Application of the EU Directive 2000/60/CE in the Veneto Region

Definition of water bodies types

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Summary

SHORT DESCRIPTION
This document intends to describe the methodology applied in the Veneto region for the definition of water bodies types, following the EU Directive 2000/60/CE

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Introduction

European Directive WFD 2000/60/EC, implemented in the Italian legislature by means of the D.Lgs 152/2006, is a reference frame for community action concerning water resources protection and management.
Member Countries have to reach the “good” ecological status of “water bodies”. An exception is made for artificial water bodies (AWB) and heavily modified water bodies (HWMB), for which quality objectives refer to the “ecologic potential”.
A water body is considered as “artificial” if it has been created by human works where no water stream existed before.
The WFD prescribes the classification of natural water streams according to physical-geological criteria indicated in two alternatives systems (System A and System B). Italy has chosen system B, which allows a certain freedom degree, also at regional level, in the parameters choice.
The attachment 1 of the D.Lgs 152/2006 gives details for significant water bodies identification. These will be monitored and classified, and include all water basin with a catchment basin larger than 10 km^2, or littler water streams with a particular environmental relevance, and all artificial channels with discharge higher than 3 m^3/s.

Reference hydrographic network

The individuation of the hydrographic network has been done following these steps:

- individuation of water streams “continuity”, overcoming problems related to river name change, and identification of main reaches.
- individuation of water streams with catchment basin larger than 10 km^2
- individuation of water streams characterized by particular environmental or hydraulic importance
- breakdown of water streams in artificial, natural or heavily modifies reaches.

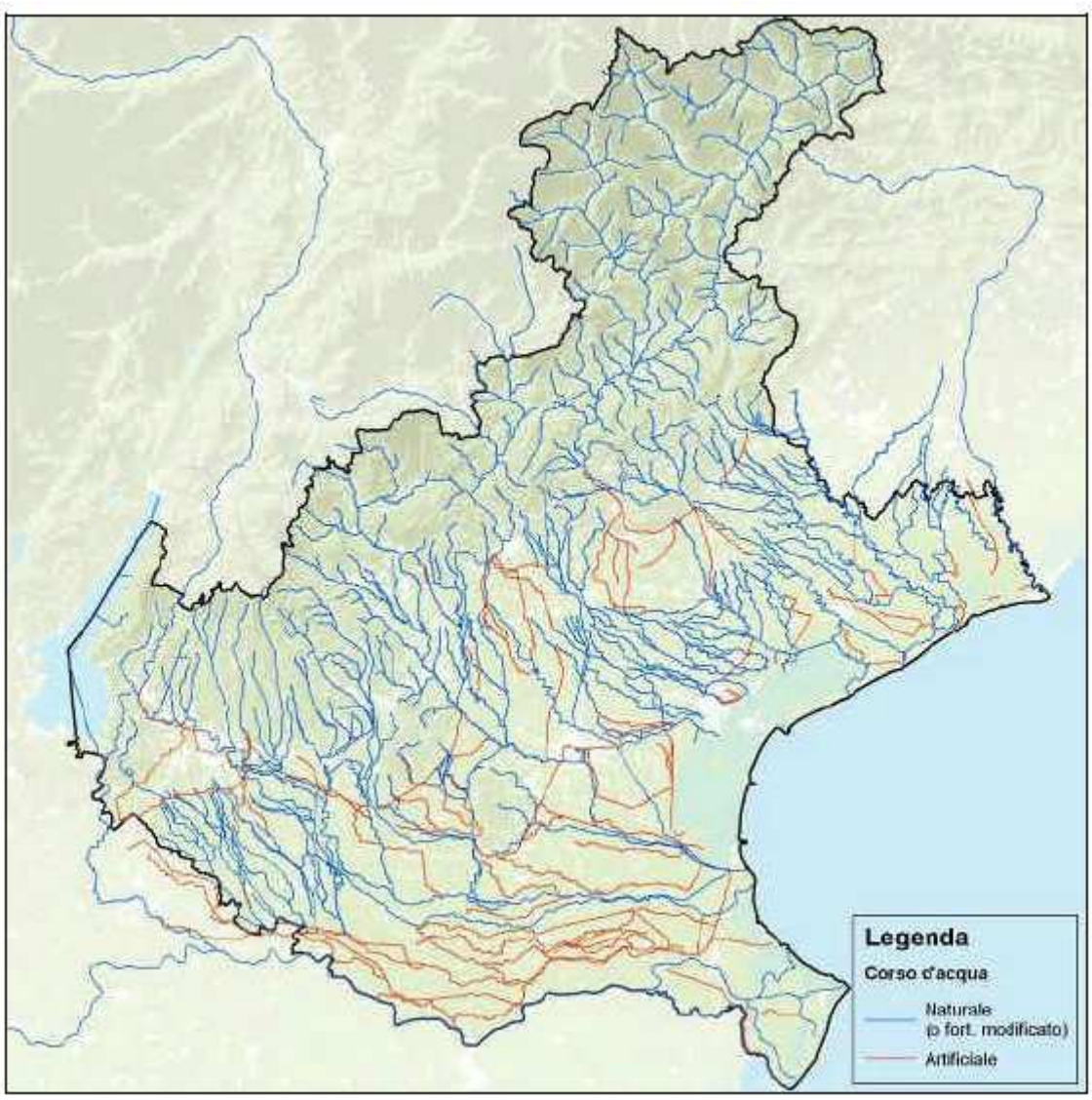

Figure 1: Reference hydrographic network broke down in artificial or natural reaches.

Stream types classification

The methodology used for the classification of river types starts from the CEMAGREF work, and is based on two subsequent deepening levels:

- definition of hidro-ecoregions (HER), that is areas with quite homogeneous chemical, physical and biological features
- definition of river types, to be recognized inside HERs, on the basis of a restricted variables number not included in the HER definition.

The hydro-ecoregion (HER) concept, is based on the hieratic control of hydrosystems. Main factors affecting hydrosystems features are geology, orography and clime.
In Italy, the approach developed by CNR-IRSA (Buffagni et al., 2006) is under approbation and consists of three steps:

- **Level 1 – Regionalization and definition oh hydro-ecoregions (HER):** it has been preferred to use directly HERs defined by CEMAGREF for Italy, and then verify at the local/regional scale.
- **Level 2 – Definition of general typologies:** typologies are defined taking as a base few descriptive elements, among those proposed by system B, easy to apply at the national scale and shared. Moreover, general typologies have to better integrate with Level 1 regionalization.
- **Level 3 – Definition of detailed typologies:** this level allows a refining of Level 2, on the basis of specific territorial features, available data, particular management requirements, etc.. For different Italian zones it can be based on different features.

Table 1 shows factors considered in the three levels proposed for the Italian river typology definition.

Table 1: List of factors considered in the three levels proposed for the Italian river typology definition

LEVEL	MANDATORY FACTORS	OPTIONAL FACTORS	OTHER FACTORS
1. Regionalization	Altitude, geologic composition (lithology). latitude, longitude	Water body medium slope, rainfall, air temperature	
2. General typology definition	Distance from spring (for the dimension)	Shape and configuration of main channel	Source, upstream basin influence, perpetuity and persistence
3. detailed typology definition		Medium substrate composition	Temperature, discharge/regime/duration curves, interactions with underground water, lentic-lotic behaviour, other

Figure 2: HERs defined by CEMAGREF for Italy

Level 1: hydro-ecoregions (HER)

CEMAGREF has individuated 21 HERs for Italy. Veneto is touched by tree HERs: Inner Alps – E, Calcareous southern Alps and Dolomites, Po Plain. They have been verified and modified at the regional scale. The first criterion adopted for HERs definition is the altitude. Starting from a digital terrain model (DTM), contours at height 200 and 800 m a.s.l. have been traced (Figure 3), as they represent the separation lines between Po Plain and Inner Alps. Because of river floodplains these contours results to be quite jagged, so they have been smoothed. Final contours are shown in Figure 4.

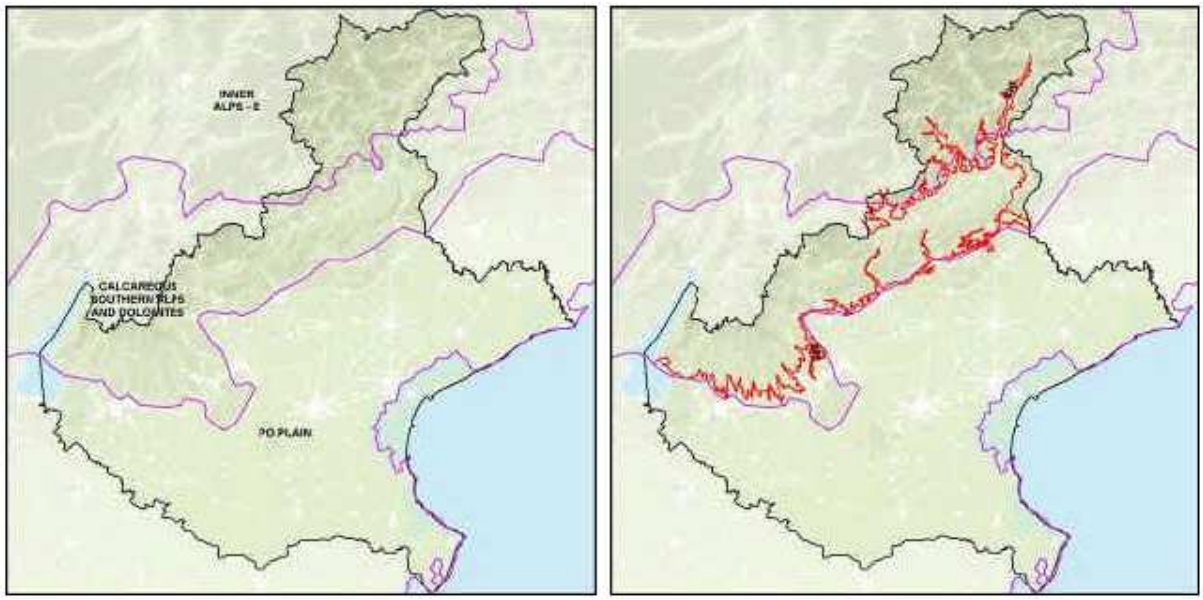

Figure 3: On the left, HERs defined by CEMAGREF. On the right, red lines represent contour lines at 800 and 200 m a.s.l.

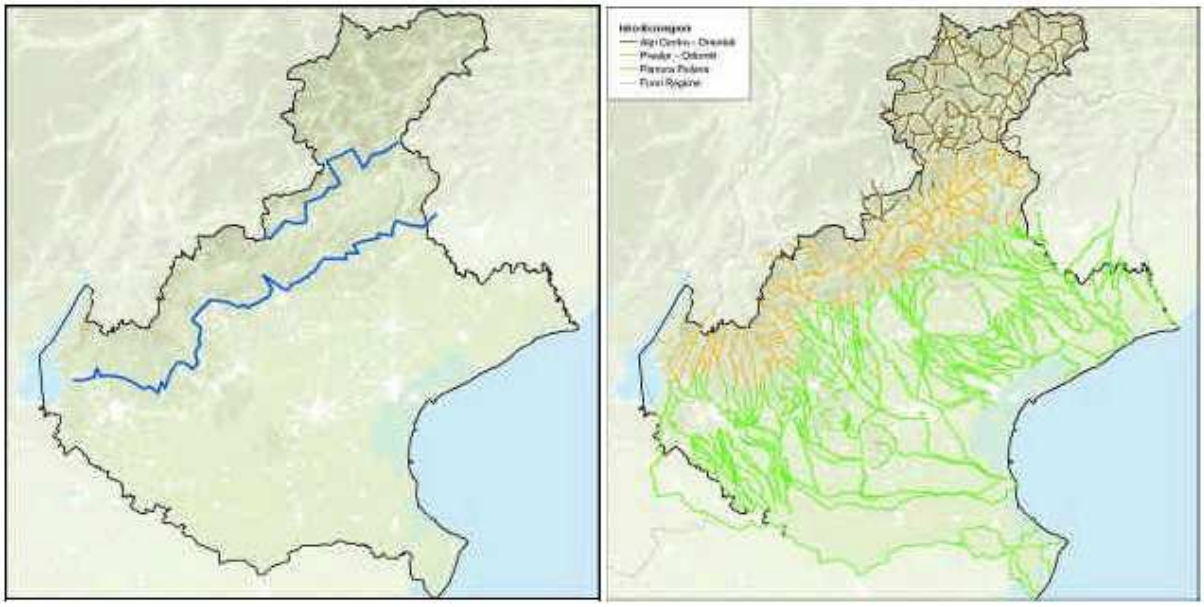

Figure 4: On the left, final contours. On the right, individuation of relevant water bodies based on HERs.

Level 2: General typology definition

The second step consists in the definition (inside previously defined HERs) of typologies which may be identified by an abiotic parameters list, describing water streams in their natural conditions, independently from anthropic artificialisation. Criteria chosen by CNR-IRSA are:

- perpetuity and persistence
- water stream source
- distance from source (it is an indicator of water stream dimensions)
- channel morphology (for temporary rivers)
- upstream river basin influence

Perpetuity and persistence

This parameter has the aim to recognize and characterize temporary rivers in the Mediterranean area. It is defined as “perpetual” a river with water 365 days a year, while it is defined as “temporary” a river which can be sometimes dry during the year and at least 2 year on 5.
Temporary rivers are then split in:

- intermittent: there is water more than 8 months a year; they can be dry only in some reaches and several times a year;
- ephemeral: there is water less than 8 months a year, but stable
- episodic: there is water only after intense rainfall, even less than once in 5 years.

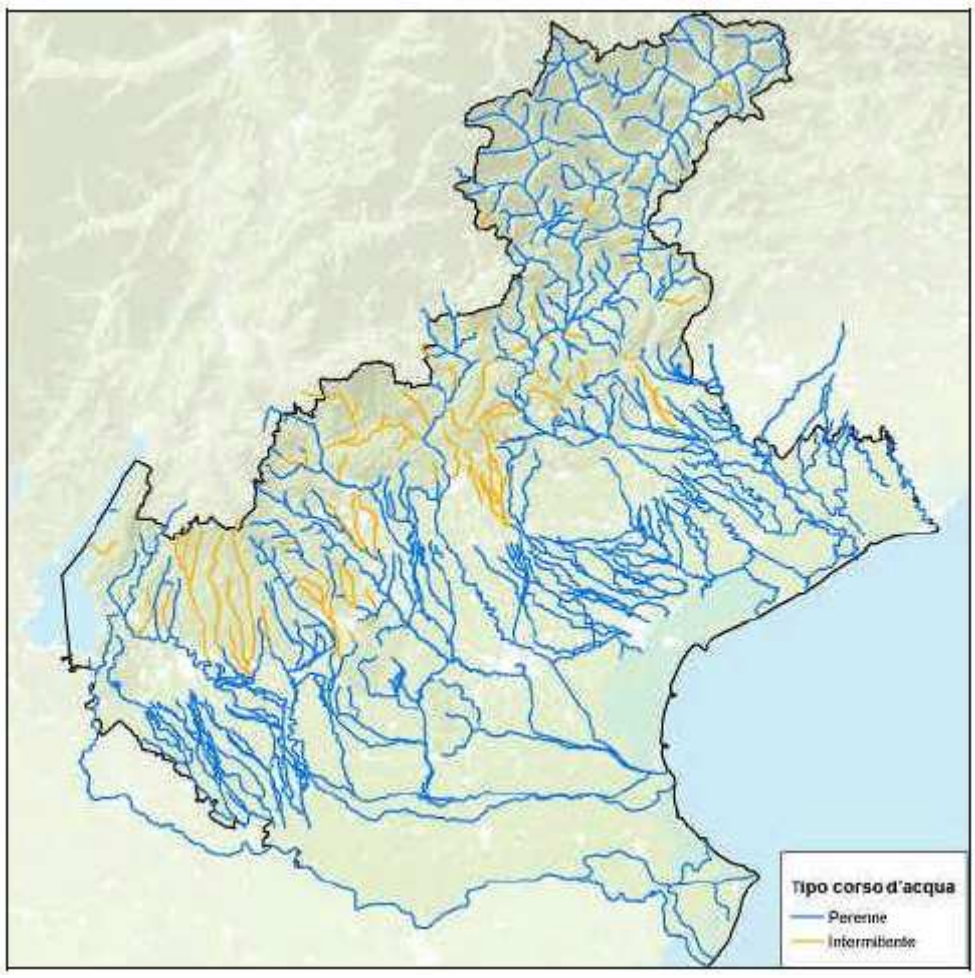

Figure 5: Division of natural streams by perpetual and temporary (intermittent) streams.

Source

Five source typologies are recognized:

- surface run from rainfall or snow melting
- big lakes
- glaciers
- springs
- underground water

This characterization has a the highest value for reaches next to the source point, but loses its influence when distance from source increases. Far from source, every river has the feature of a surface run river.

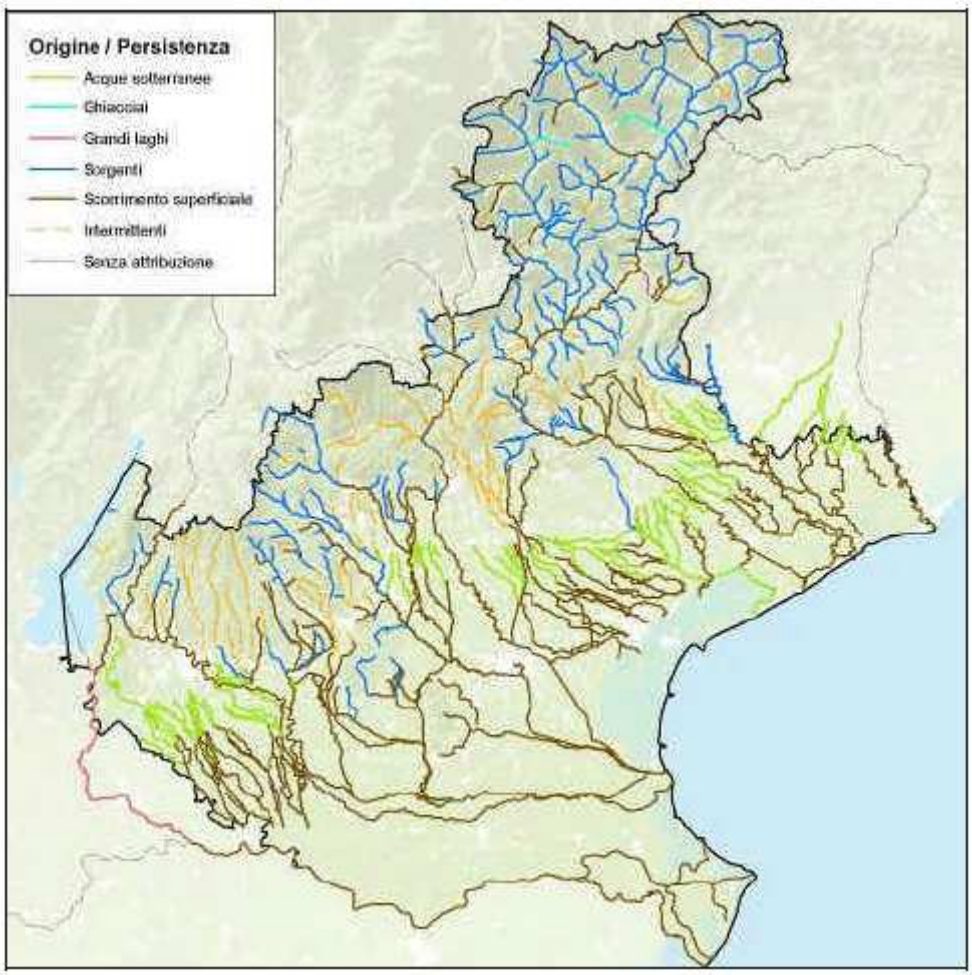

Figure 6: Division of natural streams by their origin, and possible transformation in surface run streams

Distance form source

The distance from source is strictly linked with the catchment dimension, and represents an information about river size. 5 classes have been defined

Table 2: Correlation between distance from source and water stream size.

WATER COURSE SIZE	DISTANCE FROM SOURCE
Very little	< 5 km
Little	5-25 km
Medium	25-75 km
Big	75-150 km
Very big	> 150 km

Channel morphology

Channel morphology is a criterion chosen for the classification of temporary rivers, as an alternative in place of the distance from source used for perpetual streams. For a temporary river, in fact, the relationship between discharge and catchment dimension is assumed to be weak. On the other hand biotic phenomena are strictly linked to channel morphology, which changes after every flood event. Veneto's temporary water streams belong to the category "meandering, winding or confined"

Upstream basin influence (IBM)

The IBM parameter is directly related to the hydro-ecoregion concept. Defining, in fact, macro-areas of hydro-ecoregions, it is assumed that they are characterized by similar conditions for what concerns aquatic environments. It is also assumed that different HERs present very different features. Therefore, as a consequence, a river crossing different HERs is influenced by the HER upstream the considered reach.
This influence is given by a simple mathematical computation:

IBM=Total river length/River length inside the origin HER

Table 3: IBM definition.

HER	UPSTREAM BASIN INFLUENCE (IBM)		
	NEGLIGIBLE (T)	WEAK (D)	STRONG (F)
Po Plain, Southern Alps and Dolomites	IBM < 1.25	1.25 <= IBM <= 2	IBM > 2
Inner Alps	None (N)		

Level 3: Definition of a detailed typology

The third level of types classification is optional, even if it is recommended, because it allows a detailed definition in order to exploit deep information, already available at the local scale, and considered of relevant importance for water courses characterization. The indicators to be used can be morphological parameters (channel features), chemical, physical, specific descriptors (substrate grain size gradation, lotic-lentic behaviour, variations of the interactions with underground water, ecc.).

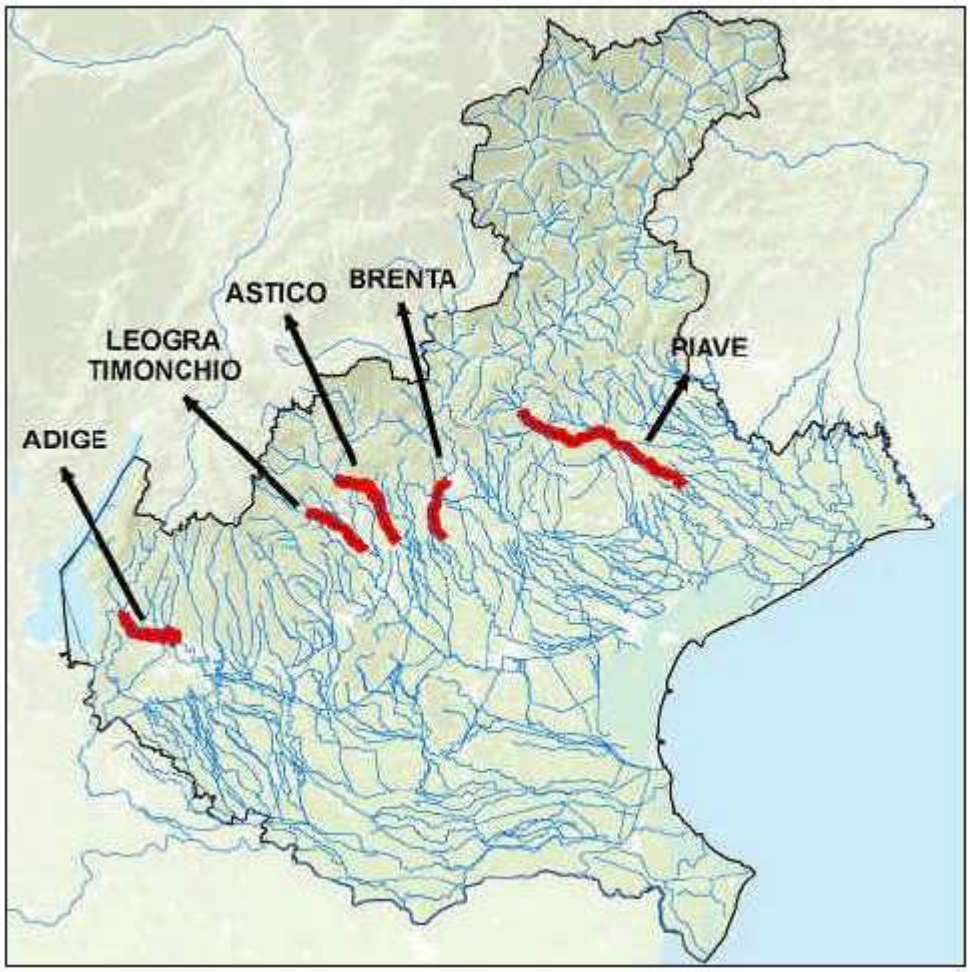

Figure 7: Rivers for which it has been defined the third level.

For the Veneto Region, big rivers (Adige, Brenta, Piave, Astico, Leogra – Timonchio) have been characterized by two hydro-morphologic parameters:

- braided channel
- dispersive channel

This is aimed to put in evidence a particular feature of the area upstream the spring line, where the presence of a thick alluvial layer permits to the river of the high floodplain to disperse part of their discharge underground, feeding downstream springs. Low floodplain rivers depend in fact on the dispersive reaches of high floodplain rivers.

Typologies codification

Table 4: Typologies codification.

HER	SOURCE			SOURCE DISTANCE		UPSTREAM BASIN INFLUENCE	
01÷20	PERPETUAL	SS	Surface run	1	< 5 km	T	None or negligible
		GL	Big lakes	2	5-25 km	D	Weak
		SR	Springs	3	25-75 km	F	Strong
		AS	Underground water	4	75-150 km	N	Not applicable
		GH	Galciers	5	>150 km		
				6	<10 km		
	TEMPORARY	PERSISTENCE		CHANNEL MORPHOLOGY			
		IN	Intermittent	7			
		EF	Ephemeral	8			
		EP	Episodic				

For river typologies and water bodies, an alphanumeric code is used:

HER			SOURCE/PERS.		DIST./MORPH.		IBM		WATER BODY			REGION	

Table 5: Typologies frequency.

TYPOLOGY	FREQUENCY	TYPOLOGY	FREQUENCY
03.GH.6.N.NO.NO	2	**06.SR.6.F.NO.NO**	1
03.GH.2.N.NO.NO	1	**06.SR.2.T.NO.NO**	2
03.SR.6.N.NO.NO	62	**06.SR.2.D.SI.NO**	1
03.SR.2.N.NO.NO	6	**06.SR.3.T.NO.NO**	1
03.SR.3.N.NO.NO	4	**06.SR.3.D.NO.NO**	1
03.SS.1.N.NO.NO	8	**06.AS.6.T.NO.NO**	78
03.SS.2.N.NO.NO	6	**06.AS.2.T.NO.NO**	7
03.SS.3.N.NO.NO	2	**06.AS.3.T.NO.NO**	2
03.IN.7.N.NO.NO	6	**06.SS.1.T.NO.NO**	60
02.GL.1.T.NO.NO	1	**06.SS.2.T.NO.NO**	70
02.SR.6.T.NO.NO	61	**06.SS.2.D.NO.NO**	7
02.SR.6.D.NO.NO	3	**06.SS.2.F.NO.NO**	1
02.SR.2.T.NO.NO	5	**06.SS.3.T.NO.NO**	28
02.SR.2.D.NO.NO	1	**06.SS.3.D.NO.NO**	3
02.SR.3.F.NO.NO	1	**06.SS.3.F.NO.NO**	1
02.SS.1.T.NO.NO	10	**06.SS.3.F.SI.NO**	1
02.SS.2.T.NO.NO	3	**06.SS.4.T.NO.NO**	4
02.SS.2.D.NO.NO	1	**06.SS.4.D.NO.NO**	2
02.SS.3.T.NO.NO	1	**06.SS.4.F.SI.SI**	2
02.SS.3.F.NO.NO	1	**06.SS.5.T.NO.NO**	5
02.SS.4.F.NO.NO	1	**06.SS.5.D.NO.NO**	1

TYPOLOGY	FREQUENCY	TYPOLOGY	FREQUENCY
02.SS.5.F.NO.NO	1	**06.SS.5.F.NO.NO**	2
02.IN.7.T.NO.NO	48	**06.SS.5.F.NO.SI**	1
06.GL.1.T.NO.NO	1	**06.SS.5.F.SI.NO**	1
06.GL.2.T.NO.NO	1	**06.IN.7.T.NO.NO**	19
06.SR.6.T.NO.NO	21	**06.IN.7.D.NO.NO**	2
06.SR.6.D.NO.NO	7	**06.IN.7.F.NO.NO**	9