

DSS application at a river basin scale, taking into account water resources exploitation risks and associated costs: The Algarve Region

Rodrigo Maia*, Cristina Silva

*Department of Civil Engineering, Faculty of Engineering of the University of Porto, Portugal
Tel. +351 (22) 508-1916; Fax: +351 (22) 508-1955; email: rmaia@fe.up.pt*

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Abstract

The increase on water demand of the different sectors lately so commonly verified, namely for domestic use, has been a major incentive towards the development and use of Decision Support Systems (DSS). In the context of a European Project, a DSS tool was developed and applied to the Algarve region, in Portugal, having as major purpose the sustainable management of the water resources existing in the whole region. Different strategies (combinations of water management options) were defined and evaluated using the DSS tool aiming at minimizing the existing and foreseen water deficits in the region having in mind the requirements specified by the Water Framework Directive (WFD). A performance assessment of strategies and an economic analysis embracing direct and environmental costs computed by the tool do enable selection of strategies. The results of the evaluation of two strategies to minimize regional ground and surface water resources exploitation risks and costs are presented. The specific case of the Querença-Silves aquifer's exploitation is addressed, as it is the most important (in quantity, quality and pressures due to current and potential future use) of the Algarve region.

Keywords: Decision support system; Environmental costs; Querença-Silves aquifer

1. Introduction

The Algarve region, the southern region of Portugal, which embraces the Ribeiras do

Algarve river basin and also a small part of the Guadiana river basin, benefits from favourable weather conditions. In this region, the increase in water demand mostly from agricultural and domestic sectors has been, for almost two decades, one of the main problems for the balanced

*Corresponding author.

economic and tourist development, as that increase has not always been compatible with the existing water resources. Until the 1990s, domestic water supply in the region was almost exclusively relying on municipal boreholes. Additionally, agriculture and industry were also using the existing groundwater resources which led to a severe decrease in the piezometric levels and to quality problems in the majority of the aquifers, mostly those in the coastal zones [1]. These coastal aquifers have also current increasing water exploitations pressures due to tourist investments (namely on new golf courses) in the region. Conflicts between the different water users and agriculture (representing more than 65% of the total water consumption volume) do then exist in the region.

In that context, in the late 1990s, decision makers agreed on the need to improve domestic water supply at regional level, in terms of water quality, water quantity and also efficiency of associated water services. The proposed solution was to implement two primary inter-municipal water supply systems (one for the eastern part of the region and the other for the western part), both based on surface water sources, which would assure the conveyance of treated water from the storage supply reservoir sources to the municipal reservoirs. The municipalities would then be only responsible for the operation and management of the secondary water supply systems, i.e. from the municipal reservoirs to the different settlements (and end-users), and would abandon their former (own) groundwater abstractions. The two primary water supply systems were then interconnected, creating the primary water supply system as known today, operated by a single water utility: the Águas do Algarve, S.A. (AdA). This company is then responsible for supplying treated water to (most of) the different municipalities of the region. This primary supply system is depending on the main storage reservoirs existing in the region (Fig. 1), corre-

sponding to the Bravura, Arade and Funcho dams, also used for agriculture, to supply the western part; and, the Odeleite-Beliche dams system (located in the Guadiana river basin), to supply the eastern part. Although based on three storage reservoirs, the water availability in the western part of the region is lower than in the eastern one as those storage reservoirs' capacity is reduced. In fact, according to the planned primary water supply system design a new water source (Odelouca dam, storage capacity 157 hm³) would also be built to supply the western part. Regrettably, the scheduled plan (start of operation in 2006) could not be fulfilled and the construction was put at risk due to environmental issues; in fact, the decision to go on with the dam construction was (re)confirmed recently (end of 2006), making the (before expected) start of operation in 2012 possible.

Meanwhile, AdA company faced some difficulties in fulfilling the increasing water demand, as this was reaching values clearly above the ones expected in planned demand scenarios. Adding to that, a dry period verified between 2003 and 2005 originated a severe decrease in water availability in the different storage reservoirs and consequently strongly limited the water abstractions for domestic water supply. This situation led to the necessity of finding alternatives on a very short term to guarantee public water supply to the region in good quantitative and qualitative terms: the executable solution, found jointly with the different municipalities, was to re-activate (as emergency supply sources) some municipal boreholes formerly abandoned due to the implementation of the primary water supply system, allowing mitigating the water shortages originated by the dry period. Additionally to this action, AdA, with the previous agreement of the National Water Institute (INAG), equipped and started exploiting some new boreholes, located in the western part of the most important aquifer of the Algarve region, the Querença-Silves aquifer

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