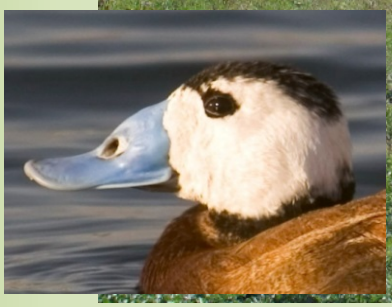
Water management in Periurban Parks: How to promote and preserve this valuable good?



Parc de Collserola

Diputació Barcelona

AMB Àrea Metropolitana de Barcelona

Ajuntament de Sant Just Desvern

Proceedings of the technical meeting held in Sant Just Desvern (Barcelona)
May 22 2014

Fedenatur

European Association Periurban Parks

Contents / Sommaire

Introduction

Water is an essential resource, scarce in much of the world. An efficient and sustainable management of water is paramount, even for rainy countries. Water management has two important dimensions. On the one hand, the provision of water for human consumption and, on the other hand, the provision of enough and good quality water for the environment. These are global challenges, which are of particular importance in metropolitan areas, especially in rural and periurban natural areas where urban and demographic pressure, the implementation of infrastructure and land artificialization produce strong environmental imbalances.

In peri-urban areas, a major challenge is how to revert this situation: how to transform the construction of infrastructures into improvements for landscape and biodiversity?

There are many examples of how some actions on the territory aimed at managing aspects related to the water cycle, such as flood areas, catchment areas , treatment facilities or pipes - eventually acquire an environmental dimension that improves the environment and biodiversity. Thus, for example, the Green Ring of Vitoria - Gasteiz and the Grand Parc de Miribel Jonage are periurban natural areas that act as flood expansion areas. They were initially established to protect cities against periodic floods. Miribel Jonage also supplies drinking water to the city of Lyon.

In recent decades, public agencies have struggled to restore the rivers contaminated by industrial activity. They have installed water treatment plants and have protected river spaces in which, slowly, biodiversity has come back. Good examples are the Canal de Roubaix in the Lille metropolitan area, or the Llobregat river, Besos River and Ripoll River in the Barcelona metropolitan context. The implementation of the Water Framework Directive (WFD, 2000/60/EC) has just given a boost to the recovery of water bodies, including those of weaker flow, such as Mediterranean streams. Periurban parks managers - regardless of water scarcity or abundance - have an obligation to use it rationally, not waste it, not pollute it, promote its treatment and reuse, especially for enhancing biodiversity.

Winning back a canal closed to navigation for 30 years for ecology and tourism

Slimane TIR, President of the Espace Naturel Lille Métropole, President of FEDENATUR

In the 19th century, large numbers of textile companies came and set up in the towns of Roubaix and Tourcoing, close to Lille. To ensure the supply of coal to these factories, an artificial canal was constructed, which enabled barges to bring coal from Belgium via the Escaut River and from the mines of the Nord Pas de Calais via the Deûle. This large 28-km construction links Deûle on the French side with Escaut in Belgium.

The work began in 1827. The Belgian barges were quickly able to reach Roubaix, but it would take another 50 years for the canal to connect the Deûle.

The canal ceased to be used in 1985 with the end of the textile industry, and was then left derelict. Plans were even considered to transform it into a road. First local associations and then local politicians launched a project to recover and restore the canal.

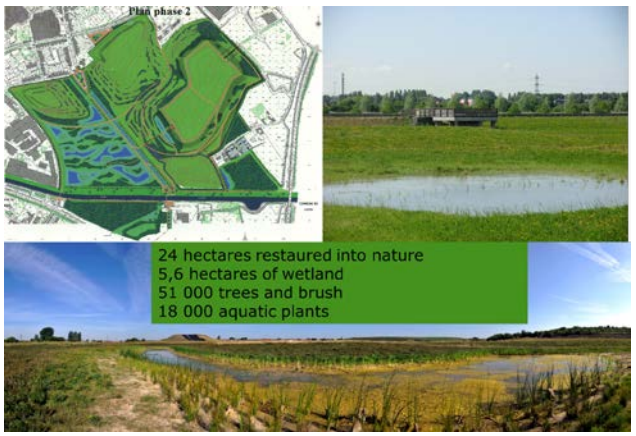
After 5 years of studies and debates, 40 million euros were needed for the scheme, and the 3-year project finally began in 2006. 13 locks and 5 bridges were restored, and 240,000 m3 of polluted sediment was dredged out. The canal was opened for shipping once more, from the Deûle to the Escaut, in 2011.

2009, Blue Days : cease of works in French side
2011: opening Deûle-Escaut connection

This opening to shipping was accompanied by an ecological regeneration of the quality of the water and the canal-side vegetation, resulting in the creation of a long ecological corridor.

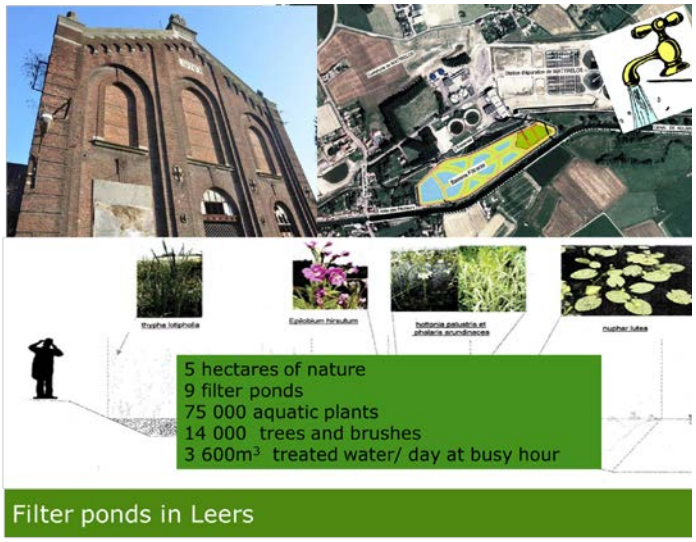
This corridor extends out into abandoned industrial sites, which are now being transformed into nature reserves. The largest project is the transformation of a 46-hectare patch of industrial wasteland. For a budget of 13 million euros, 360,000 m3 of material has been brought in to cover 130,000 m3 of sediment removed from the canal. To date, 24 hectares have been returned to nature. A wetland zone of almost 6 hectares has been recreated and 51,000 trees and bushes and 18,000 aquatic plants have been planted.

Transformation of a 46-hectare patch of industrial wasteland

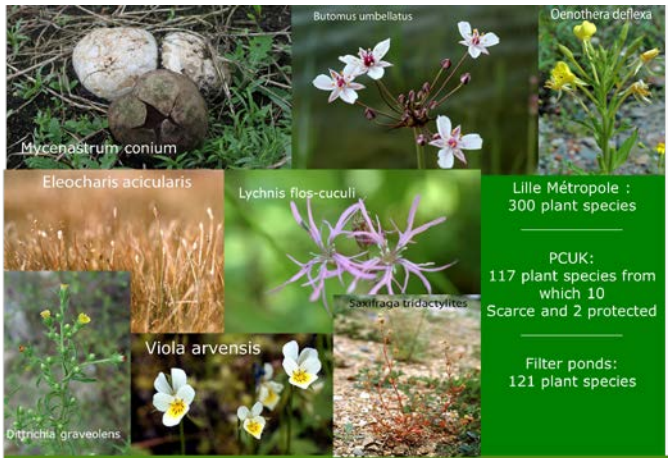


Restauration of an industrial site PCUK (Produits Chimiques Ugine Kulhmann) into a nature site

Likewise, at the outlet to a water treatment plant, filter ponds have been constructed over 5 hectares of land where the final purification takes place thanks to 9 pools of aquatic plants. The treated and purified water then goes into the canal. In addition to the innovative water treatment, the canal is also subject to an ecological management plan.



We regularly monitor the evolution of the flora and fauna, the return of which has been rapid. The overall Lille Métropole area boasts around 300 plant species. While the original industrial site had barely thirty species of plants, the regenerated site currently boasts 117 species including 10 rare and 2 protected species on what was until recently industrial wasteland. As for the filtering ponds, they are home to some 121 plant species.



In terms of wildlife, there are now 75 species of birds and 12 species of fish right in the heart of the town. The inventory is ongoing, and the curve continually rising.

This requires extremely regular monitoring of the water quality and of the treatment of the surrounding area.

12 fish species

The quality of water is constantly checked

Until recently no more than an open-air sewer, the canal has now been brought back to life, and has an important social function.

From April to October, pleasure boats from France, Belgium, Holland and sometimes much further field are an ever-increasingly common sight on the canal. To date, no less than 305 boats have already travelled along the canal.

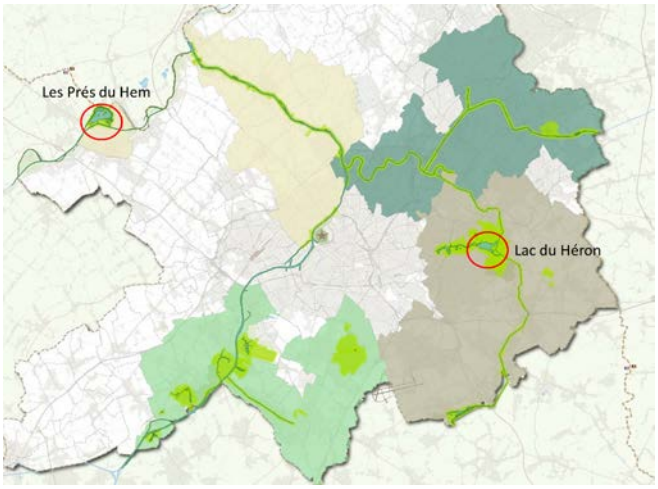
305 boats from the opening of the Canal de la Deûle

The canal used by people

The treatment of invasive plants in ponds managed by the Espace Naturel Lille Métropole

Pierre DHENIN, Managing Director of the Espace Naturel Lille Métropole

At the heart of Lille Métropole, the ENLM manages almost 90 kilometres of canal banks and, above all, a series of ponds and lakes, of which two exceed 30, and even 40 hectares in size. The Prés du Hem Lake in Armentières and the Héron Lake in Villeneuve d'Ascq regularly face problems concerning the proliferation of exotic plants. The Espace Naturel Lille Métropole is currently undertaking various experiments to control this growth.



The Héron Lake in Villeneuve d'Ascq and Western Waterweed

Western Waterweed has been massively present on the 32-hectare lake since 2012. In 2013 it invaded almost 95% of the lake, making sailing activities impossible from the end of May. Its decline was spectacular from August onwards. The plant's rapid disappearance has no obvious explanation. Since 2014, no visible return of Western Waterweed has been observed; indeed, there have been no recorded observations at all.

Western Waterweed (*Elodea nuttallii)* is a perennial aquatic plant originating in North America. It occupies a vacant ecological niche and reproduces by budding. It interacts with various local species, acting as a growth support for filamentous (threadlike) algae. Costly weed cutting trials have not provided convincing results. We have avoided using any chemical-based control techniques. The aquatic wildlife has especially appreciated this invasion: we have observed a rise in the numbers of fish, amphibians and birds using this plant as a hunting ground.

The Prés du Hem in Armentières and hornwort

It arrives regularly at the beginning of the season and requires several days to several weeks of cutting every year in order to keep the waterway navigable.

Ceratophyllum demersum, **hornwort or coontail** is a fast-growing plant. It poses problems regarding competition with the existing algae (competing for nutrition) and reproduces extremely easily both by budding and from seeds.

Control options

Managing hornwort remains difficult, and the operations to control the plant frequently prove counter-productive, encouraging its expansion even further. The following trials are worthy of note:

-**Manual/mechanical uprooting** – a technique that can reduce the proliferation dynamic of the species provided that the cutting is only undertaken once the plants have reached maturity. This method also has the advantage of limiting the effects of 'harvesting' on the populations of fish and their young.

-The use of **herbicide chemical treatment** to deal with hornwort is problematic due to the resilience of the species (allelopathic effect of the periphyton) and the secondary consequences on the rest of the aquatic ecosystem.

-**Biological combat**: while consumption of the plant by gastropods (*Lymnaea stagnalis* L.) does not represent an effective biological control measure on its own, it would appear to be beneficial when used alongside other control measures.

Concerning the species in the Héron Lake, it has managed to colonise the entire lake within the space of a single season, favouring the deepest water zones. Its development has not been detrimental to the indigenous species however, since it occupies a vacant ecological niche.

The mechanical weed cutting trials undertaken on the Héron Lake in 2013 were not particularly fruitful. The trial period was too short and the area to be cut was too large, and the results were therefore disappointing.

We have also trialled the use of water turbines to mix the lake water and thus disturb the life cycle of the cyanobacteria, but we would have needed to have covered the lake with at least ten turbines (3 tested over several years), representing a significant investment in return for modest results and unavoidable pollution.

Similarly, we tested the use of submerging bundles of barley straw in the lake to create a competitive shock with the plants, but here too the results were disappointing, with the deterioration of the bundles causing a problem in itself.

Based on the experiences and feedback, especially at the Près du Hem Lake, the weed cutting solution over the entirety of the lake would seem to have undesired effects, which represent more of a nuisance than the presence of the aquatic plants. It has frequently been observed that following weed cutting operations the cyanobacteria (primitive bacteria - formerly known as “blue-green algae”) take advantage of the absence of competition (for food resources) to proliferate in extremely large numbers.

The consequences of the presence of significant quantities of cyanobacteria are numerous:

-Colour of the water ranging from blue to green depending on the concentration of bacteria

-Sickening smell

-Cyanotoxins: In an aquatic environment, numerous species of cyanobacteria can produce toxins.

Other effects must also be considered, however, such as the 'positive' interaction with local species, which can help to boost the growth of primary producers such as the epiphytic algae, and protect against the appearance of cyanobacterial bloom.

When the Western Waterweed developed rapidly on the Héron Lake in 2013, we observed various positive environmental effects:

- Presence of thousands of fish larva in the lake
- Excellent reproduction of amphibians, dragonflies
- Greater presence of 'fishing' birds (little egrets, etc.)

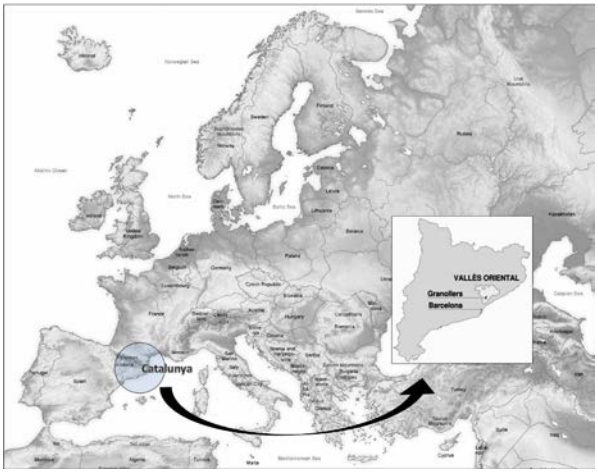
On those lakes that are less interesting from an ecological standpoint, such as the Héron Lake, the presence of these invasive species only has a negative impact on human activities (sailing, fishing).

Restoration of Can Cabanyes natural space to enhance biodiversity in the river Congost. Reuse of water at municipal . The project Sud Eau

Xavier Romero, technician Granollers City Council

1. INTRODUCTION

Granollers, capital of the region of Vallès Oriental, is a medium sized (60.000 inhabitants) city located in the second crown of Barcelona in the autonomous community of Catalonia (Spain). The city, which creates a great conurbation together with other 3 municipalities, still preserves some natural areas of great interest, such as the agricultural area of Palou and the river Congost, a tributary of the river Besòs which is included in the Natura 2000 network.



1. Location of the municipality of Granollers

The river Congost is a typical Mediterranean regime river that crosses longitudinally the entire municipality of Granollers from North to South, along 6,7 kilometres. It gave the name to the city because "Granollers" comes from "Granolla", the former Catalan name of frog, an amphibian that used to be plentiful in the wetlands of the river.

Human activity has always had a significant effect on the river, whether it is because the impact of agriculture or the water exploitation. In the oldest picture of Congost in Granollers, taken in 1927, the river was already a habitat without riverside vegetation and full of allotments.

2. River Congost and Granollers in the year 1927

At that time, Congost was still a free river with a width of 250 meters in some parts, as well as a distant city from the fluvial area. This situation will continue until the sixties, when population growth, rapid urbanization and industrialization started a continuous and intense degradation of the river. Furthermore, after the devastating flooding of 1962, it was decided to channel the river, firstly in a simple way but later, between 1974 and 1979, with the construction of a concrete wall.

Both the pollution and the channelling works, which didn't take into account the river Congost as a natural habitat, caused that Congost was a river without life and social use. The situation was so dramatic that national media considered the river Congost and the basin of river Besòs like one of the most polluted fluvial areas in Europe.

3. River Congost severely damaged in 1974

The first restoration actions were carried out in the nineties, starting with the construction of the Granollers water treatment plant in 1992 and later with the development of actions to restore the values of the fluvial landscape. These projects were well accepted by local residents, who appreciated the results, especially the fluvial promenades built in riversides. From the technical point of view, these first actions dedicated special emphasis on landscape and social issues, but didn't pay much attention on the ecological aspect, something that was solved in the next fluvial interventions.

In 2006 a new management of the river Congost began with the development of projects specifically focused on biodiversity. These actions with direct effect on species and habitats are still in progress and its outcomes have been broadly recognised as a good practise model in urban river management. As a result, river Congost was included in the Natura 2000 network in 2006 and the municipality of Granollers was awarded as one of the Spanish Capital of Biodiversity in 2011.

4. Image of the river in the city centre of Granollers in 2013

2. MANAGEMENT MODEL

The current management of river Congost in Granollers is based on three objectives:

1. Advance in the environmental restoration of the river habitat
2. Promote the social recovery of the river
3. Boost the green economy around the river

3. ACTIONS

The City Council of Granollers has carried out three different actions in order to restore the river Congost for last 15 years:

- Biodiversity projects
- Social projects
- Big projects of sustainability

3.1 Biodiversity projects

These projects work basically on the restoration of the ecological values in river habitats. Obviously the objective couldn't be to restore the original conditions of river Congost habitat, something unlikely after the negative impact suffered from the sixties to the eighties. The current approach is much more realistic and the restoration projects carry out actions to naturalise the river such as the followings:

- Foster the establishment of native riparian vegetation, particularly where the invasive vegetation is present.
- Use of bioengineering techniques for erosion control and diversify the flora species
- Creation of refuges for fauna and microhabitats
- Elimination of barriers for fauna (mainly old hydraulic constructions)
- Creation of fishpaths

5. A naturalised river and fluvial promenade, two good examples of the ecological and social recovery of the Congost in Granollers

3.1 Social projects

The restoration of Congost like a natural habitat has been followed by a social recovery of the river area. In the past, riversides were seen like marginal areas of the municipality, but today they has achieved a significant social recognition and fluvial promenades have become popular public spaces.

A wide variety of activities have promoted the social recovery of river Congost:

- Health and sport: hikers, joggers and bikers are the main users of the river. Between 400-1000 visitors received daily the fluvial promenade, a high attendance if you take into account that Granollers has 60.000 inhabitants
- Routes: different itineraries go over the river Congost, some of them with sporty purposes (the 10 km trail for prepare the famous half marathon of Granollers), and others to discover the nature (Can Cabanyes green belt) or to improve your health (three routes to enjoy walking by the river)
- Municipal allotments: this is an area for family farming where 100 local residents grow their vegetables in a sustainable way (drip irrigation; reduce use of pesticide, technical support of the city council to the peasants...)
- Rural landscape: River Congost and the neighbouring agricultural lands of Palou are the principal natural heritage; therefore many activities have been developed in order to preserve both the landscape quality and the promotion of farming in Palou.
- Environmental education: The River Congost has its own environmental education centre, where annually thousands of students visit in activities organised by the local Natural Science Museum.
- Science: Congost is also a river which has developed its own scientific potential. From fauna and flora inventories (remarkably relevant in butterflies and bats communities) to scientific studies of reusing water in the constructed wetland of Can Cabanyes, the river Congost is an important scientific hub that has received visits from delegations from Sweden, Germany, Mexico, China and Vietnam among others.

3.3 Big projects of sustainability

The Granollers City Council and different national and European public administrations has executed two recognised project in the river Congost area.

One is the project “Restoration of fluvial environments” that recovered almost 2 kilometres of the riverbank. Some innovative works were included in this project, such as the integration of the old concrete wall; an action was the first time executed in Catalonia. This ambitious action was based on hydrogeomorphological studies and enabled to enhance the ecological connectivity between the river and the fields of Palou.

6 and 7. Integration of the concrete wall in Palou.
Before the project (left) and once the project was finished (right)

On the other hand, Can Cabanyes wetland is likely the most well-known project of Granollers. It is a tertiary treatment wetland which has a double aim: biodiversity and production of reused water. Between a 2 to 5% of the effluent of the water treatment plant of Granollers goes to the Can Cabanyes wetland, where after 20-40 days the waters flow to a Reused Water Treatment Plant. There, it is a treatment of chlorination and filtration and finally the new produced waters are pumped to the Granollers non potable water network, which basically is used to irrigate the green areas and to have water for street cleaning. This project is the key element for boosting the green economy around the river, especially when the optimum objective of supplying reused water to agriculture and industry will be achieved.

Image 8. Circuit of waters in Can Cabanyes wetland,
main point of the Granollers network of non-potable water

4. SUD'EAU 2

As it was mentioned before, the Granollers City Council has cooperated with different organisations and public administrations in order to advance in the naturalisation and social recovery of river Congost. Nowadays, it is taken part of one successful European Project named SUD'EAU2, an initiative funded by the program SUDOE.

9. Illustration of SUD'EAU2 from the website sudeau.eu

A total of 8 organisations and institutions from France, Spain and Portugal are participating in the SUD'EAU2 project with the objective of improving and developing the sustainable management of water resources and rivers. This work is part of SUDOE, an inter-territorial cooperation programme in the south-east European area. The aim is to give continuity to the methods and best practices introduced in the first edition of the SUD'EAU project.

SUD'EAU2 project will be developed until the end of 2014 and their expected outputs are best practice online publication, the execution of 27 experiences of reference, the creation of a toolbox for water management and the study of setting-up a cluster of water, maybe in a third edition of the project.

XAVI ROMERO
(Environmental Officer)

xromero@ajuntament.granollers.cat
GRANOLLERS CITY COUNCIL and SUD'EAU2

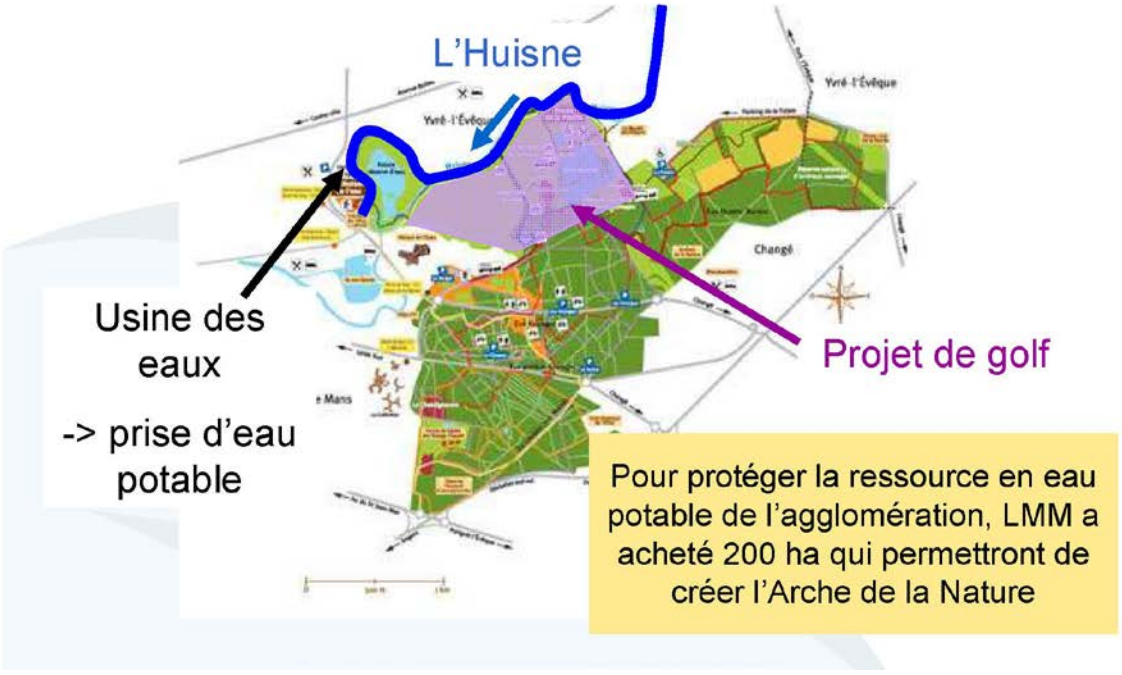
Water, an educational challenge for the Arche de la Nature (Le Mans)

Isabelle SEVERE, Deputy Mayor in charge of Children in the town of Le Mans
Florence PAIN, elected in charge of natural peri-urban areas, in the urban community of Le Mans

L'Arche de la Nature is a natural area of 450 hectares, located on the outskirts of the city of Le Mans, where the water is a major component. Actions under this theme are mainly related to environmental education, with awareness raising activities aimed at the general public and schools. The objective is to inform and spread knowledge in order to better preserve this resource.

1. Water at the Arche de la Nature

The history of the Arche de la Nature is directly related to the objective of preserving water resources: water supply for the drinking water plant that serves the Le Mans agglomeration is carried out directly from the river Huisne. However, in the 90s a project was born to create a golf course, upstream of the water intake. To oppose to the project and ensure the preservation of water quality, the Urban Community decided to buy the areas concerned. Thus the surface of the current surface increased from 250 to 450 ha, and a few years later, the Arche de la Nature was created.



L'Arche de la Nature, although representing a relatively small geographical area (450 ha), addresses three themes on a single area:

- Orchard : farm with a conservatory, a kitchen garden, fields and a network of hedges,
- Forest : with 300 ha of woodlands crossed by numerous trails and the House of Forest,
- Water: with a pond, a river (*Huisne*) and the House of Water.

The site provides a variety of supports for addressing the topic of water under several aspects:

1. ecosystem → with the presence of a river
2. planning → with large fields that act as flooding expansion areas

3. drinking water production → with the restauration of the old drinking water factory in which it is presented the history of water treatment and explanations of current drinking water production
4. energy production → with the installation of a small hydroelectric plant

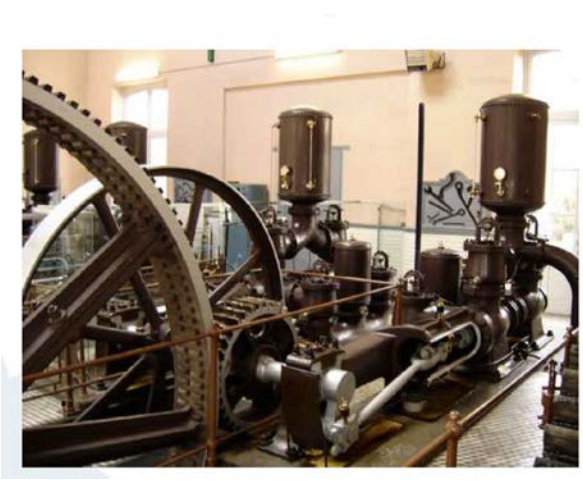
The goal for the Arche de la Nature is to inform and educate to better understand and preserve:

- the general public : 3500 people received each year (about 3000 + at themed parties : festival of water and energy, little beasts festival, Heritage Days)
- School : 3,000 children per year

This is done in a privileged place: the Water House, which thus receives nearly 10,000 people each year.

2. House of Water

The Water House is a museum dedicated to the theme of water.



This is the old plant for drinking water production from Le Mans agglomeration. It dates from 1906. The older machines have been preserved and restored, so as to illustrate the technological evolution: the use of hydropower (with two- hydraulic wheels of 8 m diameter), the use of steam and finally the use of pumps with electrical power, still operating. Machines (wheels, gears) illustrating the different techniques are switched on during public visits.

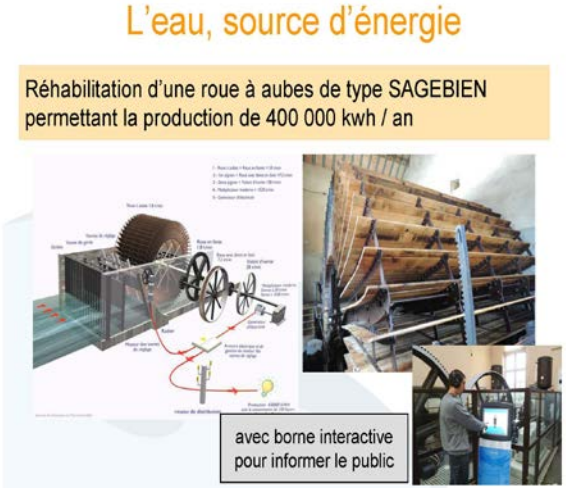
In the House of Water the public can find three large aquariums 5 m long, representing different areas of the river, from upstream to downstream: the trout area, the barbel area and the bream area. Other aquariums include small species: walleye, bitterling, studs, etc.

An exhibition complements the theme of "inhabitants" of the river, with a large mural showing a section of the river, and small interactive modules.

Another theme of the permanent exhibition is "**water as an element of life**": water in our body, the river through the seasons, the processing steps of the water cycle water, water and energy cycles, reproductive cycles of aquatic animals, respiratory adaptations, and movement patterns in the water...
L'Arche de la Nature chooses fun educational support that makes learning fun.

A panel showing the functioning has been installed, and a screen connected to sensors for viewing live production of power. In addition, a terminal touch on the theme of hydropower has been set up in the building.

Water is also discussed as a potential **source of energy**: hydraulic plant had two impellers of 8 m in diameter, which were used to send drinking water to the tanks. One of them was rehabilitated to help understanding this operation. The second has been restored, but with the objective of producing **power:** it may well produce approximately 400,000 kWh / year, which, excluding heating, corresponds to the consumption of 150 households.



Water is also an essential element in **planning**. To illustrate this topic, the Arche de la Nature uses different elements:

- Establishment of a management program to maintain the banks (creation of embankments, maintenance of plant species ...) and fight against invasive species.
- Large fields along the river correspond to an area of flood plain: each year the river overflows its banks and flows onto the adjacent areas that act as a reservoir to protect urbanized areas downstream from flooding.
- The Arche de la Nature participates in the development of the green and blue infrastructure of the town, which will be incorporated into planning documents.

3. Water for recreation

Water is also a great place for recreation. Thus, every two years, the Arche de la Nature organizes a "Water Festival ", which combines different structures. Between 3 and 5,000 people comes on the site for this festival.

A fishing path has been also located on the site. A pond is open to all, to learn about the practice of fishing without needing a fishing license.

Finally, to go to the river in an original way, a canoe rental service, managed by an association of insertion was established in 2009.

In conclusion, even if the Arche de la Nature has no major development project on the theme of water conservation, it makes education a priority to pass messages related to the need to preserve of this valuable resource, essential to sustain life.

Conservation and recovery of the Ripoll River in its crossing by the Sabadell city

Núria Centelles Rabadan, Section chief of Ecosystem Management,Sabadell City Council
Núria Saperas Sagués, technician of the Water Cycle management, Sabadell City Council

The Ripoll recovery project was born with the purpose of stopping its degradation, stimulate its recovery and design a future where social and economic use are compatible, while its natural uses and environmental and connectivity values are respected.
The Ripoll River is a tributary of the Besòs River and is 40 kilometers long. The Ripoll basin covers an area of 243 km^2 and runs, passing by Sabadell, embedded in an anthropized territory, with a landscape of slopes and alluvial terraces. Like all Mediterranean rivers, it is characterized by a low and seasonal flow, and rare but important avenues.

Because of its location near the city, it has the uniqueness of being a point of contact between the urban and the rural.

Improving the water quality of the Ripoll is one of the key points for the recovery of this environment. This point is based on two aspects: the sanitation system and water reuse.

The system of basic sanitation in the eastern side of the city of Sabadell is constituted by the interceptor collector of the Ripoll, which lead the sewers of the neighborhoods and the industries, and the pumping station of Sant Oleguer, which drives sewage to the treatment plant of Ripoll, which addresses these waters and returned them to the river through a drain or an outfall.

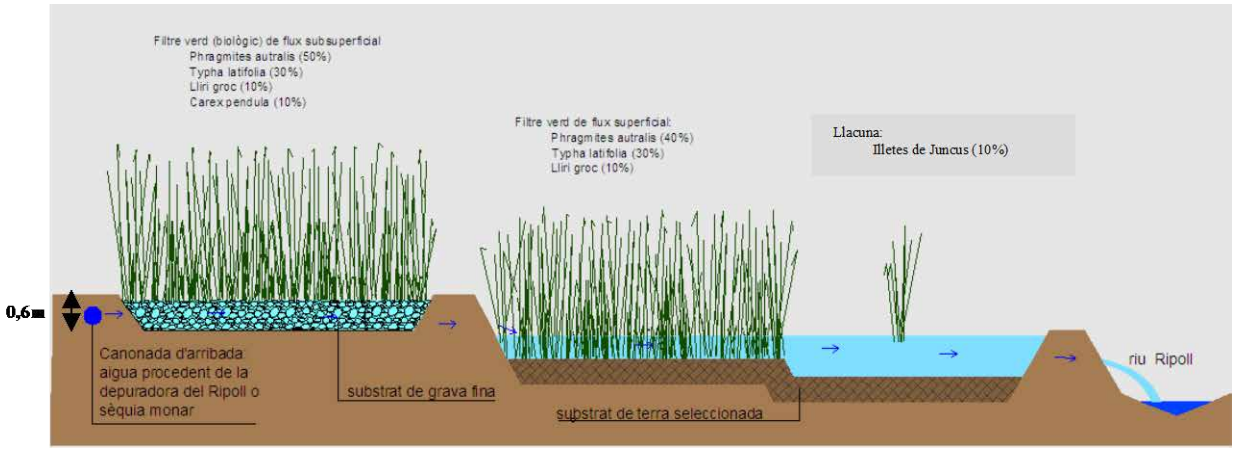
The construction of the collectors in Can Roqueta and in Poblenou allowed connecting waste water from these areas with the water treatment plant of Ripoll. At the same time, small connections that were pending in the construction of the collector interceptor will be made.

Automatic quality wastewater control network installed in the collector of the Ripoll (SYCHAR), composed of a series of points where are measured continuously different parameters indicating the water quality of the collector, is a key tool for the proper sanitation management and serves as a warning system when there are contaminants that may endanger the collectors or the treatment plant.

The treated waters at the treatment plant are returned to the Ripoll River through an outfall that flows into the river in three different places;
- Sant Oleguer (12,000 m3/year), end of the municipality at the south

- Moli Torrella (10,000 m3/year), middle of the municipality
- Torrent Colobrers (8,000 m3/year), end of the municipality at the north

With the return of treated waters, a superficial minimum flow for Ripoll is maintained, favoring the aquatic recharge of wells and the establishment of an aquatic flora and fauna.
In 2008 the area of tertiary natural treatment of waters of the EDAR Ripoll / Monar canal was completed, intercepting the outfall and the canal and, by treating 3 biofilters of horizontal sub superficial flow and 1 final filter of superficial flow, allowed:
- Providing better quality water to the river to improve the ecological state
- Improvement of the flora and fauna
- Improvement of the landscape quality
- The system allows the option of water reuse in the future for irrigation of green spaces in the area
- The choice of a subsurface system prevents the proliferation of mosquitos and bad odors



Water is a scarce resource in the Mediterranean regions. Saving and water reuse are essential for its sustainable management.
Sabadell is deficient in water and must import it from the Ter and Llobregat hydrographical basins to supply the population. The use of local water resources and the reuse of treated water contribute and should contribute more to reduce this imbalance.

Sabadell has a director Plan of external water supply to the distribution network of drinking water since 2004 and revised in 2014 with a plan of action 2014-2024. The external water reuse plan was born with three main objectives: save water, substantially reduce the water consumption of the drinking network and enable the use of external water to the drinking network.

From various facilities existing in the city, mines (Ripoll, Ribatallada and Mari), wells (Can Feu and Ca n'Armengol) and MBR sewage treatment of the Riu Sec, you can treat the water and give it the desired quality for applications that you allow in compliance with the current legislation and distribute it with an independent supply network of non-potable water.

This independent system provides water for the irrigation of green areas, street cleaning, sanitary discharges and filling of some municipal pools and the future possibility of supplying water for industrial uses.

The plan of off-grid water reuse to the red works in compliance with the European Framework Directive.

In the 90s, the environmental awareness began to develop and means for the Ripoll River the end of the degradation process that had been experienced with the urban growth of the fifties. The full recovery project comes with the intention to stimulate the recovery and design a future where the social and economic use is compatible with natural and environmental value.

The Ripoll recovery is now a reality thanks to the support of the European Union through the Cohesion Fund. In total the project of the recovery of the Ripoll River Park has performed more than 44 million euros investment.

The set of actions is enabling the Ripoll environment to be a nice and quality space which you can enjoy walking, cycling or simply watching the animals and plants species inhabiting. The axes of the comprehensive recovery plan of the Ripoll River Park are:

1. Improving water quality.
2. Recovery and protecting margins and riverbed.
3. Recovery of the leisure space.
4. Recovery and improving of the industry and its environment.
5. Vegetable garden management and disposal of marginal vegetable gardens.
6. Recovery of industrial and architectural heritage.
7. Landscape recovery.
8. Improving access and itineraries.
9. Maintenance, monitoring and dissemination.

The project to protect the banks and bed improvement of the Ripoll includes the creation of the river road, improvement of the bed and protection in front of avenues with embankments, gabion walls and the raising of existing concrete walls in the Ripoll environment, among other landscape improvements.

Water, vegetation and wildlife, are the most visible indicators to assess progress in the recovery of the river. These elements adapted to the characteristics of the place, are the typical biological resources of the river environment, of which diversity can be maintained and increased to enhance biodiversity and natural heritage.

With the landscape intervention of the creation of a water retention area in Ripoll, in the Can Puiggener area, a landscape that evokes water areas, wetlands with its riparian vegetation was recreated. This element allows enriching the appearance of the river and combining stream water areas, with the characteristic noise associated, with areas of standing water.

Linked to the water surface, a seating area has been created where you have planted poplars, oaks and ashes. In the floodplain, to recover the riparian forest, reeds, water lilies, cattails, Carex and willow stakes have been planted; elements of bioengineering also have been used to stop erosion (fiber rolls of vegetated coconuts).

The recovery in this area has made the comeback of different species of birds that nest in it, like duck, grebe, moorhen and finch. Other seasonal species have also been able to observe such as kingfisher, heron, egret and cattle egret. The improved water quality has become possible this increased biodiversity; in the river, in addition of birds, we can find species of fish such as chub, barbell and carp.

With increasing populations of fish and to ensure the maintenance and survival of these, fishing in the river was regulated. Two thirds of the northern stretches of the river have been declared fishing lodge and the southern stretch as free fishing zone without death.
For maintenance of the ecological connectivity, the Ripoll has in Sabadell 9 channel regularization dams and in the last five years, the creation works of 7 wildlife passages have been conducted, being executory 2 to take all unobstructed stretch for connectivity.

The Ripoll recovery seeks to incorporate a new activity which has traditionally been developed, with the intention that it is public and allows the fluid contact between the city and the river environment. A set of spaces with different functions are organized along seven miles of the river crossing in our municipality, adapted to the geomorphology of the river area and in order to offer the widest possible range of activities related with free time and enjoyment of nature.

The repertoire consists in the creation of four medium-sized public parks and appropriateness of a set of small spaces, generally located along the river road, offering the walker a chance to rest next to a fountain or in a grove and complemented with some occasional furniture. The linchpin of connection and relationship

between all these parks and rest areas is the river road, which connects the communication cross access roads with the city and the countryside.

The low river terraces have been historically occupied by agricultural activities and have used the dams and canals to irrigate. Some of these areas provide food for a long time into the city, before modern growth. Today, these areas of orchard survive and maintain their activity, providing a distinctive landscape of subdivisions, product variety and geometry.

Between 2002 and 2009, the usufruct of different garden plots has been recovered, becoming municipal property. Until now, a total of 668 orchards and 578 buildings have been removed. Can Roqueta orchard has yielded to the organizations of the city and the rest has been awarded through public competition for the citizens. At present there is a regulatory orchard ordinance in the town of Sabadell, which determines the functionality and value of these garden spaces to regulate and manage the set of orchards of the city.

The Ripoll River is one of the only rivers of Catalonia with a large presence of protoindustrial productive elements: Monar ditch, water mills, ice wells and lime kilns. While in other areas of Catalonia these buildings have disappeared due to urban growth and land-use changes, in our municipality interesting examples of proto-industrial architecture have survived, all along the river: Sant Oleguer mill, En Fontanet mill, Petit mill, En Torrella mill, En Font mill, En Mornau mill, in addition to the Monar ditch and a medieval orchard area.

Among the most outstanding performances, there is the rehabilitation of the most iconic mills, such as Sant Oleguer mill that houses a youth hostel.

The project of recovery and improvement of the Ripoll margins has begun the process of recovery of the river with all the elements that are part of the scope and conduct a dissemination strategy to publicize to the Sabadell citizens the new space that they can enjoy, for which they have conducted a series of studies and publications that serve both as a tool and as diffusion of the Ripoll.

Regarding the recovery and landscaping improvements, several projects along the river have been carried out. One of the most recent have been the restoration of the margins of "Colobrers Torrent" where, to prevent erosion of margins, the incorporation of bioengineering techniques (fiber roll, rock and roll deflators) has intervened, removed the American cane and by planting native plants.

The six municipalities of the Ripoll River Basin signed an agreement to draft a study of landscape recovery of the Ripoll. This paper begins with an analysis of the current situation, determines the common criteria for recovery and landscaping improvement, preservation of biodiversity and biological processes, analyzes the social uses compatible with the preservation of the space and provides proposals for concrete actions for the recovery and landscape improvement.

The study identifies nine strategic lines of action in relation to the problems associated with the field:

1. Considering the landscape as a benchmark for performance
2. Improving the structural weaknesses of the landscape.
3. Resolving urban inconsistencies.
4. Improving accessibility and mobility.
5. Acting on existing non-conforming uses.
6. Minimizing the associated risks.
7. Valuing the cultural and historical heritage.
8. Projecting in a compatible way economic activities.

Ángel Marhuenda Fluixá, chief Service Devesa-Albufera

The Albufera Natural Park was declared in 1986. This is the first declared park in Valencia Community. It has more than 21,000 ha, of which about 14,000 are occupied by rice cultivation. More than 5,000 ha of the rice surface have been gained from the Lake to the known "Tancats".

In the Natural Park varied ecosystems exist; although the rice field has a great landscape value generating biodiversity for birds it shelters, the most valuable areas in the park are Devesa Mount and Albufera Lake. The Devesa public forest has close to 800 ha surface, while the lake occupies an area of 2,700 hectares.

1. Location of the Devesa and the Albufera Park

Brief History of the Albufera Lake

The first river branches that reach the Albufera date from the late tenth century, in the Andalusian era, and come from the Turia River, through the canals that irrigate the valley of Valencia, on the right bank. But the low volume of surplus of this system that reach the lake along with the contributions of the natural cycle (just over 100 hm3/year in total) are insufficient to substantially modify the character of the ancient marine lagoon, then some 14,000 ha of extension and frankly communicated with the sea through a unique "gorge"

of large amplitude. In the bottom of Alcati, fed by the waters of the lagoon, were working the salines that will last until the seventeenth century.

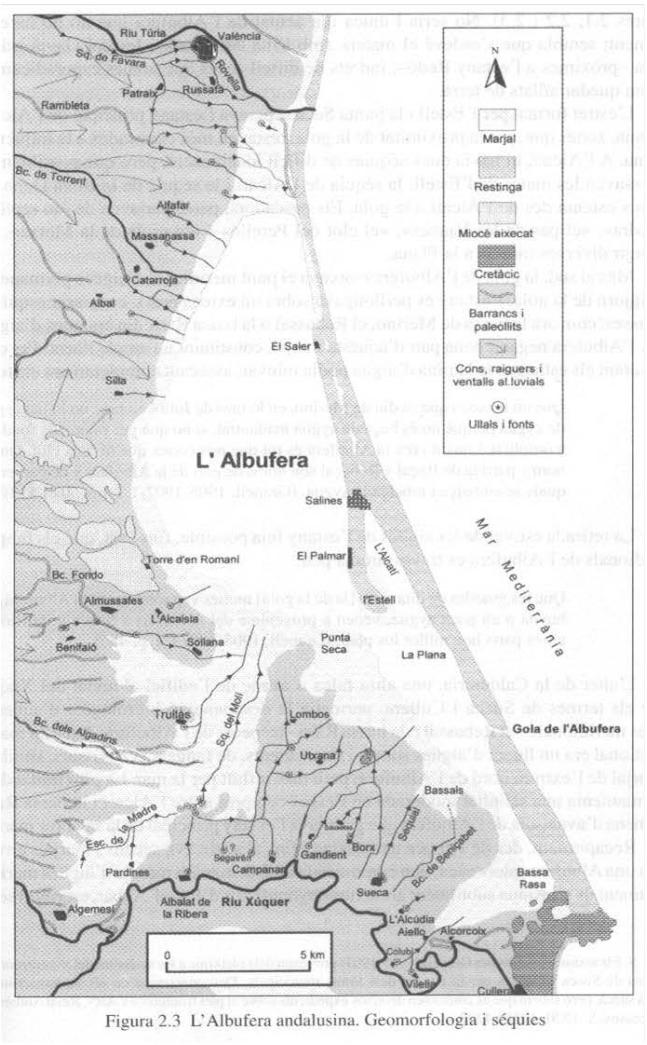
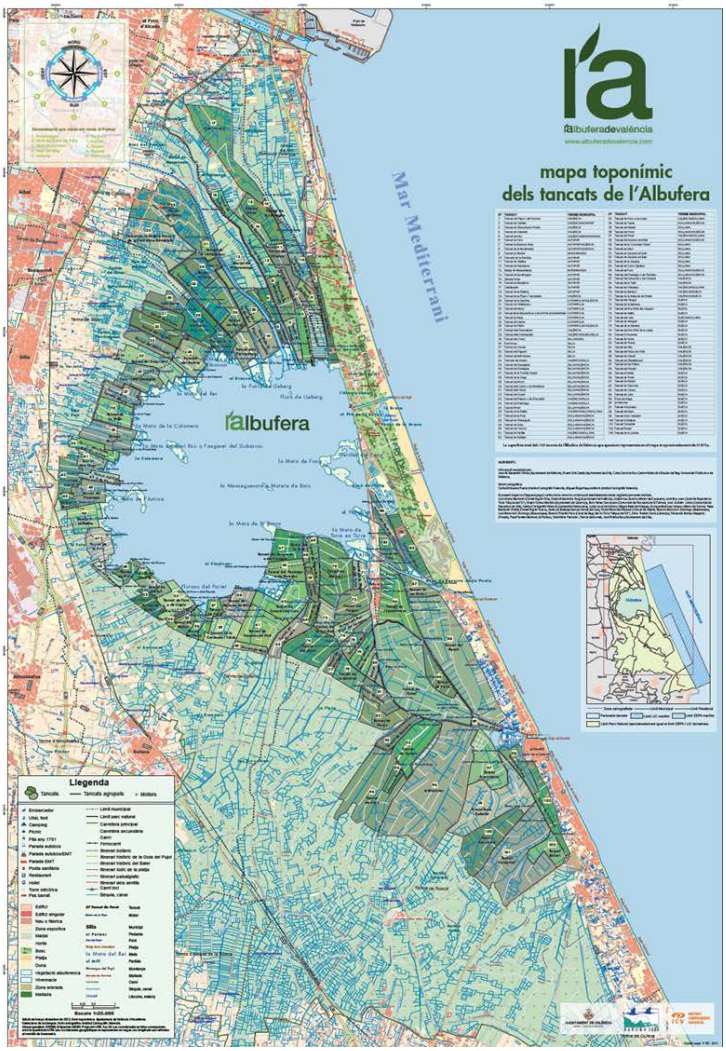


Figura 2.3 L'Albufera andalusina. Geomorfologia i séquies



2. L'Albufera in the Andalousian era (left) and at present (right)

The start of the hydrological dependence of the lake of Júcar (Xúquer) river waters date back to the late fifteenth century, with the opening of the drought of Campana, the first documented diversion of the water of this river directly for the ancient Albufera lake, and that marked the beginning of the rice growing on its banks.

The hydraulic expansion will continue throughout the seventeenth century: the canals of Carcaixent and Escalona are created and then the ones of Sueca and Cullera building fixed weirs.

The process culminates around the year 1800, when the construction of the second section of the Júcar (Xúquer) Royal Canal was completed, which carries the waters of this river to contact the area served by the canals of Turia, creating a continuous irrigation of over 30,000 ha, around the Albufera.

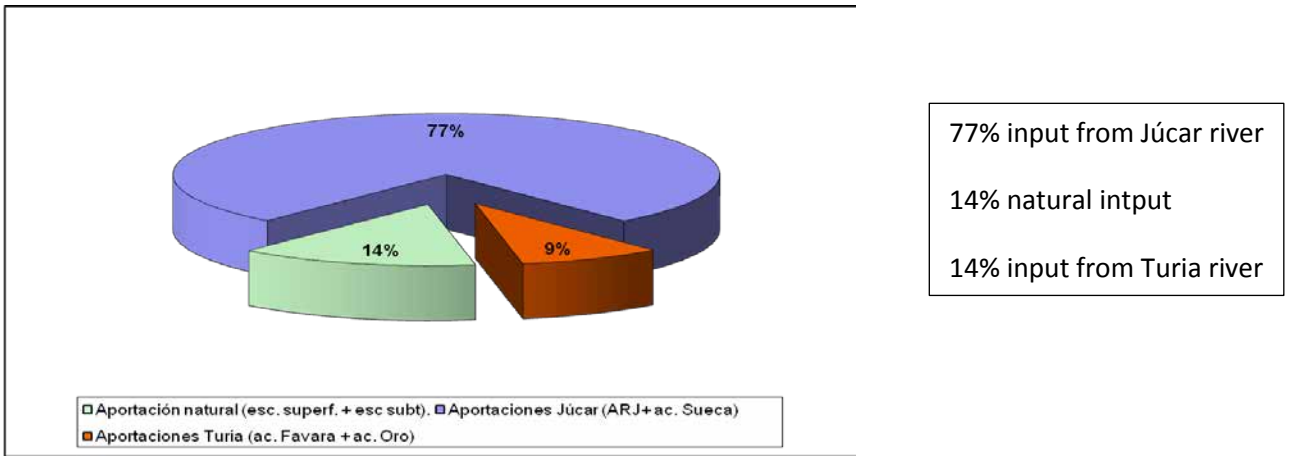
From this moment, about 1000 hm3 come annually at the Albufera from the Júcar (Xúquer). Freshwater received by the lake in the fifteenth century were multiplied by 10. It can be said that it becomes, in fact, the estuary of Júcar (Xúquer), as most of the river flow is derived to the new irrigations created around the wetland (through the Real canal of Júcar and Sueca and Cullera canals).

It is these flows of river water that drove the implementation of both the cultivation of oranges in the regions of the Ribera, as the cultivation of rice in the edge of the lake.

Thus was born the contemporary Albufera, the preindustrial Albufera that still survives in the collective imagination and fascinated historians, novelists and scientists. Certainly an intervened and partially transformed wetland, but which still manages to integrate the traditional thriving fishing and a thriving agricultural activity – that becomes as traditional as inherent to the landscape - while a natural system of extraordinary quality progresses, with clear waters and a high biodiversity that inhabits the waters of what is left of the lagoon and marsh rice field that is close.

The causes that led this unique ecosystem to the state of degradation suffered in recent decades are well known. It's time to continue working to ensure the recovery of the Lake, a task in which the various authorities competent in the matter are involved.

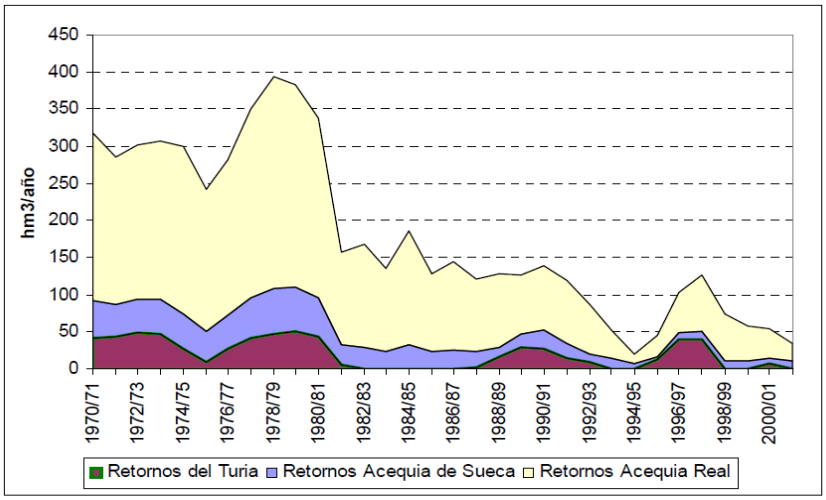
Flows from Júcar system have been quite prevalent in the water balance of the Albufera wetland since at least the late eighteenth century (see Figure 1).



3. Historic balance of the input from the Júcar (Xuquer) River in comparison with the rest of river inputs to the Lake (measurements taken from 1963 and 1980; residual waters are not taken into account).

Current status and notes for recovery

However, the flow regime is drastically reduced from the 80's, the flow rate derived from this system is currently about 75% lower (Figure 2).



4. Evolution of the inputs from different rivers and canals

As it can be seen in Figure 4, the reduction of water flow is mainly caused by the reduction from the Júcar Royal Canal, which has historically represented the largest supply of fresh water from the lake and of higher quality. In fact, today, the diminished flow of this system reaching the wetland are the only ones, apart from the contributions from springs that meet standards of good physico-chemical and biological quality established by the Water Framework Directive .

The Albufera Lake is one of the most interesting humanized traditional landscapes of the Spanish Mediterranean and one of the most ecologically valuable areas of the peninsula. The new Júcar Water Plan establishes water needs of the Albufera Lake at 167 Hm3/year "(Art. 17.4 of the Regulations), volume equal to 95th percentile of the number of annual inflows to the lake between 1990-91 and 2009-10, ie corresponding to years with lower flows Júcar entries, especially from the Júcar Royal Canal, the wetland in the history of the contemporary Albufera. This assignment, however, is higher than that established in the previous Hydrological Plan, which provided only 100 hm3.

The link between the Albufera Lake and the Júcar river is clear, this is the reason why part of water savings from the modernization of irrigation systems have to be now recovered as environmental flow.

We should continue to set parameters on the source and quality of the flows that must meet environmental needs of the lake and / or the rest of the wetland in order to restore the ecosystem.

It is considered that the effluents from sewage treatment plants should be used primarily for agricultural irrigation, limiting its use in the natural park at the rice growing season, without coming to the Lake outside that period. The rest of the season effluent flows should be reduced to a minimum in the water balance system.

It may be appropriate to establish an express flow reservation of environmental use from the Tous marsh, exclusively for the lake and for its wet surroundings. This would allow substantial progress in the process towards the gradual ecological recovery of the wetland.

It is undoubtable that there have been significant advances in sanitation since they are currently constructed and operating all cleaning systems under successive reorganization plans developed by the Valencian administration. The investment made by both the Government and by the State administration has been tremendous and has undoubtedly led to appreciate signs of improvement in recent years.

However many challenges remain in this area directly affecting Albufera and involving from direct discharges to canals, urban areas and industrial sites with poor drainage and failures in collectors and pumping stations. In addition to these deficiencies, many of the problems caused by sewage in Albufera come from the lack of sanitation separate systems in its environment. As it is known, at present most of the direct discharges of wastewater enter the park in stormy episodes (mixed with stormwater from unit collection systems in urban areas and industrial areas surrounding the space and relieving the canals that drain into the lake).

An action plan should be promoted to solve the targeted issues in sanitation, and in which the building of separate networks in urban areas surrounding the park should figure prominently. This solution will certainly be costly in time and financial resources, but would greatly reduce the entry of sewage into the Park.

This way you we would move forward in the work of restoration of ecosystems that has been practiced in the Natural Park of Albufera from the 80s and have allowed to reverse a process of urbanization, that nearly derail this singular space.

Riccardo Gini, director of the Parco Nord Milano

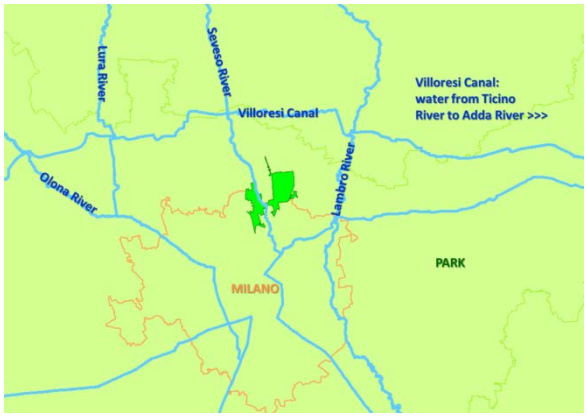
The Parco Nord Milano is situated in the high plain of Lombardy, in the northern part of the Italian peninsula. This geographical area is characterized by a copious rainfall and by the presence of a very rich natural hydrographic network, with several rivers and lakes. Annual rainfall is of approximately 7 million m^3 on the park surface.

In addition, the agricultural tradition that accompanies the history of the Po Valley over the centuries has formed a dense network of artificial canals that in a widespread manner brings irrigation water to our entire area.

To this framework of abundance of surface water it should be added the water proceeding from the water table.

The process of deindustrialization has led to the closing of numerous pumping wells in first water table, one of which is now available for irrigation in the park.

Despite this overall abundance of water, the only natural watercourse included within the boundaries of the park is the **Seveso River** (4 km), whose course has been colonized by many manufacturing industries which, with their discharges, have greatly compromised the quality of water downstream. **The situation of the River Seveso in 2000 was calamitous.**



The construction of Parco Nord Milano started in 1983 but in that period the priority was “the green system”. During the first 30 years, the process of setting up of the Park was mainly concentrated on the plantation of forests, trees rows, meadows and glades as well as on construction of bike and pedestrian paths and light equipment to improve the fruition. Water was used to sustain tree plantations.

Since2000, the park has been devoted to the construction of large bodies of water and has been acting on the river Seveso with the purpose of recovering the naturalness and reducing degradation. The park started a long process of requalification by cleaning, remodeling, and safeguarding the river banks.

The results are very impressive

In these last two years we have been involved in increasing the water system by new lakes, fountains, canals, and ponds

We have planted native aquatic plants and have constructed a new Lake with a surface of 23.741 m^2

We currently receive 1.550.000 m^3 per year from Villoresi Canal for the water system. In addition, the amount of groundwater pumped per year is 1.500.000 m^3. The amount of drinkable water is 206.000 m^3 per year.

Besides direct conservation purposes like the creation of water bodies, water is also used for watering the tree edges, to sustain vegetable gardens (828), drinking fountains (25), self-cleaning toilets (14) and fire prevention network in the park.

Vallvidrera stream: Management with Citizen participation of a small basin located in the heart of the Barcelona metropolitan area

Marian Navarro Navarro, technician Collserola Natural Park Consortium
Marià Martí Viudes, director Collserola Natural Park Consortium

With a total length of 12,5Km^2, the stream of Vallvidrera is a small watercourse of a 25-km^2 basin, located in the Collserola Park, an 83-km^2 isolated natural space in the heart of the Barcelona metropolitan area (3.2 million inhabitants and an area of 636 km2). It is the only perennial watercourse in this territory.

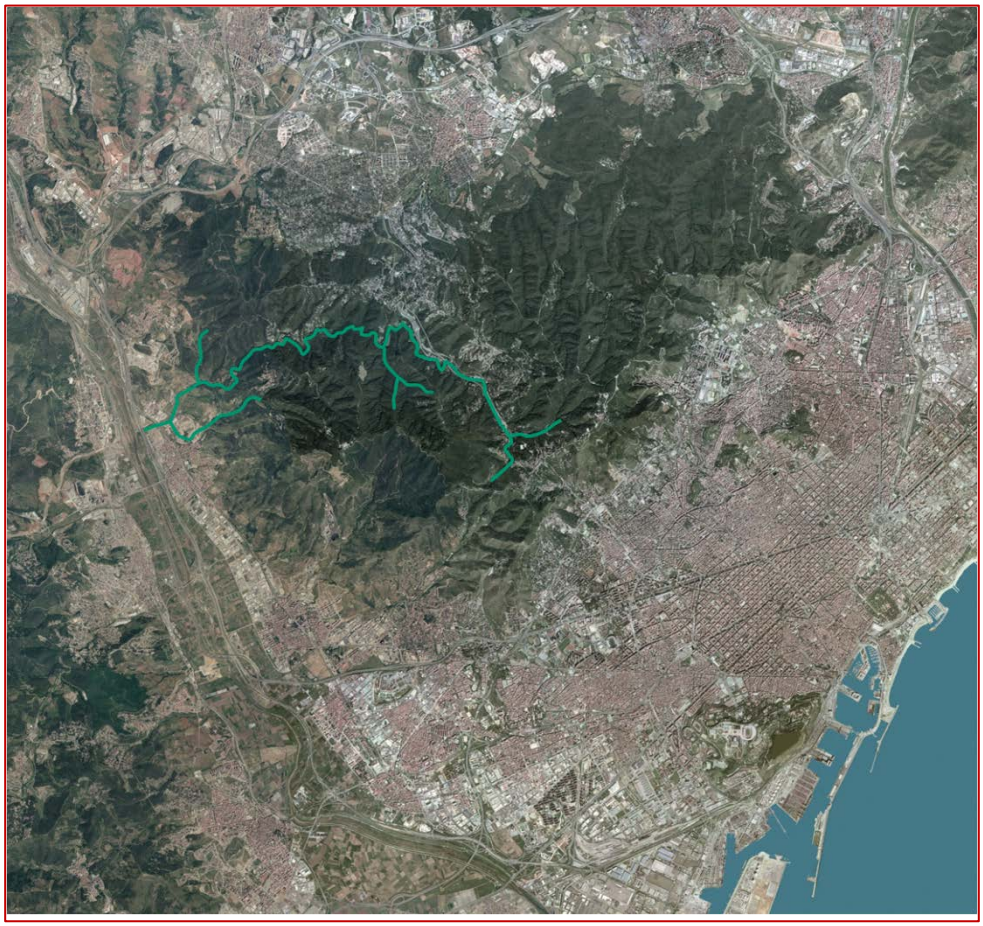


Figure 1.- View of the stream path on an aerial photo

Preserving ecosystems and biodiversity in the context of a periurban natural park - under all kind of pressure and impact - is a complex task becoming even more difficult, moreover, when protecting small watercourses. The Mediterranean climatic regime makes that these habitats with scarce and highly variable flow regimes, are exposed to large perturbations and are extremely sensitive. Therefore, it was considered that, in order to ensure a successful result, the restoration of the stream by the administration, should be conducted with citizen involvement.

The project was born with the aim of recovering the natural and ecological status of the stream and its environment as well as recovering the social interest in this space. The idea was to promote reflection and debate around the streams management and work towards the creation of a network of citizens interested in the preservation and custody of fluvial environments, in accordance with the Water Framework Directive (WFD) guidelines, adopted by the European Union in 2000.

It all started in the spring of 2007 when finally, after various attempts (the leading group had started operations in 2004), the Vallvidrera stream participative management - with neighbours, associations and institutions of the basin - began. The three municipalities crossed by the stream - Barcelona, Sant Cugat del Vallès and Molins de Rei -, also joined the project, with the agreement, approval and under the auspicious of the Catalan Water Agency (ACA).

Figure 2.- Workshops with associations

The participative process was conducted by the project leading Group consisting of the Collserola Park Consortium, the FEM (Freshwater Ecology and Management) Research Group at the University of Barcelona (UB) and Habitats, an association aimed at restoring fluvial areas with environmental volunteering. During 2007, the main problems of the basin were brought up for discussion and a "program of measures" - in order to improve the stream status and thereby fulfil the European guidelines - were developed by consensus. This process involved a total of 40 people representing 17 public and private entities, as well as experts from the different administrations. This intense and extensive work, allowed designing a program of actions ranging from lectures on vegetation, topography, fauna, etc. to collectors management and wastewater treatment.

Figure 3.- Starting position in one of the sections of the upper part of the stream (2007)

Subsequently, the proposal was submitted to the competent authorities in order to be able to respond participants about their degree of commitment concerning each one of the proposed measures as well as to influence on them and improve daily management.

Just completed this phase, the ACA (Catalan Water Agency) issued a call for grants proposals to carry out activities of management, conservation and recovery of fluvial areas. The Collserola Park Consortium presented a technical restoration project which was approved and received a grant to finance various recovery actions. The F.E.M. (Freshwater Ecology and Management) was commissioned for the advising tasks of the project and the design of the Environmental Monitoring Plan of the actions that are carried out from the same department of the Catalan government. The project also includes a Communication and Participation Plan in which the Habitats Association collaborates in the implementation of activities.

Moreover, the City of Sant Cugat del Vallès under the Agreement established with the Consortium, allocated a significant budget to interventions for the stream improvement within its municipal term for a period of three years (2009-2011).

Carried out interventions

This has allowed going ahead with the morphological restoration of the stream bed, in about half of its length. The undertaken interventions included:

- Removing invasive plants, the giant cane (*Arundo donax*), basically, on which over a total of 6,031m2 has been acted. 3,714 feet of ailanthus (*Ailanthus altissima*) have also been eliminated.
- Removing mud from slopes and shaping them through bioengineering techniques with the installation of bush matressing prepared in nurseries and planted as sod lawn.
- Planting native trees and shrubs of riparian vegetation, with a total of 1,640 feet. The first plantation, in 2008, had a success result of 60-70%. The subsequent one, the result reached the 90%.

- Creating two areas of slow water with reed swamps which intensify water purification.

Figure 4.- Eliminating giant canes, planting and reforestation (2008)

The fact that, just before starting the improvement actions, the Wastewater Treatment Plant (WWTP) remodelling project in Vallvidrera was approved meant a radical change in the flow increase and, obviously, in water quality. It is worth mentioning that thanks to the existence of this Head Wastewater Treatment Plant, the course of the stream water is basically the same, all year around.
It was also during this process that uncontrolled wastewater dumping directly into the stream, were detected. They could be corrected and, even a small treatment plant - with an inefficient operation, which absorbed by the new installation - was removed.

All this makes that the final situation, concerning the pollution problem due to biodegradable wastes dumping, to be completely different from the starting situation, with a substantial improvement. The changes have been reflected in the annual inspections results by FEM within the Environmental Monitoring Program - which aims to assess the success and improvement of the actuations carried out to the fluvial ecosystem.

Figure 5.- One of the well-preserved sections in which no intervention has been made.

Communication and Participation Plan

Besides the project disclosure - through brochures, articles, presentations and lectures - to publicize the value and benefits of this natural area, an annual program consisting of activities has been elaborated: guided tours along the stream and clean-up days of this space with citizen collaboration.

In December 2010, the Park Information Centre inaugurated the exhibition *Recovering the path of water*, where this project details are presented. It is an itinerant exhibition that besides being exhibited in the Park Centres, it has also been displayed in the different municipal centres and schools in the basin. The exhibition is presented along with two informative videos about the project and bioengineering techniques used in the restoration.

In 2012 a cooperation program with different entities committed to the basin - to monitor the evolution of the plantations established on the stream – was initiated. These entities carry out inspections twice a year; each entity in one of the sections where it has been intervening.

Figure 6.- Lectures and clean-up activities with environmental volunteering

Finally, we are pleased to report that the project received a secondary award in the Territory Award 2010, organized by the Catalan Society for Territorial Planning (SCOT). It is a biennial award established in 2008 and organized in the framework of the Sant Jordi Awards of the Institute of Catalan Studies.

The award aims at recognizing and encouraging the efforts of experts, administration and others for innovating tools as well as analysis, planning and territorial management processes and, specially, for the introduction of the environmental sustainability, social cohesion, inter-institutional coordination, citizen participation and interdisciplinary approach criteria.

Seven years after having initiated this work and established a roadmap, we note that the citizen participation dynamics have been consolidated and the objectives remain fully valid. So, despite the current economic constraints, as a responsible administration, we feel indebted to citizens and we will keep on with the undertaken activities and initiatives for the gradual recovery of this rare and precious ecosystem.

Treated water management and conservation of land and biodiversity in the region of Murcia (Spain)
The LIFE09/NAT/000516 Project Conservation of the white-headed Duck *Oxyura leucocephala* in the Region of Murcia, Spain

Gustavo A. Ballesteros Pelegrin, manager of the LIFE project

1. INTRODUCTION

The implementation and development in Spain of the new Sanitation and Treatment National Plan (2007-2015), pursues the ultimate fulfillment of the Royal Decree-Law 11/1995 which aims to help achieve the good ecological status of water bodies that the Water Framework Directive calls for the year 2015, in order to achieve a balanced and environmentally sustainable socioeconomic development.

One of the challenges of this new plan, is to generalize effective purification systems and sewage networks leading all wastewater to treatment plants, especially for many urban agglomerations of small size (<2,000 inhabitants). Therefore, although the percentage of pollutant load of this set of populations is small compared to the large urban agglomerations, their large number represents one of the most important challenges of the new National Plan for Water Quality.

Each year in Spain more than 200 million m^3 is reused water. This water is mainly used for irrigation, especially in the South Atlantic and Mediterranean coastlines and archipelagos.

In Murcia, the Regional Entity Sanitation and Wastewater Treatment (ESAMUR) dependent on the Regional government of Murcia is created by law with the task of collecting and managing the sanitation canon. This economic input is used for the operation, maintenance and control of public sanitation and sewage purification.

According to ESAMUR (2013), population in Murcia is distributed in 45 municipalities, specifically in 727 towns of very different magnitude. The population living in disseminated nuclei reaches 113,402 inhabitants. These nuclei (neighborhoods, villages, rural communities, etc.) are grouped for the collection and treatment of sewage purposes in Urban Agglomerations, following indications of the European Directive 91/271 EEC which includes guidelines on sewage treatment.
In December 2011, there were in the region of Murcia 221 Urban Agglomerations corresponding to the magnitudes shown in table 1.

Urban agglomerations	**Number of agglomerations**	**Volume yielded hm^3**	**Number of in habitants**	**Equivalent inhabitants**	**%**
With proper sanitation system	118	115,08	1.343.963	1.746.002	98,7
Without proper sanitation system or in project	103	1,08	12.704	17.710	0,1

TABLE 1. Urban agglomerations and performance of depuration systems in Murcia. Source: ESAMUR (2013).

2. CONSERVATION OF WETLANDS AND RAMSAR SITES

For some decades, environmental problems are of great concern in many international fora. Spain participates in 50 of the 80 multilateral international environmental treaties.

In 1975 the Convention on Wetlands of International Importance (Ramsar Convention), whose main objective is "the conservation and wise use of wetlands through national action and international cooperation, entered into force in order to contribute to achieving sustainable development throughout the world. "As of July 1, 2014 there are 168 countries that have declared 2,187 sites as Wetlands of International Importance, covering an area of 208,608,257 hectares (Ramsar, 2014). Since 1982, Spain has declared 63 sites, with an area of 281,768 hectares.

In the Region of Murcia "la Laguna del Mar Menor" has been declared a Ramsar site in 1994. More recently, on January 7, 2011, two artificial wetlands that receive treated water from the surrounding towns: "las lagunas de Campotéjar y de las Moreras", putting in place a model of sustainable development, where it is possible to purify water, protect a portion of territory with significant natural values and use that water for irrigation.

3. SOCIAL AND ECONOMIC IMPORTANCE OF TWO WETLANDS THAT STORE TREATED WATER

3.1. Lagunas de Campotéjar

Las Lagunas de Campotéjar, declared as a Wetland of International Importance as Special Protection Area for Birds, have an area of 61.10 hectares and are located in the southeast of the Iberian Peninsula, in the town of Molina de Segura in the region Murcia (Figure 1).

This enclave is the habitat of wet salt marsh vegetation and numerous species of birds associated with inland saline environments. It has become an important wintering, migration and reproduction site of many species of waterfowl and other species associated with wetlands, among which the nesting population of the highly threatened white-headed duck (*Oxyura leucocephala*) and Marbled duck(*Marmaronetta angustirostris*) and during the winter, the Ferruginous Duck (*Aythya nyroca*), an endangered species in the European context.

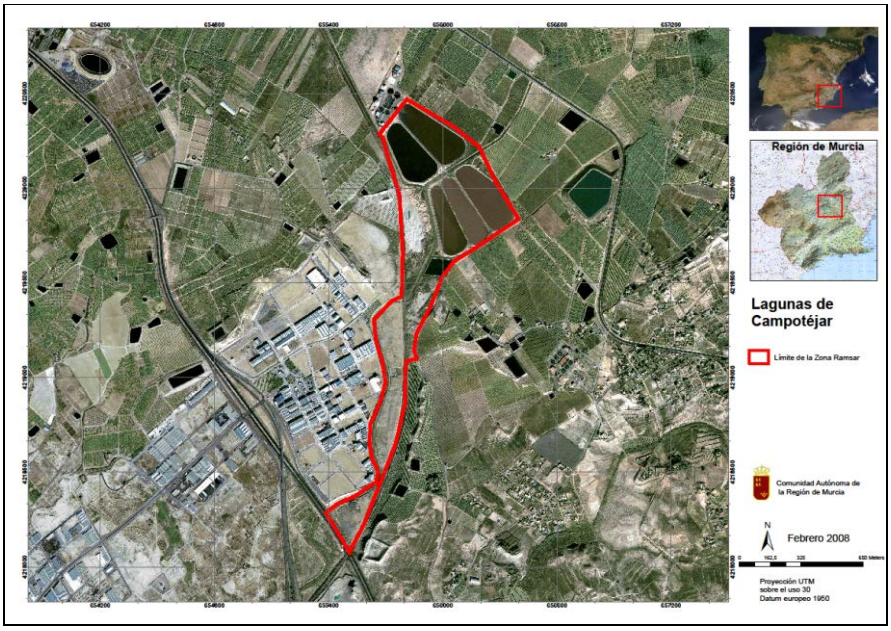


FIGURE 1. Location of the Ramsar site Las lagunas de Campotéjar, surrounded by crops and next to an industrial park.

FIGURE 2. Lagunas de Campotejar.

The Wastewater Treatment Plant (WWTP) through the system of lagoons of Campotéjar, was in operation throughout the 90s, ceasing operation in mid-2005, when the new wastewater treatment plant with a capacity of debugging 25,000 m^3 / day, for an estimated 290,000 inhabitants was launched.

Urban waste water undergoes a series of processes consisting of a primary decantation, a Secondary activated sludge treatment, other Tertiary of coagulation, flocculation and filtration, ultraviolet disinfection, gravity thickener and their mechanical and anaerobic stabilization.

The flow treated, as stated in the Resolution of the River Segura basin of 21/05/2005, is 5,612,778 m^3 / year and has been granted to meet the needs of the applicants' entities (Table 2).

ENTITY	Concession m^3/yr	%	Water use	Surface watered (has)
Irrigants community of Campotéjar	3.227.402	57,5	Agricultural irrigation	3.356,14
Irrigants community of Molina de Segura	1.025.599	18,3	Traditional irrigation	1.884,00
Proceba Exterior S.A.	257.988	4,6	Irrigation	87,93
City of Molina de Segura	101.789	1,8	Watering gardens	22,00
Segura Basin	1.000.000	17,8	Ecological flow Río Segura	-

TABLE 2. Water concession in the WWTP Molina de Segura (Murcia). Source: from Segura Basin.

Once treated, water is stored in ponds that have undergone a process of naturalization with the development of comprehensive coverage reeds on its banks (Figure 2) and, finally, the water is used for different uses, mostly agriculture by Irrigation Community from Campotéjar and Irrigation Community from Molina de Segura. Crops watered are peaches, apricots, grapes and citrus.

3.2. Lagunas de las Moreras

Las lagunas de las Moreras, with an area of 72.3 hectares, is located in the southeast of the Iberian Peninsula, south of the Region of Murcia, in the municipality of Mazarrón (Figure 3) have been declared as a Wetland of International Importance (Ramsar Convention) and as a Special Protection Area for Birds, to present among other important breeding populations of white-headed duck (Oxyura leucocephala), marbled duck (*Marmaronetta angustirostris*) and the Ferruginous Duck (Aythya niroca) as wintering.

This protected area is formed, besides the runway stretch of the avenue of mulberry trees that runs from the bridge to the town of Mazarron and to the mouth of the Mediterranean Sea, by 2 ponds: a lagoon located in the old sewage treatment plant through the system of lagoons that are abandoned, and the other lagoon is located along the banks of the ravine of the mulberry trees. Both lagoons, store water permanently thanks to the input from a modern urban sewage treatment plant.

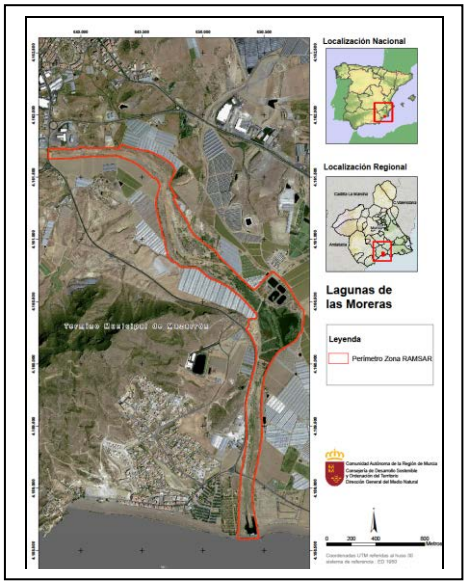


FIGURE 3. Location of the Ramsar "Las lagunas de las Moreras" surrounded by greenhouses and by the coastal town of Bonuevo in Mazarrón (Murcia). Source: Region of Murcia.

FIGURE 4. Lagunas de las Moreras along the banks of the Rambla de las Salinas.

On the shores of the lakes a vast and inaccessible fringe of reeds and tarayal has developed, while in the stretch of the avenue of the mulberry trees, at the head of the lagoons, typical Spanish Mediterranean halophytic formations are developed, including diverse habitats of Community interest (Figure 4).

The Wastewater Treatment Plant through the system of lagoons of Mazarrón, was in operation throughout the 90s, ceasing its activity in 2005 when it launched the new wastewater treatment plant with a treatment capacity of 15,000 m^3 / day, for a

population of about 15,000 inhabitants. Treatment process includes "activated sludge, extended aeration, coagulation, flocculation, ring filter and ultraviolet disinfection" technology.

4. THE PROJECT LIFE09 / NAT / 000,516 LEUCOCEPHALA OXYURA CONSERVATION IN THE REGION OF MURCIA, SPAIN

Between October 2010 and September 2014, the LIFE09 Project / ES / 000 516 " Conservation White-headed duck in the Region of Murcia (Spain)" was developed in the Lagunas de Campotéjar, Lagunas de las Moreras and Las Lagunas de Las Salinas.

The main objective was to ensure the conservation of this Waterfowl in the Region of Murcia, but also to prove that water treatment, conservation of biodiversity and re-use of water, especially for irrigation, are compatible.

The LIFE Project has a budget of € 1,342,103.00, 75% funded by the European Union, 20.6% by the Region of Murcia and 4.4% by the municipalities of Alhama de Murcia, Mazarrón and Molina de Segura.

Among the main activities carried out, highlights the declaration of Las Lagunas de Campotéjar and Las Lagunas de las Moreras as **special protection areas** (**SPA**) for Birds, which have been endowed with a management plan; the expansion of the habitat of the Headed duck by adapting new wetlands; correction power lines to avoid collision of birds; environmental campaign to schools and the local population, with special attention to water users; organization of public use, by signaling pathways, installation of observatories and building a bird watching tower and a nature classroom.

White-headed duck males. Photo: Biovisual

White-headed duck females with chicks. Photo: Biovisual