

IN THE OFFICE OF THE STATE ENGINEER

IN THE MATTER OF APPLICATIONS 38661,) 38662, 38663, 45726, 45727, 45728 and 48282) FILED TO APPROPRIATE THE PUBLIC) WATERS OF AN UNDERGROUND SOURCE IN) THE LAS VEGAS VALLEY ARTESIAN BASIN,) CLARK COUNTY, NEVADA. )

RULING

GENERAL

I.

Application 38661 was filed on July 25, 1979, by Curtis Park Manor Water Users Association to appropriate 0.40 c.f.s. of water from an underground source for quasi-municipal purposes to serve 257 residential lots within the NE1/4 Section 24, T.20S., R.60E., M.D.B.&M. The point of diversion is described as being within the NE1/4 NE1/4 Section 24, T.20S., R.60E., M.D.B.&M.<sup>1</sup>

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Application 45726 was filed on May 28, 1982, by Clark County to appropriate 1.12 c.f.s. of water from an underground source for recreation (golf course) purposes within the N1/2 NE1/4, S1/2 NE1/4, and N1/2 SE1/4 Section 32, T.21S., R.61E., M.D.B.&M. The point of diversion is described as being within the NW1/4 NE1/4 Section 32, T.21S., R.61E., M.D.B.&M.<sup>1</sup>

Application 45727 was filed on May 28, 1982, by Clark County to appropriate 1.12 c.f.s. of water from an underground source for recreation (golf course) purposes within the N1/2 NE1/4, S1/2 NE1/4, and N1/2 SE1/4 Section 32, T.21S., R.61E., M.D.B.&M. The point of diversion is described as being within the SW1/4 NE1/4 Section 32, T.21S., R.61E., M.D.B.&M.<sup>1</sup>

Application 45728 was filed on May 28, 1982, by Clark County to appropriate 1.12 c.f.s. of water from an underground source for recreation (golf course) purposes within the N1/2 NE1/4, S1/2 NE1/4, and N1/2 SE1/4 Section 32, T.21S., R.61E., M.D.B.&M. The point of diversion is described as being within the NW1/4 SE1/4 Section 32, T.21S., R.61E., M.D.B.&M.<sup>1</sup>

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<sup>1</sup> Public record in the office of the State Engineer.

Application 48282 was filed on August 8, 1984, by the City of Las Vegas to appropriate 1.39 c.f.s. of water from an underground source for recreation (golf course, baseball and soccer fields, picnic areas and equestrian trails) purposes within the N1/2 N1/2 Sections 31 and 32, T. 20S., R.60E., M.D.B.&M. The point of diversion is described as being within the NW1/4 NE1/4 Section 32, T.20S., R.60E., M.D.B.&M.<sup>1</sup>

II.

A public hearing was held on November 5, 1982, in the matter of Applications 45726, 45727 and 45728.<sup>1</sup>

III.

The State Engineer initially described and designated a portion of Las Vegas Valley on January 10, 1941, under the provisions of NRS Chapter 534, as a basin in need of additional administration.<sup>2</sup>

The State Engineer subsequently extended the designated area of the Las Vegas Valley Ground Water Basin on February 29, 1944,<sup>3</sup> November 22, 1946,<sup>4</sup> April 18, 1961,<sup>5</sup> May 25, 1964,<sup>6</sup> and December 27, 1983.<sup>7</sup>

The State Engineer issued an order on December 1, 1949, curtailing the appropriation of ground water for irrigation purposes within the following areas of the Las Vegas Valley Ground Water Basin.<sup>8</sup>

T.20S., R.60E. - Sections 13, 24, 25 and 36;

T.20S., R.61E. - Sections 13 - 36, inclusive;

T.20S., R.61E. - Sections 1-10, inclusive, and Sections 15 - 18, inclusive.

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<sup>2</sup> State Engineer's Order No. 175 dated January 10, 1941, public record in the office of the State Engineer.

<sup>3</sup> State Engineer's Order No. 182 dated February 29, 1944, public record in the office of the State Engineer.

<sup>4</sup> State Engineer's Order No. 189 dated November 22, 1946, public record in the office of the State Engineer.

<sup>5</sup> State Engineer's Order No. 249 dated April 18, 1961, public record in the office of the State Engineer.

<sup>6</sup> State Engineer's Order No. 275 dated May 25, 1964, public record in the office of the State Engineer.

<sup>7</sup> State Engineer's Order No. 833 dated December 27, 1983, public record in the office of the State Engineer.

<sup>8</sup> State Engineer's Order No. 196 dated December 1, 1949, public record in the office of the State Engineer.

The State Engineer issued an order relating to the issuance of permits for quasi-municipal use within the Las Vegas Valley Ground Water Basin on November 20, 1953.<sup>9</sup>

The State Engineer further extended the designated area of the Las Vegas Valley Ground Water Basin on December 27, 1983, and additionally declared irrigation was not a preferred use and that all further applications to appropriate water for irrigation purposes would be denied.<sup>7</sup>

IV.

Water Resources - Information Series Report 27, titled "Water-Level Changes Associated with Ground-Water Development in Las Vegas Valley, Nevada, March 1976 to March 1977" by Terry Katzer, was prepared cooperatively by the Geological Survey, U.S. Department of the Interior, and the Division of Water Resources, State of Nevada.

Geological Survey Water-Supply Paper 1780, titled "Available Water Supply of the Las Vegas Ground Water Basin, Nevada" by Glenn T. Malmberg, was prepared in cooperation with the Nevada Department of Conservation and Natural Resources, 1965.

U.S. Geological Survey Open-File Report 84-130, titled "Ground-Water Conditions in Las Vegas Valley, Clark County, Nevada, Part I, Hydrogeologic Framework, 1984" by Russell R. Plume, was prepared in cooperation with the Clark County Department of Comprehensive Plannin.

Water Resources Bulletin No. 44, titled "pumping and Ground Water Storage Depletion in Las Vegas Valley, Nevada, 1955-1974", was prepared cooperatively by the United States Department of the Interior, Geological Survey, and the State of Nevada, Division of Water Resources.

Ground-Water Resources - Information Series Report 5, titled "Land Subsidence in Las Vegas Valley, Nevada, 1935-63" by G.T. Malmberg, was prepared cooperatively by Geological Survey, U.S. Department of the Interior, and the Department of Conservation and Natural Resources, State of Nevada, May 1964.

Water Resources - Information Series Report 22, titled "Water Level Changes Association with Ground-Water Development in Las Vegas Valley, Nevada, 1971-75" by James R. Harrill, was prepared cooperatively by the Geological Survey, U.S. Department of the Interior, and Department of Conservation and Natural Resources, State of Nevada, 1976.

Water Resources - Information Series Report 29, titled "Water-Level Changes Associated with Ground-Water Development in Las Vegas Valley, Nevada, March 1977 to March 1978" by David B. Wood, was prepared cooperatively by the Geological Survey, U.S. Department of the Interior, and the Division of Water Resources, State of Nevada, 1979.

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<sup>9</sup> State Engineer's Order No. 212 dated November 20, 1953, public record in the office of the State Engineer.

Water Resources - Information Series Report 26, titled "Water-Level Changes Associated with Ground-Water Development in Las Vegas Valley, Nevada, March 1975 to March 1976" by James R. Harrill, was prepared cooperatively by the Geological Survey, U.S. Department of the Interior, and the Division of Water Resources, State of Nevada, 1976.

"Nitrates in Las Vegas Valley Water District Wells" was prepared by J.T. Monsevizt, Manager, Southern Nevada Water System, September 20, 1982.

"Nitrates in Las Vegas Valley Water District Wells" was prepared by J.T. Monsevizt, Manager, Southern Nevada Water System, March 8, 1982.

U.S.G.S. Water Supply Paper - 849-D, titled "Underground Leakage from Artesian Wells in the Las Vegas Area, Nevada" by Penn Livingston, 1941, was prepared in cooperation with the State Engineer of Nevada, Clark County, and the City of Las Vegas.

Water Resources Bulletin No. 5 titled "Geology and Water Resources of Las Vegas, Pahrump and Indian Spring Valleys, Clark and Nye Counties, Nevada", by G.B. Maxey and C.H. Jameson was prepared in cooperation with the United States Department of the Interior, Geological Survey, and the State Engineer's Office of Nevada, 1948.

Water Resources Bulletin No. 3, titled "Water Levels and Artesian Pressure in Wells in Las Vegas Valley and in Other Valleys in Nevada, 1913-1945" by T.W. Robinson, G.B. Maxey, J.C. Fredericks and C.H. Jameson, was prepared in cooperation with the United States Department of the Interior, Geological Survey, and the State of Nevada, Office of the State Engineer, 1947.

Water Resources Bulletin No. 18, titled "A Summary of the Hydrology of the Las Vegas Ground-Water Basin, Nevada, with Special Reference to the Available Supply" by Glenn T. Malmberg, was prepared in cooperation with the United States Department of the Interior, Geological Survey, and Department of Conservation and Natural Resources, 1961.

Water Resources Bulletin No. 29, titled "Ground Water in Las Vegas Valley" by P.A. Domenico, D.A. Stephenson and G.B. Maxey, was prepared by the Desert Research Institute in cooperation with the State of Nevada, Department of Conservation and Natural Resources, April 1964.

Nevada Bureau of Mines and Geology Bulletin 95, titled "Subsidence in Las Vegas Valley", was prepared by John W. Bell, 1981.

#### FINDINGS OF FACT

##### I.

In 1955, the State Engineer began issuing revocable permits for the temporary use of ground water within the Las Vegas Artesian Basin pursuant to NRS 534.120(3)(a).

The State Engineer has jurisdiction to revoke temporary permits "when water can be furnished by an entity such as a water district".<sup>10</sup>

The State Engineer can deny applications to appropriate ground water for any purpose in areas served by such an entity.<sup>10</sup>

On December 17, 1976, Curtis Park Manor Water Users Association filed Applications 38661, 38662 and 38663 to appropriate underground water from the same wells that were subject to the State revocation order of January 10, 1977.<sup>11</sup> The place of use described under these applications can be and is being provided with quasi-municipal water service from the Las Vegas Valley Water District.

Water service is also available from the Las Vegas Valley Water District in the area of the place of use under Applications 45726, 45727 and 45728.

## II.

The Las Vegas Valley fill reservoir is grouped into zones having similar hydraulic characteristics. Three rather indistinct zones of artesian aquifers - a shallow, middle and a deep zone known as the principal aquifers - are penetrated or significantly affected by large capacity wells. A shallower zone, known as the near-surface reservoir is not well defined in areal extent or depth because they do not compose a distinct lithologic or hydrologic unit.<sup>12</sup>

Well logs within Las Vegas Valley show a persistent layer of blue clay with an average thickness of 20 feet, which acts as a confining layer that holds water under pressure in the aquifers and only transmits small quantities of water. In the upper elevations of the valley, these layers occur from 380 to 450 feet below the land surface, and in the lower elevations, the depth ranges from 150 to 250 feet. Relatively thick sand and gravel lenses which act as the major water bearing strata within the valley are present below and above the blue clay layers. Faults occur in the valley fill which may cause displacements of the blue clay beds. When these blue clay beds are penetrated by wells or broken by faults, the water rises in the wells or along the faults as a result of the pressure that is present. The confining beds are not wholly impermeable and appreciable quantities of water leak through the beds, especially in the vicinity of the

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<sup>10</sup> NRS 534.120 (3a, 3b). Previous Applications 17345, 17540 and 19079 were granted under the provisions of NRS 534.120 and issued subject to revocation when water was available from the Las Vegas Valley Water District. On January 10, 1977, the State Engineer issued an order revoking Permits 17345, 17540 and 19079 effective April 11, 1979. A Complaint for Review was filed in the Eighth Judicial District Court of the State of Nevada on February 7, 1977. The Eighth Judicial District Court, Clark County, issued a decision reversing the decision of the State Engineer. This decision was appealed to the Supreme Court of Nevada. On January 3, 1985, the Supreme Court of the State of Nevada issued a decision reversing the decision by District Court, Clark County, and the matter was remanded to the District Court for reinstatement of the State Engineer's revocation order. State Engineer v. Curtis Park, 101 Nev. \_\_\_\_\_ Adv. Op. 8 (January 3, 1985).

<sup>11</sup> Order No. 599, public record in the office of the State Engineer.

<sup>12</sup> Water Resources Bulletin No. 5, by A.B. Maxey and C.H. Jameson, 1948.

fault zones. The principal aquifers are divided from the shallow water zone and near surface reservoir by the layers of blue clay. The shallow water zone and near surface reservoir can be termed as being hydrologically interconnected.<sup>12</sup>

III.

The average annual natural recharge to the Las Vegas Ground Water Basin has been estimated as 25,000 to 30,000 acre-feet annually which is derived from the precipitation in the mountains within the drainage basin.<sup>13</sup>

IV.

The estimated perennial yield of the principal aquifers is augmented by 16,000 acre-feet per year of secondary recharge from irrigation of lawns, golf courses, parks, farms, etc., and waste water from sewage treatment plants.<sup>14</sup> This secondary recharge is substantially influenced by imported water from Lake Mead through the Southern Nevada Water Project.

V.

Water imports to the basin from Lake Mead through the Southern Nevada Water Project, were estimated at 139,253 acre-feet for the 1984 calendar year.<sup>15</sup>

VI.

The State Engineer has maintained pumpage inventories and records of water levels in Las Vegas Valley since 1945. Ground water pumpage within the Las Vegas Artesian Basin for the year 1984 was inventoried as 69,006 acre-feet.<sup>15</sup> This amount of pumping represents an overdraft of ground water on the order of approximately 28,000 acre-feet annually.

VII.

Land subsidence and water level declines within the Las Vegas Valley Ground Water Basin are active and of a major concern to the State Engineer.

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<sup>13</sup> Geological Survey Water-Supply Paper 1780 titled "Available water supply of the Las Vegas Ground Water Basin, Nevada", by Glenn T. Malmberg, 1965.

<sup>14</sup> Water Resources Bulletin No. 44 titled "Pumping and Ground Water Storage Depletion in Las Vegas Valley, Nevada, 1955-1974", by James R. Harrill, 1976; Michael Dettinger, U.S. Geological Survey, oral communication, 1985.

<sup>15</sup> Data collected by the Division of Water Resources, State of Nevada, Las Vegas Branch. Pumpage inventories are maintained by meter readings and data provided by local water companies. Water levels of selected wells within the Las Vegas Valley Basin are measured periodically. The State Engineer's office and the U.S. Geological Survey have cooperatively maintained ground water level monitoring networks in the Las Vegas Valley since 1945. This record is substantial and conclusive evidence of deteriorating ground water conditions.

(A)

During the 18 year period 1955-77, approximately 1,140,000 acre-feet of ground water was pumped from the valley fill reservoir in Las Vegas Valley. This resulted in substantial water level declines, the maximum net decline was 180 feet in the northwestern part of the valley where most of the pumping was concentrated. The pumping resulted in a loss of 68,000 acre-feet of water from compacted deposits induced by land subsidence and caused storage depletions of 470,000 acre-feet in the principal aquifers, 130,000 acre-feet from the near-surface reservoir and 35,000 acre-feet from consolidated rocks adjacent to the valley - a total ground water depletion of some 700,000 acre-feet.<sup>16</sup>

Ground water pumpage was reduced from 85,436 acre-feet in 1971 to 69,006 acre-feet in 1984 due mainly to the increased availability of Lake Mead water through the Southern Nevada Water Project. Ground water permits have been revoked upon availability of Lake Mead water, thus lessening the depletion of the ground water source. Outside the areas of intense pumping, localized zones of net water level rises have occurred in the principal aquifer as a result of the cut-back of pumping in these areas coupled with an increase in infiltration of secondary recharge. Since 1973, areas of net rise within the basin have been 10-20 feet, with the Las Vegas Wash area consistently showing a net rise of about 5 feet per year.<sup>17</sup>

(B)

Land subsidence is the lowering of the earths surface due to either natural or man made processes.

Land subsidence within the Las Vegas Artesian Basin is active and subsidence in localized areas has been as much as 5.0 feet with the increase in pumping. This is due mainly to the decrease in artesian pressure below the surface as a result of excessive ground water withdrawals and storage depletion. With a reduction in the artesian head, sediment consolidation occurs and the reduced volume is reflected at the surface by land subsidence. Areas of most intense ground water pumping have historically been confined to the central portion of the basin where large decreases in artesian pressures are reflected by declining water levels in wells. These areas have also shown the greatest amount of historic land subsidence. Subsidence in the valley from 1935 to 1963, resulting principally from compaction of sediments, has been slightly more than 2 feet at some locations. Since 1963, subsidence has exceeded 2 feet along Las Vegas Boulevard near the casinos and along Highway 95 northwest of Las Vegas. Since 1935, it is estimated to be as much as 5 feet in the downtown area of Las Vegas.<sup>17</sup>

Effects of land subsidence include (1) compaction of the ground water reservoir which reduces the interstitial pore space and diminishes storage capacity of the reservoir, and (2) potential damage to man-made structures.<sup>17</sup>

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<sup>16</sup> Water Resources Bulletin No. 44 titled "Pumping and Ground Water Storage Depletion in Las Vegas Valley, Nevada, 1955-1974", prepared by the U.S. Department of the Interior, Geological Survey, and the State of Nevada, Division of Water Resources.

<sup>17</sup> Nevada Bureau of Mines and Geology Bulletin 95 titled "Subsidence in Las Vegas Valley", prepared by John W. Bell, 1981.

VIII.

Due to the decrease in the artesian pressure from the vast amount of ground water pumpage, leakage of water has reversed from an upward path (principal aquifer to near surface reservoir to ground level as springs seeps, etc.) to a downward path (irrigation waste water, sewage septic waste water, etc., to near surface reservoir to principal aquifer). This phenomina has raised a concern related to water quality because of the intrusion or migration of poor quality water of the near surface reservoir into the good quality principal aquifers.<sup>14</sup>

A study of the nitrate level in the Las Vegas Valley Water District wells is currently being conducted. Records have shown that the nitrate levels in 7 of the wells have increased from 0.0 mg/L of  $\text{No}_3$  in 1975 to 1.0 mg/L or higher of  $\text{No}_3$  in 1982. This rate cannot be sustained for any period of time without water quality deterioration to the ground water resource.<sup>18</sup> Recommendations to prevent further contamination of the ground water supply referenced in the report include retarding the rate of pumpage from the Las Vegas Valley aquifer.

XI.

The State Engineer has the authority to deny an application without publication where a previous application for a similar use of water within the same basin has been rejected on the same grounds.<sup>19</sup>

X.

Applications for irrigation purposes and quasi-municipal purposes have been denied within the Las Vegas Valley Artesian Basin.<sup>1</sup>

XI.

Permits within the general area of Applications 45726, 45727 and 45728 have been revoked upon availability of water from the Las Vegas Valley Water District.<sup>1</sup>

CONCLUSIONS

I.

The perennial yield of a hydrologic system is the maximum amount of water of usable chemical quality that can be consumed economically each year for an indefinite period of time. If the perennial yield is continually exceeded, ground water levels will decline until the ground water reservoir is depleted of water of usable quality or until the pumping lifts become uneconomical to maintain. Perennial yield cannot exceed the natural replenishment to an area indefinitely and ultimately is limited to the maximum amount of natural discharge that can be salvaged for beneficial use.<sup>20</sup>

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<sup>18</sup> "Nitrates in Las Vegas Valley Water District Wells", prepared by J.T. Monsevizt, Manager, Southern Nevada Water System, March 8, 1982.

<sup>19</sup> NRS 533.370(3).

<sup>20</sup> See attached Appendix of References.

II.

Withdrawals of ground water in excess of the perennial yield contribute to adverse conditions such as water quality degradation, storage depletion, diminishing yield of wells, increased economic pumping lifts, land subsidence and reversal of ground water gradients which could result in significant changes in the recharge/discharge relationship. These conditions have developed in several other ground water basins within the State of Nevada where storage depletion and declining water tables have been recorded and documented.<sup>20</sup>

III.

The amount of ground water withdrawal exceeds the perennial yield within the Las Vegas Artesian Basin. The records of the State Engineer's office are well documented with evidence of declining water tables, water quality deterioration and active land subsidence in the Las Vegas Valley Ground Water Basin.

IV.

The State Engineer has jurisdiction of the parties and the subject matter of this action and determination.<sup>21</sup>

V.

The State Engineer is prohibited by law from granting a permit under an application to appropriate the public waters where:<sup>22</sup>

- A. There is no unappropriated water at the proposed source, or
- B. The proposed use conflicts with existing rights, or
- C. The proposed use threatens to prove detrimental to the public interest.

VI.

The State Engineer may deny applications to appropriate ground water for any purpose in areas where service can be provided by an entity such as a water district or a municipality presently engaged in furnishing water to the inhabitants thereof.<sup>23</sup>

VII.

Water service is available from the Las Vegas Valley Water District in the area of the place of use under Applications 38661, 38662, 38663, 45726, 45727, 45728 and 48282.

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<sup>21</sup> NRS 533.325.

<sup>22</sup> NRS 533.370, subsection 3.

<sup>23</sup> NRS 534.120, subsections 1, 2 and 3.

VIII.

There is a record of substantial and conclusive evidence confirming overdraft of the ground water resource, ground water level declines, ground water storage depletion, active land subsidence, ground water quality deterioration and significant change in the recharge-discharge relationship within the Las Vegas Ground Water Basin due to sustained overdraft of the ground water resource.

RULING

Applications 38661, 38662 and 38663 are hereby denied on the grounds that water service is available from the Las Vegas Valley Water District and the approval of said applications in a basin where the current pumpage and usage exceeds the estimates of perennial yield would be detrimental to the public welfare.

Applications 45726, 45727 and 45728 are hereby denied on the grounds that the granting thereof would adversely affect existing rights and would be detrimental to the public interest and welfare.

In the matter of Application 48282, the granting of a new appropriation of underground water for irrigation purposes for the proposed golf course is hereby denied on the grounds that the granting thereof would adversely affect existing rights and would be detrimental to the public interest and welfare. The granting of a portion of Application 48282 concerning other recreational uses as a revocable permit will be further considered on the submittal of additional information concerning consumptive use.

Respectfully submitted,



PETER G. MORROS  
State Engineer

PGM/TT/bl

Dated this 25th day of  
September, 1985.

## APPENDIX OF REFERENCES

Land Subsidence in Las Vegas Valley, 1935-63, Information Series No. 5 U.S.G.S.

State of Nevada, Department of Highways, Report on Land Subsidence in Las Vegas Valley.

Evaluation of the Water Resources of Lemmon Valley with Emphasis on Effects of Ground-Water Development to 1971, J.R. Harrill, Water Resources Bulletin No. 42, United States Geological Survey and State of Nevada, State Engineer's Office, Division of Water Resources, Department of Conservation and Natural Resources, 1972.

Hydrologic Response to Irrigation Pumping in Diamond Valley, Eureka and Elko Counties, Nevada, 1950-65, J.R. Harrill, Water Resources Bulletin No. 35, United States Geological Survey and State of Nevada, State Engineer's Office, Division of Water Resources, Department of Conservation and Natural Resources, 1968.

Effects of Irrigation Development on the Water Supply Quinn River Valley area, Nevada and Oregon, 1950-1964, C.J. Huxel, Jr., Water Resource Bulletin No. 34, United States Geological Survey and State of Nevada, State Engineer's Office, Division of Water Resources, Department of Conservation and Natural Resources, 1966.

Hydrologic Response to Irrigation Pumping in Hualapai Flat, Washoe, Pershing and Humboldt Counties, Nevada, 1960-1967, J.R. Harrill, Water Resource Bulletin No. 37, United States Geological Survey and State of Nevada, State Engineer's Office, Division of Water Resources, Department of Conservation and Natural Resources, 1969.

The Effects of Pumping on the Hydrology of Kings River Valley, Humboldt County, Nevada, 1957-1964, G.T. Malmberg and G.F. Worts, Jr., Water Resource Bulletin No. 31, United States Geological Survey and State of Nevada, State Engineer's Office, Division of Water Resources, Department of Conservation and Natural Resources, 1966.

Effects of Ground-Water Development on the Water Regimen of Paradise Valley, Humboldt County, Nevada, 1948-1968, and Hydrologic Reconnaissance of the Tributary Areas, J.R. Harrill and D.O. Moore, Water Resource Bulletin No. 39, United States Geological Survey, 1970.

Ground-Water Storage Depletion in Pahrump Valley, Nevada-California, 1962-75, J.R. Harrill, Open File Report 81-635, United States Geological Survey, 1982, prepared in cooperation with Nevada Division of Water Resources.

Development of a Relation for Steady State Pumping Rate for Eagle Valley Ground-Water Basin, Nevada, F.E. Arteaga, T.J. Durbin, United States Geological Survey, 1978, prepared in cooperation with Nevada Division of Water Resources.

Basic Ground-Water Hydrology, Ralph C. Heath, U.S. Geological Survey Water Supply Paper 2220, 1983.

Methods of Determining Permeability, Transmissibility and Drawdown, U.S. Geological Survey Water Supply Paper 1536-1, R.H. Brown, J.G. Ferris, C.E. Jacob, D.B. Knowles, R.R. Meyer, H.E. Skibitzke and C.F. Theis, 1963.

Subsidence in Las Vegas Valley, John w. Bell, Nevada Bureau of Mines and Geology Bulletin 95.

Subsidence in United States due to Ground-Water Overdraft - A Review, J.F. Poland, Proceedings of the Irrigation and Drainage Division Specialty Conference, April 1973, American Society of Civil Engineers.