

GROUNDWATER RESOURCES IN THE CARACAS VALLEY (VEN/8/010) F2 New

CORE FINANCING

YEAR	Experts		Equipment	Fellowships		Scientific Visits		Training	Sub-contracts	Misc. Comp.	Total US \$
	m/d	US \$	US \$	m/d	US \$	m/d	US \$	US \$	US \$	US \$	
1995	2/0	22,800	87,000	8/0	26,400	-	-	-	-	-	136,200
1996	1/0	12,000	23,000	2/0	6,900	-	-	-	-	-	41,900
1997	1/0	12,600	15,000	1/0	3,600	-	-	-	-	-	31,200

First Year Approved: 95

OBJECTIVES: To evaluate the origin and dynamics of the aquifers in the Caracas Valley by means of isotope techniques in order to define the proper exploitation of the available water resources.

BACKGROUND: The rapid population growth of the city of Caracas (from 800,000 in the early 1960s to an estimated 5 million in 1993) has led to a sharp increase in water demand (about 17 cubic metres per second at present) and a subsequent deficit of drinking water, especially in marginal areas (about 30%). This deficit is estimated to reach 3-4 cubic metres per second by the end of 1994. Most of the water used in this area for human consumption is derived from surface resources, and owing to present climatic trends (more frequent drought periods have progressively reduced the average rainfall from 999 mm in 1985-1988 to 908 mm in 1989-1993), this deficit is foreseen to increase. The use of groundwater is minimal; although during the 1940s and 1950s about 150 wells were drilled for water, most have since been abandoned and are not in use. However, piezometric groundwater levels in the Caracas Valley have been rising in some areas owing to the effects of progressive urbanization on the natural flow patterns of groundwater (reduction of aquifer discharge owing to canalization and construction of underground barriers). This has created severe engineering problems and it has been necessary to pump significant quantities of water during the construction of public and private buildings. Owing to the increasing demand for water and the geotechnical problems resulting from the presence of shallow groundwater, local authorities have proposed to reactivate some of the wells unused for several decades, with a two-fold objective: (1) to reduce the existing deficit in the water supply to the city by increasing use of groundwater, and (2) to lower the present piezometric levels, reducing the impact (and cost) of the presence of groundwater near the surface. In addition, owing to the nature of the aquifer and its location, the vulnerability of the aquifer to pollution must be addressed as a key element for the possible exploitation of the aquifer in the future and the use of the extracted water. Exploitation of the aquifer in selected areas can contribute to reducing the water deficit and would reduce the problems caused by the high water level in other parts of the city. In order to define a rational exploitation programme, it is necessary to gather information on the origin of groundwater, the

fluxes involved, its quality and the reason for its present or future deterioration. The use of environmental isotope techniques combined with other hydrogeological conventional techniques will increase information about the system. The project was initiated during 1994 with inputs provided under the TC Reserve Fund, which made it possible to start taking samples and to perform the isotope analyses from the wells being drilled. It also allowed the provision of some field equipment including a fluorimeter. A training course was carried out on the use of nuclear techniques in groundwater hydrology with expert assistance from the Agency.

PROJECT PLAN: The counterpart is involved in the revision and compilation of existing data from previous and ongoing hydrogeological studies carried out in the Caracas Valley (maps describing the hydraulic properties of the aquifer). This compilation will permit the definition of the working hypothesis on past and present circulation patterns of groundwater in the system. The present situation on all basic hydrogeological parameters must be properly defined before any further action is taken. New wells are being drilled, from which groundwater samples at different depths are collected with the object of obtaining information on the properties of each water-bearing horizon and the quality of groundwater. Chemical and isotopic analyses will be performed to obtain information on the main characteristics of the aquifer and the possible uses of groundwater from it. Two sampling campaigns are foreseen in this initial stage of the project: one was carried out in May-June 1994 and the other will take place after the rainy season (December 1994-January 1995). The information obtained after the conclusion of the second campaign will be processed to determine the potential of the aquifer to supply water for different uses and will define the strategy for additional drilling of wells in the metropolitan area. A geophysical campaign including a well-logging survey is foreseen for the second half of 1995 and may require additional sampling and analyses. On the basis of all results obtained (hydrogeological, geophysical and geochemical) the potential of the aquifer will be assessed and, if positively evaluated, may lead to undertaking a more comprehensive well-drilling programme in the identified areas.

NATIONAL COMMITMENT: The Ministry of Environment and Natural Renewable Resources (MARNR) is conducting a project in co-operation with local authorities and other institutes to investigate the groundwater resources in the Caracas Valley. HIDROCAPITAL is dealing with the drilling of additional wells and has actively participated in several phases of the project. Qualified staff from both institutes are involved in this project, completing most of the field work during the two campaigns. The counterpart has been involved in several hydrogeological studies in the country through previous Agency assistance (RLA/8/014) and has experience in using the isotope and tracer techniques. However, new staff is now involved and should be trained in these techniques.

AGENCY INPUT: Expert services will be made available for the interpretation of hydrochemical and isotopic results and the elaboration of progress reports, including suggestions for additional locations of new drillings. The Agency will provide portable well-logging equipment to be used in the identification of lithological units present in the aquifer which will permit the elaboration of more precise hydrogeological maps, especially regarding lateral continuity of water-bearing horizons. Additional field equipment for in-situ measurements and specific sampling for hydrochemical and isotopic analysis will be supplied during 1995 as well as analytical services for isotope determinations (stable and radioactive isotopes). Fellowships are also foreseen.

IMPACT: The assessment of groundwater quality and its hydrogeological behaviour by means of isotope techniques involving tracer experiments will yield information that will lead to identifying the best areas for drilling additional wells and will provide details on the sources and mechanisms of recharge, the timetable for the renewal of groundwater and the vulnerability of the system to pollution. On the basis of this information, local authorities dealing with water management will be able to make decisions on drilling wells and for the exploitation of the available groundwater resources. This will bring about an improvement of water supply for human consumption, irrigation and industrial uses and a reduction of the problems caused by the presence of groundwater near the surface.