

## MultiMoRPh scale versions of MoRPh indices

The following are provisional formulations released on 9 February 2018

### **INDEX 1: Number of present/extensive flow types**

The number of flow types (from section 4.2) that have been recorded as P or E in any of the 10 MoRPhs (maximum possible value is 9)

### **INDEX 2: Highest energy extensive flow type**

The highest energy flow type (from section 4.2: in the order Freefall > Chute > Broken standing wave > Unbroken standing wave > Upwelling > Rippled > Smooth > No perceptible flow > Dry) recorded as E in any of the 10 MoRPhs

### **INDEX 3: Number of present/extensive bed material types**

NumBedMat: Number of channel bed natural material types (from section 4.1: (Bedrock, Boulder, Cobble, Gravel-pebble, Sand, Silt, Clay, Organic, Peat) that have been recorded as P or E in any of the 10 MoRPhs (potential maximum 9, likely maximum 6).

### **INDEX 4: Coarsest extensive bed material particle size**

Excluding bedrock, organic and peat (i.e. from section 4.1: one of the following in the order Boulder > Cobble > Gravel-pebble > Sand > Silt > Clay) the coarsest bed material recorded as E in any of the 10 MoRPhs

### **INDEX 5: Average bed material particle size (phi units)**

Average value of this MoRPh index across the 10 MoRPhs

### **INDEX 6: Average bed material particle size class**

Index 5 is translated into an approximate particle size class as follows:

Particle size description	Minimum value (phi units)	Maximum value (phi units)
Boulder		-8
Cobble	>-8	-6
Gravel-pebble	>-6	-1
Sand	>-1	+4
Silt	>+4	+9
Clay	>+9	

### **INDEX 7: Extent of bed siltation**

Using the following table of abundance scores add the scores for 'continuous silt layer' and 'patchy thin silt layer' for all 10 MoRPhs and then divide the total by 10 to give an overall indication of the 'extent of bed siltation' (potential maximum value is 15, likely maximum is 10)

	T	P	E
Patchy thin silt layer	0.5	2	5
Continuous silt layer	1	4	10

### **INDEX 8: Channel physical habitat complexity**

The index value ranges from 1 (minimal complexity) to 10 (extremely high complexity) and is calculated as a weighted average of 4 sub-indices as follows (round down to nearest integer value):

NumBedMat (i.e. Index 3): Number of channel bed natural materials sediment types that have been recorded as P or E in any of the 10 MoRPhs – maximum possible 9, likely maximum 6)

NumFlow (i.e. index 1): Number of water surface flow types that have been recorded as P or E in any of the 10 MoRPhs – maximum possible 9, likely maximum 6)

NumBedFeat: Number of types of natural bed features (from section 4.3, subsection ‘Channel bed - Natural physical features’: score 1 for each that is observed as P or E or count>0 in any of the 10 MoRPhs – maximum possible 11, likely maximum 6)

NumVegInteraction: Number of ways in which vegetation is interacting with wetted channel (from section 4.4, subsection ‘Vegetation interacting with the wetted channel’: across the 10 MoRPhs score 1 for each interaction type that is observed as P or E in any of the 10 MoRPhs apart from large wood dams and fallen trees which score 2 if count>0 – maximum 8)

**Channel physical habitat complexity** = ((NumBedMat + NumFlow + NumBedFeat + NumVegInteraction)/3.7)

#### **INDEX 9: Number of aquatic vegetation morphotypes**

Score 1 for every plant morphotype that is recorded P or E (maximum 10 types, ranging from liverworts/mosses/lichens to filamentous algae) based on observations (i) on the channel bed sheet (section 4.4, subsection ‘Vegetation within wetted channel’) and (ii) the bank face sheet (section 3.4, subsection ‘Aquatic vegetation at the bank-water margin’, where 5 of the types can also be recorded). Only score each morphotype once (maximum possible is 10).

#### **INDEX 10: Average riparian physical habitat complexity**

#### **INDEX 11: Maximum riparian physical habitat complexity**

These indices represent the number and extent of riparian physical habitats found within the MultiMoRPh subreach, accumulating those related to wood, water-related features on the bank top, physical features on the bank face and water’s edge, and natural bank profiles. The index values range from 0 (extremely low complexity) to 10 (extremely high complexity across both banks): average riparian physical habitat complexity is the average of the values from the 10 contributing MoRPh modules, whereas maximum riparian physical habitat complexity is the maximum value attained by any of the contributing MoRPh modules.

#### **INDEX 12: Riparian vegetation complexity**

This index represents the number and extent of riparian vegetation morphotypes found within the survey site. The index value is rounded down to an integer ranging from 0 (completely bare banks) to 10 (highly complex vegetation across both banks).

To calculate the index, vegetation is scored separately for the bank top (section 2.2, subsection ‘Terrestrial vegetation’) and bank face (section 3.4, subsection ‘Terrestrial vegetation on bank face’) of each bank. Scores for each vegetation type are calculated by adding the scores from the following table for each vegetation type across all 10 MoRPh surveys. This gives four total scores for each vegetation type (for the 2 bank tops and the 2 bank faces (maximum score of between 10 and 40 depending on the vegetation type for each of the bank tops and faces).

<b>Vegetation type</b>	<b>T</b>	<b>P</b>	<b>E</b>
Mosses (etc.)	1	2	4
Short/creeping herbs/grasses	1	1	1
Tall herbs/grasses	1	2	3
Scrub or shrubs	1	2	3

Saplings or trees	1	2	4
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The scores for all of the vegetation types are summed (maximum possible 150, likely maximum 100) and divided by 10 for the top and face of each bank to give 4 intermediate indices:

*LeftBankTopVegCompl, RightBankTopVegCompl, LeftBankFaceVegCompl, RightBankFaceVegCompl.*

*Riparian Vegetation Complexity = (LeftBankTopVegCompl + RightBankTopVegCompl + LeftBankFaceVegCompl + RightBankFaceVegCompl)/4* to provide an index value ranging from 0 (completely bare banks) to 10 (highly complex and well-developed vegetation).

**INDEX 13: Degree of human pressure imposed by land cover on the bank tops**

The average of the 10 indices from the MoRPh surveys

**INDEX 14: Channel reinforcement**

The average of the 10 indices for the MoRPh surveys

**INDEX 15: Extent of non-native invasive plants**

The average of the 10 indices for the MoRPh surveys