



Widespread introduction of constructed wetlands
for a wastewater treatment of Agro Pontino

LIFE+08 ENV/IT/000406

PROVINCE OF LATINA

ACTION 4.3

REPORT ON THE WATER QUALITY IN
THE "PIANURA PONTINA"

Partner:



REPORT ON THE WATER QUALITY IN THE “PIANURA PONTINA”

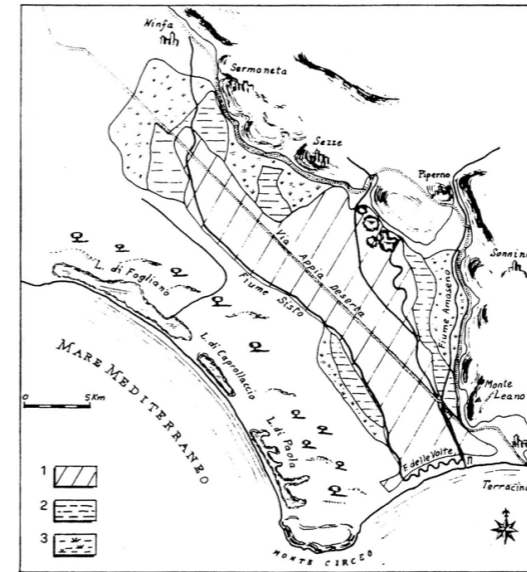


Fig. 1 The Pontine Plains before the reclamation promoted by Pius VI in the second half of the XVIII century (Rappini, 1778, in Brunamonte et al., 1994).

Legend:
1) permanent marsh;
2) marsh flooded at every rain;
3) marsh flooded at heavy rains.

¹The report on the state of the waters in the catchment basin of the “Pianura Pontina” (Pontine Plains) meets the requirements of what envisaged by Action 4.3 of the project Life08/ENV/IT/000406, and is aimed at identifying the most polluted spots and highlighting any possible lack of information and further needed in-depth examinations. In accordance with the time schedule of the project, this activity has ended in July 2010.

This report describes:

- the definition of the catchment basins and sub-basins;
- the structure of the hydrographic network and the quantitative characteristics of the water flows;
- the identification of the measuring and sampling spots used by the relevant institutions for different purposes;
- the currently available classifications of the quality of water courses;
- the available information on the production of pollutants in the basins and sub-basins.

The survey that has been carried out highlights that the available official information is not homogeneous, both as regards the types of analyses and the criteria adopted, the representation scales, and the survey times. Therefore, it

¹ This document is a summary of the Italian version.

will be necessary to implement a rigorous data interpretation and homogenisation activity. In some areas of the plain, it will also be necessary to acquire updated information, or to complete the available documentation through field surveys.

This report therefore describes the most significant data available and identifies the lacks in information. Starting from these considerations, and taking into account the needs of the LIFE project, the necessary further in-depth analyses and the possible information objectives within the project have been defined.

The catchment basin of the Pontine Plain

The hydrographic system of the Pontine Plain is shown in Figure 1, which shows a map of how the plain was before the reclamation promoted by Pius VI (Rappini, 1778). The area comprised between the Via Appia and the South-east slopes of the Lepini Mountains, has been, at least since High Pleistocene, a marsh basin that received both the underground waters from the Karst aquifer of the Lepini mountains, and the surface runoff waters from their slopes.

The current hydrography is the result of the land reclamation of the plains, which gave rise to two types of hydrographic networks:

- the natural network with its water courses (Amaseno, Ufente), which flow from the carbonate mountains down to the coast between Terracina and the Circeo Mountain;
- the artificial network (Canale Acque Alte, Linea Pio, Selcella Canale della Botte, Canale della Striscia, Canale Schiazza, etc.), which flows towards the natural network, either directly (so called “Acque medie” and “Acque alte”) or by means of pumps (“Acque basse”).

The hydrographic network is characterised by short watercourses (Table 1). The wider catchment basin in the Province is the one belonging to Canale Portatore, with a surface of 769.7 sq.km, sum of the basins of the rivers Amaseno and Ufente and the canals Selcella, Linea Pio, Pedicata and Botte.

Table 1 Characteristics of the main basins of the Province of Latina.

Water course	Surface of the basin (sq.km)	Length of the main stretch of the river (km)
Amaseno*	425,05	54,09
Botte*	43	16,05
Linea Pio*	56,02	29,03
Pedicata*	15,04	6,04
Selcella*	103	21,02
Ufente*	88,07	32,7
Badino*	37,09	5,04
Astura	86,04	20,02
Moscarello (Can. Acque Alte)	611	32,07
Rio Martino	194,09	33,08
Sisto	135,01	41,03
Minor basins		

*closed at the confluence with Canale Portatore at Ponte Maggiore.

The following peculiar features of the hydrographic network have to be taken into account:

1. the variability of the characteristics of the torrential watercourses flowing down the slopes of the Colli Albani volcanoes, which become perennial watercourses in the plains, thanks to the contribution of abundant spring waters, with flow rates comprised between a few dozens of litres per second and more than 15 cubic metres per second, and flood flow rates of about some dozens of cubic metres per second;
2. the effects of the land reclamation of the Pontine Plain, where the outflow is almost completely regulated by complex systems of canalisations, bulkheads, siphons and pumps managed by the Consorzio di Bonifica. In order to deepen the knowledge of the hydrographic network and of the management of the hydraulic works, the Province of Latina, through a specific memorandum of understanding signed by the Authority of the Regional Basins and by the Consorzio di Bonifica, has implemented a specific Territorial Information System regarding the hydrographic network.

The synergy and the continuity among the different initiatives allowed obtaining a validated hydrographic network, and, very important thing within the reclamation areas, the identification of the works that regulate the outflow, such as bulkheads, pumps, detention basins, siphons, etc.

The acquired knowledge allows to delimit the catchment basin of each watercourse at any section of the riverbed. On this basis, in order to classify and control the quality of the surface waters, the reference catchment basins and sub-basins have been identified, dividing the area according to criteria of morphological homogeneity and land use, taking into account:

- the geological and geo-morphological characteristics of the area;
- the hydro-geological structures that feed their basic flow;
- the different possible configurations of the natural basic flow.

According to the described criteria, the hydrographic network of the Pontine Plain has been subdivided into sub-basins of different extents.

The surface hydrography widely interacts with the ground waters. The Pontine Plain hosts a wide aquifer system, characterised by a complex water circulation on different levels and with different circulation modes.

At the foot of the mountains, between the fluvial deposits and the Mesozoic limestones, there are the main outcrops of the Karst aquifers hosted by the carbonate slopes with capacities of about 14.5 cubic metres/second for the Lepini Mountains and 6 cubic metres/second for the Ausoni Mountains. These aquifers are the main input for the basic flow of the watercourses of the Pontine Plain, and in particular those comprised between the base of the carbonate slopes and the river Sisto. In this area, particularly important is the presence of the artesian groundwater contained in the carbonate successions buried below the marine and fluvial sandy and clayey soils. This aquifer, connected with the other aquifers of the Lepini and Ausoni Mountains, feeds the ground waters contained in the cover soils, which are frequently artesian. Therefore, the wells in the area are characterised by a high productivity. However, in the last years, the increasing number of wells, and the presence of many artesian wells with continuous water flow, caused a considerable lowering of the piezometric surface, with consequences both on water circulation and ground subsidence, and on the capacities of the outcrops of the aquifers in the carbonate slopes.

Available data

The reference documents for studying the state of the waters of the catchment basin of the Pontine Plains are:

- PTAR, "Piano di Tutela delle Acque Regionale" (Regional Plan for the Protection of Waters), issued according to the law D.Lgs 152/1999 and its modifications.
- The "Progetto Monitoraggio acque superficiali interne e costiere" (Project for monitoring the internal and coastal surface waters) of the Province of Latina. This project contains in particular:
 - the detailed Territorial Information System of the hydrographic network and of the catchment basins and sub-basins; the database of the surveyed discharges and the estimates of the diffused discharges from nonpoint sources;
 - the database of the in situ samplings already carried out and the preliminary physical-chemical tests (years 2003-2006);
 - the database of the samplings and tests carried out on a bimonthly basis at the 16 hydrometric stations managed by the Province of Latina and in other relevant spots.
- Other physical-chemical tests carried out by ARPA Lazio (the Regional agency for the protection of the environment) in the framework of what provided for by law D.lgs 152/2006.

The Regional Plan for the Protection of Waters

The PTAR has the objective of maintaining the integrity of the water resource, compatibly with its uses and the human social-economic activities. It provides, besides the interventions for achieving the objectives of D.Lgs 152/2006, for the necessary measures for the protection of the water system.

The plan has been drafted according to the former D.Lgs 152/99, with data surveyed in the period 2001-2003, therefore it is in the process of being updated.

According to what reported in Annex 1 of D.Lgs 152/99, the state of environmental quality of all watercourses has to be defined on the base of the ecological and the chemical state.

The ecological state is expression of the complexity of the water ecosystems, of the physical and chemical nature of waters and sediments, of the characteristics of the water flow and of the physical structure of the watercourse.

In the PTAR, the numerical indexes synthetically showing the surveyed data are the "Pollution level by macro-descriptors" (LIM), defined by chem-

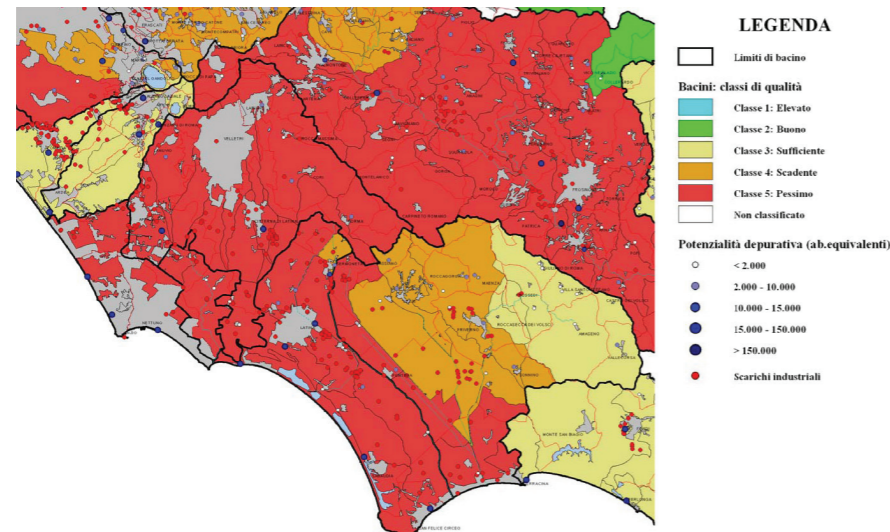


Fig. 2 PTAR: excerpt from the regional map of quality of waters.

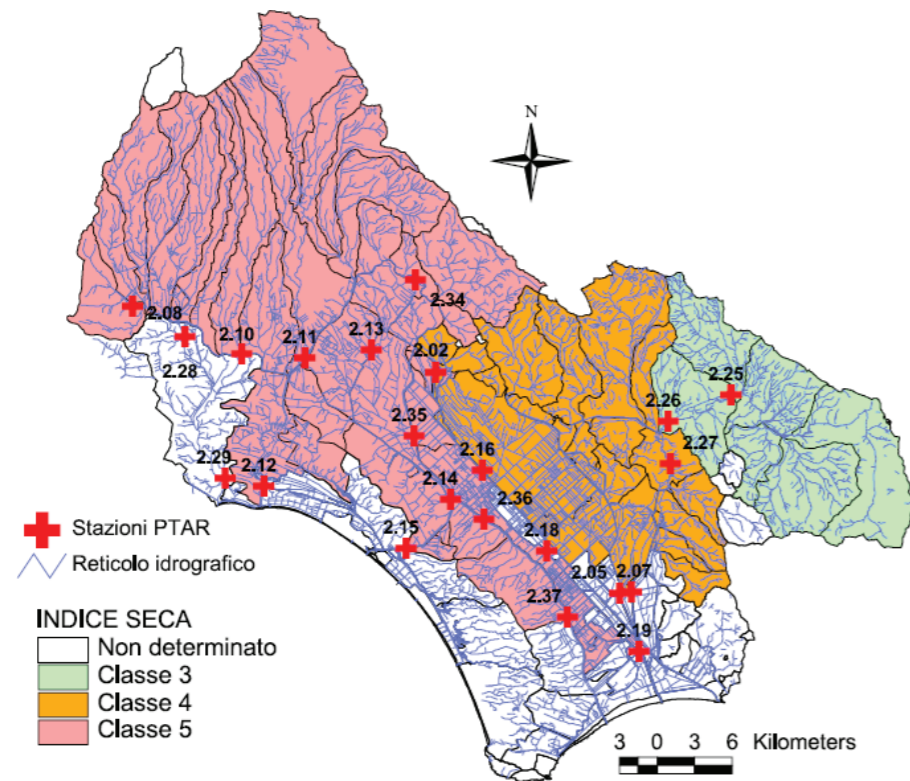


Fig. 3 Stations measuring the quality of waters and SECA indexes of the related catchment areas.

ical-physical parameters, and the "Extended Biotic Index" (EBI), which provides a synthetic assessment of the biological quality of the watercourse.

The "Ecological state of the water course" (SECA), defined by the comparison between LIM and EBI, has been calculated for each monitored station. On the other hand, the "State of environmental quality of the water course" (SACA), which is given by the comparison between the ecological state and the chemical state (defined by the presence of dangerous chemical substances), has not been defined caused to lack of data monitored for at least 24 months, as provided for by D.Lgs 152/99.

Compliance to the PTAR data to the needs of the LIFE project

For the purpose of the LIFE project, it can be said that:

- the information available in the PTAR provides an alarming picture of the water quality in the Pontine Plains, where the main water courses have an average ecological status ranging from poor to barely sufficient;
- the data belong to the period 2001-2003 and need to be updated;
- the number and distribution of the stations don't allow to have a sufficient detail for programming interventions, because often the same station works on water courses and catchment basins showing significant differences in characteristics and water quality.

The project for monitoring the surface waters

The "Progetto Monitoraggio acque superficiali interne e costiere" (Project for monitoring the internal and coastal surface waters) started in 2003, and aims at planning the monitoring of the surface waters.

The preliminary studies concentrate on the following points:

1. extension and continuity of the hydrographic network;
2. physical and land use characteristics of the catchment basins;
3. production and diffusion of pollutants;
4. water balance and characteristics of the natural and/or artificial outflow in watercourses;
5. qualitative and quantitative exchanges between surface and ground waters.

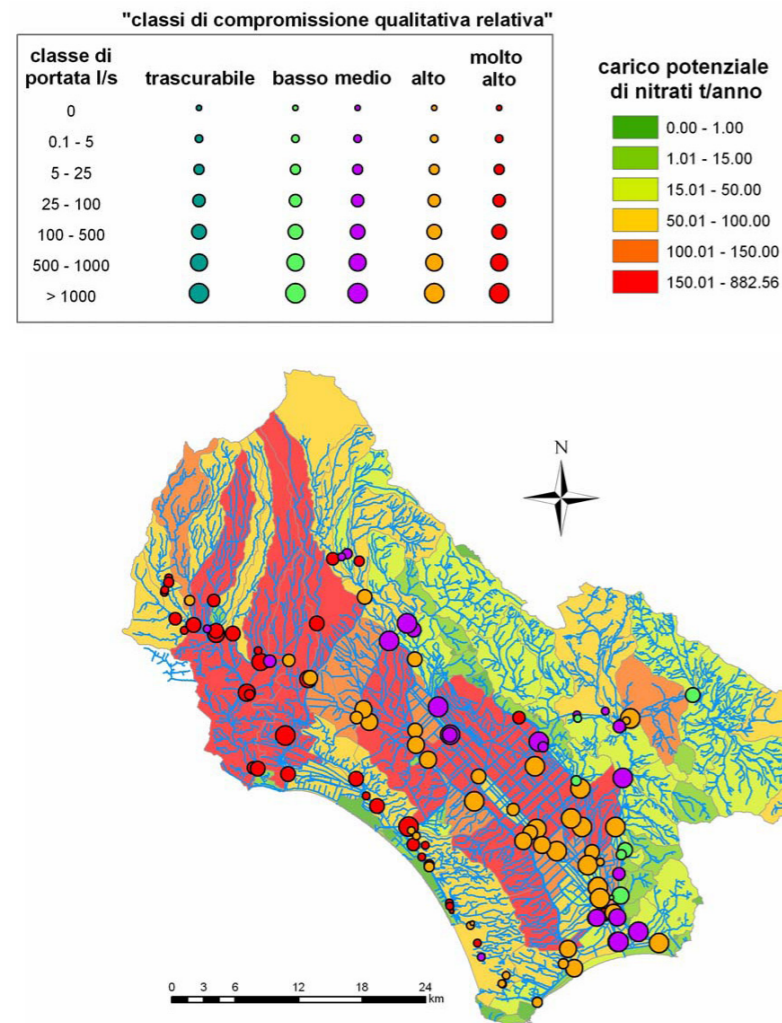


Fig. 4 Comparison between potential discharge of nitrates coming from point and nonpoint sources, and classes of "qualitative relative impairment" calculated in the measurement stations on the different water courses of the catchment basins of the Pontine Plain.

The Project makes available, at sufficient detail:

- the hydrographic network;
- the definition of the boundaries of basins and sub-basins;
- the characteristics of the water courses in terms of basic flows and yearly runoff water volumes;
- the estimate of the point and nonpoint discharges possibly existing in the sub-basins.

The information contained in the database of the basins and sub-basins of the Province of Latina allows to assess the potential loads coming from point and nonpoint sources in each basin.

Figure 4 shows the total loads of nitrates potentially produced in each sub-basin, compared with the "index of qualitative relative impairment" calculated for each measuring station.

The analysis of the data allows to derive some remarkable information:

- as already highlighted by the PTAR, the basins of the area of the "Colli Albani" (the basins flowing into the canals Spaccasassi and Acque Alte and into the river Astura) have high values of point and nonpoint discharges, together with a high degree of deterioration of the surface water quality;
- in the Pontine Plains, all the basins have high pollution loads, the highest being in the areas with great concentrations of industrial activities;
- the quality of the water courses in the Plains is not always proportional to the amount of potential loads of the catchment basins, because the highest flow rates linked to the presence of many springs in the mountain area can foster the dilution.

Possible in-depth examination activities

The situation described by the analysis of pollution loads and the measures taken in the main catchment areas, even if referred to data that are not always homogeneous and updated, can be considered indicative of the state of relative damage of the water quality, at a high detail level (scale of sub-basin). As already said, in October 2009, campaigns of in-depth, bimonthly physical-chemical tests have started where the 16 hydrometric stations of the Province are placed. The analysis of such data, and of the further updated environmental monitoring data provided by ARPA Lazio, will allow to define more precisely the state of the surface waters in the project area, depending on the pollution loads of the different sub-basins, calculated also in relation to the flow rates.



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