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Records of Selected Wells and Springs in the Rulison Project Area, Garfield and Mesa Counties, Colorado

September 1969

Open-file Report

This report is preliminary and has not been edited for conformity with Geological Survey format and nomenclature.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Special Projects Branch

Rulison-2
September 1969

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Federal Center, Denver, Colorado 80225

RECORDS OF SELECTED WELLS AND SPRINGS IN THE RULISON PROJECT AREA, GARFIELD AND MESA COUNTIES, COLORADO

By

R. Theodore Hurr, Woodrow W. Wilson, Frank A. Welder
and R. L. Emerson

INTRODUCTION

An inventory of wells and springs in the Rulison project area and vicinity was made from March 20 - April 3 and May 20 -25, 1969, by the U.S. Geological Survey in cooperation with the U.S. Atomic Energy Commission. The Rulison project is part of the Plowshare Program and is a cooperative effort of the Austral Oil Company, Inc. (operator), the CER Geonuclear Corporation (technical consultant), the U.S. Atomic Energy Commission, and the Los Alamos Scientific Laboratory. The project is an experimental study to determine the commercial feasibility of stimulating natural-gas production in the Rulison gas field by fracturing the reservoir rock with a nuclear explosion. The nuclear device will be implanted approximately 8,400 feet below land surface.

The purpose of this study was to document the physical condition of wells and springs, and to collect samples of water prior to the nuclear event, for chemical analyses. The inventory of wells and springs was limited to a circular area having an approximate radius of 20 kilometers from the emplacement hole (pl. 1). The location of the emplacement hole is in the NE¼NE¼SW¼ sec. 25, T. 7 S., R. 95 W., in Garfield County, Colorado about 65 kilometers (40 miles) northeast of Grand Junction, Colorado, and about 20 kilometers (12 miles) southwest of Rifle, Colorado. A report on the geology and hydrology of the site as determined from an exploratory hole was prepared by Voegeli (1969). The areal geology is described in more detail by Coffin and others (1968). During the field inventory, all wells and springs within a 10-kilometer (6.2-mile) radius of the emplacement hole and selected wells and springs within the 10-kilometer to 20-kilometer (12.4-mile) radius were visited. Records of the inventoried wells and springs are given in tables 1 and 2, and their locations are shown on plate 1.

Table 1.--Records of selected wells, Rulison Project Area, Garfield and Mesa Counties, Colorado

Location number: See text for well-numbering system.
Date of inventory: Date of inventory, water-level measurement, yield measurement.
Depth of well: Measured depths are given in feet and tenths below land surface (accuracy ± 0.5 ft); reported depths are given in feet.
Altitude of land surface: Altitude, estimated from 7½-minute quadrangle topographic maps, is given in feet above mean sea level.
Depth to water: Measured depths to water are given in feet and tenths below land surface; reported depths are given in feet below land surface. A "P" indicates pumping level at time of measurement.

Method of lift and type of power: J, jet; N, none; P, piston; S, submersible; T, turbine; E, electric motor; NG, natural gas engine.
Yield: All quantities are given in gallons per minute. R, reported; E, estimated.
Use of water: D, domestic; I, irrigation; Ind, industrial; N, none; S, stock.
Well permit number: Permit on file at State Engineer's office under this number.
Remarks: DC, depth well cased; Pf, perforated casing with interval shown; OH, open hole with interval shown.

Location number	Owner or tenant	Date of inventory	Year completed	Depth of well (feet)	Casing		Altitude of land surface (feet)	Depth to water (feet)	Method of lift and power	Yield (gallons per minute)	Use of water	Temperature of water (°C)	Turbidity (milligrams per liter)	Well permit number	Remarks
					Diameter (inches)	Type									
SC 6-93-15CBD	K. Johnson	3-26-69	1941	41	--	--	5,330	25	J,E	--	D	10	1	--	
-16BCB	Kozy Kottage Kourt	3-27-69	1954	50	6	--	5,300	20	--	60R	D	--	--	R1198	Pump would not start.
-16CDB	J. Layne	3-27-69	1963	40	7	Steel	5,310	19	J,E	20R	D,S	--	--	P18318	Pump was not working. Owner uses city water.
-16CDD	W. Wood	3-27-69	1964	24	7	Steel	5,305	8	J,E	20R	N	--	--	P20897	
-16DCC	R. Swallow	3-27-69	1964	44	7	Steel	5,315	18	--	20R	D	--	--	PF5733	
-17BBD	W. Shafto	3-26-69	1956	38	5	Steel	5,290	18	J,E	5E	D	11	<1	N28	Problems with salt and corrosion. Well cleaned out about 1 year ago.
-18ADB	A. Wooley	3-26-69	1965	42	5	Steel	5,290	31	J,E	10R	N	--	--	P25185	
-18DAC	Union Carbide Corp.	3-26-69	1957	30.5	96	Steel	5,270	10.6P	T,E	1,500R	Ind	15	15	--	Two 8-inch pumps in well.
-20CCC	E. Hull	3-26-69	--	300	7	Steel	5,710	80	P,E	--	D	8	4	--	
SC 6-94-23DCA	C. Saulsbury	3-24-69	1966	94	--	--	5,520	--	J,E	5E	D	10	<1	--	
-26BCC	N. Mead	3-24-69	1964	75	7	Steel	5,300	30	S,E	15R	D,S	10	<1	P19365	
-26CAC	H. Boor	3-24-69	1953	210	15	Steel	5,360	88.8	T,NG	650R	I	--	--	R13852	Well number 1.
-27DAA	L. Dotson	3-24-69	1962	103	6	Steel	5,300	--	P,E	--	D,S	17	2	--	Owner reports motor needs replacing.
-27DDA	H. Boor	3-24-69	1953	210	15	Steel	5,340	83.6	T,NG	650R	I	--	--	R13851	Well number 2.
-30CDA	E. Becktell	3-20-69	1954	140	--	--	5,280	--	S,E	--	D	5	3	--	
-31BBD	G. Ems	3-20-69	1967	105	7	Steel	5,270	65	S,E	40R	D	3	<1	--	
-31BCA	R. McDaniel	3-20-69	1965	130	7	Steel	5,350	110	S,E	23R	I,D,S	3	<1	--	DC, 130 feet.
-31BCD	Seventh Day Adventist	3-20-69	1962	100	7	Steel	5,360	80	S,E	20R	D	4	3	P13564	

Table 1.--Records of selected wells, Rulison Project Area, Garfield and Mesa Counties, Colorado--Continued

Location number	Owner or tenant	Date of inventory	Year completed	Depth of well (feet)	Casing: Diameter (inches)	Casing: Type	Altitude of land surface (feet)	Depth to water (feet)	Method of lift and power	Yield (gallons per minute)	Use of water	Temperature of water (°C)	Turbidity (milligrams per liter)	Well permit number	Remarks
SC [illegible]	W. Massey	3-24-69	1967	142	6	Steel	5,380	70	S,E	8R	D	11	<1	P32393	OH, 110-142 feet.
-[illegible]	F. Robinson	3-20-69	1964	160	7	Steel	5,600	15	E	30R	D	10	<1	--	
-[illegible]	J. Gibbs	3-21-69	1969	54.0	9	Steel	5,470	22.9	N	--	N	--	--	--	New well, no pump.
SC [illegible]	O. Mahaffey	3-20-69	1963	180	5	Steel	5,485	120	S,E	2R	D	8	2	P18113	
-34CBA	do.	3-24-69	1963	88.0	7	Steel	5,220	69.5	S,E	12R	S	--	--	P18114	
-35ACD	W. Arnett	3-27-69	--	12.0	(48x48)	Wood	5,140	10.7	N	--	N	--	--	--	
-36ADB	C. Gardner	3-26-69	--	33	7	Steel	5,220	--	J,E	5E	D	3	12	--	
-36ADD	R. Smith	3-24-69	1921	86	--	--	5,280	--	J,E	--	D	7	3	--	
-36DAB	L. Dix	3-20-69	--	110.0	96	Concrete	5,280	44.0	J,E	--	D	8	<1	--	
SC 6-96-29DAA	Sinclair Oil Co.	3-20-69	1959	40	4	Steel	5,440	20	J,E	35R	D,S	14	<1	--	
-34BDA	Union Oil Co.	3-20-69	1951	88.0	8	Steel	5,445	65.9	S,E	10	S	12	<1	--	Formerly used for irrigation. Reported to yield about 250 gpm when equipped with 4-inch turbine pump.
-34BDB	do.	3-20-69	--	85.0	4	Steel	5,425	57.9	S,E	<10R	D	7	<1	--	Casing quite rusty.
-34CAD	do.	3-20-69	1963	59.0	6	Steel	5,340	39.0	S,E	5E	S	9	27	P17375	
-34CBD	do.	3-20-69	--	121.4	6	Steel	5,380	61.0	J,E	--	N	--	--	--	
-34CDB	do.	3-20-69	1963	81.9	6	Steel	5,330	68.0	J,E	10E	S	11	<1	P17376	Casing rusty but pump in good condition.
SC 7-94- 6DDD	R. Bingman, Sr.	3-22-69	1945	140	7	Steel	6,480	100	P,E	--	D,S	6	1	--	
- 7BAB	F. Sefcovic	3-22-69	1954	85	6	Steel	6,460	--	P,E	3R	D,S	8	<1	--	
- 7BBA	J. Lemon	3-28-69	--	--	6	Steel	--	--	--	--	N	--	--	--	Pump out of hole.
SC 7-95- 2CBC	P. Baum	3-19-69	1969	295	7	Steel	5,860	130	S,E	5E	D	6	1	PF6667(?)	
- 3DCD	H. Pfost	4- 3-69	1959	125	7	Steel	5,940	--	S,E	--	N	--	--	--	Pump set at 50 feet.
- 3DDC	C. Moore	4- 3-69	1961	150	6	Steel	5,965	70	S,E	50R	I,D	--	--	PF2713	
- 4CCC	J. Savage	3-26-69	--	122.5	5	Galv. iron	5,950	120.0	S,E	--	N	--	--	--	Pump pulled.
- 7ADB	J. Lawson	5-13-69	1960	100	7	Steel	5,160	30	J,E	1R	D	16	--	P5480	DC, 63 feet.
- 7DAB	M. Zedlker	3-24-69	1968	12.5	36	Concrete	5,120	7.8	P,E	5E	I,D	11	<1	--	
- 9ADB	J. Smith	5-20-69	1968	160	7	Steel	5,920	--	N	--	N	--	--	P28859	
-10ACB	L. Hayward	4- 3-69	1968	115	5	Galv. iron	6,050	90	J,E	10R	D,S	--	--	P024	
-10ACC	Sorensen	5-20-69	1966	160	7	Steel	6,100	80	N	20R	N	--	--	P28863	
-10AIC1	K. Schwab	4- 3-69	1955	75	--	--	6,140	32	--	--	I,D	--	--	R6280	
-10AIC2	do.	5-14-69	1954	134	6	Steel	6,140	13	S,E	50R	I,D	--	--	--	
-10AIC3	do.	4- 3-69	--	--	--	--	6,140	--	S,E	--	--	--	--	--	
-10BDA	L. Hayward	5-14-69	1968	143	5	Steel	5,990	43	S,E	--	D	11	--	--	
-10BCB	do.	5-13-69	--	100	7	Steel	6,100	81.0	N	--	N	--	--	P28861	
-17BAD	R. Smith	3-28-69	1951	80	8	Steel	6,210	--	S,E	--	D,S	12	<1	--	

Table 1.--Records of selected wells, Rulison Project Area, Garfield and Mesa Counties, Colorado--Continued

Location number	Owner or tenant	Date of inventory	Year completed	Depth of well (feet)	Casing: Diameter (inches)	Casing: Type	Altitude of land surface (feet)	Depth to water (feet)	Method of lift and power	Yield (gallons per minute)	Use of water	Temperature of water (°C)	Turbidity (milligrams per liter)	Well permit number	Remarks
SC 7-95-17AAB	A. McLane	3-19-69	1966	230	5	Steel	5,660	100	S,E	3R	D	7	1	P28860	Pf, 1[illegible]-220 feet; OH, [illegible]-230 feet.
-17ABA	D. Dupice	3-19-69	1966	240	5	Steel	5,600	160	S,E	7R	D	13	10	P28862	Pf, 1[illegible]-210 feet; OH, 2[illegible]-240 feet.
-18ADB	R. Nordstrom	3-18-69	1949	100	7	Steel	5,380	50	S,E	8R	D	14	2	--	Owner reports water is rusty.
-18CBB	G. Rogers	5-13-69	1960	95	7	Steel	5,110	66	S,E	30E	D	12	--	P5517	
-18DAD	M. Christianson	3-18-69	--	--	6	Steel	5,470	--	S,E	--	D	12	2	--	
-20BBA	A. Gardner	3-26-69	1957	130	6	Steel	5,510	80	S,E	10E	D,S	12	<1	--	
SC 7-96- 1CCC	Lindauer	--	--	--	--	--	5,150	--	--	--	N	--	--	--	Tenant reports that well is no good. It was drilled in too fine and clayey material.
- 2DBB	C. Alber	3-20-69	1900	29.3	24	Rock	5,195	15.1	J,E	8R	S	--	--	N439	Motor on pump reported to have failed Dec. 1968. It has not yet been repaired.
-12BBB	B. Lindauer	3-20-69	1948	57	6	Steel	5,140	32	J,E	10E	D	16	<1	--	
-13ABB	W. Gray	3-24-69	1964	50.7	7	Steel	5,080	34.4	J,E	--	D	--	--	P16995	
-13ABD	J. Smith	3-24-69	1959	14.6	24	Concrete	5,060	7.2	J,E	5E	D	11	11	--	
-23CAD	Mountain Corp.	3-25-69	1959	13.9	23	Oil drums	5,030	11.0	P,E	5E	D	7	1	--	
-34BAC	A. DeMaestri	--	--	--	--	--	4,995	--	--	--	N	--	--	--	
-34BBC	do.	3-25-69	--	11.0	(24x24)	Concrete	4,995	8.9	J,E	5E	D	7	<1	--	
-34BCD	R. Ellis	3-25-69	1961	23.2	7	Steel	4,990	9.8	J,E	5E	D	11	12	--	
-34BDC	C. Hayward	3-25-69	1963	25.5	7	Steel	4,990	11.1	J,E	15R	D	11	37	P16997	
SC 8-96-11ACC	E. Kennon	3-18-69	--	50	8	--	5,760	38	S,E	--	D,S	9	2	--	
-11BBD	L. Knox	3-18-69	1950	10	36	None	5,600	6.0	J,E	6E	D	6	3	--	
-12AAC	N. Dutton	5-13-69	1949	160	6	Steel	6,100	144	P,E	2E	D,S	13	--	--	DC, 1[illegible] feet.
SC 8-97-14DAD	O. Mahaffey	3-26-69	1964	107.0	5	Steel	5,020	66.7	S,E	8R	S	--	--	P19065	
SC 9-94-22ACC	W. Nicoll	3-25-69	1965	290	9	Steel	6,980	100	S,E	5E	D,S	12	<1	P20032(?)	
-22BAB	W. Severson	5-15-69	1966	110	7	Steel	6,940	--	S,E	5E	D,S	10	--	--	
SC 9-95-26BAA	P. Hight	5-15-69	1951	75	5	Steel	6,320	57	J,E	--	D	15	--	--	
-34BDB	M. Campbell	3-25-69	1900	40	6	Rock	5,994	--	J,E	--	D	10	<1	--	Pump in basement of store. Well under street about 25 feet north of store.

Table 1.--Records of selected wells, Rulison Project Area, Garfield and Mesa Counties, Colorado--Continued

Location number	Owner or tenant	Date of inventory	Year completed	Depth of well (feet)	Casing		Altitude of land surface (feet)	Depth to water (feet)	Method of lift and power	Yield (gallons per minute)	Use of water	Temperature of water (°C)	Turbidity (milligrams per liter)	Well permit number	Remarks
					Diameter (inches)	Type									
SC 6-95-35ABC	T. Young	5-20-69	1964	765	7	Steel	6,100	55	S,E	50E	D	--	--	PF6238	DC, 765 feet. Pf, 175-300 feet, 405-510 feet, and 565-765 feet.
SC 10-95- 2AAB	Unknown	4- 3-69	--	35	--	--	6,240	--	--	--	N	--	--	--	Pump bad. Tenant hauling water.
- 2BAA	H. Castle	4- 3-69	1964	185	5	Steel	6,245	138	J,E	12R	D	--	--	P21409	

Table 2.--Records of selected springs, Rulison Project Area, Garfield and Mesa Counties, Colorado.

Location number: See text for spring-numbering system.
Date of inventory: Date of inventory and yield measurement.
Altitude of land surface: Altitude of point of discharge, estimated from 7½-minute quadrangle topographic maps, is given in feet above mean sea level.
Yield: R, reported; E, estimated.
Use of water: C, commercial; D, domestic; I, irrigation; M, municipal; S, stock.
Improvements: B, box; N, none; P, pipe; U, undetermined.
Temperature: Recorded to nearest 1°C.

Location number	Owner or tenant	Date of inventory	Altitude of land surface (feet)	Yield (gallons per minute)	Use of water	Improvements	Temperature (°C)	Turbidity (milligrams per liter)	Remarks
SC 6-93-18AAC	A. Wooley	3-26-69	5,340	1E	C,D	B,P	6	<1	Spring went dry once or twice 6 or 7 years ago.
-20BDD	J. Todd, Sr.	3-26-69	5,400	--	D	U	4	>150	
SC 6-94-26ACA	L. Farris	3-24-69	5,520	--	D	U	10	<1	
-26ADC	H. Boor	3-24-69	5,500	12R	D	U	7	<1	
-31BBB	B. Potter	3-20-69	5,210	100E	I,D	B	13	<1	
-32CCA	W. Wells	3-21-69	5,770	--	D	U	8	<1	
-33DBD	D. Winch	3-24-69	5,640	--	D	U	5	<1	
-34DCC	J. Smith	3-24-69	5,510	--	D	U	4	<1	
SC 6-95-36CDD	G. Scarrow	3-21-69	5,480	--	D	U	5	3	
SC 7-94- 4ACD	M. Bernklau	3-24-69	5,920	--	D	U	7	<1	
- 4BDC	C. Bernklau	3-22-69	6,040	--	D	U	5	<1	
- 6ABA	E. Pettigrew	3-21-69	5,840	--	D	U	3	21	
- 6BBA	M. Gerst	3-20-69	5,800	--	D,S	U	5	2	Supplies water to four houses.
SC 7-95- 1ABA	G. Elliott	3-21-69	5,760	--	D	U	6	<1	
- 1BAA	C. Clark	3-21-69	5,680	--	D	U	4	<1	
- 2ADD	A. Hoagland	3-26-69	5,740	--	D	U	6	<1	
- 2BCD	E. Forshee	3-21-69	5,580	--	D,S	U	4	4	

Table 2.--Records of selected springs, Rulison Project Area, Garfield and Mesa Counties, Colorado--Continued.

Location number	Owner or tenant	Date of inventory	Altitude of land surface (feet)	Yield (gallons per minute)	Use of water	Improvements	Temperature (°C)	Turbidity (milligrams per liter)	Remarks
SC 7-95- 3BDB	G. Knight	3-26-69	5,340	150E	I	N	--	--	Contour ditch along hillside collects water from numerous springs along 1/2 - 3/4 mile of spring line.
- 4ACD	do.	3-26-69	5,340	5	D	N	9	3	
- 4ADD	do.	3-26-69	5,340	155	I	N	9	14	Irrigates with sprinkler.
- 4DBB	do.	3-26-69	5,340	70	I	N	10	9	
- 5DCD	Town of Grand Valley	3-21-69	5,340	125	M	B	12	<1	Twenty-one separate spring boxes collect water from numerous springs along 1/2 mile of spring line.
- 8CCB	R. Eaton	3-24-69	5,300	47	D,I,S	N	9	2	Contour ditch along hillside collects water from two separate springs.
-18AAD	do.	3-25-69	5,320	85	S	N	7	9	
-18BCD	C. Gardner	3-26-69	5,120	--	S	U	9	<1	
SC 7-96-33DCD	W. Hammerick	3-25-69	5,040	16	D,S	N	12	<1	
-34CAA	D. Knox	3-18-69	5,080	--	D	U	10	2	
-35DCB	O. Murray	3-18-69	5,500	--	D	U	4	4	Location number is for residence.

Table 2.--Records of selected springs, Rulison Project Area, Garfield and Mesa Counties, Colorado--Continued.

Location number	Owner or tenant	Date of inventory	Altitude of land surface (feet)	Yield (gallons per minute)	Use of water	Improvements	Temperature (°C)	Turbidity (milligrams per liter)	Remarks
SC 9-95-26DAA	City of Collbran	3-25-69	6,040	--	M	U	8	<1	
-33DBA	Plateau Valley School	3-25-69	5,720	--	M	U	10	<1	
-34ADB	R. Gibson	3-25-69	6,040	--	C,D	U	7	<1	Supplies a motel and the Civilian Conservation Center of the U.S. Bureau of Reclamation.
-35DDB	E. Chapman	3-25-69	6,150	--	D,S	U	2	<1	

METHODS OF STUDY

Permits and filings for wells and springs in the area were obtained from the Colorado State Engineer's office. These records were used in planning the field inventory. The well and spring records were then updated and other wells and springs were inventoried when located in the field (tables 1, 2).

The location number and altitude of each well and spring were determined from 7½-minute quadrangle topographic maps having a 40-foot-contour interval. Depths were measured, where possible, to the nearest 0.1 foot using a steel tape. Quantity of water discharged was measured by the "bucket-and-stop-watch" method or by using a Parshall flume. Data taken from the Colorado State Engineer's records or as indicated by the well user to U.S. Geological Survey personnel is recorded on the tables as reported. Information was collected regarding the construction of wells and the improvement of springs. The water temperature was recorded and samples were collected of the water being used, for later chemical and turbidity analyses. The water samples were analyzed for pH, total alkalinity, specific conductance, and turbidity within 36 hours of collection. Selected water samples were analyzed for general chemical and radiochemical constituents (table 3). The remaining samples have been stored for possible later analysis.

The distribution of the 110 wells and springs inventoried is shown below. A coverage of nearly 100 percent within the 10-kilometer radius and 50 to 60 percent within the 10- to 20-kilometer radius was accomplished during the inventory.

Distribution of inventoried wells and springs

	Less than 10 kilometers	10 to 20 kilometers	Total
Wells			
Colorado River valley	38	33	71
Plateau Creek valley	0	7	7
Total	38	40	78
Springs			
Colorado River valley	21	7	28
Plateau Creek valley	0	4	4
Total	21	11	32

Table 3.--Chemical analysis of water from selected wells and springs

Location number: See text for well and spring numbering sys-

(Chemical analysis, in milli-

Location number	Well or spring (W, S)	Date of collection	Silica (SiO_2)	Alumium (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Strontium (Sr)	Sodium (Na)	Potassium (K)	Lithium (Li)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)
SC6-93-15cbd	W	3-26-69	--	--	0.05	--	--	--	--	--	--	--	698	0	--	--	--
17bbd	W	3-26-69	--	--	.07	--	--	--	--	--	--	--	754	0	--	--	--
18aac	S	3-26-69	--	--	.04	--	--	--	--	--	--	--	532	0	--	--	--
18dac	W	3-26-69	--	--	.04	--	--	--	--	--	--	--	222	0	--	--	--
20bdd	S	3-26-69	--	--	.06	--	--	--	--	--	--	--	519	0	--	--	--
20ccc	W	3-26-69	--	--	.05	--	--	--	--	--	--	--	395	0	--	--	--
SC6-94-23dca	W	3-24-69	--	--	.01	--	--	--	--	--	--	--	360	0	--	--	--
26aca	S	3-24-69	--	--	.01	--	--	--	--	--	--	--	428	0	--	--	--
26adc	S	3-24-69	--	--	.02	--	--	--	--	--	--	--	327	0	--	--	--
26bcc	W	3-24-69	--	--	.02	--	--	--	--	--	--	--	535	0	--	--	--
27daa	W	3-24-69	--	--	.03	--	--	--	--	--	--	--	703	0	--	--	--
30cda	W	3-20-69	--	--	.02	--	--	--	--	--	--	--	332	0	--	--	--
31bbb	S	3-20-69	34	<0.1	.02	<0.01	56	26	0.48	32	7.1	<0.01	341	0	41	3.7	0.2
31bbd	W	3-20-69	--	--	<.01	--	--	--	--	--	--	--	418	0	--	--	--
31bca	W	3-20-69	--	--	.01	--	--	--	--	--	--	--	411	0	--	--	--
31bcd	W	3-20-69	--	--	.06	--	--	--	--	--	--	--	433	0	--	--	--
31bdc	W	3-24-69	--	--	.03	--	--	--	--	--	--	--	448	0	--	--	--
31dac	W	3-20-69	--	--	.02	--	--	--	--	--	--	--	357	0	--	--	--
32cca	S	3-21-69	--	--	.02	--	--	--	--	--	--	--	697	0	--	--	--
33dbd	S	3-24-69	--	--	.01	--	--	--	--	--	--	--	412	0	--	--	--
34dcc	S	3-24-69	--	--	<.01	--	--	--	--	--	--	--	448	0	--	--	--
SC6-95-28cdd[1/]	W	3-20-69	20	.1	.04	.04	50	42	.75	750	4.0	.06	755	0	1,160	27	.6
36adb	W	3-26-69	--	--	.12	--	--	--	--	--	--	--	376	0	--	--	--
36add	W	3-24-69	--	--	.02	--	--	--	--	--	--	--	411	0	--	--	--
36cdd	S	3-21-69	33	<.1	.03	<.01	47	55	.82	65	2.9	.02	530	0	43	7.9	.3
36dab	W	3-20-69	--	--	.02	--	--	--	--	--	--	--	474	0	--	--	--
SC6-96-29daa	W	3-20-69	23	<.1	.03	.03	130	51	1.8	90	15	.07	656	0	184	7.9	1.1
34bda	W	3-20-69	--	--	.01	--	--	--	--	--	--	--	617	0	--	--	--
34bdb	W	3-20-69	--	--	.02	--	--	--	--	--	--	--	606	0	--	--	--
34cad	W	3-20-69	--	--	.75	--	--	--	--	--	--	--	627	0	--	--	--
34cdb	W	3-20-69	--	--	.06	--	--	--	--	--	--	--	628	0	--	--	--
SC7-94-04acd	S	3-24-69	--	--	<.01	--	--	--	--	--	--	--	352	0	--	--	--
06aba	S	3-21-69	31	<.1	.05	.02	58	25	.49	25	3.4	.02	309	0	39	8.5	.2
06bba	S	3-20-69	--	--	.04	--	--	--	--	--	--	--	352	0	--	--	--
06ddd	W	3-22-69	--	--	<.01	--	--	--	--	--	--	--	324	0	--	--	--
07bab	W	3-22-69	--	--	<.01	--	--	--	--	--	--	--	229	0	--	--	--
04bdc	S	3-22-69	--	--	.02	--	--	--	--	--	--	--	408	0	--	--	--
SC7-95-01aba	S	3-21-69	--	--	.03	--	--	--	--	--	--	--	442	0	--	--	--
01baa	S	3-21-69	--	--	.02	--	--	--	--	--	--	--	679	0	--	--	--
02add	S	3-26-69	--	--	.03	--	--	--	--	--	--	--	473	0	--	--	--

...er from selected wells and springs, Rulison Project Area, Garfield and Mesa Counties, Colorado

...text for well and spring numbering system. Classification: W, wells; S, spring.

(Chemical analysis, in milligrams per liter)

...te ...)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Copper (Cu)	Zinc (Zn)	Selenium (Se)	Boron (B)	Dissolved solids (residue at 180°C)	Specific conductance (micromhos/cm at 25°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	pH	Tritium T.U.	Gross beta in picocuries per liter (as Sr^{90}-Y^{90})	Gross alpha in micrograms per liter (as U equivalent)
	0	--	--	--	--	--	--	--	--	--	--	1,990	--	--	7.4	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	2,850	--	--	7.3	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	2,210	--	--	7.8	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	5,480	--	--	7.2	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,220	--	--	7.8	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	686	--	--	7.6	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	670	--	--	7.2	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,180	--	--	7.8	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,010	--	--	7.7	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,160	--	--	7.5	400	6.3	6.8
	0	--	--	--	--	--	--	--	--	--	--	1,180	--	--	7.4	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	658	--	--	8.2	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	600	247	0	7.6	<220	8.4	12
	0	41	3.7	0.2	4.8	<0.01	0.02	0.03	0.02	0.06	392	707	--	--	7.6	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	789	--	--	7.6	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	759	--	--	7.5	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	789	--	--	7.5	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	658	--	--	7.7	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,710	--	--	7.9	<220	5.2	8.0
	0	--	--	--	--	--	--	--	--	--	--	762	--	--	7.6	<220	11	53
	0	--	--	--	--	--	--	--	--	--	--	854	--	--	7.7	--	--	--
	0	1,160	27	.6	30	<.01	.06	.49	.05	.42	2,150	3,250	299	0	7.4	<220	8.1	34
	0	--	--	--	--	--	--	--	--	--	--	662	--	--	7.4	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	708	--	--	7.6	--	--	--
	0	43	7.9	.3	5.4	<.01	.03	.03	<.01	.09	507	850	345	0	7.9	<220	5.6	28
	0	--	--	--	--	--	--	--	--	--	--	805	--	--	8.2	--	--	--
	0	184	7.9	1.1	6.0	<.01	.05	.19	.01	.16	835	1,260	537	0	7.4	<220	15	31
	0	--	--	--	--	--	--	--	--	--	--	1,363	--	--	7.4	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,345	--	--	7.4	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,640	--	--	7.4	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,300	--	--	7.5	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	720	--	--	7.6	--	--	--
	0	39	8.5	.2	9.0	<.01	.02	.02	<.01	.10	341	565	248	0	8.1	<220	5.1	11
	0	--	--	--	--	--	--	--	--	--	--	597	--	--	8.2	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	545	--	--	7.7	<220	<.4	5.0
	0	--	--	--	--	--	--	--	--	--	--	366	--	--	7.6	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	796	--	--	7.5	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	689	--	--	7.6	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	1,030	--	--	7.8	--	--	--
	0	--	--	--	--	--	--	--	--	--	--	760	--	--	7.7	--	--	--

Table 3.--Chemical analysis of water from selected wells and springs, R[illegible]

(Chemical [illegible])

Location number	Well or spring (W, S)	Date of collection	Silica (SiO_2)	Aluminum (Al)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Strontium (Sr)	Sodium (Na)	Potassium (K)	Lithium (Li)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)
SC7-95-02bcd	S	3-21-69	30	<0.1	0.03	<0.01	60	16	0.40	23	2.9	<0.01	262	0	33	7.2	[illegible]
02cbc	W	3-19-69	26	.1	.02	<.01	22	35	.76	150	3.5	.05	523	0	93	1.1	.3
04acd	S	3-26-69	--	--	.01	--	--	--	--	--	--	--	378	0	--	--	--
04add	S	3-26-69	27	<.1	.04	.02	44	45	.90	82	3.1	.02	403	0	127	8.9	.2
04dbb	S	3-26-69	--	--	.06	--	--	--	--	--	--	--	322	0	--	--	--
05dcd 2/	S	3-21-69	24	<.1	.03	<.01	26	33	.76	40	2.0	.02	323	0	20	8.3	.2
Do. 3/	S	3-21-69	--	--	.02	--	--	--	--	--	--	--	310	0	--	--	--
SC7-95-07dab 1/	W	3-24-69	33	<.1	.02	<.01	69	49	.87	115	3.3	.02	505	0	181	10	.4
08ccb	S	3-24-69	--	--	.02	--	--	--	--	--	--	--	370	0	--	--	--
12bad	W	3-22-69	36	<.1	.02	<.01	84	24	.49	22	2.1	.01	373	0	37	11	.2
17aab	W	3-19-69	30	.2	.01	<.01	25	23	.47	74	4.9	.01	337	0	48	.6	.3
17aba	W	3-19-69	--	--	.02	--	--	--	--	--	--	--	369	0	--	--	--
18aad	S	3-25-69	--	--	.06	--	--	--	--	--	--	--	404	0	--	--	--
18adb	W	3-18-69	27	.6	.02	.01	60	60	.92	145	6.2	.02	408	0	308	30	.2
18bcd	S	3-26-69	27	<.1	.02	.01	82	67	1.2	170	4.2	.03	439	0	437	40	.4
18dad	W	3-18-69	--	--	.04	--	--	--	--	--	--	--	363	0	--	--	--
20bba	W	3-26-69	24	<.1	.05	.02	48	38	.75	59	2.9	.02	363	0	67	[illegible]	.3
SC7-96-12bbb 1/	W	3-20-69	19	.1	.03	.01	140	90	1.5	205	5.0	.04	626	0	595	18	.7
13abd	W	3-24-69	19	<.1	.16	.11	130	108	2.5	290	5.6	.06	851	0	657	27	[illegible]
23cad	W	3-25-69	14	<.1	.04	.02	110	28	.89	118	3.1	.02	313	0	171	164	.3
33dcd	S	3-25-69	26	<.1	.03	.01	105	63	.94	180	4.4	.02	490	0	464	16	.2
34bbc	W	3-25-69	15	<.1	.03	.15	125	38	1.0	148	3.3	.02	352	0	188	240	.3
34bcd	W	3-25-69	--	--	.12	--	--	--	--	--	--	--	392	0	--	--	--
34bdc	W	3-25-69	--	--	.17	--	--	--	--	--	--	--	383	0	--	--	--
34caa	S	3-18-69	--	--	.06	--	--	--	--	--	--	--	519	0	--	--	--
35dcb	S	3-18-69	--	--	.01	--	--	--	--	--	--	--	422	0	--	--	--
SC8-96-11acc	W	3-18-69	27	<.1	.01	<.01	69	26	.64	39	2.9	.02	365	0	56	2.4	.2
11bbd	W	3-18-69	--	--	.01	--	--	--	--	--	--	--	411	0	--	--	--
SC9-94-22acc	W	3-25-69	--	--	.37	--	--	--	--	--	--	--	361	0	--	--	--
SC9-95-26daa	S	3-25-69	30	<.1	<.01	.01	51	28	.60	32	6.9	.01	368	0	22	2.9	.4
33dba	S	3-25-69	--	--	<.01	--	--	--	--	--	--	--	507	0	--	--	--
34adb	S	3-25-69	--	--	.01	--	--	--	--	--	--	--	398	0	--	--	--
34bdb	W	3-25-69	38	<.1	.01	<.01	57	36	.60	55	14	.01	449	0	41	5.9	.4
35ddb	S	3-25-69	--	--	.01	--	--	--	--	--	--	--	471	0	--	--	--

1/ Sample taken had passed through a domestic water softener.

2/ Before chlorination.

3/ After chlorination.

[illegible] wells and springs, Rulison Project Area, Garfield and Mesa Counties, Colorado--Continued

[illegible]mical analysis, in milligrams per liter)

[illegible]	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Phosphate (PO_4)	Copper (Cu)	Zinc (Zn)	Selenium (Se)	Boron (B)	Dissolved solids (residue at 180°C)	Specific conductance (micromhos/cm at 25°C)	Hardness as CaCO3: Calcium, magnesium	Hardness as CaCO3: Noncarbonate	pH	Tritium T.U.	Gross beta in picocuries per liter (as Sr90 + Y90)	Gross alpha in micrograms per liter (as U equivalent)
[illegible]	0	33	7.2	0.1	8.4	<0.01	0.03	0.11	<0.01	0.02	302	500	216	2	7.6	<220	3.4	11
[illegible]	0	93	1.1	.3	6.1	<.01	.05	.81	<.01	.30	587	940	200	0	7.8	<220	5.6	17
[illegible]	0	--	--	--	--	--	--	--	--	--	--	709	--	--	7.9	--	--	--
[illegible]	0	127	8.9	.2	8.8	<.01	<.01	.02	<.01	.12	564	650	236	0	8.1	<220	4.0	9.1
[illegible]	0	--	--	--	--	--	--	--	--	--	--	566	--	--	7.9	--	--	--
[illegible]	0	20	8.3	.2	8.6	<.01	.01	.02	<.01	.04	336	560	202	0	7.7	<220	3.0	21
[illegible]	0	--	--	--	--	--	--	--	--	--	--	514	--	--	7.8	--	--	--
[illegible]	0	181	10	.4	<.1	<.01	.30	.25	<.01	.14	665	1,060	375	0	7.5	<220	11	28
[illegible]	0	--	--	--	--	--	--	--	--	--	--	695	--	--	8.1	--	--	--
[illegible]	0	37	11	.2	8.0	<.01	.02	.09	<.01	.01	402	665	309	3	7.4	<220	1.5	5.5
[illegible]	0	48	.6	.3	3.8	<.01	.03	2.6	<.01	.15	364	595	158	0	7.9	<220	6.9	12
[illegible]	0	--	--	--	--	--	--	--	--	--	--	622	--	--	7.7	--	--	--
[illegible]	0	--	--	--	--	--	--	--	--	--	--	1,180	--	--	8.0	--	--	--
[illegible]	0	308	30	.2	7.2	<.01	.03	2.0	<.01	.15	855	1,260	398	63	7.8	<220	4.8	<.4
[illegible]	0	437	40	.4	4.8	<.01	.01	.02	<.01	.07	1,100	1,300	482	122	7.5	<220	4.6	26
[illegible]	0	--	--	--	--	--	--	--	--	--	--	661	--	--	7.6	--	--	--
[illegible]	0	67	4.8	.3	13	<.01	.01	.18	<.01	.05	435	720	278	0	7.6	320	<.4	9.1
[illegible]	0	598	18	.7	.4	<.01	.03	1.3	<.01	.10	1,450	1,870	722	208	7.4	<220	6.5	32
[illegible]	0	657	27	.9	.4	<.01	.01	.19	<.01	.18	1,730	2,250	772	74	7.4	<220	8.7	17
[illegible]	0	171	164	.3	<.1	<.01	.14	1.2	<.01	.04	781	1,200	391	134	7.4	570	3.4	2.4
[illegible]	0	464	16	.2	3.6	<.01	.01	.02	<.01	.28	1,140	1,500	523	121	7.4	230	5.4	20
[illegible]	0	188	240	.3	<.1	<.01	.01	.34	<.01	.03	953	1,450	470	181	7.6	590	1.2	8.7
[illegible]	0	--	--	--	--	--	--	--	--	--	--	1,060	--	--	7.6	--	--	--
[illegible]	0	--	--	--	--	--	--	--	--	--	--	1,240	--	--	7.5	--	---	--
[illegible]	0	--	--	--	--	--	--	--	--	--	--	1,490	--	--	7.6	--	--	--
[illegible]	0	--	--	--	--	--	--	--	--	--	--	1,240	--	--	8.1	<220	6.7	11
[illegible]	0	56	2.4	.2	14	<.01	.02	.07	<.01	.09	414	670	280	0	7.6	<220	2.6	4.7
[illegible]	0	--	--	--	--	--	--	--	--	--	--	711	--	--	7.5	--	--	--
[illegible]	0	--	--	--	--	--	--	--	--	--	--	858	--	--	7.8	<220	15	14
[illegible]	0	22	2.9	.4	3.0	<.01	.01	.04	<.01	.02	361	590	243	0	7.6	600	8.9	10
[illegible]	0	--	--	--	--	--	--	--	--	--	--	766	--	--	7.6	--	--	--
[illegible]	0	--	--	--	--	--	--	--	--	--	--	622	--	--	7.7	--	--	--
[illegible]	0	41	5.9	.4	8.5	.17	.02	.13	<.01	.06	465	760	291	0	7.5	470	24	42
[illegible]	0	--	--	--	--	--	--	--	--	--	--	794	--	--	7.4	--	--	--

WELL AND SPRING NUMBERING SYSTEM

The well and spring numbers in the tables indicate their respective locations as shown on plate 1. The numbers are based on the U.S. Bureau of Land Management system of land subdivision and show the location of the site by quadrant, township, range, section, and position within the section. A graphic illustration of this method of location for a well is shown in figure 1. The first capital letter, "S," preceding the location number means that the site is located in the area governed by the sixth principal meridian. The second capital letter, "C" (also preceding the location number), indicates the quadrant in which the well or spring is located. Four quadrants are formed by the intersection of the base line and the principal meridian: A indicates the northeast quadrant; B, the northwest; C, the southwest; and D, the southeast. The first numeral indicates the township; the second, the range, and the third, the section in which the well or spring is located. The letters following the section number indicate the location of the well or spring within the section. The first letter denotes the quarter section; the second, the quarter-quarter section; and the third, the quarter-quarter-quarter section. The letters are assigned within the section in a counter-clockwise direction, beginning with A in the northeast quarter. Letters are assigned within each quarter section and within each quarter-quarter section in the same manner. Where two or more locations are within the smallest subdivision, consecutive numbers,

beginning with 1, are added after the letter designation in the order the wells and springs were inventoried. For example, SC6-93-16ADD2 indicates a well or spring in the SE¼SE¼NE¼ sec. 16, T. 6 S., R. 93 W.; the 2 following the location letters indicates that this well was the second well or spring inventoried in the quarter-quarter-quarter section.

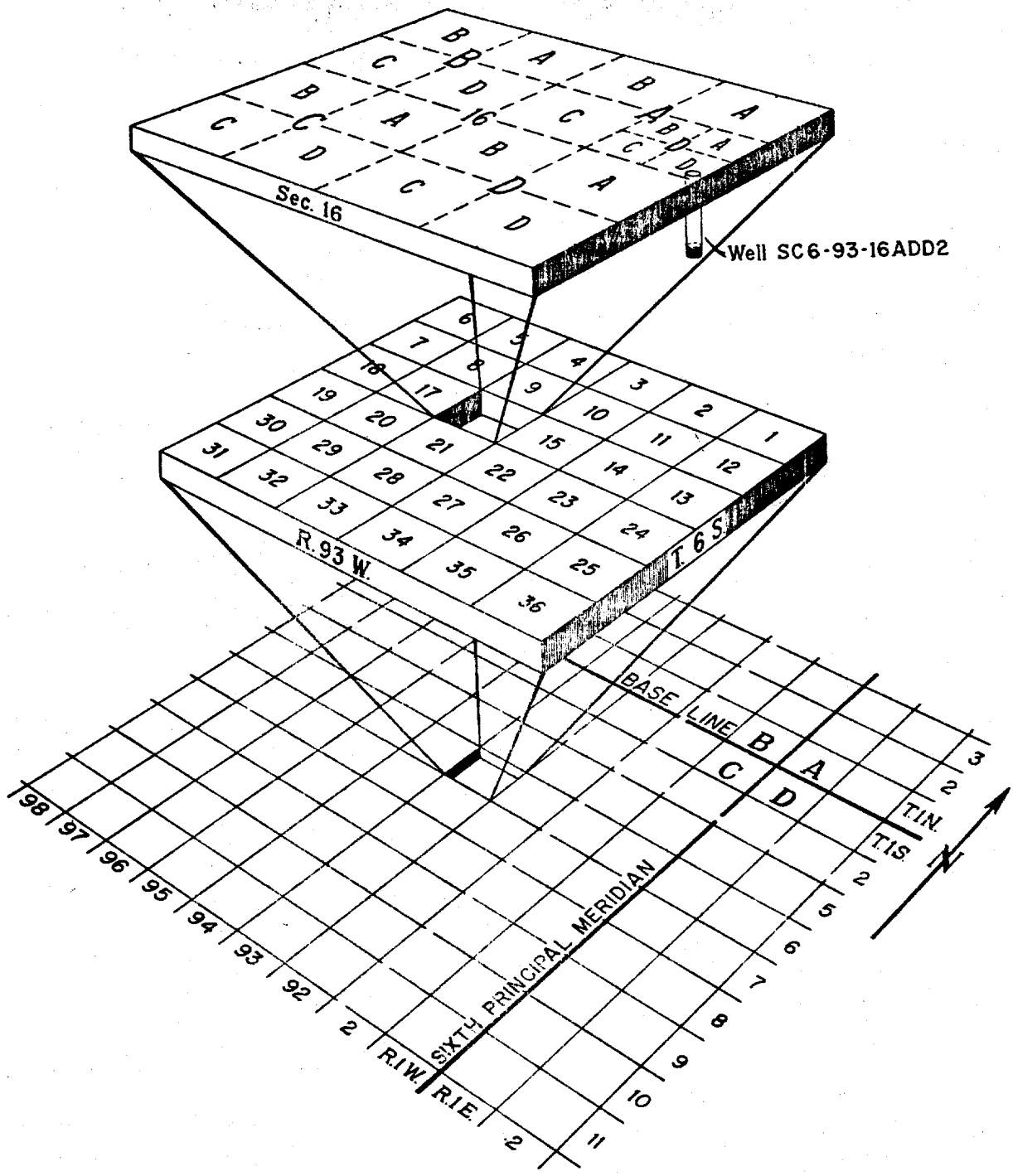

Figure 1.--System of numbering wells and springs in Colorado.

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