

Weaver, Mathew

From: Terry Scanlan [IMCEAEX-_O=FIRST+20ORGANIZATION_OU=FIRST+20ADMINISTRATIVE+20GROUP_CN=RECIPIENTS_CN=TSCANLAN@spfwater.com]
Sent: Tuesday, September 02, 2008 11:36 AM
To: McVay, Michael
Subject: MacGregor Test Data
Attachments: Test Data.xls

Mike -

As discussed, I decided to extend the test by another week or so to get a better definition of the impacts. Generally speaking, the well drawdown and the decline in flow in the pipeline seem to plot a straight line on a semi-log graph. The data has been confounded by two periods in which the pump failed (one for 14 hours and another for 23 hours) late last week. Also, one day where spring flow (both the pipeline and the weir) dropped dramatically for no apparent reason (someone in my office suggested it might be seismic – I can't come up with anything else). In any event, the irrigator will be checking the pump twice daily and recording totalized flow for the next week. Someone for my office will go up every three days or so to check temperatures and water levels.

Data are attached.

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geologica

Innovative Strategies for Managing Environmental Liability

February 26, 2009

Mr. John Westra
Western Region Manager
Idaho Department of Water Resources
2735 Airport Way
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**Review and Recommendations
MacGregor Geothermal Well Test
And Water Quantity Allocation
Permit 65-13913
Cascade, ID**

Dear Mr. Westra:

GEOLOGICA, Inc. (GEOLOGICA) was asked to review the data developed by by Scanlan Engineering for the pumping test conducted in the geothermal well on the MacGregor property in Cascade, ID in August/September 2008.

SUMMARY

Mainly because of equipment problems, the August/September 2008 pumping test did not conclusively determine the effects of pumping 80 gpm or more from the MacGregor geothermal well for extended periods of time. The well was pumped at an average rate of about 53 gpm. Total water production increased by approximately 34 gpm as a result of pumping but the actual amount of available hot water may be less. This is because both the flow rate and temperature of the hot water in-flow to the adjacent property (the Pancheri's) decreased during the test.

LIMITATIONS OF EXISTING DATA

Several limitations were identified in existing data available to evaluate the likely sustainable yield and temperature of the Macgregor geothermal well. These include:

- The pumping test conducted in August/September 2008 ceased to be a constant rate pumping test approximately 4 days after pump startup. Although pumping continued intermittently for an additional 9 to 10 days, the net effective pumping rate decreased to nearly half of that maintained for the first four days. Consequently, it is difficult to substantiate conclusions regarding the long term well yield, sustainable produced water temperature, and long-term impacts to nearby hot springs.
- Produced water chemistry was not monitored during pumping to evaluate the source of produced water and potential changes therein during long-term pumping. Monitoring water quality changes in response to pumping would potentially offer insight into the source(s) of water

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produced from the geothermal well and hot springs on the MacGregor and Pancheri properties, and changes in proportions of contributions from different sources in addition to temperature monitoring.

- Long term temperature and flow monitoring data were collected somewhat sporadically prior to the pumping test. Consequently, estimates of seasonal variability in spring yield and temperature are uncertain.
- No shallow groundwater elevation monitoring data are available near the Pancheri and MacGregor properties. The hot springs are likely situated near the top of the water column in the near surface groundwater-bearing zone. When the water table goes down, spring flow goes down, and conversely, in winter months when the water table is higher, spring flow increases. Because we lack data regarding the water table elevation relative to the spring discharge for the historic monitoring data set or during the pumping test, it is difficult to relate drawdown measured in the geothermal well during pumping to groundwater table drawdown away from the well and from there, to changes in spring flow.

DISCUSSION OF PUMPING TEST RESULTS

Several discussion points were brought out by review of the August/September 2008 pumping test data. These include:

- On average, the MacGregor geothermal well produced water at a rate of approximately 53 gallons per minute (gpm) and temperature of 110°F during the 14 day test. The MacGregor hot spring flow decreased from approximately 32 gpm before the test to an average of roughly 23 gpm during the test; the temperature decreased from 106 °F to 99 °F during the test. The flow from Pancheri spring gallery was reduced from approximately 45 gpm before the test to an average of roughly 35 gpm during the test; the temperature decreased from 106 °F to 103 °F during the test. In sum, the system produced a combined flow approximately 34 gpm greater during the test; although flow and temperature decreased in the springs, more hot water was produced with the well pumping. However, because of the lowered hot spring temperature during well pumping, the effective net increase in hot water production is less than 34 gpm.
- In our opinion, the pumping test was inconclusive on the issues of long term yield and temperature of produced water using the MacGregor geothermal well to supplement flow. The monitoring data indicated that both the hot spring discharge rate and temperature dropped during the first four days of testing, but then stabilized suggesting a potential for continued discharge from the hot springs even while the MacGregor well is pumped at 80 gpm. However, the effective well pumping rate decreased after 4 days of pumping, allowing the shallow groundwater to recover and sustain spring flow.
- In the final analysis, production from the geothermal well will need to be evaluated both in terms of quantity of water produced and temperature, and, impacts to surface water features will also need to be evaluated in terms of changes to discharge rate and temperature.

Mr. John Westra
February 26, 2009
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RECOMMENDATIONS

We recommend repeating the geothermal well pumping test at a constant pumping rate in the summer of 2009. We will follow this Letter with a plan detailing pumping test procedures and monitoring measures later this spring.

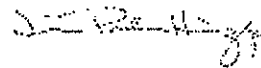
Should you have any questions about this Letter, please do not hesitate to contact me at (415) 597-7885 (Dan) or (415) 597-7881 (Jill).

Sincerely,

GEOLOGICA INC.



Daniel W. Matthews
Senior Hydrogeologist



Jill R. Haizlip
Principal

cc: Ms. Carol MacGregor