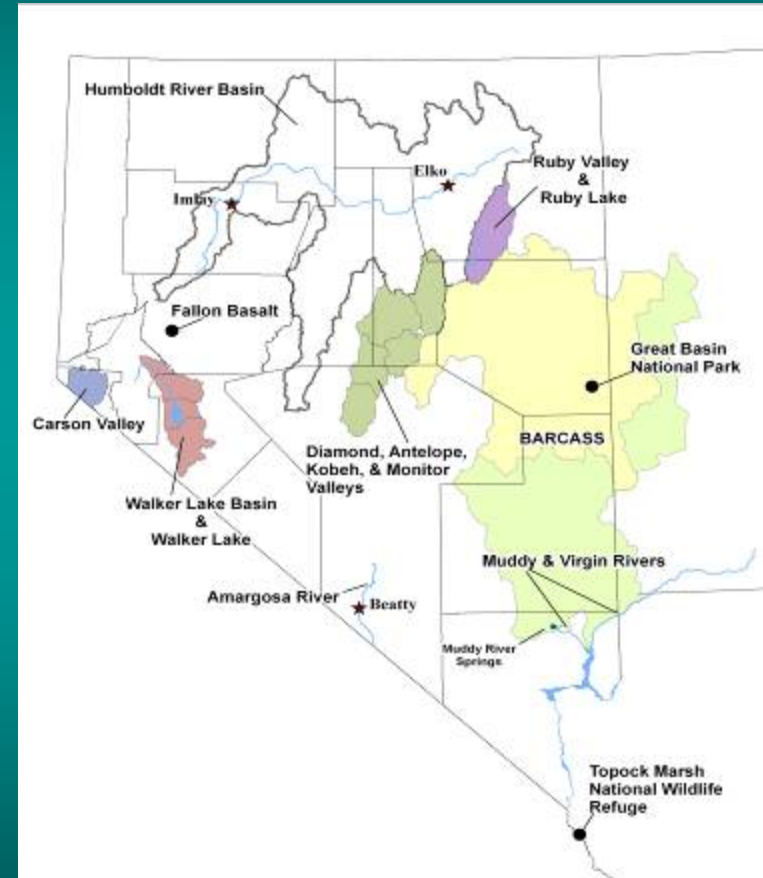


USGS Water Quantity Studies in Nevada

Michael L. Strobel, Deputy Director
Daniel Bright, Studies Chief, S. NV
Nevada Water Science Center

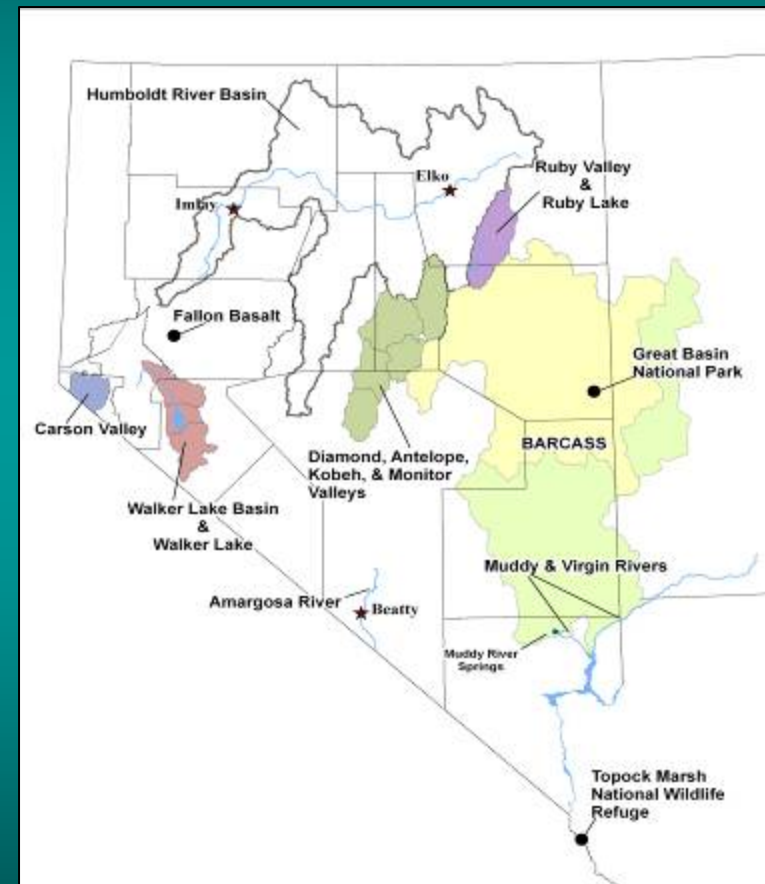
USGS Studies in Nevada

- Great Basin National Park
- Ruby Valley
- Diamond Valley
- Fallon Basalt Aquifer
- Humboldt River Basin
- Walker Lake
- Muddy and Virgin River ET
- Topock Marsh ET (LCR)
- Carson Valley
- Amargosa Desert
- BARCASS



Common Focus or Approach

General Focus of Study	SW/GW Interaction	GBNP Ruby V.	Humboldt R. Walker Lake	Carson V.
	GW	Diamond V. Fallon Aquifer BARCASS		Amargosa Desert
	Parameter Specific		Muddy/Virgin River ET Topock Marsh (LCR) ET	
		Data Synthesis/ Hydrologic Evaluation (Conceptual Model)	Numerical Model Development/ Application	Numerical Model Refinement/ Application
	General Approach of Study			



Common Terms/Themes

Hydrologic Evaluation Studies:

- Recharge
- Natural discharge – ET, springs, streams
- Water budgets – basin or regional
 - Important for perennial yield/water availability
 - Understanding inflows and outflows to aquifer system
 - Quantify discharge – may limit PY

GW Flow Models:

- Can refine water budget
- Main application – address specific assessment, particularly to evaluate potential impacts to pumping

General Focus of Study	SW/GW Interaction	GBNP Ruby V.	Humboldt R. Walker Lake	Carson V.
	GW	Diamond V. Fallon Aquifer BARCASS		Amargosa Desert
	Parameter Specific		Muddy/Virgin River ET Topock Marsh (LCR) ET	
		Data Synthesis/ Hydrologic Evaluation (Pre-Model)	Model Development/ Application	Model Refinement/ Application
General Approach of Study				

Great Basin National Park

SW/GW	GBNP Ruby V.
	Hydrologic Evaluation

Problem: Concern that proposed GW pumping in Snake and Spring Valleys may impact Park's water resources and riparian habitat

Purpose: Determine areas where springs and streams in GRNP could be affected by ground-water withdrawals from the adjacent valleys

Approach:

- Quantify discharge of major streams and springs within GBNP
- Assess natural variability in flow (disturbance)
- Evaluate geologic formations and structure to determine potential areas of hydraulic connection with adjacent basin-fill sediments

Products: Final report in review

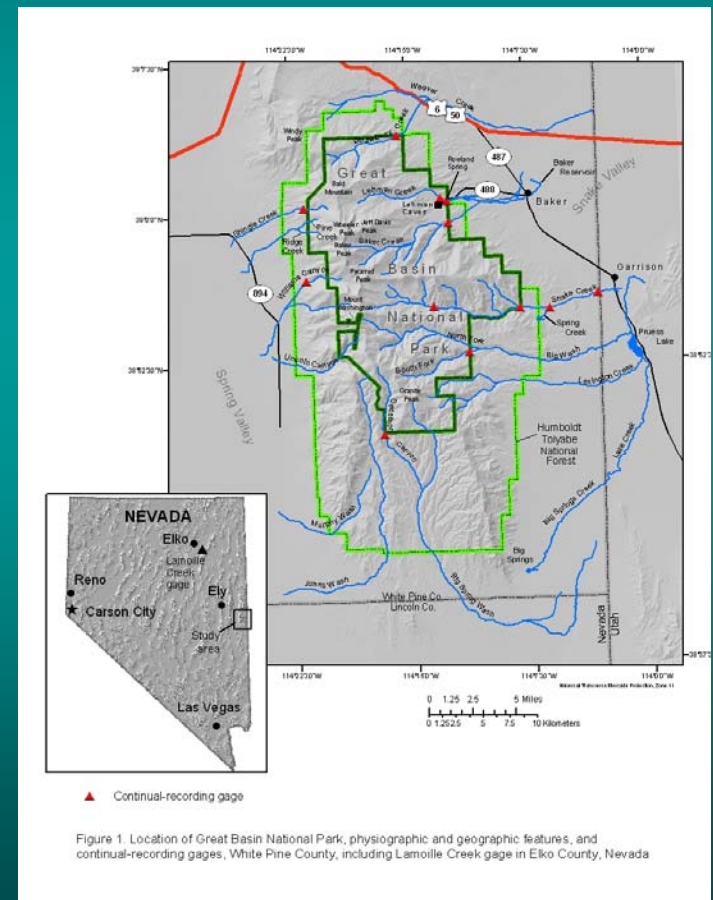


Figure 1. Location of Great Basin National Park, physiographic and geographic features, and continual-recording gages, White Pine County, including Lamolle Creek gage in Elko County, Nevada

Ruby Valley

SW/GW	GBNP Ruby V.
	Hydrologic Evaluation

Problem: Ruby Valley water resources undergoing adjudication; uncertainty in previous estimates of recharge and discharge

Purpose: Understand conceptual aquifer system; reduce uncertainty of recharge/discharge estimates and revise/validate water budget

Approach: Phase I to define ET, the principal discharge from the valley. Phase II to describe the hydrogeologic framework of Ruby Valley and update previous water budget

Products:

- Phase I: Berger and others, 2003
- Phase II: Berger, in review

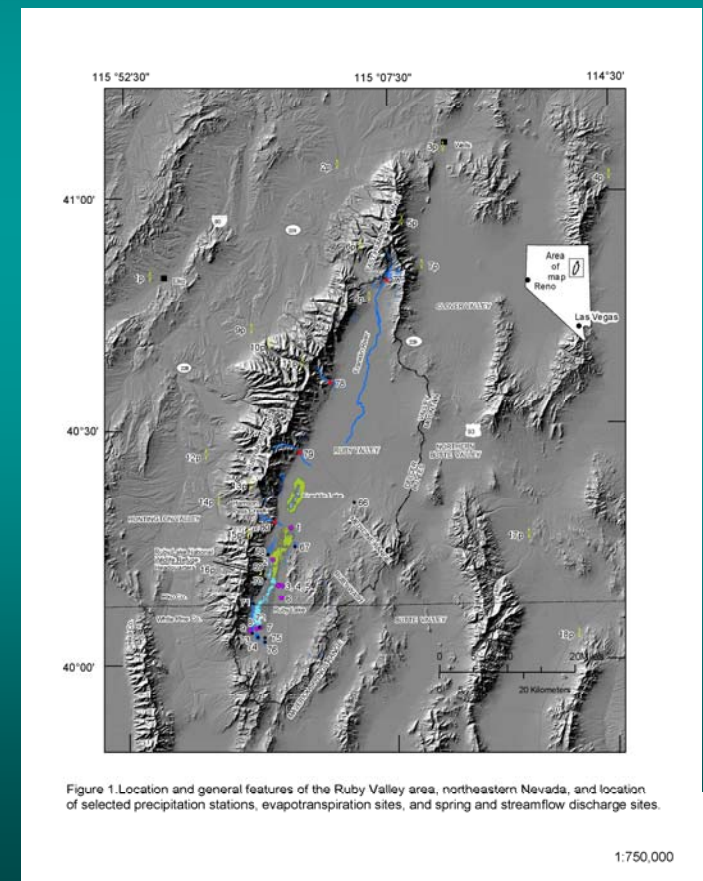


Figure 1. Location and general features of the Ruby Valley area, northeastern Nevada, and location of selected precipitation stations, evapotranspiration sites, and spring and streamflow discharge sites.

1:750,000

Diamond Valley

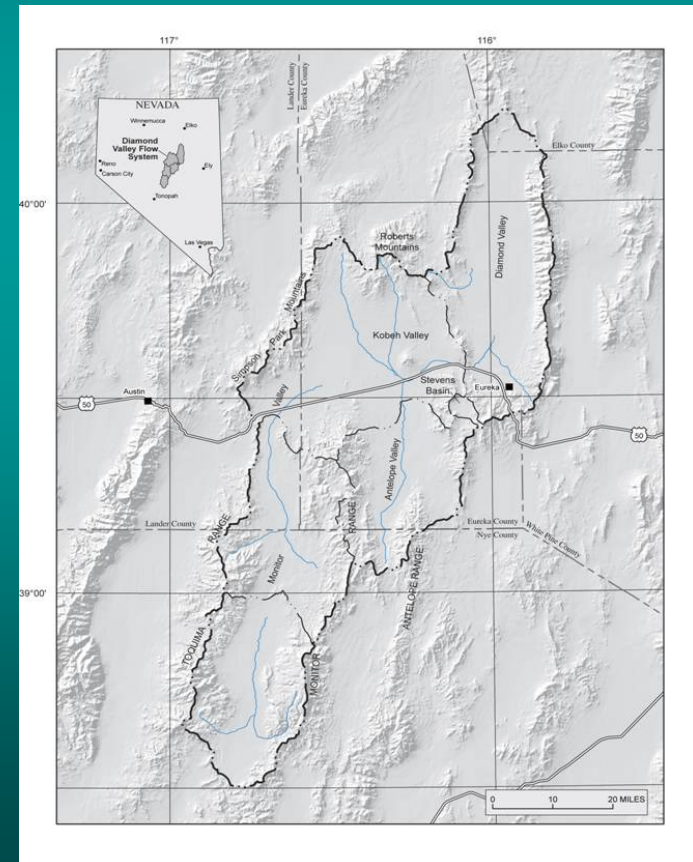
GW	Diamond V. Fallon Aquifer BARCASS
	Hydrologic Evaluation

Problem: Water-level declines from agricultural pumping; concern that water resources may be a target for development in watershed (Monitor, Kobeh, Antelope, and Diamond Valleys)

Purpose: Understand conceptual aquifer system, delineate area of WL declines, and update water budget

Approach: Phase one, FY 2005-2006

- Define extent of alluvial aquifers
 - Make preliminary estimates of subsurface flow
 - Define movement of GW in alluvial aquifers
 - Quantify water-level changes since 1960's
- Long-term objectives (proposal):
 - Refine water budgets
 - Quantify GW flow between basins
 - Define effects of pumping
 - Define interactions between alluvial and carbonate-rock aquifers



Fallon Basalt Aquifer

GW	Diamond V. Fallon Aquifer BARCASS
	Hydrologic Evaluation

Problem: Water-level declines and increases in chloride concentrations in basalt aquifer - the sole source of supply for the City of Fallon, Naval Air Station Fallon, and the Fallon Paiute-Shoshone Tribe

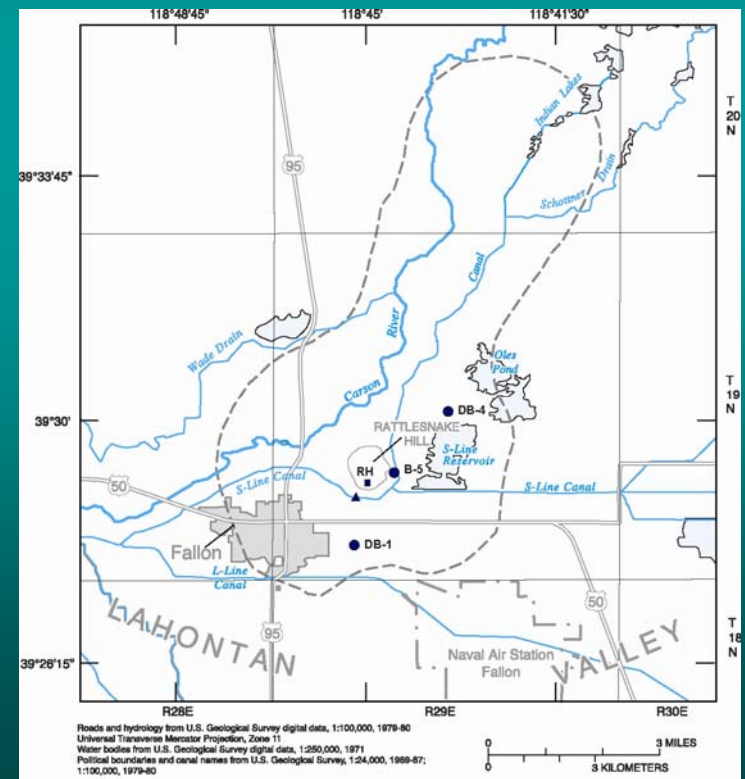
Purpose: Determine locations and volume of poor-quality water entering the basalt aquifer

Approach:

- Phase I completed: Deep-well drilling and water quality sampling (except west side of basin)
- Long-term plans:
 - Drill/sample on west side of basin
 - Linked GW and WQ model

Products:

- Test Drilling Rept: Maurer, 2002
- Hydrogeology Rept: Maurer, 2001



Humboldt River Basin

SW/GW	Humboldt R. Walker Lake
	Model Development

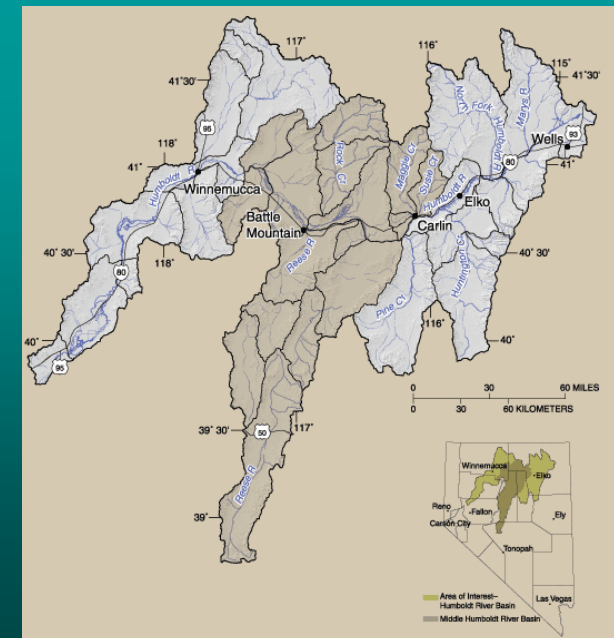
Problem: Increasing demands for limited water supply and potential effects of mine dewatering on flow of the Humboldt River

Purpose of current phase: Evaluate potential impacts to Humboldt River from mine dewatering using numerical simulation

Approach: Water budgets for 14 basins in Middle Humboldt (completed); linked streamflow, watershed, and ground-water flow models to simulate SW/GW interaction. Study from 1995 – 2006 (final report year)

Products: Numerous reports completed
(<http://nevada.usgs.gov/humb/progress.htm>)

- Studies Nearing Completion (scheduled for 2006):
 - Streamflow Trends, Humboldt River from Elko to Imlay, 1950-99
 - Carlin Trend Area Water-Level Changes, 1989-2003
 - Numerical Model of Linked Ground-Water/Surface-Water Flow, Middle Humboldt River Basin



Muddy/Virgin River ET

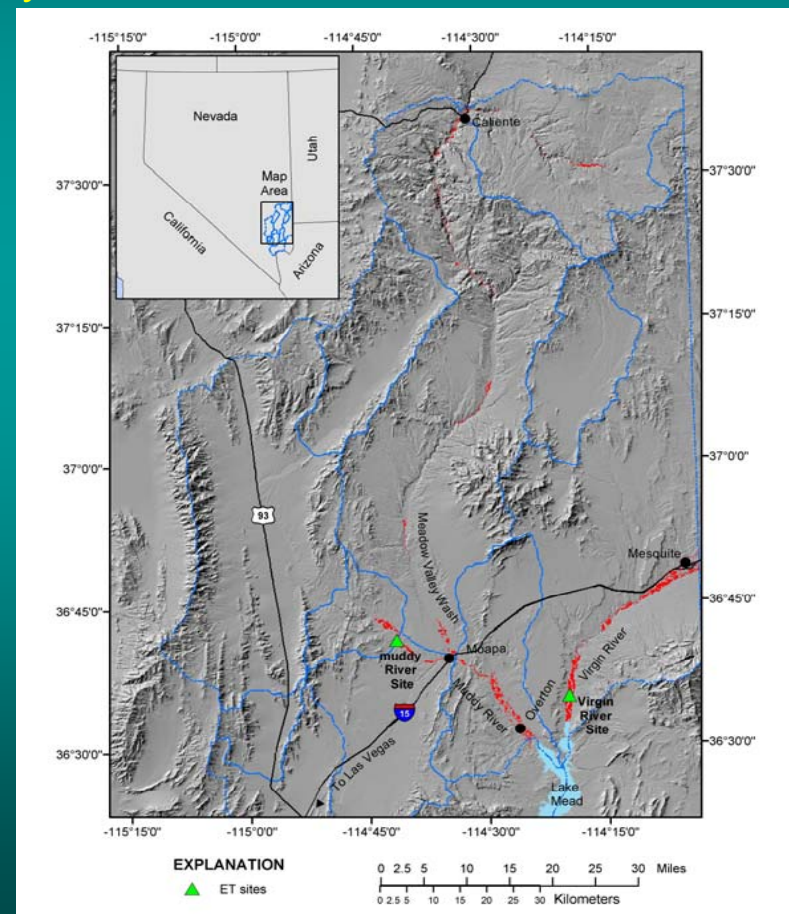
Parameter Specific	Muddy/Virgin R. Topock Marsh ET
	Model Development

Problem: USFS, NPS, and BLM concerned that pumping of ground water will adversely impact local aquatic and riparian ecosystems, including Moapa Valley NWR

Purpose: Provide estimates of evapotranspiration from major discharge areas for input into GW flow model being developed by NPS

Approach:

- Collect micrometeorological and soil data from instrumentation at multiple sites to calculate ET rates
- Based on vegetation density (not type), extrapolate ET rates using satellite imagery and remote sensing techniques
- Final report in 2007



Topock Marsh ET (LCR)

Parameter Specific	Muddy/Virgin R.
	Topock Marsh ET
	Model Development

Problem: Uncertainty about the method and rates of previously estimated ET for riparian vegetation along the lower Colorado River

ET estimates are needed for an *accounting* model used by USBR for water gains/losses

Purpose:

- Quantify ET losses from riparian vegetation along a reach of the LCR
- Compare BOR and USGS methods to estimate ET

Approach:

- Collect micrometeorological and soil data from instrumentation at multiple sites to calculate ET rates
- Based on vegetation density (not type), extrapolate ET rates using satellite imagery and remote sensing techniques
- Final report in 2006

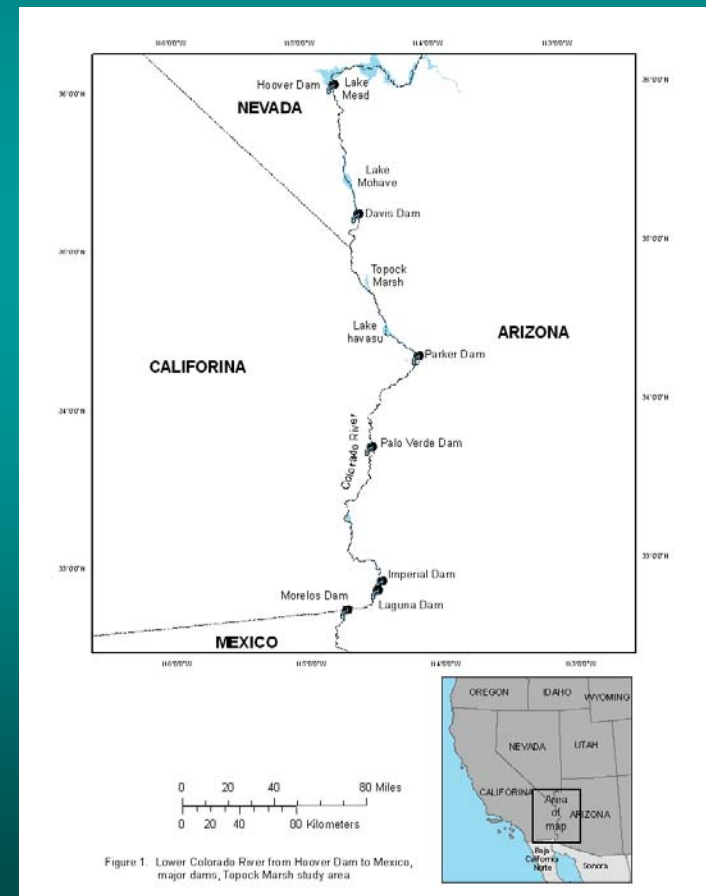


Figure 1. Lower Colorado River from Hoover Dam to Mexico, major dams, Topock Marsh study area

Carson Valley

SW/GW	Carson V.
	Model Refinement

Problem: Increasing growth is causing concern over water availability and sustainability - what is relation and potential impact to Carson River?

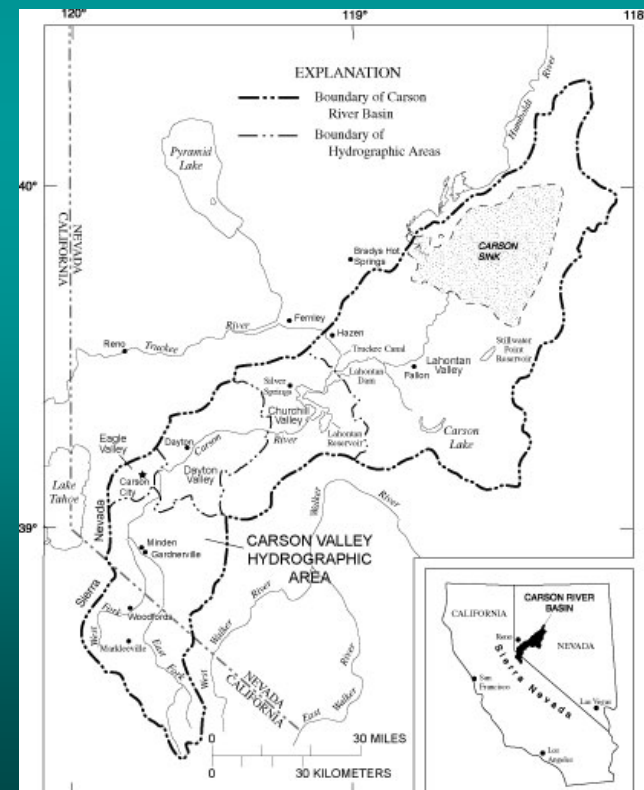
Purpose: Update water budgets for input to refined GW flow model with emphasis on estimating the effects of changes in land use (AG to urban)

Approach (completed in two phases):

- Phase I: Update water-budget components
- Phase II: Refine existing ground-water flow model to evaluate water-budget estimates, changes in land use, and effects of pumping on Carson River outflow (2006 – 2008)

Products:

- ET data: Maurer, in review
- Water budgets: Maurer, in review



Amargosa Desert

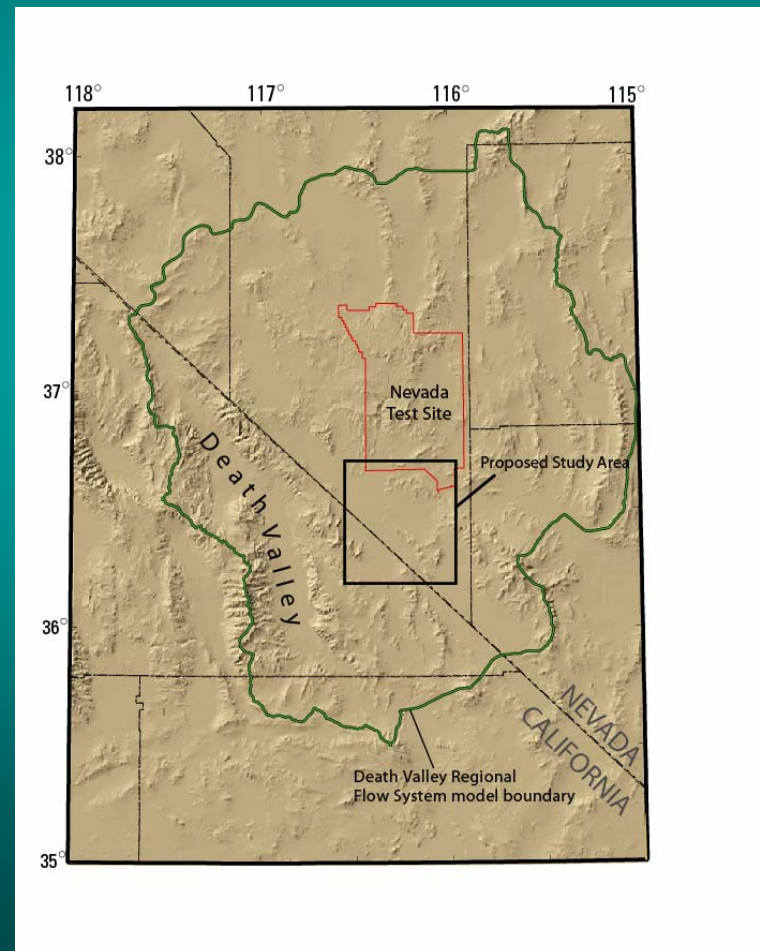
Problem: Concern that potential increases in GW pumping may effect water levels at Ash Meadows NWR and Devils Hole

Purpose: Evaluate (1) hydraulic connection between NWR, Amargosa Desert, and Pahrump Valley and (2) develop tool (model) to address DOI and Nye County concerns

Approach:

- Geologic data collection
- Develop finer-resolution 'embedded Model' in existing regional model for flow system
- Projected timeframe: 2006 - 2009

GW	Amargosa D.
	Model Refinement



BARCASS

GW	Diamond V. Fallon Aquifer BARCASS
	Hydrologic Evaluation

Background:

- BARCASS = Basin And Range Carbonate Aquifer System Study
- Present study mandated by Congress as “Lincoln County Conservation, Recreation, and Development Act of 2004” or ‘Lincoln County Land Act’ (short title)
- Funding of \$6 million over 3-years provided by amendments to SNPLMA through BLM

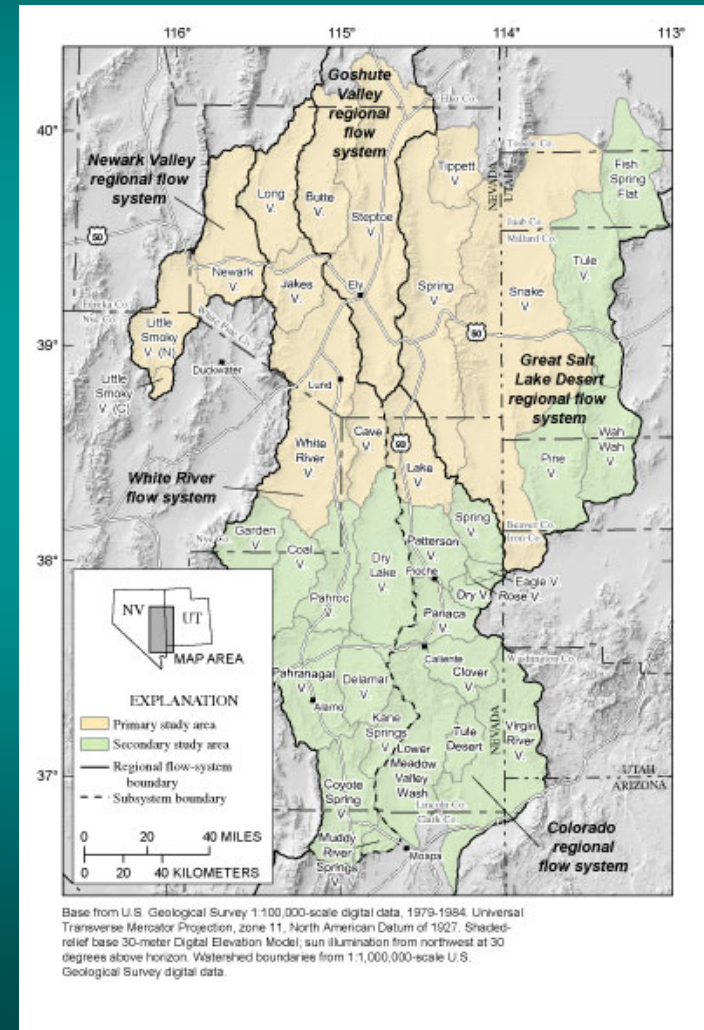
Problem: Concern that water resources in White Pine County, NV, and adjacent areas in Utah, may be a target for water development. Uncertainty exists on water availability and sustainability, and geologic controls on GW flow

Purpose: Address specific tasks outlined in Congressional mandate concerning water quantity and flow characteristics in aquifers within designated study area.

BARCASS

Lincoln County Land Act: “The Secretary, acting through the United States Geological Survey, the Desert Research Institute, and a designee from the State of Utah shall conduct a study to investigate ground water quantity, quality, and flow characteristics in the deep carbonate and alluvial aquifers of White Pine County, Nevada, and any groundwater basins that are located in White Pine County, Nevada, or Lincoln County, Nevada, and adjacent areas in Utah.”

GW	Diamond V. Fallon Aquifer BARCASS
	Hydrologic Evaluation



BARCASS

GW	Diamond V. Fallon Aquifer BARCASS
	Hydrologic Evaluation

Lincoln County Land Act mandate:

- Delineating the extent and thickness of aquifers,
- Determining the volume of water stored in aquifers,
- The delineation of subsurface geologic structures controlling ground-water flow,
- Determining ground-water flow direction and gradients, and
- The distribution and rates of recharge and discharge

BARCASS Approach:

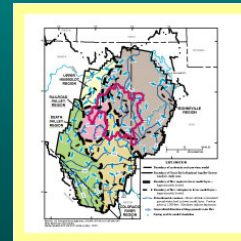
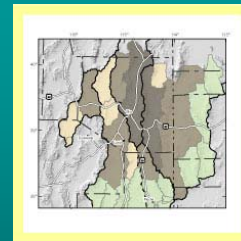
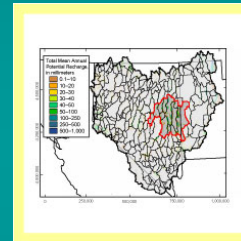
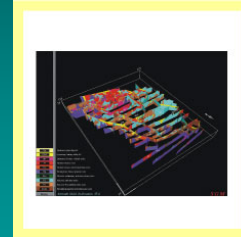
- **Geology**
 - shape, volume
- **Recharge-Discharge**
 - Springs, W/U, ET
- **Ground-water flow**
 - Represents regional flow system
- **Geochemistry**
 - Support task
- **Data synthesis and evaluation**
 - Water budgets
- **Data dissemination**
 - <http://nevada.usgs.gov/barcass/index.htm>

BARCASS

GW	Diamond V. Fallon Aquifer BARCASS
	Hydrologic Evaluation

BARCASS Products:

- 3D visualization of aquifer system (EarthVision software)
 - Aquifer shape/volume of water
 - Geologic structure
- Basin Water Budgets
 - Map/rates of recharge
 - Map/rates of discharge
 - Map of regional GW flow w/geologic structure
- Report documenting results of study
 - Draft to Congress: June 2007
 - Final to Congress: Dec. 2007
- Unified monitoring networks – WL, Streams, Springs, WQ, ET



Hydrogeology

Recharge

Discharge

GW Flow

**Conceptual
Aquifer
System**

Additional information and
data access on the Nevada
Water Science Center
website
<http://nevada.usgs.gov/>

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