GROUND CONTROL SURVEY REPORT

GROUND TRUTH SURVEY
FOR LIDAR CONTROL

Professional Management
and LiDAR Data Collection
and Processing Services

Block 7

PROJECT TITLE:	Professional Management and LiDAR Data Collection and Processing Services
WORK ORDER NAME:	Task Order A
WORK ORDER NUMBER:	2007058492720
CONSULTANT NAME:	3001, Inc., CH2M Hill, Inc.
PROJECT MANAGERS:	Jeremy Conner, 3001 Project Manager JoLee Gardner, CH2M Hill Project Manager

Services provided by:

3001, INC. THE GEOSPATIAL COMPANY
501 Robert Blvd. 2nd Floor
Slidell, Louisiana 70458

June 2008

Florida Division of Emergency Management
2555 Shumard Oak Boulevard
Tallahassee, Florida 32399-2100

Re: Professional Management and LiDAR Data Collection and Processing Services, Block 7

This photogrammetric mapping ground control survey is certified as meeting or exceeding, in quality and precision, the standards applicable for this work as set forth in Chapter 61G17-6, Florida Adminstrative Code.

Dean T. Epling, PSM
Florida Professional Surveyor and Mapper
License # 5417
401 Dividend Drive, Suite K
Peachtree City, GA 30269
(770) 631-0903

Signed:_____Date:_____

CONTENTS

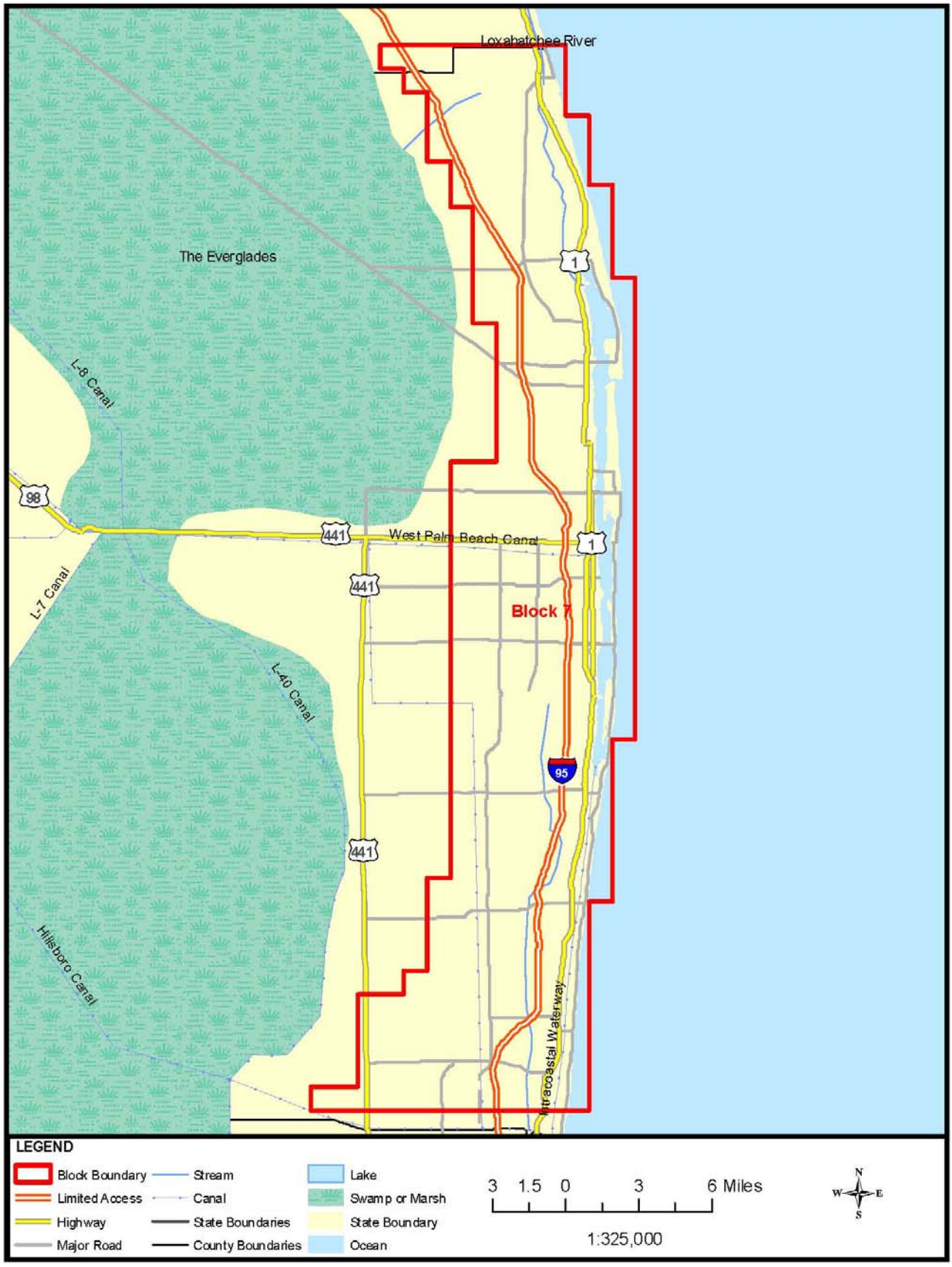
ABSTRACT

ABSTRACT

This report documents the GPS ground surveys conducted in support of LIDAR data collection for the Professional Management and LiDAR Data Collection and Processing Services project, Block 7. The data was collected between August 3 and August 10, 2007. Additional survey data was collected on December 12, 2007. The ground control stations were established utilizing six Trimble 4000 series receivers, one Trimble 4700 GPS receiver, six Trimble Compact L1/L2 antennas with ground plane, and one Trimble microcentered L1/L2 antenna without ground plane. There were no problems encountered during this survey.

Following the control network surveys, surveys were conducted at 11 sites utilizing the base stations established in the static network. These surveys established "Ground Truth" data at each site on different surface types, including bare-earth / low grass, brush lands / low trees, forested areas fully covered by trees, and urban areas.

BLOCK 7 SITE MAP



SURVEY METHODOLOGY

SURVEY METHODOLOGY

Prior to beginning the survey collection, a reconnaissance was done of the existing control in the project area, and surrounding areas. Based on the results of the findings, the controls to be included in the network were selected based on their locations, horizontal and vertical orders, and their accessibility. In addition to the survey control, several Continuously Operating Reference Stations (CORS) were included into the GPS network. All control monuments and CORS can be found in the Fully-Constrained Adjustment table, found in Section 4-B, and can also be seen on the GPS Network Map shown in Section 4-A.

The GPS network was then planned to coincide with the following set of standards:

- FGCC, GEOMETRIC GEODETIC ACCURACY STANDARDS AND SPECIFICATIONS FOR USING GPS RELATIVE POSITIONING TECHNIQUES, VERSION 5.0, AUGUST 1989
- FGDC, GEOSPATIAL POSITIONING ACCURACY STANDARDS, NATIONAL STANDARD FOR SPATIAL DATA ACCURACY (NSSDA)
- NGS-58, GUIDELINES FOR ESTABLISHING GPS-DERIVED ELLIPSOID HEIGHTS (2CM AND 5CM)
- NGS-59, GUIDELINES FOR ESTABLISHING GPS-DERIVED ORTHOMETRIC HEIGHTS (2CM AND 5CM)
- FGCC STANDARDS AND SPECIFICATIONS FOR GEODETIC CONTROL NETWORKS, 1984
- FEMA FLOOD HAZARD MAPPING PROGRAM, GUIDELINES AND SPECIFICATIONS FOR FLOOD HAZARD MAPPING PARTNERS, APPENDIX A

Control monuments were tied together with four hour occupations. These monuments were then tied to newly established monuments, or secondary control monuments, with multiple one hour occupations.

After the static GPS network was completed, the ground truth data points were collected using a total station and data collector. This data was collected from base stations tied into the static GPS network, and additional “check-in” points were collected and compared to positions established in the static network. The ground truth data was then processed and used to verify the LIDAR positions.

The horizontal and vertical datums used for this project are listed below:

Coordinate System: US State Plane
Zone: Florida East 0901
Horizontal Datum: NAD83 (1999) / HARN Adjustment
Vertical Datum: NAVD88
Geoid Model: Geoid03
Units: US Survey Feet

MAIN REPORT

STATIC GPS SUMMARY

The Standard Operating Procedure for the data collection includes a geodetic control network plan designed to maximize the use of the highest order control points in the area of interest, and to optimize the spatial distribution of geodetic control across the network. Also included is the simultaneous occupation of points designed to provide redundant vectors and loop closures, as well as a collection of a superfluity of points to compare observed values against published values of geodetic control points.

In addition, the static GPS network was established to verify the compatibility and correlation of existing published NGS controls in the project area. Horizontal and vertical constraints were selected based on the order of accuracy and correlation of the controls selected.

PRELIMINARY ANALYSIS

The baselines were processed using Trimble Geomatics Offices's baseline processing module, WAVE (*Weighted Ambiguity Vector Estimator*). Ionosphere-free fixed solutions were found to provide the best results. Preliminary blunder detections were undertaken using "Redundant Vectors" and Global Network Closures and any extremely large errors were eliminated.

MINIMALLY CONSTRAINED ADJUSTMENT

The data are then processed using a minimally constrained geodetic control network to test the network internally, without external constraints, and produce a statistical summary. The statistics from this process are required to be within the tolerance outlined in the Geometric Geodetic Accuracy Standards and Specifications for using GPS Relative Positioning Techniques, published by the FGCC. These tolerances are represented as ellipsoids showing the margin of error value on a graph of the theoretical points, covariance values that indicate the degree of error of the vectors relative to the other vectors in the network, and a chi-squared test that compares the predicted variance determined through a least-squares analysis to the observed variance. The summary is evaluated to eliminate vectors that are outside of the error tolerances to be replaced with redundant vectors that are within the tolerances until all tolerances are met.

FULLY CONSTRAINED ADJUSTMENT

The quality of the existing horizontal controls is assessed before undertaking the constrained adjustment. Geodetic inverses between the published NAD83 (1999) coordinates of existing stations were compared with the geodetic inverses derived from the minimally constrained least square adjustment results. This distance analysis is especially useful, since it provides a datum invariant means of comparison.

Once the minimally constrained network satisfies the requirements of the above tests, the highest order control points in the control network are selected with an optimum

spatial relationship to fully constrain the network to known control points, and have their published values entered as the position for those points and the network re-adjusted. The fully constrained positions are given in Section 4-B. The same statistical tests are rerun on the adjusted network, as well as visually comparing adjusted values of geodetic control points to published values of control points not used as constraints. Again, the summary is evaluated to identify vectors outside of the tolerances and constraining points reselected to obtain the best fit to the geoid where all vectors are within the prescribed tolerances.

ERROR ELLIPSES

The adjustment results show that the a posteriori variance factor of the network was close to 1.0, as should be desired, and passed the χ^2 test. None of the residual components in the network were flagged for possible rejection under the τ-max test at the 0.05 level of significance. The relative confidence ellipses reveal that the horizontal positional accuracy between all directly connected pairs of stations in the network were better than (1:100,000) at the 95% level of confidence. The horizontal and vertical Error ellipses are included in this report in Section 4-D.

GROUND TRUTH SUMMARY

Surveys were conducted to establish ground truth data at representative sites throughout the project area. These sites were selected on the basis of the various types of ground surfaces and vegetation covers that would be encountered by the LIDAR surveys. As a quality control measure, a number of “check-in” points consisted of published horizontal and vertical control points within the area. The base stations used to collect survey data were included in the static GPS network, and were selected on the basis of their having an unobstructed view of the sky, as well as being in a location considered favorable for collecting ground truth data. The vertical and horizontal accuracy of each base station was determined by the statistical tests performed in the least squares adjustment process.

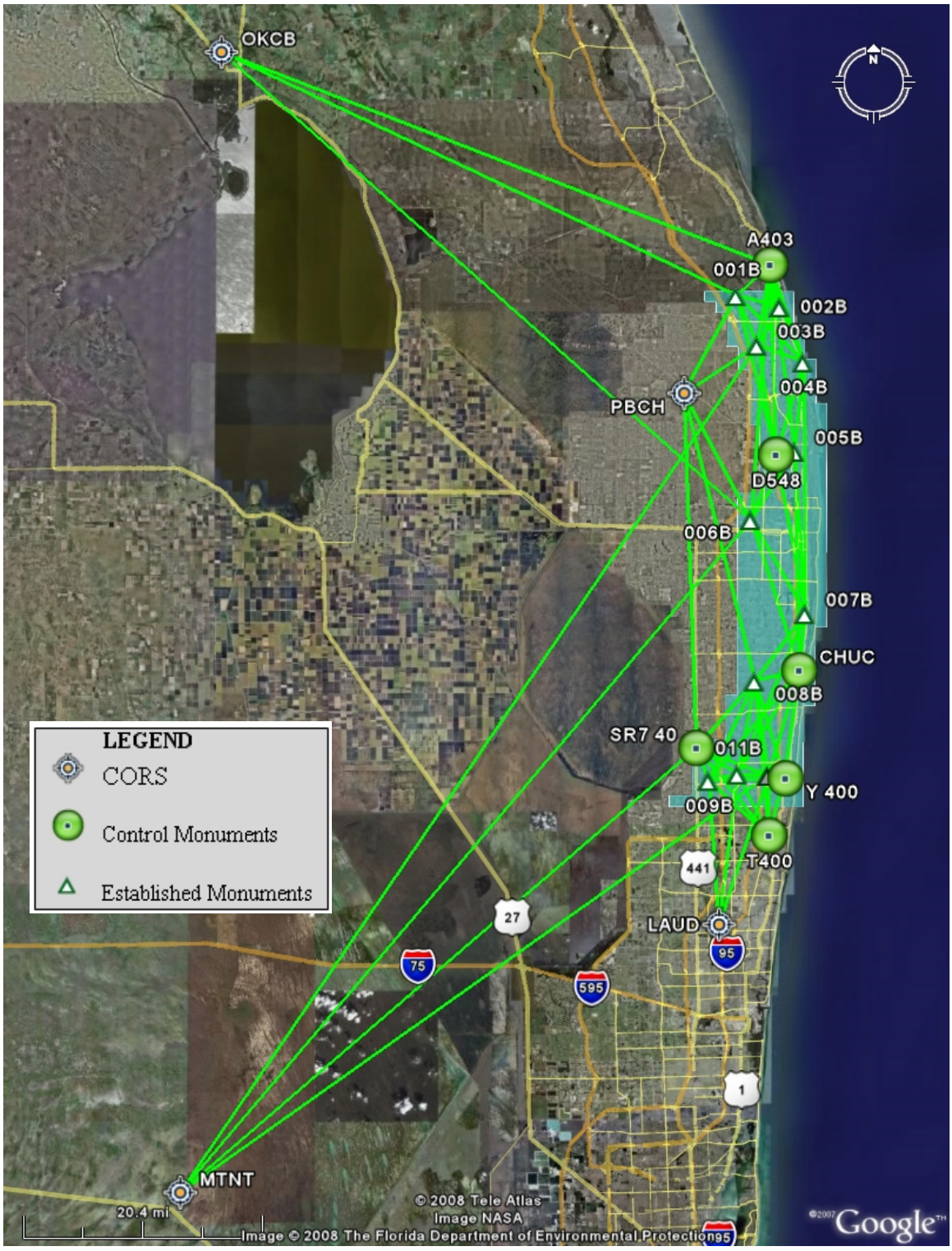
SAMPLE POINTS / TEST POINTS

The test points were distributed and categorized into sites as shown in the Map of Ground Truth Locations attached in this report (Section 5-A). These sites were selected on the basis of various types of ground surfaces and vegetation covers. At the time of LIDAR data acquisition, checkpoints were collected on surfaces with bare-earth / low grass, brush lands / low trees, forested areas fully covered by trees, and urban areas.

GPS NETWORK

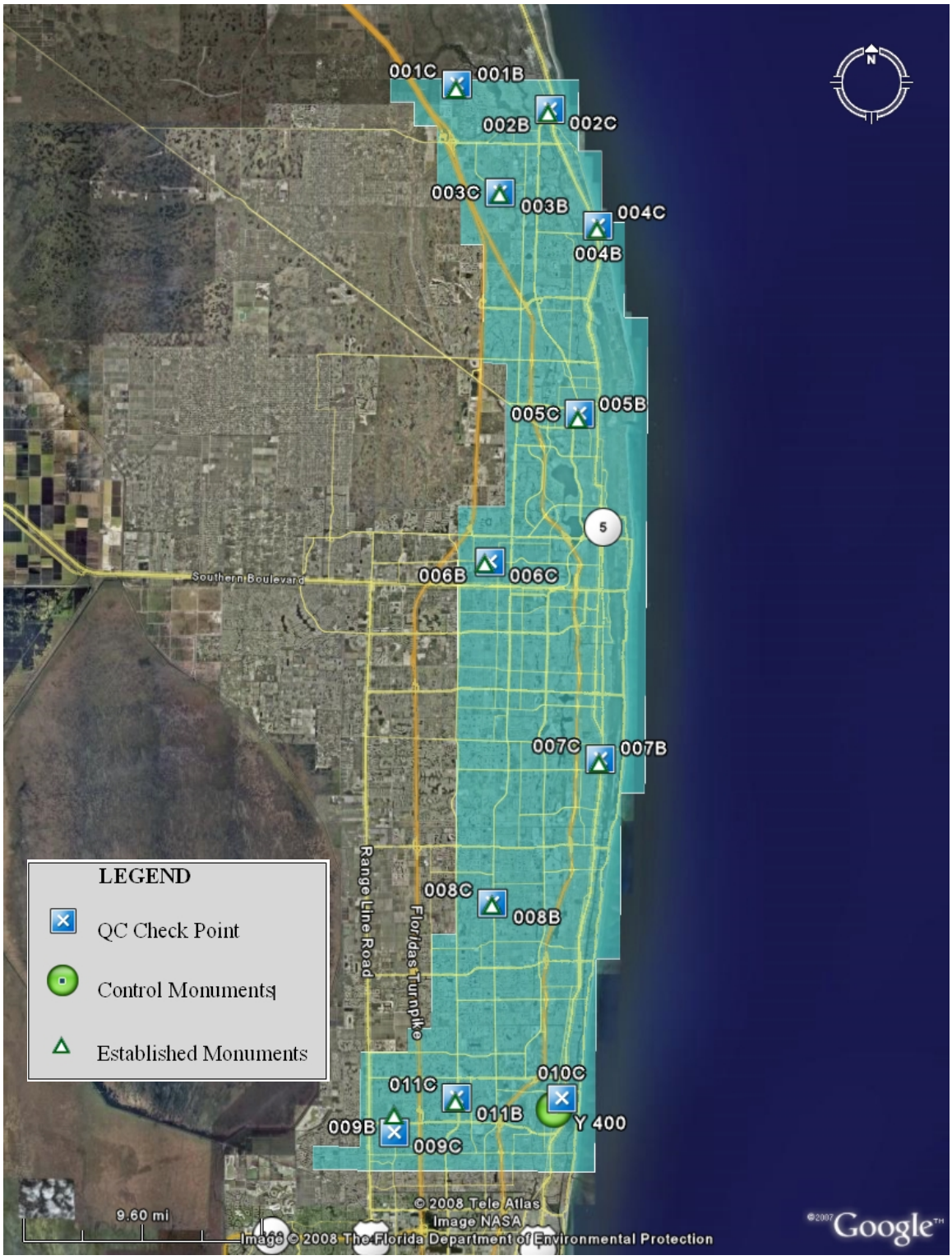
A. GPS Network Map

GPS Network Map



This map shows the GPS baselines processed for this network. The CORS and control monuments can be distinguished from the newly established monuments (see the legend above).

QC Check Points



The QC check points can be seen in the above map. The QC procedures are described in Section 3, in the Ground Truth Summary. The individual check sites can be seen in detail in Section 5-B.

B. Fully Constrained

GPS Control Network
Fully-Constrained Adjustment

Coordinate System: US State Plane
Zone: Florida East 0901
Horizontal Datum: NAD83 (1999)
HARN Adjustment
Vertical Datum: NAVD88
Geoid Model: Geoid03
Units: US Survey Feet

Name	Latitude	Longitude	Northing	Easting	Elev	Ellip Ht	North error	East error	Ellip error	Fix
LAUD	26 11 46.34168	80 10 23.01438	677867.55	927328.44	24.47	-59.52	0.00	0.00	0.00	LLh
MTNT	25 51 56.76081	80 54 25.18701	556914.06	686748.36	17.53	-62.15	0.00	0.00	0.00	LLh
OKCB	27 15 57.71572	80 51 19.18214	1065904.89	703163.25	42.12	-45.13	0.00	0.00	0.00	LLh
PBCH	26 50 46.63829	80 13 09.30061	914080.24	910743.56	36.67	-50.23	0.00	0.00	0.00	LLh
D 548	26 46 15.23186	80 05 37.31098	886946.16	951879.60	12.64	-74.49	0.00	0.00	0.00	LLh
CHUCK	26 30 25.71611	80 03 46.67268	791139.56	962610.92	12.56	-73.15	0.00	0.00	0.06	LL
T 400	26 18 18.94255	80 06 17.40383	717657.27	949427.25	14.40	-70.50	0.00	0.00	0.07	LL
A 403	27 00 13.69257	80 06 01.85034	971597.98	949054.21	16.91	-73.51	0.02	0.02	0.05	
SR7 40	26 24 45.88594	80 12 13.32518	756515.38	916795.47	18.76	-65.30	0.01	0.01	0.06	
Y 400	26 22 33.12598	80 05 01.85978	743370.97	956120.11	16.41	-68.83	0.02	0.02	0.07	
BTC3001	26 22 45.33813	80 06 20.41183	744553.92	948967.19	9.57	-75.41	0.02	0.02	0.06	
001B	26 58 00.19467	80 08 47.51555	958013.21	934160.40	12.85	-76.51	0.02	0.02	0.04	
002B	26 57 10.03100	80 05 12.07254	953083.94	953690.91	9.61	-80.34	0.02	0.02	0.05	
003B	26 54 20.65210	80 07 05.21648	935907.32	943571.28	14.60	-74.27	0.02	0.01	0.04	
004B	26 53 06.85783	80 03 17.53754	928604.26	964239.13	23.11	-66.26	0.02	0.02	0.05	
005B	26 46 32.53634	80 04 02.60906	888755.59	960450.52	14.62	-72.91	0.02	0.03	0.07	
006B	26 41 32.11289	80 07 40.35717	858279.62	940922.57	19.00	-66.87	0.02	0.02	0.07	
007B	26 34 37.30266	80 03 13.66677	816565.72	965421.96	11.79	-74.27	0.02	0.02	0.06	
008B	26 29 42.05399	80 07 23.37387	786591.73	942954.21	18.45	-66.50	0.01	0.01	0.06	
009B	26 22 24.55473	80 11 11.39780	742280.13	922516.01	17.11	-67.05	0.01	0.01	0.06	
011B	26 22 52.43725	80 08 48.60932	745179.40	935484.23	17.05	-67.51	0.01	0.01	0.05	
001C	26 58 06.72757	80 08 50.32930	958671.18	933901.35	12.35	-77.03	0.04	0.04	0.10	
002C	26 57 13.85226	80 05 11.76418	953470.01	953716.03	9.47	-80.49	0.03	0.03	0.07	
003C	26 54 20.65893	80 07 09.26669	935905.46	943204.60	14.18	-74.67	0.03	0.03	0.06	
004C	26 53 11.54341	80 03 19.30771	929076.21	964075.31	22.19	-67.19	0.03	0.03	0.08	
005C	26 46 39.90344	80 04 03.00065	889499.25	960409.57	13.72	-73.84	0.04	0.04	0.09	
006C	26 41 31.90512	80 07 31.96440	858263.86	941683.95	15.72	-70.17	0.04	0.04	0.10	
007C	26 34 41.96998	80 03 14.80835	817036.24	965314.83	12.83	-73.24	0.03	0.04	0.08	
008C	26 29 42.41087	80 07 26.82967	786625.62	942639.98	18.92	-66.02	0.04	0.04	0.09	
009C	26 22 21.09126	80 11 12.32448	741929.89	922433.93	17.60	-66.56	0.04	0.04	0.09	
010C	26 22 29.11462	80 05 02.36872	742965.61	956076.70	15.87	-69.36	0.03	0.04	0.09	
011C	26 22 57.37865	80 08 50.48847	745677.21	935310.03	16.61	-67.94	0.04	0.04	0.10	

ERRORS ARE REPORTED AT THE 95% CONFIDENCE LEVEL.

C. NGS Published Positions vs GPS Derived Positions

NGS Positions vs GPS Derived Positions

Coordinate System: US State Plane
Zone: Florida East 0901
Horizontal Datum: NAD83 (1999)
HARN Adjustment
Vertical Datum: NAVD88
Geoid Model: Geoid03
Units: US Survey Feet

NGS Positions

Name	Northing	Easting	Elev	Ellip Ht	Horiz Order	Vert Order	Ellip Order
LAUD	677867.55	927328.44		-59.52	CORS	CORS	CORS
MTNT	556914.05	686748.36		-62.15	CORS	CORS	CORS
OKCB	1065904.88	703163.25		-45.13	CORS	CORS	CORS
PBCH	914080.24	910743.56		-50.23	CORS	CORS	CORS
A 403	971597.97	949054.21	16.90	-73.49	1	1	4
CHUCK	791139.56	962610.92	12.8	-73.18	1	-	4
D 548	886946.15	951879.60	12.61	-74.48	1	1	3
SR7 40	756515.37	916795.33	18.70	-65.31	1	3	4
T 400	717657.27	949427.25	14.43	-70.45	1	1	3

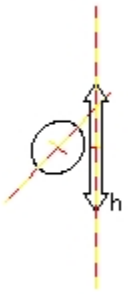
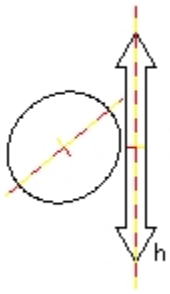
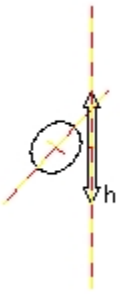
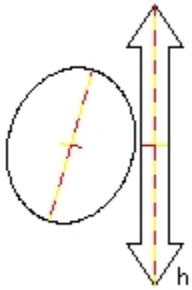
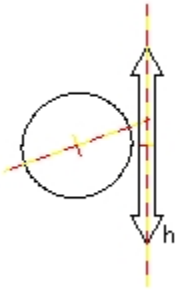
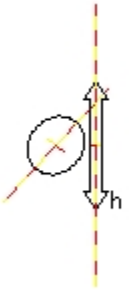
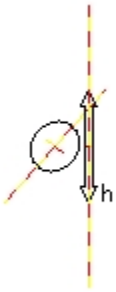
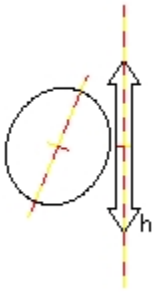
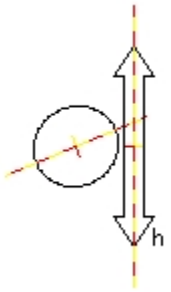
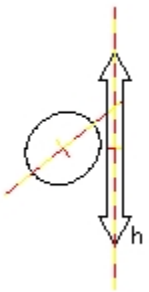
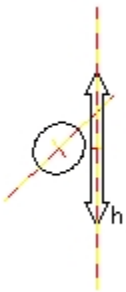
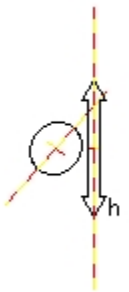
GPS Derived Positions

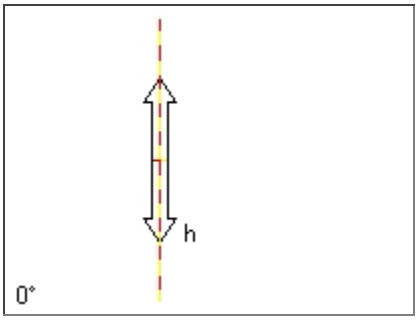
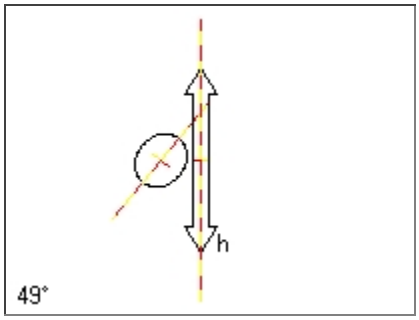
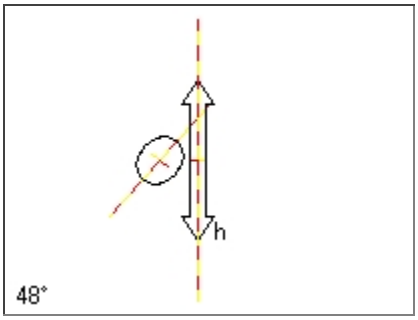
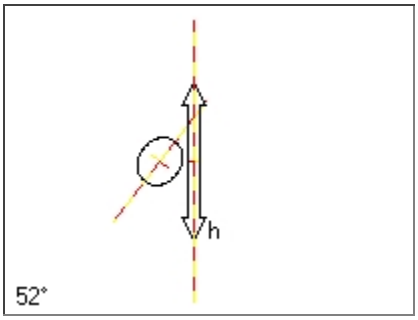
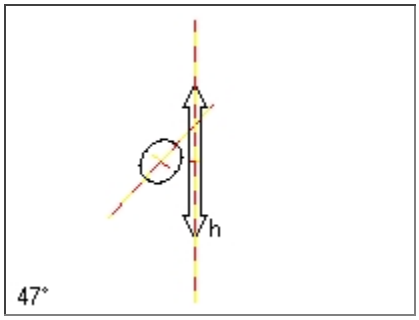
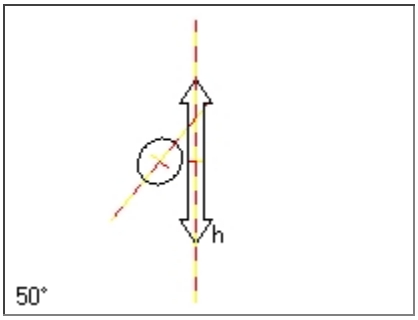
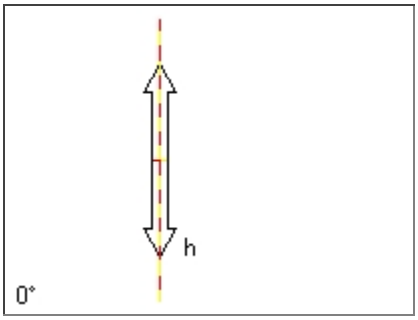
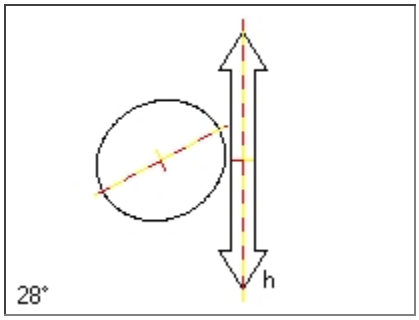
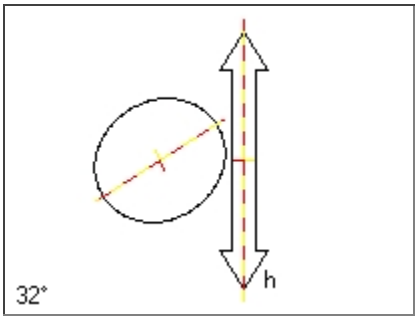
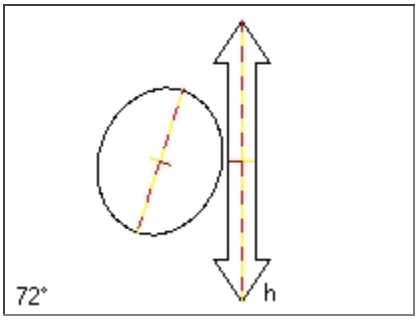
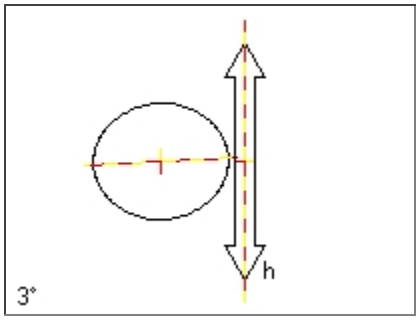
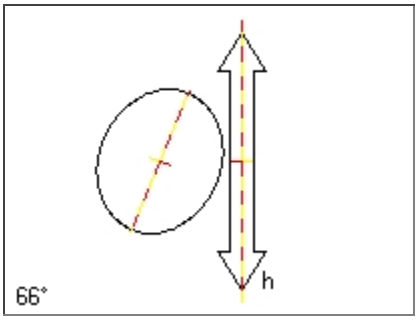
Northing	Easting	Elev	Ellip Ht
677867.55	927328.44	24.47	-59.52
556914.06	686748.36	17.53	-62.15
1065904.89	703163.25	42.12	-45.13
914080.24	910743.56	36.67	-50.23
971597.98	949054.21	16.91	-73.51
791139.56	962610.92	12.56	-73.15
886946.16	951879.60	12.64	-74.49
756515.38	916795.47	18.76	-65.30
717657.27	949427.25	14.40	-70.50

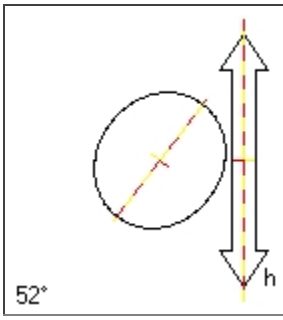
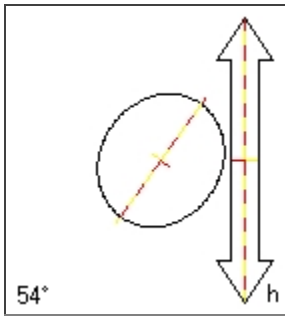
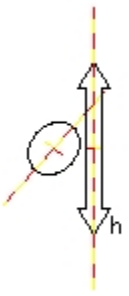
delta North	delta East	delta Elev	delta Ellip
0.00	0.00		0.00
0.00	0.00		0.00
0.00	0.00		0.00
0.00	0.00		0.00
-0.01	0.00	0.00	0.01
0.00	0.00		-0.02
0.00	0.00	-0.03	0.00
-0.02	-0.14	-0.06	-0.01
0.00	0.00	0.03	0.05

D. Error Ellipses

Point Error Ellipses

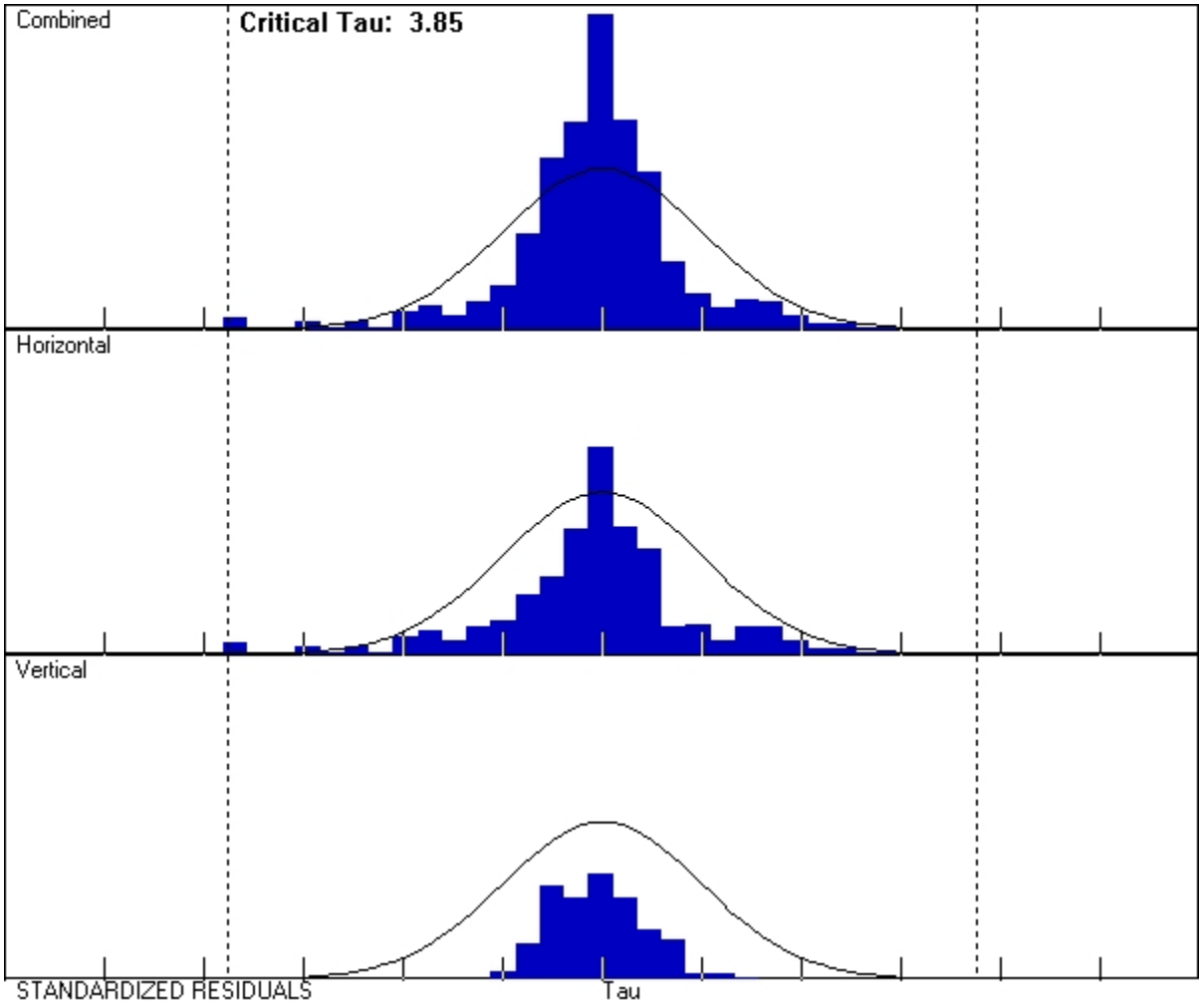
004B	004C	001B
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
001C	**002C**	**002B**
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
003B	**003C**	**005B**
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
006B	**007B**	**A403**
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		

CHUC	Y400	008B
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
009B	**011B**	**SR7 40**
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
T400	**010C**	**005C**
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		
006C	**007C**	**008C**
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		

009C	011C	BTC3001
		
Tick Size: 0.0100sft Horizontal Bivariate Scalar: 2.45σ Vertical Univariate Scalar: 1.96σ		

E. Histograms of Standardized Residuals

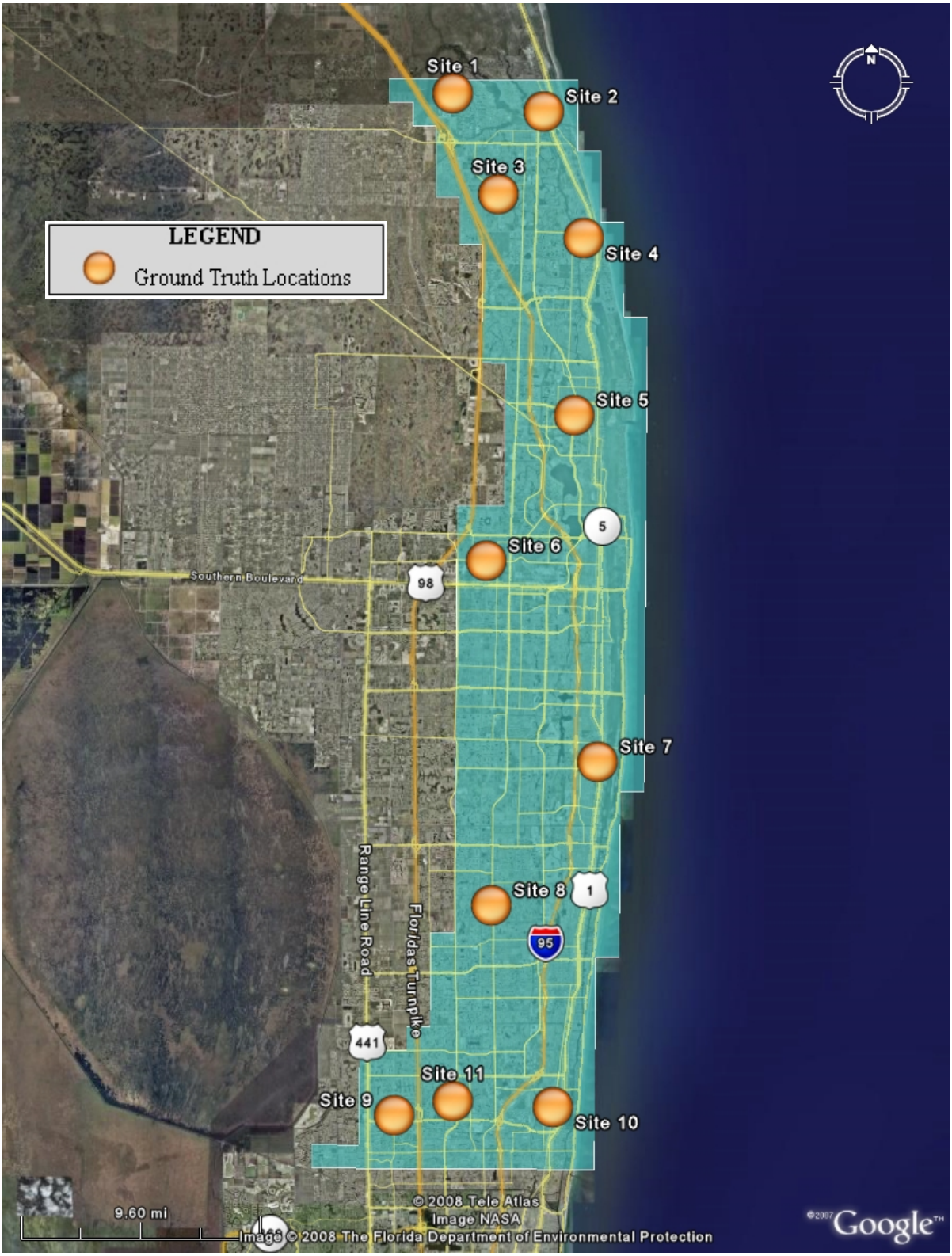
Histograms of Standardized Residuals



GROUND TRUTH SURVEY

A. Map of Ground Truth Locations

Ground Control Areas

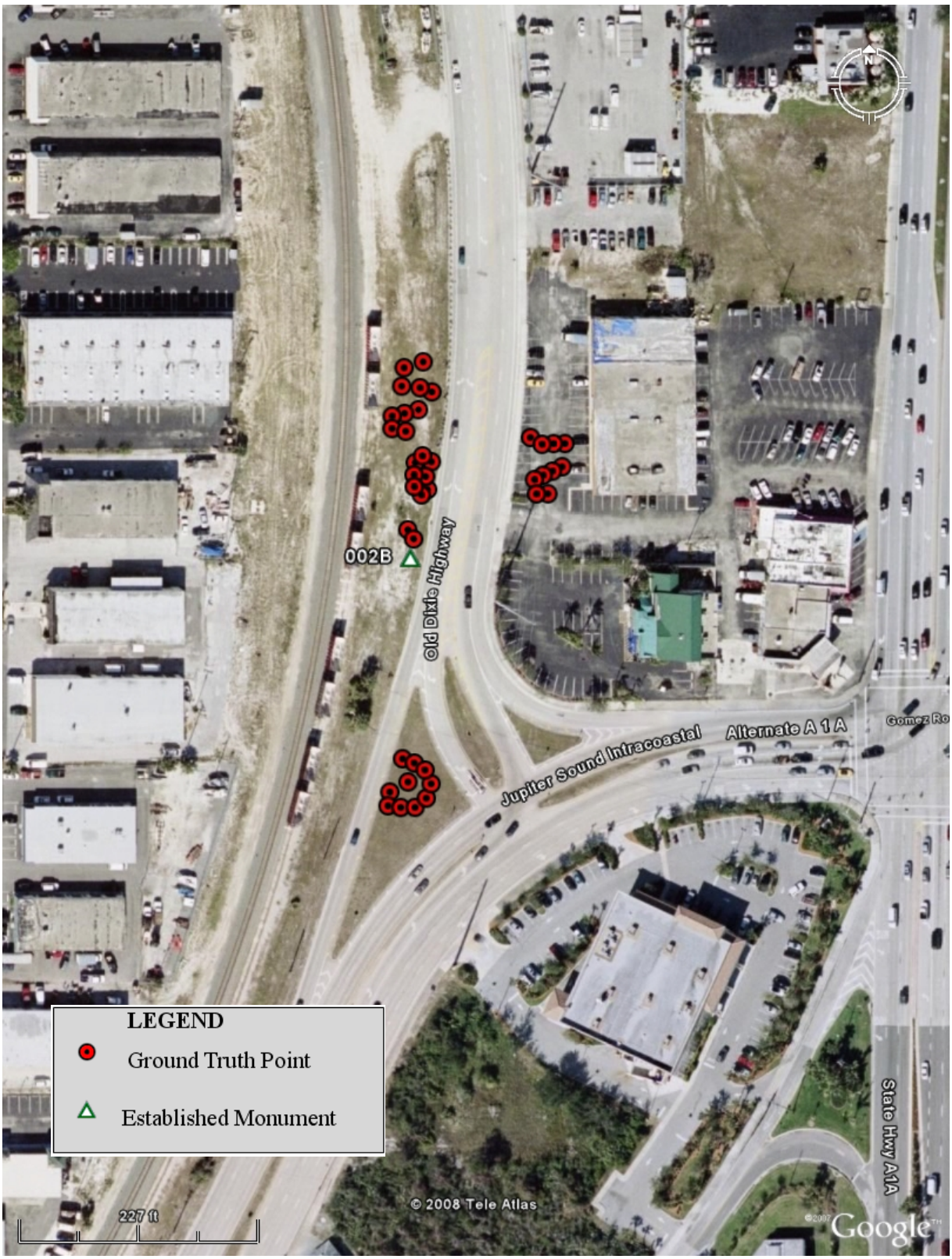


The individual check sites can be seen in detail on the following pages.

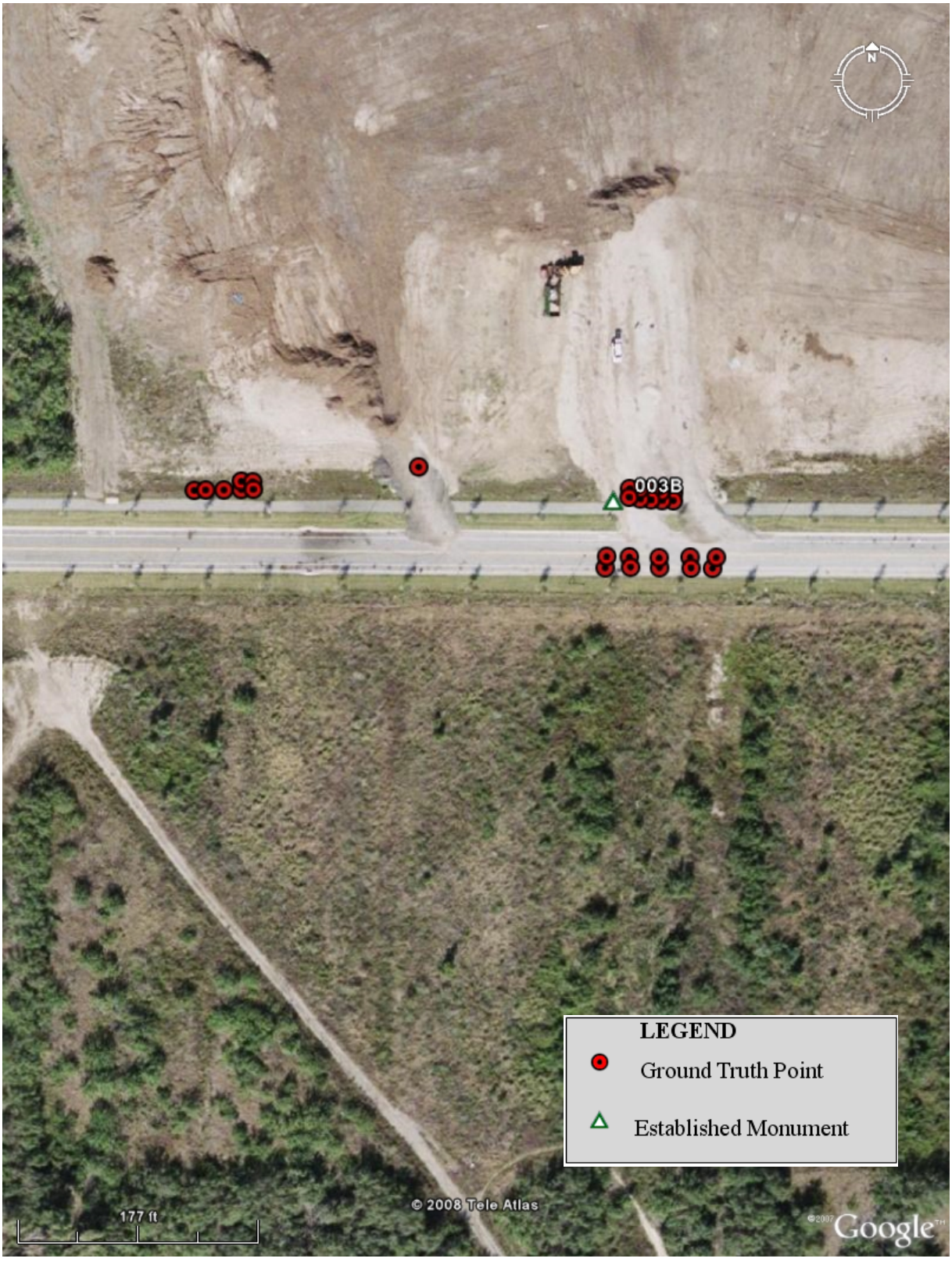
B. Ground Truth Site Maps

SITE 1 - Ground Truth Points

SITE 2 - Ground Truth Points



SITE 3 - Ground Truth Points

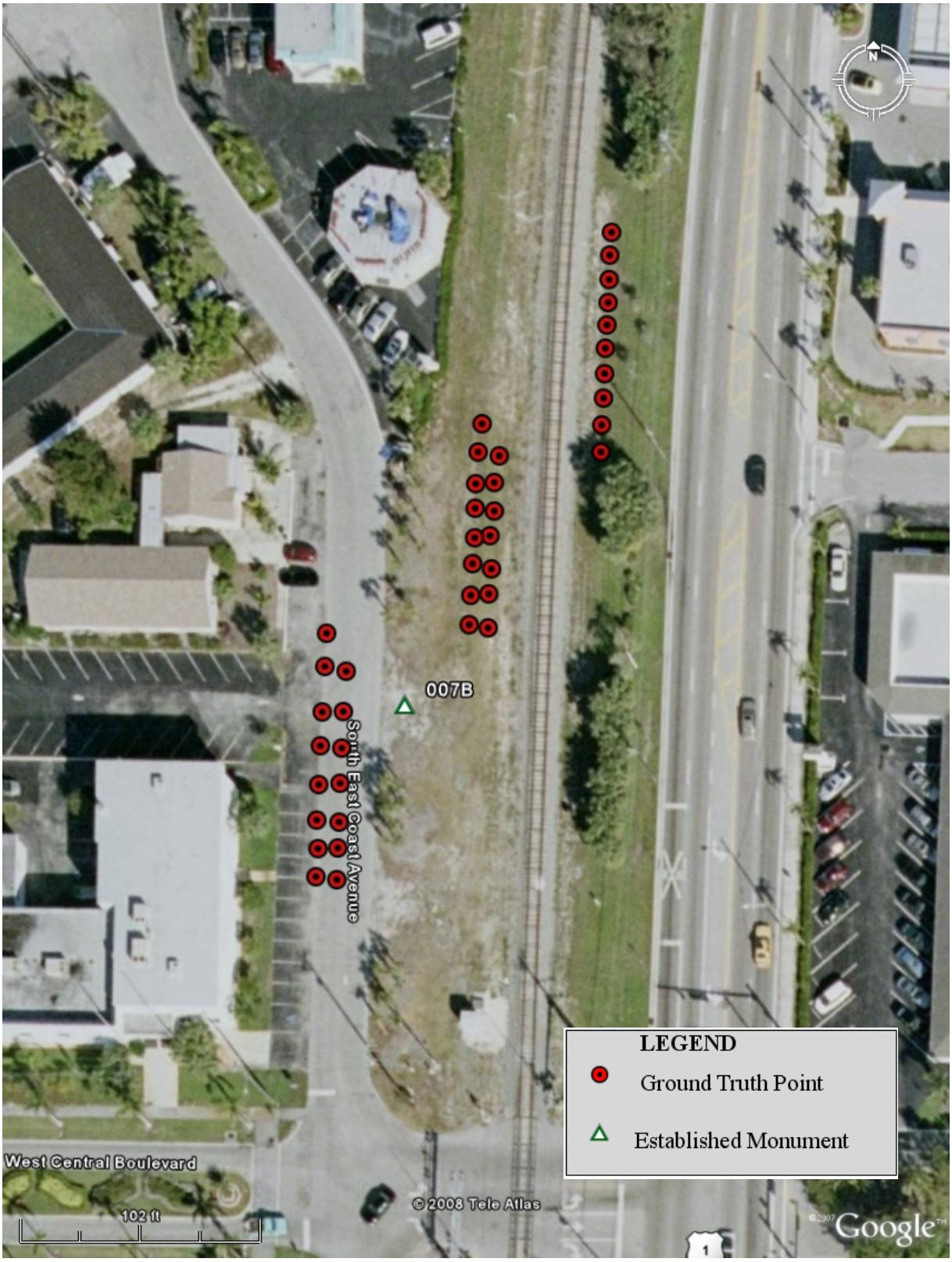


SITE 4 - Ground Truth Points

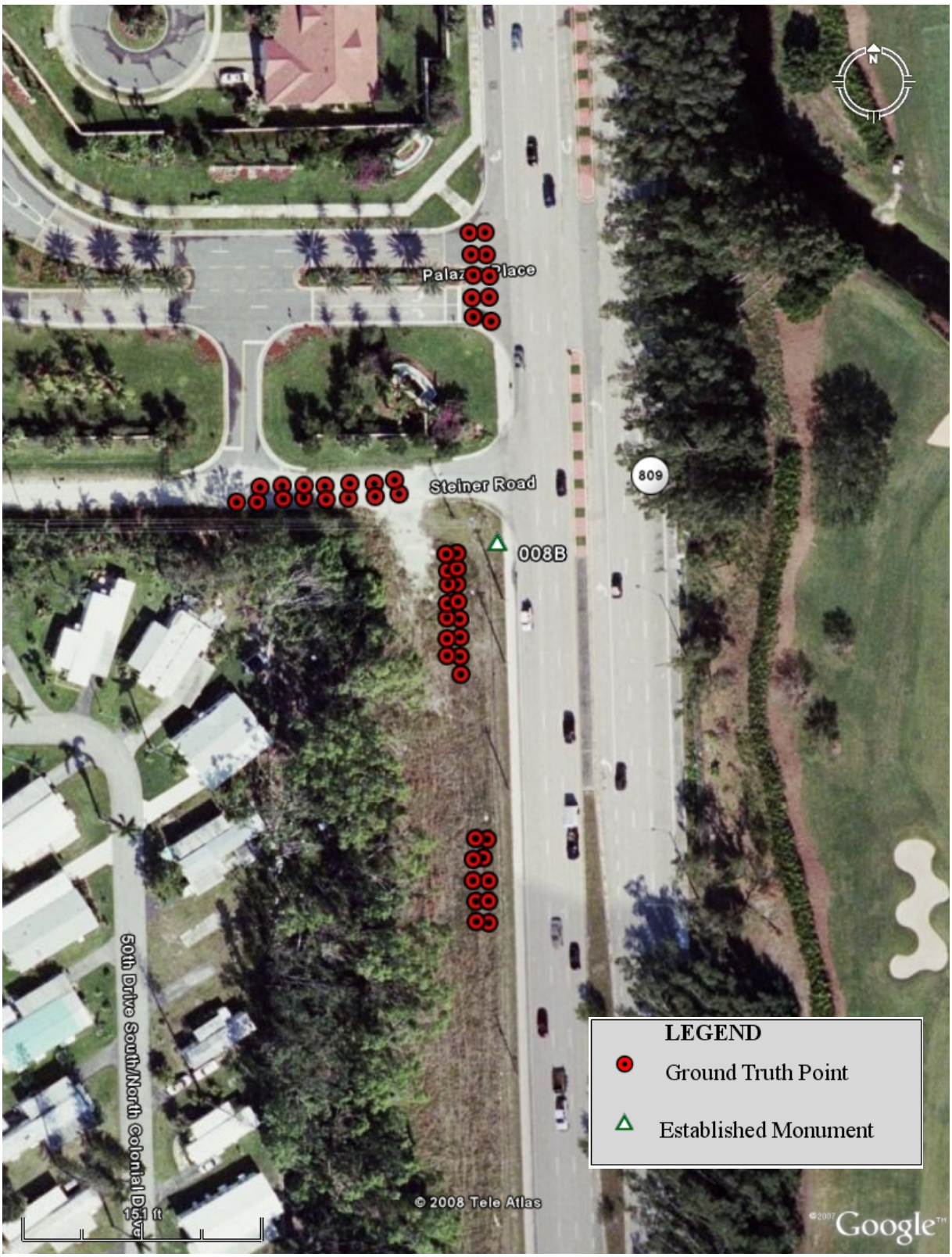
SITE 5 - Ground Truth Points

SITE 6 - Ground Truth Points

SITE 7 - Ground Truth Points



SITE 8 - Ground Truth Points



SITE 9 - Ground Truth Points

SITE 10 - Ground Truth Points

SITE 11 - Ground Truth Points

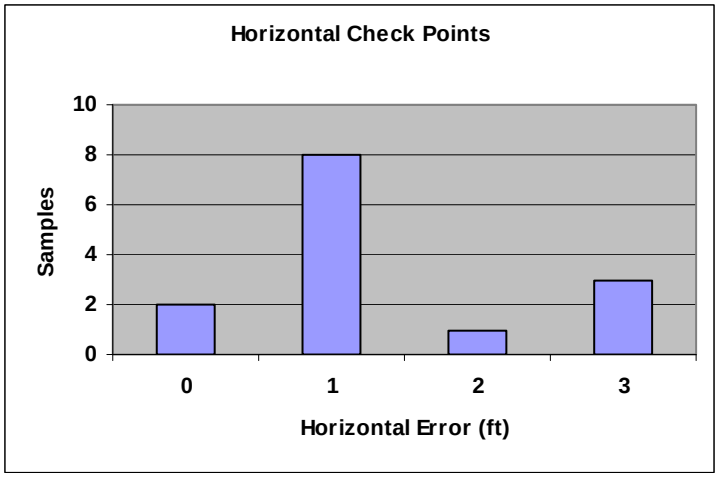
C. Horizontal Accuracy Assessment

HORIZONTAL ACCURACY CHECK POINTS

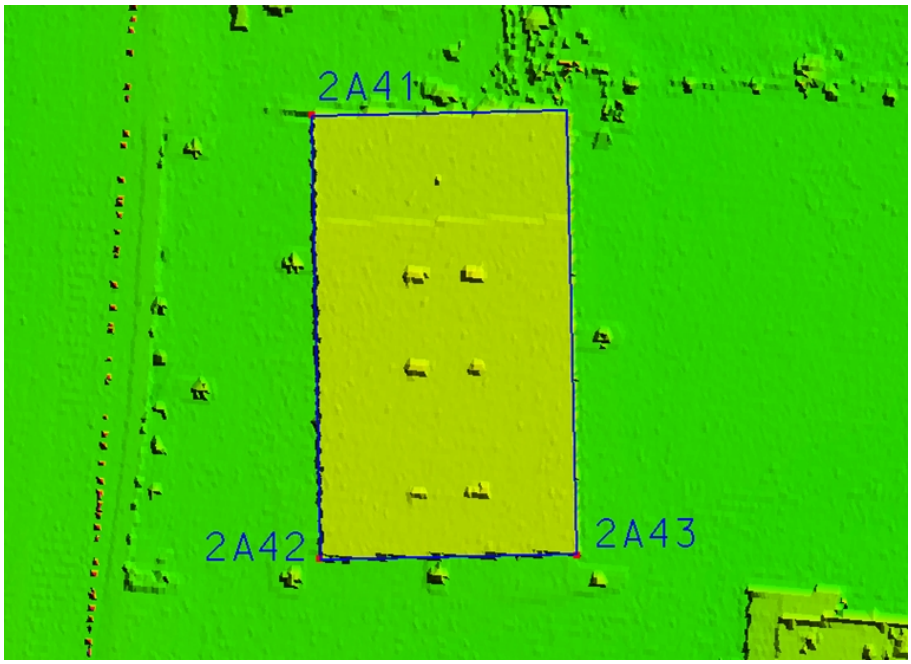
Horizontal check points were collected at several sites within the project area, in order to verify the horizontal accuracy of the LiDAR data. These check points are collected in the same locations as the vertical ground truth data, from base stations that were established in the static GPS network. The horizontal check points were collected with a total station and data collector.

After the LiDAR data has been processed these horizontal check points are plotted and compared to the approximate positions from the LiDAR data set. For this purpose building corners are most often used, because they can be identified from the LiDAR data and the corners can be estimated. Distances are measured from the estimated LiDAR positions to the surveyed positions. The statistics are shown below, and screen captures of the LiDAR derived features are shown on the following pages.

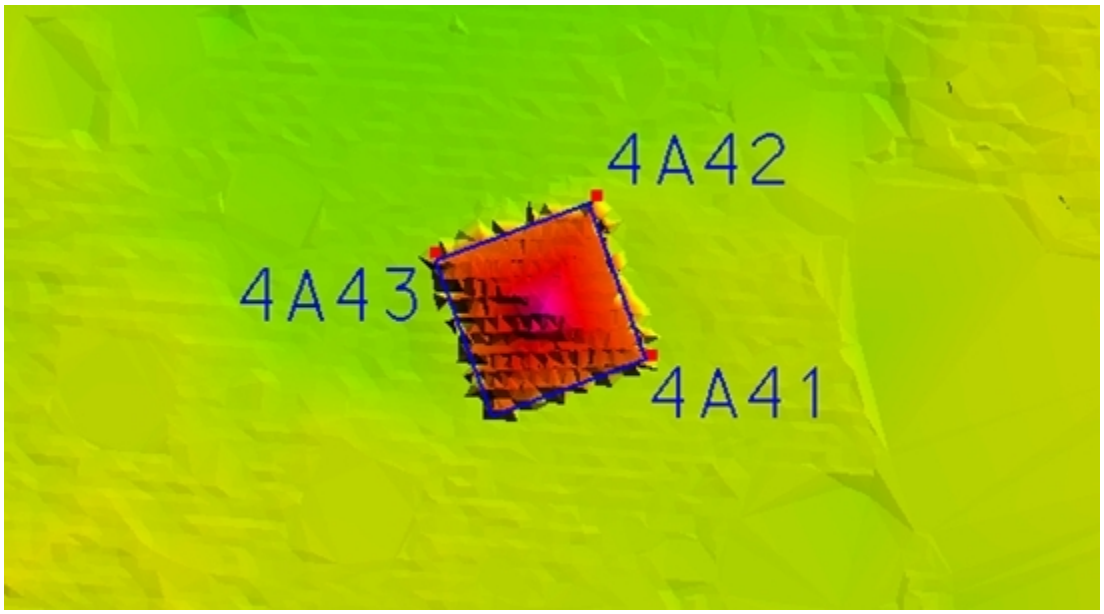
Horizontal Check Points (ft)	
RMSEr	1.73
Mean	1.40
Standard Error	0.28
Median	0.99
Standard Deviation	1.06
Sample Variance	1.11
Kurtosis	-0.28
Skewness	1.04
Range	3.16
Minimum	0.24
Maximum	3.40



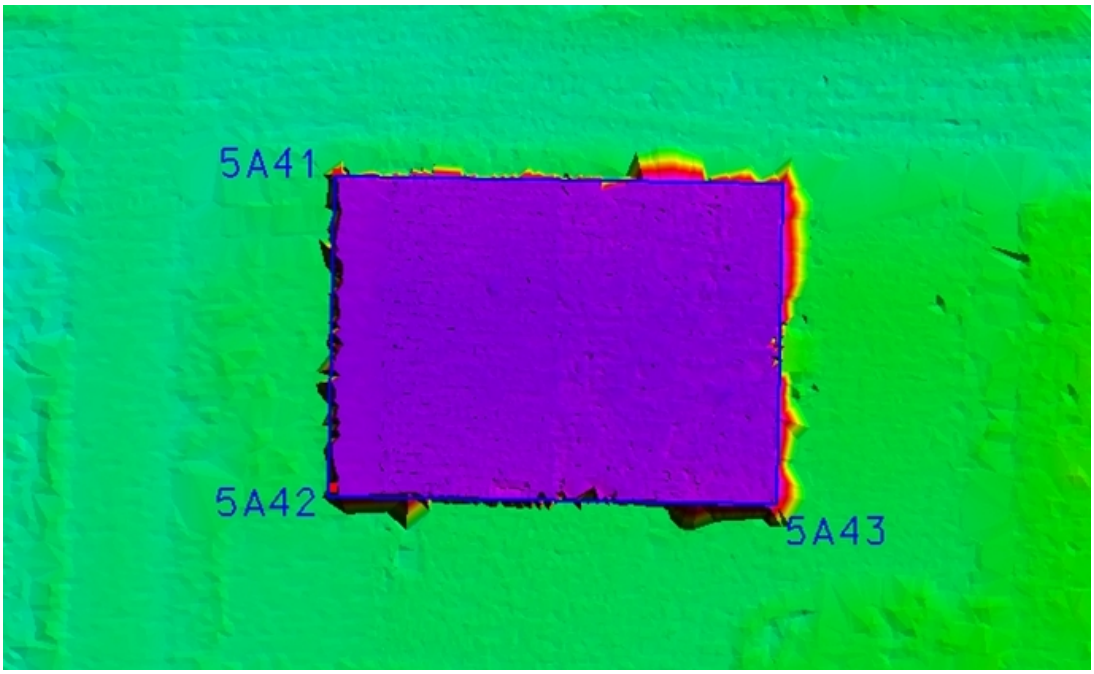
Site 2 – Horizontal Check Point



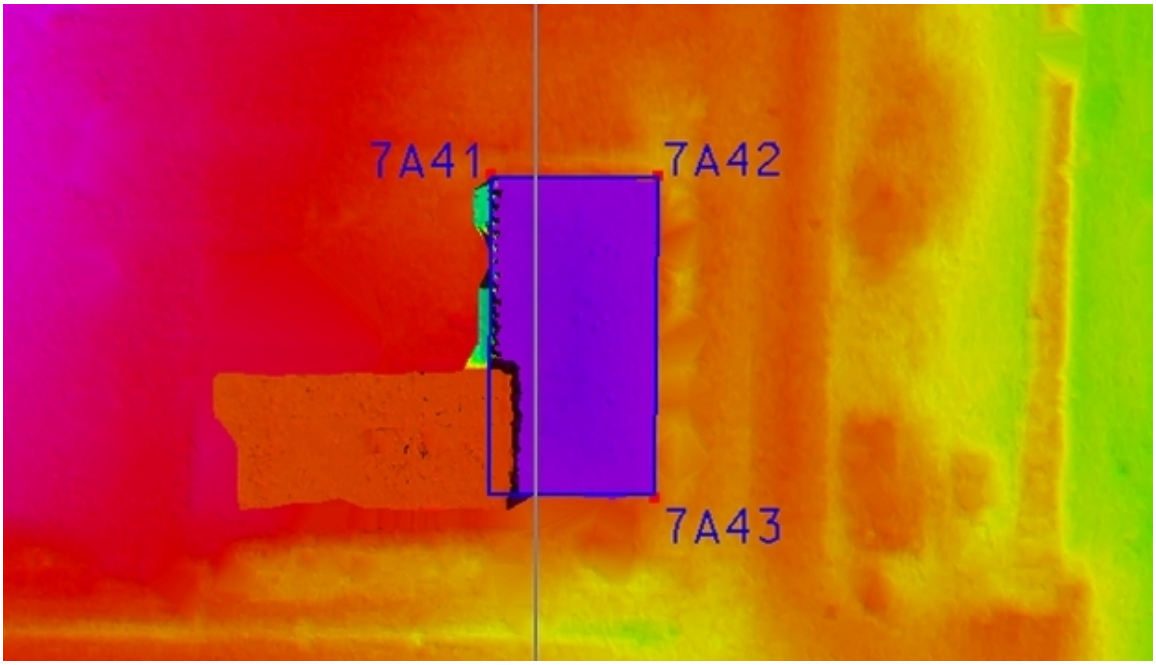
Site 4 – Horizontal Check Point



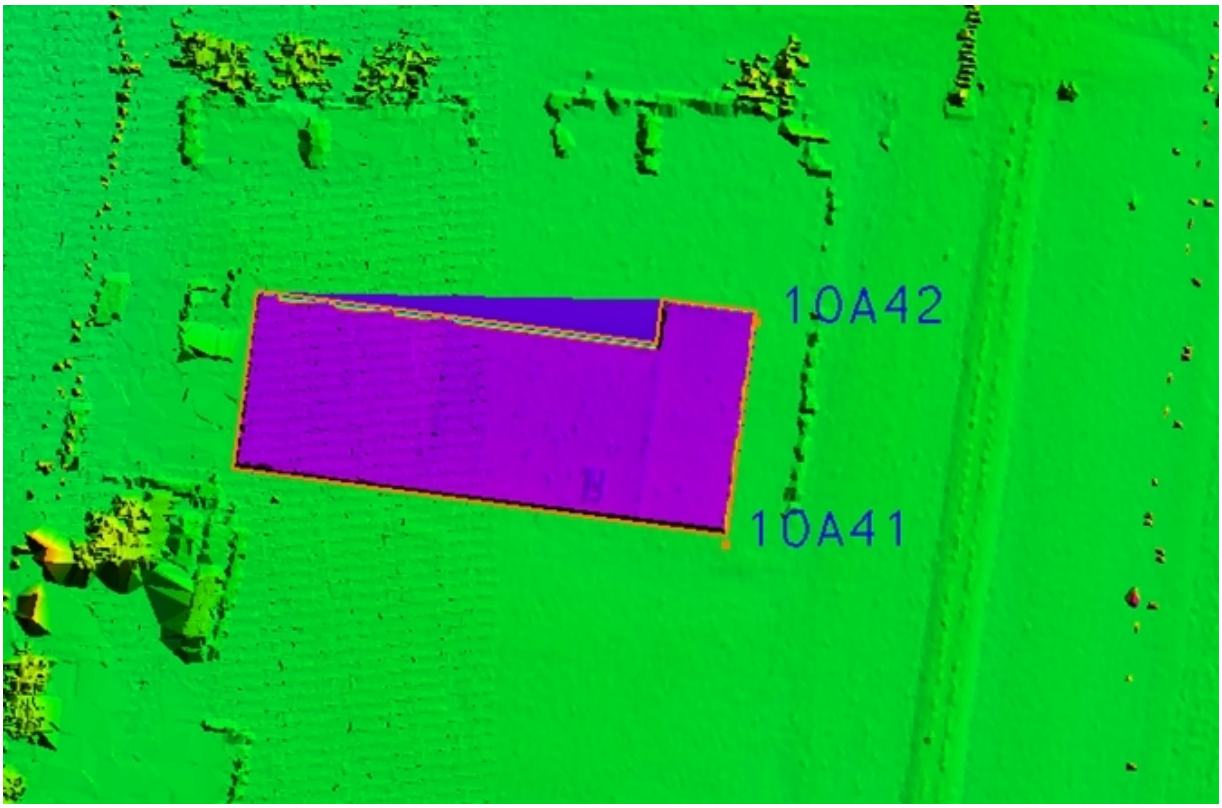
Site 5 – Horizontal Check Points



Site 7 – Horizontal Check Points



Site 10 – Horizontal Check Points



CONTROL MARK DATA SHEETS

```
DH3834 ************************************************************************
DH3834  CORS       -  This is a GPS Continuously Operating Reference Station.
DH3834  DESIGNATION -  LAUDERDALE CORS ARP
DH3834  CORS_ID    -  LAUD
DH3834  PID        -  DH3834
DH3834  STATE/COUNTY-  FL/BROWARD
DH3834  USGS QUAD   -  FORT LAUDERDALE NORTH (1995)
DH3834
DH3834                    *CURRENT SURVEY CONTROL
DH3834  ______________________________________________________________________
DH3834* NAD 83(CORS)-  26 11 46.34168(N)    080 10 23.01438(W)     ADJUSTED
DH3834* NAVD 88     -
DH3834  ______________________________________________________________________
DH3834  EPOCH DATE  -       2002.00
DH3834  X           -     977,399.485 (meters)                 COMP
DH3834  Y           -  -5,642,719.499 (meters)                 COMP
DH3834  Z           -   2,798,575.179 (meters)                 COMP
DH3834  ELLIP HEIGHT-         -18.141 (meters)          (06/??/05) GPS OBS
DH3834  GEOID HEIGHT-         -25.60  (meters)                 GEOID03
DH3834
DH3834  HORZ ORDER  -  SPECIAL (CORS)
DH3834  ELLP ORDER  -  SPECIAL (CORS)
DH3834
DH3834.ITRF positions are available for this station.
DH3834.The coordinates were established by GPS observations
DH3834.and adjusted by the National Geodetic Survey in June 2005.
DH3834.The coordinates are valid at the epoch date displayed above.
DH3834.The epoch date for horizontal control is a decimal equivalence
DH3834.of Year/Month/Day.
DH3834
DH3834
DH3834.The PID for the CORS L1 Phase Center is DH3835.
DH3834
DH3834.The XYZ, and position/ellipsoidal ht. are equivalent.
DH3834
DH3834.The ellipsoidal height was determined by GPS observations
DH3834.and is referenced to NAD 83.
DH3834
DH3834.The geoid height was determined by GEOID03.
DH3834
DH3834;                North         East     Units Scale Factor Converg.
DH3834;SPC FL E     -  206,614.443   282,650.275   MT  1.00002549   +0 21 54.3
DH3834;SPC FL E     -  677,867.55    927,328.44   sFT  1.00002549   +0 21 54.3
DH3834
DH3834!           -  Elev Factor  x  Scale Factor =   Combined Factor
DH3834!SPC FL E     -  1.00000285  x   1.00002549  =   1.00002834
DH3834
DH3834                    SUPERSEDED SURVEY CONTROL
DH3834
DH3834.No superseded survey control is available for this station.
DH3834
DH3834_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNJ8262297676(NAD 83)
DH3834_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
DH3834
DH3834                    STATION DESCRIPTION
DH3834
DH3834'DESCRIBED BY NATIONAL GEODETIC SURVEY 2005
DH3834'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
DH3834'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
DH3834'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
DH3834'   FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
DH3834'   HTTP://WWW.NGS.NOAA.GOV  UNDER PRODUCTS AND SERVICES.
```

```
DF7050 ********************************************************************
DF7050  CORS       -  This is a GPS Continuously Operating Reference Station.
DF7050  DESIGNATION -  MIAMI TNT CORS ARP
DF7050  CORS_ID    -  MTNT
DF7050  PID        -  DF7050
DF7050  STATE/COUNTY-  FL/COLLIER
DF7050  USGS QUAD  -  FIFTYMILE BEND (1995)
DF7050
DF7050                    *CURRENT SURVEY CONTROL
DF7050 ______________________________________________________________________
DF7050* NAD 83(CORS)-  25 51 56.76081(N)    080 54 25.18701(W)     ADJUSTED
DF7050* NAVD 88    -
DF7050 ______________________________________________________________________
DF7050  EPOCH DATE  -       2002.00
DF7050  X          -    907,579.127 (meters)                 COMP
DF7050  Y          - -5,670,639.703 (meters)                 COMP
DF7050  Z          -  2,765,679.841 (meters)                 COMP
DF7050  ELLIP HEIGHT-        -18.942 (meters)         (08/??/03) GPS OBS
DF7050  GEOID HEIGHT-         -24.29  (meters)                 GEOID03
DF7050
DF7050  HORZ ORDER  -  SPECIAL (CORS)
DF7050  ELLP ORDER  -  SPECIAL (CORS)
DF7050
DF7050.ITRF positions are available for this station.
DF7050.The coordinates were established by GPS observations
DF7050.and adjusted by the National Geodetic Survey in August 2003.
DF7050.The coordinates are valid at the epoch date displayed above.
DF7050.The epoch date for horizontal control is a decimal equivalence
DF7050.of Year/Month/Day.
DF7050
DF7050
DF7050.The PID for the CORS L1 Phase Center is DF7051.
DF7050
DF7050.The XYZ, and position/ellipsoidal ht. are equivalent.
DF7050
DF7050.The ellipsoidal height was determined by GPS observations
DF7050.and is referenced to NAD 83.
DF7050
DF7050.The geoid height was determined by GEOID03.
DF7050
DF7050;                 North         East     Units Scale Factor Converg.
DF7050;SPC FL E     -   169,747.743   209,321.320   MT  0.99994225   +0 02 26.1
DF7050;SPC FL E     -   556,914.05    686,748.36   sFT  0.99994225   +0 02 26.1
DF7050
DF7050!           -  Elev Factor  x  Scale Factor =   Combined Factor
DF7050!SPC FL E     -   1.00000298  x   0.99994225  =   0.99994523
DF7050
DF7050                     SUPERSEDED SURVEY CONTROL
DF7050
DF7050.No superseded survey control is available for this station.
DF7050
DF7050_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNJ0931860822(NAD 83)
DF7050_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
DF7050
DF7050                     STATION DESCRIPTION
DF7050
DF7050'DESCRIBED BY NATIONAL GEODETIC SURVEY 2003
DF7050'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
DF7050'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
DF7050'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
DF7050'   FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
DF7050'   HTTP://WWW.NGS.NOAA.GOV  UNDER PRODUCTS AND SERVICES.
```

```
DE9138 **********************************************************************
DE9138  CORS        -  This is a GPS Continuously Operating Reference Station.
DE9138  DESIGNATION -  OKEECHOBEE CORS ARP
DE9138  CORS_ID     -  OKCB
DE9138  PID         -  DE9138
DE9138  STATE/COUNTY-  FL/OKEECHOBEE
DE9138  USGS QUAD   -  TAYLOR CREEK SE (1972)
DE9138
DE9138                    *CURRENT SURVEY CONTROL
DE9138  ______________________________________________________________________
DE9138* NAD 83(CORS)-  27 15 57.71572(N)    080 51 19.18214(W)     ADJUSTED
DE9138* NAVD 88     -
DE9138  ______________________________________________________________________
DE9138  EPOCH DATE  -       2002.00
DE9138  X           -     901,666.240 (meters)                  COMP
DE9138  Y           -  -5,601,322.295 (meters)                  COMP
DE9138  Z           -   2,904,443.074 (meters)                  COMP
DE9138  ELLIP HEIGHT-        -13.755 (meters)          (12/??/02) GPS OBS
DE9138  GEOID HEIGHT-         -26.59  (meters)                  GEOID03
DE9138
DE9138  HORZ ORDER  -  SPECIAL (CORS)
DE9138  ELLP ORDER  -  SPECIAL (CORS)
DE9138
DE9138.ITRF positions are available for this station.
DE9138.The coordinates were established by GPS observations
DE9138.and adjusted by the National Geodetic Survey in December 2002.
DE9138.The coordinates are valid at the epoch date displayed above.
DE9138.The epoch date for horizontal control is a decimal equivalence
DE9138.of Year/Month/Day.
DE9138
DE9138
DE9138.The PID for the CORS L1 Phase Center is DI1672.
DE9138
DE9138.The XYZ, and position/ellipsoidal ht. are equivalent.
DE9138
DE9138.The ellipsoidal height was determined by GPS observations
DE9138.and is referenced to NAD 83.
DE9138
DE9138.The geoid height was determined by GEOID03.
DE9138
DE9138;                 North         East     Units Scale Factor Converg.
DE9138;SPC FL E     -   324,888.459   214,324.588   MT  0.99994371   +0 03 58.6
DE9138;SPC FL E     - 1,065,904.89    703,163.25    sFT  0.99994371   +0 03 58.6
DE9138
DE9138!             -  Elev Factor  x  Scale Factor =   Combined Factor
DE9138!SPC FL E     -   1.00000216  x   0.99994371  =   0.99994587
DE9138
DE9138                      SUPERSEDED SURVEY CONTROL
DE9138
DE9138.No superseded survey control is available for this station.
DE9138
DE9138_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNL1432015910(NAD 83)
DE9138_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
DE9138
DE9138                      STATION DESCRIPTION
DE9138
DE9138'DESCRIBED BY NATIONAL GEODETIC SURVEY 2002
DE9138'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
DE9138'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
DE9138'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
DE9138'   FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
DE9138'   HTTP://WWW.NGS.NOAA.GOV  UNDER PRODUCTS AND SERVICES.
```

```
DG9798 ***********************************************************************
DG9798  CORS       -  This is a GPS Continuously Operating Reference Station.
DG9798  DESIGNATION -  WEST PALM CORS ARP
DG9798  CORS_ID    -  PBCH
DG9798  PID        -  DG9798
DG9798  STATE/COUNTY-  FL/PALM BEACH
DG9798  USGS QUAD  -  DELTA (1983)
DG9798
DG9798                    *CURRENT SURVEY CONTROL
DG9798  ______________________________________________________________________
DG9798* NAD 83(CORS)-  26 50 46.63829(N)    080 13 09.30061(W)     ADJUSTED
DG9798* NAVD 88     -
DG9798  ______________________________________________________________________
DG9798  EPOCH DATE  -       2002.00
DG9798  X          -     967,386.974 (meters)                COMP
DG9798  Y          -  -5,611,813.850 (meters)                COMP
DG9798  Z          -   2,863,023.043 (meters)                COMP
DG9798  ELLIP HEIGHT-        -15.309 (meters)         (04/??/05) GPS OBS
DG9798  GEOID HEIGHT-         -26.49  (meters)                GEOID03
DG9798
DG9798  HORZ ORDER  -  SPECIAL (CORS)
DG9798  ELLP ORDER  -  SPECIAL (CORS)
DG9798
DG9798.ITRF positions are available for this station.
DG9798.The coordinates were established by GPS observations
DG9798.and adjusted by the National Geodetic Survey in April 2005.
DG9798.The coordinates are valid at the epoch date displayed above.
DG9798.The epoch date for horizontal control is a decimal equivalence
DG9798.of Year/Month/Day.
DG9798
DG9798
DG9798.The PID for the CORS L1 Phase Center is DG9799.
DG9798
DG9798.The XYZ, and position/ellipsoidal ht. are equivalent.
DG9798
DG9798.The ellipsoidal height was determined by GPS observations
DG9798.and is referenced to NAD 83.
DG9798
DG9798.The geoid height was determined by GEOID03.
DG9798
DG9798;                North        East     Units Scale Factor Converg.
DG9798;SPC FL E    -   278,612.216   277,595.193   MT  1.00001548   +0 21 09.4
DG9798;SPC FL E    -   914,080.25    910,743.56   sFT  1.00001548   +0 21 09.4
DG9798
DG9798!           - Elev Factor  x  Scale Factor =   Combined Factor
DG9798!SPC FL E    -   1.00000241  x   1.00001548  =   1.00001789
DG9798
DG9798                    SUPERSEDED SURVEY CONTROL
DG9798
DG9798.No superseded survey control is available for this station.
DG9798
DG9798_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK7756969649(NAD 83)
DG9798_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA
DG9798
DG9798                    STATION DESCRIPTION
DG9798
DG9798'DESCRIBED BY NATIONAL GEODETIC SURVEY 2005
DG9798'STATION IS A GPS CORS.  LATEST INFORMATION INCLUDING POSITIONS AND
DG9798'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE
DG9798'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.
DG9798'   FTP CORS.NGS.NOAA.GOV: CORS/COORD  AND  CORS/STATION_LOG
DG9798'   HTTP://WWW.NGS.NOAA.GOV  UNDER PRODUCTS AND SERVICES.
```

```
AJ8883 **********************************************************************
AJ8883  DESIGNATION -  D 548
AJ8883  PID         -  AJ8883
AJ8883  STATE/COUNTY-  FL/PALM BEACH
AJ8883  USGS QUAD   -  RIVIERA BEACH (1983)
AJ8883
AJ8883                    *CURRENT SURVEY CONTROL
AJ8883  ______________________________________________________________________
AJ8883* NAD 83(1999)-  26 46 15.23186(N)    080 05 37.31098(W)     ADJUSTED
AJ8883* NAVD 88     -         3.843  (meters)      12.61   (feet)  ADJUSTED
AJ8883  ______________________________________________________________________
AJ8883  X           -     980,328.856 (meters)                  COMP
AJ8883  Y           -  -5,613,385.297 (meters)                  COMP
AJ8883  Z           -   2,855,564.236 (meters)                  COMP
AJ8883  LAPLACE CORR-          -3.95  (seconds)                 DEFLEC99
AJ8883  ELLIP HEIGHT-         -22.703 (meters)          (12/12/02) GPS OBS
AJ8883  GEOID HEIGHT-         -26.55  (meters)                  GEOID03
AJ8883  DYNAMIC HT  -          3.837 (meters)      12.59  (feet)  COMP
AJ8883  MODELED GRAV-     979,117.2   (mgal)                    NAVD 88
AJ8883
AJ8883  HORZ ORDER  -  FIRST
AJ8883  VERT ORDER  -  FIRST     CLASS II
AJ8883  ELLP ORDER  -  THIRD     CLASS I
AJ8883
AJ8883.The horizontal coordinates were established by GPS observations
AJ8883.and adjusted by the National Geodetic Survey in December 2002.
AJ8883
AJ8883.The orthometric height was determined by differential leveling
AJ8883.and adjusted by the NATIONAL GEODETIC SURVEY in May 2002.
AJ8883
AJ8883.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AJ8883
AJ8883.The Laplace correction was computed from DEFLEC99 derived deflections.
AJ8883
AJ8883.The ellipsoidal height was determined by GPS observations
AJ8883.and is referenced to NAD 83.
AJ8883
AJ8883.The geoid height was determined by GEOID03.
AJ8883
AJ8883.The dynamic height is computed by dividing the NAVD 88
AJ8883.geopotential number by the normal gravity value computed on the
AJ8883.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AJ8883.degrees latitude (g = 980.6199 gals.).
AJ8883
AJ8883.The modeled gravity was interpolated from observed gravity values.
AJ8883
AJ8883;                North         East     Units Scale Factor Converg.
AJ8883;SPC FL E     -   270,341.729   290,133.482   MT  1.00004144   +0 24 29.7
AJ8883;SPC FL E     -   886,946.16    951,879.60   sFT  1.00004144   +0 24 29.7
AJ8883;UTM  17      - 2,961,381.471   590,102.728   MT  0.99970022   +0 24 29.7
AJ8883
AJ8883!             - Elev Factor  x  Scale Factor =   Combined Factor
AJ8883!SPC FL E     -  1.00000357  x   1.00004144  =   1.00004501
AJ8883!UTM  17      -  1.00000357  x   0.99970022  =   0.99970379
AJ8883
AJ8883                     SUPERSEDED SURVEY CONTROL
AJ8883
AJ8883  NAVD 88 (12/12/02)    3.84   (m)          12.6    (f) LEVELING    3
AJ8883
AJ8883.Superseded values are not recommended for survey control.
AJ8883.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AJ8883.See file dsdata.txt to determine how the superseded data were derived.
```

AJ8883
AJ8883_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK9010361381(NAD 83)
AJ8883_MARKER: DD = SURVEY DISK
AJ8883_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
AJ8883_STAMPING: D 548 2001 CERP
AJ8883_MARK LOGO: USE
AJ8883_PROJECTION: RECESSED 10 CENTIMETERS
AJ8883_MAGNETIC: O = OTHER; SEE DESCRIPTION
AJ8883_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AJ8883+STABILITY: SURFACE MOTION
AJ8883_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AJ8883+SATELLITE: SATELLITE OBSERVATIONS - April 19, 2002
AJ8883
AJ8883 HISTORY   - Date   Condition   Report By
AJ8883 HISTORY   - 20011101 MONUMENTED   MOREKL
AJ8883 HISTORY   - 20020419 GOOD   MAPTEC
AJ8883
AJ8883   STATION DESCRIPTION
AJ8883
AJ8883'DESCRIBED BY MORGAN AND EKLUND INC 2001 (MAB)
AJ8883'THE STATION IS LOCATED ABOUT 58.8 KM (36.5 MILES) EAST NORTHEAST OF
AJ8883'BELLE GLADE, ABOUT 19.0
AJ8883'KM (11.8 MILES) SOUTH OF JUPITER, ABOUT 47.7 KM (29.7 MILES) SOUTHEAST
AJ8883'OF INDIANTOWN IN
AJ8883'SECTION 31, TOWNSHIP 42 SOUTH, RANGE 43 EAST.
AJ8883'
AJ8883'OWNERSHIP PALM BEACH COUNTY (STATE ROAD 710 RIGHT OF WAY).
AJ8883'
AJ8883'TO REACH THE STATION FROM THE INTERSECTION OF INTERSTATE 95 AND COUNTY
AJ8883'ROAD 809A
AJ8883'(NORTHLAKE BLVD.), GO WEST ON COUNTY ROAD 809A FOR 5.5 KM (3.4 MILES)
AJ8883'TO THE INTERSECTION
AJ8883'OF COUNTY ROAD 809A AND STATE ROAD 710, TURN LEFT AND GO SOUTHEAST ON
AJ8883'STATE ROAD 710
AJ8883'FOR 7.4 KM (4.6 MILES) TO THE MARK ON THE LEFT.
AJ8883'
AJ8883'THE MARK IS 25.6 METERS (84.1 FEET) NORTH OF THE NORTH EDGE OF
AJ8883'PAVEMENT OF STATE ROAD
AJ8883'710, 55.6 METERS (182.3 FEET) WEST OF A CONCRETE UTILITY POLE, 11.3
AJ8883'METERS (37.0 FEET)
AJ8883'SOUTHEAST OF A CONCRETE UTILITY POLE AND 9.2 METERS (30.3 FEET) SOUTH
AJ8883'OF A CARSONITE
AJ8883'WITNESS POST AND 8 FOOT CHAIN LINK FENCE.
AJ8883'
AJ8883'NOTE A MAGNET WAS PLACED 0.21 METERS (0.7 FEET) SOUTH OF AND 0.1
AJ8883'METERS (0.3 FEET) BELOW
AJ8883'   THE MARK.
AJ8883'
AJ8883'
AJ8883
AJ8883   STATION RECOVERY (2002)
AJ8883
AJ8883'RECOVERY NOTE BY MAPTECH INCORPORATED 2002 (CDP)
AJ8883'THE STATION IS LOCATED ABOUT 58.8 KM (36.5 MILES) EAST NORTHEAST OF
AJ8883'BELLE GLADE, ABOUT 19.0
AJ8883'KM (11.8 MILES) SOUTH OF JUPITER, ABOUT 47.7 KM (29.7 MILES) SOUTHEAST
AJ8883'OF INDIANTOWN IN
AJ8883'SECTION 31, TOWNSHIP 42 SOUTH, RANGE 43 EAST.
AJ8883'
AJ8883'OWNERSHIP PALM BEACH COUNTY (STATE ROAD 710 RIGHT OF WAY).
AJ8883'
AJ8883'TO REACH THE STATION FROM THE INTERSECTION OF INTERSTATE 95 AND COUNTY

AJ8883'ROAD 809A
AJ8883'(NORTHLAKE BLVD.), GO WEST ON COUNTY ROAD 809A FOR 5.5 KM (3.4 MILES)
AJ8883'TO THE INTERSECTION
AJ8883'OF COUNTY ROAD 809A AND STATE ROAD 710, TURN LEFT AND GO SOUTHEAST ON
AJ8883'STATE ROAD 710
AJ8883'FOR 7.4 KM (4.6 MILES) TO THE MARK ON THE LEFT.
AJ8883'
AJ8883'THE MARK IS 25.6 METERS (84.1 FEET) NORTH OF THE NORTH EDGE OF
AJ8883'PAVEMENT OF STATE ROAD
AJ8883'710, 55.6 METERS (182.3 FEET) WEST OF A CONCRETE UTILITY POLE, 11.3
AJ8883'METERS (37.0 FEET)
AJ8883'SOUTHEAST OF A CONCRETE UTILITY POLE AND 9.2 METERS (30.3 FEET) SOUTH
AJ8883'OF A CARSONITE
AJ8883'WITNESS POST AND 8 FOOT CHAIN LINK FENCE.
AJ8883'
AJ8883'NOTE A MAGNET WAS PLACED 0.21 METERS (0.7 FEET) SOUTH OF AND 0.1
AJ8883'METERS (0.3 FEET) BELOW
AJ8883' THE MARK.
AJ8883'
AJ8883'STATION RECOVERY (2002)
AJ8883'RECOVERY NOTE BY MAPTECH, INCORPORATED 2002 (CDP) . RECOVERED AS
AJ8883'DESCRIBED.
AJ8883'
AJ8883'

```
AD8367 ************************************************************************
AD8367  DESIGNATION -  CHUCK
AD8367  PID         -  AD8367
AD8367  STATE/COUNTY-  FL/PALM BEACH
AD8367  USGS QUAD   -  LAKE WORTH (1983)
AD8367
AD8367                     *CURRENT SURVEY CONTROL
AD8367  ______________________________________________________________________
AD8367* NAD 83(1999)-  26 30 25.71611(N)    080 03 46.67268(W)     ADJUSTED
AD8367* NAVD 88     -        3.9    (meters)      13.     (feet)  VERTCON
AD8367  ______________________________________________________________________
AD8367  X          -     985,600.831 (meters)                  COMP
AD8367  Y          -  -5,625,765.223 (meters)                  COMP
AD8367  Z          -   2,829,443.201 (meters)                  COMP
AD8367  LAPLACE CORR-          -4.45  (seconds)                DEFLEC99
AD8367  ELLIP HEIGHT-         -22.304 (meters)          (07/06/01) GPS OBS
AD8367  GEOID HEIGHT-         -26.12  (meters)                  GEOID03
AD8367
AD8367  HORZ ORDER  -  FIRST
AD8367  ELLP ORDER  -  FOURTH    CLASS II
AD8367
AD8367.The horizontal coordinates were established by GPS observations
AD8367.and adjusted by the National Geodetic Survey in July 2001.
AD8367
AD8367.The NAVD 88 height was computed by applying the VERTCON shift value to
AD8367.the NGVD 29 height (displayed under SUPERSEDED SURVEY CONTROL.)
AD8367
AD8367.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AD8367
AD8367.The Laplace correction was computed from DEFLEC99 derived deflections.
AD8367
AD8367.The ellipsoidal height was determined by GPS observations
AD8367.and is referenced to NAD 83.
AD8367
AD8367.The geoid height was determined by GEOID03.
AD8367
AD8367;                 North         East     Units Scale Factor Converg.
AD8367;SPC FL E     -   241,139.820   293,404.395   MT  1.00004885   +0 25 05.7
AD8367;SPC FL E     -   791,139.56    962,610.92   sFT  1.00004885   +0 25 05.7
AD8367;UTM  17      - 2,932,189.526   593,372.526   MT  0.99970764   +0 25 05.7
AD8367
AD8367!             -  Elev Factor  x  Scale Factor =   Combined Factor
AD8367!SPC FL E     -   1.00000350  x   1.00004885  =   1.00005235
AD8367!UTM  17      -   1.00000350  x   0.99970764  =   0.99971114
AD8367
AD8367                      SUPERSEDED SURVEY CONTROL
AD8367
AD8367  NAD 83(1990)-  26 30 25.71443(N)    080 03 46.67183(W) AD(      ) 1
AD8367  ELLIP H (08/13/93)  -22.294  (m)                    GP(      ) 4 1
AD8367  NAD 83(1990)-  26 30 25.71484(N)    080 03 46.67150(W) AD(      ) 1
AD8367  ELLIP H (03/31/93)  -22.302  (m)                    GP(      ) 4 1
AD8367  NGVD 29 (03/31/93)    4.3    (m)          14.     (f) GPS OBS
AD8367
AD8367.Superseded values are not recommended for survey control.
AD8367.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AD8367.See file dsdata.txt to determine how the superseded data were derived.
AD8367
AD8367_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK9337332190(NAD 83)
AD8367_MARKER: DD = SURVEY DISK
AD8367_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
AD8367_SP_SET: CONCRETE POST
AD8367_STAMPING: CHUCK
```

AD8367_MARK LOGO: FL-099
AD8367_MAGNETIC: R = STEEL ROD IMBEDDED IN MONUMENT
AD8367_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AD8367+STABILITY: SURFACE MOTION
AD8367_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AD8367+SATELLITE: SATELLITE OBSERVATIONS - December 08, 2004
AD8367
AD8367 HISTORY - Date Condition Report By
AD8367 HISTORY - UNK MONUMENTED FL-099
AD8367 HISTORY - 19910810 GOOD ADRGS
AD8367 HISTORY - 20041208 GOOD USPSQD
AD8367
AD8367 STATION DESCRIPTION
AD8367
AD8367'DESCRIBED BY ADR GEODETIC SERVICES 1991
AD8367'THE STATION IS LOCATED IN THE SOUTHEAST QUADRANT OF THE INTERSECTION
AD8367'OF THE FEC RAILROAD AND SOUTHEAST 23RD AVENUE IN BOYNTON BEACH. IT IS
AD8367'45 FEET SOUTH OF THE SOUTH EDGE OF PAVEMENT OF SOUTHEAST 23RD AVENUE
AD8367'AND 22 FEET EAST OF THE CENTERLINE OF THE FEC RAILROAD TRACKS.
AD8367'TO REACH THE STATION FROM THE INTERSECTION OF ATLANTIC AVENUE (STATE
AD8367'ROUTE 806) AND INTERSTATE 95, GO EAST ON ATLANTIC AVENUE FOR 1.4 MI
AD8367'(2.25 KM) TO SOUTHEAST 6TH AVENUE (US ROUTE 1 NORTH). TURN LEFT AND
AD8367'GO NORTH FOR 1.0 MI (1.61 KM) TO FEDERAL HIGHWAY (US ROUTE 1).
AD8367'CONTINUE NORTH ON FEDERAL HIGHWAY FOR 2.4 MI (3.86 KM) TO SOUTHEAST
AD8367'23RD AVENUE. TURN LEFT AND GO 0.2 MI (0.32 KM) TO THE STATION ON THE
AD8367'LEFT.
AD8367'THE STATION IS SOUTHWEST 54.16 FT (16.51 M) FROM A PK AND TIN TAB IN
AD8367'THE SOUTH SIDE OF A POWER POLE, NORTHWEST 43.04 FEET FROM A PK AND
AD8367'TIN TAB IN THE SOUTH SIDE OF A POWER POLE, AND SOUTHEAST 7.07 FT
AD8367'(2.15 M) FROM AN X-CUT IN THE SOUTHEAST CORNER OF A CONCRETE SIGNAL
AD8367'BOX. THE STATION IS APPROXIMATELY 26 FEET NORTH-NORTHEAST OF A TRAIN
AD8367'SIGNAL POWER POLE.
AD8367
AD8367 STATION RECOVERY (2004)
AD8367
AD8367'RECOVERY NOTE BY US POWER SQUADRON 2004 (AAS)
AD8367'RECOVERED IN GOOD CONDITION.

```
AF7533 *********************************************************************
AF7533  DESIGNATION -  A 403
AF7533  PID         -  AF7533
AF7533  STATE/COUNTY-  FL/MARTIN
AF7533  USGS QUAD   -  HOBE SOUND (1983)
AF7533
AF7533                    *CURRENT SURVEY CONTROL
AF7533 ______________________________________________________________________
AF7533* NAD 83(1999)-  27 00 13.69246(N)    080 06 01.85031(W)     ADJUSTED
AF7533* NAVD 88     -        5.152  (meters)      16.90   (feet)  ADJUSTED
AF7533 ______________________________________________________________________
AF7533  X          -     977,654.664 (meters)                  COMP
AF7533  Y          -  -5,602,005.354 (meters)                  COMP
AF7533  Z          -   2,878,580.902 (meters)                  COMP
AF7533  LAPLACE CORR-          -4.41  (seconds)                DEFLEC99
AF7533  ELLIP HEIGHT-        -22.401 (meters)          (12/12/02) GPS OBS
AF7533  GEOID HEIGHT-         -27.56  (meters)                 GEOID03
AF7533  DYNAMIC HT  -          5.144 (meters)      16.88  (feet)  COMP
AF7533  MODELED GRAV-     979,094.5   (mgal)                    NAVD 88
AF7533
AF7533  HORZ ORDER  -  FIRST
AF7533  VERT ORDER  -  FIRST     CLASS II
AF7533  ELLP ORDER  -  FOURTH    CLASS I
AF7533
AF7533.The horizontal coordinates were established by GPS observations
AF7533.and adjusted by the National Geodetic Survey in December 2002.
AF7533
AF7533.The orthometric height was determined by differential leveling
AF7533.and adjusted by the NATIONAL GEODETIC SURVEY in May 1994.
AF7533
AF7533.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AF7533
AF7533.The Laplace correction was computed from DEFLEC99 derived deflections.
AF7533
AF7533.The ellipsoidal height was determined by GPS observations
AF7533.and is referenced to NAD 83.
AF7533
AF7533.The geoid height was determined by GEOID03.
AF7533
AF7533.The dynamic height is computed by dividing the NAVD 88
AF7533.geopotential number by the normal gravity value computed on the
AF7533.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AF7533.degrees latitude (g = 980.6199 gals.).
AF7533
AF7533.The modeled gravity was interpolated from observed gravity values.
AF7533
AF7533;                 North         East      Units Scale Factor Converg.
AF7533;SPC FL E     -   296,143.653   289,272.302   MT  1.00003952   +0 24 30.4
AF7533;SPC FL E     -   971,597.97    949,054.21    sFT  1.00003952   +0 24 30.4
AF7533;UTM  17      - 2,987,174.591   589,241.842   MT  0.99969831   +0 24 30.4
AF7533
AF7533!             -  Elev Factor  x  Scale Factor =   Combined Factor
AF7533!SPC FL E     -   1.00000352  x   1.00003952  =   1.00004304
AF7533!UTM  17      -   1.00000352  x   0.99969831  =   0.99970183
AF7533
AF7533                      SUPERSEDED SURVEY CONTROL
AF7533
AF7533  NAVD 88 (12/12/02)    5.15   (m)          16.9    (f) LEVELING    3
AF7533  NGVD 29 (09/01/92)    5.605  (m)          18.39   (f) ADJUSTED    1 2
AF7533
AF7533.Superseded values are not recommended for survey control.
AF7533.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
```

AF7533.See file dsdata.txt to determine how the superseded data were derived.
AF7533
AF7533_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK8924287175(NAD 83)
AF7533_MARKER: F = FLANGE-ENCASED ROD
AF7533_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
AF7533_SP_SET: STAINLESS STEEL ROD
AF7533_STAMPING: A 403 1991
AF7533_MARK LOGO: NGS
AF7533_PROJECTION: FLUSH
AF7533_MAGNETIC: M = MARKER EQUIPPED WITH BAR MAGNET
AF7533_STABILITY: A = MOST RELIABLE AND EXPECTED TO HOLD
AF7533+STABILITY: POSITION/ELEVATION WELL
AF7533_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AF7533+SATELLITE: SATELLITE OBSERVATIONS - November 10, 2003
AF7533_ROD/PIPE-DEPTH: 24.0 meters
AF7533
AF7533 HISTORY - Date Condition Report By
AF7533 HISTORY - 1991 MONUMENTED NGS
AF7533 HISTORY - 20020514 GOOD MAPTEC
AF7533 HISTORY - 20031110 GOOD USPSQD
AF7533
AF7533 STATION DESCRIPTION
AF7533
AF7533'DESCRIBED BY NATIONAL GEODETIC SURVEY 1991
AF7533'3.9 KM (2.4 MI) NORTHWESTERLY ALONG U.S. HIGHWAY 1 FROM THE JUNCTION
AF7533'OF COUNTY LINE ROAD IN TEQUESTA, 22.9 M (75.1 FT) NORTHWEST OF THE
AF7533'CENTERLINE OF THE JONATHAN DICKINSON STATE PARK ENTRANCE ROAD, 20.5 M
AF7533'(67.3 FT) SOUTHWEST OF THE CENTERLINE OF THE SOUTHBOUND LANES OF THE
AF7533'HIGHWAY, 19.7 M (64.6 FT) NORTH OF THE MOST NORTHERLY FLAG POLE, 0.8
AF7533'M (2.6 FT) SOUTHEAST OF THE NORTHWEST END OF A FENCE, AND 0.3 M (1.0
AF7533'FT) NORTHEAST OF A WITNESS POST AND FENCE. NOTE--ACCESS TO THE DATUM
AF7533'POINT IS THROUGH A 5-INCH LOGO CAP.
AF7533
AF7533 STATION RECOVERY (2002)
AF7533
AF7533'RECOVERY NOTE BY MAPTECH INCORPORATED 2002 (CDP)
AF7533'RECOVERED AS DESCRIBED.
AF7533'
AF7533
AF7533 STATION RECOVERY (2003)
AF7533
AF7533'RECOVERY NOTE BY US POWER SQUADRON 2003 (AEP)
AF7533'RECOVERED IN GOOD CONDITION.

```
AD8007 ************************************************************************
AD8007  DESIGNATION -  T 400
AD8007  PID         -  AD8007
AD8007  STATE/COUNTY-  FL/BROWARD
AD8007  USGS QUAD   -  BOCA RATON (1983)
AD8007
AD8007                    *CURRENT SURVEY CONTROL
AD8007 ______________________________________________________________________
AD8007* NAD 83(1999)-  26 18 18.94255(N)    080 06 17.40383(W)     ADJUSTED
AD8007* NAVD 88     -        4.398  (meters)      14.43   (feet)  ADJUSTED
AD8007 ______________________________________________________________________
AD8007  X          -     983,199.007 (meters)                  COMP
AD8007  Y          - -5,636,284.140 (meters)                   COMP
AD8007  Z          -   2,809,410.060 (meters)                  COMP
AD8007  LAPLACE CORR-          -3.72  (seconds)                DEFLEC99
AD8007  ELLIP HEIGHT-        -21.474 (meters)          (12/12/02) GPS OBS
AD8007  GEOID HEIGHT-         -25.88  (meters)                 GEOID03
AD8007  DYNAMIC HT  -          4.391 (meters)      14.41  (feet)  COMP
AD8007  MODELED GRAV-     979,077.6   (mgal)                    NAVD 88
AD8007
AD8007  HORZ ORDER  -  FIRST
AD8007  VERT ORDER  -  FIRST     CLASS II
AD8007  ELLP ORDER  -  THIRD     CLASS I
AD8007
AD8007.The horizontal coordinates were established by GPS observations
AD8007.and adjusted by the National Geodetic Survey in December 2002.
AD8007
AD8007.The orthometric height was determined by differential leveling
AD8007.and adjusted by the NATIONAL GEODETIC SURVEY in May 1994.
AD8007
AD8007.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AD8007
AD8007.The Laplace correction was computed from DEFLEC99 derived deflections.
AD8007
AD8007.The ellipsoidal height was determined by GPS observations
AD8007.and is referenced to NAD 83.
AD8007
AD8007.The geoid height was determined by GEOID03.
AD8007
AD8007.The dynamic height is computed by dividing the NAVD 88
AD8007.geopotential number by the normal gravity value computed on the
AD8007.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
AD8007.degrees latitude (g = 980.6199 gals.).
AD8007
AD8007.The modeled gravity was interpolated from observed gravity values.
AD8007
AD8007;                North         East     Units Scale Factor Converg.
AD8007;SPC FL E     -   218,742.373   289,386.005   MT  1.00003979   +0 23 48.2
AD8007;SPC FL E     -   717,657.27    949,427.25   sFT  1.00003979   +0 23 48.2
AD8007;UTM  17      - 2,909,799.720   589,355.507   MT  0.99969858   +0 23 48.2
AD8007
AD8007!            - Elev Factor  x  Scale Factor =   Combined Factor
AD8007!SPC FL E     -  1.00000337  x   1.00003979  =   1.00004316
AD8007!UTM  17      -  1.00000337  x   0.99969858  =   0.99970195
AD8007
AD8007                      SUPERSEDED SURVEY CONTROL
AD8007
AD8007  NAVD 88 (12/12/02)    4.40   (m)          14.4    (f) LEVELING    3
AD8007  NGVD 29 (09/01/92)    4.877  (m)          16.00   (f) ADJUSTED    1 2
AD8007
AD8007.Superseded values are not recommended for survey control.
AD8007.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
```

AD8007.See file dsdata.txt to determine how the superseded data were derived.
AD8007
AD8007_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK8935609800(NAD 83)
AD8007_MARKER: I = METAL ROD
AD8007_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
AD8007_SP_SET: STAINLESS STEEL ROD
AD8007_STAMPING: T 400 1991
AD8007_MARK LOGO: NGS
AD8007_PROJECTION: RECESSED 3 CENTIMETERS
AD8007_MAGNETIC: I = MARKER IS A STEEL ROD
AD8007_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
AD8007_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AD8007+SATELLITE: SATELLITE OBSERVATIONS - April 23, 2002
AD8007_ROD/PIPE-DEPTH: 3.4 meters
AD8007
AD8007 HISTORY - Date Condition Report By
AD8007 HISTORY - 1991 MONUMENTED NGS
AD8007 HISTORY - 20011012 GOOD USPSQD
AD8007 HISTORY - 20020423 GOOD MAPTEC
AD8007
AD8007 STATION DESCRIPTION
AD8007
AD8007'DESCRIBED BY NATIONAL GEODETIC SURVEY 1991
AD8007'IN DEERFIELD BEACH, AT THE INTERSECTION OF THE FLORIDA EAST COAST
AD8007'RAILROAD AND SOUTHWEST 10TH STREET, NEAR THE NORTHWEST CORNER OF A
AD8007'SMALL PARKING LOT, 38.9 M (127.6 FT) NORTH OF THE NORTH CURB OF THE
AD8007'STREET, 9.4 M (30.8 FT) EAST OF THE NEAR RAIL, 0.9 M (3.0 FT) WEST OF
AD8007'A RIGHT-OF-WAY POST, 0.3 M (1.0 FT) EAST OF A RIGHT-OF-WAY POST, AND
AD8007'0.3 M (1.0 FT) BELOW THE LEVEL OF THE TRACK. NOTE--ACCESS TO THE
AD8007'DATUM POINT IS THROUGH A 5-INCH LOGO CAP.
AD8007
AD8007 STATION RECOVERY (2001)
AD8007
AD8007'RECOVERY NOTE BY US POWER SQUADRON 2001
AD8007'RECOVERED IN GOOD CONDITION.
AD8007
AD8007 STATION RECOVERY (2002)
AD8007
AD8007'RECOVERY NOTE BY MAPTECH INCORPORATED 2002 (CDP)
AD8007'RECOVERED AS DESCRIBED
AD8007'
AD8007'STATION RECOVERY (2002)
AD8007'RECOVERY NOTE BY MAPTECH, INCORPORATED 2002 (CDP)
AD8007'RECOVERED AS DESCRIBED.
AD8007'
AD8007'

```
AD8545 ************************************************************************
AD8545  DESIGNATION -  SR7 40
AD8545  PID         -  AD8545
AD8545  STATE/COUNTY-  FL/PALM BEACH
AD8545  USGS QUAD   -  UNIVERSITY PARK (1983)
AD8545
AD8545                      *CURRENT SURVEY CONTROL
AD8545  ______________________________________________________________________
AD8545* NAD 83(1999)-  26 24 45.88578(N)    080 12 13.32671(W)     ADJUSTED
AD8545* NAVD 88     -         5.70   (+/-2cm)      18.7    (feet)  VERTCON
AD8545  ______________________________________________________________________
AD8545  X           -     972,572.411 (meters)                  COMP
AD8545  Y           - -5,632,763.488 (meters)                   COMP
AD8545  Z           -   2,820,081.140 (meters)                  COMP
AD8545  LAPLACE CORR-          -2.83  (seconds)                 DEFLEC99
AD8545  ELLIP HEIGHT-        -19.906 (meters)          (07/06/01) GPS OBS
AD8545  GEOID HEIGHT-         -25.62  (meters)                  GEOID03
AD8545
AD8545  HORZ ORDER  -  FIRST
AD8545  VERT ORDER  -  THIRD ? (See Below)
AD8545  ELLP ORDER  -  FOURTH    CLASS II
AD8545
AD8545.The horizontal coordinates were established by GPS observations
AD8545.and adjusted by the National Geodetic Survey in July 2001.
AD8545
AD8545.The NAVD 88 height was computed by applying the VERTCON shift value to
AD8545.the NGVD 29 height (displayed under SUPERSEDED SURVEY CONTROL.)
AD8545.The vertical order pertains to the NGVD 29 superseded value.
AD8545
AD8545.The X, Y, and Z were computed from the position and the ellipsoidal ht.
AD8545
AD8545.The Laplace correction was computed from DEFLEC99 derived deflections.
AD8545
AD8545.The ellipsoidal height was determined by GPS observations
AD8545.and is referenced to NAD 83.
AD8545
AD8545.The geoid height was determined by GEOID03.
AD8545
AD8545;                North         East     Units Scale Factor Converg.
AD8545;SPC FL E     -   230,586.345   279,439.777   MT  1.00001906   +0 21 15.3
AD8545;SPC FL E     -   756,515.37    916,795.34   sFT  1.00001906   +0 21 15.3
AD8545;UTM  17      - 2,921,639.651   579,412.672   MT  0.99967786   +0 21 15.3
AD8545
AD8545!             -  Elev Factor  x  Scale Factor =   Combined Factor
AD8545!SPC FL E     -   1.00000313  x   1.00001906  =   1.00002219
AD8545!UTM  17      -   1.00000313  x   0.99967786  =   0.99968099
AD8545
AD8545                       SUPERSEDED SURVEY CONTROL
AD8545
AD8545  NAD 83(1990)-  26 24 45.88441(N)    080 12 13.32556(W) AD(      ) 1
AD8545  ELLIP H (08/13/93)  -19.922  (m)                    GP(      ) 4 1
AD8545  NAD 83(1990)-  26 24 45.88450(N)    080 12 13.32515(W) AD(      ) 1
AD8545  ELLIP H (03/31/93)  -19.929  (m)                    GP(      ) 4 1
AD8545  NGVD 29 (03/31/93)    6.16   (m)          20.2    (f) LEVELING    3
AD8545
AD8545.Superseded values are not recommended for survey control.
AD8545.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
AD8545.See file dsdata.txt to determine how the superseded data were derived.
AD8545
AD8545_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RNK7941321640(NAD 83)
AD8545_MARKER: DD = SURVEY DISK
AD8545_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT
```

AD8545_SP_SET: CONCRETE POST
AD8545_STAMPING: SR7 40
AD8545_MARK LOGO: FL-099
AD8545_MAGNETIC: R = STEEL ROD IMBEDDED IN MONUMENT
AD8545_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO
AD8545+STABILITY: SURFACE MOTION
AD8545_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AD8545+SATELLITE: SATELLITE OBSERVATIONS - February 22, 2005
AD8545
AD8545 HISTORY - Date Condition Report By
AD8545 HISTORY - UNK MONUMENTED FL-099
AD8545 HISTORY - 19910810 GOOD ADRGS
AD8545 HISTORY - 20031119 GOOD USPSQD
AD8545 HISTORY - 20050222 GOOD USPSQD
AD8545
AD8545 STATION DESCRIPTION
AD8545
AD8545'DESCRIBED BY ADR GEODETIC SERVICES 1991
AD8545'TO REACH THE STATION FROM THE INTERSECTION OF WEST ATLANTIC AVENUE
AD8545'(STATE ROUTE 806, ALSO KNOWN AS WEST DELRAY ROAD) AND STATE ROUTE 7
AD8545'(US ROUTE 441), GO SOUTH ON STATE ROUTE 7 FOR 3.15 MI (5.07 KM) TO
AD8545'THE STATION ON THE LEFT, JUST SOUTH OF THE ENTRANCE TO STONEBRIDGE.
AD8545'THE STATION CAN ALSO BE REACHED BY GOING NORTH ON STATE ROUTE 7 FOR
AD8545'0.3 MI (0.48 KM) FROM CLINT MOORE ROAD. THE STATION IS 1.5 FEET EAST
AD8545'OF THE EAST GUARD RAIL ALONG STATE ROUTE 7 AND 10 FEET NORTH OF A 36
AD8545'INCH CORRUGATED METAL PIPE OUTFALLING ON THE EASTERLY SIDE OF A CANAL
AD8545'.
AD8545'THE STATION IS SOUTH 28.20 FT (8.60 M) FROM A NAIL AND TIN TAB IN THE
AD8545'TOP OF A GUARD RAIL POST, NORTH 21.78 FT (6.64 M) FROM A NAIL AND TIN
AD8545'TAB IN THE TOP OF A GUARD RAIL POST, AND EAST 3.33 FT (1.01 M) FROM
AD8545'AN X-CUT IN THE TOP OF A GUARD RAIL H-BEAM. THE STATION IS 1.2 FT
AD8545'(0.37 M) SOUTH OF A PALM BEACH COUNTY SURVEY WITNESS SIGN AND POST.
AD8545
AD8545 STATION RECOVERY (2003)
AD8545
AD8545'RECOVERY NOTE BY US POWER SQUADRON 2003 (AAS)
AD8545'RECOVERED IN GOOD CONDITION.
AD8545
AD8545 STATION RECOVERY (2005)
AD8545
AD8545'RECOVERY NOTE BY US POWER SQUADRON 2005 (AAS)
AD8545'RECOVERED IN GOOD CONDITION.

SURVEY INFORMATION

A. Field Personnel

The following field personnel worked on this GPS network, and related survey collection:

Field Supervisor: J. Purpera
Party Chief: M. Havard
Instrument Man: V. McNeal
Instrument Man: C. LaPrarie

The point of contact for survey related questions is:

Josh Hardy
Operations Supervisor
(985) 661-3001

B. GPS Logsheets