

WATER RESOURCES OF CEDAR BREAKS NATIONAL MONUMENT,

IRON COUNTY, UTAH

by

C. T. Sumsion, Hydrologist
U.S. Geological Survey

ADMINISTRATIVE REPORT

Prepared by the U.S. Geological Survey
in cooperation with the National Park Service

1967

Contents

	Page
Introduction-----	3
Purpose and scope-----	3
Location-----	3
Previous investigations-----	4
Acknowledgments-----	4
Geography-----	4
Geology-----	6
Water resources-----	7
Water use-----	7
Surface water-----	7
Springs-----	8
Availability of ground water from wells-----	11
Summary and conclusions-----	13
References cited-----	14

Illustration

Figure 1. Locations of selected springs in Cedar Breaks

National Monument-----	5
------------------------	---

Tables

Table 1. Chemical analysis of water from Sunset View

Spring-----	11
2. Chemical analysis of water from Alpine Pond	
Spring-----	12

WATER RESOURCES OF CEDAR BREAKS NATIONAL MONUMENT,

IRON COUNTY, UTAH

by C. T. Sumsion
Hydrologist, U.S. Geological Survey

INTRODUCTION

Purpose and scope

The water-supply system at Cedar Breaks National Monument is not adequate to sustain all requirements of the visitors' facilities during periods of less-than-average precipitation. In order to provide data and information about the available water resources and potential water supplies in Cedar Breaks National Monument, the U.S. Geological Survey, at the request of the National Park Service, investigated the area during August 1967.

The investigation consisted of an appraisal of the available supply of water from the spring that furnishes the existing water supply, potential sources of water from other springs, and the feasibility of obtaining water by drilling wells. Spring measurements were obtained volumetrically. Locations and altitudes were determined from Geological Survey topographic quadrangle maps. Water samples were obtained from two springs for chemical analyses.

Location

Cedar Breaks National Monument is about 22 miles southeast of Cedar City, Iron County, Utah. Delineating the western margin of the Markagunt Plateau, Cedar Breaks divides the Coal Creek drainage basin on the west from the Sevier River drainage basin on the east. The area

investigated is entirely within Cedar Breaks National Monument, and is about $9\frac{1}{2}$ square miles in extent (fig. 1). Of this total area, the likelihood of finding potential water supplies exists only for the area of the Markagunt Plateau, which covers about 2 square miles.

Previous investigations

A brief description of springs in Cedar Breaks National Monument is given in an administrative report by Gates (1961). The geology and hydrology of the Markagunt Plateau, including Cedar Breaks National Monument, are described by Wilson and Thomas (1964).

Acknowledgments

Ranger D. H. Castleberry and Mr. Dennis Parks were cooperative and accommodating in providing valuable information and assistance in locating springs within the monument.

GEOGRAPHY

Cedar Breaks National Monument includes part of the west edge of the Markagunt Plateau, its rim and steep descent, and the foothills bordering the plateau at lower altitudes. Topographic relief in the Monument is greater than 2,500 feet, ranging from less than 8,100 feet in altitude at Ashdown Creek on the western boundary to more than 10,660 feet near the northeastern corner, all within a horizontal distance of about $2\frac{1}{2}$ miles. The climate is cool and mean annual precipitation is more than 40 inches. At the time of the investigation, during the first part of August, several large snowbanks were still present in the southern part of the Monument. Accommodations at the Monument are open to visitors from late May to September.

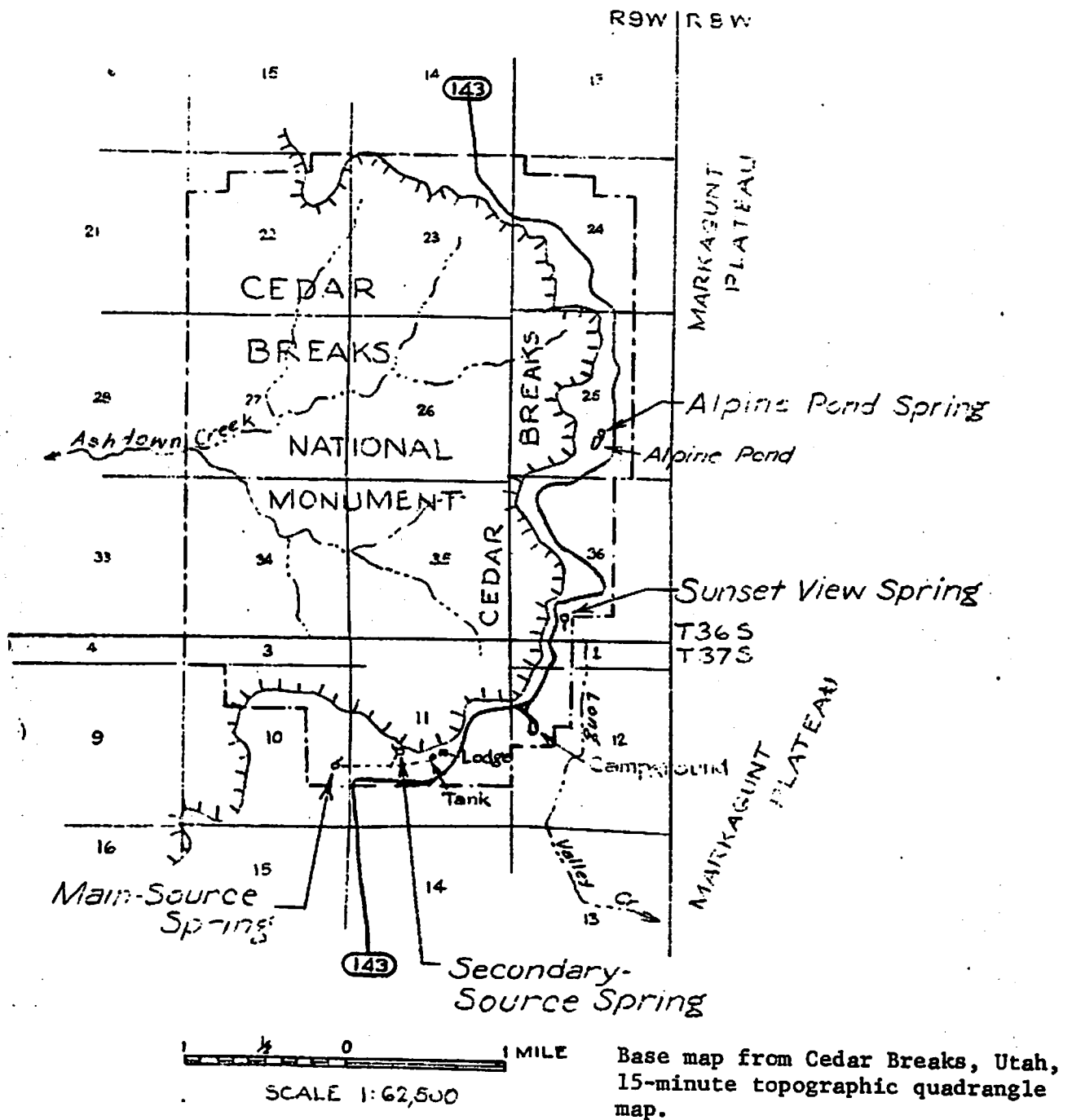


Figure 1. Locations of selected springs in Cedar Breaks National Monument.

GEOLOGY

The western and lowermost part of Cedar Breaks National Monument is underlain by the light-rust to tan sandstone and mudstone of the Kaiparowits Formation of Cretaceous age. The Kaiparowits is about 500 feet thick in this area. Rising abruptly above these sepia strata, the brilliant crimson, pink, and buff marl, limestone, calcareous shale, and sandstone of the lacustrine Wasatch Formation of Eocene age form the precipitous slopes that ascend to the rim of the Markagunt Plateau. The thickness of the Wasatch in the Monument ranges from about 1,300 feet to more than 1,500 feet. In the northeastern part of the Monument varicolored chalcedony typical of the Brian Head Formation of Miocene(?) age is conspicuous along the plateau rim, but if the Brian Head is present it is represented by only a thin erosional remnant. Rhyolitic tuff, breccia, and lava are present in the northeastern and southern parts of the Monument. Colluvium is present along some of the gentle slopes of the Markagunt Plateau at Cedar Breaks, and bog soils have accumulated in a few shallow sinks or depressions. The regional strike of the Wasatch is generally northwest-southeast, and the strata dip gently to the northeast.

WATER RESOURCES

Water use

The concessionaire of the lodge at Cedar Breaks National Monument has the existing appropriation right to the water of Main-Source Spring. The visitors' center, the campground, and the National Park Service residences depend on any excess flow that may not be used at the lodge. Of nearly 225,000 visitors to the Monument during the season, about 950 are lodge guests, 6,000 are campers, and the remainder are casual visitors. Water use by these categories can only be surmised as the water-supply system is not metered. The largest quantity of water per visitor is used at the lodge and the next largest per capita use is at the campground; but the lodge guests and campers combined are only about 3 percent of the total visitors. Casual visitors, 97 percent, use only small amounts of water, if any. However, total water use is great enough to cause shortage of supply to the campground during periods when spring discharge is low.

Surface water

The ephemeral east-trending stream courses at the west edge of the Markagunt Plateau in Cedar Breaks represent the headwaters of the Sevier River drainage basin. Perennial west-trending streamflow occurs at the lowermost part of Cedar Breaks in Ashdown Creek within the Coal Creek drainage basin. There is no perennial streamflow in the accessible part of Cedar Breaks National Monument at the western edge of the Markagunt Plateau.

Springs

Of the many springs and seeps at Cedar Breaks National Monument only a few have sufficient sustained discharge to be of value as sources of water supply. The scattered occurrence of springs in the Monument results from permeable aquifers being underlain by relatively impermeable clay aquicludes. These springs invariably discharge from perched ground-water reservoirs in unconsolidated deposits or in the upper weathered part of the Wasatch Formation. The highly permeable underlying Wasatch is honeycombed by dry solution cavities. This is evidenced by the occurrence of sinkholes and depressions along the Cedar Breaks rim and the western Markagunt Plateau.

Main-Source Spring, the present source of water for all facilities, is at the north end of Blowhard Mountain in the southwestern part of the Monument at an altitude of about 10,340 feet (NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 10, T. 37 S., R. 9 W.). It was discharging 10.6 gpm (gallons per minute) at a temperature of 38°F on August 2, 1967. The average discharge is reported to be 7.5 gpm, but there are no previously recorded discharge measurements. A pipeline connects Main-Source Spring to the storage tanks and pump-house.

A smaller spring, referred to as Secondary-Source Spring, is about 600 feet north of the pumphouse at an altitude of about 10,235 feet (NE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 11, T. 37 S., R. 9 W.). It is connected to the water system but was not in use on August 2, 1967, when it was discharging 3.9 gpm at 38°F. Discharge of Secondary-Source Spring is reported to diminish to nearly nothing in dry periods, but there are no previously recorded

discharge measurements. Assuming an average combined discharge of 9.5 gpm for the Main-Source and Secondary-Source Springs, the present water supply may average about 14,000 gpd (gallons per day).

Two unused springs examined during the investigation are considered worthy of development for additional water supplies. They are described as follows:

Sunset View Spring.--Adjacent to Sunset View overlook, this spring formerly served as a water supply for a Civilian Conservation Corps camp of 200 to 300 persons. It is near the head of a shallow draw tributary to ephemeral Long Valley Creek at an altitude of about 10,330 feet (SE $\frac{1}{4}$ SW $\frac{1}{4}$ sec. 36, T. 36 S., R. 9 W.). The spring is perennial, but its discharge disappears within a short distance in the permeable streambed. This spring was developed by means of perforated 2-inch diameter pipe or tile galleries which lead to a concrete storage tank 4-feet square in plan and about 6-feet deep. The tank has been unused since the camp was disbanded. Partial development of this spring may be accomplished by cleaning and renovating the concrete tank, testing the yield of the spring by pumping from the tank, and connecting this source of water to the supply system, a distance of about three-quarters of a mile. More water may be recovered by construction of a 3- to 4-foot deep tile gallery, backfilled with gravel, across the shallow draw. A small part of the spring discharge on August 2, 1967, was measured as 6 gpm, but there are no previous discharge records. Total spring flow may be about 30 gpm. When developing the spring, great care should be taken not to excavate below the clay seal upon which the aquifer is perched. Should this occur, surface discharge will quickly disappear into the permeable

underlying Wasatch Formation. Chemical analysis of a water sample from the spring (table 1) indicates that the water is suitable for public supply.

Alpine Pond Spring.--This spring supplies water to Alpine Pond, a solution depression now undersealed by clay. The spring was discharging 20 gpm at 38°F on August 2, 1967. There are no previously recorded discharge measurements, but discharge fluctuation is reported to be very small. Alpine Pond Spring is at the north end of the pond at an altitude of about 10,525 feet (SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 25, T. 36 S., R. 9 W.). This spring is undeveloped. A storage tank at the spring with an overflow spout to the pond could provide sufficient water for use at Cedar Breaks National Monument without lowering the water level of the pond, assuming that (1) the discharge of the spring does not fluctuate below about 75 percent of that measured, and (2) there would be no objection to eliminating most or all of the present discharge from the south end of the pond. If this spring is developed, great care should be taken not to penetrate the clay seal upon which the aquifer and the pond are perched. Distance from Alpine Pond Spring to the water-supply system is about 1 $\frac{1}{2}$ miles. Chemical analysis of a water sample from the spring (table 2) indicates that the water is suitable for public supply.

Availability of ground water from wells

Development of ground water from wells in Cedar Breaks National Monument is considered to be economically unfeasible. The Wasatch Formation is highly permeable, and considering that the recharge area is only about 2 square miles in the Monument, the likelihood of recovering water

Table 1.--Chemical analysis of water from Sunset View Spring
(Dissolved solids and constituents are given in parts per million)

Specific conductance	410 micromhos per centimeter at 25°C
Hydrogen-ion concn., pH	7.7
Silica (SiO₂)	17
Calcium (Ca)	51
Magnesium (Mg)	25
Sodium and potassium (Na+K)	4.3
Bicarbonate (HCO₃)	284
Sulfate (SO₄)	5.2
Chloride (Cl)	2.1
Nitrate (NO₃)	.2
Dissolved solids	239
Hardness as CaCO₃	232
Noncarbonate hardness	0
Temperature	48°F

Table 2.--Chemical analysis of water from Alpine Pond Spring
(Dissolved solids and constituents given in parts per million)

Specific conductance	276 micromhos per centimeter at 25°C
Hydrogen-ion concn., pH	7.6
Silica (SiO ₂)	18
Calcium (Ca)	42
Magnesium (Mg)	9.2
Sodium and potassium (Na+K)	5.7
Bicarbonate (HCO ₃)	180
Sulfate (SO ₄)	3.8
Chloride (Cl)	1.8
Nitrate (NO ₃)	.4
Dissolved solids	164
Hardness as CaCO ₃	142
Non-carbonate hardness	0
Temperature	38°F

from the lowermost part of the formation in this area is poor. The Kaiparowits Formation underlying the Wasatch is also considered to be a poor risk for well development because of its low permeability. To obtain water from the Straight Cliff and Wahweap Sandstones beneath the Kaiparowits would require drilling depths greater than 2,000 feet. That these formations might provide sufficient water is contingent on the degree to which they are fractured beneath the drilling site. Thus well drilling at Cedar Breaks National Monument is not recommended.

SUMMARY AND CONCLUSIONS

The water supply of Cedar Breaks National Monument is furnished by Main-Source Spring and supplemented by Secondary-Source Spring. Their combined average discharge is probably about 9.5 gpm or 14,000 gpd. During periods of less-than-average discharge, water shortages may occur, mainly at the campground.

Unused springs which may be developed to augment present water supplies are (1) Sunset View Spring, a former source of water for a CCC camp, and (2) Alpine Pond Spring. Sunset View Spring is only three-quarters of a mile from the present water system and may be developed by renovating the concrete collection tank used by the CCC, testing its yield by pumping, and connecting it to the existing water system. Alpine Pond Spring is about $1\frac{1}{2}$ miles from the present water-supply system. Great care should be exercised in development of springs at the Monument not to penetrate the clay seal underlying the perched aquifers which are the source of spring discharge. Should this occur, surface discharge will be lost to permeable marl and limestone below.

Well drilling is not recommended in the Monument because of the great depths required (over 2,000 feet) and the uncertainty of sufficient yields.

Water-resources evaluation and planning could be greatly facilitated by metered water use and maintenance of systematic records of spring discharge, on at least a monthly basis.

REFERENCES CITED

- Gates, J. S., 1961, Water-resources investigations at the east entrance of Zion National Park and of springs at Cedar Breaks National Monument: U.S. Geol. Survey Admin. Rept. to the National Park Service, 25 p.
- Wilson, M. T., and Thomas, H. E., 1964, Hydrology and hydrogeology of Navajo Lake, Kane County, Utah: U.S. Geol. Survey Prof. Paper 417-C, p. 1-26.