Summary of Chemical Data from Onsite and Laboratory Analyses of Groundwater Samples from the Surficial Aquifer, Las Vegas, Nevada, April and August 1993 and September 1994

Open-File Report 2012–1029

U.S. Department of the Interior
U.S. Geological Survey

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By Michael M. Reddy and Charmaine D. Gunther

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Summary of Chemical Data from Onsite and Laboratory Analyses of Groundwater Samples from the Surficial Aquifer, Las Vegas, Nevada, April and August 1993 and September 1994

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Abstract

This report presents a summary of data collected during April and August 1993 and September 1994. These results are to be used as a wet-site analog to southern Nevada soils located at the Amargosa Desert Research Site near Beatty, Nevada. The samples were collected and analyzed in conjunction with the Nevada Basin and Range study unit of the U.S. Geological Survey, National Water-Quality Assessment Program (NAWQA).

Samples were collected from groundwater wells in and about the city of Las Vegas, Nevada, and were analyzed for selected major, minor and trace constituents. Analyses of blank and reference samples are summarized as mean and standard deviation values for all positive results.

Introduction

In 1993, 33 wells were chosen in and about the city of Las Vegas, Nevada, to determine the effects of land use on underlying water quality. Groundwater samples collected from these wells were analyzed for major, minor, and trace constituents. Details of the onsite and laboratory procedures were adapted from previous studies and are described by Reddy and others (1989). Sample preparation, analytical procedures, and laboratory quality-control protocols used by the U.S. Geological Survey laboratory are described by Fishman and Freidman (1985) Garbarino and Taylor (1979; 1980), and Schroder and others (1980). Onsite procedures and equipment were adapted from a trace metal protocol developed by the U.S. Geological Survey National Research Program (Taylor and others, 1995).

Sample collection and analyses were done in conjunction with the Nevada Basin and Range study unit of the U.S. Geological Survey, NAWQA (Emmett and others, 1993, and Clary and others, 1994).

Data File

Data are available from the analysis of 45 samples from 33 wells collected during 1993 and 1994. The data file consists of 37 variables. Variable names and codes established for sample collection are listed in table 1. Definitions and units for onsite and laboratory measured variables are listed in table 2. To evaluate onsite-sampling variability, duplicate samples were collected from some wells. Field replicate samples were analyzed to identify variability caused by sample processing and handling. Paired t tests were used to assess differences due to filter pore size for each chemical species that had

the adequate data. No statistically significant difference (at the 95% confidence level) was found between either duplicate field samples or between 0.4- μ m and 0.1- μ m filtered field samples for any chemical species. Duplicate (0.4- μ m filtered) and 0.1- μ m filtered samples were averaged in the final data file. Additional distilled-water blank samples, referred to as field blanks (FB) and laboratory blanks (LB), and standard reference water samples (SRWS)¹ were analyzed using the same procedures as the onsite samples. A check on the quality of the data was provided by a verification of summary statistics for the data, sorted by sample location. Table 3 reports the detection limits for all chemical constituents included in this report. Quality-assurance/quality-control statistics are shown on table 4. During 1993 and 1994, 45 samples were processed; analytical results are presented in table 5.

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Summary

Forty-five samples from 33 groundwater wells were analyzed using a protocol designed to minimize errors from handling procedures, laboratory analyses, and data-entry operations. Analyses of blank samples and Standard Reference Water Sample results are included.

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¹ Standard Reference Water Samples are prepared and used by the U.S. Geological Survey's quality assurance program to ensure that the laboratory is producing analytical data for inorganic constituents that are of acceptable reliability (Schroder and others, 1980)

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Table 1. Variable names and codes for documenting sample collection.

Variable name	Code	Definition
Site ID	15-digit integer	Site identification number
Site name	alphanumeric string	Short description of site
Latitude (DDMMSS)	6-digit integer	Latitude (degrees minutes seconds)
Longitude (DDMMSS)	7-digit integer	Longitude (degrees minutes seconds)
Altitude (feet)	integer	Altitude of top of casing, in feet
Well depth (feet)	floating point	Well depth from top of casing, in feet
Depth to water (feet)	floating point	Depth to water from top of casing, in feet
Screen interval (feet)	alphanumeric string	Screened interval of well from top of casing, in feet
Collection date (mm/dd/yy)	alphanumeric string	Date sample collected (month/day/year)

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Table 2. Definitions and units for onsite and laboratory measured variables.

Variable name	Definition	Units
Alkalinity (meq/L)	alkalinity measured in laboratory	milliequivalents per liter
As (µg/L)	dissolved arsenic as As	micrograms per liter
B (mg/L)	dissolved boron as B	milligrams per liter
Ba (mg/L)	dissolved barium as Ba	milligrams per liter
Be (mg/L)	dissolved beryllium as Be	milligrams per liter
Ca (meq/L)	dissolved calcium as Ca	milliequivalents per liter
Cd (mg/L)	dissolved cadmium as Cd	milligrams per liter
Cl (meq/L)	dissolved chloride as Cl	milliequivalents per liter
Co (mg/L)	dissolved cobalt as Co	milligrams per liter
Cu (mg/L)	dissolved copper as Cu	milligrams per liter
DOC (mg/L)	dissolved organic carbon as C	milligrams per liter
FB	field blank	none
Fe (mg/L)	dissolved iron as Fe	milligrams per liter
Field dissolved oxygen (mg/L)	dissolved oxygen measured onsite	milligrams per liter
Field pH (std units)	pH measured onsite	standard pH units
Field specific conductivity (µS/cm)	specific conductivity measured onsite	microsiemens per centimeter at 25°C
Ion balance (%)	$100\% \times (\text{cations} - \text{anions}) / (\text{cations} + \text{anions})$	(+/-)percent
K (meq/L)	dissolved potassium as K	milliequivalents per liter
LB	laboratory blank	none
Li (mg/L)	dissolved lithium as Li	milligrams per liter
M106	major ion SRWS	none
Mg (meq/L)	dissolved magnesium as Mg	milliequivalents per liter
Mn (mg/L)	dissolved manganese as Mn	milligrams per liter
Na (meq/L)	dissolved sodium as Na	milliequivalents per liter
Se (µg/L)	dissolved selenium as Se	micrograms per liter
SiO ₂ (mg/L)	dissolved silica as SiO ₂	milligrams per liter
SO ₄ (meq/L)	dissolved sulfate as SO ₄	milliequivalents per liter
Sr (mg/L)	dissolved strontium as Sr	milligrams per liter
SRWS	Standard Reference Water Samples	none
T107	trace metal SRWS	none
V (mg/L)	dissolved vanadium as V	milligrams per liter
Water temp (°C)	water temperature measured onsite	degrees Celsius
Zn (mg/L)	dissolved zinc as Zn	milligrams per liter

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Table 3. Detection limits for laboratory and onsite analyses. (meq/L, milliequivalents per liter; µg/L, micrograms per liter; mg/L, milligrams per liter)

Constituent	Units	Typical dilution	Detection limit	Method of analysis
Alkalinity	(meq/L)	none	none	Fishman and Friedman, 1985
As	(µg/L)	none	2	Crock and Lichte, 1982 and Welsch and others, 1990
B	(mg/L)	none	.002	Garbarino and Taylor, 1979, 1980
Ba	(mg/L)	none	.001	Garbarino and Taylor, 1979, 1980
Be	(mg/L)	none	.001	Garbarino and Taylor, 1979, 1980
Ca	(meq/L)	1:10	.0005	Garbarino and Taylor, 1979, 1980
Cd	(mg/L)	none	.01	Garbarino and Taylor, 1979, 1980
Cl	(meq/L)	1:100	.2	Fishman and Friedman, 1985
Co	(mg/L)	None	.01	Garbarino and Taylor, 1979, 1980
Cu	(mg/L)	None	.005	Garbarino and Taylor, 1979, 1980
DO	(mg/L)	None	.1	Wood, 1976
DOC	(mg/L)	None	.1	Aiken, 1992
Fe	(mg/L)	None	.005	Garbarino and Taylor, 1979, 1980
K	(meq/L)	1:10	.01	Skougstad and others, 1979
Li	(mg/L)	none	.005	Garbarino and Taylor, 1979, 1980
Mg	(meq/L)	1:10	.0008	Garbarino and Taylor, 1979, 1980
Mn	(mg/L)	None	.002	Garbarino and Taylor, 1979, 1980
Na	(meq/L)	1:10	.004	Garbarino and Taylor, 1979, 1980
Se	(µg/L)	none	1	Crock and Lichte, 1982 and Welsch and others, 1990
SiO ₂	(mg/L)	none	.04	Garbarino and Taylor, 1979, 1980
SO ₄	(meq/L)	1:100	2	Fishman and Friedman, 1985
Sr	(mg/L)	none	.001	Garbarino and Taylor, 1979, 1980
V	(mg/L)	none	.005	Garbarino and Taylor, 1979, 1980
Zn	(mg/L)	none	.01	Garbarino and Taylor, 1979, 1980

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Table 4. Summary statistics for standard reference water samples (SRWS) and distilled-water field blank (FB) and laboratory blank samples. (meq/L, milliequivalents per liter; µg/L, micrograms per liter; mg/L, milligrams per liter; N/A, not applicable; FB, field blank; LB, laboratory blank).—Continued

Constituent	Sample	Units	Mean of reported values	Standard deviation	Range		Number of samples		Expected value (Schroder and others 1980)		
					Minimum	Maximum	Less than detection	N	95% confidence MPV	Standard deviation	N
Alkalinity	FB	(meq/L)	-0.03	0.05	-0.106	-0.001	0	4			
	LB	(meq/L)	-.002	.0013	-.004	-.001	0	6			
	M106	(meq/L)	.112	.001	.109	.114	0	12	.16 ± 0	.022	55
As	FB	(µg/L)	<2	N/A	<2	<2	4	4			
	T107	(µg/L)	11	.8	10	12	0	4	1.8 ± 1	2.1	57
B	FB	(mg/L)	<.002	N/A	<.002	<.002	2	2			
	LB	(mg/L)	.003	N/A	.003	.003	13	14			
	M106	(mg/L)	.042	.047	.011	.178	1	17	.044 ± 0	.037	18
	T107	(mg/L)	.125	.014	.092	.149	0	18	.13 ± 0	.021	37
Ba	FB	(mg/L)	<.001	N/A	<.001	<.001	2	2			
	LB	(mg/L)	.002	0	.002	.002	11	14			
	T107	(mg/L)	.189	.014	.157	.209	0	18	.192 ± 0	.011	53
Be	FB	(mg/L)	<.001	N/A	<.001	<.001	2	2			
	LB	(mg/L)	.002	.001	.001	.003	9	14			
	T107	(mg/L)	.01	.004	.003	.016	1	18	.011 ± 0	.0011	34
Ca	FB	(meq/L)	.0016	N/A	.0016	.0016	1	2			
	LB	(meq/L)	.0006	.0003	.0001	.001	4	14			
	M106	(meq/L)	.45	.03	.41	.51	0	17	.45 ± 0	.02	62
	T107	(meq/L)	.57	.04	.47	.63	0	18	.584 ± 0	.03	60
Cd	FB	(mg/L)	<.01	N/A	<.01	<.01	2	2			
	LB	(mg/L)	.014	.005	.01	.021	10	14			
	T107	(mg/L)	.014	.004	.01	.025	5	18	.0143 ± 0	.0021	70
Cl	FB	(meq/L)	.05	.09	.001	.188	0	4			
	LB	(meq/L)	.003	.002	.002	.004	66	68			

Table 4. Summary statistics for standard reference water samples (SRWS) and distilled-water field blank (FB) and laboratory blank samples. (meq/L, milliequivalents per liter; µg/L, micrograms per liter; mg/L, milligrams per liter; N/A, not applicable; FB, field blank; LB, laboratory blank).—Continued

Constituent	Sample	Units	Mean of reported values	Standard deviation	Range		Number of samples		Expected value (Schroder and others 1980)		
					Minimum	Maximum	Less than detection	N	95% confidence MPV	Standard deviation	N
Co	M106	(meq/L)	.39	.03	.32	.423	0	12	.37 ± 0	.034	68
	FB	(mg/L)	<.01	N/A	<.01	<.01	2	2			
	LB	(mg/L)	<.01	N/A	<.01	<.01	14	14			
Cu	T107	(mg/L)	.014	.003	.011	.019	6	18	.011 ± 0	.0014	34
	FB	(mg/L)	<.005	N/A	<.005	<.005	2	2			
	LB	(mg/L)	.017	0	.017	.017	12	14			
Fe	T107	(mg/L)	.026	.007	.011	.035	0	18	.03 ± 0	.0023	73
	FB	(mg/L)	<.005	N/A	<.005	<.005	2	2			
	LB	(mg/L)	.02	.008	.012	.029	6	14			
K	T107	(mg/L)	.04	.028	.012	.102	1	18	.052 ± 0	.007	68
	FB	(meq/L)	.02	.02	.002	.031	2	6			
	M106	(meq/L)	.017	.003	.014	.023	0	5	.02 ± 0	.003	58
Li	T107	(meq/L)	.023	.004	.019	.028	0	4	.021 ± 0	.0038	62
	FB	(mg/L)	<.005	N/A	<.005	<.005	2	2			
	LB	(mg/L)	<.005	N/A	<.005	<.005	14	14			
Mg	T107	(mg/L)	.18	.03	.1	.244	0	18	.193 ± 0	.014	21
	FB	(meq/L)	.0002	N/A	.0002	.0002	1	2			
	LB	(meq/L)	.0009	.0008	.0001	.0032	1	14			
Mn	M106	(meq/L)	.282	.013	.253	.301	0	17	.29 ± 0	.02	62
	T107	(meq/L)	.168	.01	.139	.179	0	18	.173 ± 0	.011	61
	FB	(mg/L)	<.002	N/A	<.002	<.002	2	2			
Na	LB	(mg/L)	<.002	N/A	<.002	<.002	14	14			
	T107	(mg/L)	.047	.003	.039	.052	0	18	.045 ± 0	.006	68
	FB	(meq/L)	.005	N/A	.005	.005	1	2			

Table 4. Summary statistics for standard reference water samples (SRWS) and distilled-water field blank (FB) and laboratory blank samples. (meq/L, milliequivalents per liter; µg/L, micrograms per liter; mg/L, milligrams per liter; N/A, not applicable; FB, field blank; LB, laboratory blank).—Continued

Constituent	Sample	Units	Mean of reported values	Standard deviation	Range		Number of samples		Expected value (Schroder and others 1980)		
					Minimum	Maximum	Less than detection	N	95% confidence MPV	Standard deviation	N
Se	LB	(meq/L)	.0011	.0011	.0005	.004	4	14			
	M106	(meq/L)	.38	.07	.22	.509	1	17	.4 ± 0	.02	65
	T107	(meq/L)	.8	.2	.423	1.11	0	18	.9 ± 0	.048	65
	FB	(µg/L)	<1	N/A	<1	<1	4	4			
	T107	(µg/L)	13	.8	12	14	0	4	11 ± 1	1.9	54
SiO ₂	FB	(mg/L)	<.04	N/A	<.04	<.04	2	2			
	LB	(mg/L)	<.04	N/A	<.04	<.04	14	14			
SO ₄	M106	(mg/L)	4	1	2.7	7.1	0	17	3.4 ± 0	.2	40
	T107	(mg/L)	7.6	1	5.25	9.15	0	18	7.7 ± 0	.5	43
	FB	(meq/L)	.289	.001	.288	.289	2	4			
	LB	(meq/L)	.03	N/A	.03	.03	67	68			
	M106	(meq/L)	.583	.003	.579	.586	6	12	.575 ± 0	.035	61
Sr	FB	(mg/L)	<.001	N/A	<.001	<.001	2	2			
	LB	(mg/L)	.0011	.0001	.001	.001	11	14			
V	M106	(mg/L)	.16	.04	.019	.194	0	17	.177 ± 0	.009	22
	T107	(mg/L)	.059	.005	.046	.068	0	18	.061 ± 0	.004	29
	FB	(mg/L)	<.005	N/A	<.005	<.005	2	2			
	LB	(mg/L)	<.005	N/A	<.005	<.005	14	14			
	M106	(mg/L)	.0063	.0011	.005	.008	13	17	.0044 ± 0	.0018	4
Zn	T107	(mg/L)	.014	.003	.007	.018	0	18	.014 ± 0	.0028	29
	FB	(mg/L)	.01	N/A	.01	.01	1	2			
	LB	(mg/L)	.03	.01	.02	.04	8	14			
	T107	(mg/L)	.08	.02	.04	.13	0	18	.0758 ± 0	.0099	68

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Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. A, Site locations and well information; B, Field parameters; C, Major ion chemistry; D, Trace constituents (Set A); E, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5A, Site locations and well information

Site ID	Site name	Latitude (DDMMSS)	Longitude (DDDMMSS)	Altitude (feet)	Well depth (feet)	Screen interval (feet)
3.60837E+14	4th&CLARK	360955	1150836	2,010	22	'18–22'
3.60832E+14	BLM	360559	1145827	1,590	80	'76–80'
3.60908E+14	BROADBENT	360908	1151224	2,209	27	'22–27'
3.60621E+14	C27	360621	1150559	1,938	30	'24–30'
3.60521E+14	C28	360521	1150422	1,803	19	'14–19'
3.60605E+14	C33	360605	1150525	1,912	24	'19–24'
3.60647E+14	C49	360647	1150440	1,780	25	'20–25'
3.61212E+14	CARI15	361212	1150659	1,910	46	'43–46'
3.6093E+14	CHAR-8	360930	1150834	2,008	25	'21–25'
3.61425E+14	CRAI15	361425	1150619	1,919	84	'80–84'
3.60744E+14	DIT	360718	1150405	1,730	11	'7–11'
3.60547E+14	DORIS1	360547	1150528	1,919	29	'24–29'
3.6064E+14	EA&R	360640	1150704	1,948	20	'10–15'
3.60535E+14	HAC&ANN	360535	1150509	1,872	18	'14–18'
3.60537E+14	HAC&LAKEW	360537	1150537	1,912	23	'17–23'
3.60924E+14	HUNTPK	360924	1150811	1,990	15	'11–15'
3.60924E+14	HUNTPK2	360924	1150811	1,990	17	'12–17'
3.60852E+14	HWYSHR1	360852	1150609	1,825	25	'20–25'
3.60838E+14	I15SAH	360838	1151018	2,075	24	'21–24'
3.60735E+14	I15SPRING	360735	1151052	2,120	45	'41–45'
3.61102E+14	JGAYPK1	361102	1150836	2,010	15	'11–15'
3.61102E+14	JGAYPK2	361102	1150836	2,010	33	'28–33'
3.61053E+14	LV-MGOLF	361053	1151158	2,190	33	'27–31'
3.61014E+14	MDB-6	361014	1151117	2,140	40	'20–40'
3.60601E+14	NELLIS†	360601	1150344	1,720	500†	500†
3.60522E+14	P.P.VISTA	360522	1150721	2,010	30	'26–30'
3.60617E+14	P.PARK1	360617	1150638	1,950	24	'20–24'
3.60617E+14	P.PARK2	360617	1150638	1,958	30	'25–30'
3.60937E+14	ROT1	360937	1151134	2,155	35	'30–35'
3.60937E+14	ROT2	360937	1151134	2,158	18	'14–18'
3.60648E+14	SNSC	360648	1150849	2,030	15	'10–15'
3.60401E+14	USGSOS	360401	1150823	2,086	60	'55–60'
3.60921E+14	WALLI15	360921	1150936	2,047	17	'13–14'

† The NELLIS well is an artesian well

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Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. A, Site locations and well information; B, Field parameters; C, Major ion chemistry; D, Trace constituents (Set A); E, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5B, Field Parameters

Site ID	Site name	Collection date	Depth to water (feet)	Field dissolved oxygen (mg/L)	Field pH (std units)	Field specific conductivity ($\mu\text{S}/\text{cm}$)	Water temp ($^{\circ}\text{C}$)
3.60837E+14	4 th & CLARK	8/21/1993	7.7	1.7	7.02	3100	23.6
3.60832E+14	BLM	4/16/1993	11.2	5.7	7.36	9290	25.6
		8/18/1993	10.5	0.2	7.7	11200	25.2
3.60908E+14	BROADBENT	8/24/1993	18	3.5	7.12	2900	23
3.60621E+14	C27	8/24/1993	17.9	0.9	7	5950	22
3.60521E+14	C28	8/19/1993	7.8	0.7	7.1	5400	27.3
3.60605E+14	C33	8/19/1993	18.2	2.3	7	6040	24
3.60647E+14	C49	8/21/1993	9.5	2.7	6.99	3650	23.3
3.61212E+14	CARI15	4/14/1993	27.6	2.5	7.33	575	24.9
		8/22/1993	27.4	3.6	7.44	598	23.1
3.6093E+14	CHAR-8	8/22/1993	11.9	NS	6.89	3400	23
3.61425E+14	CRAI15	8/20/1993	62.6	5.9	7.6	1390	25
3.60744E+14	DIT	4/16/1993	5.3	2	6.98	5490	16.4
		8/18/1993	8.3	2.1	6.94	5530	24.6
		9/13/1994	8.4	2.6	6.98	5250	21.9
3.60547E+14	DORIS1	8/20/1993	16.2	3.5	7.18	4650	21.9
3.6064E+14	EA&R	8/20/1993	9	1.6	6.88	4490	21.6
3.60535E+14	HAC & ANN	8/19/1993	6.2	2.7	7.1	5570	23.9
3.60537E+14	HAC & LAKEW	8/19/1993	10.3	3.2	7.07	5600	21.2
3.60924E+14	HUNTPK	8/22/1993	7.1	2.9	7.48	2970	22.9
		9/14/1994	7.1	2.7	7.14	3000	20.9

Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. A, Site locations and well information; B, Field parameters; C, Major ion chemistry; D, Trace constituents (Set A); E, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5B, Field Parameters

Site ID	Site name	Collection date	Depth to water (feet)	Field dissolved oxygen (mg/L)	Field pH (std units)	Field specific conductivity ($\mu\text{S}/\text{cm}$)	Water temp ($^{\circ}\text{C}$)
3.60924E+14	HUNTPK2	9/14/1994	7.2	2.6	7.17	3020	20
3.60852E+14	HWYSHR1	8/20/1993	6.9	0.4	7.05	5550	24.2
3.60838E+14	I15SAH	4/14/1993	6.7	1.8	7.36	2700	21.9
		8/18/1993	7	3.1	7.2	2930	24.8
3.60735E+14	I15SPRING	4/13/1993	8.8	4.1	7.01	3310	23.3
		8/18/1993	8.7	3.9	7	3470	23.4
3.61102E+14	JGAYPK1	8/23/1993	9.2	0.4	7.07	2390	21.5
3.61102E+14	JGAYPK2	8/23/1993	10	0.5	7.23	2160	20.8
3.61053E+14	LV-MGOLF	8/22/1993	9.6	3	7.28	1600	20
3.61014E+14	MDB-6	4/13/1993	8	3.8	10.8	1190	20.3
		8/23/1993	12.5	NS	10.2	1290	21
3.60601E+14	NELLIS†	4/16/1993	-63.0†	4.6	7.28	586	24.2
		9/13/1994	-62.0†	4.2	7.78	622	24.6
3.60522E+14	P.P.VISTA	8/21/1993	16.8	4.3	6.99	2540	20.6
3.60617E+14	P.PARK1	4/12/1993	11.9	NS	7.06	5000	18.7
		8/17/1993	13.8	NS	7.32	4920	23
3.60617E+14	P.PARK2	8/17/1993	13.6	2	7.06	4810	20.8
3.60937E+14	ROT1	8/17/1993	8.1	0.2	5.8	2300	18.5
3.60937E+14	ROT2	4/15/1993	9.5	1.2	6.74	5530	16.8
		8/17/1993	8.9	0.2	6.66	5320	19.6
3.60648E+14	SNSC	8/23/1993	8.4	1.6	6.95	4050	24.5
3.60401E+14	USGSOS	8/16/1993	30	3.9	6.74	1830	23.2
3.60921E+14	WALLI15	4/13/1993	7.8	1.6	6.76	4200	21
		8/21/1993	8.7	2	6.85	4650	22.6

† The NELLIS well is an artesian well

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Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. *A*, Site locations and well information; *B*, Field parameters; *C*, Major ion chemistry; *D*, Trace constituents (Set A); *E*, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5C, Major ion chemistry

Site ID	Site name	Collection date	Alkalinity (meq/L)	Cl (meq/L)	SO ₄ (meq/L)	Ca (meq/L)	Mg (meq/L)	Na (meq/L)	K (meq/L)	Ion balance (%)
3.6084E+14	4 th & CLARK	8/21/1993	6.24	5.2	29	10.7	21.4	6.89	0.83	-0.77
3.6083E+14	BLM	4/16/1993	1.33	36.3	73	26.7	42.7	49.3	2.8	4.68
		8/18/1993	1.79	50.4	94	26.6	47.2	56.1	2.23	-5.05
3.6091E+14	BROADBENT	8/24/1993	5.06	5.4	27	12.9	17.5	7.36	0.33	0.83
3.6062E+14	C27	8/24/1993	4.19	7.2	78	24.8	43.5	18.1	0.94	-1.16
3.6052E+14	C28	8/19/1993	4.61	28.6	48	22.9	22.3	19.9	1.16	-10.14
3.6061E+14	C33	8/19/1993	4.01	13.6	73	23.4	33.2	17.6	1.44	-9
3.6065E+14	C49	8/21/1993	4.17	8.8	37	15.4	15.5	10.1	0.79	-8.91
3.6121E+14	CARI15	4/14/1993	4.66	0.3	<2	3.35	3.01	0.37	0.06	15.57
		8/22/1993	4.81	0.4	<2	3.19	2.85	0.346	0.08	10.76
3.6093E+14	CHAR-8	8/22/1993	5.67	5.7	35	17.1	24.8	7.11	0.69	3.47
3.6143E+14	CRAI15	8/20/1993	3.67	4.8	7	3.71	9.92	0.566	0.09	-3.98
3.6074E+14	DIT	4/16/1993	5.18	14.1	48	25.6	28.2	17.8	1.71	4.29
		8/18/1993	5.35	14.8	58	23.8	26.9	14.5	1.86	-7.64
		9/13/1994	5.31	13.5	45	23.9	26.9	19	1.55	5.58
3.6055E+14	DORIS1	8/20/1993	3.06	10.4	49	21.6	28.1	9.05	0.92	-2.28
3.6064E+14	EA&R	8/20/1993	4.84	7.9	45	26.7	21.6	14.5	0.77	4.81
3.6054E+14	HAC&ANN	8/19/1993	3.68	14.5	62	26.9	29.2	18.2	0.85	-3.24
3.6054E+14	HAC&LAKEW	8/19/1993	3.43	14.7	58	26.7	33	16.6	1.14	0.85
3.6092E+14	HUNTPK	8/22/1993	4.24	5.8	30	11.4	19.4	6.49	0.54	-2.84
		9/14/1994	4.05	5.3	25	12.4	20.9	7.74	0.41	9.37
3.6092E+14	HUNTPK2	9/14/1994	3.87	5.5	26	12.2	20.4	7.61	0.41	6.91

Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. A, Site locations and well information; B, Field parameters; C, Major ion chemistry; D, Trace constituents (Set A); E, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5C, Major ion chemistry

Site ID	Site name	Collection date	Alkalinity (meq/L)	Cl (meq/L)	SO ₄ (meq/L)	Ca (meq/L)	Mg (meq/L)	Na (meq/L)	K (meq/L)	Ion balance (%)
3.6085E+14	HWYSHR1	8/20/1993	4.67	12.1	52	21.8	27.7	22.7	1.33	3.35
3.6084E+14	I15SAH	4/14/1993	3.67	4.5	19	13.4	16.3	7.36	0.75	16.37
		8/18/1993	3.9	6.4	27	11.4	14.7	6.13	0.9	-5.92
3.6074E+14	I15SPRING	4/13/1993	3.87	6.3	28	16.2	18.9	8.65	0.45	7.32
		8/18/1993	3.95	7	34	17.4	18.4	10.3	0.42	1.72
3.611E+14	JGAYPK1	8/23/1993	6.11	4.7	15	7.99	11.6	4.98	0.81	-0.84
3.611E+14	JGAYPK2	8/23/1993	5.04	4.2	15	5.19	11.3	4.48	0.52	-6.01
3.6105E+14	LV-MGOLF	8/22/1993	4.35	3.8	9	8.47	8.94	2.16	0.14	6.95
3.6101E+14	MDB-6	4/13/1993	0.89	1.7	5	8.66	0.317	2.94	0.3	23.36
		8/23/1993	0.833	2.8	10	9.4	0.0295	1.99	0.34	-7.38
3.606E+14	NELLIS	4/16/1993	3.05	0.2	3	1.88	1.99	2.61	0.17	3.1
		9/13/1994	3.05	0.4	3	1.99	2.07	2.77	0.23	4.52
3.6052E+14	P.P.VISTA	8/21/1993	3.76	7.4	35	20.4	17.1	11.1	0.49	3.08
3.6062E+14	P.PARK1	4/12/1993	3.85	7.8	50	22.9	28.3	17.5	0.74	5.94
		8/17/1993	3.86	8.2	58	23.6	27.4	17.6	0.61	-0.61
3.6062E+14	P.PARK2	8/17/1993	3.82	6.7	50	23.3	25.9	17.9	0.63	5.62
3.6094E+14	ROT1	8/17/1993	7.68	3.5	17	9.2	13.3	6.23	0.21	1.33
3.6094E+14	ROT2	4/15/1993	8.82	13.8	44	18.1	38.8	20.7	1.12	8.33
		8/17/1993	8.88	13.1	43	16.3	34.7	16.3	0.88	2.4
3.6065E+14	SNSC	8/23/1993	5.03	6.4	44	25.1	21.3	11.4	0.81	2.79
3.604E+14	USGSOS	8/16/1993	3.16	2.1	16	12.2	8.61	2.26	0.23	4.58
3.6092E+14	WALLI15	4/13/1993	6.21	6.7	46	21.8	34.5	10.2	1.05	6.83
		8/21/1993	6.07	6.7	50	22.4	33.6	9.24	1.14	2.8

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Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. A, Site locations and well information; B, Field parameters; C, Major ion chemistry; D, Trace constituents (Set A); E, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5D, Trace constituents (Set A)

Site ID	Site name	Collection date	DOC (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)
3.60837E+14	4 th & CLARK	8/21/1993	2	0.523	0.012	<0.001	<0.01	<0.01	<0.005	<0.005
3.60832E+14	BLM	4/16/1993	1.9	4.21	.011	.002	<.01	<.01	.006	<.005
		8/18/1993	1.8	4.38	.01	<.001	<.01	<.01	<.005	<.005
3.60908E+14	BROADBENT	8/24/1993	3.1	.936	.017	<.001	<.01	<.01	<.005	.047
3.60621E+14	C27	8/24/1993	2.7	1.82	.007	<.001	<.01	<.01	<.005	.012
3.60521E+14	C28	8/19/1993	1	1.29	.014	<.001	<.01	<.01	<.005	.012
3.60605E+14	C33	8/19/1993	3.7	3.61	.012	<.001	<.01	<.01	<.005	<.005
3.60647E+14	C49	8/21/1993	1.7	1.25	.012	<.001	<.01	<.01	<.005	<.005
3.61212E+14	CARI15	4/14/1993	1.5	.046	.201	<.001	<.01	<.01	<.005	.34
		8/22/1993	.6	.035	.181	.002	<.01	<.01	<.005	<.005
3.6093E+14	CHAR-8	8/22/1993	2.9	.518	.013	<.001	<.01	<.01	<.005	<.005
3.61425E+14	CRAI15	8/20/1993	5.8	.032	.178	<.001	<.01	<.01	<.005	<.005
3.60744E+14	DIT	4/16/1993	3.7	2.02	.016	<.001	<.01	<.01	<.005	.013
		8/18/1993	3.4	1.51	.01	<.001	<.01	<.01	<.005	.035
		9/13/1994	3.2	4.02	.014	<.001	<.01	<.01	<.005	.07
3.60547E+14	DORIS1	8/20/1993	1.8	2.55	.008	<.001	<.01	<.01	<.005	<.005
3.6064E+14	EA&R	8/20/1993	3.9	1.55	.01	<.001	<.01	<.01	<.005	<.005
3.60535E+14	HAC&ANN	8/19/1993	1.7	2.3	.008	<.001	<.01	<.01	<.005	<.005
3.60537E+14	HAC&LAKEW	8/19/1993	1.5	1.95	.008	<.001	<.01	<.01	<.005	<.005
3.60924E+14	HUNTPK	8/22/1993	20	.357	.023	<.001	<.01	<.01	<.005	.082
		9/14/1994	1.45	.993	.028	<.001	<.01	<.01	<.005	<.005

Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. A, Site locations and well information; B, Field parameters; C, Major ion chemistry; D, Trace constituents (Set A); E, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5D, Trace constituents (Set A)

Site ID	Site name	Collection date	DOC (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Cd (mg/L)	Co (mg/L)	Cu (mg/L)	Fe (mg/L)
3.60924E+14	HUNTPK2	9/14/1994	1.3	.919	.017	<.001	<.01	<.01	<.005	<.005
3.60852E+14	HWYSHR1	8/20/1993	3.1	1.96	.027	<.001	<.01	<.01	<.005	.529
3.60838E+14	I15SAH	4/14/1993	3.1	.95	.038	<.001	<.01	<.01	<.005	.863
		8/18/1993	1.9	.783	.017	<.001	<.01	<.01	<.005	<.005
3.60735E+14	I15SPRING	4/13/1993	1.9	1.22	.014	<.001	<.01	<.01	<.005	<.005
		8/18/1993	1.6	.711	.009	<.001	<.01	<.01	<.005	<.005
3.61102E+14	JGAYPK1	8/23/1993	2.3	.714	.031	<.001	<.01	<.01	<.005	<.005
3.61102E+14	JGAYPK2	8/23/1993	1.5	.597	.017	<.001	<.01	<.01	<.005	<.005
3.61053E+14	LV-MGOLF	8/22/1993	1.6	.094	.043	<.001	<.01	<.01	<.005	<.005
3.61014E+14	MDB-6	4/13/1993	1.7	.2	.047	<.001	<.01	<.01	.016	<.005
		8/23/1993	1.2	.202	.039	<.001	<.01	<.01	<.005	<.005
3.60601E+14	NELLIS	4/16/1993	.5	.258	.032	<.001	<.01	<.01	<.005	.046
		9/13/1994	.6	.501	.041	<.001	<.01	<.01	<.005	<.005
3.60522E+14	P.P.VISTA	8/21/1993	2.3	.707	.016	<.001	<.01	<.01	<.005	.035
3.60617E+14	P.PARK1	4/12/1993	3.1	2.19	.011	<.001	<.01	<.01	<.005	.02
		8/17/1993	2.7	1.79	.008	<.001	<.01	<.01	<.005	<.005
3.60617E+14	P.PARK2	8/17/1993	2.1	1.97	.011	.001	<.01	<.01	<.005	<.005
3.60937E+14	ROT1	8/17/1993	2.5	.75	.017	<.001	<.01	<.01	<.005	.094
3.60937E+14	ROT2	4/15/1993	16	.631	.036	.002	<.01	<.01	.015	.007
		8/17/1993	14.6	.463	.028	<.001	<.01	<.01	<.005	.035
3.60648E+14	SNSC	8/23/1993	4.3	1.2	.014	<.001	<.01	<.01	<.005	<.005
3.60401E+14	USGSOS	8/16/1993	.5	.196	.01	<.001	<.01	<.01	<.005	<.005
3.60921E+14	WALLI15	4/13/1993	3.4	1.91	.022	<.001	<.01	<.01	<.005	<.005
		8/21/1993	3.5	1.67	.021	<.001	<.01	<.01	<.005	<.005

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Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. A, Site locations and well information; B, Field parameters; C, Major ion chemistry; D, Trace constituents (Set A); E, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5E, Trace constituents (Set B)

Site ID	Site name	Collection date	Li (mg/L)	Mn (mg/L)	SiO ₂ (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)	As ($\mu\text{g}/\text{L}$)	Se ($\mu\text{g}/\text{L}$)
3.60837E+14	4 th & CLARK	8/21/1993	0.105	0.003	42.3	5.64	<0.005	<0.01	NS	NS
3.60832E+14	BLM	4/16/1993	1.11	.008	19.1	12.4	<.005	<.01	14	34
		8/18/1993	.578	.006	11.5	10.1	.032	.23	35	44
3.60908E+14	BROADBENT	8/24/1993	.051	.011	18.5	2.12	<.005	<.01	NS	NS
3.60621E+14	C27	8/24/1993	.183	.004	21.9	5.56	<.005	<.01	NS	NS
3.60521E+14	C28	8/19/1993	.374	.006	46.1	7.01	<.005	.03	NS	NS
3.60605E+14	C33	8/19/1993	.279	.006	25.2	7.15	<.005	<.01	NS	NS
3.60647E+14	C49	8/21/1993	.215	<.002	34.3	7.55	<.005	<.01	NS	NS
3.61212E+14	CARI15	4/14/1993	.014	.038	25.5	.794	<.005	<.01	2	1
		8/22/1993	.012	.004	21.3	.708	<.005	<.01	2	2
3.6093E+14	CHAR-8	8/22/1993	.047	.041	28.6	5.36	<.005	.02	NS	NS
3.61425E+14	CRAI15	8/20/1993	.018	.019	47.5	2.17	.007	<.01	NS	NS
3.60744E+14	DIT	4/16/1993	.234	.039	56.4	11.6	<.005	<.01	NS	NS
		8/18/1993	.137	.008	43.1	8.91	.007	<.01	NS	NS
		9/13/1994	.248	.047	66.7	11	<.005	<.01	NS	NS
3.60547E+14	DORIS1	8/20/1993	.163	.003	23.9	5.99	<.005	<.01	NS	NS
3.6064E+14	EA&R	8/20/1993	.193	.002	61.9	9	<.005	<.01	NS	NS
3.60535E+14	HAC&ANN	8/19/1993	.187	.005	31.3	7.3	<.005	<.01	NS	NS
3.60537E+14	HAC&LAKEW	8/19/1993	.178	<.002	34.6	6.82	<.005	<.01	NS	NS

Table 5. Chemical data for groundwater samples from the surficial aquifer, Las Vegas, Nev. A, Site locations and well information; B, Field parameters; C, Major ion chemistry; D, Trace constituents (Set A); E, Trace constituents (Set B). (D, degrees; M, minutes; S, seconds; mg/L, milligrams per liter; std, standard deviation; $\mu\text{S}/\text{cm}$, microseimens per centimeter; $^{\circ}\text{C}$, degrees Celsius; meq/L, milliequivalents per liter; $\mu\text{g}/\text{L}$, micrograms per liter; NS, not sampled).—Continued

Table 5E, Trace constituents (Set B)

Site ID	Site name	Collection date	Li (mg/L)	Mn (mg/L)	SiO ₂ (mg/L)	Sr (mg/L)	V (mg/L)	Zn (mg/L)	As ($\mu\text{g}/\text{L}$)	Se ($\mu\text{g}/\text{L}$)
3.60924E+14	HUNTPK	8/22/1993	.037	.007	17.5	2.51	<.005	.01	NS	NS
		9/14/1994	.064	<.002	27	3.15	<.005	.13	NS	NS
3.60924E+14	HUNTPK2	9/14/1994	.064	<.002	27.5	3.13	<.005	<.01	NS	NS
3.60852E+14	HWYSHR1	8/20/1993	.149	.095	55.5	6.12	<.005	.04	NS	NS
3.60838E+14	I15SAH	4/14/1993	.075	.039	28.7	3.2	<.005	<.01	NS	NS
		8/18/1993	.067	<.002	20.8	2.84	<.005	<.01	NS	NS
3.60735E+14	I15SPRING	4/13/1993	.076	<.002	22	4.52	<.005	.03	NS	NS
		8/18/1993	.038	<.002	14.2	3.1	<.005	<.01	NS	NS
3.61102E+14	JGAYPK1	8/23/1993	.052	.121	40.4	5.05	<.005	<.01	NS	NS
3.61102E+14	JGAYPK2	8/23/1993	.029	.01	23.8	2.23	<.005	.02	NS	NS
3.61053E+14	LV-MGOLF	8/22/1993	.013	<.002	16.9	1.21	<.005	<.01	2	12
3.61014E+14	MDB-6	4/13/1993	.025	<.002	14.1	1.24	.01	<.01	NS	NS
		8/23/1993	.018	<.002	14.3	1.14	.007	<.01	NS	NS
3.60601E+14	NELLIS	4/16/1993	.137	<.002	21.1	.788	.009	<.01	10	1
		9/13/1994	.12	<.002	23.3	.793	<.005	.12	NS	NS
3.60522E+14	P.P.VISTA	8/21/1993	.061	.118	17.9	4.44	<.005	.02	NS	NS
3.60617E+14	P.PARK1	4/12/1993	.187	.004	31.2	7.61	<.005	<.01	10	33
		8/17/1993	.162	.004	28.4	6.49	<.005	<.01	10	34
3.60617E+14	P.PARK2	8/17/1993	.172	.008	31.2	7.11	<.005	<.01	NS	NS
3.60937E+14	ROT1	8/17/1993	.024	.015	20.5	1.41	<.005	.02	NS	NS
3.60937E+14	ROT2	4/15/1993	.104	.234	31.1	8.11	<.005	<.01	3	10
		8/17/1993	.059	.227	24.2	5.9	<.005	.02	<2	8
3.60648E+14	SNSC	8/23/1993	.173	.232	63.9	8.01	<.005	<.01	NS	NS
3.60401E+14	USGSOS	8/16/1993	.052	<.002	18.5	2.61	<.005	<.01	NS	NS
3.60921E+14	WALLI15	4/13/1993	.141	.002	47.9	9.81	<.005	<.01	NS	NS
		8/21/1993	.133	.012	42.2	8.67	<.005	<.01	NS	NS

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