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Delineation of wellhead protection areas in the Umbria region. 1. A simplified procedure

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Abstract

In the Umbria region a large number of small groundwater resources is exploited to supply drinkable water to customers. More than 400 of the wells and springs managed by Umbra Acque S.p.A., one of the three Umbrian managers, draw less than 10 l/s and about 240 of them supply less than 1 l/s. The national and the regional regulations do not differentiate in the protection area delineation guidelines between large and small resources, although different degree of knowledge about the aquifer and economical budget for the operation can be expected. For these reasons, here we propose a procedure for delineating the wellhead protection areas, based on simplified models and techniques, particularly suited for the Umbria region.

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Keywords: protection area, well, spring, small resources

1. Introduction

Regulations for a safe use of drinking water resources are normally based on the principle that the area surrounding wells and springs should be protected in order to avoid any contamination. The extension of such an area is usually defined in terms of the needed travel time, compared to the duration needed to eliminate pathogenic microbes or, at least, to guarantee an adequate intervention time in case of accident. Sometimes, the simpler

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geometric criterion is accepted especially at a preliminary stage, without the need of transforming the distance in travel time by means of a groundwater model.

Italian national regulations [1], [2] define three areas around the resource catchment, prescribing land use restrictions decreasing with the distance. Precisely, the area very close to the exploited resource is the *absolute protection area* (in Italian "*zona di tutela assoluta*"), with a restricted access reserved to the manager. It is defined by a geometric criterion as a circle with a radius of 10 m and hence its delineation does not require any knowledge about the groundwater flow. The largest area surrounding the resource where some restrictions still apply is the *defense area* ("*zona di protezione*") comprehending the whole recharge area, which requires a study at hydrogeological basin scale; restrictions on land use are compatible with most of the anthropic activities. In the middle between the absolute protection area and the defense area there is the *protection area* ("*zona di rispetto*", literally the "respect zone"), that could be preliminarily defined as a circle with a radius of 200 m but that is usually associated with the 180 or 365 d travel time isochrones; in this area all the land uses that can endanger the water quality are strictly prohibited. As defined by the regulations [2], the delineation of this area requires the use of a groundwater model to define trajectories and isochrones.

The systematic application of the national rules in the Umbria region faces the existence of a distributed drawing from aquifers in the territory, with many sources supplying a small discharge to few customers. As a matter of fact, in the national rules no distinction is made with reference to the discharge drawn from the well or spring. It is assumed that the travel time criterion based on the use of groundwater models is applied for both a main well-field feeding a large community and a small spring supplying a small discharge. This circumstance is reasonable since the use of polluted water has to be avoided with the same efforts without any consideration to the number of customers that could be affected. At the same time, it is not reasonable to assume that the same amount of data can be gathered and processed, not depending on the resource importance.

The Umbria Region started its process to regulate the protection area definition at the regional scale [3], [4], [5], [6], as required by the national laws, and some preliminary guidelines have been proposed [7]. In these guidelines, the resource catchments are divided into three categories, depending on the drawn discharge, Q, and the associated customer number, N: *strategic* or *A* type resources, when $Q \geq 30$ l/s or $N \geq 6000$; *common* or *B* type resources, when $10 \leq Q < 30$ l/s or $2000 \leq N < 6000$ and *local* or *C* type resources, when $Q < 10$ l/s or $N < 2000$. No explicit reference is made to different rules in delineating the protection areas depending on this classification, even if it was auspicated.

Basing on the regional rules, the managers of the Umbrian water systems are responsible for the delineation of the protection areas.

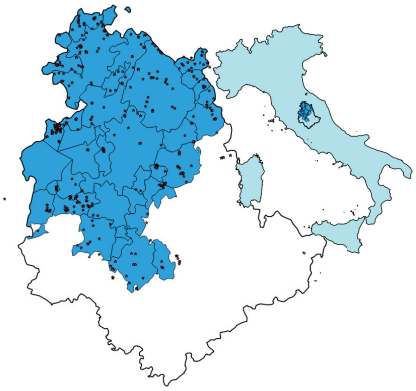

Fig. 1. The territory managed by Umbra Acque S.p.A. in the Umbria region. Dots denote wells or springs.

Umbra Acque S.p.A. (UA) is one of the three managers of the Umbria region, with a territory of about 4300 km^2 (Fig. 1). As shown in Table 1, most of the 485 resources managed by UA are of *C* type, with a maximum allowed drawing less than 10 l/s. Furthermore, as shown in Fig. 2, 242 out of the 412 type *C* sources supply less than 1 l/s. As previously mentioned, on one hand basing on the national and regional rules, no distinction is made in terms of protection area delineation methodologies between wells and springs supplying less than 1 l/s, and those supplying