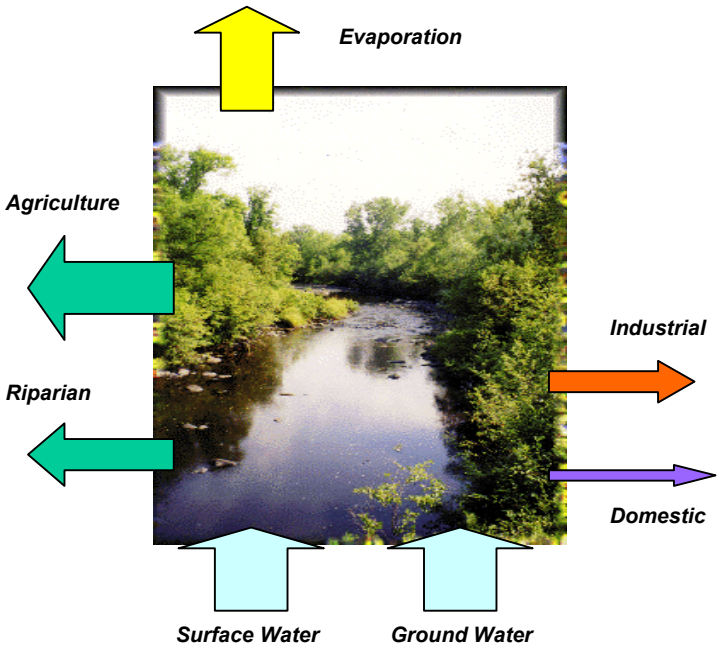
Water Use Management

Measuring, Modeling, and Managing Limited Water Resources

Background

Water is a precious, life-giving commodity. The availability of good-quality water dictates the success of most ventures, including agriculture production, municipal growth, industrial output, tourism, and maintenance of fragile ecosystems. These needs compete for already over-subscribed, seasonally and annually variable surface water and groundwater resources. The challenge for water managers is to balance the competing existing needs, legal mandates, and future water uses to maintain a sustainable water supply for us, our children, and generations to come.



In order to achieve an efficiently-managed, sustainable water supply we need to:

- Understand the basic processes controlling our water supply.
- Collect and widely disseminate information on the quantity and quality of our water resources as a basis for planning and management.
- Evaluate consequences of alternative water management strategies prior to implementation.
- Develop confidence in cooperative management of these limited resources.

Approach

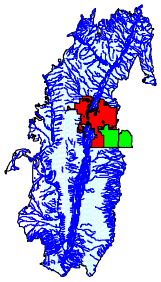
Cooperative water management must be built on mutually accepted information about the quantity and quality of water resources coupled with decision tools to help articulate the consequences of management alternatives, support long-term planning, and communicate these alternatives and their consequences broadly. Data collection must be optimally implemented to be cost–effective. Decision tools must envision water resources as an integrated system accounting for natural processes, engineering action, various water needs, and legal issues.

Implementation of this type of integrated, active water management system can be achieved in stages, building on existing relationships and cooperative monitoring/analysis activities. Sandia National Laboratories is actively engaged in integrating novel monitoring and decision analysis tools with existing capabilities of local, state, and federal water management agencies.

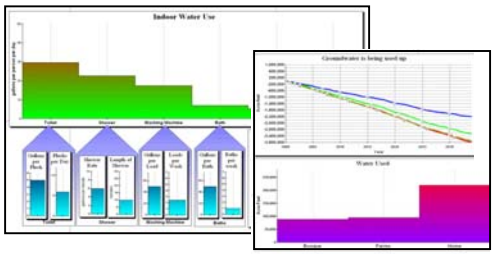
Research and Existing Projects

Sandia has research activities focused on national and international water issues using novel approaches and unique expertise in hydrologic system evaluation, numerical analysis, cooperative monitoring, data management, environmental remediation, and micro-sensor development. Current efforts include:

Water Management Model Development
Integrated water management models are being developed on a dynamic simulation platform. These models integrate the complex relations between water supply, water demand, water quality, economic productivity, demographics, environmental impacts, and social/cultural values. Demonstration models of a closed groundwater basin (Estancia Water Basin) and a major river controlled basin (Middle Rio Grande Basin) have been developed and are being refined to support current water planning activities.



Middle Rio Grande Basin, a test-bed for decision modeling

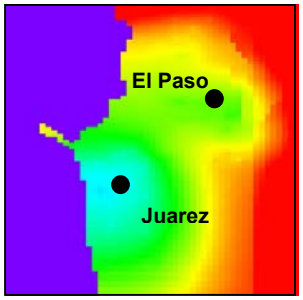


Dynamic simulation decision model showing user interface (left) and groundwater depletions for different management scenarios

Decision Analysis Technique Development
A number of alternative decision approaches ranging from expert elicitation and multi-attribute utility analysis to numerically complex uncertainty and sensitivity analysis techniques are constantly being developed, refined, and implemented for an array of DOE, domestic, and foreign groups.

Hydrological Models
Sandia has developed or modified complex spatial models of hydrogeological systems in conjunction with the U.S. Geological Survey for both the groundwater underlying Sandia National Laboratories and the Hueco Basin along the U.S.–Mexico border in southern New Mexico to evaluate the consequences of various water management activities.

Sensor Development and Evaluation for Active Water Management
Sandia is beginning to evaluate the application of a wide array of microsensors and remote sensing systems for low-cost, real-time, continuous monitoring of surface and ground water quality and quantity.



Pumping induced drawdown along the U.S.– Mexico Border

Related Sandia Water Activities

This is one component of Sandia's Water Safety, Security, and Sustainability Initiative. Other areas include: Water Infrastructure Risk Assessment, International Water, Water Quantity, and Water Quality.

For Additional Information Contact:

Erik Webb, Ph.D.
Sandia National Laboratories
P.O. Box 5800, MS 0735
Albuquerque, NM 87185-0735
Telephone:505/844-2479
Fax: 505/844-4426
email: ekwebb@sandia.gov

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company for the United States Department of Energy under contract DC-AC04-94AL85000
SAND2002-2273P

Sandia National Laboratories