River Habitat Survey Indices Summary

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River Habitat Survey (RHS) is a CEN-compliant (CEN 2004) standard methodology for hydromorphological assessment under the WFD and feature condition assessment under the Habitats Directive that is widely used in the UK and across Europe (Raven et al. 1997). RHS has been applied to more than 25,000 sites in the UK since 1994.

The RHS field method is designed to yield reliable information on the physical structure of a 500m stretch of river in a format suitable for statistical analysis (Fox, Naura & Scarlett 1998). The survey is organised in two major sections: 'spot-checks' and 'sweep-up'. The spot-checks are a series of ten 1m wide transects across the channel at 50m intervals, where bank and channel physical structure, as well as man-made modifications, land use and vegetation structure are recorded in a replicable manner. The 'sweep-up' section, is used to note other habitat components like trees and associated features, flow features, and bank structure. In addition, background map-based information on altitude, slope, distance from source, height of source, solid and drift geology, flow category and water quality class are also collected.
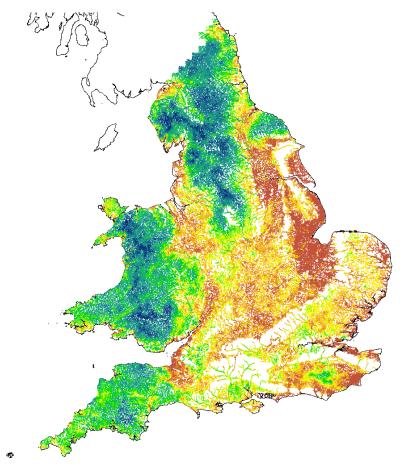
RHS data collected at spot-checks and during the sweep-up are used to calculate the following series of quality scores and indices (see table below):

- The **Habitat Modification Score** (HMS) quantifies the extent, potential impact and persistence of engineering structures on river channels, banks and riparian zones (Walker 2005). It is categorised into five classes (HMC) representing increasing levels of engineering impact, from semi-natural to severely modified. The HMS is split into sub-scores describing different engineering structures: culverts; bridges; outfalls and deflectors; bank and bed reinforcement; bank and bed resectioning; berms and embankments; weirs, dams and sluices; fords; poaching.

- The **Habitat Quality Assessment** (HQA) scores the occurrence and diversity of natural habitat features, land uses and floodplain features, such as channel substrate types, riffles, pools, woodland and wetland (Raven et al. 1998). The score provides an overall site assessment of habitat diversity and conservation value. To be meaningful, HQA scores need to be interpreted within the context of sites of similar type.

- HQA scores are classified into five quality bands following a '**context analysis**'. A context analysis consists of comparing a site HQA to the distribution of HQA scores for sites of similar type using a nearest neighbour approach. The method, approved by the Environment Agency, uses a statistical recombination of map-derived attributes representing known drivers of geomorphological change (i.e. specific stream power and shear stress; Jeffers, 1998) to select 150 sites of similar type taken from one of the baseline surveys (1994-6 and 2007-8). A site is then assessed according to its position within the distribution of HQA scores for the 150 sites. The bottom quintile of the distribution represents very low habitat quality and the top quintile very high quality (all relative). In general, we recommend assessing the scores within the context of the 2007-8 England and Wales baseline survey as they have the highest compatibility in terms of survey format and standards of surveying.

- The **River Habitat Quality** (RHQ) index combines HQA and HMS classes into one index representing the overall quality and integrity of river habitats (see matrix below and Walker 2005, Walker et al 2002).

- The **Channel Substrate Index** (CSI), **Flow Regime Index** (FRI), **Channel Vegetation Index** (CVI) and **Geomorphic Activity Index** (GAI) are derived using RHS spot-check data on channel substrate, flow-types, channel vegetation structure, erosion and deposition features, riffles and pools (Naura et al. 2016). The indices represent natural hydromorphological dimensions in British rivers. The four indices were mapped across the entire river network at 500m interval using geostatisical modelling techniques (Naura et al, 2016). Each index was mapped twice to represent current observable (including any impacts) and semi-natural conditions. The maps of observable and semi-natural condition form the basis for the calculation of impact ratios (HIR and HIA).

Map of CSI using geostatistical techniques at every 500m across the 1/50,000 river network on a gradient from bedrock/boulder (blue) to gravel-pebble (green) and silt-sand-clay (brown).

- **Hydromorphological Impact Ratios (HIR)** are indices describing departure from natural condition and impact for four hydromorphological indices (CSI, FRI, GAI and CVI) .

- The **composite Hydromorphological Impact Ratio** (HIR) combines individual HIRs for four hydromorphological indices/dimensions (CSI, FRI, GAI and CVI) to assess departure from natural condition and impact. The composite HIR varies from 1 (no impact/semi-natural condition) to 5 (very high impact).

- The **Riparian Quality Index** (RQI) combines information on bankface and banktop vegetation structure, bank material and modification in an assessment of riparian vegetation complexity, naturalness and continuity).

- The **Channel Resectioning Index** (CRI) quantifies the number of occurrences of bank and channel modification by reprofiling or dredging along a 500m stretch. Resectioning is the most common modification type and the most prevalent in the UK.

References

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Index	RHS index	Range	Description
Habitat quality indices	Habitat Modification Score (**HMS**)	0 to 6000+	Quantifies the extent, potential impact and persistence of engineering structures
	HMS class	1 (semi-natural) to 5 (severely modified)	Classification of HMS score into 5 categories using set boundaries
	Habitat Quality Assessment score (**HQA**)	0 to 100	Quantifies the diversity and naturalness of habitat features
	HQA class	1 (very low) to 5 (very high)	Classification of HQA score by comparing to sites of similar types using a context analysis.
	River Habitat Quality (**RHQ**) index	I (excellent) to V (very poor)	Classification combining HMS and HQA classes and representing overall habitat quality and conservation value
	Riparian Quality Index (**RQI**)	1 (very low) to 5 (very high)	Quantifies the complexity, continuity and naturalness of the riparian vegetation
Hydromorphological indices	Channel Substrate Index (**CSI**)	-2 (silt) to 1 (boulders)	Represents the average substrate size
	Flow Regime Index (**FRI**)	-1 (glide) to 2 (waterfall)	Represents the average flow-type
	Channel Vegetation Index (**CVI**)	-2 (free floating vegetation) to 1 (mosses and lichens)	Represents the dominant vegetation types
	Geomorphic Activity Index (**GAI**)	-1 (no activity sign) to 1.6 (high activity)	Represents the level of geomorphic activity (i.e. erosion and deposition)
	Hydromorphological Impact Ratio (**HIR**)	1 (low impact) to 5 (very high impact)	Quantifies the level of departure from natural state of CSI, FRI, CVI and GAI combined
	Channel Resectioning Index (**CRI**)	0 (no resectioning) to 30 (all resectioned)	Quantifies the occurrence of bank and channel modification by resectioning (i.e. dredging of the bed and reprofiling of the banks) along the channels