A new look at natural recharge in Las Vegas Valley

by

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Nevada Water Resources Association

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Topics

- Previous estimates
- Methods used
- Verification

Estimates based on precipitation

- Maxey and Jameson (1947, 1948)
  - 30,000 - 35,000 acre-feet
    - Rainshadows - concentrated precipitation
- Harrill (1976)
  - 30,000 acre-feet
    - Calibrated with model (Darcy)

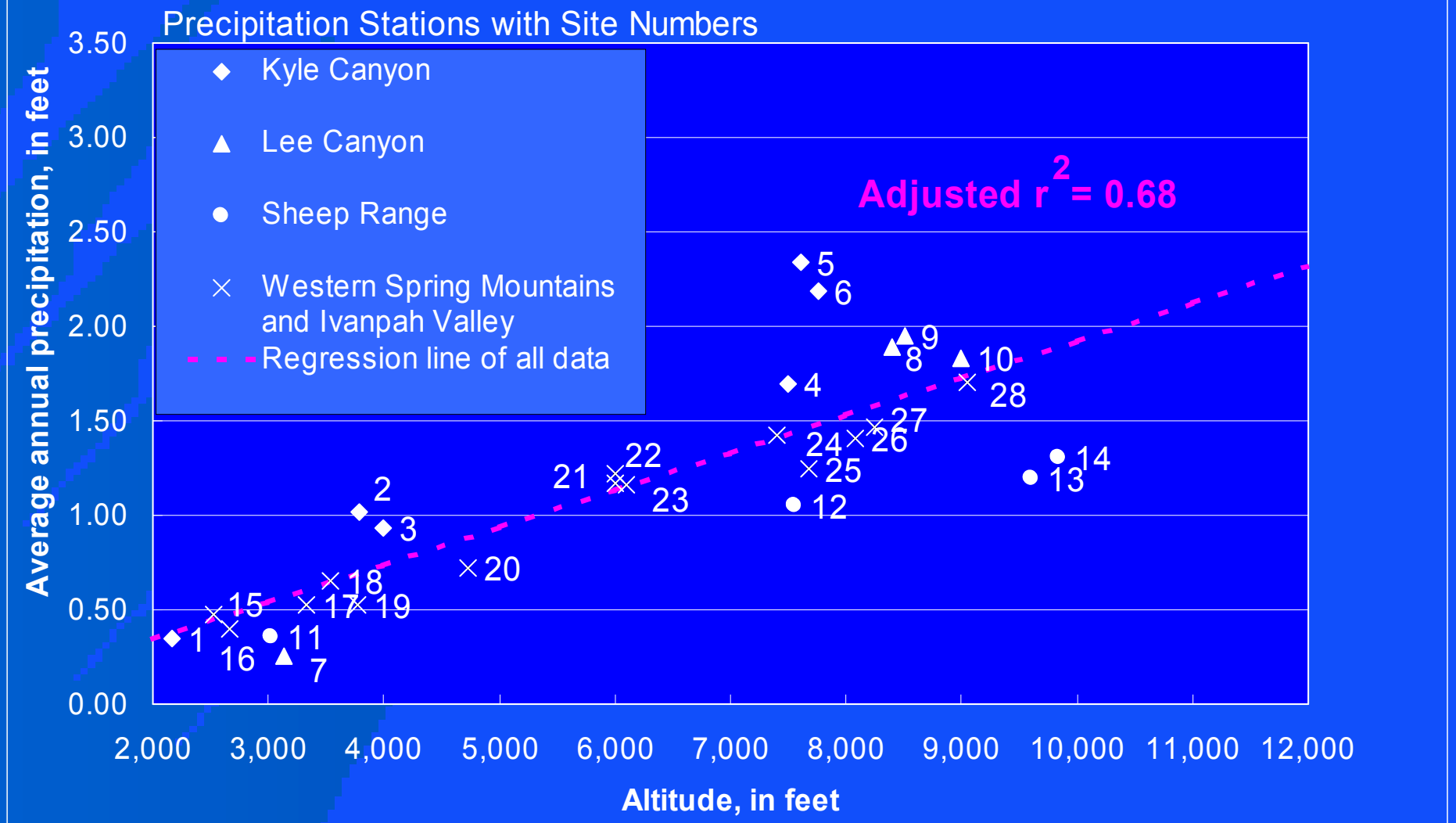
Estimates based on Darcy

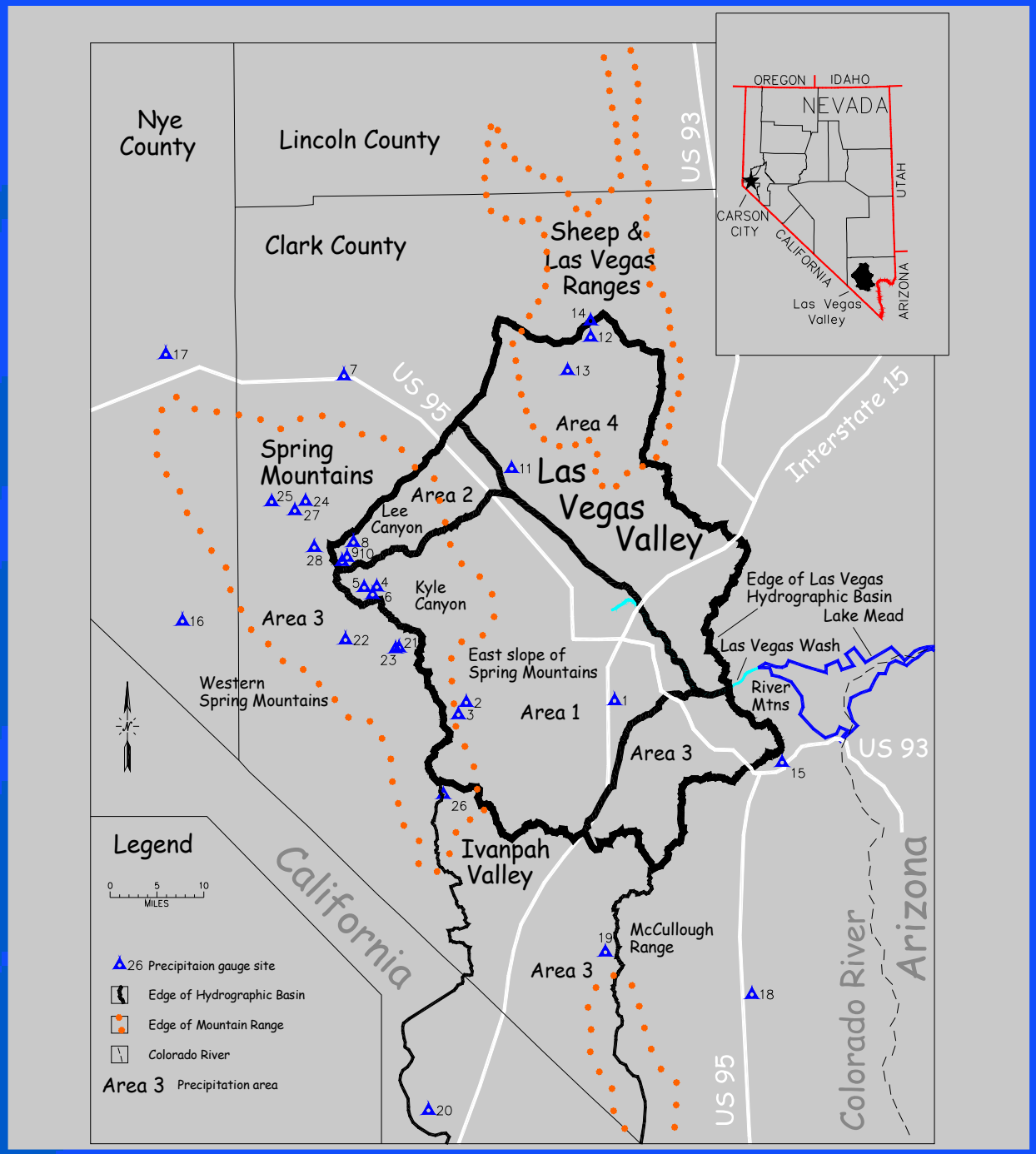
- Malmberg (1961,1965)
  - 21,000 - 24,000 acre-feet
    - Multiple methods
- Harrill (1976)
  - 30,000 acre-feet
    - Model
- Morgan and Dettinger (1994)
  - 33,000 acre-feet
    - Model

Estimates based on Geochemistry/Isotopes

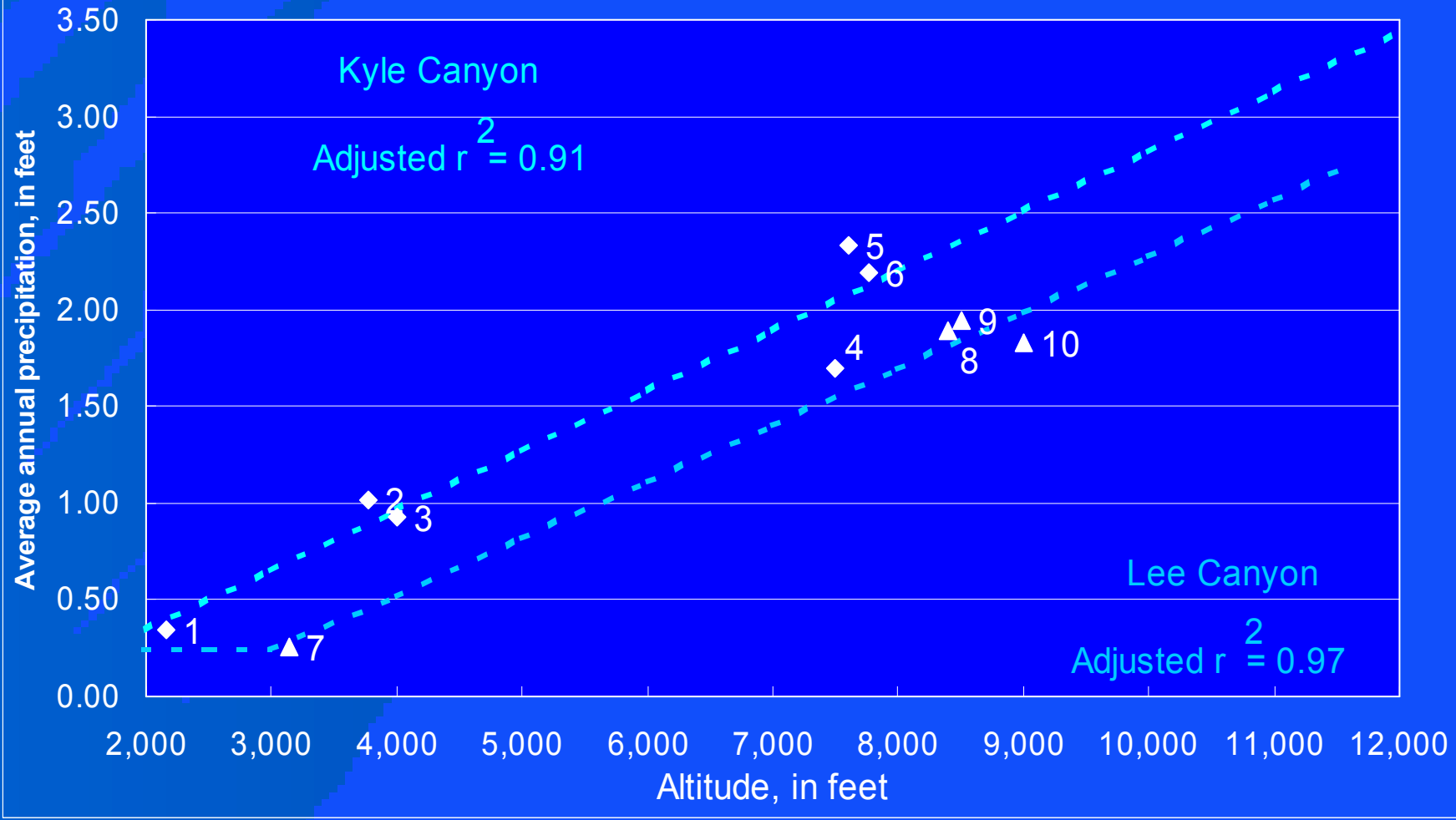
- Dettinger (1989)
  - 28,000 acre-feet
    - Chloride ion
- Thomas et. al (1996)
  - 32,000 acre-feet
    - Isotopes

Altitude verses precipitation

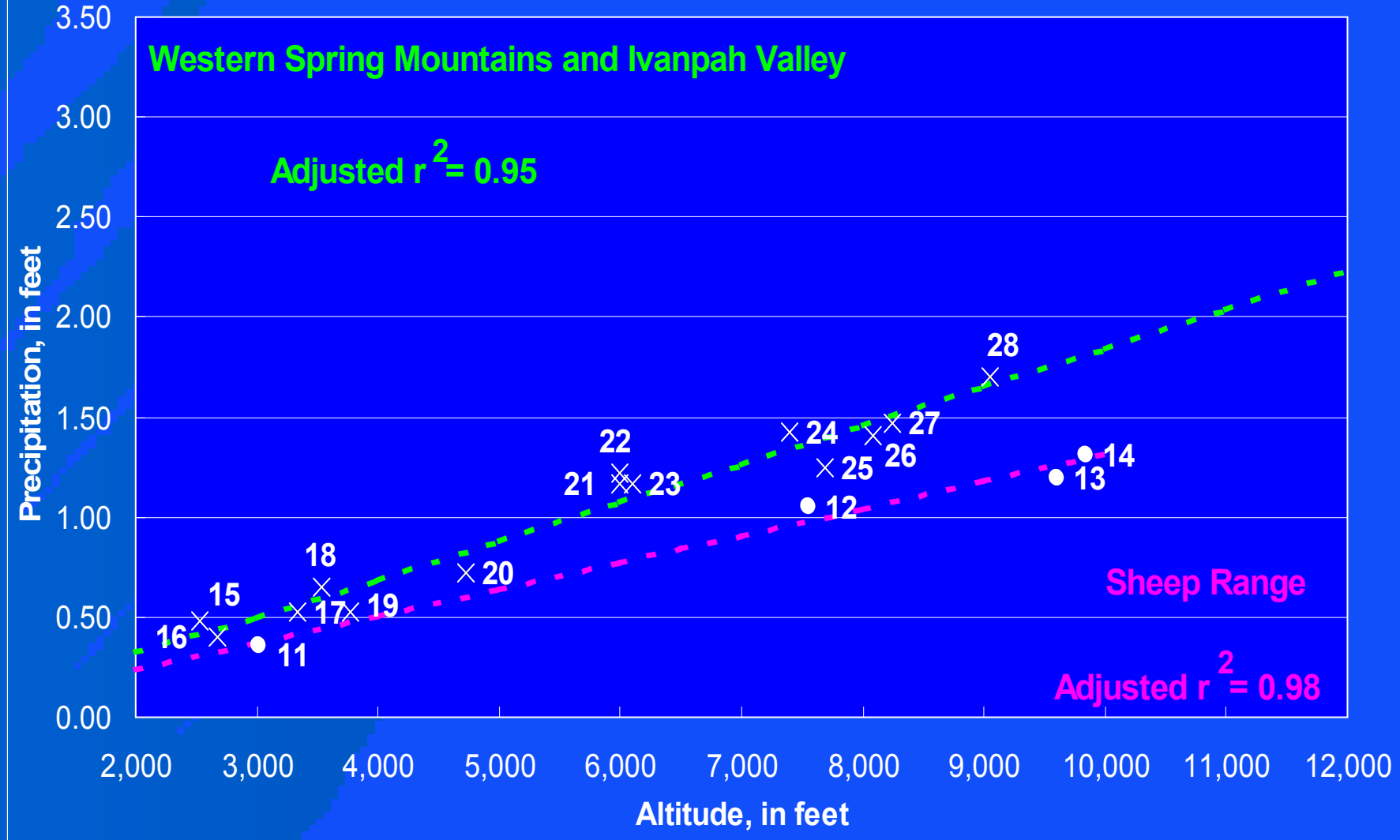



Nye County
Lincoln County
Clark County
US 93
Sheep & Las Vegas Ranges
OREGON
IDAHO
NEVADA
UTAH
CARSON CITY
CALIFORNIA
ARIZONA
Las Vegas Valley
US 95
Area 4
Spring Mountains
Area 2
Las Vegas Valley
Interstate 15
Lee Canyon
Kyle Canyon
Area 3
Edge of Las Vegas Hydrographic Basin
Lake Mead
Las Vegas Wash
River Mtns
East slope of Spring Mountains
Western Spring Mountains
Area 1
Area 3
US 93
Ivanpah Valley
McCullough Range
Area 3
US 95
Colorado River
Arizona
California
Legend
0 5 10
MILES
26 Precipitaion gauge site
Edge of Hydrographic Basin
Edge of Mountain Range
Colorado River
Area 3 Precipitation area

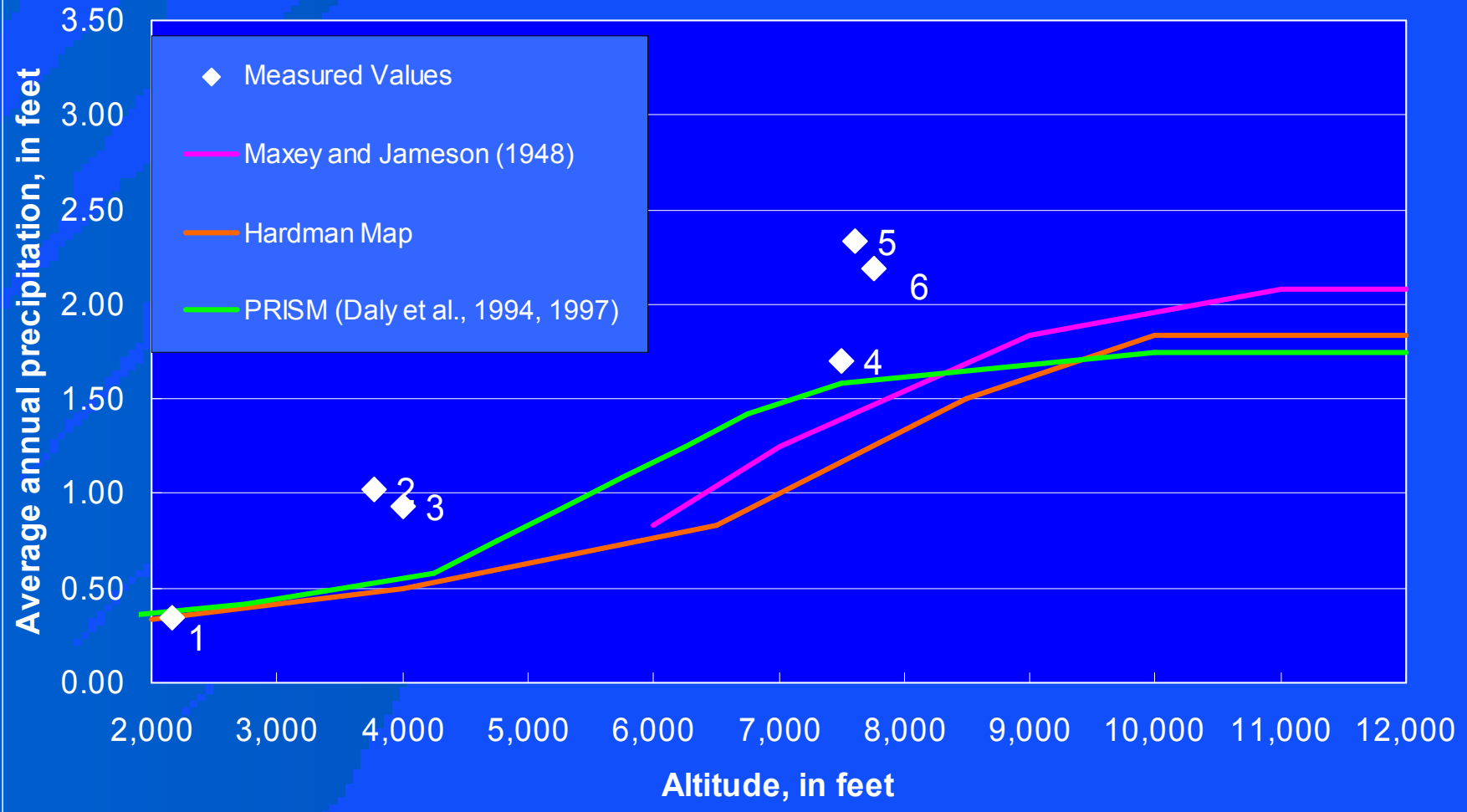
Altitude-precipitation relationships for: Kyle and Lee Canyons



Altitude precipitation relationship for: Western Spring Mountains, Ivanpah Valley and Sheep Range



Measured values and aproximation methods for: Kyle Canyon



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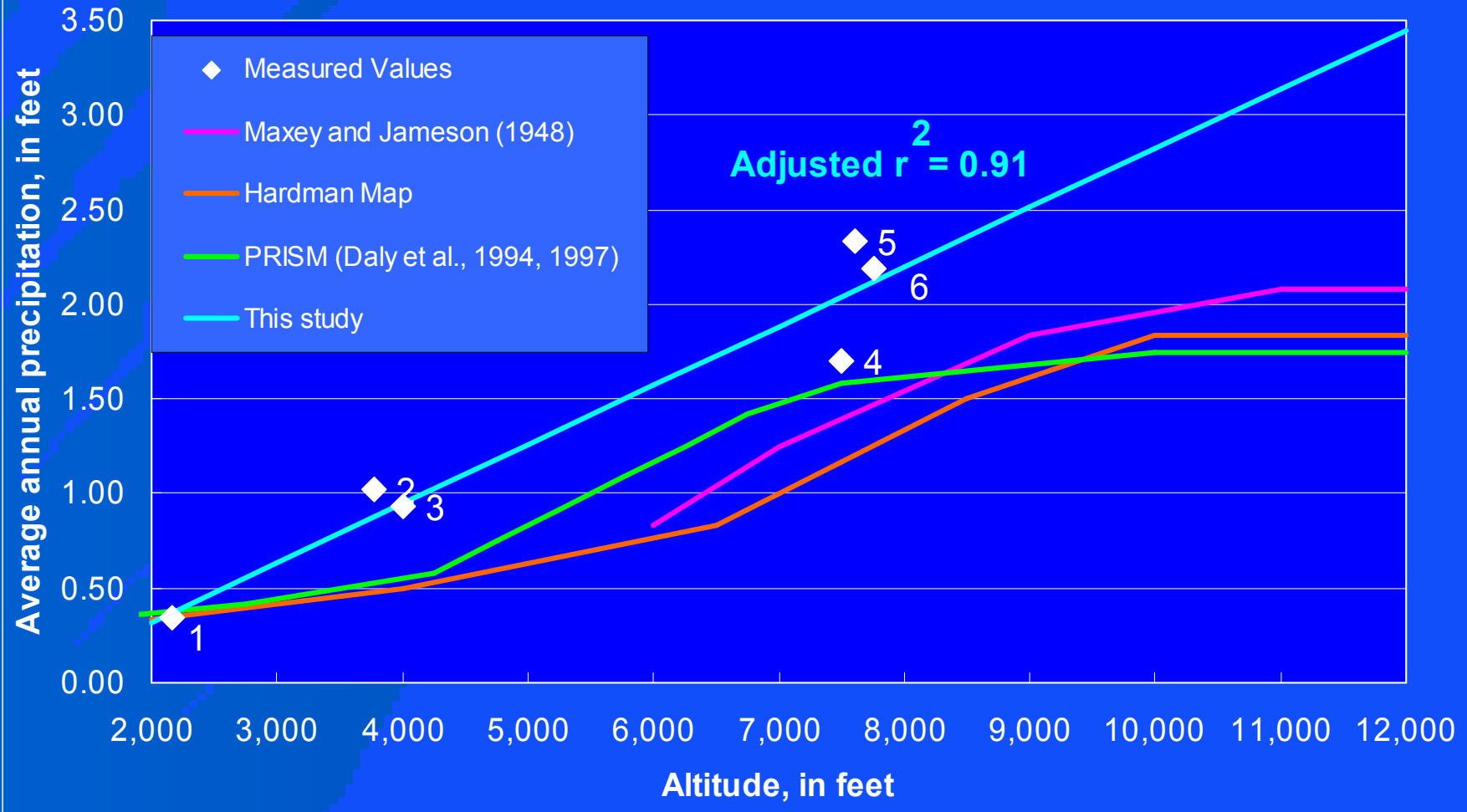
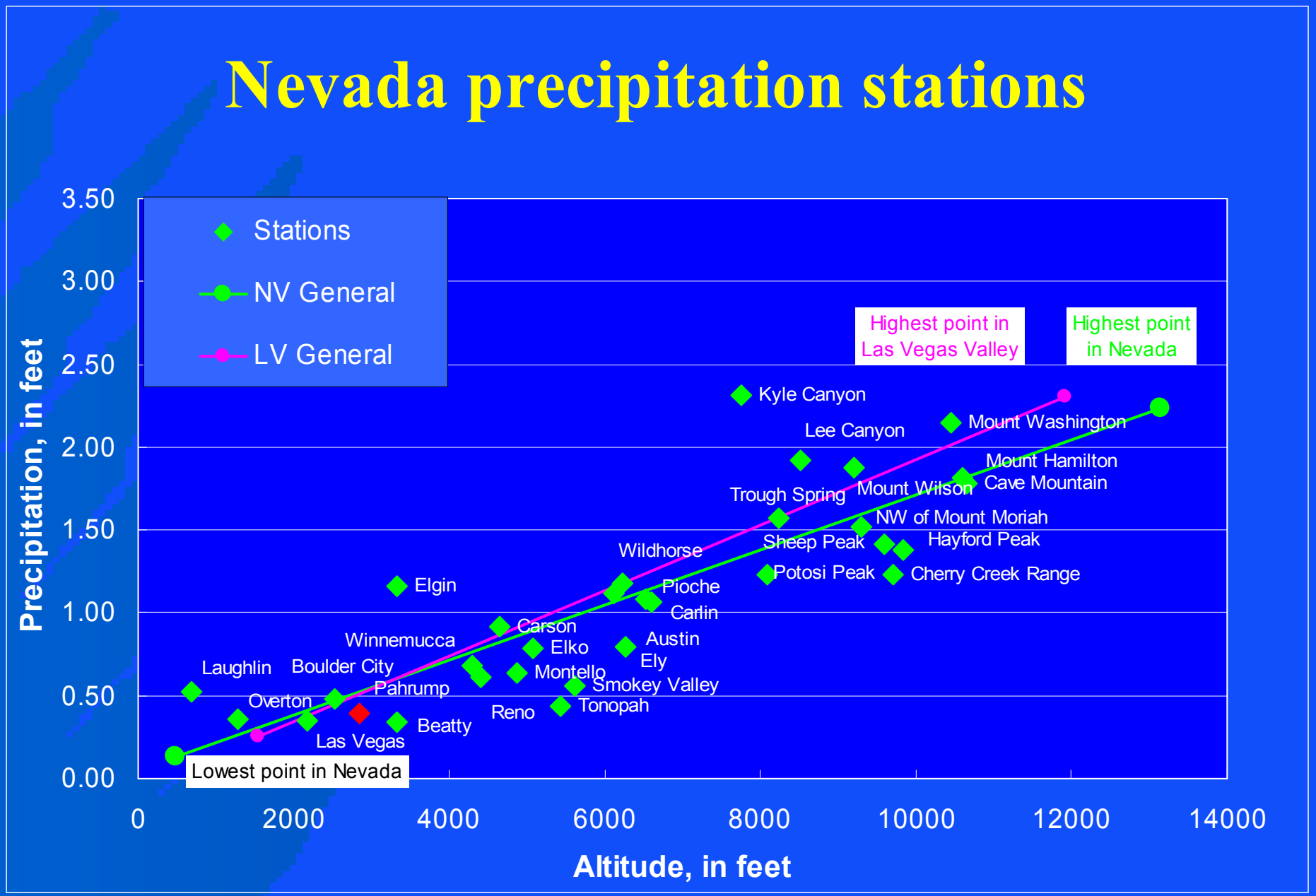
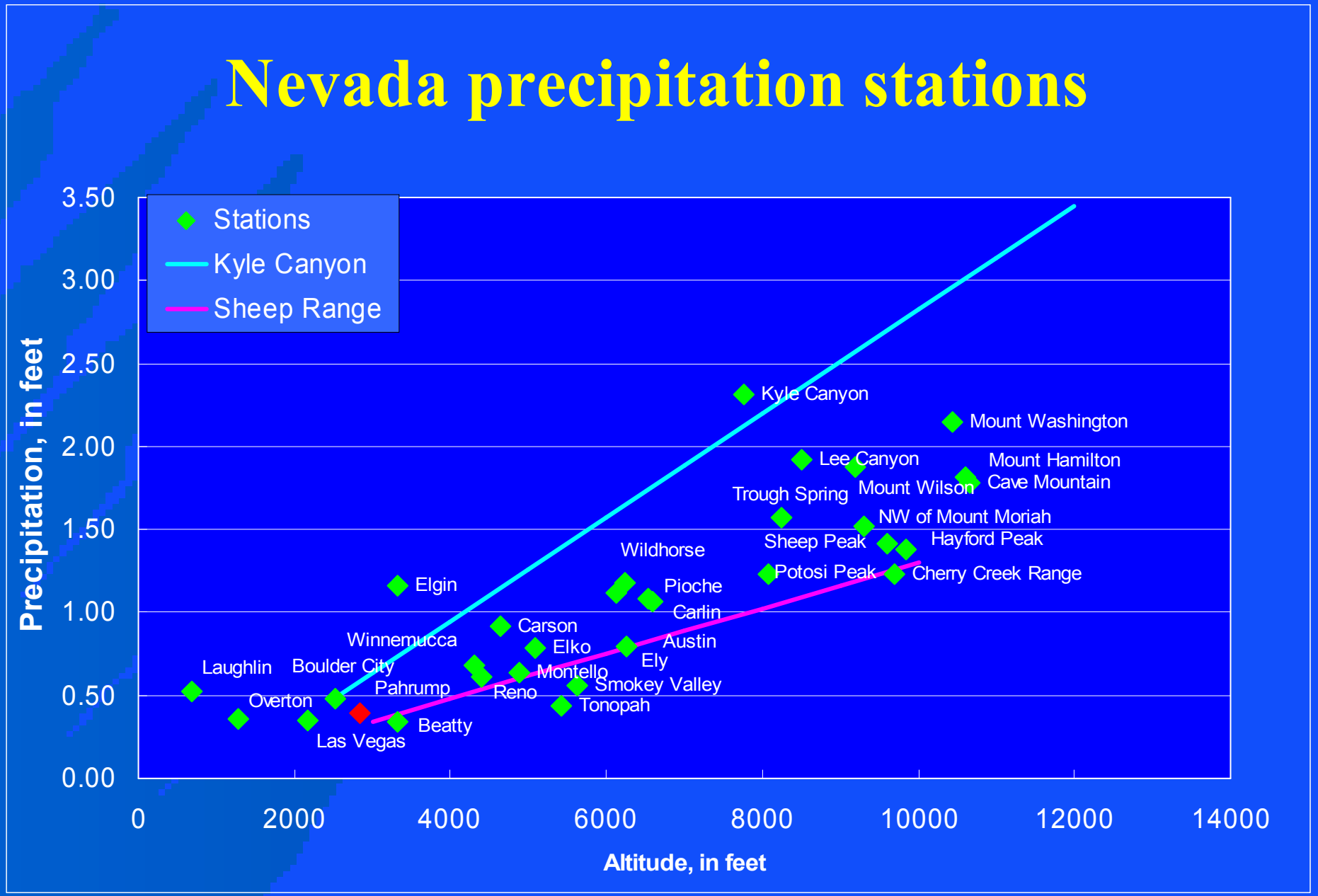


Nevada precipitation stations

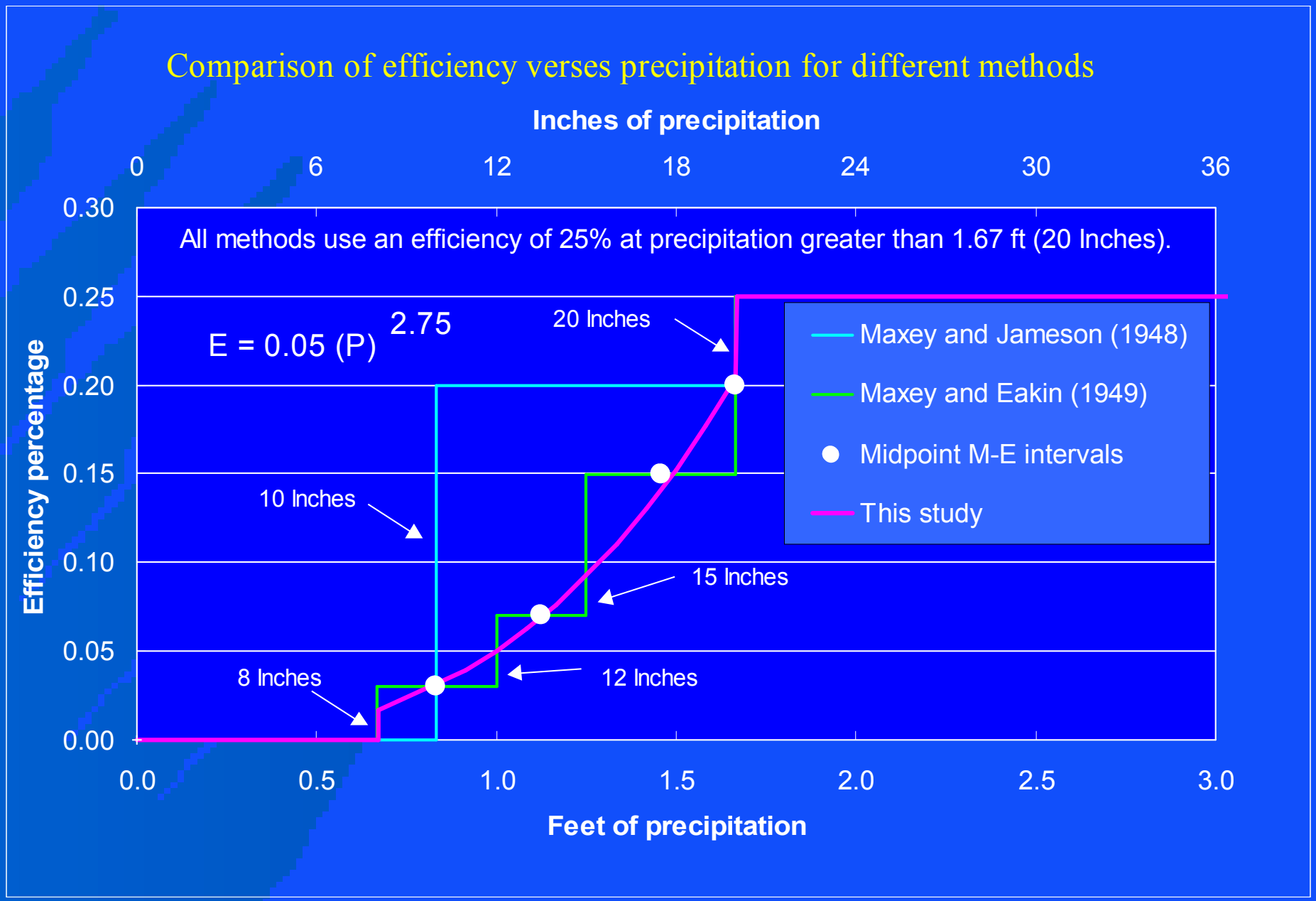


Nevada precipitation stations



Precipitation estimates

- Hardman (1936, 1965, 1972)
  - 561,000 acre-feet
- PRISM (1994, 1997)
  - 613,000 acre-feet
- This study
  - 708,000 acre-feet

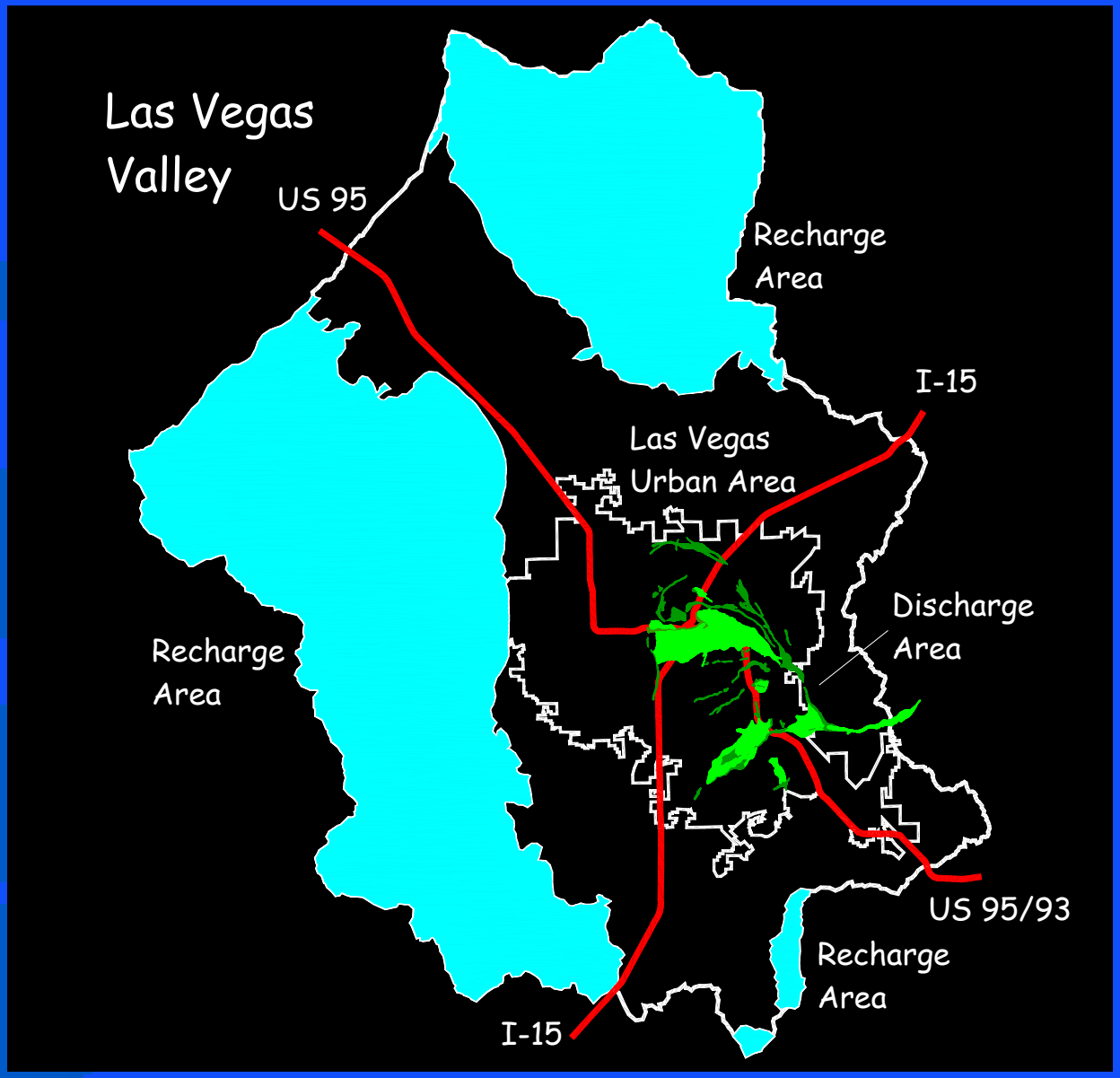

Comparison of efficiency verses precipitation for different methods
Inches of precipitation
0
6
12
18
24
30
36
All methods use an efficiency of 25% at precipitation greater than 1.67 ft (20 Inches).
E = 0.05 (P) 2.75
20 Inches
10 Inches
15 Inches
8 Inches
12 Inches
Maxey and Jameson (1948)
Maxey and Eakin (1949)
Midpoint M-E intervals
This study
Efficiency percentage
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Feet of precipitation

Natural recharge estimate

- East slope of Spring Mountains
  - 38,000 acre-feet
- Lee Canyon
  - 9,000 acre-feet
- McCullough Range
  - 100 acre-feet
- Sheep and Las Vegas Ranges
  - 3,500 acre-feet

Natural recharge estimate

- East slope of Spring Mountains
  - 75 percent
- Lee Canyon
  - 18 percent
- McCullough Range
  - < 1 percent
- Sheep and Las Vegas Ranges
  - 7 percent


Las Vegas
Valley
US 95
Recharge
Area
I-15
Las Vegas
Urban Area
Discharge
Area
Recharge
Area
US 95/93
Recharge
Area
I-15

Verification

- Precipitation
- Discharge estimate
- Darcy / Hydrogeologic Model

Natural discharge estimate

- Devitt et al. (in, prep)
  - Evapotranspiration
    - 40,000 acre-feet
  - Bare-soil evaporation
    - 7,000 acre-feet
  - Ground-water outflow
    - 6,000 acre-feet
  - Total
    - 53,000 acre-feet

Ground-water budget

- Inflow
  - Natural recharge
    - 51,000 acre-feet
  - Ground-water inflow
    - 6,000 acre-feet
- Outflow
  - Evapotranspiration and Bare-soil evaporation
    - 47,000 acre-feet
  - Ground-water outflow
    - 6,000 acre-feet

Ground-water budget

- Inflow
  - 57,000 acre-feet
- Outflow
  - 53,000 acre-feet
- Best estimate
  - 55,000 acre-feet

Use in ground-water model

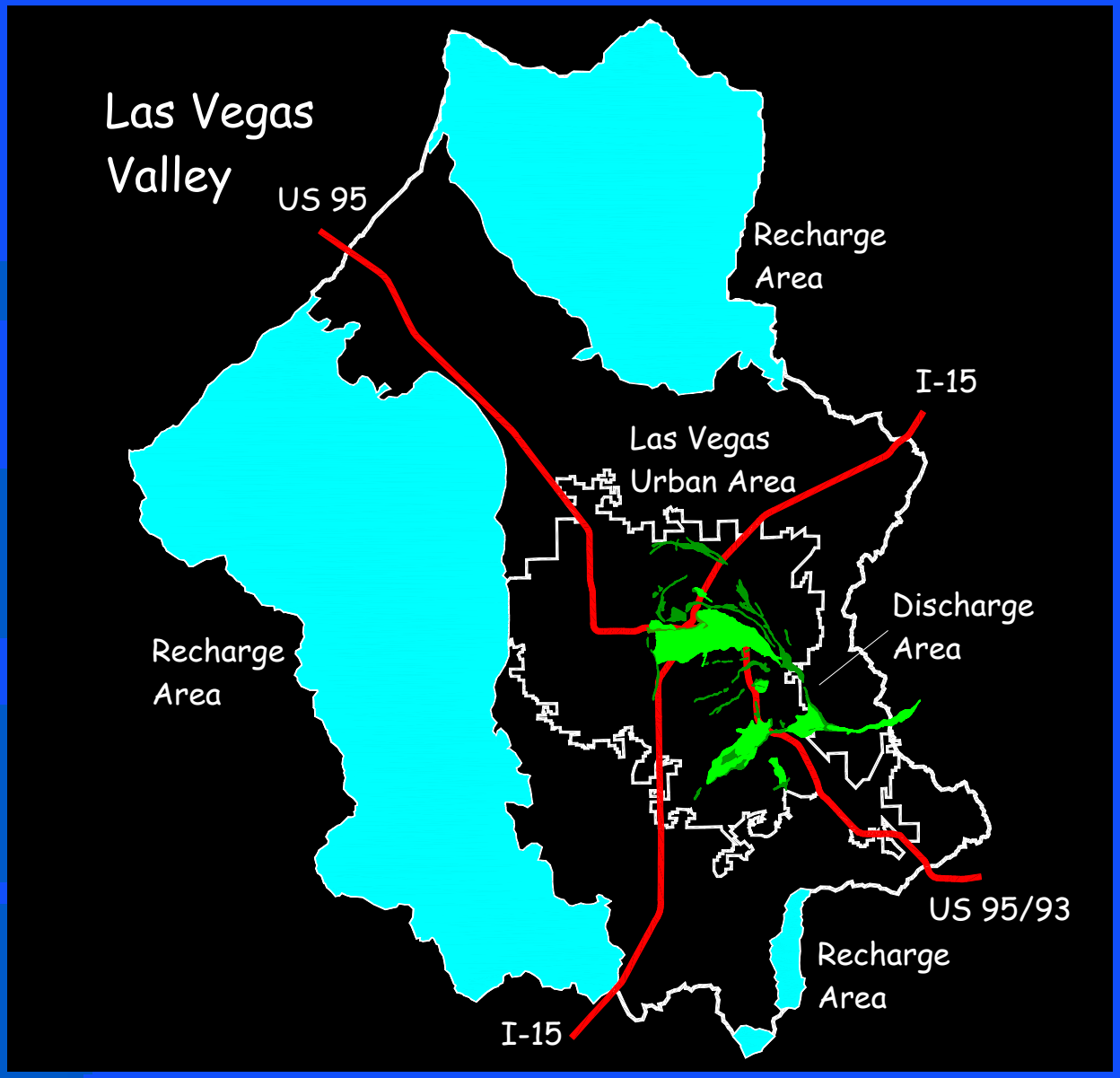
- Location
- Volumes

Implications

- Water resources
- Use in model
- Water level rise

Implications

- Water resources
- Use in model
- Water level rise in response to Artificial and Secondary Recharge and redistributed pumpage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