

Hydrogeologic Assessment of the water-supply well at Gifford Campground Lake Roosevelt National Recreation Area

Gifford Campground is located on the eastern shore of Lake Roosevelt, about 25 miles south of Kettle Falls (Figure 1). The campground has 42 sites and is open all year long, but the water system is only available seasonally from May to September. The campground has a comfort station with flush toilets in addition to several vault toilets. A well at the campground provides water for the campground, a comfort station, picnic area, maintenance shop, and trailer dump station. Water is chlorinated, with contact time provided by flow through 30 feet of zigzagging 12-inch pipe.



Figure 1. Location of Gifford Campground.

The well has the Unique Well ID # AHC127 in the WA Dept. of Ecology database. The well is 150 feet from the normal full-pool shoreline (Figure 2).



Figure 2. The water-supply well at Gifford campground is located inside the cinder block building. The boat launch ramp and dock are in the background.

Water is supplied to Gifford campground from a 152-foot well that was constructed by the National Park Service in 1966. The driller's log for the well shows:

Topsoil	0-5 feet
Gravel.....	5-17 feet
Gravel, clay	17-65 feet
Sand, gravel, clay	65-85 feet
Fine sand & silt	85-130 feet
Fine sand to heavy gravel	130-152 feet

Well screen (0.080" slot) was placed from 140-146½ feet, in a sand and gravel layer. The drillers log notes the presence of "gravel, clay" from 17-85 feet and "fine sand & silt" from 85-130 feet. These fine-grained units should slow the infiltration of surface water from the reservoir to the sand and gravel aquifer from 130-152 feet below ground surface. Although there is less opportunity for direct hydraulic connection between the well and lake at this location (compared to other locations in the park), there is sufficient cause to proceed to the next step of testing; the microparticulate analysis.

A new meter was installed at the well in May 2013. Average water use from late-May to late-September was 4,650 gallons per day. Demand was fairly constant through the entire summer (Figure 3).

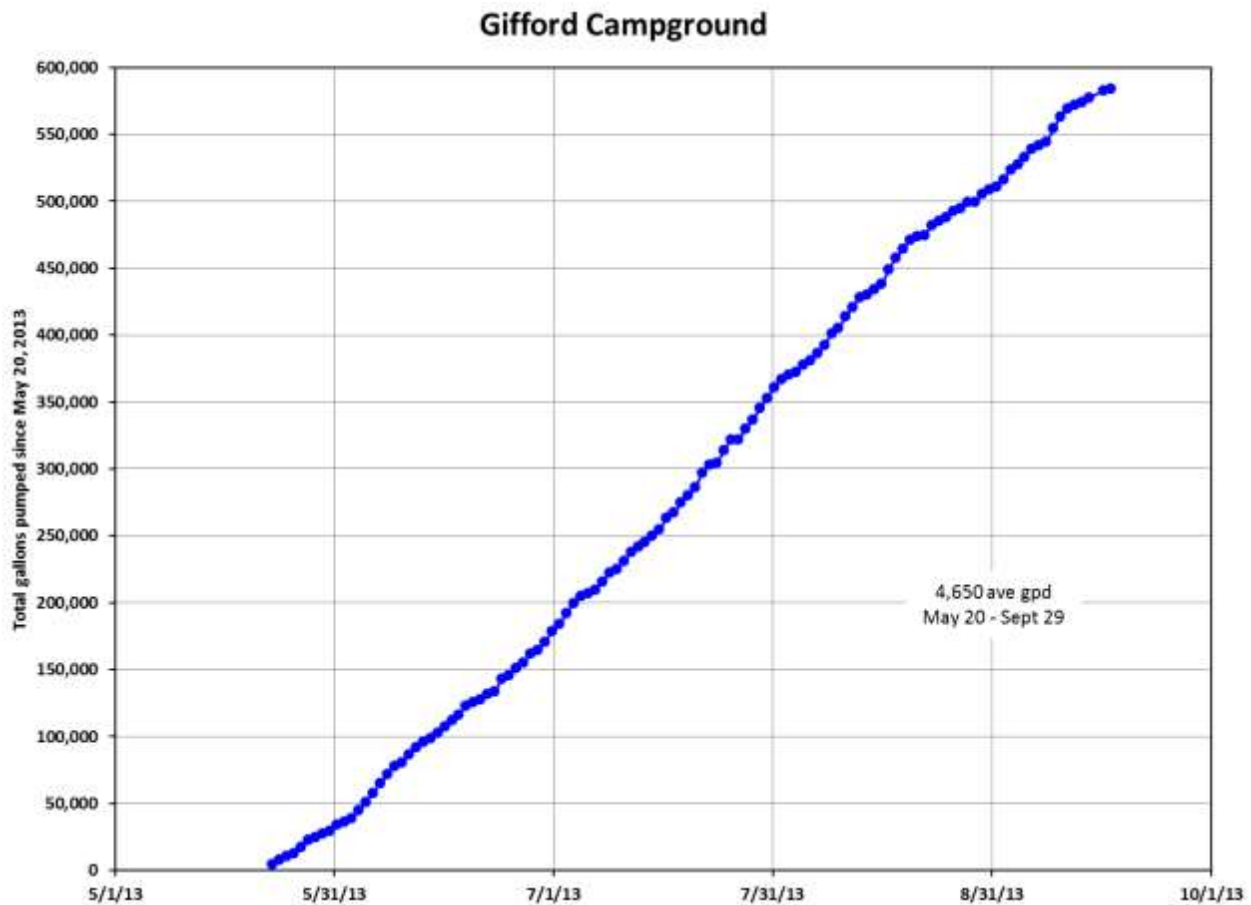


Figure 3. Groundwater pumping from the water-supply well at Gifford campground, 2013.

Geology

The well at Gifford campground is on an alluvial fan of sediment emanating from Buck Canyon (Figures 4 and 5). A large amount of gravel is exposed along the shore at low water near the boat launching ramp. The gravel is in line with sediment flowing from Buck Canyon and is interpreted as being a deltaic deposit from the tributary drainage of Buck Canyon. The gravel is interbedded with glacial-lake clay and silt sediments (Anderson, 1969). The description of sediments in this area fits with the geologic model of pulsing deposition of coarse-grained material on the alluvial fan in response to flood events flowing from Buck Canyon, followed by quiet periods of sediment deposition in a glacial lake.

Kiver and Stradling (1969) describe the geologic material at the well site as:

QA2/Q1z – Quaternary alluvial fan deposits over Quaternary lacustrine clay and/or silt interbedded in sand

The drillers log for the well construction reinforces the geologic model. The well encountered alternating layers of clay, silt, sand, and gravel. Eventually, the well encountered a thick water-

bearing sand and gravel deposit below 135 feet. The well was screened in the sand and gravel below 135 feet. The overlying fine-sand, silt, and clay sediments likely inhibit rapid hydraulic connection with surface water in the lake.



Figure 4. Google Earth view of the Gifford Campground area. View is to the northeast.

Geologic units near Gifford campground shown on Figure 5.

Qa2/Qlz - Quaternary alluvial fan deposits over Quaternary lacustrine clay and/or silt interbedded in sand

Qem/Qlz - Quaternary eolian silt over Quaternary lacustrine clay and/ or silt

Qem/Qls/Qog/Qlz - Quaternary eolian silt over Quaternary lacustrine sand over Quaternary outwash over lacustrine clay/silt interbedded in sand

Qls/Qog/Qlz - Quaternary lacustrine sand over outwash gravel (fine gravel to cobbles) over Quaternary lacustrine clay and/or silt interbedded in sand

Ou – Ordovician bedrock, undivided

Snook and others (1990) described the geology of the terraces in more general terms, lumping them into a single unit they called Quaternary surficial deposits – glacial debris and related lacustrine deposits, alluvium, and colluvium.



Figure 5. Surficial geology in the vicinity of Gifford campground.
 From NPS Geologic Resources Inventory Program. (2009).

Previous Drilling and Well Construction

Review of other well logs in the area (from the Department of Ecology database) showed similar geologic conditions. Wells encountered layers of sand, gravel, and clay, indicating deposition of pulses of sand and gravel alternating with deposition of silt and clay lake sediments during quiet periods.

Previous to constructing the well in 1966, water for the campground was obtained from a 21-foot well that was jetted into silt near the middle of the campground. During the summer of 1965, water from the well became turbid and contained silt. This prompted NPS to solicit assistance from USGS in construction and testing of the deep well in 1966 (Anderson, 1969).

Alternative Water Sources for Gifford Campground

It is likely that a deeper well could be constructed in the campground area that would obtain water from greater depth. Additionally, locating a new well farther from the reservoir (and drilling deeper) would lessen concerns about groundwater interconnection with the surface water of the reservoir. Neither of these alternatives would alleviate the concerns regarding the potential for groundwater in the area to be hydraulically connected with surface water in the reservoir.

Conclusions

Groundwater pumped from the well at Gifford campground is most likely from lateral infiltration of water from the reservoir into the sediments underlying the area. Water levels in the well fluctuate in response to changing water surface elevation of the lake, providing a fairly good indication that the lake is the primary source of water for the well. Therefore, we must assume that the water pumped from the well is hydraulically connected with the adjacent surface water. MPA tests should be conducted to determine the degree of filtration that occurs as the water flows from the reservoir to the well.

References

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- Kiver E.P. and Stradling, D.F., 1995, *Geology of the Franklin D. Roosevelt Reservoir Shoreline: Glacial Geology, Terraces, Landslides, and Lineaments*, report to Bureau of Reclamation (BOR), 148 p., 21 geologic maps, scale 1:24,000 or 1:62,500
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