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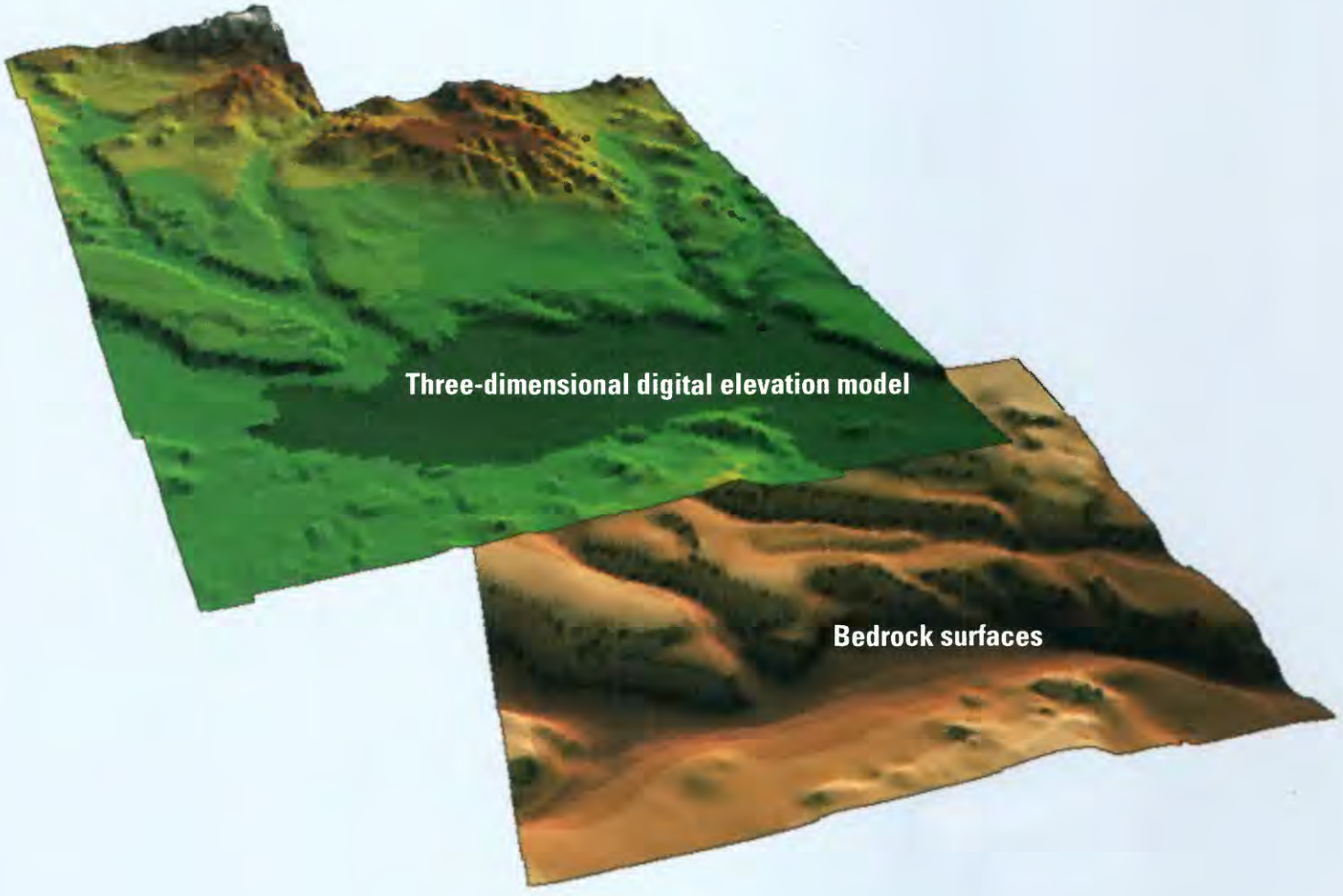
Selected Field and Analytical Methods and Analytical Results in the Dutch Flats Area, Western Nebraska, 1995–99

Open–File Report 00–413



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

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By I.M. Verstraeten, G.V. Steele, J.K. Böhlke, T.E. Kraemer, J.C. Cannia, D.E. Hitch, K.E. Wilson, and A.E. Carnes

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CONVERSION FACTORS, ABBREVIATIONS, AND VERTICAL DATUM

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
meter (m)	3.281	foot
mile (mi)	1.609	kilometer
	Weight	
gram (g)	0.03527	ounce
	Volume	
gallon (gal)	3.785	liter
liter (L)	0.2642	gallon
milliliter (mL)	0.0338	ounce, fluid
	Radioactivity	
picocuries per liter (pCi/L)	0.037	becquerels per liter

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32.$$

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C = (°F - 32) / 1.8.$$

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Altitude, as used in this report, refers to distance above or below sea level.

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (mS/cm at 25 °C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L), micrograms per liter (mg/L), or picocuries per kilogram (pg/kg).

Selected Field and Analytical Methods and Analytical Results in the Dutch Flats Area, Western Nebraska, 1995–99

By I.M. VERSTRAETEN[1], G.V. STEELE[1], J.C. CANNIA[2], J.K. BÖHLKE[3], T.E. KRAEMER[3] D.E. HITCH[4], K.E. WILSON[1], *and* A.E. CARNES[1]

Abstract

A study of the water resources of the Dutch Flats area in the western part of the North Platte Natural Resources District, western Nebraska, was conducted from 1995 through 1999 to describe the surface water and hydrogeology, the spatial distribution of selected water-quality constituents in surface and ground water, and the surface-water/ground-water interaction in selected areas. This report describes the selected field and analytical methods used in the study and selected analytical results from the study not previously published. Specifically, dissolved gases, age-dating data, and other isotopes collected as part of an intensive sampling effort in August and November 1998 and all uranium and uranium isotope data collected through the course of this study are included in the report.

INTRODUCTION

Human activities, such as agriculture, commonly affect the distribution, interaction, and quality of surface and ground water. It has been demonstrated that contaminated aquifers discharging to streams can degrade surface-water quality and that streams discharging to ground water can degrade ground-water quality, especially when induced infiltration occurs (Verstraeten and others, 1999). A study of the water resources of the Dutch Flats area in the western part of the North Platte Natural Resources District (NRD), western Nebraska, was conducted from 1995 through 1999 to describe the surface water and hydrogeology, the spatial distribution of selected water-quality constituents in surface and ground water, and the surface-water/ground-water interaction in selected areas.

The Dutch Flats area, a part of Scotts Bluff and Sioux Counties, in the western part of the North Platte NRD (fig. 1), encompasses the majority of the study area and locally is the prominent terrain feature. It also includes an area north of the Interstate Canal and south of the Platte River. Previous studies (Conservation and Survey Division, 1980a, b; Verstraeten and others, 1995; Steele and Cannia, 1997; Druliner and others, 1999) suggested that large amounts of nitrate are present in ground water from the alluvial sediment in the Dutch Flats area but are not present in surface water. These studies also suggested that at selected locations in the Dutch Flats area, large concentrations of radon, uranium, and gross alpha as natural uranium are present. Concentrations in excess of existing or proposed U.S. Environmental Protection Agency (2000) Maximum Contaminant Levels (MCLs) for nitrate, radon, and uranium were found in surface or ground water.

To evaluate the water resources in the Dutch Flats area, more information was needed about the quantity and quality of surface and ground water and their interactions. To evaluate the interaction of surface and ground water, a study was conducted from 1995 through 1999 by the U.S. Geological Survey (USGS),

[1]U.S. Geological Survey, Lincoln, Nebraska.
[2]North Platte Natural Resources District, Gering, Nebraska.
[3]U.S. Geological Survey, Reston, Virginia.
[4] U.S. Geological Survey, North Platte, Nebraska.

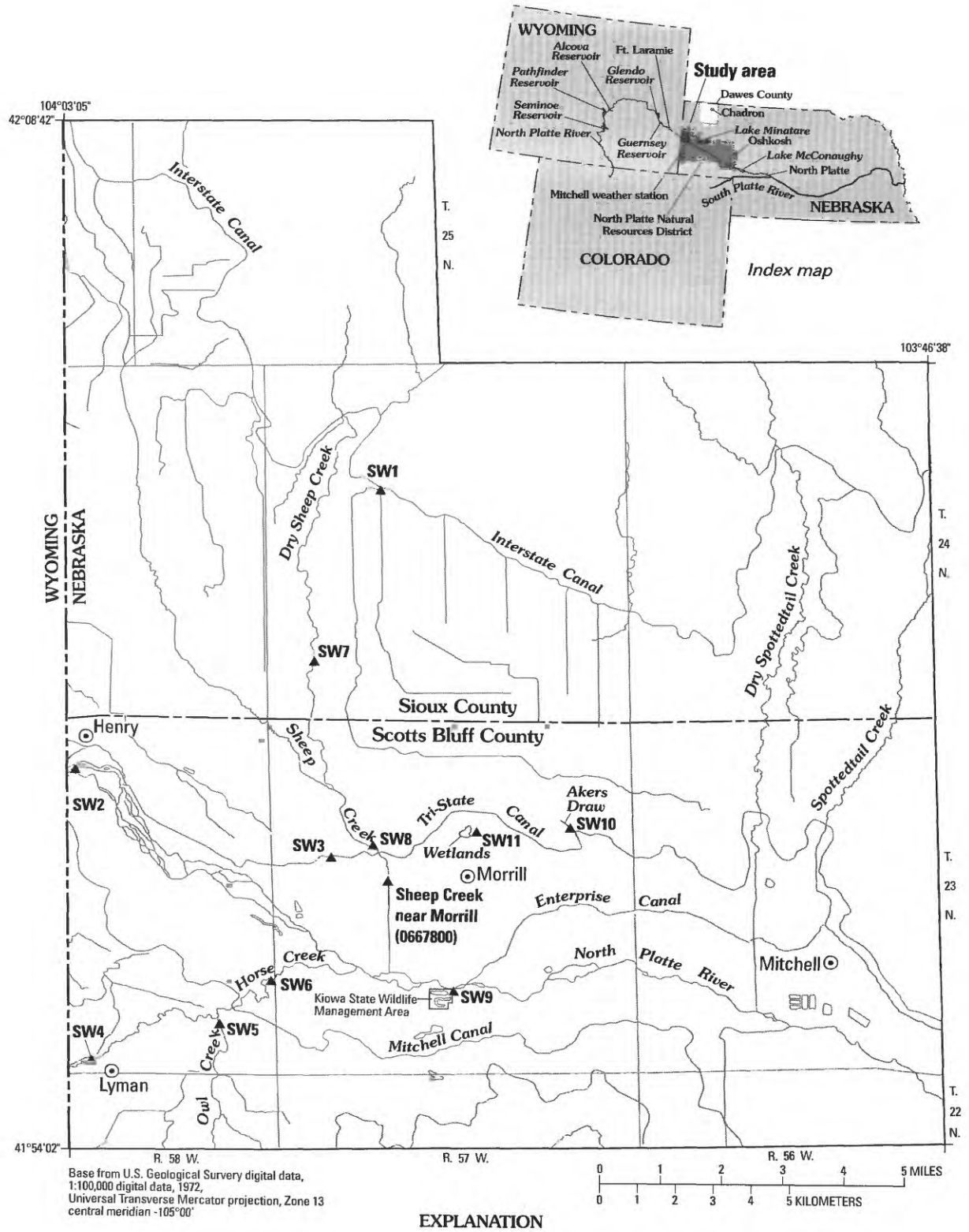

Figure 1. Location of the Dutch Flats area and surface-water sampling sites, western Nebraska.

in cooperation with the North Platte NRD, to define the surface-water/ground-water interaction and the potential effect of seepage from irrigation canals on water quantity and quality in the Dutch Flats area (fig. 1) in the western part of the North Platte NRD. The specific objectives of the study were:

- To describe surface water and hydrogeology,
- To describe spatial distribution of selected water-quality constituents in surface and ground water,
- To describe surface-water/ground-water interaction in selected areas, and
- To estimate ground-water, nitrogen, and uranium fluxes.

The purpose of this report is to describe the selected field and analytical methods used in the study and the analytical results of the study not published in the USGS Water-Data Reports for 1997, 1998, and 2000 (Boohar and Walczyk, 1997, p. 254–273, 1998, p. 303–395; Boohar, 2000, p. 342–417). The previously published analytical results can be retrieved from the USGS National Water Information system on the World Wide Web at URL: http://water.usgs.gov/ne/nwis/nwis

FIELD AND ANALYTICAL METHODS

Surface-water and ground-water site selection and identification are described in this report, in addition to ground-water monitoring-well construction methods. The sample collection and laboratory procedures also are described, as well as the quality-assurance and quality-control measures used during the study. Most of the geologic nomenclature used in this report is that used by the USGS. However, the term "Lance aquifer" is used by the University of Nebraska-Lincoln Conservation and Survey Division.

Site Selection and Identification

Surface-Water Sites

Eleven surface-water sites representing the major hydrologic features in the Dutch Flats area were selected for this study (fig. 1, table 1). One spring, Akers Draw, also was included to evaluate ground-water seepage from the upland terrace. Water in the Interstate Canal is withdrawn from the North Platte River about 50 mi upstream in Wyoming. Site accessibility was a major consideration in the site-selection process.

For identification of surface-water sampling sites, the first identifier is the USGS official station name (table 1). The second identifier, generally an eight-

Table 1. Surface-water sampling sites, Dutch Flats area, western Nebraska

[USGS, U.S. Geological Survey; ft, feet]

Map index number (fig. 1)	USGS site name	USGS identification number	Latitude and longitude (degrees, minutes, seconds)	Land-surface altitude (ft above sea level)
SW1	Interstate Canal 6 miles northwest of Morrill, Nebr.	06656630	420326 1035706	4,206
SW2	North Platte River at Wyoming-Nebraska State line	06674500	415925 1040257	4,020
SW3	Tri-State Canal 2 miles west of Morrill, Nebr.	06675100	415808 1035804	4,013
SW4	Horse Creek 0.5 mile downstream from Wyoming-Nebraska State line	06677120	415512 1040240	4,040
SW5	Owl Creek near Lyman, Nebr.[1]	06677300	415548 1040017	4,020
SW6	Horse Creek near Lyman, Nebr.	06677500	415621 1035913	3,992
SW7	Dry Sheep Creek near Morrill, Nebr.	06677985	420058 1035823	4,060
SW8	Sheep Creek north of Tri-State Canal, near Morrill, Nebr.	06677995	415814 1035714	4,008
SW9	North Platte River at Morrill, Nebr.	06678500	415612 1035544	3,978
SW10	Akers Draw near Morrill, Nebr.	06678610	415833 1035329	4,010
SW11	Wetlands 0.75 mile north of Morrill, Nebr.	415830103551701	415830 1035517	3,980

[1]This station is on that part of the stream previously called Kiowa Creek by the USGS.

digit surface-water USGS identification number, is assigned in a downstream direction along the main stream. The first two digits "06" represent the major river basin, which is the Missouri River Basin. However, because the wetlands site is not a flowing stream, the wetlands site (SW11) was identified in a fashion similar to a ground-water site as described later in this section.

Ground-Water Sites

Multiple wells at a site are referred to as "nested wells" in this report; a single well at a site or one of the wells at a nested well site is referred to as a "well." Sites were selected to produce parallel transects of semilinear lines running from the Interstate Canal to about 2 to 3 mi south of the North Platte River (fig. 2, table 2). Each transect was placed in a location that, as much as possible, allowed easy access during inclement weather.

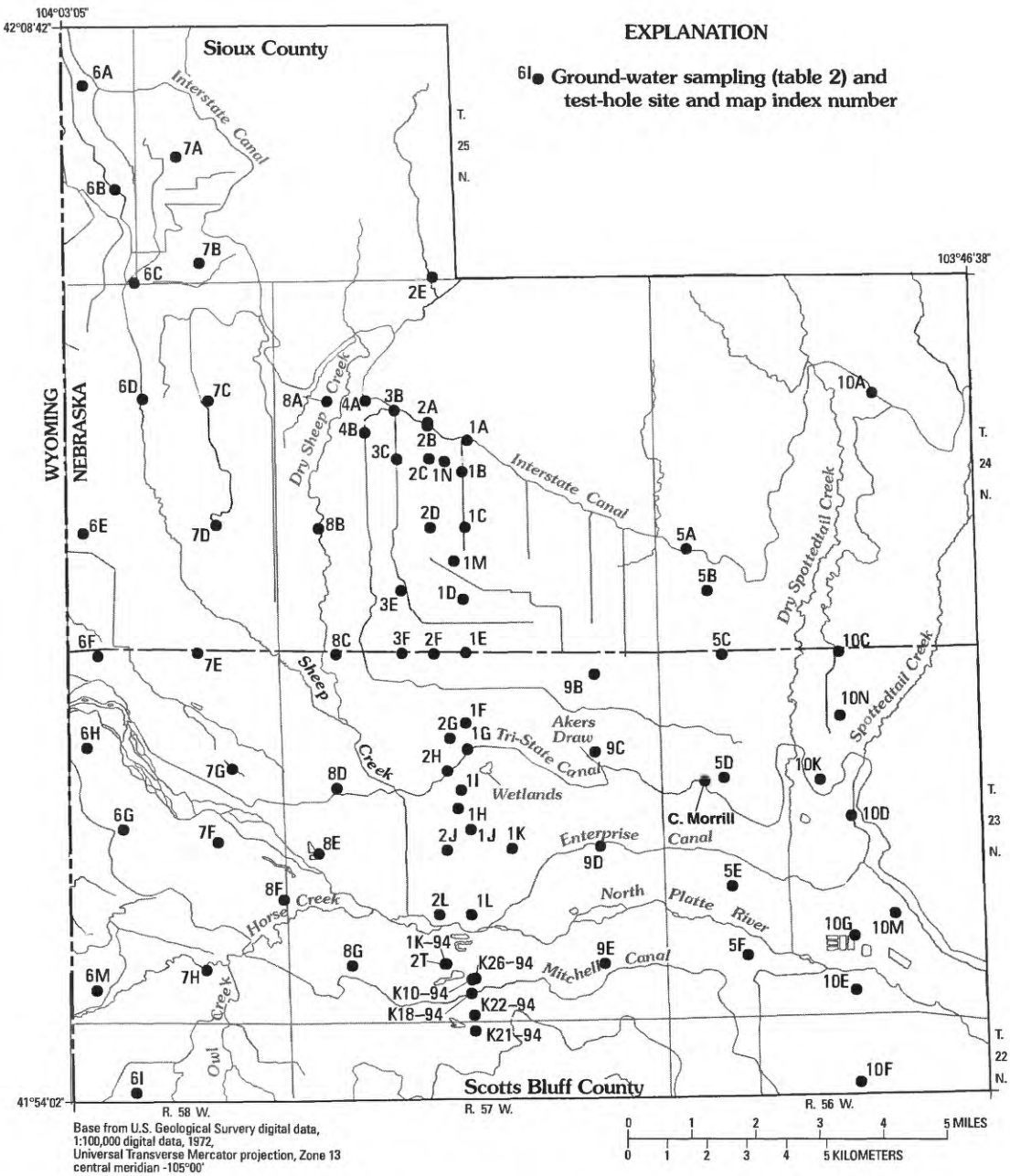

Figure 2. Location of ground-water sampling sites, Dutch Flats area, western Nebraska.

Table 2. Well information for ground-water-quality monitoring network, Dutch Flats area, western Nebraska

[ft, feet; m, meters; bls, below land surface. Well identification number: -1, deepest; -2, intermediate depth, -3, shallowest of the well nest. Hydrogeologic condition: CF, confined aquifer; UCF, unconfined alluvial aquifer. Aquifer type: BR, Brule aquifer; Q, Quaternary alluvial aquifer; CD, Chadron aquifer; LC, Lance aquifer. Well type: RM, registered monitoring well; RD, registered domestic well. --, uncased hole]

Map index number (fig. 2)	U.S. Geological Survey station identification number	Legal description	Well registration number[1]	Hydro-geologic condition	Aquifer type	Well type	Latitude and longitude	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Well depth (ft bls)	Top of screen (ft bls)	Bottom of screen (ft bls)
1A–1	420301103554801	24N 57W 15 CBBD1	G–085442	CF	BR	RM	420301 1035548	4,205	1,282	127	122	127
1A–2	420301103554802	24N 57W 15 CBBD2	G–085443	UCF	Q	RM	420301 1035548	4,205	1,282	113.5	108.5	113.5
1A–3	420301103554803	24N 57W 15 CBBD3	G–085444	UCF	Q	RM	420301 1035548	4,205	1,282	95	75	95
1B–1	420234103555501	24N 57W 22 BBCC1	G–085445	UCF	Q	RM	420234 1035555	4,165	1,269	63	43	63
1B–2	420234103555502	24N 57W 22 BBCC2	G–088541	UCF	Q	RM	420234 1035555	4,165	1,269	63	43	63
1C–1	420148103555201	24N 57W 22 CCCC1	G–085446	UCF	Q	RM	420148 1035552	4,139	1,262	110	105	110
1C–2	420148103555202	24N 57W 22 CCCC2	G–085446	UCF	Q	RM	420148 1035552	4,139	1,262	82	77	82
1C–3	420148103555203	24N 57W 22 CCCC3	G–085446	UCF	Q	RM	420148 1035552	4,139	1,262	55	35	55
1C–4	420148103555204	24N 57W 22 CCCC4	G–088542	UCF	Q	RM	420148 1035552	4,139	1,262	60	40	60
1D–1	420049103555501	24N 57W 33 AAAD1	G–088543	UCF	Q	RM	420049 1035555	4,100	1,250	67	62	67
1D–2	420049103555502	24N 57W 33 AAAD2	G–088543	UCF	Q	RM	420049 1035555	4,100	1,250	50	45	50
1D–3	420049103555503	24N 57W 33 AAAD3	G–088543	UCF	Q	RM	420049 1035555	4,100	1,250	35	15	35
1E–1	420004103555301	24N 57W 33 DDDD1	G–088545	UCF	Q	RM	420004 1035553	4,094	1,248	118	113	118
1E–2	420004103555302	24N 57W 33 DDDD2	G–088545	UCF	Q	RM	420004 1035553	4,094	1,248	73	68	73
1E–3	420004103555303	24N 57W 33 DDDD3	G–088545	UCF	Q	RM	420004 1035553	4,094	1,248	35	15	35
1F–1	415907103555301	23N 57W 9 AAAA1	G–088531	UCF	Q	RM	415907 1035553	4,078	1,243	35	15	35
1G–1	415845103555201	23N 57W 9 ADDA1	G–088533	UCF	Q	RM	415845 1035552	4,015	1,224	71	66	71
1G–2	415845103555202	23N 57W 9 ADDA2	G–088533	UCF	Q	RM	415845 1035552	4,015	1,224	51	46	51
1G–3	415845103555203	23N 57W 9 ADDA3	G–088533	UCF	Q	RM	415845 1035552	4,015	1,224	30	10	30
1H–1	415756103555401	23N 57W 16 ADAC1	G–091663	UCF	Q	RM	415756 1035554	3,990	1,216	195	190	195
1H–2	415756103555402	23N 57W 16 ADAC2	G–091663	UCF	Q	RM	415756 1035554	3,990	1,216	112	107	112
1H–3	415756103555403	23N 57W 16 ADAC3	G–091663	UCF	Q	RM	415756 1035554	3,990	1,216	30	10	30

Table 2. Well information for ground-water-quality monitoring network, Dutch Flats area, western Nebraska—Continued

Map index number (fig. 2)	U.S. Geological Survey station identification number	Legal description	Well registration number[1]	Hydro-geologic condition	Aquifer type	Well type	Latitude and longitude	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Well depth (ft bls)	Top of screen (ft bls)	Bottom of screen (ft bls)
1I–1	415811103555801	23N 57W 16 AAAC1	G–088536	UCF	Q	RM	415811 1035558	3,991	1,216	77	72	77
1I–2	415811103555802	23N 57W 16 AAAC2	G–088536	UCF	Q	RM	415811 1035558	3,991	1,216	53	48	53
1I–3	415811103555803	23N 57W 16 AAAC3	G–088536	UCF	Q	RM	415811 1035558	3,991	1,216	30	10	30
1J–1	415738103554701	23N 57W 15 CBCB1	G–088535	UCF	Q	RM	415738 1035547	3,992	1,217	195	190	195
1J–2	415738103554702	23N 57W 15 CBCB2	G–088535	UCF	Q	RM	415738 1035547	3,992	1,217	108	103	108
1J–3	415738103554703	23N 57W 15 CBCB3	G–088535	UCF	Q	RM	415738 1035547	3,992	1,217	30	10	30
1K–1	415738103551601	23N 57W 22 ABAB1	G–091664	UCF	Q	RM	415738 1035516	3,984	1,214	191	186	191
1K–2	415738103551602	23N 57W 22 ABAB2	G–091664	UCF	Q	RM	415738 1035516	3,984	1,214	117	112	117
1K–3	415738103551603	23N 57W 22 ABAB3	G–091664	UCF	Q	RM	415738 1035516	3,984	1,214	35	15	35
1L–1	415628103554901	23N 57W 28 AAAA1	G–088537	UCF	Q	RM	415628 1035549	3,980	1,213	106	101	106
1L–2	415628103554902	23N 57W 28 AAAA2	G–088537	UCF	Q	RM	415628 1035549	3,980	1,213	68	63	68
1L–3	415628103554903	23N 57W 28 AAAA3	G–088537	UCF	Q	RM	415628 1035549	3,980	1,213	30	10	30
1M–1	420121103560501	24N 57W 28 DABA1	G–091668	UCF	Q	RM	420121 1035605	4,110	1,253	200	195	200
1M–2	420121103560502	24N 57W 28 DABA2	G–091668	UCF	Q	RM	420121 1035605	4,110	1,253	99	94	99
1M–3	420121103560503	24N 57W 28 DABA3	G–091668	UCF	Q	RM	420121 1035605	4,110	1,253	40	20	40
1N–1	420244103561401	24N 57W 16 DCDD1	G–091666	UCF	Q	RM	420244 1035614	4,185	1,276	88	68	88
2A–1	420316103563201	24N 57W 16 BDAA1	G–085448	UCF	Q	RM	420316 1035632	4,211	1,284	103	83	103
2B–1	420313103563101	24N 57W 16 BDAD1	G–085450	UCF	Q	RM	420313 1035631	4,202	1,281	110	105	110
2B–2	420313103563102	24N 57W 16 BDAD2	G–085450	UCF	Q	RM	420313 1035631	4,202	1,281	91.5	87.5	91.5
2B–3	420313103563103	24N 57W 16 BDAD3	G–085450	UCF	Q	RM	420313 1035631	4,202	1,281	85.5	65.5	85.5
2C–1	420234103564001	24N 57W 16 CDDA1	G–085447	UCF	Q	RM	420234 1035640	4,188	1,276	100	95	100
2C–2	420234103564002	24N 57W 16 CDDA2	G–085447	UCF	Q	RM	420234 1035640	4,188	1,276	90	85	90
2C–3	420234103564003	24N 57W 16 CDDA3	G–085447	UCF	Q	RM	420234 1035640	4,188	1,276	80	60	80

Table 2. Well information for ground-water-quality monitoring network, Dutch Flats area, western Nebraska—Continued

Map index number (fig. 2)	U.S. Geological Survey station identification number	Legal description	Well registration number[1]	Hydro-geologic condition	Aquifer type	Well type	Latitude and longitude	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Well depth (ft bls)	Top of screen (ft bls)	Bottom of screen (ft bls)
2D–1	420148103563101	24N 57W 21 CDDD1	G–088540	UCF	Q	RM	420148 1035631	4,137	1,261	181	176	181
2D–2	420148103563102	24N 57W 21 CDDD2	G–088540	UCF	Q	RM	420148 1035631	4,137	1,261	120	115	120
2D–3	420148103563103	24N 57W 21 CDDD3	G–088540	UCF	Q	RM	420148 1035631	4,137	1,261	59	39	59
2E–1	420516103562501	25N 57W 35 DCDD1	G–091670	UCF	BR	RM	420516 1035625	4,248	1,295	80	--	--
2F–1	420005103562801	24N 57W 33 DCCC1	G–088544	UCF	Q	RM	420005 1035628	4,100	1,250	100	95	100
2F–2	420005103562802	24N 57W 33 DCCC2	G–088544	UCF	Q	RM	420005 1035628	4,100	1,250	70	65	70
2F–3	420005103562803	24N 57W 33 DCCC3	G–088544	UCF	Q	RM	420005 1035628	4,100	1,250	45	25	45
2G–1	415854103561101	23N 57W 9 ACAA1	G–088532	UCF	Q	RM	415854 1035611	4,075	1,242	55	15	55
2H–2	415823103561602	23N 57W 9 DCC2	G–088534	UCF	Q	RM	415823 1035616	4,010	1,222	30	10	30
2J–1	415721103561501	23N 57W 21 ABBA1	G–091364	UCF	Q	RM	415721 1035615	3,990	1,216	183	178	183
2J–2	415721103561502	23N 57W 21 ABBA2	G–091364	UCF	Q	RM	415721 1035615	3,990	1,216	116	111	116
2J–3	415721103561503	23N 57W 21 ABBA3	G–091364	UCF	Q	RM	415721 1035615	3,990	1,216	40	20	40
2L–1	415628103562401	23N 57W 28 BAAA1	G–088538	UCF	Q	RM	415628 1035624	3,982	1,214	86	81	86
2L–2	415628103562402	23N 57W 28 BAAA2	G–088538	UCF	Q	RM	415628 1035624	3,982	1,214	58	53	58
2L–3	415628103562403	23N 57W 28 BAAA3	G–088538	UCF	Q	RM	415628 1035624	3,982	1,214	30	10	30
2T–1	415547103561704	23N 57W 28 DCCC1	G–101646	CF	CD	RM	415547 1035617	3,986	1,215	130	90	130
3B–1	420325103570901	24N 57W 17 AAAD1	G–085451	UCF	BR	RM	420325 1035709	4,200	1,280	90	85	90
3B–2	420325103570902	24N 57W 17 AAAD2	G–085451	UCF	Q	RM	420325 1035709	4,200	1,280	80.5	60.5	80.5
3C–1	420243103570701	24N 57W 16 CCCB1	G–088539	UCF	Q	RM	420243 1035707	4,181	1,274	147	142	147
3C–2	420243103570702	24N 57W 16 CCCB2	G–088539	UCF	Q	RM	420243 1035707	4,181	1,274	119	114	119
3C–3	420243103570703	24N 57W 16 CCCB3	G–088539	UCF	Q	RM	420243 1035707	4,181	1,274	90	70	90

Table 2. Well information for ground-water-quality monitoring network, Dutch Flats area, western Nebraska—Continued

Map index number (fig. 2)	U.S. Geological Survey station identification number	Legal description	Well registration number[1]	Hydro-geologic condition	Aquifer type	Well type	Latitude and longitude	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Well depth (ft bls)	Top of screen (ft bls)	Bottom of screen (ft bls)
3E–1	420056103570301	24N 57W 28 CCCC1	G–091667	UCF	Q	RM	420056 1035703	4,110	1,253	89	84	89
3E–2	420056103570302	24N 57W 28 CCCC2	G–091667	UCF	Q	RM	420056 1035703	4,110	1,253	67	62	67
3E–3	420056103570303	24N 57W 28 CCCC3	G–091667	UCF	Q	RM	420056 1035703	4,110	1,253	45	25	45
3F–1	420005103570301	24N 57W 32 DDDD1	G–091366	UCF	Q	RM	420005 1035703	4,100	1,250	68	63	68
3F–2	420005103570302	24N 57W 32 DDDD2	G–091366	UCF	Q	RM	420005 1035703	4,100	1,250	54	49	54
3F–3	420005103570303	24N 57W 32 DDDD3	G–091366	UCF	Q	RM	420005 1035703	4,100	1,250	40	20	40
4A–1	420333103574001	24N 57W 8 DCCC1	G–091665	UCF	Q	RM	420333 1035740	4,210	1,283	97.5	77.5	97.5
4B–1	420307103574001	24N 57W 17 ACCC1	G–091365	UCF	Q	RM	4203071 035740	4,192	1,278	157	152	157
4B–2	420307103574002	24N 57W 17 ACCC2	G–091365	UCF	Q	RM	4203071 035740	4,192	1,278	130	125	130
4B–3	420307103574003	24N 57W 17 ACCC3	G–091365	UCF	Q	RM	4203071 035740	4,192	1,278	95	75	95
5A–1	420128103514801	24N 56W 30 ACAA1	G–099874	UCF	Q	RM	420129 1035148	4,228	1,289	170	120	170
5B–1	420053103512701	24N 56W 31 ABAA1	G–091669	UCF	Q	RM	420053 1035127	4,158	1,267	163	158	163
5B–2	420053103512702	24N 56W 31 ABAA2	G–091669	UCF	Q	RM	420053 1035127	4,158	1,267	125	120	125
5B–3	420053103512703	24N 56W 31 ABAA3	G–091669	UCF	Q	RM	420053 1035127	4,158	1,267	98	78	98
5C–1	420002103511101	23N 56W 6 AAAA1	G–092640	UCF	Q	RM	420002 1035111	4,098	1,249	160	85	160
5C–2	420002103511102	23N 56W 6 AAAA2	G–092640	UCF	Q	RM	420002 1035111	4,098	1,249	65	45	65
5D	415829103511001	23N 56W 7 DDDD1	G–092641	UCF	BR	RM	415829 1035110	4,050	1,234	50	40	50
5E–1	415643103505201	23N 56W 20 CCAA1	G–092643	UCF	Q	RM	415643 1035052	3,960	1,207	190	50	190
5E–2	415643103505202	23N 56W 20 CCAA2	G–092643	UCF	Q	RM	415643 1035052	3,960	1,207	30	10	30
5F	415553103504101	23N 56W 29 CDBD1	G–093234	UCF	Q	RM	415553 1035041	3,949	1,204	35	10	35
6A	420757104024701	25N 58W 13 CDBC1	G–093083	UCF	BR	RM	420757 1040247	4,206	1,282	30	10	30
6B	420628104021001	25N 58W 25 DABB1	G–094662	CF	BR	RM	420628 1040210	4,170	1,271	60	35	60

Table 2. Well information for ground-water-quality monitoring network, Dutch Flats area, western Nebraska—Continued

Map index number (fig. 2)	U.S. Geological Survey station identification number	Legal description	Well registration number[1]	Hydro-geologic condition	Aquifer type	Well type	Latitude and longitude	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Well depth (ft bls)	Top of screen (ft bls)	Bottom of screen (ft bls)
6C	420514104015101	25N 57W 31 CCCC1	G–094661	UCF	BR	RM	420514 1040151	4,163	1,269	85	50	85
6D–1	420338104014401	24N 58W 10 DDDD1	G–094659	UCF	Q	RM	420338 1040144	4,125	1,257	200	60	200
6D–2	420338104014402	24N 58W 10 DDDD2	G–094659	UCF	Q	RM	420338 1040144	4,125	1,257	30	10	30
6E	420145104025001	24N 58W 27 BBBC1	G–093242	UCF	Q	RM	420145 1040250	4,153	1,266	65	55	65
6F	420003104023801	23N 58W 3 BBAC1	G–094681	UCF	BR	RM	420003 1040238	4,070	1,240	50	10	50
6G–1	415739104021101	23N 58W 15 CDAD1	G–092647	UCF	Q	RM	415739 1040211	4,021	1,226	175	35	175
6G–2	415739104021102	23N 58W 15 CDAD2	G–092647	CF	Q	RM	415739 1040211	4,021	1,226	30	10	30
6M–1	415525104023801	23N 58W 34 BCCB1	G–092648	UCF	Q	RM	415525 1040238	4,053	1,235	115	50	115
6M–2	415525104023802	23N 58W 34 BCCB2	G–092648	UCF	Q	RM	415525 1040238	4,053	1,235	30	10	30
6H–1	415852104024801	23N 58W 9 ADDA1	G–094679	UCF	Q	RM	415852 1040248	4,027	1,227	180	50	180
6H–2	415852104024802	23N 58W 9 ADDA2	G–094679	UCF	Q	RM	415852 1040248	4,027	1,227	30	10	30
6I	415402104015501	22N 58W 3 DCCD1	G–092638	UCF	LC	RM	415402 1040155	4,054	1,236	60	10	30
7A–1	420657104010301	25N 57W 19 DCDD1	G–093082	UCF	BR	RM	420657 1040103	4,192	1,278	95	75	95
7A–2	420657104010302	25N 57W 19 DCDD2	G–093082	CF	BR	RM	420657 1040103	4,192	1,278	30	10	30
7B	420524104003901	25N 57W 32 CCBB1	G–093081	UCF	BR	RM	420524 1040039	4,175	1,272	60	30	60
7C–1	420334104003201	24N 58W 13 BBBB1	G–094660	UCF	Q	RM	420334 1040032	4,173	1,272	190	100	190
7C–2	420334104003202	24N 58W 13 BBBB2	G–094660	UCF	Q	RM	420334 1040032	4,173	1,272	80	60	80
7D–1	420153104002401	24N 58W 24 CCCC1	G–093241	UCF	Q	RM	420153 1040024	4,135	1,260	155	100	155
7D–2	420153104002402	24N 58W 24 CCCC2	G–093241	UCF	Q	RM	420153 1040024	4,135	1,260	80	60	80
7E–1	420006104004401	23N 58W 2 AABB1	G–094678	UCF	BR	RM	420006 1040044	4,124	1,257	90	50	90
7E–2	420006104004402	23N 58W 2 AABB2	G–094678	UCF	Q	RM	420006 1040044	4,124	1,257	36	26	36

Table 2. Well information for ground-water-quality monitoring network, Dutch Flats area, western Nebraska—Continued

Map index number (fig. 2)	U.S. Geological Survey station identification number	Legal description	Well registration number[1]	Hydro-geologic condition	Aquifer type	Well type	Latitude and longitude	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Well depth (ft bls)	Top of screen (ft bls)	Bottom of screen (ft bls)
7F–1	415730104002301	23N 58W 13 CCCC1	G–092646	UCF	Q	RM	415730 1040023	4,011	1,222	193	35	193
7F–2	415730104002302	23N 58W 13 CCCC2	G–092646	UCF	Q	RM	415730 1040023	4,011	1,222	30	10	30
7G–1	415837104000601	23N 58W 12 CDCB1	G–093238	UCF	BR[2]	RM	415837 1040006	4,092	1,247	95	45	95
7G–2	415837104000602	23N 58W 12 CDCB2	G–093238	UCF	Q	RM	415837 1040006	4,092	1,247	30	10	30
7H	415544104003701	23N 58W 35 AABA1	G–093239	UCF	Q	RM	415544 1040037	4,025	1,227	38	8	38
8A–1	420333103583401	24N 57W 18 AAAA1	G–094658	UCF	Q	RM	420333 1035834	4,165	1,269	125	75	125
8A–2	420333103583402	24N 57W 18 AAAA2	G–094658	UCF	Q	RM	420333 1035834	4,165	1,269	52.5	32.5	52.5
8B	420148103583101	24N 57W 30 AABB1	G–093240	UCF	Q	RM	420148 1035831	4,100	1,250	30	10	30
8C	420004103581401	23N 57W 6 AAAA1	G–093235	UCF	BR	RM	420004 1035814	4,082	1,244	80	--	--
8D–1	415814103581201	23N 57W 7 DDDD1	G–093087	UCF	Q	RM	415814 1035812	4,016	1,224	152	50	152
8D–2	415814103581202	23N 57W 7 DDDD2	G–093087	UCF	Q	RM	415814 1035812	4,016	1,224	30	10	30
8E	415719103583601	23N 57W 19 ABBA1	G–093089	UCF	Q	RM	415719 1035836	4,003	1,220	45	20	45
8F–1	415640103591201	23N 57W 19 CCCC1	G–094677	UCF	Q	RM	415640 1035912	4,000	1,219	190	51	190
8F–2	415640103591202	23N 57W 19 CCCC2	G–094677	UCF	Q	RM	415640 1035912	4,000	1,219	30	10	30
8G	415545103575801	23N 57W 32 BBBB1	G–093237	UCF	Q	RM	415545 1035758	4,002	1,220	40	10	40
9B	415944103532901	23N 57W 1 ACBC1	G–093086	UCF	Q	RM	415944 1035329	4,079	1,243	60	40	60
9C	415840103533101	23N 57W 11 DAAA1	G–093088	UCF	Q	RM	415840 1035331	4,030	1,228	37	17	37
9D–1	415722103532401	23N 57W 24 BBBB1	G–093090	UCF	Q	RM	415722 1035324	3,965	1,208	190	50	190
9D–2	415722103532402	23N 57W 24 BBBB2	G–093090	UCF	Q	RM	415722 1035324	3,965	1,208	30	10	30
9E–1	415546103532201	23N 57W 36 BBBB1	G–094680	UCF	CD	RM	415546 1035322	3,978	1,212	50	30	50

Table 2. Well information for ground-water-quality monitoring network, Dutch Flats area, western Nebraska—Continued

Map index number (fig. 2)	U.S. Geological Survey station identification number	Legal description	Well registration number[1]	Hydro-geologic condition	Aquifer type	Well type	Latitude and longitude	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Well depth (ft bls)	Top of screen (ft bls)	Bottom of screen (ft bls)
9E–2	415546103532202	23N 57W 36 BBBB2	G–094680	CF	Q	RM	415546 1035322	3,978	1,212	15	10	15
10A–1	420259103481601	24N 56W 10 CDCA1	G–093089	UCF	BR	RM	420259 1034816	4,190	1,277	100	80	100
10A–2	420259103481602	24N 56W 10 CDCA2	G–093089	UCF	BR	RM	420259 1034816	4,190	1,277	55	20	55
10C	420003103410301	23N 56W 4 AABA1	G–093084	UCF	BR	RM	420003 1034903	4,125	1,257	120	100	120
10D–1	415742103482001	23N 56W 16 DADA1	G–092642	UCF	Q	RM	415742 1034820	3,972	1,211	80	70	80
10D–2	415742103482002	23N 56W 16 DADA2	G–092642	UCF	Q	RM	415742 1034820	3,972	1,211	35	10	35
10E–1	415525103484601	23N 56W 34 BCCB1	G–092645	UCF	Q	RM	415525 1034846	3,941	1,201	212	50	212
10E–2	415525103484602	23N 56W 34 BCCB2	G–092645	UCF	Q	RM	415525 1034846	3,941	1,201	30	10	30
10G–1	415607103484801	23N 56W 28 DAAA1	G–093085	UCF	Q	RM	415607 1034848	3,940	1,201	200	50	200
10G–2	415607103484802	23N 56W 28 DAAA2	G–093085	UCF	Q	RM	415607 1034848	3,940	1,201	30	10	30
10K–1	415817103492401	23N 56W 16 BAAA1	G–101648A	UCF	BR	RM	415817 1034924	4,036	1,230	96.5	81.5	96.5
10M–1	415625103480201	23N 56W 27 ABDC1	G–092644	UCF	Q	RM	415625 1034802	3,948	1,203	115	35	115
10M–2	415625103480202	23N 56W 27 ABDC2	G–092644	UCF	Q	RM	415625 1034802	3,948	1,203	30	10	30
10N–1	415910103493701	23N 56W 09 BABA1	G–101643A	UCF	Q	RM	415910 1034937	4,050	1,234	199	194	199
10N–2	415910103493702	23N 56W 09 BABA2	G–101643B	UCF	Q	RM	415910 1034937	4,050	1,234	60	40	60
1K–94–1 (Kiowa 1–1)	415547103561701	23N 57W 28 DCCC1	G–082124B	UCF	CD	RM	415547 1035617	3,986	1,215	29	28	28.5
1K–94–2 (Kiowa 1–2)	415547103561702	23N 57W 28 DCCC2	G–082124B	UCF	Q	RM	415547 1035617	3,986	1,215	14	13.5	14

Table 2. Well information for ground-water-quality monitoring network, Dutch Flats area, western Nebraska—Continued

Map index number (fig. 2)	U.S. Geological Survey station identification number	Legal description	Well registration number[1]	Hydro-geologic condition	Aquifer type	Well type	Latitude and longitude	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Well depth (ft bls)	Top of screen (ft bls)	Bottom of screen (ft bls)
26K–94–1 (Kiowa 26–1)	415535103554501	23N 57W 28 DDDD1	G–082124C	UCF	Q	RM	415550 1035547	3,981	1,213	18	17.5	18
26K–94–2 (Kiowa 26–2)	415535103554502	23N 57W 28 DDDD2	G–082124C	UCF	Q	RM	415550 1035547	3,981	1,213	16.5	16	16.5
C. Morrill	415816103513201	23N 56W 17 BBBA1	G–093042	CF	CD	RD	415816 1035132	4,050	1,234	300	280	300

[1]Well registration numbers are assigned by the Nebraska Department of Natural Resources.
[2] Brule sand.

Initially three transects were installed in a north-south direction near the center of the study area. Sets of nested wells in a transect are about 1 mi apart. Two sites (2A and 2E) are upgradient of the Interstate Canal; all other sites are in or near areas with active surface-water irrigation and are downgradient from the Interstate Canal. Additional nested wells were installed at approximately 2-mi intervals in the study area.

Analysis of the chemical interaction between surface and ground water requires transects that are parallel to ground-water flow paths, hereinafter referred to as flow paths. Flow paths in the study area are variable. To determine vertical ground-water flow components, nested wells with screens completed at different depths were installed at locations having sufficient saturated thickness. Sufficient saturated thickness was determined by drilling a test hole. Sufficient saturated thickness was defined as areas containing saturated sand and gravel deposits of about 20 ft (feet) or more. In areas containing saturated deposits less than 20 ft thick, a single well was installed.

Four different methods of ground-water site identification were used in this report (table 2). The first method, well identification number/station name, is associated with the transect number for the wells. Each well in a transect was given a 3- or 4-character identification—number, letter, number format. The first number assigned was based on the transect number in which the well was located—first transect (1), second transect (2), and so forth. The letter sequence designated wells farthest north as A, then southward to B, C, and so forth, with some exceptions. Terminal numbers were assigned to monitoring wells in a nest and were based on relative well depth—deepest, -1; medium or intermediate depth, -2 (or shallowest for a two-well nest); and shallowest, -3 (for a three-well nest). Locations containing a single monitoring well were assigned a single terminal number (such as 1F–1) or no terminal number (such as 5D).

The second method is the unique USGS station identification number, which is a 15-character number derived from the international system of latitude and longitude. This number contains no blanks or alphabetic characters and generally is used as a control number. Although the station identification number was derived initially from the site location, the number is a numeric identifier and has no locational significance (Mathey, 1990, p. 2–10). If two or more wells are located within the same second of latitude or longitude, they are distinguished by adding a sequential digit to the number. Sequential numbers are assigned by order of inventory.

The third method, the legal description (fig. 3, table 2), is based on the land subdivisions from the U.S. Bureau of Land Management's survey of Nebraska. The number preceding N (north) indicates the township or tier, the number preceding W (west) indicates the range, and the number preceding the terminal letters indicates the section in which the well is located. The last letters, designated A, B, C, and D, denote the quarter section, the quarter-quarter section, the quarter-quarter-quarter section, and the quarter-quarter-quarter-quarter section. The designation is given in a counterclockwise direction beginning with "A" in the northeast corner of each subdivision. Like the USGS station identification number, if two or more wells are located within the same subdivision, they are distinguished by adding a sequential digit to the well number and are assigned by order of inventory. For example, 24N 57W 15 CBBD1 (fig. 3) would be in township 24 north, range 57 west, section 15, quarter section C, quarter-quarter section B, quarter-quarter-quarter section B, and quarter-quarter-quarter-quarter section D, inventory sequence 1. The fourth method is the well registration number (G–085442), which is assigned by the Nebraska Department of Natural Resources.

Nested-Well Construction

Sixty-nine nested wells were installed for this study between 1995 and 1999 (fig. 2). All nested wells consisted of one to three wells. Each well was constructed of 2.5-in., schedule-40 polyvinyl chloride (PVC) pipe with 0.010-in. slotted PVC well screen. All monitoring wells were installed using direct rotary methods and, in most instances, the deepest well of the nest was completed near or in the bedrock. Occasionally, because of the large size (typically cobbles) or the great thickness of the unconsolidated sediment, the test-hole drillers were unable to reach bedrock. In these instances, the deepest well was assumed to be near bedrock. Two wells (fig. 2, wells 2E–1 and 8C) are completed in the Brule Formation as uncased holes. Lithologic and driller's construction logs, and at some sites, electric logs, were collected at each site. Because bentonite was used to seal each well and bentonite can contain radon and uranium (two of the constituents in the water-quality samples), a test well

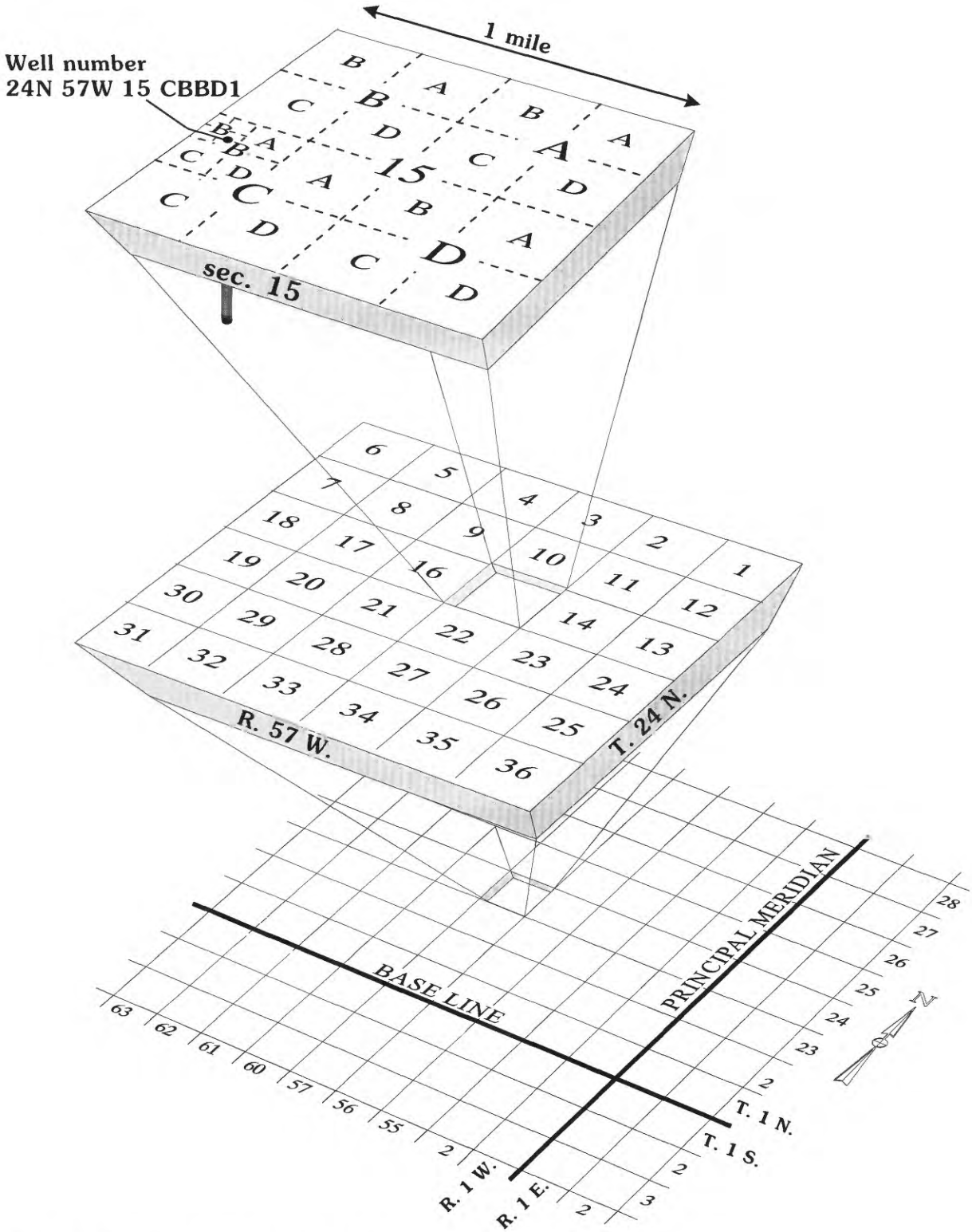

Figure 3. Township-range-section numbering system.

(1B–2) was installed near a typical monitoring-well site (1B–1) to confirm that radon and uranium detections in ground-water samples were from the water and not from the bentonite. The test well was installed using direct-mud-rotary methods without a bentonite seal.

Sample-Collection Procedures

Samples were collected following USGS guidelines to ensure the collection of representative samples. On the basis of wells constructed, the flow of water through the canals, and the information collected the previous years, a yearly sampling scheme was developed. The sampling schemes included the constituents for which samples would be analyzed, a list of the collection sites, and frequency and timing of collection.

Surface-water samples were collected using equal-width increment (EWI) sampling procedures or centroid-of-flow (COF) sampling procedures as described by Wells and others (1990). However, at the wetlands site near Morrill (site SW11, fig. 1), a dip sample was collected. COF samples were collected from both irrigation canal sites (SW1 and SW3, fig. 1). Water in these canals is considered well mixed (Steele and Cannia, 1997). EWI sampling was used at the remainder of the sites where the streamflow was not considered well mixed. All water-quality samples were collected by wading the stream or suspending the sampler by hand from a bridge. Samples subsequently were processed onsite by using protocols similar to those described by Wells and others (1990). Onsite measurements included specific conductance, pH, water and air temperature, and dissolved oxygen.

To obtain a representative ground-water sample, three casing volumes of water were removed from the well prior to the collection of a sample. Physical properties of specific conductance, pH, water temperature, and dissolved oxygen were measured at 5-minute intervals using a flow-through chamber. Samples were collected after these physical property values stabilized or after at least three casing volumes had been pumped out of the well.

Samples to be analyzed for major ions, nitrogen, and radon were collected, preserved, and transported in accordance with the methods described in Pritt and Jones (1990), Wells and others (1990), and Verstraeten and others (1995; 1999). Water samples were processed and preserved onsite and analyzed at various USGS laboratories.

Discharge measurements for the Interstate Canal (site SW1) and Tri-State Canal (site SW3) were obtained from Wyoming Water Control Office personnel in Torrington, Wyoming. Discharge for the North Platte River at Wyoming-Nebraska State line (site SW2) and Horse Creek near Lyman (site SW6), which are active gaging stations, was estimated by using the gage height with the shift indicated by the most recent measurement and the current rating as described by Rantz (1982). Discharges for Dry Sheep Creek (site SW7), Sheep Creek (site SW8), the North Platte River at Morrill (site SW9), and Akers Draw (SW10) and were determined by making streamflow measurements as described by Carter and Davidian (1968) at the time of water-quality sample collection.

A total of 137 samples were collected from the 11 representative surface-water sites. The North Platte River at Morrill (site SW9) was sampled most often, 37 times from 1996 through 1999. In 1999, water samples from surface-water bodies contributing water to the North Platte River in the study area, except the wetlands site (SW11), were collected to evaluate the sources of uranium in surface water (Verstraeten and others, 2001). A total of about 1,960 ground-water samples were collected from 1996 through 1999. The number of samples collected at a specific well varied from 1 at well 2T, constructed in 1999, to 36 at well 1C–3, constructed in 1994.

Analytical Methods

Water samples were analyzed at the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado, and the USGS Dissolved-Gas, Chlorofluorocarbon, Isotope, and Uranium Research Laboratories in Reston, Virginia (table 3).

Major Ions and Nitrogen Species

Analyses of major ions and nitrogen species were completed at the USGS laboratory in Denver, Colorado, using standard methods (Fishman and Friedman, 1989). Major ions were analyzed by inductively coupled plasma emission spectrometry (ICP). Dissolved nitrogen species were analyzed using colorimetric methods within 2 weeks of refrigerated storage, with the exception of a few surface-water samples that were analyzed after several months of

Table 3. Selected water-quality constituents, reporting levels, analytical methods, references for analytical methods, and regulatory levels used for the study, Dutch Flats area, western Nebraska

[PMCL, Primary Maximum Contaminant Level; SMCL, Secondary Maximum Contaminant Level. Analytical method: ICP, inductively coupled plasma; UV, ultraviolet; IR, infrared; GC, gas chromatography; MS, mass spectrometry; AS, alpha particle spectrometry. NA, not applicable; mg/L, milligrams per liter; µg/L, micrograms per liter; pCi/L, picocuries per liter]

Constituents	Reporting level	Analytical method	Regulatory levels[1]
Calcium[2]	0.02 mg/L	ICP	NA
Magnesium[2]	0.004 mg/L	ICP	NA
Sodium[2]	0.1 mg/L	ICP	NA
Potassium[2]	0.1 mg/L	ICP	NA
Sulfate as sulfate[2]	0.1 mg/L	ICP	250 SMCL
Chloride[2]	0.1 mg/L	ICP	250 SMCL
Fluoride[2]	0.1 mg/L	ICP	2.0 SMCL
Silica[2]	0.1 mg/L	ICP	NA
Ammonia as nitrogen[2]	0.2 mg/L	Colorimetry	NA
Nitrite as nitrogen [2]	0.01 mg/L	Colorimetry	1 PMCL
Nitrite plus nitrate as nitrogen[2]	0.05 mg/L	Colorimetry	10 PMCL (nitrate only)
Ammonia and organic nitrogen[2]	0.1 mg/L	Colorimetry	NA
Dissolved and suspended organic carbon[2]	0.2 mg/L	Dohrman UV-promoted persulfate/IR	NA
Carbon dioxide gas[3]	0 mg/L	Head space GC	NA
Iron[2]	10 µg/L	ICP	300 SMCL
Manganese[2]	4.0 mg/L	ICP	50 SMCL
Organic carbon, dissolved[2]	0.33 mg/L	Dohrman UV-promoted persulfate/IR	NA
Nitrogen gas[3]	0 mg/L	Head space GC	NA
Argon gas[3]	0 mg/L	Head space GC	NA
Oxygen gas[3]	0 mg/L	Head space GC	NA
Methane gas[3]	0 mg/L	Head space GC	NA
Uranium concentration[4]	0 ± 0.03 to 0.3 µg/L	ICP/MS or AS	30 MCL
Uranium activity ratio[5]	0 ± 0.01 to 0.10	AS	NA
Radon[6]	70 pCi/L	Scintillation	300 MCL

[1]U.S. Environmental Protection Agency (2000).
[2]Fishman and Friedman (1989).
[3]Method is listed on Internet at http://water.usgs.gov/lab/dissolved.gas/Lab/index.html.
[4]U.S. Environmental Protection Agency (1994) or Thatcher and others (1977).
[5]Thatcher and others (1977).
[6]Whittaker and others (1989).

room-temperature storage by ion chromatography in the USGS laboratory in Reston, Virginia.

Dissolved Gases

Samples to be analyzed for dissolved gases were collected in 125 mL serum bottles with butyl rubber stoppers with no headspace and were sent to the USGS Dissolved-Gas Laboratory in Reston, Virginia. Low-pressure headspace was created in the laboratory by extracting approximately 8 percent of the water. Concentrations of argon, nitrogen, and methane gases were measured by gas chromatography (GC) on the headspace (URL http://water.usgs.gov/lab/dissolved-gas). Results for samples analyzed within 2 months of refrigerated storage were similar to results for samples preserved with potassium hydroxide.

Chlorofluorocarbons

Samples to be analyzed for chlorofluorocarbons (CFCs) were collected in flame-sealed glass ampules under pure nitrogen headspace (Busenberg and Plummer, 1992). CFCs were extracted in the USGS CFC Laboratory in Reston, Virginia, using a purge-and-trap procedure and analyzed by gas chromatogra-

phy (http://water.usgs.gov/lab/cfc). Concentrations of CFC–11, CFC–12, and CFC–113 were converted to equilibrium partial pressures at local water-table altitudes at the equilibration temperatures indicated by argon and nitrogen gas concentrations. The partial pressures were compared to the atmospheric record to determine the apparent year of recharge (Plummer and Busenberg, 1999). Because some of the samples were from wells with long screens, potential effects of mixing were evaluated by comparison with tritium and helium isotope data (Cook and Böhlke, 1999).

Tritium, Helium, and Neon Isotopes

Samples to be analyzed for tritium (^{3}H)/helium-3 (^{3}He) age determination were collected in flow-through copper tubes that were crimp sealed onsite. Helium and neon were extracted for mass spectrometric analysis, then degassed aliquots were re-analyzed after several months to determine ^{3}H concentrations from ^{3}He ingrowth at the Lamont-Doherty Earth Observatory of Columbia University, Noble Gas Laboratory in Palisades, New York (Ludin and others, 1998). The age of each ground-water sample (in years between the time of recharge and time of sampling) was assumed to be equal to the time indicated by decay of ^{3}H to ^{3}He in a closed system after adjustments for atmospheric gas contributions and for excess terrigenic helium (Schlosser and others, 1998) with an assumed ^{3}He/helium-4 (^{4}He) ratio of 2×10^{-8} (Mamyrin and Tolstikhin, 1984). Temperatures used in the age calculations were determined from the concentrations of argon and neon, assuming those gases had only atmospheric sources. Adjustments for terrigenic helium were made only if the apparent concentrations of terrigenic ^{4}He were more than 5 percent of the total ^{4}He concentrations; values less than 5 percent were considered to have large relative uncertainties and result in anomalous age adjustments. Further adjustments for mixing of old and young water components commonly were made using samples from wells with long open intervals or with screens that intersect the water table, especially in fractured rock aquifers (such as Plummer and others, 1999). In the current study, most of the wells had relatively short screens at discrete depths in the alluvial aquifer where stable isotope data indicated that mixing of water from different sources was not widespread. Some of the ^{3}H/ ^{3}He and CFC data from wells with long screens near the water table were evaluated assuming piston flow (no mixing), or binary, linear, or exponential mixtures (Vogel, 1967; Cook and Böhlke, 1999; Plummer and others, 1999).

Hydrogen and Oxygen Isotopes in Water

Samples to be analyzed for hydrogen and oxygen isotopes in water were collected in 60-mL glass bottles. At the USGS Stable Isotope Laboratory in Reston, Virginia, 2-mL aliquots were equilibrated with either hydrogen (for hydrogen isotopes) or carbon dioxide (for oxygen isotopes), which then were admitted to dedicated dual-inlet mass spectrometers. Hydrogen and oxygen isotope analyses were calibrated against analyses of laboratory reference water with known δ^2H and δ^{18}O values normalized to standard values of 0 and 0 for hydrogen and oxygen, respectively, in VSMOW (Vienna-Standard Mean Ocean Water), and -428 and -55.5 for hydrogen and oxygen, respectively, in SLAP (Standard Light Antarctic Precipitation) (Coplen, 1988). The data were evaluated by comparison to the "meteoric water line", $\delta^2H = 8 * \delta^{18}O$ + d-excess (Craig, 1961; Dansgaard, 1964; International Atomic Energy Agency, 1981). Although the global average d-excess value in precipitation is +10, local precipitation may have different values of d-excess, and evaporation may produce arrays of values with slopes less than 8, or lower apparent values of d-excess (Gonfiantini, 1986; International Atomic Energy Agency, 1992).

Nitrogen Isotopes in Nitrate and Dissolved Nitrogen Gas

Samples to be analyzed for isotopes of nitrate were collected in 1 L plastic bottles and frozen. At the USGS Stable Isotope Laboratory, Reston, Virginia, aliquots were freeze dried at high pH, then loaded into pure silica glass tubes with CaO and Cu_2O; the tubes were evacuated, sealed, baked at 850 °C, and cooled slowly (Böhlke and Denver, 1995). Purified N_2 gas in the tubes was expanded into a dual inlet mass spectrometer and analyzed along with gas produced from dissolved nitrate standards prepared and analyzed as aqueous samples. Nitrate δ^{15}N data were normalized to standard values of +4.7 for International Atomic Energy Agency (IAEA)-N3 and +180.0 for USGS-32 (Böhlke and Coplen, 1995). For nitrogen isotope analysis of dissolved N_2, the headspace gases remaining after gas chromatographic analysis at the USGS Dissolved Gas Laboratory in Reston, Virginia, were sealed into evaculated glass tubes with CaO and Cu_2O,

baked, cooled slowly, then admitted to the mass spectrometer and analyzed along with air samples ($\delta^{15}N = 0$) and with headspace samples from laboratory-equilibrated water samples ($\delta^{15}N = +0.65 \pm 0.10$). The overall accuracy and precision of the N_2 isotope analyses were estimated to be approximately ± 0.2 or better for nitrate and ± 0.1 or better for N_2 (Böhlke and Coplen, 1995).

Uranium and Uranium Activity Ratios

Water samples to be analyzed for dissolved uranium were collected in polyethylene bottles, filtered, and acidified. Two different techniques were used to analyze for uranium concentrations and the uranium isotopic ratio $^{234}U/^{238}U$ or uranium activity ratio (UAR). The two techniques, alpha particle spectroscopy (AS) and ICP/mass spectrometry (MS), were performed at the USGS Uranium Research Laboratory in Reston, Virginia. To analyze the dissolution of uranium from sediment samples, a representative 1-g sample was leached for about 24 hours in 500 mL distilled water containing 0.5 g sodium bicarbonate.

For AS analyses, a 500-mL aliquot was taken, spiked with uranium-232 (^{232}U), processed by iron hydroxide precipitation and anion-ion exchange, and then electroplated onto a stainless-steel planchette for counting, using a solid-state, partially depleted silicon detector (Ivanovich and Murray, 1992). The second method, using ICP/MS, was developed during the course of this investigation and allowed a more precise determination of uranium and UAR values on a smaller volume of sample (Thomas F. Kraemer and Michael W. Doughton, U.S. Geological Survey, written commun., 2000) than AS. In this method, uranium concentrations in the sample were determined first using uranium-236 (^{236}U) as an internal standard. Upon determining the concentration, a measured volume of sample was selected for $^{234}U/^{238}U$ analysis that would produce acceptable ICP/MS performance. The volume of water was evaporated to dryness and redissolved in a 8N (normal) hydrochloric acid (liquid phase) solution. The uranium then was separated by a simple anion-exchange procedure. The uranium was eluted into a 30-mL bottle with 0.1N hydrogen chloride and distilled water, which then was injected into the ICP/MS unit using an ultrasonic nebulizer. Precision and accuracy for the uranium analyses by AS were approximately 3 percent and, for UAR by AS, were 5 to 7 percent. Using the ICP/MS technique, the precision and accuracy were less than 1 and 0.5 percent, respectively.

Calculation of Recharge Temperatures, Excess Air, and Excess Nitrogen in Ground Water

The apparent recharge temperature and amount of excess air were calculated for each sample from the concentrations of argon and neon by assuming two dissolved-gas components (Aeschbach-Hertig and others, 1999; Stute and Schlosser, 1999): (1) from air equilibration at the altitude of the water table and 100 percent relative humidity; and (2) from unfractionated excess air introduced during recharge or sampling. This calculation was done for each sample by solving iteratively an equation relating the measured concentrations of argon and neon to a common equilibration temperature and excess air quantity:

$$\text{Excess air ccSTP/L} = \{[Ar]_{measuared} - [Ar(T,elev)]_{asw}\}/$$
$$0.417\mu mol_{Ar}/cc_{air} = \{[Ne]_{meas} - [Ne(T,elev)]_{asw}\}/$$
$$0.000811\ (\mu mol_{Ne})/cc_{air}\ , \qquad (1)$$

where

ccSTP/L is cubic centimeters per liter at standard temperature and pressure;

$[Ar,Ne]_{meas}$ is the measured concentration of argon or neon in the sample (in micromoles per liter (µmol/L); and

$[Ar,Ne(T,elev)]_{asw}$ is the concentration of argon or neon in air-saturated water at the temperature and altitude of the water table (calculated using argon and neon solubility data from Weiss, 1970, 1971).

For comparison with the argon and neon data, the apparent recharge temperature and amount of excess air also were calculated similarly for each sample from the concentrations of argon and nitrogen, with nitrogen solubility data from Weiss (1970). For samples with relatively high oxygen concentrations, recharge temperatures and excess air quantities calculated from argon and neon data and from argon and nitrogen data generally were in agreement to within the uncertainty of the methods. However, for some of the samples with low oxygen concentrations (less than 50 µmol/L),

there was disagreement between the two calculations that could be accounted for by assuming that the oxygen-depleted samples contained an additional nonatmospheric component of nitrogen.

Therefore, concentrations of excess nitrogen were calculated for each sample by using the recharge temperature and excess air values derived from argon and neon data:

$$\text{Excess } N_2 \text{ in } \frac{\mu\text{mol}}{\text{L}} = [N_2]\text{meas} - [N_2(\text{T,elev})]_{\text{asw}} - [\text{Excess air in ccSTP/L}] * 34.8\ \mu\text{mol } N_2/cc_{\text{air}} . \quad (2)$$

Results indicate that the practical detection limit for excess nitrogen was approximately 18 µmol/L.

Quality Assurance and Quality Control

USGS onsite and laboratory quality-assurance (QA) and quality-control (QC) guidelines were followed throughout this study. These guidelines are necessary to assess whether or not contamination occurred and, if present, whether it occurred onsite or in the laboratory. Therefore, 134 QC samples (6.5 percent of the total 2,092 samples) were collected. QC samples collected onsite included 58 equipment blanks, 75 duplicates, and 1 spiked sample (Inorganic PotableWatR™, Lot No. 3423). Each USGS laboratory follows stringent QA/QC procedures, dependent on the analytical method used for chemical analysis. In addition, cation-anion balances of all samples analyzed for major ions were checked by comparing them.

ANALYTICAL RESULTS

This section lists selected analytical results not published in previous USGS reports (tables 4 through 7). Specifically, dissolved gases, age-dating data, and other isotopes collected as part of an intensive sampling effort in August and November 1998 and all uranium and uranium isotope data collected through the course of this study (1995 to 1999) have been included in these tables.

With respect to QA/QC of the cation/anion balances, all samples were rated as acceptable because they were within 10 percent of each other. Analytical results of equipment blanks for major ions and nitrate concentrations generally were acceptable. Nitrate concentrations in blank samples varied from less than the detection level of 0.05 mg/L as nitrogen (26 of 58 samples or 45 percent) to 0.30 mg/L as nitrogen. All but two blank samples had concentrations less than 0.10 mg/L as nitrogen.

The differences in nitrate concentrations between the 60 environmental samples and their duplicate samples varied from 0 (0 percent) to 5.0 mg/L (38 percent) with a median of 0.19 mg/L (1.7 percent). All but one set of replicate samples had a difference in concentration less than 0.50 mg/L, with larger differences generally observed at larger nitrate concentrations. A Wilcoxon rank-sum test indicated that these differences were not statistically significant (60 sets of replicates with p-value of 0.6782). Using a 95-percent confidence interval, p-values of 0.05 or less indicate that the medians of the populations being considered are significantly different. The nitrate concentration in the spiked reference sample was 7.6 mg/L instead of the expected 7.5 mg/L, a difference of 1.4 percent, or 0.10 mg/L. This analytical result is well within the acceptable performance limit for nitrate.

To investigate whether the use of bentonite in well-construction materials would affect the chemistry of the ground-water samples, especially the amounts of radon and uranium, well 1B–2 was sampled twice (generally within 0.5 hour) when well 1B–1 was sampled. Samples from these two wells were analyzed for radon (two samples), uranium (one sample), and nitrate (two samples) among other constituents, depending upon the particular sample collection. Comparison of the water chemistry between well 1B–1 and well 1B–2 indicated that well construction with bentonite did not affect the activity of radon present in the water. The differences in analytical results for radon were 16 (5 percent) and 53 (15 percent) pCi/L, both less than or near the analytical error of two standard deviations of 22 and 21 pCi/L, respectively. The differences in uranium concentrations were 0.9 µg/L or 6 percent. The differences in nitrate concentrations were 0.61 (19 percent) and 0.49 mg/L (5 percent). These results indicate that the use of bentonite in well construction did not affect the ground-water chemistry of the samples collected, but that small variations in ground-water chemistry can occur over short distances.

Table 4. Water temperature, dissolved oxygen, and dissolved-gas concentrations, and calculated recharge temperature, excess air, and excess nitrogen in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998 through 1999

[mo, month; d, day; yr, year; °C, degrees Celsius; mg/L, milligrams per liter; µM/L, micromoles per liter; ft, feet; m, meters; ccSTP/L, cubic centimeters per liter at standard temperature and pressure (for gases, this means 0 °C and 1 atmosphere); --, no data]

				Dissolved gases								
Map index number (figs. 1 and 2)	Sample date (mo/ d/yr)	Water temper-ature (°C)	Dis-solved oxygen, (mg/L)	Nitrogen, N_2 (mg/L)	Argon, Ar (mg/L)	Carbon dioxide, CO_2 (mg/L)	Methane, CH_4 (mg/L)	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Recharge tempera-ture (°C)	Excess air from argon and neon (ccSTP/L)	Excess nitrogen from argon, neon, and nitro-gen (µM/L)
Surface-water samples												
SW1	8/25/98	21.7	--	12.34	0.456	4.28	0	4,020	1,255	22.9	0.3	-2
SW3	8/25/98	21.2	7.1	12.83	.474	6.18	0	4,010	1,222	21.1	.3	0
(field duplicate)	8/25/98	21.2	7.1	12.99	.476	6.02	0	4,010	1,222	--	--	--
SW9	8/25/98	20.2	7.5	13.34	.494	6.92	0	3,972	1,211	19.2	.2	-1
	9/1/98	21.5	--	13.25	.493	6.89	0	3,982	1,214	--	--	--
(field duplicate)	9/1/98	21.5	--	13.24	.491	6.70	0	3,982	1,214	--	--	--
	11/12/98	--	13.9	18.71	.682	9.13	0	3,972	1,211	4.9	.4	23
(field duplicate)	11/12/98	--	13.9	18.53	.681	9.26	0	3,972	1,211	--	--	--
Ground-water samples												
1A–1	8/28/98	20.5	6.2	14.55	.526	11.8	0	4,205	1,282	18.6	2.1	-22
1A–3	8/27/98	18.0	7.5	15.63	.572	11.4	0	4,205	1,282	14.4	2.2	-25
1B–1	9/2/98	14.0	7.9	15.12	.552	22.6	0	4,162	1,269	14.4	1.0	-1
1C–1	8/24/98	14.5	10.0	16.04	.570	8.87	0	4,139	1,262	14.4	2.0	-4
1C–2	8/27/98	15.0	14.5	16.22	.570	13.7	0	4,139	1,262	14.8	2.3	-4
1C–3	8/24/98	14.2	12.8	16.52	.582	20.6	0	4,139	1,262	13.0	1.7	-8
1D–1	9/2/98	14.5	4.8	17.93	.616	9.63	0	4,100	1,250	12.6	3.4	-6
1D–2	9/2/98	16.0	5.0	16.58	.576	13.8	0	4,100	1,250	14.8	2.6	-4
1E–1	8/24/98	14.0	6.1	17.93	.615	9.80	0	4,094	1,248	12.6	3.4	-4
1E–2	8/24/98	14.0	7.1	17.01	.599	17.5	0	4,094	1,248	12.5	2.4	-4
1E–3	8/24/98	13.5	7.0	17.62	.616	25.2	0	4,094	1,248	12.2	3.1	-11
1F–1	9/1/98	15.0	7.3	15.87	.580	28.1	0	4,080	1,244	12.8	1.4	-8

Table 4. Water temperature, dissolved oxygen, and dissolved-gas concentrations, and calculated recharge temperature, excess air, and excess nitrogen in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Water temperature (°C)	Dissolved oxygen, (mg/L)	Dissolved gases: Nitrogen, N_2 (mg/L)	Dissolved gases: Argon, Ar (mg/L)	Dissolved gases: Carbon dioxide, CO_2 (mg/L)	Dissolved gases: Methane, CH_4 (mg/L)	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Recharge temperature (°C)	Excess air from argon and neon (ccSTP/L)	Excess nitrogen from argon, neon, and nitrogen (μM/L)
					Ground-water samples—Continued							
1G–1	8/27/98	14.0	7.3	15.48	0.573	27.9	0	4,016	1,224	13.3	1.3	-12
1G–3	8/27/98	12.5	5.6	15.90	.580	26.4	0	4,016	1,224	12.7	1.3	-4
1H–1	9/1/98	15.0	.3	20.57	.615	8.27	0	3,990	1,216	13.8	4.2	74
1H–2	9/1/98	14.5	6.6	19.19	.618	14.5	0	3,990	1,216	16.4	6.1	-18
1I–1	8/28/98	12.5	2.3	18.52	.610	20.8	0	3,991	1,216	16.1	5.4	-21
1I–3	8/28/98	11.5	1.4	17.86	.608	27.6	0	3,991	1,216	12.2	2.5	16
1J–1	9/1/98	15.5	1.1	17.38	.586	11.7	0	3,992	1,217	14.2	2.7	15
	11/12/98	--	1.3	18.44	.586	11.6	0	3,992	1,217	14.2	2.9	48
1J–2	9/1/98	15.0	3.0	16.53	.566	24.7	0	3,992	1,217	15.2	2.2	12
	11/12/98	--	.1	17.19	.578	25.0	0	3,992	1,217	--	--	--
1J–3	9/1/98	14.0	3.0	16.05	.574	31.2	0	3,992	1,217	13.4	1.3	6
	11/12/98	--	4.4	16.41	.577	32.1	0	3,992	1,217	--	--	--
1L–1	8/25/98	12.0	.1	19.07	.611	12.7	0	3,980	1,213	11.8	2.3	61
1L–2	8/25/98	12.0	.1	17.87	.604	19.0	0	3,980	1,213	13.6	3.3	4
1L–3	8/25/98	12.5	0	16.61	.576	48.5	0	3,980	1,213	--	--	--
1M–1	8/31/98	14.0	4.8	16.21	.565	11.2	0	4,110	1,253	15.3	2.3	-1
1M–2	8/31/98	14.0	7.3	16.63	.589	30.3	0	4,110	1,253	13.0	2.1	-3
1M–3	8/31/98	13.5	4.5	18.04	.611	42.7	0	4,110	1,253	--	--	--
2A–1	8/26/98	14.0	8.4	16.09	.581	11.2	0	4,225	1,288	14.8	3.0	-34
2B–1	8/26/98	15.0	8.1	15.37	.565	9.21	0	4,202	1,281	13.0	.8	0
2B–2	8/26/98	17.0	6.6	14.41	.520	9.05	0	4,202	1,281	18.0	1.4	-7
2B–3	8/26/98	18.0	8.4	14.75	.518	8.90	0	4,202	1,281	19.3	2.1	-7

Table 4. Water temperature, dissolved oxygen, and dissolved-gas concentrations, and calculated recharge temperature, excess air, and excess nitrogen in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Water temperature (°C)	Dissolved oxygen, (mg/L)	Dissolved gases: Nitrogen, N_2 (mg/L)	Dissolved gases: Argon, Ar (mg/L)	Dissolved gases: Carbon dioxide, CO_2 (mg/L)	Dissolved gases: Methane, CH_4 (mg/L)	Land-surface altitude (ft above sea level)	Land-surface altitude (m above sea level)	Recharge temperature (°C)	Excess air from argon and neon (ccSTP/L)	Excess nitrogen from argon, neon, and nitrogen (μM/L)
					Ground-water samples—Continued							
2D–1	8/27/98	12.5	5.1	16.28	0.567	9.10	0	3,991	1,216	15.5	2.6	-6
2D–2	8/27/98	15.5	4.7	15.57	.549	15.9	0	4,137	1,261	16.1	1.9	0
2D–3	8/27/98	14.5	6.8	16.42	.577	27.9	0	4,137	1,261	14.0	2.2	0
2E–1	8/26/98	13.5	7.3	16.08	.582	6.66	0	4,248	1,295	12.2	1.3	0
2H–1	9/1/98	14.5	9.5	15.68	.568	28.3	0	4,010	1,222	14.2	1.6	-9
2H–2	9/1/98	14.0	5.4	17.00	.588	28.4	0	4,010	1,222	14.1	2.8	-2
2J–1	8/31/98	14.0	.1	16.02	.545	9.30	0	3,995	1,218	16.4	1.8	21
2J–2	8/31/98	13.5	1.0	16.75	.588	19.3	0	3,995	1,218	13.5	2.3	-1
2J–3	8/31/98	13.5	4.6	16.52	.593	33.3	0	3,995	1,218	12.1	1.6	1
2L–1	9/2/98	12.5	.1	17.49	.605	12.7	0	3,982	1,214	10.7	1.2	33
2L–2	9/2/98	12.0	0	17.24	.591	20.5	0	3,982	1,214	13.1	2.2	17
2T	7/13/99	14.0	.2	21.99	.584	.03	8.315	4,100	1,250	12.3	1.2	212
6I	8/26/98	12.0	1.4	17.84	.618	3.63	0	4,054	1,236	12.1	3.1	-4
7A–1	8/23/99	14.8	5.5	18.13	.623	5.73	0	4,196	1,279	13.8	4.8	2
10K–1	7/13/99	20.0	7.7	18.88	.642	5.45	.0196	4,100	1,250	11.5	4.0	-8
1K–94–1	8/25/98	18.0	.3	16.85	.568	9.19	.0112	3,986	1,215	11.8	-.5	74
1K–94–2	8/25/98	18.0	.3	16.50	.558	9.14	.0114	3,986	1,215	--	--	--
26K–94–1	9/1/98	13.0	.1	20.62	.681	36.7	.3245	3,987	1,215	7.0	2.4	53
26K–94–2	9/1/98	13.0	.1	20.58	.680	36.8	.3199	3,987	1,215	--	--	--
C. Morrill	8/31/98	17.5	0	22.62	.662	3.36	.9598	4,050	1,234	5.9	.3	185

Table 5. Nitrogen, hydrogen, oxygen, and helium isotopes in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998 through 1999

[mo, month; d, day; yr, year; ft, feet; m, meter; δ, delta–the difference relative to the standard, in parts per thousand; per mil, parts per thousand; TU, tritium unit; ccSTP/g, cubic centimeters per gram at standard temperature and pressure (for gases, this means 0 degrees Celsius and 1 atmosphere); H_2O, water; %, percent; $^3H^o$, initial tritium (equals ^3H plus tritiogenic helium ^3He); --, no data; >, greater than]

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Water-table altitude (ft)	Water-table altitude (m)	Nitrate, $\delta^{15}N$-NO_3^- (per mil)	Water, δ^2H-H_2O (per mil)	Water, $\delta^{18}O$-H_2O (per mil)	^3H (TU) from tube (±2%)	^3H (TU) from bottle (± 2%)	^3H (TU) used for age (±2%)	Neon, Ne (total) (ccSTP/g) (±1%)	^4He (total) (ccSTP/g) (±2%)	δ^3He in-growth corrected (%)	$\pm\delta^3He$ in-growth corrected (%)
Surface-water samples													
SW1	8/25/98	4,209	1,283	--	-115.0	-14.28	13.2	12.6	13.2	1.60×10^{-7}	3.96×10^{-8}	-2.3	0.4
SW3	8/25/98	4,006	1,221	8.21	-112.5	-14.02	15.4	15.9	15.4	1.64×10^{-7}	4.00×10^{-8}	-2.4	.3
SW9	8/25/98	3,973	1,211	7.70	-111.4	-13.72	--	17.9	17.9	1.65×10^{-7}	4.05×10^{-8}	.3	.3
	11/12/98			7.70	-111.6	-13.75	24.2	24.2	24.2	1.90×10^{-7}	4.35×10^{-8}	- .2	.2
Ground-water samples													
1A-1	8/28/98	4,134	1,260	--	-119.2	-14.60	11.7	12.1	11.7	1.99×10^{-7}	1.18×10^{-7}	-48.8	.4
1A-3	8/27/98	4,134	1,260	--	-117.4	-14.74	13.0	12.9	13.0	2.06×10^{-7}	4.99×10^{-8}	-1.6	.4
1B-1	9/2/98	4,111	1,253	4.63	-118.6	-14.70	12.6	13.1	12.6	1.84×10^{-7}	4.43×10^{-8}	- .5	.3
1C-1	8/24/98	4,098	1,249	4.46	-110.3	-13.71	11.6	11.0	11.6	2.03×10^{-7}	6.26×10^{-8}	9.6	.4
1C-2	8/27/98	4,098	1,249	4.15	-113.5	-14.01	13.1	13.6	13.1	2.08×10^{-7}	5.64×10^{-8}	7.0	.4
1C-3	8/24/98	4,098	1,249	3.60	-111.2	-13.68	14.9	14.4	14.9	2.00×10^{-7}	5.10×10^{-8}	6.0	.4
1D-1	9/2/98	4,088	1,246	5.70	-118.4	-14.83	--	48.6	48.6	2.32×10^{-7}	1.07×10^{-7}	261.9	.3
1D-2	9/2/98	4,088	1,246	3.11	-117.8	-14.47	31.3	32.4	31.3	2.14×10^{-7}	5.67×10^{-8}	206.0	.3
1E-1	8/24/98	4,075	1,242	4.08	-118.3	-14.57	79.0	81.8	79.0	2.31×10^{-7}	8.95×10^{-8}	727.7	.8
1E-2	8/24/98	4,075	1,242	2.67	-116.7	-14.36	37.3	36.6	37.3	2.13×10^{-7}	5.39×10^{-8}	259.1	.4
1E-3	8/24/98	4,075	1,242	2.94	-113.3	-14.10	18.1	18.3	18.1	2.27×10^{-7}	5.59×10^{-8}	19.3	.3
1F-1	9/1/98	4,058	1,237	3.67	-115.0	-14.16	12.9	13.2	12.9	1.95×10^{-7}	4.65×10^{-8}	- .9	.4
1G-1	8/27/98	4,012	1,223	2.53	-114.3	-14.11	15.8	--	15.8	1.92×10^{-7}	4.74×10^{-8}	4.8	.4
1G-3	8/27/98	4,012	1,223	2.42	-113.8	-14.01	15.3	15.5	15.3	1.93×10^{-7}	4.69×10^{-8}	8.1	.4

Table 5. Nitrogen, hydrogen, oxygen, and helium isotopes in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998 through 1999--Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Water-table altitude (ft)	Water-table altitude (m)	Nitrate, $\delta^{15}N$-NO_3^- (per mil)	Water, δ^2H-H_2O (per mil)	Water, $\delta^{18}O$-H_2O (per mil)	^3H (TU) from tube (±2%)	^3H (TU) from bottle (± 2%)	^3H (TU) used for age (±2%)	Neon, Ne (total) (ccSTP/g) (±1%)	^4He (total) (ccSTP/g) (±2%)	δ^3He in-growth corrected (%)	$\pm\delta^3He$ in-growth corrected (%)
Ground-water samples—Continued													
1H-1	9/1/98	3,980		11.51	-114.0	-14.37	25.5	27.0	25.5	2.44×10^{-7}	2.14×10^{-7}	13.4	0.3
1H-2	9/1/98	3,980		3.98	-113.3	-13.90	19.3	19.2	19.3	2.76×10^{-7}	7.25×10^{-8}	15.7	.3
1I-1	8/28/98	3,983		1.95	-112.2	-13.79	27.9	18.9	18.9	2.63×10^{-7}	7.58×10^{-8}	31.8	.4
1I-3	8/28/98	3,983		2.03	-112.4	-13.90	16.9	16.6	16.9	2.17×10^{-7}	5.27×10^{-8}	10.2	.4
1J-1	9/1/98	3,976		5.41	-112.8	-13.84	24.0	24.6	24.0	2.17×10^{-7}	7.23×10^{-8}	16.5	.4
1J-1	11/12/98	3,976		5.36	-111.3	-13.78	24.5	25.6	24.5	2.20×10^{-7}	7.39×10^{-8}	14.2	.2
1J-2	9/1/98	3,976		3.83	-108.0	-13.25	19.9	20.1	19.9	2.06×10^{-7}	4.95×10^{-8}	36.6	.3
1J-2	11/12/98	3,976		3.65	-108.1	-13.25	20.1	20.0	20.1	--	--	--	--
1J-3	9/1/98	3,976		3.31	-113.4	-13.89	17.7	17.7	17.7	1.93×10^{-7}	4.51×10^{-8}	8.0	.4
1J-3	11/12/98	3,976		3.01	-111.8	-13.91	16.4	17.3	16.4	--	--	--	--
1L-1	8/25/98	3,970		10.20	-114.5	-14.14	--	40.0	40.0	2.17×10^{-7}	6.31×10^{-8}	225.2	.3
1L-2	8/25/98	3,970		7.98	-113.6	-14.06	39.7	39.7	39.7	2.29×10^{-7}	1.94×10^{-7}	-36.3	..4
1L-3	8/25/98	3,970		--	-112.1	-13.80	33.0	32.8	32.8	--	--	--	--
1M-1	8/31/98	4,094		5.37	-118.2	-14.57	29.5	27.4	27.4	2.07×10^{-7}	5.56×10^{-8}	145.0	.3
1M-2	8/31/98	4,094		4.10	-111.5	-13.67	15.5	--	15.5	2.08×10^{-7}	4.93×10^{-8}	18.5	.4
1M-3	8/31/98	4,094		2.98	-112.7	-13.84	14.6	13.7	13.7	--	--	--	--
2A-1	8/26/98	4,137		3.30	-108.5	-13.89	--	6.3	6.3	2.20×10^{-7}	6.30×10^{-8}	-10.1	.4
2B-1	8/26/98	4,134		3.75	-107.1	-13.50	4.3	3.8	4.3	1.83×10^{-7}	5.84×10^{-8}	-23.3	.4
2B-2	8/26/98	4,134		6.07	-117.8	-14.61	12.4	13.1	13.1	1.87×10^{-7}	4.62×10^{-8}	-2.1	.4
2B-3	8/26/98	4,134		--	-117.4	-14.53	12.9	13.2	12.9	1.97×10^{-7}	5.78×10^{-8}	-11.1	.8

Table 5. Nitrogen, hydrogen, oxygen, and helium isotopes in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998 through 1999--Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Water-table altitude (ft)	Water-table altitude (m)	Nitrate, $\delta^{15}N$-NO_3^- (per mil)	Water, δ^2H-H_2O (per mil)	Water, $\delta^{18}O$-H_2O (per mil)	^3H (TU) from tube (±2%)	^3H (TU) from bottle (± 2%)	^3H (TU) used for age (±2%)	Neon, Ne (total) (ccSTP/g) (±1%)	^4He (total) (ccSTP/g) (±2%)	δ^3He in-growth corrected (%)	$\pm\delta^3He$ in-growth corrected (%)
					Ground-water samples—Continued								
2D-1	8/27/98	4,104		4.87	-117.4	-14.82	--	25.4	25.4	$2.12x10^{-7}$	$6.76x10^{-8}$	126.1	0.3
2D-2	8/27/98	4,104		5.61	-117.4	-14.28	21.1	19.5	21.1	$1.98x10^{-7}$	$5.00x10^{-8}$	65.0	.3
2D-3	8/27/98	4,104		5.71	-113.3	-14.02	17.1	16.1	17.1	$2.06x10^{-7}$	$4.99x10^{-8}$	9.0	.4
2E-1	8/26/98	4,216		3.96	-110.7	-14.61	--	4.5	4.5	$1.92x10^{-7}$	$6.18x10^{-7}$	-90.0	.4
2H-1	9/1/98	4,014		- .47	-113.8	-14.12	14.5	14.7	14.5	$1.97x10^{-7}$	$5.09x10^{-8}$	2.8	.3
2H-2	9/1/98	4,014		- .54	-113.8	-14.05	14.7	14.0	14.7	$2.18x10^{-7}$	$5.43x10^{-8}$	2.6	.4
2J-1	8/31/98	3,980		4.91	-112.5	-13.85	24.2	23.7	24.2	$1.96x10^{-7}$	$5.84x10^{-8}$	69.3	.3
2J-2	8/31/98	3,980		3.90	-111.3	-13.70	25.6	24.3	25.6	$2.10x10^{-7}$	$5.12x10^{-8}$	54.7	.4
2J-3	8/31/98	3,980		2.34	-112.0	-13.62	19.1	18.5	19.1	$1.99x10^{-7}$	$4.64x10^{-8}$	12.5	.4
2L-1	9/2/98	3,976		11.19	-114.6	-14.28	30.4	--	30.4	$1.95x10^{-7}$	$1.62x10^{-7}$	5.4	.2
2L-2	9/2/98	3,976		5.60	-115.4	-14.17	35.1	35.1	35.1	$2.08x10^{-7}$	$8.97x10^{-8}$	86.8	.3
2T	7/13/99	3,970		3.47	-108.3	-13.90	--	17.0	17.0	--	--	--	--
6I	8/26/98	4,045		5.35	-107.0	-13.07	--	24.9	24.9	$2.27x10^{-7}$	$8.01x10^{-8}$	9.5	.4
7A-1	8/23/99	4,173		4.45	-113.7	-14.39	23.3	24.4	23.3	$2.55x10^{-7}$	$1.32x10^{-7}$	75.6	--
10K-1	7/13/99	3,967		3.00	-92.4	-11.68	3.5	4.5	3.5	$2.45x10^{-7}$	$6.42x10^{-7}$	-99.9	--
1K-94-1	8/25/98	3,976		--	-106.9	-13.61	.4	.2	.4	$1.62x10^{-7}$	$1.55x10^{-6}$	-97.1	.3
26K-94-1	9/1/98	3,973		--	-100.7	-12.09	21.6	21.7	21.6	$2.24x10^{-7}$	$5.67x10^{-8}$	2.7	.3
C. Morrill	8/31/98	4,003		--	-109.0	-14.33	.1	.2	0.1	$1.74x10^{-7}$	--	--	--

Table 5. Nitrogen, hydrogen, oxygen, and helium isotopes in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998--Continued

Map index number (figs. 1 and 2)	Sample date (month/ day/yr)	Uncorrected for terrigenic helium				Corrected for terrigenic helium					Selected age for interpretation
		^{3}He, tritogenic (TU)	^{3}H/^{3}He age (yr)	±^{3}H/^{3}He age (yr)	^{3}H° (TU)	^{4}He, terrigenic (ccSTP/g)	^{4}He, terrigenic (% of total He)	^{3}He, tritiogenic (TU)	^{3}H/^{3}He age (yr)	^{3}H° (TU)	
Surface-water samples											
SW1	8/25/98	-0.2	-0.2	0.1	13.0	7.77×10^{-11}	0	-0.2	-0.3	13..0	-0.2
SW3	8/25/98	-.2	- .2	.1	15.2	-2.16×10^{-10}	-1	-.4	- .5	15.0	-.2
SW9	8/25/98	.4	.4	.1	18.3	6.12×10^{-10}	2	.7	.6	18.5	.4
	11/12/98	.3	.3	.1	24.5	4.68×10^{-10}	1	.5	.3	24.7	.3
Ground-water samples											
1A-1	8/28/98	-31.8	--	--	--	6.85×10^{-8}	58	5.7	7.1	17.4	7.1
1A-3	8/27/98	-.1	- .1	.2	12.9	-6.40×10^{-10}	-1	-.5	-.8	12.5	-.1
1B-1	9/2/98	.2	.3	.1	12.9	4.57×10^{-11}	0	.2	.2	12.8	.3
1C-1	8/24/98	3.7	5.0	.2	15.3	1.28×10^{-8}	21	10.6	11.7	22.2	11.7
1C-2	8/27/98	2.6	3.2	.2	15.7	5.25×10^{-9}	9	5.3	6.1	18.5	6.1
1C-3	8/24/98	2.1	2.3	.1	17.0	2.56×10^{-9}	5	3.4	3.7	18.3	3.7
1D-1	9/2/98	156.6	25.8	.3	205.2	4.97×10^{-8}	46	183.7	28.1	232.3	28.1
1D-2	9/2/98	65.4	20.2	.3	96.7	3.73×10^{-9}	7	67.3	20.6	98.6	20.6
1E-1	8/24/98	362.6	30.9	.2	441.6	3.23×10^{-8}	36	380.2	31.6	459.2	31.6
1E-2	8/24/98	78.1	20.2	.3	115.4	1.85×10^{-9}	3	79.0	20.4	116.3	20.2
1E-3	8/24/98	6.4	5.4	.1	24.4	1.77×10^{-11}	0	6.3	5.3	24.3	5.4
1F-1	9/1/98	.1	.2	.1	13.0	-4.97×10^{-10}	-1	-.2	- .3	12.7	.2
1G-1	8/27/98	1.6	1.8	.1	17.4	1.34×10^{-9}	3	2.3	2.4	18.1	1.8
1G-3	8/27/98	2.5	2.7	.1	17.8	7.03×10^{-10}	1	2.8	3.0	18.0	2.7

Table 5. Nitrogen, hydrogen, oxygen, and helium isotopes in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998--Continued

Map index number (figs. 1 and 2)	Sample date (month/ day/yr)	Uncorrected for terrigenic helium				Corrected for terrigenic helium					Selected age for interpre-tation
		^{3}He, trito-genic (TU)	^{3}H/^{3}He age (yr)	±^{3}H/^{3}He age (yr)	^{3}H° (TU)	^{4}He, terrigenic (ccSTP/g)	^{4}He, terri-genic (% of total He)	^{3}He, tritio-genic (TU)	^{3}H/^{3}He age (yr)	^{3}H° (TU)	
Ground-water samples—Continued											
1H-1	9/1/98	16.3	8.9	0.3	41.8	$1.52x10^{-7}$	71	99.8	28.6	125.3	28.6
1H-2	9/1/98	6.7	5.3	.2	25.9	$1.34x10^{-9}$	2	7.3	5.8	26.6	5.3
1I-1	8/28/98	13.8	9.8	.2	32.7	$8.33x10^{-9}$	11	18.2	12.1	37.2	12.1
1I-3	8/28/98	3.4	3.3	.1	20.3	$-2.81x10^{-10}$	-1	3.1	3.0	20.0	3.3
1J-1	9/1/98	7.0	4.6	.1	31.0	$1.88x10^{-8}$	26	17.2	9.7	41.2	9.7
1J-1	11/12/98	6.2	4.0	.1	30.7	$1.92x10^{-8}$	26	16.6	9.3	41.1	9.3
1J-2	9/1/98	10.5	7.6	.2	30.3	$-1.12x10^{-9}$	-2	9.7	7.2	29.6	7.6
1J-2	11/12/98	--	--	--	--	--	--	--	--	--	--
1J-3	9/1/98	2.4	2.3	.1	20.1	$-1.46x10^{-9}$	-3	1.5	1.4	19.2	2.3
1J-3	11/12/98	--	--	--	--	--	--	--	--	--	--
1L-1	8/25/98	79.4	19.6	0.2	119.3	$9.47x10^{-9}$	15	84.5	20.4	124.4	20.4
1L-2	8/25/98	-38.9	--	--	--	$1.38x10^{-7}$	71	36.6	11.7	76.2	11.7
1L-3	8/25/98	--	--	--	--	--	--	--	--	--	--
1M-1	8/31/98	45.2	17.5	.2	72.6	$4.40x10^{-9}$	8	47.5	18.0	74.9	18.0
1M-2	8/31/98	5.4	5.4	.1	20.9	$-1.31x10^{-9}$	-3	4.6	4.7	20.1	5.4
1M-3	8/31/98	--	--	--	--	--	--	--	--	--	--
2A-1	8/26/98	-3.2	--	--	--	$8.40x10^{-9}$	13	1.3	3.5	7.6	3.5
2B-1	8/26/98	-7.2	--	--	--	$1.49x10^{-8}$	25	.9	3.3	5.1	3.3
2B-2	8/26/98	-.2	-.3	.1	12.9	$2.37x10^{-10}$	1	-.2	-.2	12.9	-.3
2B-3	8/26/98	-3.2	--	--	--	$8.62x10^{-9}$	15	1.4	1.8	14.3	1.8
2D-1	8/27/98	47.8	19.0	.2	73.3	$1.49x10^{-8}$	22	55.9	20.8	81.4	20.8
2D-2	8/27/98	18.4	11.3	.2	39.5	$1.25x10^{-9}$	3	19.0	11.5	40.1	11.3
2D-3	8/27/98	2.9	2.8	.1	20.0	$-6.93x10^{-10}$	-1	2.4	2.3	19.5	2.8

Table 5. Nitrogen, hydrogen, oxygen, and helium isotopes in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998--Continued

Map index number (figs. 1 and 2)	Sample date (month/ day/yr)	Uncorrected for terrigenic helium				Corrected for terrigenic helium					Selected age for interpre-tation
		^{3}He, tritogenic (TU)	^{3}H/^{3}He age (yr)	±^{3}H/^{3}He age (yr)	^{3}H° (TU)	^{4}He, terrigenic (ccSTP/g)	^{4}He, terrigenic (% of total He)	^{3}He, tritiogenic (TU)	^{3}H/^{3}He age (yr)	^{3}H° (TU)	
Ground-water samples—Continued											
2E-1	8/26/98	-309.0	--	--	--	5.72×10^{-7}	93	4.4	12.2	8.9	12.2
2H-1	9/1/98	1.2	1.4	0.1	15.7	2.94×10^{-9}	6	2.7	3.0	17.2	3.0
2H-2	9/1/98	1.2	1.4	.1	15.9	3.95×10^{-10}	1	1.3	1.5	16.0	1.4
2J-1	8/31/98	22.9	11.9	.2	47.1	1.01×10^{-8}	17	28.3	13.9	52.5	13.9
2J-2	8/31/98	15.9	8.7	.2	41.5	-2.90×10^{-10}	-1	15.7	8.6	41.3	8.7
2J-3	8/31/98	3.6	3.1	.1	22.7	-1.57×10^{-9}	-3	2.6	2.3	21.7	3.1
2L-1	9/2/98	5.3	2.9	.2	35.6	1.16×10^{-7}	72	68.8	21.2	99.1	21.2
2L-2	9/2/98	43.7	14.5	.2	78.8	3.88×10^{-8}	43	64.9	18.8	100.0	18.8
2T-1	7/13/99	--	--	--	--	--	--	--	--	--	--
6I	8/26/98	4.6	3.1	.1	29.5	2.42×10^{-8}	30	17.8	9.7	42.7	9.7
7A-1	8/23/99	55.9	22.0	.3	79.2	6.76×10^{-8}	51	92.9	28.8	116.1	28.8
10K-1	7/13/99	-356.4	--	--	--	5.81×10^{-7}	91	-37.9	--	--	Mixture
1K-94-1	8/25/98	-840.1	--	--	--	1.52×10^{-6}	98	-7.8	--	--	>46
26K-94-1	9/1/98	1.2	1.0	.1	22.8	3.17×10^{-9}	6	2.9	2.2	24.5	2.2
C. Morrill	8/31/98	--	--	--	--	--	--	--	--	--	>46

Table 6. Chlorofluorocarbons in surface- and ground-water samples from selected sites, Dutch Flats area, western Nebraska, 1998

[mo, month; d, day; yr, year; CFC, chlorofluorocarbon; pg/kg, picograms per kilogram; σ, sigma–the standard deviation; --, no data]

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	CFC-11 (pg/kg)	± 1σ CFC-11 (pg/kg)	CFC-12 (pg/kg)	± 1σ CFC-12 (pg/kg)	CFC-113 (pg/kg)	± 1σ CFC-113 (pg/kg)	Age, suggested, CFC data (yr)
				Surface-water sample				
SW9	8/25/98	424.2	2.3	212.8	15.9	59.7	11.0	Modern water
				Ground-water sanples				
1E–1	8/24/98	66.4	.8	39.8	.5	43.9	--	Mid-1960s
1E–2	8/24/98	352.2	5.7	168.5	3.8	59.7	2.6	Early 1980s
1J–1[1]	9/1/98	59.9	2.6	162.5	6.7	1.5	1.3	Early to mid-1980s
1J–2[1]	9/1/98	469.9	5.3	286.0	10.0	51.9	6.3	Late 1980s
1J–3	9/1/98	490.6	2.2	252.9	5.8	104.4	11.1	Early to mid-1990s
1M–1	8/31/98	301.0	1.7	183.2	7.2	10.8	2.6	1980
1M–2	8/31/98	499.2	7.6	235.7	16.6	67.0	9.1	Late 1980s to early 1990s
1M–3	8/31/98	527.0	10.4	269.3	8.8	592.3	149.5	Mid-1990s

[1]Data for wells 1J–1 and 1J–2 originally were inconsistent with other measurements from this well nest; therefore, the data were switched, which made them consistent with the other analytical results.

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999

[mo, month; d, day; yr, year; ICP, inductively coupled plasma; MS, mass spectrometry; µg/L, micrograms per liter; ES, environmental sample; LRS, laboratory replicate sample; ME, measurement error; UAR, uranium activity ratio; --, no data]

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Surface-water samples																
SW1	05/27/97	1345	9.0	--	--	--	--	--	8.4	0.2	--	--	1.51	0.05	--	--
	07/08/97	1050	7.0	8.6	--	--	--	--	7.1	.2	--	--	1.60	.05	--	--
	07/21/97	1140	6.6	--	--	--	--	--	6.7	.2	6.4	0.1	1.61	.07	1.59	0.05
	08/04/97	1130	6.3	--	--	--	1.569	0.018	6.0	.1	--	--	1.60	.05	--	--
	09/08/97	1145	7.4	--	--	--	--	--	6.4	.1	--	--	1.58	.04	--	--
	08/25/98	0830	7.3	--	--	--	--	--	7.1	.2	--	--	1.57	.04	--	--
	08/23/99	1700	7.9	--	1.571	0.009	--	--	--	--	--	--	1.57	--	--	--
SW2	06/17/97	1300	9.8	--	--	--	--	--	9.1	.2	--	--	1.61	.05	--	--
	06/25/99	0830	10.3	--	1.573	.009	--	--	--	--	--	--	--	--	--	--
	08/24/99	1030	13.0	--	1.554	.012	--	--	--	--	--	--	--	--	--	--
SW3	07/23/98	1100	11.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/25/98	1015	12.8	--	--	--	--	--	12.4	0.2	--	--	1.50	.03	--	--
	06/25/99	1115	10.6	--	1.577	.005	--	--	--	--	--	--	--	--	--	--
	08/24/99	1300	13	--	1.576	.005	--	--	--	--	--	--	--	--	--	--
SW4	06/25/99	0700	14.5	--	1.642	.005	--	--	--	--	--	--	--	--	--	--
	08/24/99	0800	22.3	--	1.636	.005	--	--	--	--	--	--	--	--	--	--
SW6	10/20/97	1300	43.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/23/98	1300	26.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	06/25/99	1015	17.4	--	1.735	.007	--	--	--	--	--	--	--	--	--	--
	08/24/99	1400	24.8	--	1.716	.006	1.743	.003	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Surface-water samples—Continued																
SW7	06/18/97	1000	14.2	13.6, 13.0	--	--	--	--	11.4	0.2	12.5	0.2	1.74	0 .04	1.73	0.03
SW8	06/18/97	0830	15.9	17.4	--	--	--	--	16.3	.2	--	--	1.89	.03	--	--
	06/25/99	1045	16.0	--	1.876	0.006	1.874	0.003	--	--	--	--	--	--	--	--
	08/24/99	1230	17.6	--	1.853	.008	--	--	--	--	--	--	--	--	--	--
SW9	06/17/97	1445	11.0	--	--	--	--	--	9.8	.2	--	--	1.63	.05	--	--
	10/20/97	1430	27.8	28.1	--	--	--	--	--	--	--	--	--	--	--	--
	11/24/97	1100	30.8	--	1.640	.004	--	--	--	--	--	--	--	--	--	--
	12/15/97	1330	29.7	30.2	--	--	--	--	--	--	--	--	--	--	--	--
	01/20/98	1500	30.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/17/98	1430	31.1	--	--	--	--	--	--	--	--	--	--	--	--	--
	03/18/98	1330	15.4	--	1.552	.005	--	--	--	--	--	--	--	--	--	--
	05/13/98	1100	16.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	06/23/98	1120	17.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/23/98	1230	19.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/18/98	1530	23.3	23.4	1.706	.005	--	--	--	--	--	--	--	--	--	--
	08/25/98	1130	20.7	--	--	--	--	--	19.6	.2	--	--	1.64	.02	--	--
	09/16/98	1030	20.9	20.9	1.703	.004	--	--	--	--	--	--	--	--	--	--
	11/12/98	1045	30.0	--	1.632	.004	--	--	--	--	--	--	--	--	--	--
	06/25/99	1215	11.2	--	1.602	.004	--	--	--	--	--	--	--	--	--	--
	07/23/99	1230	11.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/24/99	1700	21.7	--	1..688	.008	--	--	--	--	--	--	--	--	--	--
SW10	06/17/97	1530	11.4	11.8	--	--	--	--	11.1	.2	--	--	1.64	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L)		ICP/MS new method — UAR ($^{234}U/^{238}U$)				Alpha particle spectrometry — Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
							Surface-water samples—Continued									
SW11	06/18/97	1100	9.6	9.6	--	--	--	--	9.6	0.2	--	--	1.51	0.03	--	--
	09/02/98	0900	13.1	--	--	--	--	--	12.1	.3	--	--	1.47	.05	--	--
							Ground-water samples									
1A–1	06/19/97	0920	9.8	9.7	--	--	--	--	9.3	.1	--	--	1.59	.03	--	--
	08/27/98	0830	11.0	--	--	--	--	--	10.6	.1	--	--	1.61	.03	--	--
	08/28/98	0930	12.1	--	--	--	--	--	11.6	.2	--	--	1.55	.03	--	--
1A–2	06/19/97	0940	8.7	--	--	--	--	--	8.1	.2	--	--	1.62	.04	--	--
1A–3	06/19/97	1000	9.1	--	--	--	--	--	8.9	.1	--	--	1.51	.03	--	--
	08/27/98	0945	10.9	--	--	--	--	--	10.3	.1	--	--	1.56	.03	--	--
	07/14/99	1105	6.9	--	--	--	--	--	--	--	--	--	--	--	--	--
1B–1	06/19/97	1055	14.9	--	--	--	--	--	14.7	.2	--	--	1.39	.02	--	--
	09/02/98	0905	10.3	--	--	--	--	--	9.6	.2	--	--	1.41	.03	--	--
1B–2	06/19/97	1035	13.8	--	--	--	--	--	14.0	.2	--	--	1.42	.03	--	--
1C–1	06/18/97	0705	13.9	--	--	--	--	--	12.5	.2	--	--	1.73	.03	--	--
	08/24/98	1400	12.9	--	--	--	--	--	13.0	.2	--	--	1.72	.04	--	--
1C–2	06/18/97	0725	12.6	--	--	--	--	--	11.8	.2	--	--	1.69	.03	--	--
	08/27/98	1100	13.2	--	--	--	--	--	12.9	.2	--	--	1.57	.03	--	--
1C–3	06/18/97	0745	14.0	--	--	--	--	--	12.8	.2	--	--	1.41	.03	--	--
	08/27/98	1500	15.5	--	--	--	--	--	14.6	.2	--	--	1.39	.02	--	--
1C–4	06/18/97	0815	12.7	--	--	--	--	--	11.8	.2	--	--	1.40	.03	--	--
	07/14/99	1207	14.4	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L)		ICP/MS new method — UAR ($^{234}U/^{238}U$)				Alpha particle spectrometry — Uranium concentrations (µg/L)				Alpha particle spectrometry — UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
							Ground–water samples—Continued									
1D–1	06/17/97	1310	13.6	13.6	--	--	--	--	12.4	0.2	--	--	2.05	0.04	--	--
	09/02/98	1015	13.8	--	--	--	--	--	12.4	.3	--	--	2.06	.04	--	--
1D–2	06/17/97	1325	13.3	13.3, 13.2	--	--	--	--	9.5	.2	11.1	0.3	1.96	.04	2.13	0.06
	09/02/98	1100	14.5	16.8, 15.1	--	--	--	--	14.7	.2	--	--	1.82	.03	--	--
1D–3	06/17/97	1345	13.1	--	--	--	--	--	11.3	.2	--	--	1.40	.03	--	--
1E–1	06/17/97	0905	19.5	--	--	--	--	--	16.9	.2	--	--	1.94	.03	--	--
	10/21/97	0820	19.3	--	1.983	0.003	--	--	--	--	--	--	--	--	--	--
	01/21/98	0935	17.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/19/98	0910	18.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/12/98	0920	17.4	--	1.605	.006	--	--	--	--	--	--	--	--	--	--
	07/21/98	0910	17.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/24/98	1000	17.1	--	--	--	--	--	--	--	--	--	--	--	--	--
1E–2	06/17/97	0925	14.0	--	--	--	--	--	12.8	.2	--	--	1.76	.04	--	--
	10/21/97	0840	13.3	--	1.740	.004	--	--	--	--	--	--	--	--	--	--
	01/21/98	0955	14.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/19/98	0930	14.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/12/98	0935	14.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	0930	14.4	14.5	--	--	--	--	--	--	--	--	--	--	--	--
	08/24/98	1100	14.7	14.5	--	--	--	--	13.2	.2	--	--	1.77	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L)		ICP/MS new method — UAR ($^{234}U/^{238}U$)				Alpha particle spectrometry — Uranium concentrations (µg/L)				Alpha particle spectrometry — UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
1E–3	06/17/97	0940	4.0	4.0	--	--	--	--	3.6	0.1	--	--	1.49	0.06	--	--
	10/21/97	0900	4.4	--	1.461	0.006	1.423	0.024	--	--	--	--	--	--	--	--
	01/21/98	1010	5.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/19/98	0950	4.9	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/12/98	0950	3.9	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	0945	4.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/24/98	1215	3.8	--	--	--	1.438	.014	3.9	.1	--	--	1.40	.06	--	--
	07/14/99	1315	3.7	--	--	--	--	--	--	--	--	--	--	--	--	--
1F–1	06/16/97	1555	10.7	--	--	--	--	--	10.3	.3	--	--	1.69	.07	--	--
	10/21/97	0935	5.6	--	--	--	--	--	--	--	--	--	--	--	--	--
	01/21/98	1040	11.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/18/98	1445	13.6	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/12/98	1015	13.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1015	9.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	09/01/98	1600	8.6	8.6	--	--	1.456	.005	7.9	.2	--	--	1.38	.05	--	--
1G–1	06/17/97	0800	12.2	--	--	--	--	--	11.0	.2	--	--	1.61	.03	--	--
	10/21/97	1005	12.1	--	1.621	.004	--	--	--	--	--	--	--	--	--	--
	01/21/98	1130	12.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/18/98	1330	12.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1245	11.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1105	11.6	--	1.625	.005	--	--	--	--	--	--	--	--	--	--
	08/27/98	1515	11.5	11.5	--	--	--	--	11.2	.2	--	--	1.56	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
1G–2	06/17/97	0820	12.5	--	--	--	--	--	11.5	0.2	--	--	1.66	0.03	--	--
	10/21/97	1025	13.2	13.2	--	--	--	--	--	--	--	--	--	--	--	--
	01/21/98	1145	13.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/18/98	1350	12.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1305	12.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1140	11.9	--	1.647	0.007	--	--	--	--	--	--	--	--	--	--
1G–3	06/17/97	0840	12.5	--	--	--	--	--	10.6	.2	--	--	1.62	.03	--	--
	10/21/97	1045	12.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	01/21/98	1205	12.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/18/98	1410	12.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1320	12.3	12.3	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1125	12.3	--	1.583	.006	--	--	--	--	--	--	--	--	--	--
	08/27/98	1600	12.1	--	--	--	--	--	11.6	.1	--	--	1.55	.02	--	--
	07/14/99	1345	11.2	--	--	--	--	--	--	--	--	--	--	--	--	--
1H–1	06/16/97	1330	15.3	16.0	--	--	--	--	13.6	.2	--	--	1.81	.04	--	--
	10/20/97	1225	14.7	--	1.884	.004	--	--	--	--	--	--	--	--	--	--
	01/20/98	1305	17.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/28/98	1040	15.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1050	14.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	09/01/98	1230	14.0	--	--	--	--	--	13.4	.2	--	--	1.81	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—*Continued*

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L)		ICP/MS new method — UAR ($^{234}U/^{238}U$)				Alpha particle spectrometry — Uranium concentrations (µg/L)				Alpha particle spectrometry — UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
1H–2	06/16/97	1350	20.9	--	--	--	--	--	20.8	0.3	--	--	1.81	0.03	--	--
	10/20/97	1245	22.7	22.6	1.781	0.004	--	--	--	--	--	--	--	--	--	--
	01/20/98	1320	21.2	21.2	--	--	--	--	--	--	--	--	--	--	--	--
	04/28/98	1055	21.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1105	22.6	--	--	--	--	--	--	--	--	--	--	--	--	--
	09/01/98	1315	21.2	--	--	--	--	--	20.8	.3	--	--	1.70	.03	--	--
1H–3	06/16/97	1405	14.4	--	--	--	--	--	13.5	.3	--	--	1.65	.05	--	--
	10/20/97	1300	6.4	6.4	1.608	.007	--	--	--	--	--	--	--	--	--	--
	01/20/98	1335	12.5	12.5	--	--	--	--	--	--	--	--	--	--	--	--
	04/28/98	1110	13.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1125	17.0	--	--	--	--	--	--	--	--	--	--	--	--	--
1I–1	06/16/97	1435	19.3	19.3	--	--	--	--	17.4	.2	--	--	1.74	.03	--	--
	10/22/97	1320	22.3	--	1.758	.004	--	--	--	--	--	--	--	--	--	--
	01/20/98	1400	24.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/28/98	1350	24.9	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1310	21.5	--	1.728	.006	1.727	0.007	--	--	--	--	--	--	--	--
	08/28/98	1100	24.9	--	--	--	--	--	24.6	.3	--	--	1.75	.03	--	--
1I–2	06/16/97	1450	22.5	--	--	--	--	--	22.2	.4	--	--	1.75	.03	--	--
	10/22/97	1335	22.7	--	1.749	.012	--	--	--	--	--	--	--	--	--	--
	01/20/98	1400	21.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/28/98	1405	22.0	22.1	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1345	22.4	--	1.727	.007	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
1I–3	06/16/97	1510	27.0	26.9	--	--	--	--	24.7	0.3	--	--	1.72	0.03	--	--
	10/22/97	1350	27.4	--	1.712	0.004	--	--	--	--	--	--	--	--	--	--
	01/20/98	1430	24.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/28/98	1420	31.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1405	27.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/28/98	1145	26.2	--	--	--	--	--	23.2	.2	--	--	1.70	.02	--	--
1J–1	06/16/97	1140	18.6	--	--	--	--	--	17.8	.2	--	--	1.74	.03	--	--
	10/22/97	1010	20.3	--	1.628	.004	--	--	--	--	--		--	--	--	--
	01/20/98	1135	20.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/17/98	1430	20.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1405	19.6	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1200	19.9	19.9	--	--	--	--	--	--	--	--	--	--	--	--
	09/01/98	0820	19.7	19.6	--	--	--	--	19.6	.3	--	--	1.73	.03	--	--
	11/12/98	1245	--	--	--	--	--	--	18.9	.3	--	--	1.78	.03	--	--
1J–2	06/16/97	1200	14.2	--	--	--	--	--	13.4	.2	--	--	1.76	.03	--	--
	10/22/97	1025	16.1	--	1.760	.004	--	--	--	--	--	--	--	--	--	--
	01/20/98	1150	16.9	16.9	--	--	--	--	--	--	--	--	--	--	--	--
	02/17/98	1450	19.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1425	15.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1215	16.1	--	--	--	--	--	--	--	--	--	--	--	--	--
	09/01/98	0930	16.3	--	--	--	--	--	15.3	.2	--	--	1.74	.03	--	--
	11/12/98	1315	--	--	--	--	--	--	15.0	.2	--	--	1.80	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L)		ICP/MS new method — UAR ($^{234}U/^{238}U$)				Alpha particle spectrometry — Uranium concentrations (µg/L)				Alpha particle spectrometry — UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
1J–3	06/16/97	1220	20.8	--	--	--	--	--	19.2	0.3	--	--	1.64	0.03	--	--
	10/22/97	1045	21.3	--	1.628	0.004	--	--	--	--	--	--	--	--	--	--
	01/20/98	1205	20.1	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/17/98	1510	18.8	18.8	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1445	16.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1235	15.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	09/01/98	1015	15.4	--	--	--	--	--	14.4	.2	--	--	1.55	.03	--	--
	11/12/98	1345	12.8	--	--	--	--	--	12.8	.2	--	--	1.62	.04	--	--
	07/14/99	1443	13.5	--	--	--	--	--	--	--	--	--	--	--	--	--
1K–1	06/16/97	0920	21.0	--	--	--	--	--	20.2	.3	--	--	1.68	.03	--	--
	10/22/97	1500	18.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/28/98	0935	18.8	--	--	--	--	--	--	--	--	--	--	--	--	--
1K	07/20/98	1305	19.2	--	--	--	--	--	--	--	--	--	--	--	--	--
(blank)	07/20/98	1300	0	.1	--	--	--	--	--	--	--	--	--	--	--	--
(field duplicate)	07/20/98	1310	19.4	--	--	--	--	--	--	--	--	--	--	--	--	--
1K–2	06/16/97	0935	21.7	21.7	--	--	--	--	20.6	.3	--	--	1.85	.03	--	--
	10/22/97	1515	21.7	--	1.743	.005	--	--	--	--	--	--	--	--	--	--
	04/28/98	0950	20.6	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1325	21.7	--	--	--	--	--	--	--	--	--	--	--	--	--
1K–3	06/16/97	0955	17.8	--	--	--	--	--	17.6	.2	--	--	1.81	.03	--	--
	10/22/97	1530	26.4	26.4	--	--	--	--	--	--	--	--	--	--	--	--
	04/28/98	1005	25.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1640	27.0	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
1L–1	06/16/97	0810	17.0	--	--	--	--	--	17.2	0.2	16.8	0.2	1.61	0.02	1.64	0.02
	10/22/97	0855	19.4	--	1.644	0.002	--	--	--	--	--	--	--	--	--	--
	01/20/98	0945	19.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/17/98	1020	17.1	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1000	30.1	--	1.566	.004	--	--	--	--	--	--	--	--	--	--
	07/22/98	0945	34.8	34.8	1.559	.004	--	--	--	--	--	--	--	--	--	--
	08/25/98	1230	17.5	17.5	1.567	.011	--	--	--	--	--	--	--	--	--	--
1L–2	06/16/97	0825	16.4	--	--	--	--	--	15.3	.2	--	--	1.55	.02	--	--
	10/22/97	0910	16.2	--	1.570	.004	--	--	--	--	--	--	--	--	--	--
	01/20/98	1000	17.6	17.5	--	--	--	--	--	--	--	--	--	--	--	--
	02/17/98	1040	17.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1015	15.8	15.8	--	--	--	--	--	--	--	--	--	--	--	--
	07/22/98	1005	16.0	--	1.586	.007	--	--	--	--	--	--	--	--	--	--
	08/25/98	1330	15.6	--	--	--	--	--	--	--	--	--	--	--	--	--
1L–3	06/16/97	0845	31.9	--	--	--	--	--	29.6	.3	--	--	1.55	.02	--	--
	10/22/97	0930	32.5	--	1.553	.003	--	--	--	--	--	--	--	--	--	--
	01/20/98	1015	32.9	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/17/98	1100	34.0	34.0	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1035	17.9	--	1.624	.005	--	--	--	--	--	--	--	--	--	--
	07/22/98	1025	17.9	--	1.621	.004	--	--	--	--	--	--	--	--	--	--
	08/25/98	1400	35.1	--	1.558	.003	--	--	--	--	--	--	--	--	--	--
	07/15/99	1020	34.7	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
1M–1	06/17/97	1525	17.2	--	--	--	--	--	15.7	0.2	--	--	1.87	0.03	--	--
	08/31/98	0830	16.8	--	--	--	--	--	--	--	--	--	--	--	--	--
1M–2	06/17/97	1545	15.9	15.8	--	--	--	--	14.3	.2	--	--	1.44	.03	--	--
	08/31/98	1000	18.0	18.0	--	--	--	--	--	--	--	--	--	--	--	--
1M–3	06/17/97	1605	12.8	--	--	--	--	--	11.8	.2	--	--	1.27	.03	--	--
	08/31/98	1040	11.0	--	1.290	0.004	--	--	--	--	--	--	--	--	--	--
1N–1	06/18/97	1555	14.5	--	--	--	--	--	13.9	.2	--	--	1.70	.03	--	--
2A–1	06/18/97	1525	11.1	--	--	--	--	--	10.4	.2	--	--	2.10	.05	--	--
	08/26/98	1230	13.2	13.2	--	--	--	--	--	--	--	--	--	--	--	--
	07/14/99	955	10.7	--	--	--	--	--	--	--	--	--	--	--	--	--
2B–1	04/21/97	0925	9.9	--	--	--	--	--	9.0	.2	--	--	2.06	.04	--	--
	04/28/97	1115	9.9	--	--	--	2.096	0.021	8.1	.1	--	--	2.07	.04	--	--
	05/12/97	1415	9.8	9.4	--	--	--	--	8.5	.1	--	--	2.10	.04	--	--
	05/27/97	1505	10.1	--	--	--	2.092	.014	8.8	.1	--	--	2.11	.04	--	--
	06/09/97	1345	10.5	--	--	--	--	--	9.7	.1	--	--	2.11	.04	--	--
	06/19/97	0720	10.2	10.2	--	--	--	--	10.0	.1	--	--	2.06	.03	--	--
	06/23/97	1340	9.7	--	--	--	--	--	9.2	.1	--	--	2.05	.04	--	--
	07/08/97	1305	9.1	--	--	--	--	--	8.9	.1	--	--	2.05	.04	--	--
	07/21/97	1435	11.1	--	--	--	--	--	10.8	.1	--	--	1.79	.03	--	--
	08/04/97	1355	10.1	--	--	--	--	--	9.7	.2	--	--	2.05	.05	--	--
	09/08/97	1430	10.8	--	--	--	--	--	9.3	.1	--	--	2.08	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L) ES	LRS	ICP/MS new method — UAR ($^{234}U/^{238}U$) ES	ME	LRS	ME	Alpha particle spectrometry — Uranium concentrations (µg/L) ES	ME	LRS	ME	UAR ($^{234}U/^{238}U$) ES	ME	LRS	ME
Ground-water samples—Continued																
2B–1	09/30/97	0905	9.9	10.1	--	--	--	--	9.3	0.2	--	--	1.92	0.05	--	--
	08/26/98	1400	10.5	--	--	--	--	--	--	--	--	--	--	--	--	--
2B–2	04/21/97	0940	10.1	--	--	--	--	--	9.1	.2	--	--	1.97	.04	--	--
	04/28/97	1140	10.2	--	--	--	--	--	9.1	.2	--	--	2.01	.04	--	--
	05/12/97	1435	10.2	--	--	--	--	--	9.5	.2	--	--	1.88	.04	--	--
	05/27/97	1525	13.7	12.9	--	--	--	--	12.1	.2	--	--	1.88	.03	--	--
	06/09/97	1405	11.0	10.9	--	--	--	--	9.3	.2	--	--	1.83	.04	--	--
	06/19/97	0740	9.7	--	--	--	--	--	9.8	.2	--	--	1.64	.03	--	--
	06/23/97	1400	10.3	--	--	--	--	--	10.0	.1	--	--	1.69	.03	--	--
	07/08/97	1325	13.0	13.0	--	--	--	--	12.9	.2	--	--	1.60	.03	--	--
	07/21/97	1455	12.4	12.4	--	--	--	--	12.2	.2	--	--	1.60	.03	--	--
	08/04/97	1415	9.9	9.9	--	--	--	--	9.9	.1	--	--	1.61	.03	--	--
	09/08/97	1445	8.3	--	--	--	--	--	7.2	.1	--	--	1.59	.03	--	--
	09/30/97	0925	7.0	--	--	--	--	--	6.3	.2	--	--	1.71	.06	--	--
	08/26/98	1430	8.7	--	1.617	0.004	--	--	--	--	--	--	--	--	--	--
2B–3	04/21/97	1000	11.4	11.4	--	--	--	--	10.0	.2	--	--	1.90	.04	--	--
	04/28/97	1200	10.6	--	--	--	--	--	10.3	.3	--	--	1.89	.07	--	--
	05/12/97	1455	12.1	--	--	--	--	--	11.3	.2	--	--	1.90	.04	--	--
	05/27/97	1545	11.6	11.6	--	--	--	--	10.3	.2	--	--	1.74	.03	--	--
	06/09/97	1425	9.3	9.3	--	--	--	--	9.3	.2	--	--	1.61	.04	--	--
	06/19/97	0800	10.1	--	--	--	--	--	9.9	.1	--	--	1.56	.03	--	--
	06/23/97	1420	10.4	--	--	--	--	--	10.2	.1	--	--	1.58	.03	--	--
	07/08/97	1345	11.8	--	--	--	--	--	10.5	.1	--	--	1.64	.03	--	--
	07/21/97	1515	11.2	--	--	--	--	--	11.6	.2	--	--	1.53	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L)		ICP/MS new method — UAR ($^{234}U/^{238}U$)				Alpha particle spectrometry — Uranium concentrations (µg/L)				Alpha particle spectrometry — UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
							Ground–water samples—Continued									
2B–3	08/04/97	1435	8.5	--	--	--	--	--	8.3	0.1	--	--	1.54	0.03	--	--
	09/08/97	1505	7.3	--	--	--	--	--	6.8	.1	--	--	1.54	.04	--	--
	09/30/97	0945	6.9	--	--	--	--	--	6.8	.2	--	--	1.57	.06	--	--
	08/26/98	1545	7.1	7.1	1.554	0.04	--	--	--	--	--	--	--	--	--	--
	07/14/99	1030	12.2	--	--	--	--	--	--	--	--	--	--	--	--	--
2C–1	06/19/97	0825	11.1	--	--	--	--	--	10.4	.1	--	--	1.69	.03	--	--
2C–2	06/19/97	0845	10.8	--	--	--	--	--	10.6	.1	--	--	1.63	.03	--	--
2C–3	06/19/97	0905	10.0	--	--	--	--	--	9.8	.1	--	--	1.55	.02	--	--
2D–1	06/18/97	0840	13.0	--	--	--	--	--	12.9	.2	--	--	1.95	.03	--	--
	08/27/98	1215	13.5	--	--	--	--	--	--	--	--	--	--	--	--	--
2D–2	06/18/97	0900	19.2	--	--	--	--	--	18.5	.2	--	--	1.72	.03	--	--
	08/27/98	1300	23.3	--	--	--	--	--	--	--	--	--	--	--	--	--
2D–3	06/18/97	0920	14.0	--	--	--	--	--	14.9	.3	--	--	1.35	.03	--	--
	08/27/98	1400	16.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/14/99	1140	15.8	--	--	--	--	--	--	--	--	--	--	--	--	--
2E–1	06/18/97	1450	14.9	--	--	--	--	--	14.4	.2	--	--	1.96	.04	--	--
	08/26/98	1100	14.9	--	--	--	--	--	--	--	--	--	--	--	--	--
2F–1	06/17/97	1005	19.9	--	--	--	--	--	16.0	.2	18.0	.2	2.18	.04	2.05	0.03
2F–2	06/17/97	1025	16.4	--	--	--	--	--	15.0	.2	--	--	1.60	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
2F–3	06/17/97	1045	3.6	--	--	--	--	--	3.5	0.2	--	--	1.23	0.08	--	--
	07/14/99	1245	2.0	--	1.316	0.011	--	--	--	--	--	--	--	--	--	--
2G–1	06/16/97	1540	9.2	--	--	--	--	--	8.8	.2	--	--	1.43	.04	--	--
	10/22/97	1115	10.8	--	1.505	.004	--	--	--	--	--	--	--	--	--	--
	01/21/98	1105	8.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/18/98	1255	10.0	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/12/98	1045	8.8	8.8	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1040	8.4	--	--	--	--	--	--	--	--	--	--	--	--	--
2H–1	06/17/97	0715	15.3	--	--	--	--	--	15.2	.2	--	--	1.53	.03	--	--
	10/21/97	1115	12.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	01/20/98	1455	12.9	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/18/98	1055	13.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	05/12/98	1115	13.1	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1220	13.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	09/01/98	1420	12.9	--	--	--	--	--	13.0	.3	--	--	1.58	.04	--	--
2H–2	06/17/97	0730	17.1	17.2, 16.4	--	--	--	--	15.3	.2	--	--	1.63	.03	--	--
	10/21/97	1135	17.4	--	1.596	.004	1.600	0.015	--	--	--	--	--	--	--	--
	01/20/98	1510	15.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	02/18/98	1130	15.1	15.1	--	--	--	--	--	--	--	--	--	--	--	--
	05/12/98	1135	14.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/21/98	1240	14.1	--	--	--	--	--	--	--	--	--	--	--	--	--
	09/01/98	1440	14.1	--	--	--	--	--	13.0	.2	--	--	1.62	.03	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground-water samples—Continued																
2H–2	07/14/99	1415	13.6	--	--	--	--	--	--	--	--	--	--	--	--	--
2J–1	06/16/97	1030	14.8	--	--	--	--	--	12.1	0.2	14.1	0.2	1.89	0.04	1.96	0.04
	10/22/97	1415	20.3	--	1.850	0.003	--	--	--	--	--	--	--	--	--	--
	01/20/98	1045	19.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1110	21.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1415	22.6	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/31/98	1215	22.6	--	--	--	--	--	--	--	--	--	--	--	--	--
2J–2	06/16/97	1055	16.7	--	--	--	--	--	14.4	.2	--	--	1.71	.03	--	--
	10/22/97	1430	18.9	--	--	--	--	--	--	--	--	--	--	--	--	--
	01/20/98	1100	19.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1125	19.0	19.0	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1430	18.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/31/98	1300	17.6	17.7	--	--	--	--	--	--	--	--	--	--	--	--
2J–3	06/16/97	1115	14.2	--	--	--	--	--	13.6	.3	--	--	1.68	.04	--	--
	10/22/97	1445	15.3	--	1.599	.004	--	--	--	--	--	--	--	--	--	--
	01/20/98	1115	16.9	16.9	--	--	--	--	--	--	--	--	--	--	--	--
	04/27/98	1140	13.9	14.0	--	--	--	--	--	--	--	--	--	--	--	--
	07/20/98	1445	14.9	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/31/98	1345	14.4	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/14/99	1510	16.1	--	--	--	--	--	--	--	--	--	--	--	--	--
2L–1	06/16/97	0705	16.4	--	--	--	--	--	16.5	.3	--	--	1.57	.03	--	--
	09/02/98	1230	16.4	--	--	--	--	--	15.3	.2	--	--	1.53	.02	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L)		ICP/MS new method — UAR ($^{234}U/^{238}U$)				Alpha particle spectrometry — Uranium concentrations (µg/L)				Alpha particle spectrometry — UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
2L–2	06/16/97	0725	14.9	14.9	--	--	--	--	14.1	0.3	--	--	1.57	0.04	--	--
	09/02/98	1250	16.7	--	--	--	--	--	15.5	.2	--	--	1.58	.02	--	--
2L–3	06/16/97	0740	29.9	--	--	--	--	--	26.9	.4	--	--	1.53	.03	--	--
	07/14/99	1603	24.8	--	--	--	--	--	--	--	--	--	--	--	--	--
2T–1	07/13/99	0930	11.3	--	2.013	0.005	--	--	--	--	--	--	--	--	--	--
3B–1	06/18/97	1320	10.5	--	--	--	--	--	10.7	.1	--	--	1.50	.03	--	--
	07/08/99	1537	11.0	--	--	--	--	--	--	--	--	--	--	--	--	--
3B–2	06/18/97	1340	12.6	--	--	--	--	--	12.3	.2	--	--	1.57	.04	--	--
	07/08/99	1600	10.9	--	--	--	--	--	--	--	--	--	--	--	--	--
3C–1	06/18/97	0950	14.1	--	--	--	--	--	14.4	.2	--	--	1.82	.04	--	--
	07/12/99	0955	13.8	--	--	--	--	--	--	--	--	--	--	--	--	--
3C–2	06/18/97	1010	12.1	12.1	--	--	--	--	11.6	.2	--	--	1.68	.03	--	--
	07/12/99	1015	12.5	--	--	--	--	--	--	--	--	--	--	--	--	--
3C–3	06/18/97	1030	11.1	--	--	--	--	--	11.2	.2	11.1	0.1	1.47	.03	1.47	0.02
	07/12/99	1035	12.8	--	--	--	--	--	--	--	--	--	--	--	--	--
3E–1	06/17/97	1415	19.9	--	--	--	--	--	18.9	.2	--	--	1.97	.03	--	--
	07/08/99	1335	20.3	--	--	--	--	--	--	--	--	--	--	--	--	--
3E–2	06/17/97	1345	13.5	13.5	--	--	--	--	12.2	.2	--	--	1.58	.04	--	--
	07/08/99	1400	13.1	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground-water samples—Continued																
3E–3	06/17/97	1455	10.4	--	--	--	--	--	9.4	0.2	--	--	1.45	0.05	--	--
	07/08/99	1425	8.7	--	--	--	--	--	--	--	--	--	--	--	--	--
3F–1	06/17/97	1110	16.8	--	--	--	--	--	15.5	.3	--	--	1.57	.03	--	--
	07/08/99	1128	10.7	--	--	--	--	--	--	--	--	--	--	--	--	--
3F–2	06/17/97	1130	16.4	16.4	--	--	--	--	15.6	.2	--	--	1.54	.02	--	--
	07/08/99	1155	7.8	--	--	--	--	--	--	--	--	--	--	--	--	--
3F–3	06/17/97	1150	11.4	11.4	--	--	--	--	10.1	.2	--	--	1.35	.03	--	--
	07/08/99	1215	8.5	--	--	--	--	--	--	--	--	--	--	--	--	--
4A–1	06/18/97	1405	12.6	--	--	--	--	--	12.0	.2	--	--	1.65	.03	--	--
	07/08/99	1503	12.9	--	--	--	--	--	--	--	--	--	--	--	--	--
4B–1	06/18/97	1100	12.6	--	--	--	--	--	11.8	.2	--	--	1.67	.03	--	--
	07/12/99	1125	13.4	--	--	--	--	--	--	--	--	--	--	--	--	--
4B–2	06/18/97	1120	9.2	9.3	--	--	--	--	8.7	.1	--	--	1.56	.03	--	--
	07/12/99	1145	10.1	--	--	--	--	--	--	--	--	--	--	--	--	--
4B–3	06/18/97	1140	8.4	--	1.521	0.003	--	--	8.7	.2	--	--	1.52	.04	--	--
	07/12/99	1205	9.3	--	--	--	--	--	--	--	--	--	--	--	--	--
5B–1	06/19/97	1130	14.2	--	--	--	--	--	14.0	.2	--	--	1.92	.03	--	--
5B–2	06/19/97	1200	13.1	--	--	--	--	--	12.7	.2	--	--	1.81	.03	--	--
5B–3	06/19/97	1220	11.8	--	--	--	--	--	11.2	.1	--	--	1.57	.03	--	--
5C–1	07/07/99	1025	15.5	--	--	--	--	--	--	--	--	--	--	--	--	--
5C–2	07/07/99	1050	14.7	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground-water samples—Continued																
5D	07/07/99	1117	14.7	--	--	--	--	--	--	--	--	--	--	--	--	--
5E–1	07/07/99	1310	33.1	--	--	--	--	--	--	--	--	--	--	--	--	--
5E–2	07/07/99	1335	41	--	--	--	--	--	--	--	--	--	--	--	--	--
5F	07/01/99	1455	33.7	--	--	--	--	--	--	--	--	--	--	--	--	--
6A	06/28/99	1145	19.8	--	--	--	--	--	--	--	--	--	--	--	--	--
6B	06/28/99	1405	19.8	--	--	--	--	--	--	--	--	--	--	--	--	--
6C	06/28/99	1452	20.1	--	--	--	--	--	--	--	--	--	--	--	--	--
6D–1	06/29/99	1015	16	--	--	--	--	--	--	--	--	--	--	--	--	--
6D–2	06/29/99	1037	12.6	--	--	--	--	--	--	--	--	--	--	--	--	--
6E	06/28/99	1613	8.7	--	--	--	--	--	--	--	--	--	--	--	--	--
6F	06/30/99	1425	10.5	--	--	--	--	--	--	--	--	--	--	--	--	--
6G–1	06/30/99	1130	34.7	--	--	--	--	--	--	--	--	--	--	--	--	--
6G–2	06/30/99	1150	20.4	--	--	--	--	--	--	--	--	--	--	--	--	--
6H–1	06/30/99	1240	24.7	--	--	--	--	--	--	--	--	--	--	--	--	--
6H–2	06/30/99	1305	42.4	--	--	--	--	--	--	--	--	--	--	--	--	--
6I	06/30/99	0945	70.6	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/26/98	0830	55.5	55.2, 54.7	1.511	0.002	--	--	49.1	0.6	--	--	1.52	0.02	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground-water samples—Continued																
6M–1	06/30/99	1030	18.6	--	--	--	--	--	--	--	--	--	--	--	--	--
6M–2	06/30/99	1053	40.7	--	1.740	0.005	--	--	--	--	--	--	--	--	--	--
7A–1	06/28/99	1255	13.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	08/23/99	1015	12.9	--	2.334	.008	--	--	--	--	--	--	--	--	--	--
7A–2	06/28/99	1315	22.9	--	2.015	.006	--	--	--	--	--	--	--	--	--	--
7B	06/28/99	1530	18.8	--	--	--	--	--	--	--	--	--	--	--	--	--
7C–1	06/29/99	1115	12.5	--	--	--	--	--	--	--	--	--	--	--	--	--
7C–2	06/29/99	1142	8.2	--	1.259	.011	--	--	--	--	--	--	--	--	--	--
7D–1	06/29/99	1435	18.9	--	--	--	--	--	--	--	--	--	--	--	--	--
7D–2	06/29/99	1515	17.6	--	1.730	.009	--	--	--	--	--	--	--	--	--	--
7E–1	06/29/99	1555	28.8	--	--	--	--	--	--	--	--	--	--	--	--	--
7E–2	06/29/99	1625	9.9	--	1.371	.009	--	--	--	--	--	--	--	--	--	--
7F–1	07/01/99	1125	30.6	--	1.626	.004	--	--	--	--	--	--	--	--	--	--
7F–2	07/01/99	1155	29.1	--	1.550	--	--	--	--	--	--	--	--	--	--	--
7G–1	06/30/99	1503	33.4	--	1.614	.005	--	--	--	--	--	--	--	--	--	--
7G–2	06/30/99	1525	7.8	--	1.000	.015	--	--	--	--	--	--	--	--	--	--
7H	07/01/99	0945	60.6	--	1.973	.007	--	--	--	--	--	--	--	--	--	--
8A–1	06/29/99	1255	12.3	--	--	--	--	--	--	--	--	--	--	--	--	--
8A–2	06/29/99	1315	9.3	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
8B	06/29/99	1355	14.3	--	--	--	--	--	--	--	--	--	--	--	--	--
8C	07/08/99	1050	2.9	--	--	--	--	--	--	--	--	--	--	--	--	--
8D–1	07/08/99	0940	23.7	--	--	--	--	--	--	--	--	--	--	--	--	--
8D–2	07/08/99	1005	29.7	--	--	--	--	--	--	--	--	--	--	--	--	--
8E	06/30/99	1600	12.0	--	--	--	--	--	--	--	--	--	--	--	--	--
8F–1	07/01/99	1025	73.0	--	1.915	0.003	--	--	--	--	--	--	--	--	--	--
8F–2	07/01/99	1050	45.1	--	--	--	--	--	--	--	--	--	--	--	--	--
8G	07/01/99	1250	27.1	--	1.586	.003	--	--	--	--	--	--	--	--	--	--
9B	07/07/99	1525	15.9	--	--	--	--	--	--	--	--	--	--	--	--	--
9C	07/07/99	1555	11.6	--	--	--	--	--	--	--	--	--	--	--	--	--
9D–1	07/07/99	1420	31.2	--	--	--	--	--	--	--	--	--	--	--	--	--
9D–2	07/07/99	1445	34.1	--	--	--	--	--	--	--	--	--	--	--	--	--
9E–1	07/01/99	1345	88.8	--	1.324	.002	--	--	--	--	--	--	--	--	--	--
9E–2	07/01/99	1415	79.7	--	1.332	.004	1.325	0.002	--	--	--	--	--	--	--	--
10A–1	07/06/99	1415	17.5	--	--	--	--	--	--	--	--	--	--	--	--	--
10A–2	07/06/99	1444	9.1	--	1.558	.009	--	--	--	--	--	--	--	--	--	--
10C	07/07/99	0942	7.6	--	--	--	--	--	--	--	--	--	--	--	--	--
10D–1	07/06/99	1300	20.0	--	1.686	.006	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]: ICP/MS old method — Uranium concentrations (µg/L)		ICP/MS new method — UAR ($^{234}U/^{238}U$)				Alpha particle spectrometry — Uranium concentrations (µg/L)				Alpha particle spectrometry — UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
10D–2	07/06/99	1323	20.1	--	1.660	0.012	--	--	--	--	--	--	--	--	--	--
10E–1	07/01/99	1525	31.2	--	1.776	.005	--	--	--	--	--	--	--	--	--	--
10E–2	07/01/99	1545	30.9	--	1.680	.007	--	--	--	--	--	--	--	--	--	--
10G–1	07/06/99	1125	23.3	--	--	--	--	--	--	--	--	--	--	--	--	--
10G–2	07/06/99	1150	30.8	--	1.775	.010	--	--	--	--	--	--	--	--	--	--
10K–1	07/13/99	1230	17.8	--	2.156	.007	2.137	0.002	--	--	--	--	--	--	--	--
10M–1	07/06/99	1555	13.4	--	--	--	--	--	--	--	--	--	--	--	--	--
10M–2	07/06/99	1615	12.7	--	1.548	.008	--	--	--	--	--	--	--	--	--	--
1K–94–1	10/23/97	0755	6.5	--	--	--	--	--	6.6	--	--	--	--	--	--	--
	07/22/98	1215	12.5	--	1.496	.012	--	--	12.5	--	--	--	--	--	--	--
	08/25/98	1530	1.4	--	2.131	.006	--	--	1.5	0.1	--	--	2.44	0.10	--	--
	09/14/99	1120	--	--	1.494	.005	1.493	.005	--	--	--	--	--	--	--	--
1K–94–2	10/23/97	0815	74.4	--	--	--	--	--	68.0	--	--	--	--	--	--	--
	07/22/98	1225	88.3	--	1.441	.007	--	--	--	--	--	--	--	--	--	--
	09/14/99	1150	--	--	1.441	.004	--	--	--	--	--	--	--	--	--	--
26K–94–1	01/21/98	1320	24.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/22/98	1110	24.9	--	1.647	.007	1.385	.012	--	--	--	--	--	--	--	--
	09/01/98	1130	22.4	--	1.574	.007	--	--	--	--	--	--	--	--	--	--
26K–94–2	01/21/98	1305	20.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	01/21/98	1350	64.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	07/22/98	1130	23.6	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 7. Uranium concentrations and activity ratios in surface-water, ground-water, and well-cutting samples, Dutch Flats area, western Nebraska, 1995 through 1999—Continued

Map index number (figs. 1 and 2)	Sample date (mo/d/yr)	Time (24 hour)	Analytical methods and results[1]													
			ICP/MS old method		ICP/MS new method				Alpha particle spectrometry							
			Uranium concentrations (µg/L)		UAR ($^{234}U/^{238}U$)				Uranium concentrations (µg/L)				UAR ($^{234}U/^{238}U$)			
			ES	LRS	ES	ME	LRS	ME	ES	ME	LRS	ME	ES	ME	LRS	ME
Ground–water samples—Continued																
26K–94–3	01/21/98	1410	66.5	--	--	--	--	--	--	--	--	--	--	--	--	--
C. Morrill	08/31/98	1530	.1	--	--	--	--	--	0.3	0.1	--	--	1.37	0.19	--	--
Samples from well cuttings[2]																
Brule Ash first leach	--	--	--	--	1.668	0.007	--	--	--	--	--	--	--	--	--	--
Brule Ash second leach	--	--	--	--	1.638	.006	--	--	--	--	--	--	--	--	--	--
Volcanic ash	--	--	--	--	.986	.002	--	--	--	--	--	--	--	--	--	--
2B–1 at 95 feet	--	--	--	--	1.642	.004	--	--	--	--	--	--	--	--	--	--
2E–1 at 75 feet	--	--	--	--	1.326	.003	--	--	--	--	--	--	--	--	--	--
6I at 30 feet	--	--	--	--	1.509	.005	--	--	--	--	--	--	--	--	--	--
1K–94–1 at 30 feet	--	--	--	--	1.858	.003	--	--	--	--	--	--	--	--	--	--

[1]Numbers in bold represent analyses repeated on different days.
[2]Samples from well cuttings were collected when wells were constructed between 1995 and 1999.

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