Flow Characterisation

Longer term flow characterisation is necessary in order to make predictions about likely future conditions and potential energy yields from a hydropower system. DIY flow measurements can be used if sufficient values are recorded to create a hydrograph and flow duration curve as explained below.

For all but the very smallest schemes or those where the design flow is significantly less than the average flow rates, this data will be supported by other methods. These include correlation or correction of national gauging station data records to the site in question and also increasingly the use of software tools to model likely future conditions.

For improved estimates of energy capture, flow duration data can be entered into a table or uploaded to Hydromatch (Hydromatch Silver and Gold only). Hydromatch offers a flow modelling service for UK locations.

Hydrographs

A hydrograph illustrates flow variation with time. See example below

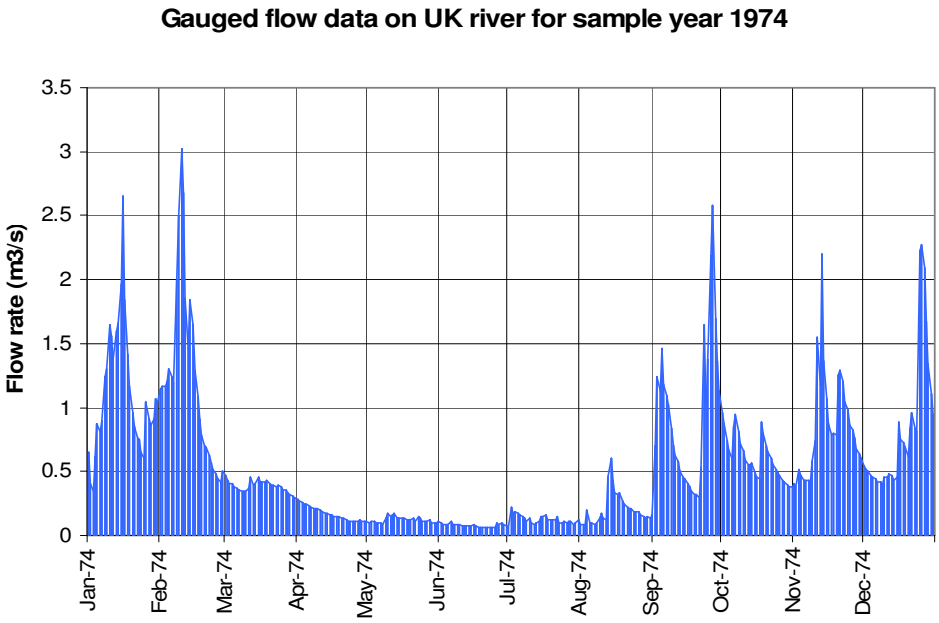
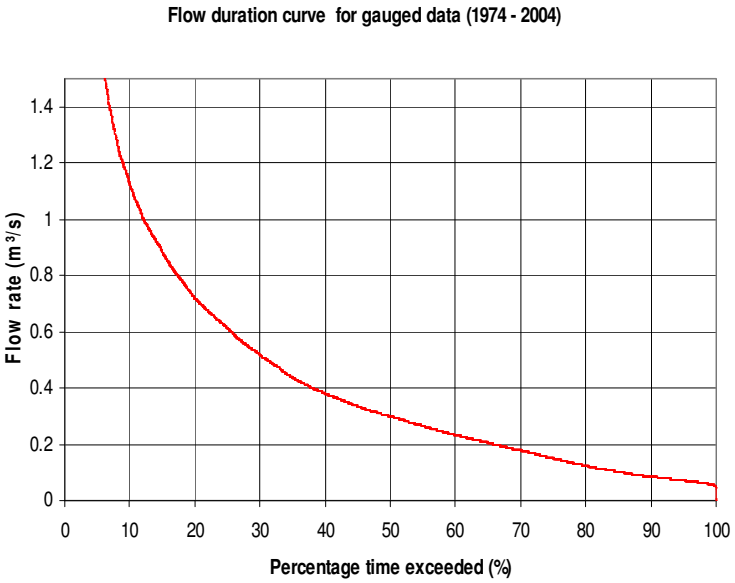


Figure 1: Hydrograph of gauged river flow over a 12 month period (River Brue)

Flow duration curves

In order to characterise the flow variation flow data such as this is usually illustrated using a Flow Duration Curve. This shows the percentage of time which a particular flow rate is likely to be exceeded in any given year. For example the flow rate equivalent to Q10 would be equalled or exceeded for just 10 % of the time and therefore represents a high flow rate. Average flow rates are typically between Q30 and Q40 for UK rivers. A typical flow duration curve is illustrated in Figure 2. The flow duration curve is likely to be more representative of future conditions if data is obtained over longer time periods.



Percentage Exceedence	Flow Rate (m^3/s)
Q_{10}	1.069
Q_{20}	0.685
Q_{30}	0.495
Q_{40}	0.364
Q_{50}	0.285
Q_{90}	0.079
Q_{95}	0.067
$Q_{mean} = Q_{31.6}$	0.474

Figure 2: Flow duration curve with table of summary values

To construct a Flow Duration Curve:

Using a spreadsheet program, sort the gauged data (measured at equal invervals, e.g. mean daily flow rates, or weekly measurements, in order of magnitude with largest first in column A. In column B, create % Probability Exceedence (PE) values.

In row 1, column B type equation:

[=(1/total number of flow values)*100]

In all subsequent rows of column B type equation:

[=(1/total number of flow values)*100+ (previous % PE value in the list)]

Data input to Hydromatch

For input to Hydromatch, flow data can be uploaded (Silver and Gold plans only)

1. Suitable file formats are: .xls, .xlsx, .ods, .csv

2. Data should be in columns and without headings

3. Flow data (in m^3/s) should be sorted into descending values and saved in Column A of the spreadsheet

4. If there are less than 100 flow values, then a Probability Exceedance value (values between 1 and 100) is required for each flow value. For 100 flow values or more, the PE% values are automatically created by Hydromatch and are therefore not required from the user

5. The Probability Exceedance values should be stored in Column B of the spreadsheet adjacent to corresponding flow values

Using gauging station data

The flow rates in all major UK Rivers are measured continuously at Environment Agency gauging stations. Mean daily flows data can be obtained from the website http://www.ceh.ac.uk/data/nrfa/index.html. Some of the data is free to download, for other gauging stations the data can be requested for a small fee.

Correlate to catchment of site

Often the nearest gauging station is a considerable distance from the site of interest and some form of correction is required to allow for the differences in catchment area. The simplest method is to compare the ratio of the catchment areas between the gauging station and the site. It should be possible to trace the overlapping catchment areas from an Ordnance survey map and then use squared paper to estimate the area. The ratio of areas will give a factor which can be applied to the gauging station data to 'correct' it to the site.

Catchment modelling and flow prediction at un-gauged sites can be achieved more rapidly and accurately using computer programs such as 'Low Flows 2'. These can also be used to produce more accurate correction factors for adjusting long term gauged data provided by the Environment Agency. Hydromatch offers a flow modelling service for UK locations.