Characterisation of water uses

What is meant by “water uses”?

Before launching economic studies to assess the consequences of a project or measure, it is first necessary to list the existing water uses in the given area. Characterisation of water uses is the term commonly employed for this description of water uses lying at the crossroads between economics and the natural environment. However, the European water framework directive (WFD) and the related documents use other terms as well (water-related activities, water services) that must be precisely defined.

Water functions and purposes

The use of water is the act consisting of using certain characteristics of the water (which may be seen as a supply in economic terms) and certain functions to satisfy one or more needs (which may be seen as a demand in economic terms).

Water uses differ depending on whether the aquatic environment serves as:

- a means (transportation, transferral of materials, energy) ;
- an environment or space (for living, activities, protection).

The first type of use generally requires water flows whereas the second requires volumes.
The various water uses may be grouped according to the **purpose** involved.

Figure 1 lists characteristics, functions and purposes of water, with examples shown in Figure 2.

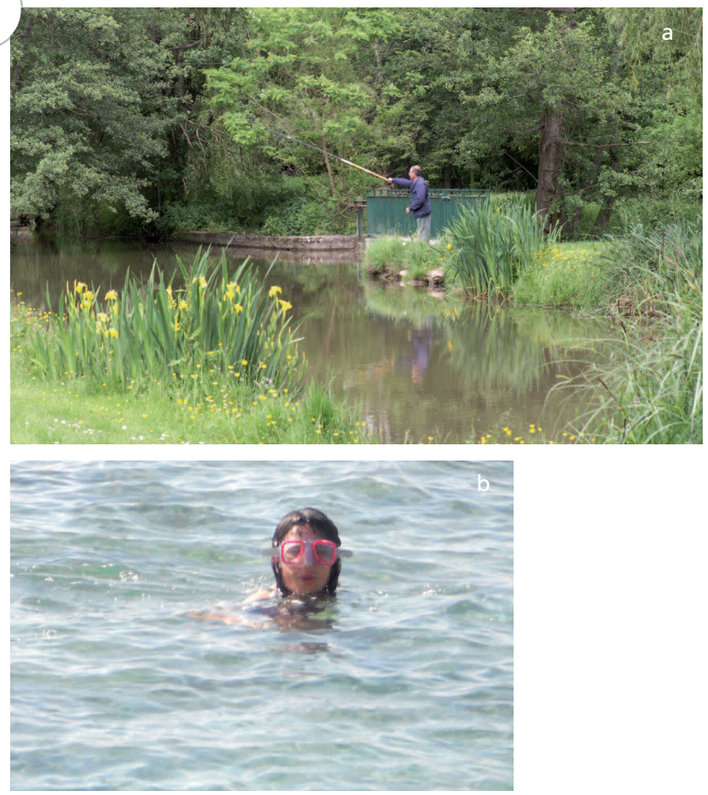
Figure 1

Water characteristics (SUPPLY)
- qualitative characteristics of aquatic environments
- quantitative characteristics of water
- physical characteristics of aquatic environments

Examples of FUNCTIONS
- cleansing
- dilution
- refrigeration
- energy
- supply of drinking water
- recreation
- ecological functions
- navigation
- watering of plants
- services for fauna and flora
- amenities
- flood protection

DEMAND expressed in terms of purposes
- agriculture (irrigation)
- industry (abstractions, hydroelectricity, nuclear power, sand and gravel mining)
- household use (drinking water, sanitation)
- recreation (boating, bathing, skiing, fishing)
- transportation (navigation, marinas)
- commercial fishing (professional fisheries, fish farming, shell fishing)
- tourism (boating, bathing, vacations on seashores, rivers, camping)
- real estate (use by local inhabitants, amenities, flood protection)
- ecosystems (observation, study areas, biodiversity)

Figure 2



a- b © C. Forst - Onema

Fishing and bathing are two recreational uses of water.

Water uses

Water uses concern both the economic sphere and the natural environment.
They may be defined directly in terms of the user's objectives, in which case a use is characterised with respect to the economic sphere because it corresponds to either production or consumption.

They may also be defined in terms of the impacts caused in the environment. Any use of water transforms its characteristics in the natural environment, a transformation that takes place between the abstraction and the discharge to the environment.

Water uses may be grouped in three main categories.

■ Water uses viewed from the economic standpoint

These uses correspond essentially to the objectives of economic entities:
- human consumption;
- other household uses (sanitary uses, air-conditioning, decoration);
- various types of production:
  - agriculture (plants), livestock farming (watering), fish farming, aquaculture,
  - industry (uses specific to products, to manufacturing processes, conditioning, conservation), including production of drinking water (though this is a special case),
  - energy,

- uses required for the production activity (consumption and hygiene of the workforce, maintenance, safety of facilities);
- transportation (navigable or raftable waterways);
- commerce and other services;
- public uses (public services), cultural uses (recreation, living conditions), rituals;
- security (fire, protection, defence).

Water uses viewed from the environmental standpoint

These uses may be divided into two subcategories:
- **extractive uses** that remove water from the natural environment and where the abstraction and return to the environment are distant in time and space;
- ***in situ* uses** that do not remove water from the natural environment, but use on-site some of its functional characteristics.

Water neutralisation

Water neutralisation consists of efforts to mitigate potential damage and/or eliminate problems (see Figure 3). Neutralisation work is defined by the **objectives pursued**:
- safety of life and property (flood control);
- land use, construction, development (evacuation of rainwater);
- underground installations (dewatering);
- agricultural production (drainage);
- mining (mine drainage);
- transportation and communications security (flood control, evacuation of rainwater).

Neutralisation removes water from the natural environment or modifies its regime. These efforts to control the environment have economic value, but are not water uses.

Figure 3

a © M. Bramard - Onema

Floods.

b © M. Carrouee - Onema

Flood control and evacuation of rainwater are defined as water neutralisations.

Water services

In the WFD, there is also the notion of “water services”, notably in view of cost recovery. Water services are water uses characterised by the existence of installations for water abstraction, storage, treatment and discharge, e.g. for irrigation, production of drinking water, hydroelectric generation, etc.

The 22 April 2004 instructions concerning the analysis of water tariffs and cost recovery of services in compliance with WFD article 9 notes however that:
“*The notion of “service” is extensive because it implicitly includes, absent any contrary indications in article 2-38, public and private services for third parties or for the provider itself, characterised by the presence of installations (abstraction, storage, discharge) and likely to influence significantly the status of water bodies.*”

The definition of water services is developed further a bit later in this document, in the chapter on cost recovery.

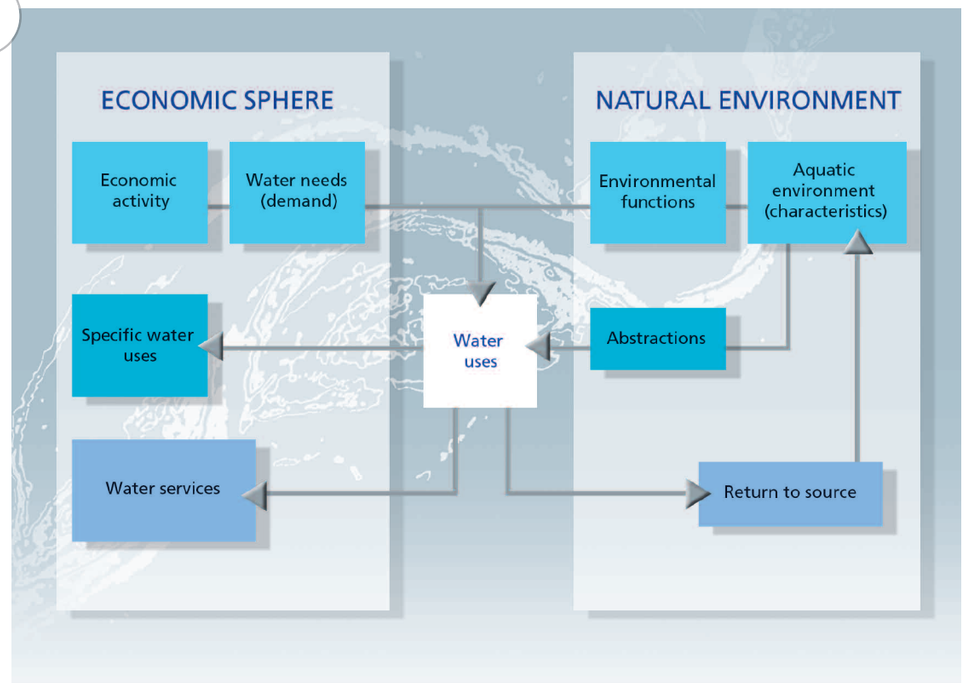
Water activities

This term is mentioned a number of times in the WFD, but never defined. It designates both human activities having an impact on water status and economic activities (see Figure 4).

The notion of “activity” is thus wider than that of “use” because there are certain activities that do not have any significant impact on water status and are not “services” in the WFD sense, nor “uses”, e.g. recreational activities and fishing. This distinction is not systematic and must be based on case by case analysis. For example, fishing in itself does not have a significant impact on water status, however overfishing may.

Analysis of water activities must be included in studies to characterise uses. This is the means to determine the relative economic importance of the activities and to assess, at a later time, the social and economic impact of programmes of measures and action plans on the activities.

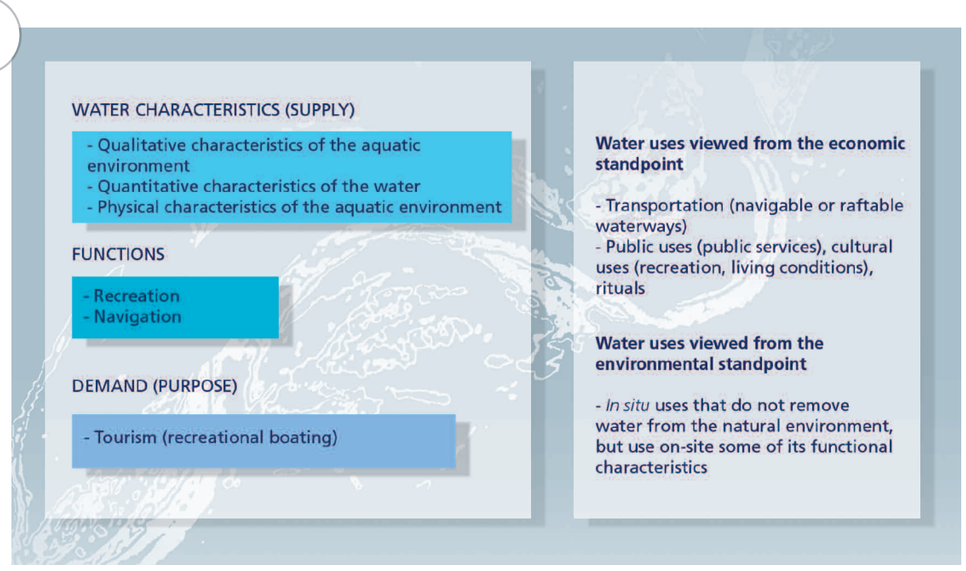
Figure 4



Water uses, interaction between the natural environment and the economic sphere.
Source: the Water agencies.

The purpose of the work to characterise water uses in a given area may, in some cases, be to describe the economic activities, or in others to describe water services, uses or functions. For example, characterisation of recreational boating (see Figure 5) concerns the economic activities pertaining to recreational boating in the area (or beyond if applicable) analysed using certain indicators providing information on its significance.

Figure 5



An example of elements characterising recreational boating.
Source: the Water agencies.

Which water uses must be characterised and how should that be done?

An economic characterisation of water uses consists of estimating the importance of water in the economy and the social-economic development of the studied river basin. The analysis must identify the significant water uses and study the basin dynamics in order to contribute to the formulation of a base scenario. It must also attempt to foresee any changes in the main economic and human activities that could impact on pressures and water quality. Study must be devoted to the probable changes in the main social-economic parameters such as the local policies implemented, growth rates of the main economic sectors, investments in the water sector, local population dynamics, etc.

Identification of uses clarifies the local objective. Listing water uses in the area serves to integrate the local economic environment and the local water-management issues in the analysis. In this sense, it constitutes an aid in thinking through problems and decision-making. Listing of uses also provides information on the social acceptance of measures and/or their compatibility with local, traditional or cultural uses that are not necessarily perceived from the start. It can thus help in adjusting objectives.

Identification of uses helps in shifting from "desirable" to "feasible". Inclusion of economic data in the analysis is the means to shift from the first step in the work devoted to the technical selection of measures (the "desirable") to a second step consisting of finalising the proposal, taking into account social-economic aspects (the "feasible").

All the above elements are **important factors in the discussions concerning programmes of measures and action plans.** The database containing the geographic data on uses assists in determining the areas concerned by a given use. It also lists the economic participants that should be consulted for discussions on the compatibility of the proposed environmental objectives and the related social-economic issues.

This type of economic analysis is thus the means to describe:

- the importance of water in the river basin;
- the main economic players influencing the pressures on and the uses of water;
- how the economic players will evolve over time and how they will influence pressures;
- how supply and demand for water will evolve over time and the problems that may emerge.

The water uses to be listed and characterised may be determined on the basis of existing typologies. The geographic location of economic uses in the basin and the assessment of the link between those uses and the chances of achieving the environmental objectives together constitute a key factor in the system intended to carry out the economic analyses. **It was with that in mind that, in the the Rhône-Méditerranée-Corse basin, the local groups were asked to inventory the uses in the basin according to their relative importance (major, long-standing, emerging, inexistent)** and using a fairly complete list of known uses in the basins, broken down into groups (see Box and Figure 6).

Example of a typology to assist in the geographic location of water uses

Agriculture
- Large-scale, irrigated farming
- Farm irrigation
- Other large-scale farming
- Wine growing - orchards
- Livestock
- Forestry
- Vegetable farming

Industry
- Mechanics - surface treatment - naval repair
- Paper - cardboard - publishing
- Food industry (except bottled water)
- Dry-cleaning - printing - textiles
- Chemicals - petrochemicals
- Trades - artisans
- Wood sector

Energy
- Hydroelectricity
- Nuclear
- Thermal power

Mining and abstractions
- Sand and gravel mining
- Production of bottled water
- Salt production, salt marshes
- Watering for aesthetic purposes (public, private)

Navigation
- Commercial navigation on rivers
- Recreational navigation on rivers
- Maritime commercial navigation and trading ports
- Maritime recreational navigation and marinas

Urbanisation and infrastructure
- Transport of untreated water (canals)
- Soil sealing (flooding)
- Transportation networks and infrastructure
- Industrial port zones
- Building in the floodplain of a river
- Sanitation
- Supply of drinking water (networks)

Fishing
- Fish farming
- Shell fishing
- Freshwater commercial fishing
- Maritime commercial fishing
- Freshwater recreational fishing
- Recreational fishing in littoral zones (on foot and otherwise)
- Fishing ports

Water-related sports and recreational activities
- Diving, bathing, water games (requiring bathing-quality water)
- Canoeing, kayaking, rowing
- Motor boating, sailing, windsurfing
- Caving, canyoning

Tourism and recreational activities in aquatic environments
- Golf courses (watering, treatment)
- Winter sports, skiing (snow making)
- Hunting
- Powerboating (jet ski, water skiing, etc.)
- Non-aquatic tourism (rural tourism in contact with the hydrosystem)
- Tourism in general
- Campgrounds
- Water cures, thalassotherapy, balneotherapy

Non-commercial uses
- Observation (plants, birds, whales, etc.)
- Walking, hiking, snorkelling
- Contribution to real-estate value

Functions of environments in good condition
- Water resources (local)
- Additional self-cleansing (and dilution)
- Flood mitigation (retention systems, resource regulation)
- Self-regulation of sediment (fewer interventions)
- Biological richness (biodiversity)

Source: Rhône-Méditerranée-Corse water agency

Figure 6

a © V. Marty - Onema
b © F. Weingertner - Onema
c © M. Bramard - Onema

Walking, recreational boating and recreational fishing are free-time activities taken into account when characterising water uses.

A simple way to characterise water uses in economic terms

It is not always easy to initiate an in-depth study on uses. It is preferable that each type of use be characterised precisely, however, a two-level approach is also possible. Depending on the available means and resources, one option can be to reserve a detailed description for the main water uses in an area (e.g. for agricultural and industrial use). Less important uses (from an economic standpoint), for example water cures, may receive less in-depth study.

The example below presents a simplified method used in the Rhône-Méditerranée basin to collect basic information for the WFD characterisation process.

A list to assist in the geographic location of economic factors

The list to assist in the geographic location of economic factors may be used to inventory the various uses in a river basin and to distinguish whether those uses are major, established, emerging or inexistent. The type of link between the listed use and the environmental objective is also noted. The goal is to determine whether the use does not depend on good status, or whether the use is dependent on or benefited by good status.

What are the criteria determining whether a use is major, established, emerging or inexistent?

- **A use is considered "inexistent or marginal"** if it is not present (or very limited) in the basin and if it is not emerging. The term "not emerging" means there are no plans to create an activity involving the use or the conditions that would enable the use to emerge.
- **A use is considered "emerging"** if it does not yet exist in the basin, but there are plans to launch an activity involving the use or to create, in the near future, the conditions that would enable the use to emerge. A use may also be considered emerging if it already exists, but is marginal (or only recently launched), though projected to grow in the years to come in numbers of users, direct and indirect jobs, volumes of water needed, participants, etc.
- **A use is considered "established"** if it is sufficiently well set up in terms of quantities, duration, quality, cultural and traditional aspects, or if its local impact is strong, e.g. snow making, highways, golf courses, etc. The local group running the survey may conclude that a use is established if a number of criteria exist, but are not sufficient for "major" status. This decision should be made by the local experts.
- **A use is considered "major"** if it is an important factor in the economic and/or social landscape of the given area.

Using the above terms, it is possible to fill out the list to assist in the geographic location of economic factors and indicate the link with good status, as shown in Table 1 for the Rhône-Méditerranée river basin.

Tableau 1 *List to assist in the geographic location of economic factors (Source: Rhône-Méditerranée-Corse water agency).*

Established uses		Link with good water status
Agriculture	Livestock farming	INDEPENDANT
	Forestry	INDEPENDANT
	Vegetable farming	DEPENDANT
Industry	Trades - artisans	INDEPENDANT
	Mechanics - surface treatment	INDEPENDANT
Mining and abstractions	Watering for aesthetic purposes (public, private)	DEPENDANT
	Sand and gravel mining	INDEPENDANT
Urbanisation and infrastructure	Supply of drinking water	DEPENDANT
	Soil sealing (flooding)	INDEPENDANT
	Sanitation	DEPENDANT
	Building in the floodplain of a river	INDEPENDANT
Fishing	Freshwater recreational fishing	BENEFITED
Water-related sports and recreational activities	Diving, bathing, water games	BENEFITED
	Caving, canyoning	INDEPENDANT
Tourism and recreational activities in aquatic environments	Hunting	BENEFITED
	Non-aquatic tourism	BENEFITED
Non-commercial uses	Observation	BENEFITED
	Walking, hiking	BENEFITED
Major uses		**Link with good water status**
Agriculture	Wine growing - orchards	DEPENDANT
Industry	Food industry	DEPENDANT
Urbanisation and infrastructure	Transportation networks and infrastructure	INDEPENDANT
	Transport of untreated water (canals)	DEPENDANT

Detailed characterisation of water uses

For detailed characterisation, it is necessary to collect a number of economic indicators and data. They serve to describe the economic importance of the use on the local level and to compare it to other uses and/or to the same use on a different geographic scale. The value of this work lies in shifting from the simplified approach (is the use important in the area?) to a more complex set of questions (does use A have greater economic impact than use B?, is the use in the studied area of importance on the regional and national level?, etc.).

Examples of representative data on economic issues in the Rhône-Méditerranée basin

Table 2 presents examples of the economic data that may be collected. The complete table may be found in the Annexe to this document. Of course, the accuracy of the collected data will depend of each use, on the access to the data (on or off site, existing databases, surveys, etc.), on the cost (fee or free, negotiated under certain conditions, etc.), and on the level at which it exists (town, farm, industrial company, professional association, etc.). It is preferable to collect chronological series of data rather than for a given year in order to estimate future trends.

Figure 7

a © C. Roussel - Onema
b © M. Salvetti - Onema

Fishing and tourism along the coast are important factors in the local economy.

Tableau 2 *Detailed economic characterisation of water-related activities and uses (Source: Rhône-Méditerranée-Corse water agency).*

Activities - Uses	Economic characterisation
Irrigation	■ The RMC basin has the highest percentage of crop irrigation. The basin represents 16% of the usable farm area in France, but 20% of the irrigated land with approximately 375 000 hectares (i.e. 8% of the usable farm land in the basin). ■ Irrigation is extensively used. The basin comprises 22% of French farms, but 35% of the farms using irrigation. A total of 25% of farms in the basin use irrigation, compared to 15% nationally.
Energy and petrochemical industries	■ The Rhône-Alpes region is the source of 21% of the primary energy in France and a quarter of the electricity. ■ In terms of nuclear power, the Rhône-Alpes region is the foremost French region with 30% of the total nuclear capacity and 24% of the electricity produced in nuclear plants. ■ The PACA region is home to 30% of French oil-refining capacity.
Sanitation and supply of drinking water	■ Percentage of the population whose water is directly managed by the local government: 28% ■ Percentage of the population for which water management is delegated by the local government: 72% ■ Number of customers for drinking water: 5 381 790 ■ Volume of drinking water billed: 1 148 million cubic metres ■ Length of drinking-water networks approximately 150 000 km ■ Length of sanitation networks approximately 70 000 km ■ Drinking-water production units: 437 ■ Wastewater-treatment plants: 4 315 ■ Non-collective sanitation units: approximately 1 million ■ Jobs in the water sector: over 120 000 in France and approximately 30 000 in the basin
Production of bottled drinking water	■ 3 700 million litres of bottled water were produced in 2002 in the river-basin district (40% of total French production). ■ The basin represents 33% of the companies and 44% of the jobs in the table-water sector in France.
Energy	■ Two-thirds of French hydroelectric generation are located in the basin. ■ A quarter of French nuclear generation is located in the basin.
Golf courses	■ Of the 531 courses in France in 2002, over 150 were located in the basin, including 57 in the Rhône-Alpes region and 53 in the PACA region, the two regions having the most courses in France. ■ A high-end, 18-hole golf course has an average consumption of 5 000 cubic metres per day, which corresponds to that of a town of 12 000 inhabitants. ■ The total water consumption for the irrigation of golf courses in 2002 amounted to 36 million cubic metres, equivalent to the annual consumption of a town of 500 000 inhabitants.

Linking economic use with the natural environment

It is also necessary to position the studied use with respect to the natural environment and to characterise the interaction between the economic sphere and the natural environment:

- how is water in fact utilised in the framework of a given use?;
- what demands are made by the use in terms of the quality and available quantities of water resources and natural environments?;
- what pressures does the use place on water resources and/or on aquatic environments? (see Figure 8).

Figure 8

a © G. Parfait - Onema
b © M. Bramard - Onema

Dams must be taken into account when characterising uses given the pressures they create and the activities that they modify or make possible.

Finally, given the relative rarity of water resources, it is important to identify as early as possible the potential for conflict between uses. Tables 3 and 4 provide basic data on these issues for each type of use. The information provided here is very general and must be filled out by the local experts.

Tableau 3 *Links between uses and natural environments (Source: the Water agencies).*

Activities - Uses	Water uses	Main requirements weighing on water resources	Main pressures weighing on water resources and/or aquatic environments	Potential conflicts concerning water uses
Agriculture	Factor of production for irrigation and watering of livestock, cleaning of production sites and products (e.g. cheese).	Available quantities.	- Direct pressure on water resources due to abstractions from surface and groundwater, organic and toxic pollutants, mainly nonpoint source (livestock effluents, fertilisers and plant-protection treatments, effluents from wine-growing installations, etc.). - Physical pressure on the environment caused by irrigation canals, water transfers, upland reservoirs, draining, etc.	Resource sharing during periods of high demand with other uses, e.g. drinking-water suppliers and industry, and taking into account the needs of aquatic environments and species.
Sanitation and supply of drinking water	Consumption for various household uses.	Physical-chemical and microbiological quality (suitability for drinking water), available quantities.	- Direct pressure on water resources due to abstractions from surface and groundwater, primarily organic pollution (discharges from wastewater-treatment plants). - Physical pressure on the environment caused by soil sealing (urbanisation, communication infrastructure, flood prevention, etc.).	- Resource sharing during periods of high demand with other uses, e.g. agriculture and industry. - Use for drinking water put into question by the pollution caused by other uses (leading to a halt in abstractions or to additional treatments).
Production of bottled drinking water	Raw material.	Naturally drinkable, special physical-chemical composition that is stable over time, available quantities.	Direct pressure on water resources through abstractions of groundwater.	Except in exceptional cases of mineral water that participates significantly to the balances ensuring the functioning and good status of neighbouring environments, the potential is for indirect conflict with other sectors, e.g. the drinking-water sector.
Water cures	Raw material.	Naturally drinkable, special physical-chemical composition (therapeutic properties) that is stable over time, available quantities.	Direct pressure on water resources through abstractions of groundwater.	- Rare cases of massive abstractions producing significant imbalances in groundwater and/or in linked surface water bodies (very rare). - Conflicts may concern the use of water resources or heat resources.
Energy	- Factor of production, the driving force for hydroelectricity. - Thermal exchange, used for cooling nuclear power plants.	Sufficient hydrological regime (quantity and discharge).	Physical pressure on water resources through abstractions (reservoirs, dams, hydropeaking, etc.), discharges of warm water from power plants.	- Breaks in hydraulic continuity and need to maintain sufficient discharge downstream of dams can lead to conflict with fishing groups, aquatic recreational activities, etc. - Mortality of migratory fish during downstream migration when passing through turbines.
Golf courses	Factor of production used to water greens.	Available quantities.	Direct pressure on water resources through abstractions and pollution caused by fertilisers and plant-protection products.	- Potential conflict with all users and uses requiring high-quality water. - Conflict with other recipients of local water sources is possible if the volumes consumed (always high per surface unit) are significant compared to potential uses elsewhere. - Tensions, during periods of restricted use, with uses for drinking water and irrigation.

A different type of typology is possible. It is structured around the links between activities, the corresponding pressures and the uses potentially harmed.

Tableau 4 *Another typology for links between uses and the environment.*

Activities - Sources	Pressures	Uses harmed
Industry, agriculture, fish farming, nuclear power plants, golf courses, supply of drinking water	Abstractions	Supply of drinking water, agriculture, industry, recreational fishing, ecological heritage, nuclear power plants, white-water sports and kayaking, recreational boating, shipping, bathing
Industry, slaughter houses/rendering, dairy/cheese industry, fish farming, sanitation, sealed surfaces, recreational boating	Oxidisable matter	Supply of drinking water, bathing, recreational fishing, ecological heritage
Industry, livestock farming, crop farming, dams (emptying), sealed soils	Heavy metals	Supply of drinking water, recreational fishing, ecological heritage, fish farming, shell fishing, fishing on foot
Industry, crop farming, sealed surfaces, recreational boating	Micropolluants	Supply of drinking water, recreational fishing, ecological heritage, fish farming, shell fishing, fishing on foot
Livestock farming, crop farming, sanitation	Nitrates and marine eutrophication	Supply of drinking water, river navigation, recreational fishing, ecological heritage
Livestock farming, crop farming, fish farming, dams (releases), sanitation	Phosphates, continental eutrophication	Supply of drinking water, river navigation, recreational fishing, ecological heritage
Fish farming, sanitation	Ammonium salts	Supply of drinking water, recreational fishing, ecological heritage
Livestock farming, sanitation, sealed surfaces	Bacterial pollution	Supply of drinking water, bathing
Sand and gravel mining, crop farming, fish farming, sealed surfaces	Suspended matter	Recreational fishing, ecological heritage, coastal fishing (drop in coastal-ecosystem productivity)
Sand and gravel mining, nuclear power plants, hydroelectric plants, dams, weirs, embankments	Warming and continental eutrophication	Recreational fishing, ecological heritage, supply of drinking water, river navigation
Sand and gravel mining, supply of drinking water, crop farming, sealed surfaces	Modification of the hydrological regime	Supply of drinking water, regional development, wetland functions, ecological heritage
Sand and gravel mining	Exposure of the water table, vulnerability to accidental pollution	Supply of drinking water
Sand and gravel mining	Damage to the landscape	Tourism, real-estate market
Sand and gravel mining, crop farming, golf courses, camp grounds, infrastructure, urbanisation, etc.	Destruction of wetlands	Supply of drinking water, ecological heritage, wetland functions
Fish farming, dams, weirs, embankments	Difficult passage	Recreational fishing (migratory fish), ecological heritage, white-water sports and kayaking
Hydroelectric plants	Variations in discharge	Recreational fishing, ecological heritage, bathing, white-water sports and kayaking
White-water sports, kayaking	Disturbances to wildlife	Ecological heritage
Tourism, river transport of goods	Pressure on river morphology	Ecological heritage, recreational fishing, wetland functions

Source: the Water agencies.

For the more complex cases, it may be necessary to sub-contract a specific study on one or more uses, on the interactions and/or the impact on the environment. In this case, it is best to contact the Water agencies which can help with the study, either by funding it if the issue is of major importance in the river basin or by providing assistance in drafting the technical specifications for the study.

■ Description of the economic players in the area covered by the St-Brieuc SBMP

The economic activities in the area covered by the SBMP (sub-basin management plan) for the St-Brieuc bay are characterised by their great diversity. The current economic importance of the various sectors covered by the SBMP (jobs, sales, added value) is presented in Table 5.

Tableau 5 *Economic importance of business sectors in the area covered by the St-Brieuc SBMP. (Source: Saint-Brieuc SBMP).*

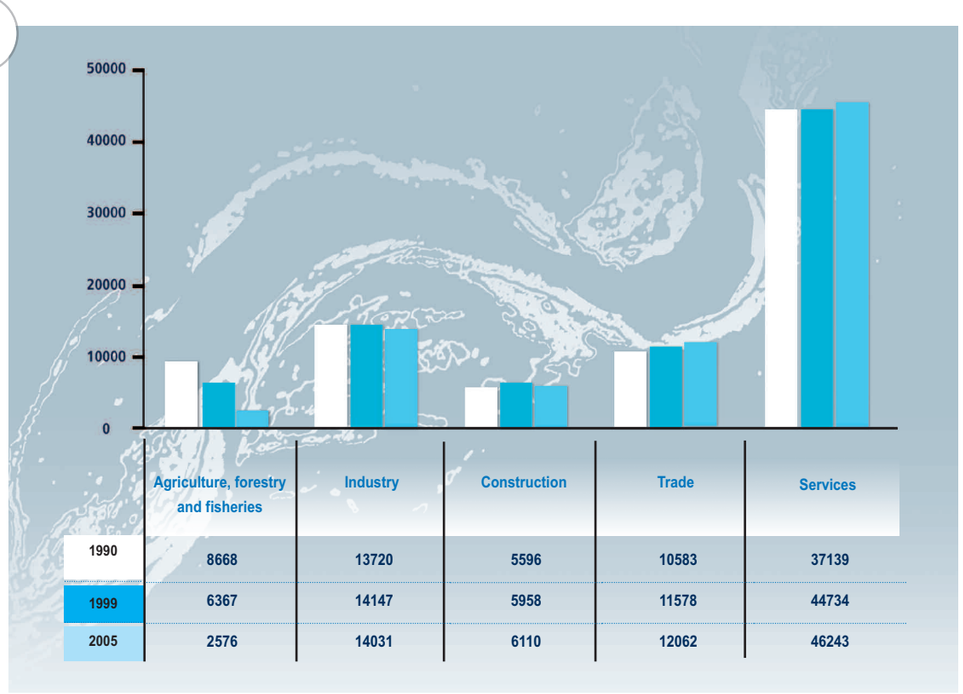
Business sector	Activity	Jobs (direct and indirect)	% total employment	Sales (€ million)	% total sales	Gross added value (€ million)	% total added value
Agriculture		4200	6%	225	3%	130	3%
Industry	Food industry	4400	6%	1200	17%	190	
	Other industry	6500	8%	950	14%	310	
	Subtotal	10900	14%	2150	31%	500	12%
Construction		5600	7%	470	7%	390	10%
Trade and services	Tourism	2900	4%	130	2%		
	Others	52400	68%	3920	56%		
	Subtotal	55300	72%	4050	58%	3000	75%
Littoral sector	Sea fishing	500	1%	30	0%		
	Shell fishing	140	0%	8	0%		
	Recreational boating	200	0%	40	1%		
	Subtotal	840	1%	78	1%		
	Total	76840	100%	6973	100%	4020	100%

The main business sectors in the area are:

- the tertiary sector with trade and services, representing 72% of total jobs and 75% of gross added value;
- the industrial sector, representing 14% of total jobs and almost one-third of total sales. The food industry represents almost 40% of all industrial jobs and 55% of industrial sales;
- the construction sector, representing 7% of total jobs;
- agriculture, with approximately 4 200 direct and indirect jobs (6% of total jobs).

Figure 9 shows the evolution in jobs for each major business sector between 1990 and 2005 in the St-Brieuc job basin (which comprises 125 towns and 210 187 inhabitants, whereas the St-Brieuc SBMP covers only 68 towns and 196 500 inhabitants).

Figure 9



	Agriculture, forestry and fisheries	Industry	Construction	Trade	Services
1990	8668	13720	5596	10583	37139
1999	6367	14147	5958	11578	44734
2005	2576	14031	6110	12062	46243

Evolution of jobs in the Saint-Brieuc job basin.
(Source: INSÉÉ data)

The data for the major business sectors reveal two stable trends over the 15-year period, i.e. a continuous drop in agricultural jobs (stronger in the St-Brieuc region than in the rest of Brittany between 1999 and 2005) and a regular increase in the tertiary sector (trade and services). In the industrial sector, the GREF Bretagne data reveal a drop in food-industry jobs between 1999 and 2005 in the St-Brieuc region whereas they were stable in the Brittany as a whole. Jobs in the rest of the industrial sector remained stable from 1999 to 2005.

Drafting a summary document to facilitate communication

Work to summarise the data is required in view of sharing the results on use characterisation with the various local stakeholders. One method is to create a geo-economic typology combining the economic issues and a consistent set of clearly defined areas in the river basin. The goal is not only to summarise the analyses carried out, but to present a diagnosis that can be used as a backdrop to inform the discussions and debates (see Figure 10).

Figure 10

a © G. Parfait - Onema
b © F. Cichy - Onema

The step involving the feedback and all communication concerning the results of the economic analysis is fundamental in providing factual substance and in clarifying the debates between stakeholders.

This information draws attention to the uses **generating high sales**, but that are also the source of **high pressures** on water resources and/or aquatic environments, and that also impact negatively on **other activities** ("sensitive" uses).

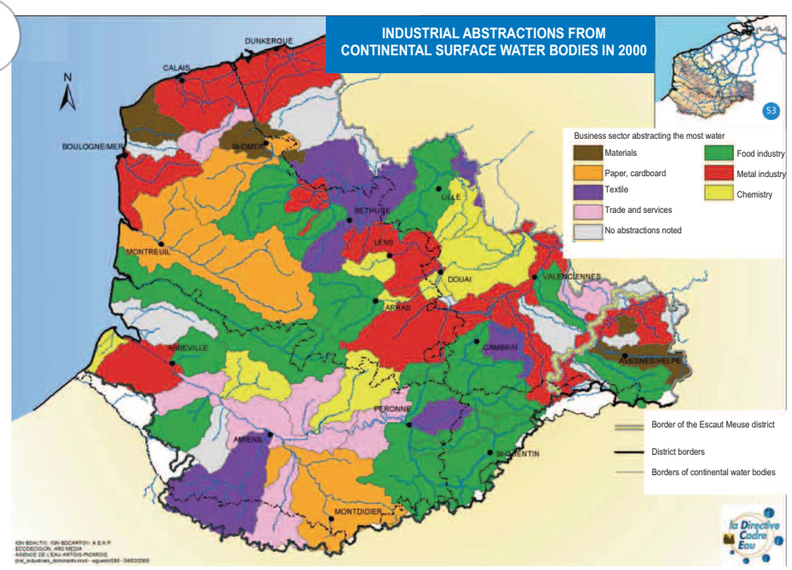
When speaking of important/major economic activities, that may mean:

- an activity causing damage and thus likely to fall in economic importance if environmental policy is implemented;
- an activity sensitive to the quantity and quality of water resources and thus likely to rise in economic importance if environmental policy is implemented;
- an activity that could both gain and lose depending on the policies implemented.

The relative importance of the various economic sectors may vary depending on whether they are considered on the local or river-basin scale. An important/major sector may be considered dominant locally (e.g. for a given water body), but that is not necessarily the case on the river-basin scale. A sector may be totally absent locally, but nonetheless remain an important/major sector for the river basin as a whole.

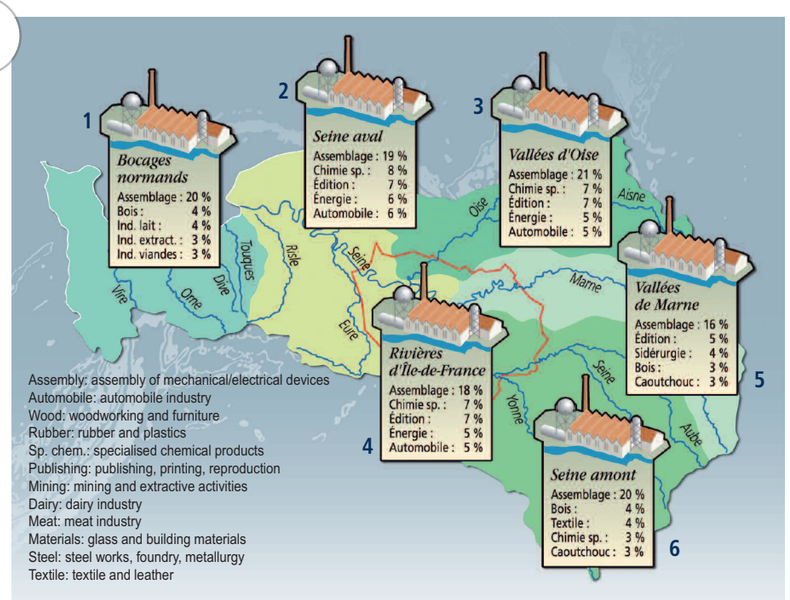
Practically speaking, the summary document can be structured by comparing the local business sectors with the characterisation of uses for several other areas in the river basin. The use of maps is advised for the presentation of data (see Figure 11).

Figure 11



Main industrial abstractions by surface water body (2000).
Source: Characterisation process for the Escaut-Meuse district, Artois-Picardie water agency.

Figure 12



1- Lower Normandy
Assembly:
Wood:
Dairy:
Mining:
Meat:
2- Lower Seine:
Sp. chem.:
Publishing:
Energy:
Automobile:
3- Oise valleys
4- Île-de-France rivers
5- Marne valleys
Steel:
Rubber:
6-Upper Seine:

Main industries with respect to jobs.
Source: WFD characterisation process, Seine-Normandie water agency.

Foreseeing changes in uses to develop prospective scenarios

When formulating management plans and programmes of measures, it is important to make sure that any changes in uses over the next 9 to 15 years are correctly taken into account in the analysis of the future situation and in selecting the environmental measures to be taken.

The preparation of a **prospective scenario,** describing what would occur in the river basin if no measures and action are taken, is considered essential in order to:

- assess the possible **deficit in water status compared to the environmental objectives,** that would result from the potential trends if no specific measures or action are taken;
- identify the main **water needs over the long term** and the solutions required in terms of the water policy for the river basin;
- formulate a programmes of measures in response to the **pressures present in the area;**
- run the **cost-recovery calculations** for services provided (this requires a long-term forecast of water supply and demand, and of the necessary investments).

The main thrust of this work lies in identifying the **driving forces** (planned investments in the water sector, demographics, current economic policies, new technologies, land-use policies, climate change, etc.) operating on the various geographic levels in the area and in foreseeing the resulting changes in terms of pressures, impacts and water status.

The general method proposed here to identify and characterise the driving forces is made up of four steps.
1) **Extrapolate** the current trends of parameters and driving forces.
2) Integrate into the parameters and driving forces any **changes that are certain,** given implementation of the European directives in the water sector (Bathing directive, Urban wastewater-treatment directive, Nitrates directive, etc.).
3) Integrate any **uncertain changes,** selecting the most probable outcomes.
4) Propose an array of scenarios diverging from the base prospective scenario, e.g. on the basis of best-case and worst-case hypotheses.

The available means to produce a relevant set of scenarios include many possibilities, including statistical analysis of past data, economic and environmental modelling, study of planning documents including those for each business sector and discussions with important stakeholders.

The prospective scenario covering the Seine-Normandie basin for the WFD characterisation process

The purpose of preparing a prospective scenario for each river-basin district by 2015 is to foresee changes in pressures weighing on water and the resulting environmental status, if current policies are pursued. The scenario should indicate the main issues and assist in formulating water policy for the river basin, notably by supplying information for the discussions, foreseen by the WFD, between the participants in water policy in the basin. The work entails a prospective analysis of changes in human activities (see Figure 13), an estimate on the point-source discharges of macropollutants (organic matter, nitrogen and phosphorus) in rivers and a calculation of the resulting water quality.

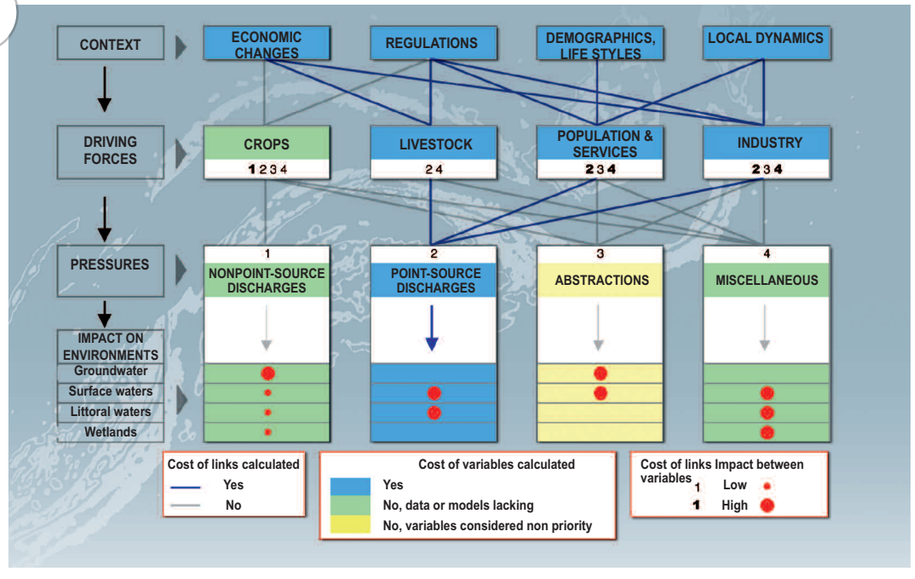
Initially, the objective is to describe a reference hydrological and social-economic system and then to identify the main variables characterising the environmental status and the human activities influencing the status and its evolution.

The technical-social-economic system determining any changes in water quality may be broken down into four levels:

- the **context,** consisting of the main factors behind the driving forces, notably demographics, local development, regulations and the economic situation;
- the **driving forces,** the human activities influenced by the context and causing the pollution and other pressures are grouped according to the four types of stakeholders involved (population and services, industry, crop farming and livestock farming);
- the **pressures** weighing on the environment, i.e. the consequences of the driving forces producing an impact on the environment, e.g. discharged pollutants, abstractions and physical damage;
- the **environmental status** resulting from the pressures, taking care to distinguish the type of environment (rivers, groundwater, littoral waters and estuaries).

The links between these four levels in the system are presented in Figure 13.

Figure 13

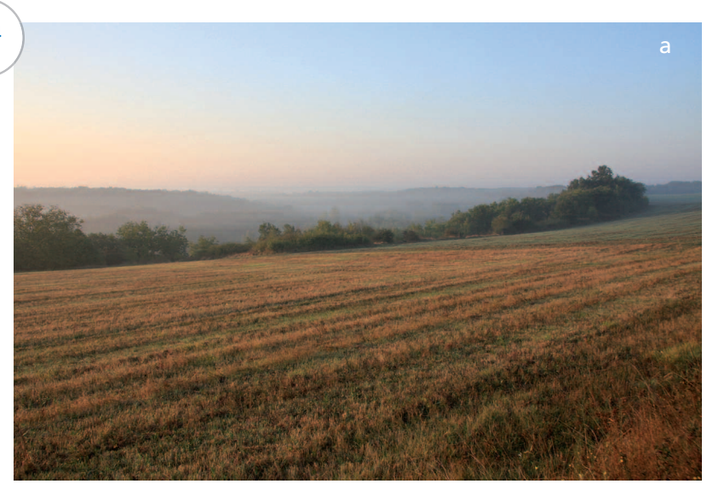


Technical-social-economic system determining the evolution of water quality and used as the baseline for the prospective scenarios.
Source: Preparation of the prospective scenario in 2004, Seine-Normandie water agency.

In addition to these links are many interdependent relationships within each category and the dynamics specific to each element. For example, changes in industrial activity depend in part on the creative capacity of companies (internal dynamics), but also on the presence of high-quality labour (interdependence between driving-force variables).
This set of links, though simplified in the diagram, would still appear fairly complex. However, an analysis of the impact of the various factors revealed certain key aspects:

- the environment is more or less sensitive (more or less reactive, more or less rapidly) to variations in the pressures weighing on it;
- the pressures resulting from driving forces depend mainly on two characteristics of the forces, i.e. their quantity and the policy to reduce the pressures);
- the national economic environment, itself largely dependent on the world situation, is a fundamental variable in explaining variations in the driving forces, notably economic activities and migratory flows;
- demographics and life styles influenced by values, but also by constraints such as the types of employment, will have a decisive impact on both the national economy and on the temporary and/or permanent migratory flows within the country.

Figure 14



a © M. Bramard - Onema
b © P. Bossard - Onema

Crop farming was one of the driving forces studied when formulating a prospective scenario for the Seine-Normandie river basin.

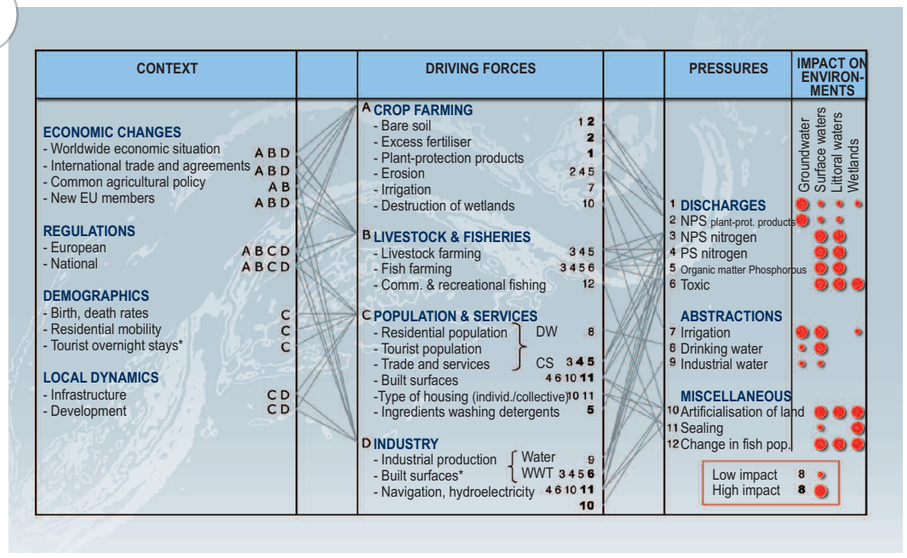
During a second stage, the actual prospective analysis was carried out starting with a complete review of the available literature and three prospective workshops on the sectors causing pollution (population & services, industry, agriculture). Experts from a number of fields (the State, local governments, scientists, representatives of the various professions) contributed to the workshops. This work served to:

- highlight the most important variables in terms of the driving forces and the context;
- study the recent trends in these main variables;
- look at the possible futures in terms of both a continuation of current trends and probable shifts;
- formulate a prospective scenario comprising three versions based on consistent, but divergent sets of trends in variables. Three versions were deemed necessary due to uncertainty concerning the decisive variables.

In preparing the prospective analysis, the entire technical-social-economic system (see Figure 15) impacting water quality was taken into account. However, to assess the trends in pressures and in water quality, the scope was limited to direct, point-source discharges in rivers of macropollutants (organic matter, nitrogen and phosphorus). This was because these discharges are monitored (fees) and geo-located, numerical data are available. Two main reasons contributed to the decision to reduce the scope of the simulation with respect to the entire hydrological and social-economic system determining water quality:

- the difficulty in obtaining basin-wide data and/or models made it impossible to take into account nonpoint-source pollution, notably by pesticides and nitrates (a simplified assessment was carried out for the latter), toxic discharges to surface waters, “artificialisation” of the environment, soil sealing (however, its impact on rainwater run-off was taken into account) and modifications in fish populations;
- abstractions were not addressed because their impact basin-wide was deemed less important than that of the discharges, even if they can constitute a non-negligible pressure locally.

Figure 15



Aspects of the technical-social-economic system taken into account for the simulation of pressures and water quality.
Source: Preparation of the prospective scenario in 2004, Seine-Normandie water agency.

The aspects covered constitute a coherent set capable of providing an image of foreseeable trends that is not complete, but is nonetheless valid, at least initially, given the often preponderant impact of macropollutant discharges on the quality of surface water.

In addition to the dynamics specific to the various stakeholders, notably their demographics, two factors stood out in the characterisation of the possible trends in context, driving forces and pressures.

- The economic situation

The long-term trend of the economic situation is the same for all three versions, i.e. a slowing average growth rate (1.76% on average for the years 1990 to 2000), compared to the rates observed in France over the previous decades (3.2% on average for the years 1970 to 1980 and 2.35% for the years 1980 to 1990). However, there are also strong annual fluctuations in economic growth rates. For example, for a given average growth rate over 15 to 20 years, GDP growth can be virtually stable or it can rise rapidly over a few years, then stagnate.

- Actions by stakeholders to protect water resources

Protection of water resources involves many stakeholders having different powers/responsibilities and variable capacity to modify their position. The overall results of protection efforts may be reduced by just one participant making less effort. In general, the prospective scenario assumes that policies will be implemented within the deadlines. However, delays have already been noted and the difficult economic conditions may hinder some stakeholders in fulfilling their obligations.

Given the above, three versions of the prospective scenario were formulated:

- one version based on a continuation of the long-term trends and that sees the recent shifts in the factors as “background noise” and not as signalling long-lasting changes, i.e. a “steady” version;
- a version seeing certain recent trends as major shifts in the future development of pressures. This version is hereinafter called the “better” version for water protection;
- a version combining the social-economic assumptions of the “steady” version with an assumption of lesser effort on the part of stakeholders to protect water resources, called the “worse” version.

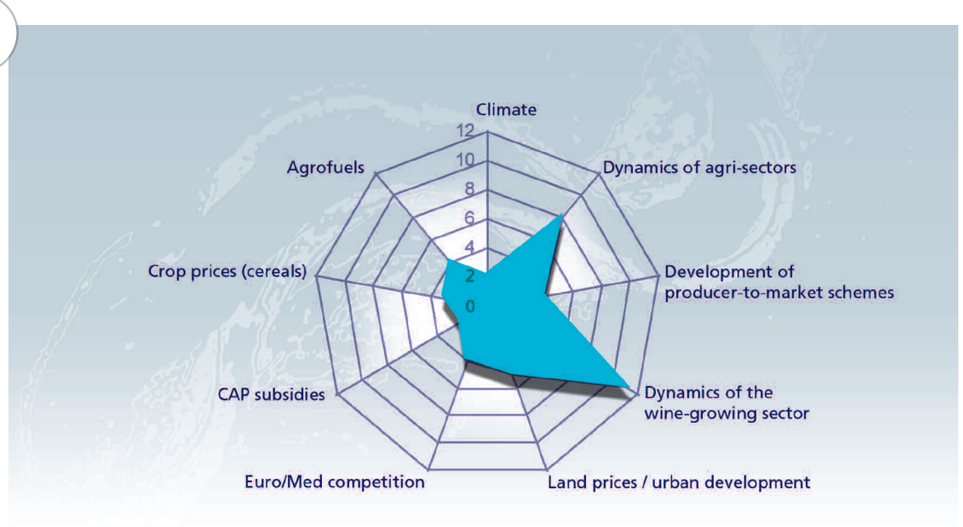
Formulating the prospective scenario for the Hérault SBMP

The prospective scenario for changes in demand for water by farmers was based on a series of meetings in June and July 2007 with some 15 stakeholders involved in water management and from the agricultural sector in the area covered by the study. Factors of change were identified prior to the meetings, on the basis of earlier prospective studies, and presented to the stakeholders. The discussions were an occasion to learn their opinions on the trends noted for the factors and, in some cases, to identify other factors, then to list the factors by order of importance.

The subsequent steps of the process were based on the results of the discussions. Generally speaking, there were a number of possible trends for each factor.

In the opinion of the participants, the factor “abstractions for vineyard irrigation” was the most important for future abstractions for irrigation in the area, as shown in Figure 16. Using this information, three scenarios were devised, one “trend” scenario corresponding to the most probable future situation and two scenarios corresponding to greater and more divergent change. These scenarios were then “translated” into numerical projections on the future surface areas for different irrigated crops.

Figure 16



Main factors of change according to the participants in the study.
Source: Hérault SBMP.