

4. HYDROLOGICAL MONITORING PROTOCOL: Automatically Sampled Data

A. Purpose

These procedures are intended as a practicing guide for those engineers and officers who are in charge of Sediment Monitoring Stations. They are technically responsible for the installation of automatic sampling equipment, changing of recorder charts, maintaining of recorders, data loggers, batteries, solar panels, etc, and the processing of data retrieved from the field from these equipments.

B. Data Mediums

There are two mediums of data output obtainable from the automatic hydrological equipment.

Recorder charts

Data logger files

These output must be carefully prepared from the beginning and processed in accordance with the procedures laid down below.

TYPES OF RECORDER CHARTS

Two types of charts are commonly found:

rainfall charts

water-level charts

SECTIONS ON DATA MEDIUMS

Section C to Section H are concerning recorder charts

Section 1 is dealing with data logger files

C. Things to do in the Field

The first step begin with the changing of charts in the field which will effect the most important element of chart data. This step also involves the writing down of station name, date, time and values.

RAINFALL CHART

When installing the rainfall chart, write down near the beginning of the chart the "On Date and Time" to the nearest minute. Use an arrow to indicate the position of the chart for this "On Date and Time". Note down the clock speed, e.g. 10mm/minute, 20mm/minute.

When taking the chart off later, do write down the "Off Date and Time" near the end of the used chart. Use another arrow to indicate the position of the chart for the "Off Date and Time". The figure on the following page shows an example of doing these.

WATER-LEVEL CHART

When installing the water-level chart, write down near the beginning of the chart the "On Date and Time" to the nearest minute. Also, read the stick gauge at that moment and write down the value on the chart, e.g. SG 2.38m.

The clock speed, on the basis of two weeks or month, should be noted down as well. Use an arrow to indicate the position of the chart that has the “On Date and Time” and the stick gauge value.

When taking off the chart later, do write down the “Off Date and Time” together with the stick gauge value near the end of the used chart. Again use another arrow to mark this position. The figure on the opposite page shows an example of the marking of water-level chart.

CLOCK SPEED

To save charts, it is advisable to change the clock speed of;

rainfall:

- for monsoon period : 20mm/minute
- for other period : 10mm/minute

water-level:

- for monsoon period : 2 weeks
- for other period : 1 month

Due to this differential speed arrangement, it is necessary to write down the clock speed at the beginning of each chart period for the convenience of data abstraction later.

TRANSPORTING CHARTS

Transportation of charts from the field back to the office must be handled with care since loss of a single chart can mean a break in a long term series. If one manual or logger data happens to be unavailable, months of effort can go down the drain. Store the charts in safe places at all time.

D. Things to Do in the Office

GROUPING OF CHARTS

There may be a number of stations that you are handling, the charts are best classified and serially stacked according to the time periods covered by the charts.

ABSTRACTION OF CHARTS

All the charts are to be abstracted according to the procedures as in the Section E if it is a rainfall chart and in Section F it is a water-level chart.

COMPARISON WITH MANUAL DATA

After abstraction of automatic recorder data, it has to be compared with the manually observed data. This is explained in Section G.

E. Abstraction of Rainfall Charts

MARKING DATE

Mark the date divide at 08:00 hours and have the date in the form of day/month written down on the chart, e.g. 3/8 hour the period starting at 08:00 hour on 3rd of August until 08:00 hour on 4th of August.

The reason for dividing at 08:00 to 08:00 is to enable comparison later of the abstracted data with that of the manually recorded data.

CHECK AND ADJUST TIMING

Compare the date and time as read from the end of the graph marked by the recorder pen with that of the time written down by the observer at the moment when the chart was taken off from the recorder, i.e. Off Date and Time. If both time readings are not the same, then the recorder is either running too fast or too slow. Write down the difference in the Form I "Station Inspection" so that any officer making the next trip to the station will be reminded to make some adjustment to the clock.

Make manual adjustment of the time scale if the difference is great. For example, if the clock is found to be running too fast by 3 hours over a period of 30 days, each daily interval on the time axis will have to be scaled up by the length of 3 hours divided by 30.

The times noted down when changing charts are assumed to be correct. Once the charts are checked and marked, they are ready to be abstracted.

DAILY ABSTRACTION

Abstract the total amount of rain over the defined day of 08:00 to 08:00 and write down in the respective cell provided for each day in the Form H2 "Daily Rainfall Abstraction".

For example, the rainfall amount over the period starting at 08:00 hour on 3rd of August until 08:00 hour on 4th of August is 10.5 mm. The value 10.5 is written on the cell reserved for 3rd of August.

SIMPLE ANALYSIS

Calculate the sum of the rainfall for one month and place it in the "SUM" cells near the bottom of the form.

Look for the highest value in each month and place it in the "MAX" cells at the bottom of the form.

Sum up all the monthly values and enter it in the box "ANNUAL TOTAL" at the bottom of the form.

The highest in the "MAX" row is placed in the box "ANNUAL MAX" at the bottom of the form.

STORAGE OF CHART

After the calculations have been carried out for the charts, store them away in a safe place, classified according to the station and year. These charts may be referred to from time to time if necessary. Take care to protect these from insects or mice.

E. Abstraction of Water-level Charts

MARKING DATE

Mark the date divide at 24:00 hours and have the date in the form of day/month written down, e.g. 11/8 for the period of 00:00 hour on 11th of August to the 24:00 hour on 11th of August.

CHECK AND ADJUST TIMING

Compare the date and time as read from the end of the graph marked by the recorder pen with that of the time written down by the observer at the moment when the chart was taken off from the recorder, i.e. Off Date and Time.

If both time readings are not the same, then the recorder is either running too fast or too slow. Write down the difference in the form I so that during the next trip to the station, the clock can be suitably adjusted.

Make manual adjustment of the time scale if the difference is great. The observer's time noted down is assumed to be the correct timing.

Once the charts are checked and marked, they are ready to be abstracted.

MAXIMUM ABSTRACTION

The charts are scanned through for the peak levels. For every peak level encountered, note down the date, time and water-level value on the form H3 "Peak Water-Level Abstraction".

ANNUAL EXTREMES

After abstracting the peak levels of all the charts covering the period of a year has been completed, the top three extremes or highest in the year is entered in the space provided as Annual Extreme Water-level at the bottom of the form. These will later be converted into Annual Extreme Discharge based on rating formula applicable for the period.

STORAGE OF CHART

After the above routines have been carried out for the charts, store them away in a safe place classified according to the station and year. These charts may be referred to from time to time if necessary. Take care to protect these from insects or mice.

G. Comparison with Manual Data

ABSTRACTED RAINFALL DATA

The rainfall data abstracted according to the above procedures can be further checked with that of rainfall measured manually.

If some serious differences are found, there are two possibilities, either the observer is not reliable or the recorder is not functioning properly.

One quick way of checking is to compare the total amount of rainfall in a month. If the observer is reliable, the amount recorded may show consistently slightly higher values (by 3% to 5%). This is due to the systematic error of tipping bucket system in the automatic recorder.

If the observer is considered to be reliable, based on field inspection or other means, the manual rainfall record can be more accurate although it is only at daily intervals.

If the monthly rainfall sums obtained from the observer differ greatly from that of the recorder and the daily readings also show a similar trend, then it is likely that the observer is not reliable. Test the observer in the next trip on the reading of some simulated rainfall. If the observer fails the test then the period of daily data from the observer has to be reexamined and marked "unreliable" on form H2.

ABSTRACTED WATER-LEVEL

Data from the form M can be compared with that of abstracted water-level extremes. Compare peak levels at the same timing with the manually recorded levels. Although the timing may not exactly coincide, the order of magnitude should not be far off. If the order of magnitude is far out, the observer has to be tested in the next trip to read the stick gauge to find out whether he is reliable.

H. Digitising of Charts

A computer program package which commands a digitising tablet can be used in picking up digital data from the recorder charts at a fast speed.

Three possible situations that the digitising program will be used:

- a. charts from stations that does not have any data logger installed;
- b. charts from stations that have loggers installed but the loggers failed or malfunctioned;
- c. charts from stations that have recorders installed well before any logger is installed, i.e. the charts that were produced before the project started.

It is vital that all these charts be kept in safe places so that they will be available in good condition by the time digitising is introduced.

Make note on details about the files transferred in the space provided for this purpose in No.9 on "Data Logger" of form I. The diskettes that you used for storing the data files should be numbered to avoid confusion later.

I. Stations with Loggers

The data logger must be carefully checked and data retrieved every time a field trip is undertaken to any station equipped with a logger.

Take good care of the diskettes when transporting them to the office. Avoid placing them near to any strong magnetic field or heat source.

SUBMISSION OF DATA

After each monsoon period, the followings files must be properly named and sent on 5 1/4" diskette to the Ministry of Agriculture for compilation and further analysis:

- all original data logger files
- all processed data files

Notify the file names on each diskette with a directory listing of each of the diskettes.

The output to printer on the followings are also to be sent:

- daily rainfall sheet
- daily water-level sheet