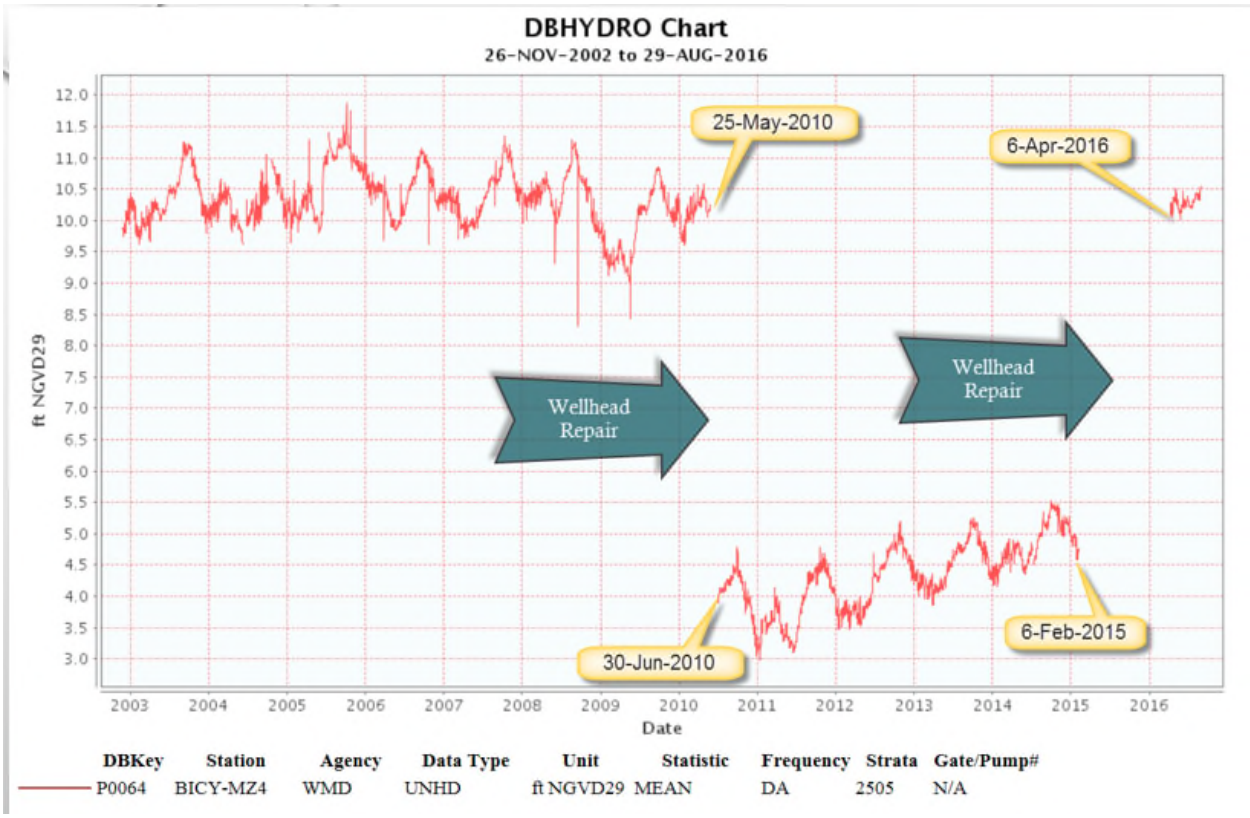
Time-Series Data Correction to Well BICY-MZ4

Preface

This document describes a problem with water-level data from BICY-MZ4, and recommended corrective actions. These actions were implemented on 18-October-2016. This documentation is provided to as part of the historical record of the data, and as an aid to end-users of the time-series data.

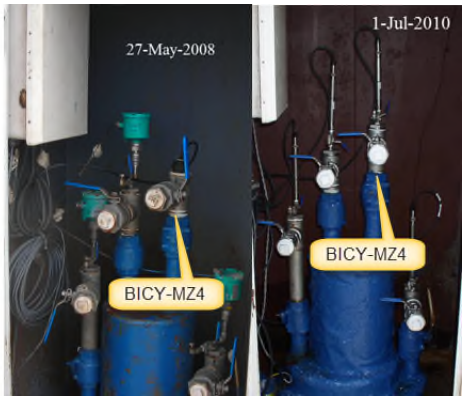
Data Correction Documentation (10/13/2016)

Currently within DBHYDRO, the uncorrected head data from lower Floridan monitor well BICY-MZ4 shows a massive drop in head (> 6 feet) between May 25th and June 30th 2010 (below). Between those



two dates, the site was taken off-line to effect repairs on the wellhead. A new survey of the measuring point elevations at the site should have been conducted after the 2010 repair, but no record of such a survey can be found. From June 2010 to February 2015, UNHD continued to be calculated using the previous measuring point elevation (2.22 ft NGVD29), which was established 3-Oct-2008. By 2015, the well-head was again requiring repair, and was again taken off-line for that purpose. Unfortunately, the lack of a survey reflecting the actual measuring point elevation for the well was not noticed at this time. After the 2015 repair, the re-constructed well-head was surveyed, with measuring point elevation of (8.58 ft NGVD). UNHD values after this last repair are much more similar to those prior to the 2010.

Photos of the well-head from SCADA's files show that after the 2010 well-head repair the well was equipped with an external transducer, while the previous measuring point was down-hole. It is clear that the low UNHD values between June 2010 and February 2015 are due to an erroneous measuring point rather than any natural reason.



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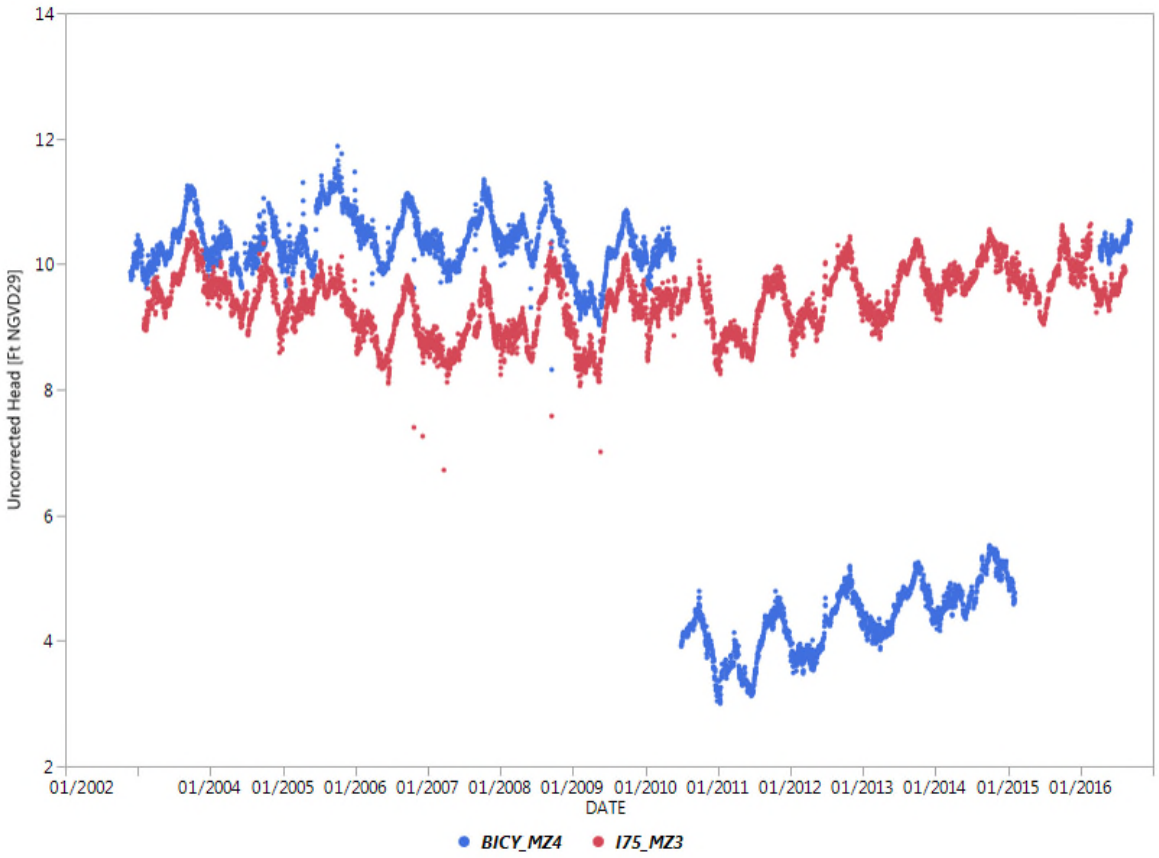
Because the well-head has been re-constructed, there is no way to physically measure the missing measuring point. Rather than lose almost five years of the period of record at this well, it is proposed that an estimated measuring point be used for that block of time.

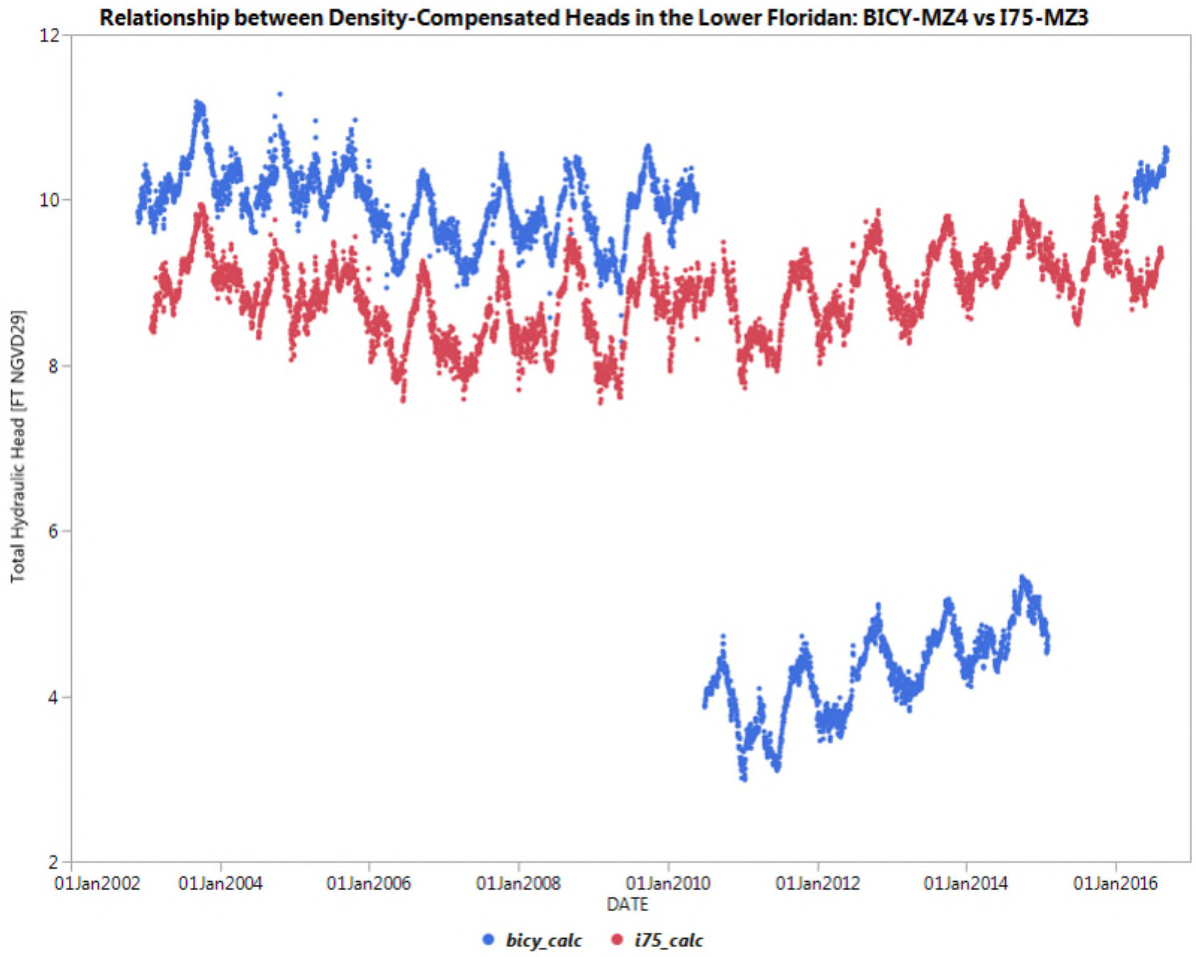
BICY-MZ4 lies in the same hydrostratigraphic unit as I75-MZ3, approximately 30 miles to the northwest. Comparison of the published daily UNHD for these two wells in DBHYDRO is shown below.



The pattern and magnitude of change in the hydrographs is very similar, but does show some degree of fluctuation in addition to the known erroneous measuring point time block. Unlike BICY-MZ4, I75-MZ3 has operated under a single measuring point elevation for its entire period of record. A review of the history of the BICY site shows that each of the observed shifts in the absolute difference between UNHD at the two wells occurs when the measuring point is changed at BICY. This would tend to cast suspicion on all of these measuring point elevations, except for the period under discussion, however, they have all been validated. The observed shifts are not actually errors, just an illustration of the need for a density correction in the data.

Both of these wells are highly saline, with dissolved solids concentrations comparable to seawater, while the standard PSI to PW (UNHD = PW + Measuring point elevation) conversion in District monitor wells is accurate only for much fresher water. Using the raw PSI values and calculated density specific to the salinity and temperature in each well, a density compensated version of the hydrographs can be

calculated (below). From the density compensated hydrographs, we can see that for most of the period of record, the relationship between the two wells was extremely stable.



Looking at the difference between the total hydraulic head in the wells (BICY_CALC – I75_CALC) in tabular format, for the periods with and without the missing measuring point elevation at BICY-MZ4:

Time Period	# Observations	Mean [ft]	Standard Deviation [ft]	Median [ft]
Validated MP	2796	1.25	0.16	1.23
Missing MP	1633	-4.68	0.20	-4.67
Offset		*5.93*		*5.90*

it is expected that the missing measuring point is 5.93 +/- 0.16 feet above what is currently being used for that period. Approaching this from a slightly different direction, a simple linear regression of the two datasets was used to allow for prediction of the hydraulic head at BICY-MZ4 as a function of the head at I75-MZ3, yielding the following relationship.

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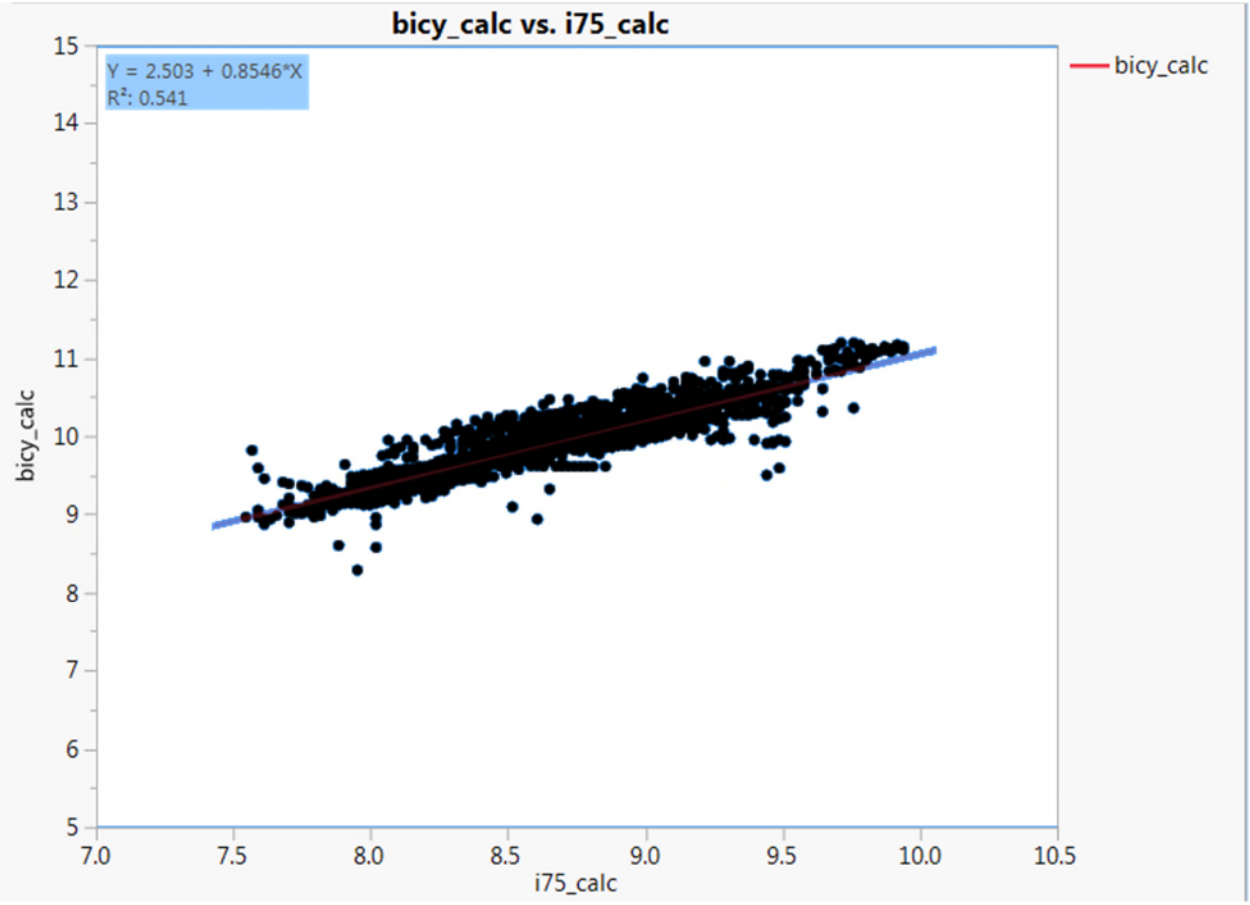

On 30-Jun-2010, the mean daily hydraulic head at I75-MZ3 was 8.83 ft NGVD29. Given that BICY-MZ4 = 0.8546 I75-MZ3 + 2.503, the predicted value of BICY-MZ4 on that date would be 10.05 ft NGVD29. The actual value was 3.89 ft, yielding an offset of *6.16 ft*.

Calculation Method	Offset [FT]	Measuring Point Elevation [FT NGVD]
Mean	5.93	8.15
Median	5.90	8.12
Predicted	6.16	8.38

The offset predicted by regression yielded the highest offset value. The correlation coefficient on the regression equation was lower than would be expected, however, from a visual inspection of the line fit, possibly influenced by outliers in the data. Given that the mean is more sensitive to outliers than the median, use of the median offset of 5.9 feet is preferred, yielding an estimated measuring point elevation of 8.12 feet NGVD29 for the missing portion of the record.

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Action Items

1. Edit DMDBASE_DM_REF_ELEV for BICY-MZ4 to incorporate the estimated measuring point.

Station	DCVP id	Effective Date	Ref Elev	Assumed	Comments	Datum
BICY-MZ4	BICY+GW4	11/26/2002 00:00	8.754	N		NGVD29
BICY-MZ4	BICY+GW4	1/15/2005 09:45	8.544	N		NGVD29
BICY-MZ4	BICY+GW4	6/17/2005 13:15	-21.78	N		NGVD29
BICY-MZ4	BICY+GW4	10/3/2008 12:29	2.22	N		NGVD29
BICY-MZ4	**BICY+GW4**	**6/30/2010 00:00**	**8.12**	**Y**	Determined by median offset with I75-MZ3	NGVD29
BICY-MZ4	BICY+GW4	3/3/2016 00:00	8.58	N		NGVD29

2. Tag all UNHD data between 6/30/2010 and 3/2/2016 as ESTIMATED using the 'E' qualifier (would not apply to the PSI data)
3. Re-load period of record to DBHYDRO
4. Attach this document as multimedia to the station BICY-MZ4 in DBHYDRO, so a clear record of the change is maintained.
5. Create a DCVP annotation for the estimated period 6/30/10-3/3/16 indicating the "Estimates were created based on estimated measuring point relative to"I75-MZ3"