

5/16/10

PSWID

Attn. Harry Jones, Manager
P.O. Box 945
Pine, AZ 85544

RE: Milk Ranch Well Investigation Results

Dear Mr. Jones,

Highland Water Resources Consulting Inc. is pleased to report on the final outcome of investigational efforts at the Milk Ranch Well in Pine, AZ. Following the initial required rig work, the well was found to be restored to at least its original capabilities (see project update, April 17th, 2010, attached). With this success in hand a pumping system suitable for permanent application was installed to investigate production capabilities, assess sediment loading and mitigation measures, and to establish a baseline for operational procedures. The well pumping system was selected based on the wells' past performance and abilities to handle anticipated sediment loads. The system includes 3" column pipe, a Berkeley model 6T-155 pump end, and use of the original Franklin 60HP motor (Please find the Milk Ranch pump and motor specifications attached as provided by Laveen Pump co.) The pumping system was set to an intake depth of 790ft, ~340ft. below a seasonally high static water level of ~451ft..

Well Performance Testing Results

The well was pumped at a total of four different production ranges including ~100, ~110, ~130, and ~140 gallons per minute (Please find: "Milk Ranch Well Testing April 30th-May 9th 2010 Depth to Water and Notable Events" chart attached). Due to sediment, flow meters were unreliable and repeatedly failed. However, flow rates were estimated via bucket and stopwatch as well as via the square and discharge pipe methods. The well performed quite well at all production ranges with drawdown never exceeding 91ft. (a pumping level of ~548ft.) The specific capacity of the well ranged between 1.5 and 1.6 gallons per foot of drawdown. Water levels were observed to recover quite rapidly at both the intermediate restart and at the end of pumping. These performance observations represent a ~12% improvement over original performance as documented in 2006. The Milk Ranch well has been confirmed as an efficient and capable producer.

ADEQ Water Quality Sampling

Following nearly three days of pumping at ~110gpm the well was quite clean with only a slight sand/silt content (suspended solids). At this time the well was sampled per the guideline below, provided by Derek Bresee of ADEQ:

Email from ADEQ on Milk Ranch source sampling requirements New Source Approval - Analytical Data Timeframe

1. If new source approval (NSA) analytical results are provided to ADEQ within 1 year of original sampling event ? No further sampling is required;
2. If NSA analytical results are provided to ADEQ between 1 - 3 years of original sampling event ? Resample and provide results for acute contaminants, total coliform bacteria, nitrate and nitrite (contaminant codes 3100, 1040 and 1041, respectively);
3. **If NSA analytical results are provided to ADEQ between 3 - 5 years of original sampling event? Resample and provide results for acute contaminants, total coliform bacteria, nitrate and nitrite (contaminant codes 3100, 1040 and 1041, respectively) and resample and provide results for IOCs ? Arsenic, Barium, Cadmium, Chromium, Cyanide, Fluoride, Mercury, Selenium, Antimony, Beryllium and Thallium (contaminant codes 1005, 1010, 1015, 1020, 1024, 1025, 1035, 1045, 1074, 1075 and 1085, respectively) .**
4. If NSA analytical results are and provided to ADEQ after 5 years of original sampling event ? New NSA is required

DEREK S. BRESEE
ENGINEERING REVIEW SECTION
DRINKING WATER FACILITIES REVIEW UNIT
ADEQ
PHONE # 602-771-4510
<http://www.azdeq.gov/engineeringreview/>

The email from Mr. Bresee above outlines several timeframes for re-sampling criteria. The Milk Ranch well's 2006 samples fell into timeframe #3 and was re-sampled accordingly. The new samples were submitted to Columbia Analytical / Transwest Analytical Services (Xenco). Results can be expected the week of the 17th of May, 2010. All previous remaining new source sample results from 2006 are still valid and must be included with the latest round of results in your engineers' ADEQ new source approval packet submittal.

Other than sediment, the water appears to be of excellent quality. [Note that suspended sediment was filtered in the field via a certified 45 μ sampling filter, per protocol to avoid reaction with samples requiring preservatives (acids).] The water's Ph was measured at ~7.2 with a conductivity of ~400 μ s and temperature of ~53°F. All the data would appear to indicate overall good water quality.

Sediment

As an integral part of Highland's testing program, sediment loading was investigated and dozens of samples collected via Imhoff cones and grab samples. At no time during the nearly seven days of testing did the water completely clear up (Please see photo attachments). A very fine suspended solid and sand is notable in all samples. Encouragingly, sand and silt production do tend to drop off substantially following ~24hours of continuous and stable flow from all rates tested (100-140gpm). Silt particles dominate over sand in total concentration from all samples. Near the end of each pumping interval sand and silt was nearly absent with less than .5mg/l total (not including suspended fines). This could be acceptable if not for a very fine suspended particulate and the fact that any subtle disturbance in flow, pressure, or pumping level results in dramatic increases in silt/sand content. As observed during testing, there is an unpredictability in sediment loading and a risk of inadvertent delivery of sediment laden water should anything change and no filtration mechanism be in place. (Please see "Milk Ranch Well Sediment Concentrations vs. Well Run Times at Tested Rates" chart attached.).

In support of the development of a sound sediment filtration concept, two representative samples (3 hour - at 110-120gpm and 48 hour - at 110-120gpm) were submitted to Spectrex analysis services for particle size counts and distribution analyses. Results indicate that between 40% to 60% of the particulates are less than 11 μ in size. Highland has contracted with McCandless Engineering Consultancy LLC (as approved by the District) to analyze the particle size distribution data and prepare a proper sediment filtration plan / conceptual design for deployment at the Milk Ranch well. McCandless' report will be provided to the District's ADEQ new source approval engineer shortly.

Operational Considerations

On May 5th, 2010 at ~15:20 during Highland's restart sediment load test, at 100gpm, PSWID operations representatives requested that the well be tested under a line head pressure of 120psi. Highland indicated that the pump/motor combination was quite capable of producing in excess of 150gpm at 120psi (with confirmation of Laveen Pump co.). Highland advised that pressurizing the well head should not be done until sediment loads drop off. The District operator insisted that it was necessary to confirm what the well can do against head pressure. Highland again suggested that such high pressure testing would increased risk of damage to the pump and/or motor caused by the presence of fine particles and silt, which were abundant at that time. Reluctantly, Highland yielded to the demands of the District's operations representative as it was proclaimed, with a Board member present, that the operator was working "under the direction of the water Board" to test the well under high head pressure. Until this moment, Highland had been unaware of this directive. Therefore, Highland stepped aside and concluded its pumping tests but allowed water level data logging to continue as the operator pursued pressure testing in opposition to Highland's recommendations. The well motor failed on the morning of May 7th at 07:45 causing a system fault and instant shut down, likely resulting in a water hammer.

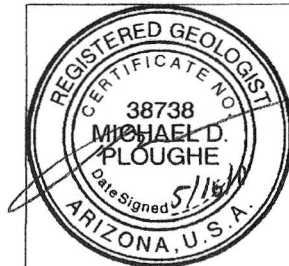
Highland does not recommend operating the Milk Ranch well pumping system at pressures above 80psi. Ideally operation should be maintained at only those pressures required to filter the water of particulates and to fill an on-site tank for boosting into the distribution system. Currently, the well may best be utilized after purging or "flushing" for 10-24 hours prior to being placed on-line. As time progresses the purge time required will likely decrease with use of the well. Slow startup procedures are found not to be necessary and may in fact be harmful as sediment loading may be extended while flow rates are changing. Care should also be taken not to shut down when sediment loads are present. As a matter of preventing water waste, a filtration system that can accept the water after 15-30 minutes of flushing is recommended and to also minimize storage and waste discharge issues. Such a filtration system, designed to handle up to 200gpm, could then also mitigate any unpredictable sediment events which might occur, thereby preventing the delivery of sediment laden water into the distribution system.

Conclusion

The goal of Highland's project team was to have works completed by the second week of May, 2010. This goal has successfully been achieved. ADEQ required samples are pending laboratory reporting and a sediment filtration report is currently being prepared by McCandless Engineering. The District can be expecting these documents shortly to support you and your engineer's efforts in pursuing a summer activation of the well. To further assist in making the Milk Ranch well expediently available, Highland has also prepared the necessary forms for filing with ADWR including ADWR well completion report, and ADWR well change of ownership forms (attached). If there are any questions please feel free to contact me at any time at (928) 970-9055 or mike@highlandh2o.com

Regards,

Michael Ploughe P.G.
Highland Water Resources
(928) 970-9055



Expires 3/31/12

Attachments

cc:

Laveen Pump Co.
ADT Drilling
McCandless Engineering Consultancy