

**Recommendations for Developing a Potable
Water Supply in the Headquarters Area
at Capitol Reef NP.**

**Richard Inglis, Hydrologist
Water Operations Branch
Water Resources Division
October, 1989**

The present potable water supply at the Headquarters area of Capitol Reef National Park (CARE) is not adequate for park needs regarding both quantity and quality of water. As part of an on-going water resources management planning process, the Water Resources Division (WRD) agreed by memoranda to the Regional Director, dated July 18, 1989 to evaluate potable water supply alternatives for CARE. Four potable water supply alternatives are evaluated in this report.

Alternatives for resolving the potable water supply problem at CARE include 1) no action - continued use of the Fremont River, 2) partial or complete use of Gifford Spring, 3) developing groundwater from a proven aquifer about 7 miles downstream near the Fremont River, or 4) developing groundwater about one half mile upstream in the Fremont River Canyon. After reviewing all the available information, I recommend option #4 which offers the best likelihood for meeting long term water supply needs.

Background Information

The present water supply at CARE is a surface diversion from the Fremont River. The diverted water is treated and pumped to a large storage reservoir that serves the entire Headquarters Area. The reservoir was designed to store several days water supply for use following thunderstorms when the Fremont River water is too turbid for treatment. The Fremont River is susceptible to extreme variations in water quality, principally turbidity. Also, there exists a strong possibility for pesticide contamination from upstream agricultural activities.

Past efforts to improve the potable water supply problem at CARE have concentrated on developing groundwater aquifers in the headquarters area. Three shallow wells and several deep wells have been drilled. The deepest well is reported to have been drilled to 1,700 feet (Ron Hermance, Personal Communication). The three shallow wells were drilled in the alluvium of the Fremont River near the treatment plant in

January, 1978 by The Well Supply Co. of Boulder, UT. using cable tool. Features of the three shallow wells, referred to as Wells No. 1, No. 2 and No. 3, are summarized in Table 1.

TABLE 1: TREATMENT PLANT SHALLOW WELL FEATURES

Feature	Well No. 1	Well No. 2	Well No. 3
Reported Total Depth	30 ft.	40 ft.	30 ft.
Depth to Bentonite	15 ft.	10 ft.	11 ft.
Measured Casing diameter	7 in.	7 in.	12 in.
Pump rating	1/2 hp	1/3 hp	no pump
Measuring point (above land surface)	1.20 ft.	1.28 ft.	0.67 ft.
Static water level (below measuring point)	9.36 ft	7.92 ft.	4.55 ft

The driller's log for Well No. 1 reports clay and boulders from 0 to 15 ft. and bentonite from 15 to 30 ft. This well was constructed with a gravel pack from 5 ft. to 15 ft. The well yield is considerably below needs. Unsuccessful attempts have been made by park staff to rehabilitate the well by excavating with a backhoe to below standing water and back filling with gravel and cleaning the slots in the well casing. An aquifer test, conducted July 12, 1989 on Well No. 1 by the Water Resources Division, determined well yield to be 2.1 gpm and thickness of the water producing zone to be 1.2 ft. confirming that production from this well is not sufficient to supply the water treatment plant.

It can be deduced that the other wells (No. 2 and No. 3) would have yields comparable to Well No. 1 due to similar locations in the alluvial aquifer and similar distance from the Fremont River. Presently, the discharge lines of Wells No. 1 and No. 2 are connected and the two wells are pumped simultaneously when used as an auxiliary water supply for the treatment plant. However, even in combination, the wells fail to meet water supply requirements. Furthermore, there is concern about the quality of shallow, alluvial groundwater, given the likelihood of contamination by upstream land uses.

The low yield of wells producing from the alluvial deposits near the water treatment plant area is due to the presence of heavy clays in the alluvium. These clays are derived from erosion of the Chinle and Moenkopi Formations (part of the Waterpocket Fold) which are exposed upstream along Cut Creek. The transported clays are partially deposited in the Fremont River alluvium beginning about a quarter mile upstream of the treatment plant. These deposits form the flat valley bottom containing the orchards and campground. The abundance of

clays result in the poor permeability of the alluvium. The location of Gifford Spring, near the confluence of Cut Creek, is seen as additional evidence that the yield of the alluvial aquifer is severely restricted beginning 1/4 mile upstream for the Treatment Plant. The presence of the spring is believed to restrict permeability of the alluvium at this site, thus causing upward ground water flow resulting in Gifford Spring.

Marine (1962) recommended that a deep well of at least 1300 ft. be drilled to encounter (what he identified as) the Coconino Formation and obtain water from secondary permeability or fractures. Recently, this formation is re-identified by Billingsley, Huntoon and Breed (1987) as the undivided Cutler Group.

Apparently, in response to Marine's (1962) recommendation, a 1340 ft. deep well was drilled in October, 1981, near the water treatment plant. No water was reported and, while the driller's log has been acquired, additional information is unavailable about this well.

not Drilled

did not drill in SL

Staff at CARE report that in July, 1984 or 1985, three additional deep wells were drilled and abandoned in the vicinity of the water treatment plant. The park has no records of these wells, nor their locations. CARE staff also report that a parallel seepage line was constructed adjacent to the Fremont River near the wells but it was unable to supply an adequate amount of water.

Huntoon (1978) identified sources for groundwater in three parts of Capitol Reef NP: the Hartnet, Fremont River, and Hall Creek areas. For the Fremont River area, he recommended a test well in the Navajo Sandstone east of Deep Creek, approximately eight miles east of Headquarters. The total depth of a test well recommended by Huntoon is 700 to 800 feet.

Alternatives

Four options to shallow alluvial wells and deep wells at the Treatment Plant for addressing water supply needs have been developed and evaluated. These options include 1) Continued diversion and treatment of water from Fremont River; 2) Complete or partial use of Gifford Spring; 3) Developing groundwater 7 miles downstream in a proven aquifer; and 4) Developing groundwater one half mile upstream. Each alternative is discussed below.

1) Continued diversion and treatment of water from Fremont River (no action). The Fremont River water is treated using a complete treatment process (coagulation, sedimentation, filtration, disinfection). Water is supplied to the

treatment plant either through a direct intake from the river or from infiltration wells located between the river and the treatment plant. On some occasions, it has been necessary to temporarily discontinue plant operation due to excessive turbidity levels of the feed water resulting from thunderstorms upstream. In cases when reserves are low, water is hauled in from a nearby community at additional expense to the park. Even under normal operation, the water supply is susceptible to contamination of the Fremont River from upstream agricultural and ranching activities and from natural sources.

2) Complete or partial use of Gifford Spring. The source of Gifford Spring, based on the recollections of long term employees, is located approximately 30 feet northwest of the comfort station in campground loop A. In the early 1960's, this area was a swamp and did not permit full utilization of the area for camping. It was reported that the wet area was excavated, perforated pipe installed and imported gravel backfill placed on top of the pipes to eliminate the swamp. A 6-inch diameter steel pipe conveys the collected water 225 feet northwest to the Fremont River.

Gifford Spring was evaluated in 1981 for its potential as a potable water supply for the Headquarters Area (NPS, 1981). It was recommended at that time that the spring not be used because of possible contamination. It was reported that the spring might be a viable water supply if water quality concerns were eliminated by rerouting a sewer line.

The yield of Gifford Spring appear to be adequate to meet park needs. On July 13, 1989 a springflow of 100 gpm was measured with a flume. Park staff report that the flow fluctuates seasonally to as low as 25 gpm and that the flow varies with irrigation practices in the nearby orchards. Thus, the spring may be susceptible to contamination from agricultural practices. The NPS may also wish to consider rehabilitation of this area to a wetland as a natural resources management project.

3) Developing groundwater 7 miles downstream in a proven aquifer. In 1977, the USGS drilled a 460 ft. well into the Navajo Sandstone about 7 miles downstream of the Headquarters area, near the Fremont River. Upon completion, the well flowed at the surface at a rate of about 40 gpm. Later, the flow was reduced by a valve to 12 gpm before the well was obliterated by a flood on the Fremont River. USGS data indicate that the artesian aquifer will probably produce about 40 gpm from a properly constructed well. The yield could be 200 gpm or more if the well were pumped heavily. The quality of water from the Navajo Sandstone may be suitable for public supply. Whereas the dissolved-solids concentration was relatively low, water from the USGS-Navajo Sandstone well was marginal with respect to sulfate

concentration. The water was very hard and had a high concentration of iron. Chemical analyses indicated that a mixture of water from the Navajo Sandstone and the overlying Carmel Formation is not of a quality suitable for public supply.

4) Developing groundwater one half mile upstream from the Treatment Plant. From analysis of the area it appears that a good well site exists about one half mile upstream from the Treatment Plant. Conditions are favorable for encountering groundwater of better quantity and quality than is presently available from the alluvial aquifer and the underlying Cutler Formation. At this site the valley is narrower and the alluvial deposits are likely to contain less clay because hydraulic conditions do not favor the deposition of fine-graded sediments. Also, the source of clay (Chinle Formation) is not present above this site. The Cutler formation dips to the east and is exposed in the channel of the Fremont River immediately to the west of the proposed drilling site. Recharge from the Fremont River should saturate the secondary permeability of the Cutler Formation as suggested by Marine (1962).

Recommendations

Based on the above information I recommend drilling a test well in the alluvium in the Fremont Canyon upstream from the treatment plant. If water yields from an alluvial well are insufficient for the needs of the park then deepening the well for additional amounts of water which may be obtained from the Cutler Formation may be considered. This site is on park land and is relatively close to NPS facilities, thus reducing pipeline expenses compared to the third option. Assuming that adequate water supplies (at least 25 gpm) are encountered, a test well can easily be upgraded into a production well. An estimated depth of 800 feet should fully penetrate the Cutler Formation at a cost of about \$60,000 may be required for a production well to assure a reliable source of potable water. An alluvial well could cost only \$10,000 but may have insufficient yields and be susceptible to changes in water quality of the Fremont River.

In summary, reasons for not recommending Alternative #1, continued use of the Fremont River, are the operating expense, unreliability of treating for turbidity, and the potential of other water quality contaminants. There is increasing risk of new contaminants in river water requiring new, more expensive types of treatment. Alternative #2, using Gifford Spring, has less concern for turbidity but contaminants from orchard agricultural practices and potentially from the sewer line may render this water supply unsafe for human use. Also, restoration of Gifford Spring as a wetland may become a viable option for natural resource

management. Developing a well in a proven aquifer, Alternative #3, will guarantee water but at the greatest expense of the four options -- due to drilling a new well, a seven mile long pipeline, a new power supply, and treatment for high sulfates and iron.

References

Billingsley, G.H., Huntoon, P.W., and Breed, W.J., 1987. "Geologic Map of Capitol Reef National Park and Vicinity, Emery, Garfield, Millard and Wayne Counties, Utah", Utah Geological and Mineral Survey, Salt Lake City, Utah.

Hermance, R. 1989. Water Resources Contact for the NPS Rocky Mountain Region, Personal Communication, Denver, Colorado.

Huntoon, P. 1978. "Ground Water Test Drilling Sites in the Hartnet, Fremont River, and Hall Creek Areas, Capitol Reef National Park, Utah", University of Wyoming, Water Resources Research Institute, Laramie, Wyoming.

Marine, I.W. 1962. "Water-Supply Possibilities at Capitol Reef National Monument, Utah", USGS Water Supply Paper 1475-G, Washington, D.C.

National Park Service, 1981. Memorandum to Superintendent, Capitol Reef National Park from Associate Regional Director, Park Operations, Rocky Mountain Region on the subject of Evaluation of spring for potable Water supply. Denver, Colorado.