Processing and Quality-Assurance Analysis of Hydrologic Data from 20 Wells at Tree Island 3AS3

SFWMD Purchase Order 4500036287

Prepared for

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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 (SFWMD) began monitoring meteorological data and groundwater and surface-water levels at three tree islands (fig. 1) 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). In January 2007, 20 additional monitoring wells were installed at island 3AS3 by researchers at Florida International University (Tiffany Troxler, FIU, written commun., 2009). The wells were installed in pairs along two east-west trending transects (fig. 2). Each transect consisted of five pairs, with each pair containing a shallow and deep well.

1.1 Objectives

The objective of this contract (Purchase Order 4500036287) is to obtain professional consulting services for the processing, quality-assurance and analysis of hydrological data at 3AS3 in the Everglades (fig. 1). The objectives of the project are as follows:

1. Obtain all site information and time-series data for the 20 FIU wells;
2. Compile an Access database to store data from the 20 wells; include data from 9 SWFMD wells at 3AS3 and selected meteorological data.
3. Conduct quality-assurance assessment of data from the 20 FIU wells
4. Provide files for eventual uploading of data into DBHYDRO

This report contains the methods used in the completion of this project, an overall description of the construction of the 20 target wells, and a summary of the quality-assurance review and revisions of the data. The report also contains five contour maps to illustrate groundwater levels around 3AS3 during different hydrologic conditions.

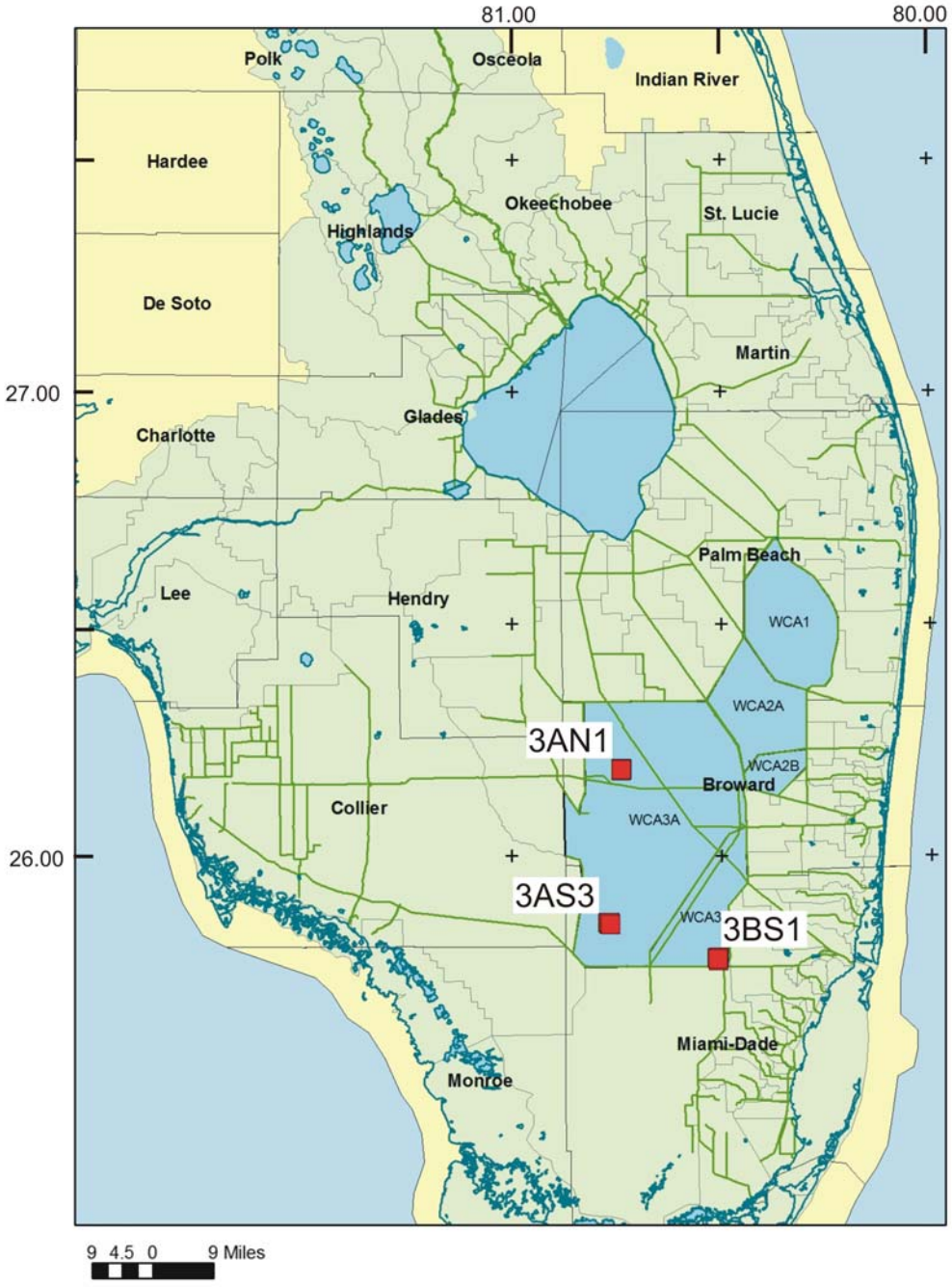

Figure 1 Location of the three tree islands (3AN1, 3AS3, and 3BS1) included in the 5-year study.

1.2 Scope of Work

The overall scope of work for the project is to process and assess site information (Meta data) and time-series data for 20 wells used to monitor ground-water levels at island 3AS3. A database containing the data and files for uploading the data into the SFWMD corporate database DBHYDRO also were generated. The work was conducted off-site by staff at Adamski Geological Consulting, LLC (AGC). The project includes the following components:

1. Obtain all site information and time-series data for the 20 target wells. Process (format and convert) 15-minute interval time-series data for loading into an Access database and DBHYDRO.
2. Download hydrometeorological data for 9 SFWMD wells and 1 weather station at 3AS3 for entering into Access database.
3. Enter site information into recorder registration worksheets and the Hydrogeologic Data Loader template. Compile maps, photographs, survey reports, and construction information into folders for loading into SWFMD SIM system.
4. Generate daily values from 15-minute time-series data for the 20 target wells. Conduct quality-assurance assessment on daily values. Generate comma-separated variables (CSV) files for uploading 15-minute time-series, data values, and reviewed daily values into DBHYDRO.
5. Construct 5 contour maps of groundwater levels at different hydrologic conditions during the period of record.

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 20 monitoring wells 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

A total of 20 wells were installed in January 2007 by researchers at Florida International University (FIU) for the purpose of monitoring shallow groundwater levels at Tree Island 3AS3 (Table 1). The wells were installed along two east-west transects that cross the island (fig. 2). Each transect consists of five pairs of well, with each pair containing a shallow and deep well.

Sequential number	*Station name*	*Well site*	*Agency*	*Latitude NAD83*	*Longitude NAD83*
1	N1D	N1	FIU	25° 51' 22.905"	80° 46' 11.710"
2	N1S		FIU	25° 51' 22.922"	80° 46' 11.707"
3	N2D	N2	FIU	25° 51' 22.875"	80° 46' 11.452"
4	N2S		FIU	25° 51' 22.900"	80° 46' 11.450"
5	N3D	N3	FIU	25° 51' 22.830"	80° 46' 10.882"
6	N3S		FIU	25° 51' 22.854"	80° 46' 10.878"
7	N4D	N4	FIU	25° 51' 22.944"	80° 46' 10.262"
8	N4S		FIU	25° 51' 22.959"	80° 46' 10.255"
9	N5D	N5	FIU	25° 51' 22.951"	80° 46' 09.986"
10	N5S		FIU	25° 51' 22.972"	80° 46' 09.990"
11	S6D	S6	FIU	25° 51' 20.805"	80° 46' 11.940"
12	S6S		FIU	25° 51' 20.826"	80° 46' 11.939"
13	S7D	S7	FIU	25° 51' 20.822"	80° 46' 11.665"
14	S7S		FIU	25° 51' 20.844"	80° 46' 11.677"
15	S8D	S8	FIU	25° 51' 20.769"	80° 46' 10.564"
16	S8S		FIU	25° 51' 20.783"	80° 46' 10.552"
17	S9D	S9	FIU	25° 51' 20.737"	80° 46' 09.450"
18	S9S		FIU	25° 51' 20.767"	80° 46' 09.456"
19	S10D	S10	FIU	25° 51' 20.753"	80° 46' 09.236"
20	S10S		FIU	25° 51' 20.780"	80° 46' 09.226"

Table 1 Site information for the 20 target wells installed by FIU personnel.

A pressure transducer was installed in each of the 20 wells for the continual collection of water-level and water-temperature data. These time-series data were collected at 15-minute increments from February 2, 2007 through December 3, 2008. All water-level data were collected as millimeters (mm) above National Geodetic Vertical Datum of 1929 (NGVD 29); temperature data were collected as degrees Celsius (^{o} C). In late July 2009, the time-series data were submitted to SFWMD in seven spreadsheet files. AGC staff downloaded the files from SFWMD ftp site for analysis. In July 2009, personnel at FIU also submitted two spreadsheet files containing well construction information directly to AGC. All units related to the elevation and depths of wells were in mm. FIU also supplied two photographs of wells. Additional photographs (Appendix A), land-

surface elevations (top of rock and top of peat or soft ground) and references elevations (top of well casings) were obtained from the survey report of Tree Island 3AS3 (Keith and Schnars, 2007). All vertical elevations are report as NGVD29. All horizontal locations are based on North American Datum of 1983 (NAD83).

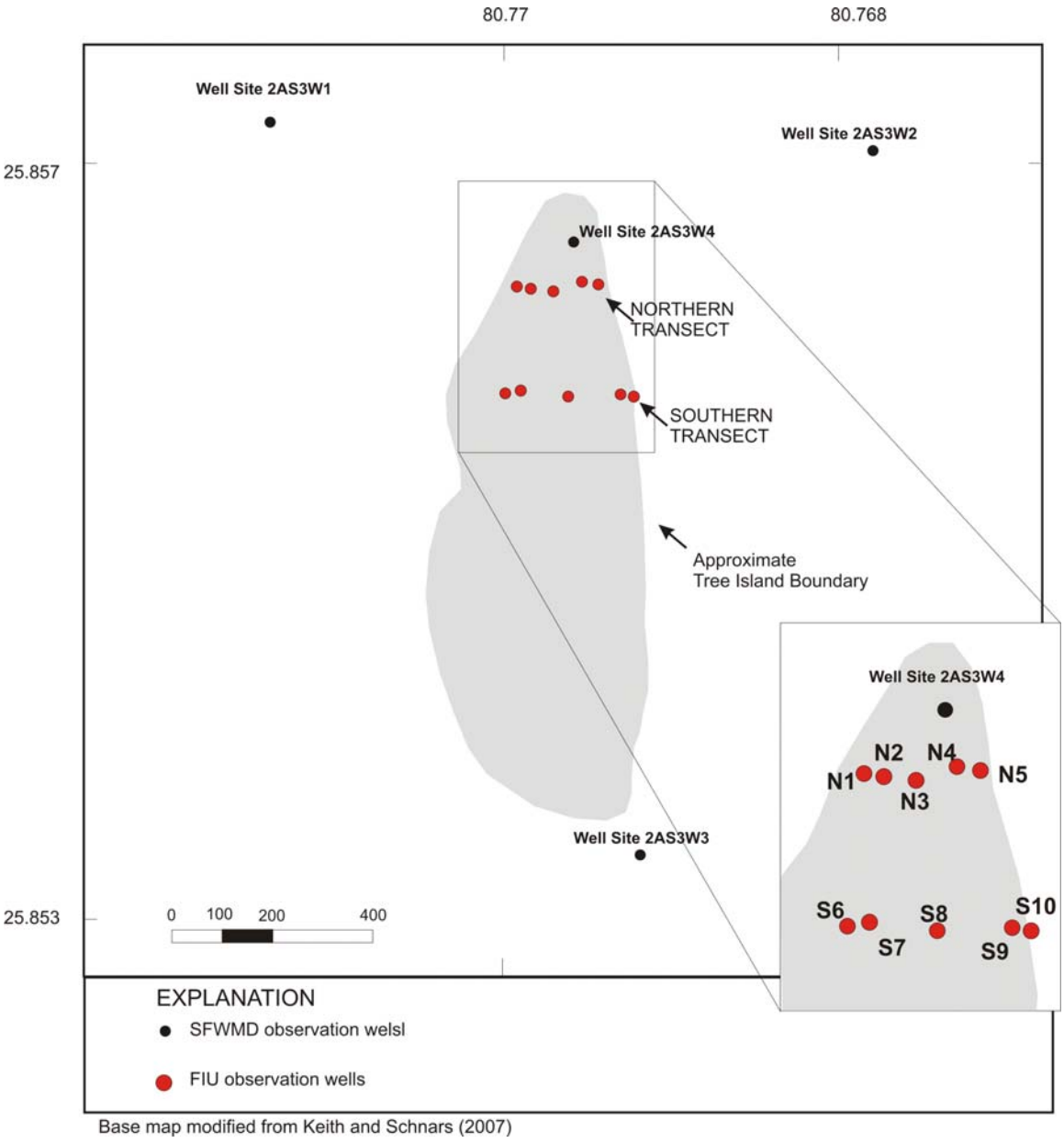

Figure 2. Location of monitor wells at Tree Island 3AS3

2 METHODS

2.1 Data Acquisition

Meta data and time-series data for the 20 target wells were obtained from FIU (Appendix B). Other site information, such as latitude-longitude coordinates, and reference and land-surface elevations, were obtained and (or) verified from survey reports.

2.2 Processing of site information and time-series data

Site information (borehole depths, casing lengths, screen lengths, screen elevations) and water-level data were collected and stored in units of millimeters. These data were necessarily converted to feet by AGC using the following equation:

Foot = [(millimeters/10)/2.54]/12 which is equivalent to

Foot = (millimeters) X (0.00328)

After water-level data were converted from millimeters to feet, the values were rounded off to two decimal places to be consistent with the surveyed reference elevations.

Available information at each well site included depth of borehole, anchor pipe length, elevation of the top and bottom of the screen, top of rock and land-surface elevations, and reference elevation (top of well casing). The depth of screen below land surface and height of casing above land surface were calculated from available data. The site information was used to generate recorder registration worksheets (Appendix C) and populate the Hydrogeologic Data Loader template. File folders were generated for each of the ten well sites for electronic storage of photographs, survey reports, construction information, and the recorder registration worksheets.

The incremental time-series data were reformatted into comma-separated variable (CSV) files, and reviewed for anomalous or missing values. Periods of missing data were assessed for continuity of the date and time sequence. Missing dates and times were added as needed. The water-level data were collected and stored both as depth to water from reference elevation and elevation of water above NGVD29. During numerous periods, water-temperature data were available even when water-level data were missing. Because the missing water-level data resulted from equipment malfunctions or from the water table declining below the pressure transducer, the water-temperature data were determined to be erroneous and deleted from the data set. After review, the incremental time-series data were stored in CSV for uploading into DBHYDRO.

Daily values (averages) of water-level and water-temperature data were calculated from the 15-minute incremental data. An extensive quality-assurance analysis was conducted on the daily values according to SFWMD protocols (Sangoyomi and Lambright, 2006). CSV files of the daily values were generated for uploading into DBHYDRO. Section 2.3 provides the methods followed for the QA analysis.

The site information and incremental time-series data were imported into an Access database. Site information and incremental time-series data from the eight existing SFWMD groundwater wells and one stilling well at 3AS3 were downloaded from DBHYDRO and also imported into the Access database. Precipitation and solar radiation (total and photosynthetic) at 3AS3 were downloaded from DBHYDRO and imported into the Access database.

2.3 Procedures for QA/QC of Water-Level Data

Quality-assurance analysis was conducted on the time-series data from each well using the methods described in SFWMD SOP (Sangoyomi and Lambright, 2006). These methods are summarized as follows:

1. Time-series data from the target stations were plotted in order to identify and document anomalies, outliers, and gaps in the record (Appendix D). 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 daily values from the 20 wells.
3. Box plots of time-series data were generated in order to quantitatively identify outliers (Appendix D). 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. 3). 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 (Appendix D). 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. Missing values were coded (tagged) as an “M”. An “M” indicates the data are missing, possibly as a result of equipment failure or some other technical problem. No attempt was made to estimate missing data.
6. The data were revised, based on the analysis of anomalies, outliers, and gaps. Summary statistics were determined for the revised time-series data. Revisions,

particularly the addition of the correction factors, caused the summary statistics to change. Final hydrographs (Appendix D) 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.

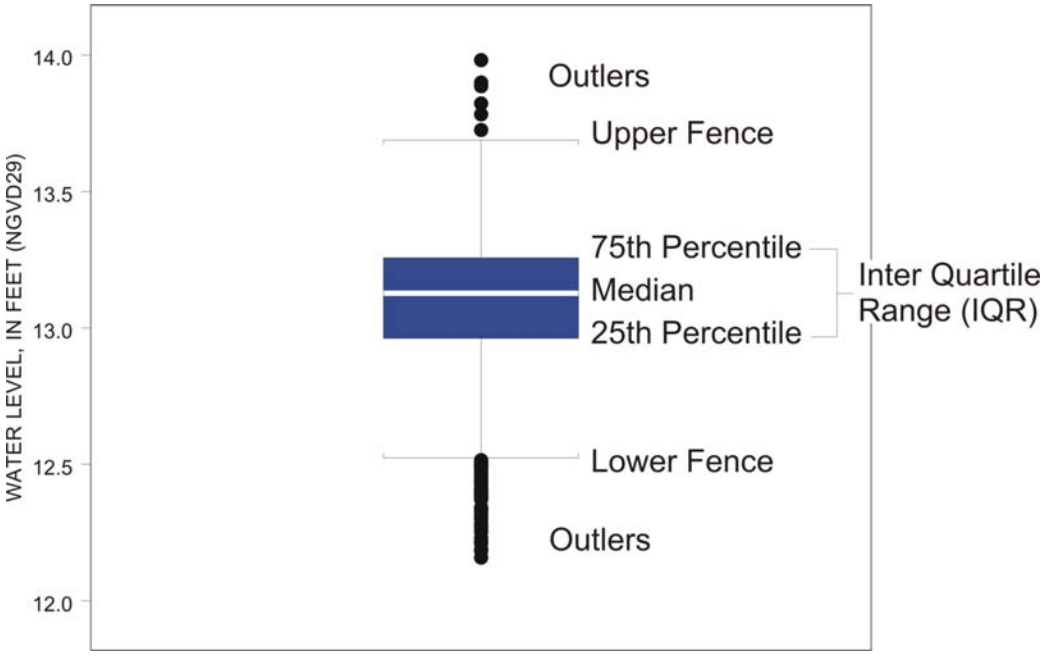

Figure 3 Sample box plot showing lower (Q1) and upper (Q3) quartiles, inter quartile range, and outliers.

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).

In January 2007, researchers at Florida International University installed 20 additional monitoring wells along two east-west transect across Tree Island 3AS3. Each transect consisted of five well pairs, with each pair consisting of a shallow (0.52 to 1.36 ft depth) well and deeper (1.71 to 2.4 ft depth) well.

The wells were constructed by using a gas-powered hand auger to drill an 8-inch diameter borehole down to the top of the limestone bedrock (Tiffany Troxler, written

comun., 2009; Appendix B). A string of 2-inch diameter PVC pipe was installed in each of the boreholes. The sections of pipe, from bottom to top, are as follows: A 2-inch diameter anchor pipe (0.61 – 2.96 ft in length) from the top of the bedrock up to the target depth; a 4-inch length of slotted pipe as the well screen; a 2-inch diameter riser from the well screen up to the top of the well (fig. 4). The depth to the bottom of the screen is considered the well depth (Strata in DBHYDRO), reported as feet below land surface (bls). Well casings extended 2.92 to 4.43 ft above land surface. The annular space around the screen was filled with sand, whereas the annular space around the anchor pipe and riser was filled with bentonite (Tiffany Troxler, written commun., 2009; Appendix B). Pressure transducers were installed in each of the wells for the continual monitoring of groundwater levels and water temperature.

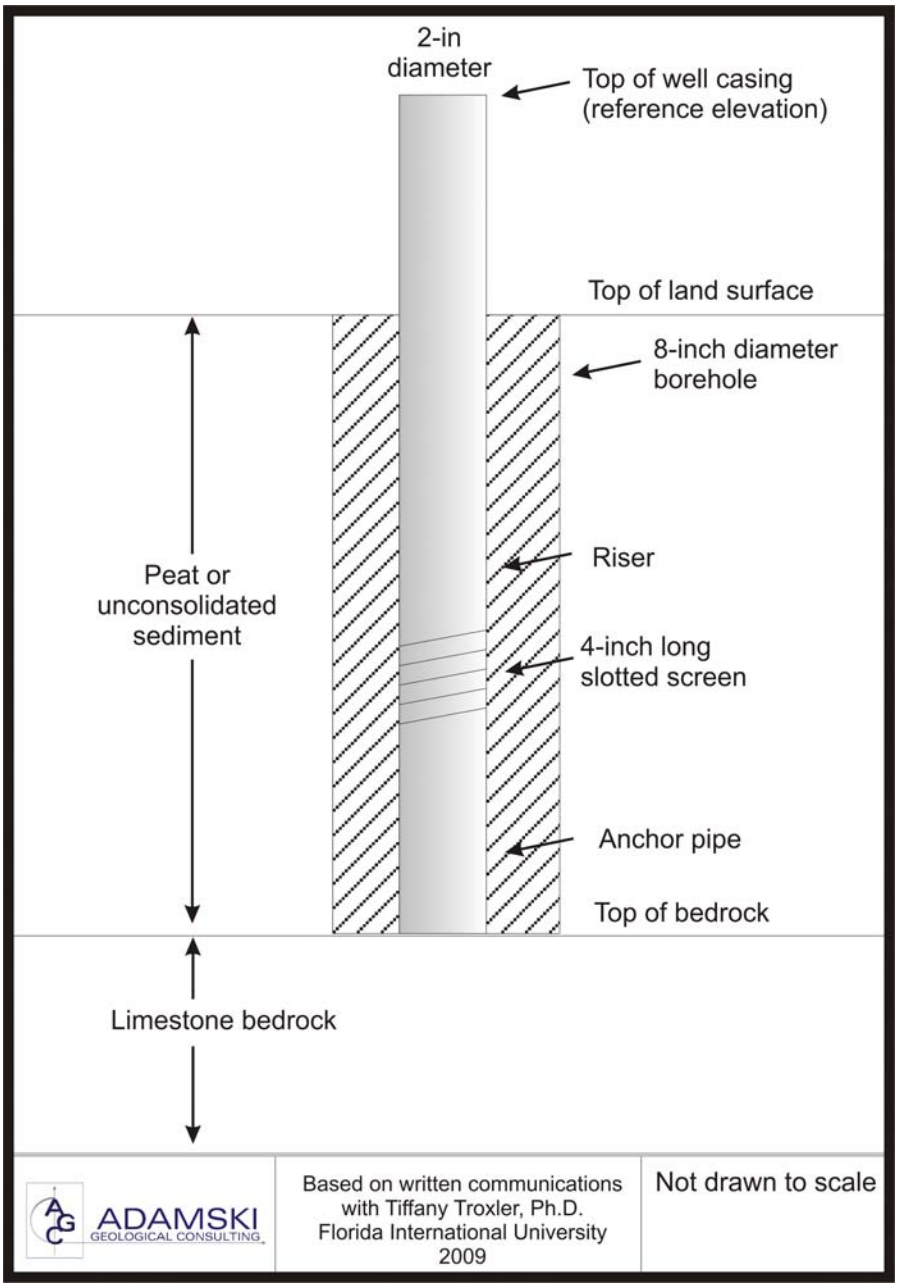

Figure 4. Generalized schematic showing construction of target wells (based on descriptions by Tiffany Troxler, FIU, written commun., 2009; Appendix B).

Well name	Soft ground (SG) elevation (NGVD 29, feet)	Hard ground (HG) elevation (NGVD 29, feet)	Hole depth (ft below land surface (SG))	Anchor length (ft)	Depth to bottom of screen (ft below land surface)	Top of well elevation (NGVD 29, feet)	Height of casing (ft above land surface (SG))
N1D			3.8	1.1	2.03	12.42	2.92
N1S	9.5	5.7	3.8	1.51	1.36	13.09	3.59
N2D			2.8	0.66	1.79	12.06	3.16
N2S	8.9	6.1	2.8	1.57	0.72	13.13	4.23
N3D			2.4	0.57	1.93	11.92	3.02
N3S	8.9	6.5	2.4	1.53	0.98	12.87	3.97
N4D			3	0.62	1.88	12.17	3.07
N4S	9.1	6.1	3	1.77	0.82	13.23	4.13
N5D			2.8	0.61	2.40	11.75	2.55
N5S	9.2	6.4	2.8	1.84	1.09	13.06	3.86
S6D			3	1.26	1.71	12.44	3.24
S6S	9.2	6.2	3	2.15	0.86	13.29	4.09
S7D			3	1.31	1.82	12.23	3.13
S7S	9.1	6.1	3	2.18	0.68	13.37	4.27
S8D			3.4	1.02	2.09	12.36	2.86
S8S	9.5	6.1	3.4	2.28	0.93	13.52	4.02
S9D			3.5	1.71	2.08	11.87	2.87
S9S	9	5.5	3.5	2.53	0.96	12.99	3.99
S10D			3.9	1.48	1.92	11.93	3.03
S10S	8.9	5	3.9	2.96	0.52	13.33	4.43

Table 2 Construction information for the 20 target wells.

The wells were surveyed in September 2007 (Keith and Schnars, 2007). The survey report also included land-surface elevations (top of soft ground) and the elevations of the top of the limestone bedrock at every well site.

4 QUALITY ASSURANCE ANALYSIS

The site information and time-series data from 20 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 QA/QC project.

The 20 target wells are extremely shallow, which affected the data collection at the sites. The depths of the shallow well range from 0.52 to 1.36 ft below land surface. Depths of the deeper wells range from 1.71 to 2.40 ft below land surface (table 2). As a result, the groundwater levels declined below the bottom of the ten shallow wells (or at least below the pressure transducers) for significant periods of time during the dry seasons. For example, water levels declined below the bottom of all five shallow wells in the northern transect and in S9S from April through mid July 2007. Water levels declined below the bottom of wells S6S, S7S, S8S, and S10S from March through early September 2007 and in May and June 2008. The data collected during these periods were considered anomalous, and coded as follows: depth-to-water data were coded with a greater-than sign (>); water-level data were coded with a less-than sign (<) (Cindy Bevier, SFWMD, personal commun., 2009). Installing the wells at slightly deeper levels would have prevented this loss of data.

Water temperature data collected during these periods were considered erroneous, as the transducers were above water. The data were subsequently deleted, and the missing values were coded as “M”.

Seven of the target wells had periods of missing data. In addition, the period of record from well S8D ended early, extending only through October 15, 2008. No other major anomalies of gaps were identified in the data sets.

4.1 Station 1: N1D

N1D is a 2.03-ft deep well located along the northern transect (figs. 1 and 2). N1D is one of two wells at the site (N1), which also includes a 1.36-ft deep well N1S.

4.1.1 Site and data description

Variable	Original value	Revised value
Station name	N1D	N1D
Station name (DBHYDRO), proposed	N1D	N1D
Latitude (NAD83)	255122.905	255122.905
Longitude (NAD83)	804611.710	804611.710
FL State Planar X Coordinate	731828.4	731828.4
FL State Planar Y Coordinate	553551.5	553551.5
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.5	9.5
Land (rock)-surface elevation (feet) (2007 survey)	5.7	5.7
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.42	12.42
Strata (feet bls) (DBHYDRO)	2.03	2.03
Pressure transducer	112922	112922

Table 3 Site information obtained for Station 1: N1D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 2.92 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is slightly less than the land-surface elevation, indicating that the land is inundated with water nearly 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.1.2 Data analysis and revision

The period of record analyzed for well N1D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 88 outliers and 31 missing values,. The summary statistics for this well are provided in table 4.

Problem: The time-series data from well N1D contain 88 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through late November 2008. The water level in N1D increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). The increase in water level in N1D is

consistent with similar increases in water levels in nearby wells. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N1D contain 31 missing values.

Analysis: Missing values occurred from July 28 through August 27, 2008. A comment in the original data file from FIU indicates equipment problems were responsible for the loss of data. No attempt was made to estimate the missing values.

Summary: The peaks and declines in water-level data from well N1D closely coincide with peaks and declines in water-level data from nearby wells (N1S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 N1D probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for N1D	Original series	Revised series
Minimum (feet NGVD29)	8.230	8.230
Mean (feet NGVD29)	9.531	9.531
Median (feet NGVD29)	9.356	9.356
Maximum (feet NGVD29)	11.542	11.542
Standard deviation	0.767	0.767
Variance	0.589	0.589
Outliers	88	88
Missing values	31	31

Table 4 Summary statistics of original time-series data for Station 1: N1D

4.2 Station 2: N1S

N1S is a 1.36-ft deep well located along the northern transect (figs. 1 and 2). N1S is one of two wells at the site (N1), which also includes a 2.03-ft deep well N1D.

4.2.1 Site and data description

Variable	Original value	Revised value
Station name	N1S	N1S
Station name (DBHYDRO) proposed	N1S	N1S
Latitude (NAD83)	255122.922	255122.922
Longitude (NAD83)	804611.707	804611.707
FL State Planar X Coordinate	731828.7	731828.7
FL State Planar Y Coordinate	553553.2	553553.2
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.8	9.8
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	5.7	5.7
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.09	13.09
Strata (feet bls) (DBHYDRO)	1.36	1.36
Pressure transducer	112948	112948

Table 5 Site information obtained for Station 2: N1S

The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.59 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is slightly less than the land-surface elevation, indicating that the land is inundated with water nearly 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.2.2 Data analysis and revision

The period of record analyzed for well N1S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 76 outliers and no missing values. The summary statistics for this well are provided in table 6.

Problem: The time-series data from well N1S contain 76 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from mid August through late November 2008. The water level in N1S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in N1S is consistent with similar increases in water levels in nearby wells. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N1S has periods of flat, anomalous water levels from March 31 through July 14, 2007.

Analysis: The periods of flat water levels, which occurred at the end of the dry season, are inconsistent with water levels in nearby wells, such as N1D. The water levels during this period generally fluctuated around 8.88 to 8.89 ft above NGVD 29. This value probably represents the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during that period were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well N1S closely coincide with peaks and declines in water-level data from nearby wells (N1D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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. Water-level data from March 31 through July 14 had periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well N1S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for N1S	Original series	Revised series
Minimum (feet NGVD29)	8.858	8.858
Mean (feet NGVD29)	9.601	9.601
Median (feet NGVD29)	9.386	9.386
Maximum (feet NGVD29)	11.552	11.552
Standard deviation	0.734	0.734
Variance	0.538	0.538
Outliers	76	76
Missing values	0	0

Table 6 Summary statistics of time-series data for Station 2: N1S

4.3 Station 3: N2D

N2D is a 1.79-ft deep well located along the northern transect (figs. 1 and 2). N2D is one of two wells at the site (N2), which also includes a 0.72-ft deep well N2S.

4.3.1 Site and data description

Variable	Original value	Revised value
Station name	N2D	N2D
Station name (DBHYDRO) proposed	N2D	N2D
Latitude (NAD83)	255122.875	255122.875
Longitude (NAD83)	804611.452	804611.452
FL State Planar X Coordinate	731852.0	731852.0
FL State Planar Y Coordinate	553548.4	553548.4
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.1	6.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.06	12.06
Strata (feet bls) (DBHYDRO)	1.79	1.79
Pressure transducer	112943	112943

Table 7 Site information obtained for Station 3: N2D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.07 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.3.2 Data analysis and revision

The period of record analyzed for well N2D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 71 outliers and no missing values. The summary statistics for this well are provided in table 8.

Problem: The time-series data from well N2D contain 71 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through late November 2008. The water level in N2D increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). The increase in water level in N2D is consistent with similar increases in water levels in nearby wells. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Summary: The peaks and declines in water-level data from well N2D closely coincide with peaks and declines in water-level data from nearby wells (N2S, 3AS3W1_GP, and

3AS3W3_GP) drilled to a similar depth (Appendix D). 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 N2D probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for N2D	Original series	Revised series
Minimum (feet NGVD29)	8.230	8.230
Mean (feet NGVD29)	9.573	9.573
Median (feet NGVD29)	9.397	9.397
Maximum (feet NGVD29)	11.532	11.532
Standard deviation	0.760	0.760
Variance	0.578	0.578
Outliers	71	71
Missing values	0	0

Table 8 Summary statistics of original time-series data for Station 3: N2D

4.4 Station 4: N2S

N2S is a 0.72-ft deep well located along the northern transect (figs. 1 and 2). N2S is one of two wells at the site (N2), which also includes a 1.79-ft deep well N2D.

4.4.1 Site and data description

Variable	Original value	Revised value
Station name	N2S	N2S
Station name (DBHYDRO) proposed	N2S	N2S
Latitude (NAD83)	255122.900	255122.900
Longitude (NAD83)	804611.450	804611.450
FL State Planar X Coordinate	731852.2	731852.2
FL State Planar Y Coordinate	553551.0	553551.0
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.1	6.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.13	13.13
Strata (feet bls) (DBHYDRO)	0.72	0.72
Pressure transducer	112926	112926

Table 9 Site information obtained for Station 4: N2S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends

about 3.07 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.4.2 Data analysis and revision

The period of record analyzed for well N2S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 90 outliers and 26 missing values. The summary statistics for this well are provided in table 10.

Problem: The time-series data from well N2S contain 90 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from early September through late November 2008. The water level in N2S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.54 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in N2S is consistent with similar increases in water levels in nearby wells. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N2S has 26 missing values.

Analysis: The missing values occurred from November 11 through December 6, 2007. The data were downloaded by FIU personnel on December 6, 2007. No information is available about the missing values; however, a power failure or some other equipment issue probably resulted in the loss of data.

Problem: The time-series data from well N2S has periods of flat, anomalous water levels from March 28 through July 14, 2007.

Analysis: The periods of flat water levels, which occurred at the end of the dry season, are inconsistent with water levels in nearby wells, such as N2D. The water levels during this period generally fluctuated around 8.90 to 8.91 ft above NGVD29. This value probably represents the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during that period were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well N2S closely coincide with peaks and declines in water-level data from nearby wells (N2D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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. Water-level data from

March 28 through July 14 had periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well N2S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for N2S	Original series	Revised series
Minimum (feet NGVD29)	8.876	8.876
Mean (feet NGVD29)	9.592	9.592
Median (feet NGVD29)	9.366	9.366
Maximum (feet NGVD29)	11.546	11.546
Standard deviation	0.742	0.742
Variance	0.550	0.550
Outliers	90	90
Missing values	26	26

Table 10 Summary statistics of time-series data for Station 4: N2S

4.5 Station 5: N3D

N3D is a 1.93-ft deep well located along the northern transect (figs. 1 and 2). N3D is one of two wells at the site (N3), which also includes a 0.98-ft deep well N3S.

4.5.1 Site and data description

Variable	Original value	Revised value
Station name	N3D	N3D
Station name (DBHYDRO) proposed	N3D	N3D
Latitude (NAD83)	255122.830	255122.830
Longitude (NAD83)	804610.882	804610.882
FL State Planar X Coordinate	731904.1	731904.1
FL State Planar Y Coordinate	553544.0	553544.0
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.5	6.5
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	11.92	11.92
Strata (feet bls) (DBHYDRO)	1.93	1.93
Pressure transducer	113243	113243

Table 11 Site information obtained for Station 5: N3D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.02 ft above land surface. A photograph of the site (Appendix A) confirms the

casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.5.2 Data analysis and revision

The period of record analyzed for well N3D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 90 outliers and 27 missing values. The summary statistics for this well are provided in table 12.

Problem: The time-series data from well N3D contain 61 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in N3D increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.47 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in N3D is consistent with similar increases in water levels in nearby wells. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N3D contain 27 missing values.

Analysis: One missing value occurred on August 28, 2007. The site appears to have been serviced on August 29, but data collection stopped on August 27. The cessation in data collection could have been caused by loss of power or another technical problem.

Missing values also occurred from October 16 – November 10, 2008. Comments inserted into the original dataset indicate that the pressure transducer was removed on October 15, 2008 due to “high water”. The transducer was replaced on November 11. The water-level in the well on October 15 was 11.45 ft above NGVD29, which is close to the top of the well casing (11.92 ft above NGVD29). However, water levels in nearby wells, such as N3S, peaked on October 1 and begin to decline after October 15. The decision to remove the transducer, if based on water levels in the wells, probably was premature, and resulted in the loss of data. No attempt was made to estimate missing values.

Summary: The peaks and declines in water-level data from well N3D closely coincide with peaks and declines in water-level data from nearby wells (N3S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 had 26 missing values from October 15 through November 10, 2008 that resulted from the removal of the pressure transducer from the well. The decision to remove the pressure transducer appeared to be based on high water levels, which peaked on October 1. Hence,

the decision to remove the transducer appears to have been premature, and resulted in the loss of data. No revisions were required.

Statistics for N3D	Original series	Revised series
Minimum (feet NGVD29)	8.192	8.192
Mean (feet NGVD29)	9.485	9.485
Median (feet NGVD29)	9.349	9.349
Maximum (feet NGVD29)	11.500	11.500
Standard deviation	0.701	0.701
Variance	0.492	0.492
Outliers	61	61
Missing values	27	27

Table 12 Summary statistics of time-series data for Station 5: N3D

4.6 Station 6: N3S

N3S is a 0.98-ft deep well located along the northern transect (figs. 1 and 2). N3S is one of two wells at the site (N3), which also includes a 1.93-ft deep well N3D.

4.6.1 Site and data description

Variable	Original value	Revised value
Station name	N3S	N3S
Station name (DBHYDRO) proposed	N3S	N3S
Latitude (NAD83)	255122.854	255122.854
Longitude (NAD83)	804610.878	804610.878
FL State Planar X Coordinate	731904.4	731904.4
FL State Planar Y Coordinate	553546.5	553546.5
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.5	6.5
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.87	12.87
Strata (feet bls) (DBHYDRO)	0.98	0.98
Pressure transducer	113249	113249

Table 13 Site information obtained for Station 6: N3S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.97 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.6.2 Data analysis and revision

The period of record analyzed for well N3S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 71 outliers and 50 missing values. The summary statistics for this well are provided in table 14.

Problem: The time-series data from well N3S contain 71 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in N3S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 16 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in N3S is consistent with similar increases in water levels in nearby wells. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N3S contain 50 missing values.

Analysis: One missing value occurred on August 28, 2007. The site appears to have been serviced on August 29, but data collection stopped on August 27. The cessation in data collection could have been caused by loss of power or another technical problem. The data from well N3D also is missing on August 28.

Missing values also occurred from May 14 through July 1, 2008. Missing values probably resulted from equipment problems or another technical issue. No attempt was made to estimate missing values.

Problem: The time-series data from well N3S has periods of flat, anomalous water levels from April 23 through June 28, 2007.

Analysis: The periods of flat water levels, which occurred at the end of the dry season, are inconsistent with water levels in nearby wells, such as N3D. The water levels during these periods generally fluctuated around 8.69 ft above NGVD29. This value probably represents the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during those periods were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well N3S closely coincide with peaks and declines in water-level data from nearby wells (N3D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 had 49 missing values from May 14 through July 1, 2008 that probably resulted from

equipment problems. No attempt was made to estimate missing values. No revisions were required.

Statistics for N3S	Original series	Revised series
Minimum (feet NGVD29)	8.650	8.650
Mean (feet NGVD29)	9.614	9.614
Median (feet NGVD29)	9.428	9.428
Maximum (feet NGVD29)	11.528	11.528
Standard deviation	0.763	0.763
Variance	0.582	0.582
Outliers	71	71
Missing values	50	50

Table 14 Summary statistics of time-series data for Station 6: N3S

4.7 Station 7: N4D

N4D is a 1.88-ft deep well located along the northern transect (figs. 1 and 2). N4D is one of two wells at the site (N4), which also includes 0.82-ft deep well N4S.

4.7.1 Site and data description

Variable	Original value	Revised value
Station name	N4D	N4D
Station name (DBHYDRO) proposed	N4D	N4D
Latitude (NAD83)	255122.944	255122.944
Longitude (NAD83)	804610.262	804610.262
FL State Planar X Coordinate	731960.7	731960.7
FL State Planar Y Coordinate	553555.7	553555.7
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.1	9.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.1	6.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.17	12.17
Strata (feet bls) (DBHYDRO)	1.88	1.88
Pressure transducer	113252	113252

Table 15 Site information obtained for Station 7: N4D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.07 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating

that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.7.2 Data analysis and revision

The period of record analyzed for well N4D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 76 outliers and 1 missing value. The summary statistics for this well are provided in table 16.

Problem: The time-series data from well N4D contain 76 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in N4D increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.53 ft from August 16 – 19 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in N4D is consistent with similar increases in water levels in nearby wells. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N4D contain 1 missing value.

Analysis: The missing value occurred on August 28, 2007. The site appears to have been serviced on August 29, but data collection stopped on August 27. The cessation in data collection could have been caused by loss of power or another technical problem. The data from other wells, such as N3D and N3S, also are missing on August 28.

Summary: The peaks and declines in water-level data from well N4D closely coincide with peaks and declines in water-level data from nearby wells (N4S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 had 1 missing value on August 28, 2008 that probably resulted from equipment problems. No attempt was made to estimate the missing value. No revisions were required.

Statistics for N4D	Original series	Revised series
Minimum (feet NGVD29)	8.211	8.211
Mean (feet NGVD29)	9.576	9.576
Median (feet NGVD29)	9.380	9.380
Maximum (feet NGVD29)	11.582	11.582
Standard deviation	0.770	0.770
Variance	0.593	0.593
Outliers	76	76
Missing values	1	1

Table 16 Summary statistics of time-series data for Station 7: N4D

4.8 Station 8: N4S

N4S is a 0.82-ft deep well located along the northern transect (figs. 1 and 2). N4S is one of two wells at the site (N4), which also includes 1.88-ft deep well N4D.

4.8.1 Site and data description

Variable	Original value	Revised value
Station name	N4S	N4S
Station name (DBHYDRO) proposed	N4S	N4S
Latitude (NAD83)	255122.959	255122.959
Longitude (NAD83)	804610.255	804610.255
FL State Planar X Coordinate	731960.4	731960.4
FL State Planar Y Coordinate	553557.2	553557.2
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.1	9.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.1	6.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.23	13.23
Strata (feet bls) (DBHYDRO)	0.82	0.82
Pressure transducer	112929	112929

Table 17 Site information obtained for Station 8: N4S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 4.13 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.8.2 Data analysis and revision

The period of record analyzed for well N4S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 75 outliers and no missing values. The summary statistics for this well are provided in table 18.

Problem: The time-series data from well N4S contain 75 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from early September through late November 2008. The water level in N4S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.54 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in N4S is consistent with similar

increases in water levels in nearby wells, such as N4D. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N4S has periods of flat, anomalous water levels from March 18 through July 19, 2007 and from June 2-17, 2008.

Analysis: The periods of flat water levels, which occurred at the end of the dry seasons, are inconsistent with water levels in nearby wells, such as N4D. The water levels during these periods generally fluctuated around 8.97 ft above NGVD29. This value probably represents the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during those periods were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well N4S closely coincide with peaks and declines in water-level data from nearby wells (N4D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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. Water-level data from March 18 through July 19, 2007 and from June 2-17, 2008 had periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well N4S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for N4S	Original series	Revised series
Minimum (feet NGVD29)	8.927	8.927
Mean (feet NGVD29)	9.603	9.603
Median (feet NGVD29)	9.376	9.376
Maximum (feet NGVD29)	11.567	11.567
Standard deviation	0.725	0.725
Variance	0.526	0.526
Outliers	75	75
Missing values	0	0

Table 18 Summary statistics of time-series data for Station 8: N4S

4.9 Station 9: N5D

N5D is a 2.40-ft deep well located along the northern transect (figs. 1 and 2). N5D is one of two wells at the site (N5), which also includes 1.09-ft deep well N5S.

4.9.1 Site and data description

Variable	Original value	Revised value
Station name	N5D	N5D
Station name (DBHYDRO) proposed	N5D	N5D
Latitude (NAD83)	255122.951	255122.951
Longitude (NAD83)	804609.986	804609.986
FL State Planar X Coordinate	731985.9	731985.9
FL State Planar Y Coordinate	553556.4	553556.4
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.2	9.2
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.4	6.4
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	11.75	11.75
Strata (feet bls) (DBHYDRO)	2.40	2.40
Pressure transducer	112957	112957

Table 19 Site information obtained for Station 9: N5D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 2.55 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.9.2 Data analysis and revision

The period of record analyzed for well N5D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 53 outliers and 75 missing values. The summary statistics for this well are provided in table 20.

Problem: The time-series data from well N5D contain 53 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in N5D increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.53 ft from August 17 – 19 after storms delivered more than 7 inches of

rainfall during that period. The increase in water level in N5D is consistent with similar increases in water levels in nearby wells. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N5D contain 75 missing values.

Analysis: Missing values occurred from May 14 though July 1, 2008, which is identical to the period of missing values in data from well N3S. As with N3S, no comments were available concerning the reason for the missing values. The loss of data possibly resulted from equipment issues. The site appears to have been visited on July 2, 2008, and the problem was fixed.

Missing values also occurred from October 16 – November 10, 2008. Comments inserted into the original dataset indicate that the pressure transducer was removed on October 15, 2008 due to "WL height". The transducer was replaced on November 11. The water-level in the well on October 15 was 11.45 ft above NGVD29, which is close to the top of the well casing (11.75 ft above NGVD29). However, water levels in nearby wells, such as N5S, peaked on October 1 and begin to decline after October 15. The decision to remove the transducer, if based on water levels in the wells, probably was premature, and resulted in the loss of data. No attempt was made to estimate missing values.

Summary: The peaks and declines in water-level data from well N5D closely coincide with peaks and declines in water-level data from nearby wells (N5S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 had two extended periods missing values from May 14 through July 1, 2008 and from October 16 through November 10, 2008. The first gap possibly resulted from equipment malfunctions, but the second gap resulted from a decision to remove the pressure transducer due to high water levels. Analysis indicates the water level in the well and in nearby N5S peaked on October 1; hence, the decision to remove the transducer was premature, and resulted in a loss of data. No attempt was made to estimate the missing value. No revisions were required.

Statistics for N5D	Original series	Revised series
Minimum (feet NGVD29)	8.190	8.190
Mean (feet NGVD29)	9.530	9.530
Median (feet NGVD29)	9.403	9.403
Maximum (feet NGVD29)	11.512	11.512
Standard deviation	0.713	0.713
Variance	0.509	0.509
Outliers	53	53
Missing values	75	75

Table 20 Summary statistics of time-series data for Station 9: N5D

4.10 Station 10: N5S

N5S is a 1.09-ft deep well located along the northern transect (figs. 1 and 2). N5S is one of two wells at the site (N5), which also includes 2.40-ft deep well N5D.

4.10.1 Site and data description

Variable	Original value	Revised value
Station name	N5S	N5S
Station name (DBHYDRO) proposed	N5S	N5S
Latitude (NAD83)	255122.972	255122.972
Longitude (NAD83)	804609.990	804609.990
FL State Planar X Coordinate	731985.6	731985.6
FL State Planar Y Coordinate	553558.5	553558.5
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.2	9.2
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.4	6.4
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.06	13.06
Strata (feet bls) (DBHYDRO)	1.09	1.09
Pressure transducer	112942	112942

Table 21 Site information obtained for Station 10: N5S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.86 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.10.2 Data analysis and revision

The period of record analyzed for well N5S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 75 outliers and no missing values. The summary statistics for this well are provided in table 22.

Problem: The time-series data from well N5S contain 75 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from early September through late November 2008. The water level in N5S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in N5S is consistent with similar

increases in water levels in nearby wells, such as N5D. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well N5S has periods of flat, anomalous water levels from March 28 through July 14, 2007.

Analysis: The periods of flat water levels, which occurred at the end of the dry season, are inconsistent with water levels in nearby wells, such as N5D. The water levels during these periods generally fluctuated around 8.89 to 8.90 ft above NGVD29. This value probably represents the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during those periods were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well N5S closely coincide with peaks and declines in water-level data from nearby wells (N5D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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. Water-level data from March 28 through July 14, 2007 had periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well N5S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for N5S	Original series	Revised series
Minimum (feet NGVD29)	8.848	8.848
Mean (feet NGVD29)	9.585	9.585
Median (feet NGVD29)	9.372	9.372
Maximum (feet NGVD29)	11.541	11.541
Standard deviation	0.730	0.730
Variance	0.532	0.532
Outliers	75	75
Missing values	0	0

Table 22 Summary statistics of time-series data for Station 10: N5S

4.11 Station 11: S6D

S6D is a 1.71-ft deep well located along the southern transect (figs. 1 and 2). S6D is one of two wells at the site (S6), which also includes 0.86-ft deep well S6S.

4.11.1 Site and data description

Variable	Original value	Revised value
Station name	S6D	S6D
Station name (DBHYDRO) proposed	S6D	S6D
Latitude (NAD83)	255120.805	255120.805
Longitude (NAD83)	804611.940	804611.940
FL State Planar X Coordinate	731807.9	731807.9
FL State Planar Y Coordinate	553339.4	553339.4
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.2	9.2
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.2	6.2
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.44	12.44
Strata (feet bls) (DBHYDRO)	1.71	1.71
Pressure transducer	112944	112944

Table 23 Site information obtained for Station 11: S6D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.24 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.11.2 Data analysis and revision

The period of record analyzed for well S6D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 77 outliers and no missing values. The summary statistics for this well are provided in table 24.

Problem: The time-series data from well S6D contain 77 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in S6D increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 17 – 20 after storms delivered more than 7 inches of

rainfall during that period. The increase in water level in S6D is consistent with similar increases in water levels in nearby wells, such as S6S. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Summary: The peaks and declines in water-level data from well S6D closely coincide with peaks and declines in water-level data from nearby wells (S6S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 S6D probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S6D	Original series	Revised series
Minimum (feet NGVD29)	8.182	8.182
Mean (feet NGVD29)	9.549	9.549
Median (feet NGVD29)	9.372	9.372
Maximum (feet NGVD29)	11.528	11.528
Standard deviation	0.769	0.769
Variance	0.591	0.591
Outliers	77	77
Missing values	0	0

Table 24 Summary statistics of time-series data for Station 11: S6D

4.12 Station 12: S6S

S6S is a 0.86-ft deep well located along the southern transect (figs. 1 and 2). S6S is one of two wells at the site (S6), which also includes 1.71-ft deep well S6D.

4.12.1 Site and data description

Variable	Original value	Revised value
Station name	S6S	S6S
Station name (DBHYDRO) proposed	S6S	S6S
Latitude (NAD83)	255120.826	255120.826
Longitude (NAD83)	804611.939	804611.939
FL State Planar X Coordinate	731807.9	731807.9
FL State Planar Y Coordinate	553341.5	553341.5
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.2	9.2
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.2	6.2
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.29	13.29
Strata (feet bls) (DBHYDRO)	0.86	0.86
Pressure transducer	112951	112951

Table 25 Site information obtained for Station 12: S6S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 4.09 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.12.2 Data analysis and revision

The period of record analyzed for well S6S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 78 outliers and no missing values. The summary statistics for this well are provided in table 26.

Problem: The time-series data from well S6S contain 78 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in S6S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 17 – 20 after storms delivered more than 7 inches of

rainfall during that period. The increase in water level in S6S is consistent with similar increases in water levels in nearby wells, such as S6D. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well S6S has periods of flat, anomalous water levels from March 13 through September 7, 2007 and from May 16 through June 17, 2008.

Analysis: The periods of flat water levels, which occurred at the end of the dry seasons, are inconsistent with water levels in nearby wells, such as S6D. The water levels during these periods generally fluctuated around 9.08 to 9.10 ft above NGVD29. This value probably represents the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during those periods were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well S6S closely coincide with peaks and declines in water-level data from nearby wells (S6D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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. Water-level data from March 13 through September 7, 2007 and from May 16 though June 17, 2008 had periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well S6S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S6S	Original series	Revised series
Minimum (feet NGVD29)	9.052	9.052
Mean (feet NGVD29)	9.625	9.625
Median (feet NGVD29)	9.367	9.367
Maximum (feet NGVD29)	11.514	11.514
Standard deviation	0.688	0.688
Variance	0.473	0.473
Outliers	78	78
Missing values	0	0

Table 26 Summary statistics of time-series data for Station 12: S6S

4.13 Station 13: S7D

S7D is a 1.82-ft deep well located along the southern transect (figs. 1 and 2). S7D is one of two wells at the site (S7), which also includes 0.68-ft deep well S7S.

4.13.1 Site and data description

Variable	Original value	Revised value
Station name	S7D	S7D
Station name (DBHYDRO) proposed	S7D	S7D
Latitude (NAD83)	255120.822	255120.822
Longitude (NAD83)	804611.665	804611.665
FL State Planar X Coordinate	731832.9	731832.9
FL State Planar Y Coordinate	553341.2	553341.2
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.1	9.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.1	6.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.23	12.23
Strata (feet bls) (DBHYDRO)	1.82	1.82
Pressure transducer	112950	112950

Table 27 Site information obtained for Station 13: S7D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.13 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.13.2 Data analysis and revision

The period of record analyzed for well S7D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 76 outliers and no missing values. The summary statistics for this well are provided in table 28.

Problem: The time-series data from well S7D contain 76 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in S7D increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in S7D is consistent with similar increases in water levels in nearby wells, such as S7S. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Summary: The peaks and declines in water-level data from well S7D closely coincide with peaks and declines in water-level data from nearby wells (S7S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 S7D probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S7D	Original series	Revised series
Minimum (feet NGVD29)	8.212	8.212
Mean (feet NGVD29)	9.568	9.568
Median (feet NGVD29)	9.380	9.380
Maximum (feet NGVD29)	11.488	11.488
Standard deviation	0.749	0.749
Variance	0.561	0.561
Outliers	76	76
Missing values	0	0

Table 28 Summary statistics of time-series data for Station 13: S7D

4.14 Station 14: S7S

S7S is a 0.68-ft deep well located along the southern transect (figs. 1 and 2). S7S is one of two wells at the site (S7), which also includes 1.82-ft deep well S7D.

4.14.1 Site and data description

Variable	Original value	Revised value
Station name	S7S	S7S
Station name (DBHYDRO) proposed	S7S	S7S
Latitude (NAD83)	255120.844	255120.844
Longitude (NAD83)	804611.677	804611.677
FL State Planar X Coordinate	731831.8	731831.8
FL State Planar Y Coordinate	553343.4	553343.4
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.1	9.1
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.1	6.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.37	13.37
Strata (feet bls) (DBHYDRO)	0.68	0.68
Pressure transducer	113237	113237

Table 29 Site information obtained for Station 16: S7S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 4.27 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.14.2 Data analysis and revision

The period of record analyzed for well S7S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 77 outliers and no missing values. The summary statistics for this well are provided in table 30.

Problem: The time-series data from well S7S contain 77 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in S7S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in S7S is consistent with similar increases in water levels in nearby wells, such as S7D. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well S7S has periods of flat, anomalous water levels from March 10 through September 11, 2007 and from May 15 through June 17, 2008.

Analysis: The periods of flat water levels, which occurred at the end of the dry seasons, are inconsistent with water levels in nearby wells, such as S7D. The water levels during these periods generally fluctuated around 9.2 ft above NGVD29 in 2007 to 9.14 ft above NGVD29 in 2008, which is above even the land-surface elevation for the site (9.1 ft above NGVD29). The data values probably represent the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during those periods were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well S7S closely coincide with peaks and declines in water-level data from nearby wells (S7D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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. Water-level data from March 10 through September 11, 2007 and from May 15 though June 17, 2008 had

periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well S7S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S7S	Original series	Revised series
Minimum (feet NGVD29)	9.106	9.106
Mean (feet NGVD29)	9.686	9.686
Median (feet NGVD29)	9.412	9.412
Maximum (feet NGVD29)	11.535	11.535
Standard deviation	0.669	0.669
Variance	0.447	0.447
Outliers	77	77
Missing values	0	0

Table 30 Summary statistics of time-series data for Station 14: S7S

4.15 Station 15: S8D

S8D is a 2.09-ft deep well located along the southern transect (figs. 1 and 2). S8D is one of two wells at the site (S8), which also includes 0.93-ft deep well S8S.

4.15.1 Site and data description

Variable	Original value	Revised value
Station name	S8D	S8D
Station name (DBHYDRO) proposed	S8D	S8D
Latitude (NAD83)	255120.769	255120.769
Longitude (NAD83)	804610.564	804610.564
FL State Planar X Coordinate	731933.6	731933.6
FL State Planar Y Coordinate	553336.0	553336.0
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.5	9.5
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.1	6.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.36	12.36
Strata (feet bls) (DBHYDRO)	2.09	2.09
Pressure transducer	112959	112959

Table 31 Site information obtained for Station 15: S8D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 2.86 ft above land surface. A photograph of the site (Appendix A) confirms the

casing height. The median water level is slightly less than the land-surface elevation, indicating that the land is inundated with water nearly 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.15.2 Data analysis and revision

The period of record analyzed for well S8D extends from February 2, 2007 through October 15, 2008 (Appendix D). The time-series data from that period contain 622 observations with 58 outliers and no missing values. The summary statistics for this well are provided in table 32.

Problem: The time-series data from well S8D contain 58 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from mid August through mid October 2008. The water level in S8D increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in S8D is consistent with similar increases in water levels in nearby wells, such as S7S. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Summary: The peaks and declines in water-level data from well S8D closely coincide with peaks and declines in water-level data from nearby wells (S8S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 S8D probably are valid data that accurately represent hydrologic conditions at the site. However, the period of record for this station ends on October 15, 2008 instead of extending until December 3. No revisions were required.

Statistics for S8D	Original series	Revised series
Minimum (feet NGVD29)	8.153	8.153
Mean (feet NGVD29)	9.452	9.452
Median (feet NGVD29)	9.347	9.347
Maximum (feet NGVD29)	11.552	11.552
Standard deviation	0.677	0.677
Variance	0.459	0.459
Outliers	58	58
Missing values	0	0

Table 32 Summary statistics of time-series data for Station 15: S8D

4.16 Station 16: S8S

S8S is a 0.93-ft deep well located along the southern transect (figs. 1 and 2). S8S is one of two wells at the site (S8), which also includes 2.09-ft deep well S8D.

4.16.1 Site and data description

Variable	Original value	Revised value
Station name	S8S	S8S
Station name (DBHYDRO) proposed	S8S	S8S
Latitude (NAD83)	255120.783	255120.783
Longitude (NAD83)	804610.522	804610.522
FL State Planar X Coordinate	731934.7	731934.7
FL State Planar Y Coordinate	553337.4	553337.4
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.5	9.5
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	6.1	6.1
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.52	13.52
Strata (feet bls) (DBHYDRO)	0.93	0.93
Pressure transducer	113245	113245

Table 33 Site information obtained for Station 16: S8S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 4.02 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is slightly less than the land-surface elevation, indicating that the land is inundated with water nearly 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.16.2 Data analysis and revision

The period of record analyzed for well S8S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 94 outliers and 1 missing value. The summary statistics for this well are provided in table 34.

Problem: The time-series data from well S8S contain 94 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through late November 2008. The water level in S8S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.55 ft from August 17 – 20 after storms delivered more than 7 inches of

rainfall during that period. The increase in water level in S8S is consistent with similar increases in water levels in nearby wells, such as S8D. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well S8S has one missing value.

Analysis: The missing value occurred on August 28, 2007. The well appears to have been serviced on August 29, but data collection has ceased on August 27. The cause of the loss of data probably was power failure or another technical problem. No attempt was made to estimate the missing value.

Problem: The time-series data from well S8S has periods of flat, anomalous water levels from March 4 through September 23, 2007 and from May 6 through June 18, 2008.

Analysis: The periods of flat water levels, which occurred at the end of the dry seasons, are inconsistent with water levels in nearby wells, such as S8D. The water levels during these periods generally fluctuated around 9.34 ft above NGVD29 in 2007 to 9.35 ft above NGVD29 in 2008. The data values probably represent the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during those periods were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well S8S closely coincide with peaks and declines in water-level data from nearby wells (S8D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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. Water-level data from March 4 through September 23, 2007 and from May 6 though June 18, 2008 had periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well S8S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S8S	Original series	Revised series
Minimum (feet NGVD29)	9.304	9.304
Mean (feet NGVD29)	9.760	9.760
Median (feet NGVD29)	9.460	9.460
Maximum (feet NGVD29)	11.552	11.552
Standard deviation	0.636	0.636
Variance	0.404	0.404
Outliers	94	94
Missing values	1	1

Table 34 Summary statistics of time-series data for Station 16: S8S

4.17 Station 17: S9D

S9D is a 2.08-ft deep well located along the southern transect (figs. 1 and 2). S9D is one of two wells at the site (S9), which also includes 0.96-ft deep well S9S.

4.17.1 Site and data description

Variable	Original value	Revised value
Station name	S9D	S9D
Station name (DBHYDRO) proposed	S9D	S9D
Latitude (NAD83)	255120.737	255120.737
Longitude (NAD83)	804609.450	804609.450
FL State Planar X Coordinate	732035.3	732035.3
FL State Planar Y Coordinate	553332.9	553332.9
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.0	9.0
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	5.5	5.5
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	11.87	11.87
Strata (feet bls) (DBHYDRO)	2.08	2.08
Pressure transducer	113250	113250

Table 35 Site information obtained for Station 17: S9D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 2.87 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.17.2 Data analysis and revision

The period of record analyzed for well S9D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 50 outliers and 78 missing values. The summary statistics for this well are provided in table 36.

Problem: The time-series data from well S9D contain 50 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred September 19 through October 15 and from November 11 through December 3, 2008. The outliers are consistent with data from nearby wells, and probably result from excessive rainfalls that occurred from mid August through mid September 2008. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well S9D contain 78 missing values.

Analysis: One missing value occurred on August 28, 2007. The site appears to have been serviced on August 29, but data collected ceased on August 27, possibly from equipment malfunction.

Missing values also occurred from July 30 through September 18 and from October 16 through November 10, 2008. The station was serviced on September 19, so missing values prior to that day probably resulted from equipment malfunction. A comment in the original dataset states that the pressure transducer was “pulled because of WL height” on October 15. Data from nearby wells, such as S9S, indicate water levels peaked on October 1, and declined steadily after October 15. Hence, the decision to remove the pressure transducer probably was premature, and resulted in loss of data. No attempt was made to estimate missing values.

Summary: The peaks and declines in water-level data from well S9D closely coincide with peaks and declines in water-level data from nearby wells (S9S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 contain 50 outliers, which are consistent with water-levels in nearby wells. The time-series data also contain 78 missing values, 26 of which resulted from a premature decision to remove the pressure transducer due to high water levels. No attempt was made to estimate missing values. The remaining time-series data from well S9D probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S9D	Original series	Revised series
Minimum (feet NGVD29)	8.161	8.161
Mean (feet NGVD29)	9.388	9.388
Median (feet NGVD29)	9.301	9.301
Maximum (feet NGVD29)	11.552	11.552
Standard deviation	0.641	0.641
Variance	0.411	0.411
Outliers	50	50
Missing values	78	78

Table 36 Summary statistics of time-series data for Station 17: S9D

4.18 Station 18: S9S

S9S is a 0.96-ft deep well located along the southern transect (figs. 1 and 2). S9S is one of two wells at the site (S9), which also includes 2.08-ft deep well S9D.

4.18.1 Site and data description

Variable	Original value	Revised value
Station name	S9S	S9S
Station name (DBHYDRO) proposed	S9S	S9S
Latitude (NAD83)	255120.767	255120.767
Longitude (NAD83)	804609.456	804609.456
FL State Planar X Coordinate	732034.7	732034.7
FL State Planar Y Coordinate	553336.0	553336.0
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	9.0	9.0
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	5.5	5.5
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	12.99	12.99
Strata (feet bls) (DBHYDRO)	0.96	0.96
Pressure transducer	112947	112947

Table 37 Site information obtained for Station 18: S9S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.99 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.18.2 Data analysis and revision

The period of record analyzed for well S9S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 72 outliers and no missing values. The summary statistics for this well are provided in table 38.

Problem: The time-series data from well S9S contain 72 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred from late August through mid November 2008. The water level in S9S increased significantly after a series of heavy storms produced excessive rainfall at the island (Appendix D). For example, water level in the well increased 0.59 ft from August 17 – 20 after storms delivered more than 7 inches of rainfall during that period. The increase in water level in S9S is consistent with similar increases in water levels in nearby wells, such as S8S. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well S9S has periods of flat, anomalous water levels from April 3 through July 14, 2007.

Analysis: The periods of flat water levels, which occurred at the end of the dry season, are inconsistent with water levels in nearby wells, such as S9D. The water levels during these periods generally fluctuated around 8.82 to 8.83 ft above NGVD29. The data values probably represent the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during those periods were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well S9S closely coincide with peaks and declines in water-level data from nearby wells (S9D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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. Water-level data from April 3 through July 14, 2007 had periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well S9S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S9S	Original series	Revised series
Minimum (feet NGVD29)	8.785	8.785
Mean (feet NGVD29)	9.575	9.575
Median (feet NGVD29)	9.361	9.361
Maximum (feet NGVD29)	11.497	11.497
Standard deviation	0.727	0.727
Variance	0.528	0.528
Outliers	72	72
Missing values	0	0

Table 38 Summary statistics of time-series data for Station 18: S9S

4.19 Station 19: S10D

S10D is a 1.92-ft deep well located along the southern transect (figs. 1 and 2). S10D is one of two wells at the site (S10), which also includes 0.52-ft deep well S10S.

4.19.1 Site and data description

Variable	Original value	Revised value
Station name	S10D	S10D
Station name (DBHYDRO) proposed	S10D	S10D
Latitude (NAD83)	255120.753	255120.753
Longitude (NAD83)	804609.236	804609.236
FL State Planar X Coordinate	732054.8	732054.8
FL State Planar Y Coordinate	553334.6	553334.6
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	5.0	5.0
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	11.93	11.93
Strata (feet bls) (DBHYDRO)	1.92	1.92
Pressure transducer	113246	113246

Table 39 Site information obtained for Station 19: S10D

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.03 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.19.2 Data analysis and revision

The period of record analyzed for well S10D extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 77 outliers and 1 missing value. The summary statistics for this well are provided in table 40.

Problem: The time-series data from well S10D contain 77 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred late August through mid November 2008. The outliers are consistent with data from nearby wells, and probably result from excessive rainfalls that occurred from mid August through mid September 2008. As with nearly all of the other wells, water levels in S10D increased significantly from August 17-20 as a result of rainfalls totally more than 7 inches. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well S10D contain 1 missing value.

Analysis: One missing value occurred on August 28, 2007. The site appears to have been serviced on August 29, but data collected ceased on August 27, possibly from equipment malfunction.

Summary: The peaks and declines in water-level data from well S10D closely coincide with peaks and declines in water-level data from nearby wells (S10S, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 contain 77 outliers, which are consistent with water-levels in nearby wells. The time-series data from well S10D probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S10D	Original series	Revised series
Minimum (feet NGVD29)	8.160	8.160
Mean (feet NGVD29)	9.534	9.534
Median (feet NGVD29)	9.345	9.345
Maximum (feet NGVD29)	11.520	11.520
Standard deviation	0.770	0.770
Variance	0.593	0.593
Outliers	77	77
Missing values	1	1

Table 40 Summary statistics of time-series data for Station 19: S10D

4.20 Station 20: S10S

S10S is a 0.52-ft deep well located along the southern transect (figs. 1 and 2). S10S is one of two wells at the site (S10), which also includes1.92-ft deep well S10D.

4.20.1 Site and data description

Variable	Original value	Revised value
Station name	S10S	S10S
Station name (DBHYDRO) proposed	S10S	S10S
Latitude (NAD83)	255120.780	255120.780
Longitude (NAD83)	804609.226	804609.226
FL State Planar X Coordinate	732055.8	732055.8
FL State Planar Y Coordinate	553337.4	553337.4
Land (muck)-surface elevation (feet NGVD29) (2007 survey)	8.9	8.9
Land (rock)-surface elevation (feet NGVD29) (2007 survey)	5.0	5.0
Reference elevation (feet NGVD29) (recorder registration and 2007 survey)	13.33	13.33
Strata (feet bls) (DBHYDRO)	0.52	0.52
Pressure transducer	113248	113248

Table 41 Site information obtained for Station 20: S10S

Analysis: The site information is consistent, and appears to be accurate. The difference between the reference and land-surface elevations indicates the casing extends about 3.43 ft above land surface. A photograph of the site (Appendix A) confirms the casing height. The median water level is higher than the land-surface elevation, indicating that the land is inundated with water more than 50 percent of the time. Inundation is consistent with the location of the site in wetlands in WCA3. No revisions were required.

4.20.2 Data analysis and revision

The period of record analyzed for well S10S extends from February 2, 2007 through December 3, 2008 (Appendix D). The time-series data from that period contain 671 observations with 77 outliers and 27 missing values. The summary statistics for this well are provided in table 42.

Problem: The time-series data from well S10S contain 77 outliers, all of which exceed the upper fence.

Analysis: The outliers occurred late August through mid November 2008. The outliers are consistent with data from nearby wells, and probably result from excessive rainfalls that occurred from mid August through mid September 2008. As with nearly all of the other wells, water levels in S10D increased significantly from August 17-20 as a result of rainfalls totally more than 7 inches. Therefore, the outliers probably are valid data that accurately represent hydrologic conditions at the site.

Problem: The time-series data from well S10S contain 27 missing values.

Analysis: Missing values occurred from August 28 through September 23, 2007. The reason for the missing values is unknown. As with other wells, such as S10D, data collection ceased on August 27, possibly from equipment malfunctions. Although S10D appears to have been serviced on August 29, S10S does not appear to have been serviced until September 24. No attempt was made to estimate missing values.

Problem: The time-series data from well S10S has periods of flat, anomalous water levels from March 12 through August 26, 2007 and from May 31 through June 17, 2008.

Analysis: The periods of flat water levels, which occurred at the end of the dry seasons, are inconsistent with water levels in nearby wells, such as S10D. The water levels during these periods generally fluctuated around 9.1 ft above NGVD29 in 2007 to 8.96 ft above NGVD29 in 2008. The land-surface elevation for the site is 8.9 ft above NGVD29). The data values probably represent the elevation of the pressure transducer in the well, indicating that the water level declined below the pressure transducer. Hence, the data were determined to be inaccurate, and were coded as less than (<) the stated values. Because the water level was below the transducer, the water-temperature data during those periods were determined to be erroneous, and deleted from the dataset.

Summary: The peaks and declines in water-level data from well S10S closely coincide with peaks and declines in water-level data from nearby wells (S10D, 3AS3W1_GP, and 3AS3W3_GP) drilled to a similar depth (Appendix D). 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 contain 77 outliers, which are consistent with water-levels in nearby wells. The time-series data also contain 27 missing values, possibly as a result of equipment malfunction. Water-level data from March 12 through August 26, 2007 and from May 31 though June 17, 2008 had periods of anomalously flat values inconsistent with data from nearby wells. The flat hydrograph probably resulted from the water levels in the well declining below the pressure transducer. The anomalous values were coded with a less-than sign. The remaining time-series data from well S10S probably are valid data that accurately represent hydrologic conditions at the site. No revisions were required.

Statistics for S10S	Original series	Revised series
Minimum (feet NGVD29)	8.932	8.932
Mean (feet NGVD29)	9.642	9.642
Median (feet NGVD29)	9.387	9.387
Maximum (feet NGVD29)	11.512	11.512
Standard deviation	0.694	0.694
Variance	0.481	0.481
Outliers	77	77
Missing values	27	27

Table 42 Summary statistics of time-series data for Station 20: S10S

5 WATER-LEVEL MAPS

Five contour maps were constructed to show groundwater levels and the configuration of the water table at 3AS3 and surrounding areas. The maps were generated to show the minimum water levels at the end of the two dry seasons and maximum water levels the end of the two wet seasons during the period of record. Minimum water levels occurred on May 31, 2007 and June 9, 2008, whereas maximum water levels occurred on November 1, 2007 and October 1, 2008 (figs. 5 through 8). In addition, a map was constructed to show the configuration of the water table during periods of median water levels (fig. 8).

Water-level maps were constructed using the four shallow SFWMD wells (8.5 to 10.7 feet deep) at 3AS3W1, 3AS3W2, 3AS3W3, and 3AS3W4 and the ten deep FIU wells (1.71 to 2.40 feet deep) at the north and south transects. The difference in depths indicates the two sets of wells tap different hydrologic units—the SFWMD wells are finished in the limestone bedrock, whereas the FIU wells are finished in overlying peat and unconsolidated sediments. The two hydrologic units likely have different hydraulic properties (conductivity and storativity), which could affect their connectivity. For example, water levels in the SFWMD wells on October 1, 2008 (fig. 8) show a steady gradient in the water table declining from north to south. In contrast, the FIU wells show mounding of groundwater on the same date. Therefore, the two sets of wells were contoured separately on each of the five maps.

The overall low number of data points, particularly for the SFWMD wells, leaves the possibility of multiple interpretations for the same data. The simplest, most straightforward interpretations were used in construction of these five maps; however, the contours shown in this report are not a unique solution to the distribution of the data.

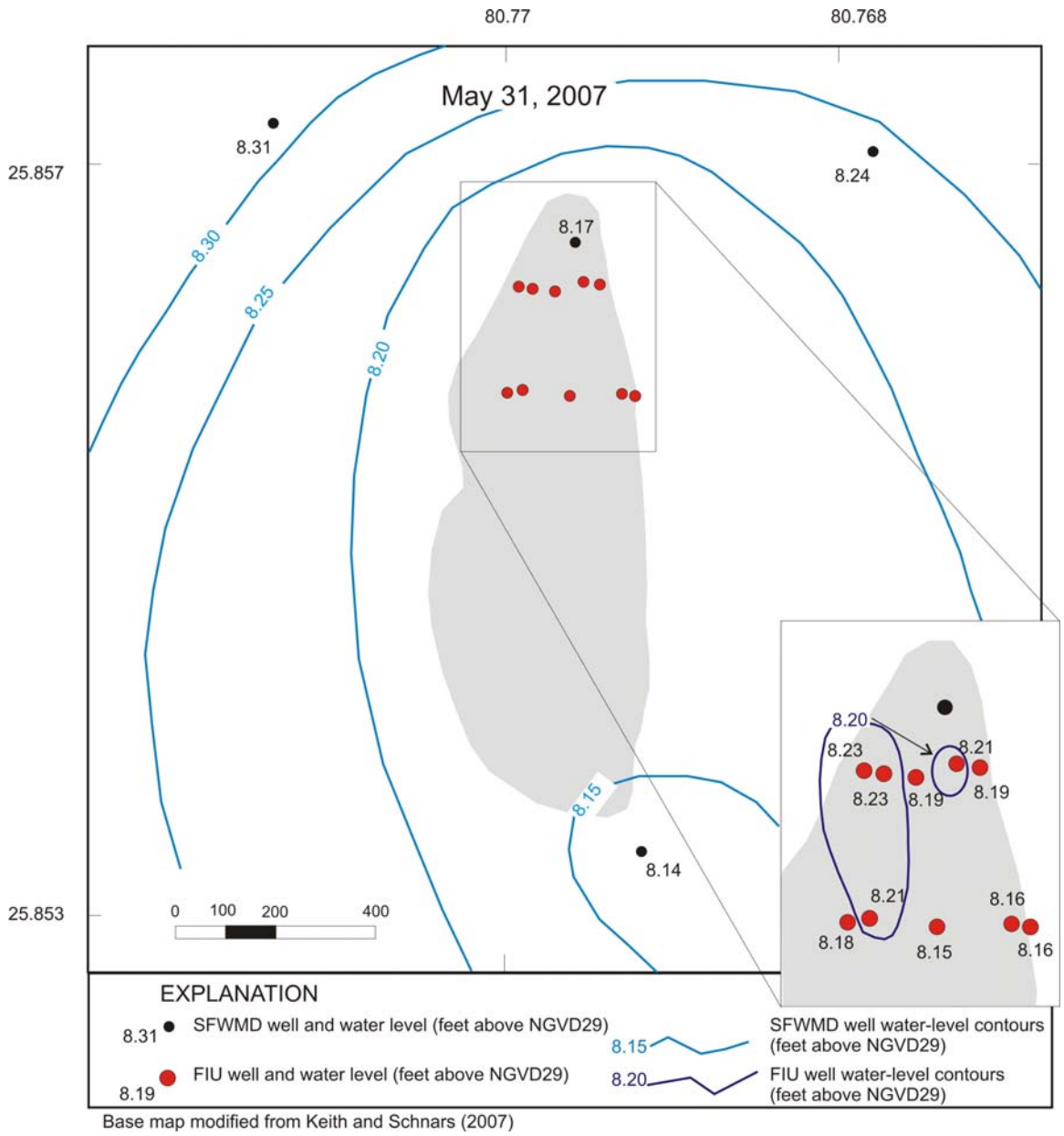

Figure 5 Contour map showing groundwater levels at 3AS3 on May 31, 2007.

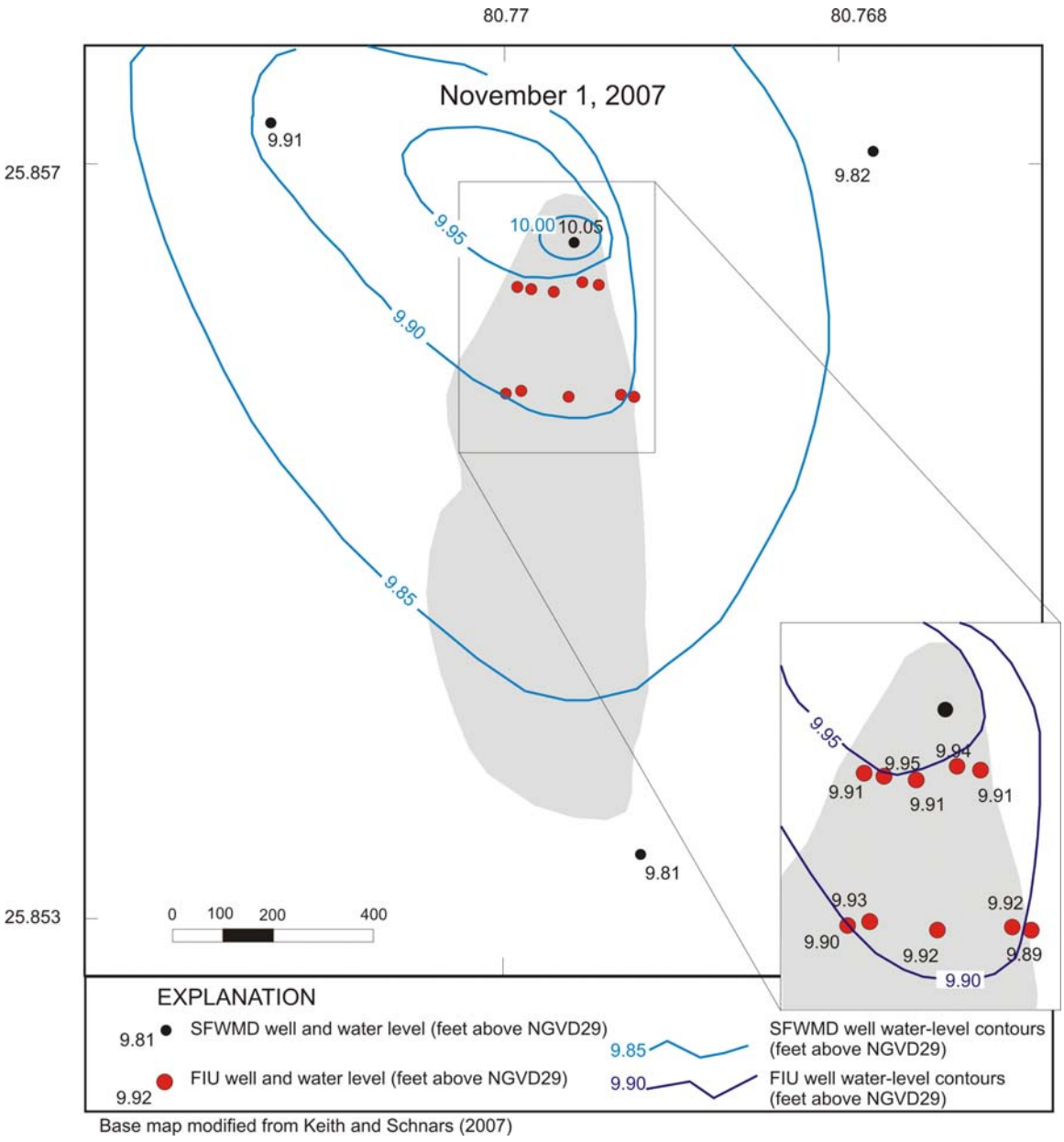

Figure 6 Contour map showing groundwater levels at 3AS3 on November 1, 2007.

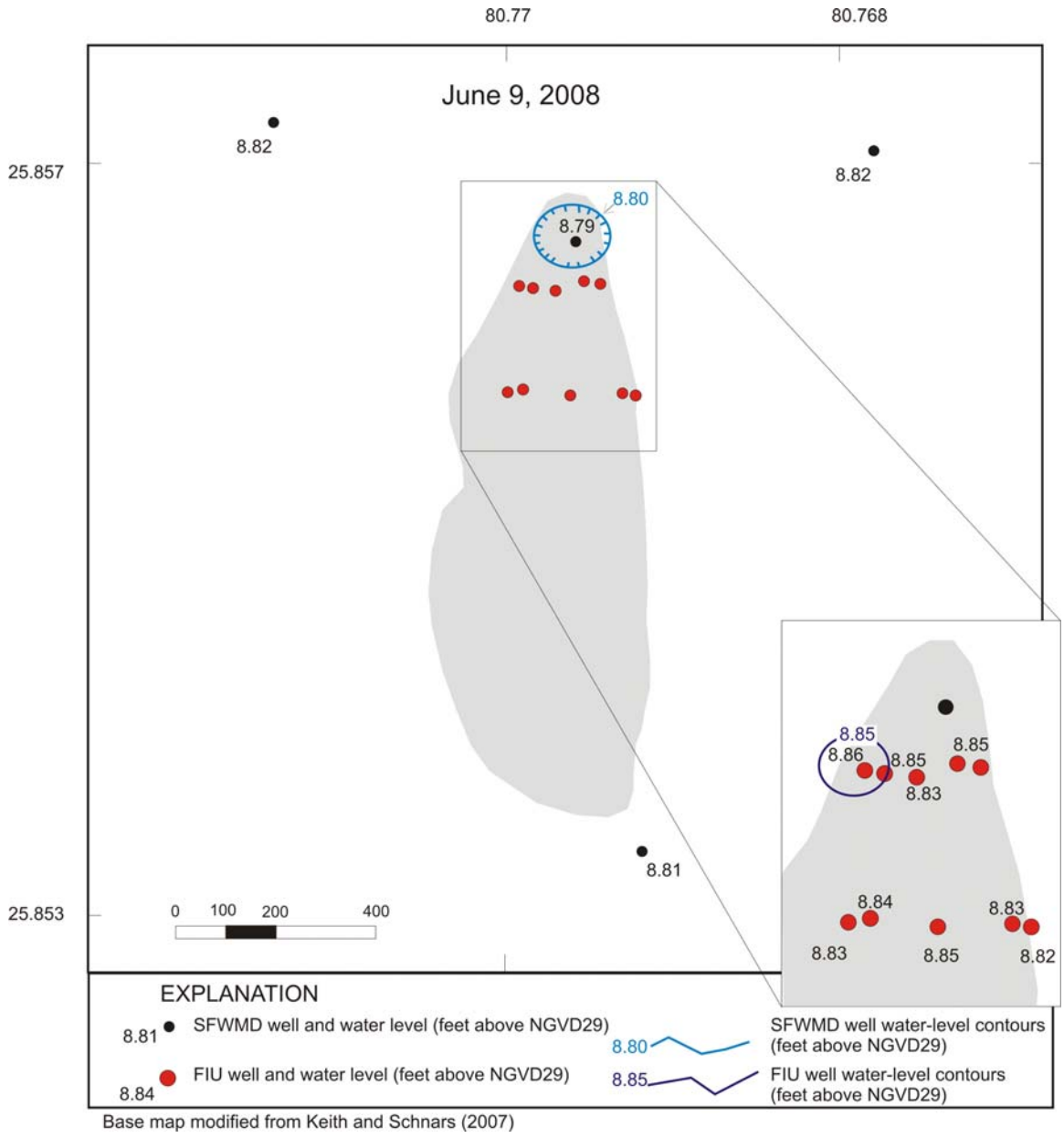

Figure 7 Contour map showing groundwater levels at 3AS3 on June 9, 2008.

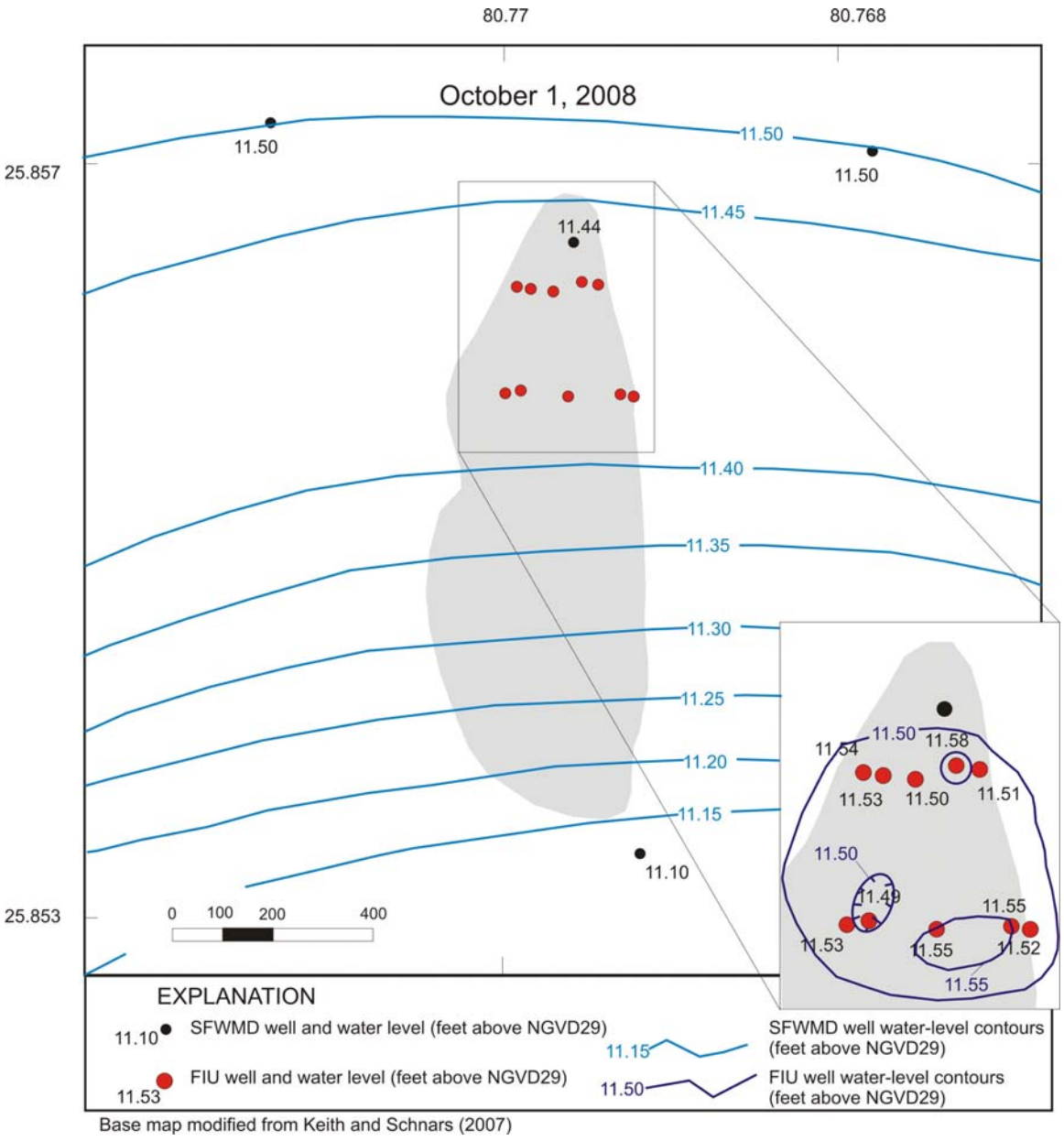

Figure 8 Contour map showing groundwater levels at 3AS3 on October 1, 2008.

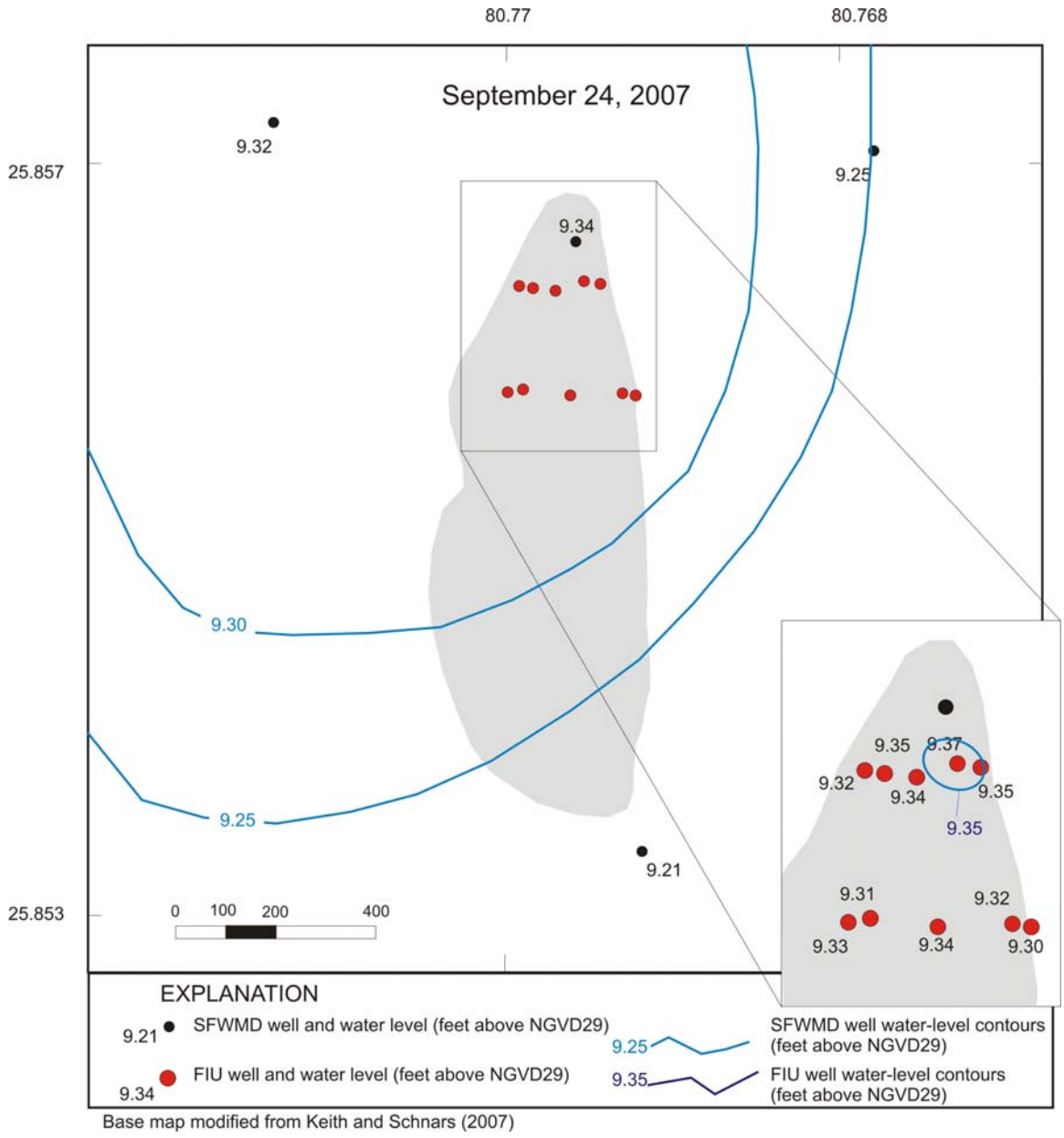

Figure 9 Contour map showing groundwater levels at 3AS3 on September 24, 2007.

6 SUMMARY

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 (SFWMD) began monitoring meteorological data and groundwater and surface-water levels at three tree islands (fig. 1) 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). In January 2007, 20 additional monitoring wells were installed at island 3AS3 by researchers at Florida International University (Tiffany Troxler, FIU, written commun., 2009). The wells were installed in pairs along two east-west trending transects (fig. 2). Each transect consisted of five pairs, with each pair containing a shallow and deep well.

The objective of this study was to compile the site information and time-series data collected by FIU for eventual uploading into the SFWMD corporate database DBHYDRO. The tasks involved in meeting that objective included, but were not limited to, the following:

1. Obtain all site information and time-series (water level and water temperature) data for the 20 wells from FIU.
2. Process and convert the data as necessary.
3. Construct an Access database for storage of the data; include time-series and site information from the nine SFWMD stations at 3AS3.
4. Enter site information from the 20 wells into recorder registration worksheets and the Hydrogeologic Data Loader template.
5. Compile site information (photographs, construction information, and survey reports) into site folders for uploading into the SFMWD SIM site.
6. Calculate daily values (averages) from water-level data from the 20 wells.
7. Conduct thorough quality-assurance analysis on the daily values.
8. Generate comma-separated variable files of all time-series data for uploading into DBHYDRO.

9. Construct five contour maps showing the configuration of the groundwater levels around 3AS3.

The site information and time-series data from the 20 target wells generally appears to be consistent and accurate. The locations of the wells are accurately known, and construction information is consistent.

Time-series data were collected at 15-minute increments in the 20 wells from February 2, 2007 through December 3, 2008, with the exception of well N8D, where data collection ceased on October 15, 2008. The time-series data from all of the wells had outliers that exceeded the upper fence (Appendix D). The outliers, which numbered from 50 to 94 per well, generally occurred from late August through mid November 2008, and were consistent with water-levels in nearby wells. The outliers probably resulted from excessive rainfalls that occurred in August and September 2008. For example, rainfalls recorded at 3AS3 from August 17-20, 2008 total more than 7 inches, which resulted in significant increases (about 0.5 ft) in water levels in all 20 wells. The outliers were determined to be valid data that accurately represented hydrologic conditions at the sites.

Ten of the wells have periods of missing time-series data. The number of missing values ranged from 1 to 78. In eight of the wells, the missing values probably were related to equipment errors or malfunctions. In two wells, N5D and N9D, the pressure transducers were removed from the wells on October 15, 2008 due to high water. The decision to remove the pressure transducers was premature, because water levels in the wells peaked on October 1, and declined in nearby wells after October 15.

All ten shallow wells had periods of anomalously flat water-level data inconsistent with data collected from the nearby deep wells. The anomalous data occurred toward the end of the dry season (late March through mid July) of 2007 in the northern transect wells. The southern transect wells had anomalous data from March through August 2007 and in late May and early June 2008 (Appendix D). In each case, the anomalous data probably resulted from water levels in the wells declining below the pressure transducers. The 20 target wells are extremely shallow; the depths of the shallow wells range from just 0.52 to 1.36 ft below land surface. The data collected during these periods were subsequently coded with a less-than sign (<) (Cindy Bevier, SFWMD, personal commun., 2009) to indicate that the actual water level was less than the value in the database. However, water temperature data collected during these periods were considered erroneous, as the transducers were above water, and deleted. The missing values were coded as “M”. Installing the wells at slightly deeper levels would have prevented this loss of data.

Water-level maps were constructed using the four shallow SFWMD wells (8.5 to 10.7 feet deep) at 3AS3 and the ten deep FIU wells (1.71 to 2.40 feet deep) at the north and south transects. The difference in depths indicates the two sets of wells tap different hydrologic units—the SFWMD wells are finished in the limestone bedrock, whereas the FIU wells are finished in overlying peat and unconsolidated sediments. The two

hydrologic units likely have different hydraulic properties (conductivity and storativity), which could affect their connectivity. For example, water levels in the SFWMD wells on October 1, 2008 (fig. 8) show a steady gradient in the water table declining from north to south. In contrast, the FIU wells show mounding of groundwater on the same date. Therefore, the two sets of wells were contoured separately on each of the five maps.

The overall low number of data points, particularly for the SFWMD wells, leaves the possibility of multiple interpretations for the same data. The simplest, most straightforward interpretations were used in construction of these five maps; however, the contours shown in this report are not a unique solution to the distribution of the data.

7 REFERENCES

Bevier, C., and Krupa, S., 2001, Groundwater-surface water interaction in Tree Islands: Water Conservation Area 3. Part 1: Phase 1 Well installation: South Florida Water Management District Technical Publication WS-4, 160 p.

Keith and Schnars, PA, 2007, Surveyor's Report: Specific purpose survey of wells and ground elevations at Tree Island 3AS3. 34 p.

Sangoyomi, T., and Lambright, D., 2006, QA/QC of groundwater level data procedures: South Florida Water Management District Procedure Q205, 70 p.

8 APPENDIX A Photographs of target wells

Figure 18: FIU well N1D

Figure 19:FIU well N1S

Figure 20: FIU well N2D

Figure 21: FIU well N2S

Figure 22:FIU well N3D

Figure 23: FIU well N3S

Figure 24: FIU well N4D

Figure 25: FIU well N4S

Figure 26: FIU well N5D

Figure 27: FIU well N5S

Figure 28: FIU well S6D

Figure 29: FIU well S6S

Figure 30: FIU well S7D

Figure 31: FIU well S7S

Figure 32: FIU well S8D

Figure 33: FIU well S8S

Figure 34: FIU well S9D

Figure 35: FIU well S9S

Figure 36: FIU well S10D

Figure 37: FIU well S10S

9 APPENDIX B Written communications and construction information for target wells

PREFIX	Well ID	Transect	Cluster	Direction	Location	Depth of screen below peat surface	Anchor Pipe Length	transducer serial #
FIU	N1S	N	1	W	E	30	46	112948
FIU	N1D	N	1	W	E	60	33.5	112922
FIU	N2S	N	2	W	I	30	48	112926
FIU	N2D	N	2	W	I	60	20	112943
FIU	N3S	N	3	O	C	30	46.5	113249
FIU	N3D	N	3	O	C	60	17.5	113243
FIU	N4S	N	4	E	I	30	54	112929
FIU	N4D	N	4	E	I	60	19	113252
FIU	N5S	N	5	E	E	30	56	112942
FIU	N5D	N	5	E	E	60	18.5	112957
FIU	S6S	S	6	W	E	30	65.5	112951
FIU	S6D	S	6	W	E	60	38.3	112944
FIU	S7S	S	7	W	I	30	66.5	113237
FIU	S7D	S	7	W	I	60	40	112950
FIU	S8S	S	8	O	C	30	69.5	113245
FIU	S8D	S	8	O	C	60	31	112959
FIU	S9S	S	9	E	I	30	77	112947
FIU	S9D	S	9	E	I	60	52	113250
FIU	S10S	S	10	E	E	30	90.3	113248
FIU	S10D	S	10	E	E	60	45	113246
FIU	X11S	X	11	N	E	30	45.2	115027
FIU	X11D	X	11	N	E	60	20.2	115039
FIU	X12S	X	12	N	I	30	15	114510
FIU	X12D	X	12	N	I	60	15	101116
		N=NORTH S=SOUTH X=EXTRA		W=WEST O=CENTER E=EAST	E=EDGE I=ISLAND C=CENTER			

Well name	NAD 83 latitude (north)	NAD 83 longitude (west)	State plane coordinate (northing/Y, U.S. Survey Feet)	State plane coordinate (easting/X, U.S. Survey Feet)	Top of well elevation (NGVD 29, feet)	Hard ground (HG) elevation (NGVD 29, feet)	Soft ground (SG) elevation (NGVD 29, feet)
N1D	25° 51' 22.905"	80° 46' 11.710"	553551.5	731828.4	12.42	5.7	9.5
N1S	25° 51' 22.922"	80° 46' 11.707"	553553.2	731828.7	13.09		
N2D	25° 51' 22.875"	80° 46' 11.452"	553548.4	731852.0	12.06	6.1	8.9
N2S	25° 51' 22.900"	80° 46' 11.450"	553551.0	731852.2	13.13		
N3D	25° 51' 22.830"	80° 46' 10.882"	553544.0	731904.1	11.92	6.5	8.9
N3S	25° 51' 22.854"	80° 46' 10.878"	553546.5	731904.4	12.87		
N4D	25° 51' 22.944"	80° 46' 10.262"	553555.7	731960.7	12.17	6.1	9.1
N4S	25° 51' 22.959"	80° 46' 10.255"	553557.2	731961.4	13.23		
N5D	25° 51' 22.951"	80° 46' 09.986"	553556.4	731985.9	11.75	6.4	9.2
N5S	25° 51' 22.972"	80° 46' 09.990"	553558.5	731985.6	13.06		
S6D	25° 51' 20.805"	80° 46' 11.940"	553339.4	731807.9	12.44	6.2	9.2
S6S	25° 51' 20.826"	80° 46' 11.939"	553341.5	731807.9	13.29		
S7D	25° 51' 20.822"	80° 46' 11.665"	553341.2	731832.9	12.23	6.1	9.1
S7S	25° 51' 20.844"	80° 46' 11.677"	553343.4	731831.8	13.37		
S8D	25° 51' 20.769"	80° 46' 10.564"	553336.0	731933.6	12.36	6.1	9.5
S8S	25° 51' 20.783"	80° 46' 10.552"	553337.4	731934.7	13.52		
S9D	25° 51' 20.737"	80° 46' 09.450"	553332.9	732035.3	11.87	5.5	9.0
S9S	25° 51' 20.767"	80° 46' 09.456"	553336.0	732034.7	12.99		
S10D	25° 51' 20.753"	80° 46' 09.236"	553334.6	732054.8	11.93	5.0	8.9
S10S	25° 51' 20.780"	80° 46' 09.226"	553337.4	732055.8	13.33		

Well name	Well Elevation mm	HG Elev mm	SG Elev mm	Screen top depth mm	Screen bottom depthmm	Middle of screen from Hard Ground mm	Middle of screen from Soft Ground mm
N1D	3785.616			2375.616	2275.616	-588.256	569.984
N1S	3989.832	1737.36	2895.6	2579.832	2479.832	-792.472	365.768
N2D	3675.888			2265.888	2165.888	-356.608	496.832
N2S	4002.024	1859.28	2712.72	2592.024	2492.024	-682.744	170.696
N3D	3633.216			2223.216	2123.216	-192.016	539.504
N3S	3922.776	1981.2	2712.72	2512.776	2412.776	-481.576	249.944
N4D	3709.416			2299.416	2199.416	-390.136	524.264
N4S	4032.504	1859.28	2773.68	2622.504	2522.504	-713.224	201.176
N5D	3581.4			2171.4	2071.4	-170.68	682.76
N5S	3980.688	1950.72	2804.16	2570.688	2470.688	-569.968	283.472
S6D	3791.712			2381.712	2281.712	-441.952	472.448
S6S	4050.792	1889.76	2804.16	2640.792	2540.792	-701.032	213.368
S7D	3727.704			2317.704	2217.704	-408.424	505.976
S7S	4075.176	1859.28	2773.68	2665.176	2565.176	-755.896	158.504
S8D	3767.328			2357.328	2257.328	-448.048	588.272
S8S	4120.896	1859.28	2895.6	2710.896	2610.896	-801.616	234.704
S9D	3617.976			2207.976	2107.976	-481.576	585.224
S9S	3959.352	1676.4	2743.2	2549.352	2449.352	-822.952	243.848
S10D	3636.264			2226.264	2126.264	-652.264	536.456
S10S	4062.984	1524	2712.72	2652.984	2552.984	-1078.98	109.736

Well name	Anchor length (mm)	Bottom of screen (calculated from HG)	Top of screen (ft above NGVD 29)*	Top of screen (ft below land surface (SG))*	Bottom of screen (ft above NGVD 29)*	Bottom of screen (below land surface (SG))*	Hole depth (mm)	Hole depth (ft below land surface (SG))*	Anchor length (ft)*
N1D	335	2072.36	7.79	1.71	7.47	2.03	1158.24	3.8	1.10
N1S	460	2197.36	8.46	1.04	8.14	1.36			1.51
N2D	200	2059.28	7.43	1.47	7.11	1.79	853.44	2.8	0.66
N2S	480	2339.28	8.50	0.40	8.18	0.72			1.57
N3D	175	2156.2	7.29	1.61	6.97	1.93	731.52	2.4	0.57
N3S	465	2446.2	8.24	0.66	7.92	0.98			1.53
N4D	190	2049.28	7.54	1.56	7.22	1.88	914.4	3	0.62
N4S	540	2399.28	8.60	0.50	8.28	0.82			1.77
N5D	185	2135.72	7.12	2.08	6.80	2.40	853.44	2.8	0.61
N5S	560	2510.72	8.43	0.77	8.11	1.09			1.84
S6D	383	2272.76	7.81	1.39	7.49	1.71	914.4	3	1.26
S6S	655	2544.76	8.66	0.54	8.34	0.86			2.15
S7D	400	2259.28	7.60	1.50	7.28	1.82	914.4	3	1.31
S7S	665	2524.28	8.74	0.36	8.42	0.68			2.18
S8D	310	2169.28	7.73	1.77	7.41	2.09	1036.32	3.4	1.02
S8S	695	2554.28	8.89	0.61	8.57	0.93			2.28
S9D	520	2196.4	7.24	1.76	6.92	2.08	1066.8	3.5	1.71
S9S	770	2446.4	8.36	0.64	8.04	0.96			2.53
S10D	450	1974	7.30	1.60	6.98	1.92	1188.72	3.9	1.48
S10S	903	2427	8.70	0.20	8.38	0.52			2.96

From: ronomad@gmail.com on behalf of Damon Rondeau [rondeaud@fiu.edu]
Sent: Wednesday, July 22, 2009 1:47 PM
To: Krupa, Steven
Cc: Tiffany Troxler; jadamski@agc-geology.com
Subject: Re: wells at tree island 3AS3

Mr. Krupa,

I am around but I don't really have the sheet which I think Mr. Adamski is needing. That sheet involved is a record of what the depth to bedrock is against the relative soil height for each soil cluster plus other notes regarding well installation. Now what I can tell him is that all FIU wells (those installed by us) are 2inch inner diameter, 157cm long (deep), with the "screen" area being roughly 10cm long starting at 141cm down pipe. Hope that makes sense. If you use the surveyed height of the pipe, then you can easily subtract 141cm to know the upper most point of the "screen". Subtracting 151cm would give you the bottom of the "screen" area. I have included the Survey excel sheet with some quick formula's thrown together for teasing out the "screen area" per pipe against NGVD 29 and when looking at the surveyed results for Hard Ground/Soft Ground. This list only includes the wells which we (FIU) installed. So I think this answers # 1, possibly # 2, sorta # 3, and the rest will either need to be pulled from hard records (field notes themselves) or from Dr. Troxler's digital records.

Sorry I couldn't be more help.

Damon

On Wed, Jul 22, 2009 at 11:58, Krupa, Steven <skrupa@sfwmd.gov> wrote:

> Hey Tiff,
>
> I can reconstruct stuff if I had to but I remember Damon made a SS with all that information in it. Is he around?
>
> Steve
>
> -----Original Message-----
> From: Tiffany Troxler [mailto:troxlert@fiu.edu]
> Sent: Wednesday, July 22, 2009 11:49 AM
> To: jadamski@agc-geology.com
> Cc: Krupa, Steven
> Subject: RE: wells at tree island 3AS3

Hi Jim,

Steve had forwarded me your message. I'm out of town and quite busy at the moment. I have some infomration written up about the well construction. Steve had the wells milled to specs he provided so he'll have that info. I'll see if I can pull up some images for you. I'l try and send this a bit later in the day.

Tiffany

From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Wednesday, July 22, 2009 9:49 AM
To: Tiffany Troxler
Subject: wells at tree island 3AS3

Greetings Tiffany,

I am working as a consultant for Steve Krupa, SFWMD, to help enter the data collected by FIU at Tree Island 3AS3 into the SFWMD corporate database. Steve sent me the site locations and time-series data for each of the wells. However, I also need any information you might have about the well construction. Would you have, or know where I can obtain, the following info for each well?

1. Well depth
2. Screen and casing lengths
3. Well and hole diameter
4. Method and date of construction
5. Finish type
6. Lithologic descriptions
7. Photographs of the wells
8. Results of any slug or aquifer performance tests

Thank you for your assistance. Please feel free to call me if you have any questions. I look forward to hearing from you.

Sincerely,

James Adamski, PG
Adamski Geological Consulting
(407) 463-3444

From: ronomad@gmail.com on behalf of Damon Rondeau [rondeaud@fiu.edu]
Sent: Monday, August 10, 2009 9:02 AM
To: jadamski@agc-geology.com
Cc: Tiffany Troxler
Subject: Re: FW: wells at tree island 3AS3

Mr. Adamski

Sorry I didn't reply to your earlier message. I'm afraid your going to need to direct your questioning to Dr. Troxler as she is the one who knows what time period and detials she sent you. Again my apologies for not being more helpful!

Have a great day!

On Mon, Aug 10, 2009 at 08:25, jadamski@agc-geology.com <jadamski@agc-geology.com> wrote:
>
> Hi Damon,
>
>
>
> I wanted to ask again about the water temperature data in the tree island wells during periods when water-level data are missing. A few of the data sets have notes indicating the “gauge was pulled because of WL height”. If the water-temperature data were collected using the pressure transducer. Hence, any temp data in the files during that period probably are not valid, unless you used a separate instrument to collect temp data. There also are extended periods when the water level in the shallow wells appears to be below the level of the pressure transducer, which makes the temperate data suspect. Thank you for any info you can provide.
>
>
>
> Sincerely,
>
>
>
> Jim Adamski
>
>
>
> -----Original Message-----

> From: jadamski@agc-geology.com [mailto:jadamski@agc-geology.com]
> Sent: Wednesday, August 05, 2009 12:52 PM
> To: 'Damon Rondeau'
> Subject: RE: wells at tree island 3AS3
>
>
>
> Hi Damon,
>
>
>
> I was hoping you could answer a quick question about the time-series data from the FIU tree island wells. Water-level data from one of the wells, N9D is missing from mid October – early November 2008. A message in the spread sheet states that the "gauge was pulled because of WL height"; however, water-temperature data are available for the same period. Were the water-temperature data collected with the pressure transducer or with a separate instrument? In other words, are these temperature data valid? BTW, have you had a chance to locate any photos of the wells?
>
>
>
> Thanks,
>
>
>
> Jim Adamski
>
>
>
> -----Original Message-----
> From: ronomad@gmail.com [mailto:ronomad@gmail.com] On Behalf Of Damon Rondeau
> Sent: Wednesday, July 22, 2009 1:47 PM
> To: Krupa, Steven
> Cc: Tiffany Troxler; jadamski@agc-geology.com
> Subject: Re: wells at tree island 3AS3
>
>
>
> Mr. Krupa,
>
>

>
> I am around but I don't really have the sheet which I think Mr. Adamski is needing. That sheet involved is a record of what the depth to bedrock is against the relative soil height for each soil cluster plus other notes regarding well installation. Now what I can tell him is that all FIU wells (those installed by us) are 2inch inner diameter, 157cm long (deep), with the "screen" area being roughly 10cm long starting at 141cm down pipe. Hope that makes sense. If you use the surveyed height of the pipe, then you can easily subtract 141cm to know the upper most point of the "screen". Subtracting 151cm would give you the bottom of the "screen" area. I have included the Survey excel sheet with some quick formula's thrown together for teasing out the "screen area" per pipe against NGVD 29 and when looking at the surveyed results for Hard Ground/Soft Ground. This list only includes the wells which we (FIU) installed. So I think this answers # 1, possibly # 2, sorta # 3, and the rest will either need to be pulled from hard records (field notes themselves) or from Dr. Troxler's digital records.
>
> Sorry I couldn't be more help.
>
>
>
> Damon
>
> On Wed, Jul 22, 2009 at 11:58, Krupa, Steven <skrupa@sfwmd.gov> wrote:
>
> Hey Tiff,
>
> I can reconstruct stuff if I had to but I remember Damon made a SS with
> all that information in it. Is he around?
>
> Steve
>
> -----Original Message-----
> From: Tiffany Troxler [mailto:troxlert@fiu.edu]
> Sent: Wednesday, July 22, 2009 11:49 AM
> To: jadamski@agc-geology.com
> Cc: Krupa, Steven
> Subject: RE: wells at tree island 3AS3
>
> Hi Jim,
>
> Steve had forwarded me your message. I'm out of town and quite busy at
> the moment. I have some infomration written up about the well
> construction. Steve had the wells milled to specs he provided so he'll

> have that info. I'll see if I can pull up some images for you. I'l try
> and send this a bit later in the day.
>
> Tiffany
> _____
> From: jadamski@agc-geology.com [jadamski@agc-geology.com]
> Sent: Wednesday, July 22, 2009 9:49 AM
> To: Tiffany Troxler
> Subject: wells at tree island 3AS3
>
> Greetings Tiffany,
>
> I am working as a consultant for Steve Krupa, SFWMD, to help enter the
> data collected by FIU at Tree Island 3AS3 into the SFWMD corporate
> database. Steve sent me the site locations and time-series data for each
> of the wells. However, I also need any information you might have about
> the well construction. Would you have, or know where I can obtain, the
> following info for each well?
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> 3. Well and hole diameter
> 4. Method and date of construction
> 5. Finish type
> 6. Lithologic descriptions
> 7. Photographs of the wells
> 8. Results of any slug or aquifer performance tests
>
> Thank you for your assistance. Please feel free to call me if you have
> any questions. I look forward to hearing from you.
>
> Sincerely,
>
> James Adamski, PG
> Adamski Geological Consulting
> (407) 463-3444
>
>

From: Tiffany Troxler [troxlert@fiu.edu]
Sent: Wednesday, July 22, 2009 2:01 PM
To: Krupa, Steven

Cc: Damon Rondeau; jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

Hey guys,

This is what we have. I can send you text about some details of the well construction later.

Tiffany

From: Krupa, Steven [skrupa@sfwmd.gov]
Sent: Wednesday, July 22, 2009 11:58 AM
To: Tiffany Troxler
Cc: Damon Rondeau; jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

Hey Tiff,

I can reconstruct stuff if I had to but I remember Damon made a SS with all that information in it. Is he around?

Steve

-----Original Message-----
From: Tiffany Troxler [mailto:troxlert@fiu.edu]
Sent: Wednesday, July 22, 2009 11:49 AM
To: jadamski@agc-geology.com
Cc: Krupa, Steven
Subject: RE: wells at tree island 3AS3

Hi Jim,

Steve had forwarded me your message. I'm out of town and quite busy at the moment. I have some infomration written up about the well construction. Steve had the wells milled to specs he provided so he'll have that info. I'll see if I can pull up some images for you. I'l try and send this a bit later in the day.

Tiffany

From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Wednesday, July 22, 2009 9:49 AM

To: Tiffany Troxler
Subject: wells at tree island 3AS3

Greetings Tiffany,

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8. Results of any slug or aquifer performance tests

Thank you for your assistance. Please feel free to call me if you have any questions. I look forward to hearing from you.

Sincerely,

James Adamski, PG
Adamski Geological Consulting
(407) 463-3444
From: Tiffany Troxler [troxlert@fiu.edu]
Sent: Wednesday, July 22, 2009 2:02 PM
To: Krupa, Steven
Cc: Damon Rondeau; jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

I'm doing too many things at once. Here's the spreadsheet.

From: Krupa, Steven [skrupa@sfwmd.gov]
Sent: Wednesday, July 22, 2009 11:58 AM
To: Tiffany Troxler
Cc: Damon Rondeau; jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

Hey Tiff,

I can reconstruct stuff if I had to but I remember Damon made a SS with all that information in it. Is he around?

Steve

-----Original Message-----
From: Tiffany Troxler [mailto:troxlert@fiu.edu]
Sent: Wednesday, July 22, 2009 11:49 AM
To: jadamski@agc-geology.com
Cc: Krupa, Steven
Subject: RE: wells at tree island 3AS3

Hi Jim,

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Tiffany

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Sent: Wednesday, July 22, 2009 9:49 AM
To: Tiffany Troxler
Subject: wells at tree island 3AS3

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Thank you for your assistance. Please feel free to call me if you have any questions. I look forward to hearing from you.

Sincerely,

James Adamski, PG
Adamski Geological Consulting
(407) 463-3444

From: Tiffany Troxler [troxlert@fiu.edu]
Sent: Wednesday, July 22, 2009 12:38 PM
To: Krupa, Steven
Cc: Damon Rondeau; jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

What's an SS?

From: Krupa, Steven [skrupa@sfwmd.gov]
Sent: Wednesday, July 22, 2009 11:58 AM
To: Tiffany Troxler
Cc: Damon Rondeau; jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

Hey Tiff,

I can reconstruct stuff if I had to but I remember Damon made a SS with all that information in it. Is he around?

Steve

-----Original Message-----
From: Tiffany Troxler [mailto:troxlert@fiu.edu]
Sent: Wednesday, July 22, 2009 11:49 AM
To: jadamski@agc-geology.com
Cc: Krupa, Steven
Subject: RE: wells at tree island 3AS3

Hi Jim,

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Tiffany

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From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Wednesday, July 22, 2009 9:49 AM
To: Tiffany Troxler
Subject: wells at tree island 3AS3

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Thank you for your assistance. Please feel free to call me if you have any questions. I look forward to hearing from you.

Sincerely,

James Adamski, PG
Adamski Geological Consulting
(407) 463-3444
From: Tiffany Troxler [troxlert@fiu.edu]
Sent: Thursday, July 30, 2009 8:17 AM
To: jadamski@agc-geology.com

Subject: RE: wells at tree island 3AS3

Hi Jim,

Sorry for the delayed reply, just catching up.

The wells were installed in Jan 2007, S and D wells were installed in their own respective boreholes and we did not make any descriptions of the soil.

Tiffany

From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Monday, July 27, 2009 9:27 AM
To: Tiffany Troxler
Subject: RE: wells at tree island 3AS3

Hi Tiffany,

Thanks for the info. I just had a few more quick questions.

1.. Do you have a date for the installation of each well?
2.. Is each well installed in its own borehole, or were shallow and deep wells nested in a single borehole?
3.. Were any lithologic or soil descriptions made during the drilling?

Thanks,

Jim Adamski

-----Original Message-----
From: Tiffany Troxler [mailto:troxlert@fiu.edu]

Sent: Thursday, July 23, 2009 9:14 AM
To: jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

Hi Jim,

Heres text regarding the well installation. Tiffany

We installed wells in two transects across WH (north) and NT (south) communities (Figure 4). Wells were installed in five clusters across each transect, with two wells per cluster, installed to 30cm and 60cm below the soil surface. The well design was a 2" PVC slotted along 10 cm at bottom of pipe and fit with pressure transducer (In-situ®) water level gauges. We installed the wells by excavating approximately 20cm diameter holes with a gas-powered hand auger. To ensure the wells did not migrate due to peat shrinkage or swelling, the pipes were installed with anchor and well sections. The

bore hole for each well was dug down to the limestone where the anchor section, attached to the well section, was rested. The slotted section of the well section was then 20-30cm and 50-60cm below the soil surface for shallow and deep wells, respectively. The annular area around the wells was then filled with betonite around the anchor section, filled with sand to completely cover the profile under and above the slotted section, and to include the slotted section. The annular area was then capped with betonite and sand. Wells were then surveyed relative to nearest benchmark by a professional surveying company, Keith & Schnars

---

From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Wednesday, July 22, 2009 2:18 PM
To: Damon Rondeau; 'Krupa, Steven'
Cc: Tiffany Troxler
Subject: RE: wells at tree island 3AS3

Hi Tiffany and Damon,

Thanks for the info. This will definitely help.

Take care,

Jim

-----Original Message-----
From: ronomad@gmail.com [mailto:ronomad@gmail.com] On Behalf Of Damon Rondeau
Sent: Wednesday, July 22, 2009 1:47 PM
To: Krupa, Steven
Cc: Tiffany Troxler; jadamski@agc-geology.com
Subject: Re: wells at tree island 3AS3

Mr. Krupa,

I am around but I don't really have the sheet which I think Mr. Adamski is needing. That sheet involved is a record of what the depth to bedrock is against the relative soil height for each soil cluster plus other notes regarding well installation. Now what I can tell him is that all FIU wells (those installed by us) are 2inch inner diameter, 157cm long (deep), with the "screen" area being roughly 10cm long starting at 141cm down pipe. Hope that makes sense. If you use the surveyed height of the pipe, then you can easily subtract 141cm to know the upper most point of the "screen". Subtracting 151cm would give you the bottom of the "screen" area. I have included the Survey excel sheet with some quick formula's thrown together for teasing out the "screen area" per pipe against NGVD 29 and when looking at the surveyed results for Hard Ground/Soft Ground. This list only includes the wells which we (FIU) installed. So I think this answers # 1, possibly # 2, sorta # 3, and the rest will either need to be pulled from hard records (field notes themselves) or from Dr. Troxler's digital records.

Sorry I couldn't be more help.

Damon

On Wed, Jul 22, 2009 at 11:58, Krupa, Steven <skrupa@sfwmd.gov> wrote:

Hey Tiff,

I can reconstruct stuff if I had to but I remember Damon made a SS with all that information in it. Is he around?

Steve

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Sent: Wednesday, July 22, 2009 11:49 AM
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Cc: Krupa, Steven
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Thank you for your assistance. Please feel free to call me if you have any questions. I look forward to hearing from you.

Sincerely,

James Adamski, PG
Adamski Geological Consulting
(407) 463-3444

From: Tiffany Troxler [troxlert@fiu.edu]
Sent: Wednesday, August 05, 2009 3:05 PM
To: jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

Hi Jim,

Sorry yes, sure, here's a pic or two. Tiffany

From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Wednesday, August 05, 2009 9:13 AM
To: Tiffany Troxler
Subject: RE: wells at tree island 3AS3

Hi Tiffany,

Thanks again for the info on the wells. Have you had a chance to locate any pictures of the wells?

Take care,

Jim Adamski

-----Original Message-----
From: Tiffany Troxler [mailto:troxlert@fiu.edu]
Sent: Thursday, July 23, 2009 9:14 AM
To: jadamski@agc-geology.com
Subject: RE: wells at tree island 3AS3

Hi Jim,

Heres text regarding the well installation. Tiffany

We installed wells in two transects across WH (north) and NT (south) communities (Figure 4). Wells were installed in five clusters across each transect, with two wells per cluster, installed to 30cm and 60cm below the soil surface. The well design was a 2" PVC slotted along 10 cm at bottom of pipe and fit with pressure transducer (In-situ®) water level gauges. We installed the wells by excavating approximately 20cm diameter holes with a gas-powered hand auger. To ensure the wells did not migrate due to peat shrinkage or swelling, the pipes were installed with anchor and well sections. The

bore hole for each well was dug down to the limestone where the anchor section, attached to the well section, was rested. The slotted section of the well section was then 20-30cm and 50-60cm below the soil surface for shallow and deep wells, respectively. The annular area around the wells was then filled with betonite around the anchor section, filled with sand to completely cover the profile under and above the slotted section, and

to include the slotted section. The annular area was then capped with betonite and sand. Wells were then surveyed relative to nearest benchmark by a professional surveying company, Keith & Schnars

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From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Wednesday, July 22, 2009 2:18 PM
To: Damon Rondeau; 'Krupa, Steven'
Cc: Tiffany Troxler
Subject: RE: wells at tree island 3AS3

Hi Tiffany and Damon,

Thanks for the info. This will definitely help.

Take care,

Jim

-----Original Message-----
From: ronomad@gmail.com [mailto:ronomad@gmail.com] On Behalf Of Damon Rondeau
Sent: Wednesday, July 22, 2009 1:47 PM
To: Krupa, Steven
Cc: Tiffany Troxler; jadamski@agc-geology.com
Subject: Re: wells at tree island 3AS3

Mr. Krupa,

I am around but I don't really have the sheet which I think Mr. Adamski is needing. That sheet involved is a record of what the depth to bedrock is against the relative soil height for each soil cluster plus other notes regarding well installation. Now what I can tell him is that all FIU wells (those installed by us) are 2inch inner diameter, 157cm long (deep), with the "screen" area being roughly 10cm long starting at 141cm down pipe. Hope that makes sense. If you use the surveyed height of the pipe, then you can easily subtract 141cm to know the upper most point of the "screen". Subtracting 151cm would give you the bottom of the "screen" area. I have included the Survey excel sheet with some quick formula's thrown together for teasing out the "screen area" per pipe against NGVD 29 and when looking at the surveyed results for Hard Ground/Soft Ground. This list only includes the wells which we (FIU) installed. So I think this answers # 1, possibly # 2, sorta # 3, and the rest will either need to be pulled from hard records (field notes themselves) or from Dr. Troxler's digital records.

Sorry I couldn't be more help.

Damon

On Wed, Jul 22, 2009 at 11:58, Krupa, Steven <skrupa@sfwmd.gov> wrote:

Hey Tiff,

I can reconstruct stuff if I had to but I remember Damon made a SS with all that information in it. Is he around?

Steve

-----Original Message-----
From: Tiffany Troxler [mailto:troxlert@fiu.edu]
Sent: Wednesday, July 22, 2009 11:49 AM
To: jadamski@agc-geology.com
Cc: Krupa, Steven
Subject: RE: wells at tree island 3AS3

Hi Jim,

Steve had forwarded me your message. I'm out of town and quite busy at the moment. I have some infomration written up about the well construction. Steve had the wells milled to specs he provided so he'll

have that info. I'll see if I can pull up some images for you. I'l try and send this a bit later in the day.

Tiffany

From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Wednesday, July 22, 2009 9:49 AM
To: Tiffany Troxler
Subject: wells at tree island 3AS3

Greetings Tiffany,

I am working as a consultant for Steve Krupa, SFWMD, to help enter the data collected by FIU at Tree Island 3AS3 into the SFWMD corporate database. Steve sent me the site locations and time-series data for each of the wells. However, I also need any information you might have about the well construction. Would you have, or know where I can obtain, the following info for each well?

1. Well depth
2. Screen and casing lengths
3. Well and hole diameter
4. Method and date of construction
5. Finish type
6. Lithologic descriptions
7. Photographs of the wells
8. Results of any slug or aquifer performance tests

Thank you for your assistance. Please feel free to call me if you have any questions. I look forward to hearing from you.

Sincerely,

James Adamski, PG
Adamski Geological Consulting
(407) 463-3444

From: Tiffany Troxler [troxlert@fiu.edu]
Sent: Tuesday, August 11, 2009 7:37 AM
To: jadamski@agc-geology.com; Damon Rondeau
Subject: RE: wells at tree island 3AS3

Hi Jim,

The temperature data are collected with the same instrument and thus not valid if the gauge is out of the water.

Tiffany

From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Monday, August 10, 2009 8:25 AM
To: Damon Rondeau
Cc: Tiffany Troxler
Subject: FW: wells at tree island 3AS3

Hi Damon,

I wanted to ask again about the water temperature data in the tree island wells during periods when water-level data are missing. A few of the data sets have notes indicating the “gauge was pulled because of WL height”. If the water-temperature data were collected using the pressure transducer. Hence, any temp data in the files during that period probably are not valid, unless you used a separate instrument to collect temp data. There also are extended periods when the water level in the shallow wells appears to be below the level of the pressure transducer, which makes the temperate data suspect. Thank you for any info you can provide.

Sincerely,

Jim Adamski

-----Original Message-----
From: jadamski@agc-geology.com [mailto:jadamski@agc-geology.com]
Sent: Wednesday, August 05, 2009 12:52 PM
To: 'Damon Rondeau'

Subject: RE: wells at tree island 3AS3

Hi Damon,

I was hoping you could answer a quick question about the time-series data from the FIU tree island wells. Water-level data from one of the wells, N9D is missing from mid October – early November 2008. A message in the spread sheet states that the "gauge was pulled because of WL height"; however, water-temperature data are available for the same period. Were the water-temperature data collected with the pressure transducer or with a separate instrument? In other words, are these temperature data valid? BTW, have you had a chance to locate any photos of the wells?

Thanks,

Jim Adamski

-----Original Message-----
From: ronomad@gmail.com [mailto:ronomad@gmail.com] On Behalf Of Damon Rondeau
Sent: Wednesday, July 22, 2009 1:47 PM
To: Krupa, Steven
Cc: Tiffany Troxler; jadamski@agc-geology.com
Subject: Re: wells at tree island 3AS3

Mr. Krupa,

I am around but I don't really have the sheet which I think Mr. Adamski is needing. That sheet involved is a record of what the depth to bedrock is against the relative soil height

for each soil cluster plus other notes regarding well installation. Now what I can tell him is that all FIU wells (those installed by us) are 2inch inner diameter, 157cm long (deep), with the "screen" area being roughly 10cm long starting at 141cm down pipe. Hope that makes sense. If you use the surveyed height of the pipe, then you can easily subtract 141cm to know the upper most point of the "screen". Subtracting 151cm would give you the bottom of the "screen" area. I have included the Survey excel sheet with some quick formula's thrown together for teasing out the "screen area" per pipe against NGVD 29 and when looking at the surveyed results for Hard Ground/Soft Ground. This list only includes the wells which we (FIU) installed. So I think this answers # 1, possibly # 2, sorta # 3, and the rest will either need to be pulled from hard records (field notes themselves) or from Dr. Troxler's digital records.

Sorry I couldn't be more help.

Damon

On Wed, Jul 22, 2009 at 11:58, Krupa, Steven <skrupa@sfwmd.gov> wrote:

Hey Tiff,

I can reconstruct stuff if I had to but I remember Damon made a SS with all that information in it. Is he around?

Steve

-----Original Message-----
From: Tiffany Troxler [mailto:troxlert@fiu.edu]
Sent: Wednesday, July 22, 2009 11:49 AM
To: jadamski@agc-geology.com
Cc: Krupa, Steven
Subject: RE: wells at tree island 3AS3

Hi Jim,

Steve had forwarded me your message. I'm out of town and quite busy at the moment. I have some infomration written up about the well construction. Steve had the wells milled to specs he provided so he'll have that info. I'll see if I can pull up some images for you. I'l try and send this a bit later in the day.

Tiffany

From: jadamski@agc-geology.com [jadamski@agc-geology.com]
Sent: Wednesday, July 22, 2009 9:49 AM
To: Tiffany Troxler
Subject: wells at tree island 3AS3

Greetings Tiffany,

I am working as a consultant for Steve Krupa, SFWMD, to help enter the data collected by FIU at Tree Island 3AS3 into the SFWMD corporate database. Steve sent me the site locations and time-series data for each of the wells. However, I also need any information you might have about the well construction. Would you have, or know where I can obtain, the following info for each well?

1. Well depth
2. Screen and casing lengths
3. Well and hole diameter
4. Method and date of construction
5. Finish type
6. Lithologic descriptions
7. Photographs of the wells
8. Results of any slug or aquifer performance tests

Thank you for your assistance. Please feel free to call me if you have any questions. I look forward to hearing from you.

Sincerely,

James Adamski, PG
Adamski Geological Consulting
(407) 463-3444

10 APPENDIX C Recorder registration worksheets for target wells

REGISTRATION WORKSHEET - N1 Activation

Site Name:	N1	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site N1. Wells N1S and N1D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat — Lock type or combination: — #

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) — Structure Type:

Array ID Configuration table attached

SURVEY INFORMATION

B.M. Elevation: — Date: — Stamp:

Agency: — Type: — Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: — Loggernet Server: — Loggernet IP Address:

Tower: — Communication Type: — R.F. Code/Modem Address: — R.F. Access Point:

Phone Number:

RTU Address: — Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location	
GW2	N1S	13.09	4/18/2007	13.09	8.14	9.5		NGVD 29	Top of well casing	
GW1	N1D	12.42	4/18/2007	12.42	7.47	9.5		NGVD 29	Top of well casing	

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location												
GW2	9.5	1.36	3.59	Static													
GW1	9.5	2.03	2.92	Static													

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 22.922	80° 46' 11.707	731828.7	553553.2	18	53	36	Fortymile Bend	CASA	Miami-Dade	
GW1	25° 51' 22.905	80° 46' 11.710	731828.449	553551.5	18	53	36	Fortymile Bend	CASA	Miami-Dade	

REGISTRATION WORKSHEET - N2 Activation

Site Name:	N2	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site N2. Wells N2S and N2D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat Lock type or combination: #

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) Structure Type:

Array ID Configuration table attached

SURVEY INFORMATION

B.M. Elevation: Date: Stamp:

Agency: Type: Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: Loggernet Server: Loggernet IP Address:

Tower: Communication Type: R.F. Code/Modem Address: R.F. Access Point:

Phone Number:

RTU Address: Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location	
GW2	N2S	13.13	4/18/2007	13.13	8.18	8.9		NGVD 29	Top of well casing	
GW1	N2D	12.06	4/18/2007	12.06	7.11	8.9		NGVD 29	Top of well casing	

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location												
GW2	8.9	0.72	4.23	Static													
GW1	8.9	1.79	3.16	Static													

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 22.900	80° 46' 11.450	731852.2	553551	18	53	36	Fortymile Bend	CASA	Miami-Dade	
GW1	25° 51' 22.875	80° 46' 11.452	731852.048	553548.4	18	53	36	Fortymile Bend	CASA	Miami-Dade	

REGISTRATION WORKSHEET - N3 Activation

Site Name:	N3	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site N3. Wells N3S and N3D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat — Lock type or combination: — #

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) — Structure Type:

Array ID Configuration table attached

SURVEY INFORMATION

B.M. Elevation: — Date: — Stamp:

Agency: — Type: — Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: — Loggernet Server: — Loggernet IP Address:

Tower: — Communication Type: — R.F. Code/Modem Address: — R.F. Access Point:

Phone Number:

RTU Address: — Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location
GW2	N3S	12.87	4/18/2007	12.87	7.92	8.9		NGVD 29	Top of well casing
GW1	N3D	11.92	4/18/2007	11.92	6.97	8.9		NGVD 29	Top of well casing

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location
GW2	8.9	0.98	3.97	Static	
GW1	8.9	1.93	3.02	Static	

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 22.854	80° 46' 10.878	731904.442	553546.5	18	53	36	Fortymile Bend	CA3A	Miami-Dade	
GW1	25° 51' 22.830	80° 46' 10.882	731904.146	553544	18	53	36	Fortymile Bend	CA3A	Miami-Dade	

REGISTRATION WORKSHEET - N4 Activation

Site Name:	N4	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site N4. Wells N4S and N4D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat — Lock type or combination: — #

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) — Structure Type:

Array ID Configuration table attached

SURVEY INFORMATION

B.M. Elevation: — Date: — Stamp:

Agency: — Type: — Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: — Loggernet Server: — Loggernet IP Address:

Tower: — Communication Type: — R.F. Code/Modem Address: — R.F. Access Point:

Phone Number:

RTU Address: — Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location
GW2	N4S	13.23	4/18/2007	13.23	8.28	9.1		NGVD 29	Top of well casing
GW1	N4D	12.17	4/18/2007	12.17	7.22	9.1		NGVD 29	Top of well casing

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location
GW2	9.1	0.82	4.13	Static	
GW1	9.1	1.88	3.07	Static	

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 22.959"	80° 46' 10.255"	731961.4	553557.2	18	53	36	Fortymile Bend	CA3A	Miami-Dade	
GW1	25° 51' 22.944"	80° 46' 10.262"	731960.685	553555.7	18	53	36	Fortymile Bend	CA3A	Miami-Dade	

REGISTRATION WORKSHEET - N5 Activation

Site Name:	N5	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site N5. Wells N5S and N5D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat — Lock type or combination: — #

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) — Structure Type:

Array ID Configuration table attached

SURVEY INFORMATION

B.M. Elevation: — Date: — Stamp:

Agency: — Type: — Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: — Loggernet Server: — Loggernet IP Address:

Tower: — Communication Type: — R.F. Code/Modem Address: — R.F. Access Point:

Phone Number:

RTU Address: — Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location	
GW2	N5S	13.06	4/18/2007	13.06	8.11	9.2		NGVD 29	Top of well casing	
GW1	N5D	11.75	4/18/2007	11.75	6.8	9.2		NGVD 29	Top of well casing	

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location												
GW2	9.2	1.09	3.86	Static													
GW1	9.2	2.4	2.55	Static													

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 22.972	80° 46' 09.990	731985.6	553558.5	18	53	36	Fortymile Bend	CA3A	Miami-Dade	
GW1	25° 51' 22.951	80° 46' 09.988	731985.925	553556.4	18	53	36	Fortymile Bend	CA3A	Miami-Dade	

REGISTRATION WORKSHEET - S6 Activation

Site Name:	S6	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site S6. Wells S6S and S6D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat — Lock type or combination: — #:

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) — Structure Type:

Array ID Configuration table attached:

SURVEY INFORMATION

B.M. Elevation: — Date: — Stamp:

Agency: — Type: — Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: — Loggernet Server: — Loggernet IP Address:

Tower: — Communication Type: — R.F. Code/Modem Address: — R.F. Access Point:

Phone Number:

RTU Address: — Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location
GW2	S6S	13.29	4/18/2007	13.29	8.34	9.2		NGVD 29	Top of well casing
GW1	S6D	12.44	4/18/2007	12.44	7.49	9.2		NGVD 29	Top of well casing

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location
GW2	9.2	0.86	4.09	Static	
GW1	9.2	1.71	3.34	Static	

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 20.826"	80° 46' 11.936"	731807.9	553341.5	18	53	36	Fortymile Bend	CA3A	Miami-Dade	
GW1	25° 51' 20.805"	80° 46' 11.940"	731807.858	553339.4	18	53	36	Fortymile Bend	CA3A	Miami-Dade	

REGISTRATION WORKSHEET - S7 Activation

Site Name:	S7	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site S7. Wells S7S and S7D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat Lock type or combination: #

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) Structure Type:

Array ID Configuration table attached

SURVEY INFORMATION

B.M. Elevation: Date: Stamp:

Agency: Type: Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: Loggernet Server: Loggernet IP Address:

Tower: Communication Type: R.F. Code/Modem Address: R.F. Access Point:

Phone Number:

RTU Address: Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location
GW2	S7S	13.37	4/18/2007	13.37	8.42	9.1		NGVD 29	Top of well casing
GW1	S7D	12.23	4/18/2007	12.23	7.28	9.1		NGVD 29	Top of well casing

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location
GW2	9.1	0.68	4.27	Static	
GW1	9.1	1.82	3.13	Static	

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 20.844	80° 46' 11.67	731831.8	553343.4	18	53	36	Fortymile Bend	CA3A	Miami-Dade	
GW1	25° 51' 20.823	80° 46' 11.665	731832.9	553341.2	18	53	36	Fortymile Bend	CA3A	Miami-Dade	

REGISTRATION WORKSHEET - S8 Activation

Site Name:	S8	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site S8. Wells S8S and S8D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat Lock type or combination: #

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) Structure Type:

Array ID Configuration table attached

SURVEY INFORMATION

B.M. Elevation: Date: Stamp:

Agency: Type: Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: Loggernet Server: Loggernet IP Address:

Tower: Communication Type: R.F. Code/Modem Address: R.F. Access Point:

Phone Number:

RTU Address: Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location
GW2	S8S	13.52	4/18/2007	13.52	8.57	9.5		NGVD 29	Top of well casing
GW1	S8D	12.36	4/18/2007	12.36	7.41	9.5		NGVD 29	Top of well casing

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location
GW2	9.5	0.93	4.02	Static	
GW1	9.5	2.09	2.86	Static	

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 20.783	80° 46' 10.552	731934.7	553337.4	18	53	36	Fortymile Bend	CA3A	Miami-Dade	
GW1	25° 51' 20.769	80° 46' 10.564	731933.569	553336	18	53	36	Fortymile Bend	CA3A	Miami-Dade	

REGISTRATION WORKSHEET - S9 Activation

Site Name:	S9	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site S9. Wells S9S and S9D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat — Lock type or combination: — #:

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) — Structure Type:

Array ID Configuration table attached:

SURVEY INFORMATION

B.M. Elevation: — Date: — Stamp:

Agency: — Type: — Datum: NGVD 29

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: — Loggernet Server: — Loggernet IP Address:

Tower: — Communication Type: — R.F. Code/Modem Address: — R.F. Access Point:

Phone Number:

RTU Address: — Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location
GW2	S9S	12.99	4/18/2007	12.99	8.04	9		NGVD 29	Top of well casing
GW1	S9D	11.87	4/18/2007	11.87	6.92	9		NGVD 29	Top of well casing

Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location
GW2	9	0.96	3.99	Static	
GW1	9	2.08	2.87	Static	

ADDITIONAL GPS INFORMATION

Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 20.767"	80° 46' 09.456"	732034.7	553336	18	53	36	Fortymile Bend	CA3A	Miami-Dade	
GW1	25° 51' 20.737"	80° 46' 09.450"	732035.254	553332.9	18	53	36	Fortymile Bend	CA3A	Miami-Dade	

REGISTRATION WORKSHEET - S10 Activation

Site Name:	S10	Today's Date:	7/22/2009			Type Recorder:	CR-10
Activity:	Activation	Effective Date:	2/2/2007			Start Date of Data :	
Customer:	Steve Krupa, PG	Bus. Area:	WSD	Agency:	SFWMD	Internal Order: / Fund:	
Project Manager:	Tiffany Troxler-Gann	Bus. Area:	Biology	Agency:	FIU	Contract #:	
Project Name:	Tree Island 3AS3 Groundwater Study			Legal Mandate:			

Short Common Name / Description:	Tree Island 3AS3 Drill Site S10. Wells S10S and S10D.
Proj. Mgr. Notes:	These wells were installed and instrumented by Florida International University. Project manager was Tiffany Troxler-Gann.
Site Directions:	
Site Address (if any):	

Transportation: Airboat — Lock type or combination: — #

Recorder Location/Purpose: Stand-Alone Recorder (Non-Flow Site) — Structure Type:

Array ID Configuration table attached

SURVEY INFORMATION

B.M. Elevation: — Date: — Stamp:

Agency: — Type: — Datum:

Benchmark Location/ Description	

COMMUNICATIONS INFORMATION

Communications System: — Loggernet Server: — Loggernet IP Address:

Tower: — Communication Type: — R.F. Code/Modem Address: — R.F. Access Point:

Phone Number:

RTU Address: — Gateways:

WELL INFORMATION

Sensor	Customer Ref	Ref Elev	Elev Date	Top of Well	Bottom of Well	Ground Elev	Benchmark Elev	Benchmark Datum	Ref Elevation Location
GW2	S10S	13.33	4/18/2007	13.33	8.38	8.9		NGVD 29	Top of well casing
GW1	S10D	11.93	4/18/2007	11.93	6.98	8.9		NGVD 29	Top of well casing

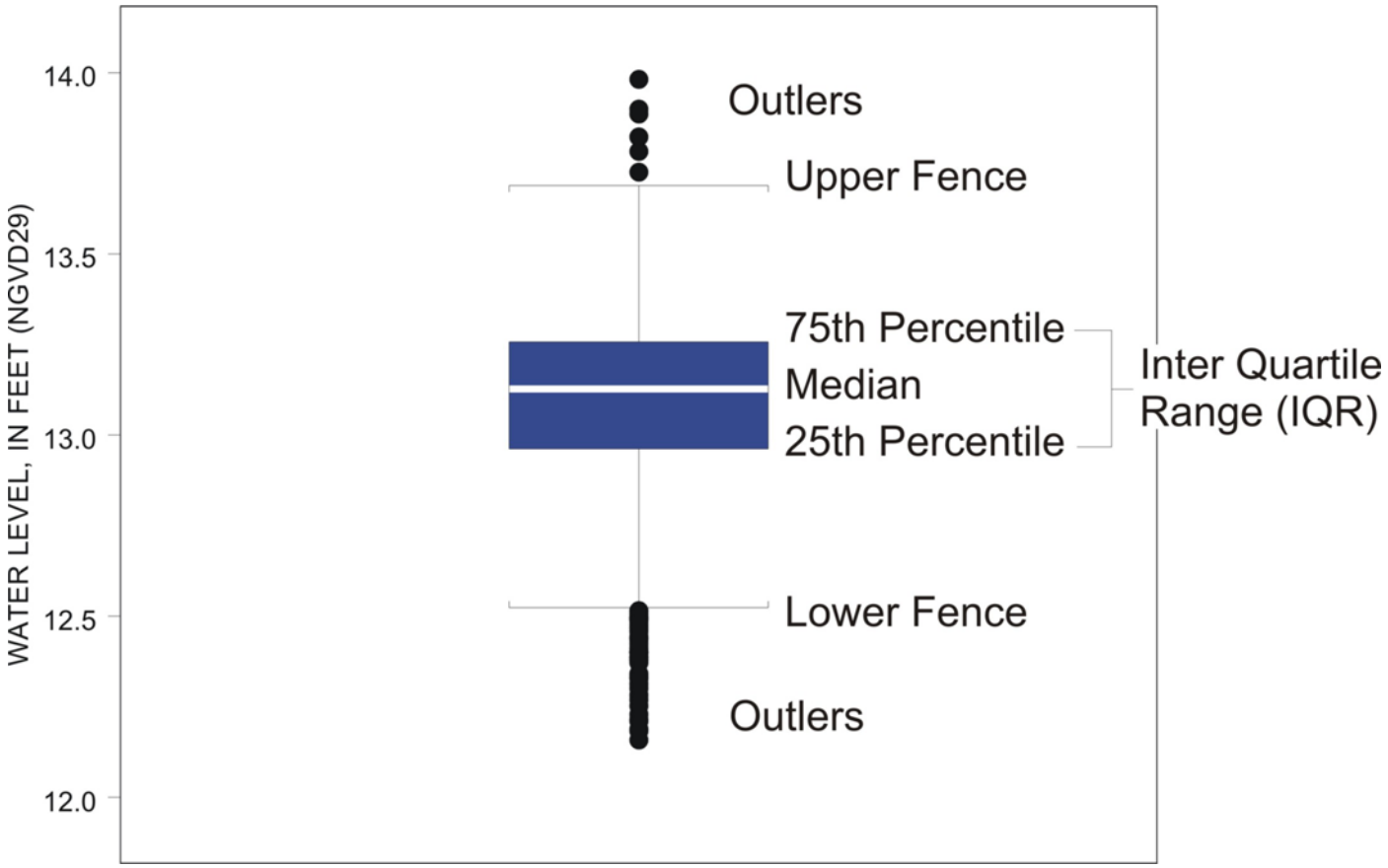
Sensor	GW Land Elevation	Depth of Well	Meas Pt Above BM	Type of Well	GW Sensor location
GW2	8.9	0.52	4.43	Static	
GW1	8.9	1.92	3.03	Static	

ADDITIONAL GPS INFORMATION

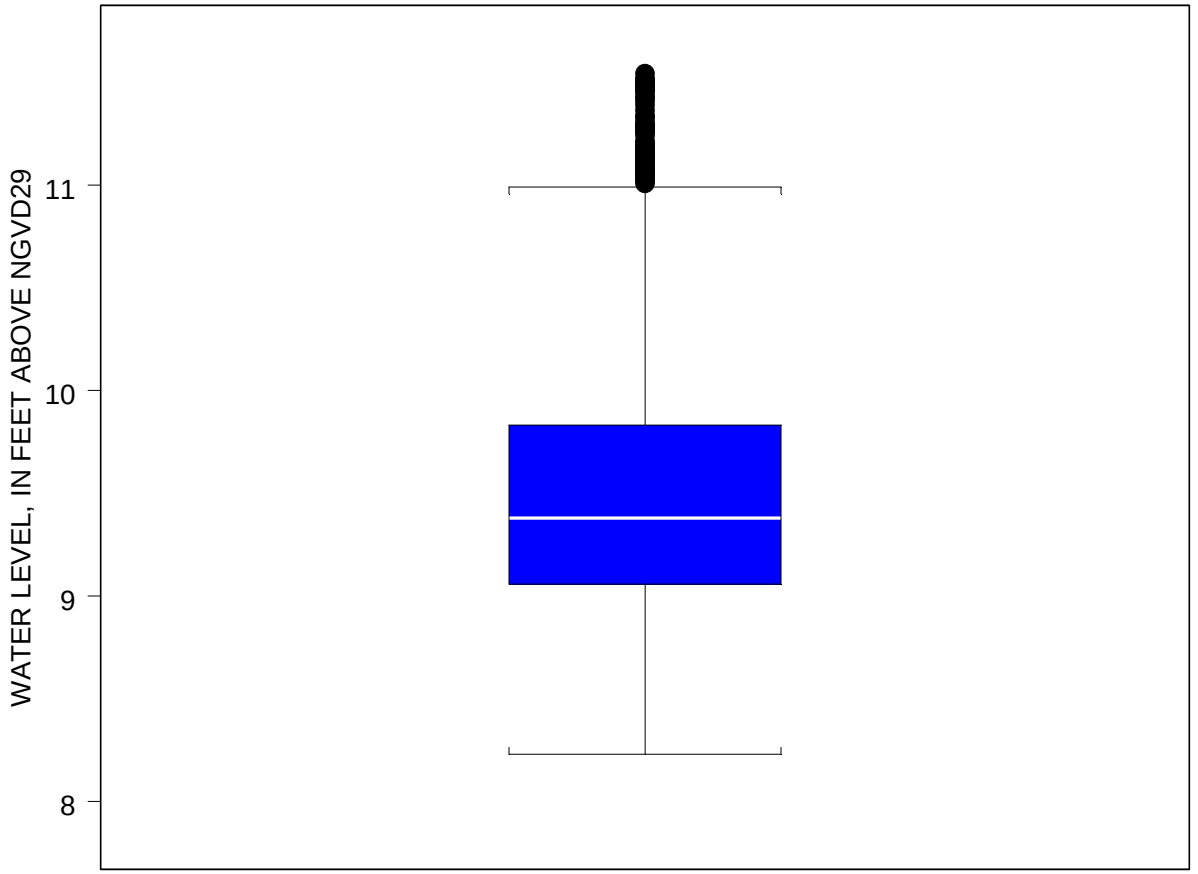
Item/Parm	Lat	Long	X-Coord	Y-Coord	Sec	Township	Range	Quad	Basin	County	Description
GW2	25° 51' 20.788	80° 46' 09.226	732055.8	553397.4	18	53	36	Fortymile Bend	CA3A	Miami-Dade	
GW1	25° 51' 20.753	80° 46' 09.256	732054.847	553334.6	18	53	36	Fortymile Bend	CA3A	Miami-Dade	

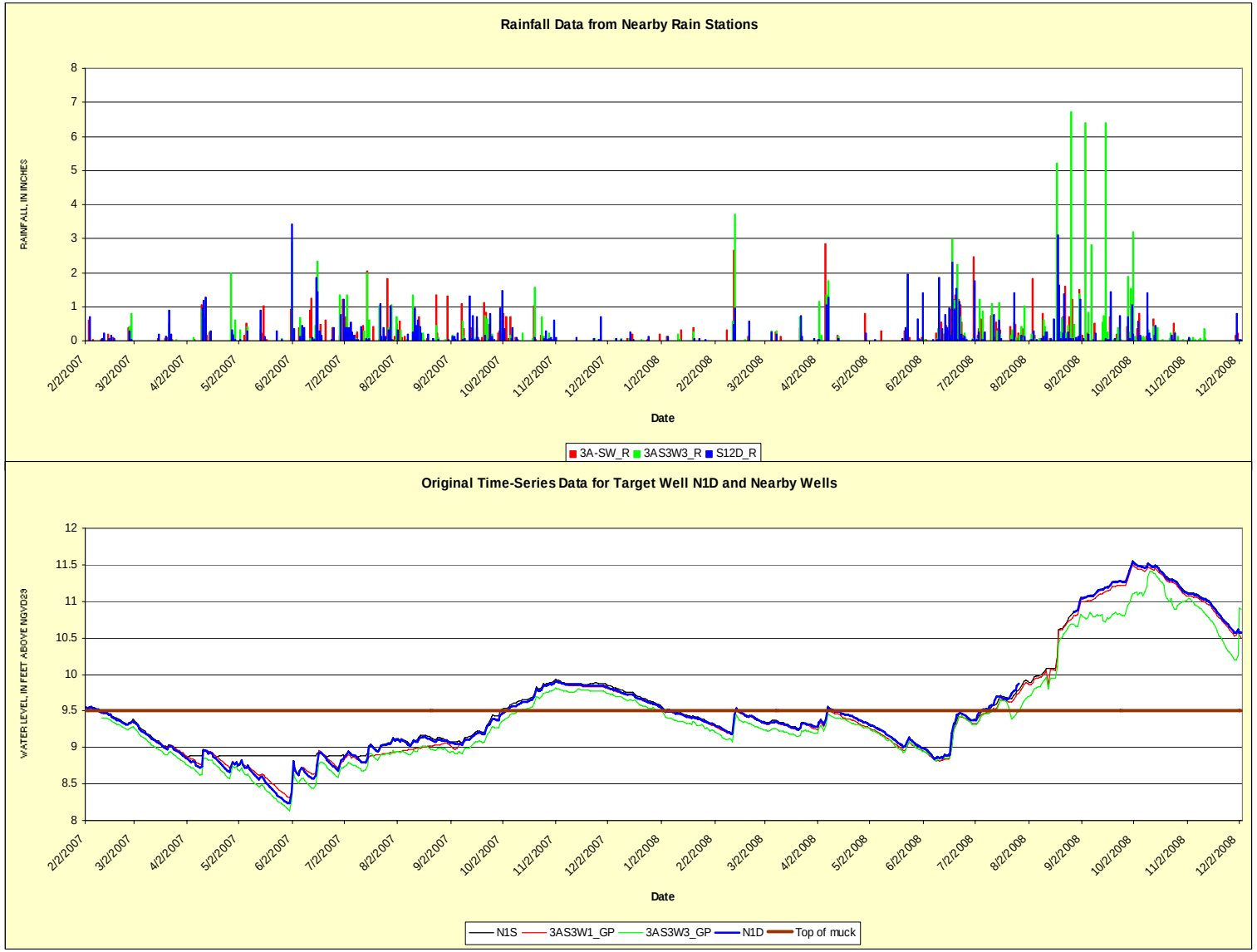
11 APPENDIX D Box plots and time-series plots for target and nearby stations

EXPLANATION



N1D




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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2/2/2007
3/2/2007
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5/2/2007
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11/2/2007
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7/2/2008
8/2/2008
9/2/2008
10/2/2008
11/2/2008
12/2/2008
Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well N1D and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
8
8.5
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9.5
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4/2/2008
5/2/2008
6/2/2008
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8/2/2008
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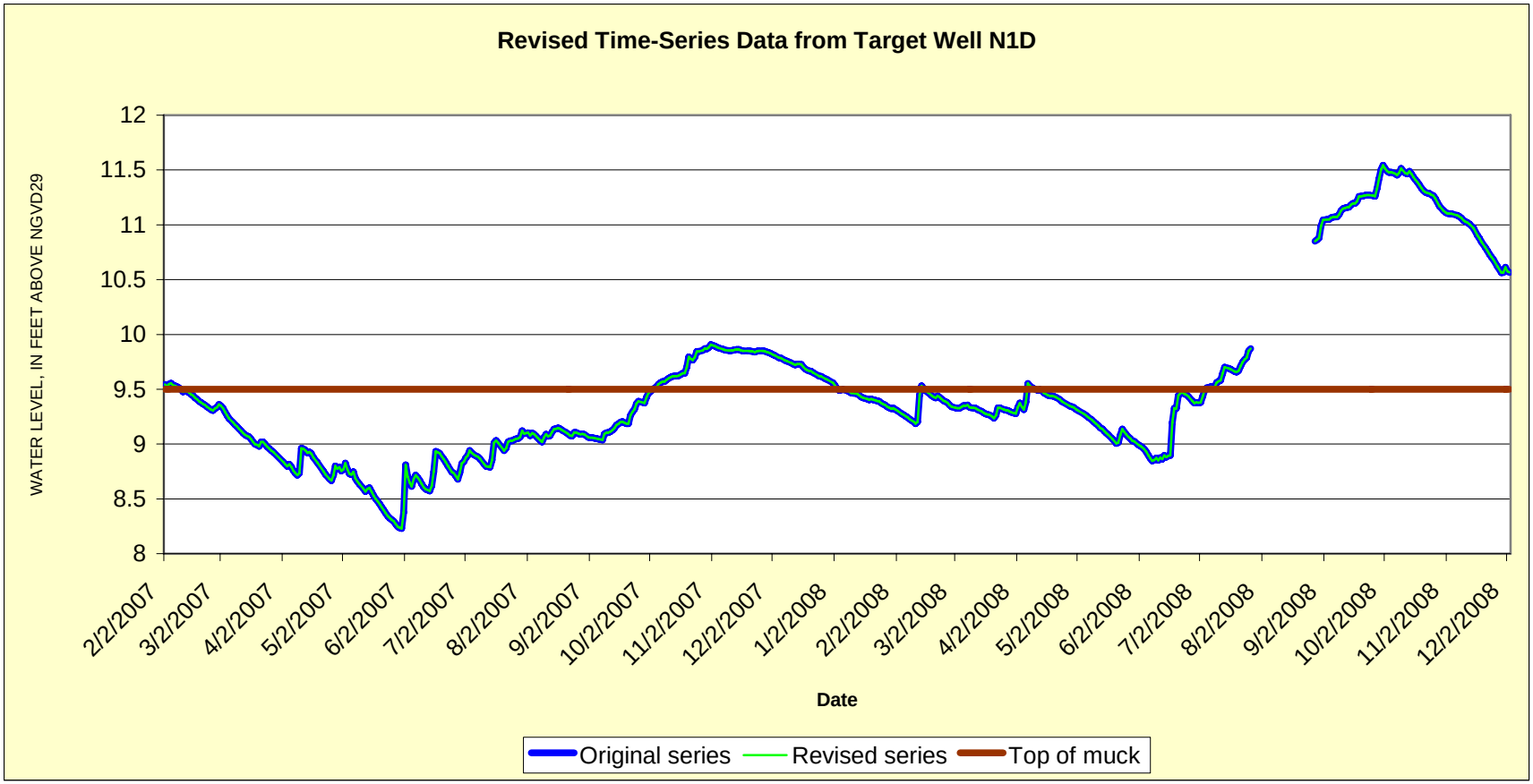
12/2/2008
Date
N1S
3AS3W1_GP
3AS3W3_GP
N1D
Top of muck


Revised Time-Series Data from Target Well N1D
WATER LEVEL, IN FEET ABOVE NGVD29
12
11.5
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8.5
8
2/2/2007
3/2/2007
4/2/2007
5/2/2007
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9/2/2008
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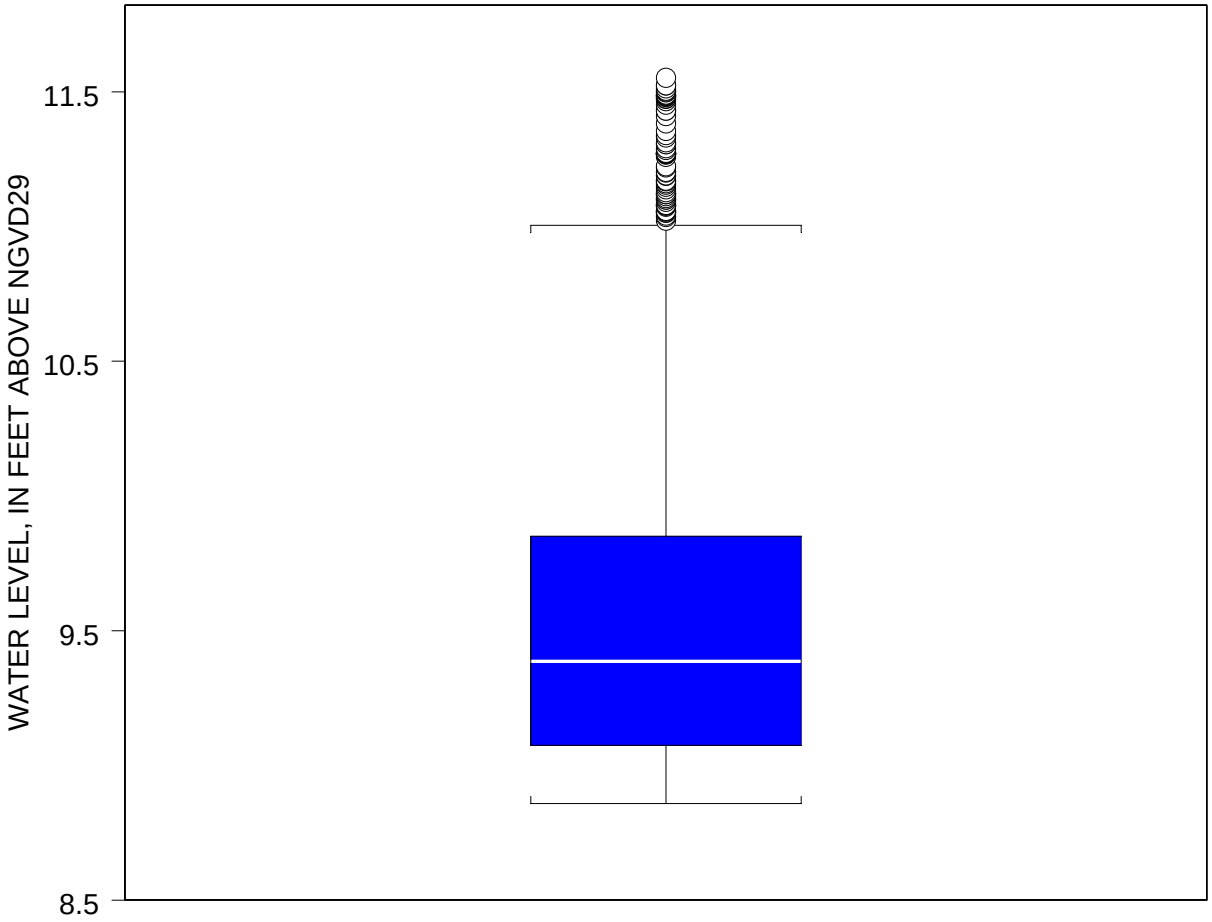
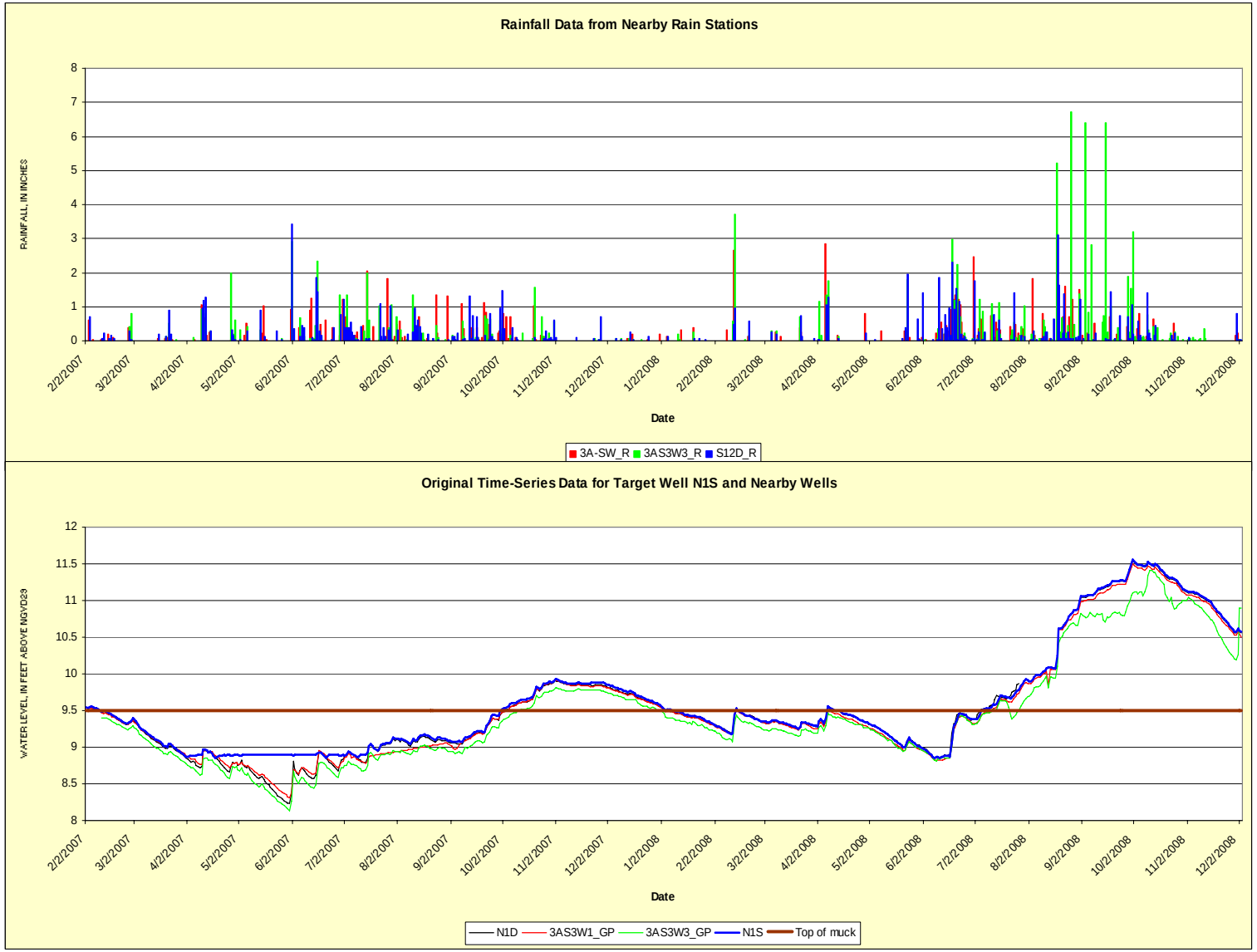
11/2/2008
12/2/2008
Date
Original series
Revised series
Top of muck

N1S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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4/2/2007
5/2/2007
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9/2/2007
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8/2/2008
9/2/2008
10/2/2008
11/2/2008
12/2/2008
Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well N1S and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
8
8.5
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7/2/2008
8/2/2008
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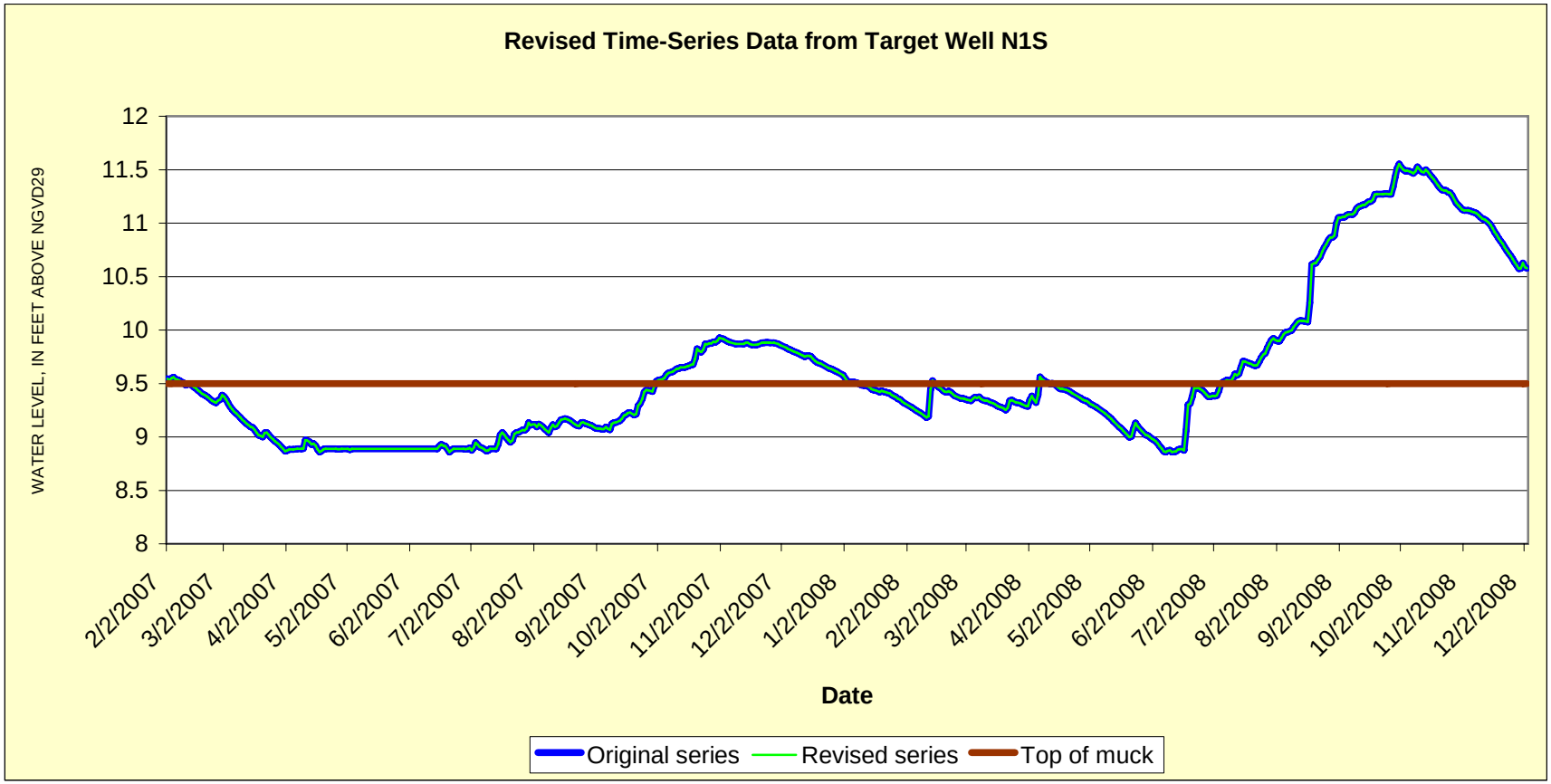
12/2/2008
Date
N1D
3AS3W1_GP
3AS3W3_GP
N1S
Top of muck


Revised Time-Series Data from Target Well N1S
WATER LEVEL, IN FEET ABOVE NGVD29
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2/2/2007
3/2/2007
4/2/2007
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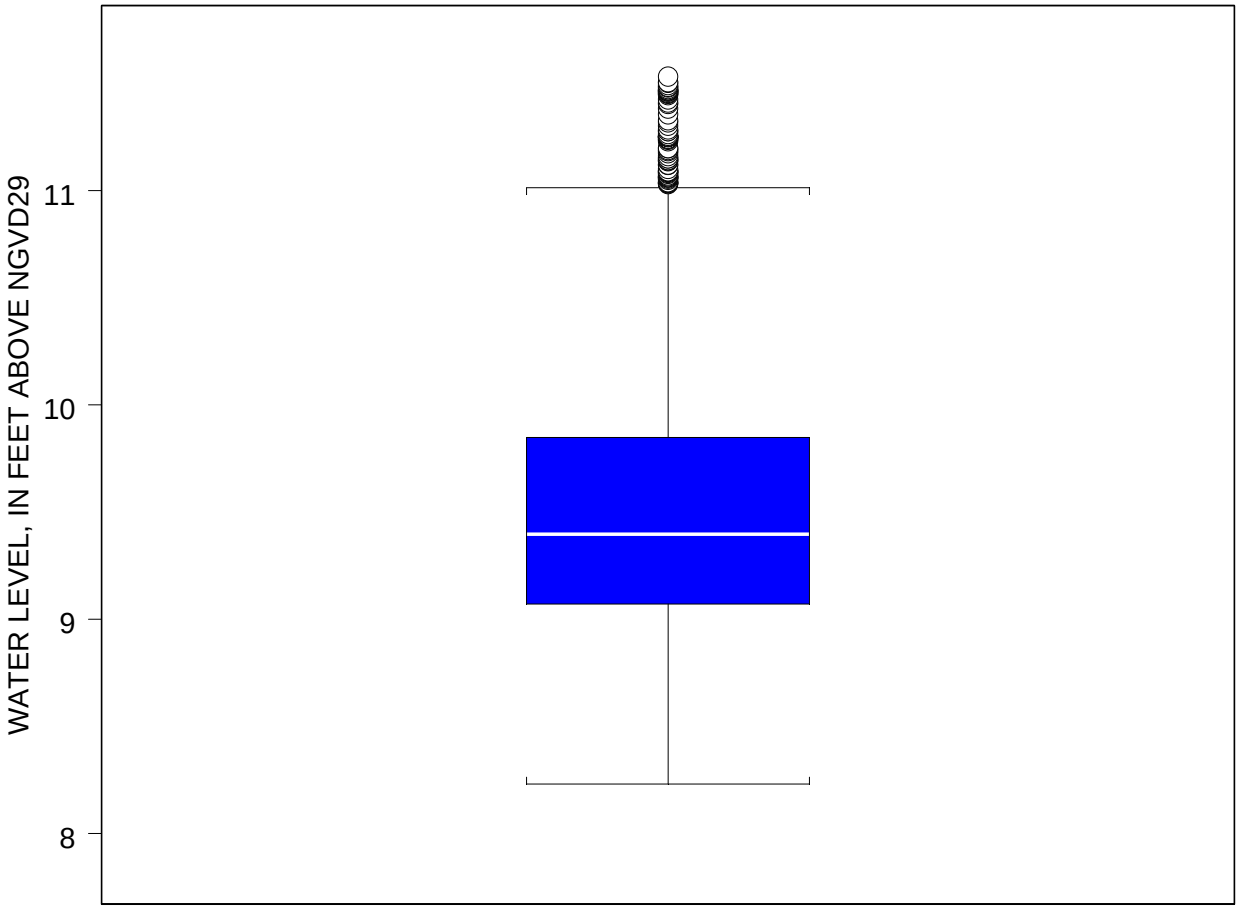
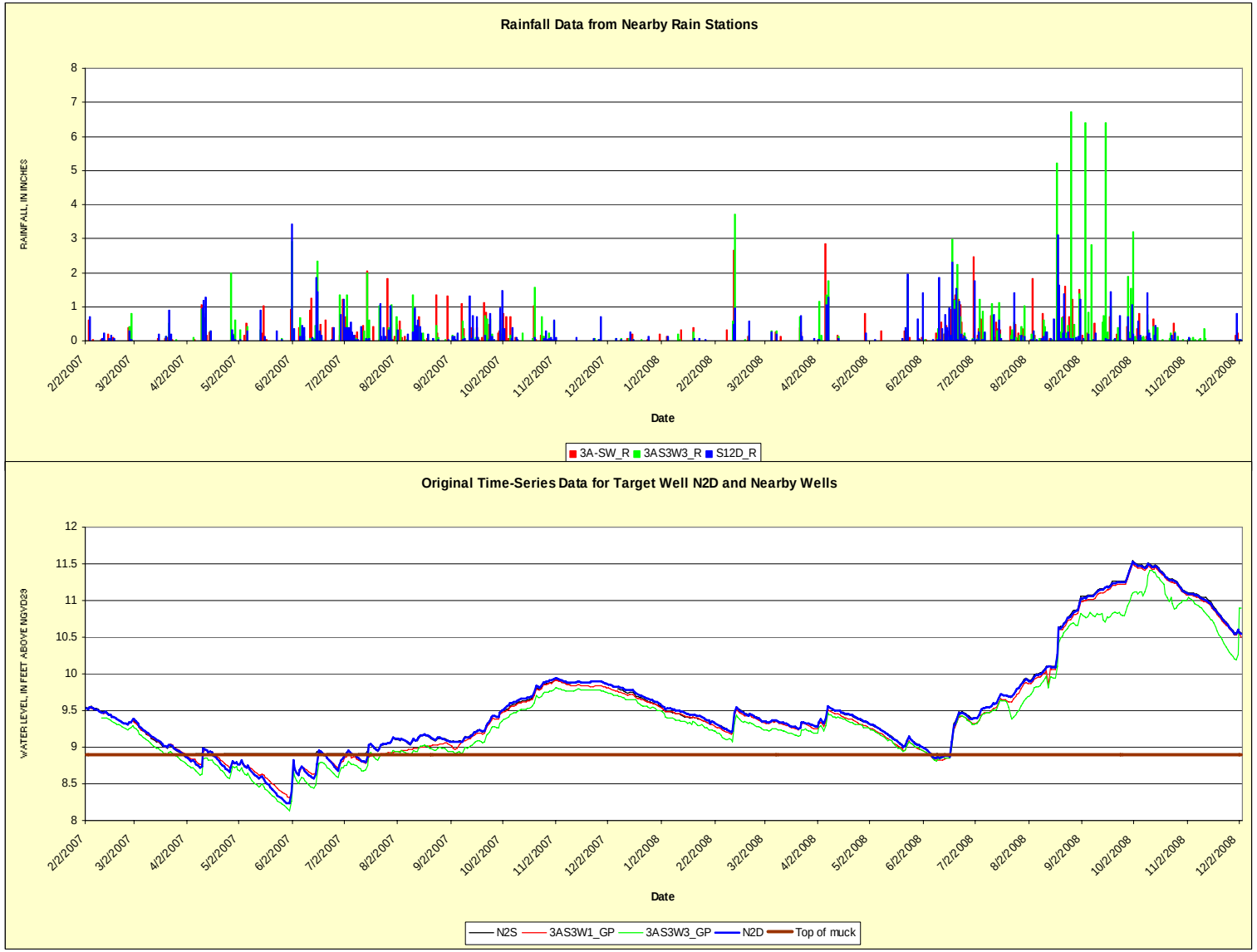
9/2/2008
10/2/2008
11/2/2008
12/2/2008
Date
Original series
Revised series
Top of muck

N2D




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well N2D and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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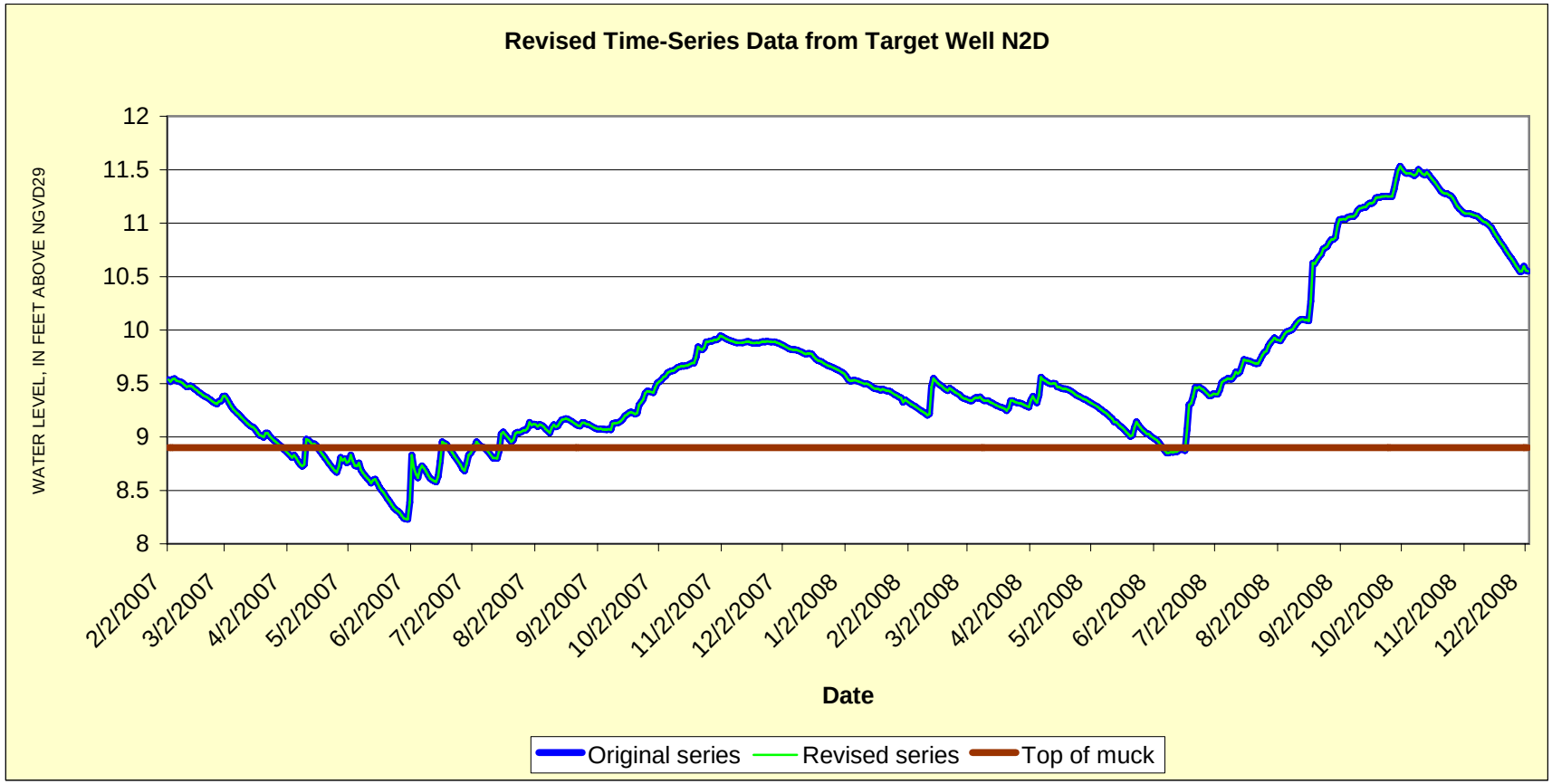
Date
N2S
3AS3W1_GP
3AS3W3_GP
N2D
Top of muck


Revised Time-Series Data from Target Well N2D
WATER LEVEL, IN FEET ABOVE NGVD29
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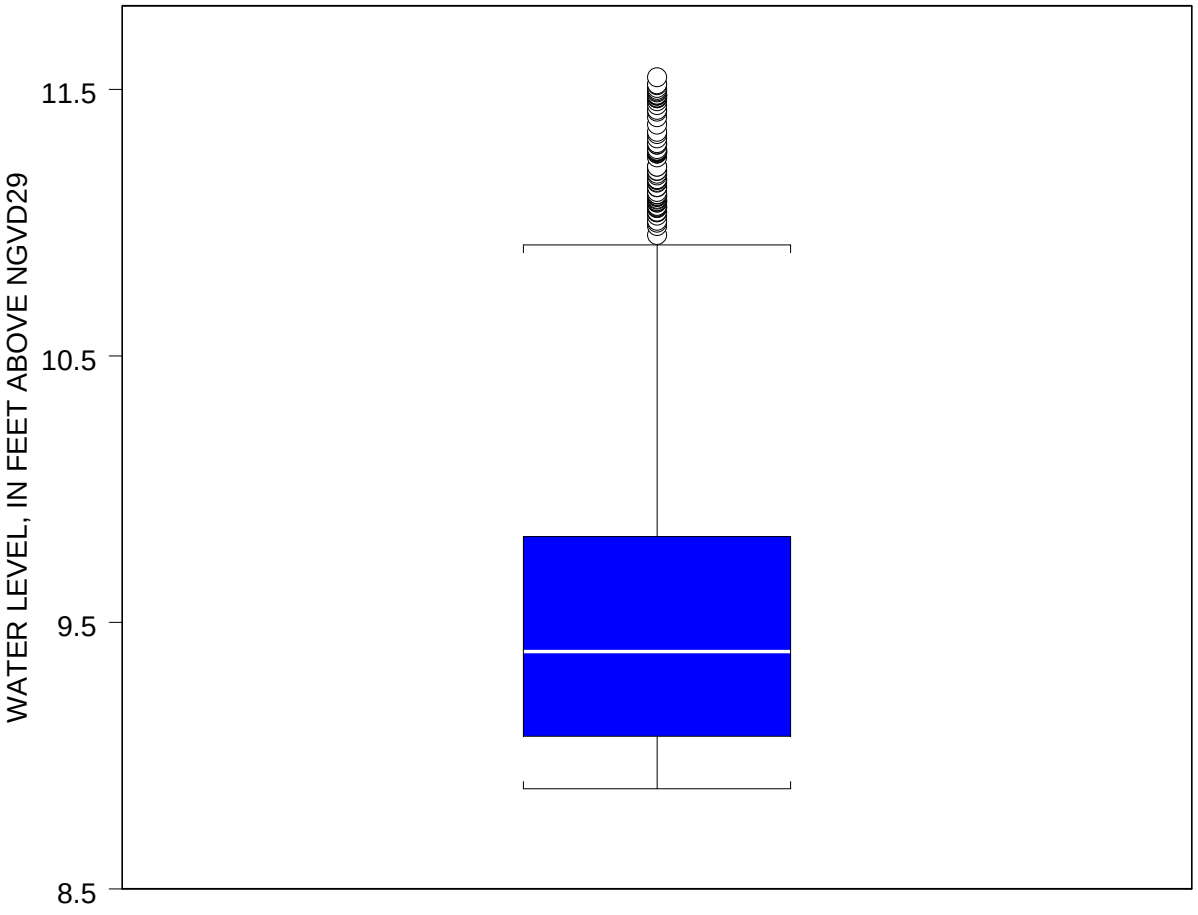
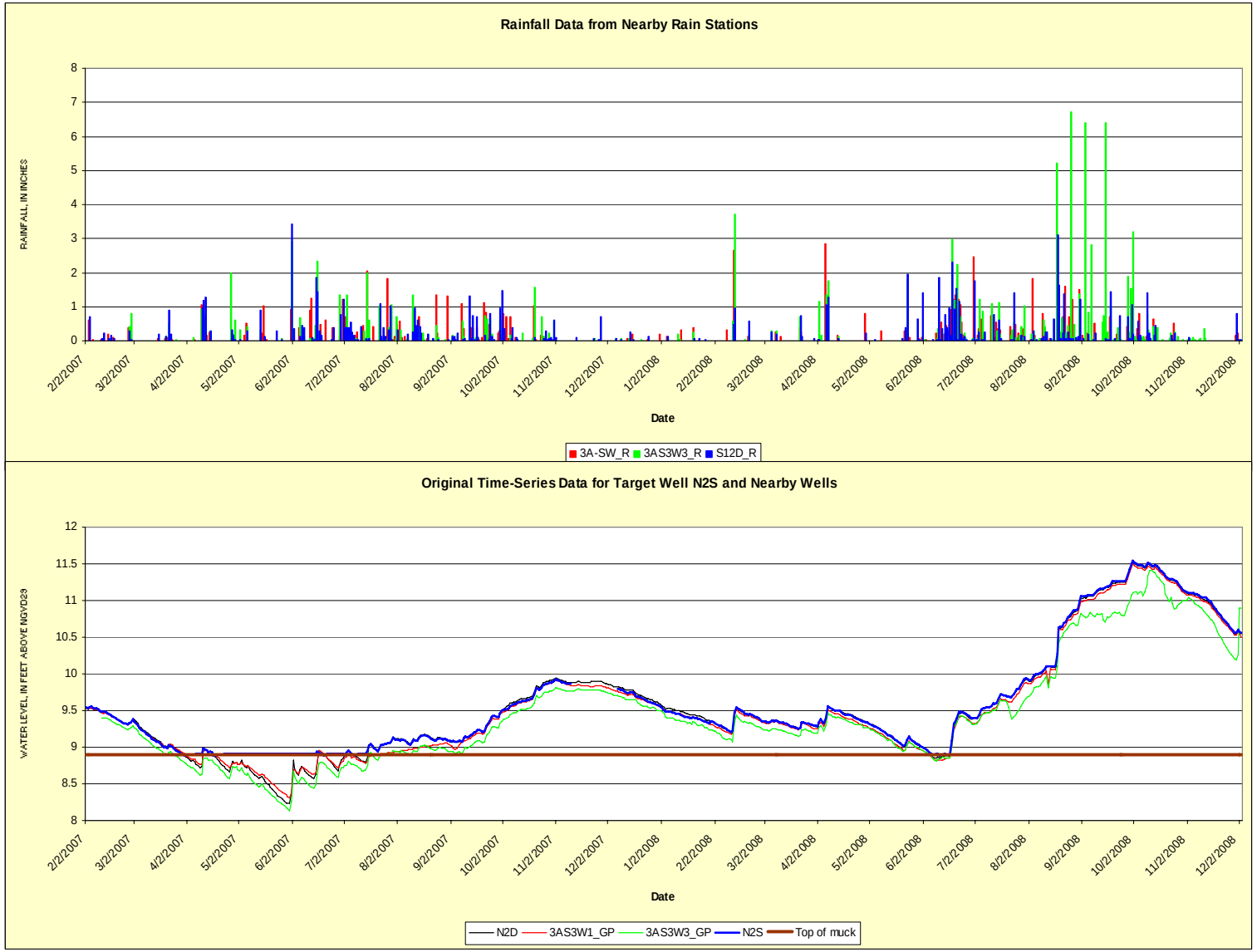
12/2/2008
Date
Original series
Revised series
Top of muck

N2S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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11/2/2008
12/2/2008
Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well N2S and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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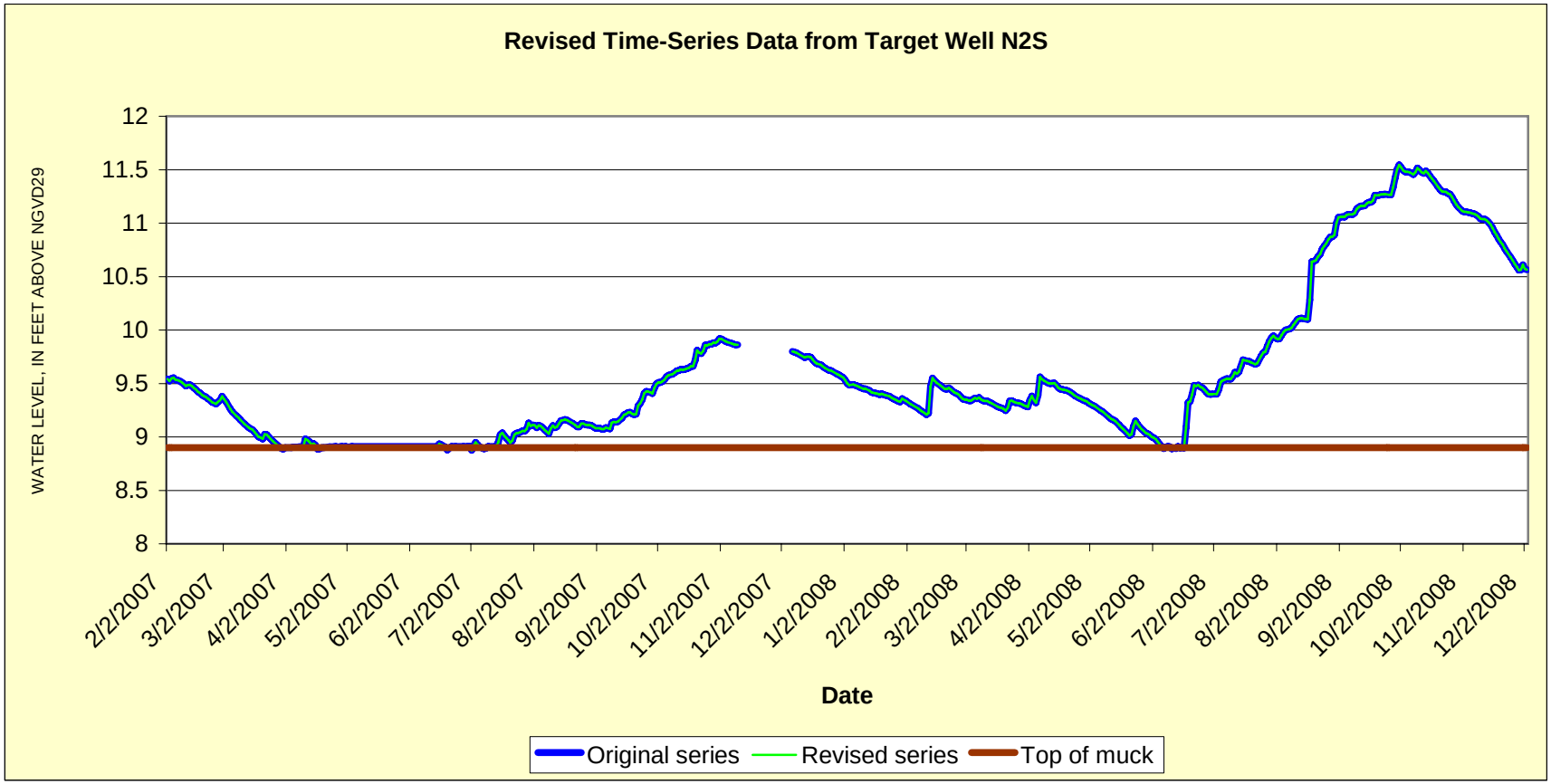
12/2/2008
Date
N2D
3AS3W1_GP
3AS3W3_GP
N2S
Top of muck


Revised Time-Series Data from Target Well N2S
WATER LEVEL, IN FEET ABOVE NGVD29
12
11.5
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2/2/2007
3/2/2007
4/2/2007
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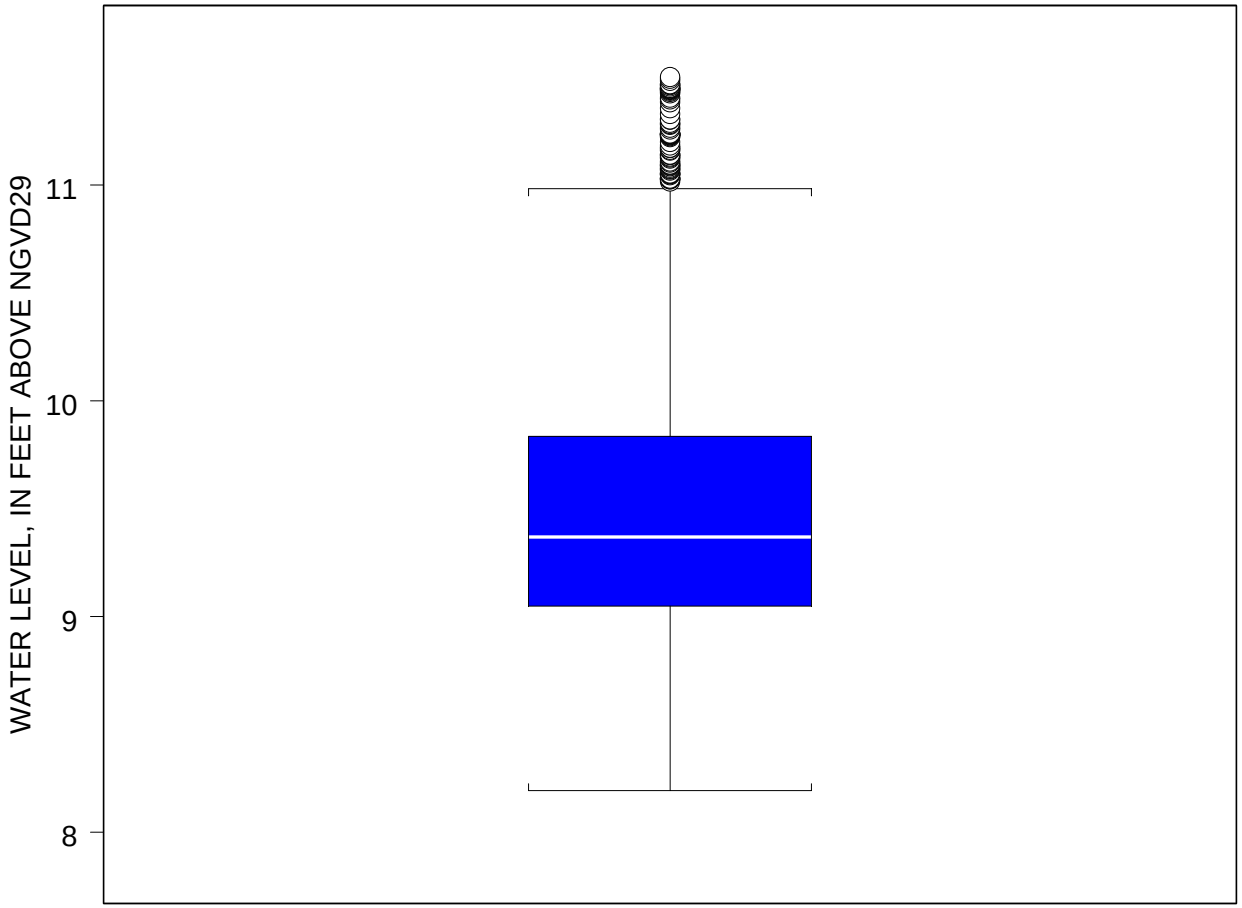
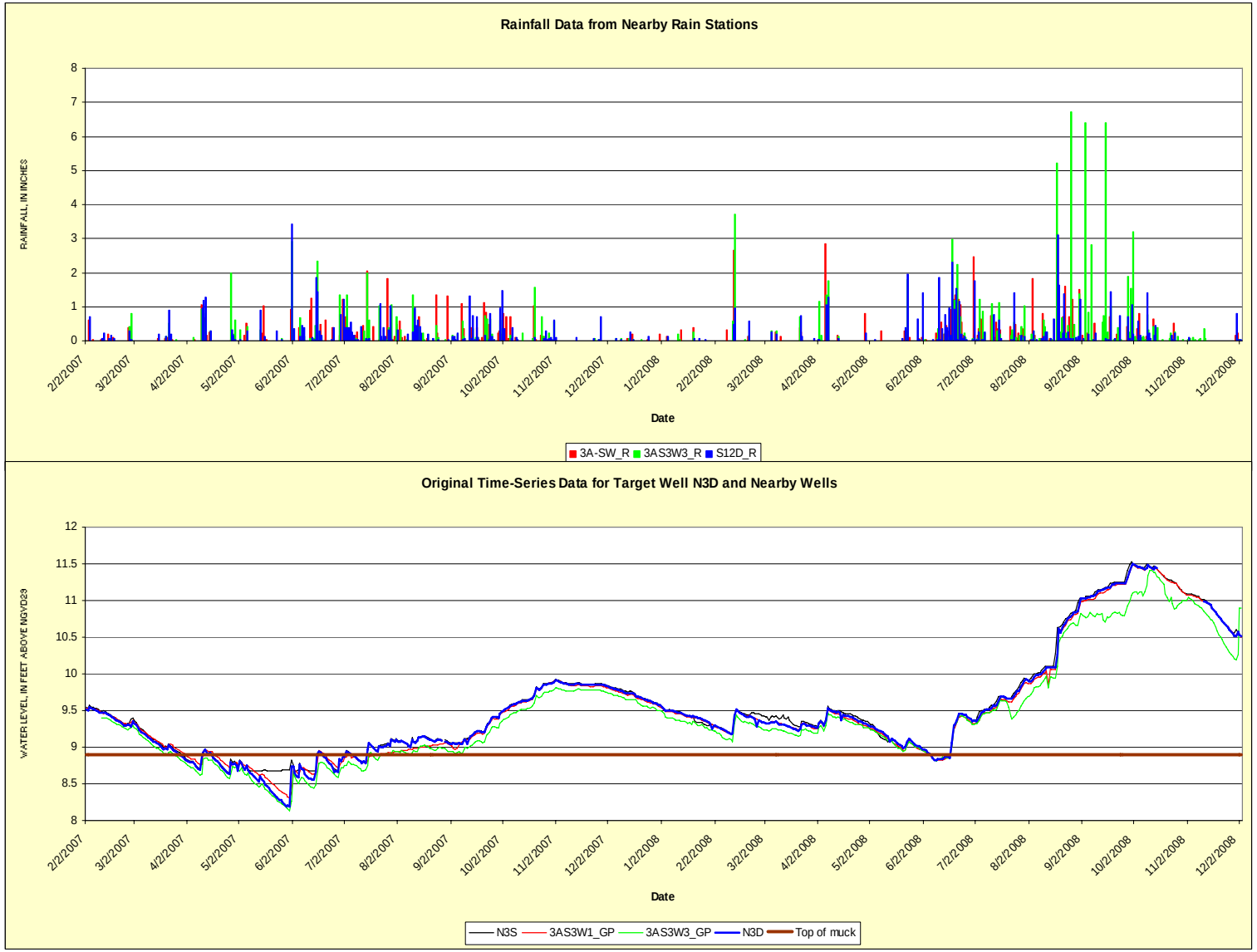
11/2/2008
12/2/2008
Date
Original series
Revised series
Top of muck

N3D




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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4/2/2007
5/2/2007
6/2/2007
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11/2/2008
12/2/2008
Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well N3D and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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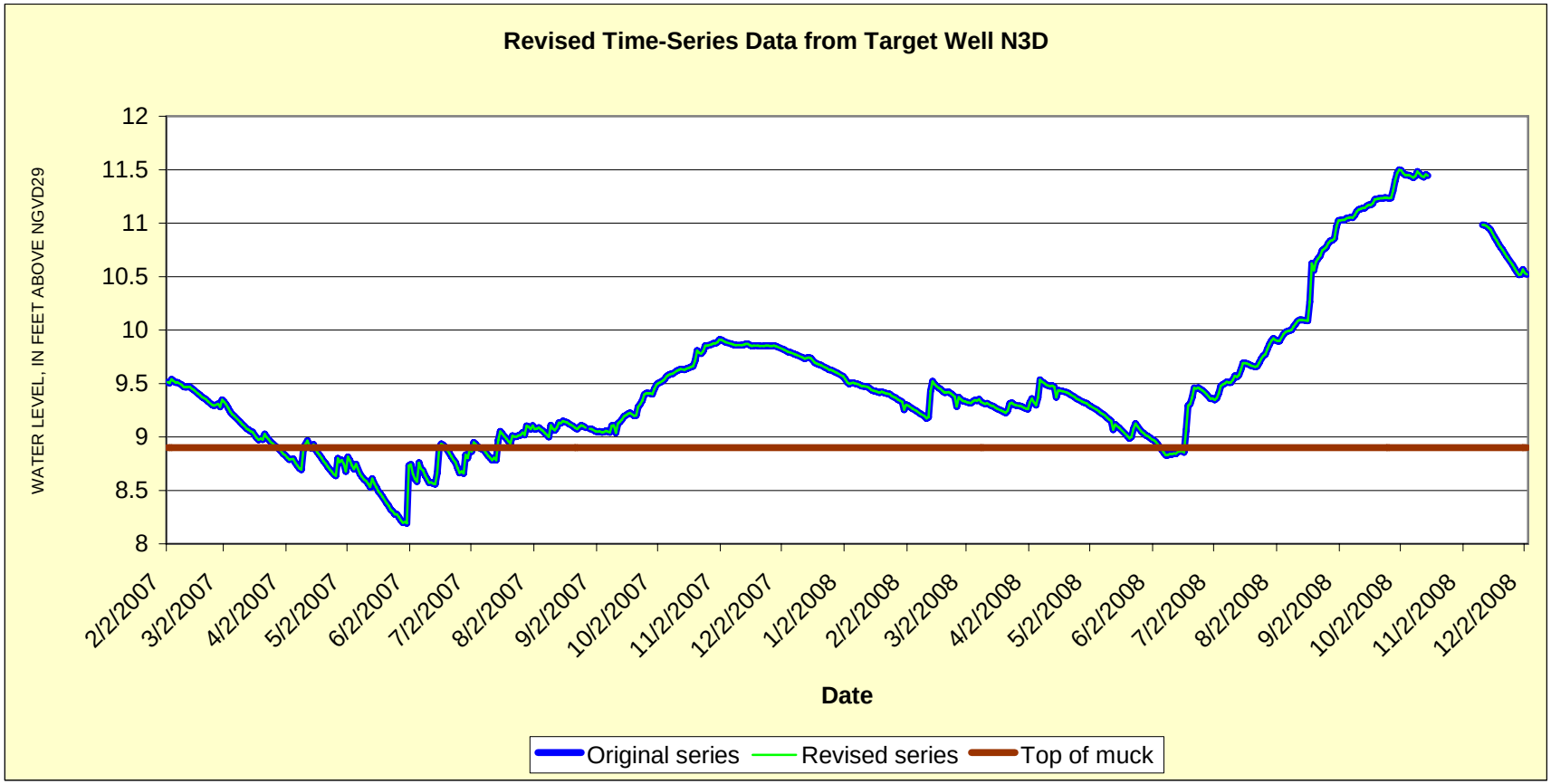
Date
N3S
3AS3W1_GP
3AS3W3_GP
N3D
Top of muck


Revised Time-Series Data from Target Well N3D
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11.5
11
10.5
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9.5
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2/2/2007
3/2/2007
4/2/2007
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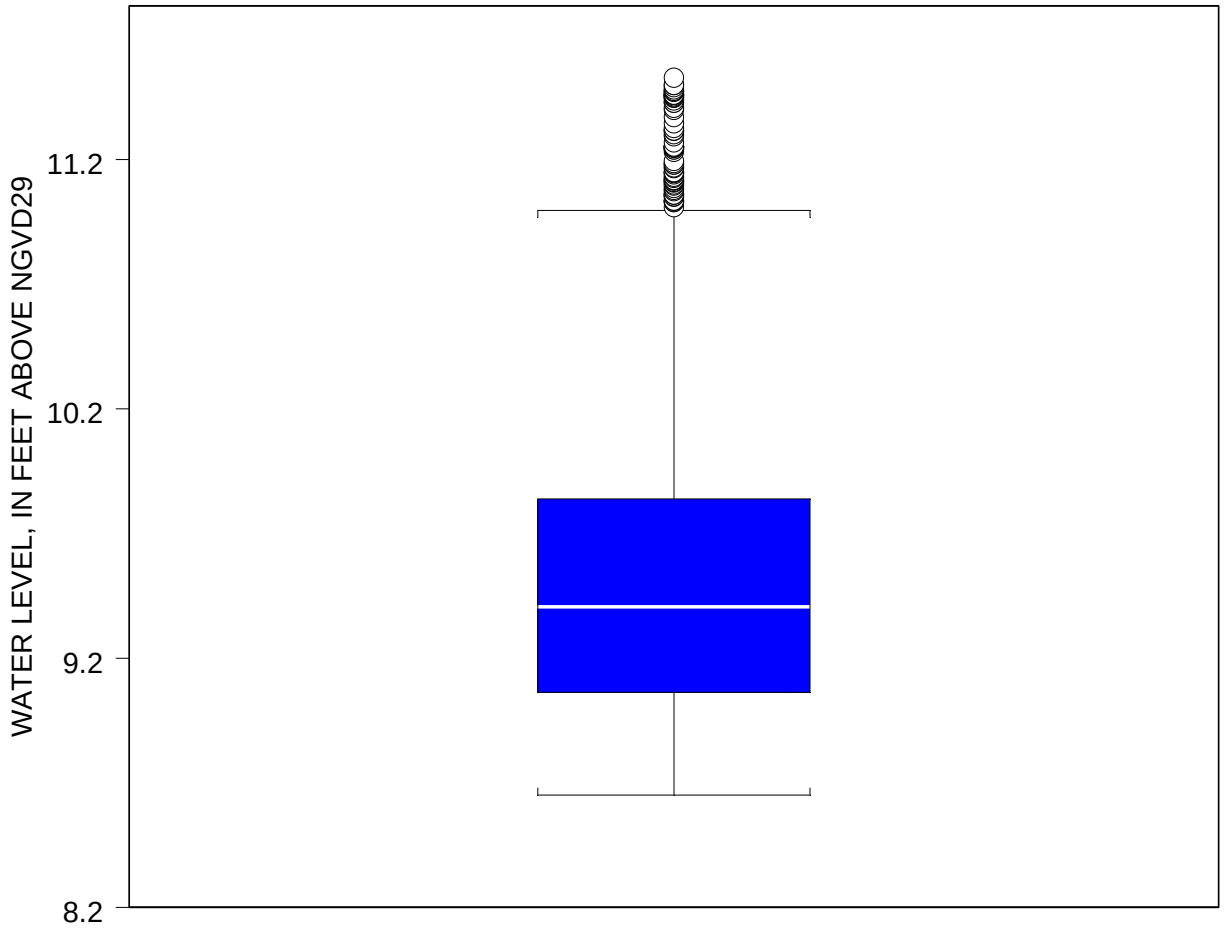
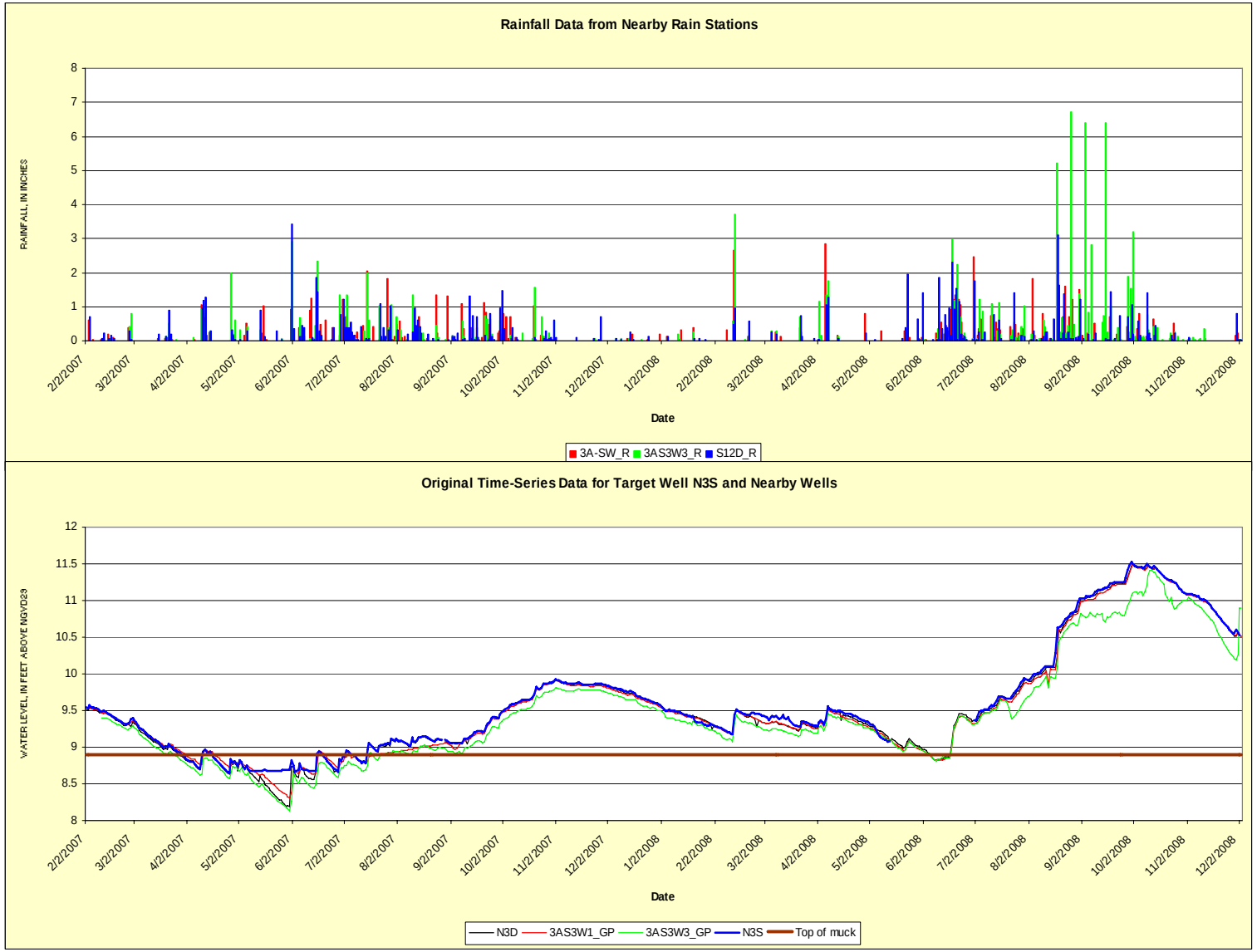
10/2/2008
11/2/2008
12/2/2008
Date
Original series
Revised series
Top of muck

N3S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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12/2/2007
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11/2/2008
12/2/2008
Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well N3S and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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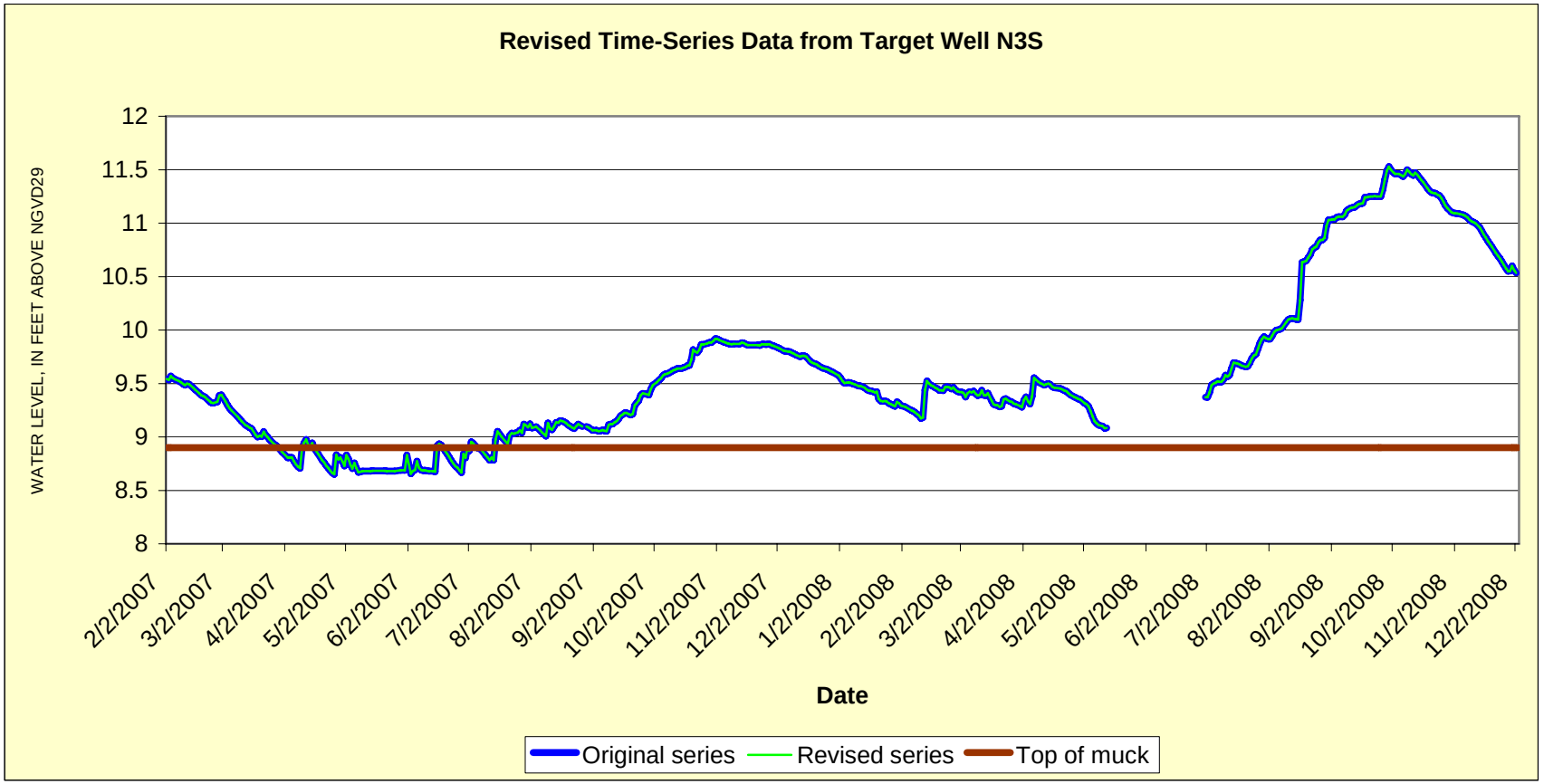
Date
N3D
3AS3W1_GP
3AS3W3_GP
N3S
Top of muck


Revised Time-Series Data from Target Well N3S
WATER LEVEL, IN FEET ABOVE NGVD29
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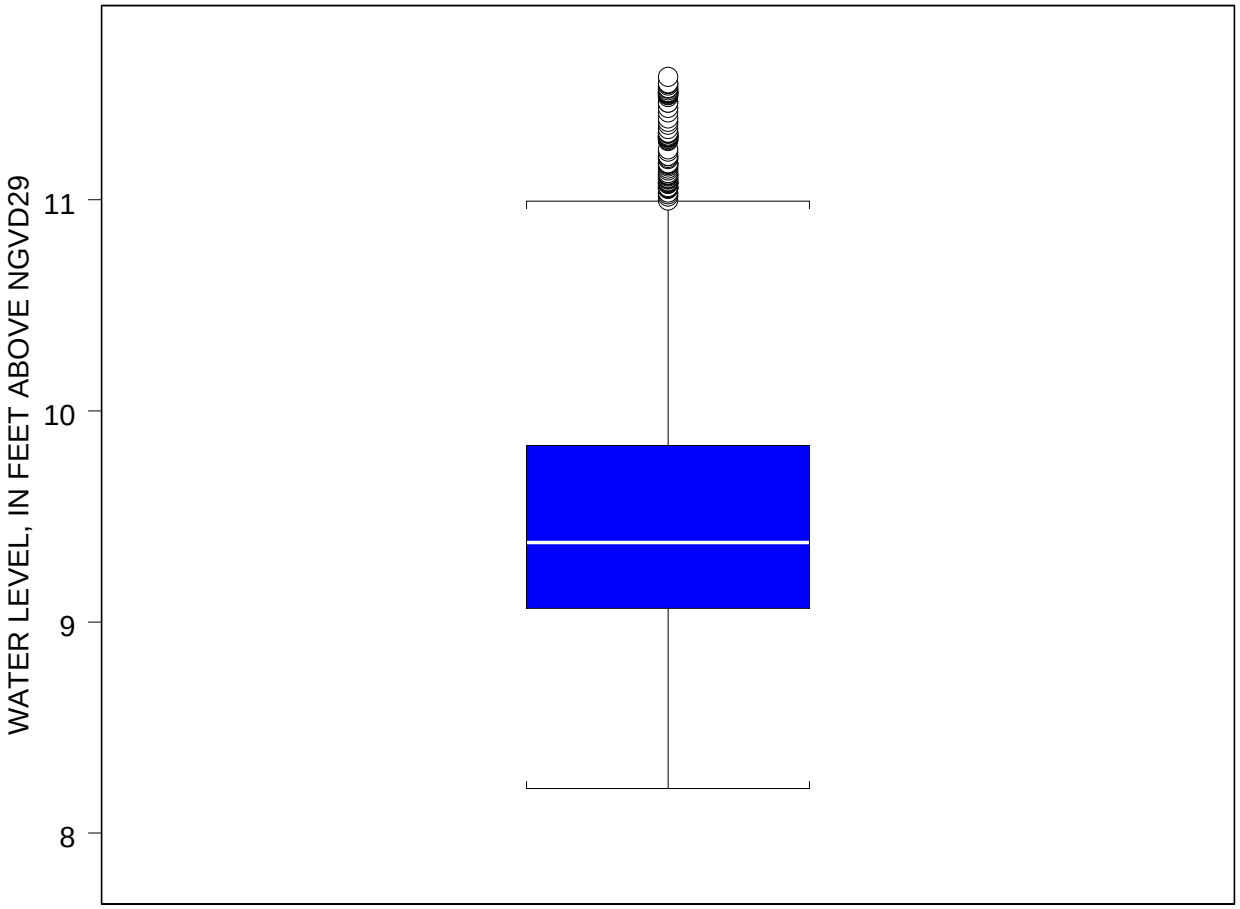
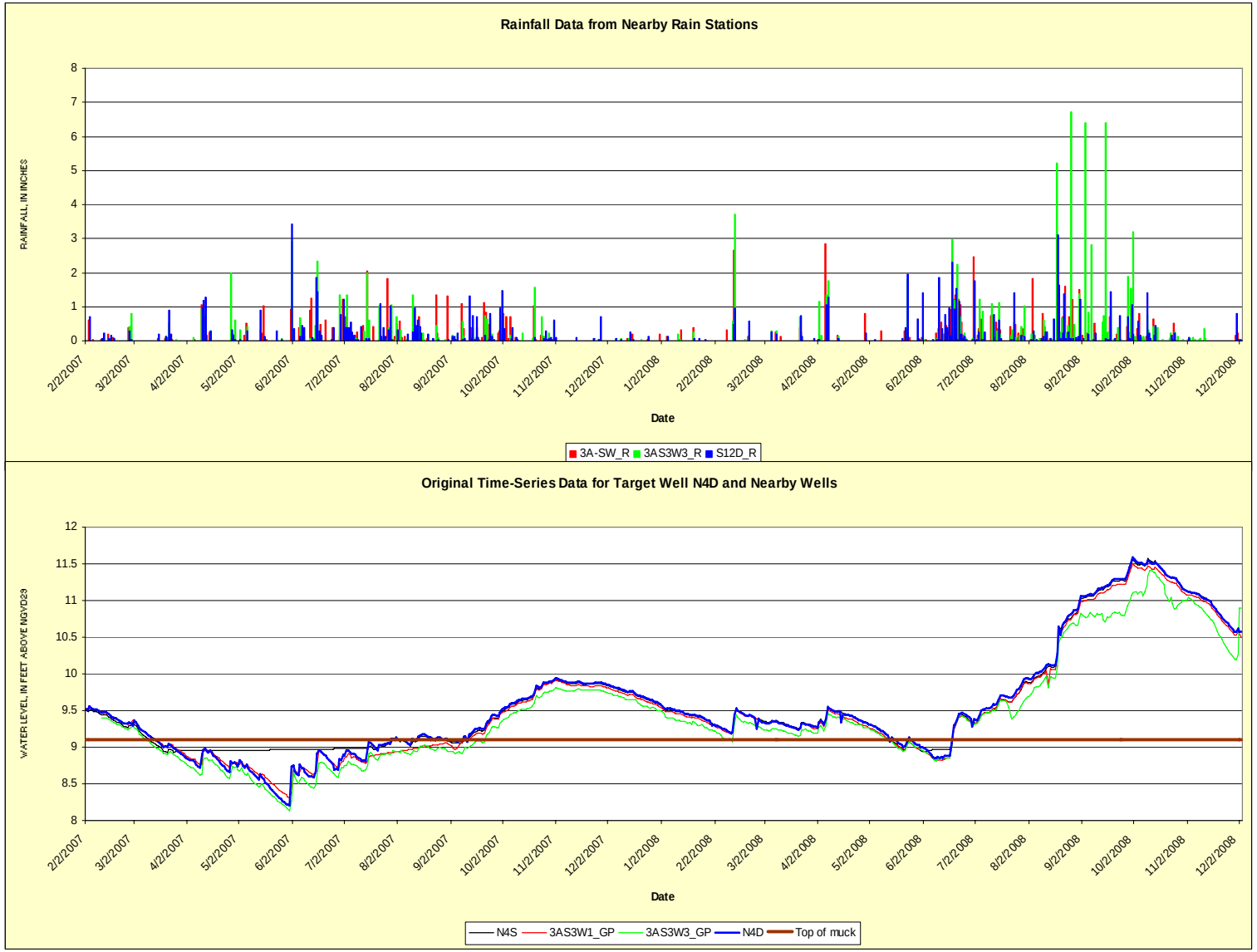
12/2/2008
Date
Original series
Revised series
Top of muck

N4D




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
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S12D_R
Original Time-Series Data for Target Well N4D and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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12/2/2008
Date
N4S
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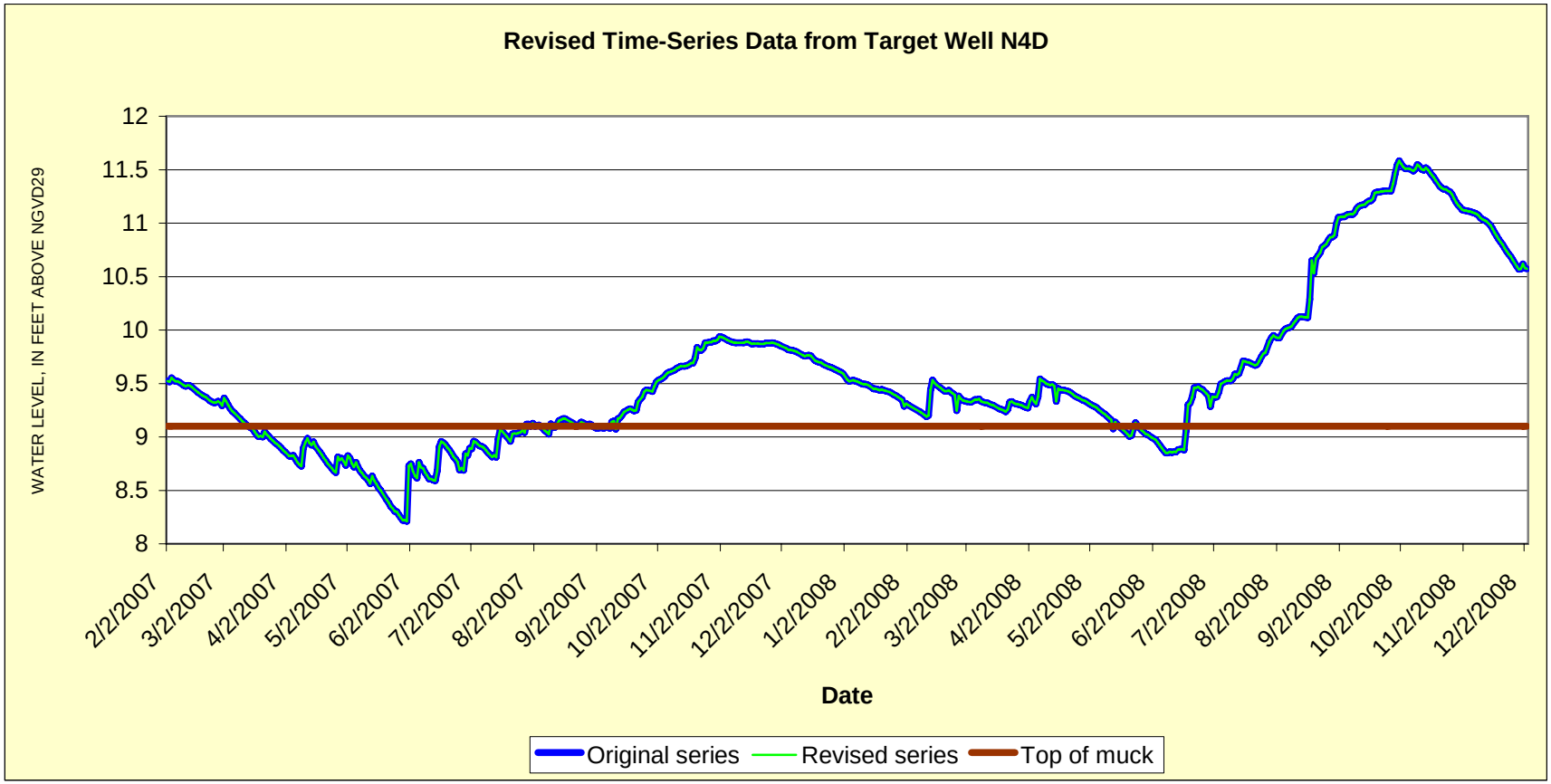
3AS3W3_GP
N4D
Top of muck


Revised Time-Series Data from Target Well N4D
WATER LEVEL, IN FEET ABOVE NGVD29
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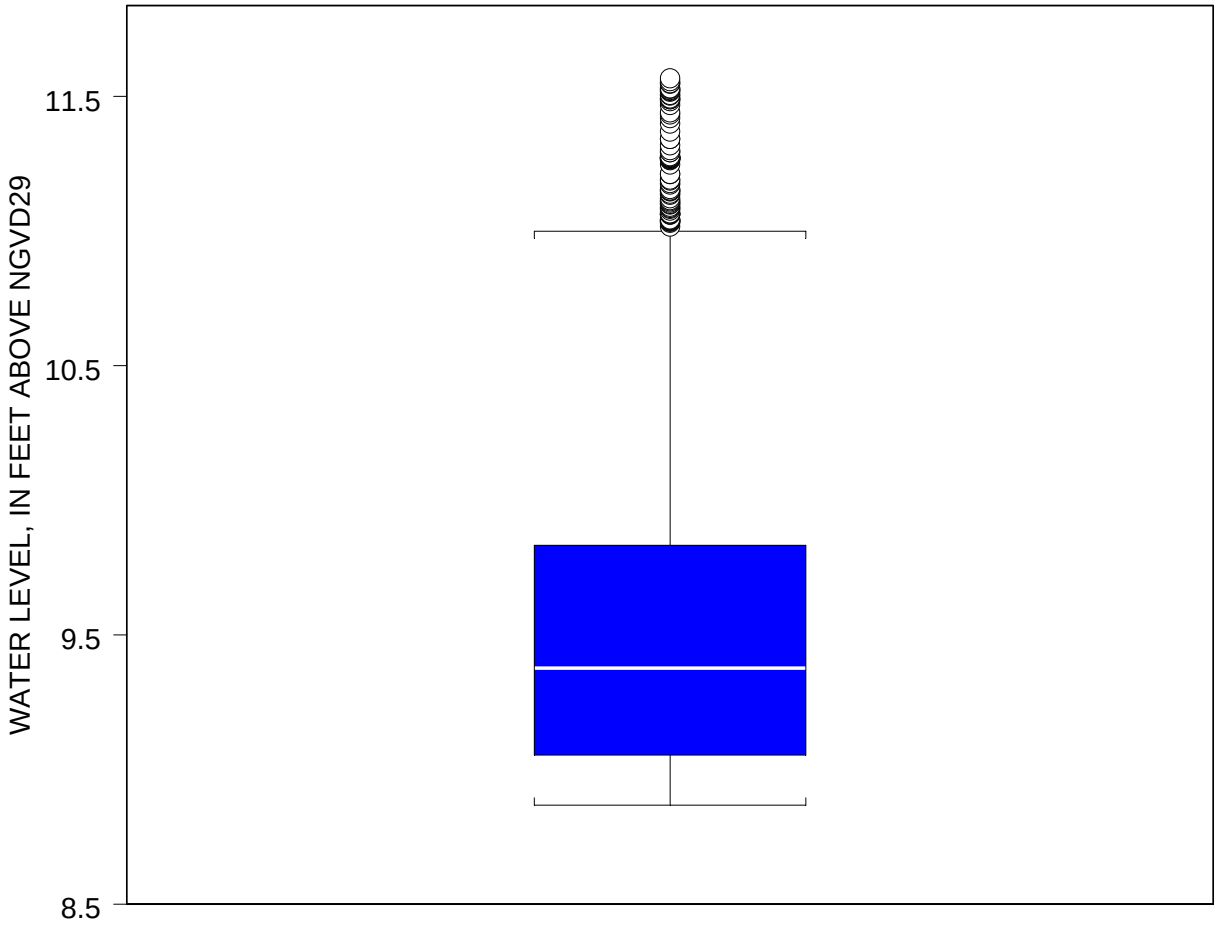
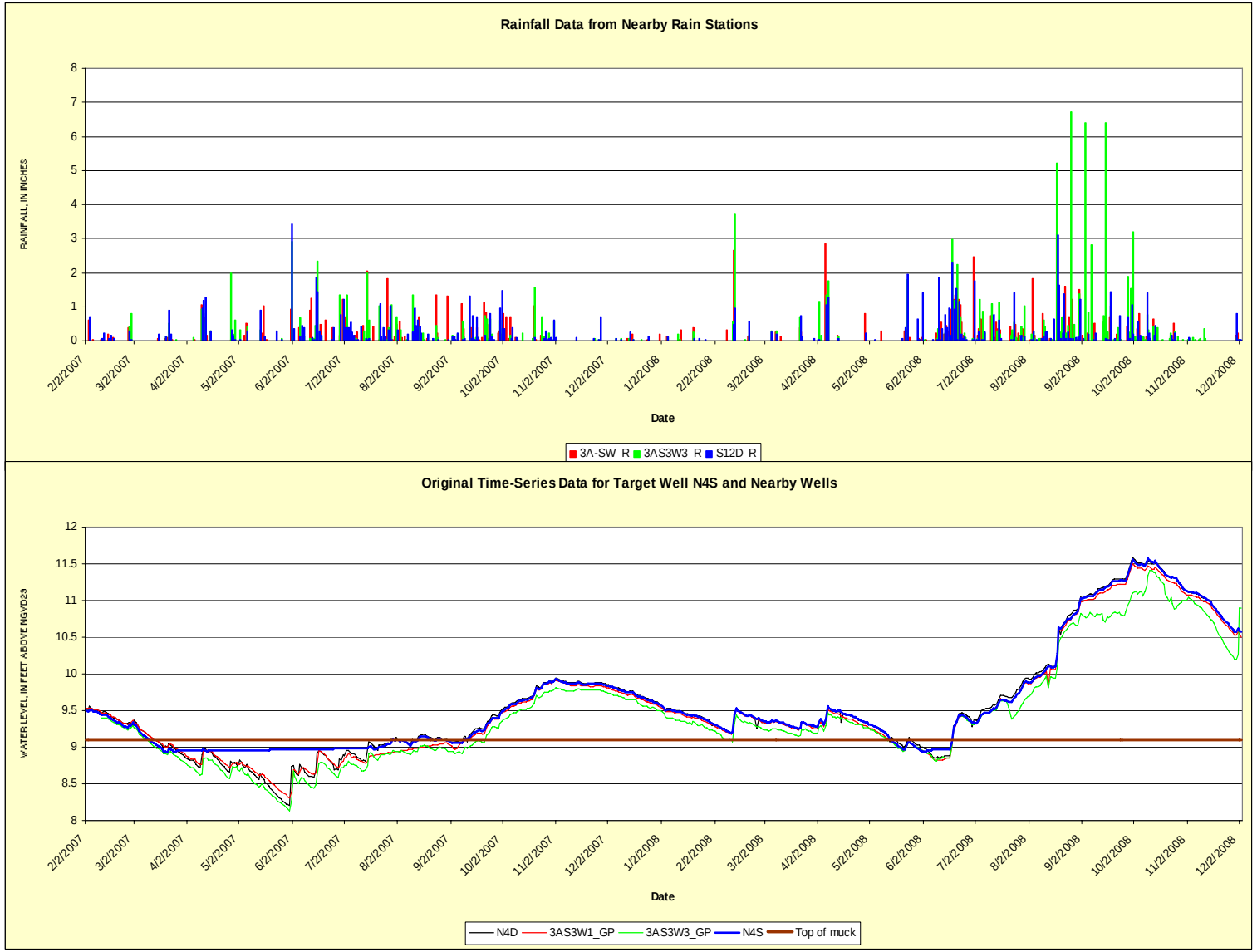
12/2/2008
Date
Original series
Revised series
Top of muck

N4S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
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Original Time-Series Data for Target Well N4S and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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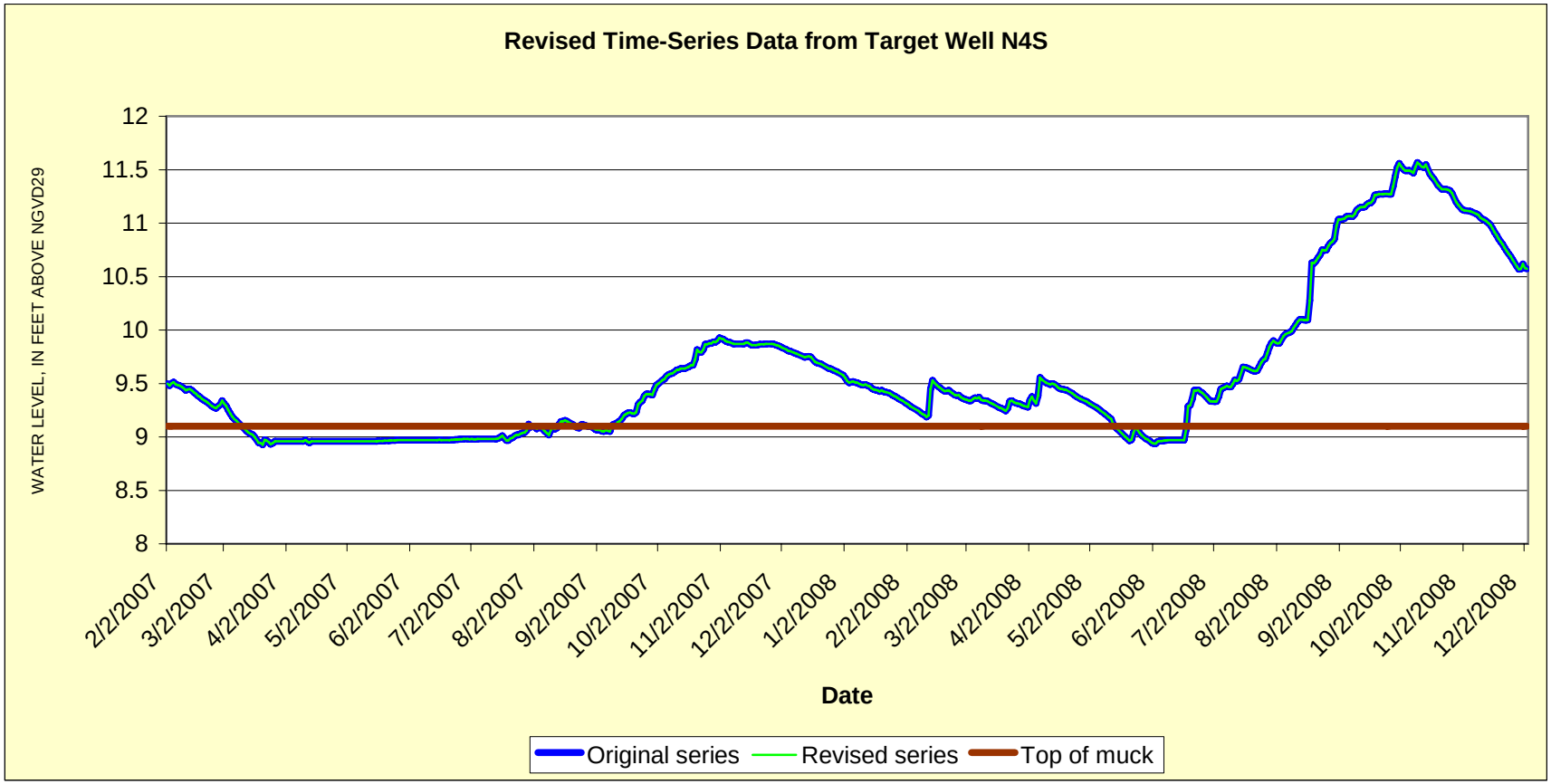
3AS3W3_GP
N4S
Top of muck


Revised Time-Series Data from Target Well N4S
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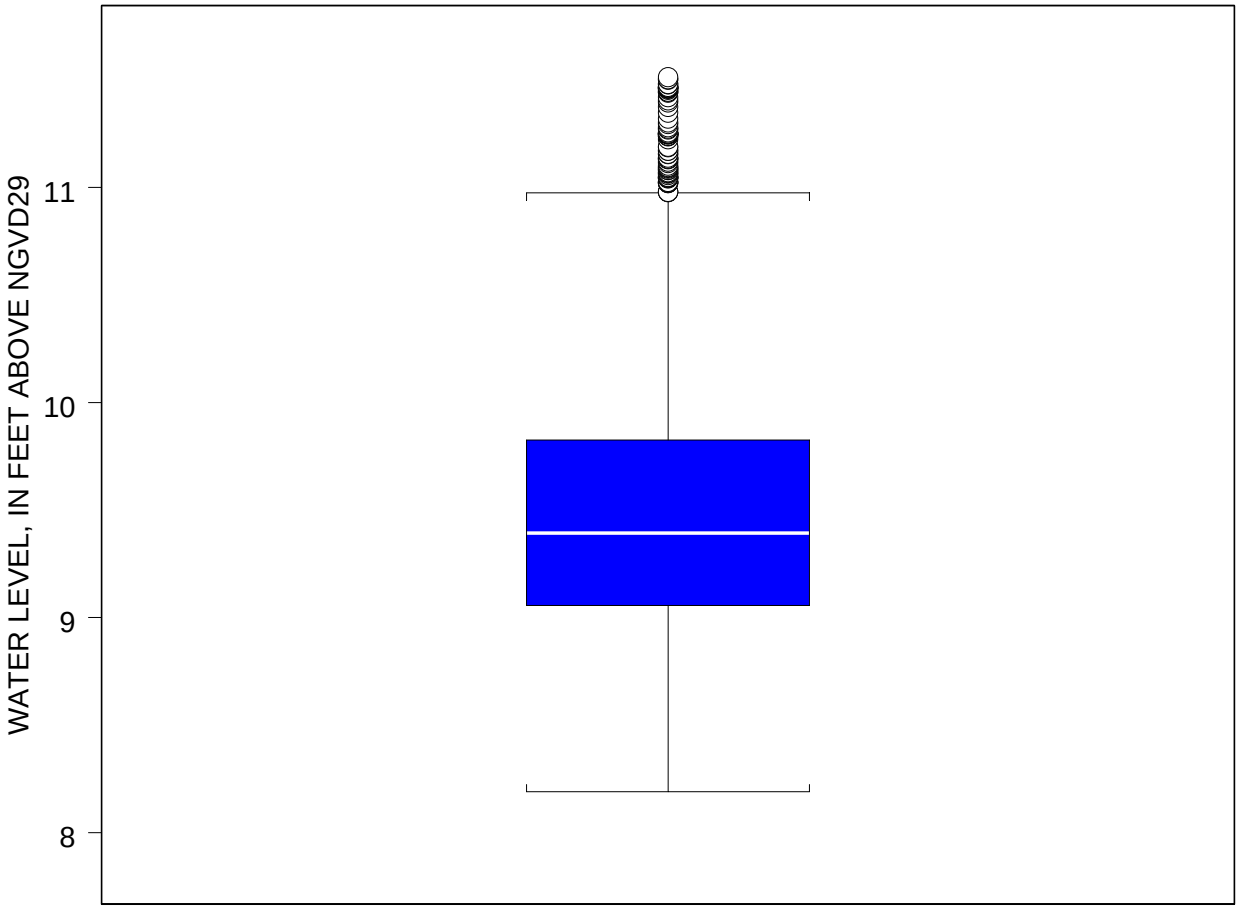
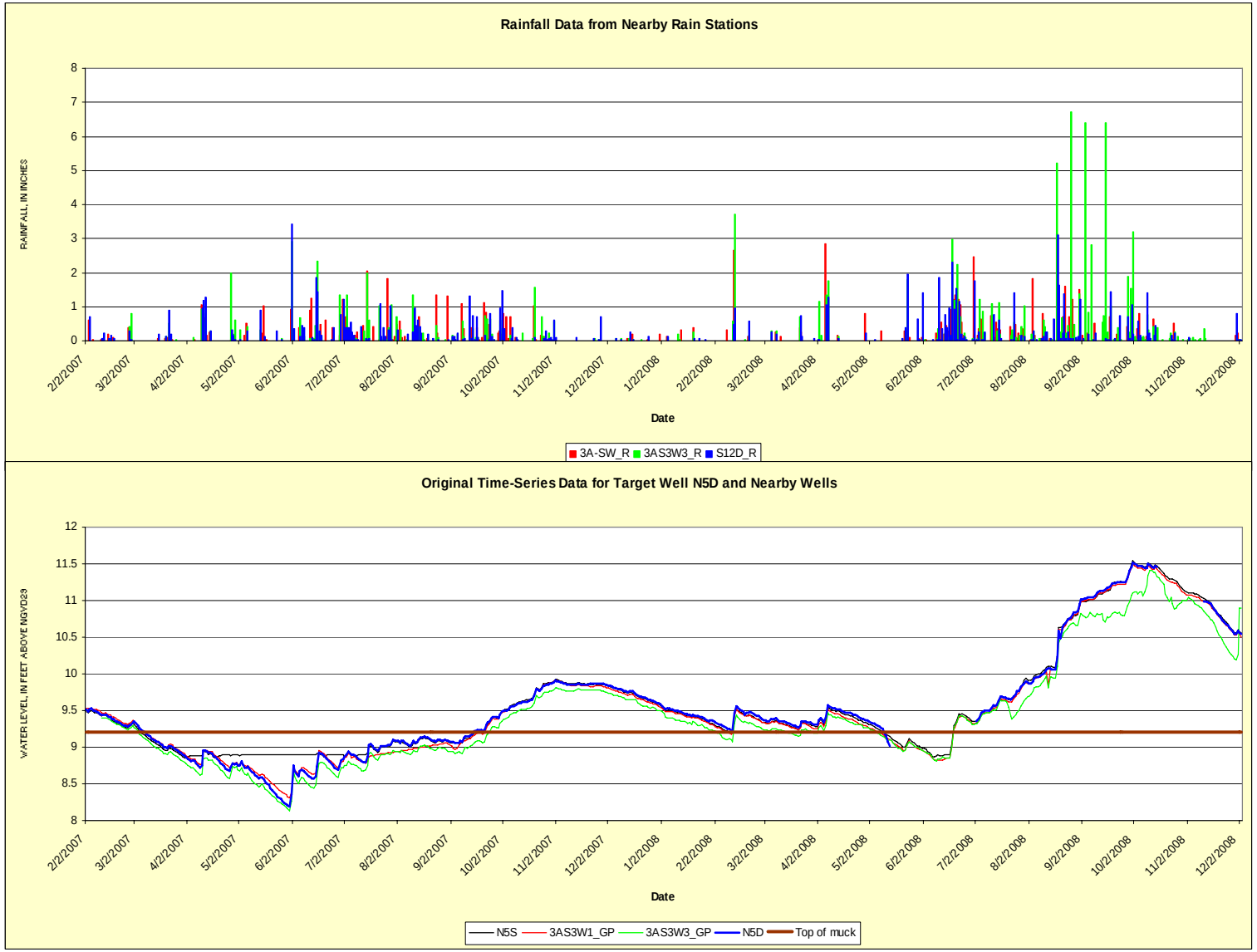
12/2/2008
Date
Original series
Revised series
Top of muck

N5D




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
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S12D_R
Original Time-Series Data for Target Well N5D and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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12/2/2008
Date
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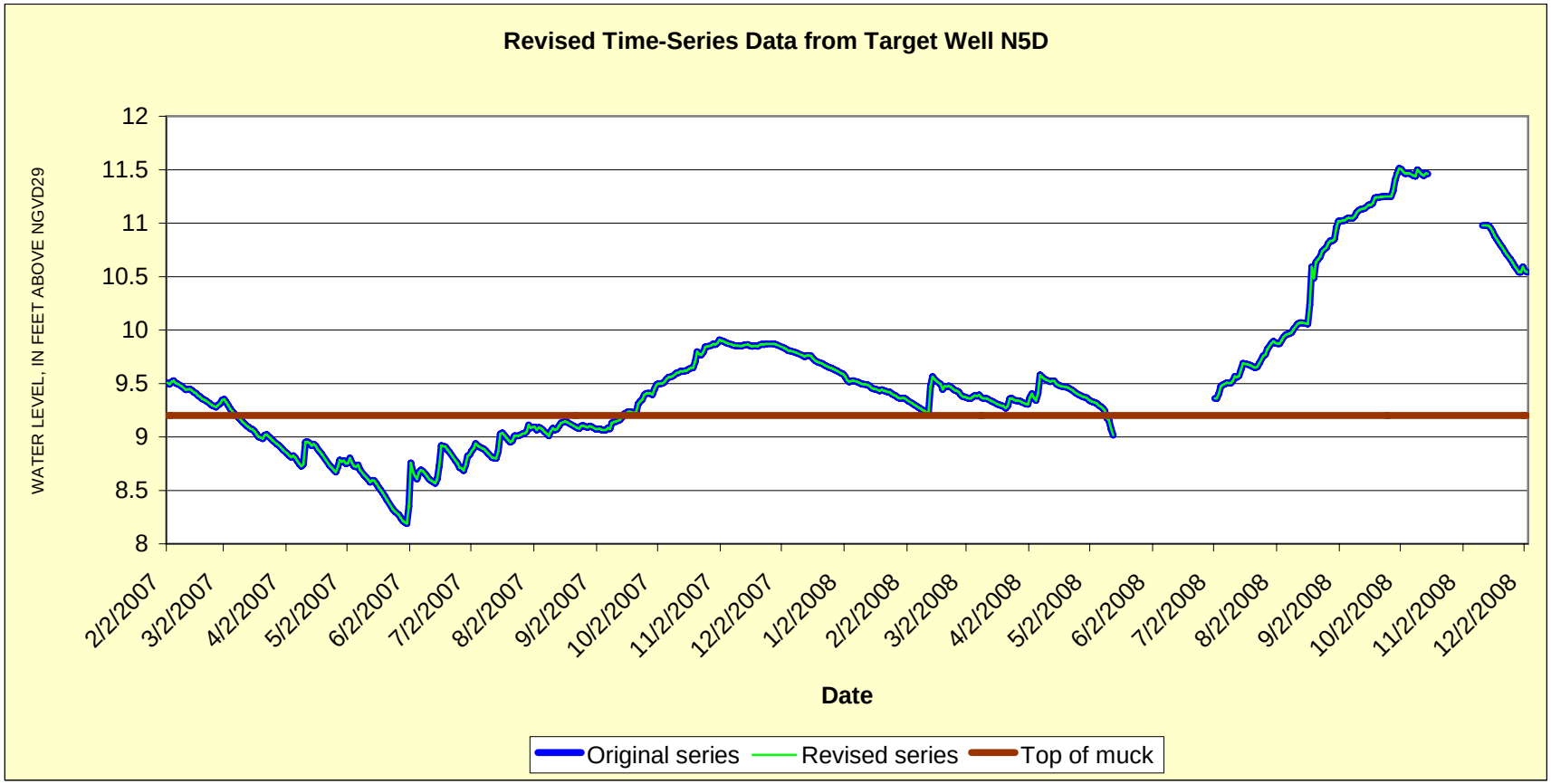
N5D
Top of muck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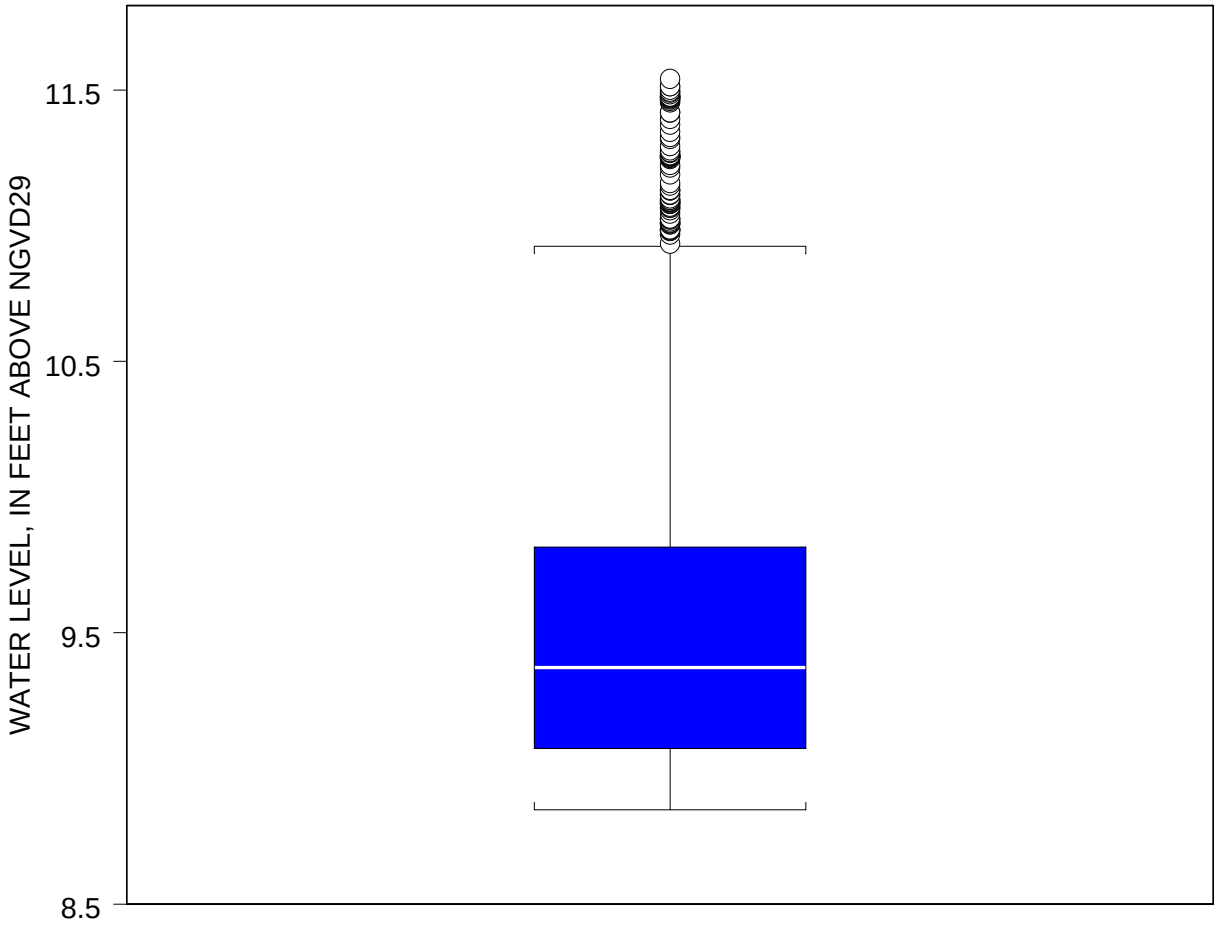
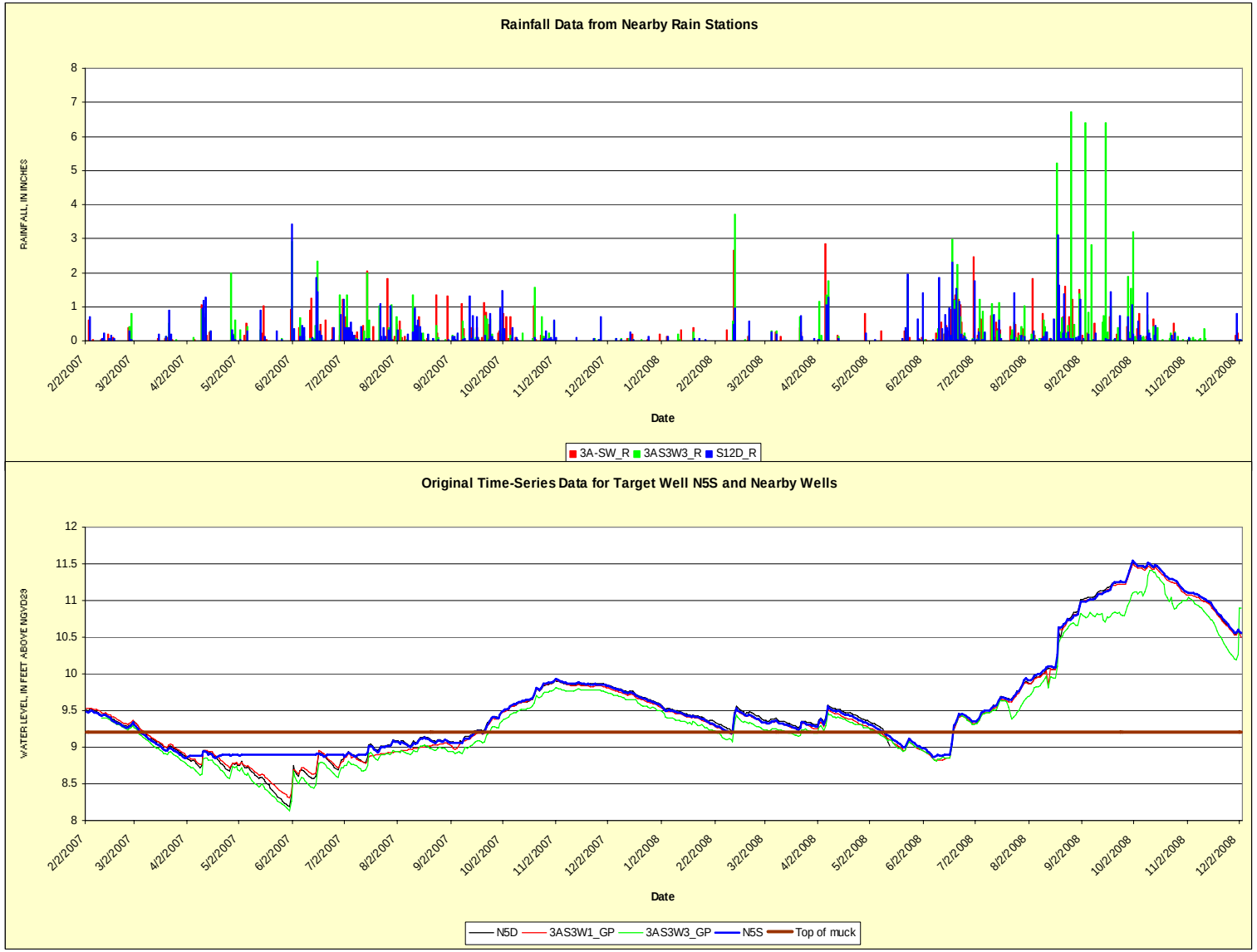
Date
Original series
Revised series
Top of muck

N5S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well N5S and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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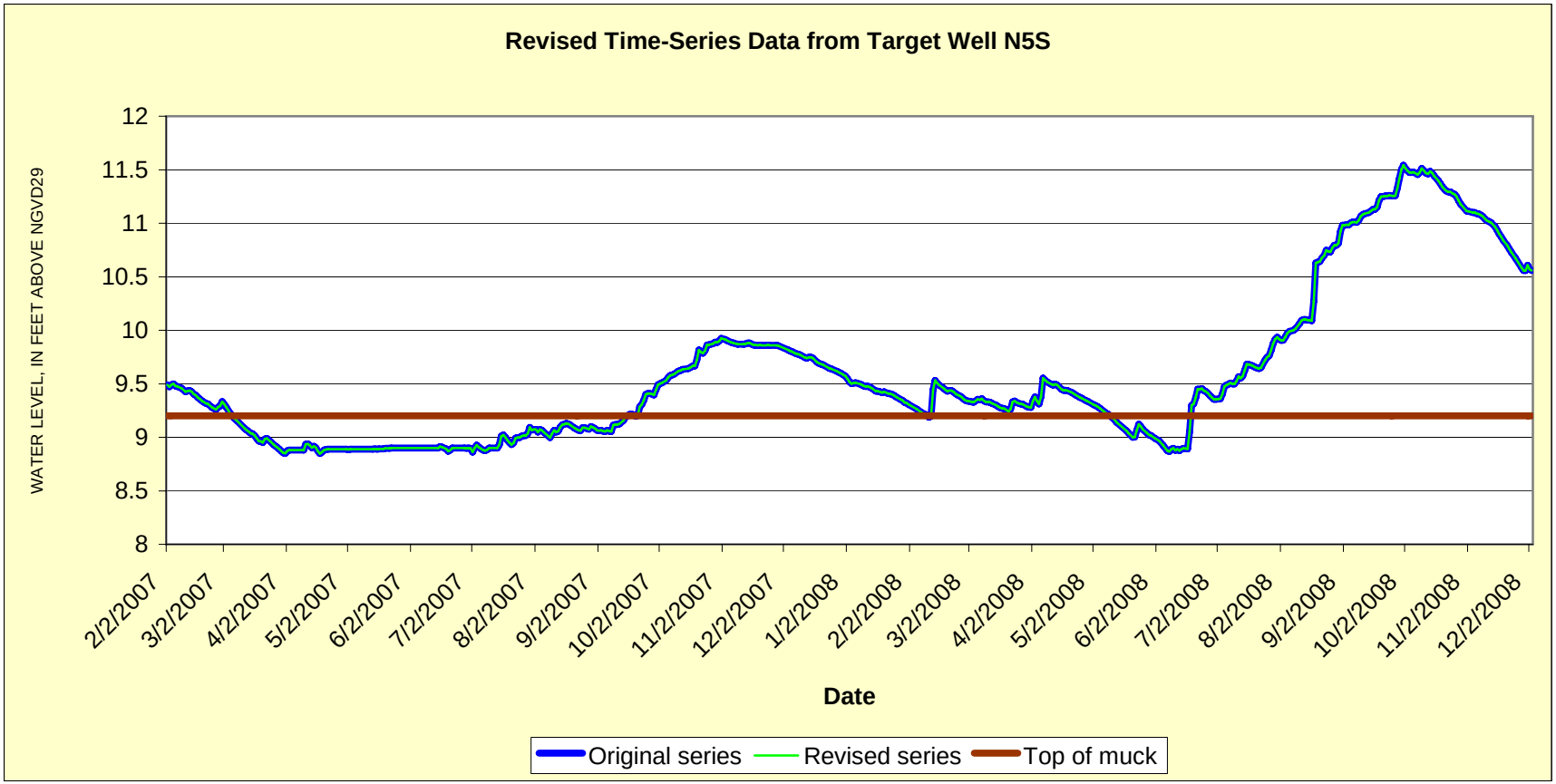
N5S
Top of muck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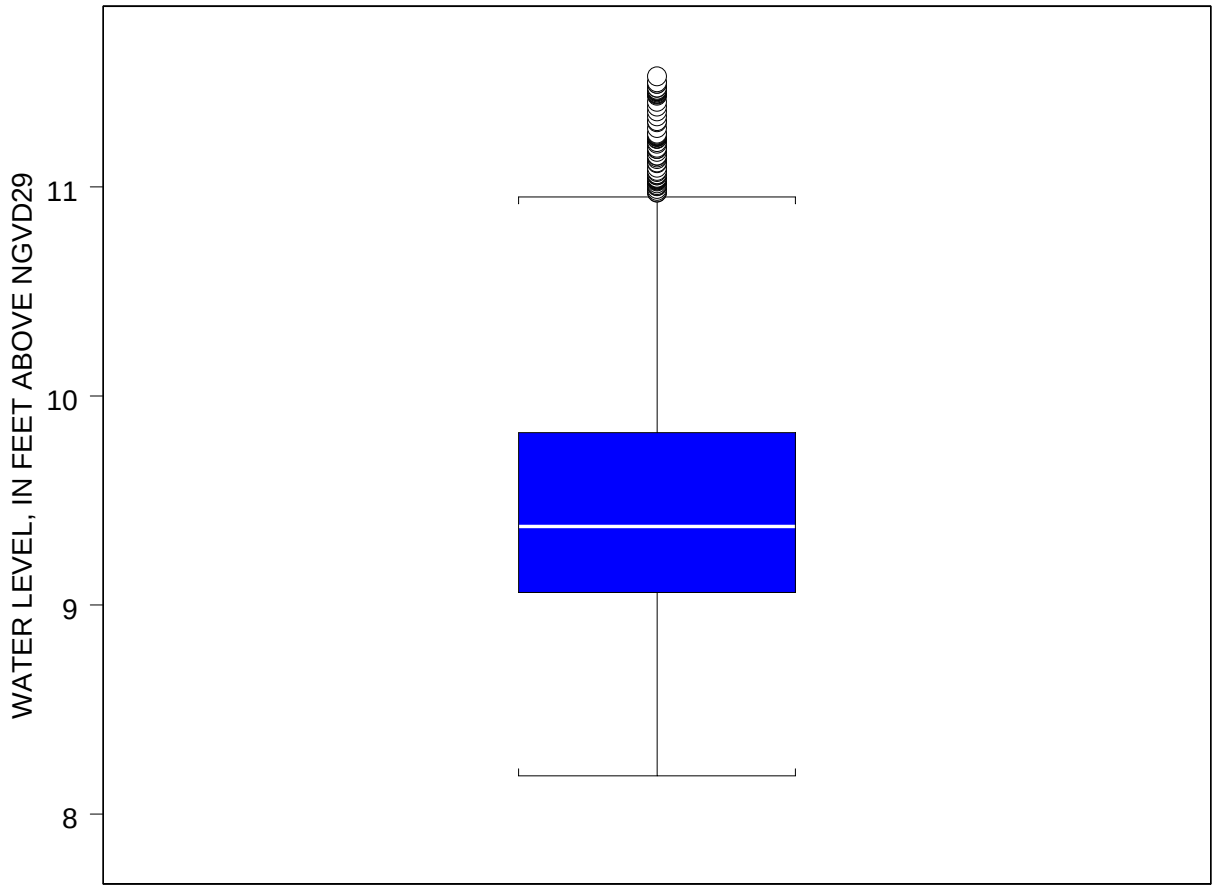
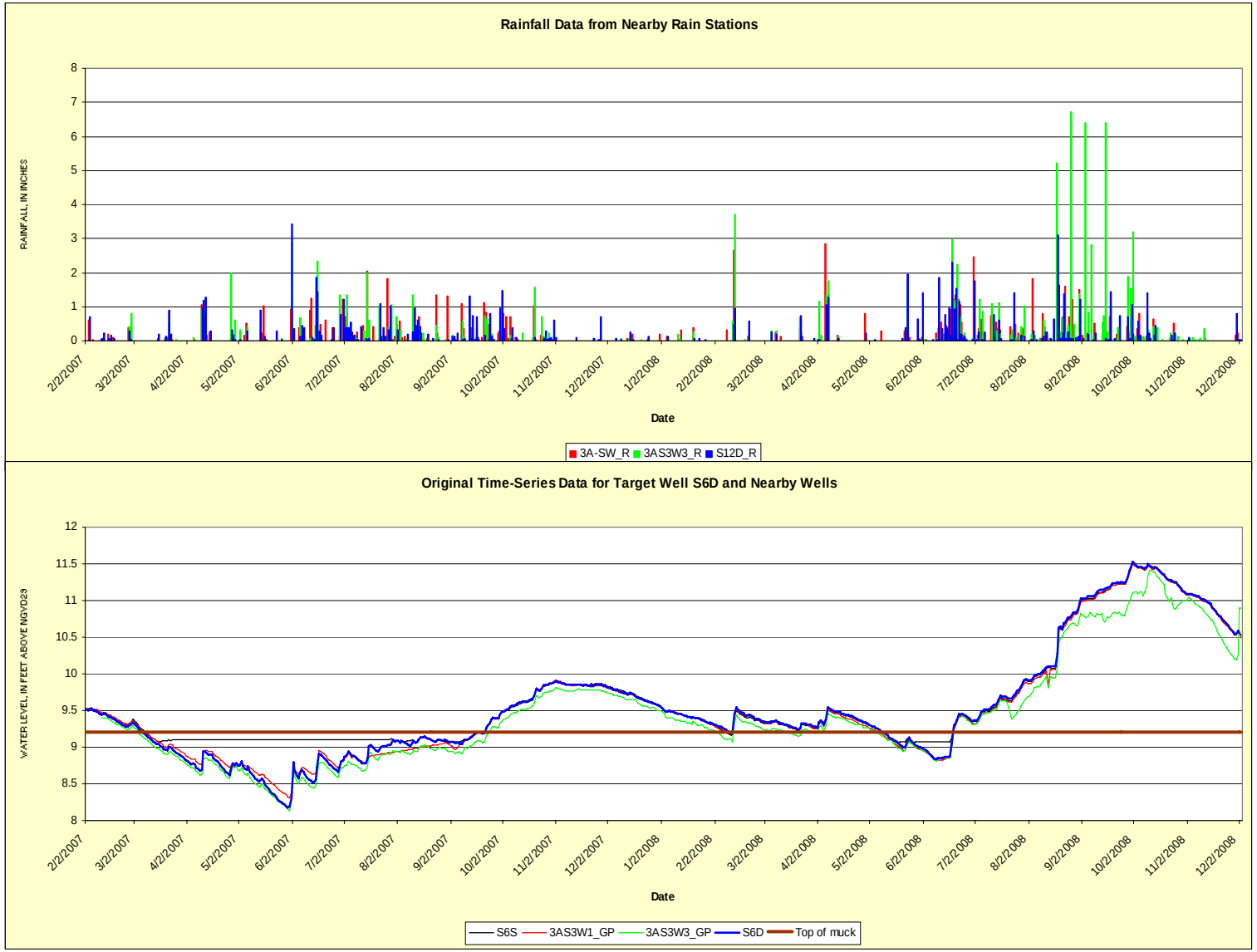
Date
Original series
Revised series
Top of muck

S6D




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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10/2/2008
11/2/2008
12/2/2008
Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well S6D and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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Date
S6S
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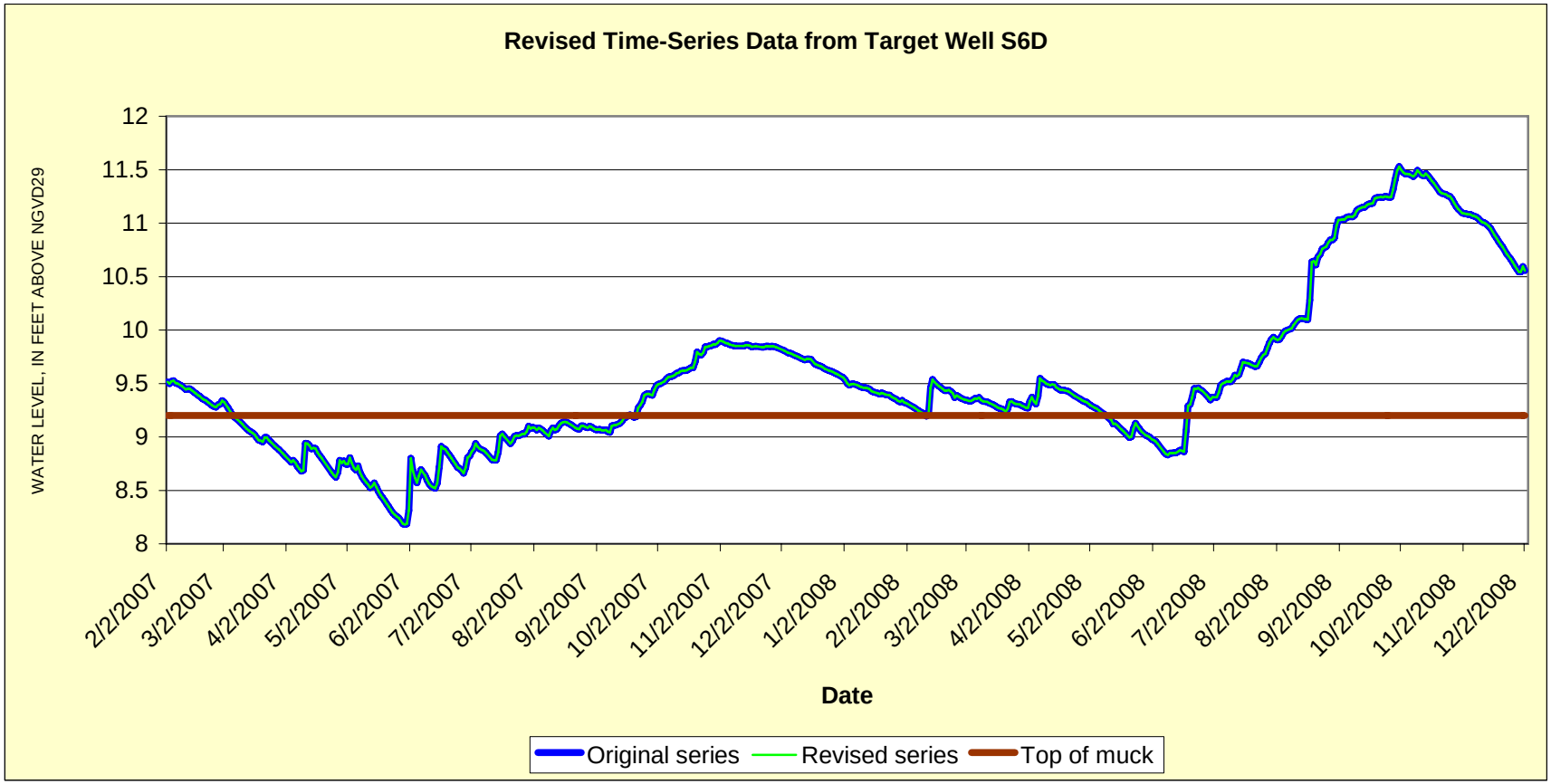
S6D
Top of muck


Revised Time-Series Data from Target Well S6D
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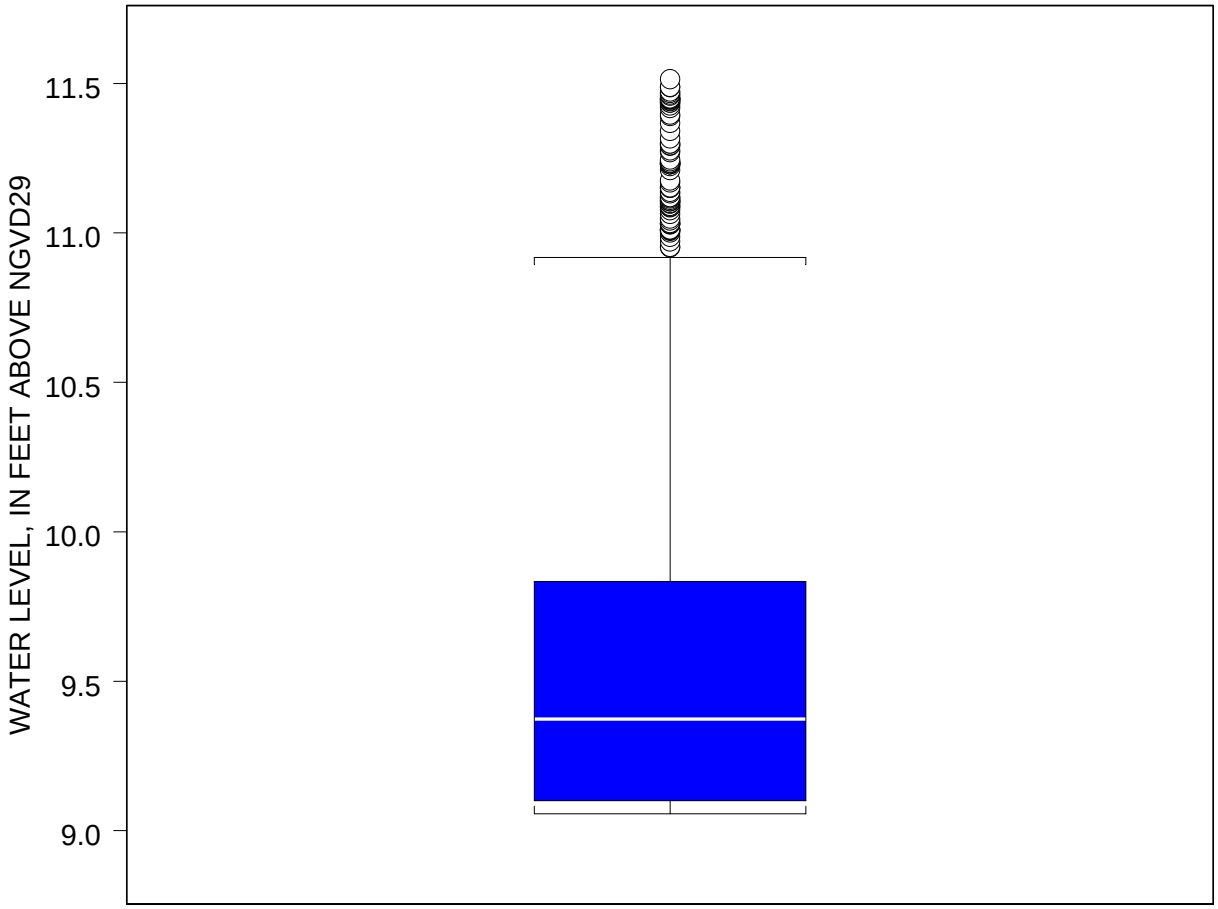
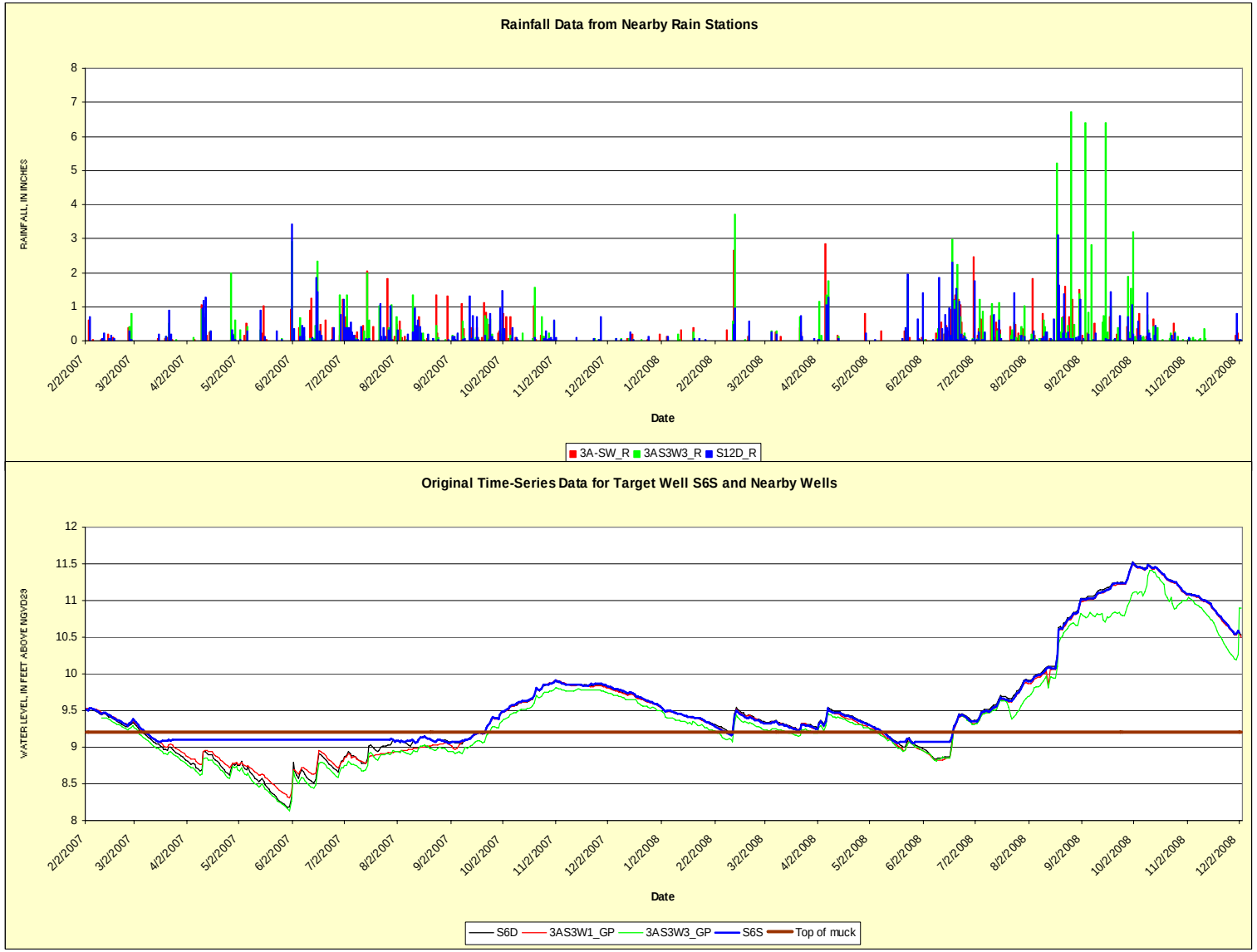
Date
Original series
Revised series
Top of muck

S6S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
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S12D_R
Original Time-Series Data for Target Well S6S and Nearby Wells
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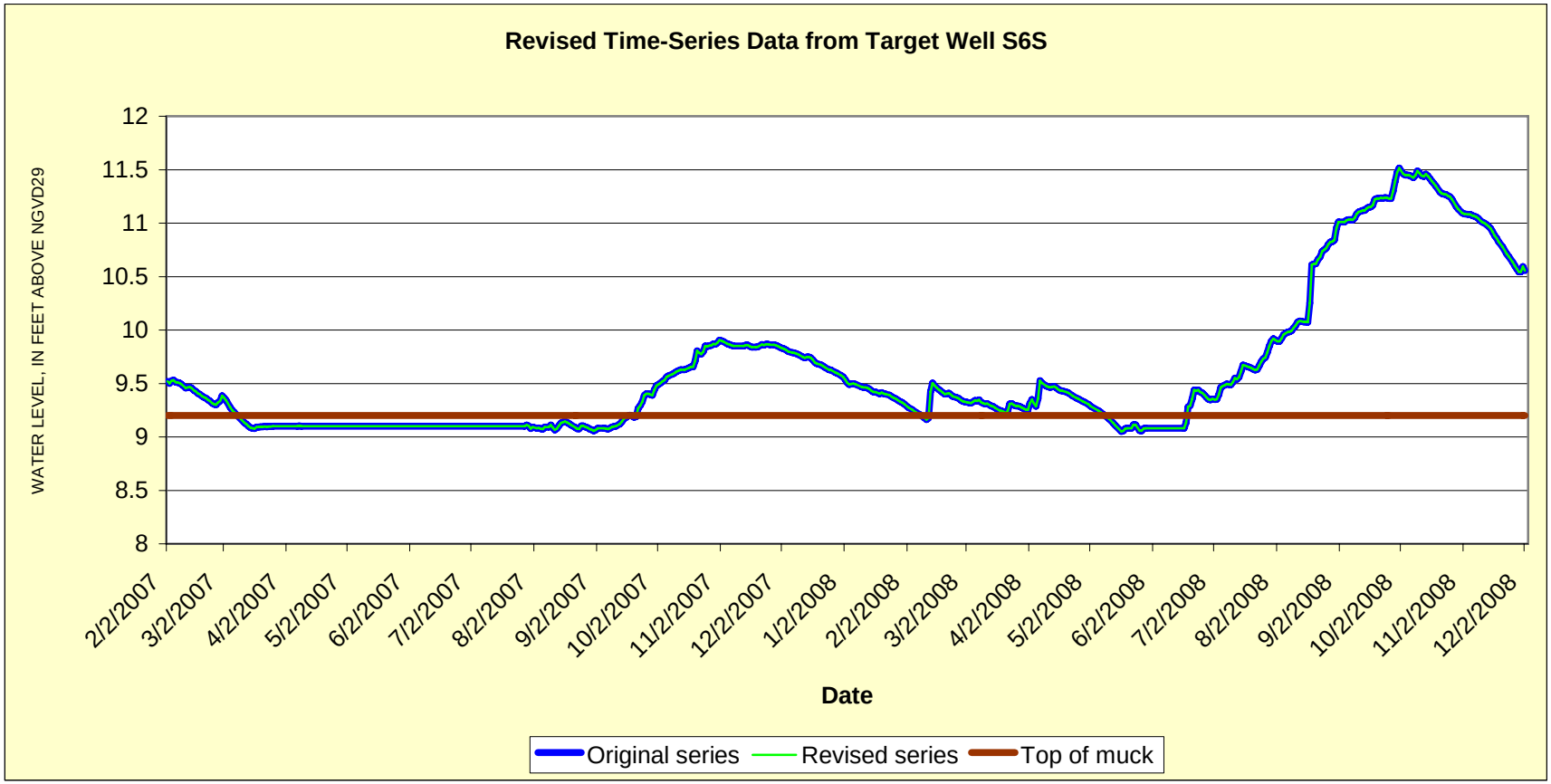
S6S
Top of muck


Revised Time-Series Data from Target Well S6S
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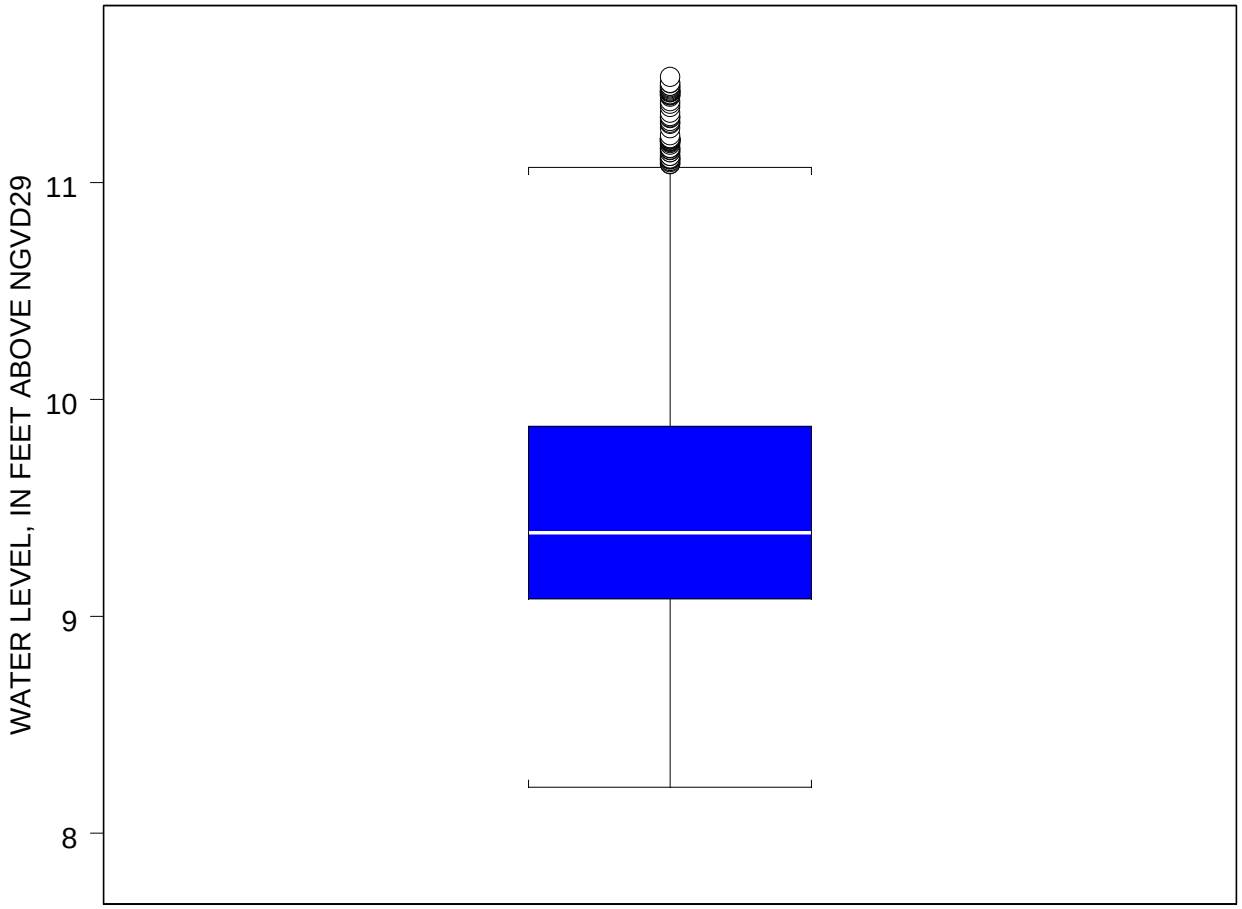
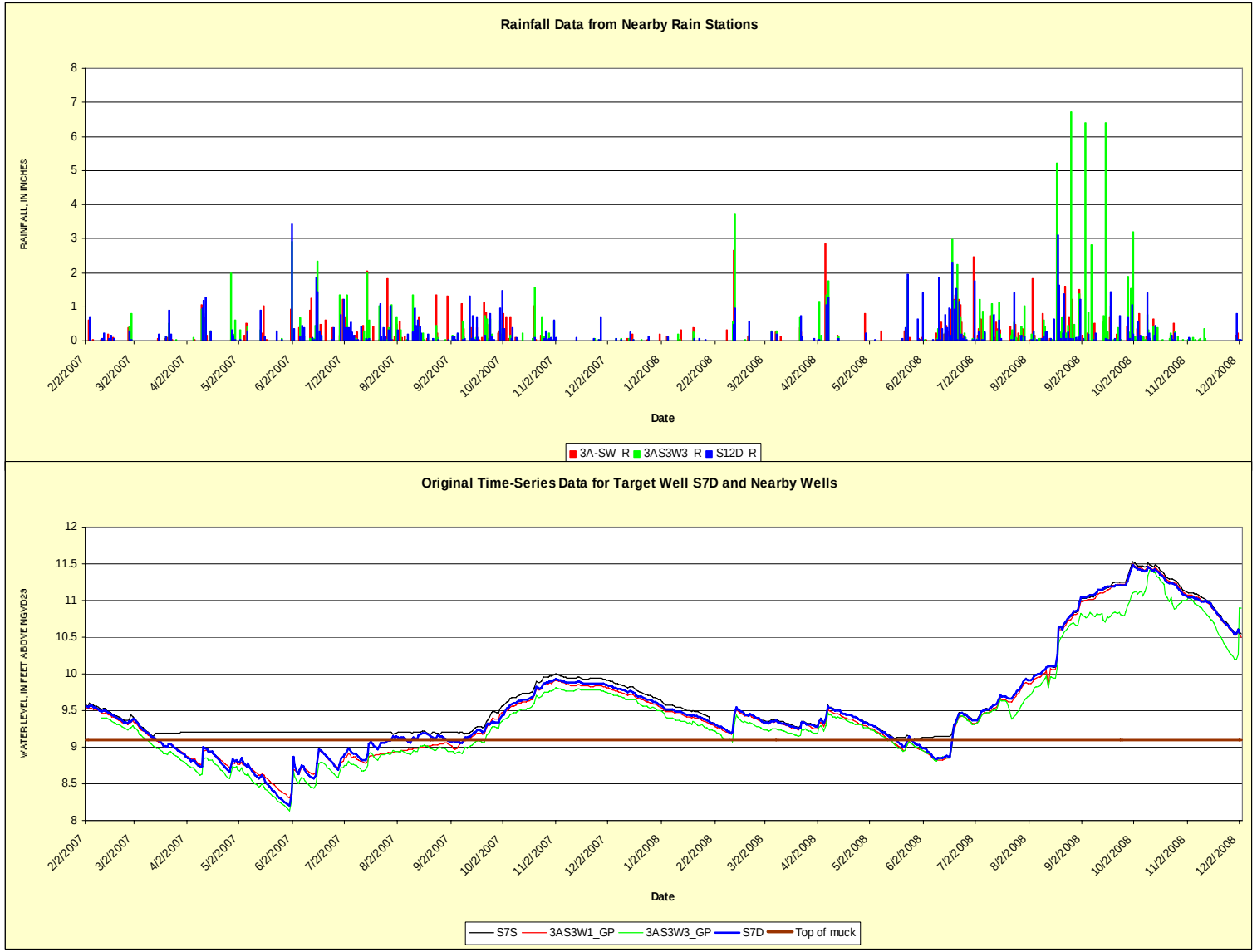
12/2/2008
Date
Original series
Revised series
Top of muck

S7D




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well S7D and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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S7S
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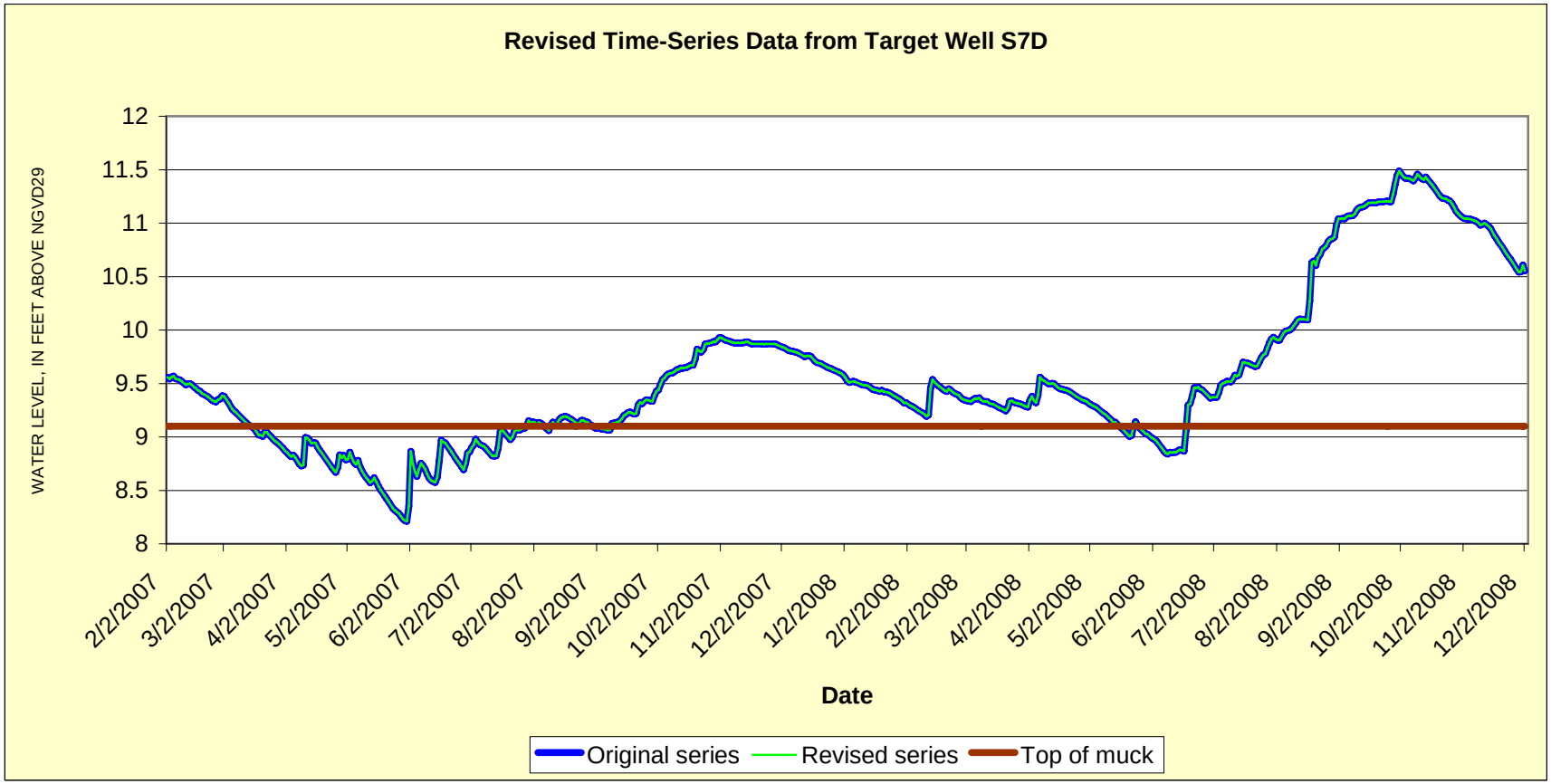
3AS3W3_GP
S7D
Top of muck


Revised Time-Series Data from Target Well S7D
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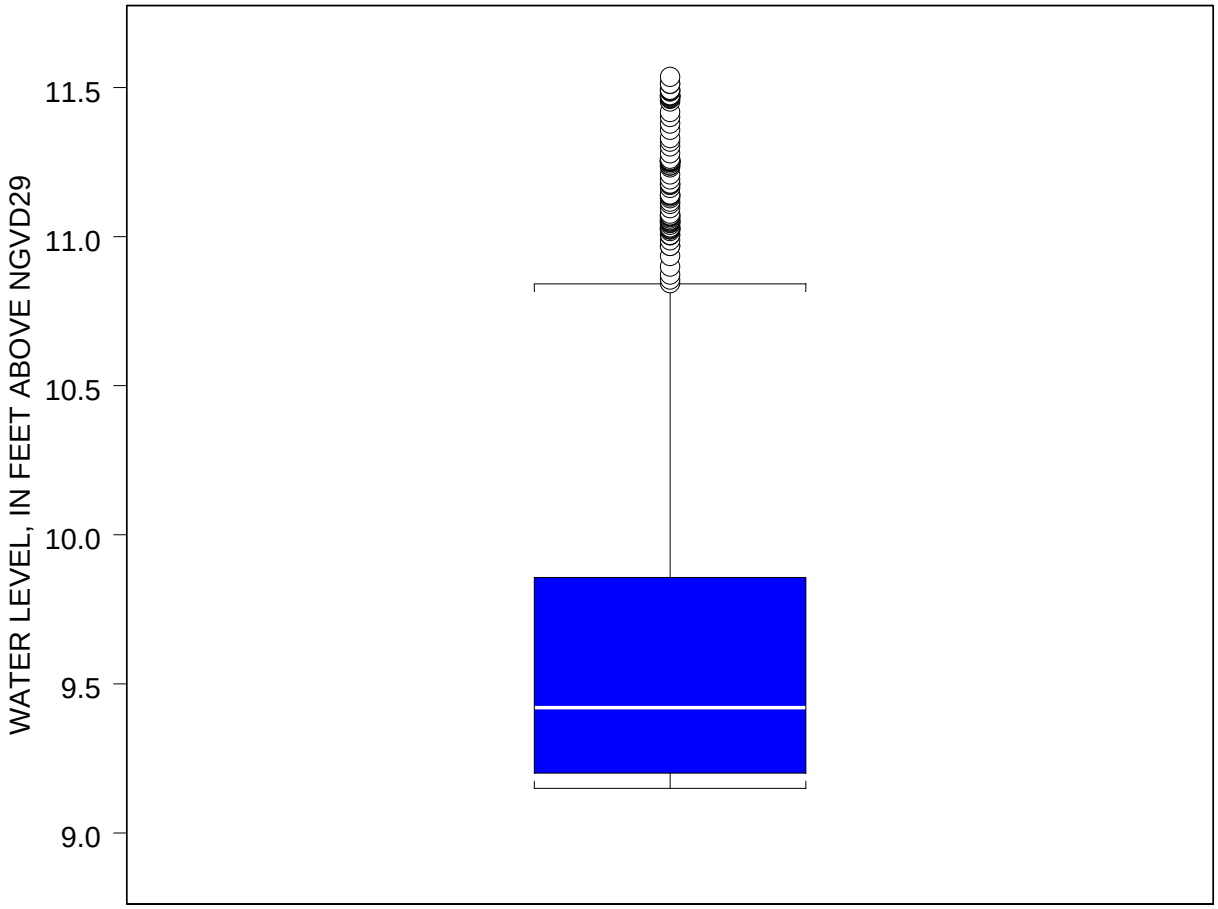
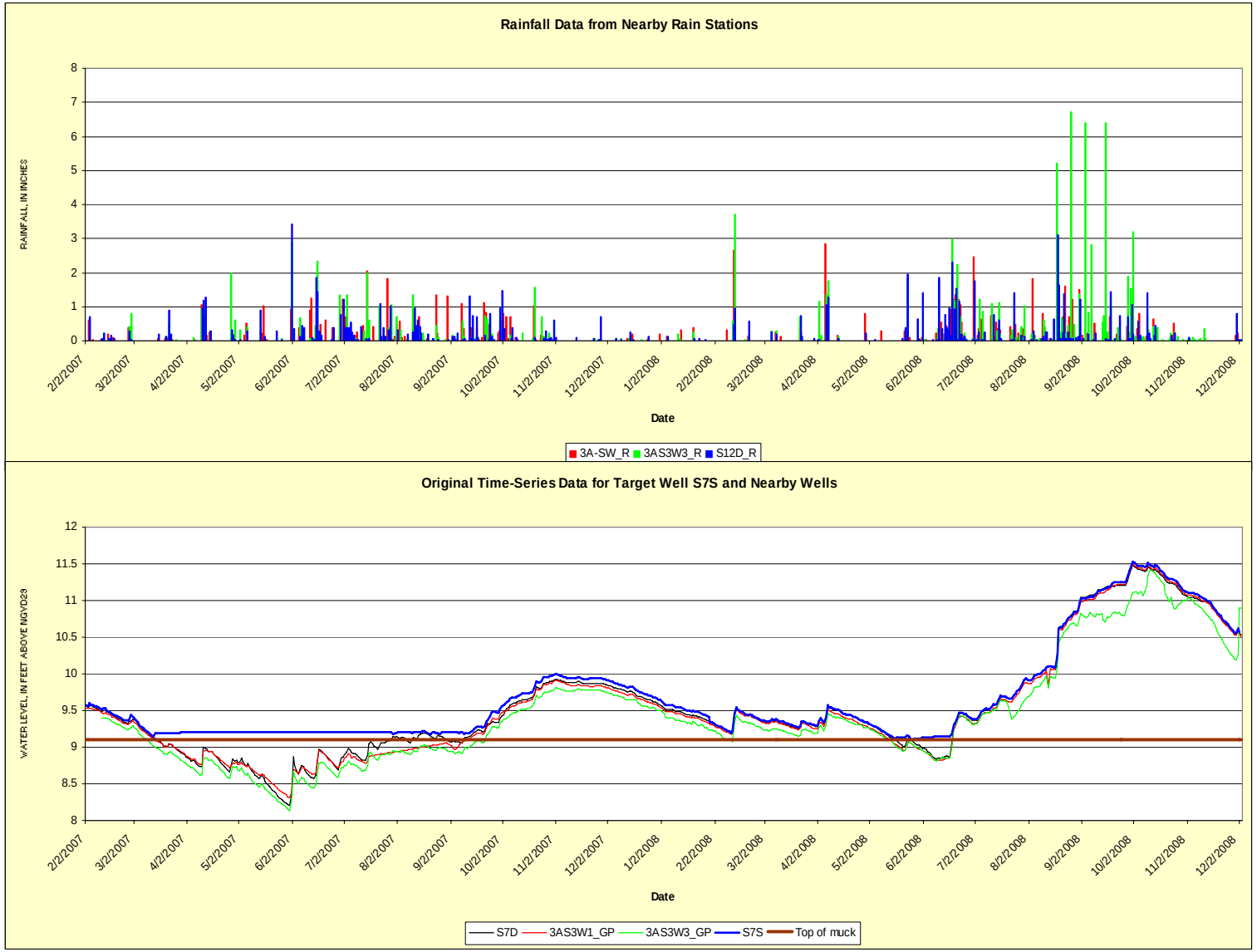
Date
Original series
Revised series
Top of muck

S7S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well S7S and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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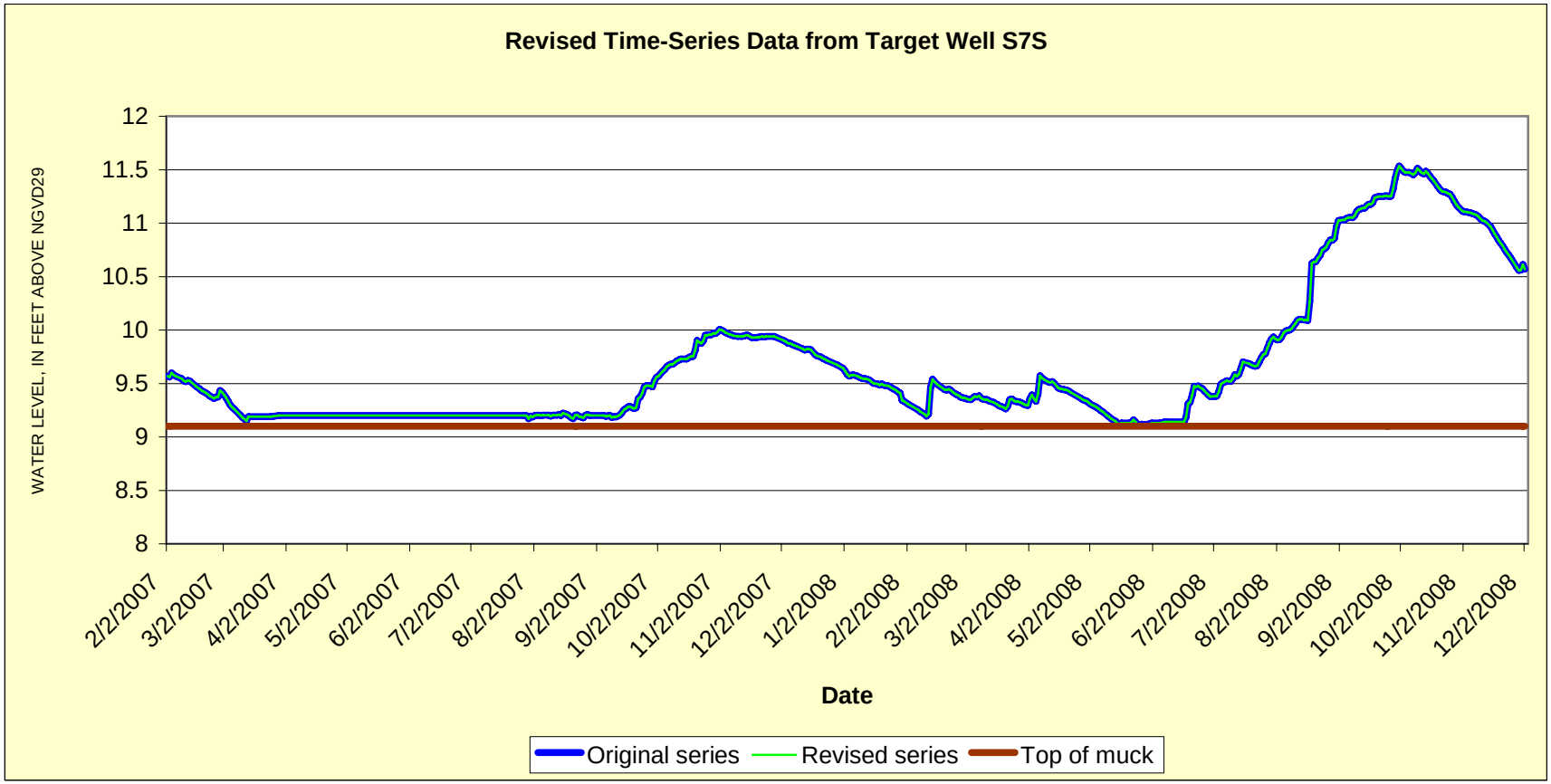
S7S
Top of muck


Revised Time-Series Data from Target Well S7S
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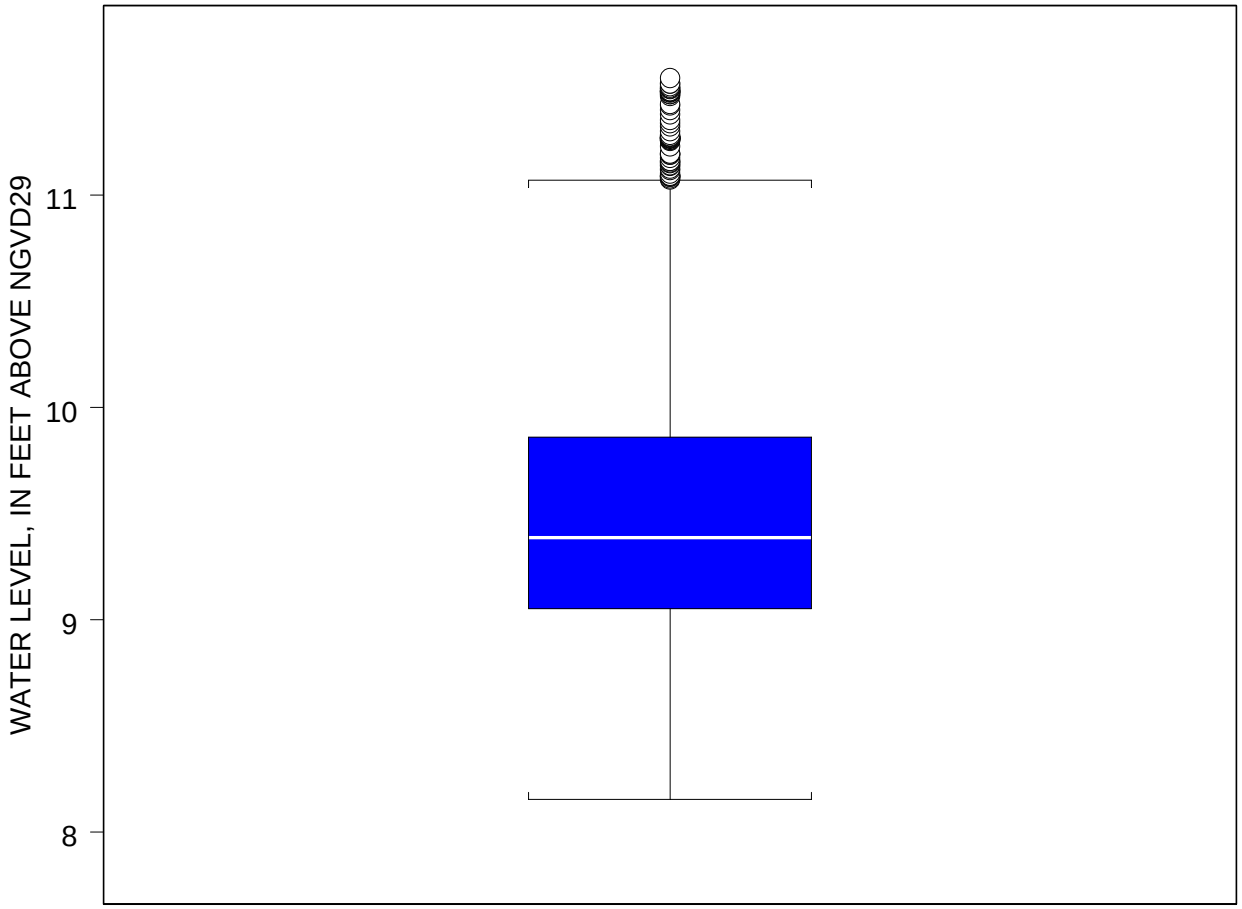
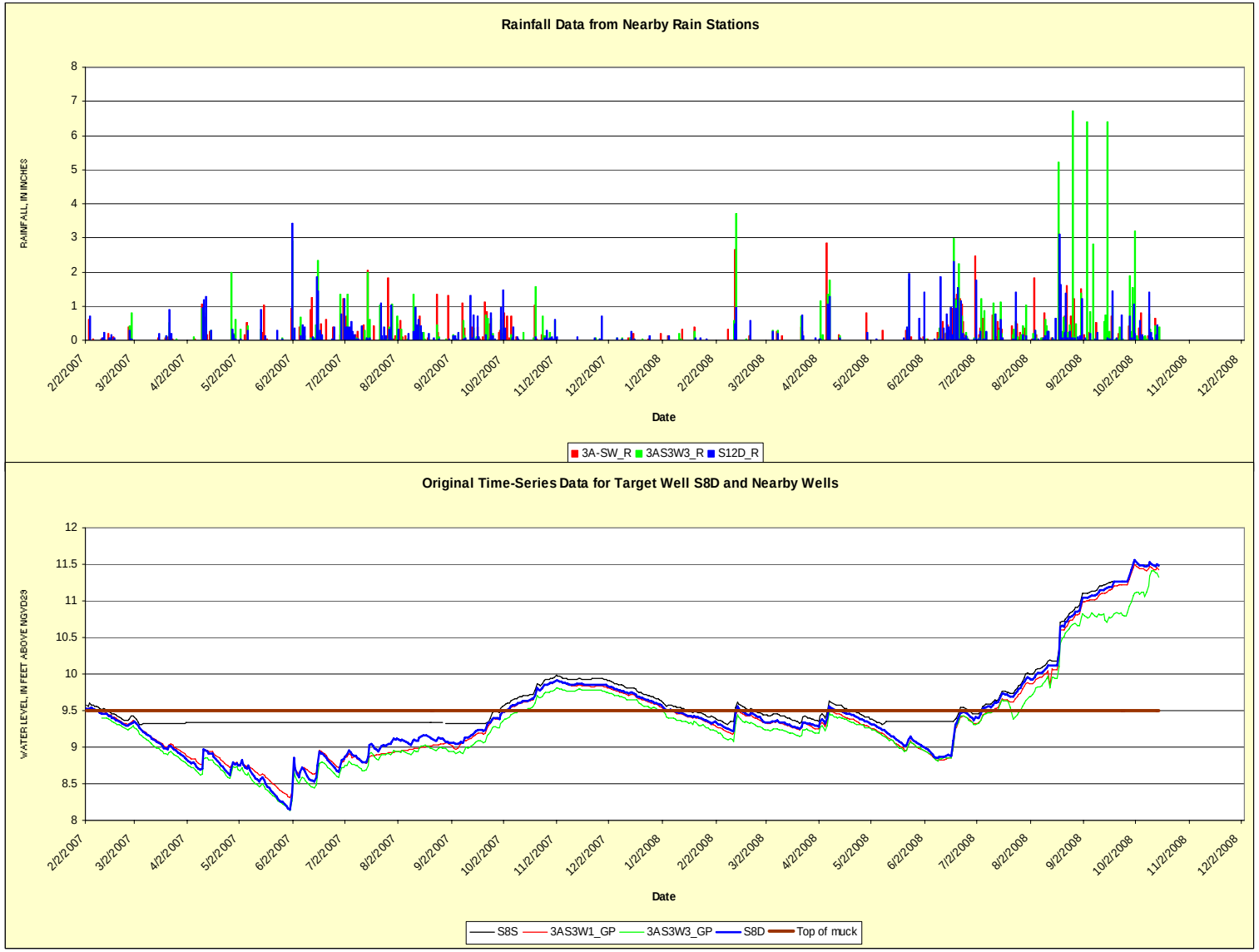
Date
Original series
Revised series
Top of muck

S8D




Rainfall Data from Nearby Rain Stations
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Date
3A-SW_R
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S12D_R
Original Time-Series Data for Target Well S8D and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
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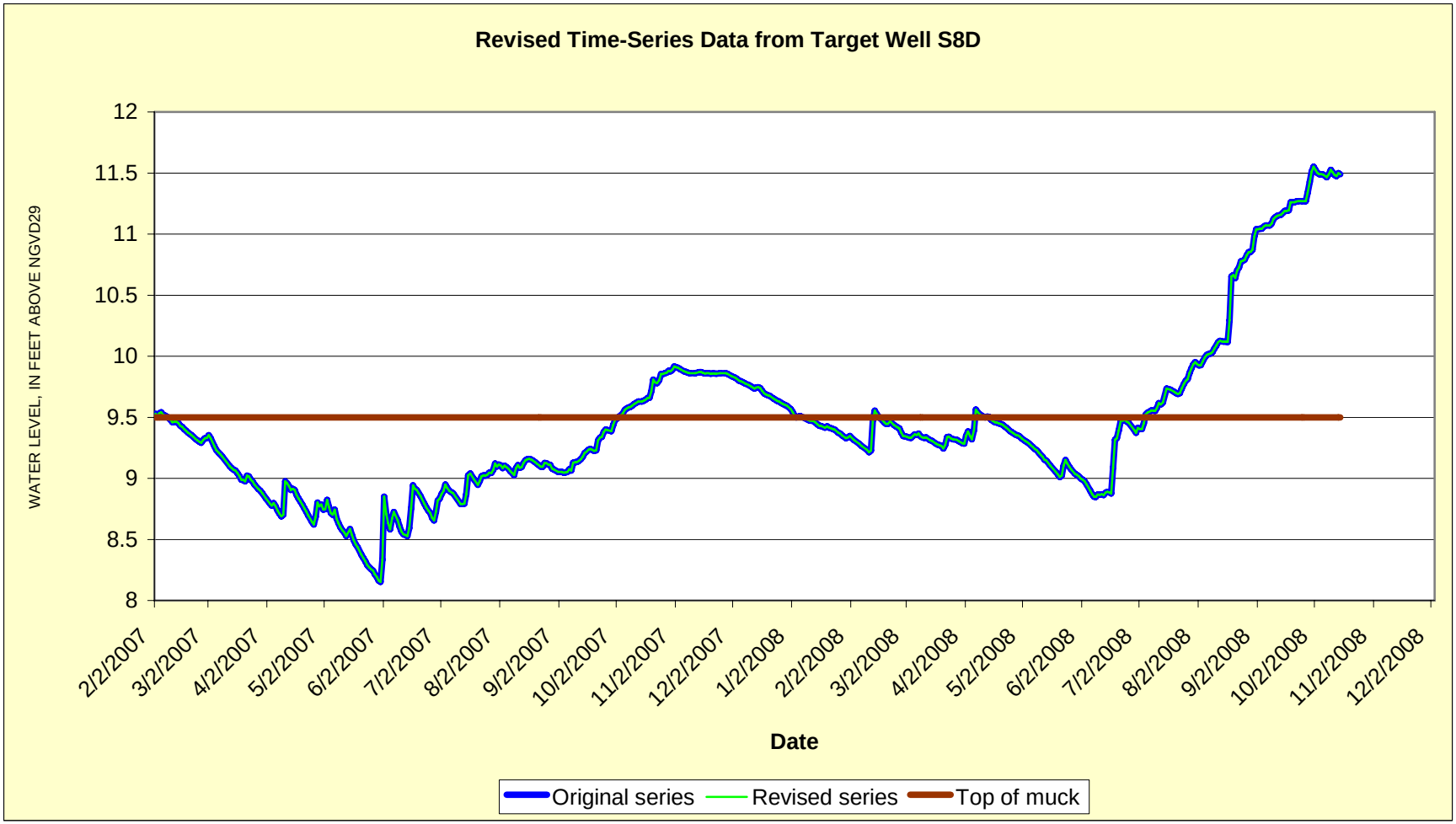
3AS3W3_GP
S8D
Top of muck


Revised Time-Series Data from Target Well S8D
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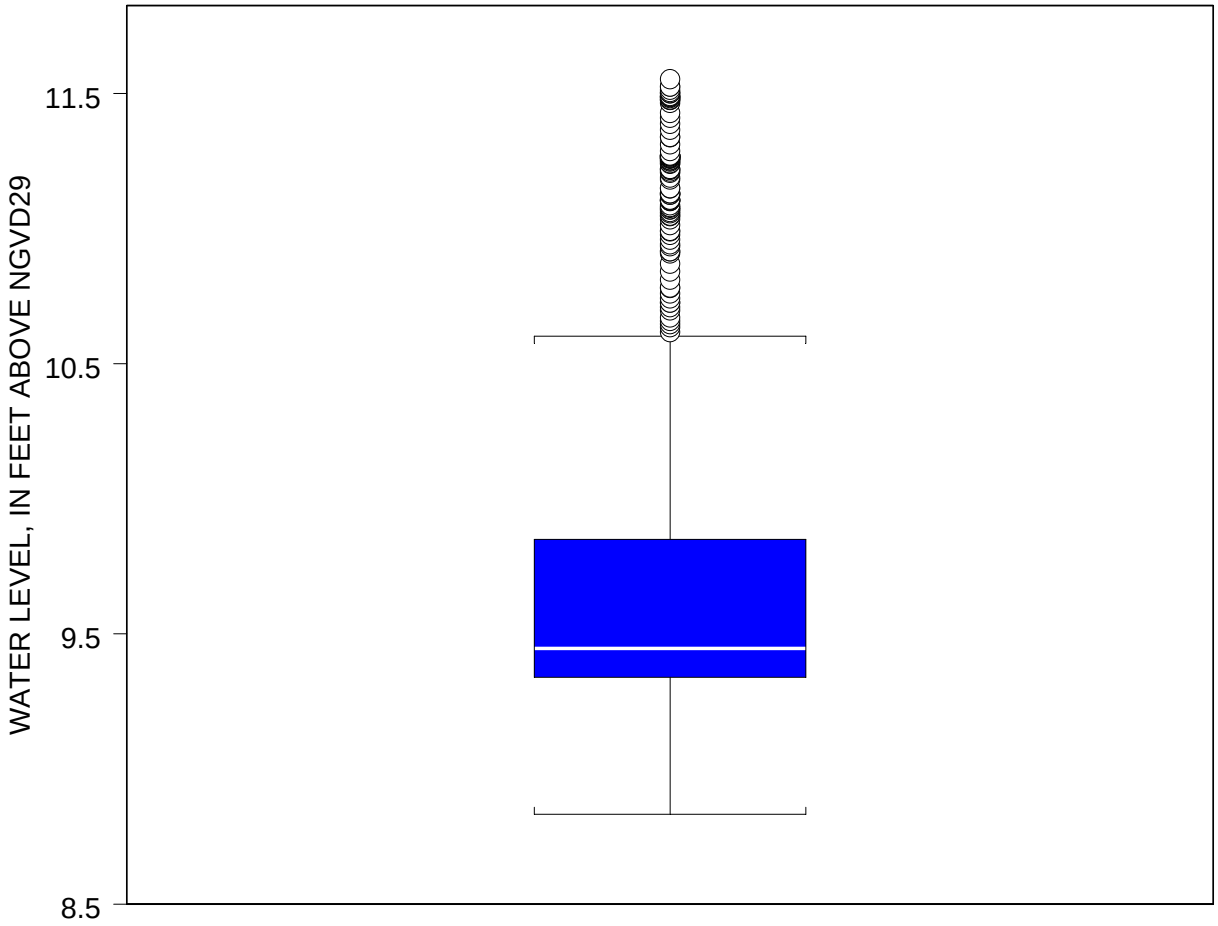
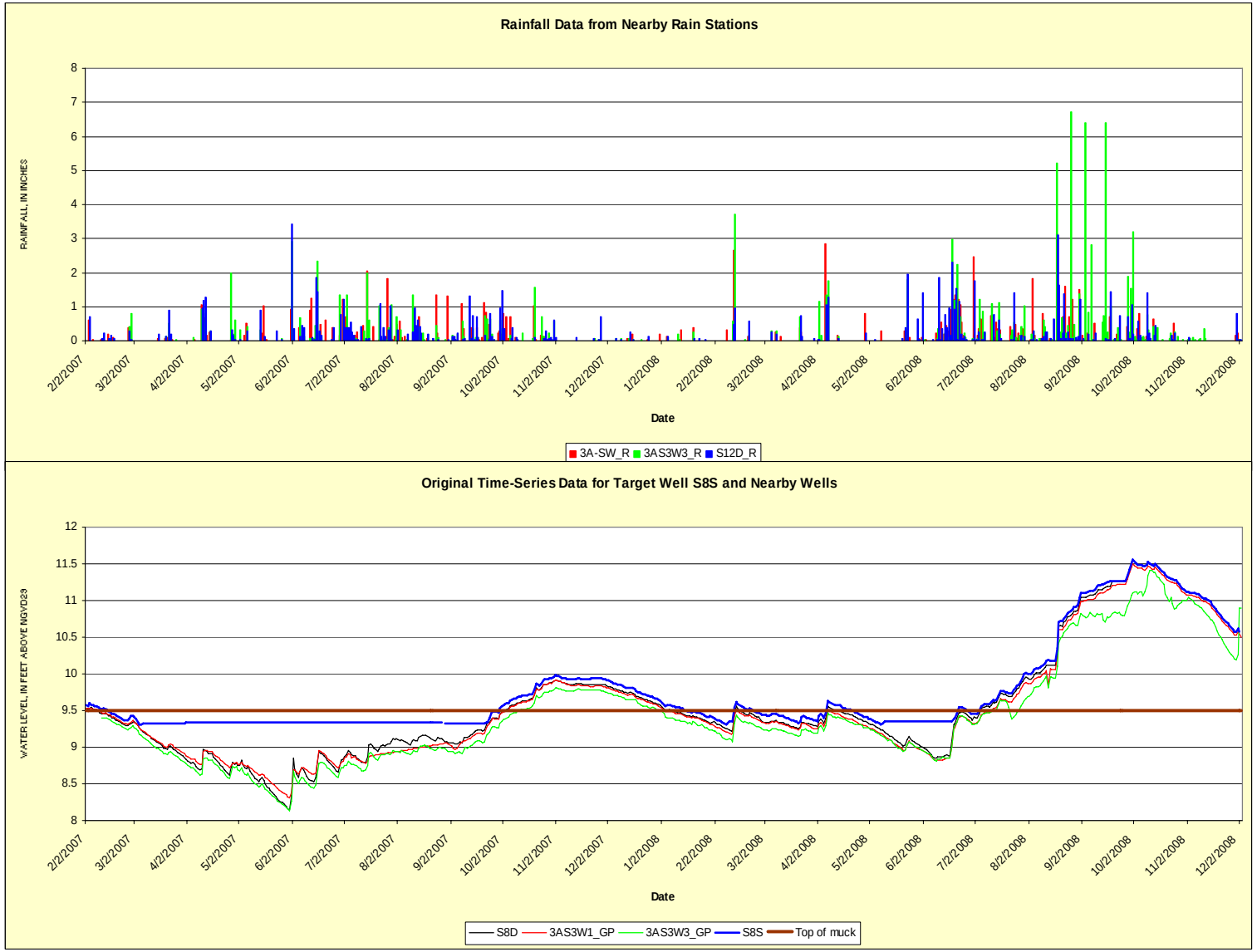
Original series
Revised series
Top of muck

S8S




Rainfall Data from Nearby Rain Stations
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3A-SW_R
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S12D_R
Original Time-Series Data for Target Well S8S and Nearby Wells
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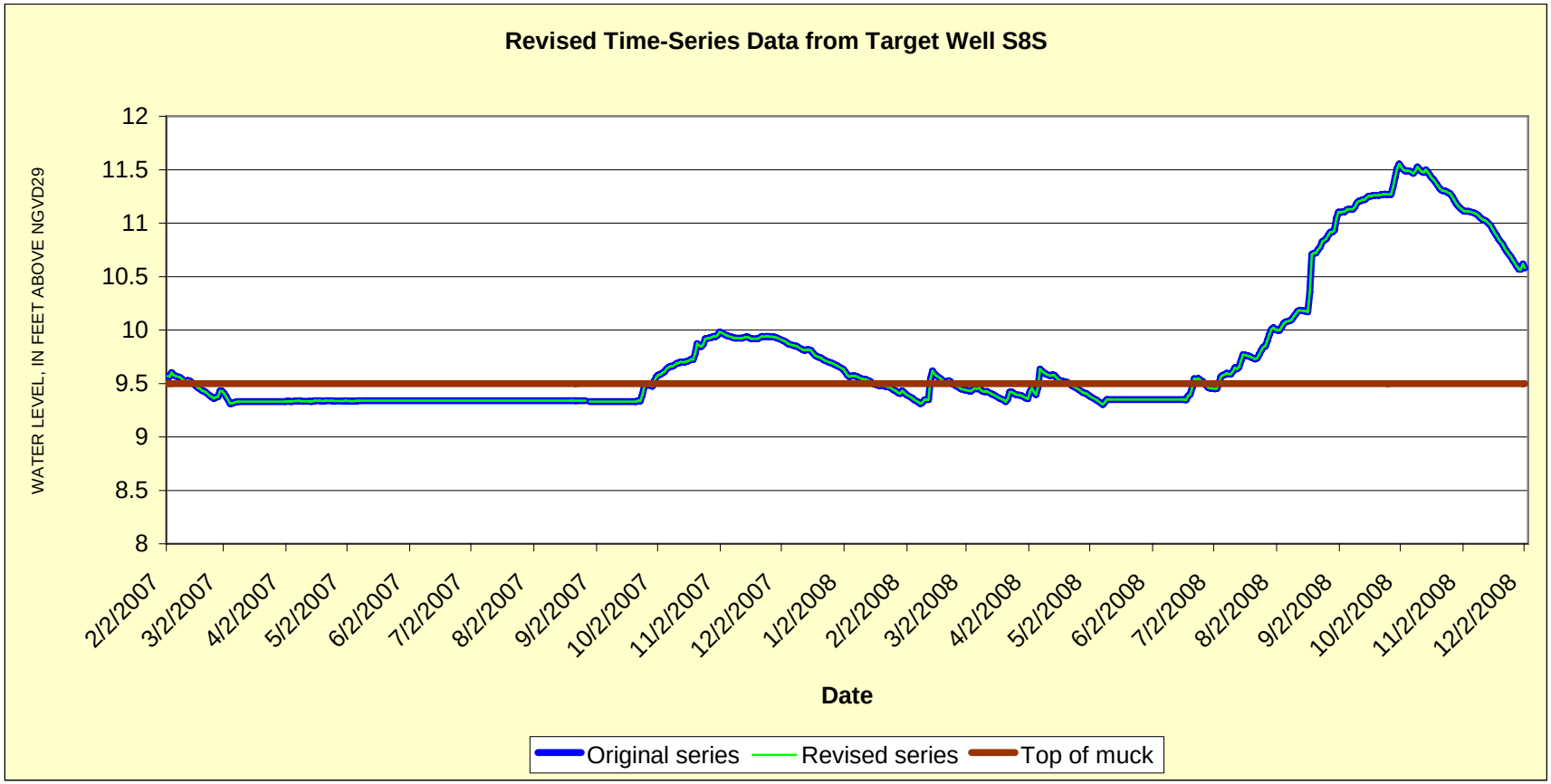
S8S
Top of muck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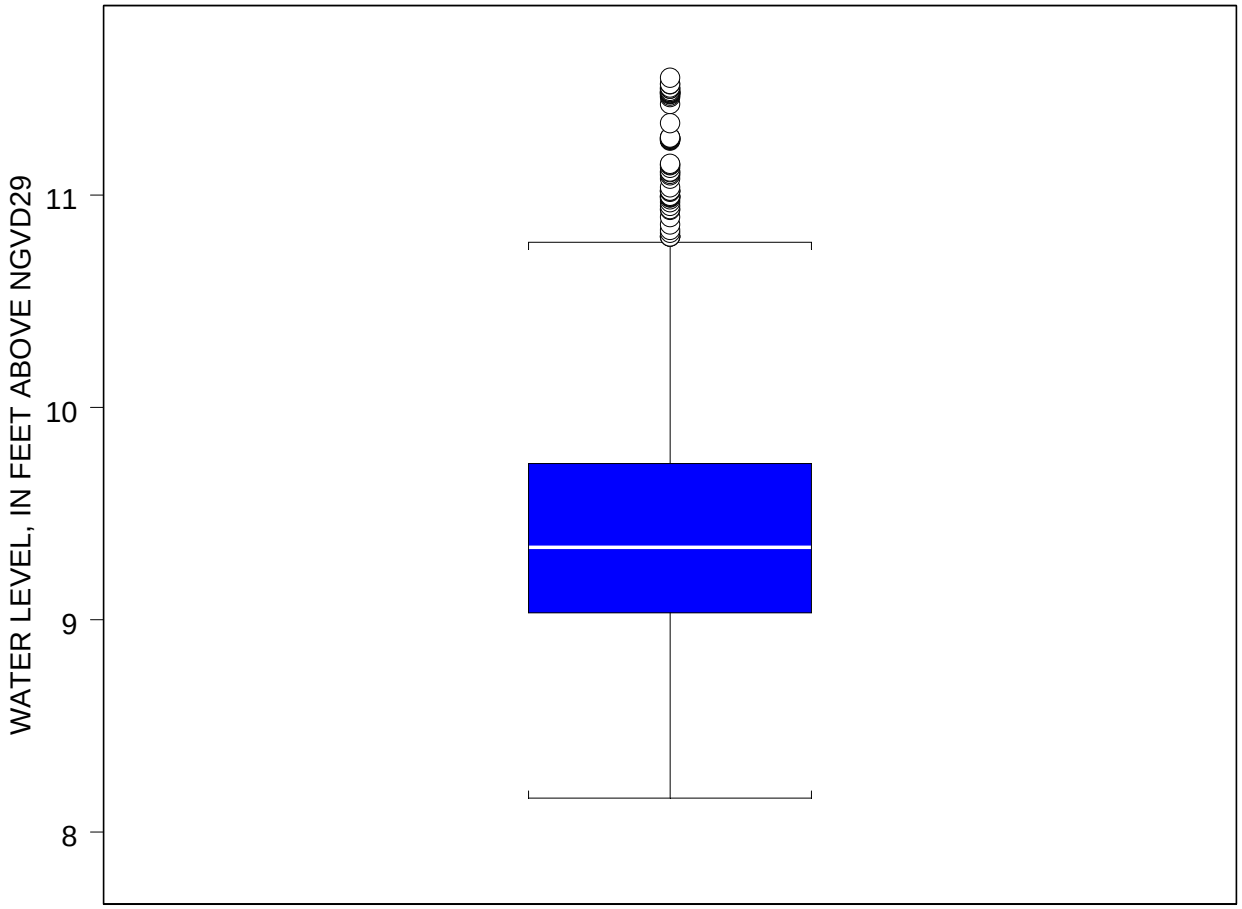
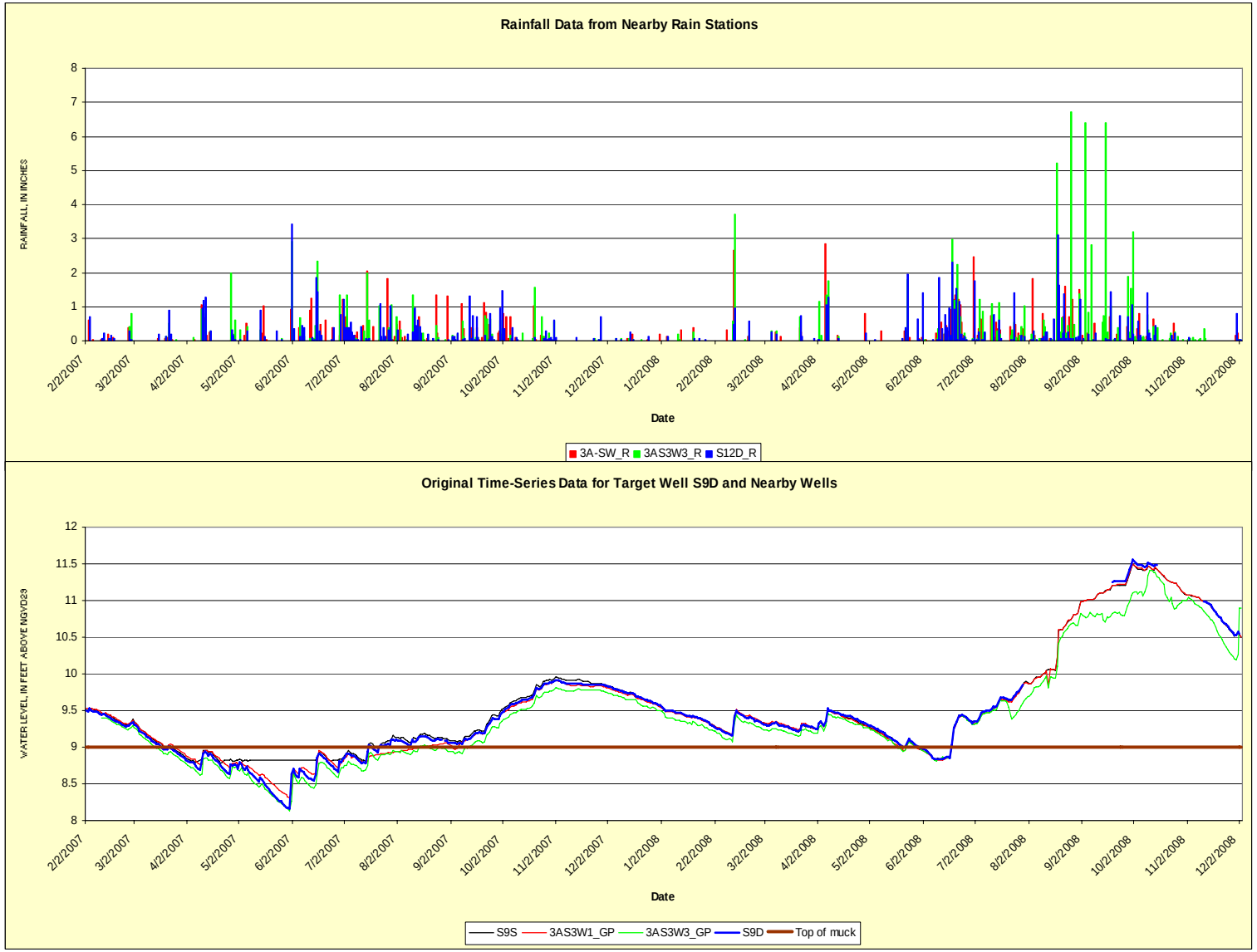
Date
Original series
Revised series
Top of muck

S9D




Rainfall Data from Nearby Rain Stations
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Date
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S12D_R
Original Time-Series Data for Target Well S9D and Nearby Wells
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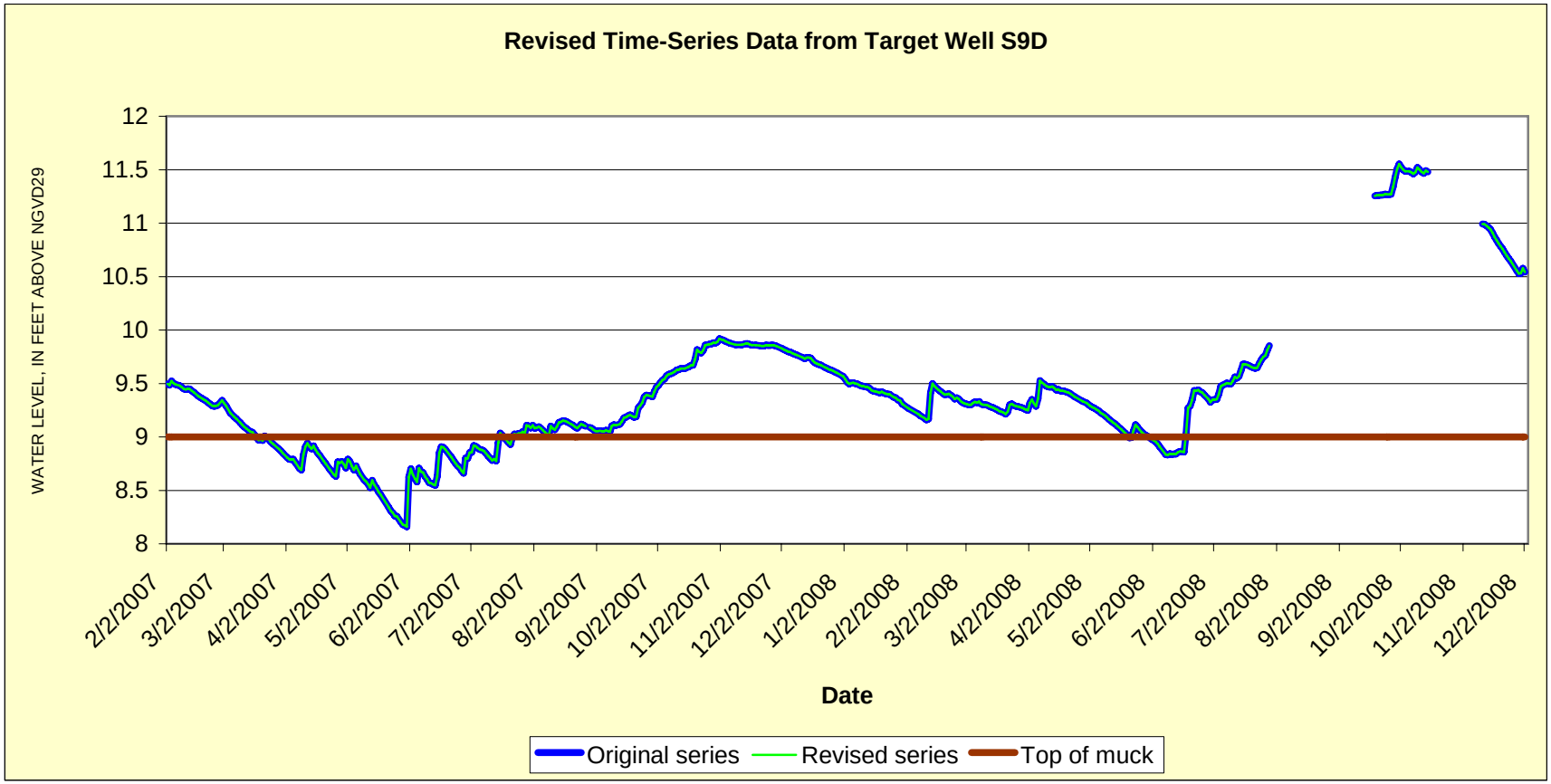
S9D
Top of muck


Revised Time-Series Data from Target Well S9D
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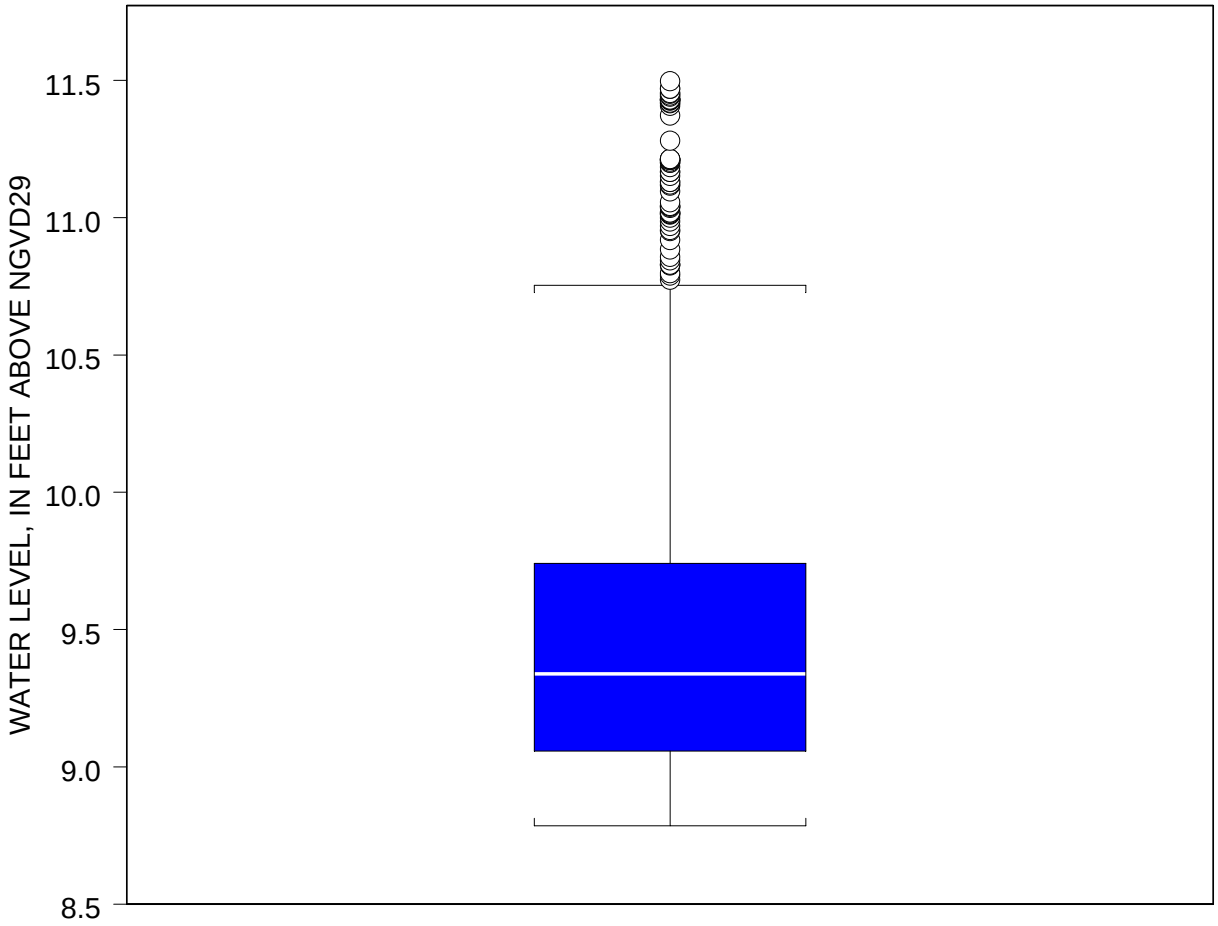
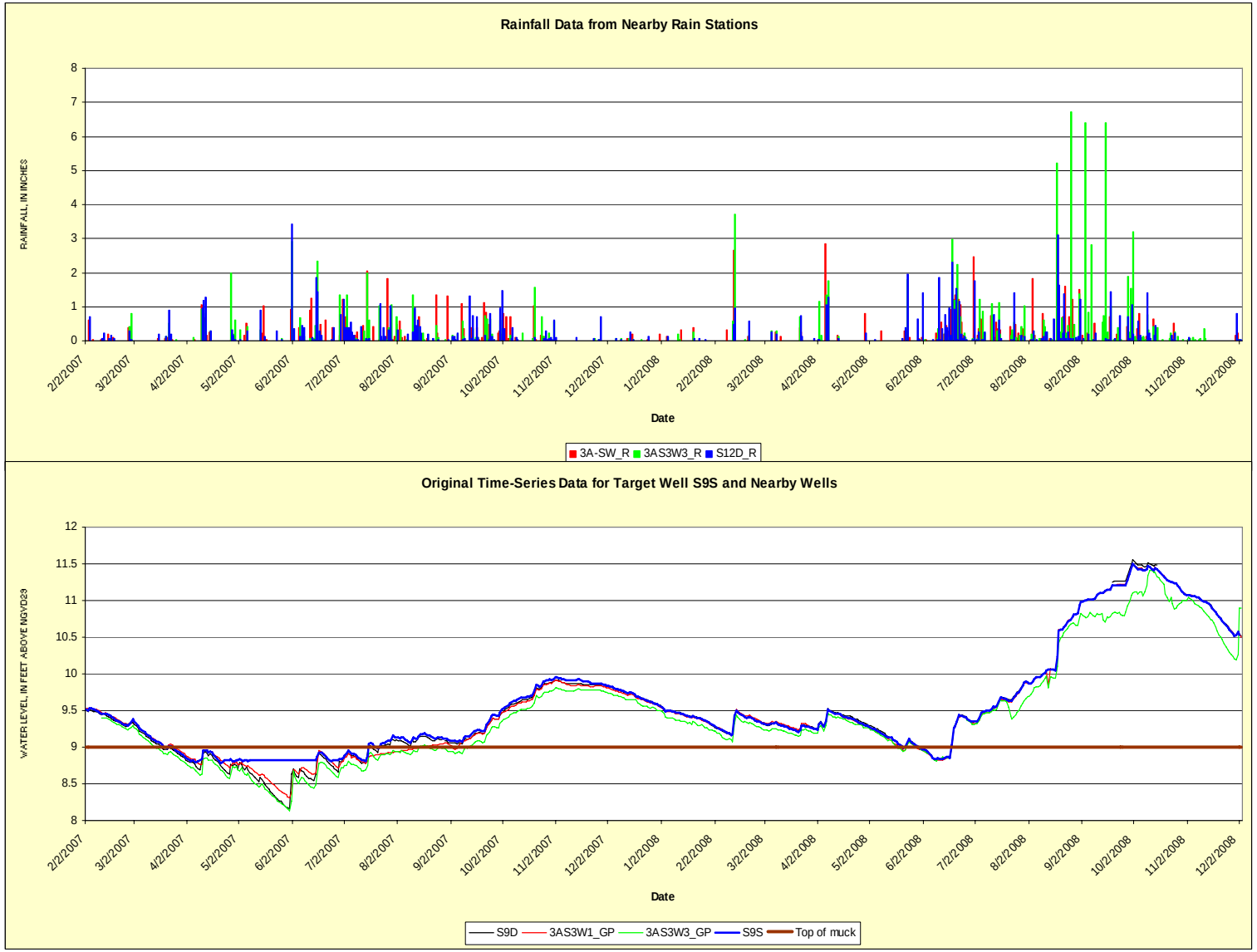
12/2/2008
Date
Original series
Revised series
Top of muck

S9S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well S9S and Nearby Wells
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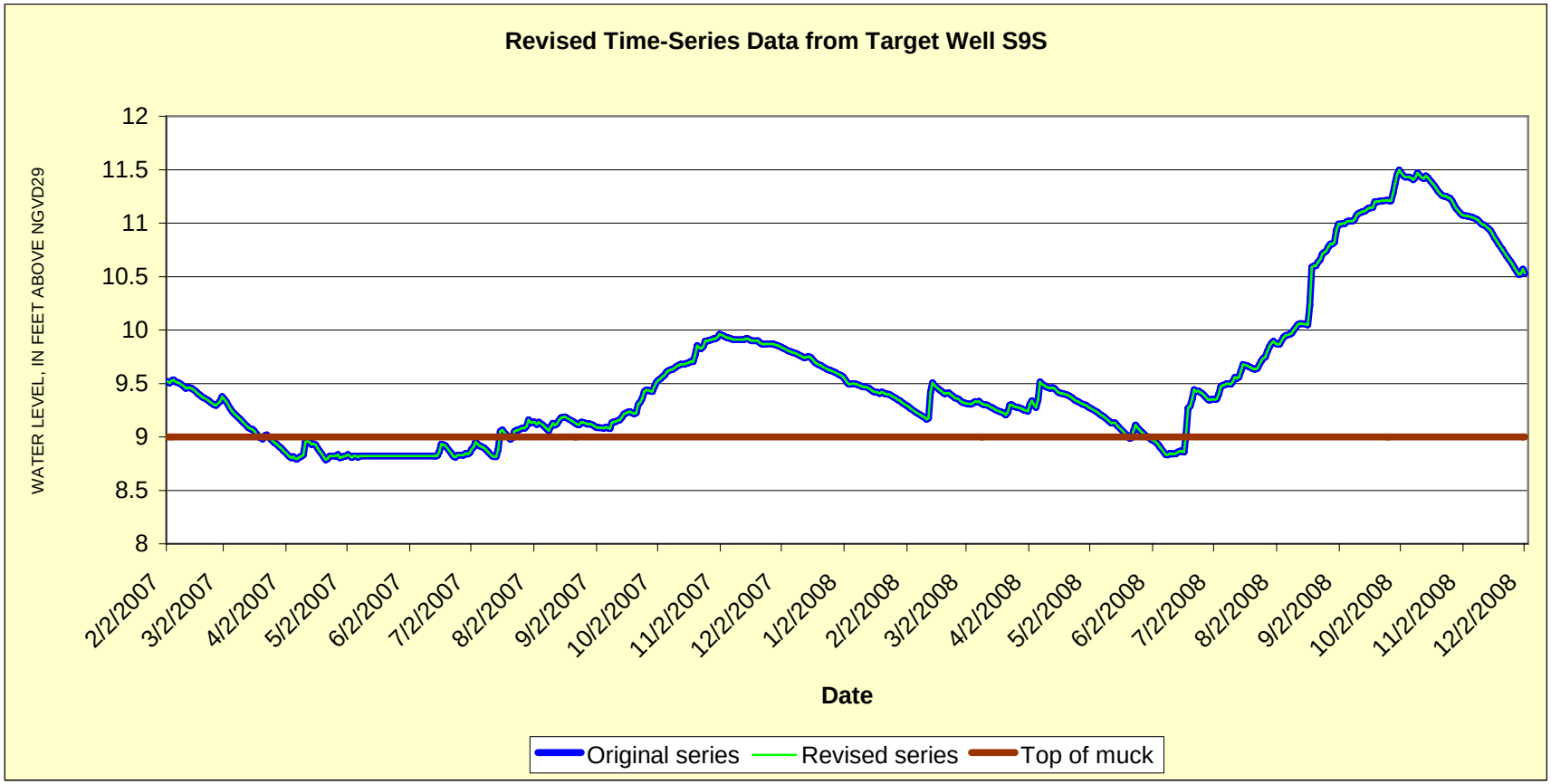
S9S
Top of muck


Revised Time-Series Data from Target Well S9S
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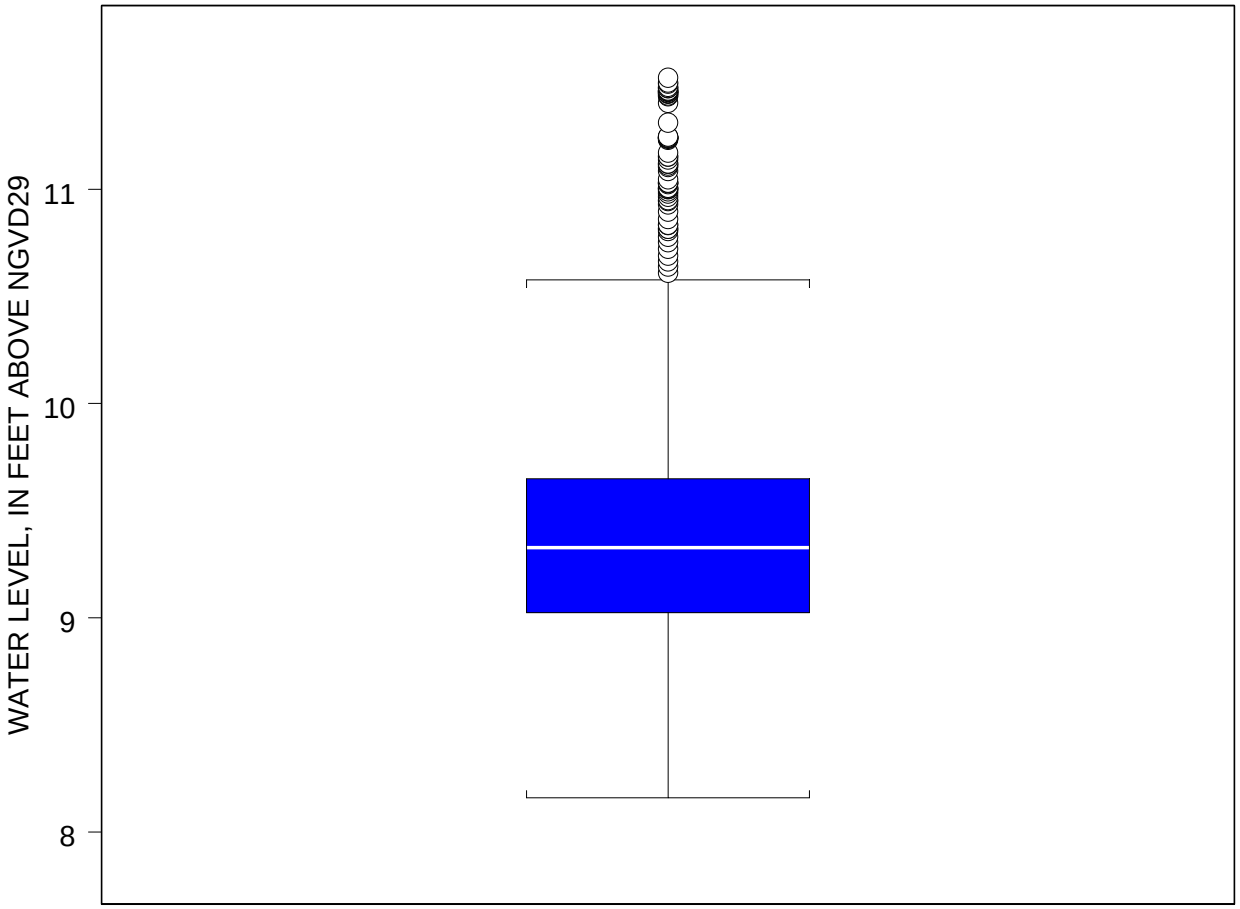
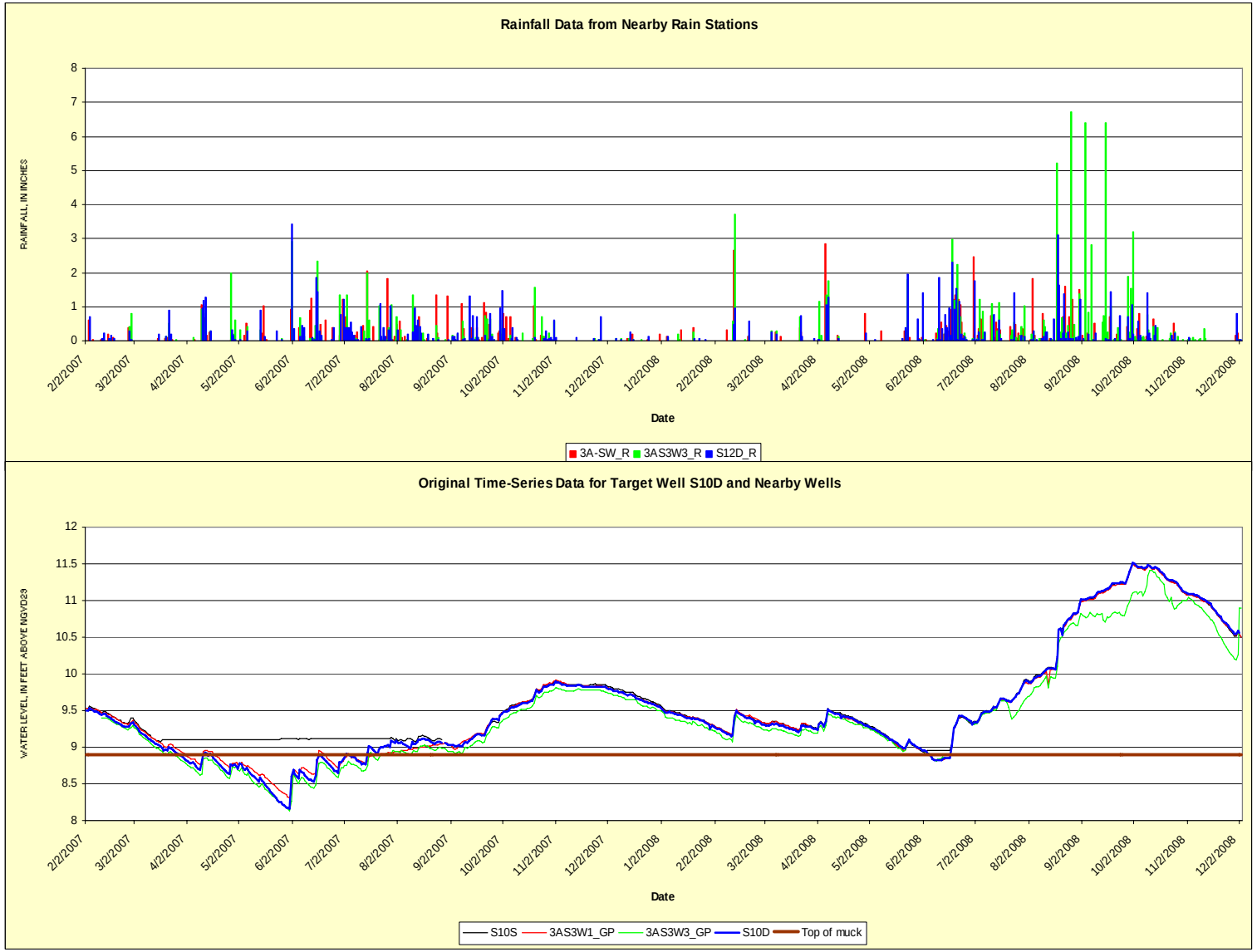
Date
Original series
Revised series
Top of muck

S10D




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
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Date
3A-SW_R
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S12D_R
Original Time-Series Data for Target Well S10D and Nearby Wells
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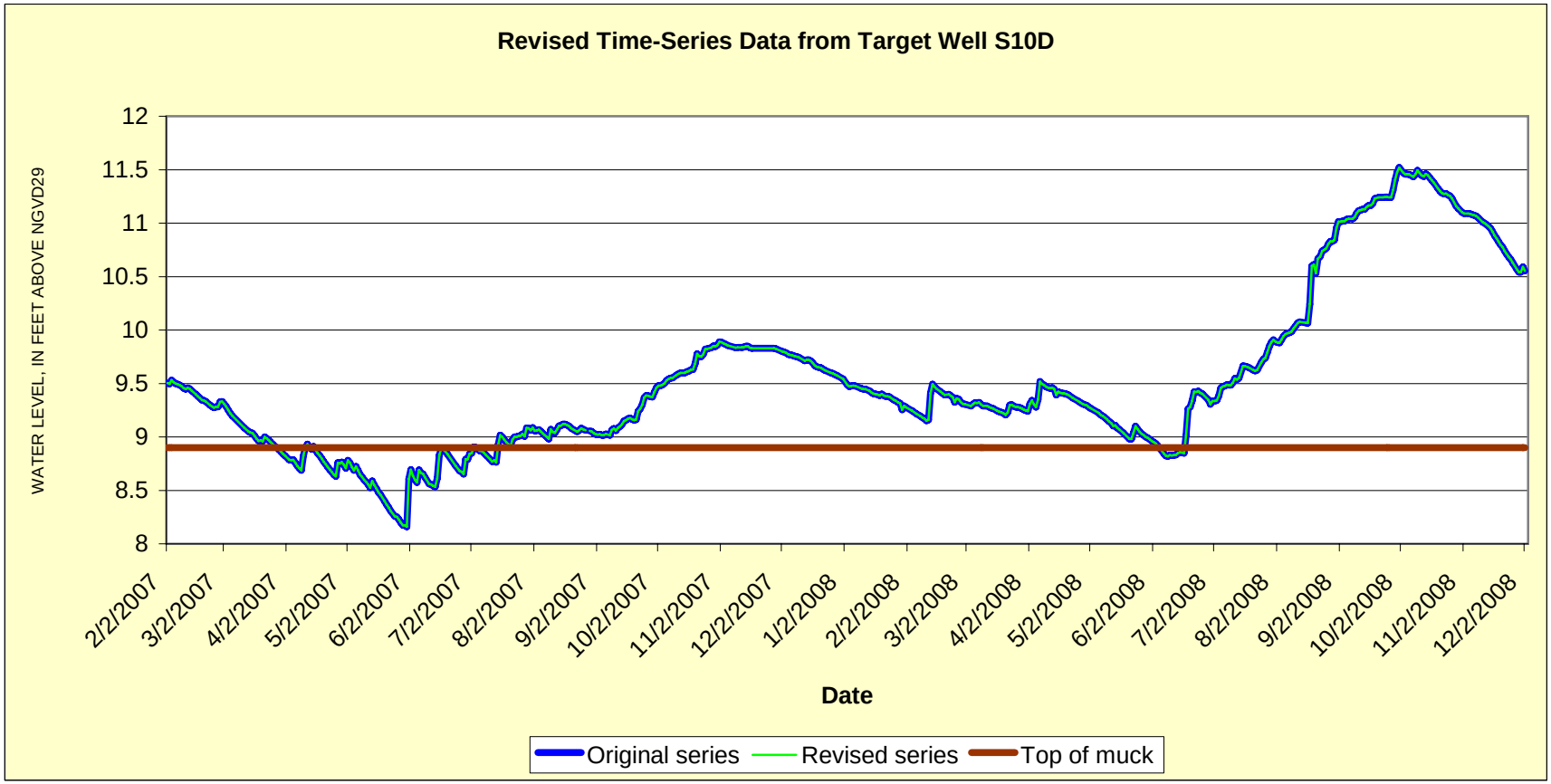
Top of muck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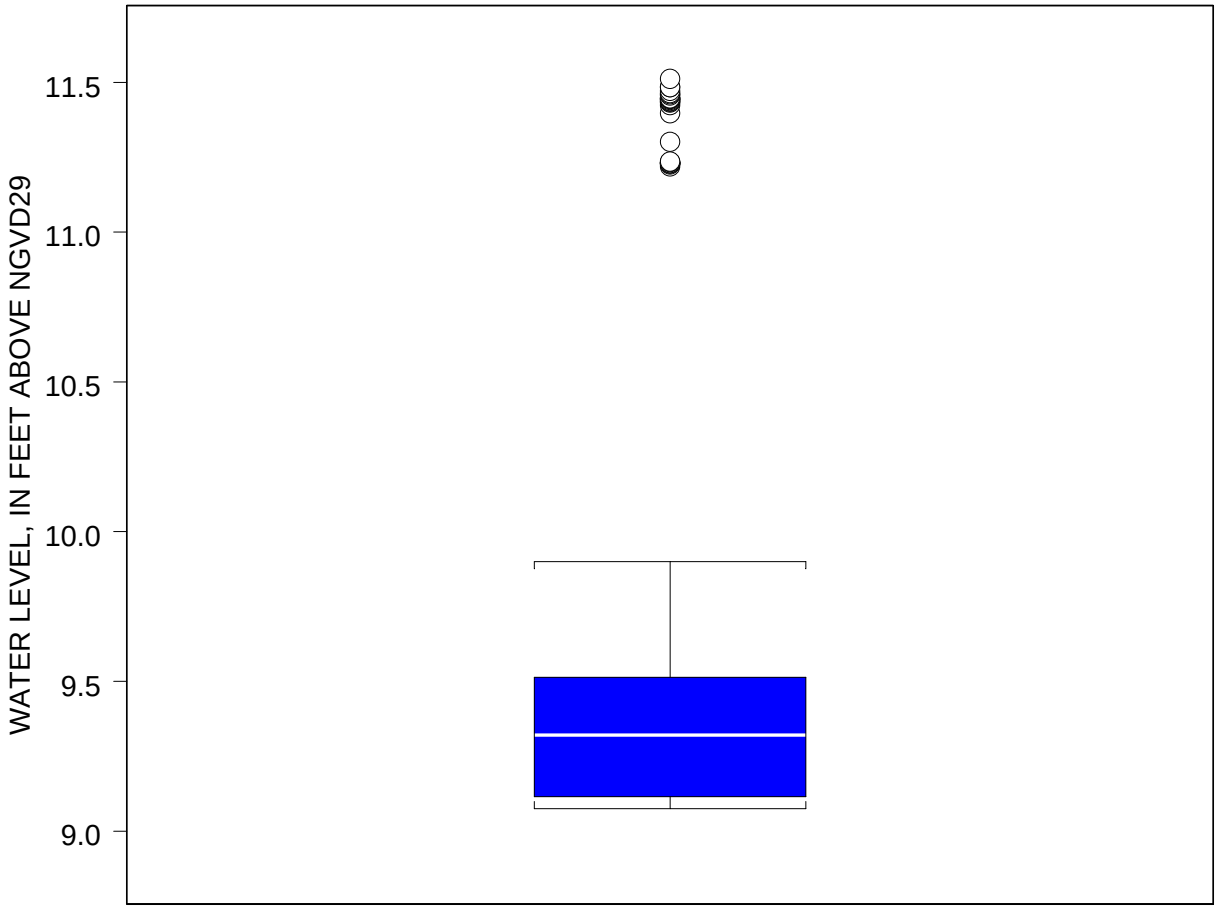
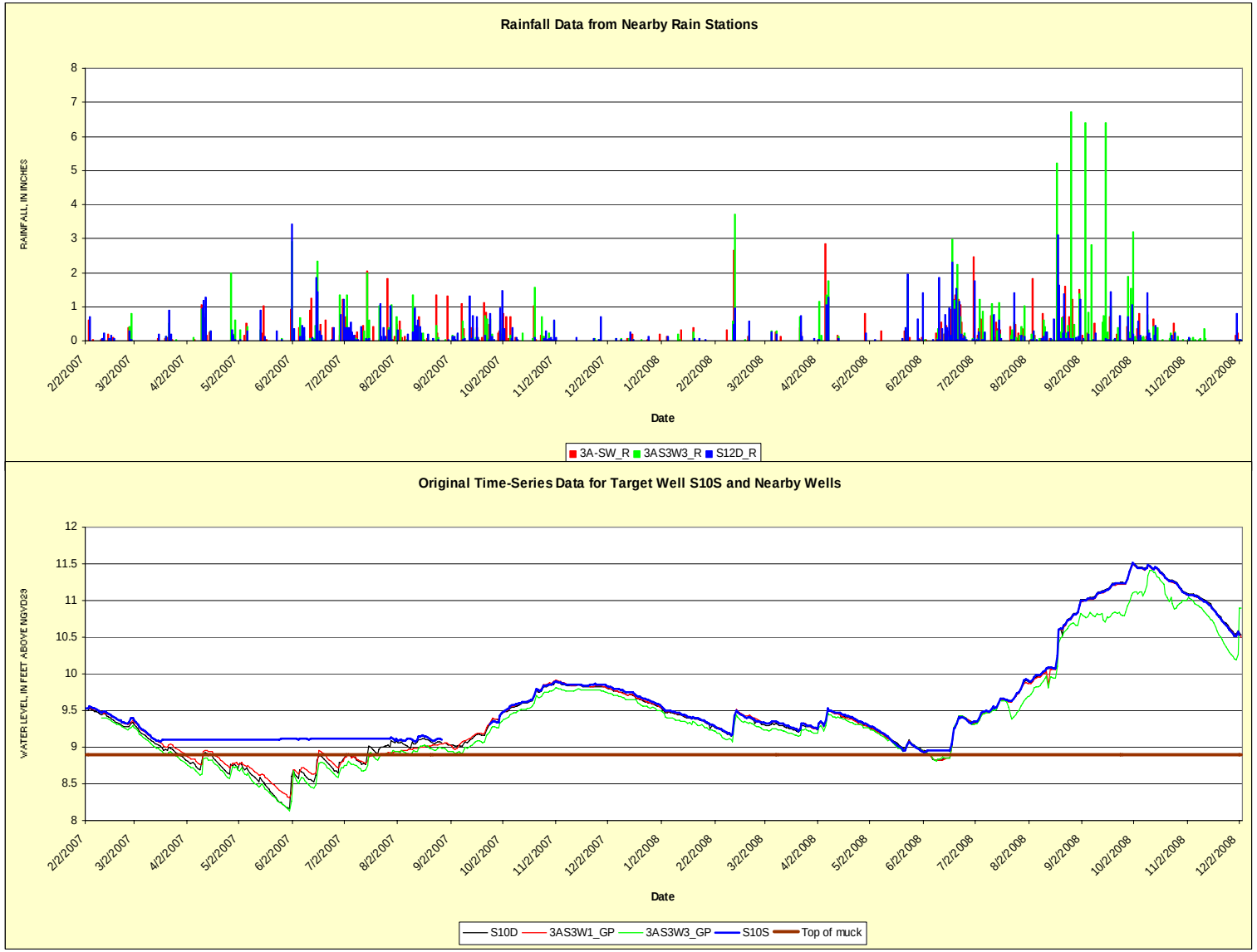
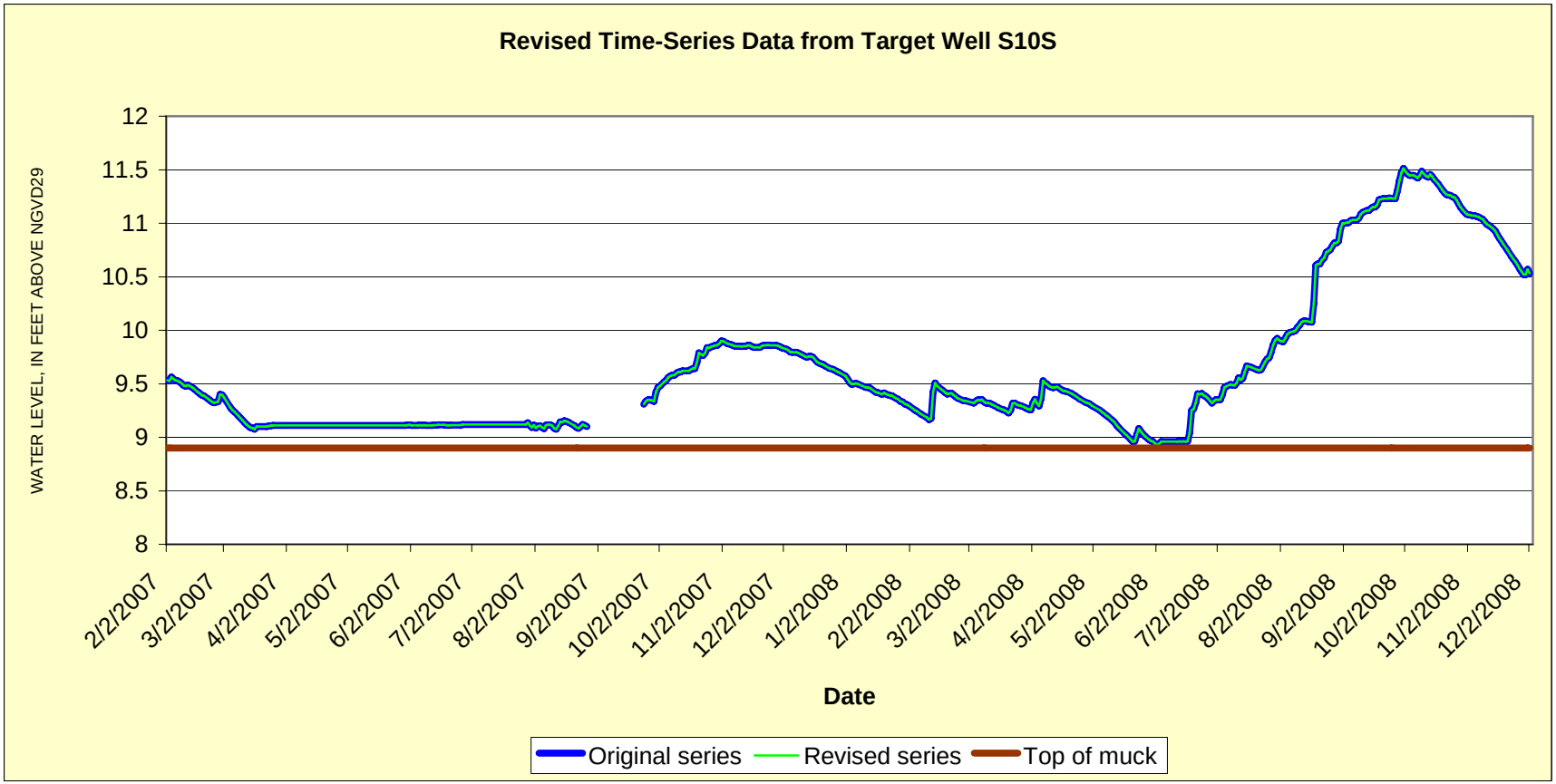
Date
Original series
Revised series
Top of muck

S10S




Rainfall Data from Nearby Rain Stations
RAINFALL, IN INCHES
0
1
2
3
4
5
6
7
8
2/2/2007
3/2/2007
4/2/2007
5/2/2007
6/2/2007
7/2/2007
8/2/2007
9/2/2007
10/2/2007
11/2/2007
12/2/2007
1/2/2008
2/2/2008
3/2/2008
4/2/2008
5/2/2008
6/2/2008
7/2/2008
8/2/2008
9/2/2008
10/2/2008
11/2/2008
12/2/2008
Date
3A-SW_R
3AS3W3_R
S12D_R
Original Time-Series Data for Target Well S10S and Nearby Wells
WATER LEVEL, IN FEET ABOVE NGVD29
8
8.5
9
9.5
10
10.5
11
11.5
12
2/2/2007
3/2/2007
4/2/2007
5/2/2007
6/2/2007
7/2/2007
8/2/2007
9/2/2007
10/2/2007
11/2/2007
12/2/2007
1/2/2008
2/2/2008
3/2/2008
4/2/2008
5/2/2008
6/2/2008
7/2/2008
8/2/2008
9/2/2008
10/2/2008
11/2/2008
12/2/2008
Date
S10D
3AS3W1_GP
3AS3W3_GP
S10S
Top of muck


Revised Time-Series Data from Target Well S10S
WATER LEVEL, IN FEET ABOVE NGVD29
12
11.5
11
10.5
10
9.5
9
8.5
8
2/2/2007
3/2/2007
4/2/2007
5/2/2007
6/2/2007
7/2/2007
8/2/2007
9/2/2007
10/2/2007
11/2/2007
12/2/2007
1/2/2008
2/2/2008
3/2/2008
4/2/2008
5/2/2008
6/2/2008
7/2/2008
8/2/2008
9/2/2008
10/2/2008
11/2/2008
12/2/2008
Date
Original series
Revised series
Top of muck