

## EVALUATION FORMS FOR CONFINED CHANNELS

Version 1 - January 2011

## GENERALITY

Date \_\_\_\_\_ Operators \_\_\_\_\_  
 Catchment \_\_\_\_\_ Stream/river \_\_\_\_\_  
 Upstream limit \_\_\_\_\_ Downstream limit \_\_\_\_\_  
 Segment code \_\_\_\_\_ Reach Code \_\_\_\_\_ Reach length (m) \_\_\_\_\_

## GENERAL SETTING AND INITIAL SEGMENTATION

## 1. Physiographic setting

Physiographic unit \_\_\_\_\_

## 2. Confinement

Confinement degree (%) \_\_\_\_\_ >90, 10-90 Confinement index \_\_\_\_\_ (1-1.5)

## 3. Channel morphology

Aerial photo or satellite image \_\_\_\_\_ (name, year)

Channel type \_\_\_\_\_ ST=single-thread, MT/W=multi-thread or wandering

Confined single-thread (ST):

Bed configuration \_\_\_\_\_ BR=Bedrock, CO=Colluvial, C/SP=Cascade/Step Pool, PB=Plane bed, RP=Riffle Pool,  
 DR=Dune ripple, A= Artificial, NC= not classified (high depth or strong alteration)

Confined multi-thread or wandering (MT/W):

Braiding index \_\_\_\_\_ 1-1.5, >1.5 Anastomosing index \_\_\_\_\_ 1-1.5, >1.5

Tipology \_\_\_\_\_ W= wandering, B= Braided, A= Anastomosed

Mean bed slope \_\_\_\_\_ Mean channel width (m) \_\_\_\_\_

Bed sediment (dominant) \_\_\_\_\_ C=Clay, Si=Silt, Sa=Sand, G=Gravel, C=Cobbles, B=Boulders

## 4. Other elements for reach delimitation

Upstream \_\_\_\_\_ Downstream \_\_\_\_\_  
 bed sope discontinuity, tributary, dam, artificialization, changes in confinement, changes in channel width,  
 changes in grain sizes or bed configuration, other (specify) \_\_\_\_\_

## Additional available data / information

Drainage area (at the downstream limit) (km<sup>2</sup>) \_\_\_\_\_

Sediment size D<sub>50</sub> (mm) \_\_\_\_\_ Unit \_\_\_\_\_ Be=Bed, Ba=Bar (SU=surface layer, SUB=sublayer)

Discharges \_\_\_\_\_ M=measured, E=estimated, NA=not available

Gauging station (if M) \_\_\_\_\_ Mean annual discharge (m<sup>3</sup>/s) \_\_\_\_\_ Q<sub>1.5</sub> (m<sup>3</sup>/s) \_\_\_\_\_

Maximum discharges (indicate year and Q when known) \_\_\_\_\_

## GEOMORPHOLOGICAL FUNCTIONALITY

## Continuity

part.	prog.	conf.
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## F1 Longitudinal continuity in sediment and wood flux

A	Absence of alteration in the continuity of sediment and wood	0		
B	Slight alteration (obstacles to the flux but with no interception)	3		
C	Strong alteration (discontinuity of channel forms and interception of sediment and wood)	5		

## F3 Hillslopes - river corridor connectivity

A	Full connectivity between hillslopes and river corridor (>90%)	0		
B	Connectivity for a significant portion of the reach (33-90%)	3		
C	Connectivity for a small portion of the reach (≤33%)	5		

part.: partial scores (to circle)

prog.: progressive scores

confidence level between A and B

conf: confidence level in the answer, with M=Medium, L=Low (High is omitted)

confidence level between B and C

## IDRAIM: stream hydromorphological evaluation, analysis and monitoring system

### Morphology

#### Morphological pattern

<b>F6</b>	<b>Bed configuration - valley slope</b>	<i>(applied to single-thread channels)</i>	
A	Bed forms consistent with the mean valley slope	0	<input type="text"/>
B	Bed forms not consistent with the mean valley slope	3	<input type="text"/>
C	Complete alteration of bed forms for the presence of artificial bed	5	<input type="text"/>

*Not evaluated for bedrock streams, and for deep streams when it is not possible to observe the channel bed*

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<b>F7</b>	<b>Forms and processes typical of the channel pattern</b>	<i>(applied to multi-thread or wandering channels)</i>	
A	Absence (<5%) of alteration of the natural heterogeneity of forms expected for that river type	0	<input type="text"/>
B	Alterations for a limited portion of the reach (≤33%)	3	<input type="text"/>
C	Consistent alterations for a significant portion of the reach (>33%)	5	<input type="text"/>

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#### Cross-section configuration

<b>F9</b>	<b>Variability of the cross-section</b>		
A	Absence (≤5%) of alteration of the cross-section natural heterogeneity (width and depth)	0	<input type="text"/>
B	Presence of alteration (cross-section homogeneity) for a limited portion of the reach (≤33%)	3	<input type="text"/>
C	Presence of alteration (cross-section homogeneity) for a significant portion of the reach (>33%)	5	<input type="text"/>

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#### Bed structure and substrate

<b>F10</b>	<b>Structure of the channel bed</b>		
A	Natural heterogeneity of bed sediments and no significant clogging	0	<input type="text"/>
B	Evident clogging in various portions of the site	2	<input type="text"/>
C1	Evident and widespread (>90%) clogging	5	<input type="text"/>
C2	Complete alteration of substrate due to bed revetment (>33% of the reach)	6	<input type="text"/>

*Not evaluated for sand-bed or bedrock streams, and for deep streams when it is not possible to observe the channel bed*

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<b>F11</b>	<b>Presence of in-channel large wood</b>		
A	Presence of large wood	0	<input type="text"/>
C	Negligible presence or absence of large wood	3	<input type="text"/>

*Not evaluated above the tree-line and in streams with natural absence of riparian vegetation*

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#### Vegetation in the fluvial corridor

<b>F12</b>	<b>Width of functional vegetation in the fluvial corridor</b>		
A	High width of functional vegetation	0	<input type="text"/>
B	Medium width of functional vegetation	2	<input type="text"/>
C	Low width of functional vegetation	3	<input type="text"/>

*Not evaluated above the tree-line and in streams with natural absence of riparian vegetation*

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<b>F13</b>	<b>Linear extension of functional vegetation along the banks</b>		
A	Linear extension of functional vegetation >90% of maximum available length	0	<input type="text"/>
B	Linear extension of functional vegetation 33-90% of maximum available length	3	<input type="text"/>
C	Linear extension of functional vegetation ≤33% of maximum available length	5	<input type="text"/>

*Not evaluated above the tree-line and in streams with natural absence of riparian vegetation*

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# **IDRAIM: stream hydromorphological evaluation, analysis and monitoring system**

## **ARTIFICIALITY**

### **Upstream alteration of longitudinal continuity**

		part.	prog.	conf.
<b>A1</b>	<b>Upstream alteration of discharges</b>			
A	No significant alteration ( $\leq 10\%$ ) of channel-forming discharges and with return interval $> 10$ years	0		
B	Significant alteration ( $> 10\%$ ) of discharges with return interval $> 10$ years	3		
C	Significant alteration ( $> 10\%$ ) of channel-forming discharges	6		

### **A2 Upstream alteration of sediment transport**

A	Absence or negligible presence of structures for the interception of sediment fluxes (dams for drainage area $< 5\%$ and/or check dams/abstraction weirs for drainage area $< 33\%$ )	0		
B1	Dams (area 5-33%) and/or retention check dams with total bedload interception (area 33-66%) and/or check dams with partial bedload interception or consolidation check dams (area $> 66\%$ )	3		
B2	Dams (area 33-66%) and/or retention check dams with total bedload interception (area $> 66\%$ )	6		
C1	Dams for drainage area $> 66\%$	9		
C2	Dam at the upstream boundary of the reach	12		

### **Alteration of longitudinal continuity in the reach**

<b>A3</b>	<b>Alteration of discharges in the reach</b>			
A	No significant alteration ( $\leq 10\%$ ) of channel-forming discharges and with return interval $> 10$ years	0		
B	Significant alteration ( $> 10\%$ ) of discharges with return interval $> 10$ years	3		
C	Significant alteration ( $> 10\%$ ) of channel-forming discharges	6		

### **A4 Alteration of sediment transport in the reach**

A	Absence of structures for the interception of sediment fluxes (dams, check dams, abstraction weirs)	0		
B	Consolidation check dams $\leq 1$ ogni 200 m and/or open check dams	4		
C	Consolidation check dams $> 1$ ogni 200 m and/or retention check dams or presence of a dam or artificial reservoir at the downstream boundary	6		
<i>In case of density of interception structures, including bed sills and ramps (see A9), is <math>&gt; 1</math> every 100 m, add</i>		12		

### **A5 Crossing structures**

A	Absence of crossing structures (bridges, fords culverts)	0		
B	Presence of some crossing structure ( $\leq 1$ every 1000 m in average in the reach)	2		
C	Presence of many crossing structure ( $> 1$ every 1000 m in average in the reach)	3		

### **Alteration of lateral continuity**

<b>A6</b>	<b>Bank protections</b>			
A	Absence or localized presence of bank protections ( $\leq 5\%$ total length of the banks)	0		
B	Presence of protections for $\leq 33\%$ total length of the banks (sum of both banks)	3		
C	Presence of protections for $> 33\%$ total length of the banks (sum of both banks)	6		
<i>In case of extremely high density of bank protection (<math>&gt; 80\%</math>) add</i>		12		

### **Alteration of channel morphology and/or substrate**

<b>A9</b>	<b>Other bed stabilization structures</b>			
A	Absence of structures (bed sills/ramps) and revetments absent or localised ( $\leq 5\%$ )	0		
B	Sills or ramps ( $\leq 1$ every 200 m) and/or revetments $\leq 25\%$ permeable and/or $\leq 15\%$ impermeable	3		
C1	Sills or ramps ( $> 1$ every 200 m) and/or revetments $\leq 50\%$ permeable and/or $\leq 33\%$ impermeable	6		
C2	Revetments $> 50\%$ permeable and/or $> 33\%$ impermeable	8		
<i>In case of widespread bed revetment (<math>&gt; 80\%</math>) add</i>		12		

# **IDRAIM: stream hydromorphological evaluation, analysis and monitoring system**

## **Intervention of maintenance and removal**

<b>A10 Sediment removal</b>			
A	Absence of significant sediment removal activities during the last 20 years	0	
B	Localized sediment removal activities during the last 20 years	3	
C	Widespread sediment removal activities during the last 20 years	6	

Not evaluated in the case of bedrock streams

<b>A11 Wood removal</b>			
A	Absence of removal of woody material at least during the last 20 years	0	
B	Selective cuts and/or clear cuts over ≤50% of the reach during the last 20 years	2	
C	Total removal of woody material during the last 20 years	5	

Not evaluated above the tree-line and in streams with natural absence of riparian vegetation

<b>A12 Vegetation management</b>			
A	No cutting interventions on riparian vegetation during the last 20 years	0	
B	Selective cuts and/or clear cuts over ≤50% of the reach during the last 20 years	2	
C	Clear cuts over >50% of the reach during the last 20 years	5	

Not evaluated above the tree-line and in streams with natural absence of riparian vegetation

## **CHANNEL CHANGES**

				part.	prog.	conf.
<b>V1 Changes in channel pattern</b> <i>(applied only to channels wider than 30 m)</i>						
A	Absence of change of channel pattern since 1950s	0				
B	Change of channel pattern since 1950s	3				

<b>V2 Changes in channel width</b> <i>(applied only to channels wider than 30 m)</i>			
A	Absent or limited changes in channel width (≤15%) since 1950s	0	
B	Changes in channel width >15% since 1950s	3	

<b>V3 Bed-level changes</b> <i>(applied only to channels wider than 30 m)</i>			
A	Negligible bed-level changes (≤0.5 m)	0	
B	Limited to moderate bed-level changes (0.5÷3 m)	4	
C	Intense bed-level changes (>3 m)	8	

Not evaluated in the case of absolute lack of data, information and field evidences

Total deviation:

Stot =

Maximum deviation:

Smax = 119 - Sna=

where Sna = sum of maximum scores for those indicators that have not been applied

Morphological Alteration Index:

IAM = Stot / Smax =

if Stot>Smax it is assumed IAM=1

Morphological Quality Index:

IQM=1-IAM =

Quality class of the reach

0≤IQM<0.3: Very Poor or Bad; 0.3≤IQM<0.5: Poor; 0.5≤IQM<0.7: Moderate;

0.7≤IQM<0.85: Good; 0.85≤IQM<1.0: Very Good or High