Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

The UK Benchmark Network (UKBN2) User Guide

A network of near-natural catchments

Last modified: 30/04/2018

NRFA nrfa.ceh.ac.uk

Environment Agency

SEPA Scottish Environment Protection Agency

Cyfoeth Naturiol Cymru Natural Resources Wales

RIVERS Agency

The UK Benchmark Network

The UK Benchmark Network (UKBN) comprises a subset of gauging stations from the national hydrometric network that are most suited for identification and interpretation of long-term hydrological variability and change. Benchmark catchments can be considered reasonably free from human disturbances such as urbanisation, river engineering, and water abstractions, so are 'near-natural' and hence can be used for detection of climate-driven changes in river flow.

The UKBN was originally designated almost 15 years ago by Bradford and Marsh (2003). The first iteration of the Benchmark Network, UKBN1, included 122 catchments that met four primary criteria: i) relatively natural flow regimes, ii) good and consistent hydrometric data quality, iii) relatively long records (ideally >25 years), and iv) were representative of UK hydroclimatic conditions with good geographical coverage.

It is recognised that the benchmark criteria are stringent and not all designated stations will meet these fully. This second iteration, UKBN2 (Harrigan et al. 2018), has made the following updates and improvements:

- Reviewed 176 catchments including the original UKBN1 list of stations along with candidate stations that did not originally meet benchmark criteria
- Engaged with each of the 4 measuring authorities (Environment Agency for England, Natural Resources Wales, the Scottish Environment Protection Agency, and the Rivers Agency for Northern Ireland) in an expert consultation exercise to gain more detailed information and confirmation about the ability of each station to capture both high and low flow extremes
- Assigned each station a *Benchmark Score* based on their benchmark suitability at low, medium, and high flows, recognising all stations cannot be benchmark across the full flow regime
- Provided a *Benchmark Qualifier* justifying why caution is needed or why a station may not be suitable for an analysis at high and/or low flows.

This process identified 146 of the 176 reviewed stations suitable for classification as benchmark status. Each station is assigned a score based on suitability for analysis of low, medium, and high flows with 2 = suitable, 1 = caution, and 0 = not suitable. Using these scores, 112 and 110 suitable for low and high flow analysis, respectively and 80 of the 146 stations can be considered benchmark across the full flow regime (Table 1). To improve spatial distribution, particularly in the south and east where many catchments are affected by water abstractions, compromises have been made and stations are instead given a score of 1 (meaning caution is necessary). The spatial distribution of the UKBN2 stations is shown in Figure 1.

The mean station record length in UKBN2 is 46 years, with a minimum of 21 and maximum of 85. Only 5 stations have records with between 10 and 30 % missing with a mean percent missing value of 1.4 %. Median catchment size of the network is 100 km^2 (ranging from 3 to 1500 km^2). 92 % of stations can be considered 'essentially rural' in terms of FEH degree of urbanisation criteria (i.e., < 2.5 % of catchment area urbanised). There are 2 stations with > 10% urban and these are a compromise to address spatial gaps in the network.

The full list of UKBN2 catchments, with their scores and qualifying comments, is available as an .XLSX download on the NRFA website along with details on how to access the data: http://nrfa.ceh.ac.uk/benchmark-network.

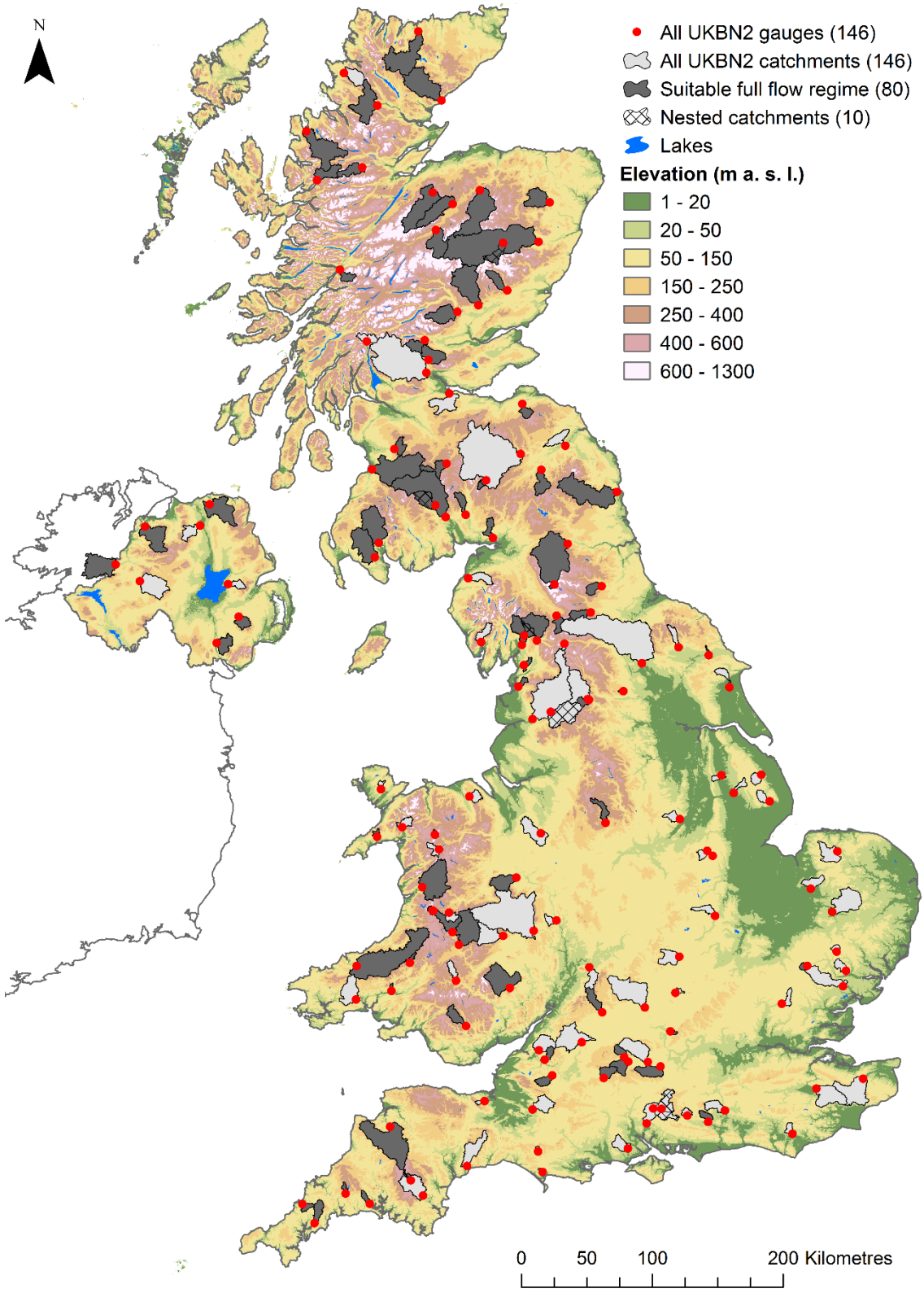

Figure 1. Catchment boundaries and gauging station locations for all 146 UKBN2 stations (gauges dots and grey catchments), 80 stations suitable for analysis across the full flow regime (i.e., benchmark score = 6) (dark grey catchments), with 10 nested catchments hatched (source: Harrigan et al., 2018).

Table 1. | Number of UKBN2 stations within each benchmark classification

Benchmark Score	Low	Medium	High	Full flow regime
2 (Suitable)	112	141	110	80
1 (Caution)	20	5	23	-
0 (Not suitable)	14	0	13	-

UKBN Version control

CURRENT UKBN STATION LIST:

– UKBN_Station_List_vUKBN2.0_1.xlsx (30/04/2018)

HOW TO CITE:

Harrigan, S., Hannaford, J., Muchan, K., Marsh, T. J. (2018) Designation and trend analysis of the updated UK Benchmark Network of river flow stations: The UKBN2 dataset, Hydrology Research, doi:10.2166/nh.2017.058.

UKBN Version notes

– UKBN_Station_List_vUKBN2.0_1.xlsx (30/04/2018)
  - Minor update, station list now includes additional comments (e.g. advice on only using part of flow records)
– UKBN_Station_List_vUKBN2.0_0.xlsx (24/01/18)
  - Minor update, station list now includes basic metadata
– UKBN_Station_List_vUKBN2.0.xlsx (23/10/2017)
  - Major update, details within Harrigan et al. (2018)

References:

Bradford R. B., Marsh T. J. (2003) Defining a network of benchmark catchments for the UK, Proceedings of the Institution of Civil Engineers - Water and Maritime Engineering 156(2): 109–116, doi: 10.1680/wame.2003.156.2.109.

Harrigan, S., Hannaford, J., Muchan, K., Marsh, T. J. (2018) Designation and trend analysis of the updated UK Benchmark Network of river flow stations: The UKBN2 dataset, Hydrology Research, doi:10.2166/nh.2017.058.

UKBN Station List (vUKBN2.0)

Details: List of UK Benchmark Network stations (Version: UKBN2.0) as of 23rd October 2017. Each station is scored based on suitability for analysis of low, medium, and high flows. A **Benchmark Score** of **2 = suitable**, **1 = caution**, and **0 = not suitable**. A station can score a maximum of 6 which means it is suitable for use across the full flow regime. Where a station scores 1 or 0 for a category, a brief **Benchmark Qualifier** is provided. The end user is advised to also consult individual station descriptions available on the NRFA website: http://nrfa.ceh.ac.uk/data/search. Where only part of the record is advised for use, a note is provided in the qualifying comments across the flow range.

Note: AIs = Artificial Influences; **cumecs** = Cubic metres per second; **HEP** = Hydro-electric Power scheme; **NRFA** = National River Flow Archive; **POT** = Peaks Over Threshold; **QMED** = mean annual maxima flood.

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