1 - METHOD BACKGROUND

NAME OR CODE	**CarHyCE - CARactérisation HYdromorphologique des Cours d'Eau**
COUNTRY	France
KEY REFERENCE	Onema (2010)
WEBPAGE	http://www.eaufrance.fr/spip.php?rubrique87/
CATEGORY	The method aims to characterize the hydromorphology of rivers (physical components)

2 - METHOD CHARACTERISTICS

A - SOURCE OF INFORMATION / DATA COLLECTION		Maps/Remote sensing	NOT APPLICABLE
		Field survey	The field survey protocol measures several physical variables at the reach (transects) scale
		Rapid field assessment	NOT APPLICABLE
		Existing database	NOT APPLICABLE
		Modelling	NOT APPLICABLE
B - SPATIAL SCALE	HIERACHICAL SPATIAL SCALE	River catchment/Water body/ Reach/Cross Section	Analyses are conducted only at the reach scale of the Surveillance Monitoring network reaches; those reaches are selected as representative of the French range of river types
	LONGITUDINAL SPATIAL SCALE	Fixed length	NOT APPLICABLE
		Scaled to channel width	The reach length corresponds to 14 times the bankfull width (1.5/2 years return period)
		Variable length	NOT APPLICABLE
	LATERAL SPATIAL SCALE	Channel	Several parameters (e.g. characterizing hydraulic geometry, bed configuration, etc.) are measured in the channel, at 15 equally-spaced transects
		Banks/Riparian zones	Banks and riparian areas are more qualitatively characterized; riparian characteristics are recorded at a strip 1/2 bankfull width long
		Floodplain	NOT APPLICABLE
C - TEMPORAL SCALE		Physical and morphological assessment	Only the present status is characterized
		Hydrological assessment	NOT APPLICABLE
D - TYPE OF METHOD		Characterization/classification	The method aims to collect data to objectively characterize the hydromorphological aspects of rivers; these data are then entered into a web database available for further purposes
		Assessment by index	NOT APPLICABLE
		Deviation from reference	NOT APPLICABLE (but potentially assessed, given that the protocol has also been applied to reference sites)
		General assessment / Design framework	NOT APPLICABLE
		Modelling status / Scenario	NOT APPLICABLE
		Final expert judgment	NOT APPLICABLE
		Links with other systems	The method could be applied in conjunction with SYRAH, the national database on hydromorphological impacts at the catchment scale, as well as together with ROE&ICE protocols, which give information on the longitudinal continuity. Finally, collected physical data could be useful for the calculation of the IAM (Index of Morphodynamic Attractiveness, De Giorgi et al., 2002)
E - REFERENCE CONDITIONS			The protocol has also been applied to the reference sites network (RSR) which corresponds to very low impacted sites, allowing comparison between unmodified and impacted hydromorphological characters of river reaches. Reference sites are selected on the basis of hydro-ecoregions and river types where possible, otherwise modelled and/or defined by expert judgment
F - GENERAL INFORMATION		RIVER TYPOLOGY	Reference sites have been selected for each hydro-ecoregion and each river type
		TYPOLOGY LIMITATIONS	The method could be applied to all river types in France
		TYPE-SPECIFIC (Protocol / Assessment method)	NOT APPLICABLE
		BASIS FOR STANDARDS / THRESHOLDS	NOT APPLICABLE
		REACH SCALE SURVEY STRATEGY	Measures are taken at 15 equally-spaced transects in the selected river reach; cross profile bed elevation and substrate are also recorded at each interval of 1/7 of channel width
		TIMING AND FREQUENCY	NOT APPLICABLE
		DATA PRESENTATION (OUTPUT/LAYOUT)	Several raw data on physical and hydrological characteristics of river reaches (models, analysis, etc.). Integration into a national database (NAIADES, Banque nationale de données sur la qualité des eaux de surface continentales)
		METHOD SUPPORT / APPLICATION TOOLS	A technical guide will be available soon
		SPATIAL COMPARISON	Comparison between rivers of the same type are allowed, and also to compare the quality status at the French national scale
		CONNECTION TO ECOLOGY	Reaches of the Surveillance Monitoring network, where CarHyCE has been formerly applied, have also been selected because of the presence of available historical data on fish communities, to allow comparison between hymo and ecological/biological data. The method could support information for the calculation of the IAM (De Giorgi et al., 2002)
		USERS	The method has been developed to be used for management/conservation purposes, but collects/uses methods coming from the scientific field
		SCALE INFORMATION	Only information at the local scale is provided (reach and station)
		NUMBER OF END PARAMETERS	NOT AVAILABLE

3. RECORDED FEATURES

A - CATCHMENT / VALLEY	LARGE SCALE CHARACTERISTICS		NOT APPLICABLE
	HYDROLOGICAL REGIME	Hydrological conditions	The method measures the bankfull discharge and stage as well as the flow rate during the survey
		Metrics of hydrological regime	NOT APPLICABLE
		Hydro-peaking	NOT APPLICABLE
	VALLEY FORM / FEATURES		NOT APPLICABLE
B - CHANNEL	CHANNEL PATTERN / PLANFORM		NOT APPLICABLE
	CHANNEL FORMS		The method measures cross section topography at each 1/7 of the bankfull width
	BED CONFIGURATION		The method measures cross section topography at each 1/7 of the bankfull width and channel slope; the method characterizes bed configuration (facies d'écoulement)
	CHANNEL DIMENSIONS		Bankfull width and stage, wetted channel width, water depth, etc.
	FLOW-TYPE		NOT APPLICABLE
	PHYSICAL / HYDRAULIC VARIABLES		Unit stream power, hydraulic geometry, modelling roughness (from grain size measurements)
	SUBSTRATE		Size classes at transects (index of grain size diversity); clogging (8 measures per reach); measure of sediment size at runs (100 random points); organic substrates
	IN-CHANNEL VEGETATION		Considered as organic habitat
	WOODY DEBRIS		Considered as organic habitat
	ARTIFICIAL FEATURES AND STRUCTURES		NOT APPLICABLE
C - RIVER BANKS/ RIPARIAN ZONE	BANK PROFILE / SHAPE		Banks height as well as cross profiles + characteristic bank habitats (refugia, exposed roots, etc.)
	BANK MATERIAL		Artificial, rip rap, etc.
	RIPARIAN VEGETATION STRUCTURE		Named "layers"
	LONGITUDINAL CONTINUITY OF RIPARIAN VEGETATION		Longitudinal continuity of riparian vegetation
	RIPARIAN VEGETATION WIDTH		Named "thickness"
	VEGETATION COMPOSITION, COVERAGE AND OTHER RIPARIAN VEGETATION CHARACTERISTICS		Natural, allochtonous vegetation
	ARTIFICIAL FEATURES AND STRUCTURES		Artificial bank materials
	LAND USE		NOT APPLICABLE
D - FLOODPLAIN	FLUVIAL FORMS		NOT APPLICABLE
	INFO ON FLOODPLAIN FEATURES		NOT APPLICABLE
	LAND USE		NOT APPLICABLE

4. RIVER PROCESSES

A - LONGITUDINAL CONTINUITY	Sediment and wood	The potential longitudinal mobility of sediment is assessed through unit stream power combined with sediment size measurement (determining the sediment transport capacity of the river)
	Water flow	NOT AVAILABLE
B - LATERAL CONTINUITY	Lateral hydraulic continuity	NOT AVAILABLE
	Sediment (and wood) lateral continuity	NOT AVAILABLE
C - BANK EROSION / STABILITY		The mean bankfull width/depth ratio provides information on erosional/stability processes characteristics of banks, as well as the unit stream power provides information on the capacity of the river to erode its banks
E - CHANNEL ADJUSTMENTS	Planimetric (pattern & width)	NOT APPLICABLE
	Vertical	NOT APPLICABLE
F - VERTICAL CONTINUITY	Groundwater connection	NOT APPLICABLE

5. APPLICATION TO WFD

OFFICIAL METHOD (WFD implementation) / COMMONLY USED METHOD (not compulsory)	The method aims to characterize rivers at the station/reach scale, to allow the hydromorphological monitoring for the Surveillance Monitoring network as required by the WFD. The method will be used as the official one for the implementation of the WFD (determine the quality elements for hymo) but a scoring system is under development
APPLICATION TO ALL WATER BODIES	The method applies to all water bodies in France
USED IN THE CLASSIFICATION OF HIGH-STATUS / OTHER STATUS CLASSES	One of the objectives of the method is also to support the planning of conservation programmes for good and high-status water bodies
USED TO PREDICT RISK OF DETERIORATION	NOT APPLICABLE
USED TO IDENTIFY IMPROVEMENT TARGETS	The method could represent a tool to support and assess the restoration projects/actions
USED TO HELP IDENTIFY CAUSE OF ECOLOGICAL IMPACTS	NOT APPLICABLE
KEY STRENGTHS FOR RIVER MANAGEMENT	The objective characterization of river hydromorphology represents the most important strength (several further applications)