SURVEYOR'S REPORT

Specific Purpose Survey of the
United States Geological Survey
Recorder Well G-2697
in
Broward County, Florida

Prepared for:

South Florida Water Management District

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Prepared by:

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Florida Professional Surveyor and Mapper
License Number 5381
State of Florida

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131 West Kaley Street, Orlando, FL. 32806
Tel (321) 354-9826

Field Date: September 19, 2019
Report Date: December 9, 2019
PO NO: 9500008146

PURPOSE

The objective of this work order is to supply NAVD 88 elevations on the site benchmark, ground elevation at the site, well monitoring point and any USGS benchmarks at the site. In addition, horizontal positions of each well and benchmark need to be provided in the North American Datum of 1983.

LOCATION OF PROJECT

The United States Geological Survey's Recorder Well **G-2697** is located in Section 05, Township 51 South, Range 42 East, Broward County, Florida.

General Location (Intended Display scale is "Not to Scale")

PROJECT VERTICAL DATUM

The project vertical datum is the North American Vertical Datum (NAVD) of 1988.

To convert the NAVD 88 elevation to the National Geodetic Vertical Datum of 1929 at station **G-2697 (G2697 2019), add 1.60'**. These values are based on Corpscon 6.0.1 a US. Army Corps of Engineers Engineering Research and Development Center Topographic Engineering Center Alexandria, Virginia Windows-based program to convert coordinates and elevations between datum's using vertcon05.txt and vertcon05.05 files supplied by the US. Army Corps of Engineers South Atlantic Division, Jacksonville, FL.

PROJECT HORIZONTAL DATUM

All horizontal data shall be collected in and based on the North American Datum of 1983, 2011 adjustment (NAD 83/11). Horizontal coordinate control shall be established from existing National Geodetic Survey (NGS) 2nd Order control or higher in the area by using GPS, RTK GPS, network RTK GPS, or OPUS derived solutions.

LEVELING METHODS / GPS METHODS (Site Benchmark Vertical Datum)

The leveling for this project was performed in accordance with standard survey practice using conventional third order methods, techniques and equipment.

The allowable error (.02 √miles) on this project meets or exceeds third order closures as required by SFWMD for this project per executed SOW for 4600003706-WO03 and discussions with SFWMD.

A GPS base receiver was set on site BM G-2697, epochs were continuously recorded on the BM from the times 20:19:10 AM to 21:44:45 PM. A second GPS receiver checked into NGS BM "BRO 1" and the check was within tolerance. The raw data from the 1.5 hour session was converted to a RINEX file and uploaded to OPUS to generate a solution.

The measurements were collected using Trimble SPS 985 receivers and notes were hand written in Whidden Surveying & Mapping, Inc. Field Book W 212 Page 60, dated November 15, 2019, reduced and adjusted electronically. Additional data was manually recorded in the field book.

GPS METHODS (horizontal position of site benchmark)

Latitude and Longitude for Benchmark G-2697 (G-2697 2019) were established by observing a 3-minute session of GPS data on November 15, 2019 using a Trimble SPS 985 and The Florida Permanent Reference Network (FPRN). The FPRN network consists of nearly 100 Continuously Operating Reference Stations (CORS) located throughout Florida.

EQUIPMENT USED

- Trimble GPS unit SPS 985 Serial #: 5614F58916
- Trimble GPS unit SPS 985 Serial #: 5609F56781

LEVELING METHODS (Site: ground elevation-well monitoring point- USGS benchmarks)

A level loop was run from the previously established Site Benchmark G-2697 (G-2697 2019), through the ground shot on North end of well casing (ground elevation), through the well monitoring point, and back to the Site Benchmark. The measurements were collected using an Automatic Level and were hand written in Dewberry Engineering, Inc. Field Book S.F.W.M.D. #1, Pages 15-17, dated September 19, 2019. Additional data was manually recorded.

GPS METHODS (horizontal position of Well G-2697 monitoring point & USGS Benchmarks)

Latitude and Longitude for Well G-2697 monitoring point (Top of metal well head) were established by observing a 3-minute session of GPS data on September 19, 2019 using a Spectra SP-80 and The Florida Permanent Reference Network (FPRN). The FPRN network consists of nearly 100 Continuously Operating Reference Stations (CORS) located throughout Florida.

EQUIPMENT USED

- Spectra SP-80 Rover Serial #: 1165
- Topcon AT-G2 Serial #: 1439

VERTICAL CONTROL POINT

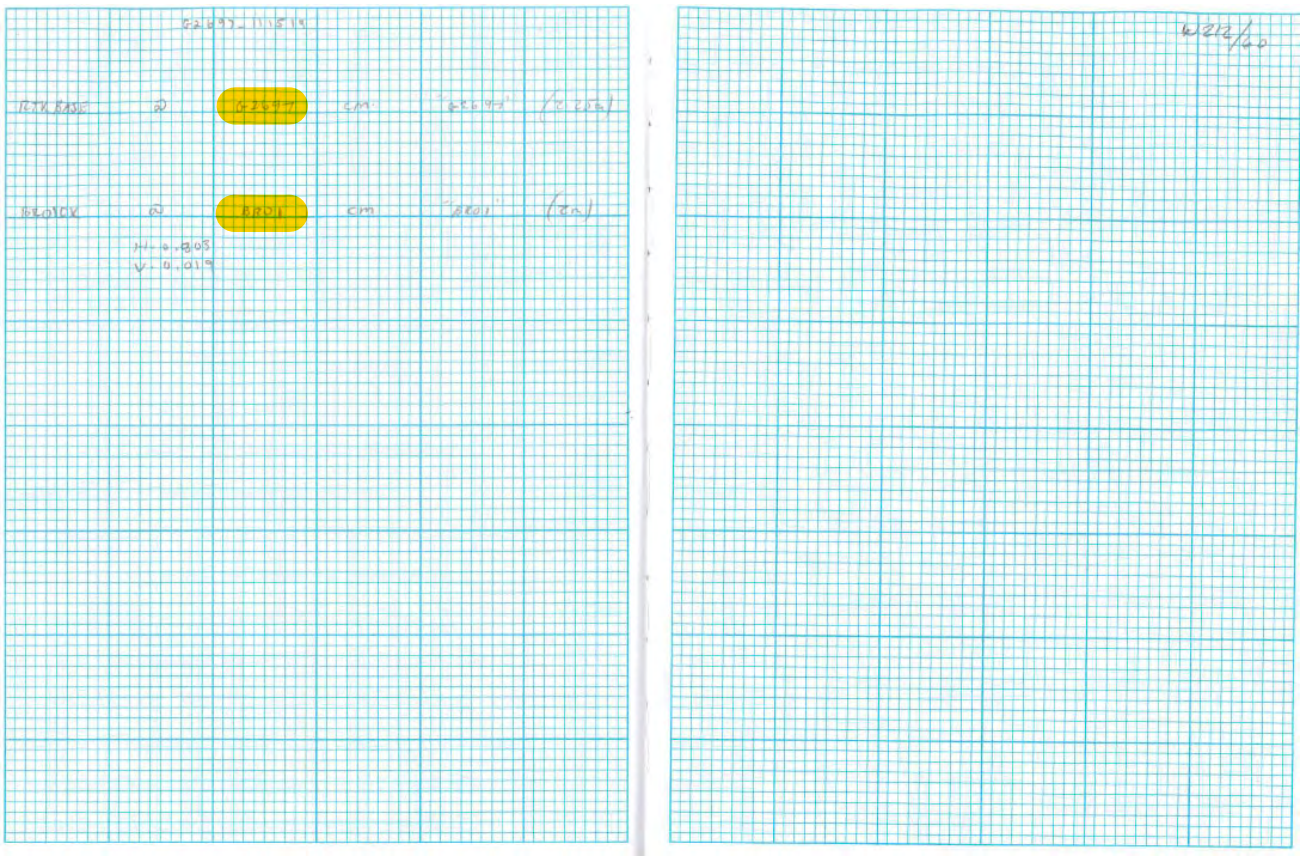
The Vertical Control point utilized and set as part of this survey is the:

NGS Benchmark "BRO 1" (AD5877)						
26° 03' 21.39" (N)	80° 08' 07.29" (W)	Published	3.75 ft.	(NAVD88)	1.14 m	Published

BEGIN AT THE U.S. HIGHWAY 1 BRIDGE OVER THE DANIA CANAL, GO SOUTH 0.25 MILE ON U.S. HIGHWAY 1 TO THE INTERSECTION OF NE 2ND ST. GO 0.5 MILE EAST ON NE 2ND ST TO THE MARK. THE MARK IS SET IN THE NE CORNER OF A 9.4-FOOT BY 4.7-FOOT CONCRETE FOUNDATION BOX FOR A WATER METER MAIN. THE MARK BEARS 33.1 FEET SOUTH OF THE CENTERLINE OF NE 2ND ST, 59.5 FEET SE OF THE CENTERLINE OF NE 5TH AVE, 85 FEET EAST OF THE NE CORNER OF THE FENCE AROUND THE PARKING LOT FOR THE DANIA JAI ALAI, AND 19.2 FEET WEST OF THE CENTERLINE OF THE WESTERNMOST DRIVE FOR THE VILLAGE CLUB APARTMENTS.THE MARK IS ABOVE LEVEL WITH GROUND
NGS BENCHMARK DISK, SET IN THE NE CORNER OF A WATER MAIN CONCRETE SLAB
STAMPING: FLORIDA DEPT OF NATURAL RESOURCES SURVEY MARK BRO 1 1981

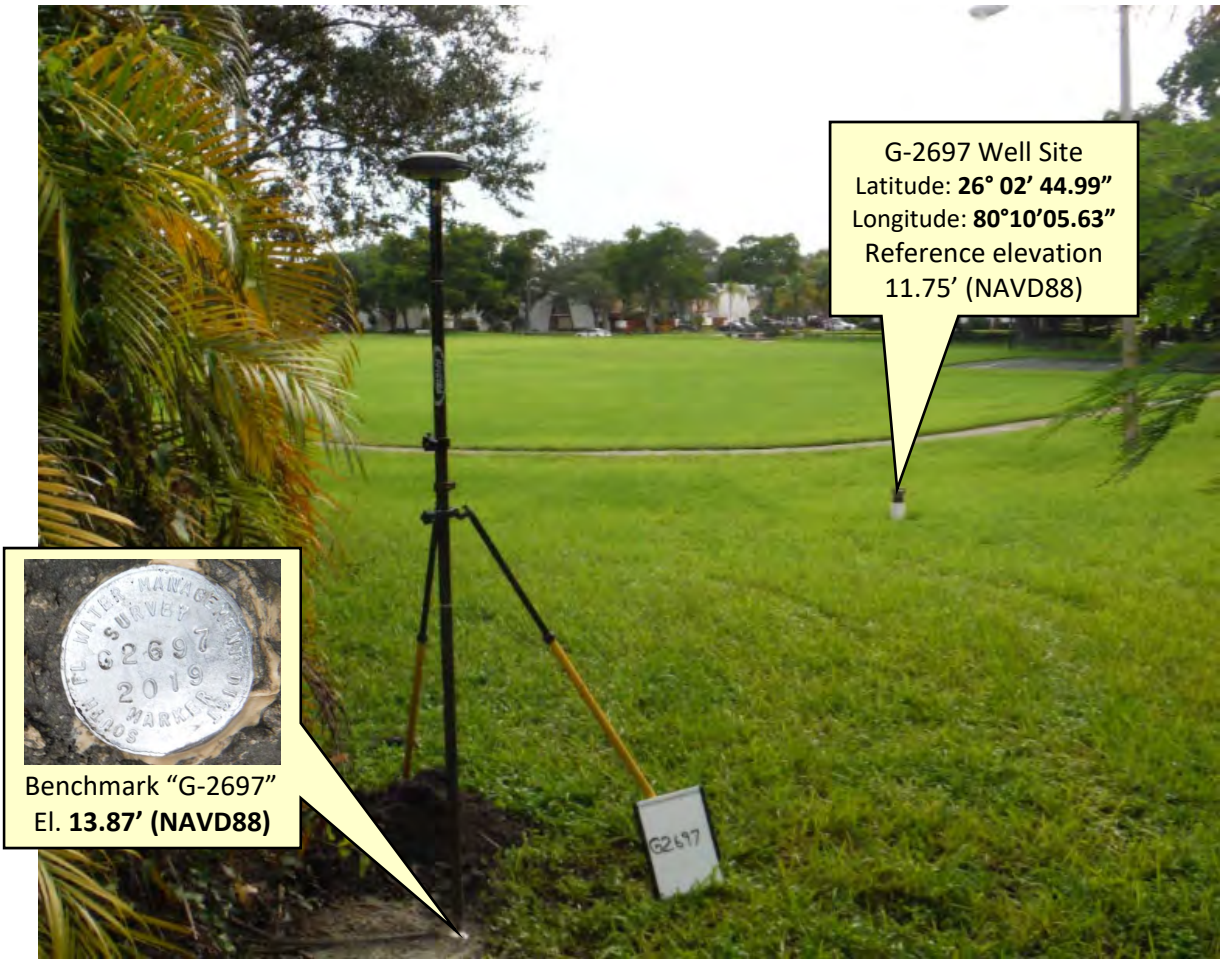
BM: G-2697 (Existing on site benchmark)						
26° 02'45.16" (N)	80° 10' 05.21" (W)		13.87 ft.	(NAVD88)	4.23 m	Level run
NAD_83(2011)			15.47 ft.	(NGVD29)	4.72 m	Converted
				1.60 ft. (conversion factor)		Corpscon 6.0.1
			STATION IS A S.F.W.M.D. BM STAMPED "G-2697 2019" SET IN GRASS AREA NEXT TO A FENCELINE RUNNING NORTHEASTERLY LOCATED: IN THE NE CORNER OF A GRASS FIELD (EMERALD HILLS LAKES PARK AND DOG PARK) BOUNDED BY A FENCE WEST OF A RAILROAD TRACK			

Field Book W212, Page 60



PROJECT RESULTS

Overall Site



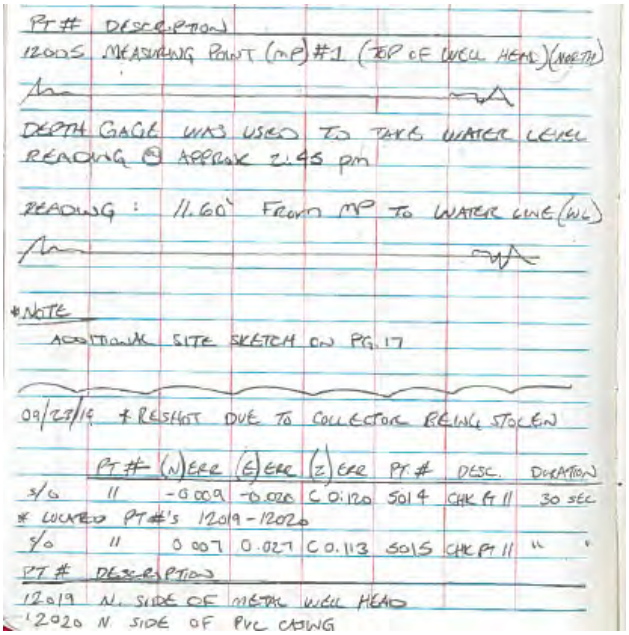
Looking Southwesterly (Oblique not to scale)

Tabular Form

Reference and Ground Elevations: NAVD88			
Well	Ground Elevation	Reference Elevation	Comments
G-2697	10.30 ft.	11.75 ft.	Top of metal well head
Offset to NGVD29: +1.60' (See Project Vertical Datum Notes in Page: 4)			
Well diameter		Casing material	DTW
4" Metal Well Head		PVC	-11.6 ft. (9/19/19 at 2:45 PM)

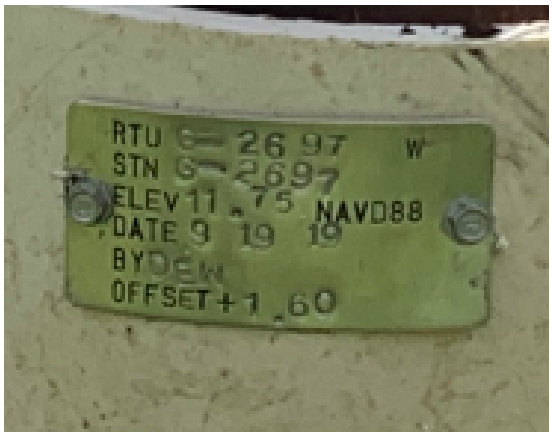
Source & Site Benchmark	NAVD88	NGVD29 (Published)	NGVD29 (Corpscon)
NGS "BRO 1" (AD5877)	3.75 ft. (Published)	5.36 ft.	
BM G-2697 (SFWMD)	13.87 ft. (Measured)		15.474 ft. (Converted)

Well Photos and Diagrams (Continued)


PT # DESCRIPTION
12005 MEASURING POINT (MP) #1 (TOP OF WELL HEAD)(NORTH)
DEPTH GAGE WAS USED TO TAKE WATER LEVEL READING @ APPROX 2:45 pm
READING: 11.60' FROM MP TO WATER LINE (WL)
*NOTE
ADDITIONAL SITE SKETCH ON PG. 17
09/23/19 * RESHOT DUE TO COLLECTOR BEING STOLEN
PT # (N)ERR (E)ERR (Z)ERR PT # DESC. DURATION
9/6 11 -0.009 -0.020 C 0.120 5014 CHK PT 11 30 SEC
* LOCATED PT #'s 12019 - 12020
9/6 11 0.007 0.027 C 0.113 5015 CHK PT 11 "
PT # DESCRIPTION
12019 N. SIDE OF METAL WELL HEAD
12020 N. SIDE OF PVC CASING

Well Photos and Diagrams (Continued)

Overhead View (Oblique Not to scale)



Surveyors' Notes:

1. All measurements herein are in United States Survey feet and decimal thereof, unless otherwise specified.
2. Underground utilities were not located as part of this survey.
3. This survey report or copies thereof are not valid without the original signature and seal of a Florida licensed Surveyor and Mapper.
4. Additions or deletions to this survey report by other than the signing party (or parties) is prohibited without written consent of the signing party (or parties).
5. To convert from NAVD 88 to NGVD 29 add 1.60 feet. This value is based on Corpscon 6.0.1 a U.S. Army Corps of Engineers Engineering Research and Development Center Topographic Engineering Center Alexandria, Virginia Windows-based program to convert coordinates and elevations between datum's using vertcon05.txt and vertcon05.05 files supplied by the U.S. Army Corps of Engineers South Atlantic Division, Jacksonville, FL.
6. Date of last field work: November 15, 2019, PO NO: 9500008146
7. SFWMD Data records (on file at the District's headquarters):
8. A. Electronic Data files:
   Miscellaneous picture files
   B. Conventional reporting
   Field Book: W212 page 60

Abbreviations:

Elev.	-	Elevation
DTW	-	Distance to the water table inside the well
BroCo.	-	Broward County
NAVD88	-	North American Vertical Datum of 1988
NGVD29	-	National Geodetic Vertical Datum of 1929
NGS	-	National Geodetic Survey
PSM	-	Professional Surveyor & Mapper
PID	-	Permanent Identifiers
SFWMD	-	South Florida Water Management District
USGS	-	United States Geological Survey
MP	-	Monitoring Point
GS	-	Ground Shot
BM	-	Benchmark
RM	-	Reference Monument

SURVEYOR'S CERTIFICATION

In my professional opinion this Specific Purpose Survey meets applicable portions of the Standards of Practice set forth by the Florida Board of Professional Surveyors and Mappers in Chapter 5J-17, Florida Administrative Code. This report is prepared for the sole and specific use of the South Florida Water Management District and is not assignable.

Last date of Survey
Nov. 19, 2019

William Donley, PSM
Florida Professional Surveyor and Mapper
License Number 5381
State of Florida
Dewberry Engineering, Inc. LB No 8011
131 West Kaley Street, Orlando, FL. 32806
Tel (321) 354-9826

South Florida Water Management District Benchmark Datasheet

Designation: G-2697	Project Name: USGS Ph 2, BROWARD	Type: V	State Plane Zone: FL East
Stamping: G2697 2019	Field Book Name: W212	Field Book Page: 60	
Established By: DEWBERRY / WHIDDEN	Recovered By: N/A	Recovery Date: N/A	
Surveyor: WILLIAM D. DONLEY	Established Date: 11/15/19	Status: New	

GEOGRAPHIC POSITION INFORMATION

Section: 5	Township: 51 SOUTH		Range: 42 EAST		
County: BROWARD	Quadrangle: FORT LAUDERDALE SOUTH		Quad Index: 1702	NGS Source BM(s): BRO 1	
NAD83 Adj. Year: 2011	Vertical Datum: NAVD1988		Horizontal Datum: NAD1983	NGS PID(s): AD5877	
NAVD88 Elevation (feet): 13.87	NGVD29 Elevation (feet): 15.474		2022 Elevation: N/A	NGS NAVD88 Elev (ft): 3.75	
NAVD88 Class: N/A	NGVD29 Class: N/A		Other Elevation: N/A	NGS NAVD88 Elev (m): 1.14	
NAVD88 Order: 3	NGVD29 Order: N/A		Other Elevation Type: N/A	NGS 2022 Elev (ft): N/A	

CORPSCON 6.0.1 CONVERSION FACTOR (NAVD88 TO NGVD29): (A U.S. Army Corps of Engineers Engineering Research and Development Center Topographic Engineering Center Alexandria, Virginia Windows-based program to convert coordinates and elevations between datum's using vertcon05.txt and vertcon05.db files supplied by the U.S. Army Corps of Engineers South Atlantic Division, Jacksonville FL)

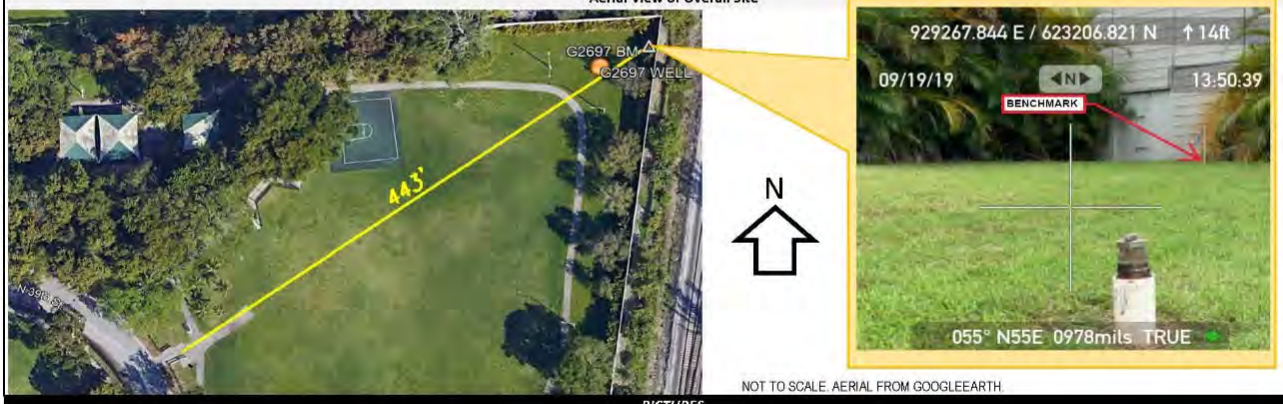
Vertical Datum Offset: + 1.60		Actual NGS Elevation or ngvd29.txt file: N/A		OPUS Ortho Height: N/A	
Northing (Y) (feet): 623236.1		Easting (X) (feet): 929299.4		Source of Latitude & Longitude: AVERAGED FPRN & TRIMBLE VRSNOW RTK	
Latitude: 26	2	45.16	Longitude:	80	10	5.21
	DD°	MM'	SS"		DD°	MM'	SS"
Latitude (Decimal Degrees): 26.045878			Longitude (Decimal Degrees):	-80.168114		

RECOVERY DATA

How to Reach:	1. FROM FL-848/STIRLING RD, HEAD SOUTH ON N 33RD AVE/N PARK RD FOR 0.3 MI 2. TURN LEFT ONTO N 37TH ST, CONTINUE 0.2 MI 3. TURN LEFT ONTO N 32ND AVE, CONTINUE 499 FEET 4. TURN RIGHT ONTO N 39TH ST, CONTINUE 0.3 MI TO EMERALD HILLS LAKES PARK & DOG PARK GATED ENTRANCE ON THE LEFT 5. THE MARK IS APPROXIMATELY 443 FEET NORTHEAST OF SAID PARK GATE
Description/Notes:	2" ALUMINUM SFWMD DISK SET IN A POURED IN PLACE CONCRETE MONUMENT, LOCATED APPROXIMATELY 19 FEET SOUTH OF THE NORTHERLY WALL AND 8 FEET WEST OF OF THE EASTERLY WALL
Notable Landmarks:	EMERALD HILLS LAKES PARK & DOG PARK
Other Source Benchmarks:	N/A

PICTURES

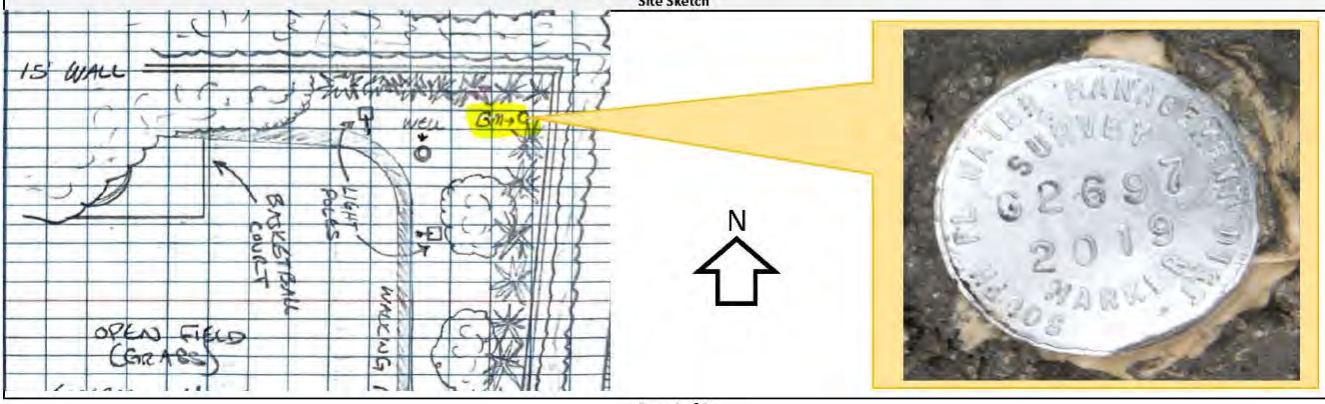
Aerial View of Overall Site



NOT TO SCALE. AERIAL FROM GOOGLEEARTH.

PICTURES

Site Sketch



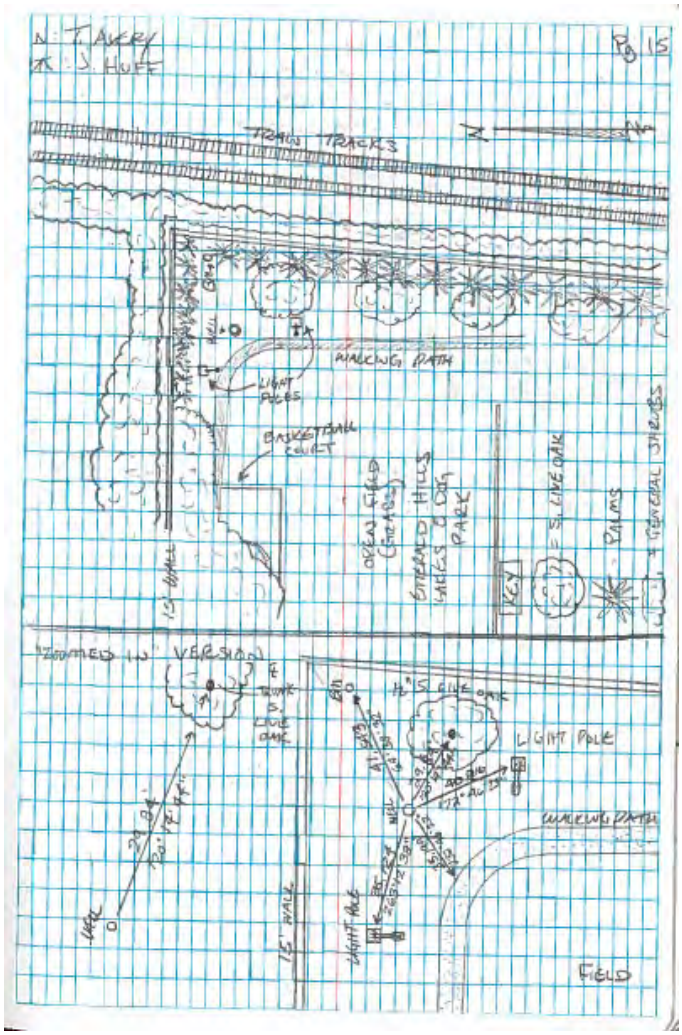
SOUTH FLORIDA WATER MANAGEMENT DISTRICT

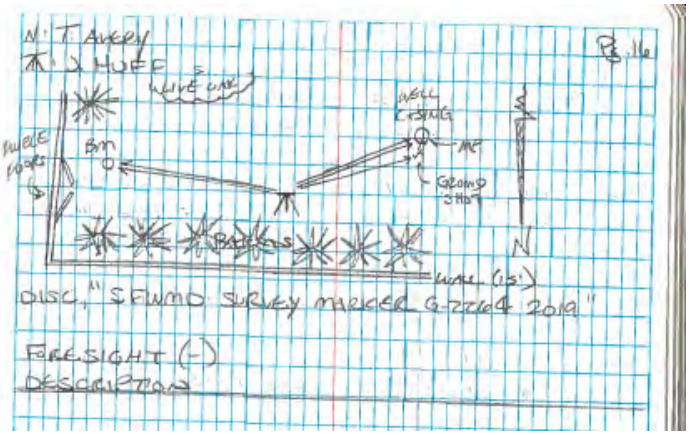
NOT TO SCALE (Google Earth Product)

SOUTH FLORIDA WATER MANAGEMNT DISTRICT

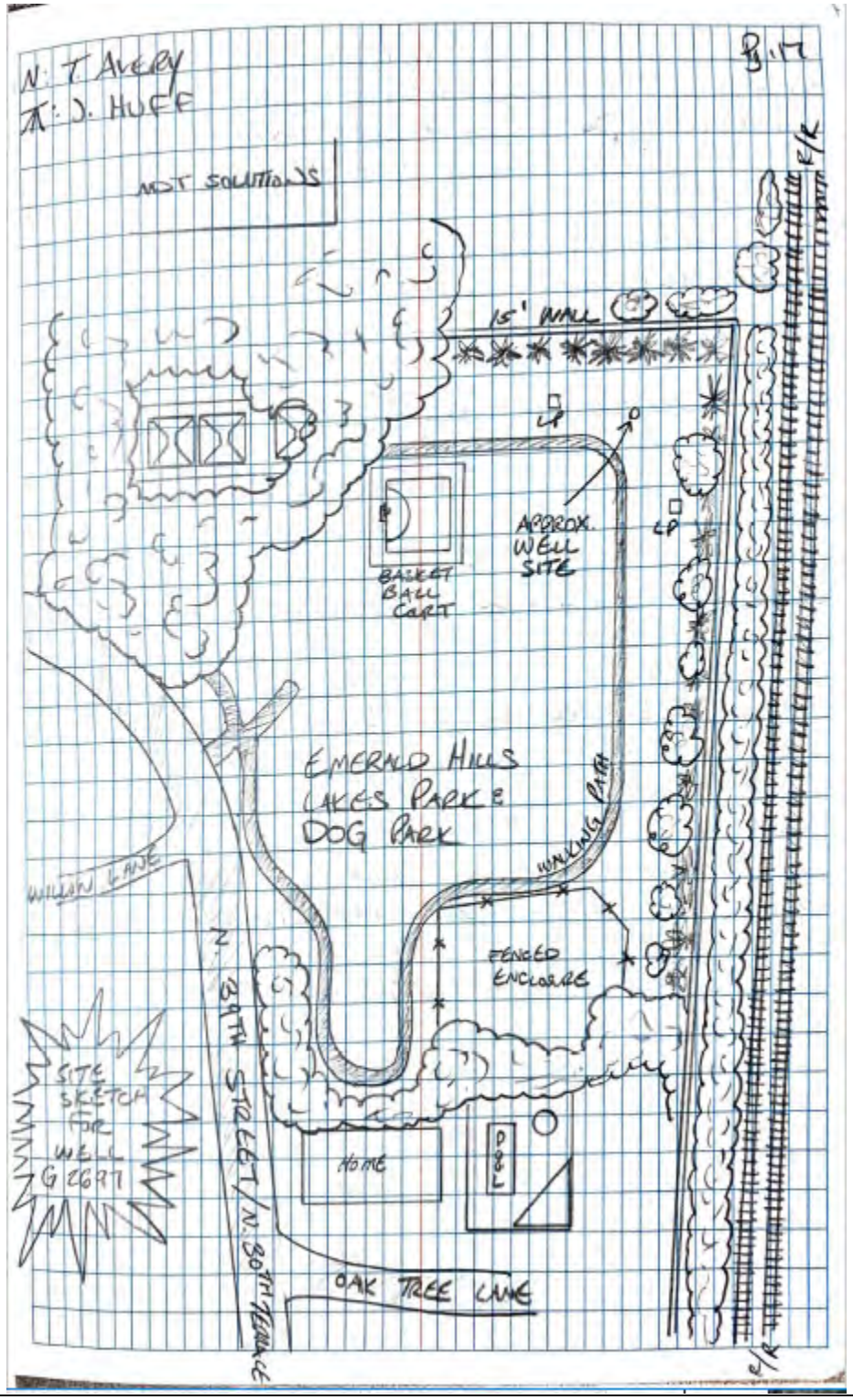
SKETCH

FIELD BOOK SFWMD #1, PAGE 15 & 16





FIELD BOOK SFWMD #1, PAGE 17



Office

Project

2 December 2019

INPUT	OUTPUT
State Plane, NAD83	Geographic, NAD83
0901 - Florida East, U.S. Feet	Vertical - NGVD29 (Vertcon94), U.S. Feet
Vertical - NAVD88, U.S. Feet	

BM G2697

1/2

Northing/Y:	623236.1	**Latitude:**	26 02 45.16286
Easting/X:	929299.4	**Longitude:**	80 10 05.21172
Elevation/Z:	13.87	**Elevation/Z:**	15.474
Convergence:	0 21 55.05949		
Scale Factor:	1.000026720		
Combined Factor:	1.000030060		

WELL G2697

2/2

Northing/Y:	623218.29'	**Latitude:**	26 02 44.98885
Easting/X:	929261.76'	**Longitude:**	80 10 05.62564
Elevation/Z:	11.75	**Elevation/Z:**	13.354
Convergence:	0 21 54.87545		
Scale Factor:	1.000026697		
Combined Factor:	1.000030138		

SKETCH SP-80 SFWMD 09/19/19
ROVER S/N: 0360 USGS WELLS & BMS 85°
TRIMBLE NET JOB # 50099949 P. CLOUDY
T G562 (HI) HORIZONTAL LOCATIONS
SITE 26997 & DEPTH MEASUREMENT

	PT #	(N) ERR	(E) ERR	(Z) ERR	PT #	DESC.	DURATION
S/O	11	0.098	0.058	0.548	5004	CHK IN G-2697 BM	180 SEC.

* LOCATED PT # 12005

	PT #	(N) ERR	(E) ERR	(Z) ERR	PT #	DESC.	DURATION
S/O	11	0.076	-0.036	C 0.019	5005	CHK OUT G-2697 BM	"

PT # DESCRIPTION
12005 MEASURING POINT (MP) #1 (TOP OF WELL HEAD) (NORTH)

DEPTH GAGE WAS USED TO TAKE WATER LEVEL READING @ APPROX 2:45 pm

READING : 11.60' FROM MP TO WATER LINE (WL)

*NOTE
ADDITIONAL SITE SKETCH ON PG. 17

09/23/19 * RESHOT DUE TO COLLECTOR BEING STOLEN

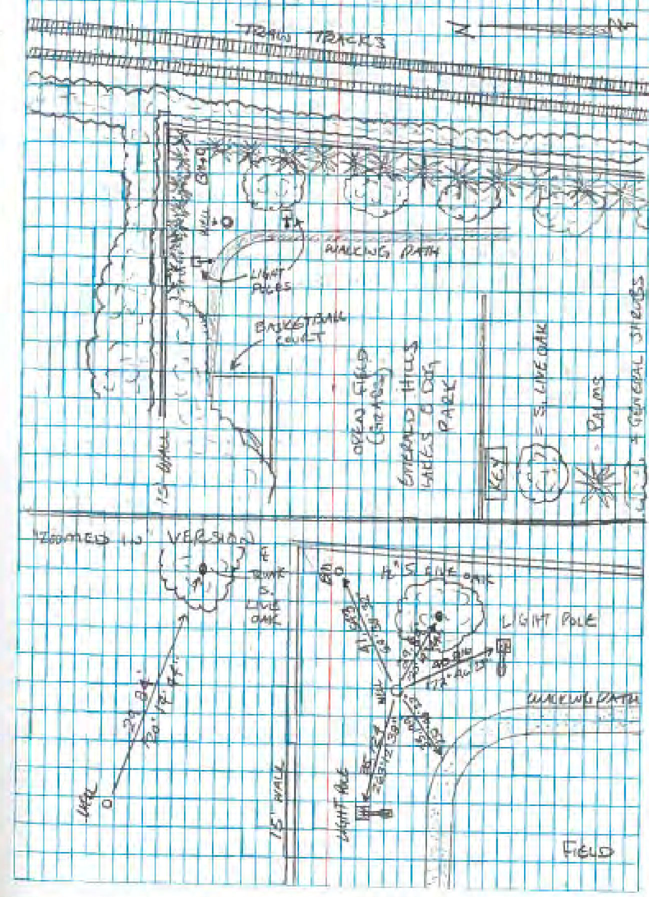
	PT #	(N) ERR	(E) ERR	(Z) ERR	PT #	DESC.	DURATION
S/O	11	-0.009	-0.020	C 0.120	5014	CHK PT 11	30 SEC

* LOCATED PT #'s 12019 - 12020

	PT #	(N) ERR	(E) ERR	(Z) ERR	PT #	DESC.	DURATION
S/O	11	0.007	0.027	C 0.113	5015	CHK PT 11	"

PT # DESCRIPTION
12019 N. SIDE OF METAL WELL HEAD
12020 N. SIDE OF PVC CASING

N: T. AVERY
⊼: J. HUFF
Pg 15



TOPCON
AT-G2
S/N: 1439

S.F.W.M.D.
U.S.G.S WELL & BMS
JOB# 60069948
WELL SITE: G-2697

09/19/19

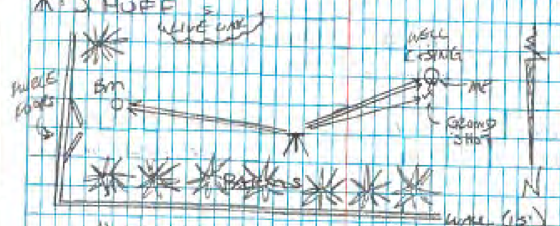
TASK: ELEVATE MONITORING POINT & GROUND SHOT @ NORTH SIDE OF WELL CASING.

	ELEVATION	DESCRIPTION
BEGIN @	~~100.00~~ 13.87 (WHIDDEN) (NAVD88)	CONC BENCH MARK W/ ALUMINUM DISC, "SFWMD SURVEY MARKER G-2264 2019"

	BACKSIGHT (+)		⊼	FORESIGHT (-)			ADJ
STA ID	READINGS	MEAN	ELEV	READINGS	MEAN	ELEV	ELEVATION
						~~100.00~~	13.87
	4.19			7.77			
BM	4.07	4.07	~~104.07~~	7.645	7.6450	~~96.425~~	~~10.455~~
	3.95		~~18.100~~	7.52			10.295
	24'/24'		17.940	25'/49'			
				6.32			
BM			~~104.07~~	6.195	6.1950	~~97.875~~	~~11.905~~
			17.940	6.07			11.745
				23'/49'			
* BREAK SETUP							
	6.17			4.045			
MP	6.05	6.0483	~~103.9233~~	3.925	3.9250	~~99.9985~~	~~14.028~~
	5.925		~~17.953~~	3.805			13.868
	24.5'/73.5'		17.793	24'/97.5'			
* END							

N: T. AVERY
⊼: J HUFF

Pg. 16



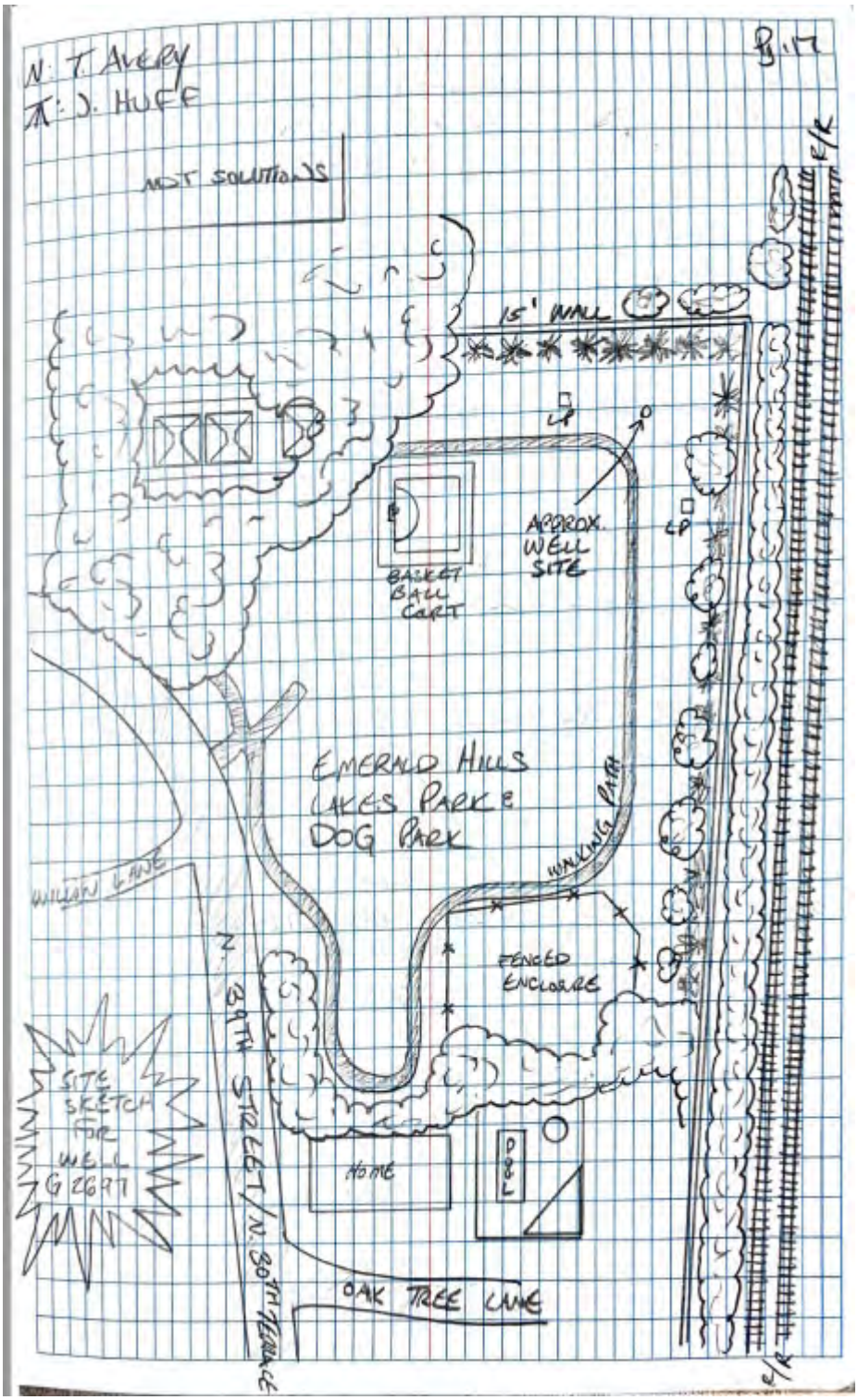
FORESIGHT (-)
DESCRIPTION

GROUND SHOT @ N. END OF WELL CASING

MEASURING POINT @ N. EDGE OF WELL CASING OPENING (MP)

(BACK @ STARTING POINT) CONC. BENCHMARK W/ ALUMINUM DISC "SFWMD SURVEY MARKER G-2264 2019"

Check In = -0.002'


N: T AVERY
A: J. HUFF
NOT SOLUTIONS
15' WALL
APPROX. WELL SITE
BASKET BALL CART
EMERALD HILLS LAKES PARK & DOG PARK
WALKING PATH
FENCED ENCLOSURE
WILLOW LANE
N. 30TH STREET
SITE SKETCH FOR WELL G-2677
HOME
POOL
OAK TREE LANE

The NGS Data Sheet

See file dsdata.pdf for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.12.5.4
1         National Geodetic Survey,   Retrieval Date = OCTOBER 22, 2019
 AD5877 ***********************************************************************
 AD5877  DESIGNATION -  BRO 1
 AD5877  PID         -  AD5877
 AD5877  STATE/COUNTY-  FL/BROWARD
 AD5877  COUNTRY     -  US
 AD5877  USGS QUAD   -  FORT LAUDERDALE SOUT (1994)
 AD5877
 AD5877                        *CURRENT SURVEY CONTROL
 AD5877
 AD5877* NAD 83(1986) POSITION- 26 03 21.4     (N) 080 08 07.3     (W)    HD_HELD2
 AD5877* NAVD 88 ORTHO HEIGHT -      1.144 (meters)         3.75  (feet) ADJUSTED
 AD5877
 AD5877  GEOID HEIGHT    -        -25.678 (meters)                       GEOID18
 AD5877  DYNAMIC HEIGHT  -          1.142 (meters)         3.75  (feet) COMP
 AD5877  MODELED GRAVITY -    979,052.8   (mgal)                         NAVD 88
 AD5877
 AD5877  VERT ORDER      -  SECOND    CLASS I
 AD5877
 AD5877.The horizontal coordinates were established by autonomous hand held GPS
 AD5877.observations and have an estimated accuracy of +/- 10 meters.
 AD5877.
 AD5877.The orthometric height was determined by differential leveling and
 AD5877.adjusted by the NATIONAL GEODETIC SURVEY
 AD5877.in June 1991.
 AD5877
 AD5877.Significant digits in the geoid height do not necessarily reflect accuracy.
 AD5877.GEOID18 height accuracy estimate available here.
 AD5877
 AD5877.Click here to see if photographs exist for this station.
 AD5877
 AD5877.The dynamic height is computed by dividing the NAVD 88
 AD5877.geopotential number by the normal gravity value computed on the
 AD5877.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
 AD5877.degrees latitude (g = 980.6199 gals.).
 AD5877
 AD5877.The modeled gravity was interpolated from observed gravity values.
 AD5877
 AD5877;                    North         East     Units  Estimated Accuracy
 AD5877;SPC FL E     -   191,099.      286,522.      MT  (+/- 10 meters HH2 GPS)
 AD5877
 AD5877_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNJ8649282166(NAD 83)
 AD5877
 AD5877                           SUPERSEDED SURVEY CONTROL
 AD5877
 AD5877  NGVD 29 (09/01/92)    1.634   (m)             5.36    (f) ADJUSTED    2 1
 AD5877
 AD5877.Superseded values are not recommended for survey control.
 AD5877
 AD5877.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
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AD5877.See file dsdata.pdf to determine how the superseded data were derived.
AD5877
AD5877_MARKER: DD = SURVEY DISK
AD5877_SETTING: 35 = SET IN A MAT FOUNDATION OR CONCRETE SLAB OTHER THAN
AD5877+WITH SETTING: PAVEMENT
AD5877_SP_SET: WATER MAIN FOUNDATION
AD5877_STAMPING: BRO 1 1981 BSM
AD5877_MARK LOGO: FLDNR
AD5877_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AD5877+STABILITY: SURFACE MOTION
AD5877_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AD5877+SATELLITE: SATELLITE OBSERVATIONS - August 01, 2008
AD5877
AD5877  HISTORY     - Date     Condition        Report By
AD5877  HISTORY     - 1981     MONUMENTED       FLDNR
AD5877  HISTORY     - 1990     GOOD             USPSQD
AD5877  HISTORY     - 1990     GOOD             USPSQD
AD5877  HISTORY     - 19910618 GOOD             USPSQD
AD5877  HISTORY     - 19950715 GOOD             USPSQD
AD5877  HISTORY     - 19980312 GOOD             USPSQD
AD5877  HISTORY     - 20021029 GOOD             USPSQD
AD5877  HISTORY     - 20080801 GOOD             MAPTEC
AD5877  HISTORY     - 20091224 GOOD             INDIV
AD5877  HISTORY     - 20170311 GOOD             USPSQD
AD5877
AD5877                          STATION DESCRIPTION
AD5877
AD5877'DESCRIBED BY FL DEPT OF NAT RES 1981
AD5877'IN DANIA.
AD5877'BEGIN AT THE U.S. HIGHWAY 1 BRIDGE OVER THE DANIA CANAL, GO SOUTH 0.25
AD5877'MILE ON U.S. HIGHWAY 1 TO THE INTERSECTION OF NORTHEAST 2ND ST.  GO
AD5877'0.5 MILE EAST ON NORTHEAST 2ND ST TO THE MARK.  THE MARK IS SET IN
AD5877'THE NORTHEAST CORNER OF A 9.4-FOOT BY 4.7-FOOT CONCRETE FOUNDATION
AD5877'BOX FOR A WATER METER MAIN.  THE MARK BEARS 33.1 FEET SOUTH OF THE
AD5877'CENTERLINE OF NORTHEAST 2ND ST, 59.5 FEET SOUTHEAST OF THE CENTERLINE
AD5877'OF NORTHEAST 5TH AVE, 85 FEET EAST OF THE NORTHEAST CORNER OF THE
AD5877'FENCE AROUND THE PARKING LOT FOR THE DANIA JAI ALAI, AND 19.2 FEET
AD5877'WEST OF THE CENTERLINE OF THE WESTERNMOST DRIVE FOR THE VILLAGE CLUB
AD5877'APARTMENTS.
AD5877'THE MARK IS ABOVE LEVEL WITH GROUND.
AD5877
AD5877                          STATION RECOVERY (1990)
AD5877
AD5877'RECOVERY NOTE BY US POWER SQUADRON 1990 (EM)
AD5877'RECOVERED IN GOOD CONDITION.
AD5877
AD5877                          STATION RECOVERY (1990)
AD5877
AD5877'RECOVERY NOTE BY US POWER SQUADRON 1990 (JHH)
AD5877'RECOVERED IN GOOD CONDITION.
AD5877
AD5877                          STATION RECOVERY (1991)
AD5877
AD5877'RECOVERY NOTE BY US POWER SQUADRON 1991 (JHH)
AD5877'RECOVERED IN GOOD CONDITION.
AD5877
AD5877                          STATION RECOVERY (1995)
AD5877
AD5877'RECOVERY NOTE BY US POWER SQUADRON 1995
AD5877'RECOVERED IN GOOD CONDITION.
```

```
AD5877
AD5877                          STATION RECOVERY (1998)
AD5877
AD5877'RECOVERY NOTE BY US POWER SQUADRON 1998
AD5877'RECOVERED IN GOOD CONDITION.
AD5877
AD5877                          STATION RECOVERY (2002)
AD5877
AD5877'RECOVERY NOTE BY US POWER SQUADRON 2002 (AM)
AD5877'RECOVERED IN GOOD CONDITION.
AD5877
AD5877                          STATION RECOVERY (2008)
AD5877
AD5877'RECOVERY NOTE BY MAPTECH INCORPORATED 2008 (JML)
AD5877'RECOVERD AS DESCRIBED
AD5877
AD5877                          STATION RECOVERY (2009)
AD5877
AD5877'RECOVERY NOTE BY INDIVIDUAL CONTRIBUTORS 2009 (ED)
AD5877'RECOVERED IN GOOD CONDITION.
AD5877
AD5877                          STATION RECOVERY (2017)
AD5877
AD5877'RECOVERY NOTE BY US POWER SQUADRON 2017 (CAC)
AD5877'RECOVERED IN GOOD CONDITION.

*** retrieval complete.
Elapsed Time = 00:00:02
```

Tom Whidden

From: opus <opus@ngs.noaa.gov>
Sent: Tuesday, October 22, 2019 6:40 PM
To: tom@whiddensurveying.com
Subject: OPUS-RS solution : 52822944.19o OP1571783805871

FILE: 52822944.19o OP1571783805871

6011 Warning - OPUS-RS was able to find a set of reference stations
6011 with data suitable for use with your dataset. However, your
6011 position does not fall within the polygon enclosing these reference
6011 stations. This means that the geographic interpolation algorithms
6011 performed within OPUS-RS must instead perform extrapolation.
6011 Extrapolation, especially if your position is far from the
6011 reference stations, is prone to error. Use this solution with
6011 caution.
flf1
okcb
mtnt
napl
flkw
wach
Your station is 33.0 KM outside the polygon enclosing the reference stations

6030 ********** WARNING **********
6030 One or both of the standard deviations associated with
6030 horizontal coordinates is greater than 5 cm, and/or the
6030 standard deviation associated with the vertical coordinate
6030 is greater than 10 cm. This means that the vectors used to
6030 determine your position did not agree as well as expected.
6030 Often this is the result of problems with the adopted coordinates
6030 at one or more of the reference stations selected by OPUS-RS.
6030 If a problem reference station can be identified, it can
6030 be excluded with the Exclude feature on the OPUS Options
6030 page.
6030

NGS OPUS-RS SOLUTION REPORT
==========

All computed coordinate accuracies are listed as 1-sigma RMS values.
For additional information: https://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

USER: tom@whiddensurveying.com DATE: October 22, 2019
RINEX FILE: 5282294u.19o TIME: 22:39:58 UTC

SOFTWARE: rsgps 1.38 RS71.prl 1.99.3 START: 2019/10/21 20:19:10

OPUS REPORT (2 of 5)

EPHEMERIS: igr20761.eph [rapid] STOP: 2019/10/21 21:44:45
NAV FILE: brdc2940.19n OBS USED: 3444 / 3645 : 94%
ANT NAME: TRMR8_GNSS3 NONE QUALITY IND. 36.56/ 25.57
ARP HEIGHT: 2.25 NORMALIZED RMS: 0.607

REF FRAME: NAD_83(2011)(EPOCH:2010.0000)		ITRF2014 (EPOCH:2019.80514)	
X:	979138.100(m) 0.023(m)	979137.283(m)	0.023(m)
Y:	-5649857.164(m) 0.249(m)	-5649855.567(m)	0.249(m)
Z:	2783620.065(m) 0.135(m)	2783619.897(m)	0.135(m)
LAT:	26 2 45.16202 0.038(m)	26 2 45.18157	0.038(m)
E LON:	279 49 54.78809 0.065(m)	279 49 54.76894	0.065(m)
W LON:	80 10 5.21191 0.065(m)	80 10 5.23106	0.065(m)
EL HGT:	-21.330(m) 0.274(m)	-22.943(m)	0.274(m)
ORTHO HGT:	4.229(m) 0.274(m) [NAVD88 (Computed using GEOID18)]		

	UTM COORDINATES (Zone 17)	STATE PLANE COORDINATES (0901 FL E)
Northing (Y) [meters]	2881029.884	189962.717
Easting (X) [meters]	583222.613	283251.018
Convergence [degrees]	0.36529444	0.36529444
Point Scale	0.99968551	1.00002672
Combined Factor	0.99968886	1.00003007

US NATIONAL GRID DESIGNATOR: 17RNJ8322281029(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DP6859	FLF1 FL FOUNDATION 1 CORS ARP	N253655.240	W0802309.913	52464.8
DE9138	OKCB OKEECHOBEE CORS ARP	N271557.715	W0805119.181	151511.5
DQ9778	FLKW FLKW KEY WEST CORS ARP	N243313.266	W0814515.399	229848.5

NEAREST NGS PUBLISHED CONTROL POINT

AD7050	STEEL	N260313.613	W0800947.029	1011.0

OPUS-RS Extended Output, Level 2

FINAL COORDINATES (ITRF at epoch of observations)

flf1	961107.175	-5674030.538	2740689.257
okcb	901665.425	-5601320.709	2904442.905
flkw	832505.304	-5744713.227	2634182.957
5282	979137.283	-5649855.567	2783619.897

Covariance matrix of the stations:

1 1.6010E-07 -1.7110E-07 7.6670E-08 9.5320E-08 1.0140E-07 -1.7810E-08 7.8140E-08 7.0440E-08 -5.9430E-08
1.2400E-07 3.3700E-08 -5.0210E-09
2 -1.7110E-07 1.9010E-06 -7.6280E-07 7.4130E-08 -7.6730E-07 3.4910E-07 9.5590E-08 -8.0060E-07 4.1530E-07 -
1.6750E-08 7.6840E-08 -2.1940E-09
3 7.6670E-08 -7.6280E-07 4.7250E-07 -3.5770E-08 4.0090E-07 -6.9110E-08 -4.0250E-08 3.6170E-07 -7.0680E-08
7.1190E-09 1.2610E-08 1.1380E-07
4 9.5320E-08 7.4130E-08 -3.5770E-08 1.4570E-07 -1.3030E-07 6.9290E-08 9.2000E-08 5.6450E-08 -3.3130E-08
1.1380E-07 7.6980E-09 -3.2450E-09
5 1.0140E-07 -7.6730E-07 4.0090E-07 -1.3030E-07 1.8400E-06 -7.2030E-07 3.1550E-08 -7.3970E-07 3.1720E-07
2.4680E-08 1.7420E-07 1.3970E-08
6 -1.7810E-08 3.4910E-07 -6.9110E-08 6.9290E-08 -7.2030E-07 5.1660E-07 -5.2410E-08 3.7350E-07 -1.1400E-07
1.7890E-08 5.8640E-08 8.7340E-08
7 7.8140E-08 9.5590E-08 -4.0250E-08 9.2000E-08 3.1550E-08 -5.2410E-08 1.6310E-07 -1.2810E-07 9.2820E-08
9.5710E-08 -4.1730E-08 8.5360E-09
8 7.0440E-08 -8.0060E-07 3.6170E-07 5.6450E-08 -7.3970E-07 3.7350E-07 -1.2810E-07 1.8740E-06 -7.3460E-07 -
7.0280E-09 8.2930E-08 -1.1650E-08
9 -5.9430E-08 4.1530E-07 -7.0680E-08 -3.3130E-08 3.1720E-07 -1.1400E-07 9.2820E-08 -7.3460E-07 5.1820E-07 -
2.5580E-08 -7.0430E-08 1.3170E-07
10 1.2400E-07 -1.6750E-08 7.1190E-09 1.1380E-07 2.4680E-08 1.7890E-08 9.5710E-08 -7.0280E-09 -2.5580E-08
8.0600E-07 -3.1240E-06 1.4490E-06
11 3.3700E-08 7.6840E-08 1.2610E-08 7.6980E-09 1.7420E-07 5.8640E-08 -4.1730E-08 8.2930E-08 -7.0430E-08 -
3.1240E-06 3.3670E-05 -1.4710E-05
12 -5.0210E-09 -2.1940E-09 1.1380E-07 -3.2450E-09 1.3970E-08 8.7340E-08 8.5360E-09 -1.1650E-08 1.3170E-07
1.4490E-06 -1.4710E-05 7.1790E-06

Covariance Matrix for the xyz OPUS Rover Position (meters^2).

0.0000008060	-0.0000031240	0.0000014490
-0.0000031240	0.0000336700	-0.0000147100
0.0000014490	-0.0000147100	0.0000071790

Covariance Matrix for the enu OPUS Position (meters^2).

0.0000007130	0.0000001547	-0.0000028012
0.0000001547	0.0000006662	-0.0000013255
-0.0000028012	-0.0000013255	0.0000402757

Horizontal network accuracy = 0.00204 meters.
Vertical network accuracy = 0.01244 meters.

Vectors

To	From	X	Y	Z
flf1	5282	-18030.108	-24174.971	-42930.640
okcb	5282	-77471.858	48534.858	120823.009
flkw	5282	-146631.979	-94857.660	-149436.940

Covariance matrix of the 3 vectors

1 7.1810E-07 -3.3120E-06 1.5236E-06 6.6352E-07 -3.0810E-06 1.4183E-06 6.6443E-07 -3.0802E-06 1.4202E-06
2 -3.3120E-06 3.5417E-05 -1.5483E-05 -3.0408E-06 3.2652E-05 -1.4417E-05 -2.9699E-06 3.2710E-05 -1.4222E-05
3 1.5236E-06 -1.5483E-05 7.4239E-06 1.4094E-06 -1.4336E-05 6.9088E-06 1.3931E-06 -1.4349E-05 6.8628E-06
4 6.6352E-07 -3.0408E-06 1.4094E-06 7.2410E-07 -3.2867E-06 1.5036E-06 6.8849E-07 -3.0682E-06 1.4447E-06
5 -3.0810E-06 3.2652E-05 -1.4336E-05 -3.2867E-06 3.5162E-05 -1.5503E-05 -3.0754E-06 3.2673E-05 -1.4336E-05
6 1.4183E-06 -1.4417E-05 6.9088E-06 1.5036E-06 -1.5503E-05 7.5209E-06 1.3702E-06 -1.4383E-05 6.8460E-06

7 6.6443E-07 -2.9699E-06 1.3931E-06 6.8849E-07 -3.0754E-06 1.3702E-06 7.7768E-07 -3.2033E-06 1.5589E-06
8 -3.0802E-06 3.2710E-05 -1.4349E-05 -3.0682E-06 3.2673E-05 -1.4383E-05 -3.2033E-06 3.5378E-05 -1.5363E-05
9 1.4202E-06 -1.4222E-05 6.8628E-06 1.4447E-06 -1.4336E-05 6.8460E-06 1.5589E-06 -1.5363E-05 7.4338E-06

Correlation matrix of the 3 vectors
1 1.0000E+00 -6.5674E-01 6.5986E-01 9.2016E-01 -6.1314E-01 6.1030E-01 8.8911E-01 -6.1112E-01 6.1467E-01
2 -6.5674E-01 1.0000E+00 -9.5485E-01 -6.0046E-01 9.2526E-01 -8.8337E-01 -5.6590E-01 9.2406E-01 -8.7650E-01
3 6.5986E-01 -9.5485E-01 1.0000E+00 6.0786E-01 -8.8729E-01 9.2459E-01 5.7978E-01 -8.8541E-01 9.2381E-01
4 9.2016E-01 -6.0046E-01 6.0786E-01 1.0000E+00 -6.5136E-01 6.4433E-01 9.1748E-01 -6.0621E-01 6.2269E-01
5 -6.1314E-01 9.2526E-01 -8.8729E-01 -6.5136E-01 1.0000E+00 -9.5333E-01 -5.8812E-01 9.2638E-01 -8.8674E-01
6 6.1030E-01 -8.8337E-01 9.2459E-01 6.4433E-01 -9.5333E-01 1.0000E+00 5.6655E-01 -8.8178E-01 9.1557E-01
7 8.8911E-01 -5.6590E-01 5.7978E-01 9.1748E-01 -5.8812E-01 5.6655E-01 1.0000E+00 -6.1071E-01 6.4834E-01
8 -6.1112E-01 9.2406E-01 -8.8541E-01 -6.0621E-01 9.2638E-01 -8.8178E-01 -6.1071E-01 1.0000E+00 -9.4730E-01
9 6.1467E-01 -8.7650E-01 9.2381E-01 6.2269E-01 -8.8674E-01 9.1557E-01 6.4834E-01 -9.4730E-01 1.0000E+00

G-FILE for the vectors

Axx2019102120191021
B20191021200020191021210 0 3 rsgps 1.38IGS
Ings14.003 NGS
C00040001 -180301081 8 -241749708 59 -429306401 27
C00040002 -774718583 8 485348582 59 1208230085 27
C00040003-1466319788 8 -948576599 59-1494369397 27
D 1 2 -6567446 1 3 6598640 1 4 9201577 1 5 -6131434 1 6 6103045 D 1 7 8891116 1 8 -6111157 1 9 6146710
2 3 -9548546 2 4 -6004589 D 2 5 9252585 2 6 -8833686 2 7 -5658976 2 8 9240602 2 9 -8764955 D 3 4 6078625
3 5 -8872947 3 6 9245873 3 7 5797813 3 8 -8854131 D 3 9 9238067 4 5 -6513637 4 6 6443332 4 7 9174827 4
8 -6062052 D 4 9 6226893 5 6 -9533303 5 7 -5881211 5 8 9263806 5 9 -8867445 D 6 7 5665478 6 8 -8817821 6
9 9155739 7 8 -6107104 7 9 6483392 D 8 9 -9473043

ITRF position of 5282 as determined by individual baselines

	X	Y	Z
flf1	979137.256	-5649855.803	2783620.061
okcb	979137.280	-5649855.561	2783619.897
flkw	979137.302	-5649855.306	2783619.800

Residuals of position determined by individual baselines from the final position

	X	Y	Z	East	North	Up
flf1	-0.027	-0.236	0.164	-0.067	0.049	0.277
okcb	-0.003	0.006	0.000	-0.002	0.003	-0.006
flkw	0.019	0.262	-0.097	0.064	0.024	-0.271

STATE PLANE COORDINATES - U.S. Survey Foot
SPC (0901 FL E)
Northing (Y) [feet] 623236.014
Easting (X) [feet] 929299.382
Convergence [degrees] 0.36529444
Point Scale 1.00002672
Combined Factor 1.00003007

********** New Reference Frame Preview **********

OPUS REPORT (5 of 5)

We are replacing the nation's NAD 83 and NAVD 88 datums, to improve access and accuracy of the National Spatial Reference System. More at https://geodesy.noaa.gov/datums/newdatums/

Below are approximate coordinates for this solution in the new frames:

APPROX ORTHO HGT: 4.277 (m) [PROTOTYPE (Computed using xGeoid19B,GRS80,ITRF2014)]

dop from interpolation is 0.882
scatter (mean square distance from rover) is 27649.420
average edop for rover is 0.660
average ndop for rover is 0.800
average hdop for rover is 1.037
average vdop for rover is 1.940
average gdop for rover is 2.570

This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.