WaterWare

Description	This UNIX based software package is an advanced water resource simulation tool that incorporates numerous models and analyses for easy access to advanced tools of data analysis, simulation modeling, rule-based assessment, and multicriteria decision support for a broad range of water resources management problems. WaterWare is implemented in an open, object-oriented architecture; it supports the seamless integration of databases, GIS, models, and analytical tools into a common sense, easy-to-use framework. This includes a multimedia user interface with Internet access, a hybrid GIS with hierarchical map layers, object data bases, time series analysis, reporting functions, an embedded expert system, and a hypermedia help-and-explain system. Real-time data management, modeling, forecasting, and reporting, and support for operational management are provided with a real-time expert system. Designed to be a highly detailed operation analysis tool at shorter timesteps (hourly to daily). Strongly linked to water quality modeling of instream flows to determine optimal wastewater loading strategies as well as related engineering, environmental, and economic aspects. WaterWare includes a number of simulation and optimization models and related tools, including a rainfall-runoff and water budget model, an irrigation water demand estimation model, dynamic and stochastic water quality models, a groundwater flow and transport model, a water resources allocation model, and an expert system for environmental impact and assessment.
Appropriate Use	Analysis and planning of complex, large-scale water resource management problems. Could be used to investigate realistic adaptation strategies under various hydrologic conditions. System includes both a rainfall/runoff model and a rule-based water resource system simulation tool, so a consistent hydrologic and water resource assessment could be made.
Scope	All locations; ground- and surface water systems; national or site-specific.
Key Output	Water allocations at demand nodes, flows in river reaches, water quality constituents throughout water system, aquifer dynamics, and other water system components.
Key Input	Extensive data requirements. Geographic: background maps with administrative boundaries, landuse; river network (geometry) graph and segment geometry (cross sections, roughness) for all channel based models. River Basin Objects: these include classes such as subcatchments, aquifers, lakes and reservoirs, cities, industries, agricultural areas and irrigation districts, representing the nodes in the river network; for each object, and depending on the type of object, data on water demand, use, consumptive use, and wastewater generation (pollution loads) are required. For aquifers, basic hydrogeological data are required; for reservoirs, morphometry and operating rules. Hydrological and Meteorological: Time series of basic hydrometeorological data (hourly to daily) covering at least one year or the period of interest for the long-term models), temperature and precipitation, optionally relative humidity, wind speeds,. cloud cover and solar radiation, potential evapotranspiration. Water Quality: hourly to daily observation data from one or more water quality observation stations; station location and regular time series for each parameter. Economic: Discrete cost functions (investment and operational costs) for a set of alternative waste water treatment technologies.
Ease of Use	Fairly difficult to use given its broad scope.

WaterWare (cont.)

Training Required	Significant training in computer modeling and the engineering, environmental, and economic aspects of water systems.
Training Available	Software purchase includes on-site installation. Training courses and on-site training available (see Contacts below).
Computer Requirements	WaterWare is currently supported for UNIX servers (SUN Sparc/Solaris, IBM RS6000/AIX, HP Risc/HP-UX, Intel Pentium/Linux), with a minimum of 64 MB RAM and 128 MB of swap space. About 2 GB disk space is required; disk space requirements depend on the amount of geographical data (in particular satellite images) and monitoring data. A graphics resolution of 1280*1024 (256 simultaneous colors) is required for the X11 platforms.
Documentation	Documentation available from Environmental Software and Services, GmbH (see Contacts below).
Applications	River Thames in England, Lerma Chapala in Mexico, West Bank and Gaza in Palestine, Kelantan River in Malaysia. River basins and coastal zones in Turkey, Lebanon, Jordan, Egypt, and Tunisia.
Contacts for Framework, Documentation, Technical Assistance	Environmental Software and Services, GmbH, P.O. Box 100 A-2352 Gumpoldskirchen, Austria; Tel: 43225263305; Fax: 432252633059; website: http://www.ess.co.at/WATERWARE/.
Cost	ECU30,000 for initial installation, support, and one-year license.
References	WaterWare: A Water Resources Management Information System — Palestinian case study. Available from Environmental Software and Services, GmbH, P.O. Box 100 A-2352 Gumpoldskirchen, Austria.