

## EVALUATION FORMS FOR SEMI- AND UNCONFINED CHANNELS

Version 1 - January 2011

## GENERALITY

Date 01 / 01 / 20 10 Operators M. Rossi  
 Catchment Idraim Stream/river Idraim River  
 Upstream limit confluence Idraim branch Downstream limit nearby S. Anna  
 Segment code 4 Reach Code 4-3 Reach length (m) 2.4 km

## GENERAL SETTING AND INITIAL SEGMENTATION

## 1. Physiographic setting

Physiographic area P HM=Hills-mountains, P=Plain Physiographic unit High plain

## 2. Confinamento

Confinement degree (%) 10- 90 >90, 10-90, ≤10  
 Confinement index >n 1-1.5, 1.5-n, >n (n=5 single-thread channels; n=2 multi-thread or wandering channels)  
 Confinement class SC SC=Semiconfined, UNC=Unconfined

## 3. Channel morphology

Aerial photo or satellite image Aerial Flight Tuscany Region 2007 (name, year)  
 Sinuosity index ~ 1.2 1-1.05, 1.05-1.5, >1.5  
 Braiding index ~ 1.3 1-1.5, >1.5 Anastomosing index 1 1-1.5, >1.5  
 Typology W ST=Straight, S=Sinuous, M=Meandering, SAB= Sinuous with alternate bars,  
 W= Wandering, B= Braided, A= Anastomosed  
 Bed configuration BR=bedrock, C/SP=Cascade/Step Pool, PB=Plane bed, RP=Riffle Pool, DR=Dune ripple  
 (only for ST, S, M, SAB morphologies) A= Artificial, NC= not classified (high depth or strong alteration)  
 Mean bed slope 0.0035 Mean channel width (m) 42  
 Bed sediment (dominant) G-C C=Clay, Si=Silt, Sa=Sand, G=Gravel, C=Cobbles, B=Boulders

## 4. Other elements for reach delimitation

Upstream Tributary Downstream \_\_\_\_\_  
 bed sope discontinuity, tributary, dam, artificialization, changes in width of alluvial plain and/or in confinement,  
 changes in channel width, changes in grain sizes, other (specify) \_\_\_\_\_

## Additional available data / information

Drainage area (at the downstream limit) (km<sup>2</sup>) 760  
 Sediment size D<sub>50</sub> (mm) 35 Unit Ba(SU) Be=Bed, Ba=Bar (SU=surface layer, SUB=sublayer)  
 Discharges NA 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) Intense flood in 2004

## GEOMORPHOLOGICAL FUNCTIONALITY

## Continuity

part. prog. conf.

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	5

There is a large check dam intercepting most of the bedload and creating a discontinuity of channel forms (disappearance of bars downstream)

F2	Presence of a modern floodplain		
A	Presence of a continuous (>66% of the reach) and wide floodplain	0	
B	Presence of a discontinuous (10÷66%) floodplain of any width or >90% but narrow	3	
C	Absence of a floodplain or negligible presence (≤10 of any width)	5	8

M +2

Not evaluated in the case of mountain streams along steep (>3%) alluvial fans

There is some uncertainty for part of the reach whether it is a modern floodplain or a low terrace

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

F4 Processes of bank retreat			
A	Presence of frequent retreating banks particularly along outer banks of bends	①	
B	Infrequent retreating banks because impeded by bank protections and/or scarce channel dynamics	2	
C	Complete absence or widespread presence of unstable banks by mass failures	3	8

*Not evaluated in the case of straight – sinuous channels of low energy (lowland rivers, low gradients and/or bedload)*

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F5 Presence of a potentially erodible corridor			
A	Presence of a wide potentially erodible corridor (EC) for a length >66% of the reach	0	
B	Presence of a narrow potentially EC for >66%, or wide but for 33-66% of the reach	②	
C	Presence of a potentially EC of any width but for ≤33% of the reach	3	10

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### Morphology

#### Morphological pattern

F7 Forms and processes typical of the channel pattern			
A	Absence (<5%) of alteration of the natural heterogeneity of forms expected for that river type	0	
B	Alterations for a limited portion of the reach (≤33%)	③	
C	Consistent alterations for a significant portion of the reach (>33%)	5	13

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F8 Presence of typical fluvial forms in the alluvial plain			
A	Presence of alluvial plain forms (oxbow lakes, secondary channels, etc.)	0	
B	Presence of traces of alluvial plain forms (abandoned after the 1950s) but with possible reactivation	2	
C	Complete absence of alluvial plain forms	3	

*Evaluated only in the case of meandering rivers (now or in the past) within a lowland plain physiographic unit*

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#### Cross-section configuration

F9 Variability of the cross-section			
A	Absence (≤5%) of alteration of the cross-section natural heterogeneity (width and depth)	0	
B	Presence of alteration (cross-section homogeneity) for a limited portion of the reach (≤33%)	③	
C	Presence of alteration (cross-section homogeneity) for a significant portion of the reach (>33%)	5	16

*Not evaluated in the case of straight, sinuous or meandering channels with natural absence of bars (lowland rivers, low gradients and/or low bedload) (natural cross-section homogeneity)*

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#### Bed structure and substrate

F10 Structure of the channel bed			
A	Natural heterogeneity of bed sediments and no significant clogging	0	
B	Evident armouring or clogging in various portions of the site	2	
C1	Evident and widespread (>90%) armouring or clogging, or occasional substrate outcrops	⑤	
C2	Widespread substrate outcrops or alteration by bed revetments (>33% of the reach)	6	21

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

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F11 Presence of in-channel large wood			
A	Presence of large wood	①	
C	Negligible presence or absence of large wood	3	21

*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**

## **Vegetation in the fluvial corridor**

<b>F12 Width of functional vegetation in the fluvial corridor</b>			
A	High width of functional vegetation	0	
B	Medium width of functional vegetation	②	
C	Low width of functional vegetation	3	23

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

<b>F13 Linear extension of functional vegetation along the banks</b>			
A	Linear extension of functional vegetation >90% of maximum available length	0	
B	Linear extension of functional vegetation 33-90% of maximum available length	③	
C	Linear extension of functional vegetation ≤33% of maximum available length	5	26

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

## **ARTIFICIALITY**

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

part. prog. conf.

<b>A1 Upstream alteration of discharges</b>			
A	No significant alteration (≤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	29

<b>A2 Upstream alteration of sediment transport</b>			
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 check dams/weirs with total bedload interception (area 33-66%) and/or check dams/weirs with partial interception (area >33% <i>plain/hills</i> or >66% <i>mountains</i> )	3	
B2	Dams (drainage area 33-66%) and/or check dams/weirs with total bedload interception (drainage area >66% or at the upstream boundary)	⑥	
C1	Dams for drainage area >66%	9	
C2	Dam at the upstream boundary of the reach	12	35

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

<b>A3 Alteration of discharges in the reach</b>			
A	No significant alteration (≤10%) of channel-forming discharges and with return interval>10 years	①	
B	Significant alteration (>10%) of discharges with return interval>10 years	3	
C	Significant alteration (>10%) of channel-forming discharges	6	35

<b>A4 Alteration of sediment transport in the reach</b>			
A	Absence of structures for the interception of sediment fluxes (dams, check dams, abstraction weirs)	0	
B	<i>Plain/hills units:</i> consolidation check dams and/or abstraction weirs ≤1 every 1000 m <i>Mountain units:</i> consolidation check dams ≤1 every 200 m and/or open check dams	④	
C	<i>Plain/hill units:</i> consolidation check dams and/or abstraction weirs >1 every 1000 m <i>Mountain units:</i> consolidation check dams >1 every 200 m and/or retention check dams or presence of a dam or artificial reservoir at the downstream boundary ( <i>any physiographic units</i> )	6	39

*In case of density of interception structures, including bed sills and ramps (see A9), is >1 every n, add 12 where n=100 m in mountain units, or n=500 m in plain/hills units*

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

<b>A5 Crossing structures</b>			
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	41

## **Alteration of lateral continuity**

<b>A6 Bank protections</b>			
A	Absence or localized presence of bank protections ( $\leq 5\%$ total length of the banks)	①	
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	41
<i>In case of extremely high density of bank protection (<math>&gt; 80\%</math>) add</i>			
		12	

<b>A7 Artificial levees</b>			
A	Absent or distant levees, or presence of levees close or at contact $\leq 10\%$ total length of the banks	①	
B	Medium presence of levees close and/or at contact (at contact $\leq 50\%$ bank length)	3	
C	High presence of levees close and/or at contact (at contact $> 50\%$ bank length)	6	41
<i>In case of extremely high density of levees at contact (<math>&gt; 80\%</math>) add</i>			
		12	

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

<b>A8 Artificial changes of river course</b>			
A	Absence of artificial changes of river course in the past (meanders cut-off, channel diversions, etc.)	①	
B	Presence of changes of river course for $\leq 10\%$ of the reach length	2	
C	Presence of changes of river course for $> 10\%$ of the reach length	3	41

<b>A9 Other grade control structures</b>			
A	Absence of structures (bed sills/ramps) and revetments absent or localised ( $\leq 5\%$ )	0	
B	Sills or ramps ( $\leq 1$ every $m$ ) and/or revetments $\leq 25\%$ permeable and/or $\leq 15\%$ impermeable	③	
C1	Sills or ramps ( $> 1$ every $m$ ) and/or revetments $\leq 50\%$ permeable and/or $\leq 33\%$ impermeable	6	
C2	Revetments $> 50\%$ permeable and/or $> 33\%$ impermeable	8	44

$m=200\text{ m}$  in mountain units;  $m=1000\text{ m}$  in plain/hills units

*In case of widespread bed revetment ( $> 80\%$ ) add* 12

## **Intervention of maintenance and removal**

<b>A10 Sediment removal</b>			
A	Absence of recent (last 20 years) and past (from 1950s) significant sediment removal activities	0	
B	Moderate activities in the past (from 1950s) but absent during last 20 years, or absent in the past but present recently (last 20 years)	3	
C	Intense activities in the past, or moderate in the past but present during last 20 years	⑥	50

*There is some uncertainty whether the activity in the past was intense or moderate.*

*There was not sediment removal activity during the last 20 years.*

<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 $\leq 50\%$ of the reach during the last 20 years	②	
C	Total removal of woody material during the last 20 years	5	52

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

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

<b>A12</b>	<b>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	52

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

## **CHANNEL CHANGES**

		part.	prog.	conf.
<b>V1</b>	<b>Changes in channel pattern</b>	<i>(applied only to channels wider than 30 m)</i>		
A	Absence of changes of channel pattern since 1950s	0		
B	Change to a similar channel pattern since 1950s	3		
C	Change to a different channel pattern since 1950s	6		55

<b>V2</b>	<b>Changes in channel width</b>	<i>(applied only to channels wider than 30 m)</i>		
A	Absent or limited changes (≤15%) since 1950s	0		
B	Moderate changes (15÷35%) since 1950s	3		
C	Intense changes (>35%) since 1950s	6		61

<b>V3</b>	<b>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		
C1	Intense bed-level changes (>3 m)	8		
C2	Very intense bed-level changes (>6 m)	12		65

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

**Total deviation:**

**Stot** = 65 62÷67

**Maximum deviation:**

**Smax = 142 - Sna** = 139

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

**Morphological Alteration Index:**

**IAM = Stot / Smax** = 0.47 0.45÷0.48

if Stot>Smax it is assumed IAM=1

**Morphological Quality Index:**

**IQM=1-IAM** = 0.53 0.52÷0.55

**Quality class of the reach**

Moderate

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