

Analysis of Water Levels and Yield of the Well at McGraw Ranch Rocky Mountain National Park, 2012

Introduction

This report summarizes the water use and water level data for the well at McGraw Ranch for 2012. The well is marginally able to keep up with the demand, and then only with extreme water conservation by residents at the ranch. Previous reports on this subject have been provided in 2008 and 2011. In July 2012, I provided a summary report regarding alternatives to increase the water supply at McGraw Ranch.

Water demand at McGraw Ranch

Water use at McGraw Ranch is not metered. We can infer the demand for water by using the data from the meter that measures the amount of water pumped from the well. Since park staff try to maintain full capacity in the storage tank, monitoring inflow to the tank serves as a surrogate for outflow. Water demand for facilities at McGraw Ranch is best illustrated by plotting the cumulative amount of water pumped since January 1, 2012 (Figure 1).

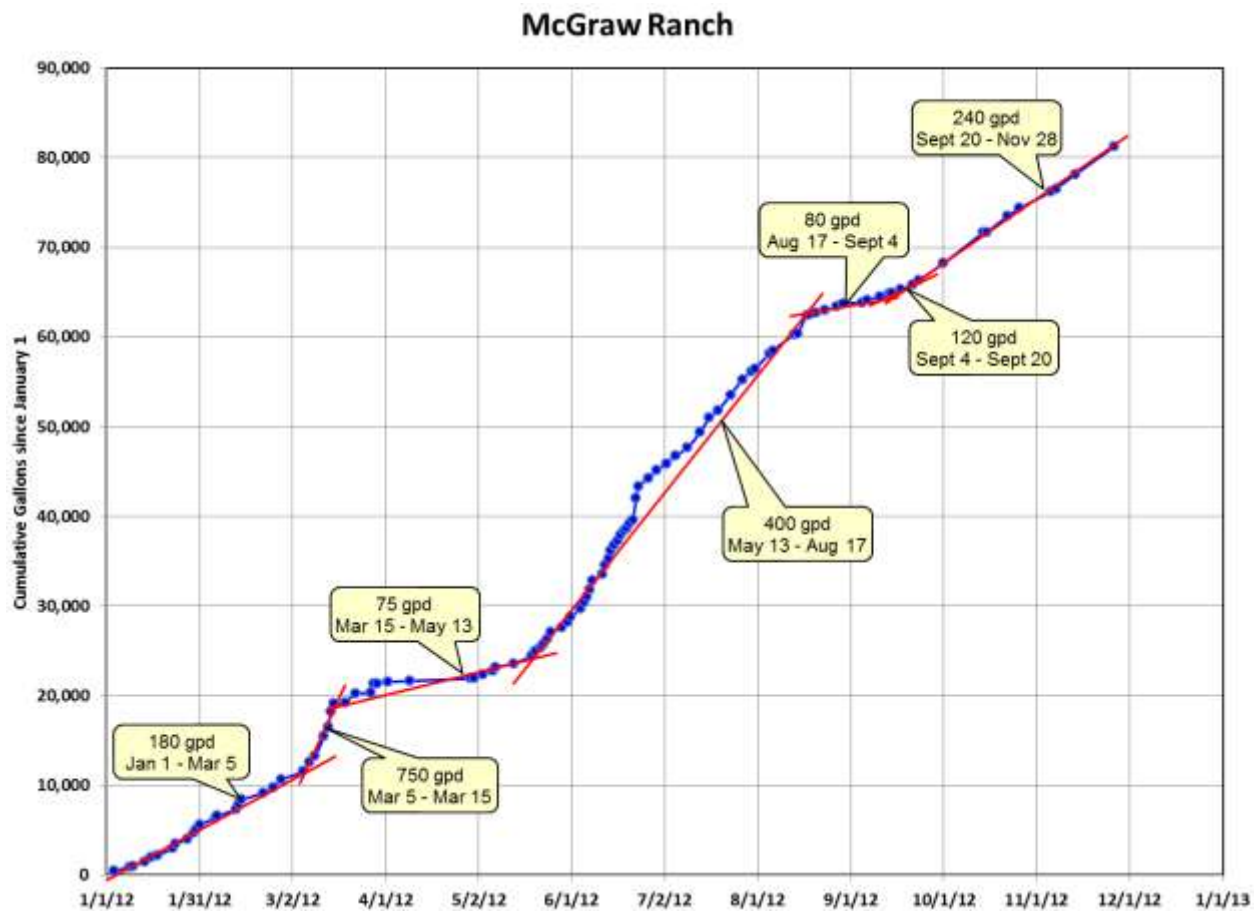


Figure 1. Water pumped from the well at McGraw Ranch – 2012, annotated with average pumping for various periods.

There was a marked increase in groundwater pumping in early-March when the storage tank was drained, cleaned, and refilled. Pumping from the well during this period averaged 750 gallons per day, with several days exceeding 1000 gallons and one day exceeding 2000 gallons.

Large amounts of water were pumped on June 22 and 23 when 2500 and 1350 gallons were pumped. There was a marked decline in the water level in the well associated with this pumping. The water level decline persisted for the remainder of the season and still persists. It likely will not recover until there is significant recharge from rain or snowmelt infiltration this winter or next spring.

Pumping from the well averaged about 400 gallons per day through most of the summer. When residents were alerted to a potential water shortage in late August, they curtailed usage and pumping was reduced to about 80 gallons per day.

A timer was installed on the pump on September 4, limiting pumping to one 15-minute period per day, for a total of 120 gallons. On Sept 20, the timer was adjusted to provide two 15-minute periods of pumping each day, for a total of 240 gallons per day.

Groundwater level response to pumping

Water level in the well is monitored with a pressure transducer and datalogger. Data is downloaded on an irregular schedule, 3-4 times a year. The pressure data are adjusted to produce a record of the depth to water, below ground surface. The depth to water in the well in 2012 is shown in Figure 2. The high points are the static (or non-pumping) water levels. The low points of the line are the water level when the well is pumping.

Figure 2 shows the effect of pumping large amounts of water on the water level in the well. Approximately 6,000 gallons were pumped during cleaning and refilling of the storage tank in mid-March. This caused a precipitous drop in the water level. Water levels then gradually recovered until pumping increased in mid-May to meet the demand of increased visitation to the ranch.

There was another large water level drop on June 22-23 when nearly 4000 gallons were pumped. Water levels continued to decline through mid-August during the high-use period, when pumping was averaging 400 gallons per day.

Water levels began to recover when residents at McGraw Ranch started conserving water in mid-August. Water levels continued to recover after the timer was installed and pumping was limited to 120 gallons per day. Water levels began to decline after September 20, when pumping was increased to two 15-minute periods per day for a total of 240 gallons per day.

More detail of the water level response to groundwater pumping during the summer and fall is provided in Figure 3.

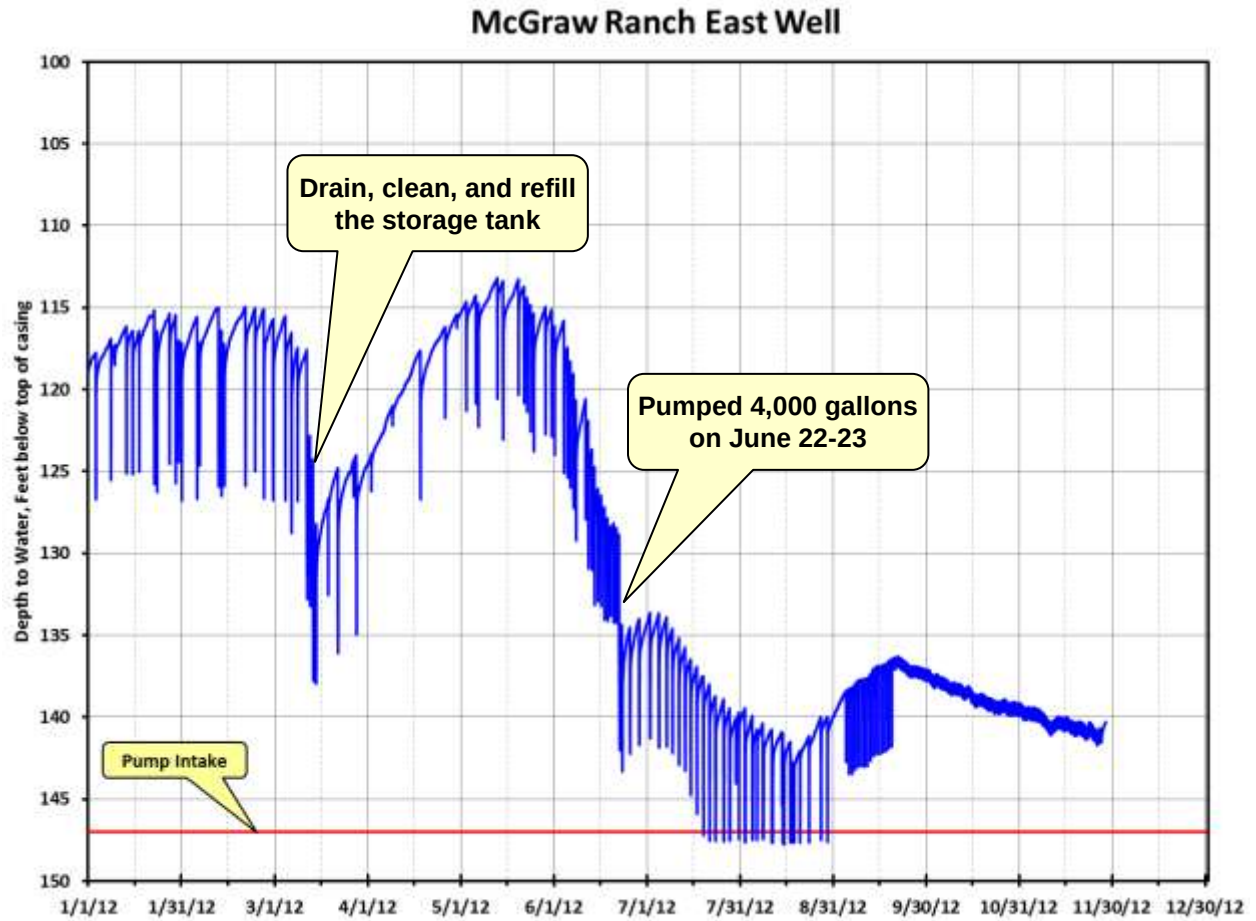


Figure 2. Depth to water in the well at McGraw Ranch – 2012.

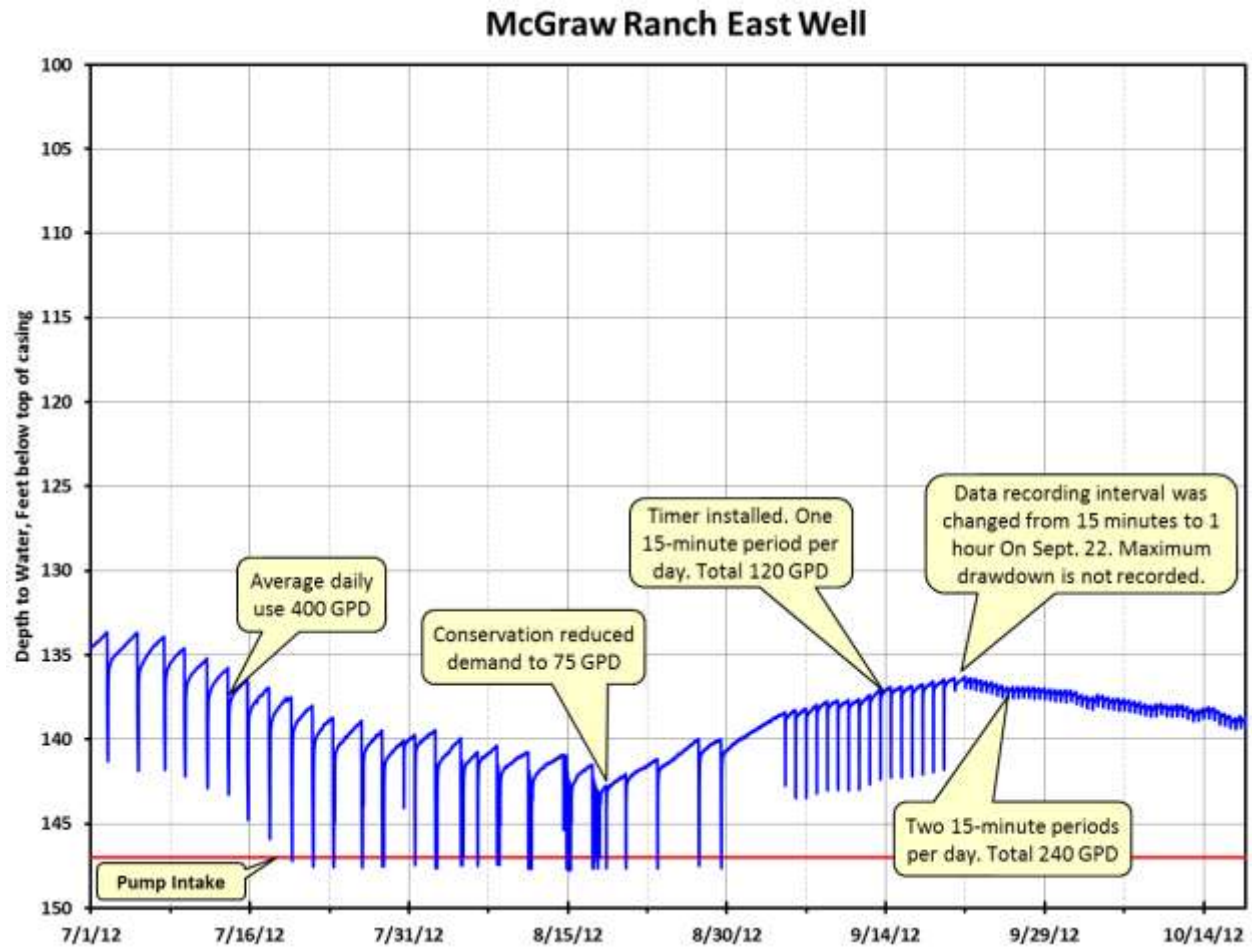


Figure 3. Water level in the well at McGraw Ranch – Summer and Fall 2012.

Conclusions

1. Pumping large amounts of water over a short time span causes large water level declines that are slow to recover. Maybe water could be hauled in to refill the storage tank after cleaning and flushing or other incidences that create the demand for large volumes of water.
2. The well probably cannot sustain production of 400 gallons per day as occurred from mid-May to mid-August this year. Although to be fair, we should note that it took three months before water levels dropped to a dangerously low level and the problem may have been made worse by the large pumping events in mid-March and mid-June and the drought conditions.
3. Analysis of the data for 2012 is affected by the exceptionally dry conditions which were pervasive through the entire year. There was little recharge from melting of the nearly non-existent snowpack. We started the summer season with the water level about 20 feet lower than in previous years.

Recommendations

1. Continue to operate the pump using the timer. Adjust and repair the float switches in the tank to operate correctly in conjunction with the timer.
2. Increase pumping to three 15-minute periods to meet the water demand in the summer (360 gpd maximum pumping).
3. Try to limit water use to about 360 gallons per day. Provide weekly updates in the form of 1-page reports that can be posted at various locations in public areas to include a running tally of average daily water use, total water use for the week, and the amount of water in the storage tank. Water level data from the well could be downloaded and included in the update, but perhaps only monthly. This will encourage residents to conserve water, but not to be too excessive about it.
4. Review the data at the end of next summer to assess whether the well is able to supply enough water to meet minimal needs at the ranch.

Alternatives for increasing the water supply remain the same as outlined in the report I provided in July 2012. Those options include;

1. Hydrofrack the West Well.
2. Fish the old pump from the bottom of the East Well so the production pump can be set at a lower level.
3. Drill a new well.
4. Haul water as necessary when the well can't keep up with demand.

None of the options seem very desirable.

Larry Martin
NPS Water Resources Division
Ft. Collins, CO
(970) 225-3515