Steelton Municipal Well Preliminary Inspection and Testing

(November 2013)

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Nov 5, 2013

Sault Ste. Marie PUC Services Inc.
C/O Kresin Engineering Corporation
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Attention: Mark Edwards, C.Tech

Reference: Steelton Well PW1
Preliminary Inspection and Testing

We have completed our preliminary inspection and testing of the Steelton Well PW1 and review of information provided for Well 6.

We provide the following observations and discussion with recommendations.

PW1 Well Performance Test

We were unable to shut down PW1 and operate Well 6 to establish a measurable "static" water level prior to performance testing. A stepped rate test was conducted on Oct 7, 2013. PW1 was already operating @ 35 L/s. The rate was increased to 55 L/s and then 75 L/s for 30 minutes each. A plot of the test data is shown on A13018 (Draft). Due to the flowing artesian conditions at this site, it is difficult to accurately determine well performance

During the test, the Goulais site was reportedly operating at 3000 m^3/day (35 L/s). . Previous reporting indicates that the operation of Goulais at 114 L/s (1500 IGM) causes a 10m (33ft) interference at Steelton. Thus during the testing on Oct 7 we expect that there is approximately 3m (10 ft) of interference during the test.

If a conservative estimate of the historic static water level of + 6m (20 ft) is used then the net drawdown for the rates of 35, 55, 75 L/s would be in the order of 5.2, 6.4 and 7.3 m. These are plotted on the attached Specific Capacity drawing A13109 (Draft)

Well performance appears to be somewhat improved compared to historic production. No well performance rehabilitation is necessary to improve well performance.

Once the pump is reinstalled in PW1, we would recommend continuing to operate Well 6 at a reduced capacity in order to further assess PW1 specific capacity during start up.

PW1 Video Inspection

A colour dual cam video inspection was conducted on October 9, 2013. Attached ia a copy of our Technician's review notes along with several captured images from the inspection.

The current video inspection showed no obvious structural concerns with the well. Comparison of the video was made to that of previous inspections by IWS in 1969 and 1993. Very similar conditions are noted and there are no apparent changes. Attached are several captured images from 1969 and 1993.

Well 6

Prior to stopping PW1, a temporary submersible pump was installed in Well 6. It has been operating at approximately 45 L/s. Pumping water levels were initially reported at approximately 2m below ground level and similar levels at PW1.

A well performance test needs to be conducted on Well 6. During the testing PW1 will need to be operating to provide a measurable "static" water level.

The water pumped will be assessed for colour and sand. Water quality analysis samples should be taken by SSM PUC for their analysis.

No water well record is available for Well 6. The well has reportedly existed for sometime. From the provided video inspection in 2011 by others, it appears that the 250 mm (10 inch) well casing terminates at the same weathered sandstone depth as PW1. The sandstone borehole continues approximately 2m where some debris was observed.

Discussion

1. A review of reporting from 1970, 1991 and 1993 indicates that the previous concerns of a well failure have not materialized to date. Sand production from the well appears to have been stabilized since some time prior to 1991. The new pump installed in 1993 which has been removed and inspected did not show evidence of sand production wear over 20 years of operation.

   The current video shows that the well condition has not materially changed since 1969. A cavity in the sandstone is not observed. The louvered screen section in the well is plugged with mineral deposits and has not contributed water for over 40+ years. Well performance appears unaffected.

   PW1 was reportedly constructed in 1934. A 24 inch diameter steel casing terminates in weathered/fractured sandstone at approximately 22.3m (73 ft). The area geology is reported to consist of a thick clay confining layer overtop of sandstone which is weathered and fractured at the contact. The sandstone depth range is reported to be at 14 to 20m depth (46 to 65 ft). The 24 inch casing is likely several feet into the weathered sandstone. The reported historic sand production would likely be the mining of sandstone fines in the weathered zone. After several years of operation this has stopped since about 1991. Current reported water quality of no sand, turbidity and bacteria counts suggest the well is fine in the short term.

2. Further assessment of PW1 structural condition using geophysical, flow logging or packer testing is not considered practical. Costs and subjective interpretation would not necessarily provide value. Casing thickness logging tools are not normally used for boreholes greater than 400m (16 inch). A flow log tool cannot be practically used in the well due to its construction. A packer cannot be easily installed in the well to conduct a leak test due to the sealed flange well head. The well casing would need to be wire brushed cleaned to allow for a good seal. Disturbing the well casing is not recommended until preparations for a liner are in place. Also, due to the artesian levels the hydraulic difference would be minor and the test not necessarily conclusive.

3. Given the age of the well it would be prudent to consider a complete well replacement for long term continued production from the site. A less costly option which may provide medium to long term security would be to install a casing liner in the cased portion of the well.

4. Any work undertaken at the site would need to be planned and scheduled to provide the necessary control of the artesian heads, with back up to ensure that the work be completed without incident. The Goulais wells would be required to be in operating, as well as Well 6 if it's use as a long term depressurization, or production well can be confirmed. The work would likely be best scheduled during the summer demand period when aquifer levels can be reduced to safely complete the work.

Recommendations

1. Reinstall the pumping equipment in PW1.

2. Complete the performance testing of Well 6 and confirm the specific capacity of PW1.

3. If well 6 is suitable for reliable dewatering use, equip the well for permanent/emergency use. Airlift cleaning of debris from the well bottom should be attempted to confirm a drilled depth prior to a permanent pump installation.

4. Plan to install a casing liner in PW1 within say 2 to 5 years. Liner installation work will require a depressurization strategy plan, complete with backups and contingency plans.

   The existing casing should be wire brushed. The well airlift cleaned and the liner installed and cemented in stages while video is used to confirm no leakage.

5. The well head seal for the pump will need to be modified to suit the liner.

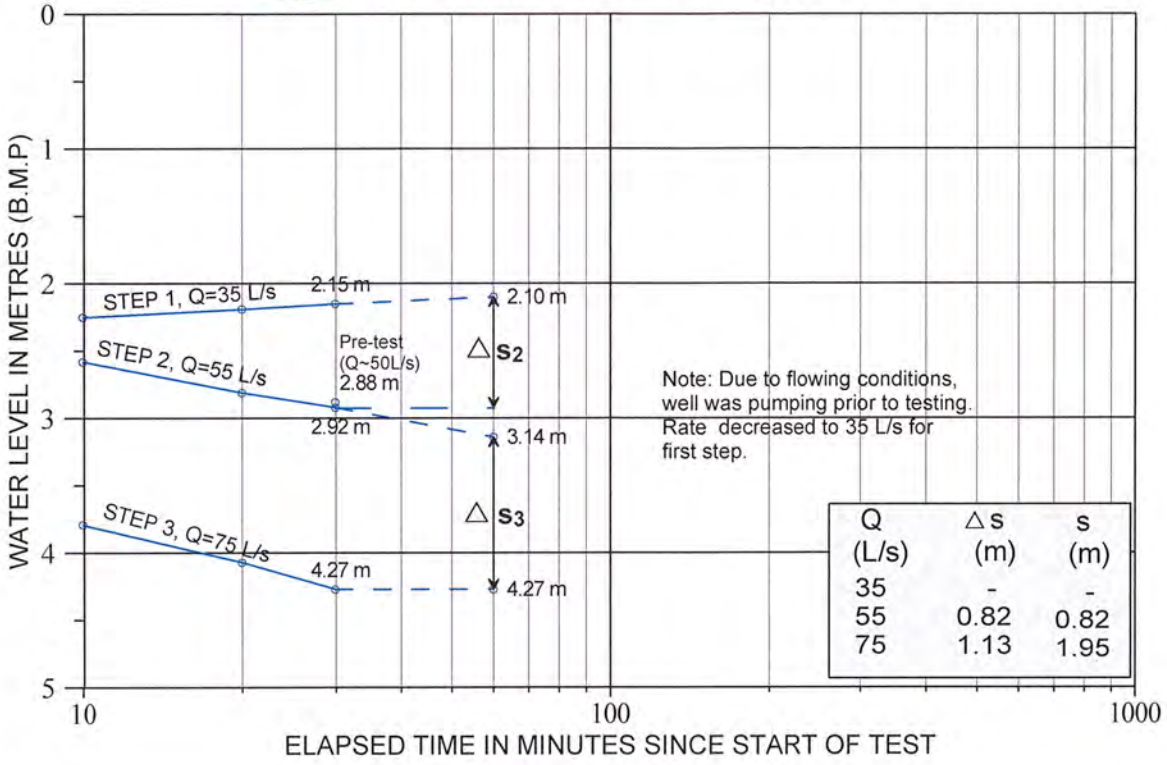
If you have any questions, please don't hesitate to contact us.

Regards,

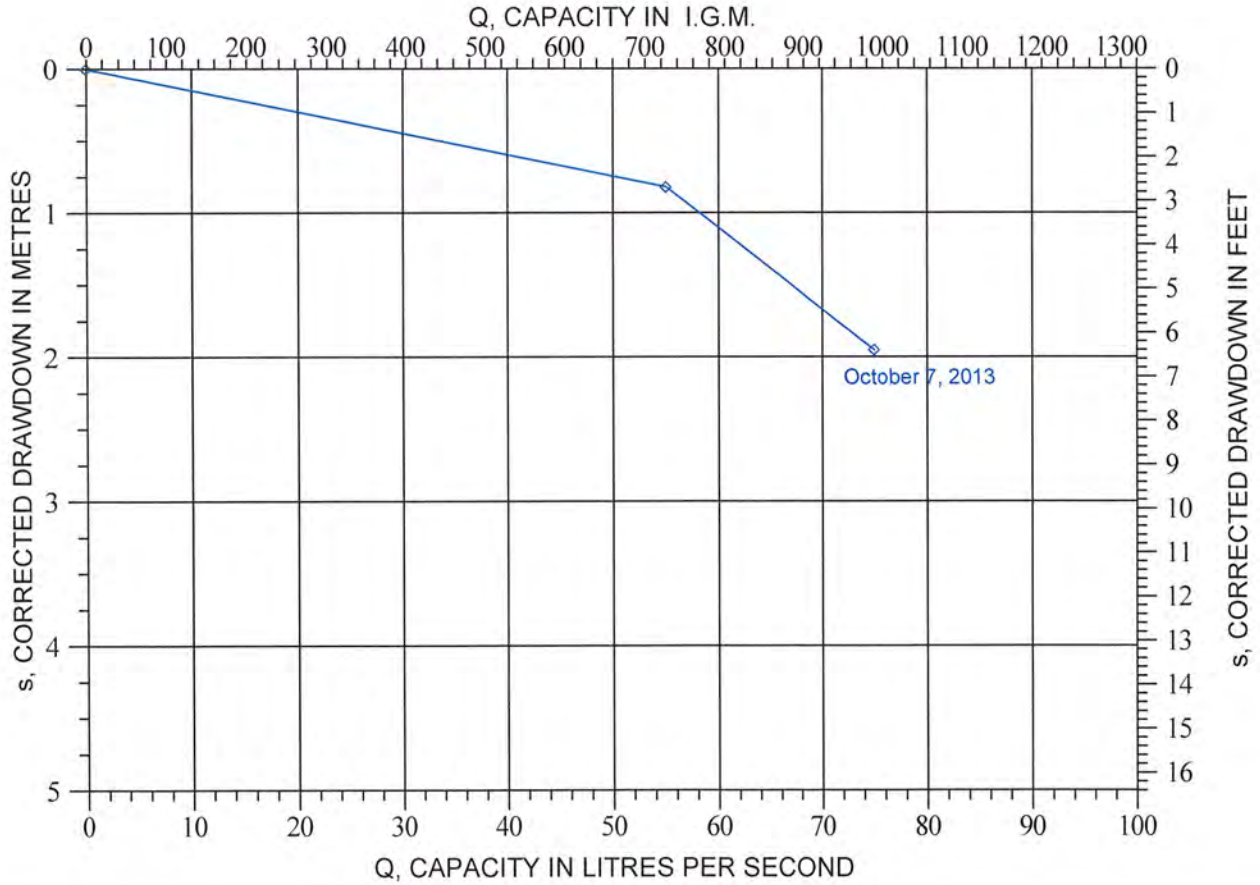
John A. Harris, P.Eng.

JAH/ww

International Water Supply Ltd.



October 7, 2013

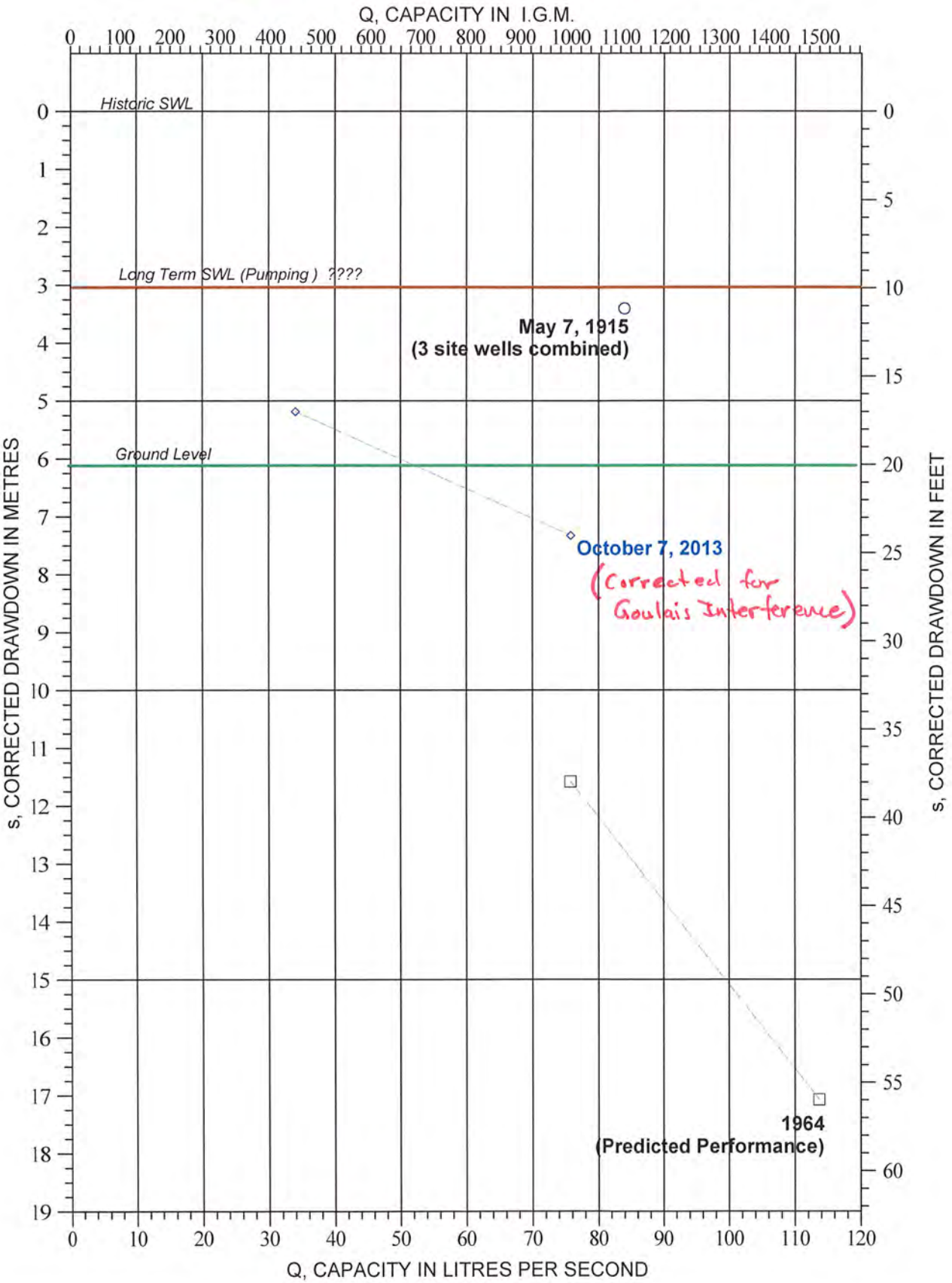


SAULT STE. MARIE

DRAFT

STEELTON WELL
WELL PERFORMANCE
Dwg. No. A13108

International Water Supply Ltd.



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STEELTON WELL
HISTORIC SPECIFIC CAPACITY
Dwg. No. A13109