

IN THE OFFICE OF THE STATE ENGINEER

IN THE MATTER OF APPLICATIONS 28935,
28965, 43408, 46106, 49759, 50048, 50049,
50086, 50182 and 50183 FILED TO
APPROPRIATE THE PUBLIC WATERS OF AN
UNDERGROUND SOURCE IN THE LAS VEGAS
ARTESIAN BASIN, CLARK COUNTY,
NEVADA.)

RULING

GENERAL

Application 28935 was filed on November 14, 1974, by William Peccole, et al, to appropriate 11.2 c.f.s. of water from an underground source for quasi-municipal (subdivision) purposes within Section 6, a portion of Section 5, T.21S., R.60E., M.D.B.&M.; and portions of Sections 31 and 32, T.20S., R.60E., M.D.B.&M. The point of diversion is described as being within Lot 4 (NW1/4 NW1/4) Section 6, T.21S., R.60E., M.D.B.&M.¹

Application 28965 was filed on November 25, 1974, by William Peccole, et al, to appropriate 11.2 c.f.s. of water from an underground source for quasi-municipal (subdivision) purposes within Section 6, a portion of Section 5, T.21S., R.60E., M.D.B.&M.; and portions of Sections 31 and 32, T.20S., R.60E., M.D.B.&M. The point of diversion is described as being within Lot 4 (NW1/4 NW1/4) Section 6, T.21S., R.60E., M.D.B.&M.¹

Application 43408 was filed on March 27, 1981, by Robert P. Oliver to appropriate 5.4 c.f.s. of water from an underground source for irrigation and domestic purposes within the E1/2 SE1/4 Section 2, NW1/4 NW1/4 Section 12, SW1/4 SE1/4, SW1/4 Section 1, T.22S., R.58E., M.D.B.&M. The point of diversion is described as being within the SE1/4 SE1/4 Section 2, T.22S., R.58E., M.D.B.&M.¹

Application 46106 was filed on September 1, 1982, by ARC Materials Corporation to appropriate 2.5 c.f.s. of water from an underground source for manufacturing and domestic (gravel plant) purposes within the N1/2 SW1/4, N1/2 SE1/4 Section 21, T.21S., R.60E., M.D.B.&M. The point of diversion is described as being within the NE1/4 SE1/4 Section 21, T.21S., R.60E., M.D.B.&M.¹

Application 49759 was filed on March 13, 1986, by Frehner Construction Company, Inc., to appropriate 1.0 c.f.s. of water from an underground source for mining (gravel) purposes within the SE/4 SW1/4 Section 13, T.19S., R.61E., M.D.B.&M. The point of diversion is described as being within the SE1/4 SW1/4 Section 13, T.19S., R.61E., M.D.B.&M.¹

¹ Public record in the office of the State Engineer.

Application 50048 was filed on July 29, 1986, by Howard Hughes Properties, Limited Partnership, to appropriate 1.56 c.f.s. of water from an underground source for construction purposes within Sections 19, 20, 30, W1/2 Section 29, 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.¹

Application 50049 was filed on July 29, 1986, by Howard Hughes Properties, Limited Partnership, to appropriate 1.56 c.f.s. of water from an underground source for construction purposes within Sections 19, 20, 30, W1/2 Section 29, T.20S., R.60E., M.D.B.&M. The point of diversion is described as being within the NE1/4 NE1/4 Section 30, T.20S., R.60E., M.D.B.&M.¹

Application 50086 was filed on August 18, 1986, by Frehner Construction Company, Inc., to appropriate 1.0 c.f.s. of water from an underground source for commercial purposes within the SE1/4 NE1/4 Section 4, T.21S., R.59E., M.D.B.&M. The point of diversion is described as being within the SE1/4 NE1/4 Section 4, T.21S., R.59E., M.D.B.&M.¹

Application 50182 was filed on September 29, 1986, by Larry P. Miller to appropriate 1.0 c.f.s. of water from an underground source for milling purposes within portions of the W1/2 SW1/4, S1/2 NW1/4, NE1/4 Section 22; N1/2 SW1/4 NW1/4 Section 23, T.19S., R.59E., M.D.B.&M. The point of diversion is described as being within the SW1/4 NW1/4 Section 23, T.19S., R.59E., M.D.B.&M.¹

Application 50183 was filed on September 29, 1986, by Larry P. Miller to appropriate 1.0 c.f.s. of water from an underground source for milling purposes within the E1/2 SE1/4 SW1/4, SW1/4 SE1/4 Section 17, T.19S., R.60E., M.D.B.&M. The point of diversion is described as being within the SW1/4 SE1/4 Section 17, T.19S., R.60E., M.D.B.&M.¹

II.

Applications 28935 and 28965 were timely protested on March 12, 1975, by the Las Vegas Valley Water District on the grounds that:¹

"The 5.6 cfs of water requested to be diverted under both Application No's 28935 and 28965 would be inadequate to satisfy even the average day demand of the proposed development, much less the maximum day demand. It would be mandatory that supplemental water be made available after the maximum day demand exceeds 11.2 cfs (2 wells at 5.6 cfs each). Supplemental water would only be obtained from additional ground water rights or from an extension of the Las Vegas Valley Water District's system.

Withdrawal of ground water from the proposed point of diversion could intercept sources of supply to existing District wells located to the east of the applicant's proposed diversion site. Such diversion of water could have a detrimental effect on the District's production of water to meet peak summer demands.

The Las Vegas Artesian Basin is currently being overdrafted in excess of 100% of the probable rate of recharge. The granting of this Application would substantially increase the overdraft.

THEREFORE protestant requests that the application be DENIED".

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:⁸

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.

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, 1953.⁹

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.⁷

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 Planning.

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.

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

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

Application 46106 was timely protested on January 3, 1983, by the Las Vegas Valley Water District on the grounds that:¹

"A Las Vegas Valley Water District (LVVWD) pipeline with sufficient pressure and quantity is approximately 2,000 feet from the proposed point of diversion and place of use. Service from the existing pipeline is adequate for manufacturing and domestic purposes provided ARC Materials Corporation installs the necessary main extension.

In the interest of groundwater conservation in the Las Vegas Artesian Basin, water service from the LVVWD is a viable and necessary alternative in lieu of appropriation of groundwater from this designated basin.

THEREFORE the protestant requests that the application be DENIED".

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.²

The State Engineer subsequently extended the designated area of the Las Vegas Valley Ground Water Basin on February 29, 1944,³ November 22, 1946,⁴ April 18, 1961,⁵ May 25, 1964,⁶ and December 27, 1983.⁷

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

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

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

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

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

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

Water Resources - Information Series Report 22, titled "Water Level Changes Associated 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.

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.

Applications 28935 and 28965 propose to serve a 13,050 unit subdivision (6 units per acre average) using 0.62 acre-feet annually (533.6 gallons per day) per unit for a total required duty of water of 8,091 acre-feet annually. The amount of diversion rate was clarified by letter of February 19, 1975, to be 5.6 c.f.s. from each well for a total of 11.2 c.f.s.¹.

Application 43408 proposes to irrigate 320 acres of private land and would consumptively use 1,600 acre-feet annually based on a duty of 5.0 acre-feet per acre per annum.¹

Application 46106 was filed to replace revocable Permit 35615 which was cancelled on August 23, 1982, for failure of applicant to comply with the provisions of the permit by not timely filing the proof of beneficial use nor a request for extension of time. Ownership of Permit 35615 was transferred into the name of ARC Materials Corporation by a document dated February 27, 1980, which was filed with the office of the State Engineer on September 1, 1982. Permit 35615 was issued for 2.5 c.f.s. and 140 million gallons annually (429.6 acre-feet annually). Revocable Permit 21998, currently in the name of WMK Transit Mix, Inc., covers the same place of use as described under Permit 35615 and Application 46106, and proof of beneficial use was filed on March 21, 1969, for 0.367 c.f.s. (86.6 million gallons annually or 265.7 acre-feet annually).¹

Application 49759 states that "water will be used in gravel mining and processing operations. Consumptive use may vary but it is estimated at 125 million gallons annually in a maximum use year" (or 383.6 AFA).

Applications 50048 and 50049 propose to divert 700 gallons per minute (1.56 c.f.s.) over a 3 month period for a total required duty of 282.4 acre-feet. The applications state that "This water is to be used, on a temporary basis, to grade roads and for certain site grading until water mains can be installed to provide Las Vegas Valley District Services."¹

Application 50086 states that "the well will be used in commercial operations which may include gravel processing and possibly the sale of potable water. Use is estimated at 100,000,000 gallons annually" (or 307 acre-feet annually).

Applications 50182 and 50183 state the use of 720 acre-feet annually under each application. The place of use under Application 50182 is not the same as under Application 50183 and therefore would be considered as separate appropriations and not supplemental.

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 it does not compose a distinct lithologic or hydrologic unit.¹⁰

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 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.¹⁰

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.¹¹

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.¹² This secondary recharge is substantially influenced by imported water from Lake Mead through the Southern Nevada Water Project.

¹⁰ Water Resources Bulletin No. 5, by A.B. Maxey and C.H. Jameson, 1948.

¹¹ Geological Survey Water-Supply Paper 1780, titled "Available water supply of the Las Vegas Ground Water Basin, Nevada", by Glenn T. Malmberg, 1965.

¹² 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.

V.

Water imports to the basin from Lake Mead through the Southern Nevada Water Project were estimated at 168,000 acre-feet for the 1986 calendar year.¹³

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 1986 was inventoried as 69,000 acre-feet.¹³ This amount of pumping represents an overdraft of ground water on the order of approximately 28,000 acre-feet annually.

Under the provisions of NRS 534.120(3)(a), the State Engineer has been issuing revocable permits since 1955. Revocable permits currently total approximately 15,600 acre-feet annually. The amount of water committed under certificates and non-revocable permits is approximately 70,000 acre-feet annually for a total amount of about 85,600 acre-feet annually of ground water resource committed within the Las Vegas Artesian Basin.

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.

(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.¹²

Ground water pumpage has been reduced from 85,436 acre-feet in 1971 to 69,000 acre-feet in 1986 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

¹³ 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 evidence of deteriorating ground water conditions.

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.¹⁴

(B)

Land subsidence is the lowering of the earth's 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.¹⁴

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.¹⁴

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 phenomena 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.¹²

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 NO_3 in 1975 to 1.0 mg/L or higher of NO_3 in 1982. This rate cannot be sustained for any period of time without water quality deterioration to the ground water resource.¹⁵ 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.

¹⁴ Nevada Bureau of Mines and Geology Bulletin 95, titled "Subsidence in Las Vegas Valley", prepared by John W. Bell, 1981.

¹⁵ "Nitrates in Las Vegas Valley Water District Wells", prepared by J.T. Monscivitz, Manager, Southern Nevada Water System, March 8, 1982.

IX.

The State Engineer had previously declared that the consumptive use of ground water to irrigate additional land was not considered to be a preferred use of the limited water resource of the Las Vegas Valley Ground Water Basin prior to the filing of Application 43408 for irrigation purposes.¹⁶

X.

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

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.¹⁷

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.¹⁷

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.¹⁸

¹⁶ See State Engineer's Ruling No. 2622 dated January 19, 1981, public record in the office of the State Engineer.

¹⁷ See attached Appendix of References.

¹⁸ NRS Chapters 533 and 534.

V.

The State Engineer is prohibited by law from granting a permit under an application to appropriate the public waters where:¹⁹

- 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.

There is a record of substantial 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.

VII.

Should Applications 28935, 28965, 43408, 46106, 49759, 50048, 50049, 50086, 50182 and 50183 be granted, an additional 12,533.6 acre-feet annually would be consumptively used resulting in a increase in overdraft of the resource.

Therefore to grant permits on the above applications would conflict with existing rights and prove detrimental to the public interest.

RULING

The protests to Applications 28935, 28965 and 46106 are hereby upheld and Applications 28935, 28965, 43408, 46106, 49759, 50048, 50049, 50086, 50182 and 50183 are hereby denied on the grounds that the granting thereof would conflict with existing rights and prove detrimental to the public interest. Application 43408 is further denied on the grounds that the irrigation of additional land is not a preferred use of the limited resource within the Las Vegas Valley Ground Water Basin.

Respectfully submitted,


PETER G. MORROS
State Engineer

PGM/SHF/jjk

Dated this 15th day of
June, 1987.

¹⁹ NRS 533.370(3).

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.

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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.

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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.

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