

Water Wells and Test Holes at Pinnacles National Monument

Summary

In the 1930s, The Civilian Conservation Corps (CCC) constructed a hand-dug well in the alluvium along Chalone Creek upstream from the Chalone Creek campground. The well has since been destroyed by flooding. In 1959, a well was drilled a little further downstream, approximately across from the campground. The well did not provide an adequate supply, attributed to the use of an excessive amount of drilling mud during construction. A new well was drilled in 1968 a short distance upstream and was the main water supply for NPS facilities on the east side until late 1993 or early 1994. The current supply well for the east side was constructed in 1993 to alleviate concerns about the water quality from shallow wells completed in the alluvium of Chalone Creek. A new well was constructed at the Pinnacles Campground in Bear Valley in 2008.

On the west side, water was originally obtained from Oak Tree Spring. Deep wells were constructed at the campground in 1965. A well was drilled in 2001 near the west entrance for proposed developments in that area.

West Side

Balconies Cave Well

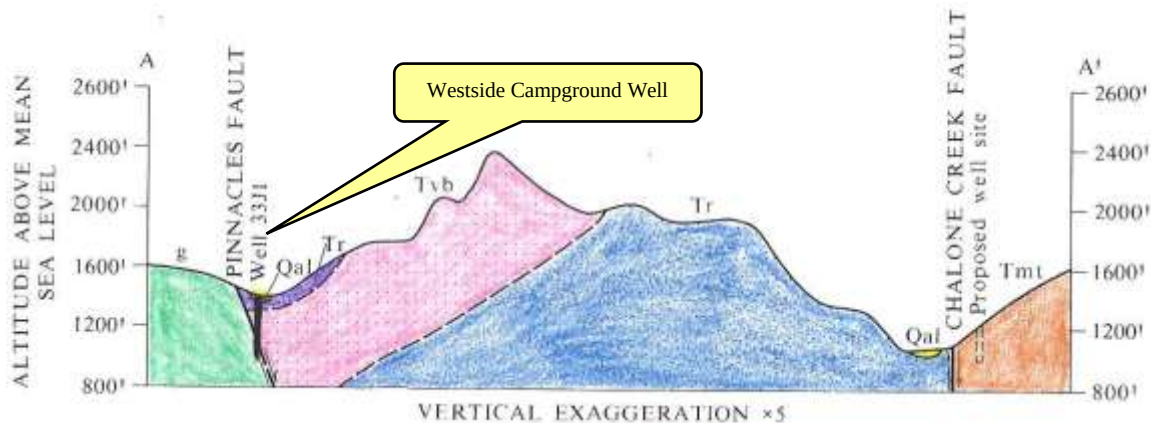
In 1968, a test well was drilled at the Old Pinnacles campground (T16S, R7E, Sec. 34bba) to the northeast of Balconies Cave. The well was drilled to 14 feet and encountered 6 feet of alluvium and 8 feet of rhyolitic breccia. Water was obtained from a fracture in the breccia at 11 feet. The estimated yield of the well was 1 gpm. It was suggested that a hand pump could be placed on the well to supply water for hikers. The general area of the well site was searched on July 11, 1979 and no trace of the well was found. It was learned from one of the maintenance staff that the casing had been pulled and the well filled in sometime during the 1970s.

Oak Tree Spring

Oak Tree Spring is located east of Juniper Canyon trail approximately 0.4 miles from the Chaparral Ranger Station (T16S, R7E, Sec. 34ccc). The flow was measured at 0.15 gpm on July 11, 1979. It was noted that there was considerable leakage from around the concrete spring box. Presumably the spring was a water supply for facilities on the west side of the park prior to construction of wells near the campground in 1965.

Westside Campground Wells

Two wells were drilled about 150 yards apart at the Westside campground in 1965 (T16S, R7E, Sec. 33dac). The wells are 335 and 343 feet deep and are completed in an artesian aquifer, most likely in the fault zone of fractured breccias and tuffs underlain by rhyolite and overlain by limestone and granodiorite. The artesian flow from the wells was about 2 gpm from each well in July 1979. One of the wells was completed with steel casing as a supply well and the other was cased with plastic tubing and left as an observation well.



Geologic setting of wells at the West Side Campground (33J1), from Akers (1967).

West Entrance Well

A test well was drilled near the West Entrance (T17S, R7E, Sec. 5dac) in 2001 to supply water for planned developments in the area. The well was drilled to a total depth of 420 feet and encountered a variety of granitic rocks (granite, granodiorite, quartz diorite, and quartz monzonite). The estimated long-term yield of the well is about 4 gpm. Pumping at higher rates caused a precipitous drop of water level in the well.

Headquarters Area

USGS conducted a reconnaissance investigation of groundwater resources at Pinnacles National Monument in the early 1960s (Evenson, 1962). At that time, water for the Headquarters area and the Bear Gulch campground was supplied from Split Rock Spring (T17S, R7E, Sec. 2cbd) in Bear Gulch, just upstream from the picnic ground near park headquarters. The spring flowed from fractures in volcanic breccia and tuff bedrock. The flow was reported by Evenson (1962) to be about ½ gpm.

Chalone Creek Area

Willow Spring

At one time, Willow Spring provided water for the Chalone Creek campground. The spring is located about 1½ miles northwest of the campground (T16S, R7E, Sec. 26cab). The spring emanates from the Temblor Formation at the fault contact of the Temblor Fm. with the underlying volcanic breccias and tuffs.

CCC Well

The Civilian Conservation Corps constructed a dug well in the alluvium of Chalone Creek near the campground in the 1930s (T16S, R7E, Sec. 35dac). The well was a concrete and wood cribbed shaft about 5-foot square and 17 feet deep. Depth to water

was about 10 feet below ground surface. In June 1979, this well was found to be completely filled in. The remains of the wood cribbing could still be seen.

Chalone Creek Campground Well No. 1

A test well was drilled in the alluvium of Chalone Creek in July 1959 (T16S, R7E, Sec. 35ddd) a short distance downstream of the Chalone Creek campground. The well is located in a pumphouse, south of Chalone Creek and west of the road. The well was drilled through alluvium to 38 feet where rhyolite was encountered. Drilling continued for 3 feet into the rhyolite. It was not determined whether that was bedrock or a very large boulder. The well yielded 11 gpm with 4 feet of drawdown. It was thought that the drilling mud used during construction of the well penetrated far into the alluvium and had partially sealed water flow from the sand and gravel, reducing the yield of the well.

A horizontal trench collection gallery was constructed in an attempt to increase the yield of the well. The trench was constructed 4 feet below the then existing water level and extended 215 feet across the valley. The collection gallery provided additional water to the well for a time, but quickly became plugged with sludge and slime.

This well has been plugged and abandoned. There is no longer any evidence of the well at land surface.

Chalone Creek Campground Well No. 2

A second well was constructed in the same general location in 1968 (T16S, R7E, Sec. 35ddd). The well was drilled to bedrock at 36 feet deep and was completed with perforated casing. The well was located about 150 feet northwest of the pumphouse at Well No. 1. The well was surrounded by a stone and cement circular structure which is covered by a steel plate. The well had 16-inch casing extending 4½ above land surface. It was the primary water supply for facilities on the east side of the monument in 1979 when the wells and springs in the park were inventoried.

In the early-mid 1990s, this well was determined to be under the direct influence of surface water from Chalone Creek. Subsequently a new deep well was drilled further from the creek (Pillar Well). The Chalone Creek Campground Well No. 2 was plugged and abandoned and all surface structures were removed.

Deep Test Well at Chalone Creek Picnic Area

A deep test well was constructed in 1968. It was located 35 feet ENE of the water tank overlooking the Chalone Creek Picnic Area (T16S, R7E, Sec. 36ccb). The well was constructed to test the potential yield of the Temblor Formation. The well penetrated 476 feet of fanglomerate. The fanglomerate was comprised of well-cemented sand and gravel. The bottom 4 feet of the test hole was in rhyolite. The well yielded only 0.3 gpm and was plugged and abandoned.

Stone Boundary Well

This well was constructed in the alluvium of Chalone Creek to a depth of 60 feet in 1968. The well penetrated about 40 feet of alluvium and then 20 feet of fanglomerate (Temblor

Formation). The well is located about 100 yards south of the stone pillars that marked the old boundary of the monument (T17S, R7E, Sec. 1bdd). The well produced more than 50 gpm, but continued to pump sand each time the pump was turned on. The sand problem is likely a result of completing the well by perforating the casing with a Mills knife, rather than installing a properly sized well screen.

The well is equipped with a pump and is available as an emergency supply for fighting fires, but the well is not connected to the water distribution system. This well has never been used as a source of potable water for the park.

Pillar Well

The current water supply well for facilities on the east side of the park was constructed in 1993. The well is on the northeast side of the Chalone Creek valley, southeast of the stone walls marking the old boundary of the monument (T16S, R7E, Sec. 1acb). The well was constructed at this location with the thought that it would intercept fractured rocks associated with the Chalone Creek fault. A deep well completed in bedrock was desired because shallow wells in the alluvium of Chalone Creek were classified as being “under the direct influence of surface water” and would require more extensive water treatment.

The well was drilled to 320 feet and completed with 6-inch steel casing. Louvred steel casing was installed from 240-320 feet. The surface seal extends to 70 feet below ground surface to prevent alluvial groundwater from entering the well. The well was test pumped at 40 gpm for 20 hours resulting in drawdown of water from 40 feet below ground surface at the start of the test to 120 feet below ground at the end of the test.

Pinnacles Land & Cattle Co.

This well is located about 200 yards south of Hwy 146 near the confluence of Bear Valley and Chalone Creek (T17S, R7E, Sec. 1adc). It was drilled through alluvium to 46 feet and then clay for 18 feet. Depth to water was 13 feet below ground surface in July 1979. There is no record of use or potential yield for this well.

Pinnacles Ranch Campground

The well supplying water for the Pinnacles Ranch campground at the east entrance (T16S, R8E, Sec. 31bdd) was constructed in 1977. It was drilled to 80 feet but was only cased to 72 feet below ground surface. The well has perforated casing from 20-72 feet to capture groundwater from the alluvial sand and gravels filling Bear Valley.

In February 2008, the casing collapsed and the well filled in to a depth of 39 feet. The well still produces about 8 gpm. Construction of a replacement well is planned for a location farther from the creek to reduce the potential for influence from the surface water source.

A new well was constructed at the campground in August 2008. The well was drilled to a total depth of 205 feet and is completed in the Temblor Formation which underlies the alluvial sediments in the valley. The Temblor Fm. is a granitic fanglomerate, composed

of cemented alluvial fan sediments that originally had their source as granitic rocks. The driller's log describes the geologic formations as sand from 0-30 feet (alluvial sediments, decomposed granite from 30-110 feet, and granite & cemented sand from 110-205 feet. The well is screened from 100-120 and 180-200 feet. The well was test pumped for 24 hours at 43 gpm, resulting in 48 feet of drawdown. Water quality is good except for high concentrations of iron and manganese.

References

Akers, J.P., 1967, *The Geohydrology of Pinnacles National Monument, California*, U.S. Geological Survey Open-File Report 67-2, 14 pp.

Evenson, R.E., 1962, *Ground-Water Reconnaissance at Pinnacles National Monument, California*, U.S. Geological Survey Water-Supply Paper 1475-K, pp.375-382.

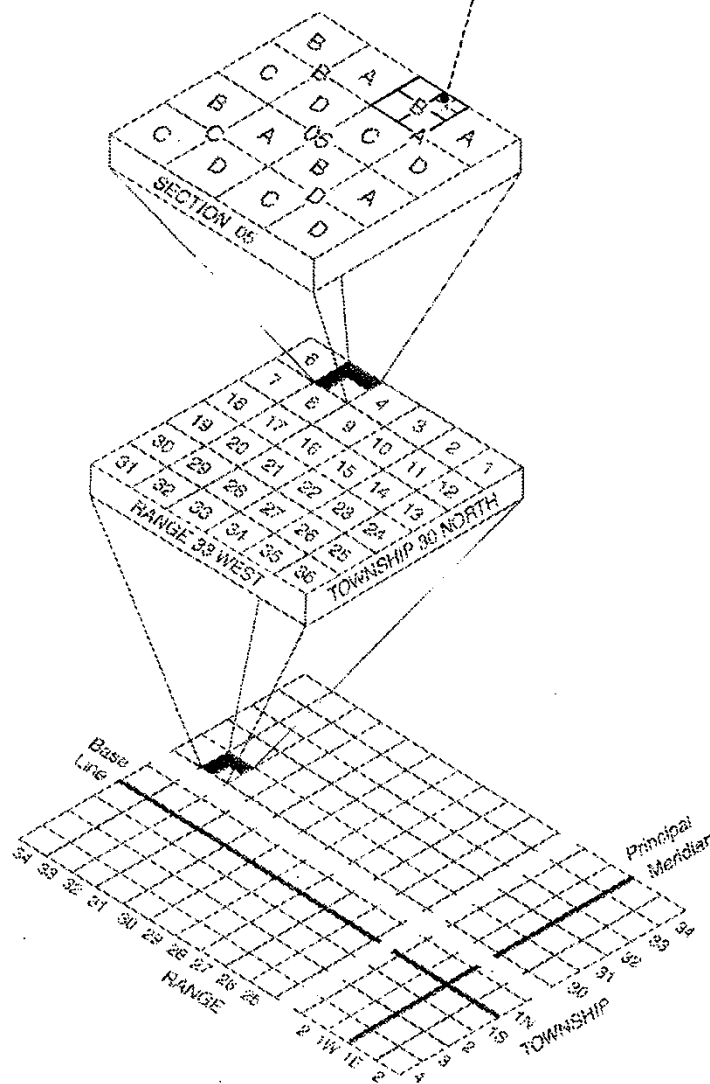
Larry Martin
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Ft. Collins, CO
January 2009

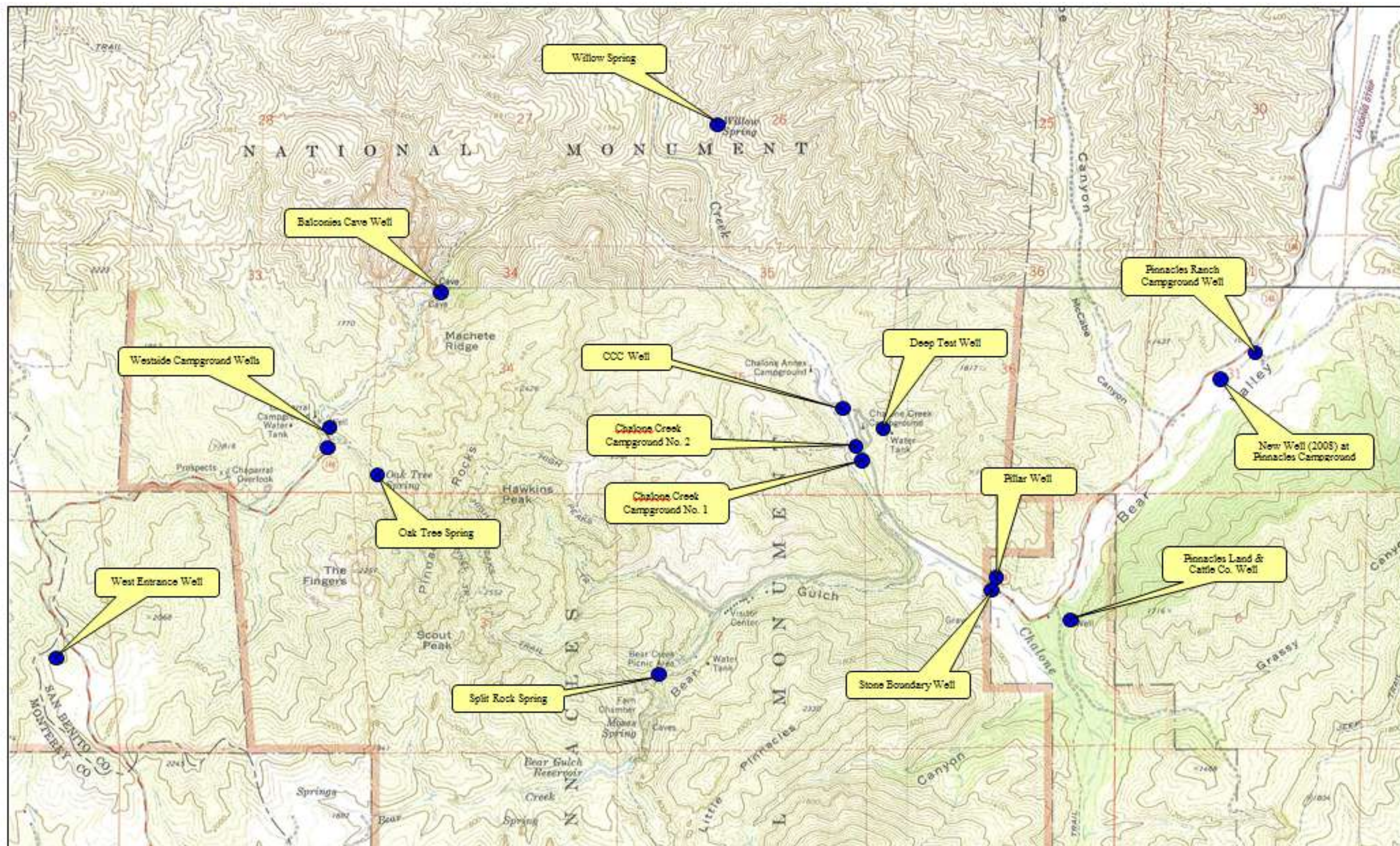
Well Numbering System

The well numbering system used in this report to describe the locations of wells at Pinnacles National Monument is based on the BLM's system of land subdivision. The first part of the well number is the township, followed by the range, followed by the section number. Letters following the section number locate the well within a section. The first letter denotes the quarter section, the second letter the quarter-quarter section, and the third letter denotes the quarter-quarter-quarter section. The letters are assigned within the section in a counter-clockwise direction beginning with an "a" in the northeast quarter, "b" in the northwest quarter, "c" in the southwest quarter, and "d" in the southeast quarter.

The example shown below would have the well number, T30N, R33w, Sec. 5aba.

Location number for well 30N33W05ABAB01

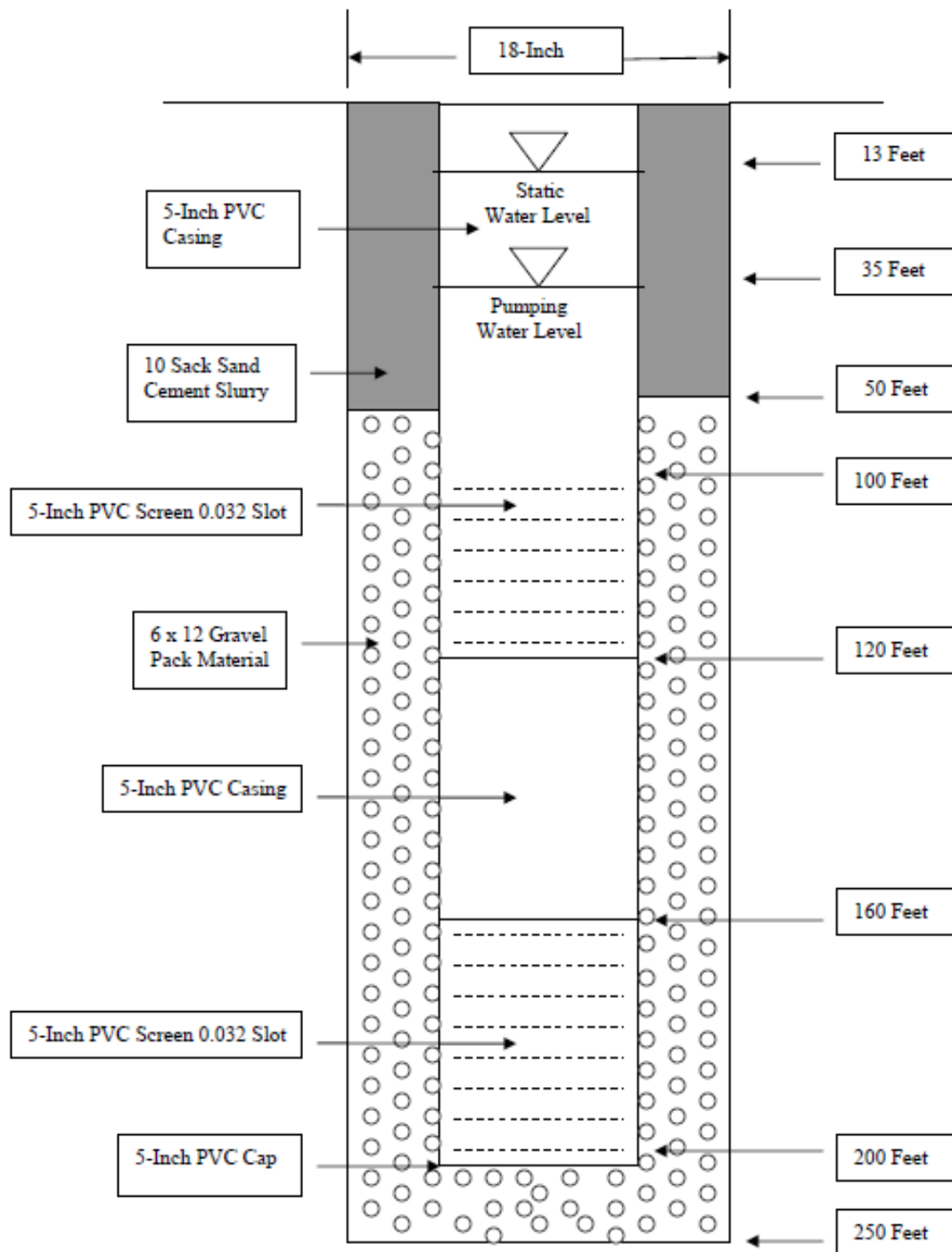




Locations of wells, springs, and test holes at Pinnacles National Monument.

Well constructed at Bear Valley Campground in August 2008

Maggiore Bros. Drilling, Inc
Test Hole



File Original with DWR

Page 1 of 1

Owner's Well Number

Date Work Began 08/07/2008

Date Work Ended 8/15/2008

Local Permit Agency: San Benito County Water District

Patrol Number WP-08-048

Permit Date 8/7/08

State of California
Well Completion Report

Refer to Instruction Pamphlet
No. 0080008

DWR Use Only - Do Not Fill In											
State Well Number Site Number											
Latitude						Longitude					
ADMINISTRATOR											

[illegible]

Well Owner

Name State of California Dept. of Interior

Mailing Address 47050 Generals Highway

City Three Rivers State CA Zip 93271

Well Location

Address 5000 HWY 146 - Pinnacles National Monument - Camanche

City Paindres County San Benito

Latitude _____ N Longitude _____ W

Dec. Min. Sec. Dec. Min. Sec.

Decimal Lat. _____ Decimal Long. _____

APN Book 028 Page 15 Parcel 0-013

Township _____ Range _____ Section _____

Location Sketch
(Sketch must be drawn by hand after form is printed.)

North

HWY 25

West

2 miles

Building

← HWY 146

South

Activity

☒ New Well

☐ Modification/Repair

☐ Deepen

☐ Other

☐ Destroy

Describe procedures and materials under "OTHER" label

Planned Uses

☒ Water Supply

☒ Domestic ☐ Public

☐ Irrigation ☐ Industrial

☐ Cathodic Protection

☐ Dewatering

☐ Heat Exchange

☐ Injection

☐ Monitoring

☐ Remediation

☐ Sparging

☐ Test Well

☐ Vapor Extraction

☐ Other

Indicate or describe distance of well from roads, buildings, fences, etc. and attach a map. Use additional paper if necessary.

Water Level and Yield of Completed Well

Depth to first water _____ (Feet below surface)
 Depth to Static _____
 Water Level 13 _____ (Feet) Date Measured 08/15/2008
 Estimated Yield * 43 _____ (GPM) Test Type Air Lift
 Test Length 24.0 _____ (Hours) Total Drawdown _____ (Feet)
 *May not be representative of a well's long term yield.

[illegible]

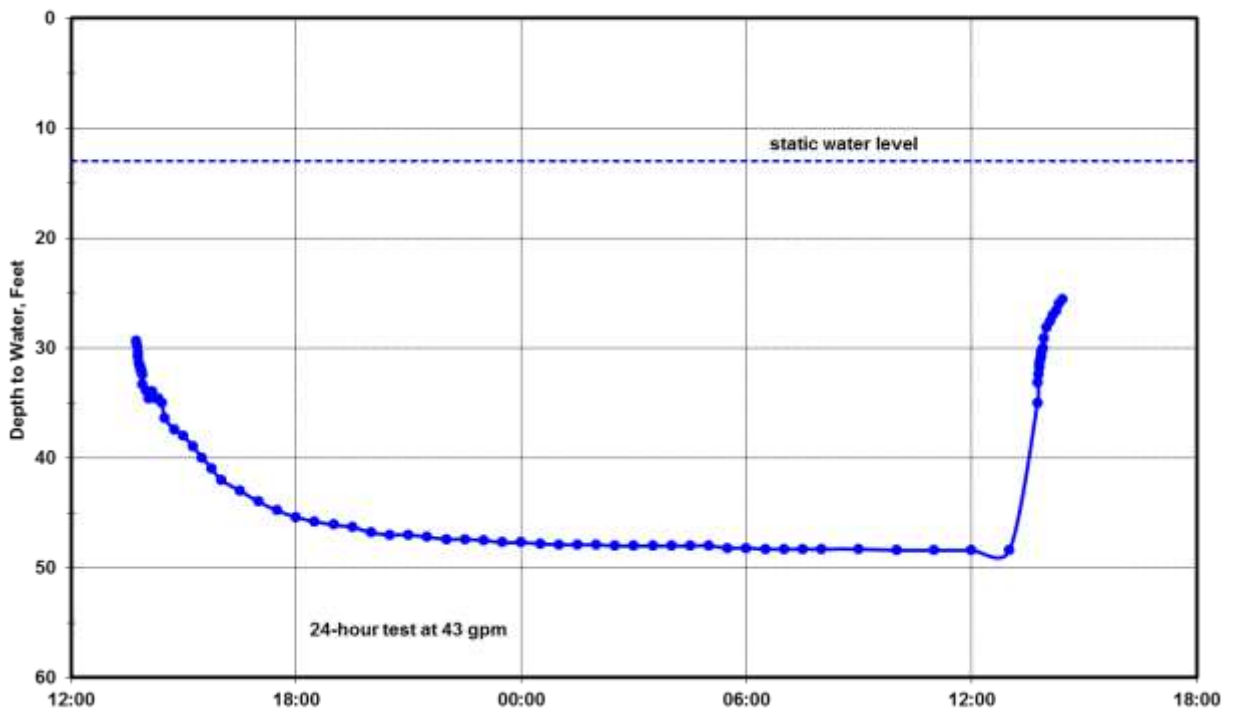
Attachments	Certification Statement
☐ Geologic Log ☐ Well Construction Diagram ☐ Geophysical Log(s) ☐ Soil/Water Chemical Analyses ☐ Other	I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief. Name <u>MAGGICHA BROS DRILLING INC</u> Person, Firm or Corporation <u>595 AIRPORT BLVD</u> <u>WATSONVILLE</u> <u>CA</u> <u>95076</u> Address City State Zip Signed <u><i>James M. Maggicha</i></u> Date Signed <u>9-25-06</u> C.S. Licensed Well Driller C-67 License Number

Attach additional information, if it exists.

DWR 100 REV 1/2008

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

New Well at Bear Valley Campground
August 18-19, 2008



Memorandum

To: Superintendent, Pinnacles National Monument
Through: Gary Rosenlieb, Chief, Water Operations Branch
From: Larry Martin, Hydrogeologist, Water Resources Division
Subject: Water supply well at Pinnacles Ranch campground

Summary: The water supply well and pump for the Pinnacles Ranch campground recently failed. Repairs have been made, but a new water source should be developed, by either constructing a new well in the alluvial valley-fill aquifer near the campground or extending the existing east side water system to service the campground also. The campground does not use enough water to affect streamflow or availability of water in Sandy Creek as it flows past the campground area. Pumping groundwater from a shallow well completed in the alluvial valley-fill aquifer will not affect flow from springs or seeps along the margins of the valley.

Discussion: Pinnacles National Monument acquired significant new property in March 2006 when the purchase of the Pinnacles Ranch and campground was completed. Approximately 2000 acres were acquired, primarily in Bear Valley and along either side of the entrance road (Hwy. 146) to the monument. A single well provides water for both the ranch and the campground. Park staff requested an assessment of the potential impact of groundwater pumping on streamflow in the adjacent Sandy Creek, the potential impact of groundwater pumping on flow from springs and seep areas at the margins of the valley, and evaluation of alternative sources of water for the campground.

The Pinnacles Ranch well is located about 2000 feet northeast of the campground store and about 30 feet southeast of Sandy Creek. Access to the well is via a dirt path from the ranchhouse area. The well was constructed by Stuart Kingman (former owner of the ranch) in 1977. The well was drilled to 80 feet deep and completed with 8-inch steel casing to 72 feet. The casing was perforated from 20-72 feet. A concrete surface seal was installed from 0-20 feet. A few days prior to my site visit on Feb. 27, 2008, the casing failed and the well filled to a depth of 39 feet with pea gravel from the gravel pack. A smaller pump was installed and it appears that the well will be useable for at least the near future at a reduced pumping rate (5-10 gpm) until either a new well is constructed or the water distribution lines are extended from main part of the monument.

The following observations are made regarding the water supply for the campground:

1. The current well would likely be classified as being “under the direct influence of surface water” and therefore subject to treating the water as if it came from a surface source.
2. The amount of consumptive use at the campground is minimal. The current usage rate will not affect streamflow in Sandy Creek.
3. A new well could be constructed closer to the campground (more conveniently located) and further from the creek to reduce the potential for surface water influence.
4. The existing water distribution system for the east side of the monument could be extended to service the campground area.

The existing well is only about 20-30 feet from the creek. Since the partial failure of the casing, the well is now only 39 feet deep. It's quite likely that the well would eventually be classified as

being under the direct influence of surface water, meaning that water pumped from the well was at least partly obtained from infiltration of surface water into the aquifer and then into the well. Water from wells that are classified as being under the direct influence of surface water must be treated as if it came from a surface water source, requiring filtration and disinfection to meet public health standards. Treatment requires more equipment, more testing, another level of certification for treatment plant operators, and a backup operator. It is far easier, and less expensive to operate a water system using a groundwater source than a surface water source. We would certainly want to have a groundwater source for the water system at the campground, either from a new well or by extending the service area for the existing east side water system. The source of water for the existing east side system is a deep well near the pillars marking the old entrance to the monument.

Water use records for the campground are available from when the park acquired the property in March 2006. Peak usage at the campground is around 5000 gallons per day in the summer months. The vast majority of this water is immediately returned to the alluvial aquifer, from which it came, within a short distance down stream via infiltration from the leachfields at the restrooms scattered throughout the campground. A general rule of thumb for domestic water systems is about a 90% recharge rate. Total consumptive use for the campground is probably in the range of 500-1000 gallons per day, a trivial amount for the alluvial aquifer filling the valley. Particularly since the groundwater in the area is continually being replenished by inflow of groundwater from “upstream” in the valley.

A new well could be constructed in the alluvial valley-fill aquifer in the vicinity of the campground to replace the partially collapsed existing well. A general reconnaissance of the area was conducted to identify potential locations for a new well. Considerations for the location of a new well included;

1. In the general vicinity of the campground.
2. Near existing roads and utilities to minimize disturbance and construction costs.
3. Maintain at least 100 feet distance from the creek to minimize the potential for classification as under the direct influence of surface water.
4. Avoid the sides of the valley where the alluvium is likely to be less thick than toward the middle of the valley.
5. Locate the well upstream of potential contaminant sources, e.g., leachfields.

One potential site for a new well is the open field immediately northeast of the swimming pool, to the northwest of the gravel road to the upper picnic area loop. This location meets all of the criteria listed above. There may be other locations that would be equally acceptable.

The existing water distribution system for the east side of the monument terminates at a fire hydrant about 1 mile southwest of the campground store. Connection of the existing water line with the existing distribution system in the campground might only require about ½ mile of new water line to connect to the water line at the most southwesterly part of the campground. Extending the existing water system to the campground would have the advantage of providing one integrated water system for all facilities on the east side of the monument. However, then all facilities would be dependent on a single well for water. Construction of a new well at the campground and extension of the existing water distribution system would provide a single

integrated water distribution system with two independent sources; a main well and a backup well.

Hydrogeology

There are two geologic formations in the vicinity of the campground that could be possible water sources, and one of those would not provide a sufficient amount of water. The valley is filled with unconsolidated sand and gravel comprising the alluvial valley-fill aquifer. The alluvium in the existing well was present to a depth of 80 feet. Similar thickness of alluvium was encountered during drilling of several wells along Chalone Creek in the past. The Temblor Formation underlies the alluvium in the valley and forms the hills on either side of the valley. The Temblor Fm. is a granitic fanglomerate – cemented sandy to bouldery sediments derived from a granitic source and originally deposited as an alluvial fan. Several investigators in the past have noted the presence of small springs and seeps emanating from the Temblor Fm. and suggested that it might therefore be a source of groundwater.

Test drilling has shown that wells in the Temblor Fm. generally will not produce large amounts of water. A test well drilled by NPS near the water storage tank northeast of Chalone Creek penetrated 476 feet of fanglomerate and produced less than ½ gpm. The well was plugged and abandoned.

The Temblor Fm. probably has a fairly low permeability due to the mix of sediment sizes (smaller grains filling the pore spaces between larger grains) and filling of the pore spaces with naturally-occurring chemical precipitates from groundwater which act as a cementing agent. There is some groundwater flow through the formation, starting as infiltration from rainfall on the upland areas and flowing toward and discharging at small springs and seeps where there is a steep exposure of Temblor Fm. on hillsides or where the Temblor Fm. overlies lower permeability volcanic rocks (primarily rhyolite).

The nearly constant low flow rate observed at springs and seeps provides additional evidence of the low permeability of the Temblor Formation. Groundwater in the Temblor Formation simply cannot drain very fast. Springs flowing from a more permeable formation would have more seasonal variability. They would have higher flow rates during and shortly after the winter rainy season. Flow would be greatly diminished, if not completely dried up, during the dry months of summer and early fall.

The hydrogeology of Bear Valley in the vicinity of the campground is depicted in a schematic cross section in Figure 1.

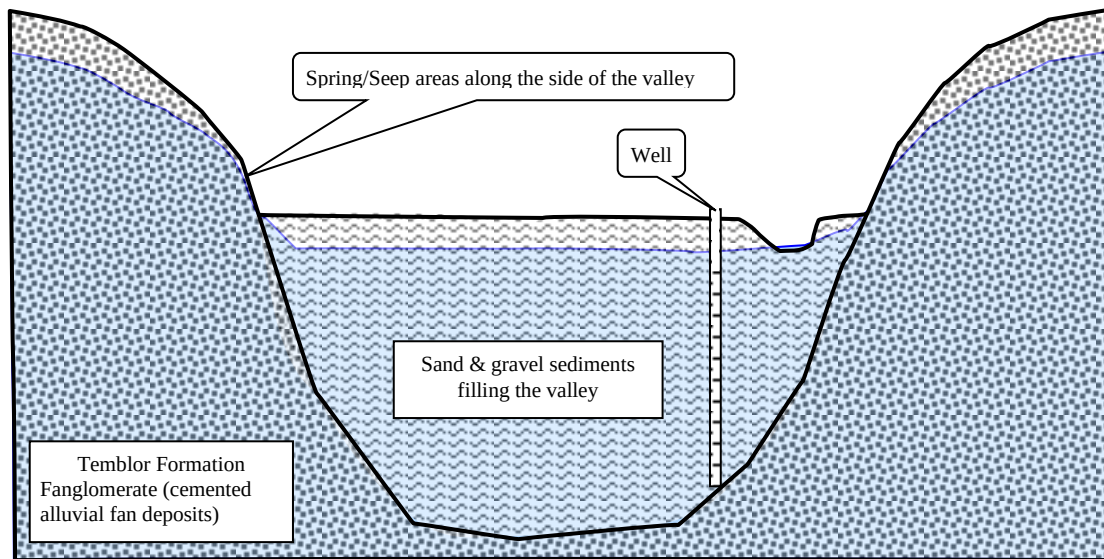


Figure 1. Schematic SE-NW cross section through Bear Valley at the water-supply well for the Pinnacles Ranch campground (looking downstream).

The only viable target aquifer for constructing a new well near the campground is the alluvial sand and gravel sediments filling the valley. Pumping groundwater from the alluvium will not affect the flow of the springs and seeps emanating from the Temblor Formation. Springflow is controlled by the low permeability of the Temblor Formation. Groundwater simply cannot drain any faster. As discussed earlier, pumping groundwater from the alluvium to meet the current needs of the campground will not significantly affect the water table elevation or streamflow in the valley.

Even if the water table elevation in the alluvial valley-fill aquifer was lowered, flow from the springs and seeps would not be affected. The situation is analogous to water flowing from a pipe into a stock tank. If there is a valve on the pipe restricting the outflow from the pipe, the flow will not change whether the tank is nearly full or nearly empty. The valve controls the flow, not the water level in the tank.

Recommendations for well construction

If a new well is constructed to replace the failing campground well, it should be relocated farther from the creek. The new well should be at least 100 feet from the creek and farther if possible. Relocating the well farther from the creek will lessen the chance of water from the well being classified as groundwater under the direct influence of surface water.

The well should be completed with well screen, not perforated casing. Perforated casing is an inefficient (albeit inexpensive) method of well construction and will not prevent fine-grained sediments from entering the well and causing excessive wear on the pump and valves. Well screen that has been sized to be compatible with the grain-size distribution of the sediments in the valley will result in a more efficient well, with a higher production rate, and minimize sand pumping. Depending on the permeability of the sediments encountered during drilling and the

desired production from the well, 10-20 feet of well screen should be sufficient. As an example, 10 feet of 6-inch, 0.010" slot size well screen will transmit about 100 gpm. Well screen could be either PVC or stainless steel. PVC would be less expensive.

The anticipated depth for a new well near the campground would be around 80-100 feet, drilling should continue until bedrock is encountered. Current California well construction standards require a minimum of 50 feet for a surface seal, so the well screen should be placed somewhere between 50 feet deep and the bottom of the alluvial valley-fill aquifer, opposite the most permeable zone encountered during drilling. Placing the well screen deeper in the aquifer and providing a 50-foot surface seal will provide vertical separation between the groundwater flowing into the well and surface water in Sandy Creek.

If additional information or explanation is needed for any aspect of this project, please call me at, (970)-225-3515.

References

Akers, J.P., 1967. The Geohydrology of Pinnacles National Monument, California. USGS Open-File Report, 14 pp.

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Borchers, James W. and Michael S. Lyttge, 2007, Results of Level-1 Water-Quality Inventory at the Pinnacles National Monument, June 2006, U.S. Geological Survey Data Series 283, 45 pp.

Evenson, R.E., 1962, Ground-Water Reconnaissance at Pinnacles National Monument, California. USGS Water-Supply Paper 1475-K, pp. 375-382

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