Technical aspects related to the wastewater recycling

The diagram in the layout describes the production cycle of recycled water for the industrial aqueduct managed by GIDA SpA.

The wastewater recycling process consists in the reuse of water coming from the centralized wastewater treatment plant.

In a separate process, the water from Bisenzio river is also treated and the two flows (wastewater and Bisenzio river), after the specific treatments, are mixed and then the final effluent is sent to the industrial aqueduct.

The mixing aim is to control and avoid the potential increase of the salinity content in the recycled water, as it is actually a close cycle.

Salinity content is basically stable both in the WWTP (Baciacavallo) and the recycling system.

Anyway, the salinity of the system may increase due to the recycling cycle (sulphate and/or chloride ions are used in the textile industry); in this case significant quantity of sodium chloride is necessary for the regeneration of the resins used in the ion exchange system applied by the industries before thermal processes.

In these conditions, the salinity of the system increases until a saturation value which can be reasonably predicted and determined.
The entire system can be considered as a continuous stirred tank reactor (CSTR) in which, by the mass balance of each component, it is possible to apply a prediction mathematical model.

In this situation, the increase in the flow rate of recycled water increases the value of the saturation concentration of the salts present in the system and thus the salts concentration of the salts of the WWTP effluent.
Some modeling tests carried out in the past showed that, without an alternative source of water with low salinity, the final concentration of chloride in the WWTP effluent can reach values higher than 900 mg/L, close to the discharge limit into rivers the WWTP effluent must comply with (1200 mg/L).

So, to avoid and control the salinity increase an additional source with a low salts content is required.

The necessary additional water source flow rate, calculated by the models, is about 30% of the total; the actual quantity is managed by GIDA to keep the Bisenzio river withdrawal as low as possible (see table and graphic below).

The reuse of recycled wastewater reduces the use of high-quality water, and it contributes to protect aquifers and maintain the minimum vital flow of rivers.
The primary water saving achieved by recycling about 3,500,000 cubic meters of wastewater, is more than 50.00 PE.

Moreover, the reuse of about 13,000 m3/d, taken from the WWTP effluent, reduces both the residual organic discharge to the river (Ombrone Pistoiese torrent) as well as the total nitrogen amount (about200 kg/day).

In conclusion, the environmental balance of the wastewater reuse is fully positive, ant it complies both with the high-quality water protection aim as well as with the industries that use the water from the industrial requirements.