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MINISTRY OF WATER RESOURCES
BANGLADESH WATER DEVELOPMENT BOARD

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MEGHNA ESTUARY STUDY

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TECHNICAL NOTE MES-024

STATUS SURVEY VESSELS AND EQUIPMENT

August 1998

DHV CONSULTANTS BV

in association with

KAMPSAX INTERNATIONAL
DANISH HYDRAULIC INSTITUTEDEVELOPMENT DESIGN CONSULTANTS
SURFACE WATER MODELLING CENTRE
AQUA CONSULTANTS AND ASS. LTD.

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Technical Note on:

STATUS SURVEY VESSELS AND EQUIPMENT

Dhaka , April 1998

Project Name	:	Meghna Estuary Study (MES)
Location	:	Meghna Estuary
Key words	:	State of "Anwasha", tender vessels, equipment Outstanding repairs, continuation of operations Operational time. Exploitation and operational costs

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1. PREAMBLE AND CONCLUSIONS

This report is made up within the objectives of the Mission Technical Advisory on the Institutional Arrangements for Meghna Estuary Development. The report is also a continuation of previous missions under the Activity BD 012101 of the Foreign Affairs of the Netherlands / Royal Netherlands Embassy – Dhaka, in relation to the Meghna Estuary Study (MES) project.

Previous mission reports date from:

- June 1995 – repairs of the survey vessel “Anwasha”
Estimate of expected works and costs for outstanding maintenance of Anwasha including new survey equipment for the MES project.
- March 1996 - repairs of the survey vessel “Anwasha”
Final inspection of the works carried out on “Anwasha” prior to mobilisation of the vessel for the MES project.
- November 1996 – maintenance advice.
Provisional report and scheduled advice for maintenance, especially in relation to the propulsion- and other mechanical systems on board of the Anwasha.

A sort review of past activities of the Anwasha is attached as Appendix A.

The objective of the mission is to prepare a concrete plan for the future of the Anwasha with its pertaining boats and equipment with operation based on commercial principles. The conclusion in this regard has been laid down in the Mission report dated March 7, 1998.

As summary, it can be concluded that the Anwasha in its present state is still fit for another 8-10 years service under the provision that certain maintenance/repairs will be completed.

Continuation of its operational condition has a financial consequence. These costs can be considered in principle on a yearly repeating basis, however is excluding any calamity.

From the past period of activities under the MES project, an operational period has been achieved of about 65% of the year (about 235 calendar days). The remaining time has been spend to waiting and repairs.

A commercial cost figure can be prepared by the future operators according the example calculation presented in Chapter.

2. PRESENT STATE OF ANWESHA AND OTHER EQUIPMENT

2.1 m.v. ANWESHA

With reference to the Appendix B- giving the status of November 1996, a number of recommendations have been followed up or have been implemented under the MES-project.

From the recommendation of November '96 the following subjects remain:

Ad 4) Major overhaul of the propulsion- and generator engines.

As result of the visit together with the engineer of Caterpillar, an offer for spare parts and supervision of the overhaul by an engineer of Caterpillar from the Netherlands was presented.

As follow up a repair has been undertaken by the engineer of the Anwesha starting in February 1998 (?). For this overhaul a number of spares are procured by DNV-MES. However it is not clear if this overhaul is completely covering the advised works, e.g. if replacement of main bearings is incorporated.

It is therefor strongly recommended that DNV-MES prepares a complete report, based on the engineers logbook, giving a full statement of all replacements, parts used and adjustments made to the propulsion-, generator-, harbour- and tender engines.

Ad 6) Additional measures not yet executed:

- Installation of propeller shaft brakes
- Installation of a frame around the propellers against wires
- Adaptation of propeller shaft seal.

2.2 Tenderboats T3 and T4

The aluminium tenderboats – hull in very good condition.

Continuous attention has to be paid to the impeller clearance inside the waterjet housing. In time replacement is the only way to ensure the speed of the boats. Wear is due to shallow water conditions containing sand particles.

2.3 Inflatable speedboat

The rubber dinghy with outboard motor is in reasonable good condition.

2.4 Survey equipment

A visual check is insufficient to judge the status. All equipment is in operational condition.

An inventory of the survey equipment and pertaining software is attached as Appendix D.

3. TECHNICAL ITEMS STILL OUTSTANDING/ ADDITIONAL

3.1 Outstanding (reference Chapter 2)

Major overhaul (item 4))

The overhaul should be completed with a full detailed report of the extend of undertaken repairs.

Additional measures (item 6)

- Installation of propeller shaft brakes
- Installation of a frame around the propellers against wires and fishing nets
- Adaptation of propeller shaft seal,

Above mentioned measures have (probably) not been implemented for reasons of financial impact and time.

Nevertheless, and although the Anwesha and her tenders have been able to complete the envisaged survey schedule in the MES project, the additional measures remain important to be carried out in direct future.

It should be noted that principle drawings could be made available for:

- Installation of propeller shaft brakes
- Adaptation of propeller shaft seal,

Procurement of these items is at limited costs.

The "Installation of a frame around the propellers against wires", remains a sensitive subject which should be taken up with the Classification Society. This Body might object in principle for reasons of danger when grounding the vessel. A basic drawing can be made available.

3.2 Additional technical items to ensure/ improve future operations:

- 1) To balance the PS generator engine – presently subject to vibrations when running on 100 % load
- 2) An additional echosounder tube might be installed on SBside – from maindeck through SB aft fuel storage tank- housing the presently mounted outboard transducer. Within the experienced operational conditions of the past period, this outboard position is too hazardous and subject to vibrations.
- 3) PS and SB waterstorage tank to be separated by valves in such way that heel compensation can be done by ballasting with fresh water.

- 4) Repair of harbour set control panel
- 5) Battery charger, made Sailor, needs repair
- 6) Navigational echosounder: transducer positioned in a well in the foreship needs replacement (dry docking required)
- 7) Procurement and installation of a new condenser unit for central Airco installation
- 8) Procurement of four (4) numbers off propellers (2*SB + 2 * PS)
The present (fitted) propellers have been repaired now too many times.
The spare propellers are in a poor condition and not worth too be repaired again.

4. CONTINUATION OF OPERATIONAL CONDITION OF M.V. ANWESHA

4.1 Spare parts consumption and position.

The registration system used in Chittagong where the main bulk of spares are based is not adequate.

Incoming spares have been accurately recorded batch-wise, however this system doesn't give an easy itemised reference of incoming/ outgoing/ remaining stock.

For the onboard spares, the engineer has made up an itemised system suitable to be converted into a computer spreadsheet system.

After Nov. 1996, another batch of spares has been procured by MES in Nov 1997. A complete review of procured and used parts could not be made in the short period of the mission.

The total value of procured parts since November '96 amounts about Dfl 150.000, =, including a new propulsion gearbox.

The exchange of (main) parts during the period Nov. 1996 – Feb 1998 is given in Appendix C. This listing refers only to main repairs of 1 mainengine, 1 generator engine, harbour engine and tender engines.

4.2 General recording of events

The present engineer has set up a Logbook for engineroom events.

Logging of events is done by the engineer in a form of computer statements, using a standard lay out, presenting:

- running hours of each engine
- fuel consumption of each engine
- lube oil consumption of each engine

A separate computer for the engine room would be most helpful.

The procedure for measuring the fuel consumption is rather complicated. A solution for this is a rather expensive measuring system of a consumption meters in the relevant 5 supply lines and at least one return line meter, however not common for such a small vessel.

Based on the detailed measurements carried out during last year operations, average fixed consumption figures are calculated by the engineer. These figures have been compared with theoretical figures and look quite acceptable. A comparison of theoretical and actual (calculated) figures is presented in Appendix F.

The present responsible captain keeps a logbook for sailing operations. Due to lack of time, this book has not been verified.
The continuation of these recordings remains important.
A separate computer with printer made available to captain and/or engineer would make the recording easier.

4.3 M.V. Anwasha

a) Lifetime

The age of the vessel is now about 18 years. A normal lifetime of 25 years is applied based on depreciation.

However, under the condition of proper maintenance lifetime up to and over 30 years is not uncommon.

b) Class certification

The vessel is classified under Lloyd's. The continuation of the hull and machinery certificates should be followed up as by schedules of the Classification Bureau.

Although this is no guarantee, it safeguards minimum regular inspection and an assessment of the hull condition and propelling installation.

c) Major engine overhaul - See Chapter 3.1.

A part of the job has started in Feb 1998 by replacement of the 8 cylinders complete with liners of the PS main engine.

The SB generator engine has been repaired for a cracked cylinderhead cover.

Overhaul to be completed and full report to be submitted.

d) Additional modifications/ improvements

See Chapter 3.2.

4.4 Tenderboats T3 and T4

The condition of these boats with an aluminium hull is very good.

The boats have been procured 1990.

The main concerns are:

- Proper maintenance of the engines.
- Regular inspection of the pumpjet. Especially the clearance of the impeller in the housing shall be regularly inspected and if required parts to be changed.

4.5 Inflatable speedboat

No further comments

4.6 Hovercraft

Not yet available, no further comments

4.7 Survey equipment

Maintenance of gear/equipment exposed to weather/ waterconditions. The storage of computer equipment shall be in a conditioned space also when not in use.

5 PENDING REPAIR- AND IMPROVEMENT COSTS

Repair costs

These costs refer to the remaining engine overhaul costs and the costs for additional measures for improvement of future operations.

Costs estimate

1) remaining engine overhaulcosts – parts	Dfl	40.000
2) shaft brakes	Dfl	4.000
3) propeller frame – design and fabrication	Dfl	10.000
4) new shaft seals (2 + 4 spare)	Dfl	3.000
5) balancing PS generator engine	Dfl	p.m.
6) additional echosounder tube	Dfl	5.000
7) Waterstorage change into ballast system	Dfl	5.000
8) new transducer for navigational echosounder	Dfl	4.000
9) new condenser for central airco installation	Dfl	5.000
10) Procurement of 4 new propellers	Dfl	40.000
11) administration computer on board	Dfl	4.000
total costs, excluding import duties (abt 72,5%)	Dfl	120.000
assistance from The Netherlands/ contingencies	Dfl	30.000
Total advised budget	Dfl	150.000

Note: costs are excluding transport

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6. OPERATIONAL TIME PER YEAR

A recording of "trip days" is presented in Appendix E.

The recorded trips are split up in actual sailing/ surveying days and waiting-and/or repair days.

The average duration, including some waiting time, of each trip is about 18,5 day = 2,5 weeks.

As rough indication for the year 1997, the operational period counts about 235 days, which equals 65% calendar days.

The extrapolation of repair days to 95 days on a yearly base, seems a bit too exaggerated and might be limited to about 70 days.

The remaining time might than be split in 15% waiting days per year and 20% repair/maintenance days per year.

The conclusion of 65% operational time per year might be disputable on the basis of 14 months operation in the MES project. The weather conditions can play an important role also. On the other hand other type of vessels, such as dredgers which are exposed to similar problems and also fighting always maintenance and repair problems, come to similar operational percentiles.



7. EXPLOITATION COSTS

7.1 Capital costs

Basically the yearly capital costs consist of:

- depreciation
- costs of interest for loans

For cost-price calculations (in case yearly income is unknown or neglectible) loss of interest on "own invested capital" might be considered.

Depreciation might be governed by the economical- or technical lifetime.

In an economical consideration the depreciation might be subject to fiscal regulations. In a technical consideration the lifetime might be spread over 20-25 years for the Anwesha (this will be much lower e.g. for a Hovercraft).

Instead of a linear depreciation, higher "start" depreciation can be used against a lower "end" depreciation (e.g. start 1,6* average depreciation against end 0,4* average depreciation). However in such case the costs for maintenance and repair have to be distributed in a correct way: viz. increasing costs at ageing of the vessel.

Interest is in fact only applicable for calculation of the commercial profit.

Although above costs considerations are not be applicable for the Anwesha with appertaining boats and equipment for historical reasons, a rough impression of life-time and values might be given as follows:

Equipment	Procurement	Lifetime	Market	Replacement
	Date /price	remaining price	price	price
<u>Anwesha</u>	1980	25 years		1999
	Dfl 4 mill.	Dfl 1,3 mill.		Dfl 7,5 mill.
	Taka 80 mill.	Taka 26 mill.	Taka 20-40 mill.	Taka 150 mill.
<u>Tenders</u>	1990	15 years		1999
	Dfl 0,15 mill	Dfl 0,1 mill		Dfl 0,3 mill
	Taka 3 mill	Taka 2 mill		Taka 6 mill
<u>Hovercraft</u>	1998			1999
(+ rubberboat)	Dfl 0,2 mill	Dfl 0,2 mill		Dfl 0,2 mill
	Taka 4 mill	Taka 4 mill		Taka 4 mill
<u>Survey equip.</u>	1996	5 years		1999
(incl process	Dfl 1,0 mill	Dfl 1,0 mill		Dfl 1,0 mill
and	Taka 20 mill	Taka 20 mill		Taka 20 mill
post-process)				

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7.2 Operational costs

To establish figures for operational costs in future, the respective items are elucidated where considered applicable or relevant to this report.

Operational costs consist of costs for:

- 1) maintenance and repair
- 2) Fuel- and lubrication oil
- 3) Fresh water
- 4) Staffing salaries and extra remuneration's
- 5) Victuals
- 6) Management- and shore provisions
- 7) (Harbour – and pilot services)
- 8) (Insurance's)

7.2.1 Estimated costs schedule for regular maintenance

Because of the mainly shallow-water conditions where the surveys are made, the Anwesha is functioning more as a mother/supply vessel for the tenders than being engaged herself in surveying. The tenders (and Hovercraft) do the actual survey work.

This results in the following "running hours" for various engines:

m.v. Anwesha

Main engines	1500 hours each/ year
Generator engines (9 hours each/day)	2500 hours' each/ year
<i>(2 generators*9 hrs*235 days – ~4250 hours + waiting – ~5000 hrs)</i>	
Harbour engine (6-hours/ night)	1500 hours

Tenderboats	1500 hours each/ year
-------------	-----------------------

A basic maintenance schedule is attached as Appendix G (already presented in the previous report). This schedule remains still applicable and has been only revised for the running hours for the generator sets (2500 hours i.l.o. 1500 hours).

Based on the running hours a cost estimate schedule is presented in Appendix H.

It can be concluded from this Appendix that about Taka 1,3 million for Anwesha and Taka 0,35 million for the tenderboats is needed.

An extra allowance for the survey equipment, Hovercraft, rubberboat etc might be added of at least Taka 0,1 million.

Total budget required is than about Taka 1,75 million on a yearly base.

It should be realised that this estimate is adequate for let's say the coming 3 years. On the long term, other events might occur e.g. special Class surveys, which include some extra costs.

7.2.2 Fuel-/ lub oil consumption

The consumption during the period Nov. '96 until Feb. '98 has been recorded on board, reference Appendix F.

As already indicated the operations of the Anwesha are limited in surveying.

Due to this the theoretical consumption calculation results in a higher consumption than actual. Especially the consumption of the main engines is lower.

The total consumption (including the tenders) amount about 250 m3 (about 200 tons) fuel oil and 2,5 m3 (about 2 tons) lubricating oil. Petrol for the inflatable raft is not recorded.

All together on a yearly base these costs amount about Taka 3,5 million.

Prices taken into account:	Diesel oil per litre	12,6 Taka
	Lubricating oil per litre	54,6 Taka
	(Petrol per litre	20,6 Taka)

7.2.3 Fresh water

Costs of freshwater (potable)/ m3 unknown.

No consumption recorded, but costs hereof can be easily retrieved on a yearly basis.

7.2.4 Staff salaries and extra remuneration

It is evident that the present personnel, especially the officers including surveyors, have built up an experience, which is of great value.

It is supposed that this team will be kept sufficiently motivated for engagement in future operations. In this context, the remuneration should be in line with seagoing operations. Also during the MES project financial compensations for the staff/crew have been applied. For reasons of discretion salaries have not been further investigated. Since there is a considerable difference in the theoretical staffing schedule and actual schedule as used in the MES project (see Appendix I), a proper practical schedule should be established first.



7.2.5 Victuals

Costs of victuals for the total crew have not been investigated.

7.2.6 Management- and shore provisions

Costs can be split up in management costs as an overhead figure.
For shore provisions the actual costs of electrical shore power can be taken into account as well as some maintenance costs for jetty provisions.

7.2.7 Harbour- and pilot services

Supposed not applicable

7.2.8 Insurance's

Applicability depending on the Body responsible for the vessels and equipment.

8. OPERATIONAL COSTS

Based on e.g. 235 operational days per annum and the cost figures for the (applicable) items as derived in Chapter 7, an operational cost figure per day can be determined.

It might be realised that the scope of equipment is such that services can be offered on varying equipment schedules. As example: the Anwesha with or without the tenders or Hovercraft in combination with or without survey equipment.

It seems therefor more logical to make separate cost schedules for the boats and survey equipment with processing and post-processing facilities.

As a rough but not complete indication, the "operational cost per day" amount:

Cost item	Anwesha Taka	Tender 3 Taka	Tender 4 Taka	Hovercraft Taka	Survey Equipment Taka
Maintenance/ Repair	1,3 million	0,17 million	0,17 million	0,07 million	0,03 million
Fuel-/luboil	2,8 million	0,35 million	0,35 million	0,7 million(?)	n.a
Fresh water	0,5 million(?)	n.a	n.a	n.a	n.a
Total	4,6 million	0,525 million	0,525 million	0,8 million (?)	0,03 million
Per day	20,000 Taka	2,500 Taka	2,500 Taka	3,500 Taka	
Staff/crew Salaries + compensation					
Victuals					
Management/ Shore provisions					
Estimated Day costs *)	60,000 Taka	5,000 Taka	5,000 Taka	7,000 Taka	10,000 Taka
Commercial Day costs *)	75,000 Taka	6,000 Taka	6,000 Taka	10,000 Taka	15,000 Taka

*) It should be realised that these figures are meant as an example and lacking proper figures.

It might be clear that e.g. for the survey equipment additional cost (depreciation/ replacement value) should be taken into account. Also a split up for various survey-, processing and post-processing components have to be made. In this way a balanced day-cost figure can be made available for internal use as well as for external use in case of hiring-out of equipment.

The figure for an independent unit should be compared with similar local facilities for hire.

J.A. Piët
BvS - (Bureau voor Scheepsbouw)
Bloemendaal – The Netherlands

1998-04-22

Project: Meghna Estuary Study (MES)
Activity: BD 012101
Stage: Operational condition m.v. Anwesha
Contractor: BvS/ 1084 -4
Report period: 26-2-'98 – 6-3-'98
Report: review technical condition

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APPENDIX A

Chronological reviews of the major activities the m.v. Anwesha.

1980:	Delivery m.v. Anwesha
1991-1992:	Overhaul m.v. Anwesha, docking, replacement of tailshaft with bearings and mainengine supports, installation of harbour generator, engine overhaul (?). Lloyds survey.
May 1995:	Delivery of tender 3 & 4 Inspection & docking of m.v. Anwesha Listing of visible repairs and works Listing of required parts Listing of additional (nautical) equipment for future survey installation
March 1996:	Completion of major repairs Lloyds survey
June 1996:	Mobilisation of the vessel and completion of installation of extra nautical- and survey provisions
July- September 1996:	First survey period
November 1996:	Engine inspection by Geveke –Caterpillar dealer – the Netherlands Replacement of PS mainengine gearbox Docking of the vessel
December 1996- February 1998:	Engagement in survey works MES including a dry-docking in June/July 1997
February 1998	partly overhaul of engines
September 1998	Termination of the MES project

Project: Meghna Estuary Study (MES)
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APPENDIX B

The Maintenance advice report of Nov 1996 contained the following recommendations:

- 1) Present responsible engineer needs an assistant to complete the outstanding works as well as regular works on board. Presently only assistance is a greaser.
- 2) Introduce proper procedure for use of network engines.
- 3) Complete outstanding works on board with parts supplied.
- 4) Overhaul Caterpillar engines early 1997 under the lead of engineer from Geveke.
 Involvement Caterpillar Bangladesh - Getco by an assistant engineer during overhaul.
 Involvement Anwesha engineer and assistant.
 Parts and tools supply from the Netherlands.
 Dry-docking for tailshafts (not required for engine overhaul)
- 5) Introduce proper maintenance schedule by:
 Engineroom logbook.
 Basic maintenance schedule.
 Split of spares in "on board" and "ashore".
- 6) Installation of propeller shaft breaks
 Installation of wire protectors
 Adaptation of propeller shaft seal
 Recording on drawings of changes/ repairs carried out, by own staff or external
- 7) Maintenance of shore power supply at jetty in Chittagong.

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Project: Meghna Estuary Study (MES)
Activity: BD 012101
Stage: Operational condition m.v. Anwasha
Contractor: BvS/ 1084 -4
Report period: 26-2-'98 – 6-3-'98
Report: review technical condition

APPENDIX C-1

Anwasha - Main parts replaced during operational period Nov. '96-Febr '98

Part-name	Quantity	Part-number
<u>Main engines – Caterpillar</u>		
Nozzles	16	7N9843
Piston rings	16	8N0822
Pistons	8	7N3633
Liners	8	2N6600
Intake inserts	16	4N5893
<u>Generator engines - Caterpillar</u>		
Nozzles	8	8N8796
Seals	1	98311
Sleeves	1	2P3858
Liners	4	2P8889
Piston-rings	8	983068
Seal group	1	1N3216
Valve group	8	8N8796
Cylinder head	1	8N1188
Inlet valve	4	8N8809/2N2621
Exhaust valve	4	8N8875/5N0875
Insert inlet	4	7N4448
<u>Harbourset</u>		
Piston	4	3344- 1717102
Metal bearing	4	1902100
Sleeve liner	4	6705400
Main bearings	5	0900200
Thrust late	3	0908200
Ring piston	4	1709012
Valve inlet	4	0410100
Inserts	4	0121400
Valve exhaust	4	0411102
Inserts	4	0121500

Project: Meghna Estuary Study (MES)
Activity: BD 012101
Stage: Operational condition m.v. Anwesha
Contractor: BvS/ 1084 -4
Report period: 26-2-'98 - 6-3-'98
Report: review technical condition

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APPENDIX C-2

Tender T3 and T4- Main parts replaced during operational period Nov. '96-Febr '98

<u>Part-name</u>	<u>Quantity</u>	<u>Part-number</u>
<u>Main engine – Ford Lehman</u>		
Bearing house	2	46133033A
Engine mountings flex	4	52103
Impeller pump	13	SK/7404
Seawater pump	2	24140-3
Inlet valve	1	60939969
Start motor	2	6092295
Solenoid assembly	3	1527447
<u>Waterjet unit - PP</u>		
Impeller	1	I0600-503A
Shaft impeller	1	90-307G
Bearing jet 90G151	8	B23127340
Reverse deflector	1	B879050213
Steering cable	1	---

APPENDIX D

Inventory of survey equipment and software



1 Navigation and communication

No.	Item	A = Anwesha T3 = Tender 3 T4 = Tender 4			Comments
		A	T3	T4	
1	GPS receiver	x			(for navigation)
1	Gyro compass	x			(for navigation and survey)
1	Echosounder	x			(for navigation)
2	Fluxgate compass		x	x	(for survey)
1	Autopilot	x			
1	Radar	x			
1	Helmsman's display	x			(used with HYDRO unit)
2	Helmsman's display (small, portable)		x	x	(used with HYDRO unit)
1	SSB radio	x			
5	Fixed VHF radio 25 W	x	x	x	(2 on Anwesha, 1 spare)
3	Portable VHF radio 5 W with charger	x	x	x	
1	Safecom unit	x			

2 Survey positioning

No.	Item	A = Anwesha T3 = Tender 3 T4 = Tender 4			Comments
		A	T3	T4	
4	RTK receiver (Trimble 7400MSi) with Radtel GXi UHF radio for reference signal transmission	x	x	x	(1 is for reference station) (interchangeable)
1	Tripod				(for reference station)
1	UHF antenna				(for reference station)

3 Survey equipment and sediment samplers

No.	Item	A	= Anwesha		Comments
		T3	= Tender 3		
		T4	= Tender 4		
		A	T3	T4	
1	ADCP current profiler (RDI 600 kHz)	x			(interchangeable)
1	Knudsen 320 echosounder (30/200 kHz)	x			
2	DESO 14 echosounder (200 kHz)		x	x	
1	S4 current meter with pressure cell, temperature/salinity sensors, tilt compensation, 64 kB data storage, S110 interface unit				(used for profiling with umbilical system or deployed as a self-recording unit)
2	S/T profiler with battery charger				(portable)
1	Portable GPS receiver				(borrowed from MES)
3	Grab sampler				(portable)
1	Umbilical pumping system, 50 m, with Grundfos pump and McArtney power winch	x			
3	Integrating bottle	x	x	x	
2	Power winch for integrating bottle		x	x	(not yet acquired)
1	Owen sampler	x			

4 Data logging and storage

No.	Item	A = T3 = Tender 3 T4 = Tender 4			Comments
		A	T3	T4	
3	HYDRO racks with RTK receiver, UHF radio, HYDRO PC, display and keyboard	x	x	x	(interchangeable)
1	ACQ rack with ADCP PC, ACQ PC, display and keyboard	x			(can be shifted to T4 or T4)
2	Backpack tape storage units				(portable)
1	SAFECOM PC	x			(also serving as a spare)
1	Compaq notebook PC with charger				(portable, for reference station set-up)
3	SVGA monitors	x			
2	OKI Microline 380 matrix printers	x			
1	HP Laserjet 5L	x			
1	Roland A3 pen plotter	x			
1	CD ROM drive	x			

5 Power supply

No.	Item	A = T3 = Tender 3 T4 = Tender 4			Comments
		A	T3	T4	
2	24 V 12 A power supply	x			
1	UPS Netpro 220 V 2000 W	x			
2	12-24 V DC/DC converter		x	x	
2	24 V battery unit		x	x	(for HYDRO rack, interchangeable)
2	24 V battery unit		x	x	(for power winch, interchangeable)
1	24 V battery unit				(for reference station)
2	12 V charger		x	x	

25

6 Bottles

No.	Item	A = Anwasha T3 = Tender 3 T4 = Tender 4			Comments
		A	T3	T4	
	1 l bottles				(for suspended sediments)
	25 l bottles				(for settling distribution)

7 Miscellaneous

No.	Item	A = Anwasha T3 = Tender 3 T4 = Tender 4			Comments
		A	T3	T4	
1	Electronic toolbox				
1	Multi-meter				
1	S4 mooring string				(not yet acquired)
3	Portable lamp				(not yet acquired)
1	Portable lantern (for country boat)				(not yet acquired)
2	Light anchors				(not yet acquired)
5	Light marker buoys (low-cost)				(not yet acquired)
1	Measuring tape				(not yet acquired)

8 Consumables

No.	Item	A = T3 = Tender 3 T4 = Tender 4			Comments
		A	T3	T4	
	Paper rolls for Knudsen echosounder				
	Paper rolls for Deso echosounder				
	Log sheets				
	Plastic bags for bed samples				
	Labels for bottles and bags				
	Printer paper for OKI Microline				
	A4 paper for HP Laserjet				
	Data storage tapes				
	1.4 Mb floppy diskettes				
	2 mm nylon rope				
	4 mm nylon rope				
	15 mm PE rope				
	4 mm chain				
	Assorted shackles				

9 Software

No.	Item	A = T3 = Tender 3 T4 = Tender 4			Comments
		A	T3	T4	
3	HYDRO software, with dongle	x	x	x	
1	ACQ software				
4	Trimble GPS remote control, with dongle				
1	S4 communication and data downloading				
1	Transect software (for ADCP)				

10 Manuals etc.

No.	Item	A	= Anwesha = Tender 3 = Tender 4		Comments
		A	T3	T4	
3	Log books	x	x	x	
1	BIWTA Tide Tables	x			
1	Geodetic survey report, SWMC June 1996	x			
1	MES survey guidelines	x			
1	Trimble 7400MSi operation manual	x			
1	DESO 14 operator's manual	x			
1	S4 user's manual	x			
1	RDI 'Read this first' (for BB-ADCP)	x			
1	ADCP technical manual (RDI)	x			
1	Transect user's manual (RDI)	x			
1	HYDRO installation guide	x			
1	HYDROedit user's guide	x			
1	HYDROtransfer user's guide	x			
1	HYDROnav user's guide (with addendum)	x			
1	OKI microline 380 printer handbook	x			
1	McArtney electrical/optical slip ring handbook	x			
1	Knudsen 320M marine echosounder operator's manual	x			
1	LF325 (S/T profiler) instruction manual	x			
1	Sailor VHF technical manuals for (1) compact VHF and (2) battery charger	x			
1	Philips message handling software, operator's guide	x			
1	Grundfos installation & operating instructions (for sediment pump)	x			
1	Backpack user's guide	x			
1	Backpack CD-ROM drive system	x			
1	Logitech (PC mouse) user's guide	x			
1	CTC1 trickle charging station info sheet	x			
1	MS-DOS user's guide	x			

Manuals etc. (continued)

(continued)

No.	Item	A = T3 = Anwasha T4 = Tender 3 = Tender 4			Comments
		A	T3	T4	
1	SBC-455 486 CPU card user's manual	x			
1	Using your backup software	x			
1	SRH VHF radio owner's manual	x			
1	CXL 2-3 LW antenna specification sheet	x			
1	Ladac battery charger, directions for use	x			
1	Roland XY plotter, user's manual	x			
1	Radtel GXI operations manual	x			
1	Sailor manual for 24/12 V regulator	x			
1	Sailor VHF RT2048 compact programme	x			

APPENDIX E

GD

Sailing trips			days operation	days wait	repair days
2	16-11-96	22-dec	24	4	
3	26-12-96	13-1-97	18	3	
4	22-1-97	14-2-97	23	5	
5	15-2-97	6-3-97	20		
6	20-3-97	31-3-97	11		
7	2-4-97	14-4-97	11	2	
8	27-4-97	12-5-97	18	3	
9	14-5-97	3-6-97	19	2	
10	4-6-97	19-6-97	17	2	
MESdock				7	21
11	24-7-97	6-8-97	13		
12	7-8-97	17-8-97	11		
13	26-8-97	3-9-97	9		
14			194	28	21
15					
16					
17					
18					
19		feb-98			
average trip			16,2	2,3	1,8

	months	operation days	wait days	repair days	total days
trip 2..13	9	194	28	21	243
	5	81	12		93
1 year average	14	275	40	21	
	12	236	34	95	365
		65%	9%	26%	100%

APPENDIX F

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Estimate fuel consumption / real consumption - Anwesha + 2 tenders

period 11/1996 - 2/ 1998

MES trips 2 t/m 19

Main engines:

maximum consumption

233 gr/kW hr

specific weight

0,835 gr/ltr

maximum consumption

231

/

0,835

=

0,277 ltr/kW hr

THEORETICAL CALCULATION

maximum power	from logbook running hours	rpm	supposed actual load kW	fuel oil consumption theoretical maximum ltr/hr	estimated reduced ltr/hr	full ltr	reduced ltr	total in ltr	total in m3
275 kW ME port	1032	1800-1200	272-120	76,1	30	78512		78512	78,5
275 kW ME starb	1336	1800-1200	272-120	76,1	30	101670		101670	101,7
55 kW PS gen	2850	100%	80%	14,2	12,1		34485	34485	34,5
80 kW SB gen	3423	100%	40%	27,8	12,1		41418	41418	41,4
25 kW Harb gen	1280	100%	80%		4,1		5248	5248	5,2
Sub-total Anwesha						180182	81151	261333	261,3
100 kW Tender 3	1531		60% ?	30,1	17,5		26793	26793	26,8
100 kW Tender 4	1504		60% ?	30,1	17,5		26320	26320	26,3
Sub-total tenders							53113	53113	53,1
Total Anwesha + tenders								314446	314,4

ACTUAL MEASUREMENT ON BOARD

	from logbook running hours	consumption calculated against ltr/hr	=total ltr	m3	THEORETICAL CALCULATION		14 months period nov'96 - feb '99 supposed running hours /day	
					actual/theoretical m3		hours /day	days
275 kW ME port	1032	60	61920	61,9	78,5	79%	4 *)	275
275 kW ME starb	1336	60	80160	80,2	101,7	79%	5*)	275
55 kW PS gen	2850	12	34200	34,2	34,5	99%	18	158
80 kW SB gen	3423	12	41076	41,1	41,4	99%	18	190
								349
25 kW Harb gen	1280	4	5120	5,1	5,2	98%	6	213 **)
				0,0				
100 kW Tender 3	1531	16	24496	24,5	26,8	91%	10	153
100 kW Tender 4	1504	16	24064	24,1	26,3	91%	10	150
TOTAL				271036	271,0	86%		

*) under full power

According information accumulated

251000 250

**) Harb gen 1 month out of order

	costs/ltr		total costs
	Taka	ltr	Taka
fuel oil	12,63	251000	3.170.130
lubrication oil	54,57	2660	145.156
			3.315.286
petrol	20,59		

Project: Meghna Estuary Study (MES)
 Activity: BD 012101
 Stage: Maintenance m.v. Anwasha
 Contractor: BvS / 1084-3
 Report period: 10/11 - 18/11/1996
 Report: Maintenance advice

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APPENDIX G

4.3 BASIC SCHEDULE

1. UNDERWATER INSPECTION

As the always existing risk of fishing nets (in relation to the particular working area of the vessel) a regular underwater inspection of the tailshafts/ propellers for possible damage will help to prevent further tailshaft damage.

2. DRY DOCKING

Considering the confined working area with risks (see 1.) a regular docking of 1* year is advised. This will also cover the Lloyd's Inspection.

		1st	2nd	3rd
		year	year	year
covering appr. operational hours:		1500	3000	4500
		under water regular inspections		
-	Hull damage	X		
-	Tailshafts with seals	X	X	X
-	clearance shaft/ bush	X	X	X
-	Condition of propellers	X	X	X
-	Condition of rudders/ bearings	X	X	X
-	Anti fouling/ paint condition	X	X	X
-	Condition of hull anodes	X	X	X
-	Cleaning of seainlets	X	X	X
-	Hull valves	X	X	X

3a STEERING INSTALLATION

-	Steeringgear machine	X	X	X
-	Rudderstock bearings	X	X	X

Project: Meghna Estuary Study (MES)
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 Contractor: BvS / 1084-3
 Report period: 10/11 - 18/11/1996
 Report: Maintenance advice

3b PROPULSION ENGINES

Main engines Caterpillar 3408 - 1500 hours/ year

Hours	50	125	<u>250</u>	1000	3000	5000	10.000
	X	X	X	X	X	X	X

3c PROPULSION GEARBOXES

Twindisc - 1500 hours/ year

	HOURS	1000
Oil & filter change	X	
Rubberblock inspection		

3d NETWORK ENGINES

Generator engines Caterpillar 3304 - 2,500 hours/year

Hours	50	125	<u>250</u>	1000	2000	<u>3000</u>	4000	6000	10000
Maintenance	X	X	X	X	X	X	X	X	X
Meggertest						X			

3e HARBOUR ENGINE

Mitsubishi - 1500 hours/ year

Hours	10	50	250	500	1000			
Maintenance	X	X	X	X	X			
Meggertest					X			
						1st	2nd	3rd
						year	year	year
covering appr. operational hours:						1500	3000	4500

For specific maintenance procedures see Owners Manual and ANNEX 3

Project: Meghna Estuary Study (MES)
 Activity: BD 012101
 Stage: Maintenance m.v. Anwasha
 Contractor: BvS / 1084-3
 Report period: 10/11 - 18/11/1996
 Report: Maintenance advice

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4 SUPPORTING SYSTEMS

Coolingwatersystem
 Lubricating oil system
 Fuel oil system
 Compressed air system
 General service system
 Bilge/ballast system

5 ELECTRICAL SYSTEM

6 DECKEQUIPMENT

Anchorwindlass
 Deckcrane

7 DOMESTIC SYSTEMS

Fresh water system
 Ventilation system
 Cooling system

8 TENDERBOATS

PROPULSION ENGINE

Hours	10	50	200	400
	X	X	X	X

WATERJETS PP-JET

X

APPENDIX H

ESTIMATED COSTS SCHEDULE FOR MAINTENANCE/ REPAIRS BASED UPON 65 % YEARLY OPERATIONAL DAYS OF mv ANWESHA

	estimated	costs						1st year					1st year	2nd year	3rd year	
		Dfl														
	m.v. ANWESHA															
1	under water inspection	100						6					600	600	600	
2	drydocking	2000						1					2000	2000	2000	
	painting	3000						1					3000	3000	3000	
	hull anodes	1500						1					1500	1500	1500	
	cleaning	500						1					500	500	500	
	check tailshafts	500						1					500	500	500	
3a	steering gear	100						1					100	100	100	
													8200	8200	8200	
1500	hrs each/year Cat 3408	HOURS	50	125	250	1000		1st year	3000		5000	(10.000)				
3b	propulsion engines	inspect	60										0	0	0	
		inspect		24									0	0	0	
	estimated costs Dfl	600			12								7200	7200	7200	
	estimated costs Dfl	750				2							1500	1500	1500	
	estimated costs Dfl	3500						2						7000		
	estimated costs Dfl	4000								2					8000	
													8700	15700	16700	
3c	gearboxes SB+PS				12								0	0	0	
		200						4					800	800	800	
													800	800	800	
2500	hrs each/year Cat 3304	HOURS	50	125	250	1000	2000	1st year	3000	4000	(6000)	(10.000)				
3d	network engines	inspect	100										0	0	0	
		inspect		40									0	0	0	
	estimated costs Dfl	500			20								10000	10000	10000	
	estimated costs Dfl	700				5							3500	3500	3500	
	estimated costs Dfl	1750					2						3500	7000	3500	
	estimated costs Dfl	2500							2				0	5000	5000	
	estimated costs Dfl	2700								2				5400	5400	
													17000	30900	27400	
1500	hrs/ year	HOURS	10	50	250	1000		1st year								
3e	harbourset	0	150										0	0	0	
		0		30									0	0	0	
	estimated costs Dfl	100			6								600	600	600	
	estimated costs Dfl	250				1							250	250	250	
	estimated costs Dfl	1000						1					1000	1000	1000	
	estimated costs Dfl	1000							1					1000	1000	
	estimated costs Dfl	2000							1						2000	
													1850	2850	4850	
4	supporting systems	3000						1					3000	3000	3000	
5	electrical system	2500						1					2500	2500	2500	
6	deckequipment	500						1					500	500	500	
7	domestic systems	1000						1					1000	1000	1000	
	TENDERBOATS															
1500	hrs each/ year	HOURS	10	50	200	400		1st year								
8a	propulsion engines	0	300										0	0	0	
		25		60									1500	1500	1500	
		300			15								4500	4500	4500	
		1200				6							7200	9600	7200	
													13200	15600	13200	
	batteries	50		30									1500	1500	1500	
8b	PP- waterjets															
	propellers+ring	500						6					3000	3000	3000	
Total estimated maintenance costs for three following years - m.v. Anwesha													in Dfl	43550	65450	64950
Total estimated maintenance costs for three following years - tenderboats													in Dfl	17700	20100	17700

APPENDIX I

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Staffing schedule intended and actually used during the MES project.

C. Survey Vessel			
Sl. No.	Description	TAPP Number	Actual ²⁾ Number
1.	Skipper (MES)	1	1
2.	Engineer Grade "A" (MES)	1	1
3.	Engineer Grade "B"	1	
4.	Skipper Grade-II	1	
5.	Sub-Assistant Engineer	1	
6.	Sailor	6	4
7.	Greaser	2	1
8.	Daughter Vessel Driver	2	
9.	Cook (Cook-B)	1	1
10.	Lasker	2	1
11.	Jetty Guard	3	3
12.	Assistant Cook	1	1
13.	Speed boat/Hovercraft operator (MES)		2
14.	Diver (MES)		1
Sub-total of C		22	16

Note ²⁾ Actual number as received from the office of the Executive Engineer, SSD/BW DB

Table 5.3 Staffing Survey Vessel

D. Measurement Sub-division			
Sl. No.	Description	TAPP Number	Actual ²⁾ Number
1.	Sub-divisional Engineer	1	1
2.	Junior River Surveyor	8	4
3.	Clerk-Cum-Typist	1	
4.	Gauge Reader	4	1
5.	Survey Khalashi	4	3
6.	M.L.S.S/Peon	1	
7.	Guard	1	
Sub-total of D		20	9

Note ²⁾ Actual number as received from the office of the Executive Engineer, SSD/BW DB

Table 5.4 Staffing Measurement Sub-division

E. Processing Sub-division			
Sl. No.	Description	TAPP Number	Actual ²⁾ Number
1.	Sub-divisional Engineer	1	1
2.	Assistant Director	1	
3.	Tracer	1	
4.	Draftsman Grade-II	1	
5.	Clerk-cumTypist	1	
6.	M.L.S.S/Peon	1	
7.	Sweeper	1	1
Sub-total of E		7	

