HYDROLOGICAL PROCEDURE NO. 22

RIVER WATER QUALITY SAMPLING

1981

JABATAN PENGAIRAN DAN SALIRAN
KEMENTERIAN PERTANIAN MALAYSIA

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1981

BAHAGIAN PARIT DAN TALI AIR
KEMENTERIAN PERTANIAN, MALAYSIA.

RIVER WATER QUALITY SAMPLING

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KEMENTERIAN PERTANIAN MALAYSIA

1981

ACKNOWLEDGEMENTS

Since this Hydrological Procedure is based on the need to document the use of a new standard type of water quality sampler suitable for the Drainage and Irrigation Department, it has drawn heavily on the earlier Hydrological Procedure No. 2, "Water Quality Sampling for Surface Water" which is a general guide to water quality sampling and types of samplers. Thus the earlier work carried out by the authors of H.P. No. 2 has been of invaluable assistance in compiling this publication.

Price: $5/-

Published by and available from:—
Publication Unit,
Ministry of Agriculture,
Jalan Mahameru,
Kuala Lumpur.

CONTENTS

SUMMARY

This procedure sets out guidelines for the water quality sampling of surface waters. The techniques for sampling of streams and rivers are described together with recommendations on procedures for storage, preservation and delivery of samples. Groundwater quality sampling, suspended sediment sampling (Ref. Hydrological Procedure No. 19, 1977) and actual laboratory analysis (Ref. Faiia, 1975) are not considered.

1. INTRODUCTION

This Hydrological Procedure was felt necessary since the Drainage and Irrigation Department (D.I.D.) was adopting a new type of water quality sampler to standardise the sampling technique and to enable samples to be taken at any depth. This was a major improvement on the earlier practice of simply scooping a surface water sample. While further improvements could be made in preservation of collected samples for specialised laboratory analysis, it is acticipated that D.I.D.'s continued concern will lie in general water quality monitoring and that other agencies have more expertise and resources to study specific problems such as, for example, trace elements or biological parameters.

2. DEFINITION OF THE PROBLEM

There are four basic situations likely to require a sampling and analysis programme:—

(a) check of compliance with effluent quality and quantity requirements,

(b) an observed deterioration in water quality:

viz by *sight*
- (i) Oil and grease.
- (ii) Dead animals and/or plants.
- (iii) Excessive plant growth.
- (iv) Discolouration of the water.
- (v) Absence of any life.
- (vi) Excessive sediments.

by *smell*
- (vii) Sulphide.
- (viii) Sewage.
- (ix) Decomposing matter.
- (x) Specific chemicals or wastes.

by *touch*
- (xi) Thermal pollution.

(c) check on the dispersal and effects of effluents on receiving waters.

(d) a need to monitor changes (if any) occuring either with time, or with position, in a body of water.

Generally the water quality sampling carried out by D.I.D. is covered under (d) above.

3. EQUIPMENT

(i) The *standard Sampler* used by D.I.D. is the KAHLSICO PVC Sampling Bottle of 3 litres capacity (Type No. 135WA103) but modified locally to 2 litres capacity. The Sampler is manufactured by the Kahl Scientific Instrument Corporation, California, U.S.A. and available in Malaysia through a local Agent.

The Samplers are sturdy, operable in any depth and are satisfactory for use in fresh or marine waters. They are also non-toxic and non-contaminating as the only surfaces coming in contact with the water sample are high-impact polyvinyl chloride (PVC) tubing and latex rubber tubing with moulded latex cups.(Plate 1).

(ii) *Thermometer* with an accuracy of $0.1^{o}C$ should be used.

(iii) *Storage Bottles for Water Samples:* The Chemistry Department requires 4 litres or one gallon of water for analysis. Since the capacity of the modified Sampling Bottle is 2 litres, *two samples* must be taken at the same location and pour into a bottle. Thus, the use of standard 4-litre capacity plastic storage bottles with screwed caps is recommended.

4. SAMPLING PROCEDURE AND FREQUENCY

Except in the case of specific studies where a series of samples at different depths are to be taken from the same spot (for example, in a study of saline intrusion in tidal waters), the water quality samples are to be taken at a depth below the *water* surface of 0.6d, where d is the total depth of water.

The Sampling Bottle is suitable for both hand sampling by wading and suspension from bridge (or boat or cableway). For hand sampling safe wading is possible only where

$$d \times V < 1$$

where

d is the depth of water (m)

and V is the maximum velocity (m/s)

4.1 *Hand Sampling by Wading*

Before entering the stream to take the sample the observer must first prepare the Sampler as follows:–

(i) Rinse the Sampler with clean water

(ii) To cock the rubber cups, place the Sampler on a firm surface. Rotate the swivel post (2, Fig. 1 & Fig. 2) anti-clockwise until its catch-cam is locked below the bar at the end of the spring-tensioned release rod (3, Fig. 1 & Fig. 2).

(iii) Pull the bottom cup out of the cylinder and extend it well beyond the lip of the cylinder. Holding the plastic cord of the cup (1, Fig. 1), pull the cup back towards the handle (7, Fig. 1) and pass the cord loop around the lower arm of the swivel post (1 & 2, Detail 'A', Fig. 2). By the same method, the cord loop from the top cup must be secured to the upper arm of the swivel post (Detail 'A', Fig. 2) Each loop is thus held separately and there is no danger of the cords fouling when the swivel post is released.

(iv) Check that the air vent screw (4, Fig. 1) and the clamp on the rubber drain tube (5, Fig. 1) are tight and will not leak.

The observer is now ready to wade out to the middle of the stream to take the sample. To avoid disturbing the natural flow as much as possible the observer should wade upstream from his entry point into the stream before submerging the Sampler. The handle (7, Fig. 1) is held in the *LEFT* hand and the Sampler lowered horizontally and parallel to the direction of flow. (Plate 2).

Having lowered the Sampler to a depth of 0.6d, the observer then strikes the head of the release rod (6, Fig. 1) with his *RIGHT* hand. The impact will release the cam and the swivel post will rotate clockwise (Detail 'B', Fig. 2) releasing the cords and thus freeing the cups, allowing them to seal the PVC cylinder and trap a water sample.

IMPORTANT POINTS TO REMEMBER:–

(a) The observer should wade slightly upstream and also face the bank when taking the sample.

(b) The Sampler must be held horizontal and parallel to the flow.

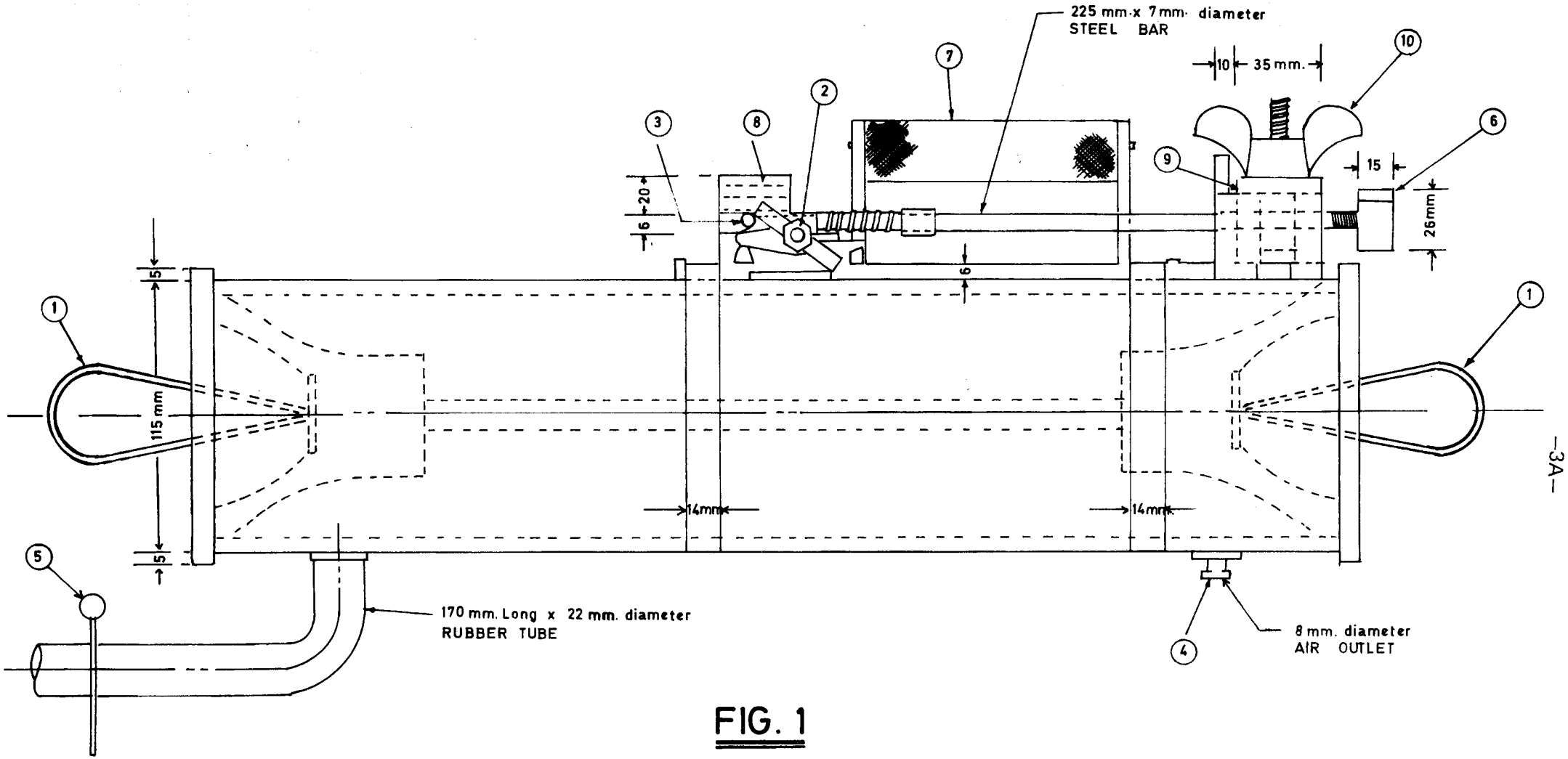


FIG. 1

PVC SAMPLING BOTTLE

(2 litre capacity)

(v) Being very careful not to bump the release rod (6, Fig. 1) lower the Samples, hanger bar and weight over the bridge railing and suspend it from the A–Frame pulleys. Remember to position the A–Frame in a position approximately mid-stream, making sure at the same time that it is well clear of any bridge pier.

(vi) Lower the sampling equipment until the Sampler is half submerged (that is, up to the swivel post). Zero the depth counter, then lower further until the weight touches the river bed. Read the depth shown by the depth counter and add the depth correction factor to obtain the true depth of water.

(vii) It is desirable that the sample be taken from a depth of 0.6d (measured from the water surface). Therefore raise the Sampler to the required depth. When ready to take the sample, attach the messenger to the wire and release it. When it strikes the release rod (6, Fig. 1) of the Sampler, the cups will be freed, allowing them to seal the cylinder ends. The Sampler is raised from the river. Both the Sampler and the messenger are then removed from the wire.

4.3 *Frequency of Sampling*

The sampling frequency will generally be on a *fortnightly basis* however specific studies might demand a more or less frequent sampling. The fortnight period has been chosen so that field staff may take the sample on their regular visit to inspect the recorder and change the recorder chart etc. (since almost all D.I.D. Water Quality Sampling sites are at existing river stations).

However, it should be noted that it is highly desirable for water quality samples to be representative of the whole range of river flow – not just low and mean flows but also flood flow. Since stream gauging should be carried out periodically to update the stage - discharge relationship, it is recommended that water quality samples should also be taken at the same time. This applies particularly to flood peaks whose occurrence is rare and invariably does not coincide with the usual station inspection/chart changing visit.

5. PRESERVATION AND DELIVERY OF SAMPLES

Before transferring the two water samples at the same location from the Sampler to the standard 4-litre capacity storage bottle, ensure that the storage bottle has been well washed with clean water, preferably distilled water and certainly *not* with river water. That is, the storage bottle should

be cleaned thoroughly to avoid any foreign contamination of the river water sample.

To drain the Sampler, hold it vertical and first loosen the air vent (4, Fig. 1) at the top. Next place the rubber drain tube into the neck of the storage bottle and then remove the clamp (5, Fig. 1) from the drain tube.

The Sampler should be washed with fresh, clean water after every use in order to keep it clean and prevent contamination of subsequent samples.

Having filled the storage bottle immediately, take the temperature reading ensuring that the thermometer is immersed well within the bottle, and not just in the neck. After allowing some time for the temperature reading to stabilise record the value to an accuracy of 0.1^{o} C.

Initially there will be no filtering or chemical treatment of samples in the field, so it is very important that the following points are remembered:—

(a) the delay between sampling and analysis should be minimised.

(b) samples which require BOD/COD analysis should either be kept on ice and delivered within the same day, or delivered straight to the laboratory within 3 hours. BOD/COD analysis will be required only in areas where pollution may be significant.

The storage bottle should be clearly identified with the river station number, station name, sampling date and sample number (see Para.6).These may be written in large clear letters on the bottle itself using a felt-tipped pen or, on a cardboard label and tied securely to the neck of the bottle.

DATA FORMS

At the time of sampling, the data forms (see Appendix A) should be filled in duplicate for each sample, the original copy is to be sent to the Chemistry Department along with the sample, the other is to be filed. Each set of samples will be sent with a covering letter requesting analysis of the samples. A typical covering letter is attached for your information (see Appendix B).

For Section I (Bacaan Luar) of the data form, the information should be supplied as follows:—

Item 1. Fill in the 7 digit Station No. according to D.I.D. Hydrological Procedure No. 6.

Item 2. The date should consist of 6 digits – two each for the day, month and year. Thus 16th of January, 1981 would be recorded as 16/01/81.

Item 3. The time should consist of 4 digits – the first pair recording the hour of the day and the second pair recording the minutes of that hour e.g. 8.30 a.m. would be 0830, 1.20 p.m. would be 1320, etc.

Item 4. The discharge will be extracted from rating curves at D.I.D. Headquarters before computer processing of data. Gauge height is supplied as item 11 and this space should be left blank.

Item 5. The depth of sample is the sampling depth, in metres, from the water surface. It should be reported to the best available accuracy (usually 0.1 metres).

Item 6. The water temperature should be recorded in degrees Centigrade to the nearest tenth (0.1) degree.

Item 7. If a pH meter is available a reading should be taken and noted (desired accuracy, 0.1 pH unit).

Item 8. Dissolved Oxygen determinations require special equipment that is not available at present. Until equipment is available the space provided should be left blank.

Item 9. The sample No. is for purposes of identification. Because two or more consecutive samples or a depth profile may be in the hands of the Chemistry Department, the use of station No. is not adequate. Any identification will do so long as samples are distinguishable from one another.

Item 10. Name of the river and the location of the sampling spot should be recorded.

Item 11. The gauge height (if available) should be recorded to the accuracy of the gauge, usually 0.01 metres.

Item 12. The type of sampler should be noted.

Item 13. Filtering, refrigeration or chemical preservation should be noted.

Item 14. The presence of rain may affect a sample (surface water samples in particular) and should be noted.

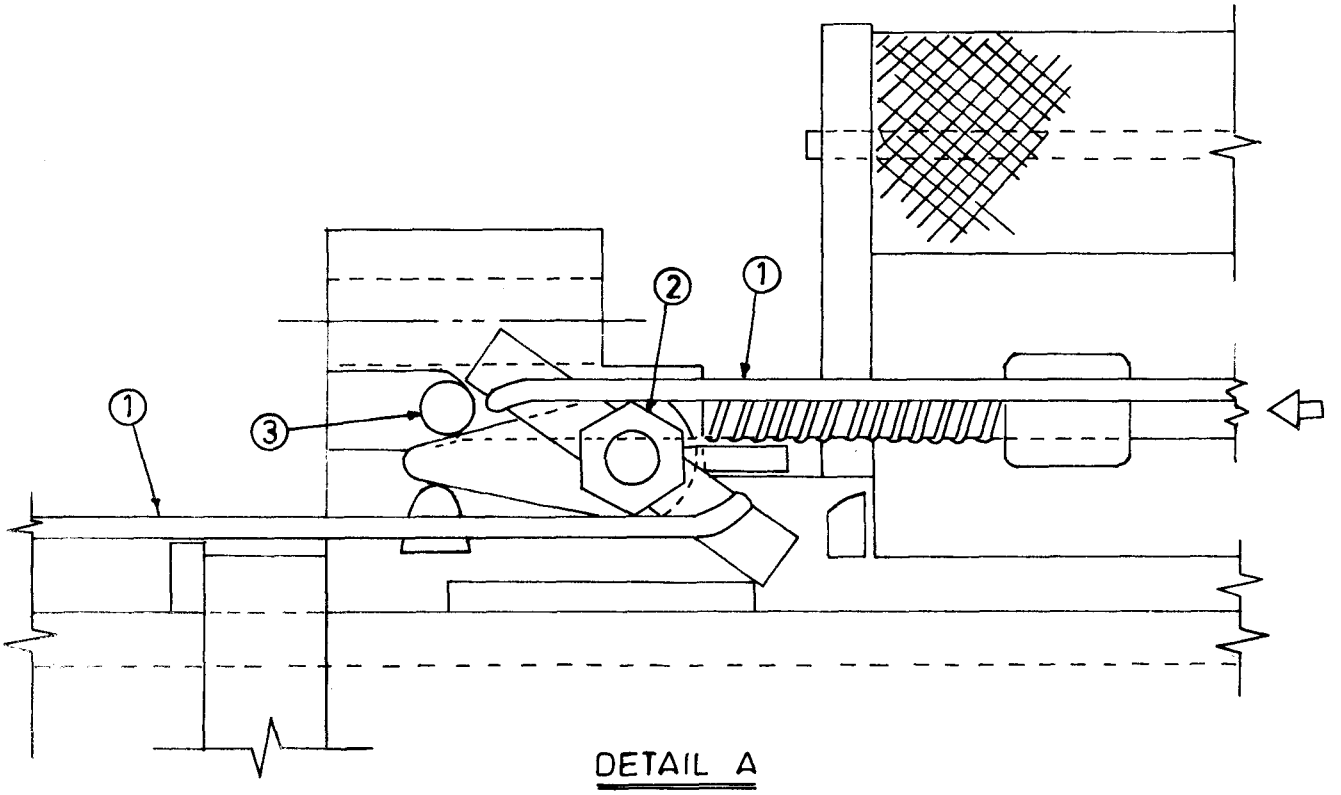
Item 15. The name of the person performing the field work should be recorded.

Item 16. General observations such as presence of odour can be noted here.

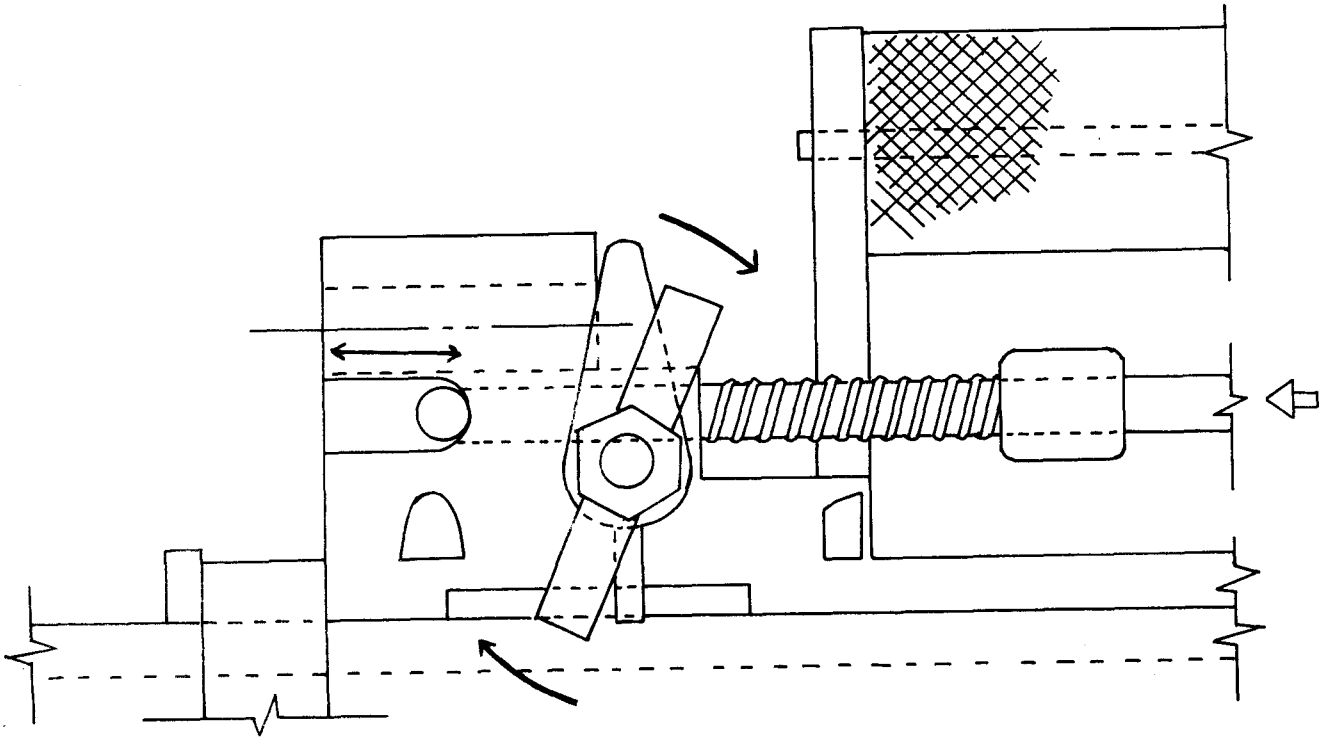
For Section II (Lapuran Makmal) of the date form,the information will be filled in by the Chemistry Department. It is only necessary to cross out these items not desired in the analysis. The analyses required vary according to the type of station as detailed in the attached list (See Appendix C). The first 15 items are common to all stations.

7. SUBMISSION OF DATA AND PUBLICATION

When the analysis comes back from the Chemistry Department (See Appendix D), the form should be forwarded to D.I.D. Headquarters in the same manner as it is done for the other types of hydrological data. The water quality data will be processed and stored in the Data Bank and, periodically, these data will be printed for distribution to the D.I.D. State Offices and other interested agencies.



DETAIL A



DETAIL B

FIG. 2

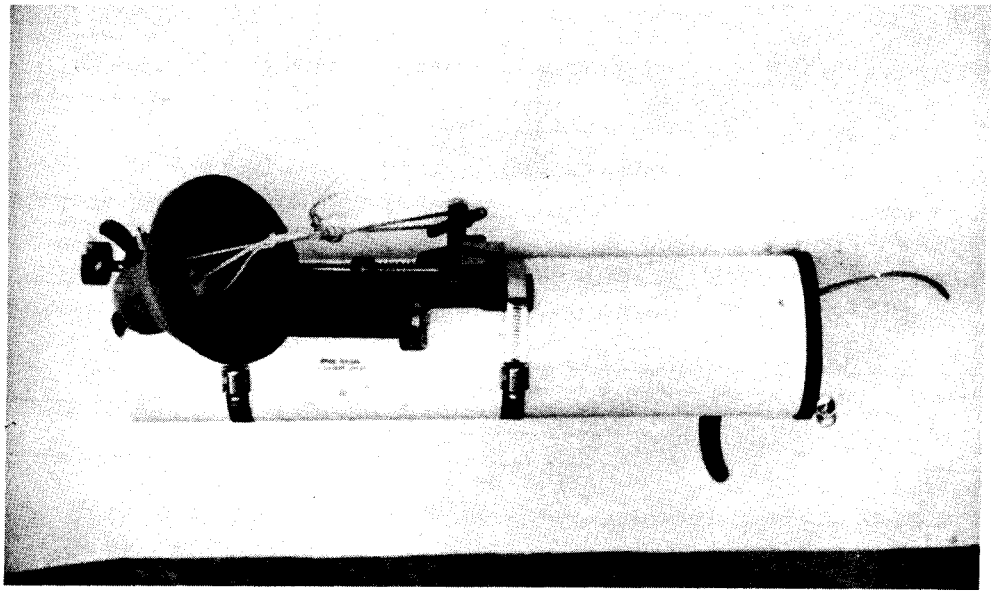


PLATE 1 – THE KAHLSICO PVC SAMPLING BOTTLE

PLATE 2 – HAND SAMPLING BY WADING

(c) While it is desirable to have the sample taken at a depth of 0.6d, the stream or river depth may be so shallow that this cannot be achieved. In this case it is most important that the Sampler does not rest on the stream bed or otherwise disturb the bed sediment. To avoid this the Sampler should be held at or just below the surface before activating the release mechanism.

4.2 *Sampling by Suspension from Bridge*

To carry out water quality sampling from a bridge the same A–Frame gauging crane, gauging winch, hanger bar and weights used for gauging by current meter from bridge (Ref. Hydrological Procedure No. 15) can be utilised (Plate 3). This equipment has already been adequately described in "Section 5, Bridge Gauging" of Hydrological Procedure No. 15 and will not be discussed here.

(i) Having assembled the A–Frame gauging crane, rest the A–Frame in position against the bridge rail above mid-stream. After fitting the gauging winch, release 1 to 2 metres of cable from the winch. Choose a suitable weight based on observation of the flow conditions. For relatively shallow, low velocity flow the 7kg. would be adequate but for stronger currents and/or deep waters the 14 or 23 kg. weight will be necessary. Secure the weight to the bottom of the hanger bar and then secure the cable connector to the top hole of the hanger bar.

(ii) The Sampler is then prepared as stated above in Para. 4.1 (1) to (iv).

(iii) When ready to place the Sampler onto the cable just above the hanger bar, hold the Sampler upright and slide the wire into the open slot (8, Fig. 1) of the guide. This will keep the bottle from swinging on the cable. After turning the wing-nut (10, Fig. 1) counter-clockwise to open the wire clamp, place the clable in this section (9, Fig. 1). Before closing the clamp by turning the wing-out clockwise, lower the Sampler until the open slot of the guide (8, Fig. 1) is just above the cable connector.

(iv) Measure the distance from the swivel post (2, Fig. 1) to the bottom of the weight - this is the *depth correction factor.*

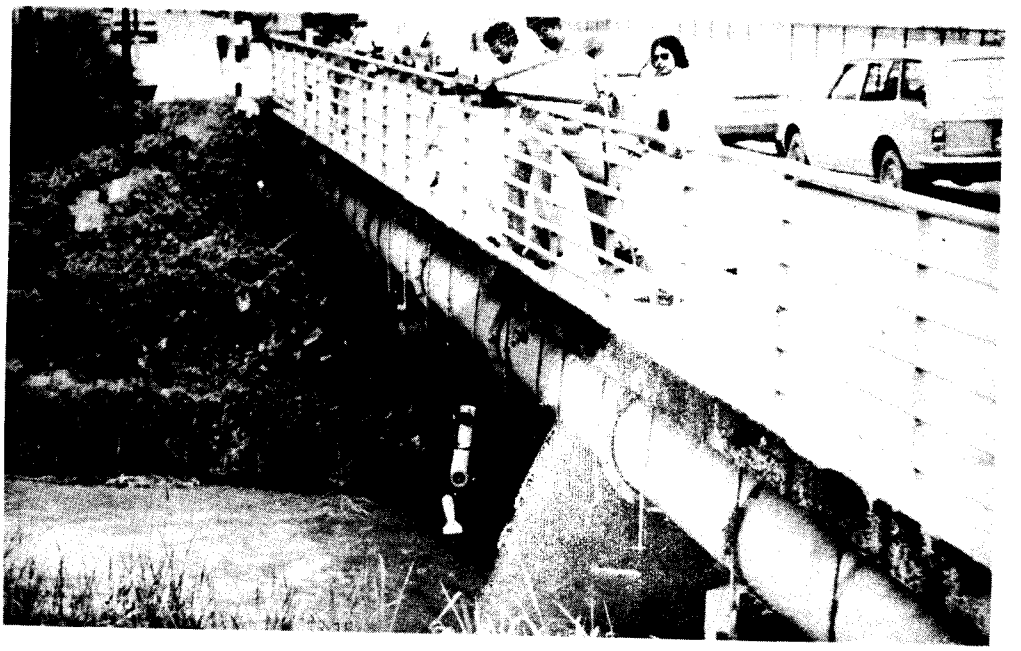


PLATE 3 – SAMPLING BY SUSPENSION FROM BRIDGE

JABATAN KIMIA
MALAYSIA

Peringatan-Lapuran ini tidak
boleh digunakan untuk iklan
No. Talipon: . . . . . .
No: Makmal: . . . . . .
Rujukan tuan:

.....19.....

LAPURAN

Berkenaan . . . . . .
contoh-contoh yang diterima daripada JPT, Ibu Pejabat,
Kuala Lumpur dibawa oleh . . . . . pada 21.2.79.

I. Bacaan Luar		**Cols**	
1. Station No.		1 – 8	9. Sample No:
2. Sampling Data (Day/M/Yr)		9 – 16	10. Station Name:
3. Time of Sampling:		17 24	11. Gauge Height (Metres):
4. Discharge (CMS):		25– 32	12 Type of Sampler:
5. Sample Depth (Metres):		33 –40	13. Sample Treatment:
6. Water Temperature °C:		41 –48	14. Raining/Not Raining (Cross out one)
7. pH (Field):		49 56	15. Name of Observer:
8. Dissolved Oxygen		57 –64	16. General Observations of Water: (viz by sight, smell, touch, etc.)

PERINGATAN: Borang ini hendaklah diisi dengan dua salinan dan borang asal di-hantarkan ke Jabatan Kimia ber-sama-sama contoh air.

11. Laporan Makmal

			Cols			Cols
1.	Colour:		65 – 72	16. BOD		25 – 32
2.	Turbidity:		73 – 80	17. COD:		33 – 40
3.	Conductivity:		1 – 8	18. Nitrate:		41 – 48
4.	Hardness:		9 – 16	19. Ammonia:		49 – 56
5.	Total Solids at 105°C		17 – 24	20. Phosphate:		57 – 64
6.	Suspended Solids:		25 – 32	21. Silica:		65 – 72
7.	Dissolved Solids:		33 – 40	22. Iron:		73 – 80
8.	pH (Lab):		41 – 48	23. Manganese :		1 – 8
9.	Alkalinity:		49 – 56	24. Flouride:		9 – 16
10.	Calcium:		57 – 64			17 – 24
11.	Chloride:		65 – 72			25 – 32
12.	Potassium:		73 – 80			33 – 40
13.	Magnesium:		1 – 8			41 – 48
14.	Sodium:		9 – 16			49 – 56
15.	Sulphate:		17 – 24			57 – 64

APPENDIX B

KEMENTERIAN PERTANIAN,
BAHAGIAN PARIT DAN TALI AIR,
JALAN MAHAMERU,
KUALA LUMPUR 10 – 02.

Telefon: 982011
Kawat: DIRRIG

Ketua Pengarah,
Jabatan Kimia Malaysia,
Jalan Sultan,
Petaling Jaya,
SELANGOR.

Bil. ( )dlm.PPT.475/9/3/3

Tarikh:

Tuan,

Permohonan bagi Analisa-Analisa Kualiti Air

Berhubung dengan surat tuan JK(KL) 16/3/20 yang bertarikh 28hb. Ogos, 1973, sukacita sekiranya tuan boleh membuat analisa-analisa kualiti air untuk ....contoh air yang dihantar bersama-sama ini.

2. Butir-butir bagi tiap-tiap contoh air adalah diisikan didalam borang - borang yang disertakan.

Saya yang menurut perintah,

bp. Ketua Pengarah,
Jabatan Parit dan Tali Air,
Malaysia.

Provisional List of Parameters for Water Quality Station Objectives

Water Supply	Fisheries	Experimental Basin Study	Pollution	Representative Basin Study	Irrigation
Colour	Colour	Colour	Colour	Colour	Colour
Turbidity	Turbidity	Turbidity	Turbidity	Turbidity	Turbidity
Conductivity	Conductivity	Conductivity	Conductivity	Conductivity	Conductivity
Hardness	Hardness	Hardness	Hardness	Hardness	Hardness
Total Solids	Total Solids	Total Solids	Total Solids	Total Solids	Total Solids
Suspended Solids	Suspended Solids	Suspended Solids	Suspended Solids	Suspended Solids	Suspended Solids
Dissolved Solids	Dissolved Solids	Dissolved Solids	Dissolved Solids	Dissolved Solids	Dissolved Solids
pH	pH	pH	pH	pH	pH
Alkalinity	Alkalinity	Alkalinity	Alkalinity	Alkalinity	Alkalinity
Calcium	Calcium	Calcium	Calcium	Calcium	Calcium
Chloride	Chloride	Chloride	Chloride	Chloride	Chloride
Potassium	Potassium	Potassium	Potassium	Potassium	Potassium
Magnesium	Magnesium	Magnesium	Magnesium	Magnesium	Magnesium
Sodium	Sodium	Sodium	Sodium	Sodium	Sodium
Sulphate	Sulphate	Sulphate	Sulphate	Sulphate	Sulphate
Silica	Silica	Silica	Silica	Silica	Silica
Ammonia	Ammonia	Nitrate			Ammonia
Fluoride	Nitrate				Nitrate
Manganese	Phosphate	Phosphate	Ammonia		
Iron	Dissolved Oxygen		Nitrate		
			Phosphate		
			BOD		
			COD		
			Dissolved Oxygen		

APPENDIX D

JABATAN KIMIA
MALAYSIA

Peringatan- Lapuran ini tidak
boleh digunakan untuk iklan
No. Talipon: 569522
No. Makmal: (KL) 1451/81
Rujukan tuan (44) dlm. PPT. 475/6/3/4 Jld. 5

3hb. Mac, 1981

LAPURAN

Berkenaan: satu contoh Air diterima daripada Sg. Tekam, Jerantut, Pahang dibawa melalui JPT. Ampang pada 16.1.1981

1. **Bacaan Luar**		Cols		
1. Station No.	**3925603**	1 – 8	9. Sample No:	**SC 2/1/81**
2. Sampling Date (Day/M/Yr)	**16/01/81**	9 – 16	10. Station Name:	**Site C**
3. Time of Sampling	**0830**	17 24	11. Gauge Height (Metres):	**0.25**
4. Discharge (CMS):	-	25 –32	12. Type of Sampler:	**Bottle**
5. Sample Depth (Metres):	**0.4**	33 – 40	13. Sample Treatment:	
6. Water Temperature ^{o}C:	-	41 – 48	14. Raining/Not Raining (Cross out one)	
7. pH (Field):	-	49 – 56	15. Name of Observer:	**Ahmad Sitam**
8. Dissolved Oxygen:	-	57 – 64	16. General Observations of Water: (viz by sight, smell, touch, etc.)	

PERINGATAN: Borang ini hendaklah diisi dengan dua salinan dan borang asal di-hantarkan ke Jabatan Kimia ber-sama-sama contoh air.

II. **Laporan Makmal**

		Cols			Cols
1. Colour:	< 5*	65 – 72	16. BOD:	0.2	25 – 32
2. Turbidity: (NTU)	36	73 – 80	17. COD:	10.6	33 – 40
3. Conductivity:	35	1 – 8	18. Nitrate:	0.27	41 – 48
4. Hardness:	21	9 – 16	19. Ammonia:	0.06	49 – 56
5. Total Solids at 105°C	86	17 – 24	20. Phosphate:	0.36	57 – 64
6. Suspended Solids:	19	25 – 32	21. Silica:	16	65 – 72
7. Dissolved Solids	67	33 – 40	22. Iron:	1.9	73 – 80
8. pH (Lab.)	6.8	41 – 48	23. Manganese:	0.06	1 – 8
9. Alkalinity:	27	49 – 56	24. Fluoride:	0.20	9 – 16
10. Calcium:	5.2	57 – 64			17 – 24
11. Chloride:	2.5	65 – 72			25 – 32
12. Potassium:	0.8	73 – 80			33 – 40
13. Magnesium:	1.9	1 – 8			41 – 48
14. Sodium:	3.0	9 – 16			49 – 56
15. Sulphate:	0.0	17 – 24			57 – 64

* After centrifuging

Colour is expressed in Hazen Units, Conductivity in /umhos/cm., pH according to the pH scale and the other parameters are expressed in parts per million (ppm).

Ketua Pengarah,
Jabatan Parit dan Tali Air Malaysia,
Cawangan Haideroloji,
Jalan Mahameru ,
KUALA LUMPUR 10 – 02

t.t
(LIM POH CHOO)
Ahli Kimia
bp. Ketua Pengarah Kimia
Malaysia

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HYDROLOGICAL PROCEDURES PUBLISHED

		Price
No. 1.	— Estimation of the Design Rainstorm (1973)	$ 8.00
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No. 3.	— A General Purpose Event Water-Level Recorder Capricorder Model 1598 (1973)	$ 5.00
No. 4.	— Magnitude and frequency of floods in Peninsular Malaysia (1974)	$ 6.00
No. 5.	— Rational method of flood estimation for rural catchments in Peninsular Malaysia (1974)	$ 3.00
No. 6.	— Hydrological station numbering system (1974)	$ 3.00
No. 7.	— Hydrological Station Registers (1974)	$ 5.00
No. 8.	— Field Installation and Maintenance of Capricorder 1599 (1974)	$ 5.00
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Dicetak oleh Unit Penerbitan,
Kementerian Pertanian.