GIS to monitor sea water quality and the influence of WWTP's

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SUMMARY
According to the Italian regulation, wastewater treatment plant managers are not charged with any specific task related to the quality control of seawater affected by the discharge of effluents from WWTP's. This has not stopped Genova Acque, the company that manages eight WWTP's within the city of Genoa, from monitoring seawater quality, thus involving the laboratory of the AMGA company in carrying out off-line analyses. Over 100 sampling points were GIS-identified and the data obtained were used for drawing theme maps which allow a very quick evaluation of seawater quality in any zone. This has proved particularly useful in the evaluation of how structural changes in WWTP's affect sea water quality.
This work focuses its attention on the Voltri plant, located in the far-west area of the city of Genoa, with a special regard to what has changed in the coastal area since all the sewers were connected to the main network and the plant itself was completed and started working.

INTRODUCTION
In August 1995 AMGA S.p.A. started monitoring the quality of sea water in front of the city of Genoa, having been charged by the Municipality of Genoa with the management of eight city waste water treatment plants. This activity was subsequently transferred to the company Genova Acque, which kept on making use of the AMGA laboratory for the off-line control of waste water and sea water and of the RSTA company for *in situ* measurements and sample collection.
The choice, made first by AMGA and then by Genova Acque, of controlling sea water quality is absolutely free as no national law has ever been issued in order to compel plant managers to do that, but it is motivated only by a need for self control, as currently seven of the eight plants discharge their effluents into the sea.
Thanks to the analyses carried out in the last eight years it has been possible to evaluate what consequences on sea water quality had the several works to which the plants underwent in that period: extension of sea outfalls, upgrading, building of new plants, waste water collection. It must be said that during this period the characteristics of the monitoring activity changed, finally reaching the current shape: on-line and off-line tests are carried out every third month on over 100 points, while 20 of them are monitored every month. The parameters to be monitored are:

- pH
- conductivity/salinity
- dissolved oxygen
- chlorophyll "a"
- temperature
- ammonia
- faecal coliforms

ELABORATION OF THE DATA COLLECTED

Data collected during seasonal monitoring campaigns are elaborated in order to produce theme maps, which just at a first glance can provide useful information even to the layman. Actually these maps are based on the association of different colours to different concentration ranges of the monitored parameters, so that even a quick examination allows to spot the most degraded areas as well as those of better quality.

This work is particularly focused on the characteristics of the Voltri plant, which is located in the far-western area of the city of Genoa. This plant has been completed only at the beginning of the year 2003, though the project dates back to the mid nineties. It has to be said that up to that moment the general situation of the sewage network in the Voltri area was quite unsatisfactory, as most sewers had not been yet connected to the main system. Thanks to a global project for the upgrading of the city of Genoa and according to what the European and Italian environmental law requires, all the necessary works were carried out in a relatively short time. The Voltri plant has been fully operating for nearly two years: it marks a highlight in the scenario of the city plants as it is the only one based not on active sludge tanks, but on biofiltration.

As the city of Genoa has, in the last decades, changed its economic interests, moving from an industrial city to a tourist one, the Voltri plant is normally not affected by problems caused by industrial discharge and can be considered a typical urban plant. Its performances are quite satisfactory in terms of removal of the main pollutants (COD, BOD_5, TSS), as shown in the following graphic (fig. 1).

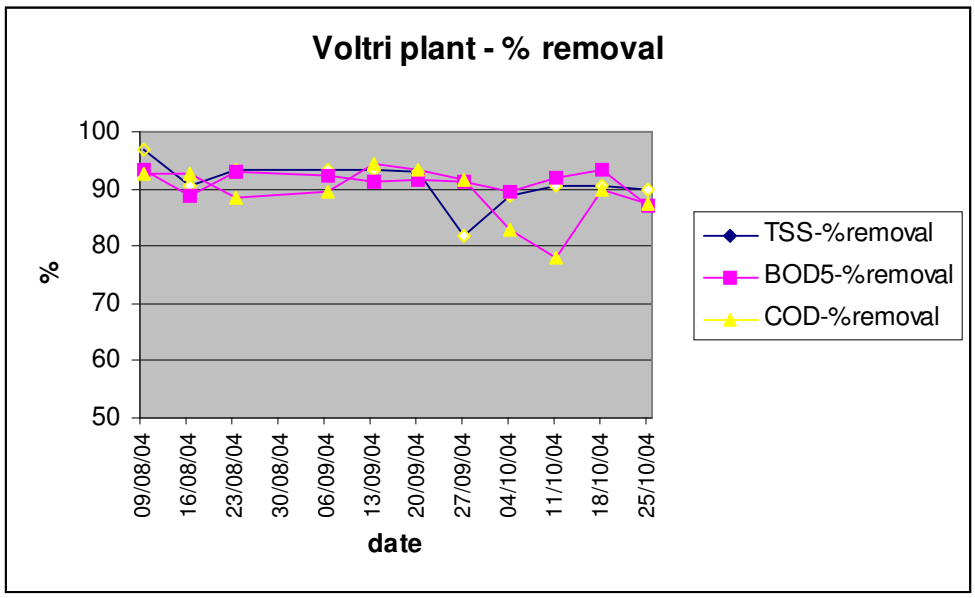

Fig. 1 – Voltri plant - % removal

According to a law issued by Regione Liguria, the effluent from the plant is discharged through a sea outfall at over 1 km from the coast, with a depth of over 30 m. The outlet is equipped with a diffusing system, which allows an efficacious distribution of the residual pollutants.

The sea monitoring of the area can be divided into two phases. In the first phase the effect of the connection of all the sewers to the main network was investigated: fig. 2 and fig. 3 show how the quality of the water changed as a consequence of this intervention.

In the second phase new sampling points were included in order to monitor the zone in proximity of the outlet of the sea outfall. Fig. 4 and fig. 5 show the results obtained, with respect to the most significant parameters, that is ammonia and faecal coliforms.

FUTURE DEVELOPMENTS

The monitoring activity is meant to be continued in the following years: a monitoring campaign will be carried out every third month and related maps will be drawn.

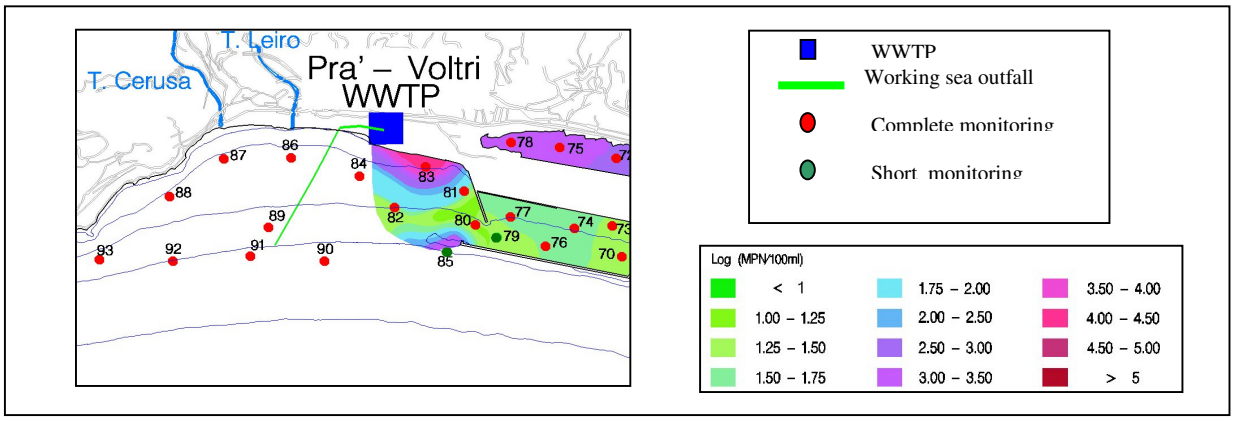

Fig. 2 - Theme map for faecal coliforms - March 2001

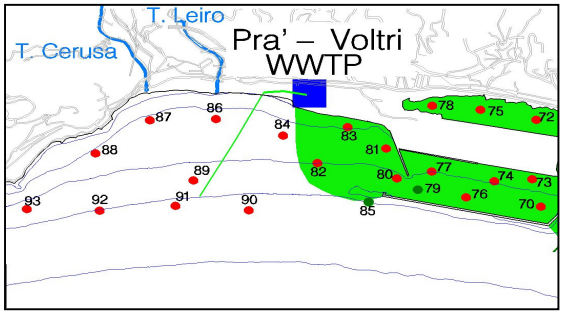

Fig. 3 - Theme map for faecal coliforms - June 2002

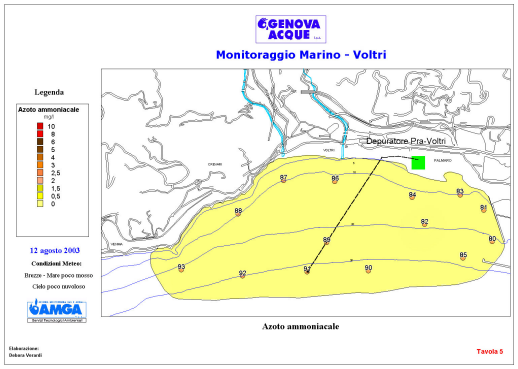

Fig. 4 – Ammonia – August 2003

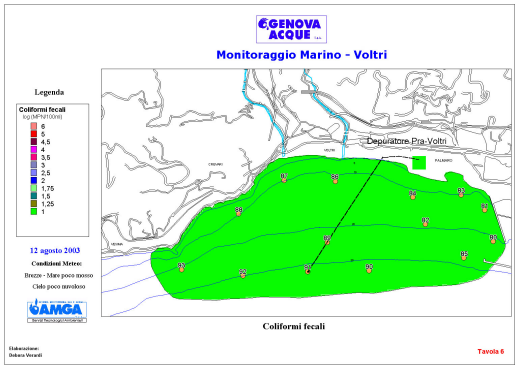

Fig. 5 – Faecal coliforms – August 2003