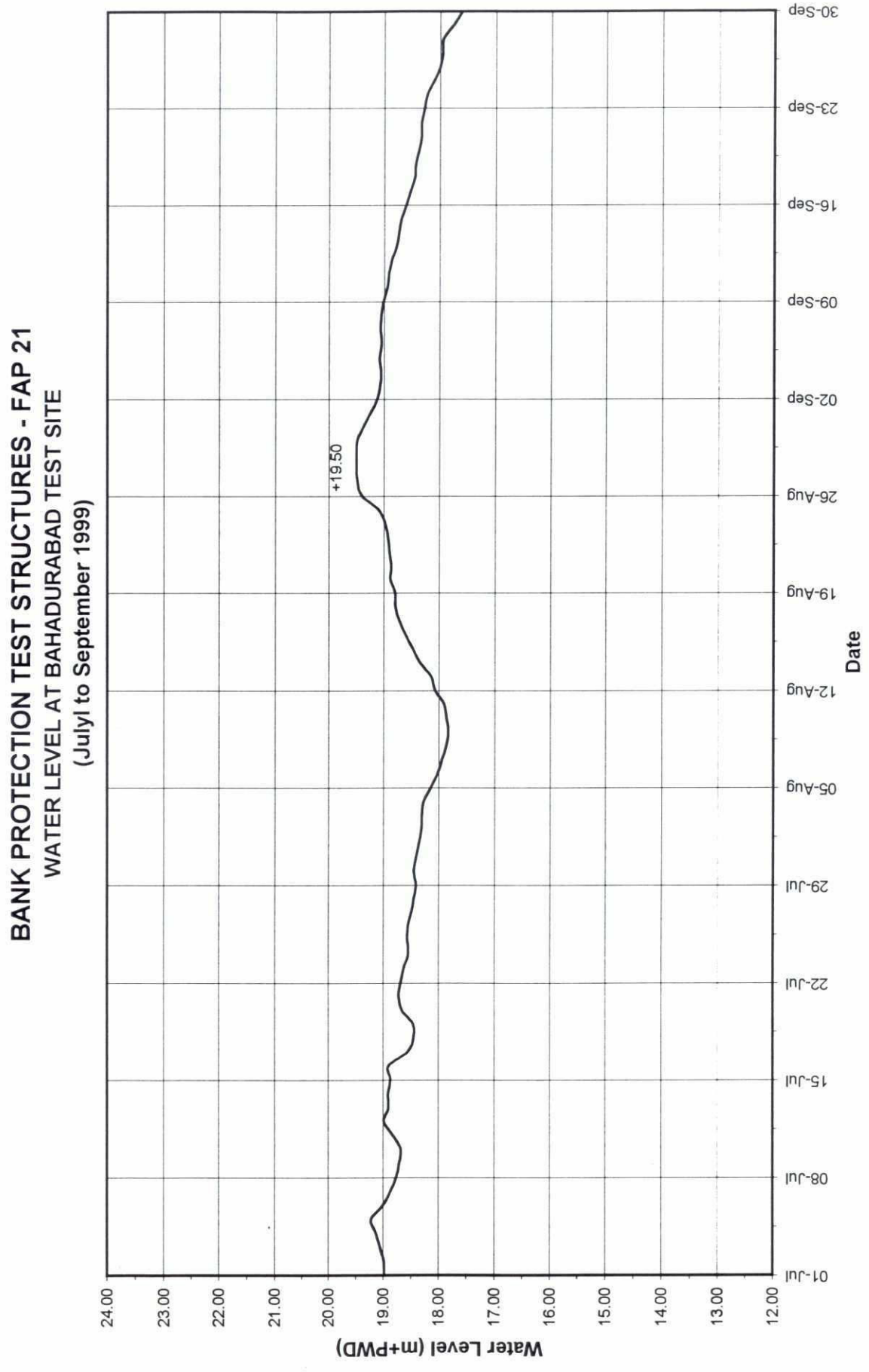
DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	18.980	18.920	19.000	
2	18.990	18.990	19.010	
3	19.060	19.090	19.110	
4	19.140	19.170	19.190	
5	19.220	19.210	19.080	
6	19.010	18.990	18.970	
7	18.870	18.830	18.810	
8	18.770	18.740	18.720	
9	18.710	18.700	18.670	
10	18.680	18.700	18.710	
11	18.830	18.900	18.940	
12	18.990	18.980	18.970	
13	18.900	18.870	18.880	
14	18.910	18.930	18.950	
15	18.870	18.870	18.810	
16	18.900	18.670	18.630	
17	18.560	18.520	18.480	
18	18.450	18.440	18.440	
19	18.460	18.500	18.560	
20	18.660	18.730	18.710	
21	18.720	18.720	18.720	
22	18.690	18.660	18.660	
23	18.640	18.590	18.590	
24	18.550	18.540	18.540	
25	18.570	18.580	18.570	
26	18.560	18.550	18.540	
27	18.500	18.490	18.480	
28	18.450	18.430	18.420	
29	18.410	18.420	18.460	
30	18.450	18.450	18.440	
31	18.410	18.410	18.410	

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
MONTH : AUGUST 1999

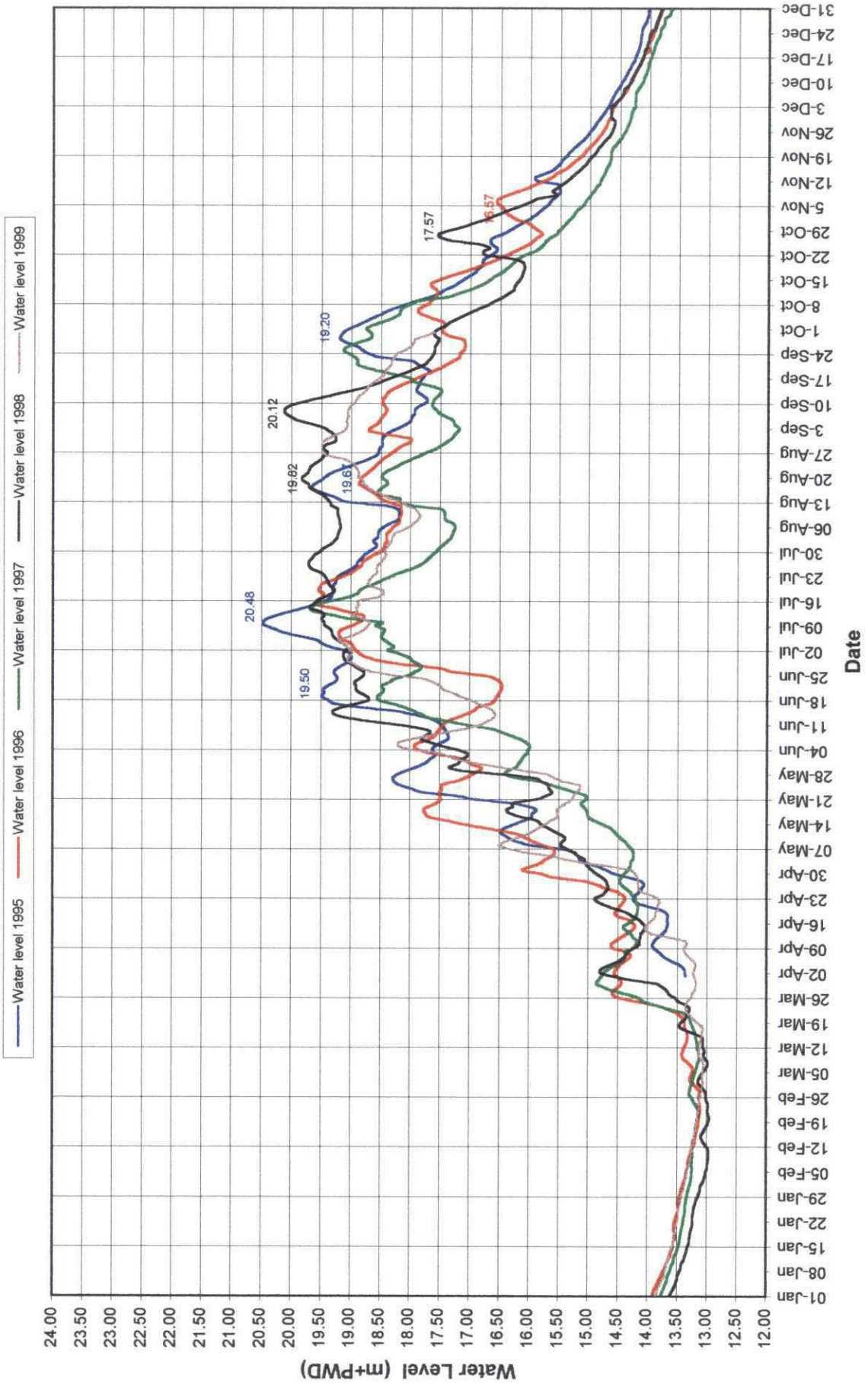
DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	18.360	18.340	18.330	
2	18.320	18.320	18.320	
3	18.310	18.310	18.310	
4	18.270	18.260	18.240	
5	18.140	18.120	18.110	
6	18.020	18.010	18.000	
7	17.940	17.900	17.880	
8	17.870	17.870	17.860	
9	17.830	17.830	17.830	
10	17.870	17.880	17.890	
11	17.910	17.930	17.960	
12	18.070	18.110	18.120	
13	18.140	18.200	18.220	
14	18.350	18.410	18.420	
15	18.480	18.490	18.500	
16	18.610	18.640	18.660	
17	18.720	18.730	18.760	
18	18.790	18.800	18.800	
19	18.800	18.830	18.850	
20	18.890	18.900	18.900	
21	18.870	18.860	18.850	
22	18.900	18.910	18.920	
23	18.930	18.940	18.950	
24	18.980	18.980	18.990	
25	19.100	19.130	19.190	
26	19.410	19.450	19.480	
27	19.480	19.500	19.510	
28	19.500	19.500	19.490	
29	19.500	19.520	19.530	
30	19.490	19.470	19.460	
31	19.380	19.350	19.340	

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
MONTH : SEPTEMBER 1999

DAYS	TIME			REMARKS
	8.00	13.00	17.00	
1	19.250	19.220	19.190	
2	19.130	19.110	19.100	
3	19.080	19.080	19.070	
4	19.060	19.050	19.050	
5	19.090	19.090	19.090	
6	19.050	19.060	19.070	
7	19.070	19.070	19.070	
8	19.060	19.070	19.080	
9	19.020	19.000	18.980	
10	18.950	18.950	18.940	
11	18.920	19.910	18.900	
12	18.870	18.830	18.830	
13	18.780	18.770	18.760	
14	18.740	18.710	18.710	
15	18.700	18.680	18.660	
16	18.610	18.590	18.580	
17	18.530	18.500	18.480	
18	18.450	18.450	18.450	
19	18.440	18.430	18.430	
20	18.380	18.370	18.370	
21	18.330	18.320	18.320	
22	18.330	18.320	18.310	
23	18.280	18.280	18.270	
24	18.230	18.220	18.210	
25	18.100	18.090	18.070	
26	18.000	17.980	17.940	
27	17.950	17.970	17.970	
28	17.940	17.900	17.870	
29	17.760	17.720	17.700	
30	17.610	17.590	17.570	

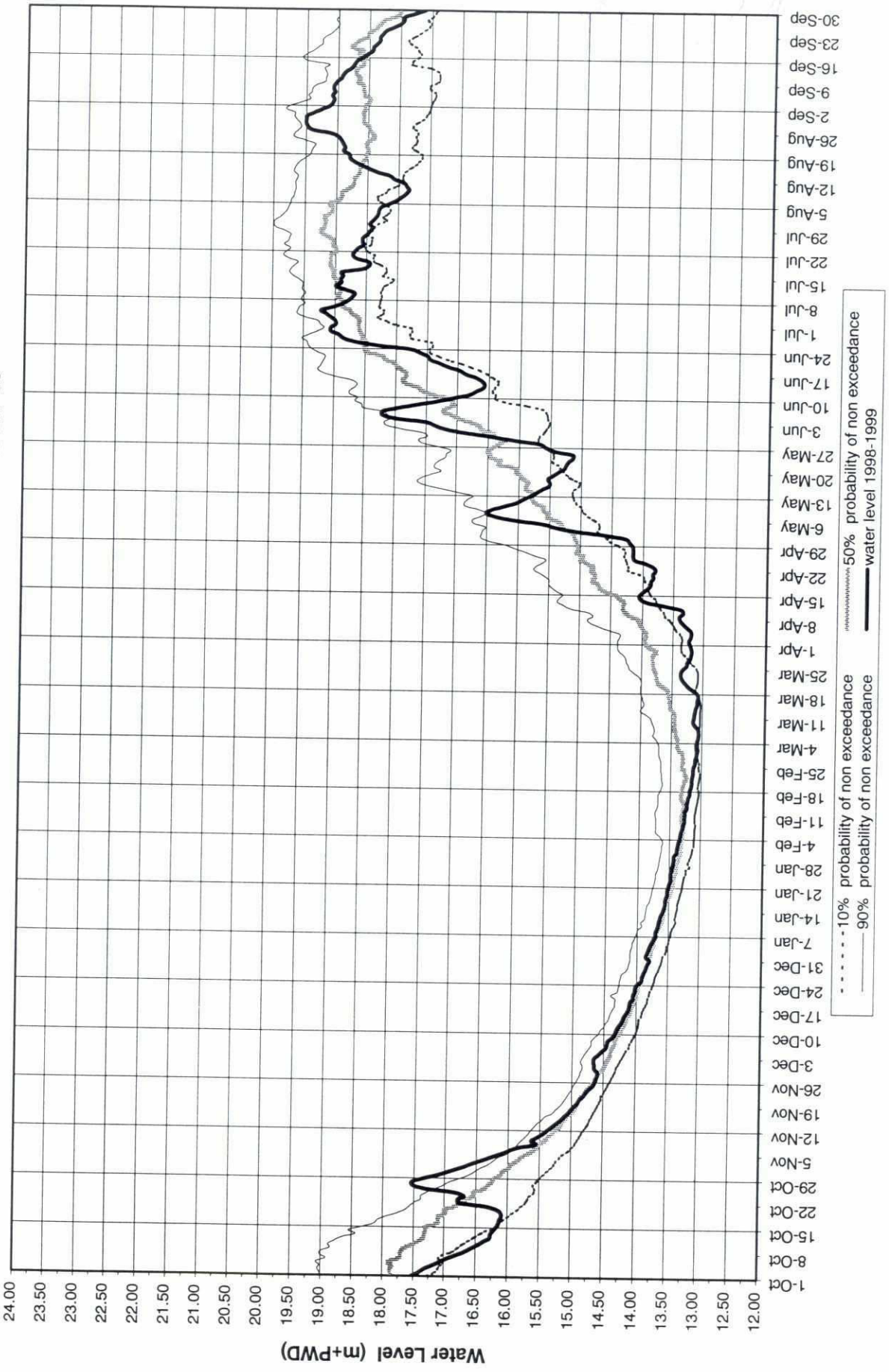

BANK PROTECTION TEST STRUCTURES - FAP 21
WATER LEVEL AT BAHADURABAD TEST SITE
(Julyl to September 1999)
+19.50
Water Level (m+PWD)
24.00
23.00
22.00
21.00
20.00
19.00
18.00
17.00
16.00
15.00
14.00
13.00
12.00
Date
01-Jul
08-Jul
15-Jul
22-Jul
29-Jul
05-Aug
12-Aug
19-Aug
26-Aug
02-Sep
09-Sep
16-Sep
23-Sep
30-Sep

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 SEPTEMBER '99

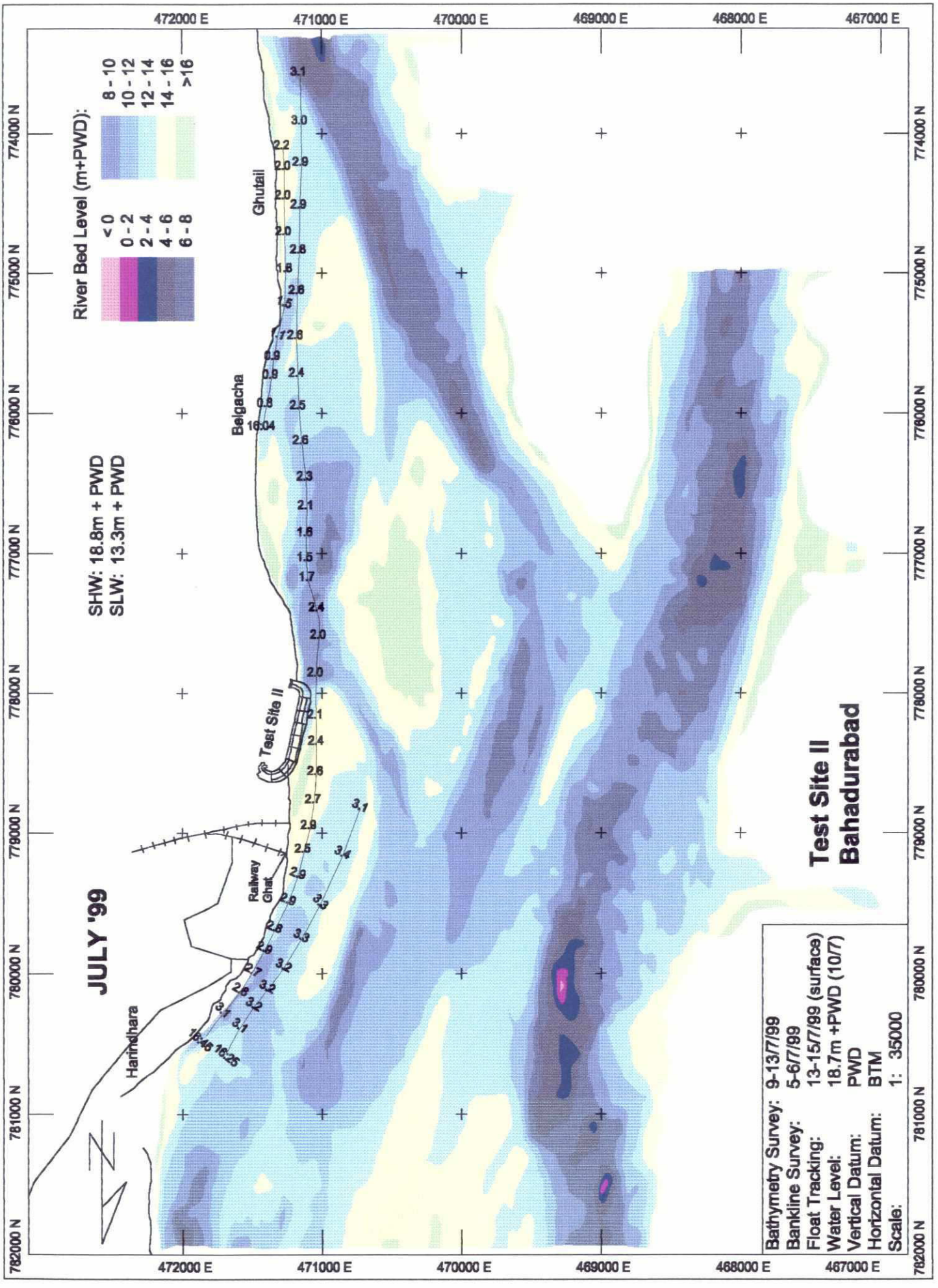


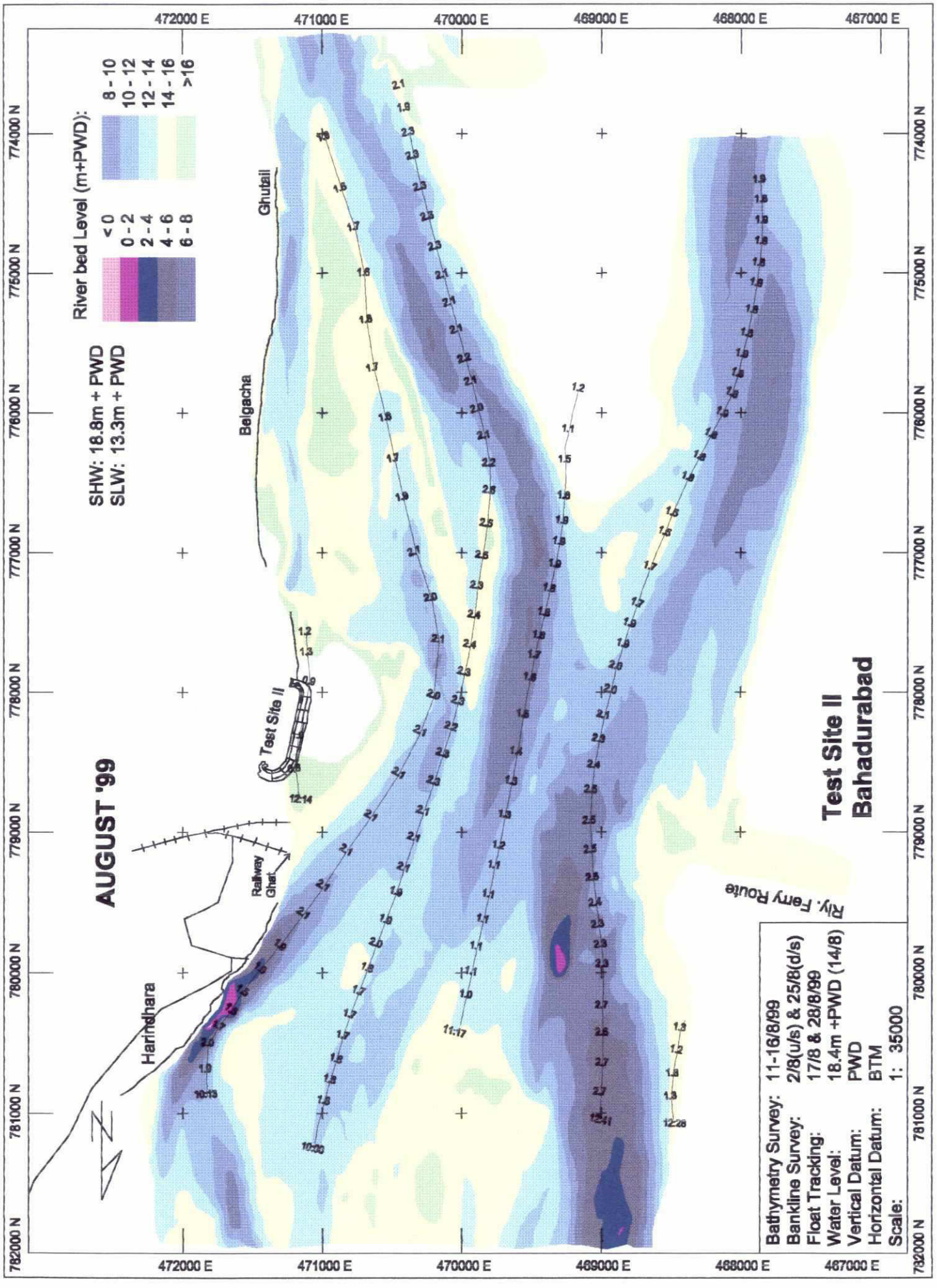
BWDB Data: Period of Record 1962 ~ 1994

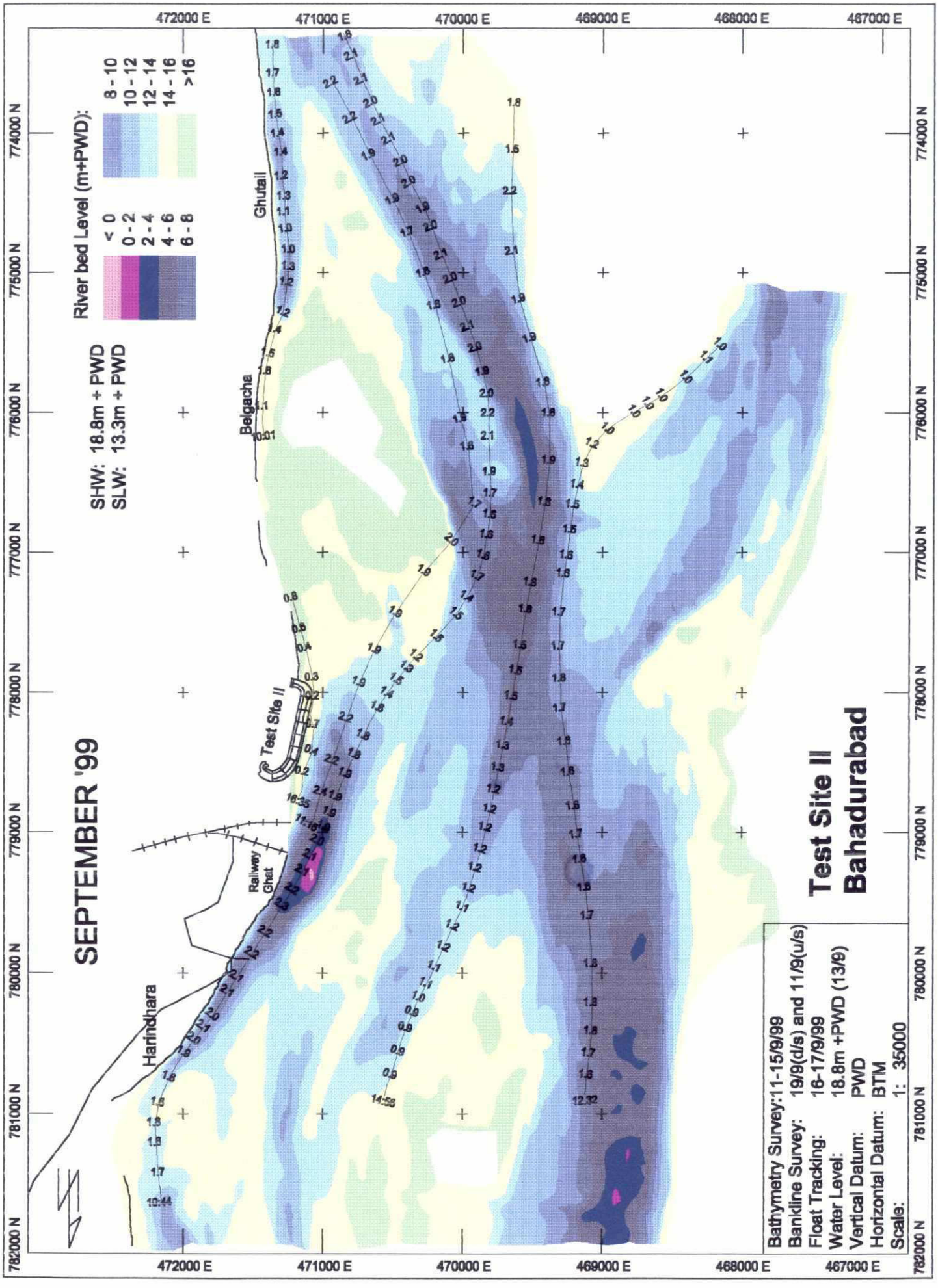
ANNEX G

FAP 21 / Test Site II

- Bathymetric Survey and Flow Velocities


River Bed Level (m+PWD):
< 0
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
14 - 16
>16
SHW: 18.8m + PWD
SLW: 13.3m + PWD
JULY '99
Test Site II
Bahadurabad
Ghutail
Belgacha
Test Site II
Railway Ghat
Harindhara
Bathymetry Survey: 9-13/7/99
Bankline Survey: 5-6/7/99
Float Tracking: 13-15/7/99 (surface)
Water Level: 18.7m +PWD (10/7)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 35000
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

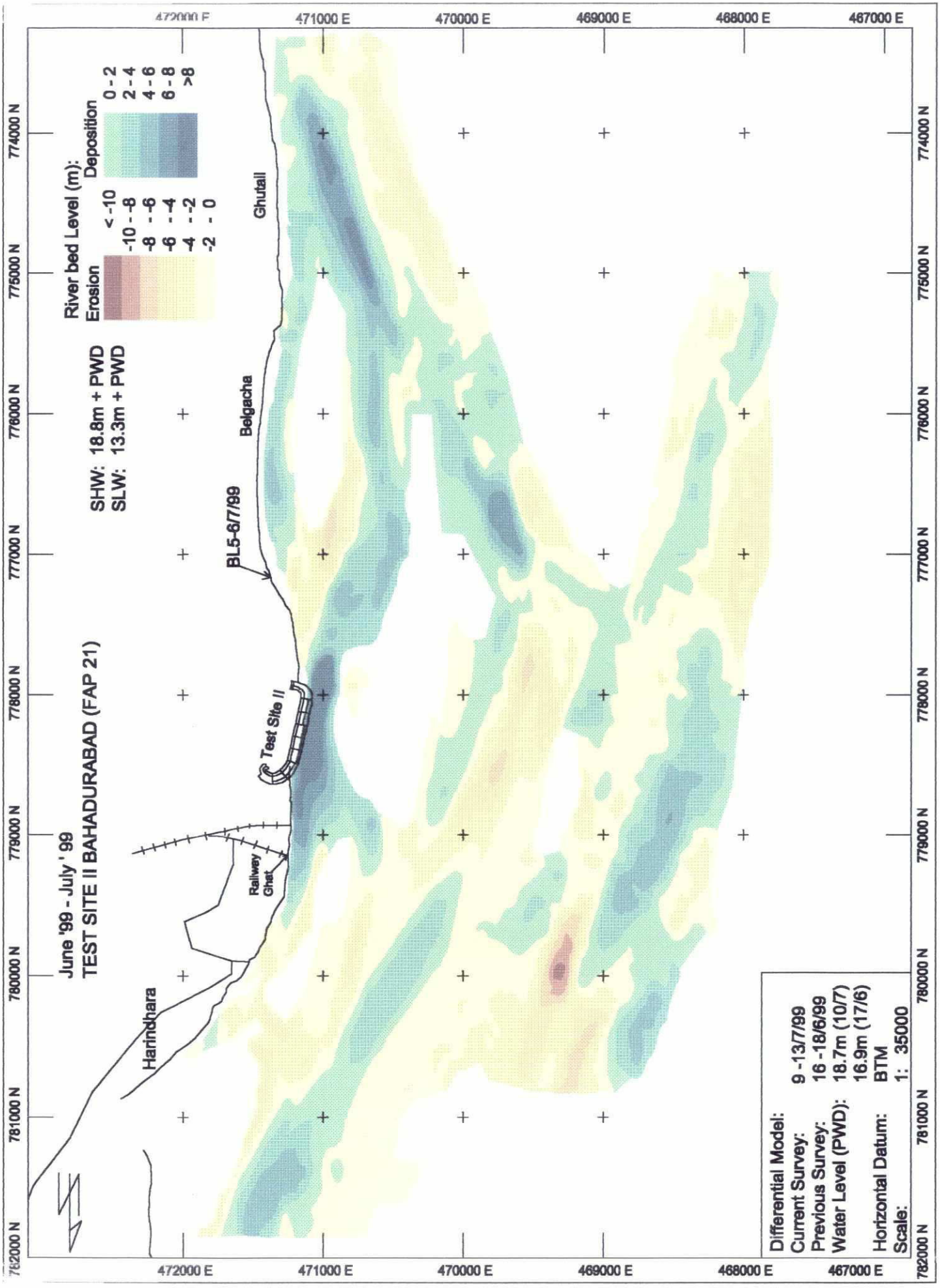

AUGUST '99
Test Site II
Bahadurabad
River bed Level (m+PWD):
< 0
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
14 - 16
>16
SHW: 18.8m + PWD
SLW: 13.3m + PWD
Ghutail
Belgacha
Test Site II
Railway Ghat
Harindhara
Rly. Ferry Route
Bathymetry Survey: 11-16/8/99
Bankline Survey: 2/8(u/s) & 25/8(d/s)
Float Tracking: 17/8 & 28/8/99
Water Level: 18.4m +PWD (14/8)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 35000
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

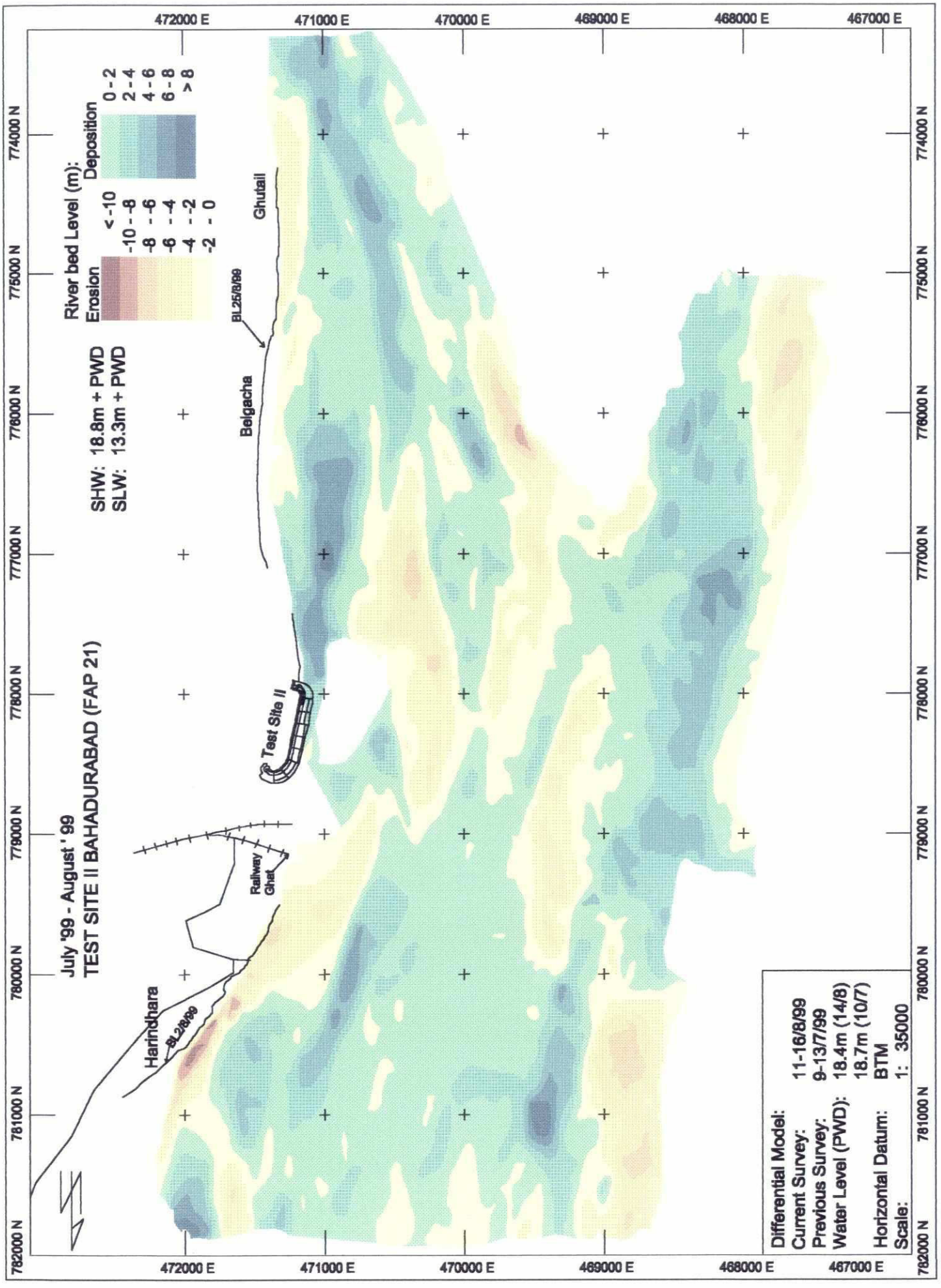

SEPTEMBER '99
Test Site II
Bahadurabad
River bed Level (m+PWD):
< 0
0 - 2
2 - 4
4 - 6
6 - 8
8 - 10
10 - 12
12 - 14
14 - 16
>16
SHW: 18.8m + PWD
SLW: 13.3m + PWD
Ghutail
Belgacha
Test Site II
Railway Ghat
Harindhara
472000 E
471000 E
470000 E
469000 E
468000 E
467000 E
774000 N
775000 N
776000 N
777000 N
778000 N
779000 N
780000 N
781000 N
782000 N
Bathymetry Survey:11-15/9/99
Bankline Survey: 19/9(d/s) and 11/9(u/s)
Float Tracking: 16-17/9/99
Water Level: 18.8m +PWD (13/9)
Vertical Datum: PWD
Horizontal Datum: BTM
Scale: 1: 35000

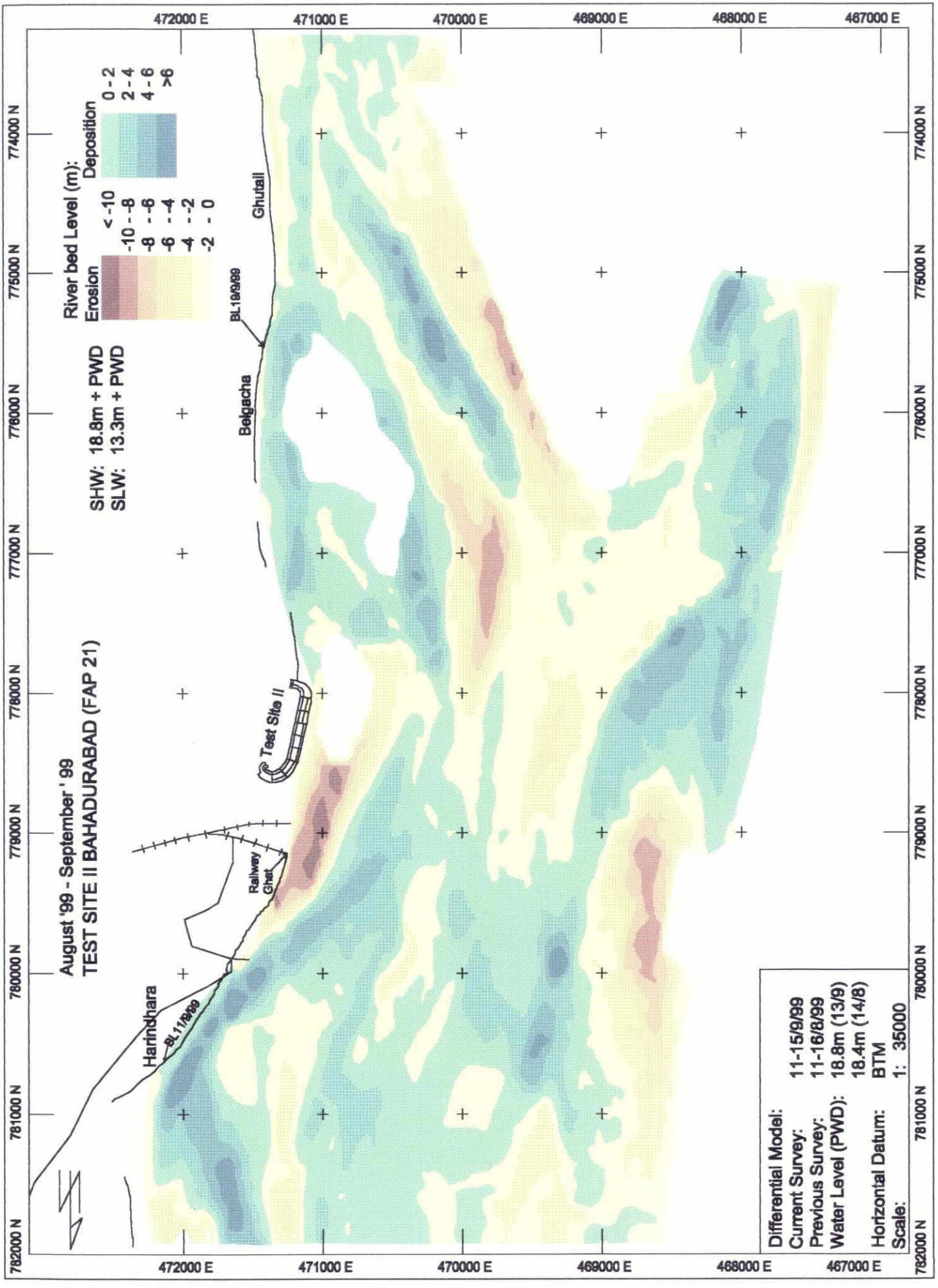
ANNEX H

FAP 21 / Test Site II

- Differential Models


June '99 - July' 99
TEST SITE II BAHADURABAD (FAP 21)
SHW: 18.8m + PWD
SLW: 13.3m + PWD
River bed Level (m):
Erosion
< -10
-10 - -8
-8 - -6
-6 - -4
-4 - -2
-2 - 0
Deposition
0 - 2
2 - 4
4 - 6
6 - 8
>8
BL5-6/7/99
Belgacha
Ghutail
Test Site II
Railway Ghat
Harindhara
Differential Model:
Current Survey: 9 -13/7/99
Previous Survey: 16 -18/6/99
Water Level (PWD): 18.7m (10/7)
16.9m (17/6)
Horizontal Datum: BTM
Scale: 1: 35000
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


July '99 - August ' 99
TEST SITE II BAHADURABAD (FAP 21)
SHW: 18.8m + PWD
SLW: 13.3m + PWD
River bed Level (m):
Erosion
< -10
-10 - -8
-8 - -6
-6 - -4
-4 - -2
-2 - 0
Deposition
0 - 2
2 - 4
4 - 6
6 - 8
> 8
Ghutail
BL25/8/99
Belgacha
Test Site II
Railway Ghat
Harindhara
BL2/8/99
Differential Model:
Current Survey: 11-16/8/99
Previous Survey: 9-13/7/99
Water Level (PWD): 18.4m (14/8)
18.7m (10/7)
Horizontal Datum: BTM
Scale: 1: 35000
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

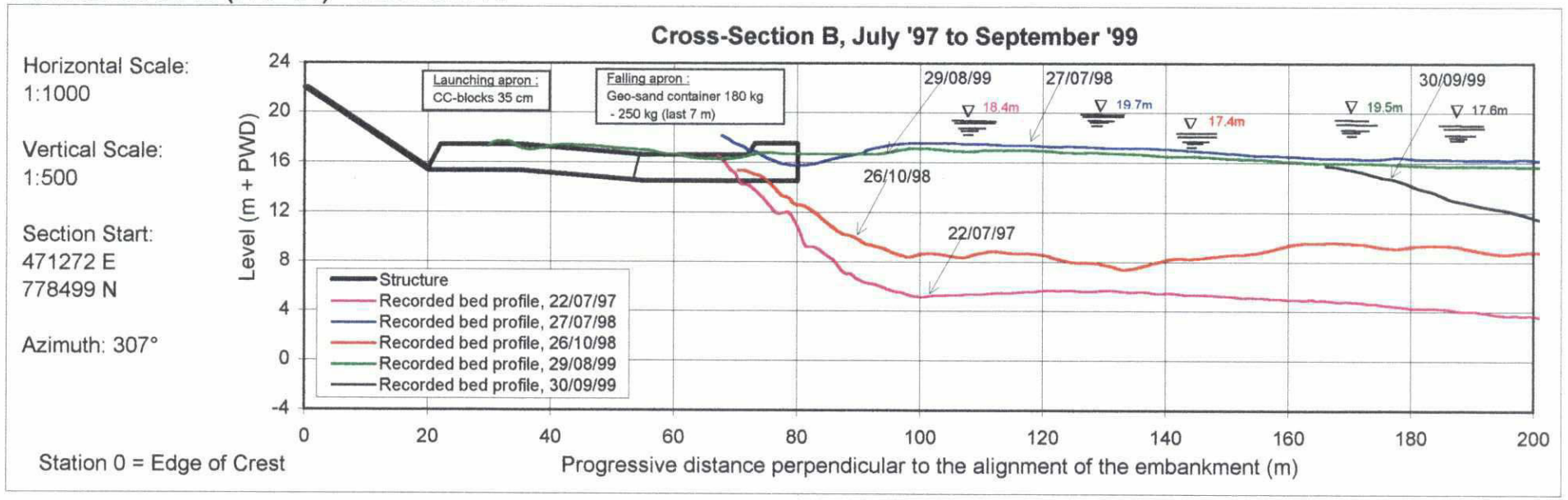

August '99 - September' 99
TEST SITE II BAHADURABAD (FAP 21)
SHW: 18.8m + PWD
SLW: 13.3m + PWD
River bed Level (m):
Erosion
< -10
-10 - -8
-8 - -6
-6 - -4
-4 - -2
-2 - 0
Deposition
0 - 2
2 - 4
4 - 6
>6
Ghutail
BL19/9/99
Belgacha
Test Site II
Railway Ghat
Harindhara
BL11/9/99
Differential Model:
Current Survey: 11-15/9/99
Previous Survey: 11-16/8/99
Water Level (PWD): 18.8m (13/9)
18.4m (14/8)
Horizontal Datum: BTM
Scale: 1: 35000
472000 E
471000 E
470000 E
469000 E
468000 E
467000 E
782000 N
781000 N
780000 N
779000 N
778000 N
777000 N
776000 N
775000 N
774000 N

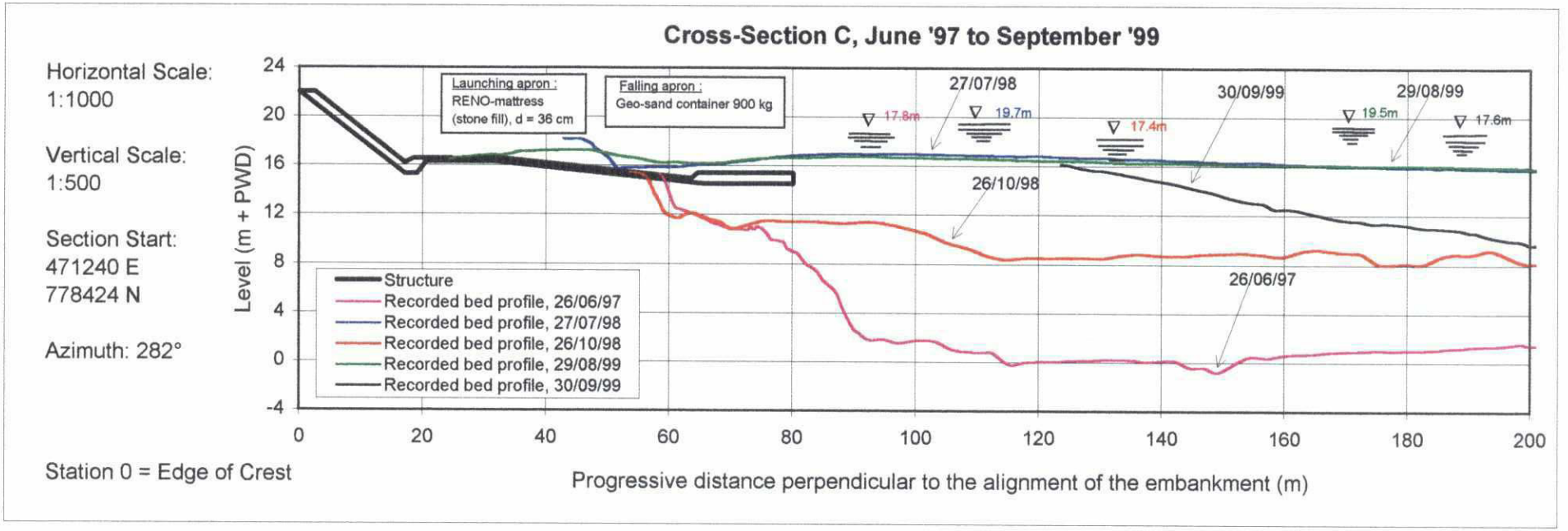
ANNEX I

FAP 21 / Test Site II

- Cross-Sections end of September 1999

BAHADURABAD (FAP 21) - TEST SITE II





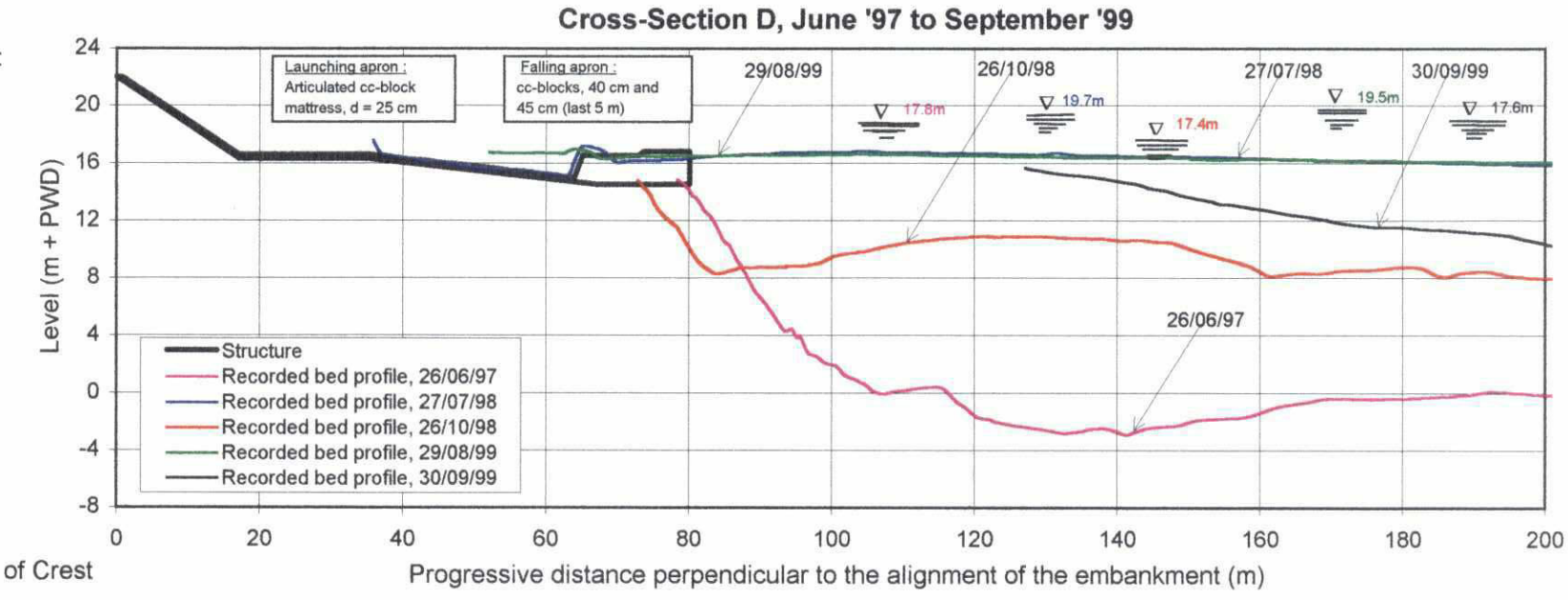
BAHADURABAD (FAP 21) - TEST SITE II

Horizontal Scale:
1:1000

Vertical Scale:
1:500

Section Start:
471222 E
778337 N

Azimuth: 282°



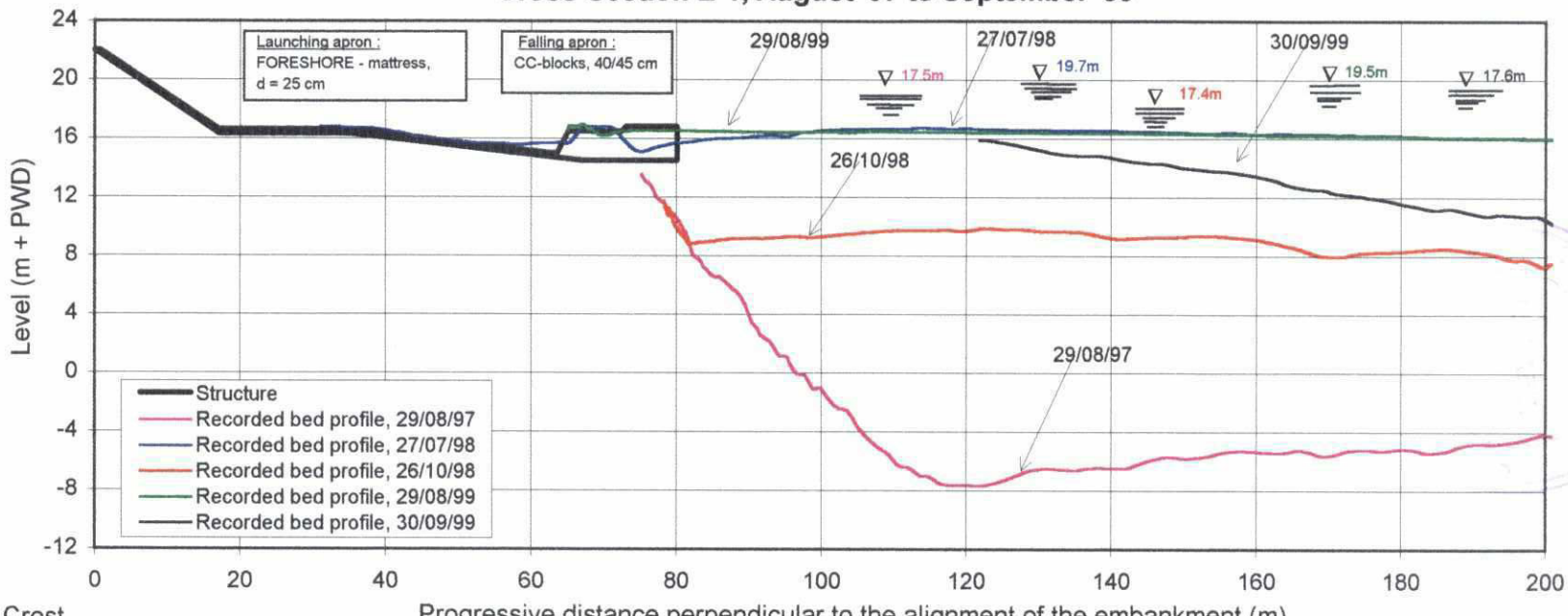
Station 0 = Edge of Crest

Horizontal Scale:
1:1000

Vertical Scale:
1:500

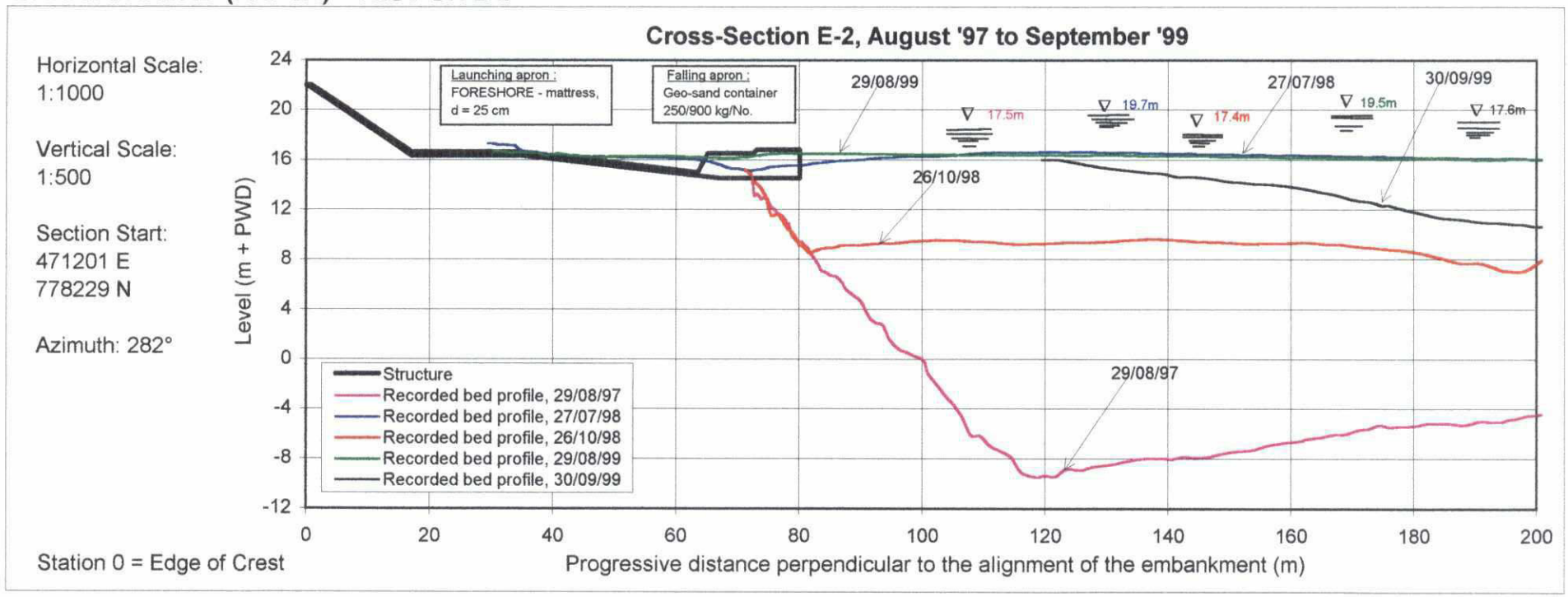
Section Start:
471203 E
778250 N

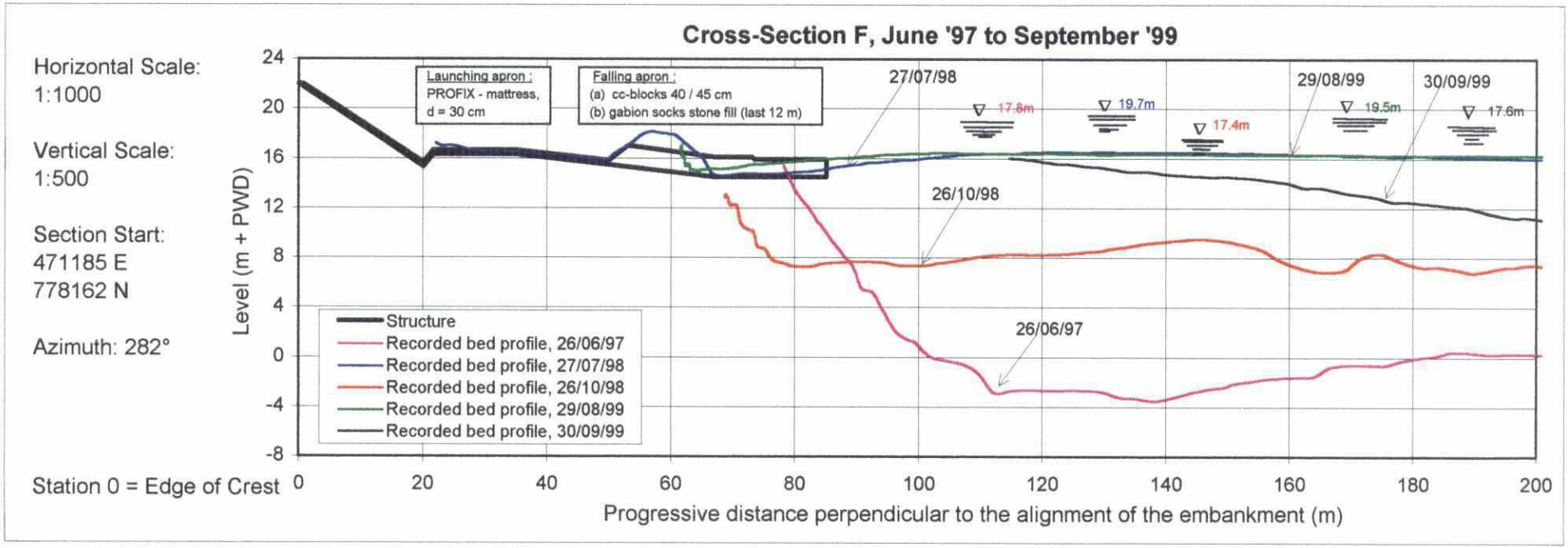
Azimuth: 282°



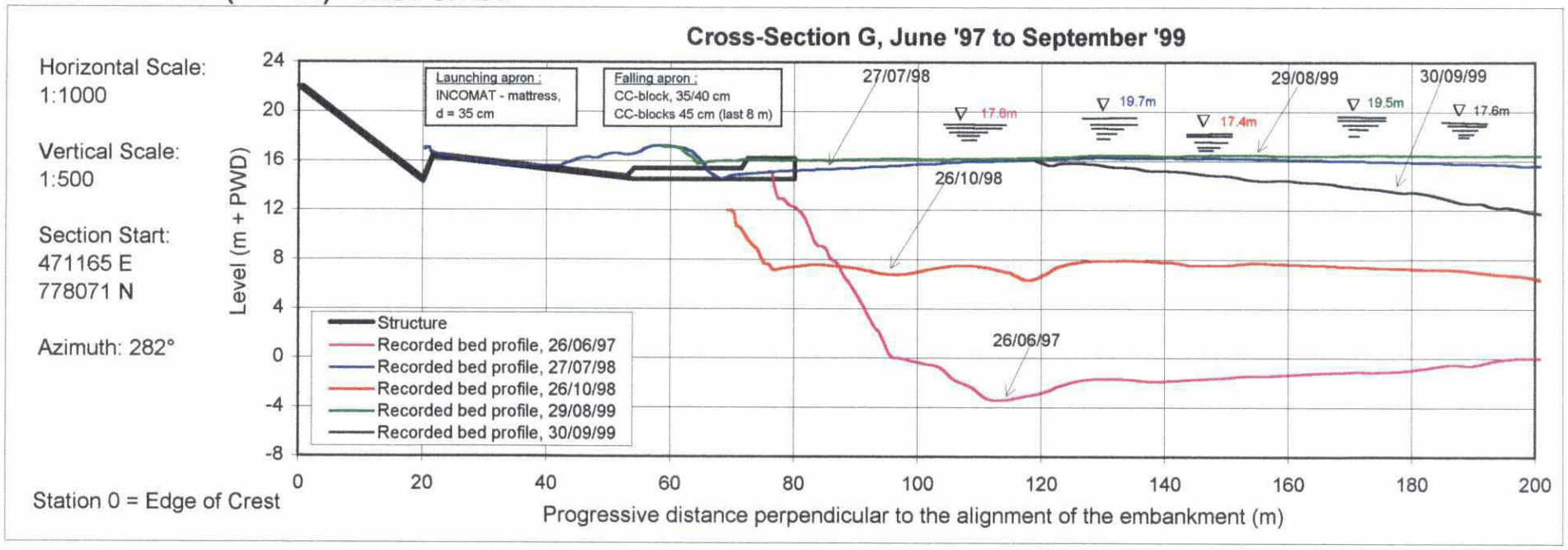
Station 0 = Edge of Crest

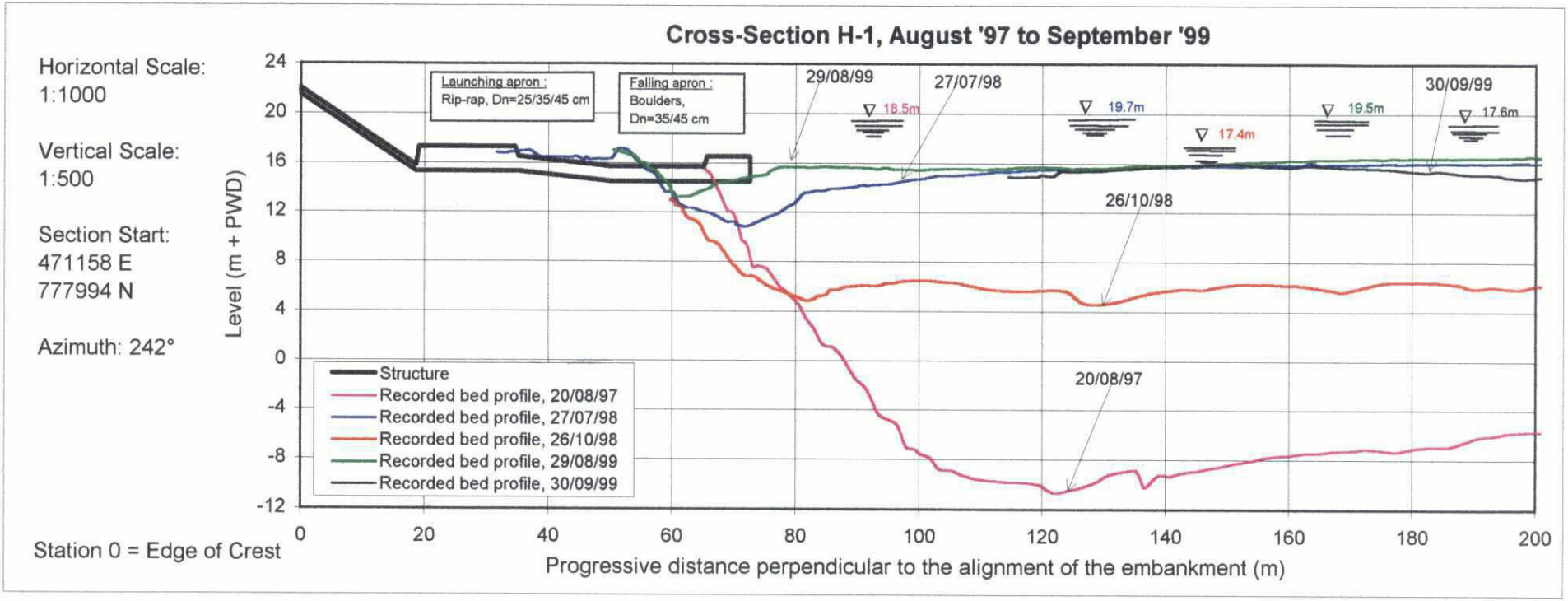
BAHADURABAD (FAP 21) - TEST SITE II



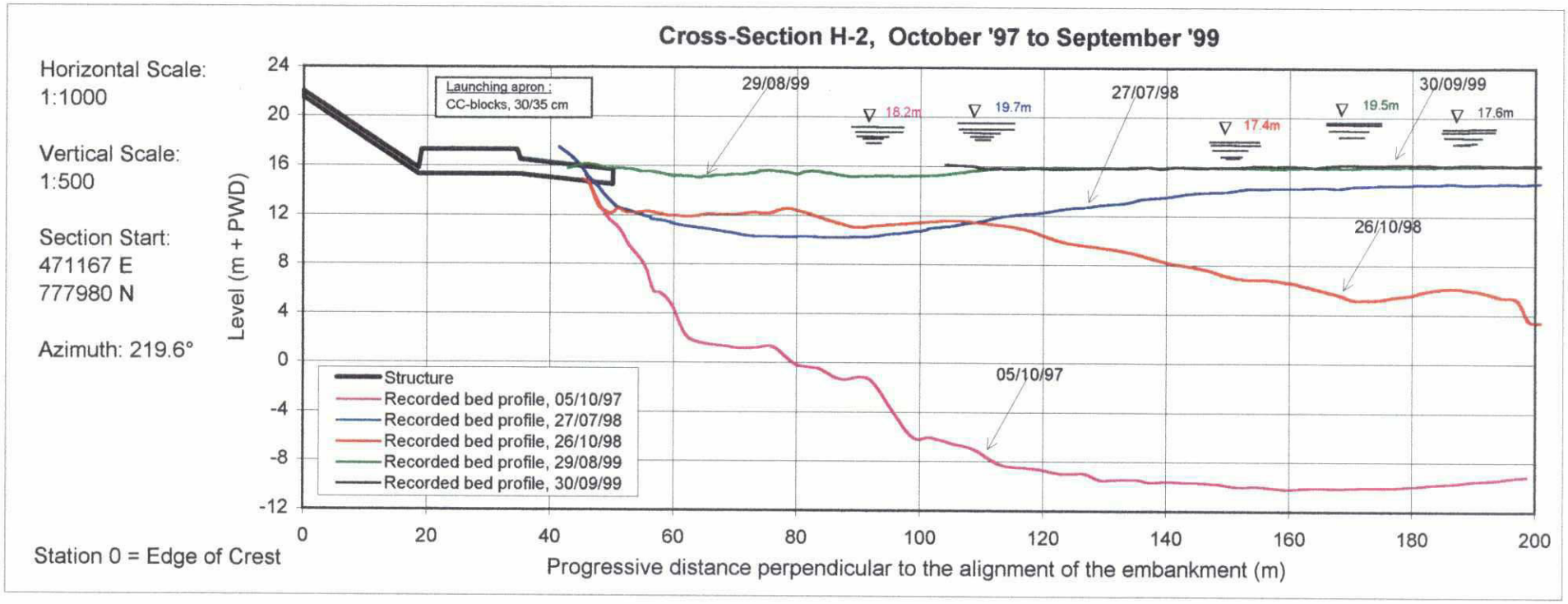


BAHADURABAD (FAP 21) - TEST SITE II





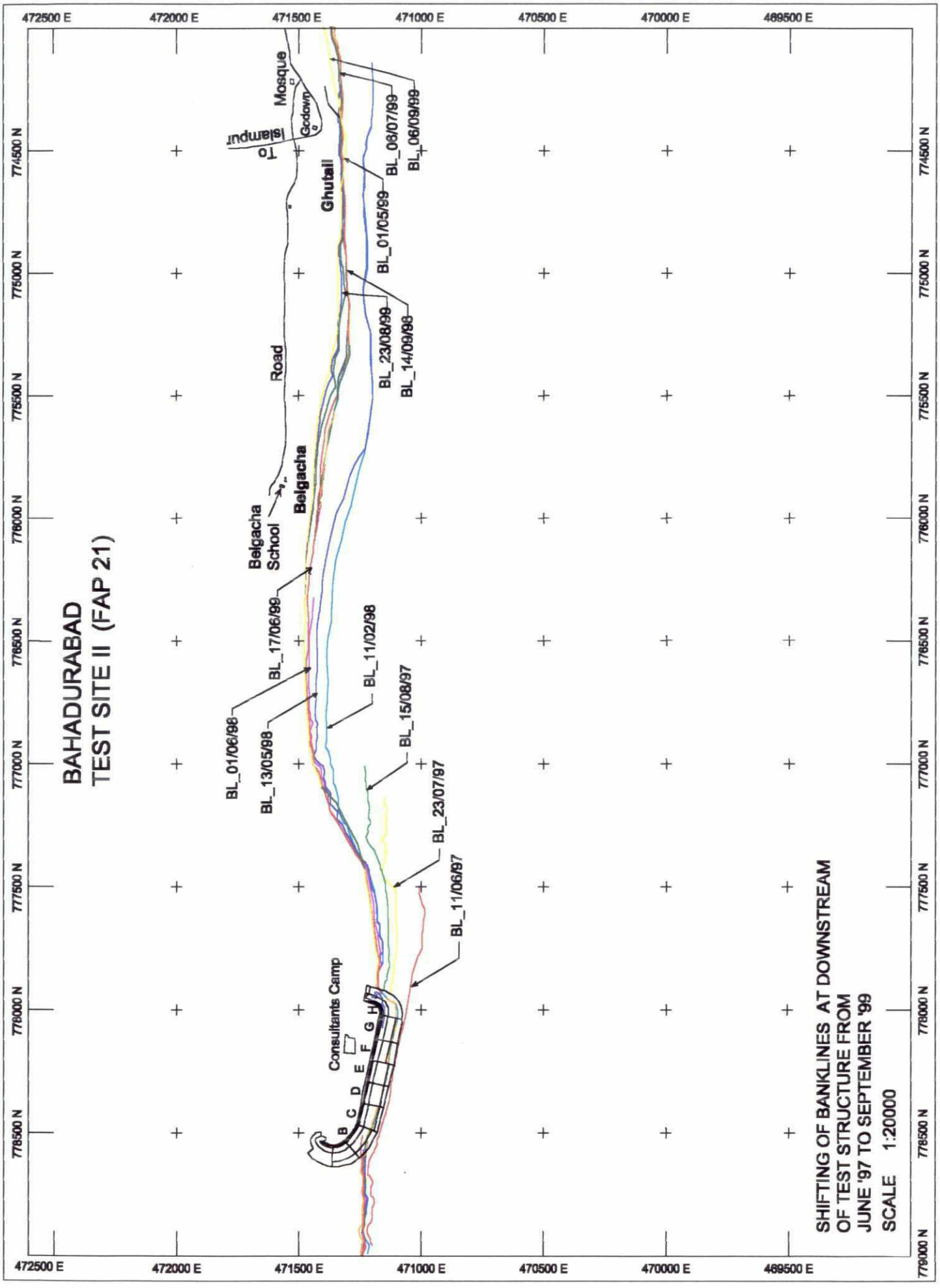
BAHADURABAD (FAP 21) - TEST SITE II



ANNEX K

FAP 21 / Test Site II

- Change of Bankline


BAHADURABAD
TEST SITE II (FAP 21)
SHIFTING OF BANKLINES AT DOWNSTREAM
OF TEST STRUCTURE FROM
JUNE '97 TO SEPTEMBER '99
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
Mosque
Godown
To Islampur
Road
Ghutail
Belgacha
Belgacha School
Consultants Camp
BL_01/06/98
BL_13/05/98
BL_17/06/99
BL_11/02/98
BL_15/08/97
BL_23/07/97
BL_11/06/97
BL_14/09/98
BL_23/08/99
BL_01/05/99
BL_06/07/99
BL_06/09/99
A
B
C
D
E
F
G
H

ภ 6

ANNEX L

FAP 21 / Test Site II

- Photographs

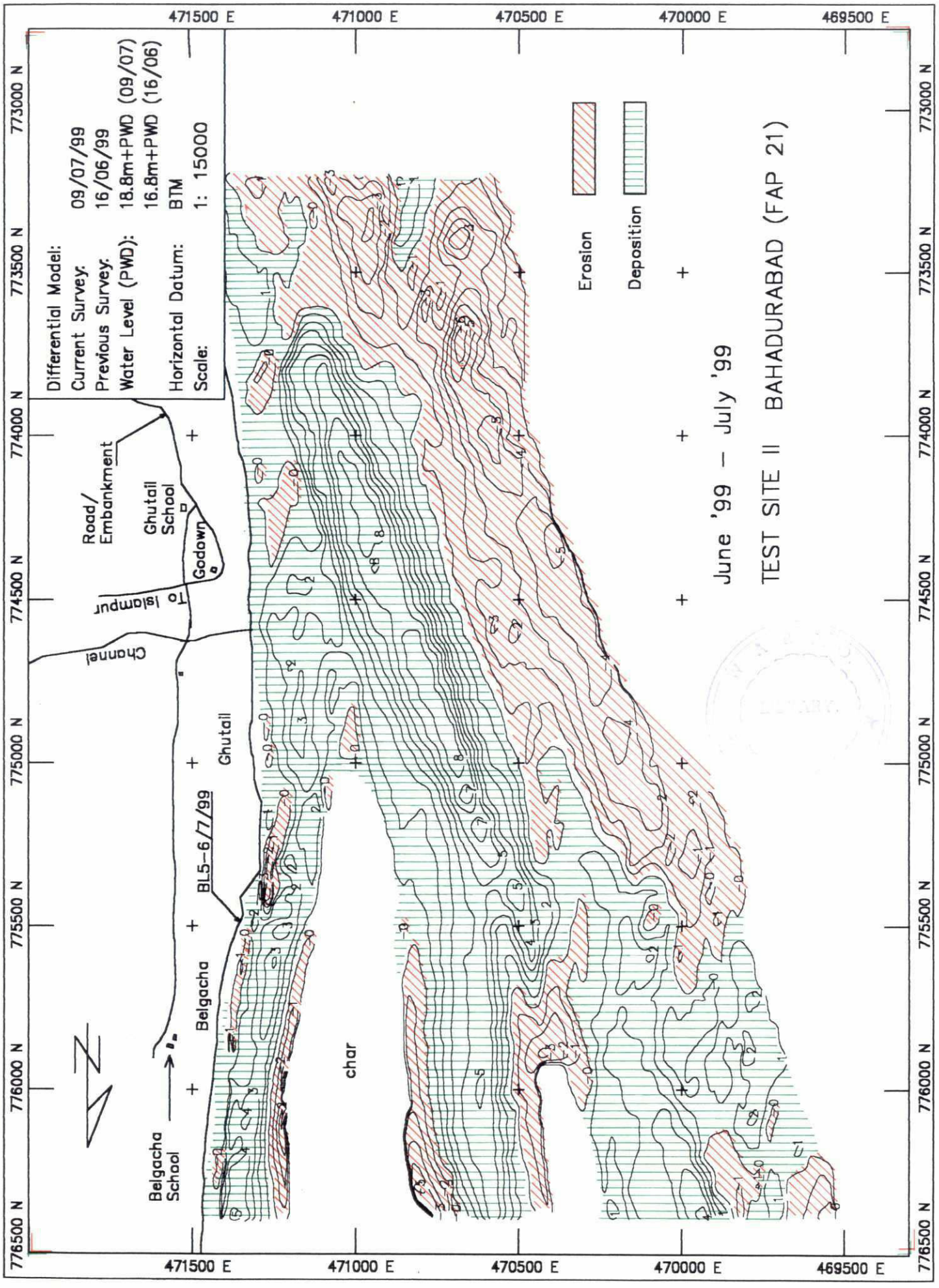
There was not further development at the test site during the period under review.

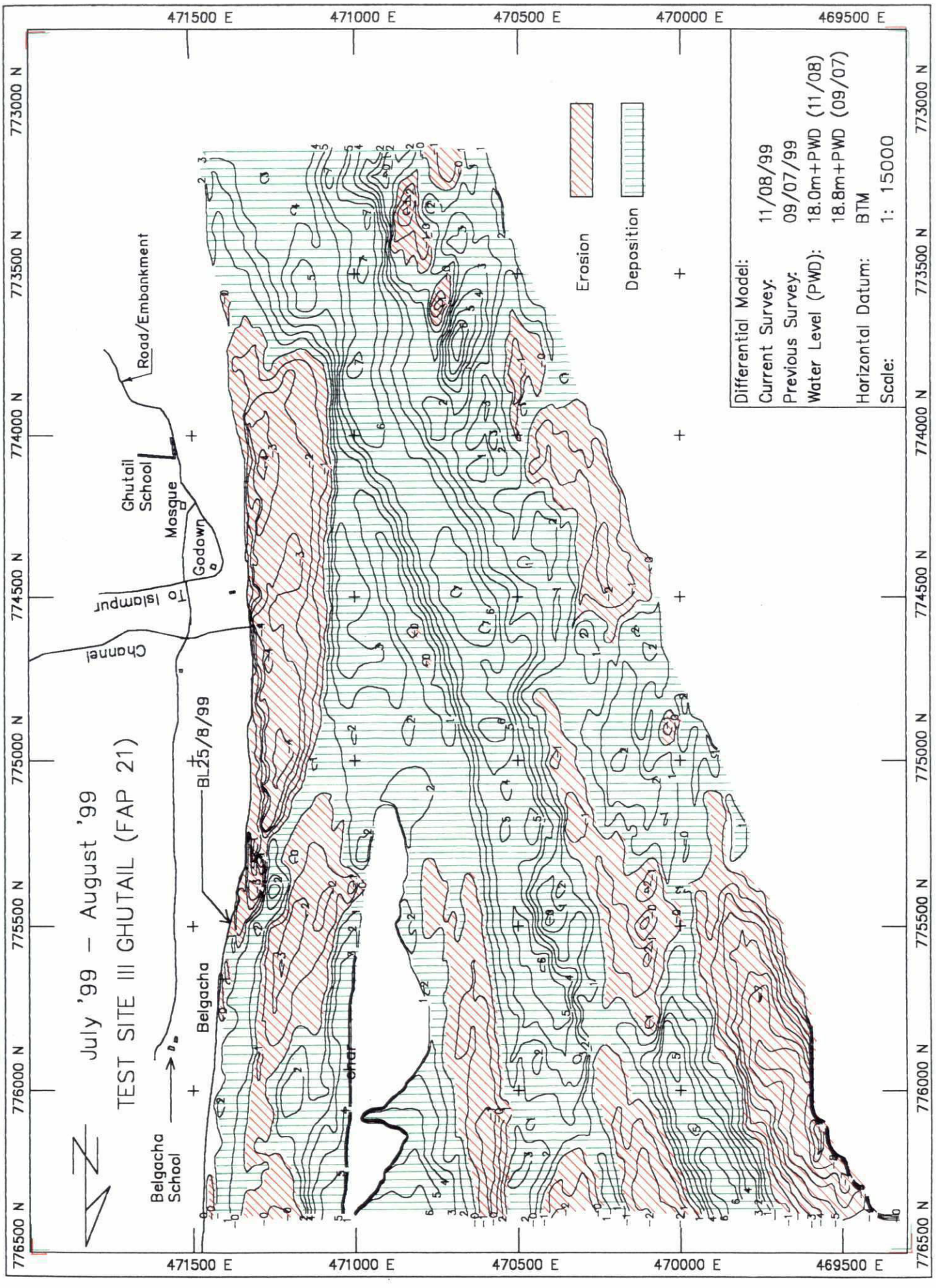
Therefore, there are no photographs.

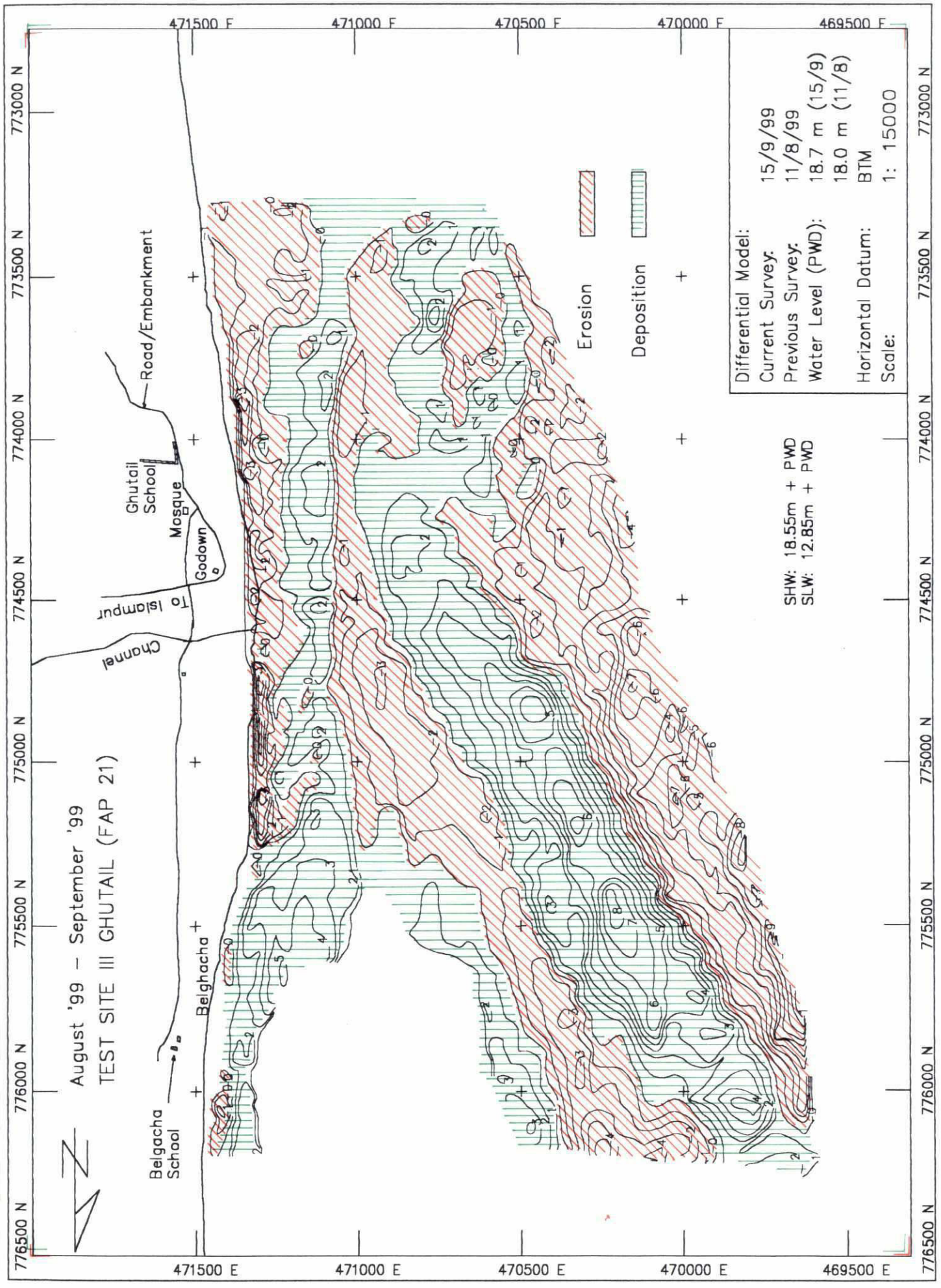
ANNEX M

FAP 21 / Test Site III

- Differential Models at Ghutail


Differential Model:
Current Survey: 09/07/99
Previous Survey: 16/06/99
Water Level (PWD): 18.8m+PWD (09/07)
16.8m+PWD (16/06)
Horizontal Datum: BTM
Scale: 1: 15000
Erosion
Deposition
TEST SITE II BAHADURABAD (FAP 21)
June '99 – July '99
471500 E
471000 E
470500 E
470000 E
469500 E
773000 N
773500 N
774000 N
774500 N
775000 N
775500 N
776000 N
776500 N
Road/ Embankment
Ghutail School
Godown
To Islampur
Channel
Ghutail
BL5-6/7/99
Belgacha
char
Belgacha School

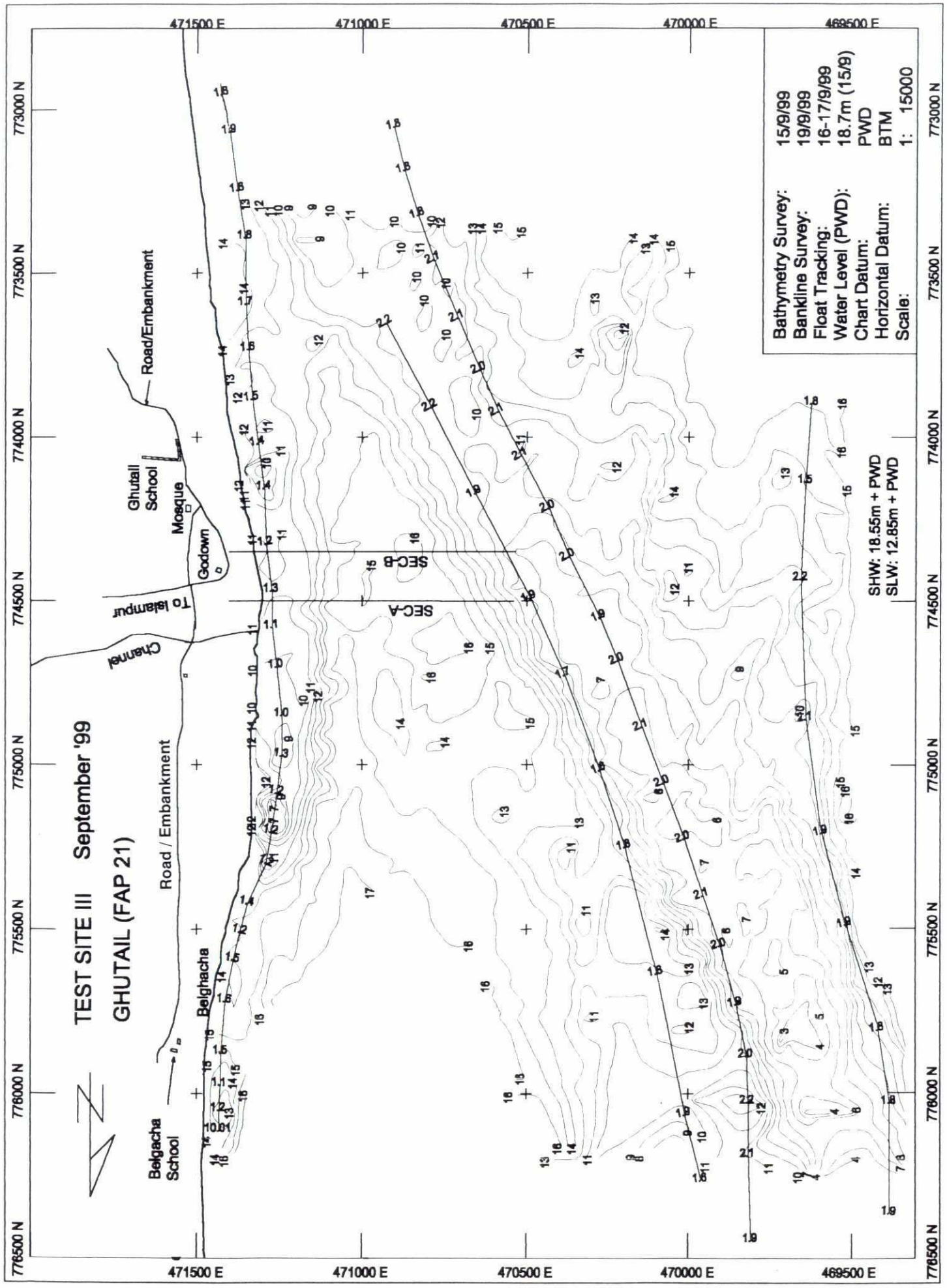

July '99 – August '99
TEST SITE III GHUTAIL (FAP 21)
Erosion
Deposition
Differential Model:
Current Survey: 11/08/99
Previous Survey: 09/07/99
Water Level (PWD): 18.0m+PWD (11/08)
18.8m+PWD (09/07)
Horizontal Datum: BTM
Scale: 1: 15000
Road/Embankment
Ghutail School
Mosque
Godown
To Islampur
Channel
BL 25/8/99
Belgacha
Belgacha School
471500 E
471000 E
470500 E
470000 E
469500 E
773000 N
773500 N
774000 N
774500 N
775000 N
775500 N
776000 N
776500 N

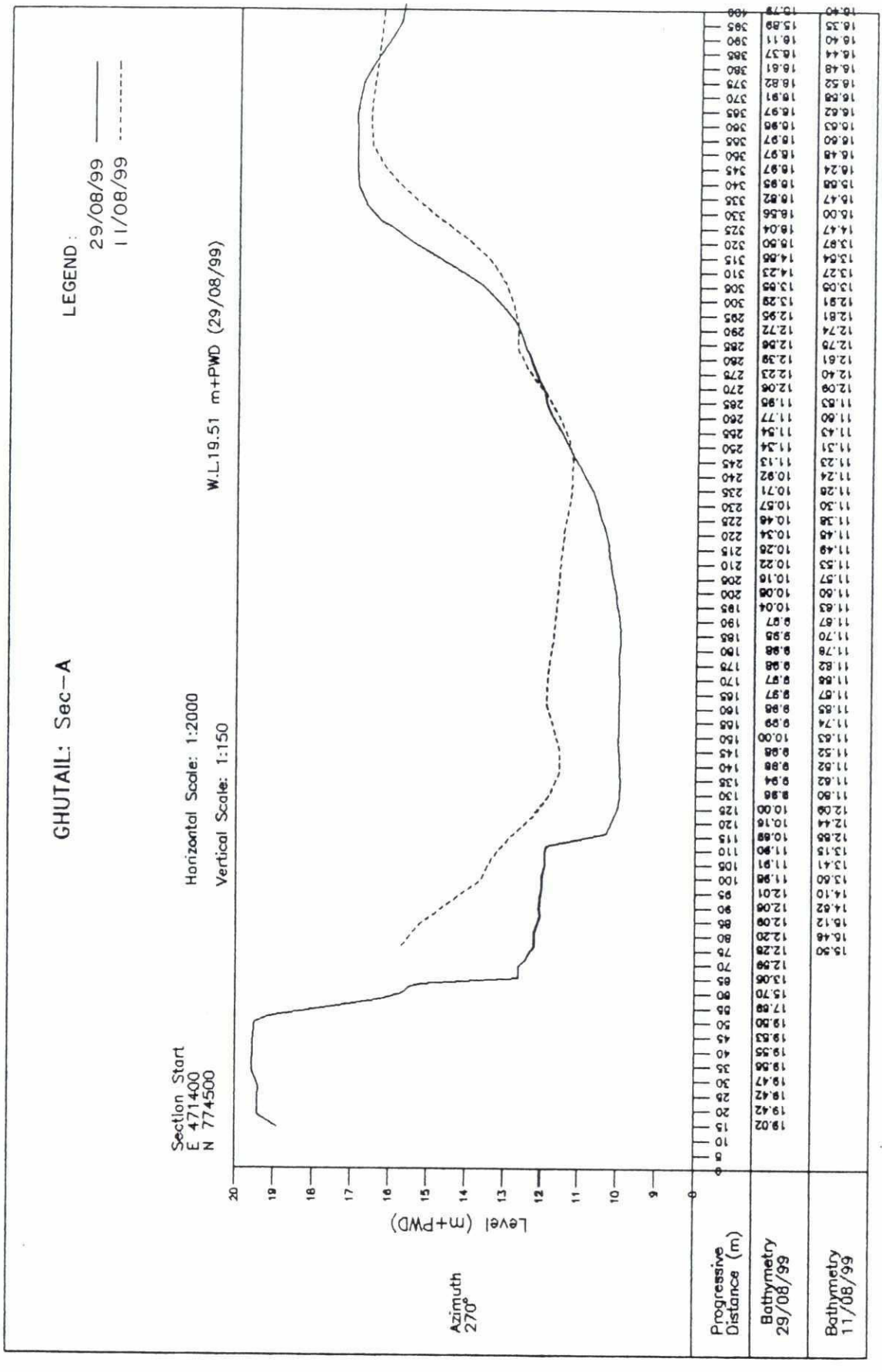

August '99 – September '99
TEST SITE III GHUTAIL (FAP 21)
Erosion
Deposition
Differential Model:
Current Survey: 15/9/99
Previous Survey: 11/8/99
Water Level (PWD): 18.7 m (15/9)
18.0 m (11/8)
Horizontal Datum: BTM
Scale: 1: 15000
SHW: 18.55m + PWD
SLW: 12.85m + PWD
Road/Embankment
Ghutail School
Mosque
Godown
To Islampur
Channel
Belghacha
Belgacha School
471500 E
471000 E
470500 E
470000 E
469500 E
773000 N
773500 N
774000 N
774500 N
775000 N
775500 N
776000 N
776500 N

ANNEX N

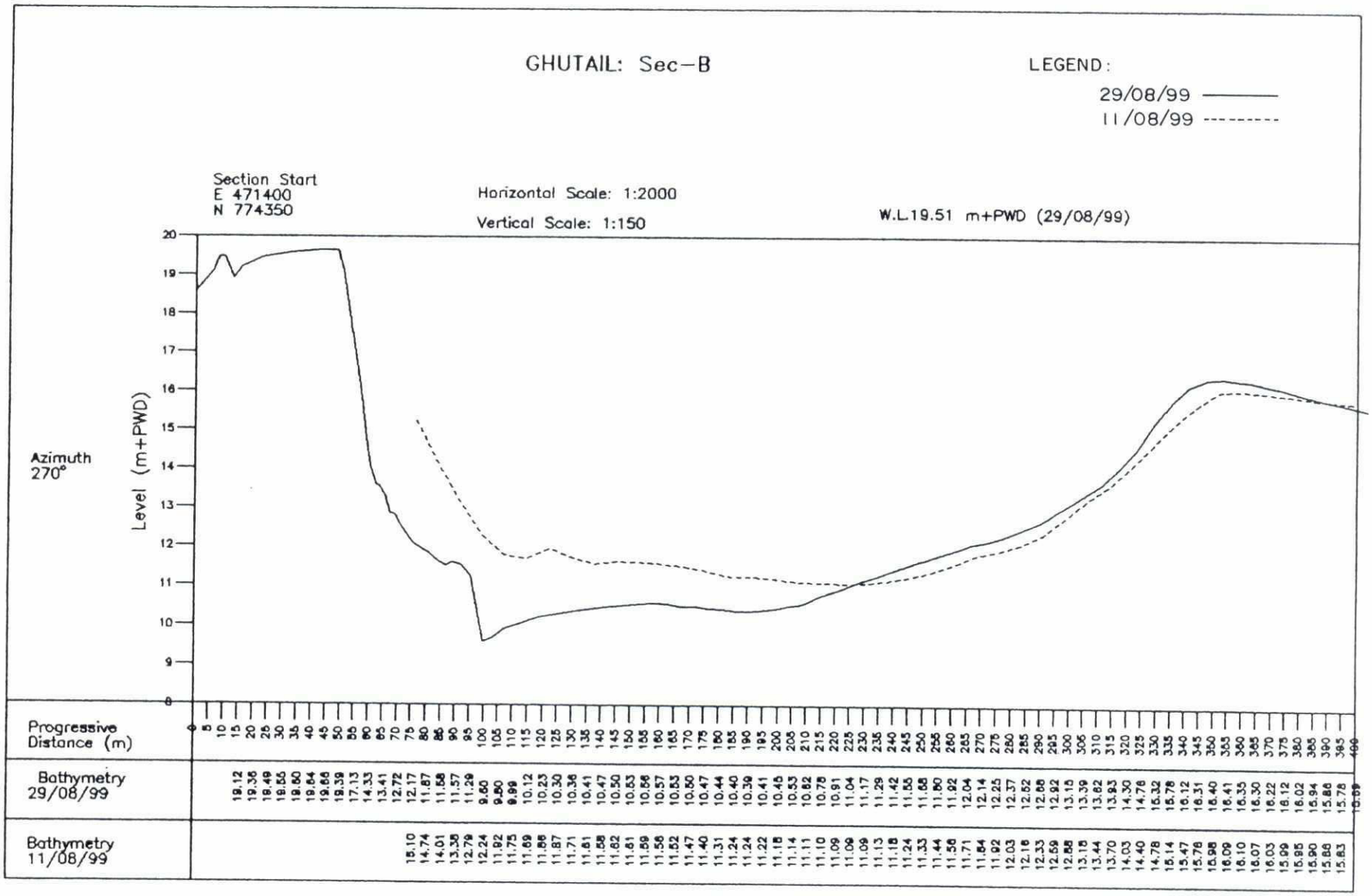
FAP 21 / Test Site III

- Cross-Sections

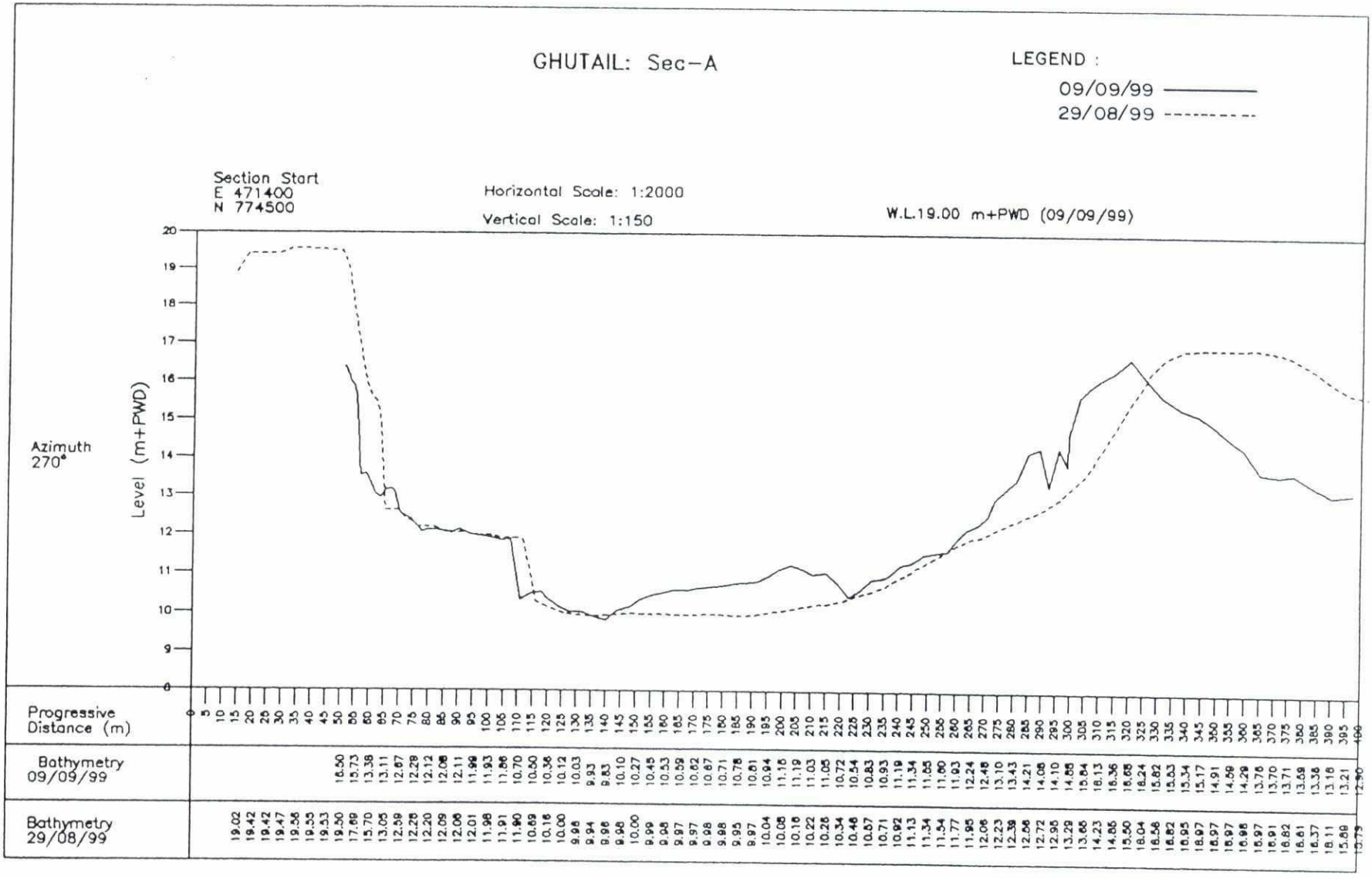

TEST SITE III September '99
GHUTAIL (FAP 21)
Bathymetry Survey: 15/9/99
Bankline Survey: 19/9/99
Float Tracking: 16-17/9/99
Water Level (PWD): 18.7m (15/9)
Chart Datum: PWD
Horizontal Datum: BTM
Scale: 1: 15000
SHW: 18.55m + PWD
SLW: 12.85m + PWD
Road/Embankment
Ghutail School
Mosque
Godown
To Islampur
Channel
Road / Embankment
Belghacha
Belgacha School
SEC-A
SEC-B
471500 E
471000 E
470500 E
470000 E
469500 E
773000 N
773500 N
774000 N
774500 N
775000 N
775500 N
776000 N
776500 N



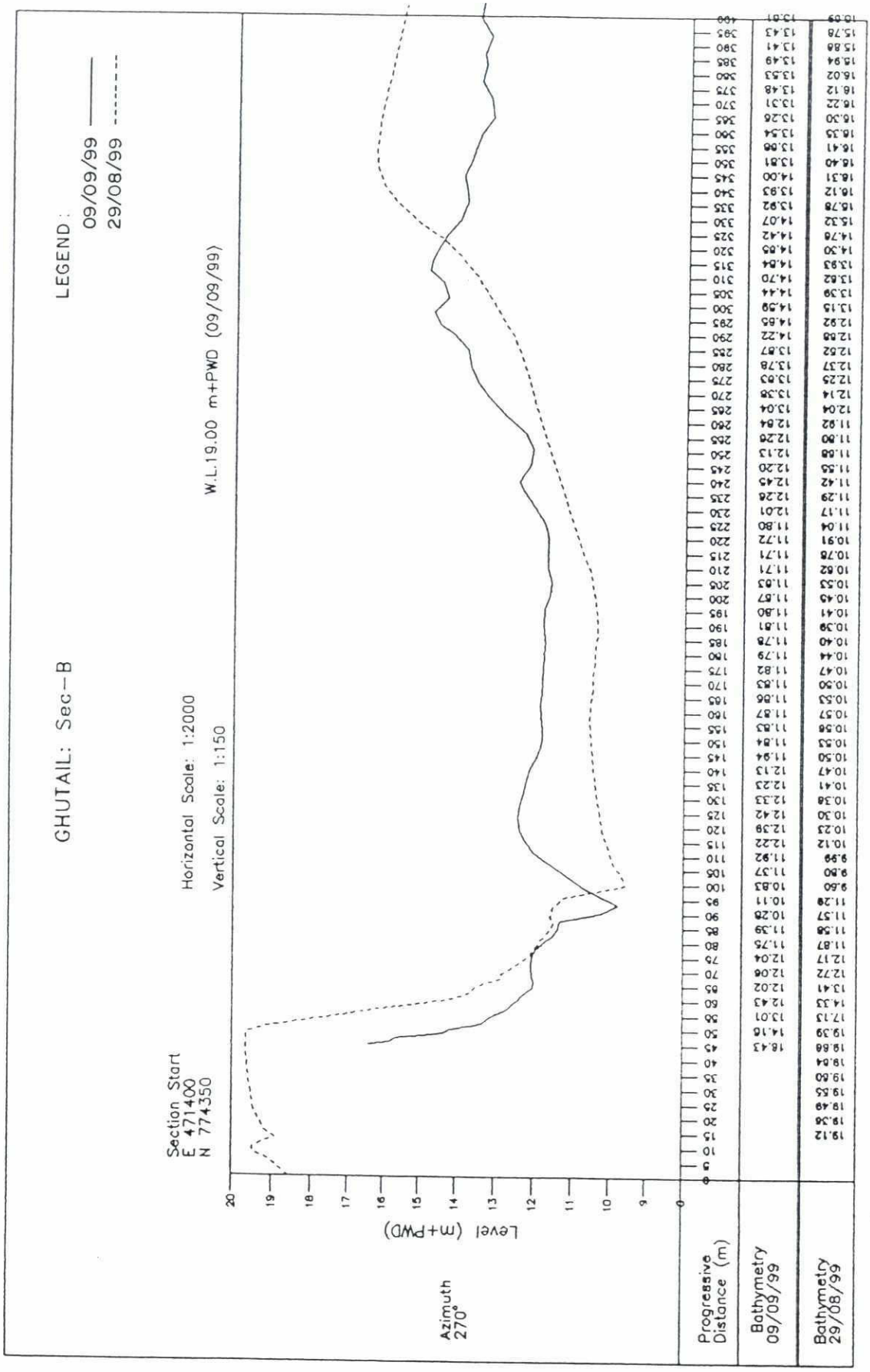
Note: For location see page N-1



Note: For location see page N-1



Note: For location see page N-1



Progressive Distance (m)	Bathymetry 09/09/99	Bathymetry 29/08/99
0		19.12
5		19.36
10		19.49
15		19.55
20		19.60
25		19.64
30		19.66
35		19.59
40		17.13
45	18.43	14.33
50	14.18	13.41
55	13.01	12.72
60	12.43	12.17
65	12.02	11.87
70	12.06	11.58
75	12.04	11.57
80	11.75	11.28
85	11.39	9.60
90	10.28	9.60
95	10.11	9.99
100	10.83	10.12
105	11.37	10.23
110	11.92	10.30
115	12.22	10.36
120	12.39	10.41
125	12.42	10.47
130	12.33	10.50
135	12.23	10.53
140	12.13	10.56
145	11.94	10.57
150	11.84	10.53
155	11.83	10.50
160	11.87	10.47
165	11.86	10.44
170	11.83	10.40
175	11.82	10.39
180	11.79	10.41
185	11.78	10.43
190	11.81	10.53
195	11.80	10.62
200	11.67	10.78
205	11.83	10.91
210	11.71	11.04
215	11.71	11.17
220	11.72	11.29
225	11.80	11.42
230	12.01	11.55
235	12.26	11.68
240	12.45	11.80
245	12.20	11.92
250	12.13	12.04
255	12.26	12.14
260	12.84	12.25
265	13.04	12.37
270	13.36	12.52
275	13.63	12.66
280	13.78	12.92
285	13.67	13.15
290	14.22	13.39
295	14.65	13.62
300	14.59	13.83
305	14.44	14.30
310	14.70	14.76
315	14.84	15.32
320	14.65	16.12
325	14.42	16.78
330	14.07	16.31
335	13.92	16.40
340	13.83	16.41
345	14.00	16.35
350	13.81	16.30
355	13.66	16.22
360	13.54	16.12
365	13.26	16.02
370	13.31	15.94
375	13.48	15.88
380	13.53	15.78
385	13.49	
390	13.41	
395	13.43	
400	13.81	

Note: For location see page N-1

ANNEX O

FAP 21 / Test Site III

- Photographs

Photo 1: Situation in front of sugar cane building and FAP 21 container as on August 24, 1999;
Water level at 18.58 m+PWD

Photo 2: CC-block production in progress on September 20, 1999

ANNEX P

FAP 21/22

- Table of Contents of
  - Final Evaluation Report;
  - Guidelines, and
  - Design Manual

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