Station Analysis Template: Continuous Groundwater-Level Sites

This document describes the elements needed for a station analysis. The headers are in the RMS Station Analysis wizard. The hydrographer should populate the fields with the information described below.

Analysis Period: *Dates of record period associated with this analysis*
Analyst (pre-populated): *Name of record-period analyst*

Instrumentation (Mandatory, if applicable): *Describe any equipment installed during the analysis period. Include equipment used to measure and record water levels and transmit the data. Describe any changes in the water-level recording interval.*

Extreme for Period of Analysis/Period of Record (Optional): *Provide the maximum and minimum measured values and recorded instantaneous- and daily-values for this period, and whether any extreme value set a new record. State the period of record high and low for the site.*

Water-Level Fluctuations/Trends (Mandatory): *State how the site water-level record is usually affected by artificial stresses (pumping, etc), earth tides, or other effects. Describe how the water-level record during the analysis period fits into the site's trend.*

Rating/Conversion of Input (Mandatory, if applicable): *Describe the equation and rating number of the conversion of input that is active for the period.*

Backup Data (Optional): *Describe where the backup data came from, the quality of the backup data, why there was a gap in the primary time-series, and the period that contains the merged data.*

Missing Data (Mandatory): *Provide dates and reasons for any gaps in the record. For example, provide dates for periods when well was dry or water levels were affected by conditions that resulted in missing data.*

Measurements (Mandatory): *List the number and dates of discrete water-level measurements that were made and note any unusual circumstances about the measurements.*

Datum Corrections (Mandatory, if applicable): *State if levels were run during the period and any noteworthy particulars about the leveling. Describe any movements of the measuring point (MP), land-surface datum (LSD), and reference marks (RMs) at the well. Describe how the surveyed effects were applied to the data.*

Water-Level Corrections (Mandatory, if applicable): *Clearly describe the reasoning and timing for any water-level corrections. Blanket statements for small instrument drift can be provided. Larger corrections need detailed discussion. Includes spike removal, editing of other*

erroneous values, etc. Include reasons for the erroneous values and methods used in making edits.

Daily Values (Mandatory, if applicable): *Explain the types of daily values (statistics) computed and the periods for which daily values were missing.*

Hydrographic Comparison (Mandatory, if applicable): *Provide sites used for hydrographic comparison, if applicable. Discuss how the comparison was done and document the results of the comparison. Where did the sites compare favorably, where did they compare poorly and why?*

Comments (Optional): *Provide any pertinent remarks or comments for the record period that are not contained in the above sections.*

Special Notes (Optional): *If the collection and maintenance of this record required any special (non-routine) trips during this period, state the date and purpose.*

Attachment 1. Example station analysis for a time-series well.

471423067450201, Theoretical Well @ Smalltown, NH
Analysis Period: *October 1, 2016 - January 1, 2017*
Analyst: *Ima Jean Yuss*

Instrumentation: *A Design Analysis (DA) H-522 Data Collection Platform (DCP) attached to a DA H-3123 (0-15 PSI) submersible pressure transducer was housed in a 2x2x5 foot galvanized steel shelter. On December 9, 2016, a Sutron 56-114-15-50 sensor replaced the faulty DA H-3123. The DCP transmits hourly water-level data every hour over the GOES system. Comparison tape-downs are made from the measuring point (MP1), which is the notch at the top of the inner PVC casing.*

Extreme for Period of Analysis/Period of Record: *The extremes in daily water level for the period of record are 11.26 feet (low - new this period on Oct 4) to 6.41 feet (high - May 6, 2011).*

Water-level fluctuations/Trends: *Water level record shows consistent variation caused by earth tides. Maximum (highest) water levels occur during irrigation season.*

Rating/Conversion of Input: *Conversion of input ratings (1.0) of -2.70 feet applied to both the DCP and EDL data convert the data from below the measuring point (MP1) to below land surface datum, which is marked at the base of the outer steel casing.*

Backup Data: *Backup record is available in label "ft.EDL." Recorded EDL data were used to fill in small gaps in the transmitted DCP data on Nov 11 and Nov 22.*

Missing Data: *Data are missing from Dec 7-9 because of a sensor failure.*

Measurements: *Three field visits were made (Oct 6, Dec 9, and Dec 16). All water level comparisons were within their percent rated except for the period of double slope, which is discussed below.*

Datum Corrections: *The measuring point is the top of the inner PVC casing, 2.70 ft above LSD, which is clearly marked on the steel casing. Levels were run on Oct 6, 2016 and showed no significant movement (≤ 0.004) among the reference marks, including MP1 which read the same elevation as in WY14 and WY15. Based on these insignificant differences, no datum corrections or changes to the conversion of input rating are needed.*

Water-Level Corrections: *Unit-value transmitted DCP and recorded EDL data were reviewed in AQUARIUS. No discrepancies were found between the two data sets. The water-level record was satisfactory and complete for the period except for period when the sensor was faulty from Dec. 7-9. Because of a programming error in the DCP, the period from Dec 9-16 had a double slope, but no data were missing (discussed below). The programming error was fixed on Dec. 16. See unit value inventory tables for more information. Label "ft.DCP" is used as the input to label "ft," which is the primary record.*

On Oct. 6, 2016, maintenance was done at the site, and the two as-found tapedowns indicated a -0.09 correction. Inspection showed that the clip that holds the hanger wire was found in an "up" position (see picture below). When this clip was flipped to the correct position, the water level was within 0.01. Therefore, no reset was made and a correction was applied to the data for the movement of this clip and wire. The previous two site visits were looked at in AQUARIUS and no obvious jump was visible. The "as left" water level comparison on Mar. 24, 2016 was within .01, so the equipment must have been moved after that measurement. The correction is being prorated on from the as-left measurement on Mar. 24 to the full -0.09 on June 2, and kept at -0.09 until the clip was reset at 12:49 on Oct 6, 2016.There were no corrections carried forward past Oct 6.

<u>Information for double slope from Dec. 9-16, 2016</u>
A site visit was made on December 9 due to erratic readings. The pressure sensor was found reading +6.65 from the as-found tapedown. Data are erroneous from Dec 7-9, when a new Sutron sensor was installed. The sensor was mis-programmed in the field. There is a hard-coded slope of +2.3073 in the sensor. The DCP was programed to have a slope of -2.3067, so effectively a double-magnitude slope was applied to the sensor. The new sensor was reading in the right direction (A. On Dec 9, sensor was pulled up and read a higher number; B. plots of state-wide groundwater trends provided confirmation; C. earth-tide daily swings doubled in magnitude during this period), but the magnitude was wrong. The double slope was fixed on a site visit on Dec 16. The period of data with a double slope is 12/9/16 at 1200 EST through 12/16/16 at 0900 EST. Two unit values on Dec 9 and one unit value on Dec 16 were deleted when the sensor was being worked on.

Data corrections in AQUARIUS are only additive or subtractive, so a correction cannot be applied to correct the double slope in sensor readings. And based on how a DCP reads, an equation rating would also not adequately correct the data because it would follow arithmetic Order of Operations, and not the two-step sensor reading process. A sensor reads in PSI, applies the slope in the sensor (+2.3073), then applies the slope defined in the DCP (-2.3037) and then applies the offset defined in the DCP (62.990). As a result, the computed unit value data were exported to an Excel file (fix_slope.xls) and examined there. The -2.70 conversion of input rating applied at this site was factored into the calculations. There were no other data corrections applied to the incoming data, which simplified the analysis.

PSI values were back-calculated in the Excel file. For the period of double slope (12/9/16 at 1200 EST through 12/16/16 at 0900 EST, red text in the Excel file), the double slope was negated. PSI values were then computed to feet in column H; for the period of single slope, values in column H should match those in Column C (black text), for the period of double slope (blue text) these are different magnitudes because of the double slope. The calculated PSI values are smooth on 12/16/16 when the slope was recomputed appropriately.

An offset and the COI were applied to values calculated in Column H; the offset applied for the period of double slope was 46.87, which was the offset as found from 12/09/16. The final

*corrected data (column H) were copied into a *.csv formatted Excel file. A new time-series (label "ft.fixdoubleslope") was created and data were imported by Append Logger. These data from "ft.fixdoubleslope" were copied into the primary time-series ("ft") from 12/09/16 at 1200 EST to 12/16/16 at 0900 EST. No corrections are interpreted at the end of the re-calculated period based on no jump in the PSI readings from 0900 to 1000. "Ft.fixdoubleslope" can be deleted after this record is approved.*

Daily Values: *Label "ft" was used to compute mean water-level daily values for the period. The period record was complete except for Dec. 7-9.*

Hydrographic Comparison: *As mentioned above, some comparisons with wells from around the state were made to confirm that the double-slope problem did not affect the direction of water-level change. Water levels in this well compare favorably with water levels in AX-123 and BZ-234 (graph below) over this time period.*

Comments: *An integrity test was last performed on during the October visit. Summary of test in the Station Description and details in archive N:/471423067450201/Integrity_Testing.*

Special Notes: *Special trips were made on Dec 9 and Dec 16, the first to replace a faulty sensor and the second to fix faulty DCP programming.*