Quantifying Resource Management Strategies within WEAP

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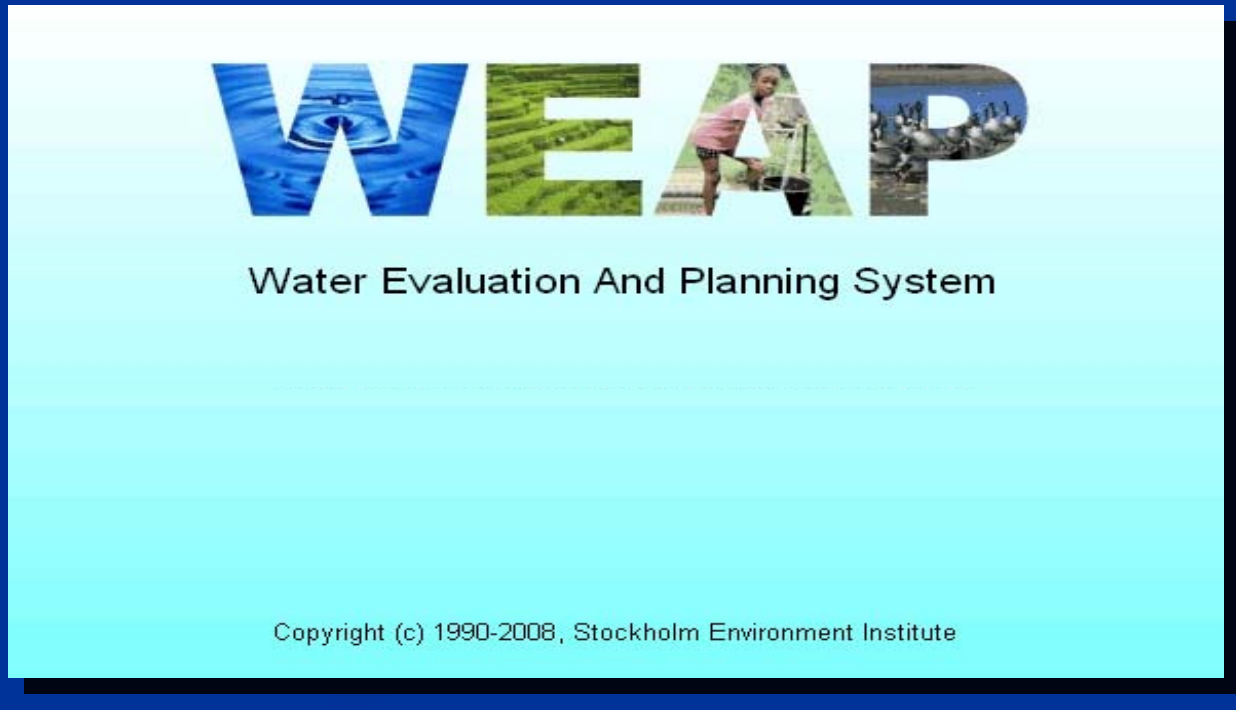
Water Evaluation and Planning System

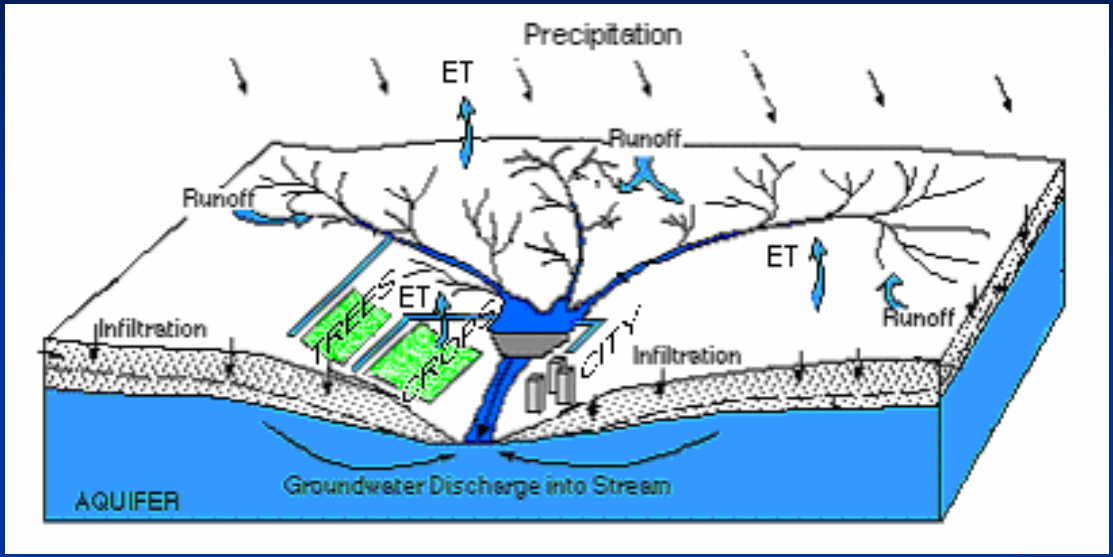
- A generic, object-oriented, programmable, integrated water resources management modeling platform



Examples of Analyses

- Sectoral demand analyses
- Water conservation
- Water rights and allocation priorities
- Financial analyses
- Groundwater and streamflow simulations
- Reservoir operations
- Hydropower generation
- Pollution tracking
- Ecosystem requirements

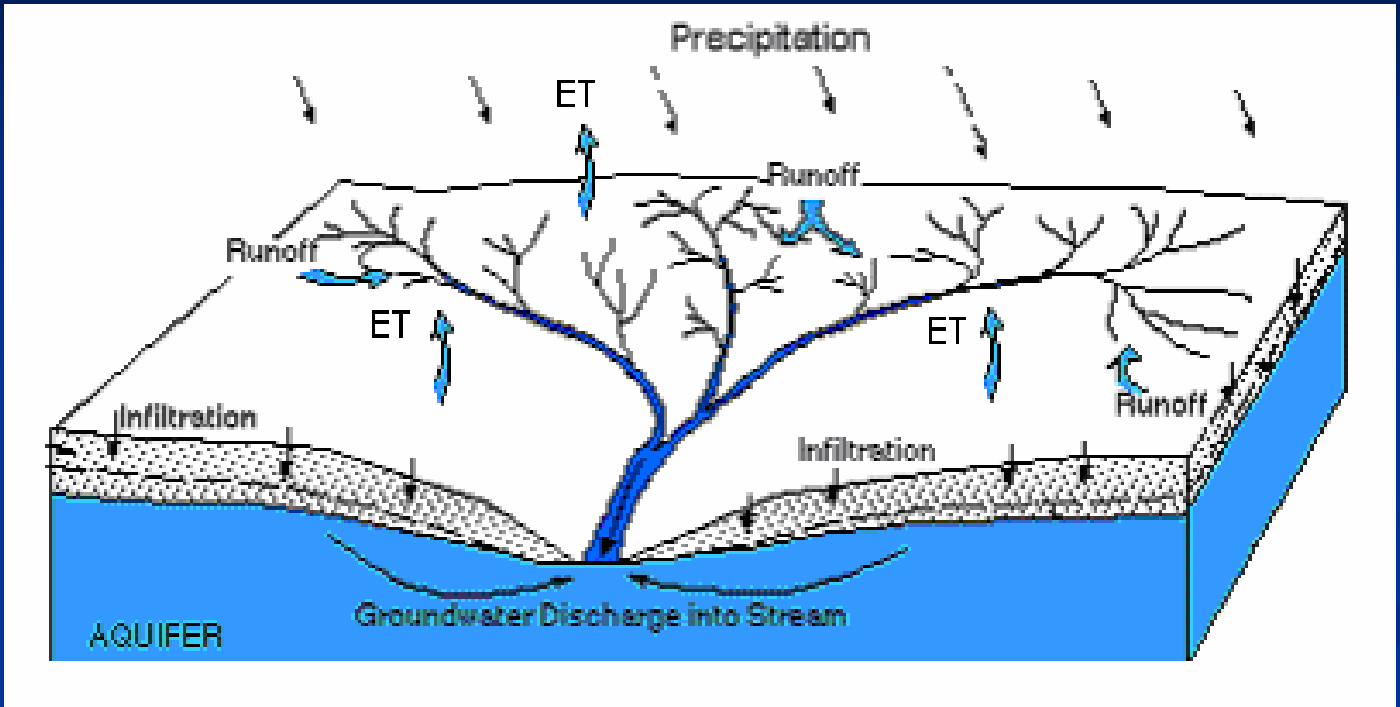
Planning Model



Critical questions:

- How should water be allocated to various uses in time of shortage?
- How can these operations be constrained to protect the services provided by the river?
- How should infrastructure in the system (e.g. dams, diversion works, etc) be operated to achieve maximum benefit?
- How will allocation, operations and operating constraints change if new management strategies are introduced into the system?

Hydrology Model

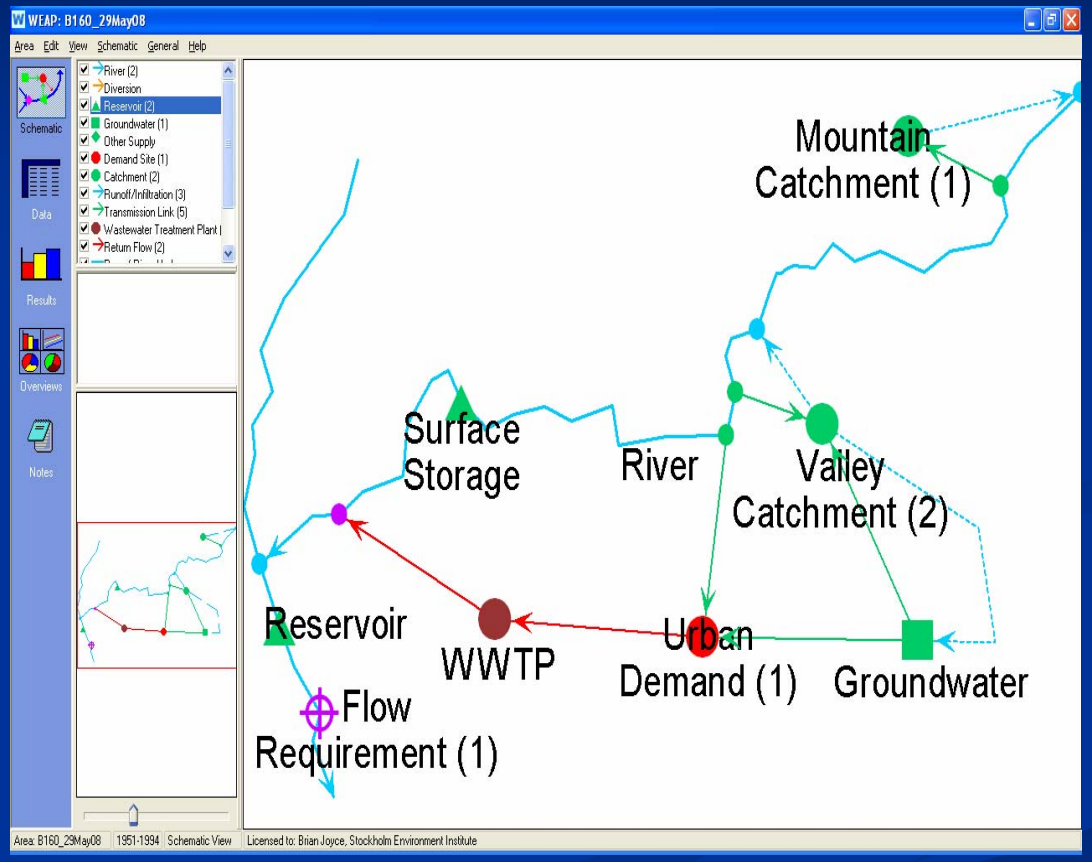


Critical questions:

- How does rainfall on a watershed translate into flow in a river?
- What pathways does water follow as it moves through a watershed?
- How does movement along these pathways impact the magnitude, timing, duration and frequency of river flows?

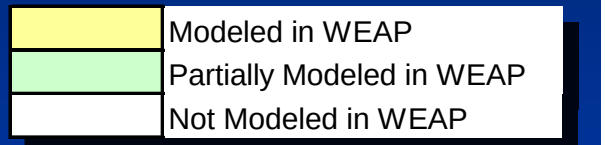
WEAP Structure

- Node-link architecture connects water supplies to demands
- Each demand is assigned a priority and a preferences among available supplies
  - Determines order in which demands are met
  - Determines order in which sources are used
- Constrained by link capacities



Resource Management Strategies

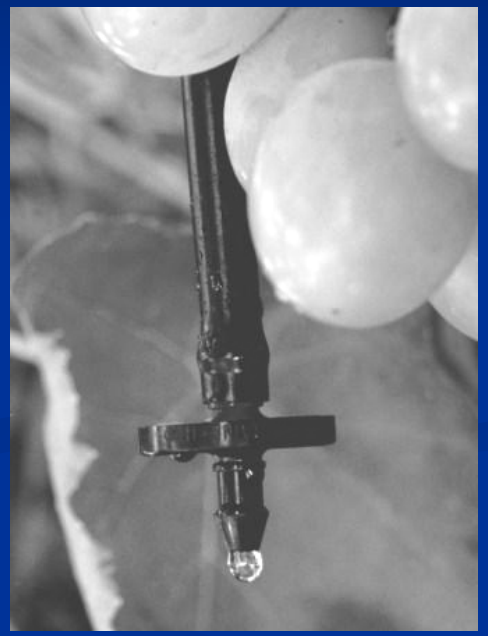
STRATEGIES TO REDUCE WATER DEMAND	
Agricultural Water Use Efficiency	YES*
Urban Water Use Efficiency	YES*
STRATEGIES TO IMPROVE OPERATIONAL EFFICIENCY	
Conveyance	YES
System Reoperation	YES
Water Transfers	YES
STRATEGIES TO INCREASE WATER SUPPLY	
Conjunctive Management & Groundwater Storage	YES*
Desalination	YES*
Precipitation Enhancement	YES*
Recycled Municipal Water	YES*
Surface Storage -- CALFED/State	YES*
Surface Storage -- Regional/Local	YES*
STRATEGIES TO IMPROVE WATER QUALITY	
Drinking Water Treatment and Distribution	SOME
Groundwater Remediation/Aquifer Remediation	SOME
Matching Water Quality to Use	SOME
Pollution Prevention	NO
Urban Runoff Management	NO
STRATEGIES TO PRACTICE RESOURCE STEWARDSHIP	
Agricultural Lands Stewardship	NO
Economics Incentives Policy	SOME
Ecosystem Restoration	NO
Floodplain Management	NO
Forest Management	NO
Recharge Area Protection	YES
Urban Land Use Management	YES
Water-Dependent Recreation	NO
Watershed Management	NO
STRATEGIES TO IMPROVE FLOOD MANAGEMENT	
Modify Flooding	SOME
Modify Impacts of Flooding	NO
Modify Susceptibility to Flooding	SOME
Preserve and Restore Natural Floodplain Functions	NO



Reducing Water Demand

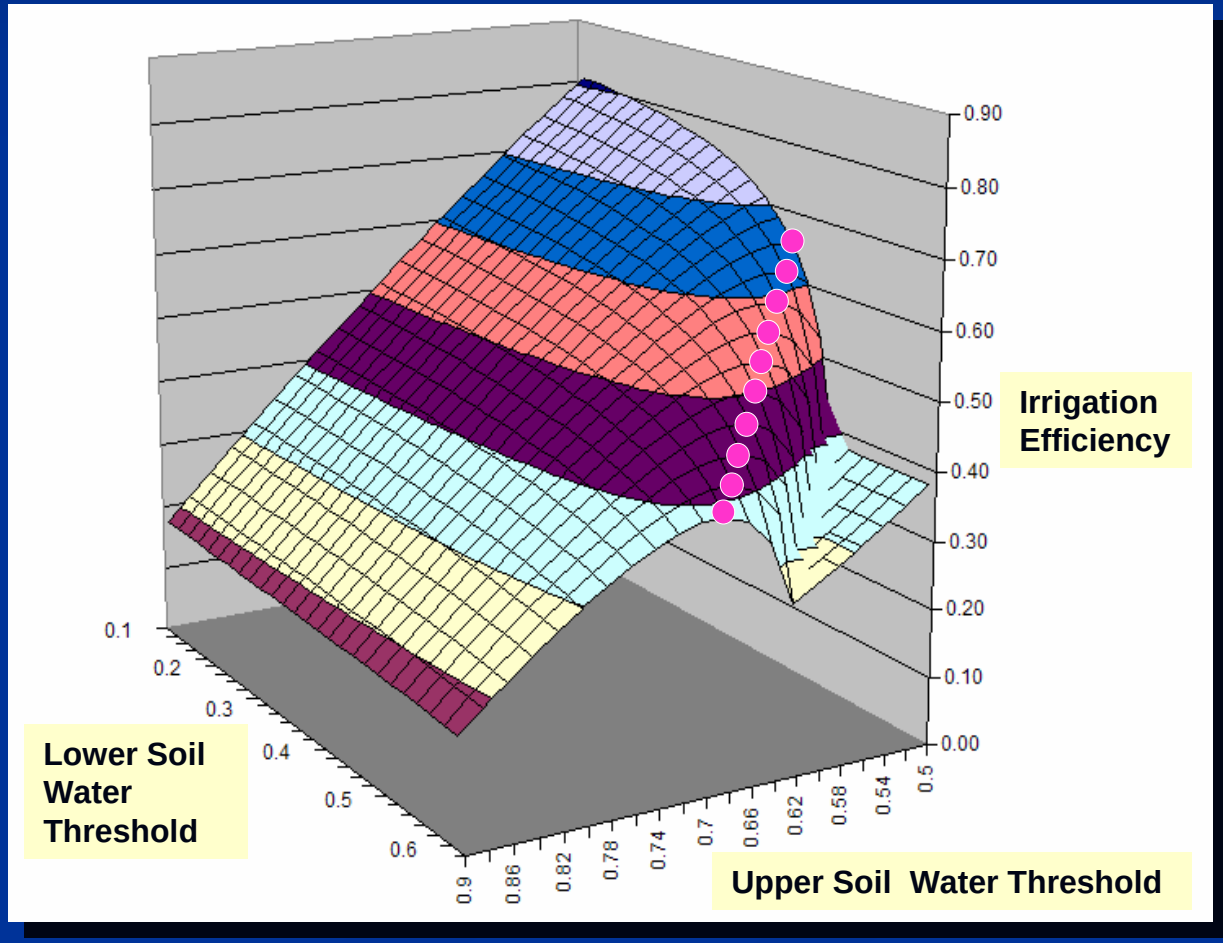
Agricultural Water Use Efficiency

- Improvements in technologies and management of agricultural water
  - Hardware (on-farm irrigation equipment)
  - Crop and farm water management practices, and
  - Improvements to water supplier distribution systems

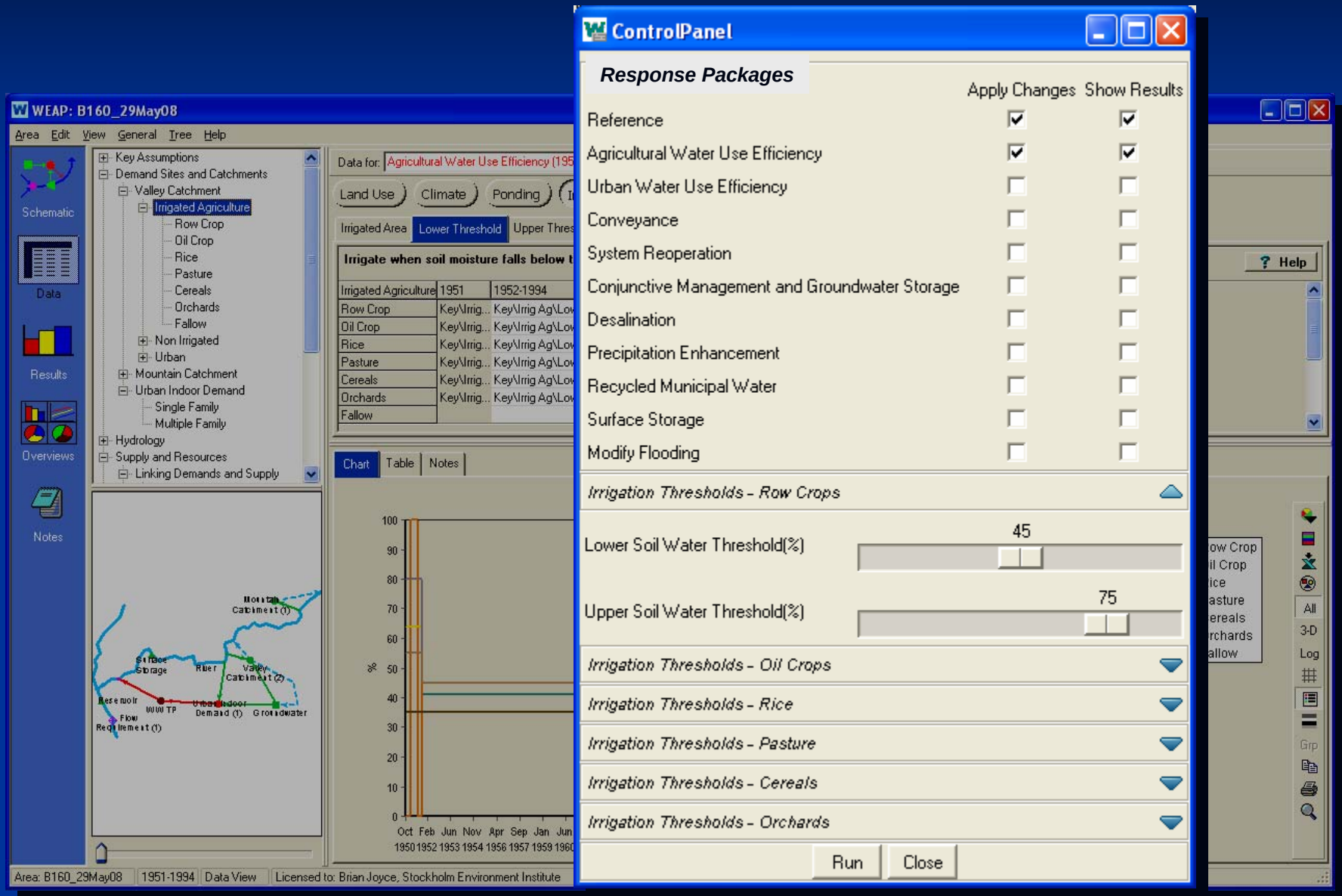


Managing Irrigation Efficiency in WEAP

- Irrigation efficiency is determined by controlling soil moisture
- Highest when soils are managed in dry range



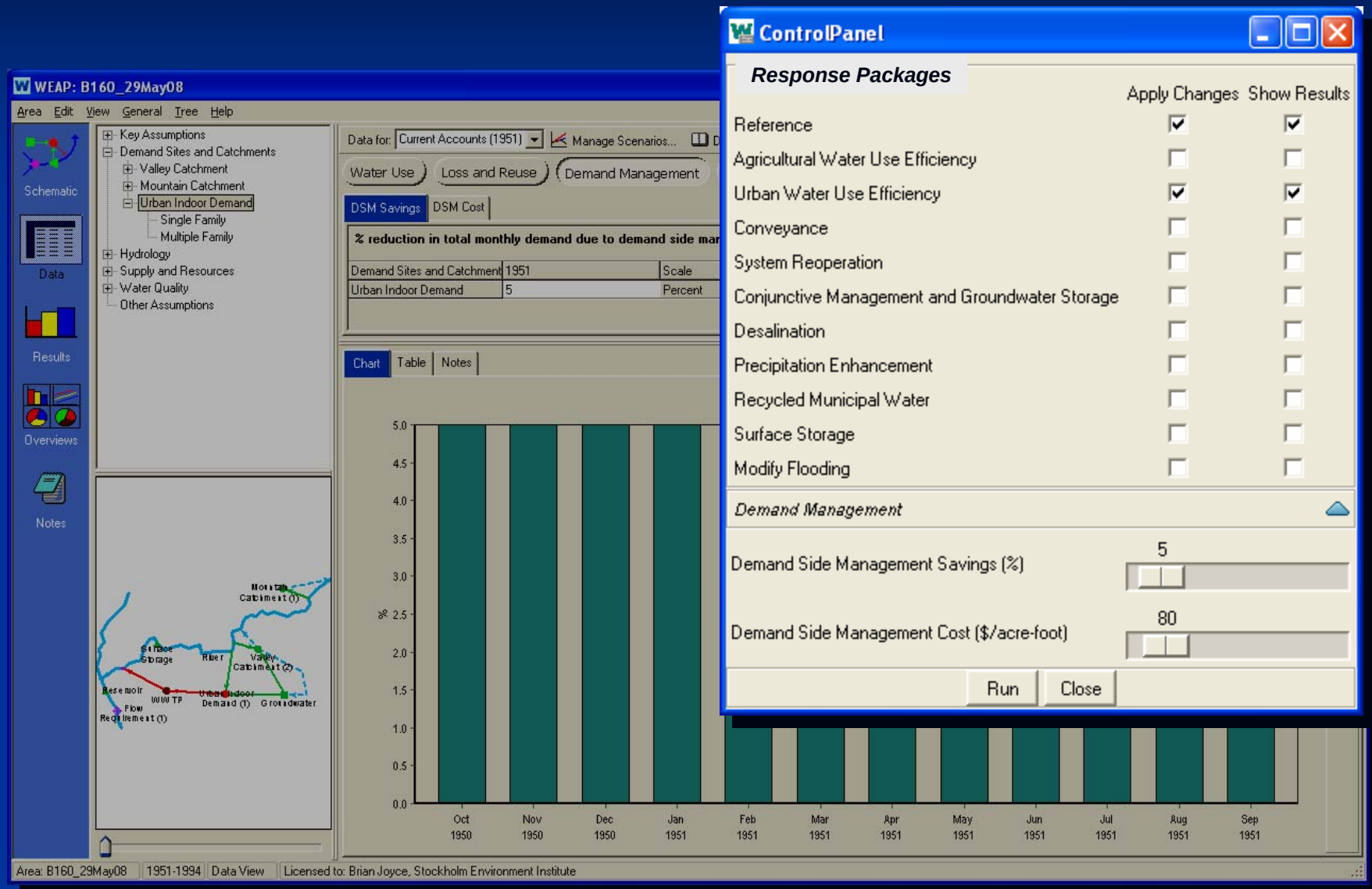
Managing Irrigation Efficiency in WEAP



Urban Water Use Efficiency

- Technological or behavioral improvements in indoor and outdoor residential, commercial, industrial and institutional water use that lower water demand, lower per capita water use, and result in benefits to water supply, water quality, and the environment.

Urban Demand Management in WEAP

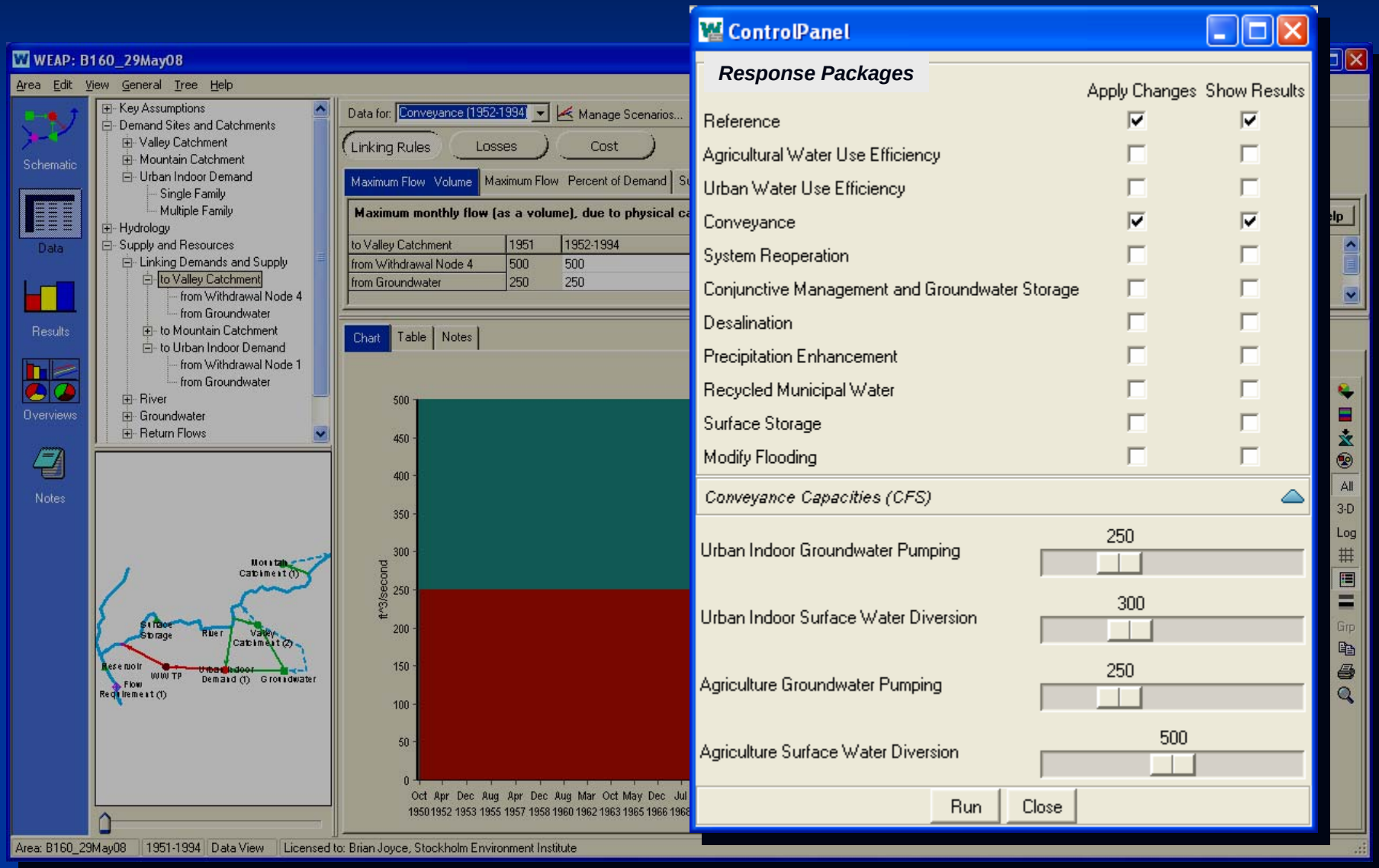


Improving Operational Efficiency

Conveyance

- Design water transmission systems with adequate water capacity to efficiently distribute imported or locally produced water to storage or the end users, so that system bottlenecks do not occur.

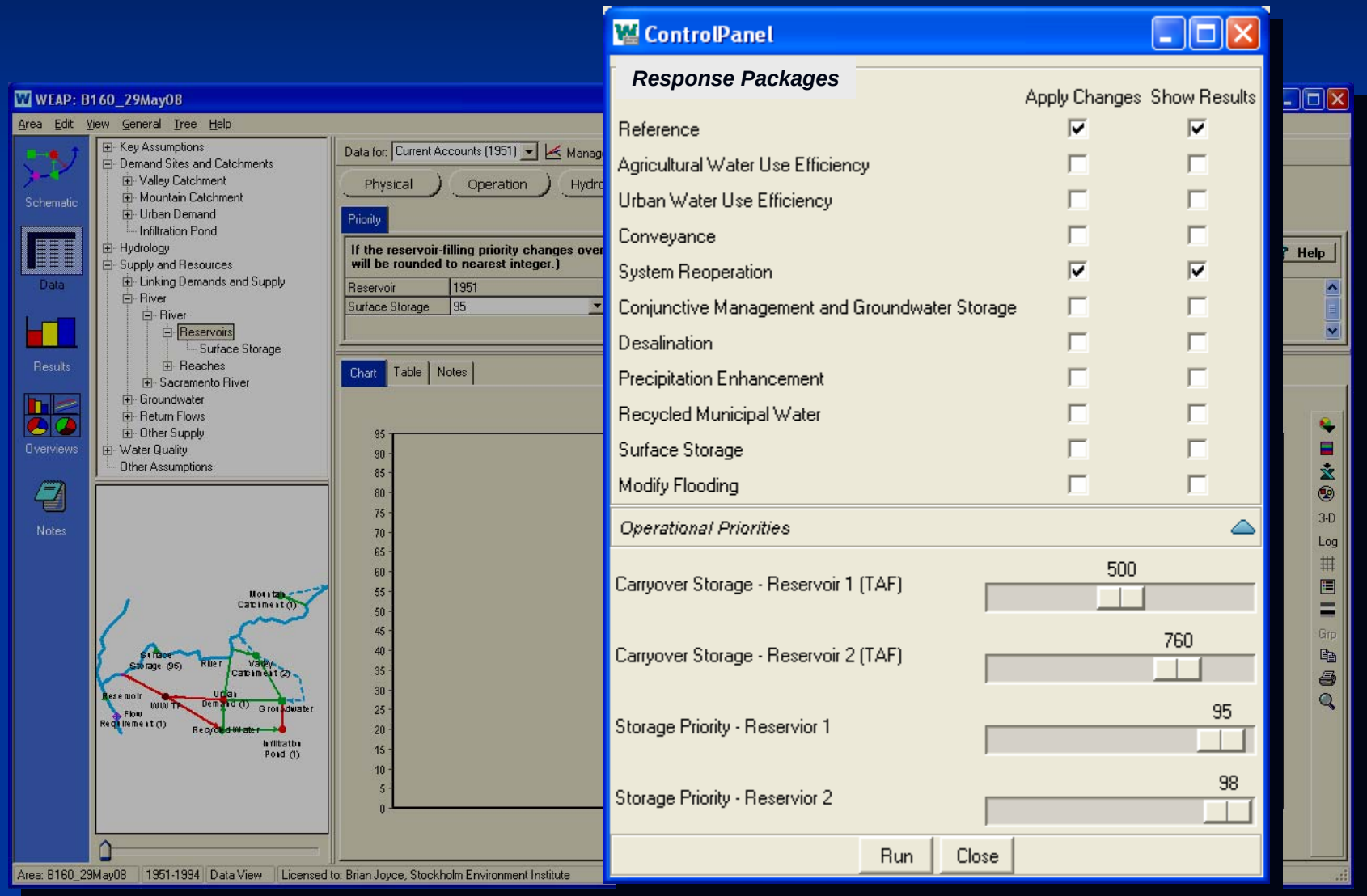
Adjusting Conveyance Capacities in WEAP



System Reoperation

- Changing the existing operation and management procedures for such water facilities as dams and canals to meet multiple beneficial uses.

Adjusting Operational Priorities in WEAP



Increasing Water Supply

Conjunctive Management and Groundwater Storage

- Coordinated operation of surface water storage and use, groundwater storage and use, and conveyance facilities to meet water management objectives.

Possible Approaches in WEAP

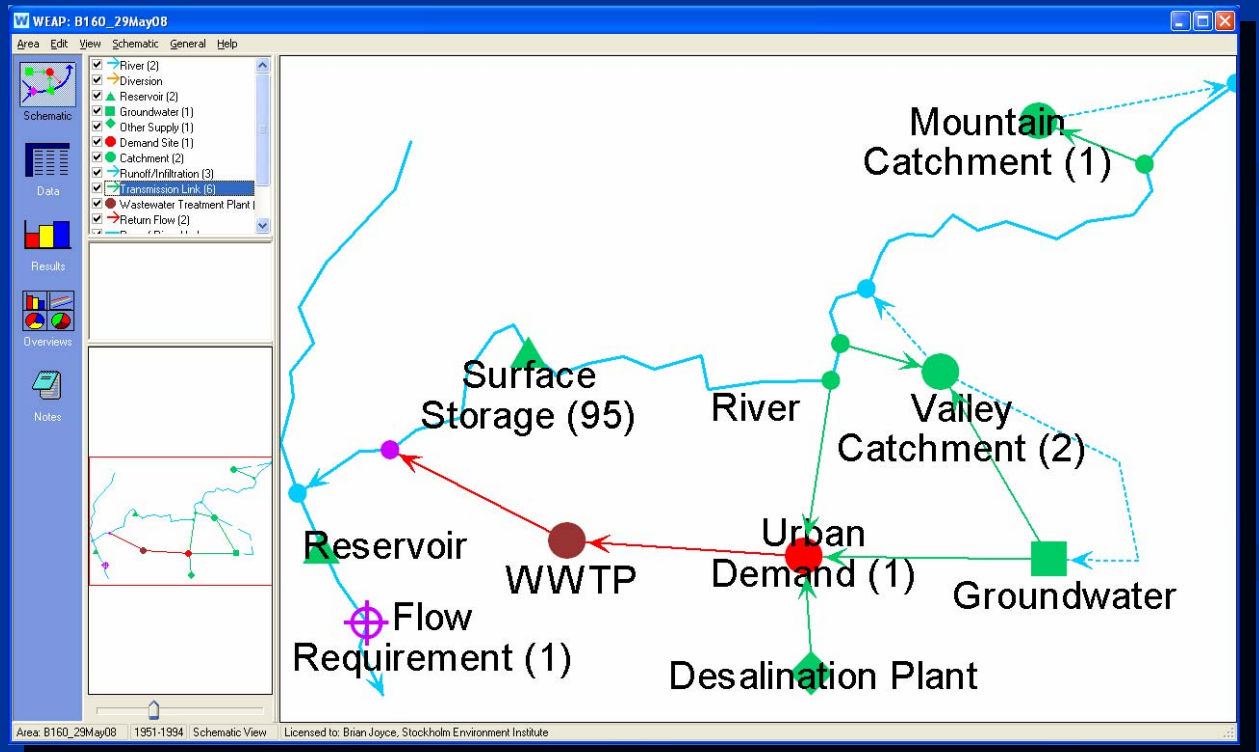
- Adjust supply preferences in wet and dry years
  - For example, Pump groundwater first in dry years, Divert surface water first in wet years
- Operate groundwater object as a bank
  - Track storage accounts, Limit puts/takes to bank

Desalination

- In California, the principal method for desalination is through reverse osmosis technology. There are two primary types of desalination:
  - Brackish (low-salinity) surface or groundwater
  - Ocean water.

Desalination in WEAP

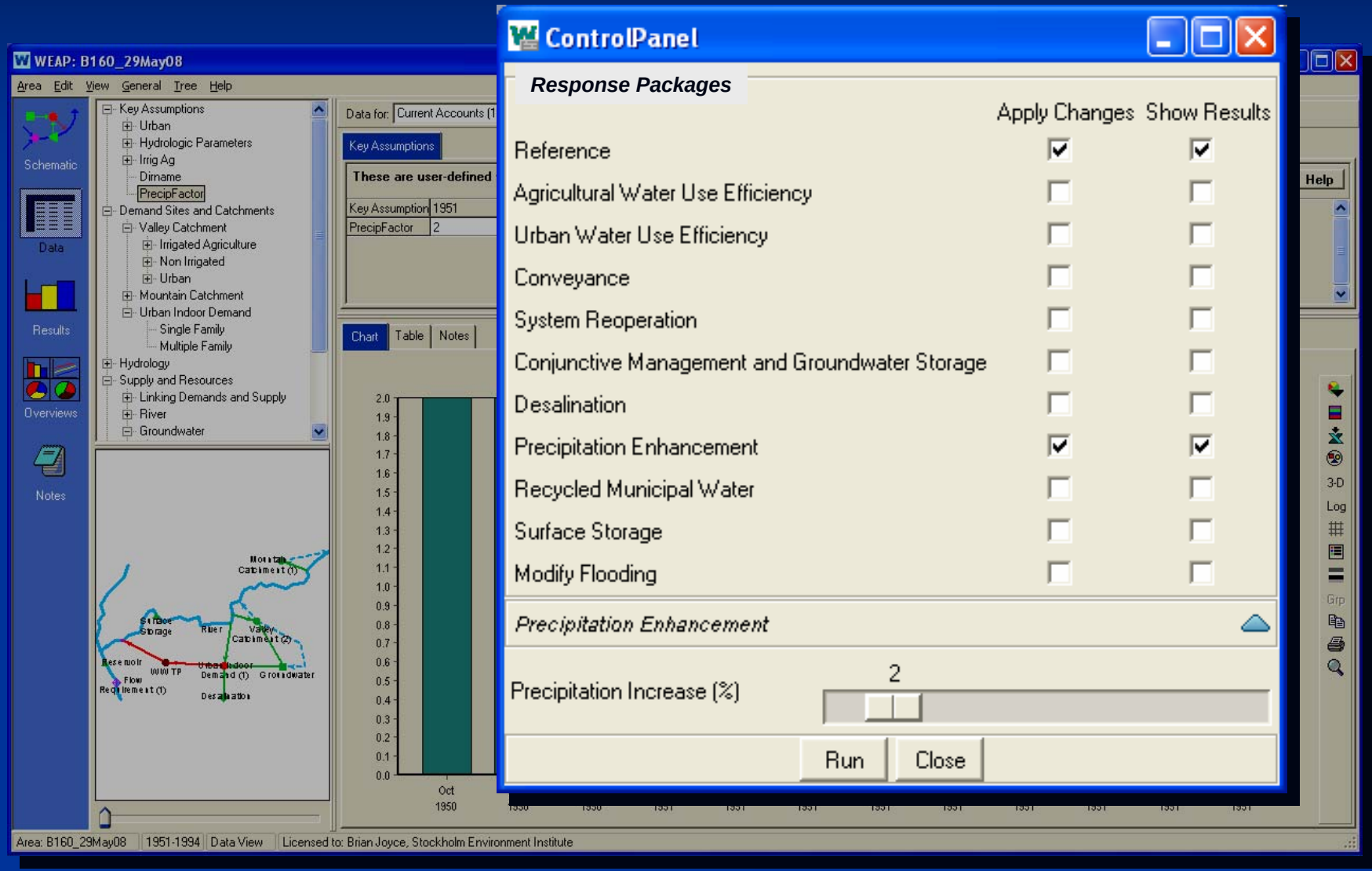
- Add desalination plant as new water supply model object
- Fixed and variable costs/benefits considered



Precipitation Enhancement

- Precipitation enhancement projects are intended to increase surface water supplies or hydroelectric power. Projects increase the amounts of water produced (~2-15%) by artificially stimulating clouds to produce more rainfall or snowfall than they would naturally.

Adjusting Precipitation in WEAP

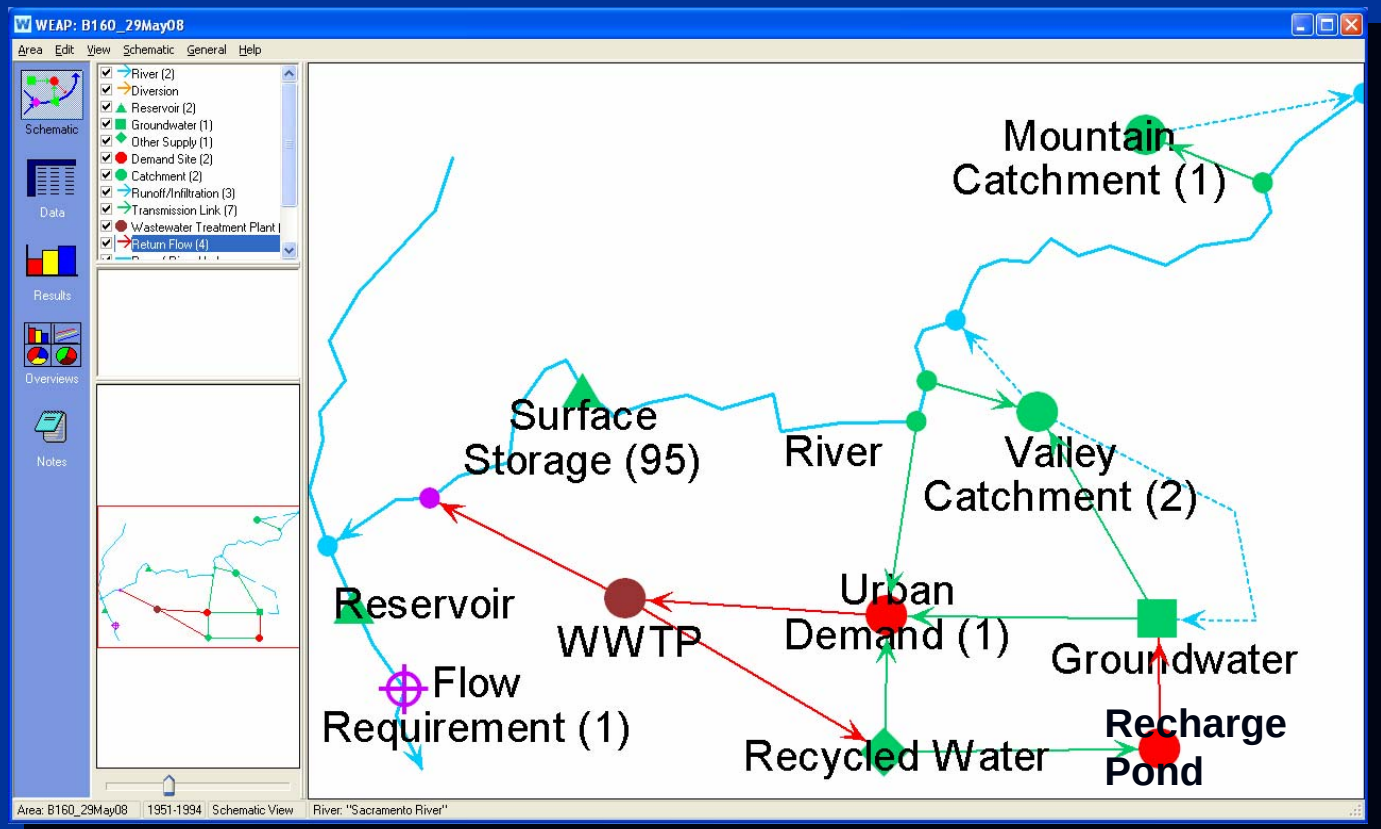


Recycled Municipal Water

- Water recycling is the process of treating wastewater from previous uses, and then storing, distributing, and using this recycled water to meet demands. Reclaimed water used for:
  - Golf courses
  - School yards
  - Residential landscape
  - Parks
  - Industrial uses

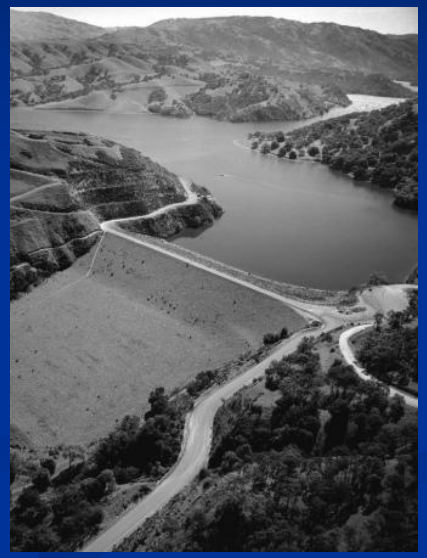
Wastewater Recycling in WEAP

- Outflows from WWTP are temporarily stored as supplemental water supply



Surface Storage

- The CALFED Record of Decision (2000) identified five potential surface storage reservoirs that are being investigated by the California Department of Water Resources, U.S. Bureau of Reclamation, and local water interests.
  - Shasta Lake Water Resources Investigation
  - North-of-the-Delta Offstream Storage
  - In-Delta Storage Project
  - Los Vaqueros Reservoir Expansion
  - Upper San Joaquin River Basin Storage Investigation



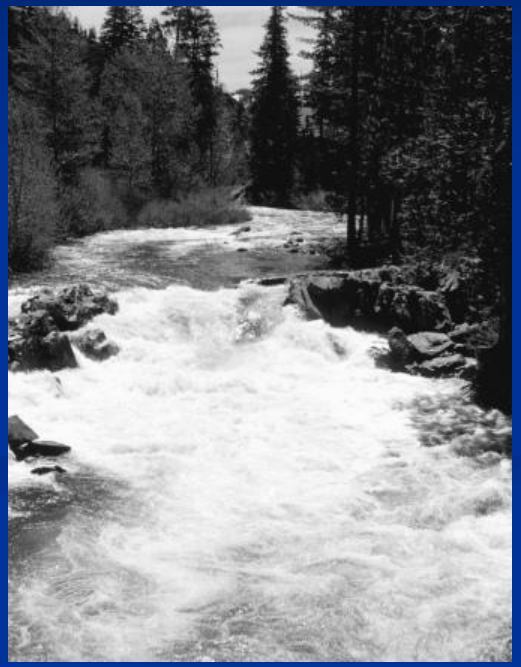
Possible Approaches in WEAP

- Modify existing storage
  - Increase storage capacity
  - Adjust reservoir operating rules (e.g. flood control storage)
- Add new facilities
  - Incorporate proposed operations and engineering specifications
  - Indicate date reservoir comes online

Improving Flood Management

Flood Management

- Projects and programs that detain or divert floodwaters or improve the ability of channels to accommodate floodwaters.



Possible Approaches in WEAP

- Adjust reservoir rule curves
  - Allow additional flood storage in certain months
- Adjust weir diversions
  - Increase amount of spilled water that is diverted to bypasses

Questions

Thank You