WD Protocol

SURFACE WATER DISCHARGE

Aim

The continuous recording of stream or river water discharge at sites where the whole catchment area of a natural, perennial stream lies within the ECN site

Rationale

The impact of environmental change is likely to bring about a response in hydrological conditions at a site. The water balance at any location is controlled by climate, vegetation cover and soil properties. Any change in the external climate or in the internal structure of the soil/vegetation system will be reflected in changes in site hydrology. This may involve changes in evaporation, in soil moisture levels, and in the amount of runoff from the site. At sites where snow forms an important component of the precipitation, climate change may have particularly important effects. Monitoring of hydrological variables in ECN may therefore provide a sensitive indicator of environmental change.

Method

Equipment

Recording of river stage, or level, will use a permanently installed weir or flume whose design will be determined by the conditions at each site but will accord with BS 3680 (BSI 1965). Data are recorded by a Campbell Scientific digital CR10 logger and this should be supplemented where possible by an analogue Ott chart recorder. A dip-flash device will also be installed to facilitate manual readings of stage.

Location

The complete installation comprises an approach channel, a measuring structure, and a downstream channel. The condition of each of these three components affects the overall accuracy of the measurements. In selecting the site, particular attention should be paid to the following:

- the adequacy of length of channel of regular cross-section available;
- the regularity of the velocity distribution over the cross-section of the approach channel;
- the avoidance of a steep channel if possible;
- the effects of any increased water levels upstream due to the structure;
- the impermeability of the ground into which the structure is to be founded;
- the necessity for flood banks to contain the maximum discharge to the channel;
- the stability of the channel downstream of the structure.

Full details are described in BS 3680, Part 4A.

Operation

The logger records stage at ten-second intervals, which the internal program averages and stores over five-minute periods. The logger also calculates an average 15-minute discharge value by taking the mean of the three stage values which it converts to discharge using a rating relationship. Fifteen-minute values of both stage and discharge are stored for quality control of the data and for possible re-calculation if the rating relationship changes. A rating curve will be developed for converting stage to discharge ($m^3 s^{-1}$).

Calibration, by the development of a rating relationship, will be carried out using current meters over a full range of flow conditions and repeated every two years, additionally if the weir approach conditions change. Each site will produce its own calibration protocol. The level of the dip-flash datum will be checked every two years. Data quality control will be carried out by site staff after initial training, according to the procedure detailed in Appendix I.

© NERC 1996 ECN is a multi-agency organisation, co-ordinated by CEH on behalf of NERC www.ecn.ac.uk

Data will be downloaded to a PC at fortnightly intervals, via a storage module. The procedure for each fortnightly site visit is as follows.

1. Take dip-flash reading.

2. Note time and stage on the old and new Ott chart; remove the old chart and insert the new chart; wind the clock and set the pen to the correct time and stage.

3. Remove the data from the Campbell logger using the storage module.

4. Plug in the key-pad, reset the stage value if necessary and check the logger voltage. If the battery voltage is low (<11.5 volts), check the solar panel (if installed) and its connections to the logger, or if necessary change the battery. Do not remove the old battery without first plugging in a temporary external battery to preserve the internal software.

5. Check the weir approach and crest for debris, sediment or ice accumulation and clear if possible without compromising safety. Check for ice in the stilling well and break up if present. Check that all cables are able to move freely.

It is recommended that a duplicate copy of the logger program should be kept at the site.

Ott charts will be stored for further reference, should this be necessary.

Authors

R.C. Johnson and T.P Burt

Reference

British Standards Institution. 1965. *BS 3680. Methods of measurement of liquid flow in open channels. Part 4. Weirs and flumes. 4A. Thin plate weirs and venturi flumes.* London: BSI.

© NERC 1996 ECN is a multi-agency organisation, co-ordinated by CEH on behalf of NERC *www.ecn.ac.uk*

Appendix I. Quality control of surface water discharge data

Procedure

1. Check that the first and last data points agree with times of data removal from logger.
2. Check manual (dip-flash) and automatic stage readings at start and finish.
3. Compare 12 noon stage values from both sensors on days when steady flow.
4. Note any missing data or times when weir could have been frozen.
5. Make notes on results of all checks, changes and maintenance (eg dredging) carried out for inclusion in the ECN database.

© NERC 1996 ECN is a multi-agency organisation, co-ordinated by CEH on behalf of NERC *www.ecn.ac.uk*

Specification of results and recording conventions

The measurement variables listed below are those required for each WD sampling location at an ECN Site. Sites submitting data to the ECNCCU should refer to the accompanying Data Transfer documentation for the specification of ECN dataset formats, available on the restricted access Site Managers' extranet. Contact ecnccu@ceh.ac.uk if you need access to this documentation.

The first 4 key parameters uniquely identify a sample or recording occasion in space and time, and must be included within all datasets:

• Site Identification Code (e.g. T05)	Unique code for each ECN Site
• Core Measurement Code (e.g. PC)	Unique code for each ECN 'core measurement'
• Location Code (e.g. 01)	Each ECN Site allocates its own code to replicate sampling locations for each core measurement (e.g. for different surface water collection points)
• Sampling Date (/time)	Date on which sample was collected or data recorded. This will include a time element where sampling is more frequent than daily

ECNCCU 2001

Core measurement: surface water discharge (WD Protocol)

The following variables are recorded automatically at 15 min intervals.

Variable	Units	Precision of recording
Site Identification Code		
Core Measurement Code		
Location Code		
Recording (Sampling) date		
Recording (Sampling) time	GMT 24-h clock	1 min
Stage (average)	m	0.001
Discharge (average)	m^3s^{-1} (cumecs)	0.001

© NERC 1996 ECN is a multi-agency organisation, co-ordinated by CEH on behalf of NERC *www.ecn.ac.uk*