



## International Middle East

### Client

Palestinian Water Authority

### Location

West Bank, Palestinian Territories

*"Cost control of the engineering and construction management contract has been excellent... The team has been responsive and aggressive in pursuing fair and reasonable settlements to the changes in the contract."*

Contractor Performance System  
evaluation, September 30, 2002

## Water Resources, Phase II and III, West Bank, Palestinian Territories

### Project Highlights

- Delivered under very difficult working conditions requiring high security measures
- Involved the study and design of wells, water supply and distribution systems, and roads
- Provided preliminary design, design-build bid documentation, and construction management of design-build contracts to provide sustainable water supplies in the West Bank

### Project Description

Phase II of this comprehensive program involved preliminary planning and project development. This phase included:

- Water resource development and conveyance systems for the Palestinian Water Authority (PWA). This component supports the US Agency for International Development (USAID) mission of providing greater access to and more effective use of scarce water resources.
- A fast-track road and utilities upgrade project to accommodate the increasing numbers of tourists expected to visit Bethlehem for the millennium and the future.
- An Integrated Water Resources Management Plan to maximize the use and reuse of available water resources, improve the general water quality of the aquifers, develop water resources and construct conveyance systems, and provide long-term planning guidance for meeting the water demands in this water-scarce environment.
- Strengthening the institutions of the Palestinian water sector responsible for managing the West Bank's water resources by providing technical assistance directly to the PWA and, through them, to the utilities making up the sector.
- Continued design of water resource development and conveyance systems and construction management of facilities.

### Completed Work—Phase II

The water resources program is aimed at increasing and improving water supplies to the Palestinians in the Hebron, Nablus, and Bethlehem Districts. CH2M HILL completed the study and design work for the water supply systems and supervised the construction and startup of the facilities. The Phase II project consisted of designing and managing the construction of 11 production wells and 16 monitoring wells (with average depths of 800 metres), and over 100 kilometres of transmission pipelines with associated storage and pumping facilities in the West Bank area for the PWA. The team also designed 100 kilometres of local distribution mains in seven villages to relieve critical shortage and inefficient use of water.



CH2M HILL completed a number of individual tasks to support USAID's overall program objective. The management model considered all potential supply sources, including reuse of wastewater and capture of storm flows to determine a sustainable yield. The work included the following tasks.

### **Groundwater Studies—Eastern and Northeastern Basins**

The groundwater program included aquifer characterization field studies; aquifer modeling and preparation of a groundwater management models; comprehensive collection and compilation of existing data; borehole geophysics; aquifer testing (pump and packer testing); and a baseline water quality monitoring program. CH2M HILL designed a set of monitoring and exploratory wells to assess sustainable yields and awarded the drilling contract for the wells. We also completed very detailed cross-sections mapping of the geology and key areas of the aquifer, as well as water quality, aquifer vulnerability, and potential contamination sources. The contamination risk analysis/vulnerability studies provided a solid foundation for Phase III.

CH2M HILL also planned and implemented water quality monitoring, aquifer testing, and geophysics programs in both the Eastern and Northeastern Basins. The team provided recommendations to make these programs more productive and cost effective. All data collected for the Basins were entered in a database (digital and hardcopy), including water levels, well logs, water quality, abstraction amounts, historic reports, geologic maps, topographic maps, and well construction data.

### **Groundwater Modeling**

Aquifer modeling was initiated to enhance and refine the groundwater model. Modeling work also included calibrating the steady-state model and demonstrating various data inputs to the management model. CH2M HILL worked with PWA trainees on the fundamentals of conceptual modeling preparatory to numerical modeling.

### **Engineering Design and Procurement Documentation**

Project components included monitoring and exploratory wells, bulk water supply and transmission facilities, and village water distribution systems, including all supply wells, treatment, storage, pumping, and transmission line components. We provided feasibility studies, preliminary designs, and final designs for these facilities, as well as procurement documentation.

### **Hebron Wastewater Monitoring**

CH2M HILL developed and implemented a wastewater-monitoring program to quantify and characterize the wastewater generated from Hebron. Sampling was conducted on selected waste streams, including industrial sources from stonecutters, tanneries, slaughterhouses, and dairies.

### **Water Master Planning Framework**

CH2M HILL updated and enhanced the Comprehensive Planning Framework for Palestinian Water Resources. Our work advanced studies, addressing Palestinian equity issues and Jordan River riparian rights and



*"CH2M HILL, under very difficult conditions caused by the unrest, has done an excellent job of performing the construction management requirements...."*

Contractor Performance System  
Evaluation

was an important technical baseline for peace process water negotiations. Past framework studies and strategic plans did not address regional water balances, but rather focused on what can be done with current allocations. This update required:

- Reviewing existing water resource management plans and reports
- Using the Eastern Aquifer model to determine maximum sustainable yields for the region
- Inventorying potential sources of water supply within the region, including the Jordan River Basin, as well as within the boundaries of the West Bank and Gaza Strip
- Evaluating potential alternative sources of supply within the Middle East
- Developing user costs for three alternatives

The update provided water resource plans in 10-year intervals to meet the projected water requirements of the Palestinian people through 2040.

### Phase III

CH2M HILL completed Phase III in the summer 2004. This phase included:

- Studied and designed municipal and industrial wastewater treatment facilities in Hebron
- Planned and designed water distribution and wastewater facilities in selected villages
- Institutional capacity building for the PWA
- Groundwater aquifer modeling
- Developed an integrated water resources master plan for the West Bank
- Construction management services and implementing demonstration projects for water reuse, conservation, groundwater recharge, and aquifer protection

### Schedule Control

Phase II was initiated in January 1999 under an accelerated project mobilization and startup in close coordination with USAID. The rapid project start met the short-term project deadlines associated with the Year 2000 celebration-related aspects of the project.

Under Phase II, CH2M HILL completed the final design work for the Bethlehem 2000 Road project on a fasttrack schedule and completed construction on the road projects.

Phase III was completed under extremely complex security requirements. Scheduled were met in spite of difficult jobsite conditions and work stoppages, curfews, and checkpoint closures.



## Quality Assurance

USAID highlighted CH2M HILL's corporate commitment and responsiveness as an important indicator of quality performance. CH2M HILL's flexibility to meet changing, and at times violent, circumstances in the Palestinian territories is proof of our corporate commitment to ensuring quality services even in the most difficult situations.

## Project Coordination

The program relied on the productive cooperation of our consulting team, working together with client organizations and other stakeholders. Recognizing the benefits of enhanced cooperation, CH2M HILL conducted an early chartering workshop to gain the active support and commitment of team members. We started with several individual or small group meetings to identify significant interests and points of view. We then facilitated an intensive workshop with over 100 participants representing the Palestinian Water Authority, Ministerial officials, the Municipality of Hebron, village mayors, NGOs, USAID, and others.

Participation was positive, with active involvement of all groups. The interactive format encouraged a productive exchange of ideas, minimizing the effect of cultural and political differences.

Strengthening institutions responsible for managing the West Bank's water resources was an essential component of the contract and crucial to ensuring a sustainable water utility. CH2M HILL involved the PWA in the core management team to achieve the contract goals. This collaborative work included streamlining or improving the project approval processes; instituting mechanisms to improve inter-government communication and coordination; designing and implementing organizational changes; developing and delivering training programs; putting policies and regulations in place; putting monitoring functions in place; developing cooperation.