



NORTH TEMPLE OFFICE

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TO: All Involved Parties

RE: Summary Report on Dammeron Valley Well Site Voltage Quality

Herein is a brief report of the quality of power at the Dammeron Valley well site. This summary report complies with the Utah PSC order dated 22 October 2003, Docket # 03-035-04. The applicable section of this order states that

The parties should also take any other steps that can reasonably be taken to determine the cause and extent of voltage fluctuations on the Dammeron Valley line. To obtain the most useful data we will extend this study through the summer months of 2004, specifically until the end of August 2004. In order to determine how to then proceed we will direct each party to, by September 15, 2004, file a brief report of the outcome of the study, the occurrence of any more events that caused damage to Dammeron Valley equipment, stating what, if anything, further that party believes needs to be done to address the power supply to Dammeron Valley, and containing any proposals for further action by this Commission.

There are three interim formal PacifiCorp reports from which this summary report will draw. These are dated 6 February 2004, 27 May 2004, and 15 September 2004. In addition, this report references a PacifiCorp response to a Utah PSC data request. This response was issued 21 June 2004. These documents contain maps, diagrams, plots, lists, and detailed textual analysis of data pertaining to the Dammeron Valley well site voltage quality. For supporting information beyond that contained in this summary report, please reference these documents. Finally, many large files of raw measurement data are electronically stored and available from the authors of this report.

We hope this letter and report are useful to you. If you have any further questions about this report please feel free to contact Dennis Hansen using the information in the letterhead. Greg Bean would also be happy to help.

Sincerely,

Greg Bean, P.E.
Dennis Hansen, P.E.

Dammeron Valley Well Site Voltage Quality SUMMARY REPORT WITH CONCLUSIONS

Introduction

The Dammeron Valley Water Company (DVWC) reported several failures in its water pumping station (well house) culminating in a formal Utah PSC complaint against Utah Power & Light Company (UP&L). This summary report gives UP&L's view of the issue from a technical perspective.

References

There are three interim formal PacifiCorp reports from which this summary report will draw. In addition, this report references PacifiCorp's response to a Utah PSC data request. These are herein cited by reference number as

1. *Dammeron Valley Well Site Causal Analysis of Power Quality*. Issued 6 Feb 2004.
2. *Dammeron Valley Well Site Report with Conclusions*. Issued 27 May 2004.
3. *Dammeron Valley Well Site Brief Report with Conclusions, July-August, 2004, Monitoring Session*. Issued 15 Sep 2004.
4. UP&L Response on 21 June 2004 to Data Request issued on 7 June 2004.

Collectively, these documents contain maps, diagrams, plots, lists, and detailed textual analysis of data pertaining to Dammeron Valley well site voltage quality. For supporting information beyond what is contained in this summary report, please refer to these and other documents that are filed as public records in this case. Finally, many large files of raw measurement data are electronically stored and available from the authors of this report.

Power System

The DVWC well site is north of Saint George, near the small town of Veyo Utah. This well site receives its power from Middleton substation through a tap to a 34.5 kV line. The well site is at the end of this tap (see map in ref. 1, p.2). The three 50 kVA service transformers at the DVWC well site are pole mounted and connected in grounded wye-wye with 277/480V secondaries. This service then goes through a pedestal-mounted billing meter and into the well house. In the well house the power is distributed to two submersible pump motors of 30 hp (west) and 40 hp (east). The 40 hp pump is the primary pump, and we were told that both pumps are rarely operated at the same time. The Feller Stone company is the nearest 3-phase customer to the DVWC well site, and is located near the tap point of the Middleton 24 feeder as indicated in the diagram in ref. 2, p.2.

Brief History

The earliest record found by UP&L's field engineer for problems at the DVWC well house is a complaint about voltage problems alleged to cause well pump failures experienced in February-April 2002. This was followed in 2002, 2003 and 2004 with a host of measurements and several site visits by UP&L personnel. A partial list of these, along with hearing/conference dates, is on the next page.

By December 2003 UP&L had not been able to identify any problems with its utility service, and hired a professional engineer (PE) experienced with well pump installations to help identify problems and

propose solutions. Throughout this time failures at the well house continued to sporadically occur. The PE accompanied UP&L's engineers for a well house site visit on 15 December 2003. During this visit two general problems were observed in the well house: wiring errors and grounding (see ref. 1, pp. 11-12). The PE identified specific things that needed to be changed, and formally reported these to DVWC at a Utah PSC-hosted Technical Conference held on 10 February 2004 in St. George. After a few months these problems were corrected. UP&L continued to monitor the power pursuant to the PSC order during this period and up to the present time. This monitoring was detailed in ref. 4, p.4.

Partial List of Events or Activities

Date	Description of Key Event or Activity
Feb-Apr 2002 18-23 Oct 2002	DVWC experiences 2 pump motor failures—root cause unknown UP&L places recording voltmeter at DVWC well house meter, voltage OK
26 Mar – 1 Apr 2003	UP&L places recording voltmeter at DVWC well house meter, voltage OK
Summer 2003	UP&L “walks the line” to find possible problems—none found
Jul 2003	Middleton 24 line reclosers installed
8 Aug – 24 Aug 2003	UP&L begins intensive monitoring at DVWC well house
12 Sep – 2 Dec 2003	DVWC experiences 3 more pump motor failures—root cause unknown
22 Oct 2003	Utah PSC order issued to monitor, find problem, and issue report
Early Dec 2003	UP&L issues informal data report from PQ monitoring thus far; voltage on 10 Oct 2003 at well house was found unbalanced—root cause unknown
15 Dec 2003	UP&L & Pump Installation Expert visit site; find wiring & grounding problems in well house
22 Dec 2003	Utah PSC hearing; technical conference planned
30 Dec 2003	UP&L & DVWC visit Feller Stone to check for problems—no problems
6 Feb 2004	UP&L Issues first formal interim report to Utah PSC—intermittent open circuit on B phase identified in well house
Dec '03 – Mar '04	DVWC corrects wiring & grounding errors
10 Feb 2004	Utah PSC-hosted Technical Conference in St. George
21 Feb 2004	Signs of B-phase arcing detected; suggested DVWC replace main breaker
Latter March 2004	Cable failure detected at DVWC—root cause unknown—latent failure?
27 May 2004	UP&L issues 2nd formal interim report to Utah PSC—no recent problems found
21 Jun 2004	UP&L issues response to Utah PSC data request—SCADA voltage data, Hydro outage data, detailed recorder deployment, customer location data, & preliminary summary analysis were included.
15 Sep 2004	UP&L issues 3rd formal report to Utah PSC—no recent problems found or complaints received
15 Sep 2004	UP&L issues this summary report to Utah PSC per the 10/22/03 order

Engineering Analysis and Conclusions

The grounding and wiring problems discovered (see ref. 1, pp. 11-12) in the Dammeron Valley well house during the December 2003 site visit and documented in the 6 February 2004 report were either the root of the voltage problem or were major contributing factors. We have found no indication that the service provided to Dammeron Valley by UP&L has caused or contributed to Dammeron Valley's voltage problems.

The alarms received by the ABB soft starter in early 2004 indicated current unbalance—not voltage unbalance—and possibly indicated a pump or motor problem. However, we can only speculate what might have caused such current unbalance. UP&L does not have access to settings of the pump motor soft starter, and has not done an evaluation of these settings.

The voltage quality as measured at the metering service to Dammeron Valley's well house is normal, as revealed by the latest recording meter measurements, and has been normal for at least five months. Furthermore, the recording meter at Feller Stone Company also shows normal fluctuation and has never shown anything but normal fluctuation, likely due to variation in Feller Stone load. This supports the position that the voltage problems at DVWC were locally generated in the well house.

In summary, in UP&L's view there is no longer any indication of a voltage problem at Dammeron Valley Water Company and neither further Commission action nor continued voltage monitoring is needed.