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CAPITOL REEF N.M.

**WATER-SUPPLY POSSIBILITIES
AT CAPITOL REEF NATIONAL MONUMENT, UTAH**

By
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**Prepared in cooperation with the
National Park Service, Department of the Interior.**

**Salt Lake City, Utah
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ABSTRACT

A water supply of 50 gpm (gallons per minute) is estimated to be sufficient to supply the present and future water demand at the Monument. The Coconino sandstone of Permian age appears to be capable of yielding this quantity of water to a well between 1,500 and 2,700 feet deep in the vicinity of Fruita. Recharge to this aquifer probably is principally from the Fremont River. Water derived from the Coconino sandstone should be of potable quality. A water supply of suitable chemical quality also could be obtained directly from the Fremont River.

INTRODUCTION

Purpose of the Investigation.---The purpose of this investigation was to evaluate the possibility of obtaining an adequate water supply for the headquarters area of Capitol Reef National Monument from a ground-water source. The National Park Service could then compare the cost of obtaining an adequate ground-water supply for the Monument with the cost of an adequate surface-water supply.

Location of the Area.---Capitol Reef National Monument is in Wayne County, Utah and occupies parts of Tps. 28, 29, and 30 S., Rs. 5, 6, and 7 E. of the Salt Lake Base and Meridian. However, the present headquarters and the area where most of the future development will take place is in the vicinity of the town of Fruita, principally in secs. 14 and 15, T. 29 S., R. 6 E. (fig. 1). This is the area covered by this investigation.

Map Coverage and Previous Investigations.---Topographic-map coverage of Capitol Reef National Monument on a scale of 1:62,500 is complete. Parts of the Monument appear on the Fruita, Natom, and Torrey quadrangle maps of the U. S. Geological Survey. Preliminary geologic maps completely cover the area of this investigation and are on a scale of 1:24,000. Several publications that discuss the stratigraphy and structure of the Monument and nearby areas are listed in "Selected References" at the end of this report. These reports, however, have few or no references to the ground-water resources of the area.

Climate.--The climate at Fruita is warm and dry. The following table shows the annual precipitation at Fruita since the station was established in 1943.

Year	Precipitation (inches)	Year	Precipitation (inches)	Year	Precipitation (inches)
1943	8.46	1949	9.48	1954	4.11
1944	8.43	1950	3.91	1955	5.22
1945	8.20	1951	11.79	1956	4.08
1946	-	1952	6.18	1957	13.78
1947	8.64	1953	4.89	1958	4.83
1948	6.26				

(From records of U. S. Weather Bureau)

Water Use and Future Water Need.--About 16,000 persons visited the Monument in 1957. Water was stored in two storage tanks near the superintendent's residence for both residence and campground use.

In connection with plans formulated under the Mission 66 program, the Park Service estimates that the peak demand for all purposes except irrigation will be about 30,000 gallons per day in 1966; and that if sufficient storage facilities are provided, a water supply of about 50 gpm should be satisfactory.

GEOLOGY

Geologic formations in the headquarters area of Capitol Reef National Monument range in age from Permian to Recent but Cretaceous and Tertiary formations are absent. The generalized section of the geologic formations in the headquarters area of Capitol Reef National Monument is shown on table 1. Figure 1 is a geologic map of the same area adapted from preliminary geologic maps of Smith and others (1957 a, b). The structure in the headquarters area is that of a simple monocline dipping 10 to 13 degrees northeast. Figure 2 is a geologic section through Fruita parallel to the general dip of the formations.

Table 1.-- Geologic section in the headquarters area, Capitol Reef National Monument, Utah
Adapted from Smith, 1952; and b; Luedke, 1953; and Luedke, 1954.

System	Series	Formation	Approximate thickness (feet)	Depth to bottom of formation at Fruita (feet)	Physical character	Water supply
Quaternary	Recent and Pleistocene			thin	Alluvium, Terrace gravel, Pediment gravel	Alluvium along parts of the Fremont River might supply limited amounts of water to shallow wells. Other Quaternary deposits are usually not saturated.
Jurassic		Unconformity				
		Navajo sandstone	750	absent	White to yellow fine-grained sandstone	Supplies large quantities of water to wells in some parts of the Colorado plateau.
Jurassic(?)		Kayenta formation	245	absent	Irregularly bedded white to reddish brown siltstone, conglomerate, and very fine to medium-grained sandstone	The fine-grained nature of this formation make it unlikely that large water supplies could be developed from it.
Triassic	Upper Triassic	Wingate sandstone	320	absent	Fine-grained reddish-brown cliff-forming sandstone, massive and crossbedded.	Jointing makes this formation permeable and enables wells to derive moderate to large quantities of water from it.
		Unconformity				
		Chinle formation	510	140	Variegated claystone, pale red and greenish-gray limestone, very fine to medium-grained sandstone, and lenses of conglomerate near the base.	Some water might be produced from the conglomerate at the base, but it would likely be high in dissolved constituents.
		Unconformity				
	Lower and Middle(?) Triassic	Moenkopi formation	950	1,170	Reddish-brown and some yellow thin bedded siltstone, claystone, and fine grained sandstone with gypsum; yellowish-gray limestone and dolomite; chert-pebble conglomerate locally at base.	The fine grained nature of most of this formation makes it unlikely that large water supplies could be developed from it. Water from this formation would likely be high in dissolved constituents.
Permian		Unconformity				
		Kaibab limestone	185	1,370	White calcareous siltstone and silty limestone with chert layers and nodules, thin crossbedded white fine-grained sandstone; some dolomite.	Small water supplies might be developed from fractures and solution cavities in this formation.
		Coconino sandstone	800 exposed 1,231 in oil test 8 miles west southwest of headquarters	2,240 if 800 feet thick 2,710 if 1,230 feet thick	Yellowish very fine to fine grained sandstone.	Fractures in this formation might make the development of 45 gpm from this formation possible.

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WATER RESOURCES

Surface Water.--The Fremont River is the principal stream of the area, and its flow is perennial. Its flow is derived chiefly from melting snow on the Fish Lake Plateau about 30 miles west of Fruita. Chemical analyses of water from the Fremont River are given in table 2. With proper precautions against bacterial contamination, this water probably could be taken directly from the river for use as a public supply.

The town of Fruita has no municipal water supply, but individual households obtain water for domestic use from the Fremont River and store it in cisterns. The water is chlorinated before use.

Sulphur Creek (fig. 1) is a perennial creek, whose source is near the base of Thousand Lake Mountain, about 13 miles northwest of Fruita. Throughout much of its course, this creek flows over the Moenkopi formation, and as a result, is high in sulfates and very hard. The chemical quality of water from this creek makes it undesirable for domestic use (table 2).

Springs.--Dewey Gifford Spring issues from the Moenkopi formation in the NW $\frac{1}{4}$ sec. 23, T. 29 S., R. 6 E. and is reported to flow 10 gpm. A chemical analysis of the water from this spring is given in table 2. Another spring issues from the Navajo sandstone in the NW $\frac{1}{4}$ sec. 14, T. 29 S., R. 6 E. It is likely that other small springs issue from the Navajo sandstone. No springs are known to issue from the Coconino sandstone in this area.

Table 2.--Chemical analyses of water from selected sources in the headquarters area,
Capitol Reef National Monument, Utah.
Chemical constituents given in parts per million

Source and location	Date of collection	Specific conductance, in microhos at 25° C	Silica (SiO ₂)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium and potassium (Na+K)	Bicarbonate (HCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Nitrate (NO ₃)	Dissolved solids	Hardness as CaCO ₃		pH	Analyzed by
														Calcium, Magnesium	Non-carbonate		
Fremont River near Fruita	7-1-49	760			77	26	30 7.8	146	198	23		.2		299	17.		Atomic Energy Commis.
	7-22-49	710			75	27	26 9.0	124	182	23		.4		298	16		Do.
	8-31-49	700			74	25	28 10	172	197	24		.1		288	17		Do.
	10-3-51	680	39	2.1	108	18	32	165	203	23	.4	1.1	526	350		7.2	Utah State Dept. of Public Health
	9-25-58	686	29		79	27	32	124	183	19		.2	465	307	149	7.3	U. S. Geol. Survey
Sulphur Creek near Fruita	8-31-49	3,400			369	150	142 70	175	1,890	111		.4		1,540			Atomic Energy Commis.
near Park headquarters	9-25-58	2,780	23		371	182	125	177	1,640	55		.8	2,490	1,680	1,510	7.6	U. S. Geol. Survey
Dewey Gifford Spring near Fruita	10-3-51	1,275	43	.2	215	32	70	232	513	35	.5	1.8	1,050	680		7.8	Utah State Dept. of Public Health

Wells in Alluvium.--Alluvium occurs along Sulphur Creek and along the Fremont River in the vicinity of Fruita. This alluvium consists principally of fine-grained detritus derived from the shales of the Moenkopi and Chinle formations. Some boulders and gravel occur in the alluvium, but these are mixed with the finer-grained material. It is unlikely that an adequate water-supply for the Monument could be developed from this body of alluvium owing to its fine-grained character. However, there are no wells in the alluvium, and its water-bearing properties perhaps should be tested before other sources of a water supply are investigated. Water occurring in the alluvium along Sulphur Creek would probably be unsuitable in chemical quality (table 2); however, water occurring in the alluvium below the junction of Sulphur Creek and the Fremont River may be acceptable for a public supply.

Wells in Bedrock.--No wells have been drilled into the bedrock within the area of this investigation. Outside of the area most of the deep wells were drilled as tests for oil and gas and do not yield significant information about the quantity or quality of water encountered. On the basis of the surface geology and hydrologic conditions, the Coconino sandstone might yield about 50 gpm, the quantity of water desired. Although the sand that makes up this formation is very fine- to fine-grained, and, hence, the primary permeability is low, the Coconino sandstone is fractured in many places (J. F. Smith, Jr., written communication), with the result that it may be relatively permeable. At the town of Fruita, the depth to the top of the Coconino sandstone should be about 1,370 feet below the surface, and it should have a thickness greater than 800 feet and perhaps as much as 1,230 feet (fig. 2). The water level in a well at this location should be near land surface. The well may even flow naturally.

If a test well is drilled into the Coconino sandstone, the overlying Kaibab limestone should be tested by the same well. It is unlikely that the Kaibab limestone alone would yield sufficient water to supply the Monument. However, water from the Kaibab limestone might make a significant addition to a supply developed primarily from the Coconino sandstone.

The principal recharge to this aquifer probably comes from the Fremont River and to a smaller extent from Sulphur Creek. Both streams flow across extensive areas in which the Coconino sandstone forms the stream bed (fig. 1). J. F. Smith, Jr., (written communication), who was in charge of the geologic mapping of this area for the U. S. Geological Survey, reports that fractures in the Coconino sandstone are particularly numerous along the Fremont River canyon west of Fruita. The presence of fractures should facilitate any recharge from the Fremont River into the Coconino sandstone in this area.

The quality of water from the Coconino sandstone in this area is unknown. However, the chemical analyses of the two recharge sources (Fremont River and Sulphur Creek) are given in table 2. The Coconino sandstone is not as extensively exposed in the stream bed of Sulphur Creek as it is in the stream bed of the Fremont River. Therefore, the Fremont River should be a more important source of recharge than Sulphur Creek, and the quality of the water from the Coconino sandstone, except as it is modified by passing through the formation, should be more nearly like that of water from the Fremont River than that of the water from Sulphur Creek. A chemical analysis of a representative rock sample of the Coconino sandstone showed that its composition was as follows:

	Percent		Percent		Percent
SiO_2	98.4	CaO	0.04	P_2O_5	0.02
Al_2O_3	1.0	Na_2O	.12	MnO	.00
Fe_2O_3	.12	K_2O	.08	H_2O	.25
FeO	.00	TiO_2	.04	CO_2	.05
MgO	.06				

(J. F. Smith, Jr., written communication)

Water passing through rock of this composition from the Fremont River to Fruita, a distance of 1 to 2 miles, should remain reasonably potable. It is recommended that a test-well site be selected in Fruita rather than at the Monument headquarters. The Fruita vicinity is directly downip from the Fremont River, and recharge is more apt to come from the Fremont River than from Sulphur Creek.

CONCLUSIONS

Two feasible sources of water for the headquarters area at Capitol Reef National Monument are: (1) the Fremont River and (2) a well between 1,500 and 2,700 feet deep to obtain water from the Coconino sandstone. A favorable area for the location of a test-well site is shown on figure 1. Because no wells in this area tap the Coconino sandstone, neither the yield nor the quality of the water from such a well can be predicted accurately. However, it is estimated that the Coconino sandstone is capable of yielding about 50 gpm of water of relatively good quality to a well drilled in the Fruita vicinity.

SELECTED REFERENCES

- Connor, J. G., Mitchell, C. G., and others, 1958, A compilation of chemical quality data for ground and surface waters in Utah: Utah State Engineer Tech. Pub. 10, 276 p.
- Gregory, H. E., and Anderson, J. C., 1939, Geographic and geologic sketch of the Capitol Reef region, Utah: Geol. Soc. America Bull. v. 50 no. 12 p. 1827-1850.
- Hunt, C. B., assisted by Averitt, P., and Miller, R. L., 1953, Geology and Geography of the Henry Mountains Region, Utah: U. S. Geol. Survey Prof. Paper 228, 234 p., 22 pls. 116 figs.
- Luedke, R. G., 1953, Stratigraphy and structure of the Miners Mountain area, Wayne County, Utah: U. S. Geol. Survey open-file report, 94 p.
- _____, 1954, Geology of the Capitol Reef area, Wayne and Garfield Counties, Utah, in: Geology of Portions of the High Plateau and Adjacent Canyon Lands Central and South-Central Utah, Fifth Annual Field Conference of Intermountain Association of Petroleum Geologists, p. 59-62.
- Smith, J. G., Jr., Hinrichs, E. H., and Luedke, R. G., 1952, Progress report of geologic studies in the Capitol Reef area, Wayne County, Utah; prepared by U. S. Geological Survey: Atomic Energy Commission Trace Element Investigation 203, 20 p., 6 ill., 1 table.

Smith, J. F., Jr., Huff, L. C., Hinrichs, E. H., and Luedke, R. G.

1957a, Preliminary geologic map of the Notom 1 SW quadrangle,

Utah: U. S. Geol. Survey Mineral Inv. Field Studies Map

MF 103.

_____, 1957b, Preliminary geologic map of the Notom 2 SE

quadrangle, Utah: U. S. Geol. Survey Mineral Inv. Field

Studies Map MF 107.