and well 3, are used for public supply. Springs also discharge ground water that is consumed by evapotranspiration, but some of the water returns to the ground-water system through infiltration. Stephens and Sumsion (1978) estimated 2,800 acre-ft per year as discharge from wells, springs, and seeps.

Ground-Water Movement

Approximate water-level altitudes and direction of ground-water movement for the confined part of the ground-water system in Dugway Valley and Government Creek Valley and the unconfined parts in the Fries area and English Village area for March-April 1999 are shown in figure 4. The direction of ground-water movement is downgradient and perpendicular to the lines of equal water-level altitude. The general direction of ground-water movement in the Dugway area is to the northwest from principal recharge areas in the Simpson Mountains, Sheeprock Mountains, Government Creek Valley, and the Old River Bed. No water-level data are available for the Government Creek Valley southeast of the Carr area. The few wells in the area have been abandoned, plugged, or the well casings have collapsed and no new wells have been developed. The direction of ground-water movement in the upper part of Government Creek Valley is probably the same as reported by Stephens and Sumsion (1978) and indicated by the arrows in figure 4. Ground water that moves through the Old River Bed converges with ground water from Dugway Valley south of DPG and is separated from ground water in Government Creek Valley by consolidated-rock outcrops of Simpson Buttes and Camels Back Ridge. Water-level altitudes and direction of ground-water movement for the unconfined part of the ground-water system in the Dugway Valley and Government Creek Valley are not included in this study but are part of numerous evaluation reports completed by consultants for HWMU and SWMU sites.

Ground-water levels and movement in the Fries area indicate that the unconfined part in this area is not well connected to the ground-water system in the adjoining areas. Consolidated rock separates ground water in the Fries area from that under unconfined conditions in English Village. South and southwest of the Fries area are Little Granite Mountain and Davis Mountain. Water levels in the Fries area are 300 ft higher than water levels in the Ditto/ Carr areas to the west. Depth to consolidated rock to the west is unknown, but water levels indicate that a zone of low transmissivity is present. There is not enough information available to determine ground-water movement to the west. Water-level altitudes show that the direction of ground-water movement is to the northwest, toward the Cedar Mountains.

Ground water in the English Village area is part of the Skull Valley drainage but is contained within a partially enclosed basin within that drainage. Monitoring wells completed along the east and west margins of the English Village area (HWMU 42, HWMU 44, HWMU 69) are screened in bedrock (table 1). Water levels in the English Village area (fig. 4) are more than 100 ft higher than water levels in the Fries area and indicate a ground-water divide where the consolidated rock is overlain by a thin layer of alluvium. Ground-water movement in the English Village area is from the margins of the valley, where wells are completed in consolidated rock and the gradient is steep, to the center of the valley where wells are screened in unconsolidated deposits and the gradient flattens out. Pumping of wells for public supply and irrigation and differences in the hydrologic properties of the consolidated rock and unconsolidated deposits influence the direction of ground-water movement in the English Village area.

Water-Level Fluctuations

Hydrographs for seven wells for 1950-2000 and cumulative departure from average annual precipitation for 1950-99 at Dugway for are shown in figure 5. Well 6, well 20, and well 21 in the English Village area all show similar patterns of water-level change. Water-level declines started in the 1950s and continued through the 1960s, and then water levels rose in the late 1960s, leveling off about 1988. The 10-ft drop in water level in well 21 in 1992 was probably caused by pumping in public supply well 27, which is less than 10 ft from well 21. DPG stopped using wells 18 and 19 in English Village for public supply in 1972 and 1967, respectively, and only used the wells for irrigation in the summer months. The decline in pumpage of wells 18 and 19, and more normal precipitation, are likely the reasons for the rise in water levels in the late 1960s. Also in 1974, well 30 was drilled in the southeastern corner of the English Village area and put into use for public water supply. Water levels in wells 6 and 20 were probably less affected than previously by pumpage for public supply in the late 1970s, and the water levels rose even with decreased precipitation because the wells were farther from the new pumping well.

Well 6 in English Village has a continuous recorder operated by the USGS since 1952. The water level for March of each year is shown in figure 5 along with an inset for the continuous record for 1996-99. Water-level fluctuations of 3 to 4 ft during the year result from pumpage of nearby wells 18 and 19 in the summer. Water levels are highest in May and lowest in September, corresponding with the irrigation season.

Two wells, Sainsbury north well and Fenn Brothers east well, in the Old River Bed, show water levels beginning to rise in the mid-1980s, a period of greater-than-average precipitation. Water levels in the Sainsbury north well showed only slight declines from the mid-1960s to the mid-1980s. Water levels in this well are affected by precipitation and ground-water flow from the Sevier Desert that moves through the Old River Bed. The Fenn Brothers east well is away from any pumping areas and water levels are most affected by precipitation. The MX observation well in the Old River Bed shows a water-level rise of almost 10 ft from 1981 to 1985, a period of greater-than-average precipitation. The well is situated in alluvial-fan deposits at an altitude about 150 ft higher than that of the irrigation wells in the Old River Bed. Water levels are probably more affected by recharge from precipitation than by pumpage for irrigation. The water level in MX observation well near the Dugway Range shows less than 2 ft of change during the period of record. Because this well is located away from pumping wells and principal recharge areas, few factors affect the water level.

Hydrologic Properties

The shape of the contour lines (fig. 4) that depict equal water-level altitude, and the hydraulic gradient that these contours represent, give some indication of the nature of the hydrologic properties and boundary conditions of the ground-water system. In areas where ground-water withdrawals do not influence water levels, a steep hydraulic gradient indicates that one or both of two conditions exist: (1) the transmissivity of the ground-water system is lower than in areas where the gradient is less steep or (2) the amount of ground water moving through an equal cross section is higher than in areas where the gradient is less steep. For example, along an approximate flow line (fig. 4) from the headwaters of Old River Bed to the mud flats on DPG, the gradient between the MX well in the Old River Bed and Sainsbury well at the uppermost part of Old River Bed is about 0.006 ft/ft. The gradient between Sainsbury well and Snarr well is about 0.004 ft/ft, and the gradient from Snarr well to Riverbed Trail well is about 0.005 ft/ft. These relatively steep gradients all occur within the confines of the Old River Bed. The hydraulic gradients, starting in the area where Old River Bed and Dugway Valley merge, are substantially smaller. The gradient from Riverbed Trail well to Fenn Brothers well is about 0.00014 ft/ft; from Fenn Brothers well to well 24 the gradient is about 0.00025 ft/ft; and from well 24 to well 23 the gradient is about 0.00042 ft/ft. Although no current (1998-99) water-level data are available, Stephens and Sumsion (1978) demonstrate the same pattern in Government Creek Valley where hydraulic gradients transition from a high of 0.027 ft/ft within the valley to 0.00064 ft/ft beyond the confines of the valley. This trend down a flow line is consistent with the expected hydrogeologic framework: (1) total saturated thickness, and therefore transmissivity, in the main part of the ground-water system is substantially greater than in the narrower valleys between consolidated-rock outcrops, (2) down-valley flow of ground water per unit cross-sectional area of basin fill could be larger than in the central main ground-water system, and (3) hydraulic conductivity and ground-water flow velocity are greater in these upper valleys than in the central main part of the ground-water system.

Hydraulic-conductivity values (K) for generalized lithologic descriptions estimated by Mower and Cordova (1974) for the northern Milford area, which has a similar depositional environment as the Dugway area, were compared with values from Ageiss Environmental (1998) and Parsons Engineering Science (1996). Lithologic descriptions from individual slug tests conducted on 11 monitoring wells by Parsons and average hydraulic-conductivity values for 8 HWMU sites determined by Ageiss were used to compare lithologic descriptions in the northern Milford area (table 3). Results of the comparison show that generalized descriptions given by Mower and Cordova (1974) would give reasonable estimates for K for basin-fill deposits in the Dugway area. Parsons Engineering Science (1996) also completed six slug tests in the consolidated rock on the west edge of English Village. The K values in these wells vary by four orders of magnitude (0.05 ft/d to 107.9 ft/d). Many more detailed and extensive slug test data and analyses are available in the reports published by consultants working at the numerous SWMU and HWMU sites on the DPG.

CHEMICAL QUALITY OF GROUND WATER

Water samples from 10 wells and 5 springs were collected during this study (1998-99) and analyzed for major ions, selected trace metals, alkalinity, and dissolved-solids concentrations (table 4). Temperature, pH, and specific conductance were measured in the field for most of the samples. Wells were pumped long enough to remove three well casing volumes of water before collecting a water sample for analysis. Three well volumes were not removed from one well, well 29, to avoid having to containerize and dispose of a large amount of purge water. Instead the well was pumped at a very slow rate (0.5-1.0 liter per minute) with the pump intake placed even with the screened interval of the casing. Pumping at a low rate minimizes drawdown in the well and only draws in water through the screened interval. Temperature, specific conductance, and pH were monitored and the sample collected when the values stabilized. All water samples were analyzed by Severn Trent Laboratories in Arvada, Colorado.

Water samples from all the wells and three of the springs were analyzed for the volatile and semivolatile organic compounds listed in table 5, and water from four wells was analyzed for the explosive compounds listed in table 5. Because most of the water-sample analyses did not detect any volatile or semivolatile organic compounds and no explosives compounds were detected, the analytical data are not presented in this report. Two wells and one spring had reported volatile organic compound (VOC) concentrations that could not be attributed to laboratory contamination. Sainsbury middle well had ethylbenzene (estimated, 0.13 µg/L) and toluene (4.6 µg/L) detected in the water sample. These VOCs could have been from sources around the site. The only available sampling port for the well was downwind from diesel engine exhaust, and grease and oil spills were on the ground around the site. None of these VOCs were detected in the water from any wells downgradient from Sainsbury middle well. Toluene (1.2 µg/L) was reported in water from well 29 on DPG and ethylbenzene (estimated, 14 µg/L) was reported in water from Indian Spring. Both of these VOCs are petroleum products and the water samples were most likely contaminated during handling in the field.

Results of chemical analyses and physical properties for 29 springs, 31 wells, and 6 surface-water sites are also presented in table 4. Water-quality data for wells, springs, reservoirs, and surface-water sites from previous studies are included in this table. Water from 15 wells and 4 springs has been sampled more than once. Of the wells and springs sampled during 1998-99, four springs and four wells had been previously sampled. There has been little change in the dissolved-solids concentration in water from most of the wells and springs. Water from two irrigation wells, well 18 and well 19, in the English Village area did show some changes in dissolved-solids concentrations. These are most likely a result of the time of year the wells were sampled and the amount of water pumped continuously from the well before sampling (Hood and Waddell, 1968). During a 6-hour pumping period in 1956, estimated concentrations of dissolved solids in water from well 19 increased from 615 mg/L to 920 mg/L (Hood and Waddell, 1968). Well 18 is constructed with perforated intervals at similar depths as well 19, and fluctuations in dissolved-solids concentration in the water from well 18 also may be related to the amount of pumping. Also, the dissolved-solids concentration in water from Dugway-Topaz well was 10,400 mg/L in 1957, 5,470 mg/L in 1964, and 4,940 mg/L in 1998. The reason for the change in concentration is unknown.

Dissolved-solids concentrations from the most recent analyses of water from wells and springs are shown in figure 6. Dissolved-solids concentrations of water from wells completed in basin-fill deposits ranged from 454 mg/L to 10,200 mg/L. Dissolved-solids concentrations of water from wells and springs with a water source in consolidated rocks ranged from 186 to 2,300 mg/L. Springs in the Simpsons Mountains had the lowest dissolved-solids concentrations, and the highest concentrations were in basin-fill wells used for stock around the Dugway Range. The temperature of water from the Dugway-Topaz well was 36.5 °C and the Fera 38 well, 27 °C. Water from the Fandangle well had the highest dissolved-solids concentration, 10,200 mg/L. The well is reported as drilled to 202 ft, which is at least 100 ft less than the other three wells near the Dugway Range. The higher dissolved-solids concentration could be related to the shallower depth of the well or to the time of year when the well was sampled.

Arsenic is a naturally occurring element in rocks and soil and in the waters in contact with them. Concentrations of arsenic in ground water generally are highest in the Western United States (Welch and others, 2000). The U.S. Environmental Protection Agency has proposed lowering the maximum contaminant level (MCL) of 50 µg/L allowed for arsenic in drinking water to 5 µg/L. Arsenic concentrations detected in water from wells and springs ranged from an estimated 3.7 to 25 µg/L. Arsenic concentrations of more than 5 µg/L were found in water from five wells: River Bed Trail well (25 µg/L), and Old River Bed observation well (21 µg/l), in the Old River Bed; Bullion well (7.9 µg/L), and Fera 38 well (22 µg/L) near the Dugway Range; and Davis well (14 µg/L) in Skull Valley (table 4). Arsenic concentrations reported in water from public-supply wells on DPG were 16.5 and 21.1 µg/L in English Village, 9.8 and 7.7 µg/L in Ditto, and 2.2 µg/L in Carr (John H. Woffinden, U.S. Department of the Army, written commun., 2000).

SUMMARY

Dugway Proving Ground (DPG) is a U.S. Department of Defense chemical, biological, and explosives testing facility in northwestern Utah. The DPG was activated for military use in 1942, and open-air testing of chemical and biological agents was conducted until 1969. Numerous Solid Waste Management Units and Hazardous Waste Management Units have been identified on the proving ground and are being monitored under the supervision of the Utah Department of Environmental Quality and the U.S. Department of the Army. Consultants have documented ground-water conditions at these sites; however, information about ground-water conditions in the areas adjoining DPG is limited.

Ground water in the basin fill in the DPG area occurs under confined and unconfined conditions. Most of the monitoring wells for numerous HWMU and SWMU sites in the Carr, Ditto, and Baker areas are completed in unconfined or semiconfined parts of the ground-water system. Wells providing potable water in these areas are completed in the deeper, confined part of the ground-water system. Ground water in the English Village and Fries areas occurs under unconfined conditions, and the two areas are separated by consolidated rock overlain by a thin layer of alluvium.

Areas of principal recharge were determined on the basis of precipitation, geology, and hydrology. Areas that receive more than 8 inches or more of winter precipitation, during October through April, have the greatest potential to recharge the ground-water system. Fractures and faults in crystalline rock and enlarged solution cavities in carbonate rock provide conduits for precipitation to infiltrate and recharge the basin-fill deposits at subsurface contacts. Stream runoff from consolidated rock also recharges the basin-fill deposits along the mountain fronts where alluvial and colluvial deposits are composed of gravels and sands, with minor amounts of clay and silt. Areas with the greatest potential to recharge the ground-water system are the Simpson Mountains, Sheeprock Mountains, alluvial and colluvial deposits along the flanks of these mountains, and parts of the Old River Bed. Discharge areas are designated where ground water discharges to the surface through natural means, mainly seeps and mudflats, where phreatophyte growth is well established, or where the depth to the water table is 20 feet or less.

The general direction of ground-water movement in the Dugway Valley/Government Creek Valley areas is to the northwest from principal recharge areas in the Simpson Mountains, Sheeprock Mountains, Government Creek Valley, and Old River Bed. Ground-water levels and movement in the Fries area indicate that the unconfined part of the ground-water system in this area is not well connected to the ground-water system in the English Village area or Government Creek Valley area. In the English Village area, pumping of wells and differences in the hydrologic properties of consolidated rock and unconsolidated deposits have influenced the movement of ground water.

Water samples from 10 wells and 5 springs were collected and analyzed for major ions, selected trace metals, alkalinity, and dissolved-solids concentrations. Water from all the wells and three of the springs was also analyzed for volatile and semivolatile organic compounds, and water from four wells was analyzed for explosive compounds. No explosive compounds or semivolatile organic compounds were detected in the water samples. Volatile organic compounds that were detected were attributed to laboratory contamination or contamination from handling in the field.

Current and historical water-quality analyses for 29 springs, 31 wells, and 6 surface-water sites are presented. Dissolved-solids concentration from the most recent analyses ranged from 186 to 2,300 mg/L for wells and springs with a water source in consolidated rocks and 454 to 10,200 mg/L for water from wells completed in basin-fill deposits. Arsenic concentrations detected in water from wells and springs ranged from an estimated 3.7 to 25 µg/L. Arsenic concentrations of more than 5 µg/L were detected in water from five wells sampled for the study and reported for water from four wells used for public supply.

Table 1. Records of selected wells, Dugway Proving Ground and adjoining area, Utah

[—, no data]

Well number: See figure 2 for an explanation of the numbering system used for hydrologic-data sites in Utah.
Owner/Well name: MW, Monitoring well; HWMU, Hazardous Waste Management Unit; EVW, English Village wastewater.
Primary use of water: P, public supply; M, monitoring well; I, irrigation; U, unused; S, stock; D, well destroyed or plugged; A, abandoned according to State of Utah, Administrative Rules; Z, dust and fire control.
Formation: Source of water to well: ALVM, alluvium; TE, extrusive igneous rocks; PCG, intrusive igneous rocks; PZC, carbonate rocks.
Altitude of land surface: Altitude is rounded to the nearest 0.1 foot when the well has been surveyed by the U.S. Geological Survey. All other altitudes were determined from a 7 1/2- minute quadrangle map.
Altitude of top of casing: Feet above sea level. Altitude is rounded to the nearest 0.1 foot when the well has been surveyed. Surveyed by consultant.
Casing: Finish: S, screen; P, perforated; depth of open interval.
Remarks: C, chemical analyses listed in table 4.

Well number	Owner/Well name	Year of construction	Primary use of water	Formation	Altitude of land surface (feet)	Altitude of top of casing (feet)	Casing: Depth of well (feet)	Casing: Diameter (inches)	Casing: Finish (feet)	Date water level measured	Water level below land surface (feet)	Water level below top of casing (feet)	Remarks
(C-7-8)2ccb-1	LDS Church/LDS Church well	1988	P	ALVM	4,840	—	202	8;10	S 110-180	—	—	—	C
(C-7-8)7cdc-1	US Army/Landfill-MW03	1998	M	ALVM	—	4,825.6	196	4	S 186-196	03-09-1999	—	191.97	—
(C-7-8)7dcd-1	US Army/Landfill-MW01	1998	M	ALVM	—	4,843.0	213	4	S 203-213	03-09-1999	—	209.10	—
(C-7-8)9dad-1	US Army/Well 19	1951	I	ALVM	4,837.1	—	400	16	P 85-180	03-08-1999	78.70	—	C
									P 290-385				
(C-7-8)9dca-1	US Army/Well 18	1951	I	ALVM; TE	4,839.9	—	345	16	P 100-195	03-08-1999	81.25	—	Bedrock at 340 feet; C
									P 215-320				
(C-7-8)10cbd-1	US Army/Well 6	1942	U	ALVM	—	4,834.4	175	8	P 155-175	03-05-1999	—	76.1	USGS recorder well.
(C-7-8)10cbd-2	US Army/HWMU130-MW01	1995	M	ALVM	—	4,836.7	—	4	S —	03-08-1999		78.6	—
(C-7-8)10dad-1	US Army/HWMU42-MW01	1992	M	ALVM;PZC	—	4,835.5	137	4	S 132-137	03-08-1999		70.9	Bedrock at 135 feet.
(C-7-8)10dad-2	US Army/HWMU42-MW02	1992	M	ALVM;PZC	—	4,834.2	122	4	S 112-122	03-08-1999		69.5	Bedrock at 109 feet.
(C-7-8)10dad-3	US Army/HWMU42-MW05	1993	M	ALVM	—	4,834.4	88	4	S 72-88	03-08-1999		69.9	—
(C-7-8)10dda-1	US Army/HWMU42-MW03	1992	M	ALVM;PZC	—	4,836.5	103	4	S 93-103	03-08-1999		72.3	Bedrock at 79 feet.
(C-7-8)10dda-2	US Army/HWMU42-MW04	1992	M	ALVM;PZC	—	4,835.6	92	4	S 77-92	03-08-1999		71.2	Bedrock at 80 feet.
(C-7-8)10dda-3	US Army/HWMU42-MW06	1993	M	ALVM	—	4,836.5	94	4	S 73-93	03-08-1999		72.0	—
(C-7-8)15bcb-1	US Army/Well 20	1954	U	ALVM	4,833.3	—	500	8	P 98-120	03-04-1999	75.23	—	C
(C-7-8)15cba-1	US Army/Well 26	1957	P	ALVM	4,838.3	—	432	16;20	P 104-140	03-09-1999	80.23	—	C
									P 150-220				
									P 265-320				
									P 405-410				
(C-7-8)16abc-1	US Army/HWMU44-MW01	1994	M	TE	—	4,840.8	90	4	S 80-90	03-08-1999		81.7	Bedrock at 20 feet.
(C-7-8)16acb-1	US Army/HWMU44-MW02	1994	M	TE	—	4,843.4	89	4	S 79-89	03-08-1999		79.2	Bedrock at 15 feet.
(C-7-8)16acb-2	US Army/HWMU44-MW03	1994	M	TE	—	4,841.3	89	4	S 79-89	03-08-1999		82.3	Bedrock at 15 feet.
(C-7-8)16acc-1	US Army/HWMU69-MW01	1994	M	TE	—	4,844.0	89	4	S 79-89	03-08-1999		85.0	Bedrock at 15 feet.
(C-7-8)16acc-2	US Army/HWMU69-MW02	1994	M	TE	—	4,842.6	89	4	S 79-89	03-08-1999		80.9	Bedrock at 15 feet.
(C-7-8)17ccb-1	US Army/EVW-MW05	—	M	ALVM	—	4,850.5	225	4	S 205-225	03-09-1999	—	206.18	—
(C-7-8)18abd-1	US Army/Landfill-MW02	1998	M	ALVM	—	4,810.6	175	4	S 165-175	03-09-1999	—	171.82	—
(C-7-8)18bbd-1	US Army/Landfill-MW04	1998	M	ALVM	—	4,778.3	146	4	S 136-146	03-09-1999	—	140.63	—
(C-7-8)18dcb-1	US Army/HWMU47-MW03A	1992	M	ALVM	—	4,810.7	182	4	S 168-183	03-09-1999	—	166.23	—
(C-7-8)18ddc-1	US Army/HWMU47-MW04	1992	M	ALVM	—	4,799.2	192	4	S 172-187	03-09-1999	—	153.43	—
(C-7-8)18ddd-1	US Army/HWMU47-MW02	1992	M	ALVM	—	4,824.0	216	4	S 197-217	03-09-1999	—	178.24	—
(C-7-8)19aaa-1	US Army/EVW-MW03	—	M	ALVM	—	4,838.1	—	4	S —	03-09-1999	—	192.60	—
(C-7-8)19aab-1	US Army/HWMU47-MW05	1992	M	ALVM	—	4,813.1	222	4	S 200-215	03-09-1999	—	166.82	—
(C-7-8)22adb-1	US Army/Well 21	1954	U	ALVM	4,851.2	—	718	8;20	P 112-125	03-04-1999	92.13	—	—
									P 140-160				
									P 280-310				
									P 365-400				
									P 490-497				
(C-7-8)22adb-2	US Army/Well 27	1957	P	ALVM	4,852	—	545	16;20	P 105-120	—	—	—	C
									P 140-170				
									P 180-240				
									P 260-290				
									P 300-340				
									P 345-350				
									P 375-390				
									P 445-450				
									P 475-540				
(C-7-8)22bda-1	US Army/HWMU43-MW02	1992	M	ALVM	4,848.3	105	4	S 90-105	03-09-1999		89.6	—	
(C-7-8)22bda- 2	US Army/HWMU43-MW03	1992	M	ALVM	—	4,854.3	128	4	S 113-128	03-09-1999		96.8	—
(C-7-8)22bdd-1	US Army/HWMU43-MW06	1993	M	ALVM	—	4,858.4	112	4	S 97-112	03-09-1999		99.9	—
(C-7-8)22caa-1	US Army/HWMU43-MW04	1992	M	ALVM	—	4,864.3	126	4	S 114-126	03-09-1999	—	105.7	—
(C-7-8)22caa-2	US Army/HWMU43-MW05	1992	M	ALVM	—	4,863.0	120	4	S 106-121	03-09-1999	—	104.19	—
(C-7-8)22cad-1	US Army/HWMU43-MW07	1993	M	ALVM	—	4,871.0	135	4	S 118-133	03-09-1999	—	112.31	—
(C-7-8)22cba-1	US Army/HWMU43-MW01	1992	M	ALVM	—	4,889.0	153	4	S 138-153	03-09-1999	—	126.51	—
(C-7-8)22ddd-1	US Army/Well 30	1974	P	ALVM	4,862.4	—	450	16	P —	03-18-1999	102.5	—	—
(C-7-8)36ccc-1	Castlerock, Inc./Davis well	—	S	ALVM	4,979	—	272	6;20	P —	—	—	—	C
(C-7-9)12ddd-1	US Army/Landfill-MW05	1998	M	ALVM	—	4,814.2	179	4	S 169-179	03-09-1999		177.36	—
(C-7-9)32ccd-1	US Army/Well 5	1944	P	ALVM	4,359	—	355	10;8	P 320-355	03-11-1999	21.03	—	C
(C-7-10)25ccd-1	US Army/Well 1	1935	D	ALVM	4,339	—	317	6;8	P 290-317	—	—	—	C
(C-7-10)25ccd-2	US Army/Well 28	1959	P	ALVM	4,339	—	336	12;16	P 280-333	—	—	—	C
(C-7-10)25cdd-1	US Army/Well 2	1942	D	ALVM	4,341	—	328	6;10	P 168-180	—	—	—	C
(C-7-10)36bab-1	US Army/Well 3	1945	P	ALVM	4,341	—	330	10;12	P 300-320	—	—	—	C
(C-7-11)25ccb-1	US Army/Well 15	1950	U	ALVM	4,307	—	356	10;12	—	03-11-1999	6	—	—
(C-7-11)26daa-1	US Army/Well 17	1951	A	ALVM	4,310	—	320	6	P 288-304	—	—	—	Well drilled to 1,003 feet; plugged with concrete to 320 feet; C.
(C-7-11)26dad-1	US Army/Well 16	1951	A	ALVM	4,310	—	292	12	P 260-273	—	—	—	C
(C-7-13)34acc-1	US Army/Well 10	1944	Z	PCG	4,350	—	155	12	P 135-155	—	—	—	Bedrock at 155 feet; salty; C.
(C-8-9)5bba-1	US Army/Well 4	1942	D	ALVM	4,357	—	170	6;10	P 150-170	—	—	—	C
(C-8-9)8acb-1	US Army/Well 29	1972	U	ALVM	4,381	—	450	12	—	—	03-25-1999	36.66	—
(C-8-10)10dda-1	US Army/Well 7	1942	D	PZC	4,370	—	120	8	P 110-120	—	—	—	Bedrock at 120 feet; C.
(C-8-11)17dbc-1	US Army/Well 25	1955	U	ALVM	4,320	—	193	10	P 72-89	03-10-1999	17.60	—	
									P 100-105				
									P 132-142				
									P 167-168				
(C-9-10)6bdd-1	US Army/Old River Bed observation well	1999	U	ALVM	4,345	—	75	2	P 55-75	04-20-1999	27.65	—	C
(C-9-11)1ddb-1	US Army/Well 22	1954	Z	ALVM	4,395	—	205	8	P 98-205	—	—	—	C
(C-9-11)16add-1	US Army/Well 24	1954	U	ALVM	4,338	—	200	10	—	—	03-18-1999	26.35	—
(C-9-11)19acc-1	US Air Force/MX observation well	1979	U	ALVM	4,337	—	195	2	P 190-195	03-05-1999	30.33	—	C
(C-9-11)33ccb-1	Bureau of Land Management/ Fandangle well	1952	U	ALVM	4,480	—	202	6	P 169-202	03-05-1999	167.14	—	C
(C-9-12)1dac-1	US Army/Well 23	1954	U	ALVM	4,316	—	210	10	—	—	03-18-1999	11.59	—
(C-9-12)25cba-1	Bureau of Land Management/ Bullion Canyon well	1969	S	ALVM	4,465	—	307	8	P 183-228	03-05-1999	155.2	—	C
									P 240-260				
									P 285-300				
(C-10-9)8ccc-1	Bureau of Land Management/ Riverbed Trail well	1957?	S	ALVM	4,410	—	130	—	—	03-23-1999	83.81	—	C
(C-10-9)21acc-1	C.A. Snarr/Snarr well	1964	I	ALVM	4,425	—	127	16	P 51-98	03-23-1999	48.53	—	C
(C-10-10)2dcc-1	Fenn Brothers/West well	1973	U	ALVM	4,425	—	235	16	P 105-215	—	—	—	C
(C-10-10)2ddc-1	Fenn Brothers/East well	1973	U	ALVM	4,430	—	375	16	P 120-375	03-23-1999	106.1	—	—
(C-10-10)31bbb-1	Bureau of Land Management/ Fera 38 well	1935	S	ALVM	4,524	—	551	6;8	—	—	03-05-1999	191.4	—	C
(C-11-8)18dcb-1	Sainsbury, Brent E./South well	1962	I	ALVM	4,553	—	200	12	P 95-170	—	—	—	C
(C-11-8)21bbc-1	US Air Force/MX observation well	1980	U	—	4,680	—	197	2	P 177-197	03-16-1999	99.72	—	C
(C-11-9)1bca-1	Sainsbury, Brent E./North well	1958	I	ALVM	4,530	—	448	12;16	P 138-448	03-29-1999	68.05	—	C
(C-11-9)1cdb-1	Sainsbury, Brent E./Middle well	1962	I	ALVM	4,530	—	445	12	P 80-165	—	—	—	C
(C-11-11)12aba-1	Bureau of Land Management/ Dugway-Topaz well	1949	S	ALVM	4,602	—	306	6	—	—	—	—	C

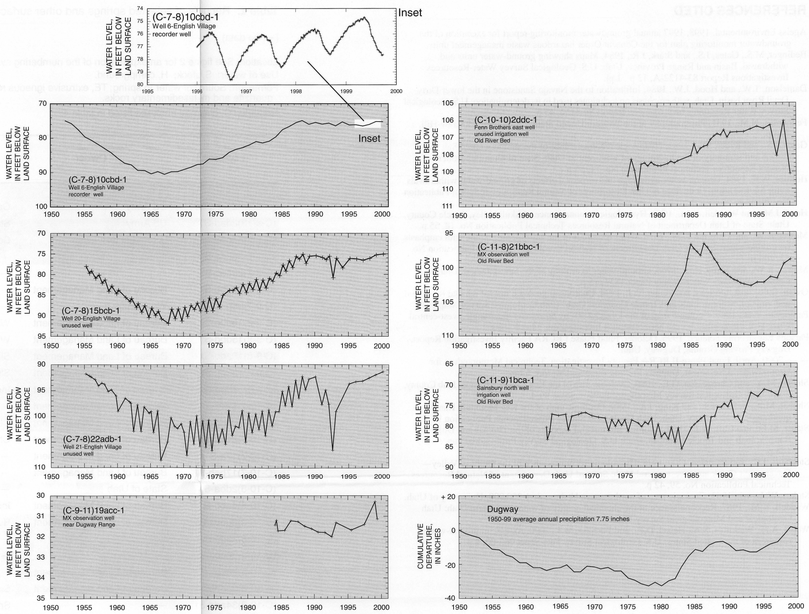

Figure 5. Water-level fluctuations in selected wells, 1950-2000, and cumulative departure from average annual precipitation, 1950-99, Dugway Proving Ground and adjoining area, Utah.

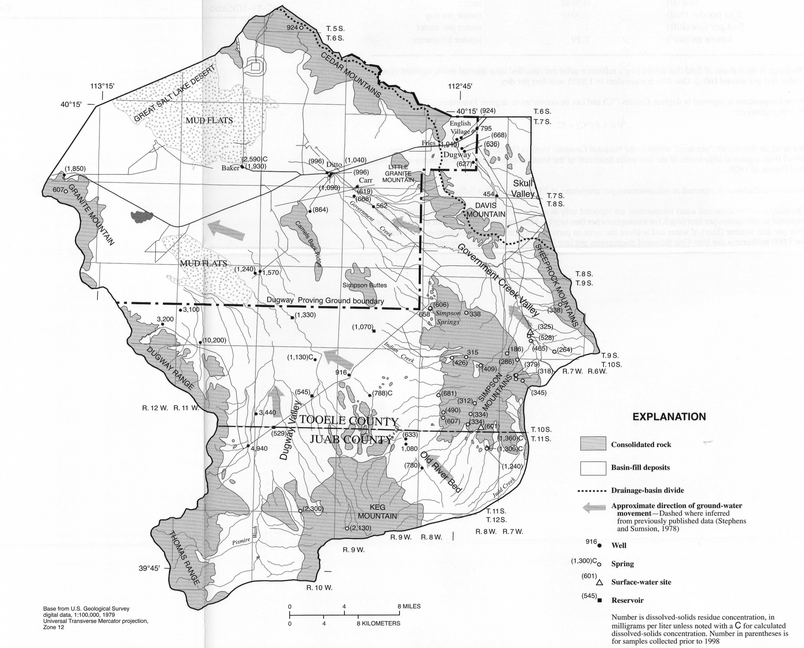

Figure 6. Dissolved-solids concentration for water from selected wells, springs, and other surface-water sites, Dugway Proving Ground and adjoining area, Utah.

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