Data Reduction and Analysis of Hydrologic Data for Selected Tree Islands (3AN1, 3AS3, and 3BS1)
Volume 1—Quality-Assurance Assessment
SFWMD Purchase Order 4500026695

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1 INTRODUCTION

Tree islands are topographically elevated, typically tear-shaped features with their long axis oriented parallel to surface-water flow. The islands consist of tall trees, shrubs, and saw grass, and "provide habitat for a wide variety of terrestrial plants and animals" (Bevier and Krupa, 2001). Tree islands, which are very sensitive to changes in hydrologic conditions and extreme wet and dry periods, are considered indicators of the overall ecological health of the Everglades system. Hence, information collected from tree islands will be crucial to better understanding the hydrologic conditions in the Everglades.

In 2000, South Florida Water Management District began monitoring meteorological data and groundwater and surface-water levels at selected tree islands as part of a 5-year, multidisciplinary study conducted in cooperation with the Florida Fish and Wildlife Conservation Commission, the Florida Center for Environmental Studies, the U.S. Geological Survey, and several universities. The three selected tree islands—3AN1, 3AS3, and 3BS1—are all located in Water Conservation Area 3 (fig. 1). Reports have documented the construction of wells and stilling wells at the tree islands (Bevier and Krupa, 2001) and summarized the results of a preliminary assessment of groundwater-surface-water interactions (Krupa and Gefvert, 2006; Steve Krupa, SFWMD, written commun., 2008). However, a compilation report is needed to assess the quality of the data collected, and to analyze factors affecting groundwater levels and flow. This two-volume report summarizes the results of a quality-assurance and data-analysis project conducted on site information and time-series data collected from May 2000 through June 2008.

1.1 Objectives

The objective of this contract (Purchase Order 4500026695) is to obtain professional consulting services for quality assurance and analysis of hydrometeorological data at three tree island sites (3AN1, 3AS3, and 3BS1) in the Everglades (fig. 1). The objectives of the project are as follows:

1. Generate sets of high-quality site information and time-series data collected from monitoring stations at 3AN1, 3AS3, and 3BS1
2. Analyze seasonal, meteorological, and other factors that affect groundwater and surface-water levels at the three tree islands
3. Determine horizontal and vertical groundwater flow at the three tree islands

Volume 1 of this report contains the summary of the quality-assurance review and revisions of the data (objective 1). Volume 2 contains an analysis of the factors affecting surface-water and ground-water levels at the three tree islands (objectives 2 and 3).

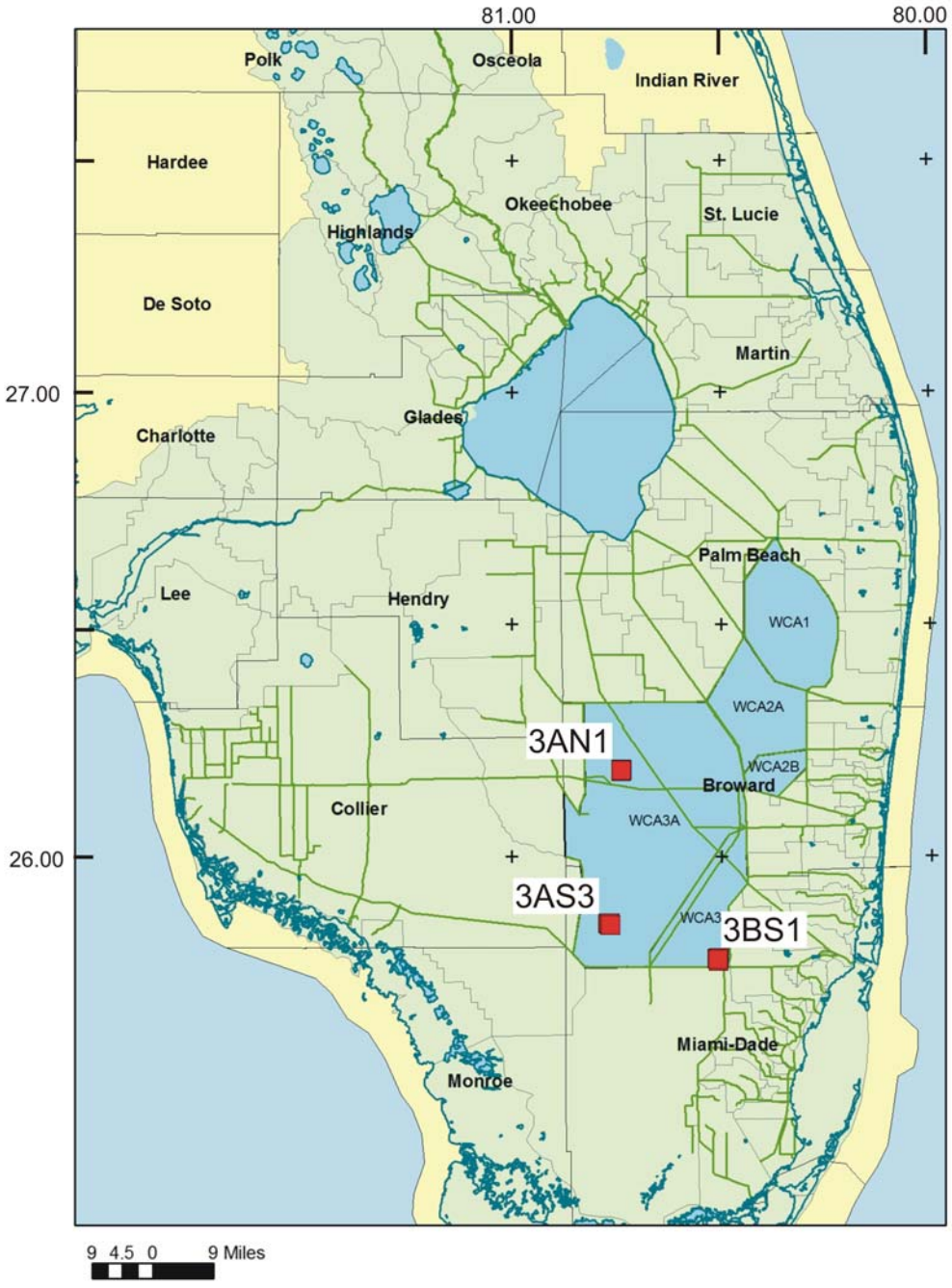


Figure 1 Location of the three tree islands

1.2 Scope of Work

The overall scope of work for the project is to conduct quality assurance/quality control assessment of site information (Meta data) and time-series data for 23 wells and 3 stilling wells used to monitor ground-water levels and surface-water stage. The hydrologic conditions, seasonal fluctuations, and factors affecting ground- and surface-water levels also were analyzed. The work was conducted off-site by staff at Adamski Geological Consulting, LLC (AGC). The project includes the following components:

Component 1 Quality assurance and quality control analysis were conducted on Meta data (site information) and time-series data collected at the three tree islands. The site location, construction information, and time-series data through December 31, 2006, were previously reviewed as part of a 2-year project for Taiye Sangoyomi, PE (SFWMD). However, a new survey of the stations was conducted in September 2007, which resulted in slight adjustments to the reference and land-surface elevations at most of the stations. Time-series data collected at the stations were adjusted using correction factors to account for the new reference elevations. In addition, data from the three stilling wells and meteorological station had not been previously reviewed, but were extensively analyzed as part of this project. All QA/QC analysis closely followed methods outlined in standard operating procedures (SOPs) of the SFWMD (Sangoyomi and others, 2005; Sangoyomi and others, 2006; Sangoyomi and Lambright, 2006).

Component 2 The seasonal fluctuations in ground-water level and surface-water stage at the three islands were identified. The dates on which maximum and minimum water levels occurred were documented for analysis in component 3. Data were analyzed for the effects of weather and operation of structures on fluctuations of ground-water levels and stage.

Component 3 The vertical and horizontal movement of water at the three tree islands was mapped and analyzed. The maps and analysis were done using extreme data (periods of water level minimums and maximums) and average data. The results were documented in this report.

The purpose of this report is to summarize work conducted by AGC on the project and document the results. During this period, Meta and time-series data from 23 monitoring wells, 3 surface-water stations, and 1 meteorological station (henceforth, known as target stations) were reviewed and revised for quality assurance and quality control. The revised data are submitted with this report for approval and uploading into DBHYDRO.

1.3 Data Sources

The Meta and time-series data for all 27 stations were collected by SFWMD and stored in the DBHYDRO database. The data from the 27 target stations used for analysis during this project were downloaded directly from DBHYDRO (Table 1).

Station number from SOW	*Station name*	*Source DBKEY*	*Agency*	*Strata (feet)*	*MOD1 DBKEY*
1	3AN1W1_GP	OH532	WMD	14.5	UD202
2	3AN1W1_GW	OH531	WMD	32.9	UD201
3	3AN1W1_H	OH538	WMD	0	
4	3AN1W2_GP	OH534	WMD	15	UD200
5	3AN1W2_GW	OH533	WMD	49.6	UD199
6	3AN1W3_GP	OH536	WMD	14.5	UD204
7	3AN1W3_GW	OH535	WMD	31.7	UD205
8	3AN1W4_GP	OH537	WMD	4.1	UD203
9	3AS3W1_GP	PT035	WMD	8.7	UD311
10	3AS3W1_GW	M6884	WMD	26.4	UD300
11	3AS3W1_H	M6883	WMD	0	
12	3AS3W2_GP	PT036	WMD	8.5	UD361
13	3AS3W2_GW	M6885	WMD	25	UD360
14	3AS3W3_GP	PT037	WMD	8.5	UD312
15	3AS3W3_GW	M6887	WMD	28.6	UD301
16	3AS3W4_GP	PT038	WMD	10.7	UD313
17	3AS3W4_GW	M6886	WMD	30	UD299
18	3BS1W1_GP	PT039	WMD	15	UD307
19	3BS1W1_GW	M6890	WMD	34	UD295
20	3BS1W1_H	M6889	WMD	0	
21	3BS1W2_GP	PT040	WMD	13.5	UD308
22	3BS1W2_GW	M6891	WMD	30	UD296
23	3BS1W3_GP	PT041	WMD	15	UD309
24	3BS1W3_GW	M6892	WMD	28.5	UD298
25	3BS1W4_GP	PT042	WMD	14	UD310
26	3BS1W4_GW	M6893	WMD	34	UD297
27	3AS3W3_R	M6888	WMD		
28	3AS3WX	LA373	WMD		
29	3AS3WX	LA374	WMD		
30	3AS3WX	LA372	WMD		
31	3AS3WX	LA364	WMD		

Table 1 Site information for target wells, stilling wells, and weather station. [WMD, South Florida Water Management District]

The time-series data from nearby weather stations also were downloaded from DBHYDRO. A discussion of the results in provided in the following Results and Discussion section.

2 METHODS

2.1 Data Acquisition

Meta data and time-series data for the 27 stations were downloaded from DBHYDRO. Other site information, such as reference and land-surface elevations and well depths, were previously obtained and (or) verified from survey reports and recorder registration worksheets.

2.2 Procedures for Verification of Well Location and Elevation

Accurate site information, particularly locations and reference elevations (defined as the elevation of the measuring point, usually the top of the casing or platform, in feet above mean sea level), is critical in conducting quality-assurance procedures on monitoring wells. Quality-assurance procedures include comparison of time-series data from the target well with data from nearby rain gages and other active monitoring wells. An incorrect reference elevation for a target well will lead to an erroneous set of time-series data upon which the reference elevation is based. In addition, accurate site information is important in maintaining the integrity of the database. Much of the assessment of site information was conducted as part of the previously noted QA/QC analysis for these stations. The methods used in this analysis included AGC staff becoming familiar with the stations, plotting the stations using GIS to verify the county and geographic location of the sites, and viewing photographs of the wells to verify information such as the casing height. In addition, staff from AGC spoke with personnel at SFWMD to resolve any discrepancies.

The reference and land-surface elevations were revised using the new information from surveys conducted in September 2007 (Keith and Schnars, PA, 2007). The difference between the old and new elevations was calculated for each station to determine the correction factor to be applied to the time-series data. For example, the original reference elevation for well 3BS1W1_GP was 12.13 ft above mean sea level, whereas the new reference elevation was determined to be 12.21 ft above mean sea level (NGVD 29). The difference between the two elevations is 0.08 ft, the correction factor added to the time-series data.

2.3 Procedures for QA/QC of Water-Level Data

After well locations were verified, quality assurance was conducted on time-series data from each well using the methods described in SFWMD SOPs (Sangoyomi and others, 2005; Sangoyomi and others, 2006; Sangoyomi and Lambright, 2006). These methods are summarized as follows:

1. Time-series data from the target station were plotted in order to identify and document anomalies, outliers, and gaps in the record. Gaps, or periods of missing

data, are easily identified. Anomalies are shifts in the values that might or might not represent valid hydrologic data. Anomalies could also be periods of flat or suspiciously linear data. Outliers are extreme values that are significantly greater than or less than a specified range within which most of the data occur. Anomalies and outliers might represent valid hydrologic conditions such as a drought or excessive rainfall. However, anomalies and outliers that are inconsistent with data from nearby wells and rain gages could indicate errors in the time-series data.

2. Summary statistics (minimum, mean, median, maximum, and standard deviation) were determined for each set of time-series data prior to revision (Appendix A).

3. Box plots of time-series data were generated in order to quantitatively identify outliers. Box plots consist of a box with one end (lower quartile, Q1) representing the 25^{th} percentile, and the opposite end (upper quartile, Q3) representing the 75^{th} percentile of the time-series data (fig. 2). A line is drawn near the middle of the box to represent the median of the data. The distance between the lower and upper quartiles is the inter quartile range (IQR). An outlier is defined as any data point greater than the upper fence (upper quartile plus 1.5*IQR), or any data point less than the lower fence (lower quartile minus 1.5*IQR).

4. Time-series data were plotted with data from nearby monitoring stations and rain gages in order to evaluate anomalies and outliers. For example, heavy rains could explain a sudden increase in water levels in the target well. Trends in nearby wells also were used to document and verify that anomalies in the time-series data of the target wells represented valid hydrologic conditions.

5. Anomalies and outliers that did not appear to represent valid hydrologic conditions were deleted from the record. The values were coded as an “M” for missing.

6. Gaps in data can either be tagged as an “M” or an “N”. An “M” indicates the data are missing, possibly as a result of equipment failure or some other technical problem. During the previous QA/QC analysis, missing values were estimated using interpolation (gaps of 7 or less days) or regression analysis with data from nearby wells. However, the time-series data from the two sites needed to be significantly correlated (R^2>0.70) in order to use regression analysis. No attempt was made to estimate missing data tagged with an “M” that was collected after December 31, 2006.

7. Gaps in the time-series data tagged with an “N” indicate that the data are not yet available. Personnel at SFWMD were contacted to determine if data were available for processing. If data were not available, the gaps were processed using the same techniques as gaps tagged with an “M”.

8. The data were revised, based on the analysis of anomalies, outliers, and gaps. Summary statistics were determined for the revised time-series data (Appendix A). Revisions, particularly the addition of the correction factors, caused the summary

statistics to change. Final hydrographs (Appendix A) of the revised data were reviewed to verify that the data were valid.

Revised time-series data are submitted with this report for approval and uploading into DBHYDRO.

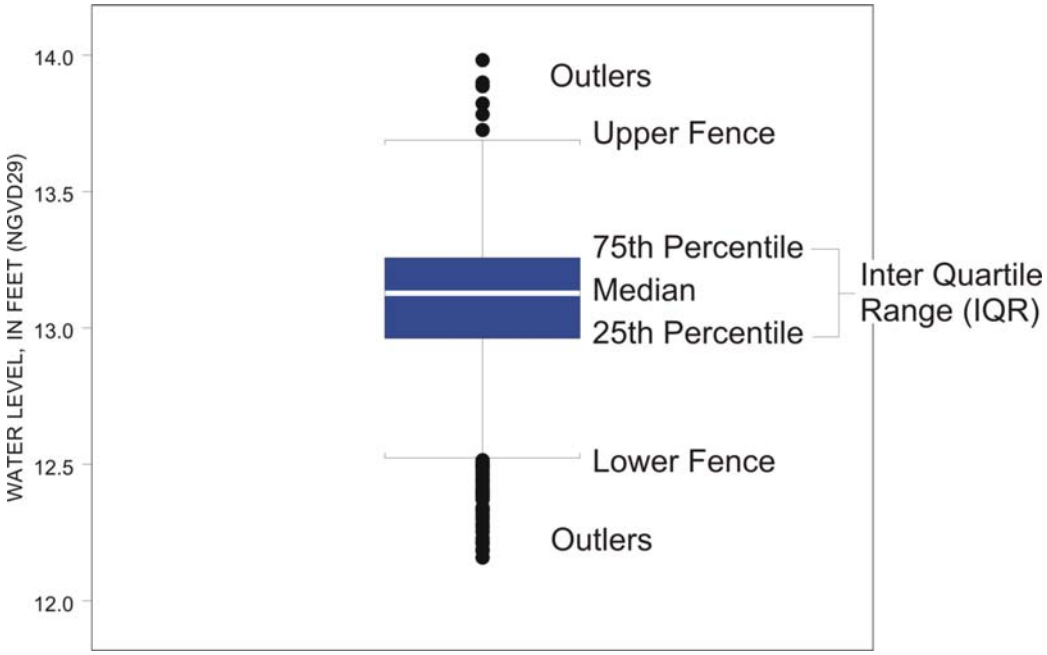


Figure 2 Sample box plot showing lower (Q1) and upper (Q3) quartiles, inter quartile range, and outliers.

Well depths (strata variable in DBHYDRO) are listed as feet below land surface (bls), unless otherwise noted. Water-level data, and reference and land-surface elevations are listed as feet above mean sea level, and are based on the National Geodetic Vertical Datum of 1929 (NGVD29). Horizontal locations are based on North American Datum of 1983 (NAD83) and Florida State Plane coordinates.

3 BACKGROUND

In 2000, South Florida Water Management District began monitoring the ground-water and surface-water interactions at selected tree islands as part of a 5-year, multidisciplinary study conducted in cooperation with the Florida Fish and Wildlife Conservation Commission, the Florida Center for Environmental Studies, the U.S. Geological Survey, and several universities. The three selected tree islands—3AN1, 3AS3, and 3BS1—are all located in Water Conservation Area 3 (fig. 1).

Monitoring is conducted at sets of dual-zone monitor wells installed at each of the tree islands. Dual-zone wells were installed northwest, northeast, and south of each tree island, with a final set of wells located within the tree island. The resulting four sets of

wells at each island are identified as W1, W2, W3, and W4, respectively. With one exception, each dual-zone site contains a shallow (depths range from 4.1 to 15 ft) ¾-inch diameter piezometer and a deeper (depths range from 26.4 to 49.6 ft) 2-inch diameter well installed in the same borehole; 3AN1W4 consists of just the shallow piezometer. A detailed description of well construction and data-collection activities is provided in Bevier and Krupa (2001).

In addition, each W1 site also has an adjacent stilling well to monitor surface-water stage data. Finally, a weather station for monitoring air temperature, barometric pressure, evapotranspiration, humidity, and wind speed was installed at 3AS3. A preliminary assessment of water-level and water-quality data from the tree islands is discussed in Krupa and Gefvert (2006).

4 QUALITY ASSURANCE ANALYSIS

The site information and time-series data from 26 stations were reviewed and analyzed according to SFWMD quality-assurance protocols. The following discussion includes analysis conducted for this project as well as a brief summary of the work done as part of the 2-year QA/QC project.

The station name used for storing the wells in DBHYDRO often refers to both the shallow piezometer and the deeper well at the same site. For example, the station name 3AS3W1_G is used for both the 8.7-ft deep piezometer and the 26.4-ft deep well. For this report, the station names were slightly modified for clarity by adding a P or a W at the end to distinguish the piezometer (3AS3W1_GP) from the well (3AS3W1_GW), respectively. The station name in DBHYDRO is included in the following tables for consistency.

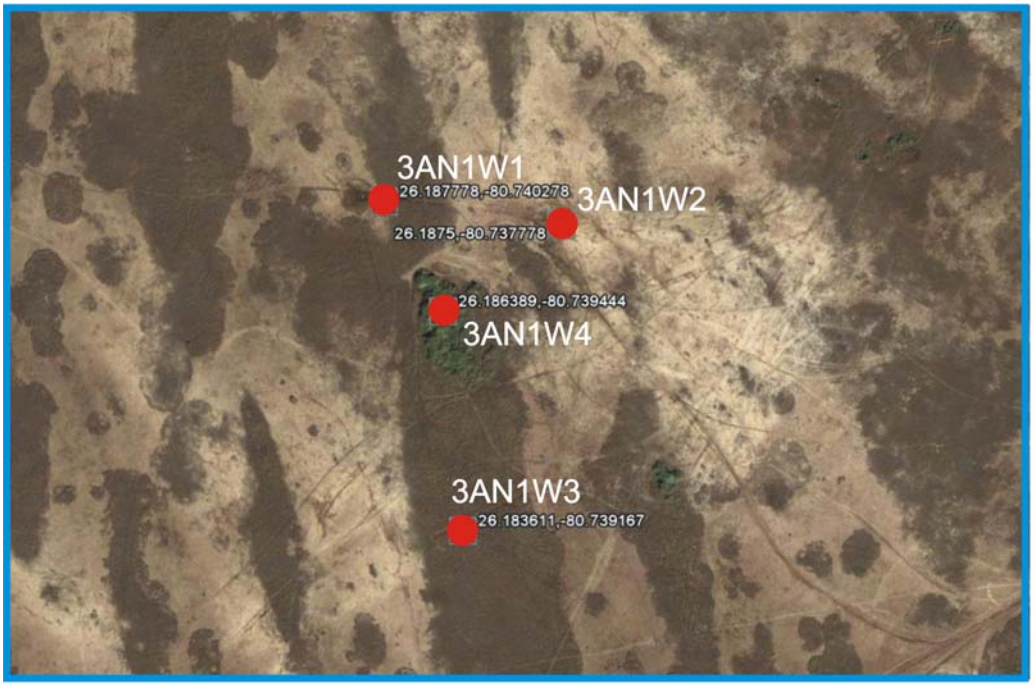


Figure 3 Location of target stations at Tree Island Site 3AN1.

Figure 4 Location of target stations at Tree Island 3AS3.

Figure 5 Location of target stations at Tree Island 3BS1.

4.1 Station 1: 3AN1W1_GP

3AN1W1_GP is a 14.5-ft deep well located in Broward County (figs. 1 and 3). 3AN1W1_G is one of two wells at the site (3AN1W1), which also includes a 32.9-ft deep well 3AN1W1_GW and a surface-water station 3AN1W1_H.

4.1.1 Site and data description

Variable	Original value	Revised value
Station	3AN1W1_GP	3AN1W1_GP
Station (DBHYDRO)	3AN1W1_G	3AN1W1_G
Source DBKEY	OH532	OH532
MOD1 DBKEY	UD202	UD202
Latitude (NAD83)	26 11 16	26 11 16
Longitude (NAD83)	80 44 25	80 44 25
FL State Planar X Coordinate	741311	741311
FL State Planar Y Coordinate	674056	674056
Land-surface elevation (feet NGVD29) (dm_location)	10.219	10.219
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.22	10.22
Land (rock)-surface elevation (feet) (2007 survey)	9.9	9.9
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	17.407	17.39
Strata (feet bls) (DBHYDRO)	14.5	14.5
Recorder	CR10	CR10

Table 2 Site information obtained for Station 1: 3AN1W1_GP

Analysis: The reference elevation determined from the 2007 survey is 0.017 ft less than the elevation listed on the recorder registration. The difference between the reference and land-surface elevations indicates the casing extends about 7.2 ft above land surface. A photograph of the site (below) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. Inundation is consistent with the location of the site in wetlands in WCA3.

Station 3AN1W1

Overall, the site information is consistent, and appears to be accurate. No other revisions were required.

4.1.2 Data analysis and revision

The period of record analyzed for well 3AN1W1_GP extends from July 18, 2002 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,175 observations with 36 outliers and 204 missing values, all of which were estimated as part of the previous QA/QC project. The summary statistics for this well are provided in table 3.

Problem: The time-series data from well 3AN1W1_GP contain 36 outliers.

Analysis: The outliers, which are less than the lower fence, all occurred in spring 2007 at the end of the dry season. These outliers are consistent with declines in water levels in nearby wells drilled to similar depths (Appendix A), and, therefore, probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The 2007 survey indicates the reference elevation is 0.017 ft lower than initially determined.

Analysis: The correction factor of 0.017 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AN1W1_GP closely coincide with peaks and declines in water-level data from nearby wells (3AN1W2_GP, 3AN1W3_GP, and 3AN1W4_GP) drilled to a similar depth (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3ANIW1_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than subtracting the correction factor of 0.017 ft from the time-series data.

Statistic	Original series	Revised series
Minimum (feet NGVD29)	8.692	8.675
Mean (feet NGVD29)	11.020	11.007
Median (feet NGVD29)	10.887	10.887
Maximum (feet NGVD29)	12.582	12.565
Standard deviation	0.706	0.681
Variance	0.498	0.463
Outliers	36	43
Missing values	204	0

Table 3 Summary statistics of original time-series data for Station 1: 3AN1W1_GP

4.2 Station 2: 3AN1W1_GW

3AN1W1_GW is a 32.9-ft deep well located in Broward County (figs. 1 and 3). 3AN1W1_GW is one of two wells at the site (3AN1W1), which also includes a 14.5-ft deep well 3AN1W1_GP and a surface-water station 3AN1W1_H.

4.2.1 Site and data description

Variable	Original value	Revised value
Station	3AN1W1_GW	3AN1W1_GW
Station (DBHYDRO)	3AN1W1_G	3AN1W1_G
Source DBKEY	OH531	OH531
MOD1 DBKEY	UD201	UD201
Latitude (NAD83)	26 11 16	26 11 16
Longitude (NAD83)	80 44 25	80 44 25
FL State Planar X Coordinate	741311	741311
FL State Planar Y Coordinate	674056	674056
Land-surface elevation (feet NGVD29) (dm_location)	10.22	10.22
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.2	10.2
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	9.9	9.9
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	17.417	17.40
Strata (feet bls) (DBHYDRO)	32.9	32.9
Recorder	CR10	CR10

Table 4 Site information obtained for Station 2: 3AN1W1_GW

Analysis: The reference elevation determined from the 2007 survey is 0.017 ft less than the elevation on the recorder registration. The difference between the reference and land-surface elevations indicates the casing extends 7.2 ft above land surface. In a photograph of the site (see station 1: 3AN1W1_GP), the top of the casing appears to be

elevated above land surface, probably to allow access during high water. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. Inundation is consistent with a location in WCA3.

Overall, the site information is consistent, and appears to be accurate. No other revisions were required.

4.2.2 Data analysis and revision

The period of record analyzed for well 3AN1W1_GW extends from July 18, 2002 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,175 observations with 43 outliers and 174 missing values, all of which were estimated as part of the previous QA/QC project. The summary statistics for this well are provided in table 5.

Problem: The time-series data from well 3AN1W1_GW contain 43 outliers, all of which were less than the lower fence.

Analysis: Outliers primarily in spring 2007 at the end of the dry, probably as water levels declined from sparse rainfall. The outliers coincide with declines in nearby wells drilled to similar depths. The outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The 2007 survey indicates the reference elevation is 0.017 ft lower than initially determined.

Analysis: The correction factor of 0.017 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AN1W1_GW generally coincide with peaks and declines in water-level data from nearby wells (3AN1W2_GW, 3AN1W3_GW, and 3AS3W1_GW) drilled to a similar depth (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3AN1W1_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than subtracting the correction factor from the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.716	8.699
Mean (feet NGVD29)	11.017	11.021
Median (feet NGVD29)	10.897	10.918
Maximum (feet NGVD29)	12.665	12.648
Standard deviation	0.717	0.697
Variance	0.515	0.486
Outliers	43	44
Missing values	174	0

Table 5 Summary statistics of time-series data for Station 2: 3AN1W1_GW

4.3 Station 3: 3AN1W1_H

3AN1W1_H is a stilling well located in Broward County (figs. 1 and 3). 3AN1W1_H is located at the same site as 3AN1W1_GP and 3AN1W1_GW.

4.3.1 Site and data description

Variable	Original value	Revised value
Station	3AN1W1_H	3AN1W1_H
Station (DBHYDRO)	3AN1W1	3AN1W1
Source DBKEY	OH538	OH538
Latitude (NAD83)	26 11 16	26 11 16
Longitude (NAD83)	80 44 25	80 44 25
FL State Planar X Coordinate	741311	741311
FL State Planar Y Coordinate	674056	674056
Land-surface elevation (feet NGVD29) (dm_location)	10.05	10.05
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.2	10.2
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	9.9	9.9
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	18.655	18.64
Strata (feet bls) (DBHYDRO)	0	0
Recorder	CR10	CR10

Table 6 Site information obtained for Station 3: 3AN1W1_H

Analysis: The reference elevation determined from the 2007 survey is 0.15 ft less than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 8.4 ft above land surface. A photograph of

the site (see Station 1: 3AN1W1_GP) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time, as would be expected for a surface-water station.

4.3.2 Data analysis and revision

The period of record analyzed for well 3AN1W1_H extends from July 18, 2002 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,175 observations with 8 outliers and 91 missing values. The summary statistics for this well are provided in table 7.

Problem: The time-series data from well 3AN1W1_H contain 8 outliers.

Analysis: The data from this station closely coincide with data from the other two stilling wells (3AS3W1_H and 3BS1W1_H) and to the water levels in the adjacent piezometer 3AN1W1_GP. The outliers probably are valid data that accurately represent conditions at the site.

Problem: The time-series data from stilling well 3AN1W1_H contain 91 missing values, all of which are coded as M.

Analysis: Missing values occurred from August 14 – November 12, 2002 and possibly result from equipment problems. The missing values were not estimated as part of this project.

Problem: The time-series data from stilling well 3AN1W1_H contain anomalous periods of flat data.

Analysis: The anomalous data occurred during periods of water level declines, in May 2006 and in March, April, and May 2007. These periods of flat data are inconsistent with the water level in nearby well 3AN1W1_GP, which continued to decline during the same time. During each period, the water level in 3AN1W1_H declined to slightly less than 9.8 ft above mean sea level. The recorder registration indicates the elevation of the bottom of the stilling well is 9.535 ft above mean sea level, so the anomalous data probably result from the water level declining below the pressure transducer. The anomalous data also occurred during periods when the water level declined below land-surface elevations (fig. 6). The anomalous data were tagged with a less than sign (<) in DBKEY OH538, and deleted and tagged with an M in the preferred MOD1 DBKEY.

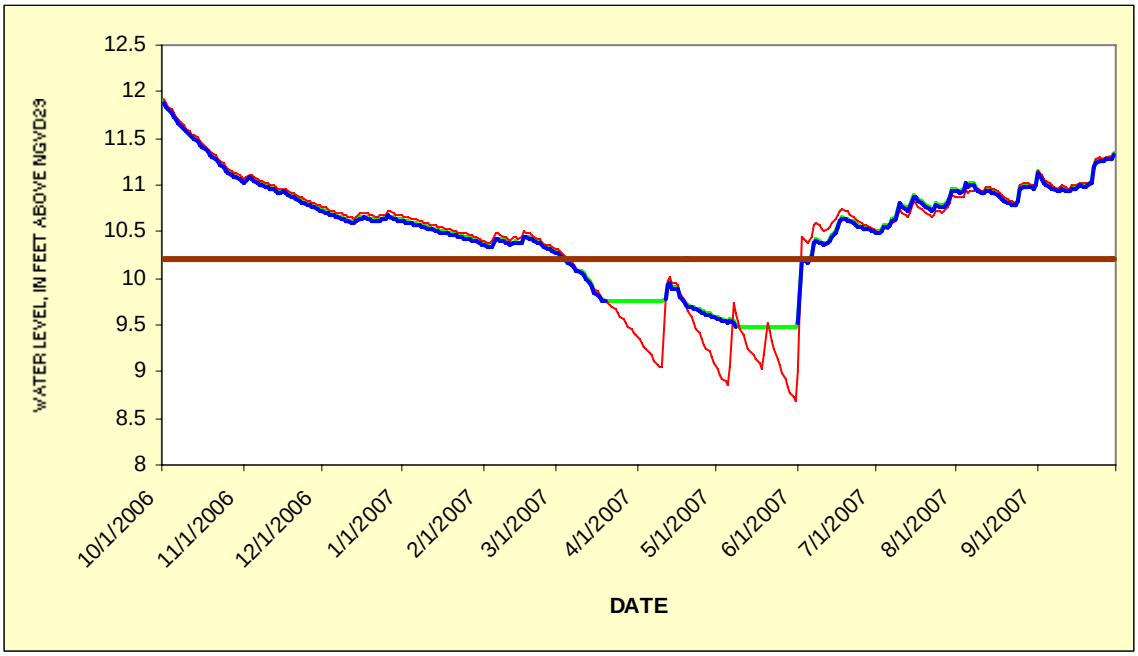


Figure 6 Water-level data from the target station (blue) show two periods of anomalously flat hydrographs (green), which are inconsistent with data from nearby well 3AN1W1_GP (red). The anomalous data were deleted, and tagged with M in the preferred data set. The horizontal brown line represents the land-surface elevation.

Problem: The 2007 survey indicates the reference elevation is 0.015 ft less than the initial reference elevation.

Analysis: The correction factor of 0.015 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AN1W1_H generally coincide with peaks and declines in water-level data from nearby stations (3AN1W1_GP, 3AS3W1_H, and 3BS1W1_H) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3AN1W1_H probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than removing the anomalous data and subtracting the correction factor.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	9.473	9.487
Mean (feet NGVD29)	11.026	11.054
Median (feet NGVD29)	10.894	10.899
Maximum (feet NGVD29)	12.647	12.632
Standard deviation	0.671	0.635
Variance	0.450	0.403
Outliers	8	0
Missing values	91	152

Table 7 Summary statistics of original time-series data for Station 3: 3AN1W1_H

4.4 Station 4: 3AN1W2_GP

3AN1W2_GP is a 15-ft deep well located in Broward (figs. 1 and 3). 3AN1W2_GP is one of two wells at the site (3AN1W2), which also includes a 49.6-ft deep well (3AN1W2_GW).

4.4.1 Site and data description

Variable	Original value	Revised value
Station	3AN1W2_GP	3AN1W2_GP
Station (DBHYDRO)	3AN1W2_GW2	3AN1W2_GW2
Source DBKEY	OH534	OH534
MOD1 DBKEY	UD200	UD200
Latitude (NAD83)	26 11 15	26 11 15
Longitude (NAD83)	80 44 16	80 44 16
FL State Planar X Coordinate	742162	742162
FL State Planar Y Coordinate	673965	673965
Land-surface elevation (feet NGVD29) (dm_location)	10.05	10.05
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.1	10.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	9.4	9.4
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	18.281	18.27
Strata (feet bls) (DBHYDRO)	15	15
Recorder	CR10	CR10

Table 8 Site information obtained for Station 4: 3AN1W2_GP

Analysis: The reference elevation determined from the 2007 survey is 0.011 ft less than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 8.2 ft above land surface. A photograph of

the site (see below) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. The photograph also shows the site is surrounded by water, which is not unexpected for stations located in wetlands of WCA3.

Station 3AN1W2

Overall, the site information is consistent, and appears to be accurate. No other revisions were required.

4.4.2 Data analysis and revision

The period of record analyzed for well 3AN1W2_GP extends from July 17, 2002 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,176 observations with 47 outliers and no missing values. The summary statistics for this well are provided in table 9.

Problem: The time-series data from well 3AN1W2_GP contain 47 outliers, all of which occurred in spring 2007.

Analysis: All of the outliers were less than the lower fence, and coincide with similar declines in water levels in nearby wells that occurred at the end of the dry season. The outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The reference elevation from the 2007 survey is 0.011 ft less than the initial reference elevation.

Analysis: A correction factor of 0.011 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AN1W2_GP coincide with peaks and declines in water-level data from nearby wells (3AN1W1_GP, 3AN1W3_GP, and 3AN1W4_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3AN1W2_GP appear to be valid data that accurately

represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.572	8.561
Mean (feet NGVD29)	11.018	11.007
Median (feet NGVD29)	10.918	10.908
Maximum (feet NGVD29)	12.571	12.560
Standard deviation	0.712	0.712
Variance	0.506	0.506
Outliers	47	47
Missing values	0	0

Table 9 Summary statistics of time-series data for Station 4: 3AN1W2_GP

4.5 Station 5: 3AN1W2_GW

3AN1W2_GW is a 49.6-ft deep well located in Broward (figs. 1 and 3). 3AN1W2_GW is one of two wells at the site (3AN1W2), which also includes a 15-ft deep well (3AN1W2_GP).

4.5.1 Site and data description

Variable	Original value	Revised value
Station	3AN1W2_GW	3AN1W2_GW
Station (DBHYDRO)	3AN1W2_GW1	3AN1W2_GW1
Source DBKEY	OH533	OH533
MOD1 DBKEY	UD199	UD199
Latitude (NAD83)	26 11 15	26 11 15
Longitude (NAD83)	80 44 16	80 44 16
FL State Planar X Coordinate	742162	742162
FL State Planar Y Coordinate	673965	673965
Land-surface elevation (feet NGVD29) (dm_location)	10.05	10.05
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.1	10.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	9.4	9.4
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	18.291	18.28
Strata (feet bls) (DBHYDRO)	49.6	49.6
Recorder	CR10	CR10

Table 10 Site information obtained for Station 5: 3AN1W2_GW

Analysis: The reference elevation from the 2007 survey is 0.011 ft less than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 8.2 ft above land surface. A photograph of the site (see station 4: 3AN1W2_GP) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. The photograph also shows the site is surrounded by water.

Overall, the site information is consistent, and appears to be accurate. No other revisions were required.

4.5.2 Data analysis and revision

The period of record analyzed for well 3AN1W2_GW extends from July 17, 2002 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,176 observations with 47 outliers and no missing values. The summary statistics for this well are provided in table 11.

Problem: The time-series data from well 3AN1W2_GW contain 47 outliers, all of which occurred in spring 2007.

Analysis: All of the outliers were less than the lower fence, and coincide with similar declines in water levels in nearby wells that occurred at the end of the dry season. The outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The reference elevation from the 2007 survey is 0.011 ft less than the initial reference elevation.

Analysis: A correction factor of 0.011 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AN1W2_GW coincide with peaks and declines in water-level data from nearby wells (3AN1W1_GW, 3AN1W3_GW, and 3AS3W1_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3AN1W2_GW appear to be valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.651	8.640
Mean (feet NGVD29)	11.046	11.035
Median (feet NGVD29)	10.936	10.925
Maximum (feet NGVD29)	12.679	12.668
Standard deviation	0.704	0.704
Variance	0.495	0.495
Outliers	47	47
Missing values	0	0

Table 11 Summary statistics of time-series data for Station 5: 3AN1W2_GW

4.6 Station 6: 3AN1W3_GP

3AN1W3_GP is a 14.5-ft deep well located in Broward County (figs. 1 and 3). 3AN1W3_GP is one of two wells at the site (3AN1W3), which also includes 3AN1W3_GW.

4.6.1 Site and data description

Variable	Original value	Revised value
Station	3AN1W3_GP	3AN1W3_GP
Station (DBHYDRO)	3AN1W3_GW2	3AN1W3_GW2
Source DBKEY	OH536	OH536
MOD1 DBKEY	UD204	UD204
Latitude (NAD83)	26 11 01	26 11 01
Longitude (NAD83)	80 44 21	80 44 21
FL State Planar X Coordinate	741735	741735
FL State Planar Y Coordinate	672543	672543
Land-surface elevation (feet NGVD29) (dm_location)	10.58	10.58
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.5	10.5
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	9.3	9.3
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	18.273	18.23
Strata (feet bls) (DBHYDRO)	14.5	14.5
Recorder	CR10	CR10

Table 12 Site information obtained for Station 6: 3AN1W3_GP

Analysis: The reference elevation from the 2007 survey is 0.043 ft less than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends 7.7 ft above land surface. In a photograph of the site (below), the well casing appears to extend several feet above land surface. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water about half of the time. Inundation of the site is not unexpected for stations located in wetlands in WCA3.

3AN1W3 site

Overall, the site information is consistent, and appears to be accurate. No other revisions were required.

4.6.2 Data analysis and revision

The period of record analyzed for well 3AN1W3_GP extends from July 18, 2002 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,175 observations with 33 outliers and no missing values. The summary statistics for this well are provided in table 13.

Problem: The time-series data from well 3AN1W3_GP contain 33 outliers, all of which occurred in spring 2007.

Analysis: All of the outliers were less than the lower fence, and coincide with similar declines in water levels in nearby wells that occurred at the end of the dry season. The outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The reference elevation from the 2007 survey is 0.043 ft less than the initial reference elevation.

Analysis: A correction factor of 0.043 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AN1W3_GP coincide with peaks and declines in water-level data from nearby wells (3AN1W1_GP, 3AN1W2_GP, and 3AN1W4_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3AN1W3_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.628	8.585
Mean (feet NGVD29)	10.967	10.924
Median (feet NGVD29)	10.848	10.805
Maximum (feet NGVD29)	12.585	12.542
Standard deviation	0.724	0.724
Variance	0.524	0.524
Outliers	33	33
Missing values	0	0

Table 13 Summary statistics of time-series data for Station 6: 3AN1W3_GP

4.7 Station 10: 2AN1W3_GW

3AN1W3_GW is a 31.7-ft deep well located in Broward County (figs. 1 and 3). 3AN13_GW is one of two wells at the site (3AN1W3), which also includes 3AN1W3_GP.

4.7.1 Site and data description

Variable	Original value	Revised value
Station	3AN1W3_GW	3AN1W3_GW
Station (DBHYDRO)	3AN1W3_GW1	3AN1W3_GW1
Source DBKEY	OH535	OH535
MOD1 DBKEY	UD205	UD205
Latitude (NAD83)	26 11 01	26 11 01
Longitude (NAD83)	80 44 21	80 44 21
FL State Planar X Coordinate	741735	741735
FL State Planar Y Coordinate	672543	672543
Land-surface elevation (feet NGVD29) (dm_location)	10.58	10.58
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.5	10.5
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	9.3	9.3
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	18.285	18.25
Strata (feet bls) (DBHYDRO)	31.7	31.7
Recorder	CR10	CR10

Table 14 Site information obtained for Station 7: 3AN1W3_GW

Analysis: The reference elevation from the 2007 survey is 0.035 ft less than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 7.8 ft above land surface. In a photograph of the site

(see Station 6: 3AN1W3_GP), the top of the casing appears to be elevated above land surface, probably to allow access during high water. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. Overall, the site information is consistent, and appears to be accurate. No other revisions were required.

4.7.2 Data analysis and revision

The period of record analyzed for well 3AN1W3_GW extends from July 18, 2002 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,175 observations with 28 outliers and no missing values. The summary statistics for this well are provided in table 15.

Problem: he time-series data from well 3AN1W3_GW contain 28 outliers, all of which occurred in spring 2007.

Analysis: All of the outliers were less than the lower fence, and coincide with similar declines in water levels in nearby wells that occurred at the end of the dry season. The outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The reference elevation from the 2007 survey is 0.035 ft less than the initial reference elevation.

Analysis: A correction factor of 0.035 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AN1W3_GW coincide with peaks and declines in water-level data from nearby wells (3AN1W1_GW, 3AN1W2_GW, and 3AS3W1_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3AN1W3_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.595	8.560
Mean (feet NGVD29)	11.017	10.982
Median (feet NGVD29)	10.904	10.869
Maximum (feet NGVD29)	12.641	12.606
Standard deviation	0.740	0.740
Variance	0.547	0.547
Outliers	28	28
Missing values	0	0

Table 15 Summary statistics of time-series data for Station 7: 3AN1W3_GW

4.8 Station 8: 3AN1W4_GP

3AN1W4_GP is a 4.1-ft deep well located in Broward (figs. 1 and 3). 3AN1W4_GP is the only well at the site (3AN1W4).

4.8.1 Site and data description

Variable	Original value	Revised value
Station	3AN1W4_GP	3AN1W4_GP
Station (DBHYDRO)	3AN1W4_GW2	3AN1W4_GW2
Source DBKEY	OH537	OH537
MOD1 DBKEY	UD203	UD203
Latitude (NAD83)	26 11 11	26 11 11
Longitude (NAD83)	80 44 22	80 44 22
FL State Planar X Coordinate	741616	741616
FL State Planar Y Coordinate	673551	673551
Land-surface elevation (feet NGVD29) (dm_location)	10.61	10.61
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	11.8	11.8
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	10.8	10.8
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	16.212	16.19
Strata (feet bls) (DBHYDRO)	4.1	4.1
Recorder	CR10	CR10

Table 16 Site information obtained for Station 8: 3AN1W4_GP

Analysis: The reference elevation from the 2007 is 0.022 ft less than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends 4.4 ft above land surface, which is consistent with the casing shown in the photograph (below). The maximum water level is higher than the land-surface elevation, indicating that the land is periodically inundated with water. The well is within the tree island; hence, rare or occasional inundation is not unexpected.

3AN1W4_GW2

Overall, the site information is consistent, and appears to be accurate. No other revisions were necessary.

4.8.2 Data analysis and revision

The period of record analyzed for well 3AN1W4_GP extends from July 18, 2002 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,175 observations with 31 outliers and 179 missing values, all of which were estimated as part of the previous QA/QC project. The summary statistics for this well are provided in table 17.

Problem: The time-series data from well 3AN1W4_GP contain 31 outliers, all but one of which occurred in spring 2007.

Analysis: All of the outliers were less than the lower fence, and coincide with similar declines in water levels in nearby wells that occurred at the end of the dry season. The outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The reference elevation from the 2007 survey is 0.022 ft less than the initial reference elevation.

Analysis: A correction factor of 0.022 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AN1W4_GP coincide with peaks and declines in water-level data from nearby wells (3AN1W1_GP, 3AN1W2_GP, and 3AN1W3_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3AN1W4_GP probably are valid data that

accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.573	8.551
Mean (feet NGVD29)	11.054	11.052
Median (feet NGVD29)	10.945	10.955
Maximum (feet NGVD29)	12.593	12.571
Standard deviation	0.704	0.686
Variance	0.495	0.471
Outliers	31	34
Missing values	179	0

Table 17 Summary statistics of time-series data for Station 8: 3AN1W4_GP

4.9 Station 9: 3AS3W1_GP

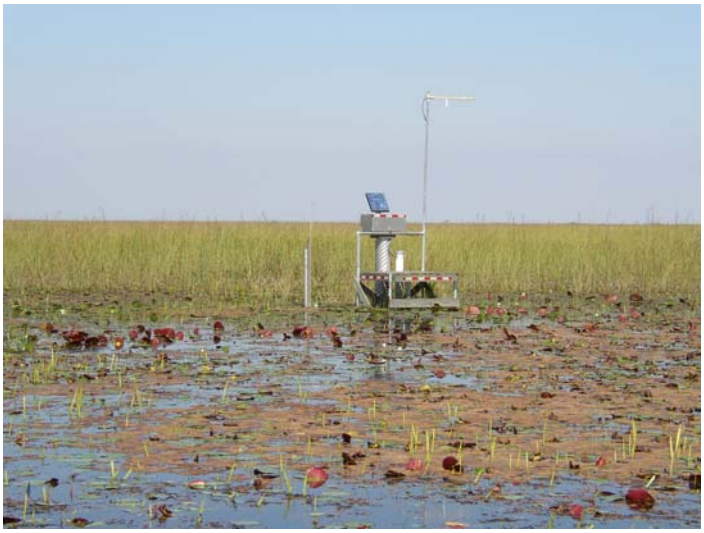
3AS3W1_GP is an 8.7-ft deep well located in Miami-Dade County (figs. 1 and 4). 3AS3W1_GP is one of three stations at the site (3AS3W1), which also includes well 3AS3W1_GW and stilling well 3AS3W1_H.

4.9.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W1_GP	3AS3W1_GP
Station (DBHYDRO)	3AS3W1_G	3AS3W1_G
Source DBKEY	PT035	PT035
MOD1 DBKEY	UD311	UD311
Latitude (NAD83)	25 51 26	25 51 26
Longitude (NAD83)	80 46 17	80 46 17
FL State Planar X Coordinate	731346.66	731346.66
FL State Planar Y Coordinate	553896.56	553896.56
Land-surface elevation (feet NGVD29) (dm_location)	7.33	7.33
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.4	8.4
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	4.6	4.6
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	14.50	14.50
Strata (feet bls) (DBHYDRO)	8.7	8.7
Recorder	CR10	CR10

Table 18 Site information obtained for Station 9: 3AS3W1_GP

Analysis: The reference elevation from the 2007 survey is identical to the initial reference elevation. No correction factor was needed. The difference between the reference and land-surface elevations indicates the casing extends 6.1 ft above land surface, which is consistent with the well casing showin in a photograph of the site (below). The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. The photograph also shows the well surrounded by water, which is not unexpected for sites located in wetlands of WCA3. The site information for the target well is consistent, and appears to be accurate. No revisions were required.



Site 3AS3W1

4.9.2 Data analysis and revision

The period of record analyzed for well 3AS3W1_GP extends from July 29, 2003 through June 30, 2008 (Appendix A). The time-series data from that period contain 1,799 observations with no outliers and no missing values. The summary statistics for this well are provided in table 19.

Summary: The peaks and declines in water-level data from well 3AS3W1_GP coincide with peaks and declines in water-level data from nearby wells (3AS3W2_GP, 3AS3W3_GP, and 3AS3W4_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3AS3W1_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.309	8.309
Mean (feet NGVD29)	9.724	9.724
Median (feet NGVD29)	9.623	9.623
Maximum (feet NGVD29)	11.232	11.232
Standard deviation	0.726	0.726
Variance	0.527	0.527
Outliers	0	0
Missing values	0	0

Table 19 Summary statistics of time-series data for Station 9: 3AS3W1_GP

4.10 Station 10: 3AS3W1_GW

3AS3W1_GP is a 26.4-ft deep well located in Miami-Dade County (figs. 1 and 4). 3AS3W1_GW is one of three stations at the site (3AS3W1), which also includes well 3AS3W1_GP and stilling well 3AS3W1_H.

4.10.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W1_GW	3AS3W1_GW
Station (DBHYDRO)	3AS3W1_G	3AS3W1_G
Source DBKEY	M6884	M6884
MOD1 DBKEY	UD300	UD300
Latitude (NAD83)	25 51 26	25 51 26
Longitude (NAD83)	80 46 17	80 46 17
FL State Planar X Coordinate	731346.66	731346.66
FL State Planar Y Coordinate	553896.56	553896.56
Land-surface elevation (feet NGVD29) (dm_location)	7.33	7.33
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.4	8.4
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	4.6	4.6
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	14.49	14.48
Strata (feet bls) (DBHYDRO)	26.4	26.4
Recorder	CR10	CR10

Table 20 Site information obtained for Station 10: 3AS3W1_GW

Analysis: The reference elevation from the 2007 survey is 0.01 ft less than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 6.1 ft above land surface, which is consistent with the well casing shown in a photograph of the site (see station 9: 3AS3W1_GP). The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. The photograph also shows the well surrounded by water. The site information is consistent, and appears to be accurate. No revisions were required.

4.10.2 Data analysis and revision

The period of record analyzed for well 3AS3W1_GW extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,975 observations with no outliers and no missing values. The summary statistics for this well are provided in table 21.

Problem: The reference elevation from the 2007 survey is 0.01 ft less than the initial reference elevation.

Analysis: A correction factor of 0.01 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from well 3AS3W1_GW coincide with peaks and declines in water-level data from nearby wells (3AS3W2_GW, 3AS3W3_GW, and 3AS3W4_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3AS3W1_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.097	8.087
Mean (feet NGVD29)	9.695	9.685
Median (feet NGVD29)	9.669	9.659
Maximum (feet NGVD29)	11.283	11.273
Standard deviation	0.694	0.694
Variance	0.482	0.482
Outliers	0	0
Missing values	0	0

Table 21 Summary statistics of time-series data for Station 10: 3AS3W1_GW

4.11 Station 11: 3AS3W1_H

3AS3W1_H is a stilling well located in Miami-Dade County (figs. 1 and 3). 3AS3W1_H is one of three stations at the site (3AS3W1), which also includes wells 3AS3W1_GP and 3AS3W1_GW.

4.11.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W1_H	3AS3W1_H
Station (DBHYDRO)	3AS3W1_H	3AS3W1_H
Source DBKEY	M6883	M6883
MOD1 DBKEY		
Latitude (NAD83)	25 51 26	25 51 26
Longitude (NAD83)	80 46 17	80 46 17
FL State Planar X Coordinate	731346.66	731346.66
FL State Planar Y Coordinate	553896.56	553896.56
Land-surface elevation (feet NGVD29) (dm_location)	7.33	7.33
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.4	8.4
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	4.6	4.6
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	16.18	16.15
Strata (feet bls) (DBHYDRO)	0	0
Recorder	CR10	CR10

Table 22 Site information obtained for Station 11: 3AS3W1_H

Analysis: The reference elevation from the 2007 survey is 0.03 ft less than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 7.75 ft above land surface. In a photograph of the site (see station 9: 3AS3W1_GP), the top of the casing appears to be elevated above land surface, probably to allow access during high water. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. The photograph also shows the well surrounded by water. The site information is consistent, and appears to be accurate. No revisions were required.

4.11.2 Data analysis and revision

The period of record analyzed for station 3AS3W1_H extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,975 observations with no outliers and no missing values. The summary statistics for this station are provided in table 23.

Problem: The reference elevation from the 2007 survey is 0.03 ft less than the initial reference elevation.

Analysis: A correction factor of 0.03 ft was subtracted from the time-series data.

Summary: The peaks and declines in water-level data from station 3AS3W1_H coincide with peaks and declines in water-level data from nearby wells (3AN1W1_H, 3AS3W1_GW, and 3BS1W1_H) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3AS3W1_H probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.065	8.035
Mean (feet NGVD29)	9.676	9.646
Median (feet NGVD29)	9.659	9.629
Maximum (feet NGVD29)	11.246	11.216
Standard deviation	0.704	0.704
Variance	0.495	0.495
Outliers	0	0
Missing values	0	0

Table 23 Summary statistics of time-series data for Station 11: 3AS3W1_H

4.12 Station 12: 3AS3W2_GP

3AS3W2_GP is an 8.5-ft deep well located in Miami-Dade County (figs. 1 and 4). 3AS3W2_GP is the one of two wells at the site (3AS3W2), which also includes 3AS3W2_GW.

4.12.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W2_GP	3AS3W2_GP
Station (DBHYDRO)	3AS3W2_G	3AS3W2_G
Source DBKEY	PT036	PT036
MOD1 DBKEY	UD361	UD361
Latitude (NAD83)	25 51 26	25 51 26
Longitude (NAD83)	80 46 04	80 46 04
FL State Planar X Coordinate	732508	732508
FL State Planar Y Coordinate	553815	553815
Land-surface elevation (feet NGVD29) (dm_location)	7.97	7.97
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.1	8.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	4.8	4.8
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	15.990	16.00
Strata (feet bls) (DBHYDRO)	8.5	8.5
Recorder	CR10	CR10

Table 24 Site information obtained for Station 12: 3AS3W2_GP

Analysis: The reference elevation from the 2007 survey is 0.01 ft higher than the initial reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 8.0 ft above land surface, which is consistent with the casing height shown in a photograph (below). The minimum water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. The photograph also shows the well surrounded by water, which is common in wetlands in WCA3. The site information is consistent, and appears to be accurate. No revisions were required.

3AS3W2_G

4.12.2 Data analysis and revision

The period of record analyzed for well 3AS3W2_GP extends from July 30, 2003 through June 30, 2008 (Appendix A). The time-series data from that period contain 1,798 observations with no outliers and 86 missing values. The summary statistics for this well are provided in table 25.

Problem: The time-series data from well 3AS3W2_GP contain 86 missing values coded as M.

Analysis: Thirty-six of the missing values occurred in 2003 and nine occurred from December 23 – 31, 2006. These missing value were estimated using regression analysis as part of the previous QA/QC project. Missing values also occurred from January 1 through February 10, 2007, but have not been estimated. The missing values probably are related to equipment issues, as the tree island sites are in remote locations.

Problem: The reference elevation from the 2007 survey is 0.01 ft higher than the initial reference elevation.

Analysis: A correction factor of 0.01 ft was added from the time-series data.

Summary: The peaks and declines in water-level data from well 3AS3W2_GP coincide with peaks and declines in water-level data from nearby wells (3AS3W1_GP, 3AS3W3_GP, and 3AS3W4_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3AS3W2_GP probably are valid data that accurately represent hydrologic conditions at the site. No other revisions were required, other than applying the correction factor.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.235	8.245
Mean (feet NGVD29)	9.668	9.701
Median (feet NGVD29)	9.552	9.592
Maximum (feet NGVD29)	11.240	11.287
Standard deviation	0.734	0.744
Variance	0.539	0.554
Outliers	0	0
Missing values	86	41

Table 25 Summary statistics of time-series data for Station 12: 3AS3W2_GP

4.13 Station 13: 3AS3W2_GW

3AS3W2_GW is a 25-ft deep well located in Miami-Dade County (figs. 1 and 4). 3AS3W2_GW is the one of two wells at the site (3AS3W2), which also includes an 8.5-ft deep well 3AS3W2_GP.

4.13.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W2_GW	3AS3W2_GW
Station (DBHYDRO)	3AS3W2_G	3AS3W2_G
Source DBKEY	M6885	M6885
MOD1 DBKEY	UD360	UD360
Latitude (NAD83)	25 51 26	25 51 26
Longitude (NAD83)	80 46 04	80 46 04
FL State Planar X Coordinate	732508	732508
FL State Planar Y Coordinate	553815	553815
Land-surface elevation (feet NGVD29) (dm_location)	7.97	7.97
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.1	8.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	4.8	4.8
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	15.975	16.01
Strata (feet bls) (DBHYDRO)	25	25
Recorder	CR10	CR10

Table 26 Site information obtained for Station 13: 3AS3W2_GW

Analysis: The reference elevation from the 2007 survey is 0.035 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 8.0 ft above land surface, which is

consistent with the casing height shown in a photograph of the site (see station 12: 3AS3W2_GP). The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. The photograph also shows the well surrounded by water, which is not unexpected for sites located in wetlands in WCA3. The site information is consistent, and appears to be accurate. No revisions were required.

4.13.2 Data analysis and revision

The period of record analyzed for well 3AS3W2_GW extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data from that period contain 2,975 observations with no outliers and 26 missing values, which were estimated as part of the previous QA/QC project. The summary statistics for this well are provided in table 27.

Problem: The reference elevation from the 2007 survey is 0.035 ft higher than the initial reference elevation.

Analysis: A correction factor of 0.035 ft was added from the time-series data.

Summary: The peaks and declines in water-level data from well 3AS3W2_GW coincide with peaks and declines in water-level data from nearby wells (3AS3W1_GW, 3AS3W3_GW, and 3AS3W4_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. Therefore, the time-series data from well 3AS3W2_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.051	8.086
Mean (feet NGVD29)	9.639	9.686
Median (feet NGVD29)	9.639	9.684
Maximum (feet NGVD29)	11.224	11.259
Standard deviation	0.693	0.701
Variance	0.480	0.491
Outliers	0	0
Missing values	26	0

Table 27 Summary statistics of time-series data for Station 13: 3AS3W2_GW

4.14 Station 14: 3AS3W3_GP

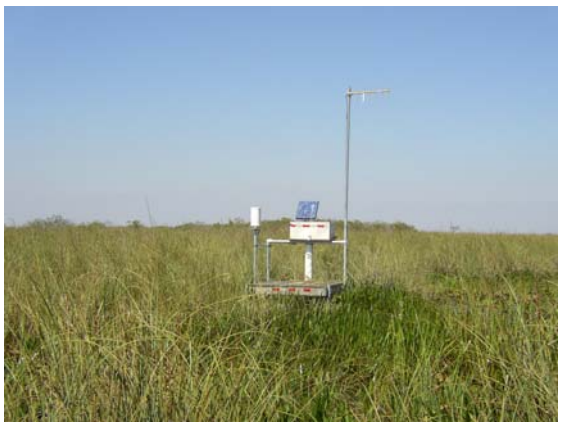
3AS3W3_G is an 8.5-ft deep well located in Miami-Dade County (figs. 1 and 4). 3AS3W3_GP is one of two wells at the site (3AS3W3), which also includes 3AS3W3_GW.

4.14.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W3_GP	3AS3W3_GP
Station (DBHYDRO)	3AS3W3_G	3AS3W3_G
Source DBKEY	PT037	PT037
MOD1 DBKEY	UD312	UD312
Latitude (NAD83)	25 51 12	25 51 12
Longitude (NAD83)	80 46 09	80 46 09
FL State Planar X Coordinate	732097.39	732097.39
FL State Planar Y Coordinate	552418.02	552418.02
Land-surface elevation (feet NGVD29) (dm_location)	7.9	7.9
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	3.3	3.3
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	16.13	16.20
Strata (feet bls) (DBHYDRO)	8.5	8.5
Recorder	CR10	CR10

Table 28 Site information obtained for Station 16: 3AS3W3_G

Analysis: The reference elevation from the 2007 survey is 0.07 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends 7.3 ft above land surface, which is consistent with the casing height shown in a photograph of the site (below). The median water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. Inundation of the site is not unexpected due to its location in wetlands in WCA3. The site information is consistent, and appears to be accurate. No revisions were required.



Site 3AS3W3_G

4.14.2 Data analysis and revision

The period of record analyzed for well 3AS3W3_GP extends from July 31, 2003 through June 30, 2008 (Appendix A). The time-series data from that period contain 1,797 observations with no outliers and 50 missing values, 9 of which were estimated as part of the previous QA/QC project. The summary statistics for this well are provided in table 29.

Problem: The time-series data from well 3AS3W3_GP contain 41 missing values coded as M.

Analysis: Missing values occurred from January 1 through February 10, 2007, and probably result from equipment issues. The missing values were not estimated as part of this project.

Problem: The new reference elevation from the 2007 survey is 0.07 ft higher than the original reference elevation.

Analysis: A correction factor of 0.07 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3AS3W3_GP coincide with peaks and declines in water-level data from nearby wells (3AS3W1_GP, 3AS3W2_GP, and 3AS3W4_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3AS3W3_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.138	8.208
Mean (feet NGVD29)	9.662	9.733
Median (feet NGVD29)	9.557	9.637
Maximum (feet NGVD29)	11.193	11.263
Standard deviation	0.741	0.739
Variance	0.549	0.546
Outliers	0	0
Missing values	50	41

Table 29 Summary statistics of time-series data for Station 14: 3AS3W3_GP

4.15 Station 15: 3AS3W3_GW

3AS3W3_GW is a 28.6-ft deep well located in Miami-Dade County (figs. 1 and 4). 3AS3W3_GW is one of two wells at the site (3AS3W3), which also includes 3AS3W3_GP.

4.15.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W3_GW	3AS3W3_GW
Station (DBHYDRO)	3AS3W3_G	3AS3W3_G
Source DBKEY	M6887	M6887
MOD1 DBKEY	UD301	UD301
Latitude (NAD83)	25 51 12	25 51 12
Longitude (NAD83)	80 46 09	80 46 09
FL State Planar X Coordinate	732097.39	732097.39
FL State Planar Y Coordinate	552418.02	552418.02
Land-surface elevation (feet NGVD29) (dm_location)	7.9	7.9
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	3.3	3.3
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	16.14	16.21
Strata (feet bls) (DBHYDRO)	28.6	28.6
Recorder	CR10	CR10

Table 30 Site information obtained for Station 15: 3AS3W3_GW

Analysis: The reference elevation from the 2007 survey is 0.07 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends 8.2 ft above land surface, which is consistent with the casing height shown in a photograph of the site (see station 16: 3AS3W3_G). The

minimum water level is higher than the land-surface elevation, indicating that the land is inundated with water most of the time. Inundation is not unexpected as the site is located in wetlands in WCA3. The site information is consistent, and appears to be accurate. No revisions were required.

4.15.2 Data analysis and revision

The period of record analyzed for well 3AS3W3_GW extends from May 9, 2000 to June 30, 2008 (Appendix A). The time-series data for that period contain 2,975 observations with no outliers and 50 missing values, of which 9 were estimated as part of the previous QA/QC project. The summary statistics for well 3AS3W3_GW are provided in table 31.

Problem: The time-series data from well 3AS3W3_GW contain 41 missing values coded as M.

Analysis: Missing values occurred from January 1 through February 10, 2007, and probably result from equipment issues. The missing values were not estimated as part of this project.

Problem: The new reference elevation from the 2007 survey is 0.07 ft higher than the original reference elevation.

Analysis: A correction factor of 0.07 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3AS3W3_GW coincide with peaks and declines in water-level data from nearby wells (3AS3W1_GW, 3AS3W2_GW, and 3AS3W4_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3AS3W3_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.007	8.077
Mean (feet NGVD29)	9.615	9.686
Median (feet NGVD29)	9.601	9.672
Maximum (feet NGVD29)	11.196	11.266
Standard deviation	0.705	0.704
Variance	0.497	0.495
Outliers	0	0
Missing values	50	41

Table 31 Summary statistics of time-series data for Station 15: 3AS3W3_GW

4.16 Station 16: 3AS3W4_GP

3AS3W4_G is a 10.7-ft deep well located in Miami-Dade County (figs. 1 and 4). 3AS3W4_GP is one of two wells at the site (3AS3W4), which also includes 3AS3W4_GW.

4.16.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W4_GP	3AS3W4_GP
Station (DBHYDRO)	3AS3W4_G	3AS3W4_G
Source DBKEY	PT038	PT038
MOD1 DBKEY	UD313	UD313
Latitude (NAD83)	25 51 24	25 51 24
Longitude (NAD83)	80 46 10	80 46 10
FL State Planar X Coordinate	731945.46	731945.46
FL State Planar Y Coordinate	553625.92	553625.92
Land-surface elevation (feet NGVD29) (dm_location)	11.74	11.74
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.3	10.3
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.2	6.2
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	15.682	15.75
Strata (feet bls) (DBHYDRO)	10.7	10.7
Recorder	CR10	CR10

Table 32 Site information obtained for Station 16: 3AS3W4_GP

Analysis: The reference elevation from the 2007 survey is 0.068 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 5.5 ft above land surface, which is consistent with the photograph below.

The maximum water level in the well is higher than the land-surface elevation, indicating the site is periodically inundated with water. Occasional inundation is not unexpected for site located on tree islands. A walkway was installed next to the well (see photograph), probably to allow access to the site during high water. No revisions were necessary.

Site 3AS3W4_G

4.16.2 Data analysis and revision

The period of record analyzed for well 3AS3W4_GP extends from July 30, 2003 through June 30, 2008 (Appendix A). The time-series data for that period contain 1,798 observations with no outliers and 43 missing values, of which 2 were estimated as part of the previous QA/QC project. The summary statistics for well 3AS3W4_GP are provided in table 33.

Problem: The time-series data from well 3AS3W4_GP contain 41 missing values coded as M.

Analysis: Missing values occurred from January 1 through February 10, 2007, and probably result from equipment issues. The missing values were not estimated as part of this project.

Problem: The new reference elevation from the 2007 survey is 0.068 ft higher than the original reference elevation.

Analysis: A correction factor of 0.068 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3AS3W4_GP coincide with peaks and declines in water-level data from nearby wells (3AS3W1_GP,

3AS3W2_GP, and 3AS3W3_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3AS3W4_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	8.169	8.237
Mean (feet NGVD29)	9.679	9.747
Median (feet NGVD29)	9.614	9.682
Maximum (feet NGVD29)	11.155	11.223
Standard deviation	0.735	0.735
Variance	0.540	0.540
Outliers	0	0
Missing values	43	41

Table 33 Summary statistics of time-series data for Station 16: 3AS3W4_GP

4.17 Station 17: 3AS3W4_GW

3AS3W4_GW is a 30-ft deep well located in Miami-Dade County (figs. 1 and 4). 3AS3W4_GW is one of two wells at the site (3AS3W4), which also includes well 3AS3W4_GP.

4.17.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W4_GW	3AS3W4_GW
Station (DBHYDRO)	3AS3W4_G	3AS3W4_G
DBKEY	M6886	M6886
MOD1 DBKEY	UD299	UD299
Latitude (NAD83)	25 51 24	25 51 24
Longitude (NAD83)	80 46 10	80 46 10
FL State Planar X Coordinate	731945.46	731945.46
FL State Planar Y Coordinate	553625.92	553625.92
Land-surface elevation (feet NGVD29) (dm_location)	11.74	11.74
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.3	10.3
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.2	6.2
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	15.682	15.75
Strata (feet bls) (DBHYDRO)	30	30
Recorder	CR10	CR10

Table 34 Site information obtained for Station 17: 3AS3W4_GW

Analysis: The reference elevation from the 2007 survey is 0.068 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 5.5 ft above land surface, which is consistent with a photograph (see Station 16: 3AS3W4_GP).

The maximum water level in the well is higher than the land-surface elevation, indicating the site is periodically inundated with water. A walkway was installed next to the well (see photograph), probably to allow access to the site during high water. No revisions were necessary.

4.17.2 Data analysis and revision

The period of record analyzed for well 3AS3W4_GW extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data for that period contain 2,975 observations with no outliers and 58 missing values, all of which were estimated as part

of the previous QA/QC project. The summary statistics for well 3AS3W4_GW are provided in table 35.

Problem: The new reference elevation from the 2007 survey is 0.068 ft higher than the original reference elevation.

Analysis: A correction factor of 0.068 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3AS3W4_GW coincide with peaks and declines in water-level data from nearby wells (3AS3W1_GW, 3AS3W2_GW, and 3AS3W3_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3AS3W4_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	7.998	8.066
Mean (feet NGVD29)	9.629	9.707
Median (feet NGVD29)	9.591	9.685
Maximum (feet NGVD29)	11.210	11.278
Standard deviation	0.699	0.696
Variance	0.489	0.484
Outliers	0	0
Missing values	58	0

Table 35 Summary statistics of time-series data for Station 17: 3AS3W4_GW

4.18 Station 18: 3BS1W1_GP

3BS1W1_G is a 15-ft deep well located in Miami-Dade County (figs. 1 and 5). 3BS1W1_GP is one of three stations at the site (3BS1W1), which also includes 3BS1W1_GW and 3BS1W1_H.

4.18.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W1_GP	3BS1W1_GP
Station (DBHYDRO)	3BS1W1_G	3BS1W1_G
DBKEY	PT039	PT039
MOD1 DBKEY	UD307	UD307
Latitude (NAD83)	25 46 49	25 46 49
Longitude (NAD83)	80 30 41	80 30 41
FL State Planar X Coordinate	816927.98	816927.98
FL State Planar Y Coordinate	526166.98	526166.98
Land-surface elevation (feet NGVD29) (dm_location)	4.45	4.45
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	5.4	5.4
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	2.8	2.8
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.13	12.21
Strata (feet bls) (DBHYDRO)	15	15
Recorder	CR10	CR10

Table 36 Site information obtained for Station 18: 3BS1W1_GP

Analysis: The reference elevation from the 2007 survey is 0.08 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 6.8 ft above land surface. A photograph (below) confirms the casing height. The median water level in the well is higher than the land-surface elevation, indicating that the site is inundated most of the time. The photograph shows the site is surrounded by water, which is not unexpected for a location in the wetlands of WCA3. Overall, the site information for the station was accurate, and no revisions were necessary.

3BS1W1_G

4.18.2 Data analysis and revision

The period of record analyzed for well 3BS1W1_GP extends from July 19, 2003 through June 30, 2008 (Appendix A). The time-series data for that period contain 1,809 observations with no outliers and no missing values. The summary statistics for well 3BS1W1_GP are provided in table 37.

Problem: The new reference elevation from the 2007 survey is 0.08 ft higher than the original reference elevation.

Analysis: A correction factor of 0.08 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3BS1W1_GP coincide with peaks and declines in water-level data from nearby wells (3BS1W2_GP, 3BS1W3_GP, and 3BS1W4_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W1_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	4.611	4.691
Mean (feet NGVD29)	6.562	6.642
Median (feet NGVD29)	6.638	6.718
Maximum (feet NGVD29)	8.327	8.407
Standard deviation	0.875	0.875
Variance	0.765	0.765
Outliers	0	0
Missing values	0	0

Table 37 Summary statistics of time-series data for Station 18: 3BS1W1_GP

4.19 Station 19: 3BS1W1_GW

3BS1W1_GW is a 34-ft deep well located in Miami-Dade County (figs. 1 and 5). 3BS1W1_GW is one of three stations at the site (3BS1W1), which also includes 3BS1W1_GP and 3BS1W1_H.

4.19.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W1_GW	3BS1W1_GW
Station (DBHYDRO)	3BS1W1_G	3BS1W1_G
Source DBKEY	M6890	M6890
MOD1 DBKEY	UD295	UD295
Latitude (NAD83)	25 46 49	25 46 49
Longitude (NAD83)	80 30 41	80 30 41
FL State Planar X Coordinate	816927.98	816927.98
FL State Planar Y Coordinate	526166.98	526166.98
Land-surface elevation (feet NGVD29) (dm_location)	4.45	4.45
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	5.4	5.4
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	2.8	2.8
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.15	12.22
Strata (feet bls) (DBHYDRO)	34	34
Recorder	CR10	CR10

Table 38 Site information obtained for Station 19: 3BS1W1_GW

Analysis: The reference elevation from the 2007 survey is 0.07 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 6.8 ft above land surface. A photograph (see station 18: 3BS1W1_GP) confirms the casing height. The median water level in the well

is higher than the land-surface elevation, which is consistent with its location with WCA3. The photograph shows the site is surrounded by water. Overall, the site information for the well is accurate. No revisions were necessary.

4.19.2 Data analysis and revision

The period of record analyzed for well 3BS1W1_GW extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data for that period contain 2,975 observations with 2 outliers and no missing values. The summary statistics for well 3BS1W1_GW are provided in table 39.

Problem: The time-series data from well 3BS1W1_GW contain 2 outliers, all of which are less than the lower fence.

Analysis: The outliers occurred in May 2001, after a period of low rainfall. These lower outliers also coincide with declines in water levels in nearby wells drilled to similar depths. The outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The new reference elevation from the 2007 survey is 0.07 ft higher than the original reference elevation.

Analysis: A correction factor of 0.07 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3BS1W1_GW coincide with peaks and declines in water-level data from nearby wells (3BS1W2_GW, 3BS1W3_GW, and 3BS1W4_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W1_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	3.987	4.057
Mean (feet NGVD29)	6.572	6.642
Median (feet NGVD29)	6.635	6.705
Maximum (feet NGVD29)	8.314	8.384
Standard deviation	0.873	0.873
Variance	0.762	0.762
Outliers	2	2
Missing values	0	0

Table 39 Summary statistics of time-series data for Station 19: 3BS1W1_GW

4.20 Station 20: 3BS1W1_H

3BS1W1_H is a stilling well to monitor surface-water stage (figs. 1 and 5). 3BS1W1_H is one of three stations at the site (3BS1W1), which also includes 3BS1W1_GP and 3BS1W1_GW.

4.20.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W1_H	3BS1W1_H
Station (DBHYDRO)	3BS1W1_H	3BS1W1_H
Source DBKEY	M6889	M6889
MOD1 DBKEY		
Latitude (NAD83)	25 46 49	25 46 49
Longitude (NAD83)	80 30 41	80 30 41
FL State Planar X Coordinate	816927.98	816927.98
FL State Planar Y Coordinate	526166.98	526166.98
Land-surface elevation (feet NGVD29) (dm_location)	4.45	4.45
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	5.4	5.4
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	2.8	2.8
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	14.00	14.05
Strata (feet bls) (DBHYDRO)	0	0
Recorder	CR10	CR10

Table 40 Site information obtained for Station 20: 3BS1W1_H

Analysis: The reference elevation from the 2007 survey is 0.05 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 8.6 ft above land surface. A photograph (see station 18: 3BS1W1_GP) confirms the casing height. The minimum water level in the

well is less than the land-surface elevation, indicating that the site is periodically dry. However, the elevation of the well bottom is 4.1 ft above mean sea level (from recorder registration), so water-level data were accurately recorded even during periods when the land surface was dry. Overall, the site information for the well is accurate. No revisions were necessary.

4.20.2 Data analysis and revision

The period of record analyzed for station 3BS1W1_H extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data for that period contain 2,975 observations with no outliers and no missing values. The summary statistics for station 3BS1W1_H are provided in table 41.

Problem: The new reference elevation from the 2007 survey is 0.05 ft higher than the original reference elevation.

Analysis: A correction factor of 0.05 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from station 3BS1W1_H coincide with peaks and declines in water-level data from nearby stations (3BS1W1_GW, 2AN1W1_H, and 3AS3W1_H) (Appendix A). In addition, water levels in the target station decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W1_H probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	4.270	4.320
Mean (feet NGVD29)	6.612	6.662
Median (feet NGVD29)	6.664	6.714
Maximum (feet NGVD29)	8.475	8.525
Standard deviation	0.898	0.898
Variance	0.807	0.807
Outliers	0	0
Missing values	0	0

Table 41 Summary statistics of time-series data for Station 20: 3BS1W1_H

4.21 Station 21: 3BS1W2_GP

3BS1W2_GP is a 13.5-ft deep well located in Miami-Dade County (figs. 1 and 5). 3BS1W2_GP is one of two wells at the site (3BS1W2), which also includes 3BS1W2_GW.

4.21.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W2_GP	3BS1W2_GP
Station (DBHYDRO)	3BS1W2_G	3BS1W2_G
DBKEY	PT040	PT040
MOD1 DBKEY	UD308	UD308
Latitude (NAD83)	25 46 50	25 46 50
Longitude (NAD83)	80 30 25	80 30 25
FL State Planar X Coordinate	818360.43	818360.43
FL State Planar Y Coordinate	526241.98	526241.98
Land-surface elevation (feet NGVD29) (dm_location)	4.45	4.45
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	5.5	5.5
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	3.1	3.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.40	13.49
Strata (feet bls) (DBHYDRO)	13.5	13.5
Recorder	CR10	CR10

Table 42 Site information obtained for Station 21: 3BS1W2_GP

Analysis: The reference elevation from the 2007 survey is 0.09 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends 8 ft above land surface. A photograph (below) confirms the casing height.

The median water level in the well is higher than the land-surface elevation, indicating that the site is inundated most of the time. The photograph shows the site is surrounded by water, which is consistent for a location in WCA3. Overall, the site information for the well is consistent and appears to be accurate. No revisions were necessary.

Site 3BS1W2_G

4.21.2 Data analysis and revision

The period of record analyzed for well 3BS1W2_GP extends from July 23, 2003 through June 30, 2008 (Appendix A). The time-series data for that period contain 1,805 observations with no outliers and 70 missing values, all of which were estimated as part of the previous QA/QC project. The summary statistics for well 3BS1W2_GP are provided in table 43.

Problem: The new reference elevation from the 2007 survey is 0.09 ft higher than the original reference elevation.

Analysis: A correction factor of 0.09 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3BS1W2_GP coincide with peaks and declines in water-level data from nearby wells (3BS1W1_GP, 3BS1W3_GP, and 3BS1W4_G) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W2_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	4.520	4.610
Mean (feet NGVD29)	6.491	6.614
Median (feet NGVD29)	6.569	6.718
Maximum (feet NGVD29)	8.295	8.385
Standard deviation	0.899	0.898
Variance	0.808	0.806
Outliers	0	0
Missing values	70	0

Table 43 Summary statistics of time-series data for Station 21: 3BS1W2_GP

4.22 Station 22: 3BS1W2_GW

3BS1W2_GW is a 30-ft deep well located in Miami-Dade County (figs. 1 and 5). 3BS1W2_GW is one of two wells at the site (3BS1W2), which also includes 3BS1W2_GP.

4.22.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W2_GW	3BS1W2_GW
Station (DBHYDRO)	3BS1W2_G	3BS1W2_G
Source DBKEY	M6891	M6891
MOD1 DBKEY	UD296	UD296
Latitude (NAD83)	25 46 50	25 46 50
Longitude (NAD83)	80 30 26	80 30 26
FL State Planar X Coordinate	818360.43	818360.43
FL State Planar Y Coordinate	526241.98	526241.98
Land-surface elevation (feet NGVD29) (dm_location)	4.45	4.45
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	5.5	5.5
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	3.1	3.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.40	13.49
Strata (feet bls) (DBHYDRO)	30	30
Recorder	CR10	CR10

Table 44 Site information obtained for Station 22: 3BS1W2_GW

Analysis: The reference elevation from the 2007 survey is 0.09 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends 8 ft above land surface. A photograph (see station 21: 3BS1W2_GP) confirms the casing height.

The median water level in the well is higher than the land-surface elevation, indicating that the site is inundated most of the time. The photograph shows the site is surrounded by water, which is consistent with a location in WCA3. Overall, the site information for the well is consistent and appears to be accurate. No revisions were necessary.

4.22.2 Data analysis and revision

The period of record analyzed for well 3BS1W2_GW extends from May 1, 2000 through June 30, 2008 (Appendix A). The time-series data for that period contain 2,983 observations with no outliers and no missing values. The summary statistics for well 3BS1W2_GW are provided in table 45.

Problem: The new reference elevation from the 2007 survey is 0.09 ft higher than the original reference elevation.

Analysis: A correction factor of 0.09 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3BS1W2_G coincide with peaks and declines in water-level data from nearby wells (3BS1W1_G, 3BS1W3_G, and 3BS1W4_G) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W2_G probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	3.922	4.012
Mean (feet NGVD29)	6.507	6.597
Median (feet NGVD29)	6.589	6.679
Maximum (feet NGVD29)	8.302	8.392
Standard deviation	0.905	0.905
Variance	0.820	0.820
Outliers	0	0
Missing values	0	0

Table 45 Summary statistics of time-series data for Station 22: 3BS1W2_GW

4.23 Station 23: 3BS1W3_GP

3BS1W3_GP is a 15-ft deep well located in Miami-Dade County (figs. 1 and 5). 3BS1W3_GP is one of two wells at the site (3BS1W3), which also includes 3BS1W3_GW.

4.23.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W3_GP	3BS1W3_GP
Station (DBHYDRO)	3BS1W3_G	3BS1W3_G
Source DBKEY	PT041	PT041
MOD1 DBKEY	UD309	UD309
Latitude (NAD83)	25 46 27	25 46 27
Longitude (NAD83)	80 30 34	80 30 34
FL State Planar X Coordinate	817560.13	817560.13
FL State Planar Y Coordinate	523914.98	523914.98
Land-surface elevation (feet NGVD29) (dm_location)	4.45	4.45
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	6.2	6.2
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	2.2	2.2
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.35	13.45
Strata (feet bls) (DBHYDRO)	15	15
Recorder	CR10	CR10

Table 46 Site information obtained for Station 23: 3BS1W3_GP

Analysis: The reference elevation from the 2007 survey is 0.10 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 7.25 ft above land surface. A photograph (below) confirms the casing height.

The median water level in the well is higher than the land-surface elevation, indicating that the site is inundated most of the time. The photograph shows the site is surrounded by water, which is consistent with a location in WCA3. The site information is consistent, and probably is correct. Overall, the site information from the well is consistent, and probably is accurate. No revisions were necessary.

3BS1W3_G

4.23.2 Data analysis and revision

The period of record analyzed for well 3BS1W3_GP extends from July 23, 2003 through June 30, 2008 (Appendix A). The time-series data for that period contain 1,805 observations with no outliers and 36 missing values. The summary statistics for well 3BS1W3_GP are provided in table 47.

Problem: The time-series data from well 3BS1W3_GP contain 36 missing values, all of which were coded as M.

Analysis: Missing values occurred from January 10 through February 9, 2007, and from June 26 – 30, 2008. The missing values probably resulted from equipment issues. None of the missing values were estimated as part of this project.

Problem: The new reference elevation from the 2007 survey is 0.10 ft higher than the original reference elevation.

Analysis: A correction factor of 0.10 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3BS1W3_GP coincide with peaks and declines in water-level data from nearby wells (3BS1W1_GP, 3BS1W2_GP, and 3BS1W4_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W3_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required, other than applying the correction factor.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	4.484	4.584
Mean (feet NGVD29)	6.533	6.633
Median (feet NGVD29)	6.646	6.746
Maximum (feet NGVD29)	8.241	8.341
Standard deviation	0.929	0.929
Variance	0.862	0.862
Outliers	0	0
Missing values	36	36

Table 47 Summary statistics of time-series data for Station 23: 3BS1W3_GP

4.24 Station 24: 3BS1W3_GW

3BS1W3_GW is a 28.5-ft deep well located in Miami-Dade County (figs. 1 and 5). 3BS1W3_GW is one of two wells at the site (3BS1W3), which also includes 3BS1W3_GW.

4.24.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W3_GW	3BS1W3_GW
Station (DBHYDRO)	3BS1W3_G	3BS1W3_G
DBKEY	M6892	M6892
MOD1 DBKEY	UD298	UD298
Latitude (NAD83)	25 46 27	25 46 27
Longitude (NAD83)	80 30 34	80 30 34
FL State Planar X Coordinate	817560.13	817560.13
FL State Planar Y Coordinate	523914.98	523914.98
Land-surface elevation (feet NGVD29) (dm_location)	4.45	4.45
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	6.2	6.2
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	2.2	2.2
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.35	13.45
Strata (feet bls) (DBHYDRO)	28.5	28.5
Recorder	CR10	CR10

Table 48 Site information obtained for Station 24: 3BS1W3_GW

Analysis: The reference elevation from the 2007 survey is 0.10 ft higher than the original reference elevation. The difference between the reference and land-surface elevations indicates the casing extends about 7.25 ft above land surface. A photograph (see Station 23: 3BS1W3_GP) confirms the casing height.

The median water level in the well is higher than the land-surface elevation, indicating that the site is inundated most of the time. The photograph shows the site is surrounded by water. The site information is consistent, and probably is correct. Overall, the site information from the well is consistent, and probably is accurate. No revisions were necessary.

4.24.2 Data analysis and revision

The period of record analyzed for well 3BS1W3_GW extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data for that period contain 2,975 observations with 1 outlier and 31 missing values. The summary statistics for well 3BS1W3_GW are provided in table 49.

Problem: The time-series data from well 3BS1W3_GW contain 1 outlier.

Analysis: The outlier, which is less than the lower fence, occurred in May 2001 at the end of the dry season. The outlier coincides with similar declines in water levels in nearby wells, such as 3BS1W2_GW, and, therefore, probably is a valid data point.

Problem: The time-series data from well 3BS1W3_GP contain 31 missing values, all of which are coded as M.

Analysis: Missing values occurred from January 10 through February 9, 2007. 3BS1W3_GP also was missing values during these same dates, so the missing values probably resulted from equipment issues. None of the missing values were estimated as part of this project.

Problem: The new reference elevation from the 2007 survey is 0.10 ft higher than the original reference elevation.

Analysis: A correction factor of 0.10 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3BS1W3_GW coincide with peaks and declines in water-level data from nearby wells (3BS1W1_GW, 3BS1W2_GW, and 3BS1W4_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W3_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required other than applying the correction factor.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	3.957	4.057
Mean (feet NGVD29)	6.518	6.618
Median (feet NGVD29)	6.612	6.712
Maximum (feet NGVD29)	8.318	8.418
Standard deviation	0.899	0.899
Variance	0.808	0.808
Outliers	1	1
Missing values	31	31

Table 49 Summary statistics of time-series data for Station 24: 3BS1W3_GW

4.25 Station 25: 3BS1W4_GP

3BS1W4_GP is a 14-ft deep well located in Miami-Dade County (figs. 1 and 5).3BS1W4_GP is one of two wells at the site (3BS1W4), which also includes 3BS1W4_GW.

4.25.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W4_GP	3BS1W4_GP
Station (DBHYDRO)	3BS1W4_G	3BS1W4_G
Source DBKEY	PT042	PT042
MOD1 DBKEY	UD310	UD310
Latitude (NAD83)	25 46 44	25 46 44
Longitude (NAD83)	80 30 35	80 30 35
FL State Planar X Coordinate	817461.52	817461.52
FL State Planar Y Coordinate	525677.48	525677.48
Land-surface elevation (feet NGVD29) (dm_location)	9.9	9.9
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.1	10.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.73	13.84
Strata (feet bls) (DBHYDRO)	14	14
Recorder	CR10	CR10

Table 50 Site information obtained for Station 25: 3BS1W4_GP

Analysis: The reference elevation from the 2007 survey is 0.11 ft higher than the original survey. The difference between the reference and land-surface elevations indicates the casing extends about 3.7 ft above land surface. A photograph (below) confirms the casing height. The maximum was level is less than the land-surface

elevation, indicating that the site is rarely inundated with water. Rare or occasional inundation is consistent with its location on a tree island. Overall, the site information for the well is consistent, and probably is accurate. No revisions were necessary.

Site 3BS1W4_G

4.25.2 Data analysis and revision

The period of record analyzed for well 3BS1W4_GP extends from July 25, 2003 through June 30, 2008 (Appendix A). The time-series data for that period contain 1,803 observations with no outliers and 30 missing values, all of which were estimated as part of the previous QA/QC project. The summary statistics for well 3BS1W4_GP are provided in table 51.

Problem: The new reference elevation from the 2007 survey is 0.11 ft higher than the original reference elevation.

Analysis: A correction factor of 0.11 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3BS1W4_GP coincide with peaks and declines in water-level data from nearby wells (3BS1W1_GP, 3BS1W2_GP, and 3BS1W3_GP) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W4_GP probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	4.596	4.706
Mean (feet NGVD29)	6.562	6.694
Median (feet NGVD29)	6.634	6.767
Maximum (feet NGVD29)	8.458	8.568
Standard deviation	0.916	0.924
Variance	0.838	0.854
Outliers	0	0
Missing values	30	0

Table 51 Summary statistics of time-series data for Station 25: 3BS1W4_GP

4.26 Station 26: 3BS1W4_GW

3BS1W4_GW is a 34-ft deep well located in Miami-Dade County (figs. 1 and 5).3BS1W4_GW is one of two wells at the site (3BS1W4), which also includes 3BS1W4_GP.

4.26.1 Site and data description

Variable	Original value	Revised value
Station	3BS1W4_GW	3BS1W4_GW
Station (DBHYDRO)	3BS1W4_G	3BS1W4_G
Source DBKEY	M6893	M6893
MOD1 DBKEY	UD297	UD297
Latitude (NAD83)	25 46 44	25 46 44
Longitude (NAD83)	80 30 35	80 30 35
FL State Planar X Coordinate	817461.52	817461.52
FL State Planar Y Coordinate	525677.48	525677.48
Land-surface elevation (feet NGVD29) (dm_location)	9.9	9.9
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	10.1	10.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.725	13.84
Strata (feet bls) (DBHYDRO)	34	34
Recorder	CR10	CR10

Table 52 Site information obtained for Station 26: 3BS1W4_GW

Analysis: The reference elevation from the 2007 survey is 0.095 ft higher than the original survey. The difference between the reference and land-surface elevations indicates the casing extends about 3.7 ft above land surface. A photograph (see Station 26: 3BS1W4_GP) confirms the casing height. The maximum was level is less than the

land-surface elevation, indicating that the site is rarely inundated with water. Occasional or rare inundation is consistent with the well's location on a tree island. Overall, the site information for the well is consistent, and probably is accurate. No revisions were necessary.

4.26.2 Data analysis and revision

The period of record analyzed for well 3BS1W4_GW extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data for that period contain 2,975 observations with 3 outliers and 51 missing values, all of which were estimated as part of the previous QA/QC project. The summary statistics for well 3BS1W4_GW are provided in table 53.

Problem: The time-series data from well 3BS1W4_GW contain 3 outliers, all of which were less than the lower fence.

Analysis: The outliers occurred in May 2001, at the end of the dry season, and closely coincide with similar declines in nearby wells, such as 3BS1W1_GW. The outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The new reference elevation from the 2007 survey is 0.095 ft higher than the original reference elevation.

Analysis: A correction factor of 0.095 ft was added to the time-series data from this station.

Summary: The peaks and declines in water-level data from well 3BS1W4_GW coincide with peaks and declines in water-level data from nearby wells (3BS1W1_GW, 3BS1W2_GW, and 3BS1W3_GW) drilled to similar depths (Appendix A). In addition, water levels in the target well decline as expected during periods of low rainfall, and increase as expected during periods of excessive rainfall recorded by nearby rain gages. The time-series data from well 3BS1W4_GW probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required other than applying the correction factor to the time-series data.

Statistics	Original series	Revised series
Minimum (feet NGVD29)	3.995	4.090
Mean (feet NGVD29)	6.550	6.663
Median (feet NGVD29)	6.633	6.741
Maximum (feet NGVD29)	8.299	8.394
Standard deviation	0.874	0.877
Variance	0.764	0.770
Outliers	3	3
Missing values	51	0

Table 53 Summary statistics of time-series data for Station 26: 3BS1W4_GW

4.27 Station 27: 3AS3W3_R

3AS3W3_R is a rain station located at the same location as well 3AS3W3_GP and 3AS3W3_GW (figs. 1 and 4). The site information for this station is consistent with the site information for the two wells, and, therefore, probably is correct.

4.27.1 Site and data description

Variable	Original value	Revised value
Station	3AS3W3_R	3AS3W3_R
Station (DBHYDRO)	3AS3W3_R	3AS3W3_R
Source DBKEY	M6888	M6888
MOD1 DBKEY		
Latitude (NAD83)	25 51 12	25 51 12
Longitude (NAD83)	80 46 09	80 46 09
FL State Planar X Coordinate	732097.391	732097.391
FL State Planar Y Coordinate	552418.016	552418.016
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	3.3	3.3
Recorder	CR10	CR10

Table 54 Site information obtained for Station 27: 3AS3W3_R

4.27.2 Data analysis and revision

The period of record analyzed for station 3AS3W3_R extends from May 9, 2000 through June 30, 2008 (Appendix A). The time-series data for that period contain 2,975 observations with 587 outliers and 100 missing values. The summary statistics for station 3AS3W3_R are provided in table 55.

Problem: The time-series data contain 587 outliers.

Analysis: The median value for the time-series data is 0, which indicates that no precipitation occurred during at least half the period of record. Therefore, days with even

slight precipitation (greater than 0.07 inch) are statistical outliers, but valid data. Daily precipitation of 1 inch or more occurred on 112 days. These excessive rainfalls were recorded at one to three nearby stations (3A-SW_R, S12D_R, and S140W) on 82 (73 percent) of those days, indicating that the data from 3AS3W3_R closely coincide with nearby stations.

Problem: The time-series data from station 3AS3W3_R contain 100 missing values.

Analysis: Missing values occurred from October 4 – 30, 2000, July 26 and 27, 2001, July 2 – 13, 2002, June 20 – 22 and July 5 and 6, 2004, September 10 – 14, 2004, and December 23, 2006 through February 9, 2007. These gaps probably result from equipment issues. Wells 3AS3W3_GP and 3AS3W3_GW also were missing values from December 23, 2006 through February 9, 2007, which could indicate a problem with the data logger or power source. None of the missing values were estimated as part of this project.

Summary: The precipitation recorded at 3AS3W3_R coincides with precipitation data from nearby wells (3A-SW_R, S12D_R, and S140W), particularly with excessive rainfall of 1 inch or more (Appendix A). In addition, periods of low rainfall also coincide with dry periods recorded at nearby stations. The time-series data from 3AS3W3_R probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics	Original series	Revised series
Minimum (inches)	0.000	0.000
Mean (inches)	0.131	0.131
Median (inches)	0.000	0.000
Maximum (inches)	3.720	3.720
Standard deviation	0.389	0.389
Variance	0.151	0.151
Outliers	587	587
Missing values	100	100

Table 55 Summary statistics of time-series data for Station 27: 3AS3W3_R

4.28 Station 28: 3AS3WX

3AS3WX is a weather station operated at the 3AS3 Tree Island (figs. 1 and 4). Data collected there include minimum, maximum, and means for air temperature, barometric pressure, evapotranspiration potential (ETP), humidity, solar radiation, rainfall, and wind speed and wind gusts. Most of the data collection began in April 2000, with the exception of rainfall, which began on October 1, 2007. A preferred data set exists for the ETP data, which does not need to be reviewed as part of this project. However, none of the other weather data have been previously submitted to extensive QA/QC. For this project, the mean daily values of air temperature, barometric pressure, humidity, and wind speed were reviewed for quality control. The rainfall data from this station were not reviewed because of the brief period of record and the availability of data from 3AS3W3_R.

4.28.1 Site and data description

Variable	Original value	Revised value
Station	3AS3WX	3AS3WX
Latitude (NAD83)	25 51 06	25 51 06
Longitude (NAD83)	80 45 59	80 45 59
FL State Planar X Coordinate	733034.259	733034.259
FL State Planar Y Coordinate	551868.573	551868.573
Air Temperature DBKEY	LA373	LA373
Barometric pressure DBKEY	LA374	LA374
ETP DBKEY (PREF)	OH515	OH515
Humidity DBKEY	LA372	LA372
Photosynthetic radiation DBKEY	LA368	LA368
Wind Speed DBKEY	LA364	LA364
Recorder	CR10	CR10

Table 56 Site information obtained for Station 28: 3AS3WX

Analysis: The site information is consistent with other stations at 3AS3. Therefore, the location of the weather station probably is correct, and no revisions are necessary.

4.28.2 Air Temperature (LA373)

The period of record analyzed for air temperature from station 3AS3WX extends from April 4, 2000 through June 30, 2008 (Appendix A). The time-series data contain 3,010 observations with 58 outliers and 523 missing values. All four sets of time-series data contain large periods of missing values extending from October 25, 2005 through March 4, 2007. A shorter period of missing values also occurred from October 5 – 31, 2000 in all four DBKEYs. The missing values were not estimated as part of this project. The summary statistics for air temperature from station 3AS3WX are provided in table 57.

Problem: The air-temperature data from 3AS3WX contain 58 outliers, all of which are less than the lower fence.

Analysis: The outliers generally occurred from late December through early February of each year of record. These outliers are consistent with low air temperature values recorded at two nearby stations. For example, the minimum air temperature from 3AS3WX of 7.25 degrees Celsius (^{o} C) was recorded on January 24, 2003. The two nearby stations S140W and S331W recorded 6.08 and 8.18^{o} C on that same date. Therefore, the outliers probably are valid data that accurately represent conditions at the site.

Summary: The peaks and declines in air-temperature data from 3AS3WX closely coincide with peaks and declines in air-temperature data from nearby stations (S140W and S331W) (Appendix A). In addition, the data indicate the air temperatures peak in summer and decline in late fall and early winter as expected. The air temperature data

from 3AS3WX appear to be valid data that accurately represent conditions at the site. No revisions were required.

Statistics	Original series	Revised series
Minimum (^{o}C)	7.250	7.250
Mean (^{o}C)	23.885	23.885
Median (^{o}C)	24.649	24.649
Maximum (^{o}C)	30.051	30.051
Standard deviation	3.966	3.966
Variance	15.731	15.731
Outliers	58	58
Missing values	523	523

Table 57 Summary statistics for air-temperature data from Station 28: 3AS3WX

4.28.3 Barometric Pressure (LA374)

The period of record analyzed for barometric (air) pressure from station 3AS3WX extends from April 4, 2000 through June 30, 2008 (Appendix A). The time-series data contain 3,010 observations with 50 outliers and 523 missing values. As with air temperature, missing values occurred from October 25, 2005 through March 4, 2007, and from October 5 – 31, 2000. The missing values were not estimated as part of this project. The summary statistics for barometric pressure from station 3AS3WX are provided in table 58.

Problem: The barometric-pressure data from 3AS3WX contain 50 outliers.

Analysis: A total of 25 outliers were less than the lower fence of 756.12 and 25 outliers exceeded the upper fence of 769.5 millimeters (mm). The lower and upper outliers coincide with low and high values recorded by two nearby stations. For example, the maximum value of 773.77 mm occurred on January 3, 2008. Data from stations S140W and S331W also show barometric pressures exceeded 773 mm on that date. The minimum value of 747.83 recorded on October 24, 2005 coincides with values of 746.54 and 746.04 mm, respectively, at stations S140W and S331W. In addition, these low barometric pressures coincide with heavy rainfalls that occurred on that date. 3AS3W3_R, 3A-SW_R, and S140W recorded rainfalls of 1.86, 2.72, and 4.98 inches of rain, respectively, on October 24, 2005. Barometric pressures less than 750 mm also occurred on September 5 and 26, 2004. Precipitation on those two dates also exceeded 1 inch at one or more rain stations. The outliers probably are valid data that accurately represent conditions at the site.

Summary: The peaks and declines in barometric-pressure data from 3AS3WX closely coincide with peaks and declines in barometric-pressure data from nearby stations (S140W and S331W) (Appendix A). In addition, low barometric pressures coincide with heavy rainfalls. The barometric-pressure data from 3AS3WX appear to be valid data that accurately represent conditions at the site. No revisions were required.

Statistics	Original series	Revised series
Minimum (mm)	747.833	747.833
Mean (mm)	762.794	762.794
Median (mm)	762.766	762.766
Maximum (mm)	773.770	773.770
Standard deviation	2.713	2.713
Variance	7.361	7.361
Outliers	50	50
Missing values	523	523

Table 58 Summary statistics for barometric-pressure data from Station 28: 3AS3WX

4.28.4 Humidity (LA372)

The period of record analyzed for humidity from station 3AS3WX extends from April 4, 2000 through June 30, 2008 (Appendix A). The time-series data contain 3,010 observations with 39 outliers and 528 missing values. As with air temperature, missing values occurred from October 25, 2005 through March 4, 2007, and from October 5 – 31, 2000. The missing values were not estimated as part of this project. The summary statistics for humidity from station 3AS3WX are provided in table 59.

Problem: The humidity data from 3AS3WX contain 39 outliers.

Analysis: A total of 31 outliers were less than the lower fence of 60.26 percent and 8 outliers exceeded the upper fence of 94.41 percent. The lower and upper outliers coincide with low and high values recorded by two nearby stations. For example, the maximum value of 95.45 percent occurred on April 14, 2000. Data from stations S140W and S331W also show humidity exceeded 95 percent on that date. The minimum value of 48.84 recorded on January 2, 2008 coincides with values of 46.29 and 49.07 percent, respectively, at stations S140W and S331W. The outliers probably are valid data that accurately represent conditions at the site.

Summary: The peaks and declines in humidity data from 3AS3WX closely coincide with peaks and declines in humidity data from nearby stations (S140W and S331W) (Appendix A). The humidity data from 3AS3WX appear to be valid data that accurately represent conditions at the site. No revisions were required.

Statistics	Original series	Revised series
Minimum (percent)	48.842	48.842
Mean (percent)	76.210	76.210
Median (percent)	76.415	76.415
Maximum (percent)	95.465	95.465
Standard deviation	6.249	6.249
Variance	39.051	39.051
Outliers	39	39
Missing values	528	528

Table 59 Summary statistics for humidity data from Station 28: 3AS3WX

4.28.5 Wind Speed (LA364)

The period of record analyzed for wind speed from station 3AS3WX extends from April 4, 2000 through June 30, 2008 (Appendix A). The time-series data contain 3,010 observations with 53 outliers and 529 missing values. As with air temperature, missing values occurred from October 25, 2005 through March 4, 2007, and from October 5 – 31, 2000. The missing values were not estimated as part of this project. The summary statistics for wind speed from station 3AS3WX are provided in table 60.

Problem: The wind-speed data from 3AS3WX contain 53 outliers, all of which exceeded the upper fence of 14.9 miles per hour (mph).

Analysis: The wind-speed data from 3AS3WX is strongly correlated to data from nearby sites such as S331W (R^2=0.80; fig. 7). However, the wind speed is consistently higher at 3AS3WX compared to wind speed at S331W. The difference probably results different equipment or different conditions at the two sites. The outliers probably are valid data that accurately represent conditions at the site.

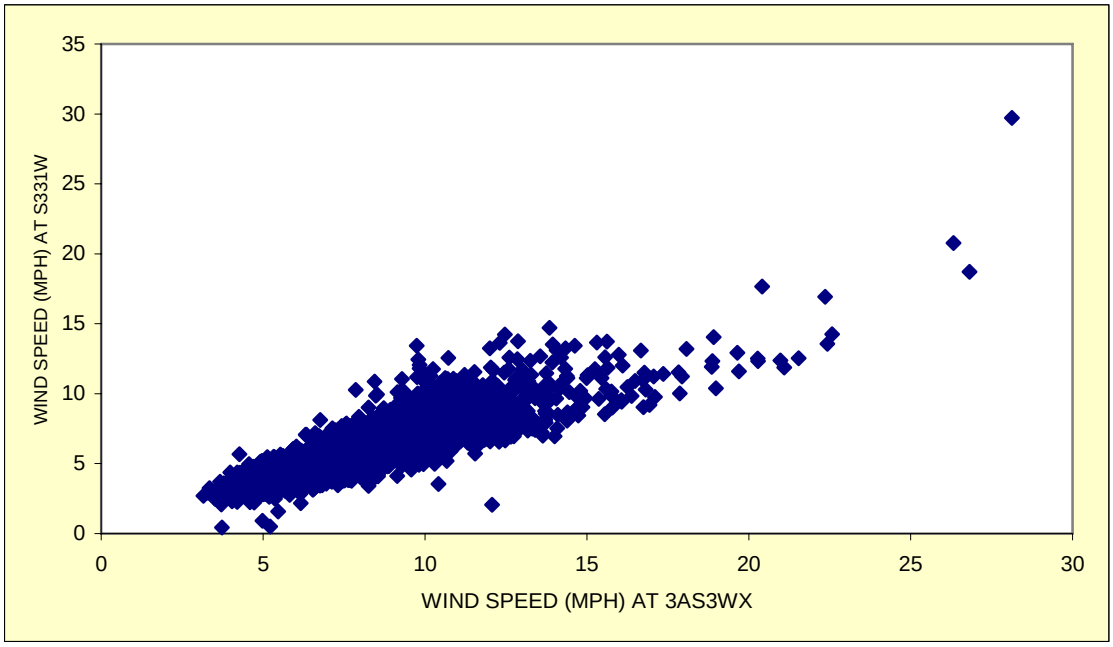


Figure 7 Wind speed at target station 3AS3WX plotted against wind speed from nearby station S331W.

Summary: The wind-speed data from 3AS3WX strongly correlated with wind-speed data from nearby stations (S140W and S331W) (Appendix A). The wind-speed data from 3AS3WX appear to be valid data that accurately represent conditions at the site. No revisions were required.

Statistics	Original series	Revised series
Minimum (mph)	3.151	3.151
Mean (mph)	7.939	7.939
Median (mph)	7.451	7.451
Maximum (mph)	28.128	28.128
Standard deviation	2.843	2.843
Variance	8.082	8.082
Outliers	53	53
Missing values	529	529

Table 60 Summary statistics for wind-speed data from Station 28: 3AS3WX

5 SUMMARY

Tree islands are tear-shaped topographic features in the relatively flat, low-lying landscape of southern Florida. Tree islands are only slightly (a few feet) elevated above the surrounding wetland, but are an important habitat for plants and animals. Tree islands are sensitive to changes in their hydrologic conditions; hence, a better understanding of the factors affecting the hydrology of tree islands is needed in the efforts to protect and restore the Everglades.

In 2000, the South Florida Water Management (SFWMD) began monitoring groundwater and surface-water levels, respectively, at three tree islands (designated 3AN1, 3AS3, and 3BS1) in Water Conservation Area 3 to better understand the unique hydrologic and ecologic conditions of the sites. A total of four well pairs were installed at each of the three tree islands. Well pairs, consisting of a shallow piezometer (depths from 4.1 to 15 ft below land surface) and a deep groundwater well (depths from 25 – 49.6 ft below land surface), were installed just northwest, northeast, and south of each island. A well pair also was installed within each island. A stilling well was installed at one well pair at each of the three islands to monitor surface-water stage. A meteorological station also was established at tree island 3AS3.

This two-volume report summarizes the results of a data-analysis project conducted in 2008 by staff at Adamski Geological Consulting, LLC. The project consisted of three components, the first of which was to assess the quality assurance of the site information and time-series data. The second component included analysis of seasonal fluctuations in groundwater and surface-water levels, and determination of factors affecting water levels. Finally, the third component was an analysis of the vertical and horizontal flow of groundwater at each of the tree islands. Results of component 1 are published in volume 1 (this report), and results of components 2 and 3 are published in volume 2.

The site and time-series data from the 23 wells, 3 stilling wells, and 1 meteorological station were reviewed for quality assurance. The location, depth, and construction information were thoroughly reviewed during this project and during two previous groundwater quality-assurance projects conducted in 2006 and 2007. In general, the site information for the wells appeared to be accurate; however, new ground-elevation surveys of the three tree islands were conducted in 2007 (Keith and Schnars, 2007). As a result, the reference elevations (elevation of the measuring point at the top of the well casing) and land-surface elevations were revised for 25 of the 26 stations.

The time-series data (groundwater level, surface-water stage, and selected meteorological data) were reviewed for accuracy according to SFWMD protocols. All analyses were conducted using daily values. The objective of this part of the project was to produce sets of preferred time-series data for use by SFWMD scientists and engineers, consultants, and the general public. The review included analyzing the data for outliers, anomalies, and missing values.

The groundwater and surface-water data from each station at 3AN1 contained up to 47 outliers. However, the local minimum and maximum values were consistent with precipitation data and water-level data from nearby wells drilled to similar depths. The data, therefore, were considered accurate. The time-series data from three wells and the stilling well at 3AN1 were missing up to 204 values, most of which were estimated as part of the previous quality-assurance projects. Data from the stilling well were not previously reviewed, and missing data were not estimated. In addition, the time-series data from the stilling well had 61 anomalous data values that resulted from surface-water levels declining below the bottom of the well. The anomalous data were deleted from the preferred set of time-series data and coded as M.

The time-series data from wells and the stilling well at 3AS3 contained no outliers or anomalous data; however, data from six wells contained missing values. The number of missing values per station ranged from 26 to 86, with up to 41 values estimated as part of the previous quality-assurance projects.

The time-series data from the wells and still well at 3BS1 contained 0 – 3 outliers, all of which were consistent with precipitation data and water-level data from nearby stations. The time-series data from five of the wells contained missing values. The number of missing values per stations ranged from 30 to 70. Missing values from three of the wells were estimated as part of the previous quality-assurance projects. None of the time-series data from stations at 3BS1 contained anomalous data.

Finally, the groundwater and surface-water data from the three tree islands were corrected based on the new reference elevations. A correction factor was determined by subtracting the new reference elevation from the old reference elevation. The correction factor was then applied to the time-series data in the new preferred data sets.

Selected meteorological data [air temperature, barometric pressure, humidity, precipitation (rainfall), and wind speed] also were briefly reviewed for accuracy. As with the groundwater and surface-water level data, all analyses were conducted using daily values. The meteorological data generally were accurate and consistent with expected seasonal fluctuations. The rainfall data also were relatively consistent with rainfall data from nearby stations. However, the number of missing values was large. Rainfall data were missing 100 values, whereas air temperature, barometric pressure, humidity, and wind speed were each missing more than 520 values. None of the missing values were estimated as part of this project.

6 REFERENCES

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