WP7-2 – Arc-Isere

Pilot Case Study Monography

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Summary

SHORT DESCRIPTION
This document intends to characterize the Isère river basin, with a focus on the pilot case study area (upstream Grenoble). **The information contained in this report corresponds to the current status of the basin from the point of view of the uses of land resources and the uses of water resources. The management plans showed have been recently developed (2009) by the Waters Agency en relation to water bodies typology in function to natural or atrophic condition according to WFD.** **Hyperlink: http://www.share-alpinerivers.eu/pp-area/WP7/action-7.2/wp7-19-to-36_pilot-case-studies-monographies/pilot-case-studies-monographs-version-2/SHARE_WP7-2_IserePilot_Case_Study_Monograph_V2.pdf/view**

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Table of content

Introduction

As part of the SHARE project, a pilot section of the Isère River will be studied in order to determine the best alternatives in terms of hydropower production and preservation of aquatic environments. This report aims at describing the characteristics of the basin, including the pilot site and the uses and pressures on the water resources of the basin. In addition, management plans and monitoring plans that are in place are described, in particular the SDAGE which functions in accordance with the European WFD. A side aim of this report is to give an overview of the availability and sources of existing data on the pilot site.

The first part evokes the geographical and administrative areas in which the basin is located, along with its climatic, geological and land use characteristics. The hydrological regimes at several locations of the river are characterized, and the human impacts on these regimes, resulting from hydropower generation and industrial, agricultural or domestic water withdrawals are discussed. Lastly, the water quality of the river, in biological and physico-chemical terms is evaluated. In the studied basin, the water status changes from good to poor, with two areas of very poor water quality near Grenoble and near Saint-Jean-de-Maurienne.

In the second part, the French legislative framework and the water management plans and programs are explained. The SDAGE has realized a first assessment of the basin in 2005, and plans to realize by 2015 a program of measures in order to attain environmental objectives in accordance with the WFD, following 8 basic guiding principles. These principles are prevention, non-degradation, incorporation of socio-economical dimensions, reinforcement of local management, fight against pollution, preservation and redevelopment of aquatic ecosystems, attainment of a quantitative balance, and attention to flood risks. A monitoring program implemented allows to follow the efficiency of these measures.

A third part describes water uses, especially for hydropower generation, agriculture, industry, and recreation. Wastewater outfalls and drinking water supplies are also described in this part.

Then the pressures and impacts associated with water uses are outlined. In particular, hydropower generation changes the hydrology and the sediment transport of the basin in a significant way, which has implications on several levels, especially on ecosystems.

Mitigation and restoration action are tackled in the last part.

Summary

This document gives the main characteristics of the Isère River Basin, with an emphasis on the current pilot site that was defined in the report WP7.1. The information hereby corresponds to the current state of the basin, from the point of view of its land use as well as the state of its bed (hydrology, water quality, water use). The management plans were recently defined (in 2009) by the *Agences de l'Eau* in relation to the water body typology that relies on their natural and anthropological conditions, and is in concordance with the typology established in the Water Framework Directive (WFD).

Pilote Site Case Study

The Isère River Basin (figure 1) is located in the South-East of France, on the western side of the Alp Mountains, between 45°54' and 44°37' North, and between 04°52' and 06°49' East. Its drainage area is 11,800 km² down to its confluence with the Rhone River, which drains into the Mediterranean Sea. The peak of the basin is the summit of the Mont Aiguille de la Grande Sassière; it has an altitude of 3747 m. The point of confluence of the Isère River with the Rhone River is only at an altitude of 115m (IGN). The Isère River Basin shows a lot of contrasts. In the space of a few tens of kilometres one can find the very well preserved **high glaciated mountains** approaching 4000 m in height, the **developed and urban mountains** with a high concentration of ski resorts (Tarentaise Valley, Maurienne Valley) and the most important hydroelectric scheme of France (with a complex development in the Upper Isère Valley and in the Arc Valley), and lastly the **alluvial valley**, won over the river in the 19th century, when industrial (metalworking, papermaking, petrochemical industries), agricultural and urban activities developed in and around Grenoble (Peiry et al., 1999).

The Isère River basin is located over 5 different administrative units of France (*Départements*) : Haute -Savoie, Hautes-Alpes, Drôme, Savoie et Isère.

The later 2 *départements* are the most important in terms of percent territory (around 80%). This territotory hosts around 65,000 inhabitants, most of them concentrated in the Grenoble urban area (532,746 inhabitants) (INSEE, 2007).

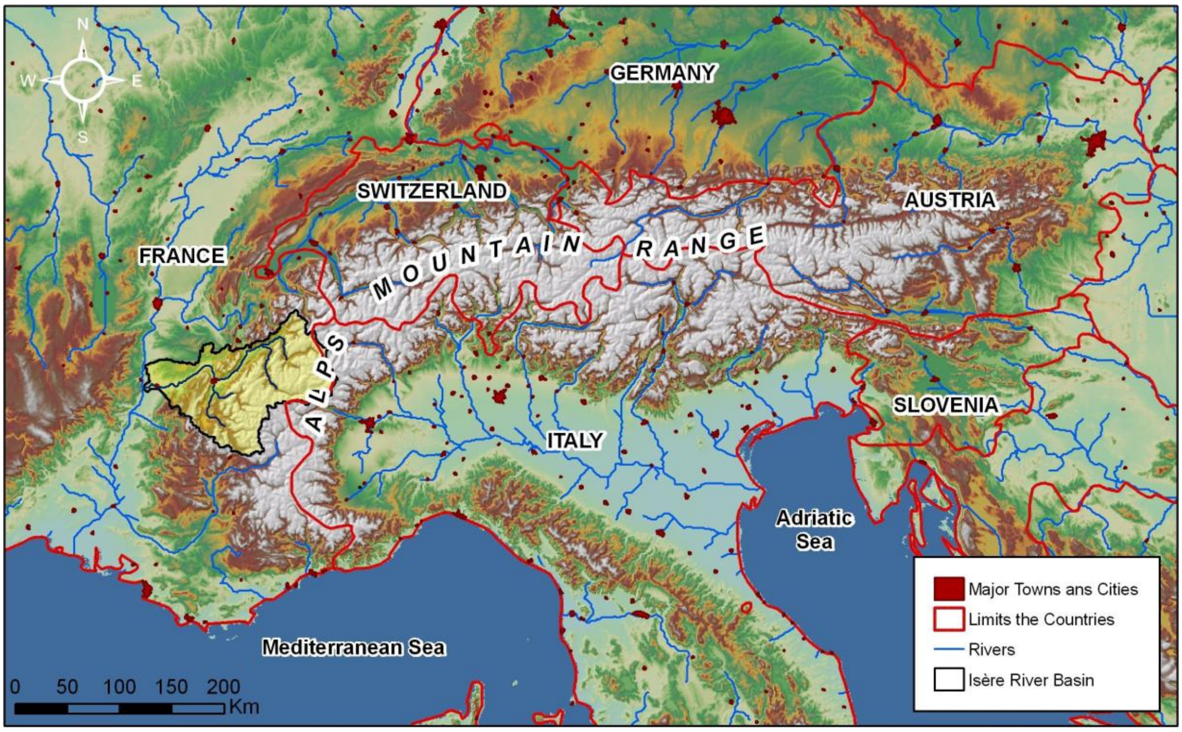

Figure 1. Localisation du basin de l'Isère dans le contexte Alpin
Source: SHARE Project et Gtopo

The selected pilot site is a section of the Isère River and of the Arc River, its tributary. The Isère section is located between the cities of Albertville and Grenoble, while the Arc section is located between the cities of Saint-Jean-de-Maurienne and its confluence with the Isère River, as shown on figure 2.

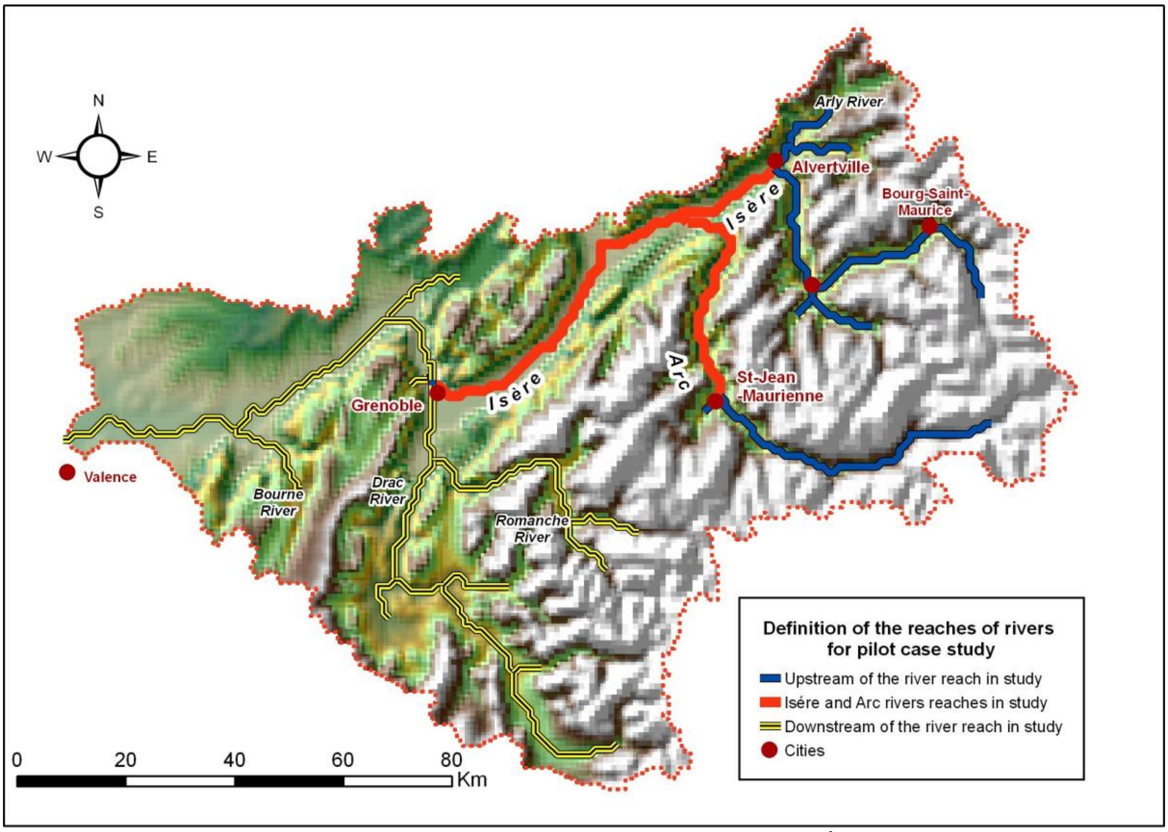

Figure 2.River sections for the pilote site case study of the Isère River Basin
Source: SHARE Project

Hydrography

The Isère River has its source in a high mountain area, on Mount Galise (3344 m), near the Italian border and near the *Grande Aiguille Rousse* Glacier (3482m). At its origin it is a small glacial torrent (slope of 0.0116), the Isère then descends rapidly through the sinuous and narrow Tarentaise Valley. It receives the waters of the Dordon and Borzal River. The average discharge in Moûtiers is 21.3 m^3/s. Near Alberville (altitude 400m), the slope decreases. After it has travelled around 75 km, the Isère River meets with the Arly River, which has an average discharge of 25 m^3/s. It then enters the so-called Combe de Savoie, where it becomes a large alluvial plain with an average slope of 0.0017 m/m. This section receives on its left bank the waters of one of the main tributary of the Isère River, the Arc River; which drains the Maurienne Valley. This river has a basin area of around 200 km², and a yearly modular discharge of 48.8 m^3/s at Epierre. After this last confluence, the Isère River flows in the Grésivaudan Valley, a large alluvial plain which slope does not exceed 0.0010 m/m. The Isère River has no other important tributary until downstream of Grenoble (Altitude 210 m), where it meets on its left bank with the Drac Rvier, its main tributary, which earlier receives the waters of the Romanche River. The Drac River Basin has an area of 3350 km² and a yearly average discharge of 99 m^3/s at Fontaine. Downstream of Grenoble, the joined waters of the Isère River and the Drac River leave the Sillon Alpin and go through the narrow *Cluse de Grenoble* (transverse valley), which separates the prealpines massifs of Chartreuse and Vercors. A few tens of kilometres downstream of this point, the Isère River receives the waters of two less significant tributaries named Bourne River (mean yearly discharge of 21 m^3/s) and Herbasse River (1.5 m^3/s). Finally, the Isère River travels 286 km up to the Rhone River (98,000 km²). At Beaumont-Monteux in the Drôme, 8km North of Valence and near the confluence, the mean/modular yearly discharge of the Isère River is 333 m^3/s.

Figure 3 shows the location of important basins and sub-basins. Table 1 gives the length and drainage area for different tributaries.

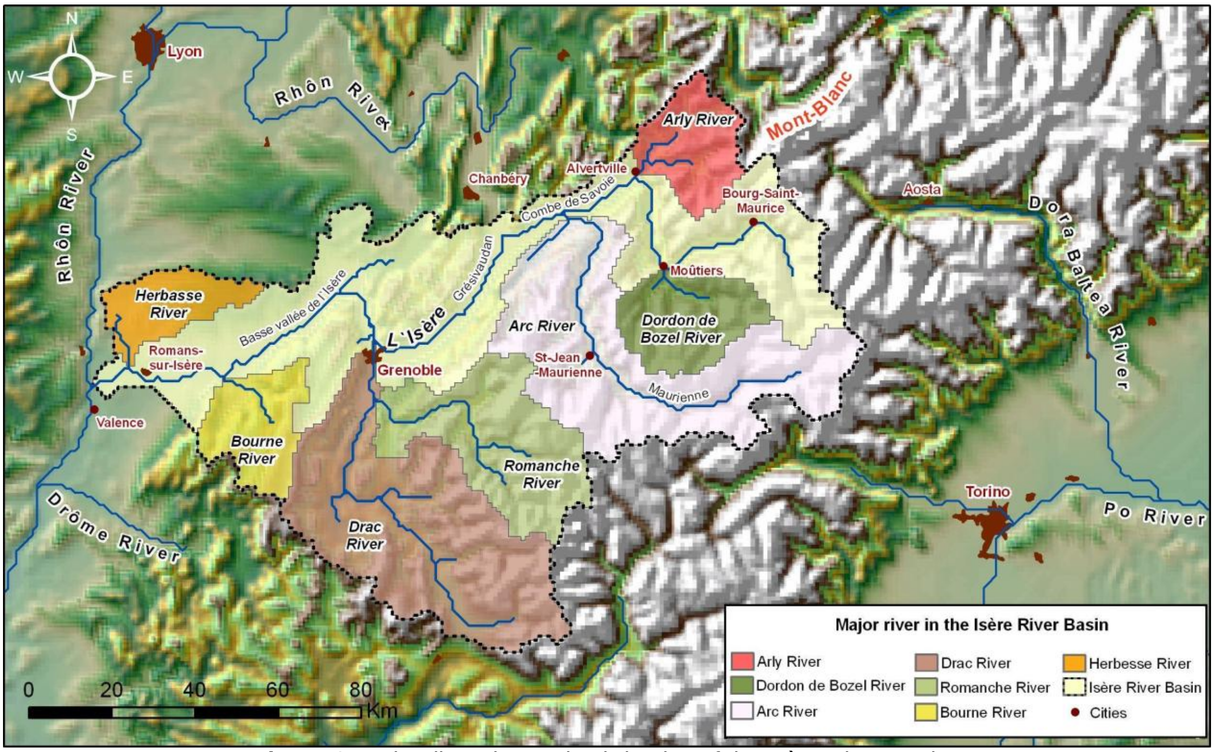

Figure 3. Main tributaries and sub-basins of the Isère River Basin.
Source: SHARE Project

Tableau 1. Main tributaries of the Isère River Basin

Sous-bassin	Surface Aire (km^2)	Longitude (km)
Doron de Bozel	668	38,7
L'Arly River	671	38,0
Arc River	2000	127,5
Le Drac River	3350	130,3
La Romanche River	1240	78,4
La Bourne	787	43,1
L'Herbasse	187	40,0

Geology

Several geological zones make up the Isère basin. In its upper part, the zone of the internal Alps, It is composed the Tarentaise Valley (Upper Isère) and the Maurienne Valley (Arc River). This complex geological system is formed by many thrust layers; the schists and gypsum formations of the Trias particularly favourable to surface runoff. The middle part of the basin (Beaufortin, Grand Arc, Belledonne Massif), is characterized by outcrops of consolidated crystalline formations, more or less strongly fractured (granites, gneiss). In the lower part of the basin, the Isère River flows in contact with the limestone of the prealpine mountains (Bauges, Chartreuse), which it crosses downstream of Grenoble at a bottleneck separating the Chartreuse and the Vercors mountains. In the last part of its course, the Isère River follows a deep narrow course along the tertiary sandstones and a succession of quaternary terraces. Generally speaking, the Isère River Basin is characterized by high altitudes: until Grenoble (approximately 5,700 km²), 77% of the basin is over 1000m, and 17% over 2500 m (Peiry et al., 1999).

In the case of the Isère section form its confluence with the Arc River to Grenoble (most of the Pilot site case study), the Isère River runs through a large valley of structural origin located in the contact zone of the prealpine mountains on the one hand (Bauges, Chartreuse, Vercors), with the external crystalline Alps on the other (figure 4). Widened and transformed by quaternary glaciations, this valley has been filled to a thickness of more than 200m, first with a thick fine glaciolacustrine material, then with a sandy-gravel material in the upper meters (Fournaux, 1976; Hanss, 1984). On this river section, the Holocene deposits on which the Isère alluvial plain was created, are predominantly gravel and pebbles, which are more or less covered by sandy-lime deposits resulting from flooding. Near Grenoble, sand and mud deposits prevail, including in the Isère channel, due to the weak hydrodynamics which have persisted for a long period of time (Peiry et al. 1999).

Land Cover and Land Use

The land use of the Isère River Basin could be obtained from the CORINE 2000 Project (EEA, 2005). Land use patterns are classified using four categories: (i) artificial surfaces, (ii) agricultural areas, (iii) forested and semi-natural areas, and (iv) water bodies and wetlands. A great percentage of the basin is made of natural and semi-natural areas, mainly due to the uneven topography and to the climatic conditions. Human land use (agriculture, urbanization, industries) are located mainly in fluvial valleys, where the slopes are lowest. Figure 5 shows land use in the Isère River Basin. It is clear on this map that agriculture land use of the basin occurs in the lower area (Basse Isère), in the Combe de Savoie and in the Grésivaudan Valley.

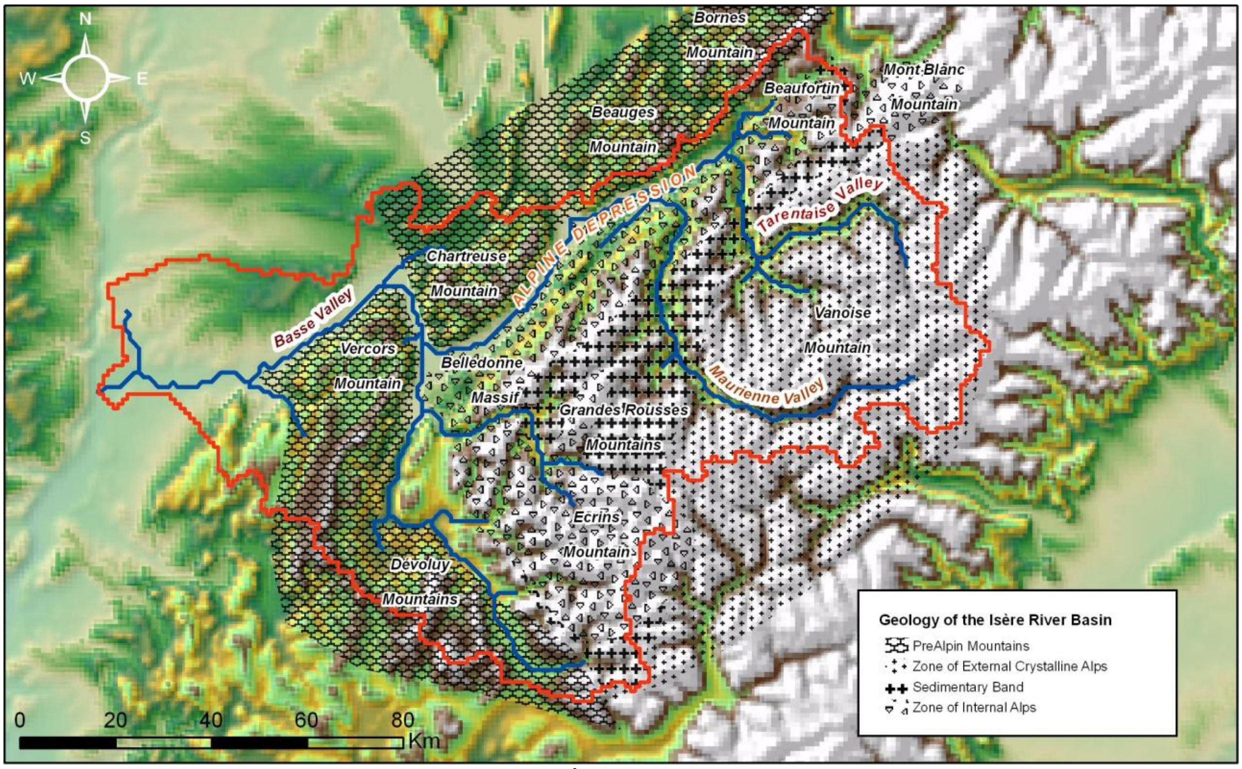

Figure 4. Isère Basin Geology
Source: SHARE Project and after Pupier, 1996

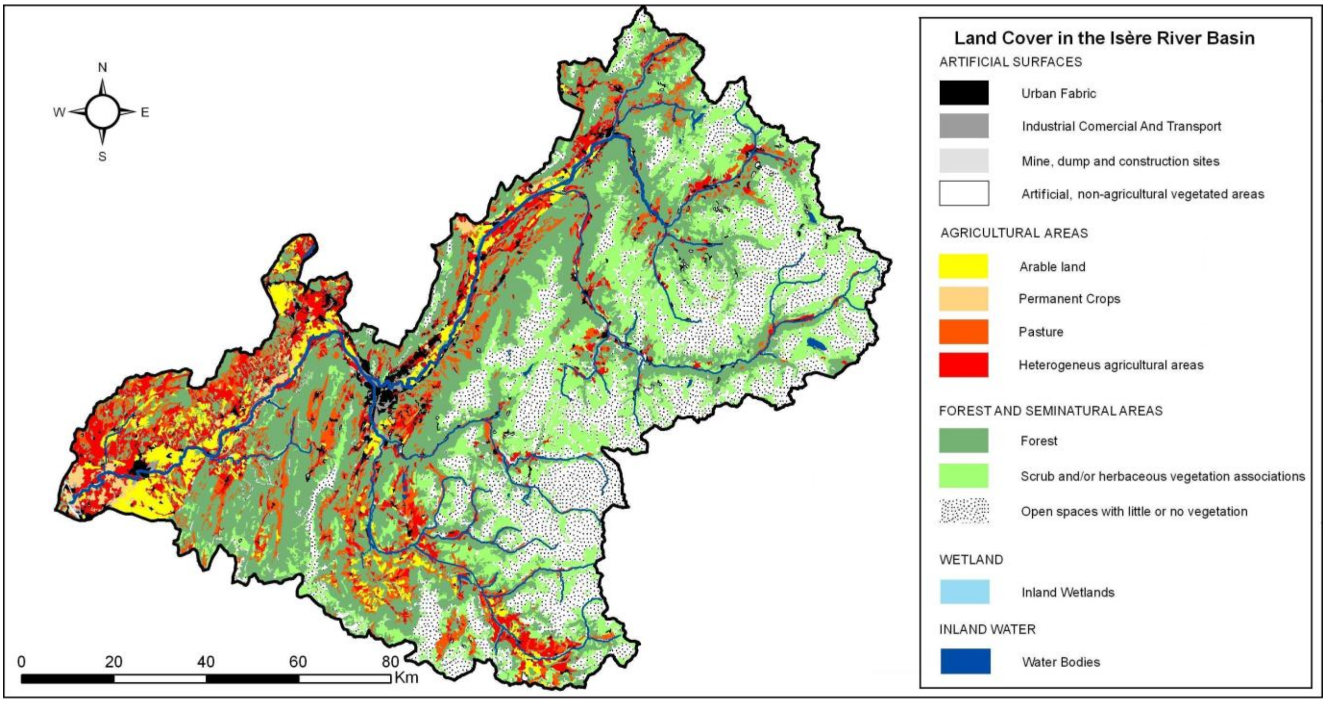

Figure 5.Characterization of land use and land cover in the Isère River Basin
Source: SHARE Project and CORINE Project, 2000

Tableau 2. Classification of land cover and land use in the Isère River Basin after Corine 2000

CLASSIFICATION NIVEAU I	CLASSIFICATION NIVEAU II	CLASSIFICATION NIVEAU III	POURCENTAGE NIVEAU III	POURCENTAGE NIVEAU I
Artificial Surface	Urban Fabric	Continuous urban fabric	0,03	3,2
		Discontinuous urban fabric	2,28	
	Industrial, commercial and transport units	Industrial or commercial units	0,46	
		Road and rail networks and associated land	0,09	
		Airports	0,01	
	Mine, dump and construction units	Mineral extraction sites	0,09	
		Dump sites	0,00	
	Artificial, non-agricultural vegetated areas	Green urban areas	0,01	
		Sport and leisure facilities	0,20	
Agricultural Areas	Arable land	Non-irrigated arable land	7,76	22,4
	Permanent corps	Vineyards	0,20	
		Fruit trees and berry plantations	0,78	
	Pasture	Pastures	5,95	
	Heterogeneous agricultural areas	Complex cultivation patterns	5,95	
		Land principally occupied by agriculture, with significant areas of natural vegetation	1,78	
Forest and Semi Natural Areas	Forest	Broad-leaved forest	12,84	74,0
		Coniferous forest	13,48	
		Mixed forest	5,56	
	Scrub and/or herbaceous vegetation	Natural grasslands	15,75	
		Moors and heathland	1,02	

	associations	Transitional woodland-shrub	1,66	
	Open spaces with little or non vegetations	Beaches, dunes, sands	0,03	
		Bare rocks	14,15	
		Sparsely vegetated areas	7,81	
		Glaciers and perpetual snow	1,67	
Wetlands	Inland wetlands	Inland marshes	0,004	0,4
Water Bodies	Inland waters	Water courses	0,11	
		Water bodies	0,32	

Climate

Associated with the geological complexity, there is a great variety in the climatic characteristics, which are strongly influenced by the relief and the orientation of valleys and slopes in relation with the prevailing atmospheric situation. The Northern Alps, drained by the Isère River are mainly dominated by a continental highland climate. As in all other mountain regions, important thermal and pluviometric contrasts exist between mountains and plains, and between the sun-facing or prevailing wind-facing slopes and the less sunny slope or more protected from winds. Some basic climatic data are summarized in Table 3 (after the *Bulletin Climatologique Annuel de l'Isère* of 1995).

Table 3. Climatic data of the Isère River Basin for different altitudes

Altitude (m)	Mean yearly temperature (°C)	Mean Temperature of the coldest month (C°)	Mean Temperature of the warmest month (C°)	Number of days with frost (jour/an)	Total precipitation (mm)	Number of days with snow (jour/an)
200-300	11,5	-2,0	27,0	50-70	800-1000	10-20
1000	8,0	-3,0	21,5	100-140	1000-1600	50-60
1800	5,0	-5,0	18,0	150-200	1100-2000	80-90

After Table 3, the highlands are the areas with the most precipitations. Rainfall tends to be quite regular, with nevertheless preponderance of winter precipitation (oceanic influence) and with summer and fall storms (continental mountainous influence).
Due to the predominant influence of western oceanic flows, at equal altitudes one can see a gradual decrease in total rainfall from the prealpine zones to the internal alpine mountains (see figure 4). Moreover, the large valleys (Sillon Alpin/Alpine Depression, Maurienne and Tarentaise), deeply cut in the relief, benefit from a shelter effect and thus receive systematically less precipitations than the slopes.

In the lower valleys, about 10% of precipitations take the form of snow. This number increases to 50% between 1000 and 2000 m, and above 2000m 70 to 85% of precipitations take the form of snow (Peiry et al., 1999).

Following the Köppen climatic classification, two of the five of the main climatic classes are present in the basin: group **D** (***Moist Mid-Latitude Climates with Cold Winters***) and **E** (***Polar Climates, with extremely cold winters and summers***). The former is represented by the sub-classes **Dfb** (**Humid continental climate**) and **Dfc** (**Subarctic climate**, also called **boreal climate**). They are mainly found in the low altitudes. In fact, the main part of the basin belongs to the polar climate group, represented by the sub-class **ET** (***Tundra climate***) (McKnight & Hess, 2005). This type of climate is present in the upper part of the basin, above 1000 m.

Characterization of the Hydrological Regime

The seasonal regime of discharge can be qualified as contrasted. It is characterized by a winter low flow period resulting from water retention under the form of snow, and abundant sping discharges resulting from snow melt.
Thus one can classify the Upper Isère (Val d'Isère) as a nivo-glacial regime. The regime becomes nival in the middle valley (Moûtier), with a maximal discharge in June. At Grenoble, the Isère River regime is a combination of several components. It retains a strong nival character with maximal discharges in June, yet it also presents an increase in discharges as soon as March, resulting from snow melt in areas located under 1000m. Finally, in the lower basin (Beaumont, Monteux), the regime is nivo-pluvial, with a maximum discharge in June too, but also with another maximum discharge in November (rain runoff).

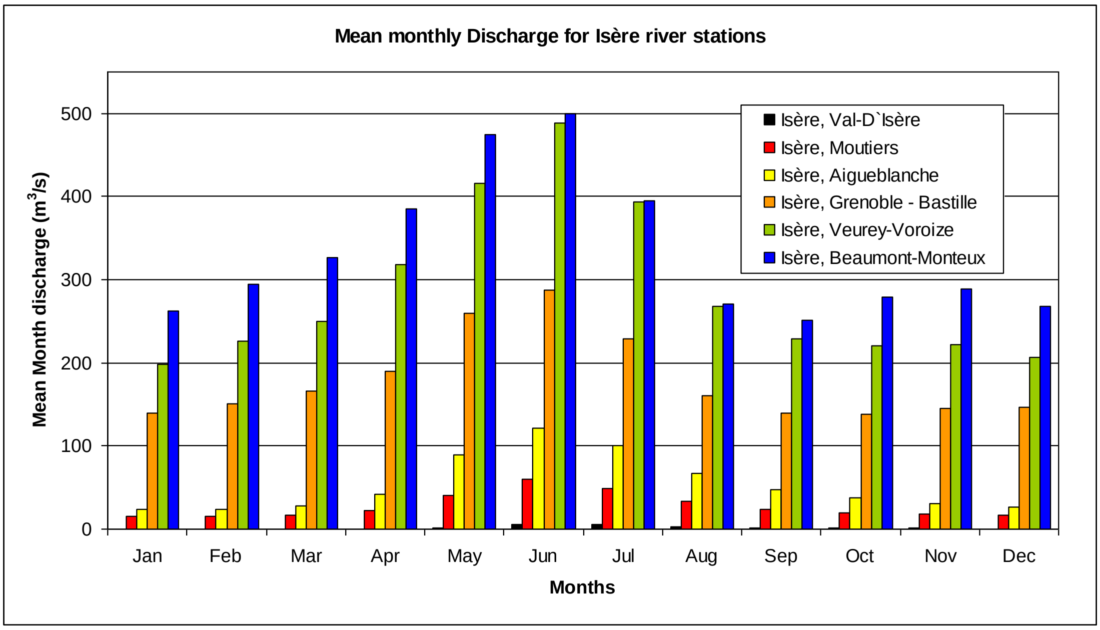

Figure 6. Mean monthly discharge for the Isère River
Source: SHARE Project and Banque Hydro

In the Isère River Basin, discharge series exist for approximatly 45 stations. These stations are administrated by different institutions : Electricité de France (EDF), Direction régionale de l'environnement, de l'aménagement et du logement (DREAL Rhône-Alpes), Compagnie Nationale du Rhône CN Rhône, la Direction Régionale de l'Environnement - Provence Alpes Côte d'azur (DIREN-PACA), Direction Départementale des Territoires Isère (DDE Isère), Université de Grenoble. All the data for these stations are available on the Banque Hydro on the web http://www.hydro.eaufrance.fr/. The availability of these discharge series, the station codes and the station names are given in table 4. Additionally, figure 7 shows the spatial location, the mean yearly discharges, and the station codes.

Table 4. Discharge Stations in the Isère River Basin of the Banque Hydro

CODE DE STATION	NOM DE STATION	DEPARTEMENT	DISCHARGE DATA AVAILABILITY
W3540011	L'Isère à Beaumont-Monteux	Drôme (26)	2003 - 2007
W3540010	L'Isère à Beaumont-Monteux	Drôme (26)	1956 - 2009
W3534020	L'Herbasse à Clérieux [Pont de l'Herbasse]	Drôme (26)	1969 - 2010
W3335210	L'Adouin à Saint-Martin-en-Vercors [Tourtre]	Drôme (26)	1970 - 2010
W1410010	L'Isère à Grenoble [Bastille]	Isère (38)	1960 - 2010
W1310010	L'Isère au Cheylas	Isère (38)	2006 - 2008
W1300010	L'Isère à Barraux [La Gache]	Isère (38)	2006 - 2009
W1144020	Le Bréda à Pontcharra	Isère (38)	2009 - 2010
W3344011	La Bourne à Saint-Just-de-Claix [Pont de Manne]	Isère (38)	2003 - 2005
W3344010	La Bourne à Saint-Just-de-Claix [Pont de Manne]	Isère (38)	1969 - 2009
W3315010	Le Meaudret à Méaudre	Isère (38)	1972 - 2010
W3200010	L'Isère à Saint-Gervais [Le Port]	Isère (38)	1969 - 2009
W3125020	La Fure à Charavines [Fures]	Isère (38)	1970 - 1972
W2832020	Le Drac à Fontaine	Isère (38)	1984 - 2009
W2804020	La Gresse à Gresse-en-Vercors [Pont Jacquet]	Isère (38)	1987 - 2010
W2767210	La Duy à Vizille	Isère (38)	1979 - 2010
W2764010	La Romanche au Bourg-d'Oisans [Champeau]	Isère (38)	1951 - 2009
W2755010	L'Eau d'Olle à Allemond [La Pernière]	Isère (38)	1951 - 2008
W2714010	La Romanche à Mizoën [Chambon amont]	Isère (38)	1948 - 2008
W2405010	La Jonche à la Mure	Isère (38)	1972 - 2010
W2335210	La Roizonne à la Valette [La Rochette]	Isère (38)	1919 - 2010
W2314010	La Bonne à Entraigues [Pont Battant]	Isère (38)	1905 - 2010
W2222010	Le Drac à Corps [Le Sautet]	Isère (38)	1969 - 1999
W2216410	La Ribière à Agnières-en-Dévoluy [La Combe]	Hautes-Alpes (05)	1977 - 2010
W2215030	La Souloise à Saint-Étienne-en-Dévoluy [2]	Hautes-Alpes (05)	1977 - 2010
W2114010	La Séveraisse à Villar-Loubière	Hautes-Alpes (05)	1969 - 2010
W2035010	Le torrent de Malcros à Champoléon	Hautes-Alpes (05)	1982 - 2010
W2022010	Le Drac à Saint-Jean-Saint-Nicolas [Les Ricous]	Hautes-Alpes (05)	1972 - 2010
W2015020	Le Drac de Champoléon à Champoléon [Pont de Corbière]	Hautes-Alpes (05)	1989 - 2010
W2002021	Le Drac Noir à Orcières [Les Tourengs]	Hautes-Alpes (05)	1989 - 2010
W1110010	L'Isère à Montmélian	Savoie (73)	1988 - 2010
W1105030	Le Gelon à la Rochette	Savoie (73)	1981 - 1984 - 2010
W1100010	L'Isère à Chamousset [Pont-Royal]	Savoie (73)	1969 - 2009
W1055020	L'Arvan à Saint-Jean-d'Arves [La Villette]	Savoie (73)	2000 - 2010
W1034010	L'Arc à Saint-Michel-de-Maurienne [La Saussaz]	Savoie (73)	1948 - 2008
W1024010	L'Arc à Bramans	Savoie (73)	1970 - 2008
W1006010	L'Avérole à Bessans [Avérole]	Savoie (73)	1969 - 2008
W0425010	La Chaise à Ugine [Pont de Soney]	Savoie (73)	2001 - 2010
W0414010	L'Arly à Ugine [Moulin Ravier]	Savoie (73)	1974 - 2010
W0300010	L'Isère à Aigueblanche	Savoie (73)	1955 - 2008
W0224010	Le Doron de Bozel à la Perrière [Vignotan]	Savoie (73)	1948 - 2003
W0110010	L'Isère à Moûtiers	Savoie (73)	1903 - 2010
W0000010	L'Isère à Val-d'Isère	Savoie (73)	1948 - 2009

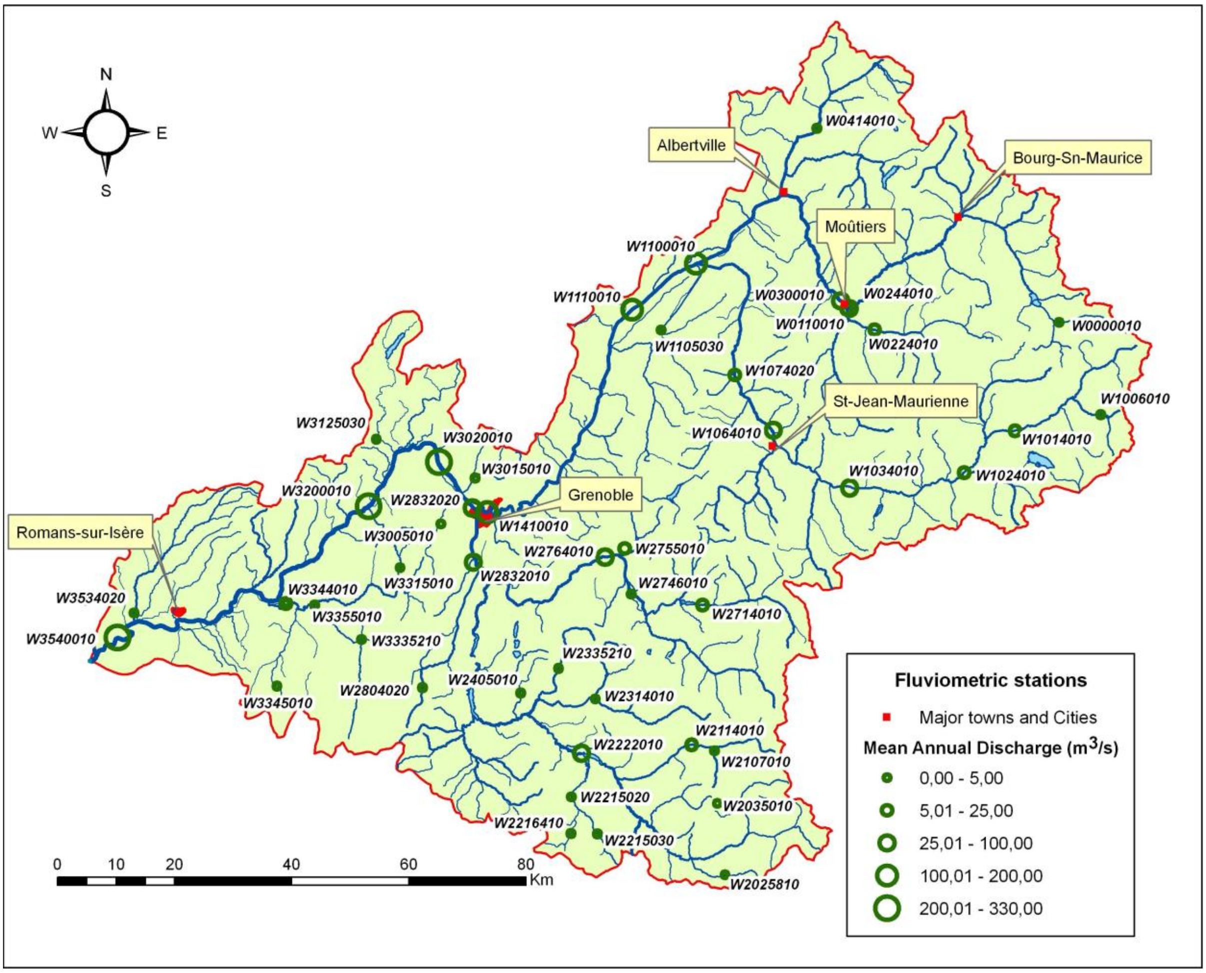

Figure 7. Fluviometric stations in the Isère River Basin, station codes and yearly mean discharges
Source: SHARE Project

As regard to the discharge regime, it is altered by the water extractions realized by hydroelectric power stations (especially those that retain water and those where some portions of the water are court-circuited or where water is diverted into other basins). Other factors altering the water regime are water extractions for the industry, for drinking water, and for agricultural irrigation. The alteration as compared to the natural Isère hydrological regime has repercussion at the hourly, daily, monthly, and even yearly scale. The graph on figure 8 clearly shows that the natural monthly regime is altered by the Arc River at Saint-Michel-de-Maurienne (939 km²) compared to the station Arc Bramans (635 km²), from June to October.

At the daily scale, discharges show significant alterations, which have important effects during the low flow period (it affects the possibility of aquatic habitat, especially for species that cannot adapt to sudden changes introduced by the water levels and the flow velocity). This theme will be developped more in depth in the section: “pressure and impacts related to water uses”.

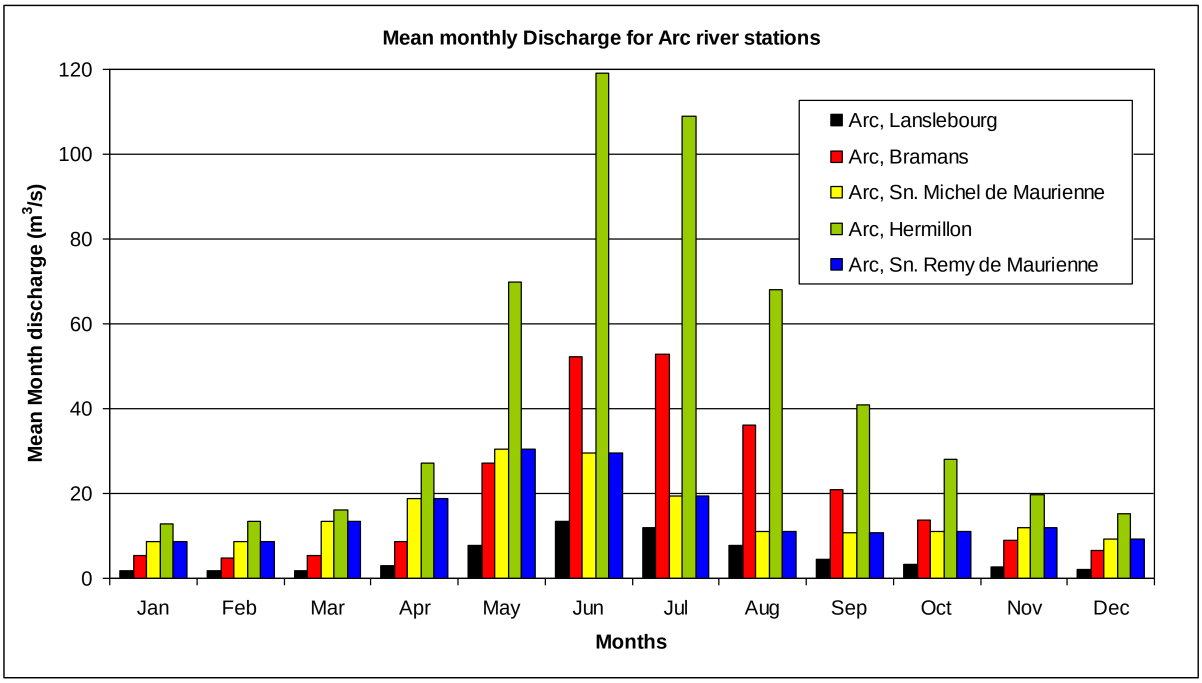

Figure 8. Mean monthly discharges for the fluviometric stations of the Arc River
Source: SHARE Project.

River Quality

Quality elements of the WFD

Biological elements

As regards to biological elements, the 1996 SDAGE identified the relevant elements and it has realized an atlas for the Isère River Basin. For this purpose, the basin was divided in two parts: Downstream and upstream Isère, the later corresponding to the sub-basin designated for the pilote case of this study. Fauna, Flora and noteworthy ecosystems are shown on figure 9, along with the *Indice Biologique Global*[1] (Comprehensive biological Index) and the faunistical group. This cartography is mainly based on the inventories of Natural Zones of Ecological, Faunistical and Floristical Interest (Zones Naturelles d'Intérêt Ecologique, faunistique et floristique), and those of the Zones of Community Ornithological Interest (Zones d'intérêt communautaire Ornithologique).

[1] It consists of a synthesized expression of the ability of a site to develop benthic macro-fauna (aquatic invertebrates, insects). This index (IBG) is established from a double entry table : taxonomic variety (number of taxa present among a list of 138 taxa) and indicator group (most "pullosensitive" group among a list of 138 taxa divided into 9 classes). This index allows to determine the comprehensive quality of a stream, taking into account all ecological factors of the environment (water quality, habitat quality).

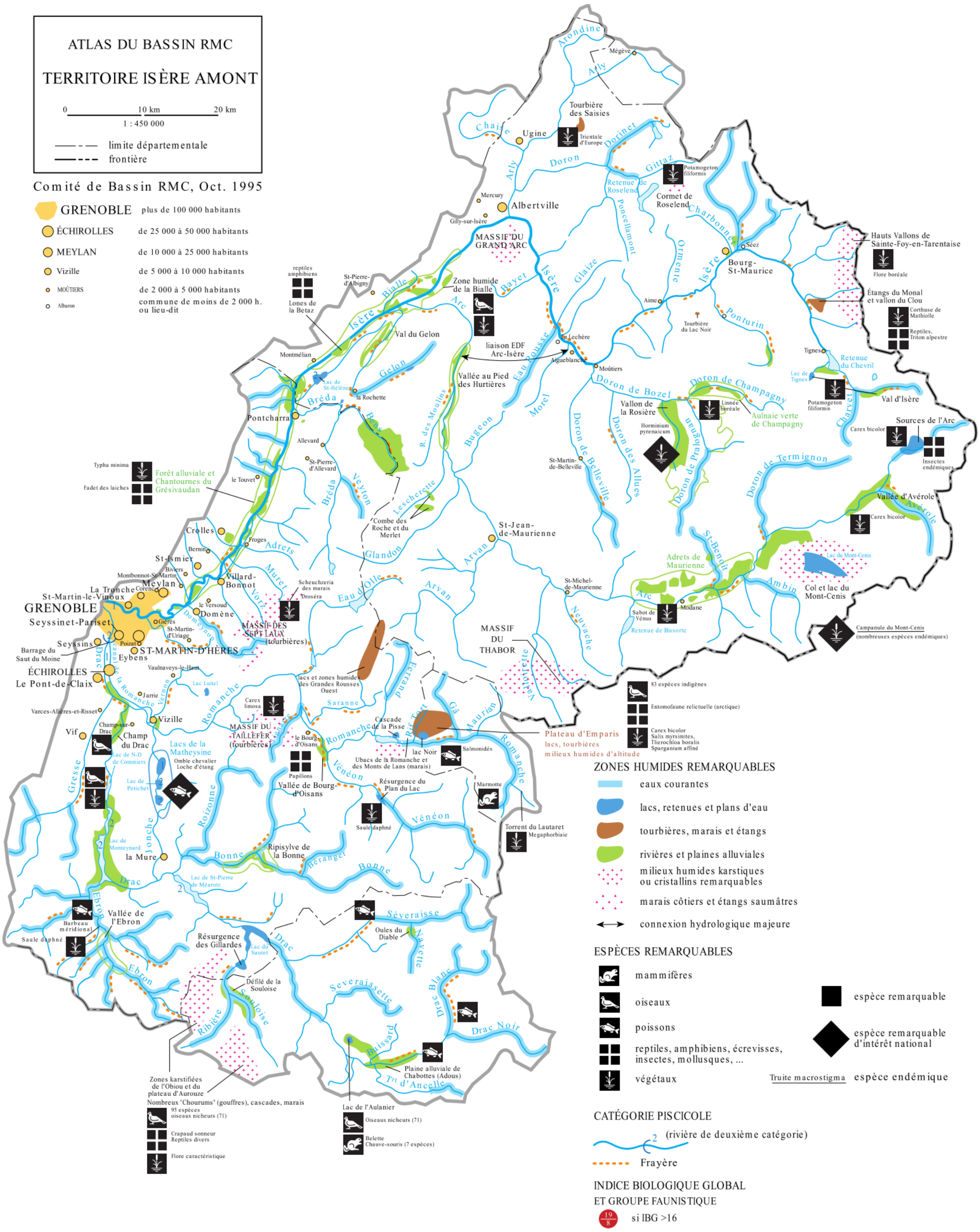

Figure 9. Fauna, Flora and noteworthy ecosytems upstream of Grenoble
Source: L'atlas de Bassin (SDAGE, 1996).

Hydromorphological elements supporting the biological elements

Hydrological Regime: As was presented in the section "Characterization of Hydrological Regimes", the Isère River shows a regular discharge pattern, whose hydrological regime has been altered by hydroelectric developments. For more precision, see "Hydrological Characterization – discharge regimes" and "pressure and impacts related to water use – Hydropower Generation" where an example of regime alteration due to regulation and hydropower generation is to be found.

River continuity**:** In the framework of the 2009 SDAGE (Rhone-Mediterranean Basin), the sub-basins or river sections affected by damages to longitudinal and lateral ecological continuity preventing to reach a good state by 2015 have been identified. On these sections it is necessary to restore the continuity of sediment flow (see Figure 21).

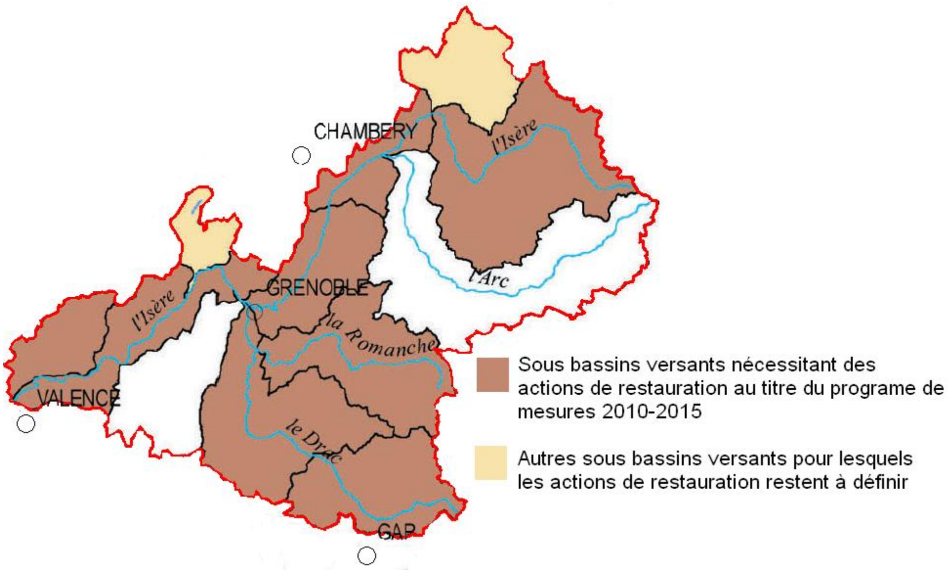

Figure 10. Territories in the Isère River Basin where actions towards the restoration of the longitudinal biological continuity must be taken

Source: SDAGE Rhône-Mediterranée Basin Committee 2009, modified by SHARE Project

Morphological Conditions

- The channel and river corridor before developments (before 1785): In the Combe de Savoie and in much of the Grésivaudan Valley, the Isère River had a braided geomorphology (slope 0.009 to 0.012). A meandering form developed only in the surroundings of Grenoble, under the influence of the alluvial fan of the Drac which, by partially blocking the Isère Valley, greatly reduced the slope of the Isère through a process of downstream control. In the braided zone, the average width of the braiding band was 600 m, locally exceeding 1000 meters. The fluvial landscape was made up essentially of a complex number of more or less active river arms, surrounded by vast gravel and pebble banks. The highly variable flows of the Isère resulted in the flooding and submersion of the river banks several times per year. The bedload was frequently moved, thus leading to unceasing displacement of channel forms and preventing the enduring installation of riparian vegetation. The coarse deposits, less frequently moved, were occupied by tender wood communities or moors used as pasture for herds. In the last twelve kilometres before Grenoble, the Isère gradually loses its braided characteristics to become a river with a meandering channel. The channel width decreased greatly to an average of 150 meters. The longitudinal river banks were transformed by transport into lateral alternate banks, located at the convexity of the meanders.

- The channel and river corridor today: The morphology of the Isère River corresponds to that of a highly developed river. In a first phase, the interventions made during the 17th and 19th century considered the longitudinal embankment facilities as unsinkable, so that the braided pattern of the river disappeared in less than a century. Later, hydroelectric development resulted in the alteration of liquid and solid flow regimes. Thus, the Isère River currently has one single channel, which has a width of 40m downstream of the city of Alberville. Downstream of its confluence with the Arc River, its width reaches 100-120 m. There banks are present with a development of stable vegetation. Some 20 km before the city of Grenoble, the Isère River has modest meanders (most of them were artificially cut off and today they are in fact Oxbow lakes with a low connectivity), and its width is 80 meters before the confluence with the Drac River.

Physical and chemical elements supporting the biological elements

In order to characterize the physical and chemical quality of the superficial water of the Isère River (streams, lakes), their level of deterioration and the causes of these perturbations (domestic, agricultural or industrial waste), one may refer to figure 11 (realized in the framework of the 1996 SDAGE). This map allows to establish an assessment of environmental degradation in terms of water quality and to identify areas where there are still problems. On the map one can see more specific problems in regard to specific categories of priority pollutants such as nitrogen and phosphorous, toxic micro-pollutants and microbial pollution.

The elements related to water quality shown on the map are taken from the new regional quality maps developed from a synthesis of data acquired between 1988 and 1994 in the framework of the Network.

The information is either linear (overall quality of rivers, eutrophication) or selective (nitrogen, phosphorus, chlorophyll, metals, etc.). For the latter, only the parameters that a used to determine a lower quality status (from poor or *médiocre* to extremely poor or *hors class*) are present on the map.

The quality classes are determined from a grid, for the overall quality of rivers, that takes into account organic and oxidizable matter, and the biological quality estimated from the IBG (Comprehensive Biological Index), and from other grids specific to certain classes of pollutants such as nitrogen, phosphorus, bacteriology, etc.

Data on the quality of bathing water, collected by the *Directions Départementales des Affaires Sanitaires et Sociales* (DDASS), are also reported. For lakes, a grid of water quality has been established based on simple criteria, namely the trophic level and the trophic status of the lakes, with three quality classes: balanced state, disturbed state and highly degraded state.

Lastly, the different sources of domestic and industrial pollution leading to degradation of the environmental quality are identified. These sources can be either localized or diffuse, or represented in a set of scattered small releases.

Definition of classes:

Class 1A (blue): good quality water. Absence of significant pollution.

Class 1B (green): fairly good water quality, moderate pollution.

Class 2 (yellow): poor quality water, marked pollution.

Class 3 (orange): very poor quality water, significant pollution.

Class HC (red): water or extremely poor quality, very significant pollution.

Non-determined quality: absence of sufficient data allowing to evaluate the stream quality.

Eutrophication

Presentation of the different forms of eutrophication:

- Plankton: suspended microscopic algae, mainly affecting lakes and slow streams. Plankton causes water pigmentation, a decrease in transparency, and can give a bad taste to the water.
- Filamentous algae (Cladophora): established vegetation that can become invasive. They can cause aesthetic nuisance as well as inconveniences for certain uses such as recreation, and they can cause delayed pollution.
- Diatoms benthic: microscopic algae established on all media, making them slippery, whether in running water or slow water environments.

All these plants are naturally present in streams as they are part of the biological balance of the aquatic environment. Their presence is only a nuisance when they are overabundant and cause a dysfunction in the biological system. This proliferation of plants can be explained by physical factors (temperature and lighting) and excessive intakes of nutrients like phosphorus and nitrogen.

Sections with eutrofication

Two levels of eutrophication are reported in streams depending on the size and frequency of the phenomenon. This information is a summary of information from an eutrophication map that is being made by the Agence de l'Eau, which will show in much more details the levels and forms of eutrophication.

Chlorophyll A

Numbers for chlorophyll A concentration is used to indicate the presence of phytoplankton suspended in the water. On the regional quality maps, maximum and median values of chlorophyll A are reported. Only the maximum values being reported here.

Nitrogen and Phosphorus

The presence of phosphorus and nitrogen is incorporated in the overall quality of the river, yet it is also represented locally on the maps. High concentrations of nitrogen and phosphorus cause various forms of alterations: O2 consumption, toxicity (NH4, NO2), nutrients promoting eutrophication (all forms of N and P).

The levels of orthophosphate (P) and nitrogen (N) are given in the form of pollution levels, as set by an interpretative grid. For nitrogen, the grid provides an assessment of the different forms of its cycle, namely ammonia (NH4), nitrite (NO2), nitrate (NO3), Kjeldahl nitrogen.

Micropollutants

These compounds are likely, at low levels, to cause serious dysfunctions in aquatic ecosystems, and to affect the entire food chain. It is important to remember that many of these compounds are persistent and accumulate in sediments, some of which are also bio-accumulative.

Metals and metalloids

The monitoring of the presence of metals in water is performed in 189 observation points of the bassin and allows to highlight the problems of toxic metal pollution in aquatic ecosystems. These elements (7 metals and a metalloid) are looked for in different components of the environments: the bryophytes (water mosses), the sediments, and the suspended material. The results reported on the maps are a summarized representation of the data.

Comment: the almost systematic occurrence of mercury in Rhône-Alpes rivers is problematic as to its provenance and to its interpretation.

Organic Micropollutants

Indicators of organic contamination are grouped into four categories: compounds of the type "volatile chlorinated solvents." Their monitoring is more recent (1990-1994) and concerns only 36 observation points. The results have no ecotoxicological meaning, but they allow to define a scale of contamination of the environment.

little or no contamination: pollution factor less than 6,
average contamination: pollution factor between 6 and 18,
significant contamination: pollution factor greater than 18.

Lake Quality

The evaluation of lake quality calls upon climatology, the geological nature of the substrates, morphometric, biological, physical, and chemical parameters, biological, physical, interactions among living organisms from the food chain, and external inputs coming from the basin.
The different classes are obtained by overlapping the trophic status of the lake (for the type of ecosystem functioning) and its trophic level (nutritional potential).

A methodology is under study concerning the development of a biogenic lake index in order to develop a ranking of the quality of different lakes. Based on the determination of the benthic macrofauna, this method of diagnosis can give each lake the two levels of information mentioned above, trophic level and throphic status.

In the end, three categories can be used: balanced state, disturbed state, and very disturbed state.

On the maps, the natural water bodies or those with little water level changes, the reservoirs with frequent water level changes, and the lagoons are represented in different ways. This type of information is important to understand the functioning of these environments.

Bacteriological quality of bathing waters

The data comes from the sanitary control of the quality of bathing waters (rivers or lakes) conducted by the *Directions Départementales des Affaires Sanitaires et Sociales*. The monitoring consists of germ tests of faecal contamination (coliforms and streptococci).

The bacteriological quality of the water is not within the classification criteria used to define the overall quality of the environment. Although these data provide only localized information, it is important to include them because river swimming increases as a recreational activity, along with water sports (canoeing, rafting, etc.), and it needs to be considered by water managers.

Pollution Sources

The incoming discharges to the natural environments that cause a deterioration of surface water quality are reported on the map. They consist in urban or industrial waste, treated or non-treated.

The triangles representing these discharges are positioned approximately where the discharge occurs in the natural environment.

Domestic or urban point source discharges: two triangle sizes indicate the importance of the discharge or its impact on the environment. All net releases above a threshold of 5,000 population equivalent (PE) (large triangles) are shown. This threshold level represents a significant amount of pollution emitted into the environment. The small triangles correspond to discharges below the threshold of 5000 PE, but which have a significant impact on receiving environment (class change) because of its sensitivity (low flows).

Industrial point source discharges: two triangle sizes in the same logic as above. The threshold is set in this case at 300 kg of organic matter per day.

In the triangles, the initials of the industrial branch of the factory at the origin of the waste are mentioned. This precision gives information about the nature of the effluent.

Toxic pollution: In the case of industries, the releases toxic pollution, expressed as equitoxic kg / day (dilution factors applied to the effluent for its toxicity to disappear) are also mentioned. The threshold for representation on the map is set at 10Ket / d.

Mixed Treatment Plant: The treatment plants that deal only with domestic sewage stations and those that are connected to industries are distinguished.

Drainage channel: an arrow materializes the drainage channel of treated or non treated sewage waters towards the natural environment.

Zones of agricultural non point source pollution: pollution characterized by the existence, on an extended space, of a continuum of low-intensity leaks. It is non continuous and is activated under the influence of weather, soil, or cultivation method. In some areas, this type of pollution can degrade the quality of the surface water (nitrogen inputs), however the impacts are generally larger in terms of groundwater.

Zones with many scattered releases: areas with multiple small discharges from industrial or domestic waste, below the threshold, hardly mappable individually but whose cumulative effect has an impact on the environment. These releases are represented by tint areas. These zones may include areas where there are many small food industries, leaks in the sewer of a town, etc.

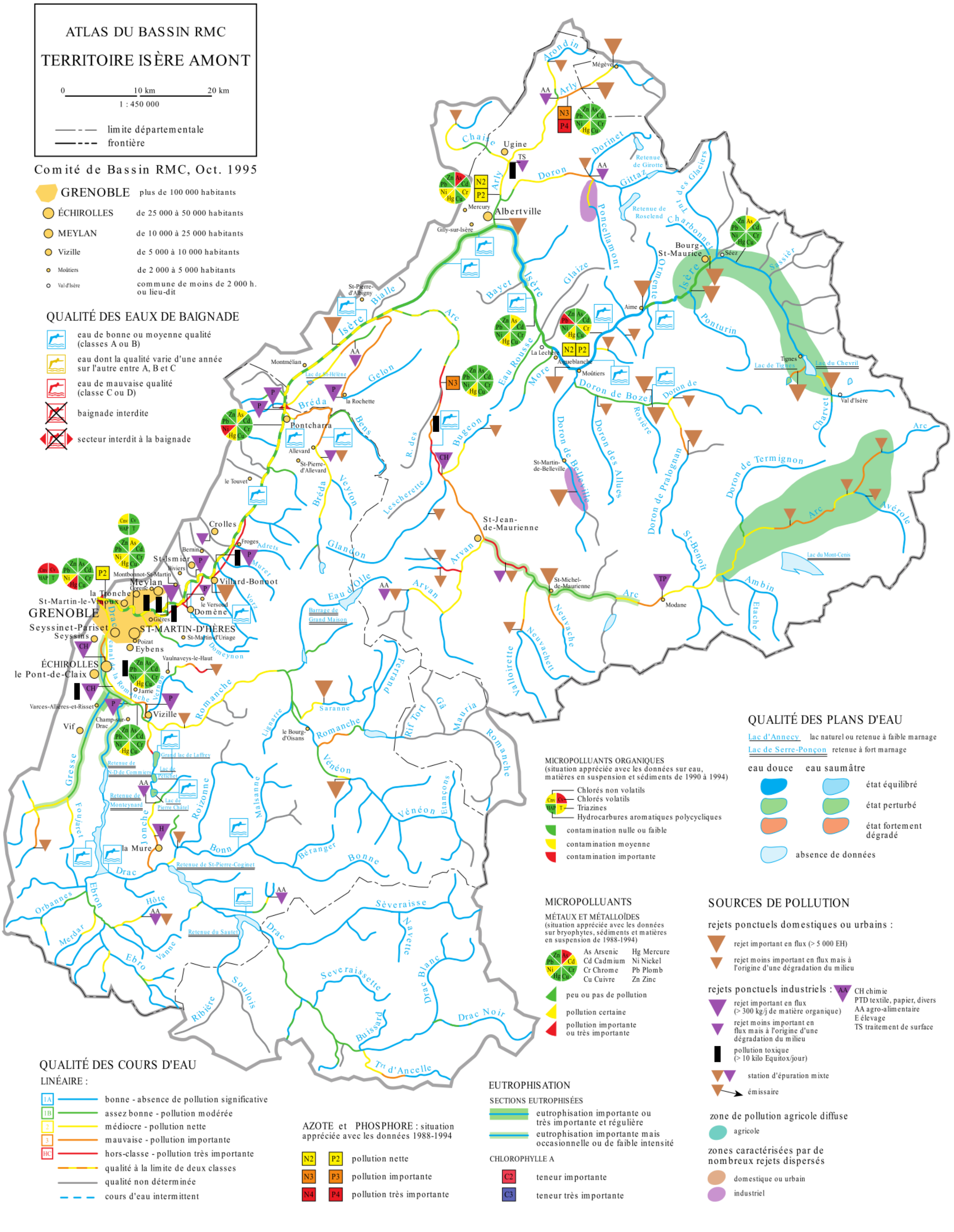

Figure 11. Surface water Quality and pollution sources in the Isère River Basin, downstream of Grenoble
Source: L'atlas de Bassin (SDAGE, 1996).

Typology of the WFD Hydro-Ecoregions (HER)

Homogenous spatial entity in terms of physical controls on the organization and the overall functioning of aquatic ecosystems. At the basin scale, the primary, universally accepted controls on stream ecological functioning are geology, topography and climate. This concept is inspired by the theories of hierarchical control of water systems, and is based particularly on the nesting of physical scales, from the micro-habitat to the basin. The CEMAGREF defined the hydro-ecoregion in the case of metropolitan France. It developed the conceptual framework of regionalization by "hydro-ecoregion" and the general aspects of the method, its objective being to define and characterize Hydro-ecoregions for metropolitan France. There are two levels for hydro-ecoregions (HER): Level 1 and Level 2. A total of 22 Level 1 Hydro-ecoregions (HER-1) were identified on criteria combining geology, topography and climate, universally regarded as the primary determinants of the functioning of water ecosystems at the 1/1.000.000 scale. Level 2 (HER-2) has 112 hydro-ecoregions resulting from a finer breakdown of the previous units. They were identified by the CEMAGREF in 2002 across the French metropolitan territory.

The Isère Basin area, and consequently the pilot site, is located for the greatest part in areas classified as the internal Alps by the HEC-1 (Figure 12). This classification is characterized by mountains with an extremely marked relief. The streams are characterized by the importance of alpine low flows, the geology is heterogeneous but with little carbonate, and the climate is typical of mountain regions with a strong continental trend.

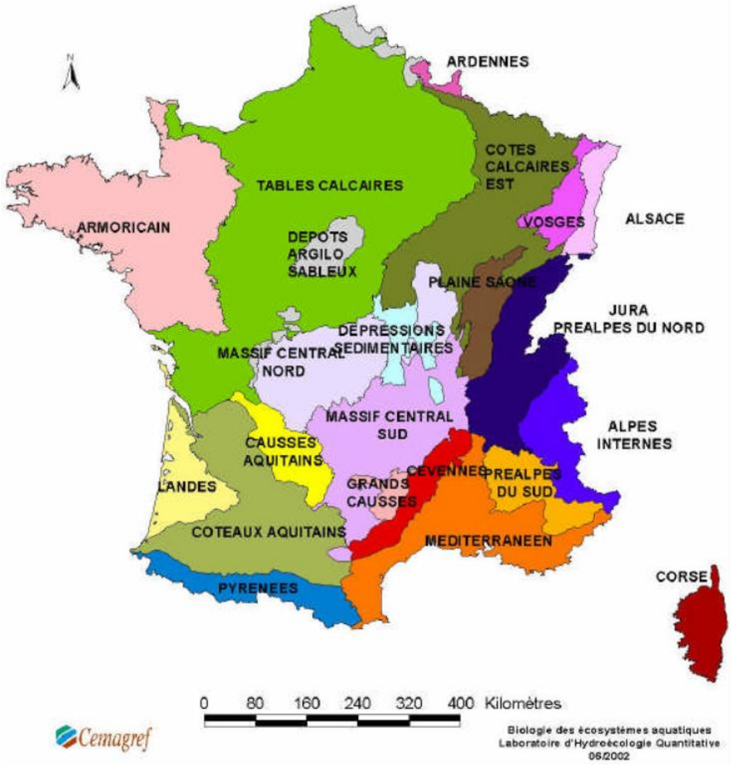

Figure 12. Classification oh hydro-ecoregion in metropolitan France

Source: Cemagref: Wasson et al., 2002

Regarding the SHARE project, the hydrographic district (larger geographical unit than the hydrographic basin) of the Rhone River and coastal Mediterranean Sea is affected by 16 Level-2 hydro-ecoregions 16 (see Figure 13). In the case of the HEC-2 classification, the Isère River Basin includes five of the 16 hydro-ecoregions (Internal Alps, Northern Pre-Alps, hills of Lower Dauphiné, Southern Pre-Alps, and the Mediterranean plains). However, as in the case of HEC-1, the pilot site is located entirely within the area classified Internal Alps, as can be seen in Figure 13.

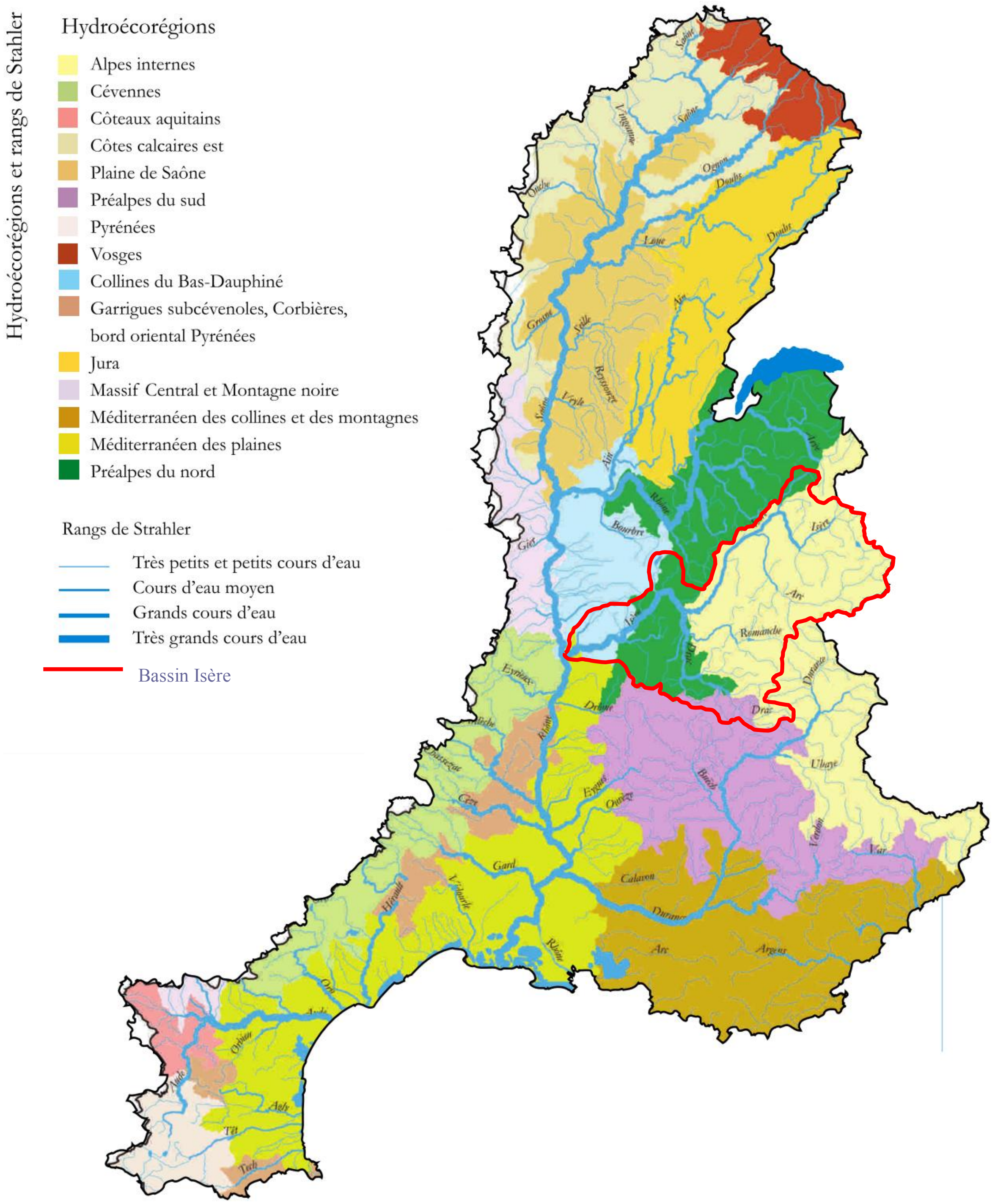

Figure13. Hydro-ecoregions et Stahler rankings for the hydrographic district Rhone and Mediterranean coasts

Source: Cemagref 2002

Typology of Water Bodies of the WFD

The Water Framework Directive (WFD) is particular in the sense that it introduces the concept of types of water bodies. It aims to distinguish between water bodies heavily impacted by human activities that have permanently lost their natural functioning, and water bodies that are not so disturbed. By water bodies, the WFD means the spatial clustering of waters in terms of ecological and physiochemical assessment. This distinction leads to changes in objectives from the point of view of the WFD.

The implementation of this classification in the district Rhône-Méditerranée is made by the Master Plan for the Refurbishment and Management of Water Resources *(Schéma Directeur d'Aménagement et de Gestion des Eaux* , SDAGE) which is described in this report in the section "Plan and Management Program - existing management plans." The SDAGE takes into account all aquatic environments and environments in connection with them, whether designated as a body of water under the Water Framework Directive or not.

Table 5. Types of aquatic environments

TYPES DE MILIEUX	MELIEU CONSIDERE COMME MASSE D'EAU PAR LA DCE
Glaciers	No
Natural streams	Yes (RB>10 km2)
Stream designated as highly modified water bodies	Yes (RB>10 km2)
Navigation channels (artificial water bodies)	Yes
Non-treated water transportation channels (artificial water bodies)	Yes
Natural lakes	Yes (RB>10 km2)
Stream water retentions, designated as highly modified water bodies	Yes (RB>10 km2)
Artificial lakes (ponds, gravel ponds, water storages)	Yes (RB>10 km2)
Wetlands	No
Natural littoral lagoons (transition waters)	Yes
Littoral lagoons, designated as highly modified water bodies	Yes
Natural coastal waters	Yes
Coastal waters, designated as highly modified water bodies	Yes
Groundwater (there is no highly modified water bodies for groundwater)	Yes

In the following section, we will present the realized classifications, that correspond to water bodies – streams and lakes.

Streams : The identification of water bodies –streams results from the division of the river system into homogeneous sections in terms of function: (i) hydro-region changes (hydro-regions are geographical features expressing the diversity of "natural" contexts in the Rhône-Médirterrenée, and defined according to their climatic, geological, and topographic characteristics (ii) stream size (Stralis ranking) (iii) membership to a fish domain (iv) presence of human activities significantly disturbing the state of the water.

In the following section, the final product of the classification of typology (Figure 14) performed by the SDAGE are presented, concerning rivers which include the Natural Water Bodies (NWB) and rivers designated as Heavily Modified Water Bodies (HMWB). These water bodies are not necessarily a management unit, but rather a unit for the assessment of ecological status and of objectives under the WFD, including the good status.

In Appendix I, a table can be found on which the Water Body code is pointed out along with the name of its class, its ecological status, and its chemical status, for running water bodies and for lakes (natural and artificial).

Figure 14 . Running Water Bodies (lakes are not included on this map)
Source: SDAGE Rhône-Mediterrannée Basin Committee 2009, modified for SHARE Project

Lakes and artificial lakes : Lakes are characterized by water stagnation and stratification; the biosynthesis and biodegradation cycles occur in a vertical fashion. The main elements of the functioning of the system are water mixing mostly relation to weather, food supplies from tributaries, connectivity with littoral wetlands and the slow turn over of the water. 3 types of lakes can be distinguished depending on the basin, on the feeding habits, on their morphology, and of their genesis: (i) Natural Lakes, (ii) Man-made Lakes, built on perennial streams (reservoirs), in which case they as designated as Highly Modified Water Bodies (HMWB), and (iii) artificial lakes (gravel pits, ponds, water storage), fed by either groundwater, or through runoff and/or diversion.

For natural lakes, the French typology distinguishes between 12 types of lakes. The water bodies of the Basin correspond to the four following types:

- High mountain lake with littoral zone
- High Mountain lake with bare banks
- Calcareous, shallow middle mountain lake
- Calcareous, deep middle mountain lake

In the case of reservoirs on streams designated as Highly Modified Water Bodies (HMWB), the basin counts 6 types of lakes :

- High montain reservoir
- Calcareous, shallow middle mountain reservoir
- Calcareous, deep middle mountain reservoir
- Non-calcareous, deep middle mountain reservoir
- Non-calcareous, deep, low altitude reservoir
- Calcareous, deep, low altitude reservoir

Artificial lakes are fed by either groundwater, or runoff and/or diversion. One can distinguish the following environments : (i) very shallow freshwater ponds mainly used for fishing or recreation, sometimes less than 1m deep, (ii) gravel pits in activity or rehabilitated, linked to gravel extraction and fed by alluvial aquifers. Once rehabilitated, they can be used for recreational purposes, or support the avifauna and aquatic ecosystems, (iii) water storages, usually rather small, used for storing water and water tranfers for irrigation, or as a complement to reservoirs for hydropower production. In the Isère River Basin, 5 types are found:

- Artificial lakes with frequent water level changes (water storages)
- Artificial lakes obtained through excavating or dyking drained at regular intervals (ponds)
- Artificial lakes obtained through excavating or dyking, non-drained (Etangs)
- Artificial lakes obtained through excavating hard rocks, non-drained (gravel pits)
- Shallow artificical lakes obtained through excavation in the river bed, in relation with groundwater (gravel pits)

The different lakes identified from the classification previously defined are represented on the figure below.

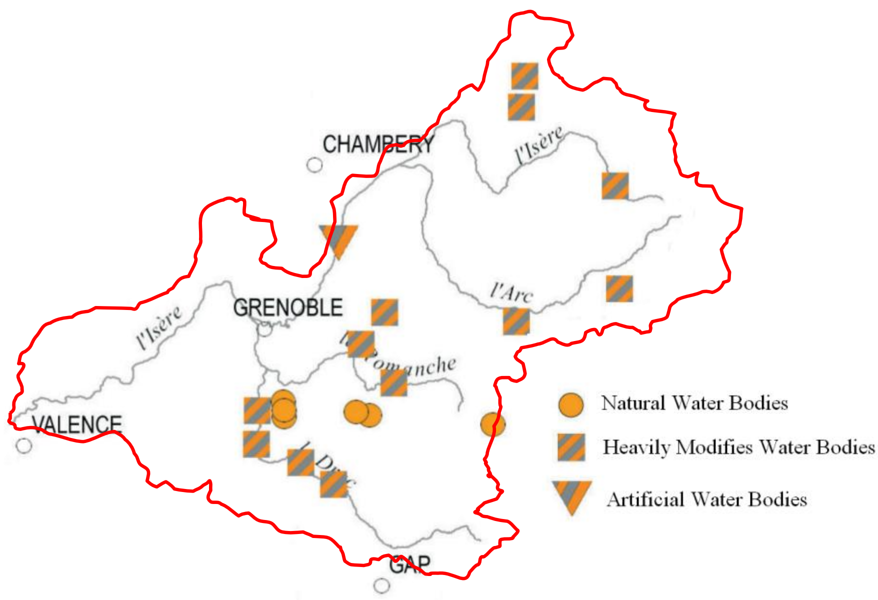

Figure 15. Lakes and artificial lakes after SDAGE 2009
Source: SDAGE Rhône-Mediterranée Basin Committee 2009, modified by SHARE Project

Managment Plans and Programs

As regard to the environment, the French legislation follows two main objectives : i) the maintenance of biological diversity, which provides a framework for the main actions towards the care of nature and of ecosystem elements (including river ecosystems); (ii) the promotion of sustainable development.
The legal framework is guided by successive laws: **law of 1976** on the **Protection of Nature** (*Protection de la Nature*), in which this protection becomes "of general interest," et which establishes "impact assessment" as a prerequisite to any kind of development that may disturb the environment integrity; the Law on Water of 1992 (*Loi sur l'Eau*), which provide a the means for multi-scale management plans of lakes, rivers, wetlands, and water resources through the instauration of the the Master Plan for the Refurbishment and Management of Water Resources *(Schéma Directeur d'Aménagement et de Gestion des Eaux* , **SDAGE**), which takes into account the WFD (200). In river basins, dividing areas into homogeneous management units is one of the main objectives of the SDAGEs established by the Law on Water. 8 administrative units were formed in metropolitan France, each having Water Agencies (Agences de l'Eau) and Basin committees (Comités de bassin). The Isère Basin is part of the Rhone-Mediterranean Water Agency (Agence de l'Eau Rhône-Méditerranée).

Existing Management Plans

The SDAGE of the Rhone-Mediterranean Bassin has the following program:

2005: **First assessment of the Basin** (i) diagnosis of the current situation of water and of the risks of non achievement of the good water status (ii) Identification of the main issues.

2010-2015: **Drafting of the SDAGE of the Rhone-Mediterranean Basin,** the document of water policy with 8 basic guiding principles (*Orientations Fondamentales*) for water Water Bodies.

2010-2015: **Measure Program. Pluriannual program** of actions to be put in place in order to reach the environmental objectives.

2007-2012: **Monitoring program.** Monitoring of the environments and of the effectiveness of the measure program : (i) Comprehensive monitoring of the basin environments; (ii) more localized monitoring of the evironments that have not yet attained the good water status; (iii) renewal of the monitoring program in 2013.

In the Rhone-Mediterranean Basin, 8 basic guiding principles have been defined (Comité du Bassin Rhône-Mediterranée, 2009) :

- **Give priority** to prevention and to interventions at the source of the problems for more efficiency
- **Concretize** the implementation of principles of non-degradation of aquatic environments
- **Integrate** social and economical dimensions in the implementation of environmental objectives
- **Reinforce** local water managment and insure the coherence between territorial planning and water managment
- **Fight** against pollution, giving priority to dangerous pollutants and to health
- **Preserve et re-develop** the natural functions of the basins and of the quatic environments
- **Reach** a quantitative balance by improving the sharing of water resources and by anticipating the future
- **Manage** the risks of flooding, taking into account the natural functioning of rivers

These 8 basic guiding principles, directly linked to important issues identified during the assessment or coming from other topics concerning water, are show in the following table.

Tableau 6. Basic guiding principles defined in the Rhone Mediterranean SDAGE

Important questionq and environment assessment	Orientation Fondamentels	OF 1 Prevention	OF 2 Non dégradation	OF 3 Society, economy and objectives	OF 4 Local management and territory planning	OF 5 Fight against pollution	OF 6 Physical Restoration of environments	OF 7 Quantitative balance	OF 8 Fllood management
Iq 1	Local Managment				■				
Iq 2	Territory planning				■				
Iq 3	Sampling							■	
Iq 4	Hydropower						■	■	
Iq 5	Physical Restoration						■		
Iq 6	Overbank flows and floods								■
Iq 7	Toxic substances					■			
Iq 8	Pesticides					■			
Iq 9	Water and Health					■			
Iq 10	Society and Economy			■					
Iq 11	Efficiency of strategies	■	■						
Iq 12	Sustainability of water policy			■					
Iq 13	Mediterranean Context	■	■	■	■	■	■	■	■
Out of Iq	Fight against pollution					■			
Out of Iq	Eutrophication					■			
Out of Iq	Watlands						■		
Out of Iq	Species and biodiversity						■		

Source: Comité du Bassin Rhône-Mediterrannée, 2009

In order to insure on the one hand a close consultation of the field, and on the other hand to deal with specific issues, this program relies on:

- 9 territorial basin commissions (the borders of these territorial commissions do not coincide with the geographical limits of the basin – see figure 16).
- The commission of Natural Aquatic (CMNA);
- The social and economical working group and the scientific council

The Isère River Basin is located within the borders of the territory that corresponds to the Territorial Commission of Isère Drôme.

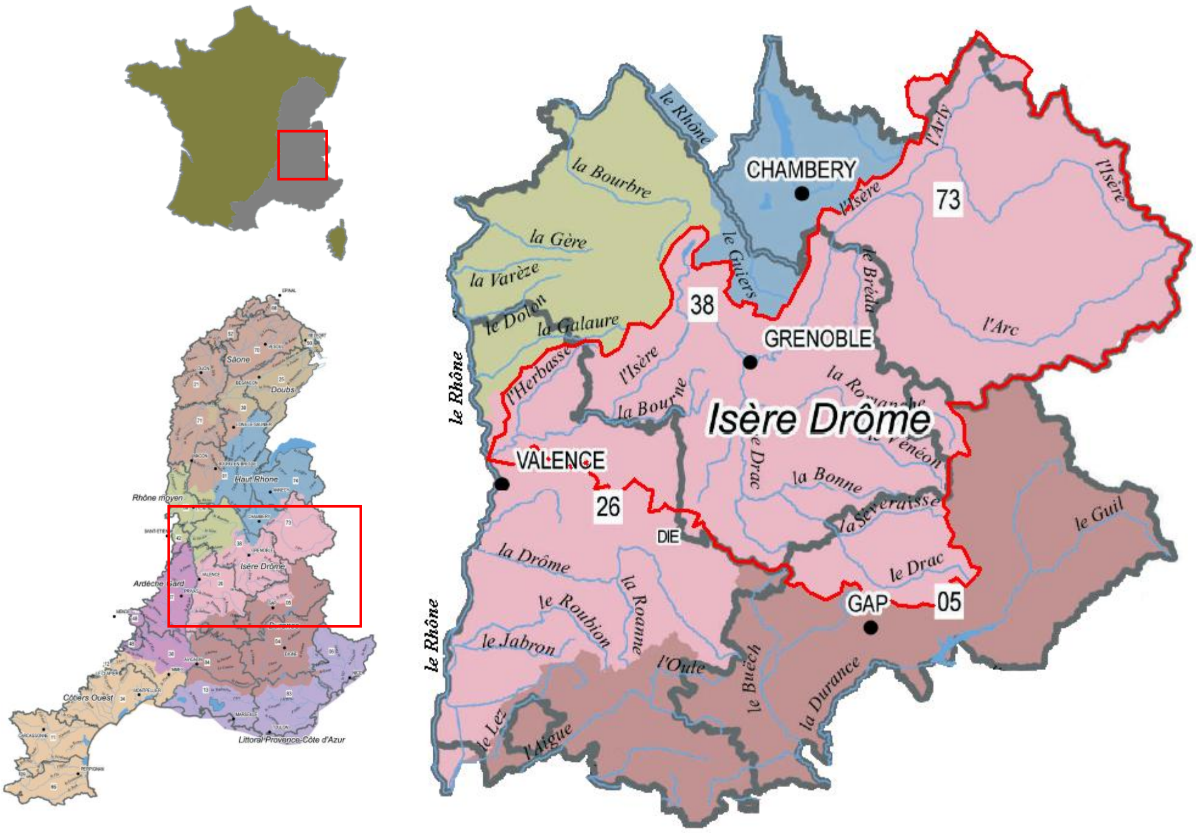

Figure 16. Delimitation of the Isère Basin on the Rhone-Mediterranean Bassin
Source: SDAGE 2009, Rhône-Mediterranée Basin Committee, modified by SHARE Project

In the following section, we will outline the main objectives that are aimed at for all basic guiding principle that correspond to the Rhone-Mediterranean basin management.

The **Prevention measures (BGP. 1)** aim at the following objectives:

- Draft, by 2010, prospective scenarios for the evolution of the Rhone Mediterranean Basin over the medium term, that incorporated in particular the possible evolutions in the field of water and aquatic environments that are caused by climate change
- Significantly increase, by 2015, the number of actions taken for prevention the field of water
- Materialize, by 2015, a few exemplary partnerships, associated to concrete actions that bring into play the synergy between water and other economical fields.

The **measures of Non-Degradation (BGP. 2)** aim at the following objectives:

- Preserve the functioning and therefore the status of the environments as very good or good;
- Not to accentuate the level of perturbations to which the degraded environments are subjected;
- Preserve the areas of good functioning of the aquatic environments, and not to compromise the quantitative balance of aquatic environments;
- Not to compromise the integrity of the zones defined as strategic for drinking water supplies;
- Preserve public health;

- Incorporate the necessary enforcement of the environmental objectives into the documents for urban planning, infrastructure projects, and economic development policies:
- Incorporate the principle of non-degradation in the definition of policies that rely on new or developing practices: artificial snow, bio fuel, hydropower;
- Anticipate and manage accidental and chronic pollutions.

A reinforcement of the monitoring of the impacts of development projects will allow to better understand their long term impact on the aquatic ecosystems, and to better anticipate the implementation of the principle of non degradation for the new projects.

The **Social, Economical and Environmental measures (BGP. 3)** aim at the following objectives**:**

- Have an observation post of the operational costs by the end of 2009
- Each new SAGE must include a socio-economical section
- Improve the recovery of costs by making sure that they are fairly shared

The **measures of local management and of Territory planning (BGP. 4)** aim at the following objectives:

- Stabilize by 2015 an institutional and financial system that warrants the durability of the water management structures by basin.
- Implement by 2015 a system of concerted local management most of the priority orphan basins (see figure 10).
- Insure that all local management procedures (SAGE, *contrat de milieu*…) systematically incorporate the objectives of the SDAGE.
- Realize a few exemplary operations of incorporation of water issues into territory planning projects (urban planning, land management, financing…) et advertise appropriately

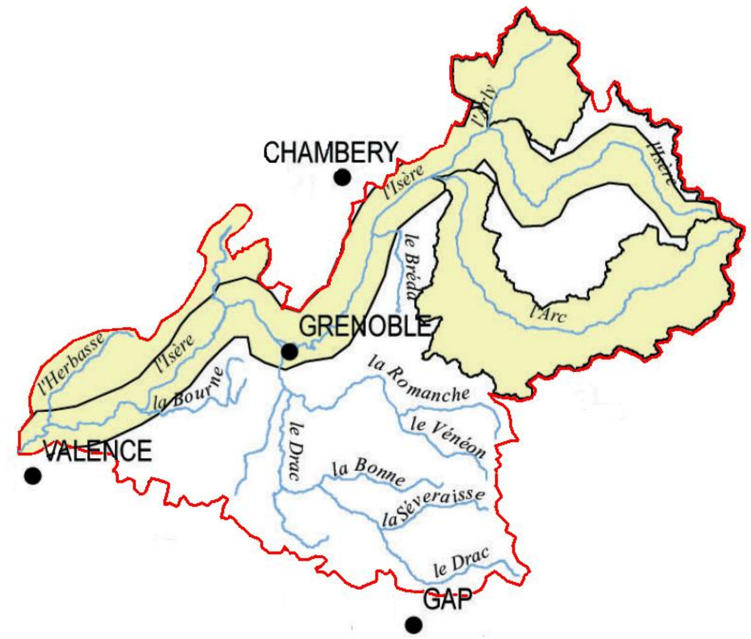

Figure 17. Prioritary environments for the implementation of a concerted management (After the SDAGE 2009)
Source: Rhône-Méditerranée Basin Committee, modified by SHARE Project

On this map, are represented the territories for which the implementation of a concerted management approach like SAGE or *contrat de milieux* is essential to attain the objectives of the directive under the three management plans (2015, 2021 et, 2027).
It is about, depending on the case, to implement new structures when none exist on this topic, or to rely on the existing structure by expending their field on intervention (e.g.: surface waters AND groundwater).

As regard to the **fight against pollution (BGP5)**, we distinguish between the pollutions that have a domestic source and those that have an industrial source **(5a)**, those against eutrophication of aquatic environments **(5b)**, those against dangerous substances **(5c)**, those against pesticides **(5d)**, and those against health risks **(5e)**

The pilot site is concerned with of these types of pollutions, except eutrophication (5b).

Concerning domestic and industrial pollutions (5a), efforts must be continued, especially because the Rhone-Mediterranean basin is characterized by: (a) a delay in the compliance of several dozens of large communities of the basin with the Urban Residual Water directive (*eaux résiduaires urbaines*, ERU); (b) a growth of the population that leads to an increase in pollution and tends to accelerate the aging of the depollution facilities; (c) the development of tourism that amplifies the seasonal variation of population (montain and littoral) and (d) the development of urbanisation and of infrastructures which increases the processes of pollution related to runoff from the rain.

The objective that are aimed at to fight the pollution type **(5a)** are:

- The total completion of the compliance of the sanitation systems and of the agglomerations of more than 2000 EH with the ERU directive ERU as soon as possible;
- General coverage of the basin in sanitation master plans and their integration into local urban plans. This plans must include a "rain" component for all the urban communities.
- General coverage of the basin in departmental management plans for sewage sludge and human waste;
- The realization of a basin intervention plan that aims at coordinating the departmental plan for the major accidental pollutions.

In order to figh against the **pollution against dangerous substances (5c)**, the targeted objectives are:

- Attain good chemical status for all water bodies.
- Reduce by at least one half the releases of priority dangerous substances that must be removed within 20 years. For these substances, emissions will be eliminated or reduced in a sufficient number of facilities in order to reach the national objective of reducing at least 50% of the know releases by 2015. Moreover, new releases of these substances will not be allowed.
- On the sectors identifies in level 1 basins (figure 18), where the norms of environmental quality (NQE) are not met or are compromised by important pollutant input, significantly reduce the individual releases for the concerned substances, so as to ensure compliance with the NQE.
- Reduce emissions in a sufficient number of establishments in order to contribute the national target of 30% of release of priority substances and of 10% of releases of relevant substances under the national action program against pollution of aquatic environments by certain dangerous substances.
- Observe the emission limits recommended by the earth protocol of the convention of Barcelona;
- Prevent and limit the introduction of dangerous substances in to groundwater in accordance with article 6 of the related directive on Groundwater ;
- By 2010, have a plan of actions to reduce releases by substance at the scale of the Rhone-Mediterranean Basin, in particular in level 1 river basins.
- Deepen the diagnosis on the levels of environmental contamination and the sources of dangerous substances for the level 1 and 2 river basins.

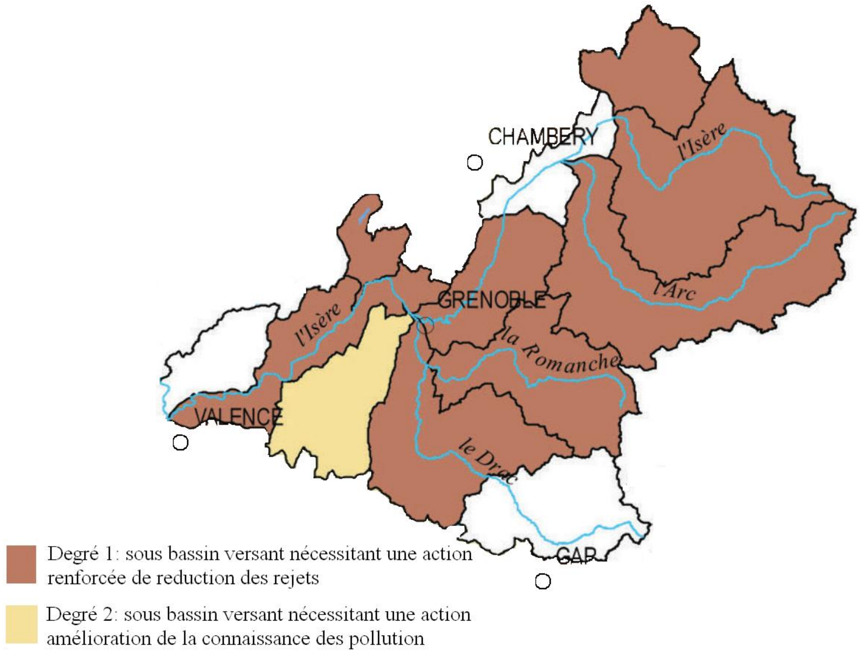

Figure 18. Fight against pollution by dangerous substances
Source: SDAGE 2009, Rhône-Méditerranée Basin Committee, modified by SHARE Project

Two lists of the 41 substances that must be taken into account in order to characterize the chemical status of the waters can be found in annex II.

The fight against the **pollution by pesticides and by significant changes in the current practices (5d)** aim at the following objectives:

- Reaching the objectives in all contaminated water bodies cannot be considered for 2015, and the actions will have to be scheduled until 2027, due to the persistence of certain substances.
- For the streams, the actions undertaken in the first management plan will achieve good status in some areas affected by low contamination and/or in which more voluntary steps are taken compared with the rest of the basin. Figure 19 shows the sub-basins of the Isère River which will need complementary measures in order to restore and/or contribute to the reduction of emissions.
- The recovery of a good status for all groundwater bodies cannot be effective by 2015 in view of the size of the area. Nevertheless, this deadline can be held for some of them that are now polluted, for which ones experimental pilot action can be taken even from the first management plan on suitable basins in order to initiate fundamental changes in agricultural exploitation systems..

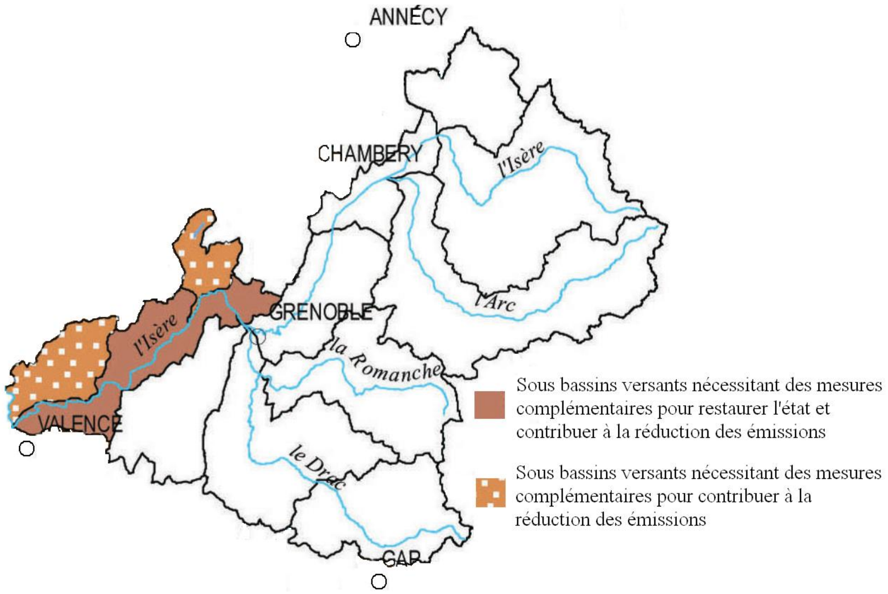

Figure 19. Fight against pollution by pesticides on surface water bodies
Source: SDAGE 2009, Rhône-Méditerranée Basin Committee, modified by SHARE Project

In order to evaluate, prevent and control risks to **human health (5e)**, several objectives are also targeted:

1. Ensure the objective of non-degradation of the first management plan for :
    - The water used for drinking water supplies
    - The water resources intended to be used as drinking water supplies in the future
    - Water used for bathing, recreation, as well as fishing and aquaculture

2. At the end of the first management plan in 2015, to obtain,
    - A quality of non-treated water that meets the requirements of the WFD on water;
    - A list of major resources that must be preserved for current and future drinking water supplies, defined and locally approved;
    - A recovery of a good status of water bodies or part of water bodies whose resources must be preserved for human consumption ;
    - The creation of management structures of these major resources for drinking water when relevant.

The groundwater bodies in which the strategic zones that must be preserved are to be identified are shown on the map of figure 20.

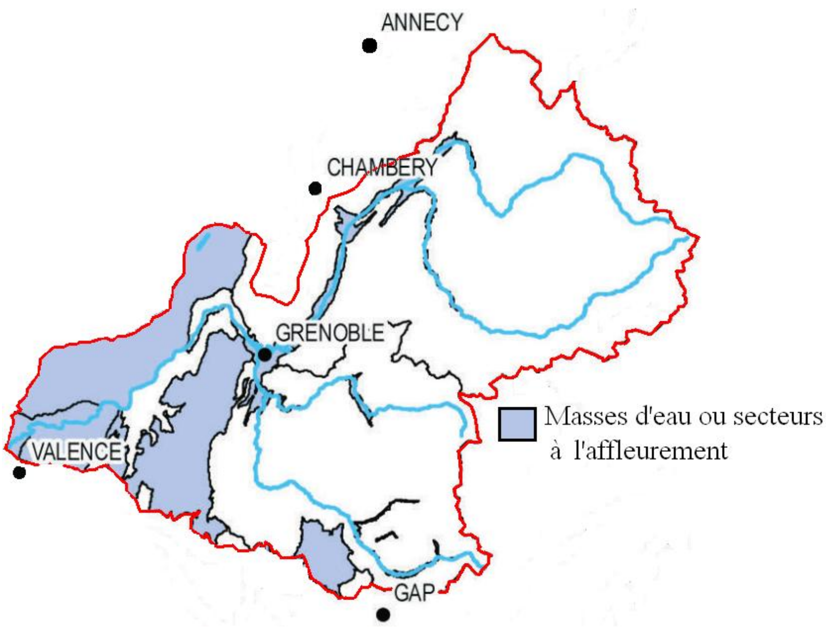

Figure 20. Major water resources important for drinking water supplies in the Isère River Basin
Source: SDAGE 2009, Rhône-Méditerranée Basin Committee, modified by SHARE Project

With regard to the **preservation and re-development of the natural functions of the basin and aquatic environments (BGP. 6),** there are three types of sub-guidelines: act on the morphology and the decompartmentalization in order to preserve and restore the aquatic ecosystems **(6a)**, take into account, preserve, and restore the wetlands **(6b)** and incorporate the management of faunistic and floristic species into water management policies **(6c)**

For sub-guideline 6a, the targeted objectives are:

- Take into account the areas of well-functioning of aquatic environments in local policies (including the implementation of a policy of sediment management, see figure 21 and 22);
- For the streams, arrange the elements necessary to the revision of existing rankings and to the establishments of new listings meeting the criteria set by the environmental code;
- On the water bodies whose disturbances, which constitute a limiting factor in achieving a good status, can be reduced by a commitment to relatively "simple" actions, to restore the stream morphology, dynamics and biological functions compatible with achieving a good status or a good ecological potential of the environment by 2015
- On water bodies that require an organization and an implementation of more complex measures, to realize several pilot operations.

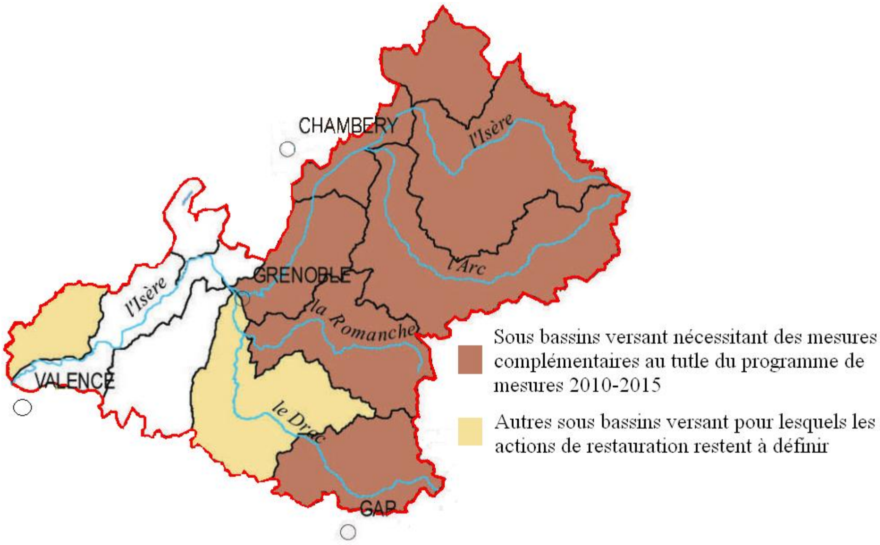

Figure 21. Sub-basins considered for a restoration of sediment transport
Source: SDAGE 2009, Rhône-Méditerranée Basin Committee, modified by SHARE Project

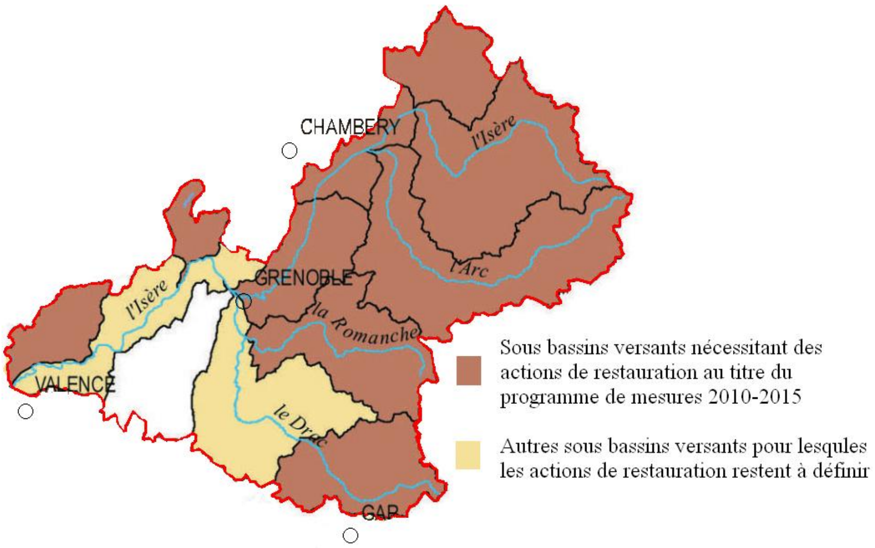

Figure 22. Sub-basins considered for a restoration of morphological diversity of the environment Source: SDAGE 2009, Rhône-Méditerranée Basin Committee, modified by SHARE Project

As regard to the goal of **achieving a quantitative balance by improving the share of water resources and by anticipating the future (BGP. 7)**, by 2015, the targeted objectives are:

- To achieve a good quality in areas or in sub-basins that are in quantitative unbalance, and for which sufficient knowledge exist and stakeholders are organized;
- To achieve sufficient knowledge and to start instances of enduring in other degraded areas, in order to return to a good quantitative status starting in the next 2016-2021 SDAGE;
- To respect the objective of non-degradation of the resources that are currently in balance.

As regard to **Managing the risks of flooding, taking into account the natural functioning of rivers (BGP. 8)**, the strategy of the SDAGE includes the four objectives of the current public policy of prevention. These objectives are:

- Limit hazards causing risks, taking into account the environmental objectives of the SDAGE
- Reduce vulnerability
- Know how to better live with the risks
- Develop knowledge and planning in the field of flooding risks, in coherence with the directive 2007/60CE on the assessment and management of flood risks.

In order to enable a more integrated and a more efficient water management, a local plan is realized at the local scale: the Plan for the Refurbishment and Management of Water Resources (*Schéma d'Aménagement de Gestion de l'Eau*, SAGE). They define the objectives and the rules for an integrated water management at the local scale. Thus their ambition is to bring together the different uses and users of water resources on the concerned territory, in order to elaborate concerted decisions. They are applied acrosse a set of sub-basins. They are elaborated by a Local Comission on Water (*Commission Locale de l'Eau*, CLE), composed of representatives of concerned communities, of different representatives of water users (industries, farmers, associations of environmental protection…), and of State representatives. The CLE should continue to play its consultation role after the approval of the SAGE, and it should ensure its implementation.

The Isère River Basin is located on a territory on which 2 different SAGEs are implemented: Drac-Romanche and Drac Amont, both located downstream of Grenoble (pilote site).

Both SAGEs are managed by the Water Agency of the Rhone Mediterranean Water Basin.

The SAGE of Drac-Romanche was approved by the CLE on March 27th, 2007. It is currently in the first revision.

The CLE ambitions to address each of 5 priority issues :
- Ambition 1: Improve water quality of rivers and reach the minimum quality objectives for the implementation of the WFD
- Ambition 2: To improve the sharing of water (quantity)
- Ambition 3: Conserve the resource and secure drinking water supply
- Ambition 4: Conserve the aquatic environment, including wetlands
- Ambition 5: Organize frequenting of and access to the river

The idea is to provide the CLE with a monitoring and control tool by sharing information within an observatory and by validating the results before dissemination by a working group.

The observatory is currently being put into place with the implementation of:
- 20 management indices expressing the 5 ambitions in order to evaluate the working of the SAGE
- a network of surface water quality monitoring, made of 30 stations spread over the whole Drac and Romanche territory, in partnership with the WFD.

As regard to the Drac Amont SAGE, a meeting of the CLE was held on September 12th, 2005, in order to accept the modifications, thereby also accepting the document "Recommandation of the Haut Drac SAGE." The interdepartmental decree of January 26th, 2006 officially approved the Haut Drac SAGE. The supporting structure of the SAGE is the joint association of the local community of Drac Amont (Communauté Locale de l'Eau du Drac Amont, CLEDA). In 2006, the implementation of priority operations is planned (groundwater study, implementation and/or modernization of a hydrological and hydrogeological monitoring network). Simultaneously to these action carried out on an ad hoc basis, it is intended to develop a river contract in order to implement the recommendations.

The main issues are:
- Ensure a low flow discharge of biological continuity, while meeting the existing water uses
- To enable the restoration of a natural functioning of rivers, while preserving the safety of persons and of areas with existing issues
- Continue to improve the quality of surface water to meet the demands of uses and of environments
- Conserve the biodiversity of the Drac Basin, guaranteeing the meeting of water related uses

It is also in the first revision phase.

Monitoring Programs

The European Water Directive 2000/60/EC establishing a framework for Community action in the field of water requires to implement monitoring programs allowing to determine the status of aquatic environments and to identify the causes of degradation, in order to guide and evaluate the actions to be implemented so that these areas attain a good status.
Depending on the identified risk of non-compliance with the environmental objectives of the WFD, one or two network types, corresponding to levels of control required by the Directive, were introduced on rivers:

- a **network of monitoring control** *(réseau de contrôle de surveillance, RCS)*, that aims to assess the general condition of the water at the scale of each district and its evolution over time. This network must be enduring and must consist of sites representative of the different situations encountered in each district. This enduring network was implemented on January 1st, 2007. It replaces the Basin National Network (*Réseau National de Bassin*, RNB) and the Complementary Basin Network (*Réseau Complémentaire de Bassin*, RCB).
- An **operational control** (*Résaux de Control Operationel*, RCO), a program, defined according to the results of the characterization of water bodies and of the monitoring control program, in order to "establish the chemical status of all surface water bodies identified as being at risk of not achieving good status by 2015, to establish the presence of any increasing trend in long-term concentration of any pollutant due human activity," and to report inversions of these increasing trends. This operational control involves only the monitoring of parameters that can decommission the water bodies. This monitoring is intended to be interrupted as soon as the water body recovers a good status. Thus this network is not enduring.

In figure 23, one can see the control points for both types of monitoring, including the parameters defined by the WFD. In Table 7, the following elements of surface water control are included: monitoring frequency, and the areas that are concerned by these measures.

The quality data, which gives indications about the biological and phisico-chemical quality of the water, are measurable and thus quantifiable, which has allowed the european union to harmonizes criteria and thresholds of attribution.

As regard to the different methods that are used in order to measure the parameter, see APPENDIX 1 of the report Isère River Basin, WP5-action 5.2 : good status requirements of compartments regarding EU directives, How it is transposed in French legislation.

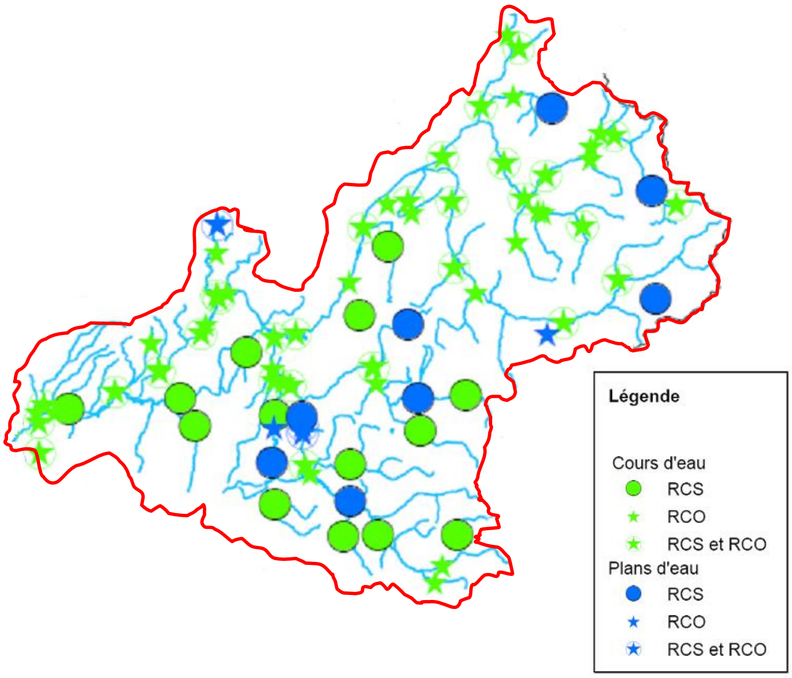

Figure 23. Monitoring control network (RCS) and operational control network (RCO) of the Isère River Basin
Source: SDAGE 1996, Rhône-Méditerranée Basin Committee, modified by SHARE Project

Monitored elements	Periodicity of the management monitoring (years)	Monitoring frequency by year	Schedule	Concerned areas	Client
Hydromorphologie					
Morphology	1	1	To be spread over the management plan	Tous	ONEMA
Biologie					
Fish	3 (sites shared over 2 consecutive years)	1	Starting in 2007	All except for types where this element is not relevant and except artificial channels	ONEMA
Invertebrates	6	1	Starting in 2007	All In artificial channels: oligochaetes	DIREN/DREAL
Phytoplankton	6	4	Starting in 2007	All except for types where this element is not relevant	DIREN/DREAL
Diatoms	6	1	Starting in 2007	All except for types where this element is not relevant	DIREN/DREAL
Macrophytes	3	1	Starting in 2007	30 to 50 % of sites on types where this element is not relevant. Artificial Channels excluded	DIREN/DREAL
Physicochemestry					
Micropollutants : priority substances	2	In water: 12 per year In sedimetns: 1 par an	1 st year, analyze all substances of the norm NF T90-350 et 354, then analyze those that are problematic	All	Agence de l'Eau RMC
Micropollutants : other substances (calles relevant) and pesticides	2	In water: 4 per year In sedimetns: 1 par an	Starting in 2007	25% of sites	Agence de l'Eau RMC
Macropollutants	6	6	Starting in 2007	All	Agence de l'Eau RMC
Hydrology					
Hydrology	6	Depending on biological and phisico-chemical needs	Starting in 2007	All. Hydro stations on all non-necessary sites, extrapolation from other stations or isolated measures. Artificial channeles excluded	DIREN/DREAL

Water Use

Hydropower

Hydroelectric development in the Isère River Basin is one of the most sophisticated equipment of the world. An annual productivity of 4505 GWh provides 7% of French hydropower (68,800GWh), and 1% of annual electricity production in France (460,300 GWh), all types of energy included. The main feature of hydropower is the speed of energy availability, since barely 10 minutes are necessary to provide 2000 MW. It is thus an extra source of energy at times of high demand (peak of electricity consumption during the day, extremely cold periods), which makes hydropower KWh more valuable than thermal or nuclear KWh. The capacity of the Isère River Basin is 2520 MW, that is 10% of hydropower located in France (23,330 MW).

Based on the EDF web page and on the basin atlas published in the 1996 SDAGE, a total of 102 hydropower generation plants exist upstream of Grenoble (without considering the stations of the Drac River Basin). Among these, 50 where qualified in the 1996 SDAGE as micro-hydropower plants (see figure XXX). EDF administrates 54 of the 102 power plants. For the Isère River Basin upstream of Grenoble, there are 18 dams are EDF's responsibility, that have a storage capacity of 100 Mm^3. The locations of these dams are identified on the following figure.

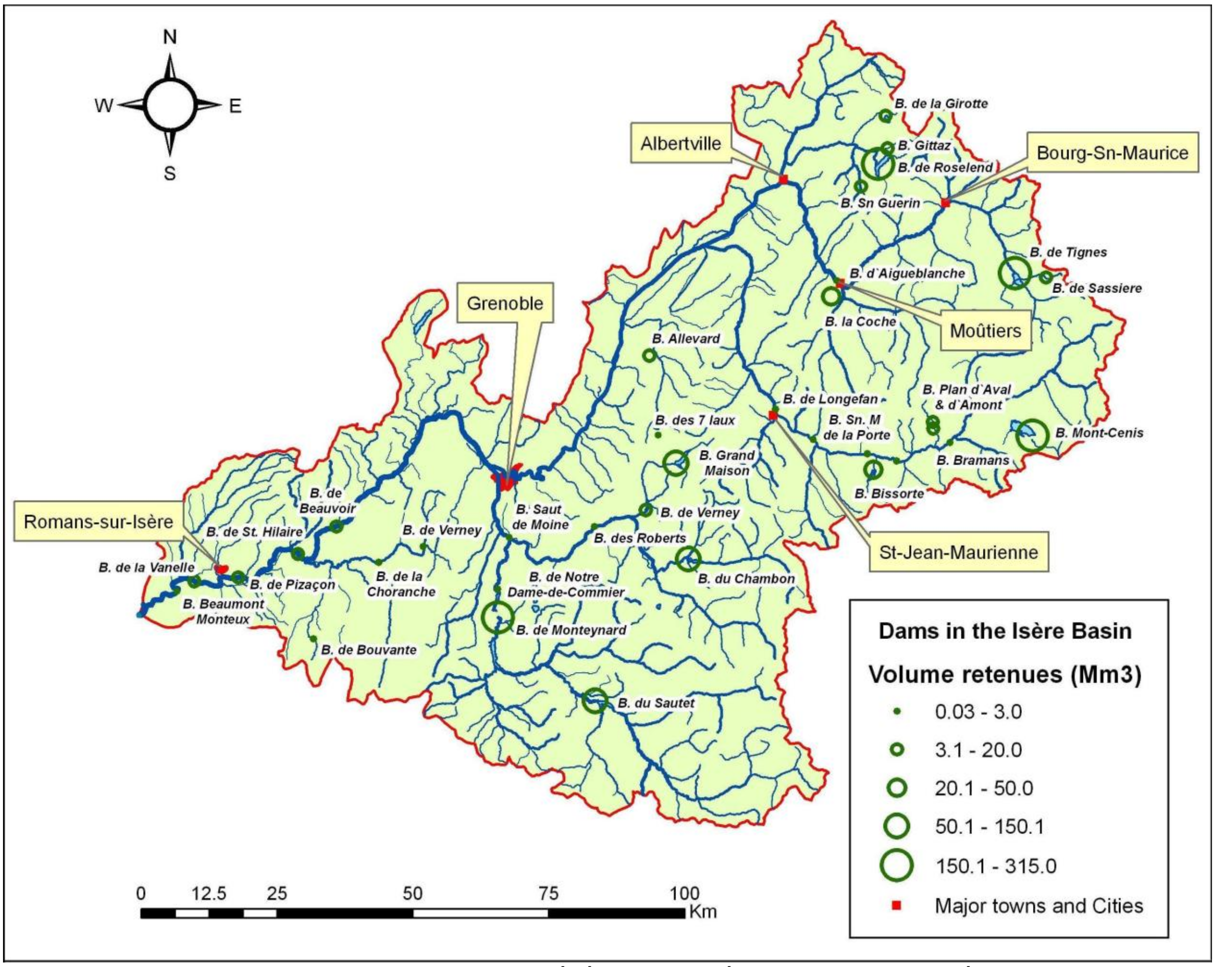

Figure 24. Localisation des barrages pour le génération hydroélectrique et la capacité de ses retenues
Source: SHARE Project

Farming

Water is an important resource for agriculture. Figure 5 in the section *Pilot Case Study- Land Cover and Land Use* present the land use of the Isère Basin. Agricultural areas represent 22.4 of the basin Surface, which proves that agriculture has an important role in the Isère River Basin, and this especially in the Grésivaudan Valley, in the lower part of the pilot case study area.

In particular, agricultural irrigation in Isère was a subject of an examination in the framework of the Departmental Irrigation Master Plan. This report gives information relative to water use for agriculture only in the part of the basin which is included with the department of Isère, that is in the high-Grésivaudan Region (figure 25). As far as agriculture is more present in this part of the basin than upstream, this section describes this region in particular.

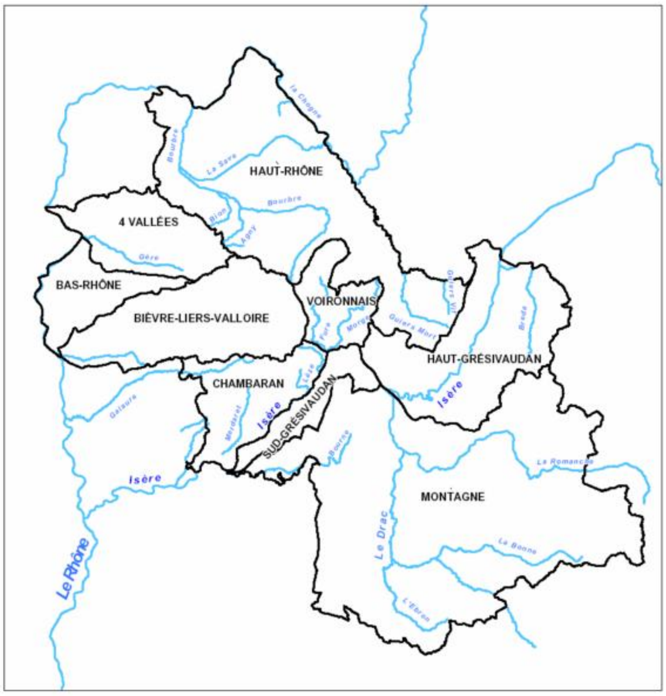

Figure 25. Location of the High-Grésivaudan Region in relation to the Isère Department
Source : Schéma directeur départemental d'irrigation, Isère, 2006

In the areas, 762 ha are irrigated, which corresponds to a total authorized discharge of 3957 m3/h, coming entirely form surface water. Agriculture is the main consumer of surface water in the area, as it represents 78% of total surface water withdrawals. However, when groundwater withdrawals are also taken into account, only 47% of water demand in the area is for irrigation. Figure 26 shows the evolution of the irrigated area as well as the volume of water withdrawn each year in the High-Grésivaudan region between 2005 and 2008.

The main types of crops that require irrigation in the Isère River Basin are first corn, which represent 59% of irrigation demand in this region, and then gardening, which is 23% of the irrigation demand. For information purposes, effective water needs for corn are 1700 m3/ha each year on average, and 2 600 m3/ha each driest year in 5.

The Departmental Irrigation Master Plan considers no major irrigation issue in the area, and foresees no significant development of irrigation in the future.

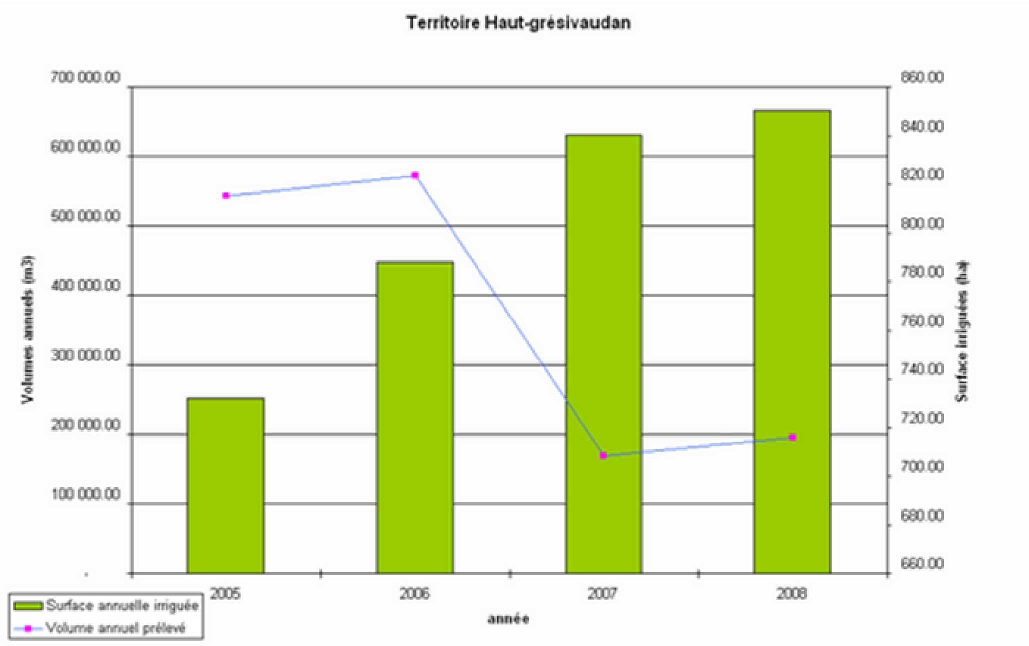

Figure 26. Evolution of irrigated area as and volume of yearly water withdrawal each year in the High-Grésivaudan region between 2005 and 2008.
Source : DDAF 38 – Base IRRIG-MG

Factory

Industrial activities of the Isère River Basin are diverse. They include textile industries, metal making, chemical industry, paper making, power production (thermal plant), or waste and storage of waste. Some of them are declining, for example metal making or textile industries. They are located throughout the basin, on the High Isère and on the Arc (especially metal-making), as well as in the Grésivaudan Valley (especially paper-making). Insdustry is also well-developed downstream of the pilot case, and on the Drac/Romanche River Basin.
As an example, in the High-Grésivaudan, the industrial demand on surface water is 1109m3/h. It is 1980 m3/h on groundwater. Overall, 37% of withdrawals are used for industries in this region. This percentage is likely more significant higher in the basin, as agriculture is less important.
Industries that use water are the point source of wastewater discharges, which are more or less polluted and therefore are significant to the physico-chemical health of the basin, although non-related to HP. Figure 27 shows the locations of industrial wastewater discharges in the Isère Basin.

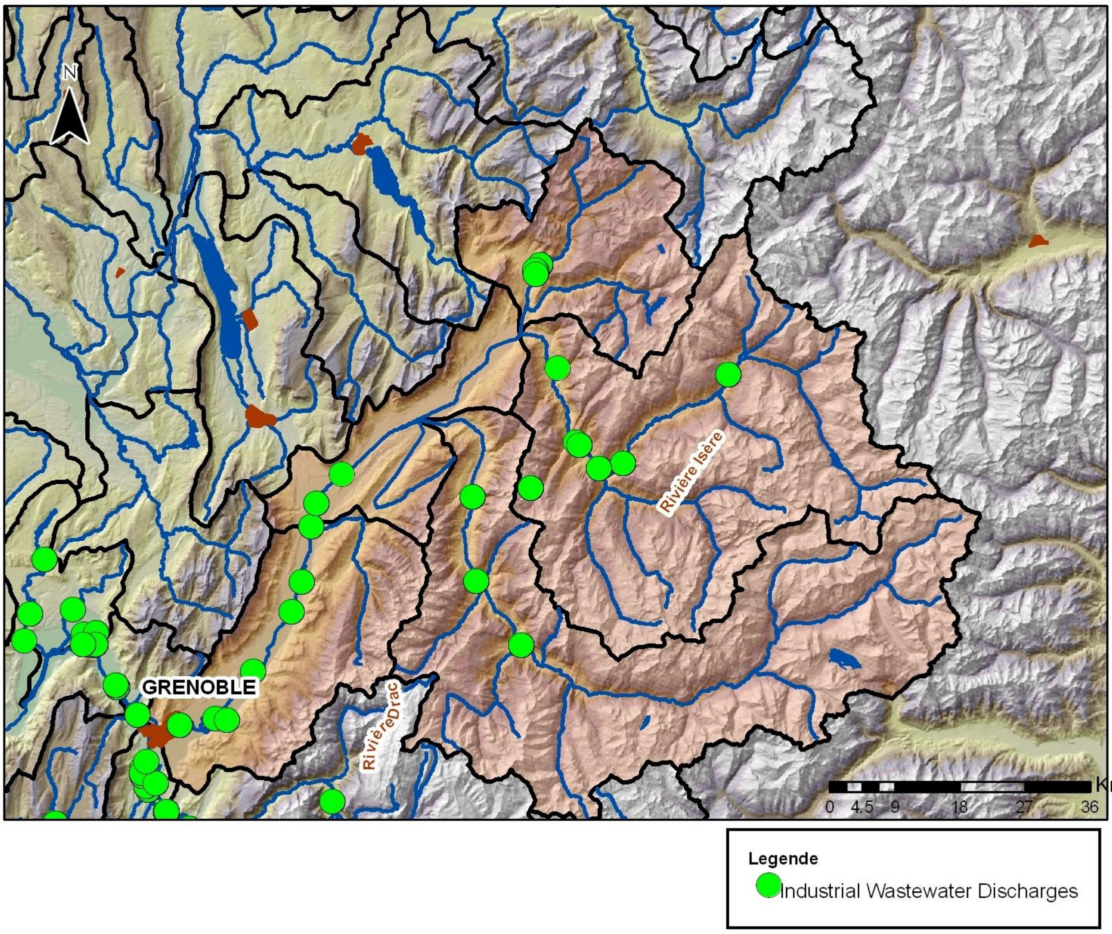

Figure 27. Industrial Wastewater Discharge Locations in the Isère River Basin
Source: Agence de l'eau Rhône-Alpes/Méditerranée

Wastewater Outfalls

As regard to discharges of domestic and industrial wastewater, Figure 11, in the section *River Quality – Physical and Chemical Elements that Support the Biological Elements* of the present report, shows the location of the most important wastewater outlets (domestic and industrial) for the Isère River Basin upstream of Grenoble. In the following part, one can find a description of the most important outlet points on the pilot site that corresponds to Grenoble and its adjacent area.

In Grenoble and in the neighbouring towns, wastewater is collected by a network of underground pipes, and directed towards a treatment plant (Aquapole), located near the Isère River bank, downstream of Grenoble. This water has a domestic, industrial or pluvial origin. This plant has an average treatment capacity of 200,000 m^3/day. In wet weather, the pollution is fairly diluted, so that the plant can treat up to a rate of 5 m^3/s of wastewater and rainwater. In ordinary weather, the pollution being more concentrated, an additional level of biological treatment is necessary, after the physico-chemical treatment. The water discharged by the station (2.3 m^3/s on average) mixes with the minimal Isère discharge of 100 m^3/s at the outlet point, which ensures a good dilution of the treated water.

Drinking Water

Grenoble and the neighbouring towns benefit from an exceptional ease for drinking water supplies. Indeed the water is pumped near Grenoble, in the superficial groundwater of the Drac and Romanche River. It is sufficiently pure to be distributed as drinking water supplies, and this with no treatment (water without bacterial germs, cool – temperature 11 to 12°C in summer and winter, low agressivity – pH 7.5 – and low calcium and magnesium). Each pumping zone is surrounding by 3 km of protection in order to avoid any king of potential pollution of the catchments zone. The total area of the protected perimeters is 2,400 ha; Poplar and birch were planted, game was let out (roe deers, feasants…).

These plantations, in addition to their landscaping and environmental role, have a very technical objective: to mitigate the effects of potential air pollution on soil and groundwater. The evolution of the water table is monitored in particular, in order to ba able to start an artificial support if it is too low; an agreement with EDF allows dam releases to increase groundwater recharge by surface infiltration.

Recreation

At the basin scale, recreational activities are very diverse. They include bathing, kayaking, rafting, hydrospeed, water skiing, sailing, windsurfing, and fishing. For the upstream part of the Isère, recreational activities are presented on figure 25, obtained from the 1996 Basin Atlas. Later, one will find a more specific description for the pilot site zone, and for the surroundings of Grenoble.

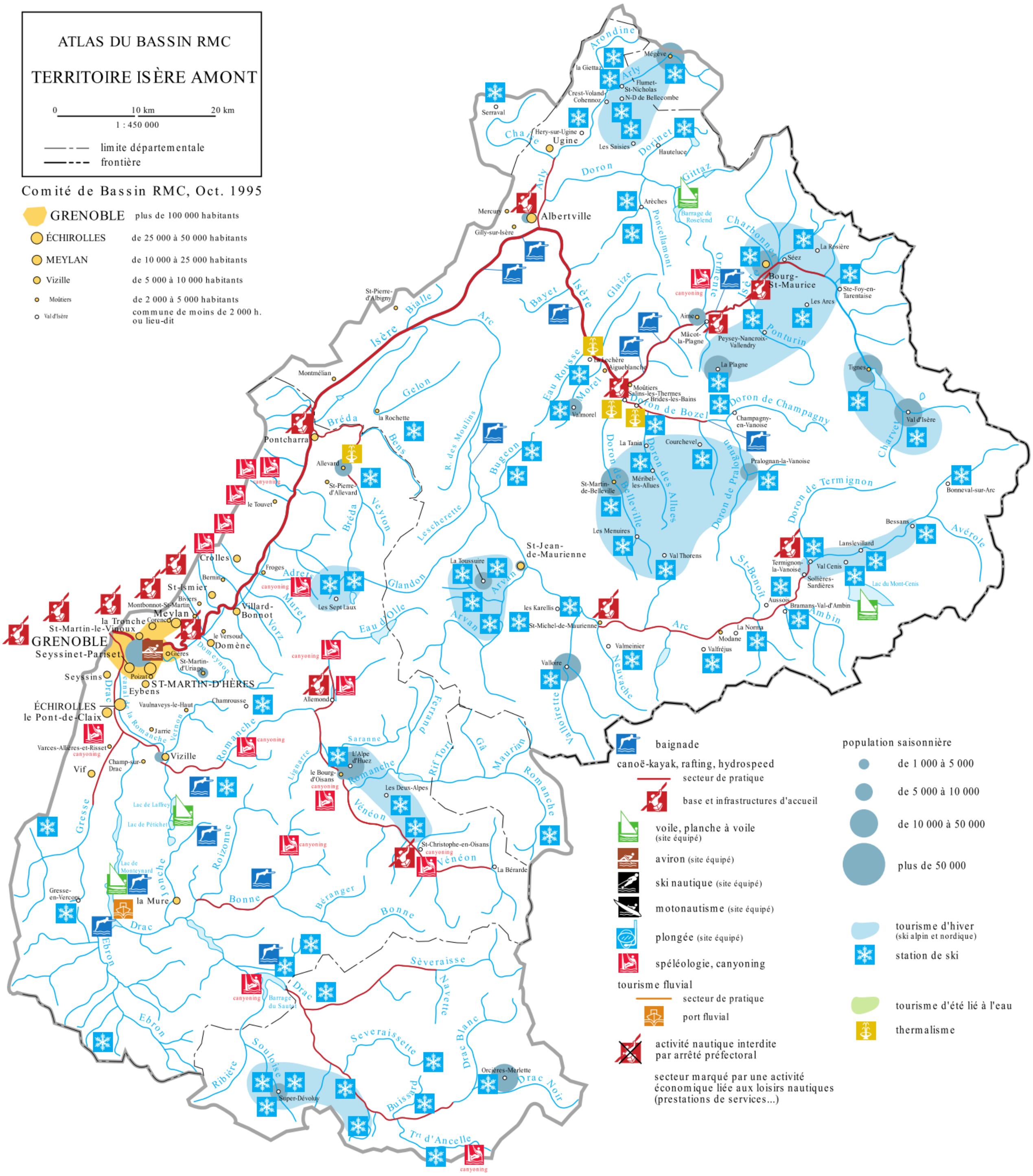

Figure 28. Thermalism, tourism et recreation
Source: L'atlas de Bassin (SDAGE, 1996).

Two main categories of recreation and leisure areas have developed in the Isère Valley near Grenoble :

a) The Isère River with a relatively slow current, its banks, it vegetal corridor are very well appreciated from athletic people. Upstream of Grenoble, the Isère channel is intensely use for rowing. The banks, completely closed to traffic, have been redeveloped over several tens of kilometres as a bike path, and the welcome every week-end thousands of users and walkers. Downstream of Grenoble, the reservoir of Saint-Egrève was designed in order to accommodate recreational activities. The dam is equipped in order to rid the Isère off all floating bodies coming form upstream. They are sent to heating plants (wood) or to waste treatment centres. On the reservoir, near the water sport accommodations, reed beds have been built to attract migratory and nesting birds. The banks have been landscaped as staircases, to serve both as storage area for flood and to increase walking trails, bike paths etc.

b) In the floodplain, the old beds of the Isère River and the excavations opened to extract gravel are often redeveloped as recreational areas. In the specific case of the French Wood, artificially cut in 1968, the upstream part of the old arm has been protected by a classification as "natural reserve," an eco-trail has been built and animations are regularly organized for the association of nature protection. The middle part of the old bed is reserved for fishing and water sports. The downstream part of the old channel has been landscaped and specific infrastructures have allowed to establish a swimming area.

Pressures and Impacts Related to Water Use

In the 1996 SDAGE, the different pressures exerted on the water bodies identified on figure 14 and 15 were identified. Industrial and domestic wastewater, diffuse pollution by agriculture, and pressures on the bed morphology are presented on figure 26. It clearly shows that in the specific case of morphological pressures, three elements play a role: gravel extraction from the bed, bed development (recalibration, dykes, cut), and the hydroelectric development, which will be dealt with more in depth later on.

Hydropower Generation: Effects, Hydrology and Sediment Transport

The modification of hydrological regimes is one of the major effects of hydropower dams. Each type of structure, or almost, leads to specific hydrological and sedimentological consequences, which in turn impact the whole aquatic system (river morphology, aquatic habitats, water quality, water availability) at different time and geographical scales.

In the case of hydrological impacts of the Isère River, we consider that in the upper parts of the hydrosystem, the water collection arrangements implanted within complex interconnections lead to an important reduction of flow into the main outfall of the high altitude river basins. Subglacial water collection short-circuits the contributions of the high snow-covered mountains. On the upper Isère, for example, the Girotte, Roselend and Chevril complexes leave a good number of dry talwegs (Peiry et all., 1999).

In the valleys, hydropower stations affect flows at all times, from interannual modules to the hourly flows (figure 27A). Flows are qualified as “residual” when they are very deeply perturbed by engineering works; b) when the perturbation is less significant, the flows are qualified as “influenced” (Vivian, 1986, 1989, 1994; Peiry and Vivian, 1994). The Maurienne Valley is very profoundly affected by hydrological perturbations, and thus belongs to the group of rivers with residual flow on a great part of its course (cf. figure 27A).

On the mid-Isère, where hydrologic changes combine in a complex manner from upstream to downstream, flows are only influences as compared with the reference flow. The nature and intensity of the influence of works depends very largely on the type of modification and its position in the chain of works; thus, all attempts to generalize involve great simplification. However; there is a prevailing tendency towards the attenuation of alpine hydrologic seasonal contrasts, contrasts which in the past, characterized Apline hydrology; obviously the priority function of these hydropower stations is to produce kWhs during the winter consumption peaks. On the upper Isère and the Arc, hydroelectric developments very clearly tend to increase the flow during the winter low water period, when water reserves stored in reservoirs are released; conversely, in spring, the tendency towards the retention in reservoirs of the bigger water flows from snow melt often leads to a marked decrease in the abundant summer flows (Edouard and Vivian, 1982, 1984), (cf figure 27B). With regard to fluctuations of shorter duration, the functioning in regular water releases of these works, including those with a limited reservoir capacity, generates important daily variations in flow and water level (figure 27C). On the Isère at Grenoble, for example, the release of water from the Cheylas hydropower station, located approximately 30 km upstream, is potentially capable of doubling the average water flow for some hours (200 m^3/s) (Peiry *et al*., 1999).

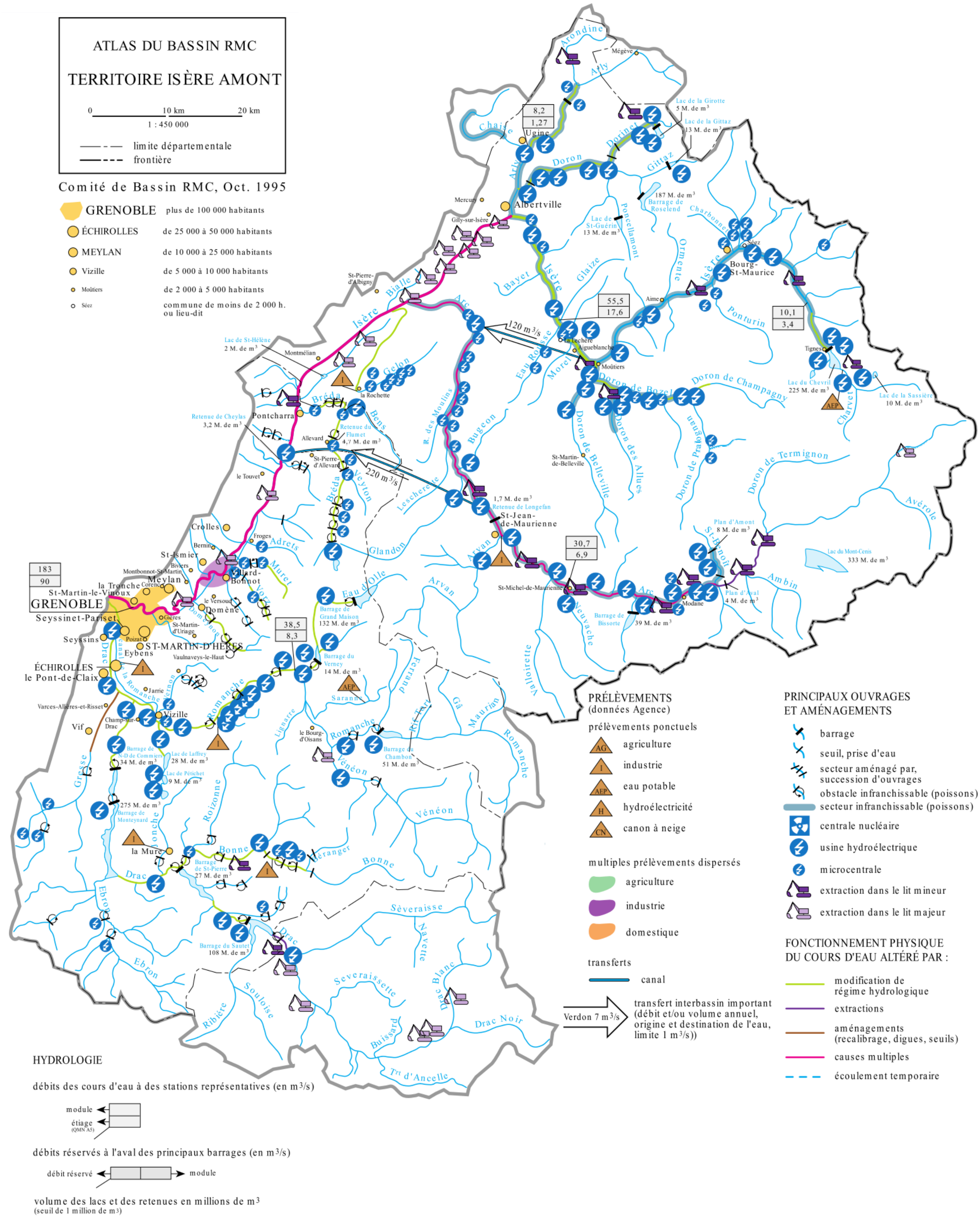

Figure 29. Physical state of the surface water environments and origins of perturbation for the Isère River Basin
Source: L’atlas de Bassin (SDAGE, 1996).

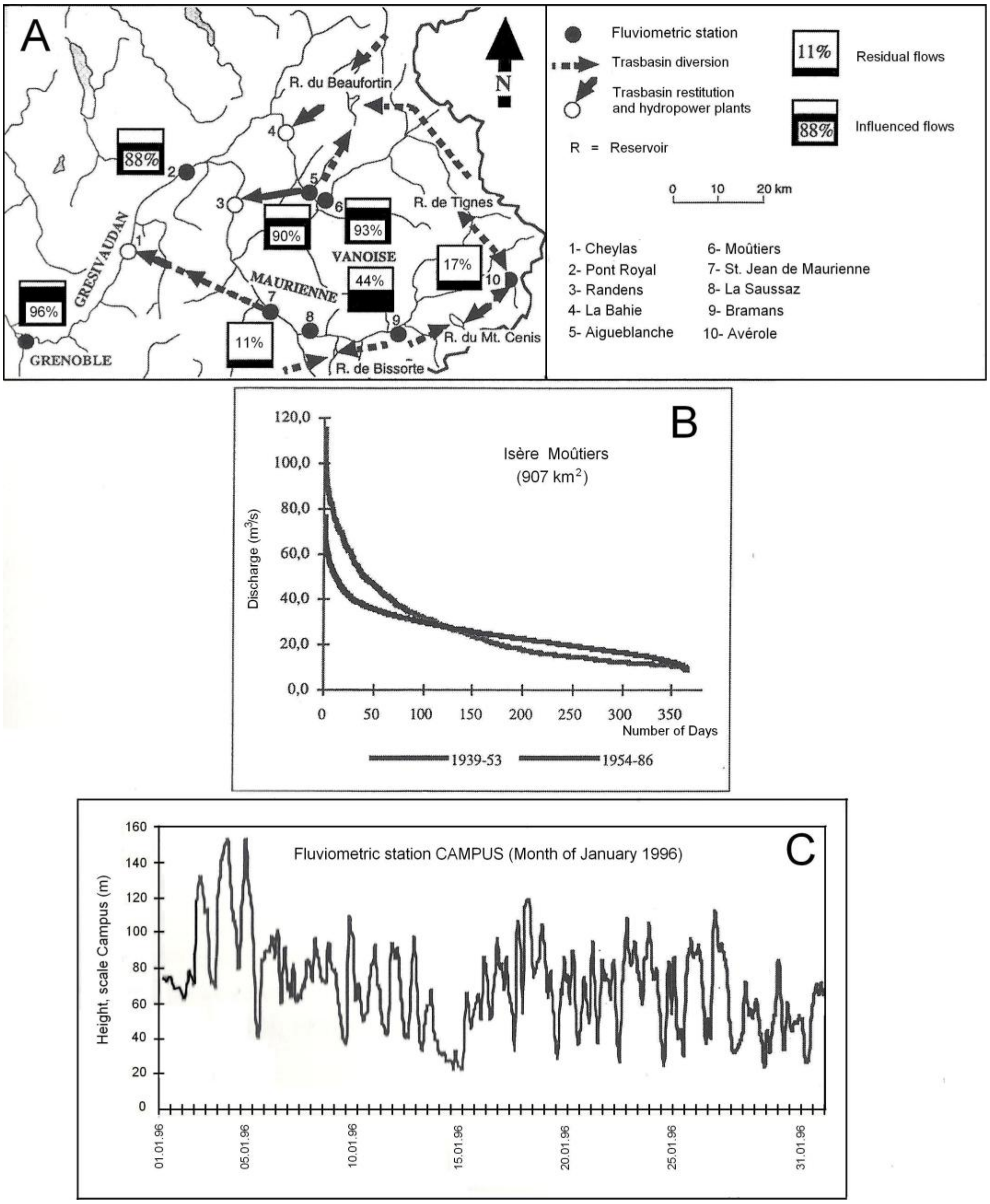

Figure 30. Changes affecting the flows of the Isère River and the Arc River annually (modules), daily (classified flow curve) and hourly (chronicle of the month of january 1996)
Source: Peiry, 1997

As regard to the artificial hydrological impacts on solid transport, dams act at two levels : 1) they 1) they are insurmountable barriers to the coarser material (grave land cobbles) and reduce the supply of coarse sediments ; 2) they modify (often reduce) the number of days that the coarse sediment load is set in motion. This creates spatial discontinuities in solid transport regimes and compromises the supply in material for the sections location downstream of the zone with perturbed hydrology. For example, the Arc-Isère deviation, commissioned in 1980, deprives the Isère River of 30% of its module between the confluence of the Arc and the restitution in Cheylas. In the short-circuited section, high spring flows are clearly reduced by the deviation (Vivian, 1994). The consequence of the solid transport reduction appears very clearly in the geomorphologic functioning of the Isère, as since the past fifteen years the banks of the Isère in the Combe de Savoie and in the Grésivaudan are subject to a process of accelerated phytostabilisation.

Restoration and Mitigation Actions

Since 1981, a decision of the Interministerial Committee on the Quality of Life has instituted a policy of River Contracts. It is an instrument of relation of cards of quality objectives using not regulation, but contractual obligation. This means that by engaging in a contract, all stakeholders in the river management contribute to its rehabilitation by the actions listed in the contract, and the subsequence maintenance of the river through the formation of structures able to support it (River Unions bringing together riparian towns, for example). As part of the River contract, works can be done in order to improve water quality for example (for example, the construction of wastewater treatment plants, of sewage systems, of flood protection structures…). The State, the Region and the Department, through the Water Agencies, take part in the financing of these restoration programs. These programs have been progressively replaced by the SAGE-SDAGE, which responds more specifically to the requirements imposed but the Law on Water of 1992 and to the WFD.

In this way, the 1996 SDAGE has considered several actions related to the restoration of aquatic environments in order to obtain a good concerted ecological status of the WFD. The basic guiding principles were presented in the report in the section "*Management Plans and Programs.*" These guiding principles are currently developed and implemented.

Annexes

ANEXE I .Tables with the identification of each water body after the 2009 SDAGE

Code masse d'eau	Nom masse d'eau	Catégorie	Etat écologique		Etat chimique	Objectif de bon état	Motif d'exemption	Paramètre(s) justifiant l'exemption ou faisant l'objet d'une adaptation (objectif moins strict)	Activité(s) spécifiée(s)
			état	échéance	échéance	échéance			
	Sous bassin versant : ID 09 01 - Arc								
FRDL53	lac du mont-cenis	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDL56	lac de bissorte	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDR10064	ruisseau de saint-bernard	Cours d'eau	BE	2015	2015	2015			
FRDR10138	torrent du merderel	Cours d'eau	BE	2015	2015	2015			
FRDR10155	torrent de la ravoire	Cours d'eau	BE	2015	2015	2015			
FRDR10191	torrent de la lombarde	Cours d'eau	BE	2015	2015	2015			
FRDR10193	torrent du tépey	Cours d'eau	BE	2015	2015	2015			
FRDR10227	ruisseau de montartier	Cours d'eau	BE	2015	2015	2015			
FRDR10286	ruisseau des glaires	Cours d'eau	BE	2015	2015	2015			
FRDR10398	torrent l'arvette	Cours d'eau	BE	2015	2015	2015			
FRDR10447	ruisseau de la roche	Cours d'eau	BE	2015	2015	2015			
FRDR10473	ruisseau d'hermillon	Cours d'eau	BE	2015	2015	2015			
FRDR10505	ruisseau le merderel	Cours d'eau	BE	2015	2015	2015			
FRDR10539	ruisseau savalin	Cours d'eau	BE	2015	2015	2015			
FRDR10570	ruisseau de la lenta	Cours d'eau	BE	2015	2015	2015			
FRDR10716	torrent la neuvache	Cours d'eau	BE	2015	2015	2015			
FRDR10717	ruisseau de la balme	Cours d'eau	BE	2015	2015	2015			
FRDR10718	ruisseau de la cure	Cours d'eau	BE	2015	2015	2015			
FRDR10739	ruisseau saint-bernard	Cours d'eau	BE	2015	2015	2015			
FRDR10769	torrent du ribon	Cours d'eau	BE	2015	2015	2015			
FRDR10787	ruisseau de pradin	Cours d'eau	BE	2015	2015	2015			
FRDR10866	torrent du merlet	Cours d'eau	BE	2015	2015	2015			
FRDR10968	torrent de la lauzette	Cours d'eau	BE	2015	2015	2015			
FRDR11097	torrent de la leisse	Cours d'eau	BE	2015	2015	2015			
FRDR11213	ruisseau de saint-benoît	Cours d'eau	BE	2015	2015	2015			
FRDR11273	ruisseau du nant	Cours d'eau	BE	2015	2015	2015			
FRDR11336	ruisseau de povaret	Cours d'eau	BE	2015	2015	2015			
FRDR11383	nant bruant	Cours d'eau	BE	2015	2015	2015			
FRDR11396	ruisseau de la chavière	Cours d'eau	BE	2015	2015	2015			
FRDR11566	torrent des aiguilles	Cours d'eau	BE	2015	2015	2015			
FRDR11589	ruisseau la cenise	Cours d'eau	BE	2015	2015	2015			
FRDR11596	torrent la neuvachette	Cours d'eau	BE	2015	2015	2015			
FRDR11617	ruisseau d'étache	Cours d'eau	BE	2015	2015	2015			
FRDR11647	ruisseau de bissorte	Cours d'eau	BE	2015	2015	2015			
FRDR11652	rivière l'arc	Cours d'eau	BE	2027	2015	2027	FT	morphologie	
FRDR11693	torrent des roches	Cours d'eau	BE	2015	2015	2015			
FRDR11850	ruisseau de savine	Cours d'eau	BE	2015	2015	2015			
FRDR11852	ruisseau de la letta	Cours d'eau	BE	2015	2015	2015			
FRDR11893	le rieu froid	Cours d'eau	BE	2015	2015	2015			
FRDR11910	ruisseau du charmaix	Cours d'eau	BE	2015	2015	2015			
FRDR11915	torrent bonrieu	Cours d'eau	BE	2015	2015	2015			
FRDR11959	ruisseau de la reculaz	Cours d'eau	BE	2015	2015	2015			
FRDR11961	ruisseau le merderel	Cours d'eau	BE	2015	2015	2015			
FRDR11974	ruisseau du grand pyx	Cours d'eau	BE	2015	2015	2015			
FRDR12029	torrent du bacheux	Cours d'eau	BE	2015	2015	2015			
FRDR358	L'Arc de l'Arvan à la confluence avec l'Isère	Cours d'eau	BP	2027	2015	2027	FT	substances dangereuses, morphologie	infrastructures (dvp durable)
FRDR359	Le Glandon (Trt)	Cours d'eau	BE	2015	2027	2027	FT	substances prioritaires (HAP seuls)	

FRDR360	Le Bugeon (Trt)	Cours d'eau	BE	2015	2015	2015			
FRDR361a	L'Arc de la source au Rau d'Ambin inclus et Doron de Termignon	Cours d'eau	BE	2015	2015	2015			
FRDR361b	L'Arc du Rau d'Ambin à l'Arvan, La Valloirette et le ravin de Saint Julien	Cours d'eau	BP	2027	2015	2027	CN	morphologie	stockage d'eau pour hydroélectricité Infrastructures (dvp durable)
FRDR361c	L' Arvan	Cours d'eau	BE	2015	2015	2015			
	Sous bassin versant : ID 09 02 - Combe de Savoie								
FRDR10052	ruisseau de fontaine claire	Cours d'eau	BE	2015	2015	2015			
FRDR10107	ruisseau l'ancien lit du gelon	Cours d'eau	BE	2015	2015	2015			
FRDR10236	torrent le joudron	Cours d'eau	BE	2015	2015	2015			
FRDR10346	ruisseau de verrens	Cours d'eau	BE	2015	2015	2015			
FRDR10509	ruisseau gargot	Cours d'eau	BE	2015	2015	2015			
FRDR10964	ruisseau nant bruyant	Cours d'eau	BE	2015	2015	2015			
FRDR11296	ruisseau du glandon	Cours d'eau	BE	2015	2015	2015			
FRDR11629	ruisseau le coisetan	Cours d'eau	BE	2015	2015	2015			
FRDR1168a	Le Gelon et le Joudron en amont de leur confluence	Cours d'eau	BE	2015	2015	2015			
FRDR1168b	Le Gelon en aval de sa confluence avec le Joudron	Cours d'eau	BP	2015	2015	2015			Protection contre les crues : zones agricoles Protection contre les crues : zones urbaines
FRDR11819	ruisseau le chiriac	Cours d'eau	BE	2015	2015	2015			
FRDR11831	ruisseau du bondeloge	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR11887	Aitelène	Cours d'eau	BE	2015	2015	2015			
FRDR12125	La Bialle	Cours d'eau	BE	2015	2015	2015			
FRDR354b	L'Isère de l'Arly au Breda	Cours d'eau	BP	2027	2027	2027	FT/CN	hydrologie, morphologie, continuité, substances prioritaires (HAP seuls)	Protection contre les crues : zones urbaines Infrastructures (dvp durable)
	Sous bassin versant : ID 09 03 - Drac aval								
FRDL69	lac de monteynard-avignonet	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDL71	lac de notre-dame de commiers	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDL72	retenue de saint-pierre-cognet	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDL77	Lac de Vallon (38)	Plans d'eau naturel	BE	2015	2015	2015			
FRDL79	lac de pierre-châtel	Plans d'eau naturel	BE	2015	2015	2015			
FRDR10128	ruisseau de goirand	Cours d'eau	BE	2015	2015	2015			
FRDR10150	ruisseau de bénivent	Cours d'eau	BE	2015	2015	2015			
FRDR10208	ruisseau de bourgeneuf	Cours d'eau	BE	2015	2015	2015			
FRDR10228	ruisseau de jonier	Cours d'eau	BE	2015	2015	2015			
FRDR10507	ruisseau de dame	Cours d'eau	BE	2015	2015	2015			
FRDR10559	ruisseau des achards	Cours d'eau	BE	2015	2015	2015			
FRDR10828	ruisseau de berrièves	Cours d'eau	BE	2015	2015	2015			
FRDR10887	ruisseau la mouche	Cours d'eau	BE	2015	2015	2015			
FRDR10892	ruisseau de la chapelle	Cours d'eau	BE	2015	2015	2015			
FRDR11036	ruisseau de bonson	Cours d'eau	BE	2015	2015	2015			
FRDR11107	torrent de riffol	Cours d'eau	BE	2015	2015	2015			
FRDR11173	ruisseau de l'amourette	Cours d'eau	BE	2015	2015	2015			
FRDR11256	ruisseau du fanjaret	Cours d'eau	BE	2015	2015	2015			
FRDR11278	ruisseau de mens	Cours d'eau	BE	2015	2015	2015			
FRDR1141	La Jonche	Cours d'eau	BE	2021	2015	2021	CN	substances dangereuses	
FRDR11477	torrent le tourot	Cours d'eau	BE	2015	2015	2015			

Code masse d'eau	Nom masse d'eau	Catégorie	Etat écologique		Etat chimique	Objectif de bon état	Motif d'exemption	Paramètre(s) justifiant l'exemption ou faisant l'objet d'une adaptation (objectif moins strict)	Activité(s) spécifiée(s)
			état	échéance	échéance	échéance			
FRDR11489	ruisseau de la salle	Cours d'eau	BE	2021	2015	2021	FT	matières organiques et oxydables, morphologie	
FRDR11701	ruisseau de chapotet	Cours d'eau	BE	2015	2015	2015			
FRDR11814	rif perron	Cours d'eau	BE	2015	2015	2015			
FRDR11816	ruisseau de claret anglot	Cours d'eau	BE	2015	2015	2015			
FRDR11929	ruisseau de charbonnier	Cours d'eau	BE	2015	2015	2015			
FRDR12047	ruisseau de vaux	Cours d'eau	BE	2015	2015	2015			
FRDR12095	ruisseau de la croix-haute	Cours d'eau	BE	2015	2015	2015			
FRDR2018	L' Ebron, la Vanne, le ruisseau d'Orbannes et le Riffol	Cours d'eau	BE	2015	2015	2015			
FRDR3054	Canal de la Romanche	Cours d'eau Mea	BP	2021	2015	2021	CN	substances dangereuses	
FRDR325	Le Drac de la Romanche à l'Isère	Cours d'eau	BP	2021	2021	2021	CN	substances dangereuses, substances prioritaires	Protection contre les crues : zones urbaines
FRDR326	Le Lavanchon	Cours d'eau	BP	2015	2015	2015			Protection contre les crues : zones urbaines
FRDR327	La Gresse de l'aval des Saillants du Gua au Drac	Cours d'eau	BP	2015	2015	2015			Protection contre les crues : zones urbaines
FRDR328	La Gresse à l'amont des Saillants du Gua	Cours d'eau	BE	2015	2015	2015			
FRDR337*	Le Drac de l'aval de Notre Dame de Commiers à la Romanche	Cours d'eau	BE	2015	2015	2015			
FRDR344	Le Drac aval retenue St-Pierre de Cognet à retenue de Monteynard et la Bonne aval barr. de Pont-Haut	Cours d'eau	BE	2015	2015	2015			
FRDR345	La Bonne à l'amont du barrage de Pont-Haut, la Roizonne, la Malsanne et le ruisseau de Béranger	Cours d'eau	BE	2015	2015	2015			
FRDR346	Le Drac de l'aval de la retenue du Sautet à la retenue de Saint Pierre de Cognet	Cours d'eau	BE	2015	2015	2015			
FRDR347	La Sézia	Cours d'eau	BP	2015	2015	2015			Protection contre les crues : zones urbaines
	Sous bassin versant : ID 09 04 - Grésivaudan								
FRDL73	Retenue du Cheylas	Plans d'eau artificiel	BP	2015	2015	2015			
FRDR10003	ruisseau le sonnant d'uriage	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR10045	ruisseau de la combe madame	Cours d'eau	BE	2015	2015	2015			
FRDR10078	ruisseau d'eybens	Cours d'eau	BE	2027	2015	2027	FT	morphologie	
FRDR10302	ruisseau de crolles	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR10406	ruisseau de la coche	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR10477	ruisseau le pleynet	Cours d'eau	BE	2015	2015	2015			
FRDR10714	torrent le gleyzin	Cours d'eau	BE	2015	2015	2015			
FRDR10880	ruisseau de laval	Cours d'eau	BE	2015	2015	2015			
FRDR10897	ruisseau de vorz	Cours d'eau	BE	2015	2015	2015			
FRDR11035	ruisseau salin	Cours d'eau	BE	2015	2015	2015			
FRDR11368	torrent le bens	Cours d'eau	BE	2015	2015	2015			
FRDR11492	ruisseau de craponoz	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR11585	ruisseau de la combe de lancey	Cours d'eau	BE	2015	2015	2015			
FRDR11623	ruisseau d'alloix	Cours d'eau	BE	2015	2015	2015			
FRDR11687	torrent le veyton	Cours d'eau	BE	2015	2015	2015			
FRDR11807	ruisseau des adrets	Cours d'eau	BE	2015	2015	2015			
FRDR11874	ruisseau du doménon	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR11924	ruisseau de la terrasse	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR354c	L'Isère du Breda au Drac	Cours d'eau	BP	2015	2021	2021	FT	substances prioritaires	Protection contre les crues : zones urbaines Infrastructures (dvp durable)
FRDR356	La Bréda	Cours d'eau	BE	2015	2015	2015			

	Sous bassin versant : ID 09 05 - Haut Drac								
FRDL70	lac du sautet	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDR10006	torrent du tourond	Cours d'eau	BE	2015	2015	2015			
FRDR10012	torrent de durmilouse	Cours d'eau	BE	2015	2015	2015			
FRDR10087	le riou	Cours d'eau	BE	2015	2015	2015			
FRDR10334	torrent de la bonne	Cours d'eau	BE	2015	2015	2015			
FRDR10390	ruisseau des granges	Cours d'eau	BE	2015	2015	2015			
FRDR10773	torrent d'archinard	Cours d'eau	BE	2015	2015	2015			
FRDR11156	torrent du gioberney	Cours d'eau	BE	2015	2015	2015			
FRDR11270	torrent de brudour	Cours d'eau	BE	2015	2015	2015			
FRDR11453	torrent de prentiq	Cours d'eau	BE	2015	2015	2015			
FRDR11529	torrent de méollion	Cours d'eau	BE	2015	2015	2015			
FRDR11866	torrent de blaisil	Cours d'eau	BE	2015	2015	2015			
FRDR11930	torrent la ribière	Cours d'eau	BE	2015	2015	2015			
FRDR2027	Le Drac de l'aval de St Bonnet à la retenue du Sautet + Rageoux/Chétive	Cours d'eau	BE	2015	2015	2015			
FRDR348	La Souloise	Cours d'eau	BE	2015	2015	2015			
FRDR350	La Séveraisse	Cours d'eau	BE	2015	2015	2015			
FRDR352	Trt de la Séveraissette / Trt de la Muande	Cours d'eau	BE	2015	2015	2015			
FRDR353a	Le Drac de sa source au Drac de Champoléone inclus	Cours d'eau	BE	2015	2015	2015			
FRDR353b	Le Drac, du Drac de Champoléone à l'amont de St Bonnet	Cours d'eau	BE	2015	2015	2015			
FRDR353c	Torrent d'Ancelle	Cours d'eau	BE	2021	2015	2021	FT	hydrologie	
	Sous bassin versant : ID 09 06 - Isère en Tarentaise								
FRDL55	lac du chevril	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDR10076	ruisseau de la sassière	Cours d'eau	BE	2015	2015	2015			
FRDR10144	torrent l'ormente	Cours d'eau	BE	2015	2015	2015			
FRDR10194	torrent des encombres	Cours d'eau	BE	2015	2015	2015			
FRDR10285	torrent le charbonnet	Cours d'eau	BE	2027	2015	2027	FT/CD	morphologie	
FRDR10392	torrent du lou	Cours d'eau	BE	2015	2015	2015			
FRDR10413	nant de tessens	Cours d'eau	BE	2015	2015	2015			
FRDR10414	torrent d'eau rousse	Cours d'eau	BE	2015	2015	2015			
FRDR10438	torrent l'arbonne	Cours d'eau	BE	2015	2015	2015			
FRDR10498	ruisseau de montgellaz	Cours d'eau	BE	2027	2015	2027	FT	morphologie	
FRDR10614	torrent le bonrieu	Cours d'eau	BE	2021	2015	2021	FT/CD	morphologie, nutriments	
FRDR10658	torrent des moulins	Cours d'eau	BE	2021	2015	2021	FT/CD	morphologie	
FRDR10772	ruisseau du vallon	Cours d'eau	BE	2021	2015	2021	FT/CD	morphologie	
FRDR10788	torrent le nant brun	Cours d'eau	BE	2015	2015	2015			
FRDR10946	ruisseau des fours	Cours d'eau	BE	2015	2015	2015			
FRDR10970	torrent de bénétant	Cours d'eau	BE	2015	2015	2015			
FRDR10988	torrent de glaize	Cours d'eau	BE	2015	2015	2015			
FRDR11005	torrent le morel	Cours d'eau	BE	2027	2015	2027	FT/CD	morphologie	
FRDR11081	ruisseau de bonnegarde	Cours d'eau	BE	2021	2015	2021	FT/CD	morphologie	
FRDR11084	ruisseau le py	Cours d'eau	BE	2015	2015	2015			
FRDR11230	torrent de mercuel	Cours d'eau	BE	2021	2015	2021	FT/CD	morphologie	
FRDR11233	le nant cruet	Cours d'eau	BE	2015	2015	2015			
FRDR11267	torrent de pissevieille	Cours d'eau	BE	2015	2015	2015			
FRDR11275	torrent le réclard	Cours d'eau	BE	2027	2015	2027	FT/CD	morphologie	
FRDR11323	le grand ruisseau	Cours d'eau	BE	2021	2015	2021	FT/CD	morphologie	
FRDR11343	torrent des glaciers	Cours d'eau	BE	2015	2015	2015			
FRDR11347	torrent de bayet	Cours d'eau	BE	2015	2015	2015			
FRDR11426	ruisseau nant benin	Cours d'eau	BE	2015	2015	2015			

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			état	échéance	échéance	échéance			
FRDR11597	ruisseau du lac	Cours d'eau	BE	2021	2015	2021	FT/CD	morphologie	
FRDR11670	Le doron de prémou	Cours d'eau	BE	2015	2015	2015			
FRDR11678	ruisseau la rosière	Cours d'eau	BE	2015	2015	2015			
FRDR11818	ruisseau du clou	Cours d'eau	BE	2015	2015	2015			
FRDR11933	grand nant de naves	Cours d'eau	BE	2015	2015	2015			
FRDR354a	L'Isère du Doron de Bozel à l'Arly	Cours d'eau	BP	2027	2021	2027	FT/CD	morphologie, continuité, hydrologie, substances prioritaires	Protection contre les crues : zones urbaines Infrastructures (dvp durable)
FRDR367a	L'Isère de la confluence avec le Versoyen au barrage EDF de Centron	Cours d'eau	BP	2027	2015	2027	FT/CD	morphologie, continuité, hydrologie	stockage d'eau pour hydroélectricité Protection contre les crues : zones urbaines
FRDR367b	L'Isère du barrage EDF de Centron à la confluence avec le Doron de Bozel	Cours d'eau	BP	2021	2015	2021	FT/CD	hydrologie, morphologie, continuité	Protection contre les crues : zones urbaines stockage d'eau pour hydroelectricite
FRDR368a	Le Doron de Bozel et le doron de Champagny de leurs sources jusqu'à leur confluence	Cours d'eau	BE	2021	2015	2021	FT/CD	hydrologie, continuité, morphologie	
FRDR368b	Le Doron de Bozel (aval de la confluence avec le Doron de Champagny)	Cours d'eau	BP	2021	2015	2021	FT/CD	hydrologie, continuité, morphologie	infrastructures (dvp durable)
FRDR368c	Le Doron des Allues	Cours d'eau	BP	2021	2015	2021	FT/CD	hydrologie, continuité, morphologie	Protection contre les crues : zones urbaines
FRDR368d	Le Doron de Belleville	Cours d'eau	BE	2021	2015	2021	FT/CD	hydrologie, continuité, morphologie	
FRDR370	Le Ponturin	Cours d'eau	BE	2021	2015	2021	FT/CD	hydrologie, continuité	
FRDR371	Le Versoyen	Cours d'eau	BE	2021	2015	2021	FT/CD	hydrologie, continuité	
FRDR372*	L'Isère du barrage de Tignes à la confluence avec le Versoyen (et ruisseau de Davie et de Sachette)	Cours d'eau	BE	2015	2015	2015			
FRDR373	L'Isère en amont du remous du barrage de Tignes	Cours d'eau	BE	2015	2015	2015			
	Sous bassin versant : ID 09 07 - Romanche								
FRDL68	réservoir de grand-maison	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDL74	lac du chambon	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDL75	lac du verney	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDL76	Lac de Lauvitel	Plans d'eau naturel	BE	2015	2015	2015			
FRDL82	grand lac de laffrey	Plans d'eau naturel	BE	2015	2015	2015			
FRDL83	lac de pétichet	Plans d'eau naturel	BE	2015	2015	2015			
FRDR10060	ruisseau le roubier	Cours d'eau	BE	2015	2015	2015			
FRDR10063	ruisseau de la pisse	Cours d'eau	BE	2015	2015	2015			
FRDR10151	ruisseau la rive	Cours d'eau	BE	2015	2015	2015			
FRDR10209	ruisseau du vernon	Cours d'eau	BE	2015	2015	2015			
FRDR10276	ruisseau de la pisse	Cours d'eau	BE	2015	2015	2015			
FRDR10379	ruisseau de tirequeue	Cours d'eau	BE	2015	2015	2015			
FRDR10544	rif de la planche	Cours d'eau	BE	2015	2015	2015			
FRDR10645	le rif tort	Cours d'eau	BE	2015	2015	2015			
FRDR10685	ruisseau de la pisse	Cours d'eau	BE	2015	2015	2015			
FRDR10960	rivière de la salse	Cours d'eau	BE	2015	2015	2015			
FRDR10980	torrent du ga	Cours d'eau	BE	2015	2015	2015			
FRDR10981	ruisseau de la mariande	Cours d'eau	BE	2015	2015	2015			
FRDR11068	torrent du diable	Cours d'eau	BE	2015	2015	2015			
FRDR11279	rif garcin	Cours d'eau	BE	2015	2015	2015			
FRDR11393	le grand rif	Cours d'eau	BE	2015	2015	2015			

FRDR11478	torrent le maurian	Cours d'eau	BE	2015	2015	2015			
FRDR11497	torrent de la béous	Cours d'eau	BE	2015	2015	2015			
FRDR11503	torrent des étançons	Cours d'eau	BE	2015	2015	2015			
FRDR11572	ruisseau le flumet	Cours d'eau	BE	2015	2015	2015			
FRDR11577	ruisseau de la muande	Cours d'eau	BE	2015	2015	2015			
FRDR11590	ruisseau de la cochette	Cours d'eau	BE	2015	2015	2015			
FRDR11843	ruisseau de la pisse	Cours d'eau	BE	2015	2015	2015			
FRDR11883	ruisseau du vallon des étages	Cours d'eau	BE	2015	2015	2015			
FRDR329a	Romanche de la confluence avec le Vénéon à l'amont du rejet d'Aquavallées	Cours d'eau	BP	2015	2015	2015			Protection contre les crues : zones urbaines
FRDR329b	Romanche de l'amont du rejet d'Aquavallès à la confluence avec le Drac	Cours d'eau	BP	2015	2015	2015			
FRDR330	L'Eau d'Olle à l'aval de la retenue du Vernay	Cours d'eau	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDR331	L'Eau d'Olle de la retenue de Grand Maison à la retenue du Vernay	Cours d'eau	BE	2015	2015	2015			
FRDR332	L'Eau d'Olle à l'amont de la retenue de Grand Maison	Cours d'eau	BE	2015	2015	2015			
FRDR333	La Lignare	Cours d'eau	BE	2015	2015	2015			
FRDR334	La Sarenne	Cours d'eau	BE	2015	2015	2015			
FRDR335a	le Vénéon	Cours d'eau	BE	2015	2015	2015			
FRDR335b	Le Ferrand de sa source à la prise d'eau du Chambon	Cours d'eau	BE	2015	2015	2015			
FRDR335c	Le Ferrand aval prise d'eau du Chambon et la Romanche de la retenue du Chambon à l'amont du Vénéon	Cours d'eau	BE	2015	2015	2015			
FRDR336	La Romanche à l'amont de la retenue du Chambon	Cours d'eau	BE	2015	2015	2015			
	Sous bassin versant : ID 09 08 - Val d'Arly								
FRDL54	lac de roselend	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDL57	lac de la girotte	Plans d'eau anthropique	BP	2015	2015	2015			stockage d'eau pour hydroélectricité
FRDR10422	nant des lautarets	Cours d'eau	BE	2015	2015	2015			
FRDR10582	torrent le glapet	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR10604	torrent de la gittaz	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR10640	ruisseau du dorinet	Cours d'eau	BE	2015	2015	2015			
FRDR10865	ruisseau le flon	Cours d'eau	BE	2015	2015	2015			
FRDR10944	ruisseau de treicol	Cours d'eau	BE	2015	2015	2015			
FRDR11180	torrent planay	Cours d'eau	BE	2015	2015	2015			
FRDR11241	ruisseau du plan de la chevalière	Cours d'eau	BE	2015	2015	2015			
FRDR11262	torrent nant rouge	Cours d'eau	BE	2015	2015	2015			
FRDR11277	ruisseau du grand mont	Cours d'eau	BE	2015	2015	2015			
FRDR11525	torrent la chaise	Cours d'eau	BE	2015	2015	2015			
FRDR11762	ruisseau de cassioz	Cours d'eau	BE	2021	2015	2021	FT	nutriments, morphologie	
FRDR362a	L'Arly de la source à l'entrée de l'agglomération de Flumet	Cours d'eau	BE	2015	2015	2015			
FRDR362b	L'Arly en aval de l'entrée de l'agglomération de Flumet	Cours d'eau	BP	2021	2027	2027	FT	substances dangereuses, hydrologie, morphologie, continuité, substances prioritaires (HAP seuls)	Protection contre les crues : zones urbaines stockage d'eau pour hydroelectricite
FRDR363	Le Doron de Beaufort	Cours d'eau	BE	2015	2015	2015			
FRDR364	L'Arrondine	Cours d'eau	BE	2015	2015	2015			

	Sous bassin versant : ID 10 03 - Isère aval et Bas Grésivaudan								
FRDR10010	ruisseau le vézy	Cours d'eau	BE	2015	2015	2015			
FRDR10217	rivière la drevenne	Cours d'eau	BE	2015	2015	2015			
FRDR10235	ruisseau de baillardier	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR10353	ruisseau de serne	Cours d'eau	BE	2015	2015	2015			
FRDR10364	ruisseau le riousset	Cours d'eau	BE	2015	2015	2015			
FRDR10415	ruisseau le tenaison	Cours d'eau	BE	2015	2015	2015			
FRDR10416	ruisseau le nant	Cours d'eau	BE	2015	2015	2015			
FRDR10458	ruisseau la grande rigole	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR10670	ruisseau le bessey	Cours d'eau	BE	2015	2015	2015			
FRDR10904	ruisseau l'ivéry	Cours d'eau	BE	2015	2015	2015			
FRDR11022	ruisseau de pierre hébert	Cours d'eau	BE	2015	2015	2015			
FRDR1117	Cumane	Cours d'eau	BE	2021	2015	2021	FT/CD	hydrologie, pesticides	
FRDR11210	ruisseau de béaure	Cours d'eau	BE	2015	2015	2015			
FRDR11295	ruisseau la lèze	Cours d'eau	BE	2015	2015	2015			
FRDR11446	ruisseau l'armelle	Cours d'eau	BE	2015	2015	2015			
FRDR11575	ruisseau le frison	Cours d'eau	BE	2021	2015	2021	FT	nutriments et/ou pesticides	
FRDR11626	ruisseau le versoud	Cours d'eau	BE	2015	2015	2015			
FRDR11683	torrent la roize	Cours d'eau	BE	2021	2015	2021	FT	morphologie	
FRDR11934	ruisseau de sarcenas	Cours d'eau	BE	2015	2015	2015			
FRDR12104	ruisseau de la maladière	Cours d'eau	BE	2021	2015	2021	FT	nutriments et/ou pesticides, morphologie	
FRDR3053	Canal de la Bourne	Cours d'eau Mea	BP	2015	2015	2015			
FRDR312	L'Isère de la Bourne au Rhône	Cours d'eau	BP	2021	2021	2021	CN	pesticides, substances dangereuses, substances prioritaires	stockage d'eau pour hydroélectricité
FRDR315	Le Furand et son affluent le Merdaret	Cours d'eau	BE	2021	2015	2021	FT/CD	hydrologie, pesticides	
FRDR319	L'Isère de la confluence avec le Drac à la confluence avec la Bourne	Cours d'eau	BP	2021	2021	2021	FT/CD	morphologie, pesticides, substances dangereuses, substances prioritaires	Protection contre les crues : zones urbaines stockage d'eau pour hydroelectricite
FRDR320	Le Tréry	Cours d'eau	BE	2015	2015	2015			
FRDR324	La Vence	Cours d'eau	BE	2015	2015	2015			

ANEXE II – List of the 41 substances used to qualify the chemical status of water (SDAGE , 2009)

	Les Substances Dangereuses Prioritaires de la DCE (SDP)	Les Substances Prioritaires de la DCE (SP)	Substances Liste I de la directive 76/464/CEE non incluses dans la DCE
Objectifs de réduction nationaux (circulaire du 7 mai 2007**)	50 % du flux des rejets à l'échéance 2015 (année de référence 2004)	30 % du flux des rejets à l'échéance 2015 (année de référence 2004)	50 % du flux des rejets à l'échéance 2015 (année de référence 2004)
Objectifs DCE sur les rejets	Suppression des rejets d'ici 2021	Réduction des rejets (pas de délai fixé)	Pas d'objectifs DCE sur les rejets
substances ou familles de substances concernées	Composés du Tributylétain (TBT) (Tributylétain-cation)	DEHP (Di (2-éthylhexyl)phtalate)	Perchloréthylène (Tétrachloroéthylène)
	PBDE (Pentabromodiphényléther)	Chlorure de méthylène (Dichlorométhane ou DCM)	Trichloroéthylène
	Nonylphénols (4-(para)-nonylphénol)	Octylphénols (Para-tert-octylphénol)	Aldrine
	Chloroalcanes C10-C13	Diuron	Tétrachlorure de carbone
	Somme de 5 HAP = Benzo (g,h,i) Pérylène, Indeno (1,2,3-cd) Pyrène, Benzo (b) Fluoranthène, Benzo (a) Pyrène, Benzo (k) Fluoranthène	Nickel et ses composés	DDT (Dichlorodiphényltri-chloroéthane)
	Anthracène HAP ***	Plomb et ses composés	Dieldrine
	Pentachlorobenzène	Fluoranthène	Isodrine
	Mercure et ses composés	Chloroforme (Trichlorométhane)	Endrine
	Cadmium et ses composés	Atrazine	
	Hexachlorobenzène	Trichlorobenzène (TCB)	
	Hexachlorocyclohexane (Lindane)	Chlorpyrifos	
	Hexachlorobutadiène	Naphtalène	
	Endosulfan *** (Alpha-endosulfan)	Alachlore	
		Isoproturon	
		Chlorfenvinphos	
		Pentachlorophénol	
		Benzène	
		Simazine	
		1,2 Dichloroéthane	
		Trifluraline	
nombre de substances et familles de substances	13	20	8
code couleur nationale	rouge	jaune	orange

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