THE EFFECTS OF LOW ENTHALPY GEOTHERMAL SYSTEM ON GROUNDWATER OF THE CESINE WETLAND

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The Cesine Wetland represents one of the most valuable wetlands of Apulia. It is located in Salento, along the Adriatic coast, not far from Lecce. It was recognized as "wetland of international interest"; it became "state natural reserve" and since 1980 it is managed by the "World Wide Fund for nature" (WWF).
The protected area, 620 hectares wide, is shaped as a narrow and elongated strip that follows the coastline. It is crossed by numerous artificial channels, some of which represents the inland boundary. The core of the reserve, the eastern sector, includes the brackish water marshes, wooded areas and those of the Mediterranean marquis that give hospitality to the major habitats of community interest. The environmental peculiarities of the Cesine Wetland are due to a complex hydrogeological pattern, the high contribution of groundwater outflow, and to a peculiar dynamic equilibrium with sea, also due to the role of the wide coastal aquifer of Salento. The western part hosts the reclaim activities, where the ancient rural building "Masseria Cesine", used as the wetland visit center.
This visit center site was selected for the construction of a low-enthalpy geothermal power plant as part of a pilot project funded by the EU IPA Legend 2007-2013 Adriatic. The pilot plant is a case perhaps unique in a protected wetland, made to check the replicability of geothermal air conditioning systems in environmentally valuable contexts. It was designed and realized for the monitoring of the environmental effects of heat exchange.
The geothermal heat pump system consists of two double U-shaped geothermal probes, 200 meters deep, intercepting three aquifers separated by aquiclude levels with different hydraulic and hydrogeochemical characteristics. Piezometric boreholes were realized at different depths and different distances from the system, allowing the estimation of several parameters or measurements of physical variables, including temperature. Hydrogeological conceptualization and periodic measurements support the implementation of a numerical model, designed for future assessment of environmental effects.
The heat transport numerical model was developed in FEFLOW, in order to estimate the extension of the thermal plume generated within the aquifers after a long period of heat exchange.
The numerical model was developed assigning different values of hydraulic, thermal and geochemical properties to each layer, considering in particular saline concentration of groundwater. The model parameters definition was based on thermal properties of ground

samples, Ground Response Test (GRT), groundwater level measurements, temperature logs and groundwater surveys.
Initial simulation results contributed to the evaluation of geothermal plant influence on groundwater, a fundamental resource ensuring the existence of wetlands and autochthonous plant and animal species, and confirmed the sustainability characteristics of the heat pump system.