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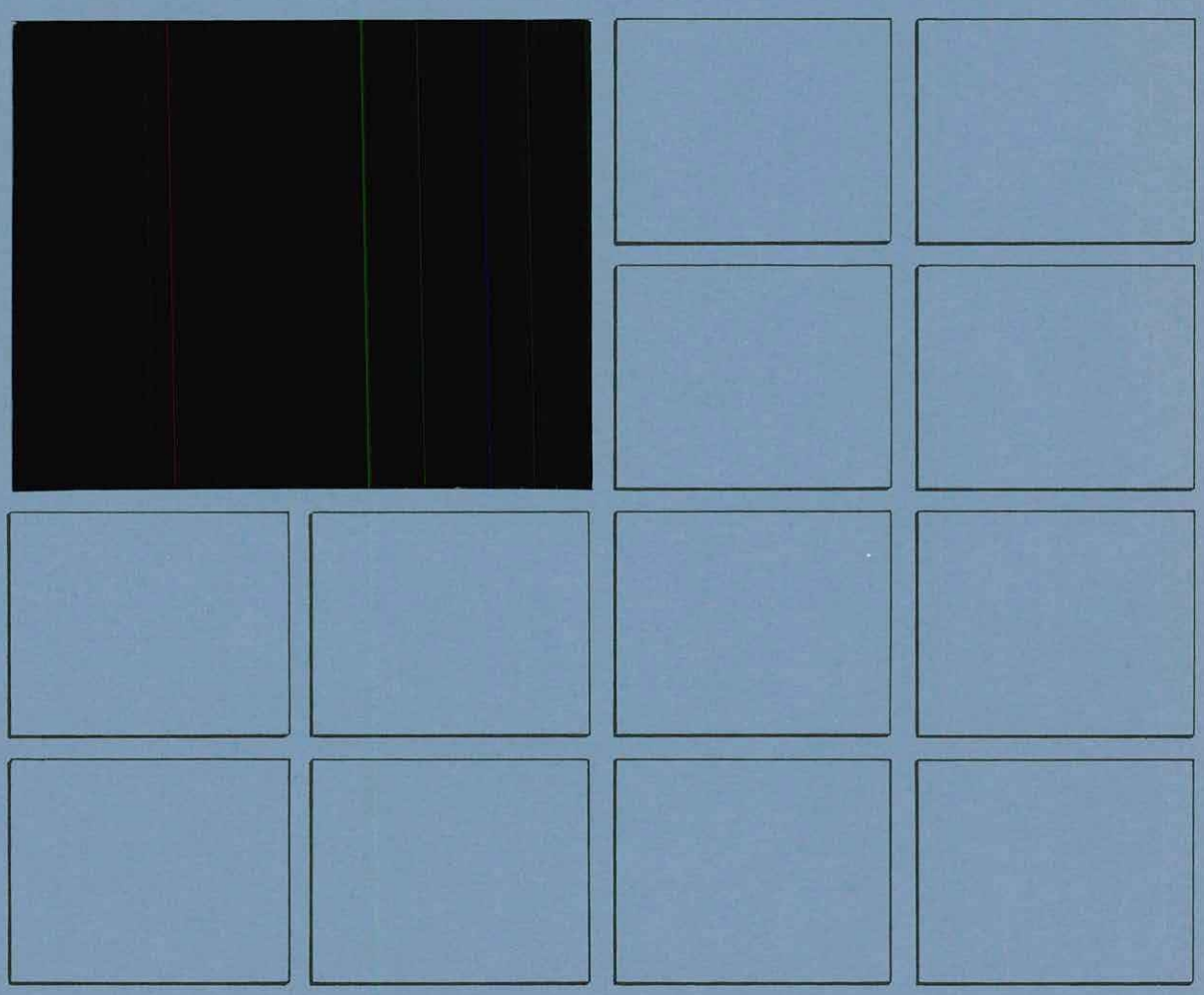

SOMALIA HYDROMETRY PROJECT

PROJECT REVIEW AND PROPOSAL FOR STAGE 3

JANUARY 1986

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WALLINGFORD
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1. Background

The Hydrometry project is concerned with the operation of the hydrometric network of river level and flow gauging stations in Somalia. At present these stations are concentrated on the two main perenial watercourses of Southern Somalia, the Jubba and Shebelli rivers.

Stage 1 of the project was initiated following a request by the Somali Government for assistance to bridge the gap between the end of a FAO funded project in 1980/81 and the proposed establishment of the national 'Water Centre', part of a UNDP 'IPF' country programme originally scheduled for 1985. A joint proposal (April 1983) by Sir M. MacDonald & Partners (MMP) and the Institute of Hydrology (IH) was accepted by the Overseas Development Administration (ODA) and the Project commenced in November 1983.

The main objective of project is to provide assistance to the Hydrology Section, the Department of Land and Water Resources, of the Ministry of Agriculture (MOA). This aim of this assistance is to ensure:

(a) Continuity of hydrological records in the future. These records are used both in the design of all major surface water related projects and also in the day to day management of the two river systems.

(b) All historic records are checked and processed to the same standard.

(c) Counterpart staff are trained in the techniques of field work and office work so that they are able to contribute to and eventually take over, the running of the Hydrology Service.

It became clear towards the end of Stage 1 that further assistance would be required to ensure that these objectives could be fulfilled and that the continuity of the hydrological data would be preserved. Stage 2 was therefore proposed to follow Stage 1 and run along much the same lines as before. Unfortunately, due to a delay in signing of contracts, there

was a break in project activities from the end of Stage 1 (December 1984) and the start of Stage 2 (April 1985). It is during this very period, before the Gu floods, that river levels are low enough to permit access for fieldwork.

2. Progress and achievements of Stage 2

The major item of field work which was planned for the first quarter of 1985 was the installation of five electronic water level recorders at the following locations:

(a) Jubba river - Lugh Ganana
(b) Jubba river - Bardheere
(c) Jubba river - Kamsuma
(d) Shebelli river - Beled Weyn
(e) Shebelli river - Kurton Warey

The delay in the start of Stage 2 meant that the installation work started in the Gu flood season when river levels were at the annual maximum. However, in spite of these difficulties, the recorder houses were installed at all the above sites except for Kurton Warey. The stilling wells (plastic pipes beneath the recorders) were installed as far down into water as river levels would allow. This work was the first achievement of Stage 2 and was completed during the first visit of the MMP hydrologist in April/May 1985.

Lower water levels between the Gu and Der floods allowed further sections of stilling well to be added in July and August 1985 during the second visit of the MMP hydrologist. The final sections of stilling well will be added in the period of annual minimum flows from January to April 1986.

At the start of Stage 2 the computer which had performed a key role in the data processing side of Stage 1 was shipped back to UK for a service and upgrade. Due to delays both in shipment and with the computer agents in UK the computer was not back in service in the Mogadishu office until August 1985.

From the start of Stage 2, the IH hydrologist has undertaken a major review of the data processing software, incorporating many of the enhancements recommended in Stage 1. During this revision, care was taken

to ensure that the software written was non machine specific so that programs could be transferred to another machine with minimum effort should failure occur on the original computer. The larger computer memory available after the upgrade was used to make the programs easier to operate and more powerful. In particular a set of graphics programs were written to aid the quality checking of historic data entered onto the computer during Stage 1. The programme of quality checking is to form a large part of the remaining work of Stage 2.

The purpose of the third visit to Somalia, this time by the IH hydrologist, was to install these new programs on the computer at Mogadishu and train the staff in their operation. This has been achieved and the staff now have a knowledge of the day to day operation of the computer and are aware of the care required to run the machine such as keeping the room clean and as cool as possible and changing the air filters regularly. About one third of the time during this visit was spent on fieldwork and preparation for fieldwork since it was clear on arrival that the flow of data from the river stations had ceased with no data for many stations since June. All stations on the Shebelli were visited and plans were being made to visit the Lugh Ganana and Bardheere on the Jubba. This visit is to be unsupervised. Due to this unforeseen activity, some of the less frequently used programs (such as rating curve development), could not be implemented in time. However the computer system at the moment is fully operational for day to day use. The plotting facilities are being used for quality control of all new data. In addition data from the Jowhar Offstream Storage scheme are now being entered onto the computer.

The next visit by the MMP hydrologist is scheduled for February 1986 and will involve the remaining installation work required for the new electronic logging stations and general station maintenance. In the office, the programme of checking all old data will be started as well as the addition of data from stations not already on the system.

The final visit by the IH hydrologist in Stage 2 is scheduled for March/April 1985 and will involve the setting up on the computer of a real time model of the Shebelli to enable forecasts of river flow to be made to help with the day to day management of the Shebelli river.

3. Objectives of Stage 3

Stage 2 is due to finish in June 1986. It is clear that although the programme of installation of new electronic stations and improvements on the computing side should be achieved by that date, the Hydrology Section at the Ministry of Agriculture does not yet have the resources, both in terms of finance and personnel, to continue work unsupported.

At the request of the Director of Land and Water Resources, the implementing organisations, MOA, MMP, and IH held discussions in Mogadishu on 6th November 1985 on the subject of continued support for the Hydrology Section at MOA. It was considered by all, that continued external suport for the project was essential if hydrometric data collection and processing was to survive in Somalia. The remainder of this report summarises the conclusions of this meeting.

The following objectives of a possible Stage 3 were identified as necessary to maintain the status quo and to expand the nature of work accomplished by the Hydrology Section:

(a) To maintain the existing data collection network of river level stations.

(b) To maintain the flow of data from those stations to Mogadishu.

(c) To continue the programme of river gauging and rating curve development

(d) To maintain the data storage and processing facility on the computer at Mogadishu.

(e) To further develop the computer model of the Shebelli used in real time flow forecasting.

(f) To develop a model of the Jubba river on the same lines as that for the Shebelli.

(g) To introduce water quality measurements (conductivity) at key stations within the network.

(h) To introduce water sediment measurements at key stations within the network.

(i) To increase the network to gauge wadis to the north, but only to a degree which will not drain resources from the data collection programme on the Jubba and Shebelli.

These aspects of a future study fall into two categories; fieldwork and office or computer work. The objectives above are considered below in more detail under the two major groupings:

3.1 Field Work

The programme of field work should ensure that the flow of data is, in so far as possible, maintained at or returned to a high level. The performance of the solid state electronic loggers should be evaluated and if found successful the network of these instruments increased. A programme of measurement of water quality (conductivity) should be instigated and observers at key stations issued with conductivity measurement devices and given training in their operation. The programme of return of data on weekly cards should be reviewed to see if the present system of using the postal service is satisfactory. In particular:

(a) A regular programme of field visits should be set up where each station is visited once a month. At present the sporadic visits means that data takes many months to arrive in Mogadishu. This not only makes management of the rivers difficult but means that any problems at a station are not found until next visit by which time a long gap may have developed in the station's record. If a regular programme of visits were set up, maintenance of stations should be improved as well as the speed of return of data from the field.

(b) Towards the end of Stage 2 it should have become clear whether the system of recording river level on electronic loggers is successful. Such a system has considerable advantages over both the conventional observer read staff gauge and the clockwork chart and ink system. Automatic recorders overcome the problem of observer error and fabrication of readings. Electronic recorders have less moving parts (less to go wrong) and are able to transfer data directly to the

computer, thus avoiding typing errors. Provision should therefore be made in Stage 3 for increasing the logger network to the remaining Shebelli sites (Bulo Burti, Mahaddey Weyn, Afgoi and Audgele). Loggers on the Jowhar Offstream Storage Reservoir should also be considered.

(c) Water quality and in particular salinity are important in river systems where extensive areas of agriculture depend on river water for irrigation. It is proposed to introduce conductivity measurements at certain stations on Jubba and Shebelli. Measurement of conductivity is a relatively straightforward task and could be undertaken by the existing observers after they have been given suitiable training. Initially the two upstream stations at Beled Weyn (Shebelli) and Lugh Ganana (Jubba) should be supplied with conductivity meters. Additional stations may then be added after gaining experience with those two sites.

(d) Sediment loads on both the Shebelli and Jubba appear to be high. This has important implications for irrigation canals and reservoir sites which suffer loss of capacity or storage as sediment is deposited. At present there are no measurements of sediment made on a regular basis on either river. Sediment is a difficult quantity to measure and it is anticipated that any measurements which would be made would have to be done at the same time as a flow gauging by a field crew from the Mogadishu office. Both bed load and suspended load would need to be sampled. As with conductivity, these measurements would initially be made at the two 'input' stations (Beled Weyn and Lugh Ganana). Other stations could be added later depending on resources available.

(e) At present the only rivers or wadis in Somalia which have long term flow gauging stations are the Jubba and Shebelli. This is because they are the two major perenial water courses and support most of the agricultural production of the country. However it has been recognised that there may be potential for further agricultural development in northern Somalia. In order to assess the water resources of this region it would be necessary to establish river gauging stations on potentially useful wadis. Logistical problems of access and distance makes this a difficult task. Difficulties arise

not only from the selection of suitable sites but also maintenance of stations and of recording 'flashy' floods. As a follow up to the desk study of the area to be undertaken as part of Stage 2, it is suggested that before site visits are undertaken, a period of a few weeks should be spent in the Colonial Office in the UK. Here reports on the old colony of British Somaliland would be examined to look for places in the past which had been flow measurement sites and also to look for any old (but potentially useful) data which might already exist. After this study, if sufficient resources were available, possible locations for measurement would be identified, visited and stations established.

3.2 Office and computer work

Until now the emphasis has been on the development of a suite of computer programs to store, process and present water level and flow data. Some new facilities will be required in this area but it is hoped that the main input on the computing side will be the development of models and analysis programs to assist with the day to day running of the river systems. Some possible program developments are given below:

(a) Incorporation of storage/level relationships and stored volume data on the computer database so that data from the Jowhar offstream storage reservoir may be stored and processed and used in model development.

(b) Provision to allow water quality measurements and sediment measurements to be stored on the computer database.

(c) During the second half of Stage 2 development of a computer model of the Shebelli river is planned. The purpose of this model is to assist with the daily management of the river and in particular of the Jowhar reservoir. Current water level information will be sent by existing Ministry of Agriculture radio links from Beled Weyn and Jowhar. These data, together with recent historic data will form the basis of prediction of river flows. The model may be run several times to experiment with different Jowhar abstractions or Jowhar releases to determine satisfactory flows downstream. Only a limited amount of time has been allocated in Stage 2 for this work. It is

hoped to refine the model development during Stage 3 and to gain from the experience of the first season's operation. Development of a similar model on the Jubba river is also planned later on in Stage 3.

(d) A Stage 3 to the project would enable the development of day to day management tools such as quantity of water so far delivered in year and departure from the average situation. Programs could also be developed to give probabilities of water to come from the present day to the end of the flood season as well as any other computer aided guidelines which emerge during the remainder of Stage 2 and in the course of Stage 3. This aspect of the study would also investigate ways in which Jowhar reservoir scheme could be more efficiently operated with the computer tools available.

4. Staffing considerations for Stage 3

In the original proposal for Stage 1 it was stated that a continuous presence in Somalia was the most satisfactory means of servicing the project. However this approach was not adopted because it was considered that maintenance of such a presence would be prohibitive in terms of the cost involved. Consequently the work programmes of Stage 1 and Stage 2 were arranged around a series of inputs of several months at a time followed by a break in consultant support for one or more months.

It is now clear that such a system of sporadic inputs is not a suitable way to operate the project. The reasons for this are:

(a) Momentum of the project is constantly lost. Because of financial difficulties (and other difficulties such as shortage of fuel) it is very difficult for the Somali counterparts to undertake any field work during the periods of absence of consultant staff. Consequently the return of data ceases as does the maintenance of stations.

(b) Any technical problems which arise such as equipment breakage or problems with the computer remain until the next consultant input.

(c) Continuity is also lost by the consultant hydrologist who may well be involved in other work during the period of absence and time is lost on catching up and re-adjusting to this project.

(d) In order to maintain continuity is is essential that the same expatriate hydrologists return on subsequent visits. Other commitments often make this difficult. Staffing such a project is therefore not easy.

It is considered that a continuous presence in Somalia would obviate some of the difficulties which have hitherto affected the project. It was also considered necessary to establish a long term base for the project with forward planning for a five year period. It was recognised that it would be difficult to obtain a financial commitment over such a long period and that funding would need a periodic review - say every 2 years.

5. Equipment requirements for Stage 3

The following major items of equipment should be considered for Stage 3:

(a) A second Land-Rover. The fieldwork of this project demands that a large number of kilometers are travelled over poor roads. For example a visit to Lugh Ganana and Bardheere is approximately 1500 km. A second Land-Rover would serve as a backup and also allow expansion of the field visit programme to allow monthly visits to all stations. The Land-Rover should be of the 'Safari' station wagon type and be equipped with a full length roof rack. A similar roof rack is required for the original Land-Rover because of the large amount of equipment and fuel which is required on each trip. In order to reduce the amount of fuel carried in jerry cans and 200 litre drums in the field, it is suggested that both Land-Rovers be fitted with the second fuel tank option (i.e. under passenger seat).

(b) Contingency for a second computer system. The existing system has served well in very bad conditions of heat, humidity and dust. It has also survived three air freight journeys to and from the UK. It is reasonable to expect that a failure might occur in the near future.

(c) Conductivity meters will be required together with spare instruments as a backup.

(d) Sediment measurement equipment will be required.

6. Work Programme

Figure 1a shows the proposed work programme designed to accomplish the objectives of Stage 3. Staffing required to undertake the work programme is given in Figure 1b.

7. Estimated costs

Estimates of Institute of Hydrology costs are given below and are divided into the two financial years 1986/87 and 198 7/88. These figures represent the best available figures at the time of writing. Costs prevailing during project execution will be charged. The following points should be rated:

(1) All costs are exclusive of VAT.

(2) Mogadishu subsistence is calculated at half rate. Double this figure will be charged if MacDonald's mess is not available.

(3) It is assumed that a project Land-Rover will again be available, with fuel, for the use of IH personnel. If not, the cost of local hire will be added.

(4) Staff costs are based on a 5 day working week in the UK and a 6 day working week in Somalia.

(5) The cost of the IBM computer includes all discounts available to the Institute.

Figure 1.a ACTIVITY CHART

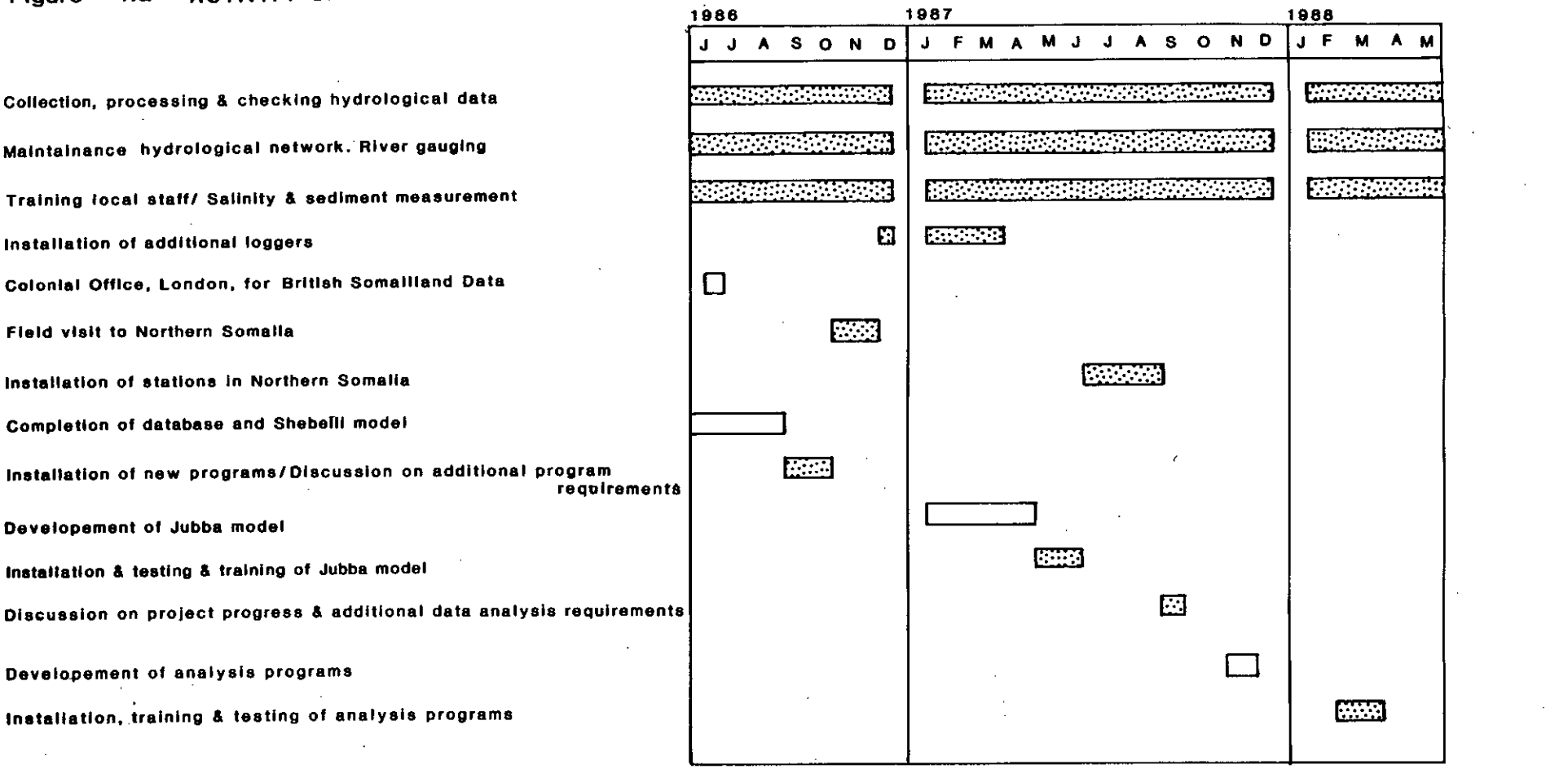
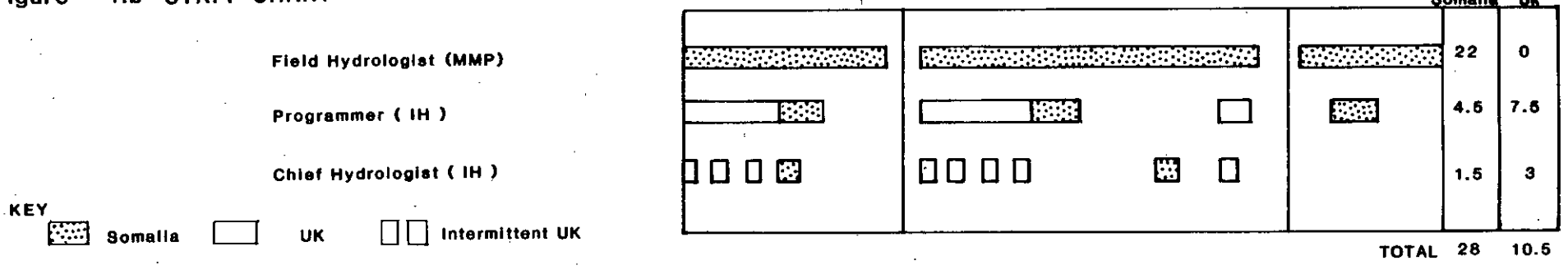


Figure 1.b STAFF CHART



1986/87 Costs

Staff

			£
5 days	PSO	Project supervision (UK)	840
1½ months	SSO	Chief hydrologist (UK)	3860
3 weeks	SSO	Chief hydrologist (Somalia)	2138
5½ months	HSO	Programmer/hydrologist (UK)	11484
1½ months	HSO	Programmer/hydrologist (Somalia)	3710
			22032

Subsistence

(£1 = 50.78/- Somali on 29.1.86)

3 weeks	SSO	Mogadishu half rate (1558/- Somali/day)	644
1½ months	HSO	Mogadishu half rate (1558/- Somali/day)	1289
			1933

Travel

2 x Return air fares London-Mogadishu (Club class)	2660
1 x Shipment of computer and consumables and voltage regulator	900
UK travel to/from airport with equipment	150
	3710

Equipment

IBM-AT computer (512k memory, 20 mb disc, enhanced graphics, printer and plotter)	5709
Voltage stabiliser	1000
Consumables for computer and minor recurrent expenditure	500
	7209

Total 1986/87 = £34,884

1987/88 Costs

Staff

			£
5 days	PSO	Project supervision (UK)	890
1½ months	SSO	Chief hydrologist (UK)	4094
3 weeks	SSO	Chief hydrologist (Somalia)	2268
2 months	HSO	Programmer/hydrologist (UK)	4427
3 months	HSO	Programmer/hydrologist (Somalia)	7867
			19546

Subsistence

(£1 = 50.78/- Somali on 29.1.86)

3 weeks	SSO	Mogadishu half rate (1652/- Somali/day)	683
3 months	HSO	Mogadishu half rate (1652/- Somali/day)	2732
			3415

Travel

3 x Return air fares London-Mogadishu (Club class)	4230
Shipment of consumables	200
UK travel to/from airport	200
	4630

Equipment

Fresh supply of computer consumables	200
	200

Total 1987/88 = £27,791

Total IH costs for 2 year project = £62,675

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The Institute of Hydrology is a component establishment of the Natural Environment Research Council