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SEKI/General

Memorandum

To: Superintendent, Sequoia and Kings Canyon National Parks

Through: William L. Jackson, Chief, Water Resources Division (WRD)
Gary Rosenlieb, Chief, Water Operations Branch (WOB)

From: Larry Martin, Hydrogeologist, Water Operations Branch, WRD

Subject: Assessment of water use and the need for groundwater monitoring at
Grant Grove and Wilsonia, Kings Canyon National Park

Introduction

The General Management Plan for Sequoia and Kings Canyon National Parks commits to assessing the impact of private wells in Wilsonia. The GMP asks, “How does water and wastewater usage by Wilsonia residents impact the park or the nearby sequoia grove?” (GMP, Vol. 1, Page. 3)

The GMP also raises the issue of exploring the need for additional storage to meet the water demand of the Grant Grove area. Additional water storage at Grant Grove might be needed to mitigate the effects of reduced withdrawal rates during drought periods.

This report will address those issues and attempt to assuage fears that water withdrawals in the Grant Grove area might threaten the water supply of nearby sequoia groves.

Water Use and Wastewater Disposal in Wilsonia

Wilsonia is a 100-acre area of privately-owned land adjacent to NPS facilities at Grant Grove (Figure 1). Seasonal use cabins have been constructed on many of the privately-owned tracts. Potable water is supplied from numerous private wells scattered throughout Wilsonia. Available records indicate the wells are shallow, generally less than 100 feet deep. Specific details regarding the wells and water systems are not available as they are privately owned, and many of them were constructed prior to the need for reporting their construction details to state or local agencies.

Wastewater disposal at Wilsonia is via individual on-site disposal systems (leachfields or cesspools). The operating status and efficacy of private septic systems in Wilsonia is unknown. The potential for groundwater pollution is related to a number of environmental factors such as adequate soils, slopes, and distance to waterbodies, as well as to the adequacy of the design, operation, and maintenance of the septic or other disposal systems. Groundwater quality impacts (if they occur at all) are probably limited to the immediate vicinity of Wilsonia because of the small number of cabins and, therefore, small volume of wastewater. Additionally, natural biological processes occur as the wastewater percolates through the soil profile, providing remediation.

Water usage data for Wilsonia is not available. Because most of these homes are little more than summer cabins, water usage is small—probably less than a couple hundred gallons per day (gpd) at each cabin. Most of the water is returned to the groundwater system after infiltration in the septic leachfields. Net consumption is very small. Consumptive use for small domestic water systems with individual onsite wastewater disposal is generally estimated at no more than 10-15%. Another way of stating this is that for every 100 gallons pumped into a cabin, 85-90 gallons are recharged to the groundwater system via the wastewater disposal system.

The topographic slope and surface water drainage in Wilsonia is toward the west-southwest (Figure 1), toward Sequoia Creek and eventually to Sequoia Lake west of the park. A topographic divide and bedrock outcrop separates surface water and shallow groundwater in the Wilsonia area from surface water and meadows in the Grant Grove area and the sequoia trees in the General Grant Grove.

Bill Werrell (NPS hydrologist) constructed a water table map of the Wilsonia area in 1977 based on water level measurements at 26 wells. That map (unpublished) shows that groundwater at Wilsonia flows in a southwesterly direction (Figure 1).

There is no reasonable expectation that water use or wastewater disposal in Wilsonia would have any measurable impact on park resources in adjacent areas. The slope and surface water drainage in Wilsonia would cause water from the area to flow toward Sequoia Creek, well south of the sequoia groves and meadows. The small amount of water used at Wilsonia, the small amount of wastewater generated, the distance (approximately one mile) from Wilsonia to the General Grant Sequoia Grove, and the topographic divide effectively separate the hydrologic systems of the two areas.

NPS Water Sources and Water Use at Grant Grove

The park service operates a water supply and distribution system for facilities in the Grant Grove area. These facilities include campgrounds, picnic areas, a visitor center, showers and laundry, restaurant, the John Muir Lodge, rental cabins, and employee housing. NPS and concession facilities at Grant Grove are supplied by water from four sources (Figure 2).

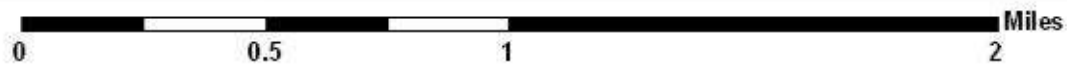
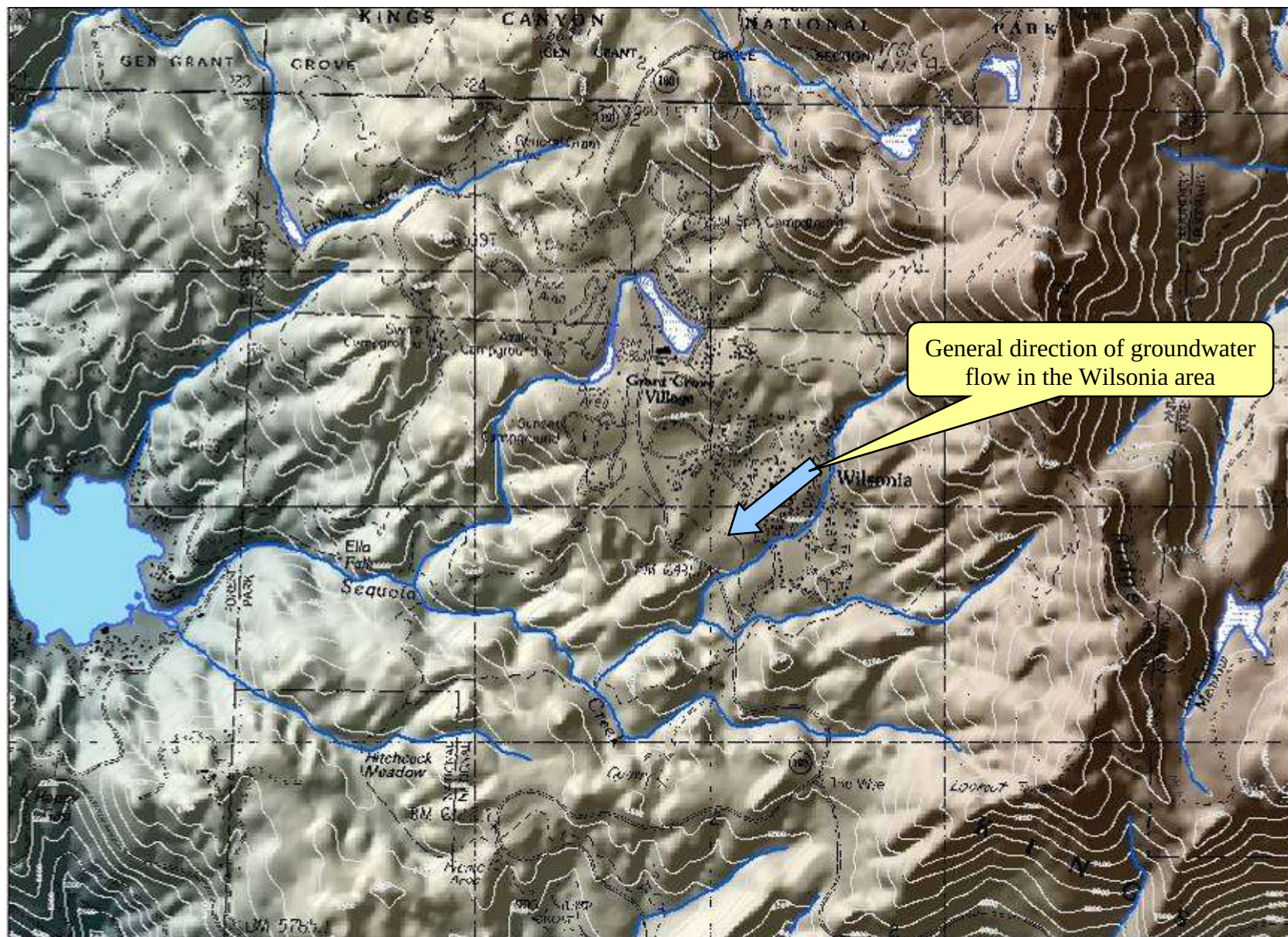


Figure 1. Topography and hydrology of the Wilsonia and Grant Grove areas.

The primary source of potable water in the Grant Grove area is an artesian well in Round Meadow (Well No. 1). Round Meadow drains into Abbott Creek. There is no known groundwater connection between Abbott Creek and the Mill Flat and Sequoia Creek drainage basins, which are the location of the General Grant sequoia grove.

Rona and Merritt Springs have been developed as water-supply sources and can provide a combined flow of 5-8 gallons per minute (gpm). Merritt Spring is in the headwaters of the Sequoia Creek basin. Rona Spring is called Winter Spring in some of the older documents and reports.

The fourth source is a 400-foot well near the water storage tank in the Sequoia Creek drainage basin. Private inholdings at Wilsonia also use wells located in the headwaters of the Sequoia Creek drainage.

Water use at Grant Grove has varied in the past five years (Figure 3). Peak demand in 2006-07 was about 1.5 million gallons per month, but those data are skewed by excessive losses to leaks. A major leak was repaired in July 2007. Additional leak repairs were made in September 2008, which should further reduce water withdrawals in the area.

The distribution system is old and prone to leaks. The distribution system is scheduled for an upgrade and replacement in the near future. That project, combined with additional conservation measures, should further reduce the water use in the area.

In 2003-05 and again in 2008, peak demand was slightly more than 1 million gallons per month. It would appear that 1 million gallons per month is a reasonable estimate for water use at the current level of development at Grant Grove (and absent excessive losses to leaks). An average inflow rate of 25 gpm will be sufficient to provide 1 million gallons per month.

Flow from the artesian well in Round Meadow is sufficient to meet the demand in most years. The 400-foot well near the storage tank and two springs provide adequate backup supplies.

The GMP (Appendix E) states that the total production of the combined sources during drought conditions would be 31,824 gpd. This appears to be an entirely contrived number based on one-time estimates of the production capability of each of the individual sources during the dry season. At best, the potential production under drought conditions should be reported as an approximate range, e.g. 30-35,000 gpd. Production of 31,824 gpd would yield 950,000 gallons per month, nearly the entire current peak demand. Any shortfall could be made up by drawing on storage from the 1.2 million gallon storage tank. Additional leak detection and repair, conservation measures, more efficient operations, and public education could further reduce water use below current levels. The need for additional storage may not be as critical or necessary as stated in the GMP. Additional water production for the area might be achieved by hydrofracking the 400-foot well to increase production, or utilizing Well No. 2 near Round Meadow.

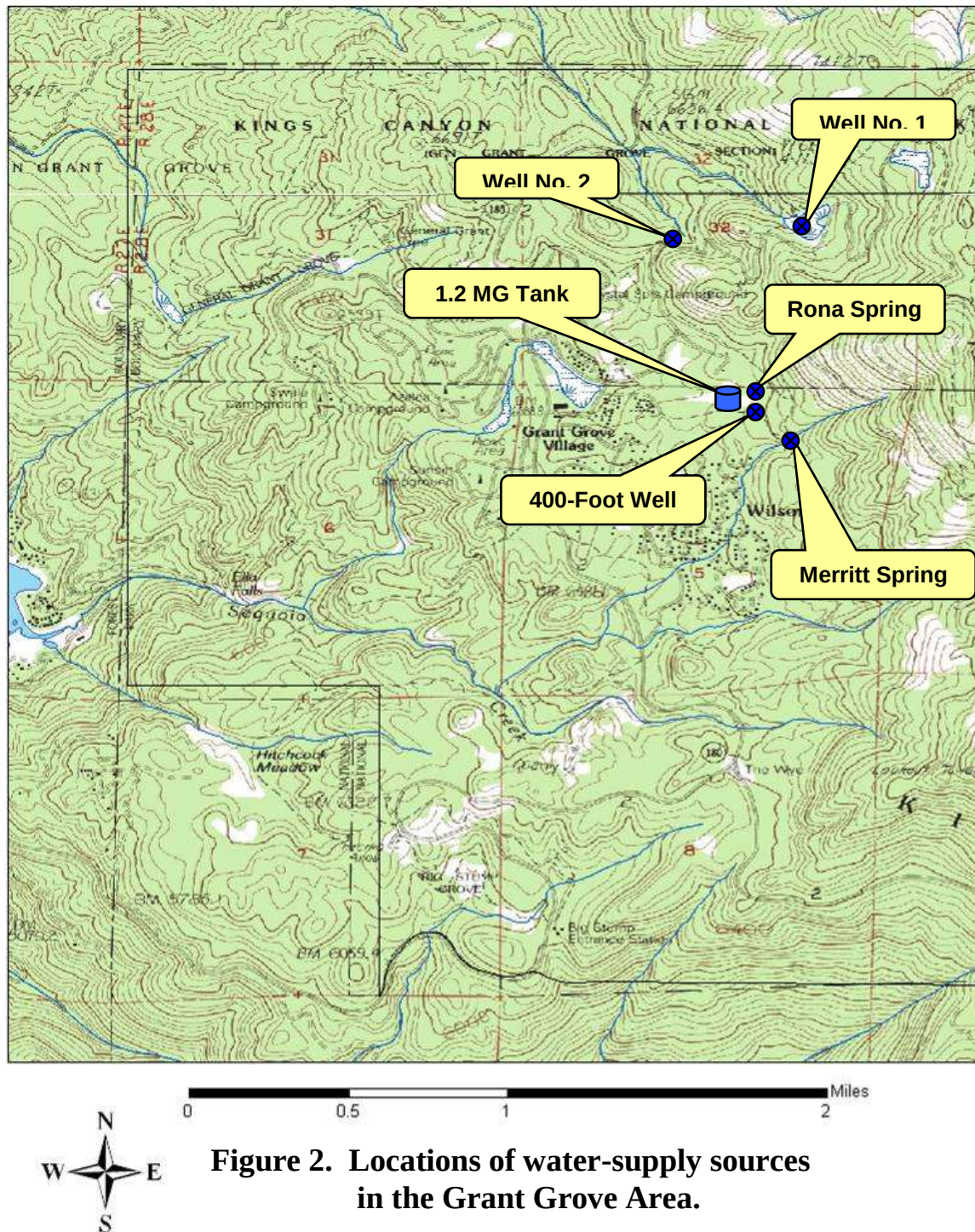


Figure 2. Locations of water-supply sources in the Grant Grove Area.

NPS Water-Supply Wells at Grant Grove

Two wells were drilled in the Grant Grove area in 1964 (Figure 2). Well No. 1 was drilled to a depth of 33 feet and is located near the middle of Round Meadow. The well has an artesian flow of about 25 gpm and is the main water supply for facilities at Grant Grove. Well No. 1 was test pumped at rates up to 110 gpm. Testing suggested that the sustainable yield for the well was probably in the range of 75-100 gpm. The well is not

equipped with a pump, so the current yield from the well is limited to its natural artesian flow; probably in the range of 20-25 gpm.

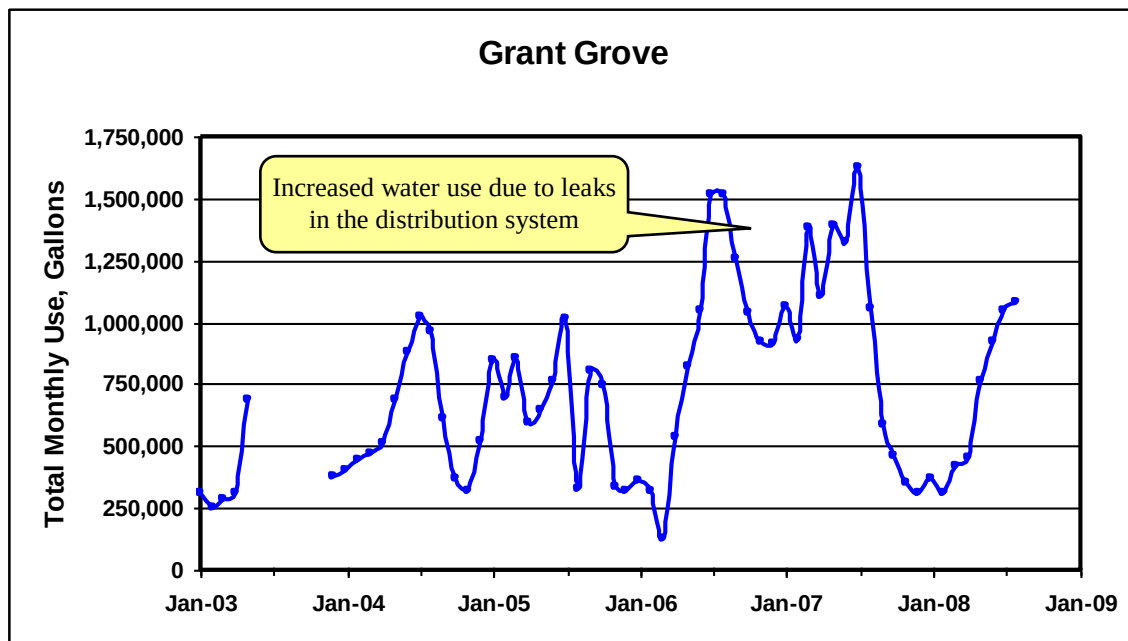


Figure 3. Total monthly water use for the National Park Service water supply and distribution system at Grant Grove.

Well No. 2 was drilled to a depth of 32 feet. It was located about 500 feet west of the 200,000-gallon underground storage tank, west of Round Meadow. The well was test pumped at rates up to 60 gpm. The sustainable yield was estimated to be around 40 gpm. There is no record of Well No. 2 ever being used as a water-supply source. Park staff seem to be unaware of its existence. It is unknown whether the well still exists, has been plugged and abandoned, or is simply “lost”. However, its previous existence provides evidence that a new well could be constructed in the same general area to provide supplemental water if there is a need for additional supplemental water for the Grant Grove water supply system.

The “400-foot Well” was constructed near the 1.2 million gallon storage tank in 1993. It was drilled entirely through granitic rock and obtains a small amount of water from fractures in the granite. The driller estimated its yield at 30 gpm, but the current yield is reportedly around 10 gpm. There is no record of drawdown and yield testing at this well to determine its potential sustainable yield. This well might be a good candidate for hydrofracking to increase its yield.

Groundwater Monitoring

There is little or no reason to initiate a groundwater monitoring program in the Grant Grove area. Very little water withdrawal occurs in the same drainage basin as the meadows or sequoia groves, or in close proximity to sensitive natural resources.

Water use at the private cabins at Wilsonia is minimal and most of the water is returned to the local groundwater system. Wilsonia is hydrologically separated from sensitive park resources (meadows and sequoia groves) in the Grant Grove area.

Most of the water withdrawn for use at NPS facilities at Grant Grove is from sources that are hydrologically separated from sensitive park resources. The artesian well in Round Meadow produces water that would have otherwise discharged into the headwaters of Abbott Creek. Merritt Spring is located in the headwaters of Sequoia Creek. The 400-foot well is used sparingly and produces a fairly small amount of water. Rona and Merritt Springs have a combined capacity of 5-8 gpm, so any withdrawals from those springs will primarily affect only the flora and fauna in the immediate vicinity of the springs. The springs are used sparingly to augment the water supply from Well No. 1.

If monitoring wells were constructed in the Grant Grove area, it's likely that the natural seasonal water table fluctuation and effects of wet vs. dry years would mask any effects due to groundwater pumping. It would be an expensive monitoring network to construct and operate, and it's likely that we would be unable to separate a trend due to groundwater pumping from the natural variation of the climatic/hydrologic systems.

Summary

There is no need to attempt to monitor water use or potential impacts from groundwater pumping at Wilsonia. There is no reasonable expectation for the occurrence of even minor changes to the local hydrologic systems. The net consumptive use is small, Wilsonia is hydrologically separated from sensitive park resources (meadows and sequoia groves), and the distance between Wilsonia and sensitive park resources is too great (1 mile).

The existing water supply sources at Grant Grove are adequate for the current level of development. Flow measurement and testing during the dry season would provide better data to substantiate the sustainable yield of individual sources and the total system for planning future development in the area.

Leak detection and repair, and water conservation could result in significantly reducing water use and peak demand. The cost savings of not treating water that is lost to leakage could offset some of the cost of the repair/rehab projects. Analysis of the current operating system and revision of standard operating procedures (and operator training) could result in a more efficient operating system, further reducing the need to remove water from its natural environment.

If there are any questions regarding this trip report, please call me at (970)-225-3515.

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