

# Spring, Cave, Dry Lake and Delamar Valleys



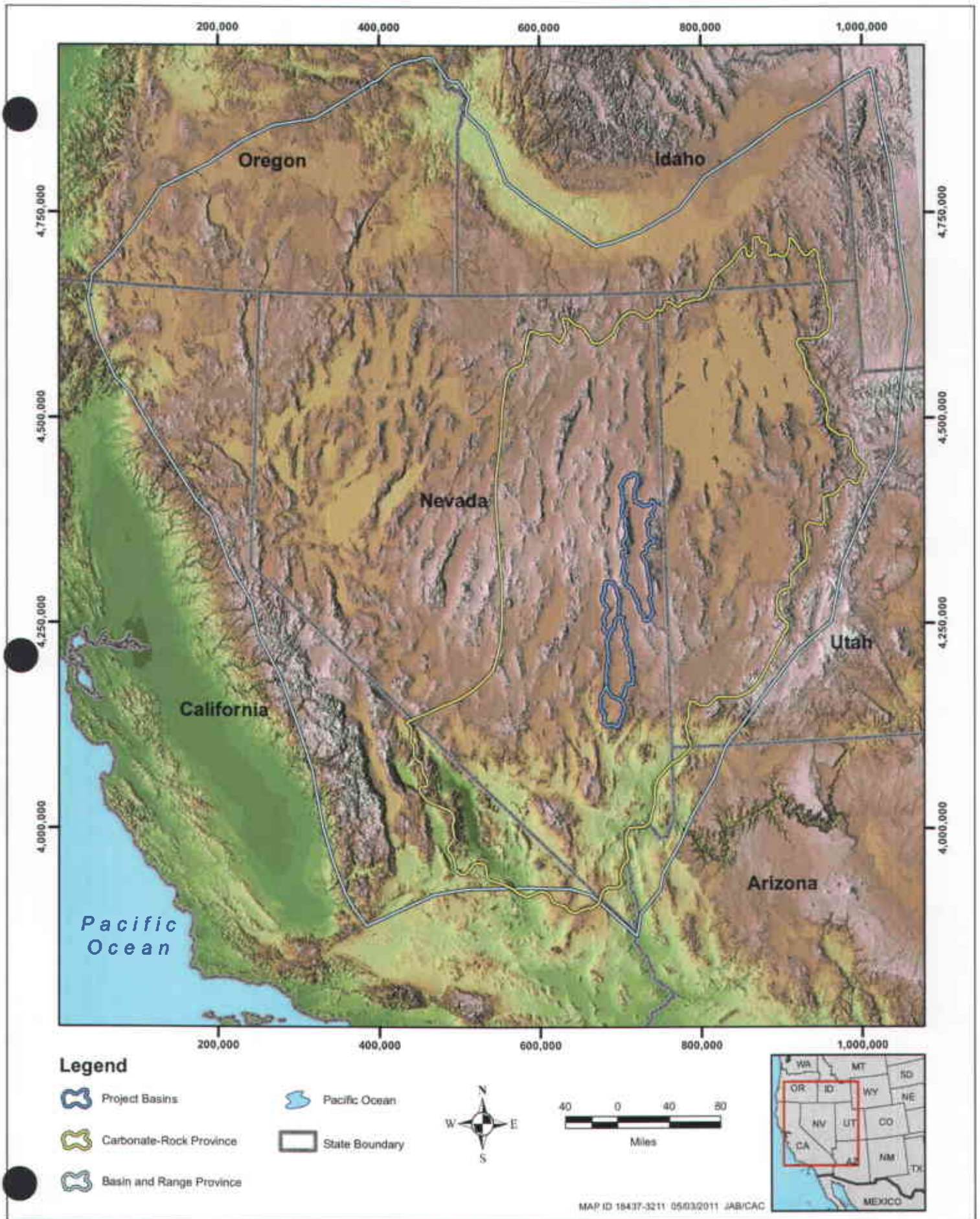
SOUTHERN NEVADA  
WATER AUTHORITY

Presentation for  
Burns and Drici Testimony  
September 28, 2011

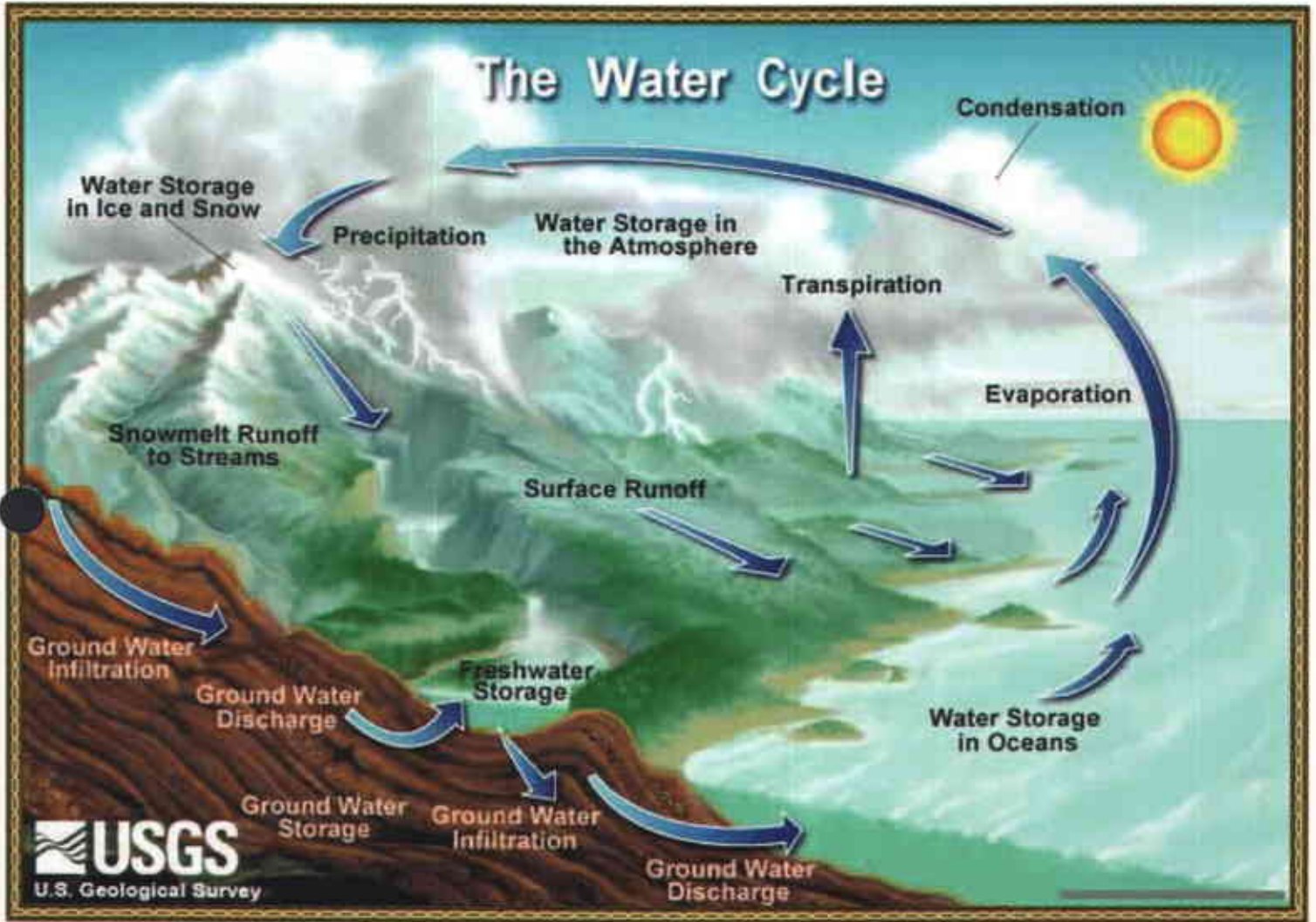
$$R_T = ET_{gw} + Outflow - Inflow \quad (\text{Eq. F-1})$$

where,

- $R_T$  = Total recharge (afy)
- $ET_{gw}$  = Total groundwater ET (afy)
- $Inflow$  = Total groundwater inflow (afy)
- $Outflow$  = Total groundwater outflow (afy)

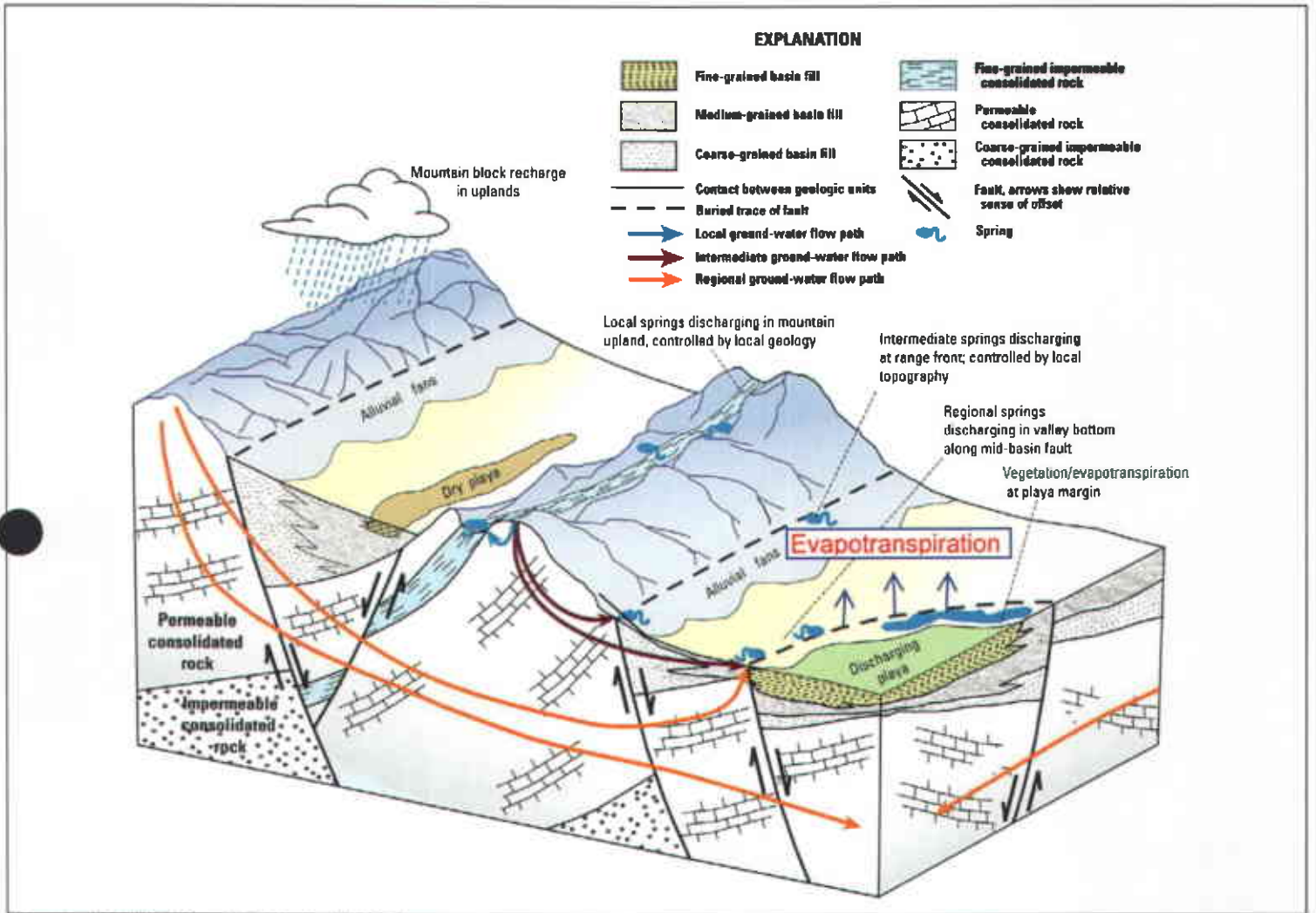


**Figure 2-3**  
**Location of Spring, Cave, Dry Lake and Delamar Valleys**  
**in the Basin and Range and Carbonate-Rock Provinces**



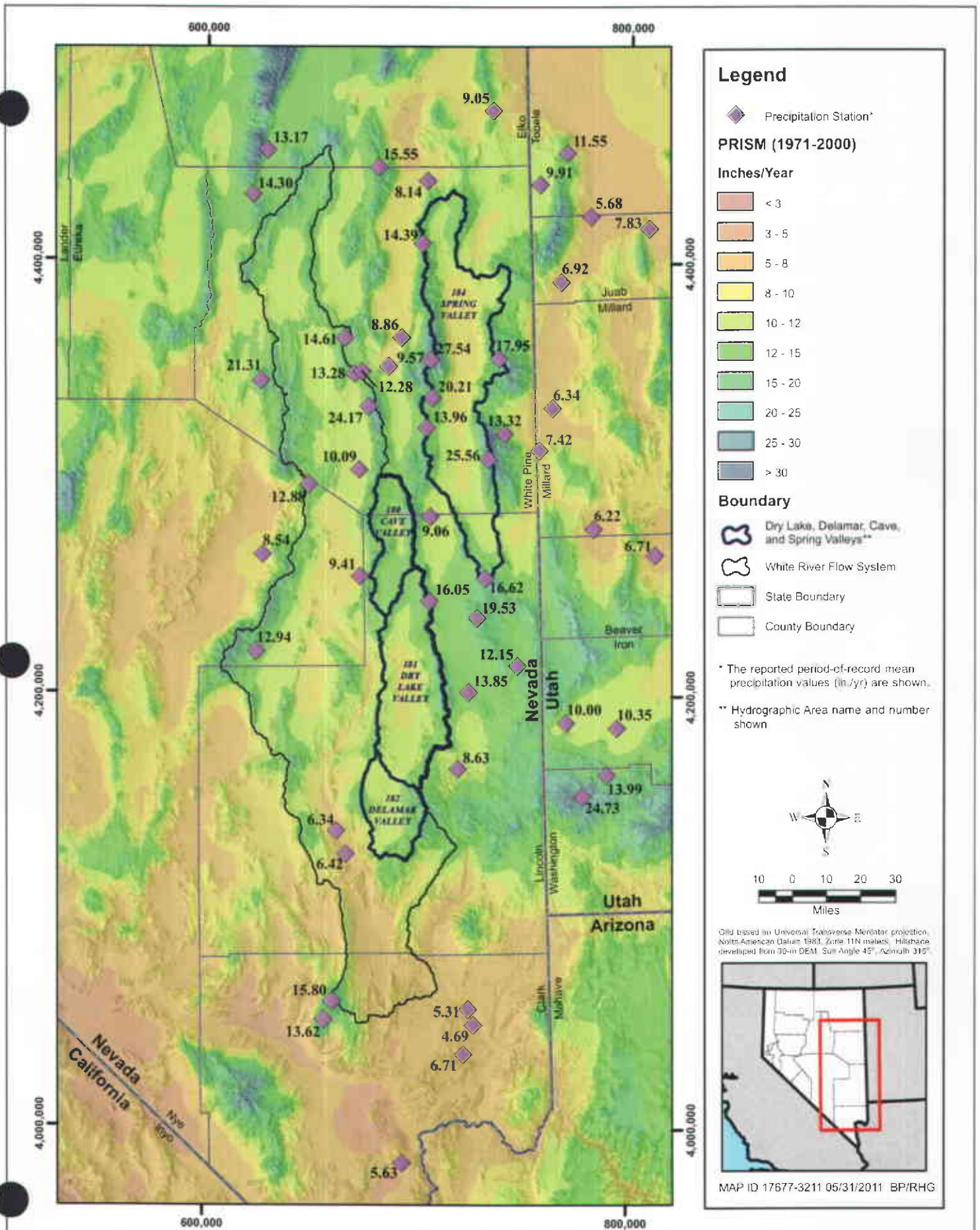
Source: Evans (2004)

**Figure 2-2**  
**Simplified Representation of the Hydrologic (Water) Cycle**

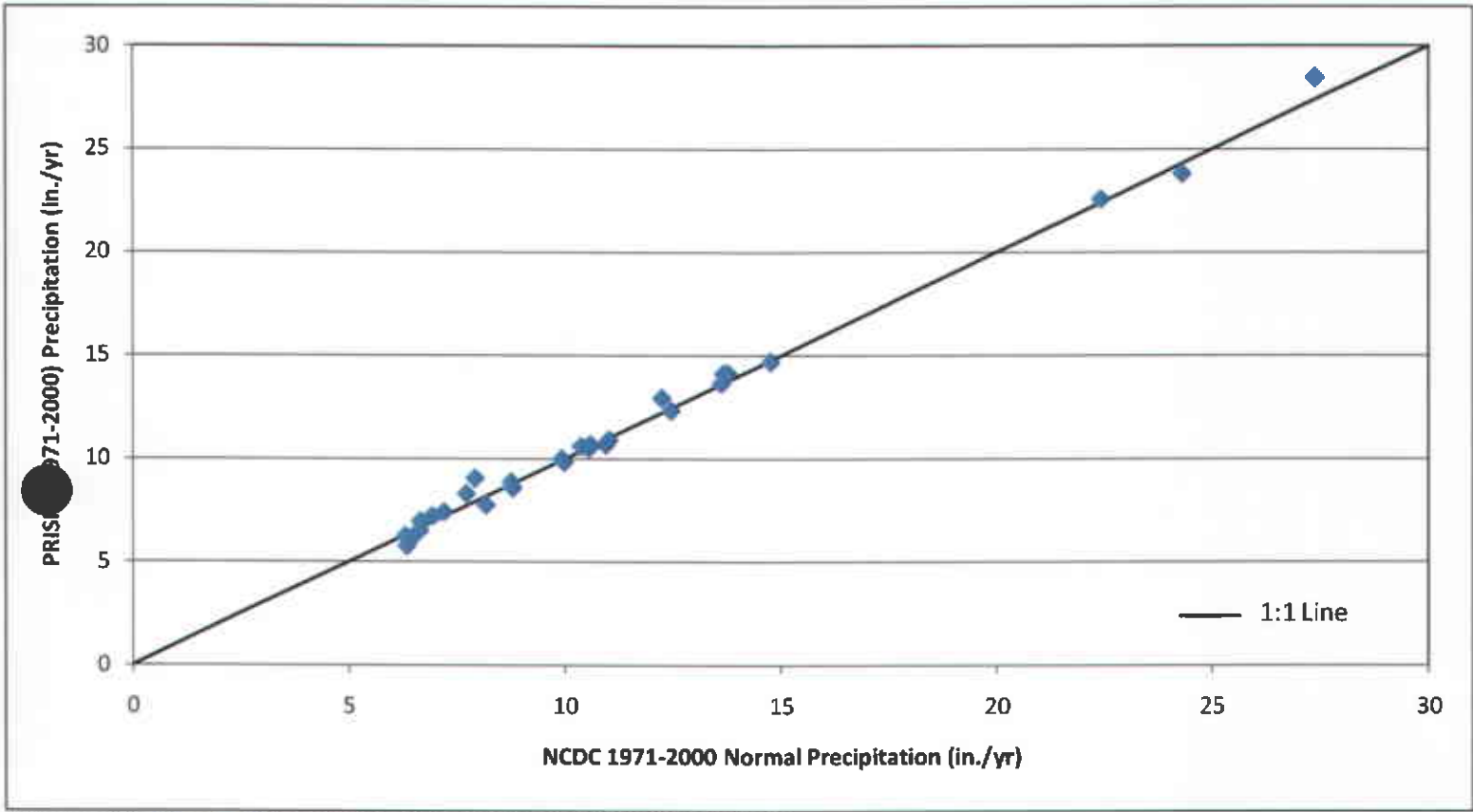


Source: Modified from Welch et al. (2007)

**Figure 2-4**  
**Typical Groundwater Flow Patterns in the Project Basins and Neighboring Basins**

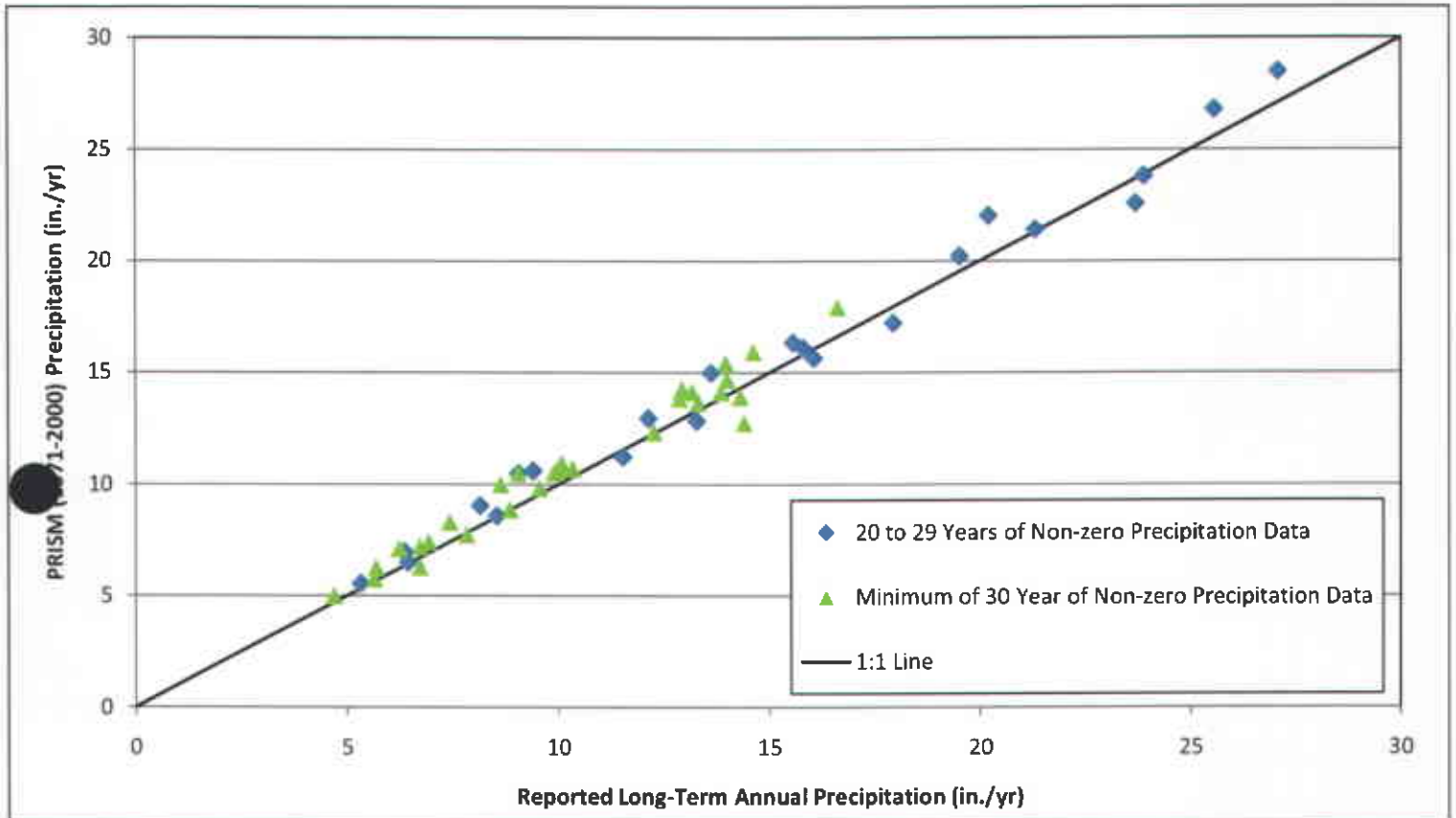


**Figure B-3**  
**Period-of-Record Mean Precipitation Values for Precipitation Stations Located in Area Encompassing Spring, Cave, Dry Lake, and Delamar Valleys**



Note: See Table B-1 for names of "normal" precipitation stations.

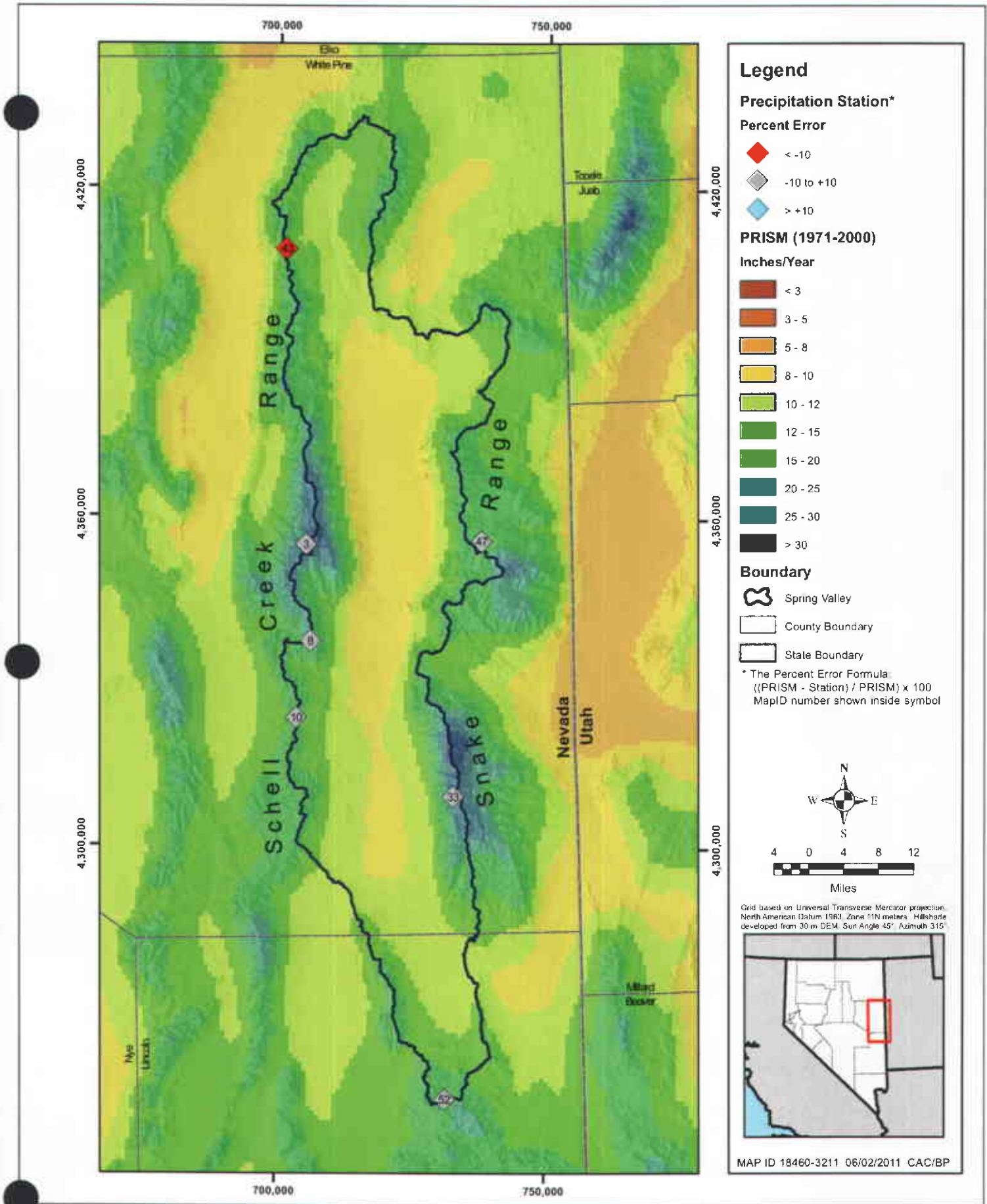
**Figure B-4**  
**Comparison of 800-m PRISM Precipitation Values**  
**to Normal Station Precipitation Values within Area of Interest**



Note: See Table B-1 for precipitation values for selected stations.

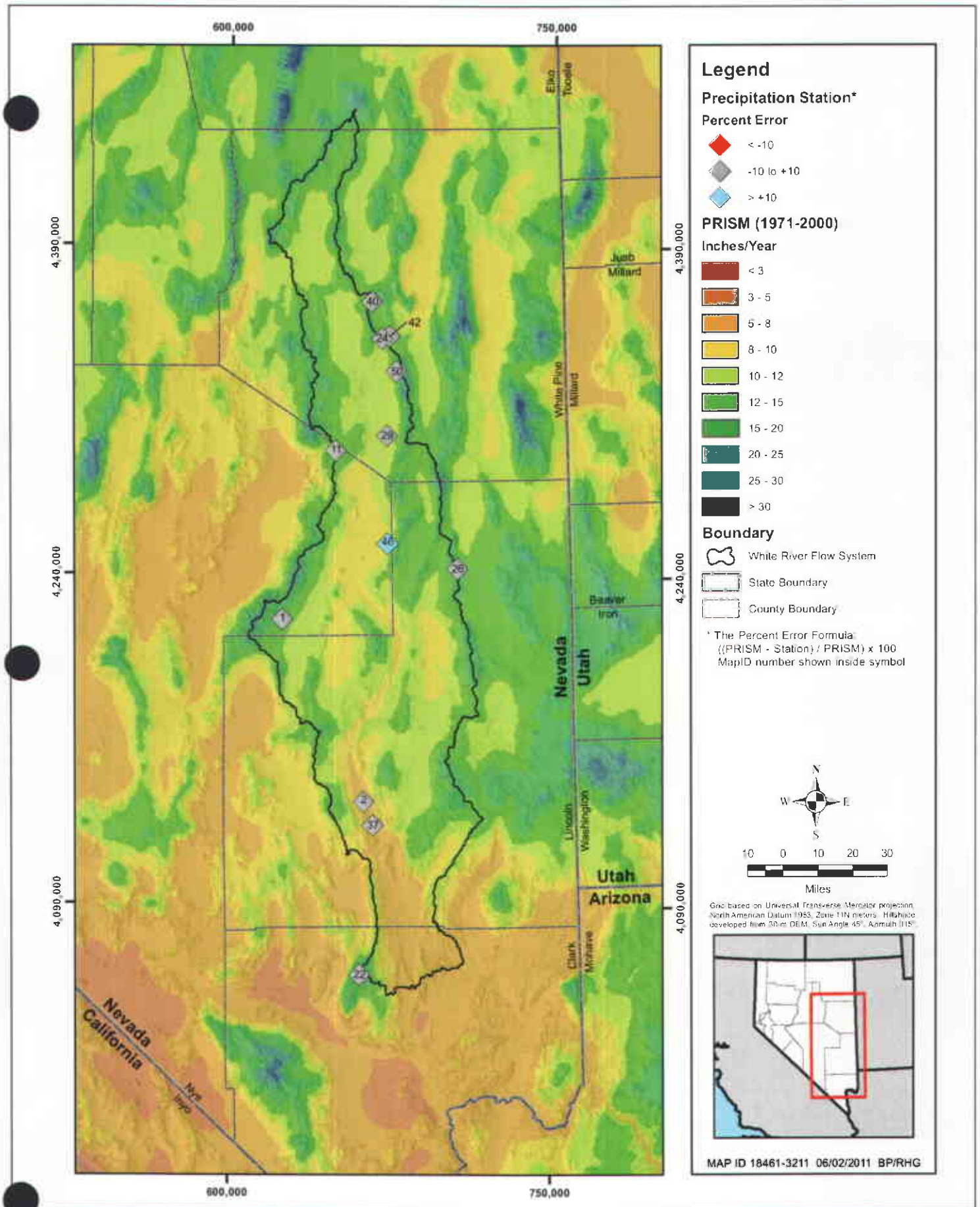
**Figure B-5**  
**Comparison of 800-m PRISM Precipitation Values**  
**to Period-of-Record Mean Station Values within Area of Interest**





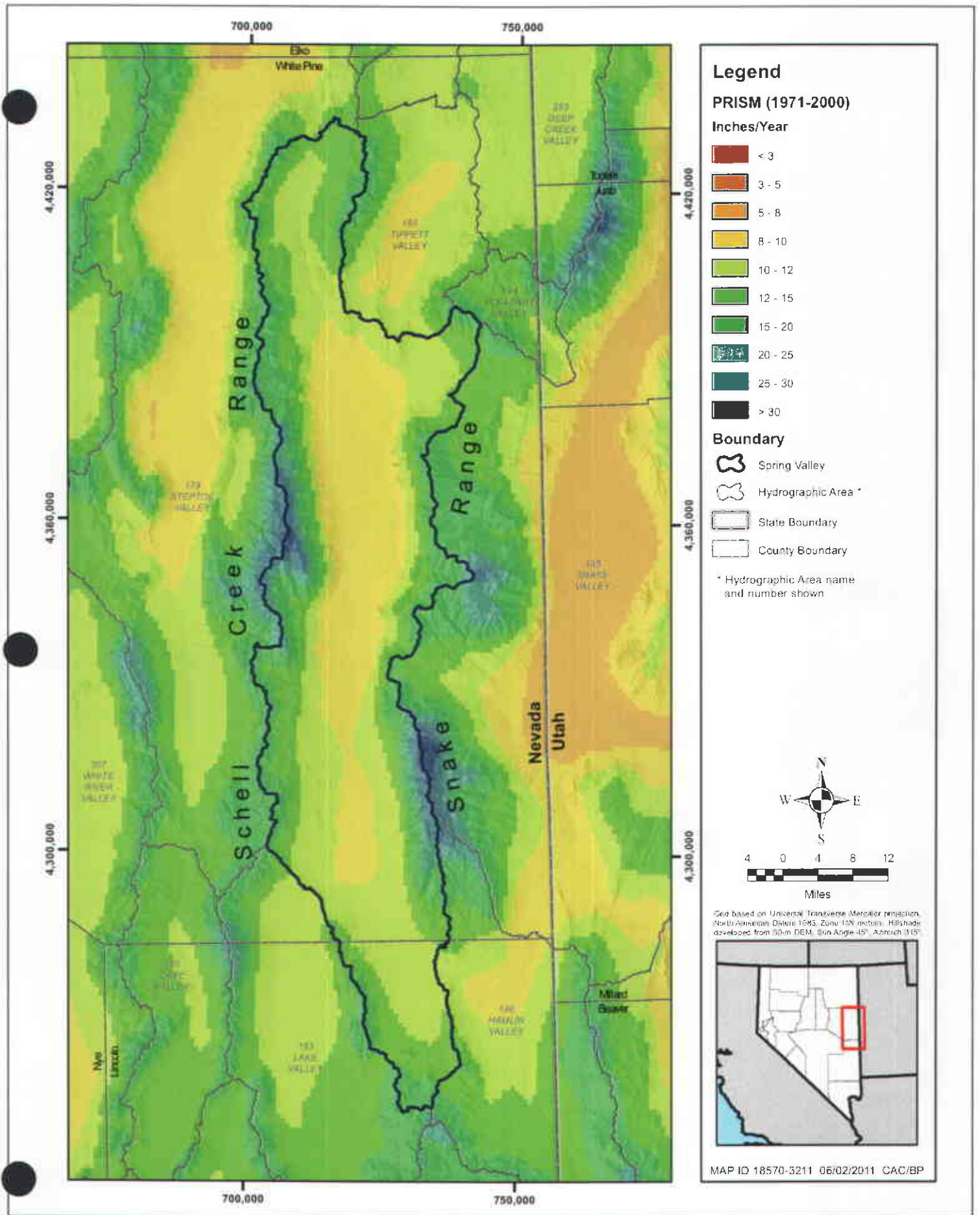
Note: See Table B-1 for precipitation values at the selected stations.

**Figure B-6**  
**Percent Error between 800-m PRISM and Period-of-Record Average**  
**for Precipitation Stations Located in Spring Valley Potential Recharge Areas**



Note: See Table B-1 for precipitation values at the selected stations.

**Figure B-7**  
**Percent Error between 800-m PRISM and Period-of-Record Average for Precipitation Stations Located in White River Flow System's Potential Recharge Areas**



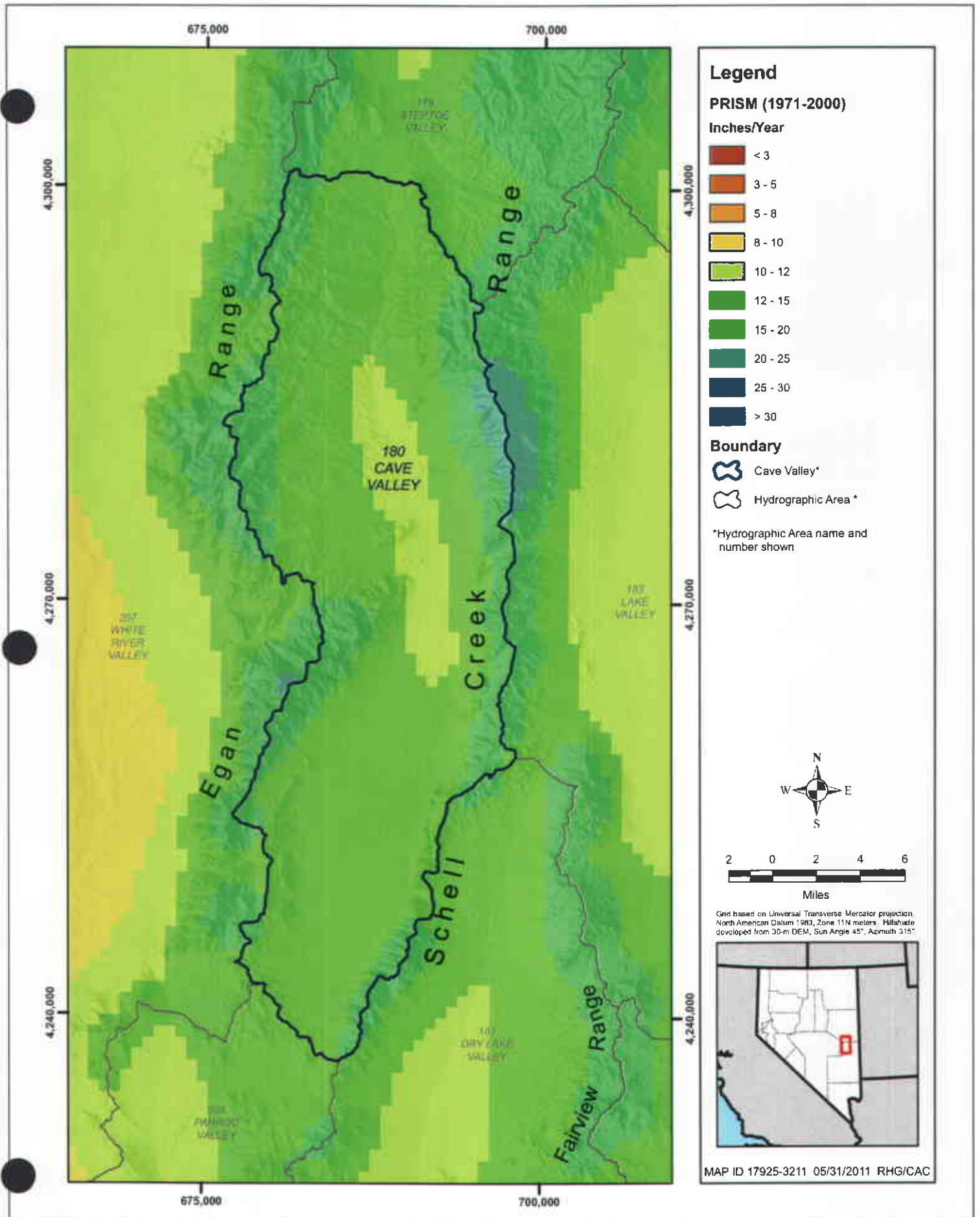
Note: See Table B-1 for Site Information.

**Figure 3-1**  
**PRISM 800-m Normal Precipitation Distribution for Spring Valley and Vicinity**

**Table 3-1**  
**Comparison of Spring Valley**  
**Annual Precipitation Volume to Reported Values**

| Method                  | Annual<br>Precipitation <sup>a</sup><br>(afy) | Source                       |
|-------------------------|---|------------------------------|
| 800-m PRISM (Version 3) | 1,119,700                                     | This Study                   |
| 800-m PRISM (Version 2) | 1,116,000                                     | SNWA (2009a, p. 6-8)         |
| Hardman maps            | 960,000                                       | Scott et al. (1971, p. 37)   |
| 4-km PRISM              | 1,141,400                                     | Nichols (2000, p. C20)       |
| Modified 4-km PRISM     | 1,131,000                                     | Flint and Flint (2007, p. 5) |

<sup>a</sup> All numbers rounded to nearest 100

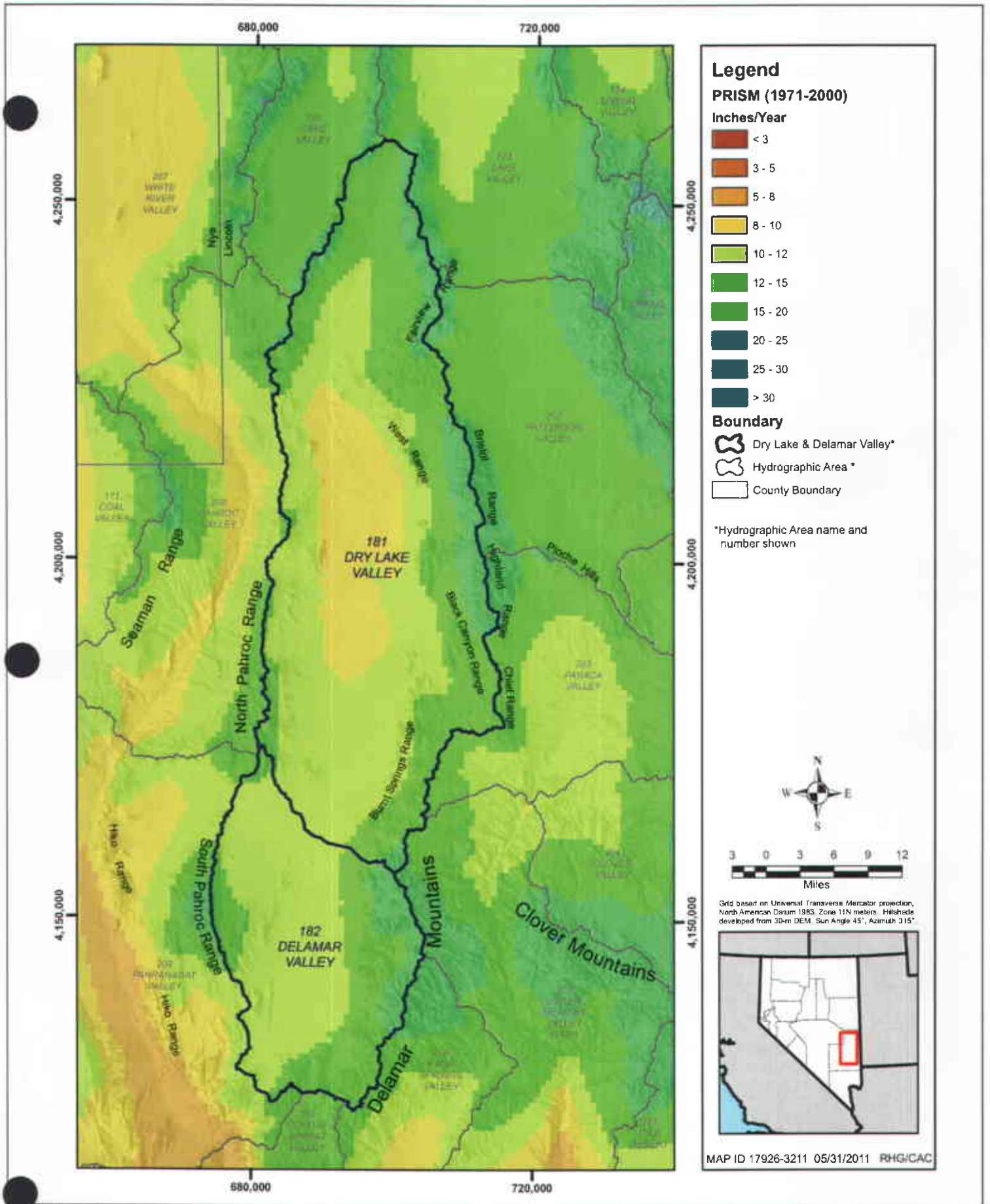


Note: See Table B-1 for Site Information.

**Figure 3-2**  
**800-m Normal Precipitation Distribution for Cave Valley and Vicinity**

**Table 3-2**  
**Comparison of Cave Valley**  
**Annual Precipitation Volume to Reported Values**

| Method                            | Annual Precipitation<br>(afy) | Source                       |
|-----------------------------------|-------------------------------|------------------------------|
| 800-m PRISM (Version 3)           | 264,700                       | This Study                   |
| 800-m PRISM (Version 2)           | 265,000                       | SNWA (2009a, p. 6-8)         |
| Hardman maps                      | 220,000                       | Scott et al. (1971, p. 36)   |
| Precipitation-altitude regression | 258,000                       | LVVWD (2001, p. 4-15)        |
| Modified 4-km PRISM               | 245,000                       | Flint and Flint (2007, p. 5) |



Note: See Table B-1 for Site Information.

**Figure 3-3**  
**800-m Normal Precipitation Distribution**  
**for Dry Lake and Delamar Valleys and Vicinity**

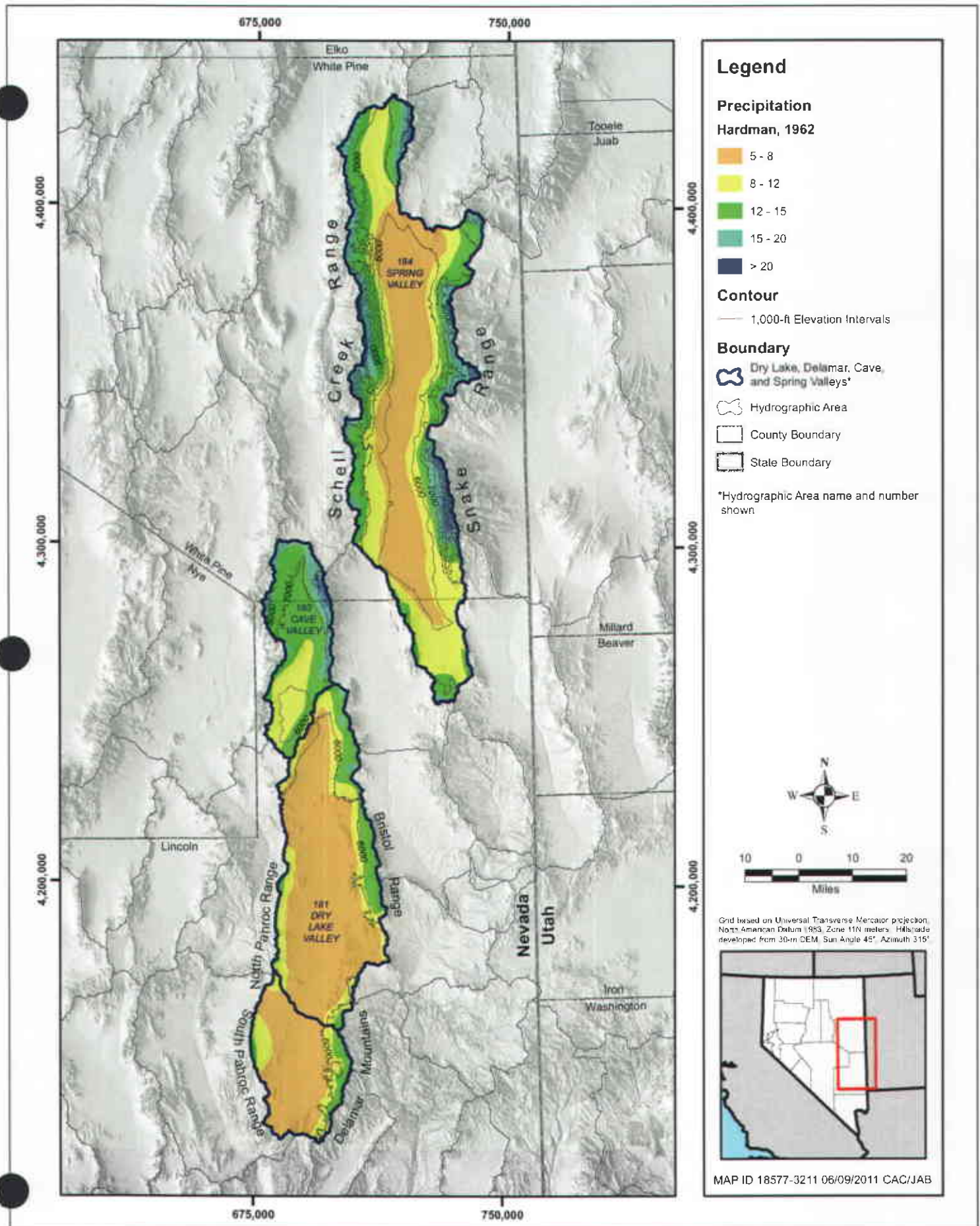
**Table 3-3**  
**Comparison of Dry Lake and Delamar Valleys**  
**Annual Precipitation Volumes to Reported Values**

| Method                            | Annual Precipitation (afy) |                | Source                     |
|-----------------------------------|----------------------------|----------------|----------------------------|
|                                   | Dry Lake Valley            | Delamar Valley |                            |
| 800-m PRISM (Version 3)           | 569,600                    | 236,400        | This Study                 |
| 800-m PRISM (Version 2)           | 571,000                    | 236,000        | SNWA (2009a, p. 6-8)       |
| Hardman Maps                      | 340,000                    | 140,000        | Scott et al. (1971, p. 36) |
| Precipitation-altitude regression | 455,000                    | 176,000        | LVVWD (2001, p. 4-15)      |



**Table 3-4**  
**Comparison of Estimated Annual Precipitation**  
**Volume in afy to Values Reported by Scott et al. (1971)**

| <b>Method</b>   | <b>800-m PRISM<br/>(Version 3)<br/>(This Study)</b> | <b>Hardman<br/>(1936; 1962) Maps<br/>Scott et al.<br/>(1971, p. 36, 37)</b> | <b>Underestimation<br/>Value<br/>(Percent)</b> |
|-----------------|---|---|--|
| Spring Valley   | 1,119,700   | 960,000   | 14   |
| Cave Valley     | 264,700   | 220,000   | 17   |
| Dry Lake Valley | 570,600   | 340,000   | 40   |
| Delamar Valley  | 236,400   | 140,000   | 41   |



**Figure 3-4**  
**Digitized Hardman (1962) Precipitation Map for**  
**Spring, Cave, Dry Lake, and Delamar Valleys**

**Table 3-5  
Comparison of Precipitation Estimates Derived by  
Scott et al. (1971) and from the Hardman Map (1962)**

| HA Name            | Precipitation Zone (in.) | Area (acres)                               |                          |                    | Precipitation (afy)                         |                          |                    |
|--------------------|--------------------------|--|--------------------------|--------------------|---|--------------------------|--------------------|
|                    |                          | Eakin(1962; 1963) or Rush and Kazmi (1965) | Digitized Hardman (1962) | Percent Difference | Eakin (1962; 1963) or Rush and Kazmi (1965) | Digitized Hardman (1962) | Percent Difference |
| Spring Valley      | > 20                     | 59,100                                     | 31,586                   | 47                 | 103,000                                     | 55,275                   | 46                 |
|                    | 15 to 20                 | 107,300                                    | 114,518                  | -7                 | 156,000                                     | 167,196                  | -7                 |
|                    | 12 to 15                 | 183,500                                    | 246,519                  | -34                | 206,000                                     | 276,101                  | -34                |
|                    | 8 to 12                  | 393,000                                    | 319,887                  | 19                 | 326,000                                     | 265,506                  | 19                 |
|                    | < 8                      | 342,000                                    | 353,553                  | -3                 | 171,000                                     | 176,777                  | -3                 |
|                    | <b>Total</b>             | <b>1,084,900</b>                           | <b>1,066,063</b>         | <b>2</b>           | <b>962,000</b>                              | <b>940,856</b>           | <b>2</b>           |
| Cave Valley        | > 20                     | 3,500                                      | 4,655                    | -33                | 6,125                                       | 8,146                    | -33                |
|                    | 15 to 20                 | 19,500                                     | 35,573                   | -82                | 28,470                                      | 51,937                   | -82                |
|                    | 12 to 15                 | 69,000                                     | 129,990                  | -88                | 77,280                                      | 145,589                  | -88                |
|                    | 8 to 12                  | 114,000                                    | 58,998                   | 48                 | 94,620                                      | 48,968                   | 48                 |
|                    | < 8                      | 29,000                                     | 429                      | 99                 | 12,035 <sup>a</sup>                         | 178 <sup>a</sup>         | 99                 |
|                    | <b>Total</b>             | <b>235,000</b>                             | <b>229,645</b>           | <b>2</b>           | <b>218,530</b>                              | <b>254,818</b>           | <b>-17</b>         |
| Dry Lake Valley    | > 20                     | 200  | NA                       | NA                 | 350   | NA                       | NA                 |
|                    | 15 to 20                 | 3,200                                      | 3,380                    | -6                 | 4,672                                       | 4,935                    | -6                 |
|                    | 12 to 15                 | 16,000                                     | 74,011                   | -363               | 17,920                                      | 82,892                   | -363               |
|                    | 8 to 12                  | 114,000                                    | 98,686                   | 13                 | 94,620                                      | 81,909                   | 13                 |
|                    | < 8                      | 442,000                                    | 397,322                  | 10                 | 221,000 <sup>b</sup>                        | 198,661 <sup>b</sup>     | 10                 |
|                    | <b>Total</b>             | <b>575,400</b>                             | <b>573,399</b>           | <b>0</b>           | <b>338,562</b>                              | <b>368,397</b>           | <b>-9</b>          |
| Delamar Valley     | > 20                     | NA   | NA                       | NA                 | NA  | NA                       | NA                 |
|                    | 15 to 20                 | NA   | NA                       | NA                 | NA  | NA                       | NA                 |
|                    | 12 to 15                 | 4,000                                      | 22,292                   | -457               | 4,480                                       | 24,967                   | -457               |
|                    | 8 to 12                  | 35,000                                     | 45,648                   | -30                | 29,050                                      | 37,888                   | -30                |
|                    | < 8                      | 208,000                                    | 163,503                  | 21                 | 104,000 <sup>b</sup>                        | 81,752 <sup>b</sup>      | 21                 |
|                    | <b>Total</b>             | <b>247,000</b>                             | <b>231,443</b>           | <b>6</b>           | <b>137,530</b>                              | <b>144,607</b>           | <b>-5</b>          |
| <b>GRAND TOTAL</b> |                          | <b>2,142,300</b>                           | <b>2,100,550</b>         | <b>0</b>           | <b>1,656,622</b>                            | <b>1,708,678</b>         | <b>-3</b>          |

NA = Not applicable

<sup>a</sup>Precipitation rate used to calculate volume is half of 0.83 ft/yr.

<sup>b</sup>Precipitation rate used to calculate volume is 0.5 ft/yr.

**Table 3-6  
Comparison of Precipitation Estimates  
Derived from the Hardman Map and the PRISM Map**

| HA Name            | Precipitation Zone (in.) | Area (acres)             |                  |                    | Precipitation (afy)      |                  |                    |
|--------------------|--------------------------|--------------------------|------------------|--------------------|--------------------------|------------------|--------------------|
|                    |                          | Digitized Hardman (1962) | This Study       | Percent Difference | Digitized Hardman (1962) | This Study       | Percent Difference |
| Spring Valley      | > 20                     | 31,586                   | 63,654           | -102               | 55,275                   | 125,510          | -127               |
|                    | 15 to 20                 | 114,518                  | 146,642          | -28                | 167,196                  | 202,833          | -21                |
|                    | 12 to 15                 | 246,519                  | 246,867          | 0                  | 276,101                  | 274,906          | 0                  |
|                    | 8 to 12                  | 319,887                  | 608,900          | -90                | 265,506                  | 516,424          | -95                |
|                    | < 8                      | 353,553                  | 0                | 100                | 176,777                  | 0                | 100                |
|                    | <b>Total</b>             | <b>1,066,063</b>         | <b>1,066,063</b> | <b>0</b>           | <b>940,856</b>           | <b>1,119,674</b> | <b>-19</b>         |
| Cave Valley        | > 20                     | 4,655                    | 3,007            | 35                 | 8,146                    | 5,408            | 34                 |
|                    | 15 to 20                 | 35,573                   | 46,209           | -30                | 51,937                   | 63,880           | -23                |
|                    | 12 to 15                 | 129,990                  | 158,808          | -22                | 145,589                  | 174,719          | -20                |
|                    | 8 to 12                  | 58,998                   | 21,621           | 63                 | 48,968                   | 20,655           | 58                 |
|                    | < 8                      | 429                      | 0                | 100                | 178 <sup>a</sup>         | 0                | 100                |
|                    | <b>Total</b>             | <b>229,645</b>           | <b>229,646</b>   | <b>0</b>           | <b>254,818</b>           | <b>264,663</b>   | <b>-4</b>          |
| Dry Lake Valley    | > 20                     | NA                       | 0                | NA                 | NA                       | 0                | NA                 |
|                    | 15 to 20                 | 3,380                    | 50,338           | -1,389             | 4,935                    | 68,579           | -1,290             |
|                    | 12 to 15                 | 74,011                   | 188,575          | -155               | 82,892                   | 209,148          | -152               |
|                    | 8 to 12                  | 98,686                   | 334,486          | -239               | 81,909                   | 292,920          | -258               |
|                    | < 8                      | 397,322                  | 0                | 100                | 198,661 <sup>b</sup>     | 0                | 100                |
|                    | <b>Total</b>             | <b>573,399</b>           | <b>573,399</b>   | <b>0</b>           | <b>368,397</b>           | <b>570,647</b>   | <b>-55</b>         |
| Delamar Valley     | > 20                     | NA                       | NA               | NA                 | NA                       | NA               | NA                 |
|                    | 15 to 20                 | NA                       | 22,692           | NA                 | NA                       | 30,456           | NA                 |
|                    | 12 to 15                 | 22,292                   | 74,919           | -236               | 24,967                   | 83,434           | -234               |
|                    | 8 to 12                  | 45,648                   | 133,833          | -193               | 37,888                   | 122,494          | -223               |
|                    | < 8                      | 163,503                  | 0                | 100                | 81,752 <sup>b</sup>      | 0                | 100                |
|                    | <b>Total</b>             | <b>231,443</b>           | <b>231,443</b>   | <b>0</b>           | <b>144,607</b>           | <b>236,385</b>   | <b>-63</b>         |
| <b>GRAND TOTAL</b> |                          | <b>2,100,550</b>         | <b>2,100,552</b> | <b>0</b>           | <b>1,708,678</b>         | <b>2,191,368</b> | <b>-28</b>         |

<sup>a</sup> - Not applicable

<sup>a</sup>Precipitation rate used to calculate volume is half of 0.83 ft/yr.

<sup>b</sup>Precipitation rate used to calculate volume is 0.5 ft/yr.