

**Nevada State Water Plan  
SUMMARY**

**Section 3  
Water Resources and Use Assessment**

***Introduction***

An understanding of the state's water resources and its usage is a necessary component to the planning and management process. This section provides an overview of the physical characteristics of Nevada's water resources and historic water use for the last 25 years.

***Water Resources Background***

The following discussion provides an overview of Nevada's surface water and groundwater resources.

**Topography**

The topography of Nevada and the surrounding areas makes for a unique and diversified climate. Nearly all of Nevada is in the Basin and Range Province of the Intermountain Plateaus, a rugged elevated area between the Rocky Mountains and the Pacific mountain system. The topography of the Basin and Range province is characterized by isolated, long and narrow, roughly north-south trending, parallel mountain ranges and broad, intervening valleys. Internal drainage is a significant feature of the hydrology of much of Nevada with about 84 percent of the drainage flowing to low areas in enclosed basins rather than to the sea.

The topography and related geology of the State has resulted in complex surface and ground water systems, complicating the management of these resources. In the 1960s, the Nevada State Engineer's Office and the U.S. Geological Survey (USGS) recognized the need for a systematic identification of the valleys or hydrographic areas, and developed a hydrographic area map. The current hydrographic area map delineates 256 hydrographic areas within 14 major hydrographic regions and basins (Figure 3-1, Table 3-1). Of the 14 hydrographic regions and basins, only the Snake River Basin and the Colorado River Basin drain to the sea.

Figure 3-1 - Hydrographic Regions and Basins

**Table 3-1. List of Hydrographic Areas**

**1. NORTHWEST REGION**

1. Pueblo Valley
2. Continental Lake Valley
3. Gridley Lake Valley
4. Virgin Valley
5. Sage Hen Valley
6. Guano Valley
7. Swan Lake Valley
8. Massacre Lake Valley
9. Long Valley
10. Macy Flat
11. Coleman Valley
12. Mosquito Valley
13. Warner Valley
14. Surprise Valley
15. Boulder Valley
16. Duck Lake Valley

**2. BLACK ROCK DESERT REGION**

17. Pilgrim Flat
18. Painter Flat
19. Dry Valley
20. Sano Valley
21. Smoke Creek Desert
22. San Emidio Desert
23. Granite Basin
24. Hualapai Flat
25. High Rock Lake Valley
26. Mud Meadow
27. Summit Lake Valley
28. Black Rock Desert
29. Pine Forest Valley
30. Kings River Valley
  - (A) Rio King Subarea
  - (B) Sod House Subarea
31. Desert Valley
32. Silver State Valley
33. Quinn River Valley
  - (A) Orovada Subarea
  - (B) McDermitt Subarea

**3. SNAKE RIVER BASIN**

34. Little Owyhee River Area
35. South Fork Owyhee River Area
36. Independence Valley
37. Owyhee River Area
38. Bruneau River Area
39. Jarbidge River Area
40. Salmon Falls Creek Area
41. Goose Creek Area

**4. HUMBOLDT RIVER BASIN**

42. Marys River Area
43. Starr Valley Area
44. North Fork Area
45. Lamoille Valley
46. South Fork Area
47. Huntington Valley
48. Dixie Creek - Tenmile Creek Area
49. Elko Segment
50. Susie Creek Area
51. Maggie Creek Area
52. Marys Creek Area
53. Pine Valley
54. Crescent Valley
55. Carico Lake Valley
56. Upper Reese River Valley
57. Antelope Valley
  - (A) Eastern Part
  - (B) Western Part
58. Middle Reese River Valley
59. Lower Reese River Valley
60. Whirlwind Valley
61. Boulder Flat
62. Rock Creek Valley
63. Willow Creek Valley
64. Clovers Area
65. Pumpmickel Valley
66. Kelly Creek Area
67. Little Humboldt Valley
68. Hardscrabble Area
69. Paradise Valley
70. Winnemucca Segment
71. Grass Valley
72. Inlay Area
73. Lovelock Valley
  - (A) Oreana Subarea
74. White Plains

**5. WEST CENTRAL REGION**

75. Bradys Hot Springs Area
76. Fernley Area
77. Fireball Valley
78. Granite Springs Valley
79. Kumiva Valley

**6. TRUCKEE RIVER BASIN**

80. Winnemucca Lake Valley
81. Pyramid Lake Valley
82. Dodge Flat
83. Tracy Segment
84. Warm Springs Valley
85. Spanish Springs Valley
86. Sun Valley
87. Truckee Meadows
88. Pleasant Valley
89. Washoe Valley
90. Lake Tahoe Basin
91. Truckee Canyon Segment

**7. WESTERN REGION**

92. Lemmon Valley
  - (A) Western Part
  - (B) Eastern Part
93. Antelope Valley
94. Bedell Flat
95. Dry Valley
96. Newcomb Lake Valley
97. Honey Lake Valley
98. Skedaddle Creek Valley
99. Red Rock Valley
100. Cold Spring Valley
  - (A) Long Valley

**8. CARSON RIVER BASIN**

101. Carson Desert
  - (A) Packard Valley
102. Churchill Valley
103. Dayton Valley
104. Eagle Valley
105. Carson Valley

**9. WALKER RIVER BASIN**

106. Antelope Valley
107. Smith Valley
108. Mason Valley
109. East Walker Area
110. Walker Lake Valley
  - (A) Schurz Subarea
  - (B) Lake Subarea
  - (C) Whisky Flat - Hawthorne Subarea

**10. CENTRAL REGION**

111. Alkali Valley (Mineral)
  - (A) Northern Part
  - (B) Southern Part
112. Mono Valley
113. Huntoon Valley
114. Teels Marsh Valley
115. Adobe Valley
116. Queen Valley
117. Fish Lake Valley
118. Columbus Salt Marsh Valley
119. Rhodes Salt Marsh Valley
120. Garfield Flat
121. Soda Spring Valley
  - (A) Eastern Part
  - (B) Western Part
122. Gabbs Valley
123. Rawhide Flats
124. Fairview Valley
125. Stingaree Valley
126. Cowkick Valley
127. Eastgate Valley Area
128. Dixie Valley
129. Buena Vista Valley
130. Pleasant Valley
131. Buffalo Valley
132. Jersey Valley
133. Edwards Creek Valley
134. Smith Creek Valley
135. Ione Valley
136. Monte Cristo Valley
137. Big Smoky Valley
  - (A) Tonopah Flat

- (B) Northern Part
138. Grass Valley
139. Kobeh Valley
140. Monitor Valley
  - (A) Northern Part
  - (B) Southern Part
141. Ralston Valley
142. Alkali Spring Valley (Esmeralda)
143. Clayton Valley
144. Lida Valley
145. Stonewall Flat
146. Sarcobatus Flat
147. Gold Flat
148. Cactus Flat
149. Stone Cabin Flat
150. Little Fish Lake Valley
151. Antelope Valley (Eureka & Nye)
152. Stevens Basin
153. Diamond Valley
154. Newark Valley
155. Little Smoky Valley
  - (A) Northern Part
  - (B) Central Part
  - (C) Southern Part
156. Hot Creek Valley
157. Kawich Valley
158. Emigrant Valley
  - (A) Groom Lake Valley
  - (B) Papoose Lake Valley
159. Yucca Flat
160. Frenchman Flat
161. Indian Springs Valley
162. Pahrump Valley
163. Mesquite Valley (Sandy Valley)
164. Ivanpah Valley
  - (A) Northern Part
  - (B) Southern Part
165. Jean Lake Valley
166. Hidden Valley (South)
167. Eldorado Valley
168. Three Lakes Valley (Northern Part)
169. Tikapoo Valley (Tickaboo Valley)
  - (A) Northern Part
  - (B) Southern Part
170. Penoyer Valley (Sand Spring Valley)
171. Coal Valley
172. Garden Valley
173. Railroad Valley
  - (A) Southern Part
  - (B) Northern Part
174. Jakes Valley
175. Long Valley
176. Ruby Valley
177. Clover Valley
178. Butte Valley
  - (A) Northern Part (Round Valley)
  - (B) Southern Part
179. Steptoe Valley
180. Cave Valley
181. Dry Lake Valley
182. Delamar Valley
183. Lake Valley
184. Spring Valley
185. Tippet Valley
186. Antelope Valley (White Pine & Elko)
  - (A) Southern Part
  - (B) Northern Part
187. Goshute Valley
188. Independence Valley (Pequop Valley)

**11. GREAT SALT LAKE BASIN**

189. Thousand Springs Valley
  - (A) Herrill Siding - Brush Creek Area
  - (B) Toano - Rock Spring Area
  - (C) Montello - Crittenden Creek Area (Montello Valley)
190. Grouse Creek Valley
191. Pilot Creek Valley
192. Great Salt Lake Desert
193. Deep Creek Valley
194. Pleasant Valley
195. Snake Valley
196. Hamlin Valley

**12. ESCALANTE DESERT**

197. Escalante Desert

**13. COLORADO RIVER BASIN**

198. Dry Valley
199. Rose Valley
200. Eagle Valley
201. Spring Valley
202. Patterson Valley
203. Panaca Valley
204. Clover Valley
205. Lower Meadow Valley Wash
206. Kane Springs Valley
207. White River Valley
208. Pahroc Valley
209. Pahrnagat Valley
210. Coyote Spring Valley
211. Three Lakes Valley (Southern Part)
212. Las Vegas Valley
213. Colorado Valley
214. Piute Valley
215. Black Mountains Area
216. Garnet Valley (Dry Lake Valley)
217. Hidden Valley (North)
218. California Wash
219. Muddy River Springs Area (Upper Moapa Valley)
220. Lower Moapa Valley
221. Tule Desert
222. Virgin River Valley
223. Gold Butte Area
224. Greasewood Basin

**14. DEATH VALLEY BASIN**

225. Mercury Valley
226. Rock Valley
227. Fortymile Canyon
  - (A) Jackass Flats
  - (B) Buckboard Mesa
228. Oasis Valley
229. Crater Flat
230. Amargosa Desert
231. Grapevine Canyon
232. Oriental Wash

## **Climate**

Nevada is truly a land of great climatic differences. The climate of Nevada is characterized as semi-arid to arid. Temperatures can fall below -40°F in the northeast, and rise over 120°F in the south. Precipitation can range from only three to four inches in Southern Nevada to over 40 inches (and over 300 inches of snowfall) in the Carson Range portion of the Sierra Nevada Mountains. With total precipitation averaging approximately nine inches per year, Nevada is the most arid state in the nation.

## **Surface Water**

Surface water is a limited and precious resource in Nevada providing about 70 percent of the total water supply used in the state. Spring and summer snowmelt supplies most of the streamflow in Nevada. However, isolated summer convective storms probably cause a majority of the streamflow in southern Nevada's low altitude basins.

**Major Rivers, Lakes and Reservoirs.** Nevada can claim very few large rivers and streams compared to other states. With the exception of the Colorado River, Nevada's perennial rivers are small by nationwide standards. The rivers in the Snake River and Colorado River basin regions flow to the oceans, with the remaining stream systems discharging into terminal sinks and lakes. The major river systems in Nevada are the Colorado, Walker, Carson, Truckee, and Humboldt (Figure 3-2). Table 3-2 summarizes the main lakes and reservoirs within these river systems and in Nevada.

**Streamflow Characteristics.** Most of the streamflow in Nevada is the result of runoff from melting snow. Runoff patterns in Nevada vary seasonally and geographically, and are mainly determined by precipitation patterns (location and timing) and other climate patterns, such as temperature. Other factors such as surface geology, vegetation, land use affect the amount of runoff entering the rivers and streams. Streamflows are further affected by human-induced influences such as diversions and reservoir operations.

Table 3-3 summarizes some basic streamflow characteristics for selected USGS gaging stations throughout Nevada. As shown, average annual flows vary widely from river to river. Within a given river system, flows fluctuate year to year in response to changes in precipitation amounts. Monthly and annual flows for the Humboldt River are shown on Figures 3-3 and 3-4.

**Water Yields and Committed Resources.** The estimated average annual yield from Nevada's surface water systems is approximately 3.2 million acre-feet per year (Table 3-4). Generally, Nevada's surface water sources, such as lakes, streams and springs, have been fully appropriated and used for many years. In some instances, water may be available from these sources during high water years, however storage facilities would be required to capture the surplus flows for later use.

**Figure 3-2 - Rivers**

Table 3-2. Major Lakes and Reservoirs of Nevada and Portions of California

Hydrographic Region	Lake/Reservoir	Surface Area, acres	Active Storage Capacity, acre-feet	Total Storage Capacity, acre-feet
Carson River	Lahontan Reservoir	14,600	317,000	317,000
Colorado River	Lake Mead	158,000	26,200,000	29,700,000
	Lake Mohave	28,000	1,810,000	1,820,000
Humboldt River	Pitt-Taylor Reservoir, Lower	2,570	22,200	22,200
	Pitt-Taylor Reservoir, Upper	2,070	24,200	24,200
	Rye Patch Reservoir	12,400	194,300	194,300
	South Fork Reservoir	1,650	41,000	41,000
Snake River	Wild Horse Reservoir	2,830	73,500	73,500
Truckee River	Big and Little Washoe Lakes	5,800	14,000	38,000
	Boca Reservoir	980	40,870	41,110
	Donner Lake	800	9,500	Not reported
	Independence Lake	700	17,500	Not reported
	Lake Tahoe	124,000	744,600	125,000,000
	Martis Creek Lake	770	20,400	21,200
	Prosser Creek Reservoir	750	28,640	29,840
	Pyramid Lake <sup>1</sup>	111,400 (as of 9/30/96)	not applicable	21,760,000 (as of 9/30/96)
	Stampede Reservoir	3,440	221,860	226,500
Walker River	Bridgeport Reservoir	2,914	40,500	40,500
	Topaz Lake	2,410	61,000	126,000
	Walker Lake <sup>1</sup>	33,500 (as of 9/30/96)	not applicable	2,153,000 (as of 9/30/96)
	Weber Reservoir	950	13,000	13,000

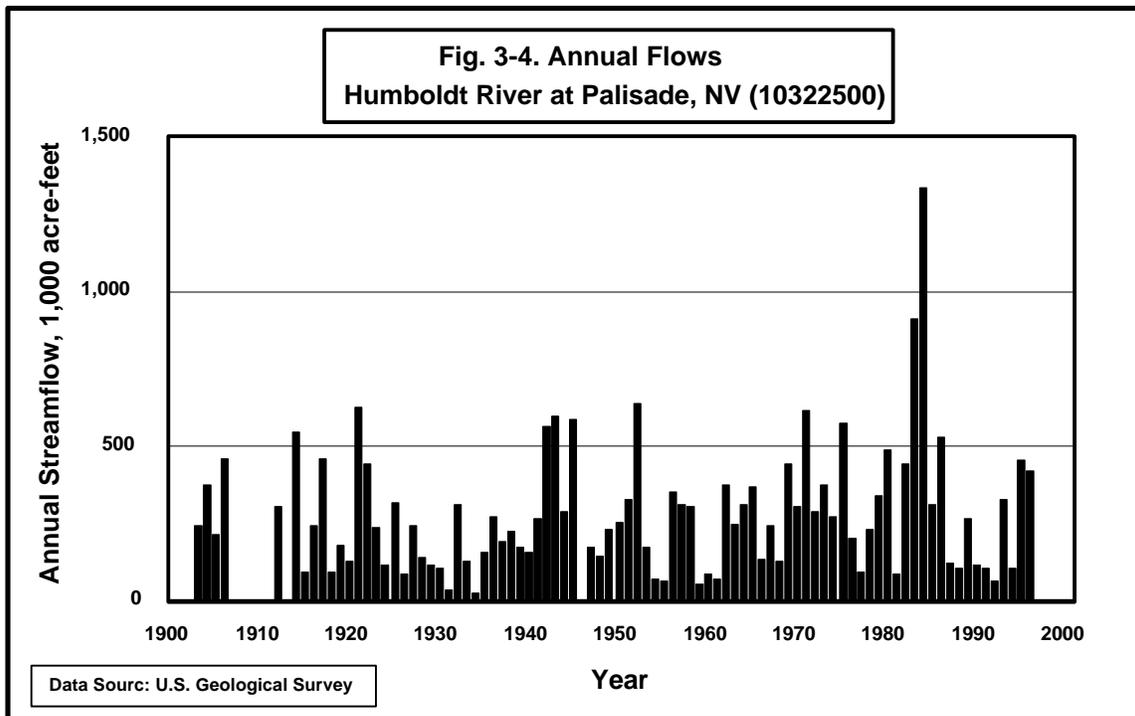
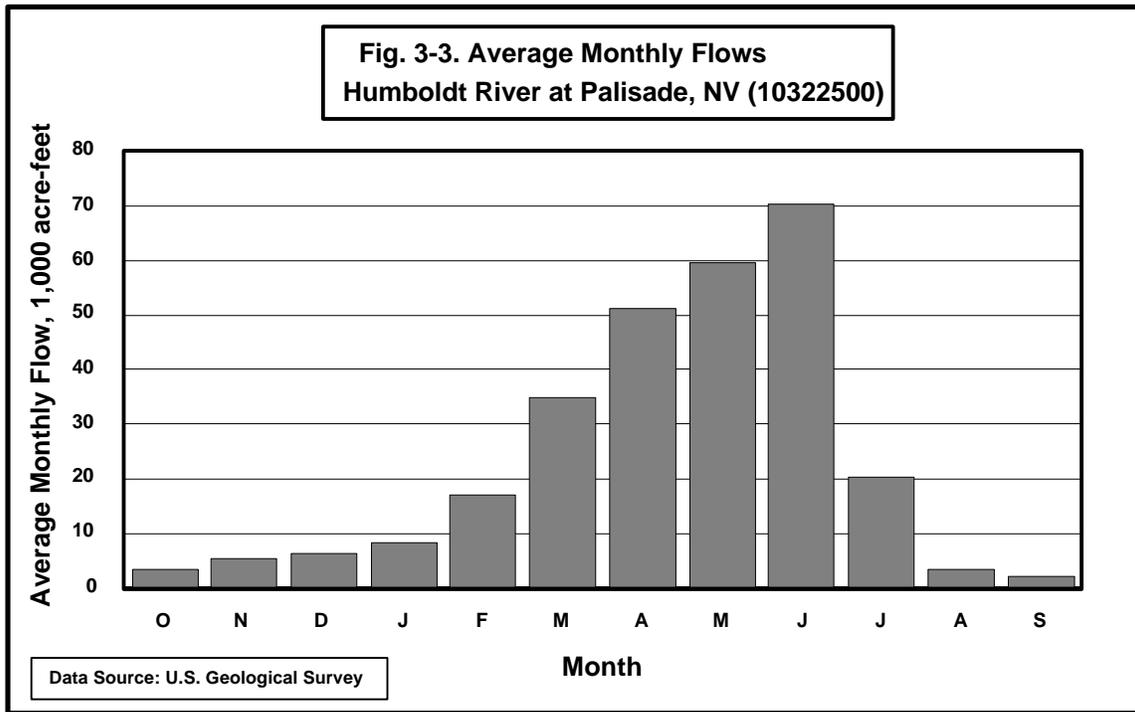
<sup>1</sup>Pyramid and Walker lakes are natural terminal lakes with no outlet.

**Table 3-3. Summary of Streamflow Data for Selected Gaging Stations**

Hydrographic Region	Gaging Station Name (Number)	Period of Record	Annual Streamflow Statistics, acre-feet		
			Average Annual	Lowest Annual	Highest Annual
Carson River	East Fork Carson River near Gardnerville, NV (10309000)	1890-1997	278,800	66,300	655,200
	West Fork Carson River at Woodfords, CA (10310000)	1901-97	81,000	18,900	210,000
	Carson River near Carson City, NV (10311000)	1940-97	298,700	42,400	826,800
	Carson River near Ft. Churchill, NV (10312000)	1911-97	272,900	26,300	804,400
Colorado River	Virgin River at Littlefield, AZ (09415000)	1930-97	175,600	72,400	504,600
	Muddy River near Glendale, NV (09419000)	1913-97	30,600	23,500	35,900
	Colorado River below Hoover Dam, AZ-NV (09421500)	1935-97	10,050,000	5,556,000	22,150,000
Humboldt River	Humboldt River at Palisade, NV (10322500)	1903-97	288,800	25,200	1,336,000
	Humboldt River near Imlay, NV (10333000)	1935-97	201,000	18,800	1,460,000
Snake River	Owyhee River above China Diversion Dam near Owyhee, NV (13176000)	1939-84	107,600	33,500	230,800
Truckee River	Truckee River at Farad, CA (10346000)	1909-97	554,500	133,200	1,769,000
	Truckee River at Reno, NV (10348000)	1907-96	492,500	76,700	1,701,000
	Truckee River below Derby Dam near Wadsworth, NV (10351600)	1918-97	289,100	4,500	1,759,000
Walker River	East Walker River near Bridgeport, CA (10293000)	1922-97	105,800	27,100	320,700
	West Walker near Coleville, CA (10296500)	1903-97	202,100	53,900	484,300
	Walker River near Wabuska, NV (10301500)	1902-97	123,300	9,300	602,300

Note: Some years of data may be missing within each period of record.

Source: U.S. Geological Survey



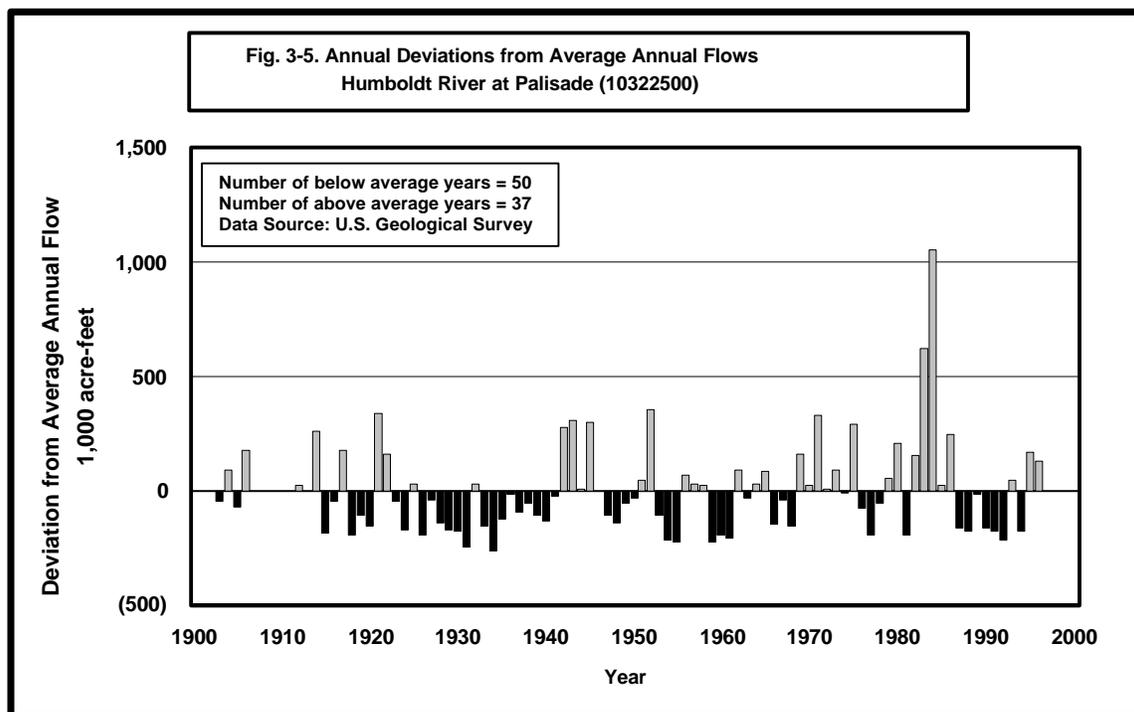
**Table 3-4. Summary of Surface Water Runoff and Flows (excluding Colorado River)**

Description	Acre-feet per year
Average Annual Surface Runoff	
From Watersheds within Nevada	1,900,000
Inflow from Other States	1,300,000
Total	3,200,000
Average Annual Surface Outflow to Other States	700,000

Source: “Water for Nevada, Report No. 3”, State Engineer’s Office, 1971

**Droughts and Floods.** Nevada is a land of extremes, with droughts and floods common in our highly variable climate. Years of average streamflows are rarely experienced. Periods of high flows followed by low flows are more the norm in Nevada.

Drought periods (consecutive years with streamflows much less than average) are frequent in Nevada. In many cases, Nevada’s river systems experience more “below average water years” than “above average water years” (Figure 3-5).

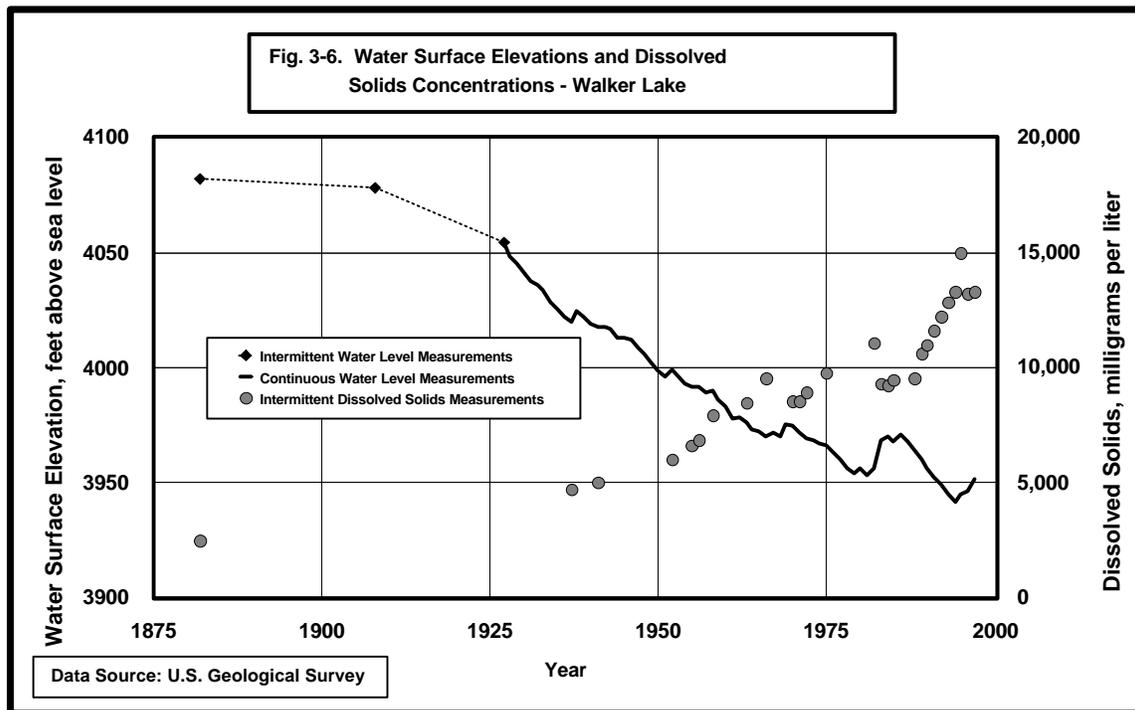


Even though Nevada is the driest state with an average annual precipitation of nine inches, floods are

common and have occurred in all parts of the state. The effects of floods in Nevada have increased steadily as population and development have increased since the mid-1900s. Development has encroached upon natural floodplains, including alluvial fans, and thereby increased flood damage risks.

On the Truckee, Carson, and Walker rivers in west-central Nevada, the most severe floods have resulted from winter rains on snow in the Sierra Nevada Mountains. In the large drainages in southern Nevada, and small drainages and alluvial fans throughout Nevada, flash floods resulting from intense rainfall over relatively small areas are the most common.

**Water Quality.** Nevada’s surface water quality is regulated by the Nevada Division of Environmental Protection (NDEP) and the State Environmental Commission (SEC). The quality of surface water in Nevada varies greatly from location to location and from month to month with changes in flows. In planning, both water quantity and quality need to be considered concurrently as both are interrelated. In general, constituent concentrations vary with changes in streamflow. Similarly, lake water quality has deteriorated with lowering water levels in the State’s terminal lakes, such as Walker Lake (see Figure 3-6).



## **Groundwater**

Groundwater in Nevada is an important water supply source. The surface water resources in our state have been virtually fully appropriated and future development must rely on either ground-water sources or the reallocation of surface water supplies. Groundwater provides about 40 percent of the total water supply used in Nevada and in some areas provides the entire supply. The extent to which groundwater is used may vary considerably from year to year. In many areas, groundwater is pumped to supplement surface water sources. As a result, groundwater usage in these areas increases during periods of low streamflow and decreases during high runoff periods.

**Principal Ground-water Aquifers.** Principal ground-water aquifers in Nevada are basin-fill aquifers, carbonate-rock aquifers, volcanic-rock aquifers, and volcanic- and sedimentary-rock aquifers. The basin-fill aquifers, composed primarily of alluvial, colluvial and lacustrine deposits, are the major aquifers in the State. Virtually all major ground-water development has been in the basin-fill aquifers with the withdrawals from the upper 500 feet of these aquifers. In eastern and southern Nevada, thick sequences of carbonate rock underlie many of the alluvial basins forming a complex regional aquifer system or systems that are largely undeveloped and not yet fully understood. The carbonate-rock aquifer supplies water to numerous springs which are used for irrigation. Volcanic-rock aquifers extend over hundreds of square miles but only one volcanic-rock aquifer in the Carson Desert (Churchill County) of west-central Nevada has been developed as a municipal water supply.

**Perennial Yield and Committed Resources.** Perennial yield is the amount of usable water from a ground-water aquifer which can be economically withdrawn and consumed each year for an indefinite period of time without depleting the source. Estimates of perennial yield are necessary to provide the State Engineer with a guideline by which to limit groundwater allocations (committed resources). Over the years, the USGS has developed a series of perennial yield estimates.

Under the authority granted in Nevada Revised Statutes 534, the State Engineer issues groundwater rights. The term “committed resource” represents the total volume of the permitted, certificated and vested groundwater rights which are recognized by the State Engineer and generally can be withdrawn from a basin or area in any given year. When reviewing groundwater right applications, the State Engineer considers the individual and regional perennial yield estimates, system yield estimates, and the committed resources amounts among other things in making his determination.

To assist in the tracking of the committed groundwater resources, NDWR maintains a computer database of state-issued water rights. Based upon this database, the total committed groundwater resource amount in Nevada equals about 3 million acre-feet per year (as of March/April 1998). The term “committed” refers to those water rights that are either permitted or certificated. Table 3-5 summarizes the committed resources by hydrographic region and by type of use. Committed resource values presented in the *State Water Plan* are time sensitive and subject to change from future actions on pending applications and other procedures. It must be noted that the 3 million acre-feet figure is calculated from NDWR database output and represents the estimated amount of the groundwater resources committed (permitted or certificated) to a particular beneficial use. The database is still under development and all committed resource numbers presented in the *State Water*

**Table 3-5. Approximate Perennial Yield and Committed Groundwater Resources (as of March/April 1998) by Use and Hydrographic Region**

Hydrographic Region	Combined Perennial Yield, acre-feet per year	Committed Groundwater Resources by Category, acre-feet per year (as of March/April 1998)					Total
		Irrigation & Stock	Municipal & Quasi-municipal	Mining & Milling <sup>1</sup>	Commercial & Industrial	Other <sup>2</sup>	
1. Northwest Region	55,500	28,625	6	132	5	64	28,832
2. Black Rock Desert Region	178,825	215,658 <sup>3</sup>	608	58,952 <sup>4</sup>	920 <sup>5</sup>	1,687 <sup>5</sup>	277,825
3. Snake River Basin	62,100	8,091	1,145	7,813	4,877	511	22,437
4. Humboldt River Basin	463,900	492,307 <sup>3,6</sup>	53,737	141,576	63,637 <sup>5</sup>	91,055 <sup>7</sup>	842,312
5. West Central Region	8,200	1,678	8,743	58	28,249 <sup>5</sup>	1,289	40,017
6. Truckee River Region	76,425	34,989 <sup>3</sup>	83,902 <sup>8</sup>	5,172	68,030 <sup>5</sup>	19,014	211,107
7. Western Region	17,850	18,662	5,174	5,174	518	508	25,328
8. Carson River Basin	70,255	95,926 <sup>3</sup>	62,438	4,068	12,979 <sup>5</sup>	13,196 <sup>5</sup>	188,607
9. Walker River Basin	57,300	205,354 <sup>3</sup>	14,949	8,657	12,383 <sup>9</sup>	6,019	247,362
10. Central Region	798,460	573,277	50,978	96,765	37,141 <sup>5</sup>	9,775 <sup>5</sup>	767,936
11. Great Salt Lake Basin	63,150	28,155	3,506	1,305	732	13	33,711
12. Escalante Desert Basin	1,000	2	0	0	0	0	2
13. Colorado River Basin	219,800	78,057 <sup>3</sup>	101,362 <sup>10</sup>	11,171	35,895	19,165 <sup>11</sup>	245,650
14. Death Valley Basin	24,550	22,325	2,154	6,086	638	333	31,536
<b>TOTAL</b>	<b>2,097,315</b>	<b>1,803,106</b>	<b>388,702</b>	<b>342,221</b>	<b>266,004</b>	<b>162,629</b>	<b>2,962,662</b>

General notes:

- A. Data on committed resources were obtained from the Nevada Division of Water Resources water rights database and represent estimated resources committed as of March/April 1998.
- B. The committed resources values include permitted and certificated amounts only.
- C. These numbers are preliminary and intended to be used for planning purposes only. Totals may include water rights that have not been adjusted for supplemental relationships with other groundwater rights. Also, totals do not include any adjustment for supplemental relationships with surface water rights. Values are subject to change due to pending water right applications, and possible cancellations and forfeitures.

Other notes:

- <sup>1</sup> Mining is considered a temporary use by the State Engineer's Office and upon cessation of mining, many permits will expire. The "Mining & Milling" category includes only those rights associated with the consumptive use needs of the mines. Permits associated with dewatering operations are included in the "Other" category.
- <sup>2</sup> "Other" includes following uses: domestic, environmental, power generation, recreation, storage, wildlife, other/decreed. Includes environmental permits issued for environmental cleanup projects. These environmental permits are temporary and expire upon cessation of cleanup activities.
- <sup>3</sup> Portions of rights are supplemental to surface water and are used only when surface water is not available.
- <sup>4</sup> Majority of rights held for a mine operation that is no longer pumping.
- <sup>5</sup> Portion of rights include geothermal pumpage for power generation, with majority of geothermal water reinjected into geothermal reservoir.
- <sup>6</sup> Portion of rights not exercised as mine pit dewatering discharge is being used as a substituted water source. See Footnote 7.
- <sup>7</sup> Includes rights associated with mine pit dewatering. Portion of withdrawals are used as a water source for irrigation. See Footnote 6.
- <sup>8</sup> Actual annual pumpage limited to lower value by State Engineer restrictions.
- <sup>9</sup> Portion of rights include geothermal pumpage for power generation, with some of geothermal water not reinjected.
- <sup>10</sup> Includes permits that will be revoked when water right holders provided water from another source (Colorado River).
- <sup>11</sup> Includes environmental permits issued for environmental cleanup projects. These environmental permits are temporary and expire upon cessation of cleanup activities. Also includes permits granted for pumping of shallow poor quality groundwater in the Las Vegas area as needed to alleviate potential hazards resulting from rising groundwater levels caused by secondary recharge.

Plan are approximate. Actual groundwater withdrawal and consumption amounts are far less than the committed resource value of 3 million acre-feet from the NDWR database. In 1995, approximately 1.6 million acre-feet of groundwater was withdrawn with about 0.7 million acre-feet

consumed. There are a number of reasons for these differences:

- Some groundwater rights are *supplemental* to surface water rights and are only exercised during low surface water flow periods;
- In some basins, the NDWR database may be double counting a smaller portion of groundwater rights that are *supplemental* to other groundwater rights;
- Some groundwater rights may not be exercised to their fullest extent every year;
- Some groundwater rights are not currently being exercised as a water supply is being provided from another replacement source; and
- The State Engineer has placed administrative limits on pumping in some areas.

The committed resource figures derived from the NDWR database may not reflect long-term groundwater commitments for the following reasons:

- Mining is considered a temporary use by the State Engineer’s Office. With some mines, existing water right permits will expire once the mining operations have ceased;
- Environmental permits issued for environmental cleanup projects are included in the committed resource figures in Table 3-5. The cleanup projects are considered temporary, and once a cleanup operation is complete the associated water rights expire; and
- The NDWR database includes committed resource amounts associated with revocable groundwater permits issued in the Las Vegas area. These rights will be revoked when the water right holders are provided water from another source, such as the Colorado River.

**Designated Groundwater Basins.** As the demand for groundwater has increased over the years, the State Engineer has had to increase administrative efforts in some of the groundwater basins. The State Engineer may designate a groundwater basin which is being depleted or is in need of additional administration. Basins are designated through orders issued by the State Engineer. By “designating” a basin, the State Engineer is granted additional authority in the administration of the groundwater resources within the designated basin.

Figure 3-7 displays the designation status for the 256 groundwater basins in Nevada. This map is a useful tool to generally determine where the greatest impediments to groundwater development may exist. However, the associated State Engineer’s orders and rulings need to be examined for a complete understanding of the management issues and water availability within a basin. The designation status of basins as defined by the State Engineer’s orders have been divided into four general categories as shown in Table 3-6.

**Figure 3-7 Designated basins**

**Table 3-6. Designated Groundwater Basin Categories**

Designation Status	General Description of Associated State Engineer’s Orders
<b>Designated</b>	State Engineer’s order(s) do not define any administrative controls.
<b>Designated - Irrigation Denied</b>	State Engineer’s order(s) state that irrigation is <u>not</u> a preferred use in these basins and applications for new irrigation appropriations will be denied.
<b>Designated - Preferred Uses</b>	State Engineer’s order(s) list certain types of uses as preferred in these basins, and quantity restrictions may be placed on these preferred uses.
<b>Designated - Preferred Uses; Irrigation Denied</b>	State Engineer’s order(s) list certain types of uses as preferred in these basins. Quantity restrictions may be placed on these preferred uses. State Engineer’s order(s) also state that irrigation is <u>not</u> a preferred use in these basins and applications for new irrigation appropriations will be denied. Other uses may also be listed as denied.

Whether or not a basin is designated dictates the procedures to be followed in obtaining a groundwater permit. In undesignated basins, a person can drill a well in these basins prior to filing an application for a groundwater permit. In designated basins, a groundwater permit must be obtained prior to drilling a well. Domestic wells are exempt from the permitting process, however, drillers are required to notify the State Engineer of their intent to drill a domestic well and submit a well log following completion.

**Groundwater Levels.** Groundwater levels fluctuate seasonally and annually in response to changes in pumpage and the climate. In some areas, groundwater levels during the late 1980s and early 1990s tended to decline due to heavier than average reliance upon groundwater during the drought of that period, but have been recovering with the return to normal and above-normal precipitation.

**Groundwater Quality.** The water quality in most aquifers in Nevada is suitable or marginally suitable for most uses, with constituent concentrations not exceeding State and national drinking water standards. However, there are parts of some aquifers with constituent concentrations exceeding these standards. It is important to realize that these excessive concentrations of certain constituents in groundwater may result from natural processes and/or human activities.

The quality of groundwater in the unconsolidated deposits in the Basin and Range alluvial aquifers varies from basin to basin. Dissolved-solids concentrations range from less than 500 parts per million (ppm) to more than 10,000 ppm in some areas. By comparison, ocean water has dissolved-solids concentrations of about 35,000 ppm. Locally, saline water is present near thermal springs and in areas where the basin-fill aquifers include large amounts of soluble salts. In discharge or sink areas such as the Carson and Humboldt sinks, the dissolved-solid concentrations can make the water economically unuseable. Although highly mineralized water is common in aquifers beneath playas, a deeper freshwater flow system may be present in some areas.

## ***Historic and Current Water Use***

Comprehensive water use information is critical to the success of all water planning and management functions. The following discussion provides an overview of historic and current water use estimates and discusses observed trends in Nevada's water use.

### **Estimating Water Use**

It has been estimated that 50 to 75 percent of the total water withdrawn from groundwater and surface water sources in Nevada is actually measured, with only a portion of these data reported to any state planning agencies. Therefore in order to develop comprehensive statewide water use figures, it is necessary to generate estimates for many of the values. The most significant water use estimation program in Nevada is implemented by the U.S. Geological Survey (USGS) as part of the USGS National Water Use Information Program.

The USGS has the only program in Nevada responsible for estimating statewide water use on a routine and comprehensive basis. Staff in the USGS's National Water Use Information Program compile and disseminate water use information on local, state and national levels. In developing their estimates, the USGS staff work in cooperation with local, state, and federal agencies.

Since 1950, the USGS has estimated statewide water use at 5-year intervals and published these estimates in a national summary report. It must be stressed that the Nevada water use figures developed by USGS staff are estimates and that the water use values developed are based upon a mixture of measured and estimated water use. To the extent possible, the USGS compiles water use data collected by other agencies, water purveyors, and irrigation districts. Upon review of the USGS estimates, the Division of Water Planning identified some inconsistencies in the data. However, it is difficult to make adjustments to these data because the USGS does not produce a separate state water report documenting data sources and assumptions. Nevertheless, modifications were made by the Nevada Division of Water Planning (NDWP) as feasible to address a portion of these inconsistencies. Clearly a more comprehensive water measurement and/or estimation program is needed to improve water use quantification.

### **Current Water Use and Past Trends**

This section presents statewide water use estimates for the period 1970-1995 at 5-year intervals (Tables 3-7 through 3-10). These estimates are divided into 8 categories of water use:

- public supply
- domestic
- commercial
- industrial
- thermoelectric
- mining
- irrigation
- livestock

**Public Supply Water Use.** *Public supply* refers to water withdrawn by public and private water suppliers and delivered for a variety of uses such as domestic, commercial, industrial, thermoelectric, and public uses such as park landscape irrigation. Public supply use is also referred to as Municipal and Industrial (M&I) water use. “Public supply systems” are defined as those which provide water to at least 25 people or 15 connections.

As expected, public supply water use has increased as Nevada’s population has grown. Public supply withdrawals have increased from approximately 151,000 acre-feet to 525,000 acre-feet from 1970 to 1995. For the same period, the population served by public supply systems increased from about 441,000 to about 1,488,000. From 1970 to 1990, public supply water use rates in Nevada increased from 306 to 334 gallons per capita per day (gpcd). Successful conservation programs during the 1990s have lowered statewide M&I water use down to 315 gpcd by 1995. A majority of this decrease was due to aggressive conservation in the Las Vegas area. For example, M&I use within the Las Vegas Valley Water District decreased from 358 gpcd in 1989 to 320 gpcd in 1997.

**Domestic Water Use.** *Domestic use* refers to water used for household purposes and includes both indoor and outdoor uses, such as drinking, food preparation, bathing, clothes and dish washing, and lawn and garden watering. Domestic water needs are met by either public supply systems or self-supplied systems (domestic wells, individual pumps, cisterns, etc.).

Domestic water use has increased over the years in response to the growing population. From 1970 to 1995, domestic water use increased from about 117,000 acre-feet to about 361,000 acre-feet. Nevada’s population increased from about 488,700 to 1,579,150 during the same period, with the percentage of people served by public supply systems increasing from about 90% to 94% of the total population.

**Commercial Water Use.** *Commercial use* includes water for casinos, motels, restaurants, office buildings, campgrounds, other commercial facilities, and civilian and military institutions. Commercial water needs are met by either public supply systems (community water systems) or self-supplied systems (non-community systems).

Commercial water use has increased from about 67,000 acre-feet to about 153,000 acre-feet during the period 1985 to 1995. Commercial water use trends cannot be established for previous years. Prior to 1985, the USGS had not provided water use estimates for commercial purposes as a separate category but rather commercial usage was aggregated under other uses.

**Industrial Water Use.** *Industrial use* includes water for manufacturing and construction. Industrial water needs are met by either public supply systems or self-supplied systems. Total industrial water use changed little during the period 1985 to 1995, ranging from about 14,000 to 19,000 acre-feet per year. Industrial water use trends cannot be established for previous years. Prior to 1985, the USGS did not separate out water use estimates for industrial purposes, rather industrial usage was aggregated with other uses.

**Thermoelectric Water Use.** *Thermoelectric use* includes water used in the production of electric power generation from fossil fuel and geothermal sources. Nevada has 22 thermoelectric powerplants of which 7 are fossil fueled and 15 are geothermal. Total thermoelectric water use has more than doubled from 1985 to 1995 increasing from about 29,000 acre-feet to 65,000 acre-feet. Over the 10 year period, public supply systems provided a minor portion of the total thermoelectric water used. Usage trends cannot be presented for previous years. Prior to 1985, the USGS did not compile water use estimates for all thermoelectric purposes as a separate category.

**Mining Water Use.** *Mining use* refers to water used in the extraction, milling, and processing of naturally occurring minerals (including petroleum), and other activities that are part of mining, such as dust control. Minerals mined in Nevada can be divided into two categories, metals and industrial minerals. Metals mined in Nevada include gold, silver, lead, zinc, molybdenum and copper. Mined industrial minerals include aggregate, barite, cement, clay, gypsum, lime, diatomite, lithium carbonate and silica. Water use varies widely from operation to operation and is dependent upon the mineral being recovered and the recovery process employed.

Mining water withdrawals have changed significantly, increasing from about 27,000 acre-feet in 1985 to about 274,000 acre-feet in 1995. A majority of this increase is attributable to an increase in mining activities within the Humboldt River basin. Mining water use trends cannot be established for previous years. Prior to 1985, the USGS did not compile water use estimates for mining as a separate category.

**Irrigation Water Use.** *Irrigation use* refers to water withdrawn and applied to lands to grow crops and pasture as well as water used to irrigate golf courses and parks. Under this category, water for irrigation is self-supplied or supplied by irrigation companies or districts. Landscape watering included in the other categories, such as public supply, domestic, and commercial, is not included in the *irrigation use* category.

The main field crops grown in Nevada include alfalfa and other hay, alfalfa seed, winter and spring wheat, potatoes, garlic and onions. These crops account for about 70% of the total irrigated acreage. In addition to harvested field crops, about 30% of the irrigated acreage in Nevada is pasture.

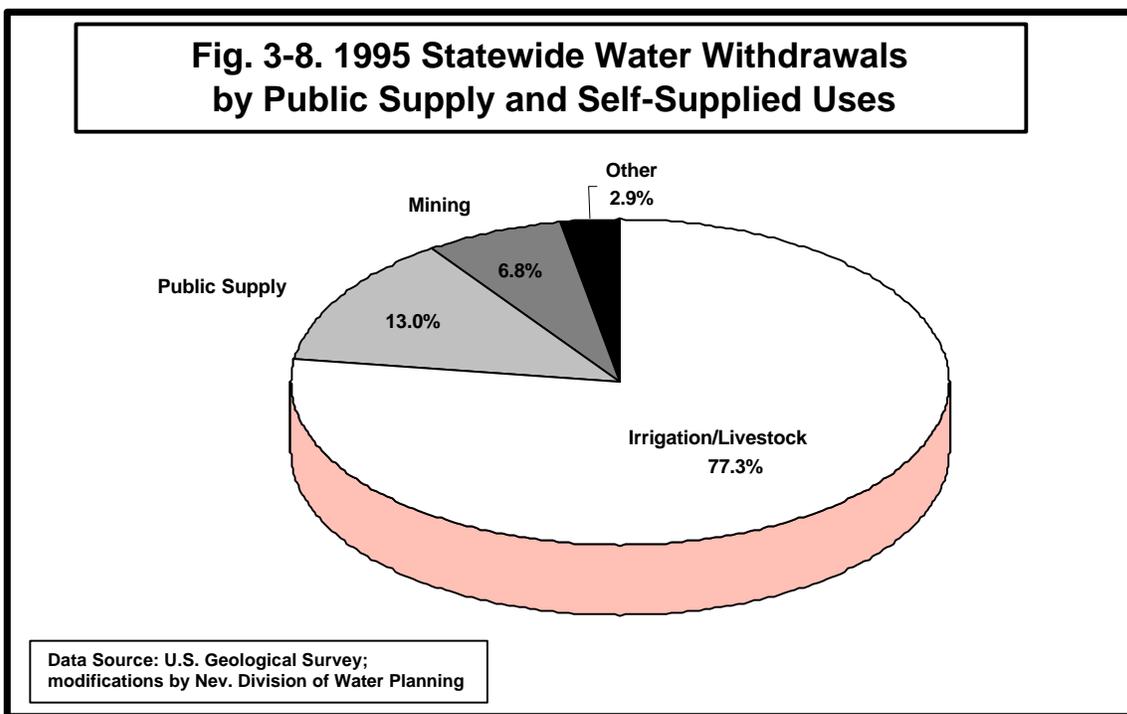
USGS estimates (with 1995 Division of Water Planning modifications) show that irrigated acreage and water use decreased during the period 1970 to 1995. Withdrawals have decreased from about 3.4 million acre-feet in 1970 to about 3.1 million acre-feet in 1995. Due to the uncertainty with the data, it is unknown if this decrease is indicative of any statewide trend or is merely an artifact of the estimation process.

**Livestock Water Use.** *Livestock use* refers to water used for stock watering, feed lots, dairy operations, and other on-farm needs. Cattle are the major livestock raised in Nevada with most grazed on open range. Other livestock include sheep, horses and hogs. USGS estimates for 1970-95 shows wide fluctuations in statewide livestock water use. The variations in the data may be the result of inconsistent estimation techniques from year to year. As a result, these data may not be suitable as a basis for evaluating past water use trends. The *Nevada Agricultural Statistics* reports are an alternative data source for examining livestock trends includes. According to the *Nevada*

*Agricultural Statistics*, during the 1970 to 1995 period there was a general decline in the number of head of cattle, sheep and hogs from about 850,000 to about 600,000.

**Water Use Summary.** Statewide water use for the period 1970 to 1995 is summarized in Tables 3-7 through 3-10. Over the last 20 years, statewide water withdrawals in Nevada have been about 4 million acre-feet per year, with a little under 2 million acre-feet consumptively used. In 1995, about 60 percent of the withdrawals were from surface water sources (Tables 3-8 and 3-10). Irrigation has historically been the largest water use in Nevada varying from about 80 percent to 90 percent of the total statewide water withdrawals and consumptive use. Variations in irrigation water use are primarily the result of Nevada’s variable weather and streamflow conditions. Irrigation accounted for about 77 percent of the state withdrawals in 1995 (Figure 3-8).

The total statewide water use has changed little since 1970 but with some significant changes within certain use sectors. The most significant changes have occurred with “Public Supply” and “Mining” water uses. Public supply water use has more than tripled since 1970 in response to Nevada’s ever increasing population. Mining water use has experienced a significant increase since 1985 mostly as a result of increased mining activity in the Humboldt River basin.



**Table 3-7. Summary of Estimated Statewide Water Use (1970-95) Grouped by Public Supply and Self-Supplied Uses (in acre-feet)**

Water Use Category		1970	1975	1980	1985	1990	1995
<b>Public Supply</b>							
<b>Domestic</b>	Withdrawals	106,400	134,400	168,000	211,900	266,900	342,600
	Consumptive Use	43,000	49,000	65,000	107,100	133,400	171,000
<b>Commercial</b> <sup>1</sup>	Withdrawals				60,300	100,200	129,700
	Consumptive Use				12,100	18,400	23,300
<b>Industrial</b> <sup>1</sup>	Withdrawals	44,800	58,300	93,000	7,100	2,900	2,500
	Consumptive Use	8,500	9,200	12,300	1,400	600	500
<b>Thermoelectric</b> <sup>1</sup>	Withdrawals				2,700	900	1,600
	Consumptive Use				2,700	900	1,600
<b>Public Uses and Losses</b> <sup>1</sup>	Withdrawals	Included in "Public Supply - Domestic" Category			40,100	60,400	48,500
	Consumptive Use				0	0	0
<b>Total Public Supply</b>	Withdrawals	151,200	192,700	261,000	322,100	431,300	524,900
	Consumptive Use	51,500	58,200	77,300	123,400	153,300	196,400
<b>Self-Supplied</b>							
<b>Domestic</b>	Withdrawals	10,200	13,400	16,500	19,700	16,700	18,100
	Consumptive Use	5,100	6,700	8,300	10,100	8,400	9,000
<b>Commercial</b> <sup>1</sup>	Withdrawals				8,300	25,400	23,500
	Consumptive Use				1,700	3,600	3,200
<b>Industrial</b> <sup>1</sup>	Withdrawals				11,400	11,400	16,800
	Consumptive Use	150,000	260,000	270,000	2,100	2,200	5,000
<b>Thermoelectric</b> <sup>1</sup>	Withdrawals	55,000	80,000	95,000	26,300	74,000	63,800
	Consumptive Use				23,700	49,300	39,400
<b>Mining</b> <sup>1</sup>	Withdrawals				27,300	120,100	274,400
	Consumptive Use				22,500	67,900	89,200
<b>Irrigation</b>	Withdrawals	3,400,000	3,500,000	3,500,000	3,750,000	3,160,700	3,113,600
	Consumptive Use	1,600,000	1,700,000	1,700,000	1,934,000	1,633,800	1,612,100
<b>Livestock</b>	Withdrawals	4,900	13,400	13,400	29,100	6,300	6,300
	Consumptive Use	2,400	9,900	10,000	7,400	2,300	2,300
<b>Total</b>							
	Withdrawals	3,716,300	3,979,500	4,060,900	4,194,100	3,846,000	4,041,400
	Consumptive Use	1,714,000	1,854,800	1,890,600	2,124,800	1,920,800	1,956,600

Source: U.S. Geological Survey; modifications by Nevada Division of Water Planning

Note: Figures may not add to totals because of independent rounding. Data are estimates only and subject to revision.

<sup>1</sup> Individual estimates were not available for 1970-80

**Table 3-8. Estimated 1995 Statewide Groundwater and Surface Water Withdrawals for Public Supply and Self-Supplied Uses (in acre-feet)**

Category	Source	Amount
<b>Public Supply</b>		
<b>Total Public Supply</b>	Groundwater	132,000
	Surface water	392,900
	Total	524,900
<b>Self-Supplied</b>		
<b>Domestic</b>	Groundwater	17,800
	Surface water	300
	Total	18,100
<b>Commercial</b>	Groundwater	7,900
	Surface water	15,600
	Total	23,500
<b>Industrial</b>	Groundwater	8,300
	Surface water	8,400
	Total	16,700
<b>Thermoelectric</b>	Groundwater	40,700
	Surface water	23,200
	Total	63,900
<b>Mining</b>	Groundwater	270,500
	Surface water	3,900
	Total	274,400
<b>Irrigation</b>	Groundwater	1,138,200
	Surface water	1,975,400
	Total	3,113,600
<b>Livestock</b>	Groundwater	1,100
	Surface water	5,200
	Total	6,300
<b>Total</b>		
<b>Statewide Total</b>	Groundwater	1,616,500
	Surface water	2,424,900
	Total	4,041,400

Source: U.S. Geological Survey; modifications by Nevada Division of Water Planning

Note: Figures may not add to totals because of independent rounding. Data are estimates only and subject to revision.

**Table 3-9. Summary of Estimated Statewide Water Use (1970-95) Grouped by Type of Use (in acre-feet)**

Water Use Category		1970	1975	1980	1985	1990	1995
<b>Domestic</b>	Withdrawals	116,600	147,800	184,500	231,600	283,600	360,700
	Consumptive Use	48,100	55,700	73,300	117,200	141,800	180,000
<b>Commercial</b> <sup>1</sup>	Withdrawals				68,600	125,600	153,200
	Consumptive Use				13,800	22,000	26,500
<b>Industrial</b> <sup>1</sup>	Withdrawals				18,400	14,400	19,200
	Consumptive Use	194,800	318,300	363,000	3,600	2,800	5,500
<b>Thermoelectric</b> <sup>1</sup>	Withdrawals	63,500	89,200	107,300	29,000	74,900	65,400
	Consumptive Use				26,400	50,200	41,100
<b>Mining</b> <sup>1</sup>	Withdrawals				27,300	120,100	274,400
	Consumptive Use				22,500	67,900	89,200
<b>Irrigation</b>	Withdrawals	3,400,000	3,500,000	3,500,000	3,750,000	3,160,700	3,113,600
	Consumptive Use	1,600,000	1,700,000	1,700,000	1,934,000	1,633,800	1,612,100
<b>Livestock</b>	Withdrawals	4,900	13,400	13,400	29,100	6,300	6,300
	Consumptive Use	2,400	9,900	10,000	7,400	2,300	2,300
<b>Public Supply - Public Uses and Losses</b>	Withdrawals	Included in "Domestic" Category			40,100	60,400	48,500
	Consumptive Use				0	0	0
<b>Total</b>	Withdrawals	3,716,300	3,979,500	4,060,900	4,194,100	3,846,000	4,041,400
	Consumptive Use	1,714,000	1,854,800	1,890,600	2,124,800	1,920,800	1,956,600

Source: U.S. Geological Survey; modifications by Nevada Division of Water Planning

Note: Figures may not add to totals because of independent rounding. Data are estimates only and subject to revision.

<sup>1</sup> Individual estimates were not available for 1970-80.

**Table 3-10. Estimated 1995 Statewide Groundwater and Surface Water Withdrawals for Use Types**

Category	Source	Amount
<b>Domestic (self-supplied &amp; public supplied)</b>	Groundwater	104,100
	Surface water	256,700
	Total	360,800
<b>Commercial (self-supplied &amp; public supplied)</b>	Groundwater	40,600
	Surface water	112,600
	Total	153,200
<b>Industrial (self-supplied &amp; public supplied)</b>	Groundwater	8,900
	Surface water	10,300
	Total	19,200
<b>Thermoelectric (self-supplied &amp; public supplied)</b>	Groundwater	41,100
	Surface water	24,400
	Total	65,500
<b>Mining</b>	Groundwater	270,500
	Surface water	3,900
	Total	274,400
<b>Irrigation</b>	Groundwater	1,138,200
	Surface water	1,975,400
	Total	3,113,600
<b>Livestock</b>	Groundwater	1,100
	Surface water	5,200
	Total	6,300
<b>Public Supply - Public Uses and Losses</b>	Groundwater	12,200
	Surface water	36,300
	Total	48,500
<b>Total</b>	Groundwater	1,616,700
	Surface water	2,424,800
	Total	4,041,500

Source: U.S. Geological Survey; modifications by Nevada Division of Water Planning  
 Note: Figures may not add to totals because of independent rounding. Data are estimates only and subject to revision.