PREPARED FOR

SPECIFIC PURPOSE SURVEY
SURVEYOR'S REPORT
VERTICAL DATUM UPGRADE PROJECT

WO# 4600002187-WO08R2

SAP PO# 9500006234

WGI™





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PROJECT OVERVIEW

Purpose of Project:

Procure all materials to construct and install 89 staff gauges calibrated to the North American Vertical Datum of 1988 (NAVD88) at various sites identified by the Vertical Datum Project Manager. Establish a NAVD88 Reference Elevation on the inside deck of existing Telemetry Stations and stamp site specific data onto a brass tag, using a steel stamp die set. The brass tags were delivered to SFWMD and would be installed by SFWMD Field Personnel during site inspections.

Accuracy:

Staff gauges have been set (adjusted) to the nearest two hundredth (.02') of a foot, and reference elevations established to the nearest hundredth (.01') of a foot. Elevations have been transferred from provided bench mark using a digital level, leveling rods, and redundant measurements.

Bench Marks:

A bench mark was provided by SFWMD at each location, unless otherwise noted, and used to establish the reference elevation and calibrate each staff gauge. Where bench marks were destroyed or not provided, a new bench mark was established and a SFWMD Bench Mark Sheet was filled out and provided.

Survey Equipment Used:

Topcon DL-502 (Digital Level)
Fiberglass Digital Level Rods
Conventional Level Rod
GPS Equipment - Topcon GR3

Vertical Datum Factor:

The reference elevations and staff gauges, in this report, have been correctly calibrated to the North American Vertical Datum of 1988. The datum conversion to the National Geodetic Vertical Datum of 1929 (NGVD 29), as shown herein and engraved on each gauge, were provided by the SFWMD VDUP Project Manager.

Completion Date:

Staff Gauge installation, calibration, and the establishment of telemetry station reference elevation was completed on November 19, 2015.

Construction:

Each Staff Gauge is attached to a 4" O.D. galvanized steel pipe with stainless steel hardware. The pipes were driven to a depth to achieve required stability, to a minimum of 10', unless otherwise noted, in field notes. In some instances, additional cross bracing was used and attached to existing structure or an additional 2" O.D. galvanized pipe set. Sections of pipes were driven by jack hammer, and attached together with a galvanized threaded coupling. On I-Beams, staff gauges were attached with stainless steel 316 hardware.

Details of Staff Gauges

Staff Gauge Detail Summary For Miami Sites

Gauges completed:

Staff Gauge Site	Latitude	Longitude	Bench-mark Used	Benchmark Elevation NAVD88	Well Head Reference BM Elevation	Conversion Elevation to NGVD29
G58_H	25° 54' 01.87"	80° 09' 45.496"	G58	7.456	5.851	**1.56**
G72_H	25° 52' 09.022"	80° 20' 21.19"	FCE4665	5.49	9.258	**1.55**
G72_T	25° 52' 09.954"	80° 20' 19.332"	FCE4665	5.49	9.369	**1.55**
S27_H	25° 51' 04.199"	80° 11' 17.673"	FCE1696	3.975	7.865	**1.54**
S27_T	25° 51' 03.057"	80° 11' 18.196"	FCE1696	3.975	7.856	**1.54**
S28_H	25° 52' 22.908"	80° 10' 52.199"	S28	4.597	7.578	**1.54**
S28_T	25° 52' 21.543"	80° 10' 50.754"	S28	4.597	7.587	**1.54**
S29_H	25° 55' 45.153"	80° 09' 05.949"	FCE3089	17.932	9.792	**1.56**
S29_T	25° 55' 45.209"	80° 09' 04.824"	FCE3089	17.932	6.443	**1.56**
S30_H	25° 57' 24.485"	80° 25' 54.642"	SNAKE RM3	6.49	10.752	**1.52**
S30_T	25° 57' 24.465"	80° 25' 49.536"	SNAKE RM3	6.49	9.10	**1.52**
S337_H(S31_H)	25° 56' 34.331"	80° 26' 26.385"	FCE1248	10.135	20.021	**1.52**
S31_T	25° 56' 32.002"	80° 26' 24.633"	FCE1248	10.135	13.009	**1.52**
S32_H	25° 56' 31.779"	80° 26' 22.833"	FCE1248	10.135	10.413	**1.52**
S32A_H(S337_T)	25° 56' 32.002"	80° 26' 24.633"	FCE1248	10.135	11.908	**1.52**
S32A_T	25° 56' 32.002"	80° 26' 24.633"	FCE1248	10.135	11.912	**1.52**
S120_H	25° 40' 15.857"	80° 19' 19.297"	S120	13.429		**1.54**
S120_T	25° 40' 14.949"	80° 19' 16.516"	S120	13.429		**1.54**
C2SW1	25° 42' 34.6"	80° 22' 54.3"	C2SW1	6.682	10.312	**1.56**
C2SW2	25° 41' 28.14"	80° 18' 06.8"	C2SW2	5.123	8.273	**1.54**
L31NN	25° 44' 46.526"	80° 29' 52.591"	JBA33	6.44	11.467	**1.56**
L31NN GW1	25° 44' 46.526"	80° 29' 52.591"	JBA33	6.44	14.399	**1.56**
L31NN GW2	25° 44' 46.526"	80° 29' 52.591"	JBA33	6.44	14.227	**1.56**
L31NN GW3	25° 44' 46.526"	80° 29' 52.591"	JBA33	6.44	14.122	**1.56**
L31NN GW4	25° 44' 46.526"	80° 29' 52.591"	JBA33	6.44	14.439	**1.56**
L31NS	25° 42' 07.12"	80° 29' 46.495"	JBA22	6.73	10.526	**1.56**
L31NS GW1	25° 42' 07.12"	80° 29' 46.495"	JBA22	6.73	13.705	**1.56**
L31NS GW2	25° 42' 07.12"	80° 29' 46.495"	JBA22	6.73	13.847	**1.56**
L31NS GW3	25° 42' 07.12"	80° 29' 46.495"	JBA22	6.73	13.71	**1.56**
L31NS GW4	25° 42' 07.12"	80° 29' 46.495"	JBA22	6.73	13.931	**1.56**
S25_H	25° 47' 00.4"	80° 14' 24.69"	S25	3.658	8.821	**1.54**
S25_T	25° 46' 59.97"	80° 14' 24.14"	S25	3.658	8.81	**1.54**
S25B_H	25° 47' 38.48"	80° 15' 44.27"	FCE3228	7.205	11.976	**1.55**
S25B_T	25° 46' 59.97"	80° 14' 24.14"	FCE3828	7.205	12.028	**1.55**
S25BM_H	25° 47' 37.24"	80° 15' 45.88"	FCE3828	7.205	6.024	**1.55**

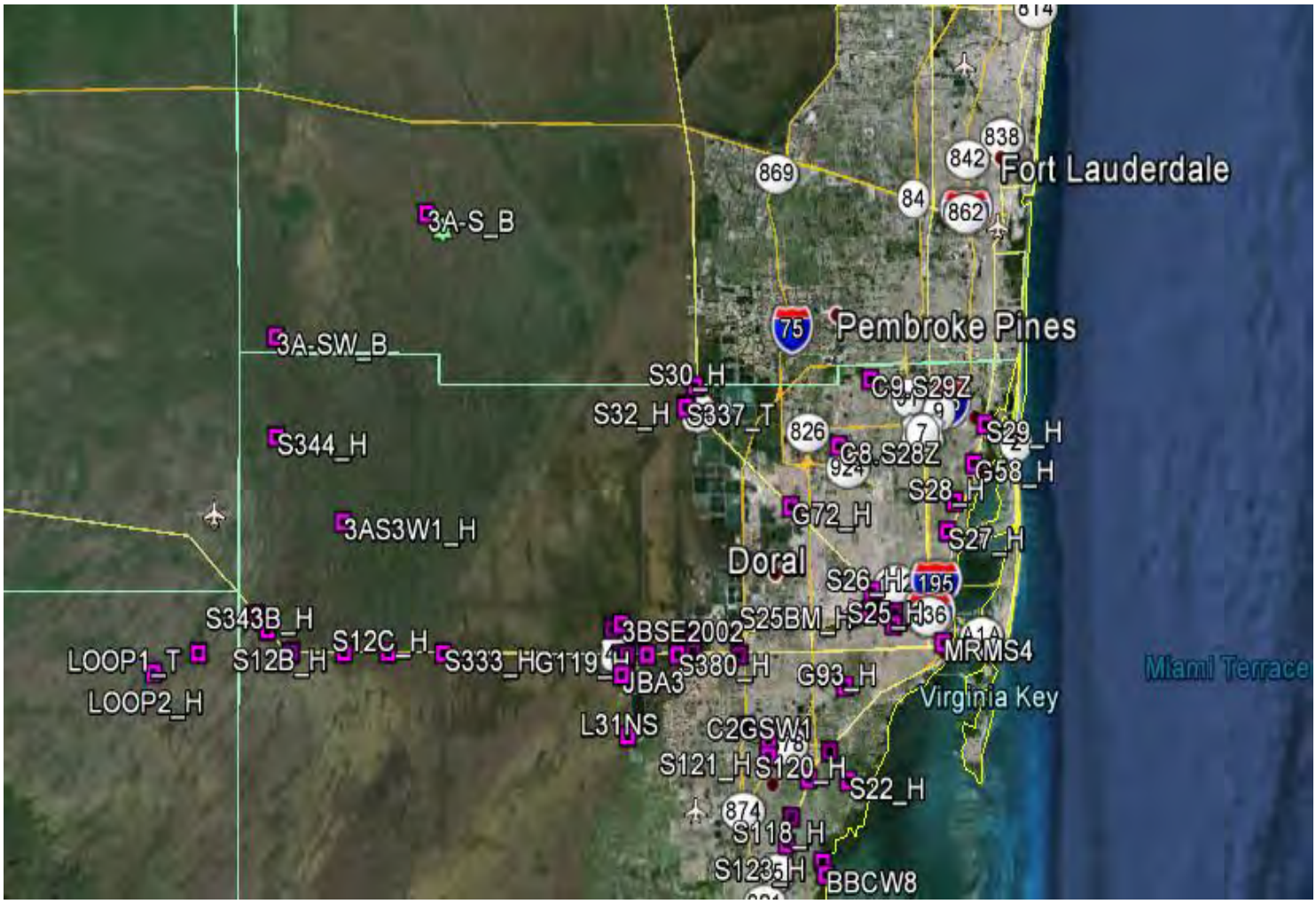
Staff Gauge Site	Latitude	Longitude	Bench-Mark Used	Benchmark Elevation NAVD88	Well Head Reference BM Elevation	Conversion Elevation to NGVD29
S25BM_T	25° 47’ 37.96”	80° 15’ 40.68”	FCE3828	7.205	6.158	**1.55**
S26_H	25° 48’ 27.459”	80° 15’ 39.028”	MIR22	6.984	11.782	**1.54**
S26_T	25° 48’ 25.966”	80° 15’ 36.94”	MIR22	6.984	11.76	**1.54**
S336_H	25° 45’ 40.46”	80° 29’ 49.58”	PR42	9.39	13.217	**1.56**
S336_T	25° 45’ 40.412”	80° 29’ 47.571”	PR42	9.39	10.59	**1.56**
T5W	25° 45’ 41.338”	80° 23’ 19.133”	T5 BM02	5.86	9.331	**1.57**
C8.S28Z	25° 54’ 48.338”	80° 17’ 35.177”	C8.S28Z	7.508	9.953	**1.56**
C9.S29Z	25° 57’ 43.25”	80° 15’ 45.51”	FCE4699	9.326	10.067	**1.58**
G93_H	25° 44’ 18.555”	80° 17’ 13.922”	J400	11.55	8.792	**1.56**
G93_T	25° 44’ 18.837”	80° 17’ 12.615”	J400	11.55	8.87	**1.56**
G420_H	25° 46’ 18.414”	80° 26’ 01.641”	G421	11.266	8.864	**1.57**
G420_T	25° 46’ 18.389”	80° 26’ 02.963”	G421	11.266	13.029	**1.57**
LOOP1_T	25° 45’ 40.369”	80° 54’ 38.238”	**LOOP1 MS**	8.54	11.682	**1.48**
S14_H	25° 45’ 43.138”	80° 49’ 19.079”	V237	14.45		**1.50**
S14_T	25° 45’ 41.445”	80° 49’ 19.11”	V237	14.45		**1.50**
S118_H	25° 37’ 24.949”	80° 20’ 34.967”	S118	8.534	12.384	**1.54**
S118_T	25° 37’ 24.645”	80° 20’ 33.628”	S118	8.534	12.42	**1.54**
S119_H	25° 38’ 35.169”	80° 20’ 18.262”	S119	8.54	12.254	**1.54**
S119_T	25° 38’ 34.483”	80° 20’ 17.268”	S119	8.54	12.248	**1.54**
S121_H	25° 41’ 14.51”	80° 21’ 38.892”	PR48	5.673		**1.56**
S121_T	25° 41’ 12.804”	80° 21’ 38.776”	PR48	5.673		**1.56**
S123_H	25° 36’ 38.68”	80° 18’ 31.89”	S123	8.523	13.989	**1.53**
S123_T	25° 36’ 38.79”	80° 18’ 27.72”	S123	8.523	13.994	**1.53**
C2GSW1	25° 41’ 57.17”	80° 21’ 38.369”	C2GSW1	6.243	9.313	**1.56**
C2GSW1_GW1	25° 41’ 57.17”	80° 21’ 38.369”	C2GSW1	6.243	6.342	**1.56**
C2GSW1_GW2	25° 41’ 57.17”	80° 21’ 38.369”	C2GSW1	6.243	6.423	**1.56**
G420S_H	25° 46’ 19.599”	80° 26’ 02.29”	G421	11.266	11.458	**1.57**
G422_H	25° 45’ 49.287”	80° 26’ 01.192”	T626	10.722	9.745	**1.57**
G422_T	25° 45’ 50.131”	80° 26’ 02.566”	T626	10.722	11.828	**1.57**
LOOP2_H	25° 44’ 48.145”	80° 57’ 14.352”	LOOP2	9.02	11.396	**1.47**
LOOP2_T	25° 44’ 47.362”	80° 57’ 14.257”	LOOP2	9.02	11.301	**1.47**
S12A_H	25° 45’ 43.263”	80° 49’ 16.737”	V237	14.45		**1.50**
S12A_T	25° 45’ 41.7”	80° 49’ 16.764”	V237	14.45		**1.50**
S22_H	25° 40’ 10.89”	80° 17’ 01.684”	FCE1694	7.016	10.904	**1.54**
S22_T	25° 40’ 10.264”	80° 17’ 01.449”	FCE1694	7.016	10.93	**1.54**
S343A_H	25° 47’ 21.167”	80° 51’ 18.474”	L-28	15.55	14.254	**1.49**
S343A_T	25° 47’ 20.021”	80° 51’ 19.871”	L-28	15.55	13.413	**1.49**
S343B_H	25° 46’ 41.965”	80° 50’ 38.313”	S343B	14.69	14.357	**1.49**
S343B_T	25° 46’ 40.835”	80° 50’ 39.343”	S343B	14.69	13.818	**1.49**
S344_H	25° 55’ 08.178”	80° 50’ 10.493”	G502	15.69	14.81	**1.48**
S344_T	25° 55’ 08.689”	80° 50’ 12.309”	G502	15.69	13.25	**1.48**

Staff Gauge Site	Latitude	Longitude	Bench-mark Used	Benchmark Elevation NAVD88	Well Head Reference BM Elevation	Conversion Elevation to NGVD29
S380_H	25° 45’ 40.991”	80° 26’ 54.931”	S380	10.18	9.412	**1.56**
S380_T	25° 45’ 40.913”	80° 26’ 51.968”	S380	10.18	9.442	**1.56**
3BS1W1_H	25° 46’ 49.361”	80° 30’ 41.235”	3BS1W1	6.85	12.495	**1.56**
G3BS11_GW1	25° 46’ 49.361”	80° 30’ 41.235”	3BS1W1	6.85	10.71	**1.56**
G3BS11_GW2	25° 46’ 49.361”	80° 30’ 41.235”	3BS1W1	6.85	10.72	**1.56**
3B-SE_B	25° 47’ 16.358”	80° 29’ 59.199”	3BSE2002	8.56	12.27	**1.56**
C4SW2	25° 46’ 01.234”	80° 26’ 27.039”	C4SW2	5.27	12.50	**1.57**
G119_H	25° 45’ 40.441”	80° 28’ 39.131”	G119	9.781	10.377	**1.56**
G119_T	25° 45’ 40.85”	80° 28’ 36.941”	G119	9.781	10.874	**1.56**
MRMS1	25° 47’ 31.886”	80° 14’ 21.024”	MS1	5.131	7.334	**1.54**
MRMS4	25° 46’ 12.267”	80° 11’ 32.105”	MRMS4	4.016	7.048	**1.56**
S12B_H	25° 45’ 44.259”	80° 46’ 10.775”	T237	14.57		**1.51**
S12B_T	25° 45’ 41.822”	80° 46’ 10.863”	T237	14.57		**1.51**
S12C_H	25° 45’ 44.648”	80° 43’ 38.92”	Q237	14.44		**1.52**
S12C_T	25° 45’ 42.045”	80° 43’ 37.929”	Q237	14.44		**1.52**
S333_H	25° 45’ 43.243”	80° 40’ 26.952”	A410X	12.94	16.849	**1.53**
S333_T	25° 45’ 42.774”	80° 40’ 25.702”	A410X	12.94	16.867	**1.53**
S334_H	25° 45’ 40.509”	80° 30’ 09.305”	S334	12.215	15.814	**1.56**
S334_T	25° 45’ 40.554”	80° 30’ 08.046”	S334	12.215	8.892	**1.56**
S334_MW1	25° 45’ 40.554”	80° 30’ 08.046”	S334	12.215	6.933	**1.56**
S334_MW2	25° 45’ 40.554”	80° 30’ 08.046”	S334	12.215	6.704	**1.56**
S334_MW3	25° 45’ 40.554”	80° 30’ 08.046”	S334	12.215	6.463	**1.56**
S334_MW4	25° 45’ 40.554”	80° 30’ 08.046”	S334	12.215	7.025	**1.56**
3A-S_B	26° 04’ 55.534”	80° 41’ 29.551”	MOSSEY	10.83	16.015	**1.47**
3AS3W1_H	25° 51’ 26.333”	80° 46’ 16.979”	3AS3W1	9.68	14.475	**1.50**
3AS3W1_GW1	25° 51’ 26.333”	80° 46’ 16.979”	3AS3W1	9.68	12.998	**1.50**
3AS3W1_GW2	25° 51’ 26.333”	80° 46’ 16.979”	3AS3W1	9.68	13.011	**1.50**
3A-SW_B	25° 59’ 23.334”	80° 50’ 10.225”	3ASW	8.82	15.905	**1.46**
BBCW8 WQ1S	25° 36’ 04.457”	80° 18’ 20.777”	S123	8.523	7.261	**1.53**
BBCW8 WQ2	25° 36’ 04.457”	80° 18’ 20.777”	S123	8.523	6.196	**1.53**
BBCW8 STG3	25° 36’ 04.457”	80° 18’ 20.777”	S123	8.523	5.836	**1.53**
NESRS3_B	25° 44’ 25.365”	80° 30’ 17.201”	JBA3	5.564	11.394	**1.56**
S335_H	25° 46’ 33.817”	80° 28’ 58.741”	S335	9.856	13.957	**1.56**
S335_T	25° 46’ 33.112”	80° 28’ 58.827”	S335	9.856	13.956	**1.56**

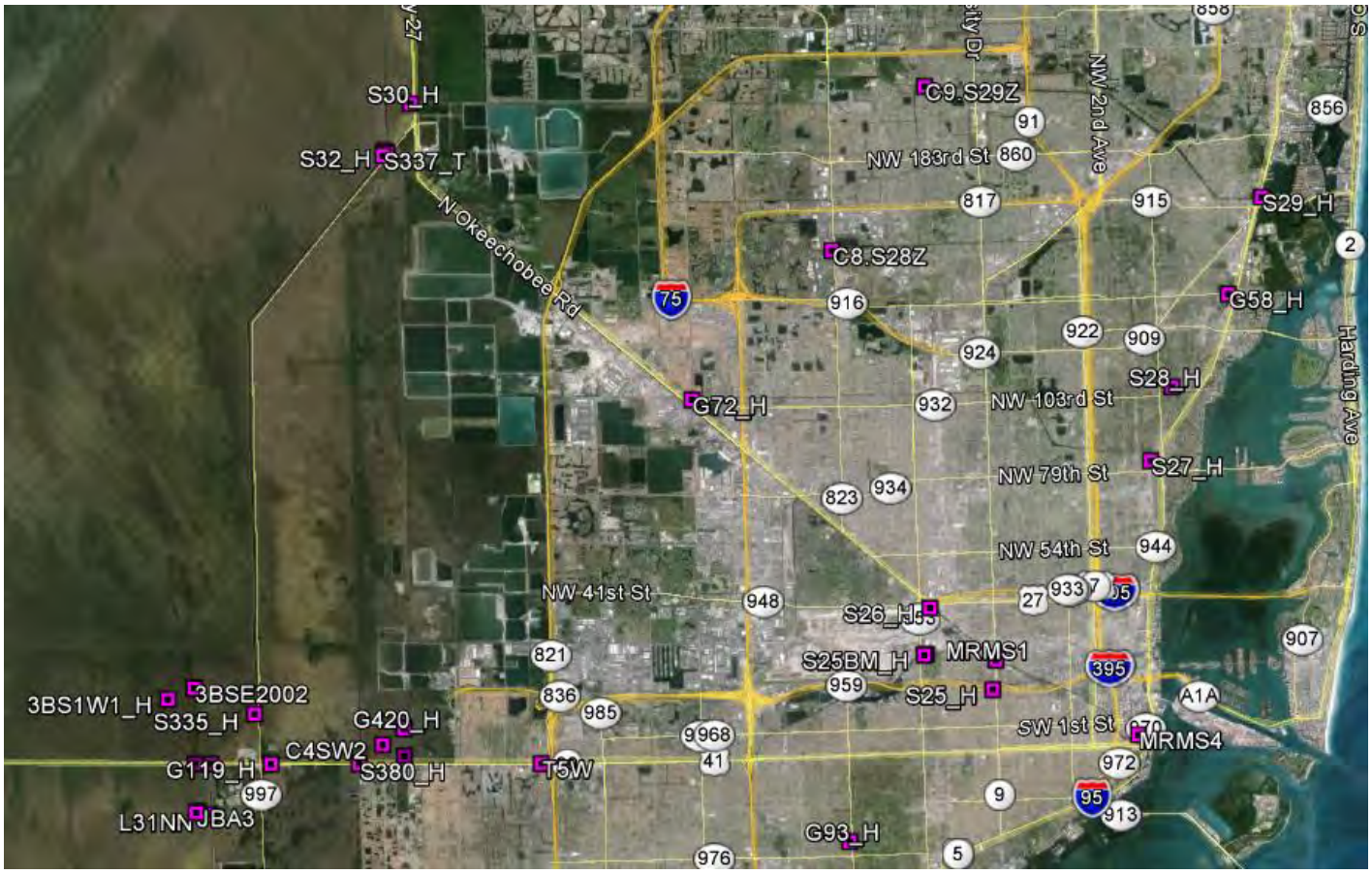
- **<u>All Elevations shown are NAVD 88</u>**

Project Location Maps:

Overall Site



Site Close Up 1 of 3:



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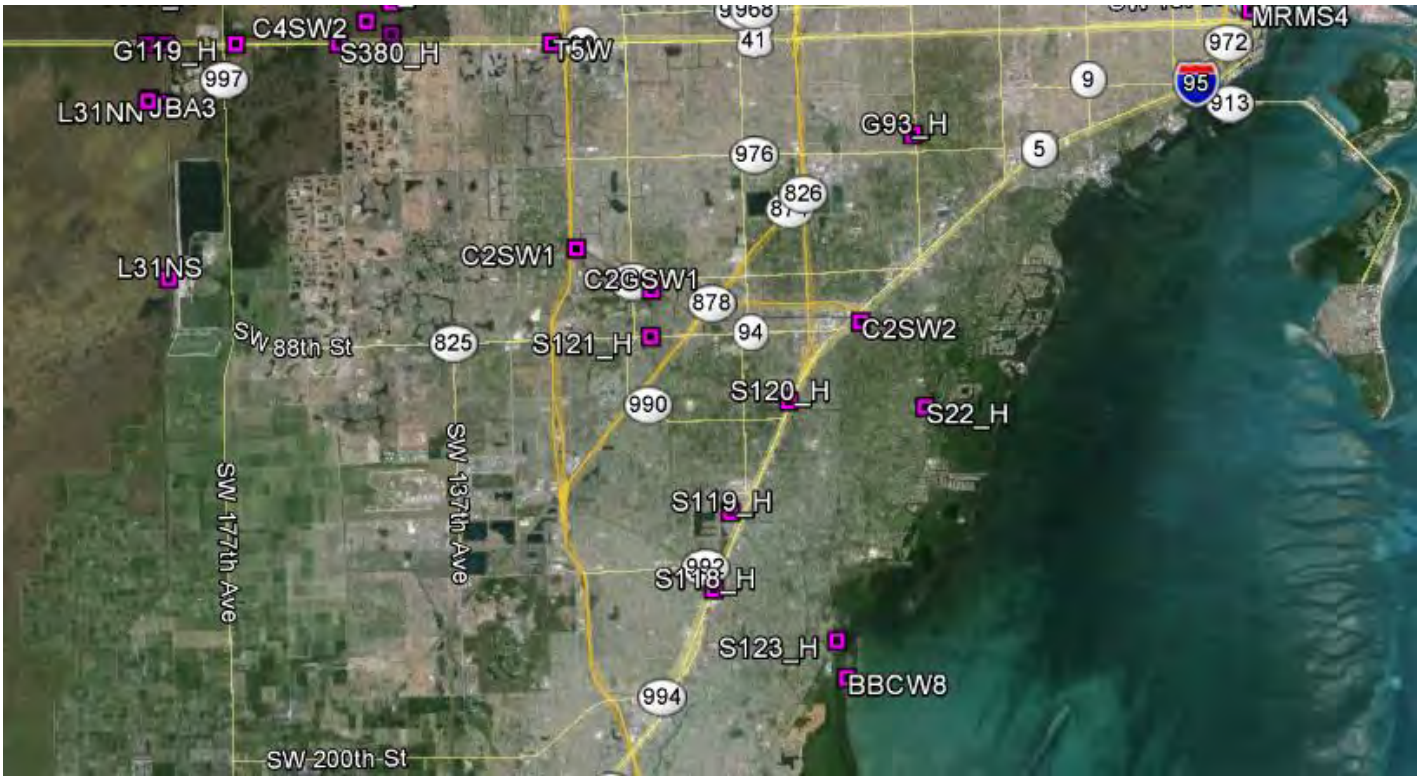


Site Close Up 3 of 3:

Project Results

Stage Recorder Site: BBCW8_WQ1S

Party Chief: Jose Mendoza	**Field Book Number:** 602/ BK 9	**Page Number:** 69
Benchmark Elevation (NAVD 88): 8.523	**Date of Field Work:** November 11, 2015	**Datum Offset to NGVD 29:** +1.53
Benchmark Agency: SFWMD	**Benchmark Type:** Aluminum Disk	**Benchmark Stamp:** S123 BM
Reference Elevation (NAVD88): 7.261		**Existing Tag Elevation (Datum):** 8.87 NGVD29
Latitude: 25° 36′ 04.457″		**Longitude:** 80° 18′ 20.777″
Notes: Datum difference SFWMD +1.53 Field +1.609. Elevation established using RTK observations from SFWMD BM S123 & U705 EL+7.41		
Removed Old Board: No Existing Gauge on site.		

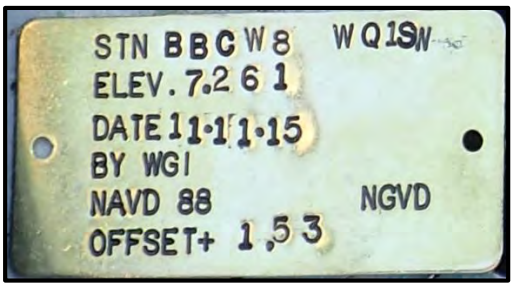
Photographs:

Overall Site:

Benchmark Location:

Benchmark Close Up:

Brass Tag Close Up:



Reference Mark:

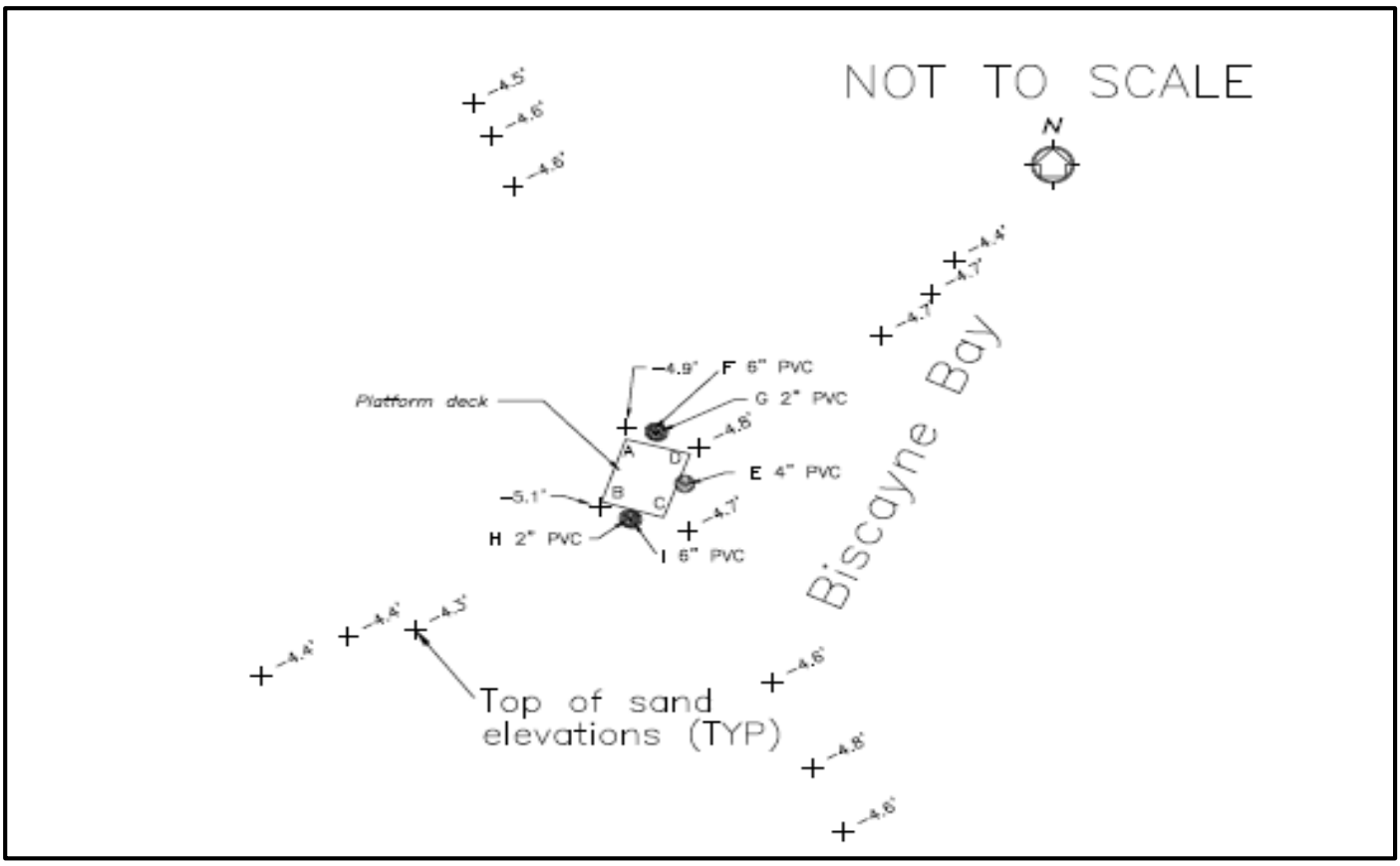
Brass Tag & Reference:

New Staff Gauge:
Front View:

Side View:

Stage Recorder Site: BBCW8_WQ1S

Location	NAVD88 ELEV.	Northing	EASTING	LAT.	LONG.	DESCRIPTION
A	4.2	461363.2427	884952.4562	25°36′04.4″	80°18′20.7″	Deck Corner
B	4.1	461357.3440	884950.4909	25°36′04.4″	80°18′20.8″	Deck Corner
C	4.2	461355.8819	884955.5414	25°36′04.4″	80°18′20.7″	Deck Corner
D	4.2	461361.8639	884957.6958	25°36′04.4″	80°18′20.7″	Deck Corner
E	7.261	461359.0397	884957.2825	25°36′04.4″	80°18′20.7″	Well 4in PVC
F	6.685	461363.9429	884954.8453	25°36′04.4″	80°18′20.7″	Well 6in PVC
G	5.836	461363.8558	884955.0855	25°36′04.4″	80°18′20.7″	Well 2in PVC
H	6.196	461355.7962	884952.7224	25°36′04.4″	80°18′20.7″	Well 2in PVC
I	6.746	461355.6857	884952.9732	25°36′04.4″	80°18′20.7″	Well 6in PVC



Stage Recorder Site: BBCW8_WQ2 GW1

Party Chief: Jose Mendoza	**Field Book Number:** 602/ BK 9	**Page Number:** 69
Benchmark Elevation (NAVD 88): 8.523	**Date of Field Work:** November 11, 2015	**Datum Offset to NGVD 29:** +1.53
Benchmark Agency: SFWMD	**Benchmark Type:** Aluminum Disk	**Benchmark Stamp:** S123 BM
Reference Elevation (NAVD88): 6.196		**Existing Tag Elevation (Datum):** 7.80 NGVD29
Latitude: 25° 36′ 04.457″		**Longitude:** 80° 18′ 20.777″
Notes: Datum difference SFWMD +1.53 Field +1.604. Elevation established using RTK observations from SFWMD BM S123 & U705 EL+7.41		
Removed Old Board: No Existing Gauge on site.		

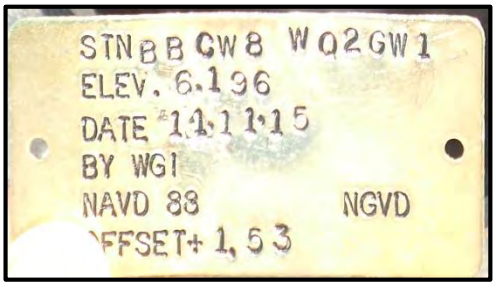
Photographs:

Overall Site:

Benchmark Location:

Benchmark Close Up:

Brass Tag Close Up:



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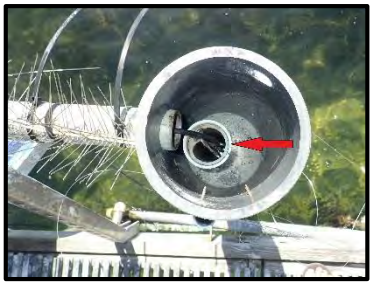


Brass Tag & Reference:

New Staff Gauge:
Front View:

Side View:

Stage Recorder Site: BBCW8_STG3 GW2

Party Chief: Jose Mendoza	**Field Book Number:** 602/ BK 9	**Page Number:** 69
Benchmark Elevation (NAVD 88): 8.523	**Date of Field Work:** November 11, 2015	**Datum Offset to NGVD 29:** +1.53
Benchmark Agency: SFWMD	**Benchmark Type:** Aluminum Disk	**Benchmark Stamp:** S123 BM
Reference Elevation (NAVD88): 5.836		**Existing Tag Elevation (Datum):** 7.40 NGVD29
Latitude: 25° 36′ 04.457″		**Longitude:** 80° 18′ 20.777″
Notes: Datum difference SFWMD +1.53 Field +1.604. Elevation established using RTK observations from SFWMD BM S123 & U705 EL+7.41		
Removed Old Board: No Existing Gauge on site.		

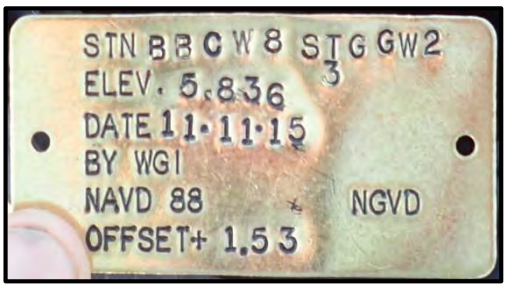
Photographs:

Overall Site:

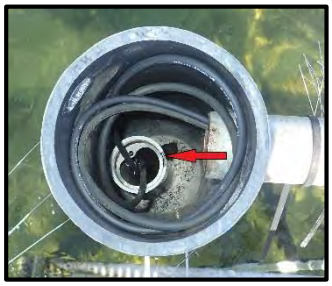
Benchmark Location:

Benchmark Close Up:

Brass Tag Close Up:



Reference Mark:



Brass Tag & Reference:

New Staff Gauge:
Front View:

Side View:

Project Results

Deliverable Items to South Florida Water Management District:

The following items were delivered to South Florida Water Management District with this Surveyor's Report. Neither the report nor the items listed below are complete without the other.
A CD Containing the following digital information:

- Survey Report in PDF Format
- Digital Photos of Set Staff Gauges
- Electronic Copy of Field Notes in PDF Format

Legend:

BM – Bench Mark
NAVD 88 – North American Vertical Datum of 1988
NGVD 29 – National Geodetic Vertical Datum of 1929
NGS – National Geodetic Survey
SFWMD – South Florida Water Management District
ACOE – Army Corp of Engineers
O.D. – Outside Diameter

Survey Notes:

1. Survey map & report, or copies thereof, are not valid without the signature and the original raised seal of a Florida Licensed Surveyor and Mapper.
2. Additions or deletions to the survey maps or reports by other than the signing party or parties are prohibited without the written consent of the signing party or parties.
3. The purpose of the survey is to show results of establishing reference elevations and calibrating staff gauges, as shown herein.
4. Latitude and longitude, as shown on Staff Gauge Detail Summary Chart pages, was provided by the District and not verified as part of this survey.
5. Pursuant to client's request, the face boards of old NGVD 29 staff gauges were removed when possible. Posts were not removed.
6. New 4" galvanized posts were driven to a minimum depth of 10' below ground, unless otherwise noted in field notes. All pipes were structurally stable and plumb at time of installation.

Surveyor's Certification:

I hereby certify that this Specific Purpose Survey meets applicable portions of 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. All NAVD88 staff gauges were calibrated to a vertical accuracy of +/- 0.02' and reference elevations calibrated to a vertical accuracy of +/- 0.01'.

For the Firm:
Wantman Group, Inc.
L.B. Number 7055

Wantman Group, Inc.
2035 Vista Parkway
West Palm Beach, FL 33411
PH: (561) 687-2220

By: _____
Derek G. Zeman, PSM
State of Florida
Certificate No. LS5655

10-11-15 SEWMD 95° CLEAR

MENDOZA

MILLER

FRASER BASE @ S123

STK	STO		DESC
	10001A		SET NLD IN 2x6 @ LADDER LB7085
	10001Z		✓ ON NLD FROM SECOND BASE "
	10001ZZ		
	HELD 10001ZZ & 10001A AVG FOR VERTICAL = 4.136		
	10500		MISC TOPO SHOTS @ PLATFORM
	10527		

+	HI	−	ELEV	DESC
			4.136	AVG RTK PNT SET NL & DISK PUB
5.36	9.496			
		2.75	6.746	6" PVC @ REF PT 10504
		3.30	6.196	2" WQ2 GW1 / 7.160
		2.81	6.685	6" 10507
		3.656	5.836	2 STG 3 @ W2 10508 HELD FOR 7.40 BRASS TACKS
		2.235	7.261	4" 10506 WQ13 W/ 8.857
1.70	8.961			
		2.21	6.751	6" CHK SHOTS
		2.77	6.196	2"
		2.28	6.681	6"
		3.13	5.831	2"
		5.08	3.880	TOP OF SET GAUGE
2.94	8.052			
		4.69	4.13	✓ INGS TO BM