

Southwest Florida Water Management District

FY 2009 PEACE RIVER TOPOGRAPHIC MAPPING (H024)
Peace River South LiDAR Re-flight

Florida Minimum Technical Standards for Mapping Projects
Survey and Map Report

Submitted to:



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Merrick & Company Job Number: 02016178

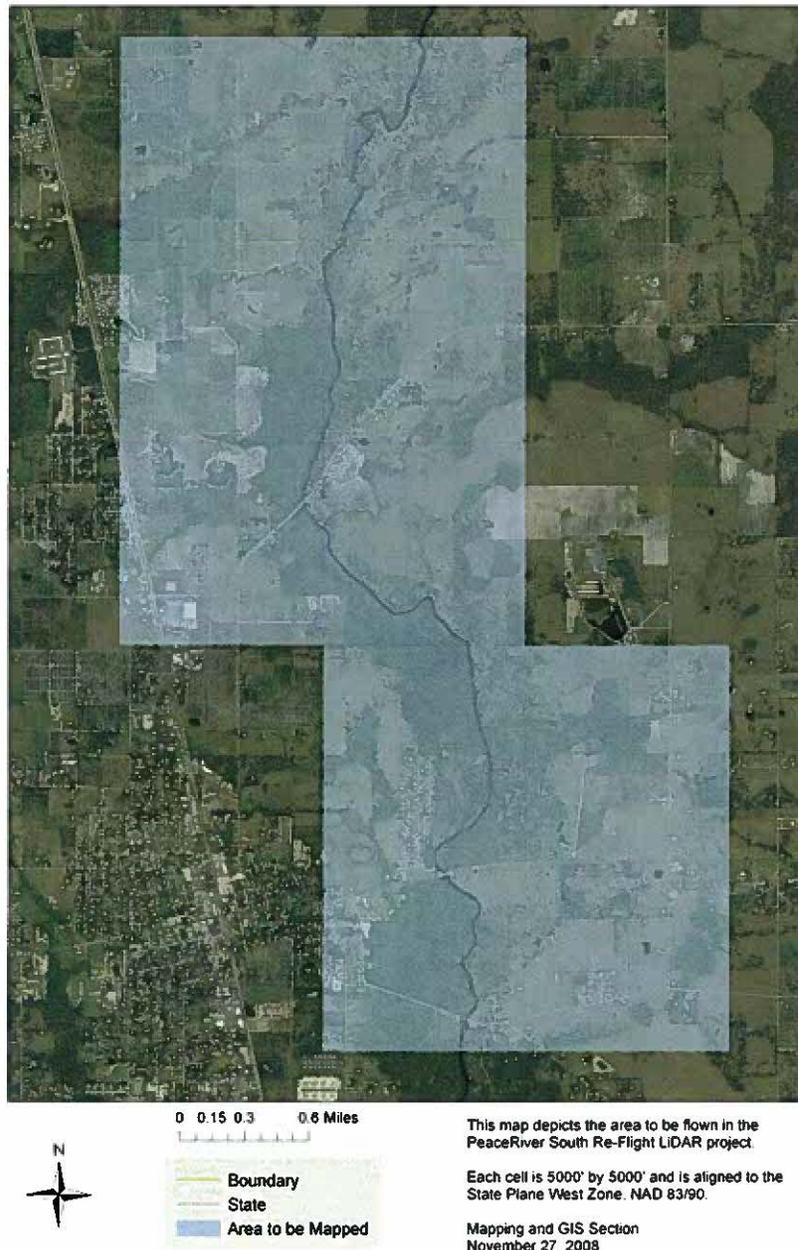
Florida Minimum Technical Standards for Mapping Projects

Survey and Map Report for the Peace River South LiDAR Re-flight Project performed for the Southwest Florida Water Management District

Merrick Job Number 02016178

The Southwest Florida Water Management District (SWFWMD) contracted with Merrick & Company (Merrick) to acquire one-meter (1m) Ground Sample Distance LiDAR data over a project area of approximately nine (9) square miles. The LiDAR will be used for developing topography (i.e., breaklines and one-foot [1'] contours) for ten (10) – 5,000' x 5,000' formatted tiles. See Figure 1 for illustration of the Peace River South LiDAR Re-flight Project area.

Figure 1

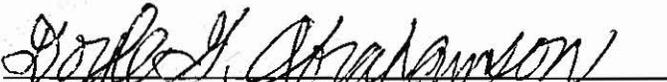


I, Doyle G. Abrahamson, a Professional Surveyor and Mapper (PSM) licensed in the State of Florida (LS 0006156) do hereby state that this Survey and Map Report is correct and accurate, all to the best of my knowledge and belief for the mapping data, which was signed by me along with the signature date and job number as listed below, and submitted to SWFWMD under Job No. 02016178:

<u>No. of DVD's</u>	<u>Description of Contents*</u>	<u>Date</u>
1	Project Deliverables (submittal of 10 – 5,000' x 5'000' tiles of classified LiDAR point cloud in LAS format, file geodatabase containing feature classes for breaklines and contours, metadata) - PRELIMINARY**	4/9/09
1	Project Deliverables (resubmittal of 10 – 5,000' x 5'000' tiles of classified LiDAR point cloud in LAS format, file geodatabase containing feature classes for breaklines and contours, metadata) - PRELIMINARY**	5/7/09
0 (1 HDD)	Project Deliverables (final submittal of 10 – 5,000' x 5'000' tiles of classified LiDAR point cloud in LAS format, file geodatabase containing feature classes for breaklines and contours, metadata) – FINAL***	6/26/09

- * A full description of the deliverables is outlined below under *Listing of final files and descriptions of media*.
- ** PRELIMINARY indicates that deliverables were submitted to SWFWMD for review. These deliverables were not signed and sealed by a Florida PSM; therefore, said deliverables are not considered complete and final.
- *** FINAL indicates the project-wide submittal of the reviewed and accepted deliverables signed and sealed by a Florida PSM, and accompanied by the Florida Minimum Technical Standards report.

THIS PHOTOGRAMMETRIC MAPPING DATA AND REPORT IS CERTIFIED TO THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT AS MEETING OR EXCEEDING, IN QUALITY AND PRECISION, THE STANDARDS APPLICABLE FOR THIS WORK, AS SET FORTH IN CHAPTER 61G17-6, FLORIDA ADMINISTRATIVE CODE.


 Doyle G. Abrahamson, PSM #6156

Dated: 6/26/09
 Merrick & Company Job No. 02016178

None of the above mentioned media are full and complete without this Survey and Map Report.

This certification is not valid without the signature and raised seal of a Florida Licensed Surveyor and Mapper.

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Glossary of Terms

<u>Term</u>	<u>Description</u>
AGL	Above Ground Level
AGPS	Airborne Global Positioning System
ASPRS	American Society of Photogrammetry and Remote Sensing
AT	Aerial Triangulation
CD	Compact Disk
CMS	Certified Mapping Scientist
CVA	Consolidated Vertical Accuracy
DACST [™]	Digital Airborne Camera System
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Maps
DSM	Digital Surface Model
DTM	Digital Terrain Model
DVD	Digital Versatile Disk / Digital Video Disk
DXF	Data Exchange Format / Drawing Interchange Format / Drawing Exchange Format
FIRM	Flood Insurance Rate Maps
FDEM	Florida Department of Emergency Management
FDOT	Florida Department of Transportation

FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FPRN	Florida Permanent Reference Network
FVA	Fundamental Vertical Accuracy
FY	Fiscal Year
GIS	Geographic Information System
GISP	Geographic Information System Professional
GSD	Ground Sample Distance
GPS	Global Positioning System
HARN	High Accuracy Reference Network
HDD	Hard Drive Disk
HPGN	High Precision Geodetic Network
LB	License Business
LS	Land Surveyor
LiDAR	Light Detection And Ranging
MARS®	Merrick Advanced Remote Sensing
Merrick	Merrick & Company
MSL	Mean Sea Level
NDEP	National Digital Elevation Program
NGS	National Geodetic Survey
NMAS	National Map Accuracy Standards
No.	Number
NSRS	National Spatial Reference System
NSSDA	National Standard for Spatial Data Accuracy
PDOP	Positional Dilution Of Precision
PLSS	Public Land Survey System
PSM	Professional Surveyor and Mapper
RMSE	Root Mean Square Error
SHA	Secured Hash Standard
SWFWMD	Southwest Florida Water Management District
SPCS	State Plane Coordinate System
SVA	Supplemental Vertical Accuracy
XML	eXtensible Markup Language

Survey and Map Report for the Peace River South LiDAR Re-flight Project

- ***Project title***

FY 2009 PEACE RIVER TOPOGRAPHIC MAPPING (H024) Peace River South LiDAR Re-flight

- ***Name of client***

Southwest Florida Water Management District

- ***Client contact information***

Mr. Al Karlin, Ph.D. GISP
Senior GIS Analyst
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- ***Intended use***

Geographic Information System (GIS). SWFWMD regularly uses digital topographic information to support regulatory, land management and acquisition, planning, engineering and habitat restoration projects. LiDAR data will support hydrologic modeling activities associated with the Federal Emergency Management Agency (FEMA), and in the creation of Digital Flood Insurance Rate Maps (DFIRM). The LiDAR data will support the creation of Federal Emergency Management Agency Flood Insurance Rate Maps (FEMA FIRM) and an integrated ground and surface water model for the Peace River watershed.

- ***Responsible PSM name, number and address***

Mr. Doyle G. Abrahamson
PSM #6156
2450 South Peoria Street
Aurora, CO 80014
303-353-3902
doyle.abrahamson@merrick.com

- ***Name of PSM company***

Merrick & Company
2450 South Peoria Street
Aurora, CO 80014
303-751-0741
www.merrick.com

- ***LB number of PSM company***

Merrick & Company LB #7224

- ***Dates of survey***

February 10 and February 16, 2009

- ***Dates of photography***

N/A

- ***Dates of LiDAR acquisition***

February 3- 6, 2009

- ***Horizontal and vertical datum's***

Projection - Florida State Plane Coordinate System (SPCS), West Zone (0902)

Horizontal Datum - North American Datum 1983 (NAD 83), National Spatial Reference System adjustment of 2007 (NSRS 2007)

Vertical Datum - North American Vertical Datum 1988 (NAVD 88) using the latest geoid (Geoid03 or Geoid06) for converting ellipsoidal heights to orthometric heights

Units - U.S. Survey Foot

- ***Horizontal and vertical control monuments used (descriptions, coordinates, elevations, to-reach, monument type, etc).***

National Geodetic Survey (NGS) monuments and horizontal and vertical values were used as the basis to control the SWFWMD project. All GPS checkpoint control was tied into the above-mentioned NGS control. NGS monument descriptions, horizontal values, elevations and to-reach descriptions, as well as other control data sheets and references are all contained within the aforementioned **Exhibit A**.

- ***Accuracy statement of survey***

SWFWMD performed the ground control checkpoint survey activities in support of the required accuracies for this project. The control checkpoint survey was supervised, signed and sealed by Jim Owens, Florida PSM #5014. A copy of SWFWMD's *Report Of Specific Purpose Survey* is incorporated later in this Survey and Map Report as **Exhibit B**.

- ***Supplemental monument type (if required by contract)***

N/A

- ***Accuracy statement of photography***

N/A

- ***Accuracy statement of LiDAR***

The Fundamental Vertical Accuracy (FVA) of the LiDAR bare-earth was tested to meet a 0.60' fundamental accuracy at 95% confidence level using $RMSE_z \times 1.9600$ (where as $RMSE_z \leq 0.30'$) as defined by the National Standard for Spatial Data Accuracy (NSSDA) in open well defined terrain. The vertical accuracy testing for LiDAR data over well-defined surfaces will meet or exceed requirements as set forth in the Federal Geographic Data Committee's (FGDC) Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy (NSSDA).

The *LiDAR Mapping Report (Exhibit C)* illustrate the procedures used during the planning, acquisition, post-processing, boresight, and classification; and, include an accuracy assessment performed by Merrick using the aforementioned SWFWMD checkpoint coordinates.

Merrick prepared the *Vertical Accuracy Report (Exhibit D)*, which illustrates the accuracy results stemming from the land cover class survey performed by SWFWMD.

- ***Accuracy statement of final deliverables***

The final topographic deliverables (i.e., breaklines and contours) for this project meets a 0.60' fundamental accuracy at 95% confidence level using $RMSE_z \times 1.9600$ as defined by the National Standard for Spatial Data Accuracy (NSSDA) in open well defined terrain. Said deliverables are derived directly from the classified LiDAR, whose accuracy is documented later in **Exhibit C** and **Exhibit D**.

- ***Intended display scale***

The topographic data is intended to be displayed at a scale of 1"=100' (1:1,200) or smaller.

- ***Metadata***

The HDD that accompanies this report is inclusive of the XML formatted metadata template(s) used for topographic mapping deliverables. These XML files are located at *D:\metadata* (whereas [D:] represents *PeaceRiver*), and are as follows:

- COASTALSHORELINE.xml
- CONNECTOR.xml
- CONTOUR_1FT.xml
- CONTOUR_2FT.xml

FLIGHTPLAN.xml
 GROUNDCONTROL.xml
 HYDROGRAPHICFEATURE.xml
 ISLAND.xml
 LAS.xml
 LIDARTILES.xml
 LOWCONFIDENCEAREAS.xml
 OVERPASS.xml
 ROADBREAKLINE.xml
 SOFTFEATURE.xml
 VERTACCTESTPTS.xml
 WATERBODY.xml

- **Database design documentation**

The following represents the SWFWMD topographic database design:

Simple feature class		Geometry		Polyline	
COASTALSHORELINE		Contains M values	No	Contains Z values	Yes
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision Scale Length
OBJECTID	Object ID				
Shape	Geometry	Yes			
DATESTAMP_DT	Date	Yes			0 0 8
Shape_Length	Double	Yes			0 0
Shape_Area	Double	Yes			0 0

Simple feature class		Geometry		Polyline	
CONTOUR		Contains M values	No	Contains Z values	No
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision Scale Length
OBJECTID	Object ID				
Shape	Geometry	Yes			
CONTOUR_ELEVATION_MS	Double	Yes			0 0
CARRYING_CONTOUR_ELEVATION_MS	Double	Yes			0 0
CONTOUR_TYPE_DESC	String	Yes		dCONTOURTYPE	50
DATESTAMP_DT	Date	Yes			0 0 8
Shape_Length	Double	Yes			0 0

Coded value domain	
dCONTOURTYPE	
Description	
Field type	String
Split policy	Default value
Merge policy	Default value
Code	Description
1	NORMAL
2	CARRYING
3	SUPPLEMENTARY
4	DEPRESSION

Simple feature class		Geometry		Polyline		
HYDROGRAPHICFEATURE		Contains M values	No	Contains Z values	Yes	
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale Length
OBJECTID	Object ID					
Shape	Geometry	Yes				
DATESTAMP_DT	Date	Yes			0	0 8
Shape_Length	Double	Yes			0	0

Simple feature class		Geometry		Polygon		
ISLAND		Contains M values	No	Contains Z values	Yes	
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale Length
OBJECTID	Object ID					
Shape	Geometry	Yes				
DATESTAMP_DT	Date	Yes			0	0 8
Shape_Length	Double	Yes			0	0
Shape_Area	Double	Yes			0	0

Simple feature class		Geometry		Multipoint		
MASSPOINT		Contains M values	No	Contains Z values	Yes	
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale Length
OBJECTID	Object ID					
Shape	Geometry	Yes				
DATESTAMP_DT	Date	Yes			0	0 8

Simple feature class		Geometry		Polygon		
LOWCONFIDENCEAREAS		Contains M values	No	Contains Z values	No	
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale Length
OBJECTID	Object ID					
Shape	Geometry	Yes				
DATESTAMP_DT	Date	Yes			0	0 8
Shape_Length	Double	Yes			0	0
Shape_Area	Double	Yes			0	0

Simple feature class		Geometry		Polyline		
OVERPASS		Contains M values	No	Contains Z values	Yes	
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale Length
OBJECTID	Object ID					
Shape	Geometry	Yes				
DATESTAMP_DT	Date	Yes			0	0 8
Shape_Length	Double	Yes			0	0

Simple feature class ROADBREAKLINE						Geometry	Polyline
						Contains M values	No
						Contains Z values	Yes
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length
OBJECTID	Object ID						
Shape	Geometry	Yes					
DATESTAMP_DT	Date	Yes			0	0	8
Shape_Length	Double	Yes			0	0	

Simple feature class SOFTFEATURE						Geometry	Polyline
						Contains M values	No
						Contains Z values	Yes
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length
OBJECTID	Object ID						
Shape	Geometry	Yes					
DATESTAMP_DT	Date	Yes			0	0	8
Shape_Length	Double	Yes			0	0	

Simple feature class WATERBODY						Geometry	Polygon
						Contains M values	No
						Contains Z values	Yes
Field name	Data type	Allow nulls	Default value	Domain	Prec- ision	Scale	Length
OBJECTID	Object ID						
Shape	Geometry	Yes					
WATERBODY_ELEVATION_MS	Double	Yes			0	0	
DATESTAMP_DT	Date	Yes			0	0	8
Shape_Length	Double	Yes			0	0	
Shape_Area	Double	Yes			0	0	

- **Statement of any data limitations**

There are no limitations other than the previously defined map accuracies and intended display scales.

- **Listing of final files and descriptions of media**

- Ten (10) FDEM formatted (5,000' x 5,000') tiles of the following data deliverables:
 - Classified LiDAR point cloud in ASPRS LAS 1.1 format
 - Breaklines in ArcGIS file geodatabase
 - 1' contours in ArcGIS file geodatabase
 - 2' contours in ArcGIS file geodatabase
 - FGDC compliant metadata in XML format
 - Secured Hash Standard (SHA) document(s)
- Miscellaneous reports
 - *LiDAR Mapping Report*
 - *Vertical Accuracy Report*
 - *Florida Minimum Technical Standards for Mapping Projects - Survey and Map Report*

All of the aforementioned deliverables were signed and submitted on a HDD to Mr. Al Karlin on 6/26/09.

None of the aforementioned deliverables are full and complete without this Survey and Map Report.

Miscellaneous items such as flight plans, various reports, etc. were submitted for the SWFWMD project as ancillary products over the duration of the project / contract.

Preliminary submittals were made to SWFWMD over the course of the project. Only those submitted with the signature and raised seal of a Florida Licensed Surveyor and Mapper should be deemed final.

- ***Type of Survey being done***

Topographic survey.

Florida Minimum Technical Standards for Mapping Projects

Survey and Map Report

Exhibit A

NGS Datasheets

The NGS Data Sheet See file dsdata.txt for more information about the datasheet. DATABASE =
,PROGRAM = datasheet, VERSION = 7.67

1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009

DE9087 *****

DE9087 DESIGNATION - B 558

DE9087 PID - DE9087

DE9087 STATE/COUNTY- FL/MANATEE

DE9087 USGS QUAD - DUETTE (1987)

DE9087

DE9087 *CURRENT SURVEY CONTROL

DE9087

DE9087* NAD 83(1986)- 27 34 13. (N) 082 06 15. (W) SCALED

DE9087* NAVD 88 - 36.860 (meters) 120.93 (feet) ADJUSTED

DE9087

DE9087 GEOID HEIGHT- -24.93 (meters) GEOID03

DE9087 DYNAMIC HT - 36.804 (meters) 120.75 (feet) COMP

DE9087 MODELED GRAV- 979,143.2 (mgal) NAVD 88

DE9087

DE9087 VERT ORDER - SECOND CLASS I

DE9087

DE9087.The horizontal coordinates were scaled from a topographic map and have

DE9087.an estimated accuracy of +/- 6 seconds.

DE9087

DE9087.The orthometric height was determined by differential leveling

DE9087.and adjusted in May 2004.

DE9087

DE9087.The geoid height was determined by GEOID03.

DE9087

DE9087.The dynamic height is computed by dividing the NAVD 88

DE9087.geopotential number by the normal gravity value computed on the

DE9087.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

DE9087.degrees latitude (g = 980.6199 gals.).

DE9087

DE9087.The modeled gravity was interpolated from observed gravity values.

DE9087

DE9087; North East Units Estimated Accuracy

DE9087;SPC FL W - 358,600. 189,710. MT (+/- 180 meters Scaled)

DE9087

DE9087 SUPERSEDED SURVEY CONTROL

DE9087

DE9087.No superseded survey control is available for this station.

DE9087

DE9087_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RLL910500(NAD 83)

DE9087_MARKER: F = FLANGE-ENCASED ROD

DE9087_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)

DE9087_STAMPING: B 558 2001

DE9087_MARK LOGO: NGS

DE9087_PROJECTION: FLUSH

DE9087_MAGNETIC: M = MARKER EQUIPPED WITH BAR MAGNET

DE9087_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

DE9087_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

DE9087+SATELLITE: SATELLITE OBSERVATIONS - December 13, 2001

DE9087_ROD/PIPE-DEPTH: 17.5 meters

DE9087

DE9087 HISTORY - Date Condition Report By

DE9087 HISTORY - 20011213 MONUMENTED FLDEP

DE9087

DE9087 STATION DESCRIPTION

DE9087

DE9087'DESCRIBED BY FL DEPT OF ENV PRO 2001 (PBM)

DE9087'THE MARK IS ABOUT 21.0 MI EAST OF PARRISH, 16.0 MI SOUTHWEST OF

DE9087'WAUCHULA, IN SECTION 33,

DE9087'TOWNSHIP 33 SOUTH, RANGE 22 EAST.

DE9087'

DE9087'TO REACH THE MARK FROM THE JUNCTION OF U.S. HIGHWAY 301 AND STATE ROAD

DE9087'62 IN PARRISH, GO

DE9087'EAST ON STATE ROAD 62 FOR 3.85 MI TO THE JUNCTION OF CORBETT JOHN ROAD

DE9087'ON THE LEFT,

DE9087'CONTINUE EAST ON STATE ROAD 62 FOR 4.45 MI TO THE JUNCTION OF SAFFOLD

DE9087'ROAD ON THE LEFT,

DE9087'CONTINUE EAST ON STATE ROAD 62 FOR 8.8 MI TO THE JUNCTION OF COUNTY

DE9087'ROAD 39 ON THE LEFT,

DE9087'CONTINUE EAST ON STATE ROAD 62 FOR 2.1 MI TO THE JUNCTION OF STATE

DE9087'ROAD 37 ON THE LEFT,

DE9087'CONTINUE EAST ON STATE ROAD 62 FOR 0.9 MI TO THE JUNCTION OF DUETTE

DE9087'ROAD ON THE RIGHT,

DE9087'TURN RIGHT ON DUETTE ROAD AND GO SOUTH FOR 1.25 MI TO THE MARK ON THE

DE9087'LEFT, A STAINLESS

DE9087'STEEL ROD DRIVEN TO REFUSAL AT A DEPTH OF 57.5 FT WITH A NGS LOGO CAP

DE9087'FLUSH WITH THE

DE9087'GROUND AND LEVEL WITH THE ROAD, THE DATUM POINT IS RECESSED 0.5 FT

DE9087'BELOW THE LEVEL OF

DE9087'THE NGS LOGO CAP.

DE9087'

DE9087'LOCATED 82.5 FT EAST NORTHEAST OF POWER POLE NUMBER 16-163-19, 31.8 FT

DE9087'EAST OF THE

DE9087'APPROXIMATE CENTERLINE OF DUETTE ROAD, 20.0 FT EAST OF THE EAST EDGE

DE9087'OF THE PAVEMENT,

DE9087'6.8 FT EAST-SOUTHWEST OF THE BARB WIRE FENCE CORNER, 1.8 FT WEST OF

DE9087 THE BARB WIRE FENCE
 DE9087 AND 1.3 FT WEST OF A CARSONITE WITNESS POST.
 DE9087
 DE9087 NOTE ACCESS TO THE DATUM POINT IS HAD THROUGH A 5-INCH NGS LOGO CAP.
 DE9087
 DE9087 NOTE A MAGNET WAS SET IN THE GROUND 0.3 FT SOUTH OF THE MONUMENT.
 DE9087

I National Geodetic Survey, Retrieval Date = JUNE 19, 2009

DJ6179 *****

DJ6179 DESIGNATION - D 654

DJ6179 PID - DJ6179

DJ6179 STATE/COUNTY- FL/HARDEE

DJ6179 USGS QUAD - WAUCHULA (1993)

DJ6179

DJ6179 *CURRENT SURVEY CONTROL

DJ6179

DJ6179* NAD 83(1986)- 27 31 22. (N) 081 45 06. (W) SCALED

DJ6179* NAVD 88 - 31.182 (meters) 102.30 (feet) ADJUSTED

DJ6179

DJ6179 GEOID HEIGHT- -25.27 (meters) GEOID03

DJ6179 DYNAMIC HT - 31.135 (meters) 102.15 (feet) COMP

DJ6179 MODELED GRAV- 979,143.1 (mgal) NAVD 88

DJ6179

DJ6179 VERT ORDER - SECOND CLASS I

DJ6179

DJ6179.The horizontal coordinates were scaled from a topographic map and have

DJ6179.an estimated accuracy of +/- 6 seconds.

DJ6179

DJ6179.The orthometric height was determined by differential leveling

DJ6179.and adjusted in May 2008.

DJ6179.No vertical observational check was made to the station.

DJ6179

DJ6179.The geoid height was determined by GEOID03.

DJ6179

DJ6179.The dynamic height is computed by dividing the NAVD 88

DJ6179.geopotential number by the normal gravity value computed on the

DJ6179.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

DJ6179.degrees latitude (g = 980.6199 gals.).

DJ6179

DJ6179.The modeled gravity was interpolated from observed gravity values.

DJ6179

DJ6179; North East Units Estimated Accuracy

DJ6179;SPC FL W - 353,350. 224,530. MT (+/- 180 meters Scaled)

DJ6179

DJ6179 SUPERSEDED SURVEY CONTROL

DJ6179

DJ6179.No superseded survey control is available for this station.

DJ6179

DJ6179_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML257445(NAD 83)

DJ6179_MARKER: F = FLANGE-ENCASED ROD

DJ6179_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)

DJ6179_STAMPING: D 654 2006
 DJ6179_MARK LOGO: NGS
 DJ6179_PROJECTION: FLUSH
 DJ6179_MAGNETIC: M = MARKER EQUIPPED WITH BAR MAGNET
 DJ6179_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
 DJ6179_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 DJ6179+SATELLITE: SATELLITE OBSERVATIONS - April 25, 2006
 DJ6179_ROD/PIPE-DEPTH: 9.7 meters
 DJ6179
 DJ6179 HISTORY - Date Condition Report By
 DJ6179 HISTORY - 20060425 MONUMENTED FLDEP
 DJ6179
 DJ6179 STATION DESCRIPTION
 DJ6179
 DJ6179'DESCRIBED BY FL DEPT OF ENV PRO 2006 (BPJ)
 DJ6179'THE MARK IS NEAR THE SOUTHWEST CORNER OF THE NEW HOPE CEMETARY, 4.0
 MI
 DJ6179'SOUTHEAST OF WAUCHULA, 3.2 MI NORTHEAST OF ZOLFO SPRINGS, IN SECTION
 DJ6179'18, TOWNSHIP 34 SOUTH, RANGE 26 EAST.
 DJ6179'
 DJ6179'TO REACH THE MARK FROM THE JUNCTION OF STATE ROAD 64 AND STATE ROAD
 DJ6179'636 (EAST MAIN STREET) ABOUT 6.7 MI EAST OF WAUCHULA, GO SOUTHWEST ON
 DJ6179'STATE ROAD 64 FOR 3.85 MI TO THE JUNCTION OF MERLE LANGFORD ROAD ON
 DJ6179'THE LEFT AND THE MARK ON THE LEFT. THE MARK CAN ALSO BE REACHED
 FROM
 DJ6179'THE INTERSECTION OF STATE ROAD 64 AND U.S. HIGHWAY 17 IN ZOLFO
 DJ6179'SPRINGS, GO EAST ON STATE ROAD 64 FOR 3.35 MI TO THE INTERSECTION OF
 DJ6179'POPASH ROAD ON THE LEFT AND MEL BRYAN ROAD ON THE RIGHT, CONTINUE
 DJ6179'NORTHEAST ON STATE ROAD FOR APPROXIMATELY 200.0 FT TO THE JUNCTION
 OF
 DJ6179'MERLE LANGFORD ROAD ON THE RIGHT AND THE MARK ON THE RIGHT, A
 DJ6179'STAINLESS STEEL ROD DRIVEN TO REFUSAL AT A DEPTH OF 31.9 FT WITH AN
 DJ6179'NGS LOGO CAP FLUSH WITH THE GROUND AND ABOUT 1.0 FT BELOW THE LEVEL
 OF
 DJ6179'STATE ROAD 64, THE DATUM POINT IS RECESSED 0.4 FT BELOW THE LEVEL OF
 DJ6179'THE NGS LOGO CAP.
 DJ6179'
 DJ6179'LOCATED 37.7 FT SOUTHEAST OF THE APPROXIMATE CENTERLINE OF STATE
 ROAD
 DJ6179'64, 29.2 FT EAST OF THE APPROXIMATE CENTERLINE OF MERLE LANGFORD
 DJ6179'ROAD, 1.5 FT WEST OF A HEDGE ROW AND 1.3 FT WEST OF A CARSONITE
 DJ6179'WITNESS POST.
 DJ6179'
 DJ6179'NOTE A MAGNET WAS PLACED INSIDE OF THE NGS LOGO CAP.
 DJ6179'
 DJ6179'NOTE ACCESS TO THE DATUM POINT IS THROUGH A 5-INCH NGS LOGO CAP.
 1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009
 AF6045 *****
 AF6045 DESIGNATION - D 66
 AF6045 PID - AF6045
 AF6045 STATE/COUNTY- FL/HARDEE

AF6045 USGS QUAD - FT GREEN (1987)

AF6045

AF6045 *CURRENT SURVEY CONTROL

AF6045

AF6045* NAD 83(1986)- 27 35 41. (N) 081 56 23. (W) SCALED

AF6045* NAVD 88 - 32.127 (meters) 105.40 (feet) ADJUSTED

AF6045

AF6045 GEOID HEIGHT- -25.09 (meters) GEOID03

AF6045 DYNAMIC HT - 32.079 (meters) 105.25 (feet) COMP

AF6045 MODELED GRAV- 979,149.0 (mgal) NAVD 88

AF6045

AF6045 VERT ORDER - SECOND CLASS 0

AF6045

AF6045.The horizontal coordinates were scaled from a topographic map and have

AF6045.an estimated accuracy of +/- 6 seconds.

AF6045

AF6045.The orthometric height was determined by differential leveling

AF6045.and adjusted in June 1991.

AF6045

AF6045.The geoid height was determined by GEOID03.

AF6045

AF6045.The dynamic height is computed by dividing the NAVD 88

AF6045.geopotential number by the normal gravity value computed on the

AF6045.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

AF6045.degrees latitude (g = 980.6199 gals.).

AF6045

AF6045.The modeled gravity was interpolated from observed gravity values.

AF6045

AF6045; North East Units Estimated Accuracy

AF6045;SPC FL W - 361,300. 205,950. MT (+/- 180 meters Scaled)

AF6045

AF6045 SUPERSEDED SURVEY CONTROL

AF6045

AF6045 NGVD 29 (??/??/92) 32.417 (m) 106.35 (f) ADJ UNCH 2 0

AF6045

AF6045.Superseded values are not recommended for survey control.

AF6045.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AF6045.See file dsdata.txt to determine how the superseded data were derived.

AF6045

AF6045_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML072526(NAD 83)

AF6045_MARKER: DB = BENCH MARK DISK

AF6045_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

AF6045_SP_SET: SET IN TOP OF CONCRETE MONUMENT

AF6045_STAMPING: D 66 1934

AF6045_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO

AF6045+STABILITY: SURFACE MOTION

AF6045_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AF6045+SATELLITE: SATELLITE OBSERVATIONS - October 01, 2003

AF6045

AF6045 HISTORY - Date Condition Report By

AF6045 HISTORY - 1934 MONUMENTED CGS

AF6045 HISTORY - 1960 GOOD NGS
 AF6045 HISTORY - 1963 GOOD NGS
 AF6045 HISTORY - 19970430 MARK NOT FOUND USPSQD
 AF6045 HISTORY - 20031001 GOOD FL-105

AF6045

AF6045 STATION DESCRIPTION

AF6045

AF6045'DESCRIBED BY NATIONAL GEODETIC SURVEY 1960

AF6045'AT FORT GREEN SPRINGS.

AF6045'AT FORT GREEN SPRINGS, 137 YARDS EAST OF A WOODEN HIGHWAY BRIDGE,
 AF6045'128 FT. WEST OF THE WEST RAIL OF THE SEABOARD AIR LINE RAILROAD,
 AF6045'29.5 FT. NORTH OF THE CENTER LINE OF STATE HIGHWAY 62, 50.7 FT.

AF6045'SOUTH OF THE SOUTHWEST CORNER OF A CONCRETE BLOCK MASONIC
 AF6045'BUILDING, NORTH OF AND ACROSS THE HIGHWAY FROM A WHITE FRAME
 AF6045'HOUSE, SET IN THE TOP OF A CONCRETE POST WHICH IS FLUSH WITH
 AF6045'THE GROUND.

AF6045

AF6045 STATION RECOVERY (1963)

AF6045

AF6045'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1963

AF6045'RECOVERED IN GOOD CONDITION.

AF6045

AF6045 STATION RECOVERY (1997)

AF6045

AF6045'RECOVERY NOTE BY US POWER SQUADRON 1997

AF6045'MARK NOT FOUND.

AF6045

AF6045 STATION RECOVERY (2003)

AF6045

AF6045'RECOVERY NOTE BY POLK COUNTY FLORIDA 2003 (RWY)

AF6045'RECOVERED AS DESCRIBED. RECOVERY NOTE BY POLK COUNTY PROPERTY
 AF6045'APPRAISER GIS DEPARTMENT. SET CARSONITE WITNESS POST N10E AT 3.0'FT.

1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009

AF0480 *****

AF0480 HT_MOD - This is a Height Modernization Survey Station.

AF0480 CBN - This is a Cooperative Base Network Control Station.

AF0480 DESIGNATION - FORT RESET

AF0480 PID - AF0480

AF0480 STATE/COUNTY- FL/HARDEE

AF0480 USGS QUAD - FT GREEN (1987)

AF0480

AF0480 *CURRENT SURVEY CONTROL

AF0480

AF0480* NAD 83(2007)- 27 35 41.96772(N) 081 59 22.03253(W) ADJUSTED

AF0480* NAVD 88 - 37.17 (meters) 121.9 (feet) GPS OBS

AF0480

AF0480 EPOCH DATE - 2002.00

AF0480 X - 788,286.148 (meters) COMP

AF0480 Y - -5,601,465.840 (meters) COMP

AF0480 Z - 2,936,808.725 (meters) COMP

AF0480 LAPLACE CORR- -1.31 (seconds) DEFLEC99

AF0480 ELLIP HEIGHT- 12.191 (meters) (04/16/08) ADJUSTED
 AF0480 GEOID HEIGHT- -25.03 (meters) GEOID03

AF0480

AF0480 ----- Accuracy Estimates (at 95% Confidence Level in cm) -----

AF0480 Type PID Designation North East Ellip

AF0480 -----

AF0480 NETWORK AF0480 FORT RESET 0.73 0.69 1.55

AF0480 -----

AF0480 ELLP ORDER - THIRD CLASS I

AF0480

AF0480.The horizontal coordinates were established by GPS observations

AF0480.and adjusted by the National Geodetic Survey in February 2007.

AF0480

AF0480.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).

AF0480.See National Readjustment for more information.

AF0480.The horizontal coordinates are valid at the epoch date displayed above.

AF0480.The epoch date for horizontal control is a decimal equivalence

AF0480.of Year/Month/Day.

AF0480

AF0480.The orthometric height was determined by GPS observations and a

AF0480.high-resolution geoid model.

AF0480.The orthometric height was determined by GPS observations and a

AF0480.high-resolution geoid model using precise GPS observation and

AF0480.processing techniques.

AF0480

AF0480.The X, Y, and Z were computed from the position and the ellipsoidal ht.

AF0480

AF0480.The Laplace correction was computed from DEFLEC99 derived deflections.

AF0480

AF0480.The ellipsoidal height was determined by GPS observations

AF0480.and is referenced to NAD 83.

AF0480

AF0480.The geoid height was determined by GEOID03.

AF0480

AF0480; North East Units Scale Factor Converg.

AF0480;SPC FL W - 361,330.118 201,041.167 MT 0.99994119 +0 00 17.6

AF0480;SPC FL W - 1,185,463.90 659,582.56 sFT 0.99994119 +0 00 17.6

AF0480;UTM 17 - 3,052,729.366 402,350.340 MT 0.99971770 -0 27 30.1

AF0480

AF0480! - Elev Factor x Scale Factor = Combined Factor

AF0480!SPC FL W - 0.99999808 x 0.99994119 = 0.99993928

AF0480!UTM 17 - 0.99999808 x 0.99971770 = 0.99971579

AF0480

AF0480: Primary Azimuth Mark Grid Az

AF0480:SPC FL W - FORT GREEN TANK 055 09 11.7

AF0480:UTM 17 - FORT GREEN TANK 055 36 59.4

AF0480

AF0480|-----|

AF0480| PID Reference Object Distance Geod. Az |

AF0480| dddmmss.s |

AF0480| AF0479 FORT GREEN TANK APPROX. 5.5 KM 0550929.3 |

AF0480| AF0477 BOWLING GREEN MUN TANK APPROX.17.2 KM 0730151.2 |
 AF0480| CW7140 FORT AZ MK 0913758.4 |
 AF0480| AF0478 WAUCHULA NEW MUN TANK APPROX.18.5 KM 1053907.8 |
 AF0480| CW7141 FORT RM 1 42.285 METERS 12729 |
 AF0480| CW7142 FORT RM 2 35.232 METERS 22439 |
 AF0480| CW7143 FORT RM 3 35.348 METERS 22446 |

AF0480|-----|

AF0480

AF0480 SUPERSEDED SURVEY CONTROL

AF0480

AF0480 ELLIP H (02/10/07) 12.133 (m) GP()
 AF0480 NAD 83(1999)- 27 35 41.96740(N) 081 59 22.03280(W) AD() B
 AF0480 ELLIP H (05/31/01) 12.133 (m) GP() 5 1
 AF0480 NAD 83(1990)- 27 35 41.96599(N) 081 59 22.03226(W) AD() B
 AF0480 ELLIP H (09/13/90) 12.160 (m) GP() 4 1
 AF0480 NAD 83(1986)- 27 35 41.96660(N) 081 59 22.05049(W) AD() 2
 AF0480 NAD 27 - 27 35 40.83862(N) 081 59 22.74478(W) AD() 2
 AF0480 NGVD 29 (09/13/90) 37.5 (m) 123. (f) GPS OBS 3

AF0480

AF0480.Superseded values are not recommended for survey control.

AF0480.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AF0480.See file dsdata.txt to determine how the superseded data were derived.

AF0480

AF0480_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML0235052729(NAD 83)

AF0480_MARKER: DD = SURVEY DISK

AF0480_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

AF0480_SP_SET: CONCRETE POST

AF0480_STAMPING: FORT 1937 1974

AF0480_MARK LOGO: NGS

AF0480_PROJECTION: FLUSH

AF0480_MAGNETIC: N = NO MAGNETIC MATERIAL

AF0480_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO

AF0480+STABILITY: SURFACE MOTION

AF0480_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AF0480+SATELLITE: SATELLITE OBSERVATIONS - April 23, 2007

AF0480

AF0480 HISTORY	- Date	Condition	Report By
AF0480 HISTORY	- 1974	MONUMENTED	NGS
AF0480 HISTORY	- 1963	MARK NOT FOUND	CGS
AF0480 HISTORY	- 1974	SEE DESCRIPTION	NGS
AF0480 HISTORY	- 1974	GOOD	NGS
AF0480 HISTORY	- 19890302	GOOD	NGS
AF0480 HISTORY	- 19910501	GOOD	KEISCH
AF0480 HISTORY	- 20010426	GOOD	FL-057
AF0480 HISTORY	- 20031001	GOOD	FL-105
AF0480 HISTORY	- 20070423	GOOD	PICKET

AF0480

AF0480 STATION DESCRIPTION

AF0480

AF0480'DESCRIBED BY NATIONAL GEODETIC SURVEY 1974 (RAE)

AF0480'STATION IS ABOUT 13.7 MILES BY ROAD N AND W OF WAUCHULA, 2.8

AF0480'MILES W OF THE FORT GREEN POST OFFICE, ON THE N SIDE OF STATE
AF0480'ROUTE 32, BETWEEN ROADWAY AND FENCE LINE ON RIGHT-OF-WAY
AF0480'PROPERTY. IT IS 42 FEET N OF THE CENTER LINE OF ROUTE 32, 12
AF0480'FEET S OF FENCE LINE, 58 FEET W OF THE CENTER LINE OF A CATTLE
AF0480'GUARD, 89 FEET E OF GATEPOST, ABOUT 0.1 MILE W OF WARNING SIGN
AF0480'STOP FOR SCHOOL BUS. PROJECTS 2 INCHES.

AF0480'

AF0480'SURFACE, UNDERGROUND, REFERENCE AND AZIMUTH MARKS ARE STANDARD
AF0480'BRONZE DISKS SET IN CONCRETE.

AF0480'

AF0480'REFERENCE MARK NO. 1 IS SE OF THE STATION, 42 FEET S OF THE
AF0480'CENTER LINE OF ROUTE 32, 1-1/2 FEET N OF FENCE LINE. MARK IS
AF0480'FLUSH WITH TOP OF GROUND.

AF0480'

AF0480'REFERENCE MARK NO. 2 IS SW OF THE STATION, 42 FEET S OF THE
AF0480'CENTER LINE OF ROUTE 32, 1-1/2 FEET N OF FENCE LINE. MARK
AF0480'PROJECTS 2 INCHES.

AF0480'

AF0480'AZIMUTH MARK IS E OF THE STATION, 41 FEET S OF THE CENTER LINE
AF0480'OF ROUTE 32, 1-1/2 FEET N OF FENCE LINE, 30 FEET W OF THE CENTER
AF0480'LINE OF CATTLE GUARD AND TRAIL SOUTHWARD THROUGH SCRUB
AF0480'PALMETTOES. MARK PROJECTS 3 INCHES.

AF0480'

AF0480'TO REACH FROM WAUCHULA, GO N ON U.S. ROUTE 17 FOR 3.4 MILES TO
AF0480'JUNCTION WITH ROUTE 32. HERE TURN W AND GO 10.3 MILES TO THE
AF0480'STATION ON RIGHT OR 2.8 MILES W OF THE FORT GREEN POST OFFICE TO
AF0480'STATION.

AF0480'

AF0480'HEIGHT OF LIGHT ABOVE STATION MARK 34.7 METERS.

AF0480

AF0480

STATION RECOVERY (1963)

AF0480

AF0480'RECOVERY NOTE BY COAST AND GEODETIC SURVEY 1963 (VRS)

AF0480'THE STATION WAS NOT RECOVERED AFTER A THOROUGH SEARCH. IT IS
AF0480'BELIEVED THAT THE STATION WAS DESTROYED WHEN THE HIGHWAY WAS
AF0480'WIDENED AND REPAVED.

AF0480

AF0480

STATION RECOVERY (1974)

AF0480

AF0480'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1974 (CLN)

AF0480'RM 1 TO RM 3 OBSTRUCTED BY HIGH BRUSH.

AF0480'

AF0480'THE STATION UNDERGROUND MARK AND REFERENCE MARK 1 WERE
RECOVERED

AF0480'AND FOUND IN GOOD CONDITION. THE SURFACE STATION MARK AND
AF0480'REFERENCE MARK 2 WERE FOUND DESTROYED. AZIMUTH MARK WAS
SEARCHED

AF0480'FOR AT LENGTH BUT NOT FOUND. APPARENTLY THE AZIMUTH MARK WAS
AF0480'DESTROYED WHEN THE HIGHWAY WAS RECONSTRUCTED. A NEW SURFACE
AF0480'STATION MARK WAS SET DIRECTLY OVER THE UNDERGROUND STATION
AF0480'MARK. REFERENCE MARK 3 WAS ALSO ESTABLISHED AT THIS TIME. THE

AF0480'DISTANCE TO REFERENCE MARK 1 CHECKED THE ORIGINAL DESCRIPTION.
AF0480'A NEW AZIMUTH MARK WAS ESTABLISHED AT THIS TIME. DUE TO
AF0480'CHANGES, A COMPLETE NEW DESCRIPTION FOLLOWS.

AF0480'

AF0480'STATION IS ABOUT 37 MILES SOUTHEAST OF TAMPA, 22 MILES SOUTHWEST
AF0480'OF BARTOW, 12 MILES WEST-NORTHWEST OF WAUCHULA, 2.8 MILES WEST
AF0480'OF FORT GREEN SPRINGS AND ON PROPERTY OF MR. D. WATERS WHO LIVES
AF0480'0.4 MILES EAST OF STATION ON THE NORTH SIDE OF STATE HIGHWAY 62.

AF0480'

AF0480'TO REACH THE STATION FROM THE JUNCTION OF STATE HIGHWAY 62 AND
AF0480'SECONDARY ROAD S-663 IN FORT GREEN SPRINGS, GO WEST ON STATE
AF0480'HIGHWAY 62 FOR 2.75 MILES TO STATION ON RIGHT.

AF0480'

AF0480'STATION MARK, A STANDARD DISK STAMPED FORT 1937 1974, IS SET IN
AF0480'THE TOP OF A 12-INCH CYLINDRICAL CONCRETE MONUMENT THAT IS SET
AF0480'3-INCHES BELOW THE GROUND SURFACE. IT IS 261 FEET EAST OF POWER
AF0480'LINE POLE 16-89A, 128 FEET WEST OF POWER LINE POLE 1689, 41.5
AF0480'FEET NORTH OF THE CENTER OF STATE HIGHWAY 62, 6.1 FEET NORTH OF
AF0480'A METAL WITNESS POST, 5.8 FEET NORTH OF A WIRE RIGHT-OF-WAY
AF0480'FENCE AND 1 FOOT SOUTH OF A METAL WITNESS POST. THE UNDERGROUND
AF0480'MARK IS A STANDARD DISK STAMPED FORT 1937, IS SET IN THE TOP
AF0480'OF AN IRREGULAR MASS OF CONCRETE ABOUT 28-INCHES BELOW THE
AF0480'GROUND SURFACE.

AF0480'

AF0480'REFERENCE MARK 1, A STANDARD DISK STAMPED FORT NO 1 1937, IS
AF0480'SET IN THE TOP OF A 12-INCH SQUARE CONCRETE MONUMENT THAT IS
AF0480'SET FLUSH WITH THE GROUND SURFACE. IT IS 94 FEET SOUTH-SOUTHWEST
AF0480'OF POWER LINE POLE NUMBERED 1689, 42 FEET SOUTH OF THE CENTER OF
AF0480'STATE HIGHWAY 62, 1.3 FEET NORTH OF A WIRE RIGHT-OF-WAY FENCE AND
AF0480'1.1 FEET NORTHWEST OF A METAL WITNESS POST.

AF0480'

AF0480'REFERENCE MARK 3, A STANDARD DISK STAMPED FORT 1937 NO 3 1974,
AF0480'IS SET IN THE TOP OF A 12-INCH CYLINDRICAL CONCRETE MONUMENT
AF0480'THAT IS SET FLUSH WITH THE GROUND SURFACE. IT IS 201 FEET
AF0480'SOUTHEAST OF POWER LINE POLE 16-89A, 41.3 FEET SOUTH OF THE CENTER
AF0480'OF HIGHWAY, 1.5 FEET NORTH OF THE WIRE FENCE AND 1 FOOT NORTH OF
AF0480'A METAL WITNESS POST.

AF0480'

AF0480'AIRLINE DISTANCE AND DIRECTION FROM NEAREST TOWN
AF0480'2.8 MILES WEST OF FORT GREEN SPRINGS.

AF0480

AF0480 STATION RECOVERY (1974)

AF0480

AF0480'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1974

AF0480'RECOVERED IN GOOD CONDITION.

AF0480

AF0480 STATION RECOVERY (1989)

AF0480

AF0480'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1989

AF0480'THE STATION IS LOCATED ABOUT 59.54 KM (37.00 MI) SOUTHEAST OF TAMPA,
AF0480'35.40 KM (22.00 MI) SOUTHWEST OF BARTOW, 19.31 KM (12.00 MI)

AF0480'WEST-NORTHWEST OF WAUCHULA, 13.04 KM (8.10 MI) EAST OF DUETTE, 6.12 KM AF0480'(3.80 MI) WEST OF FORT GREEN SPRINGS, ON THE NORTH SIDE OF STATE AF0480'HIGHWAY 62. OWNERSHIP--UNKNOWN.

AF0480'TO REACH THE STATION FROM THE JUNCTION OF STATE HIGHWAY 62 AND COUNTY

AF0480'ROAD 663 IN FORT GREEN SPRINGS, GO WEST FOR 4.10 KM (2.55 MI) ON AF0480'HIGHWAY 62 TO THE D. WATERS RESIDENCE (BOX 113) ON RIGHT. CONTINUE AF0480'WEST FOR 0.56 KM (0.35 MI) ON HIGHWAY 62 TO THE STATION ON RIGHT.

AF0480'LOCATED 62.03 M (203.5 FT) WEST FROM UTILITY POLE NUMBER 1689, 48.74 M AF0480'(159.9 FT) EAST FROM UTILITY POLE NUMBER A1689A, 12.65 M (41.5 FT)

AF0480'NORTH FROM THE APPROXIMATE CENTER OF HIGHWAY 62, 1.86 M (6.1 FT) NORTH AF0480'FROM A WITNESS POST AND 1.77 M (5.8 FT) NORTH FROM A BARBED WIRE AF0480'FENCE.

AF0480'DESCRIBED BY R.L. TAYLOR.

AF0480

AF0480 STATION RECOVERY (1991)

AF0480

AF0480'RECOVERY NOTE BY KEITH AND SCHNARS - LAKELAND 1991

AF0480'RECOVERED IN GOOD CONDITION.

AF0480

AF0480 STATION RECOVERY (2001)

AF0480

AF0480'RECOVERY NOTE BY HILLSBOROUGH COUNTY FLORIDA 2001 (RJA)

AF0480'THE STATION IS LOCATED IN HARDEE COUNTY, FLORIDA, ABOUT 37.0 MILES

AF0480'SOUTHEAST OF THE CITY OF TAMPA, 22.0 MILES SOUTHWEST OF BARTOW, IN

AF0480'SECTION 22 TOWNSHIP 33 SOUTH, RANGE 23 EAST. OWNERSHIP---UNKNOWN.

THE

AF0480'STATION IS A 12 INCH ROUND CONCRETE MONUMENT. FLUSHED WITH THE AF0480'GROUND. TO REACH THE STATION FROM THE INTERSECTION OF C.R. 39 7 S.R.

AF0480'674 IN FT. LONESOME, PROCEED EAST ON S.R.674 FOR 7.7 MILES TO C.R.

AF0480'37, TURN RIGHT (SOUTH) AND GO 10.1 MILES TO S.R. 62, TURN LEFT (EAST)

AF0480'AND GO FOR 8.1 MILES TO THE STATION ON THE LEFT (NORTH) SIDE OF

AF0480'ROAD. 10.2 MILES EAST OF C.R. 39.

AF0480'

AF0480'5.8 FT NORTH OF A BARB WIRE FENCE (LAYING DOWN). 6.1 FT NORTH OF A

AF0480'METAL WITNESS POST AND NGS SIGN. 29.8 FT NORTH OF A NAIL AND HILLS

AF0480'COUNTY DISK IN THE NORTH EDGE OF PAVEMENT OF S.R.62. 42.1 FT

AF0480'EAST-NORTHEAST OF A NAIL KEITH SCHNARS PCP DISK IN THE SOUTH FACE OF

AF0480'A 7.FT WOOD POLE AND TELEPHONE RISER. 160. FT EAST-SOUTHEAST OF A

AF0480'UTILITY POLE A1689A. 203.5 FTWEST-SOUTHWEST OF A UTILITY POLE 1689.

AF0480

AF0480 STATION RECOVERY (2003)

AF0480

AF0480'RECOVERY NOTE BY POLK COUNTY FLORIDA 2003 (RWY)

AF0480'RECOVERED AS DESCRIBED. RECOVERY NOTE BY POLK COUNTY PROPERTY

AF0480'APPRAISER GIS DEPARTMENT.

AF0480

AF0480 STATION RECOVERY (2007)

AF0480

AF0480'RECOVERY NOTE BY PICKETT AND ASSOCIATES 2007 (JKR)

AF0480'RECOVERED AS DESCRIBED.

1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009
 AG6339 *****
 AG6339 HT_MOD - This is a Height Modernization Survey Station.
 AG6339 DESIGNATION - G 66
 AG6339 PID - AG6339
 AG6339 STATE/COUNTY- FL/HARDEE
 AG6339 USGS QUAD - DUETTE (1987)
 AG6339
 AG6339 *CURRENT SURVEY CONTROL
 AG6339
 AG6339* NAD 83(2007)- 27 35 43.20907(N) 082 02 50.96498(W) ADJUSTED
 AG6339* NAVD 88 - 38.49 (meters) 126.3 (feet) GPS OBS
 AG6339
 AG6339 EPOCH DATE - 2002.00
 AG6339 X - 782,609.554 (meters) COMP
 AG6339 Y - -5,602,245.124 (meters) COMP
 AG6339 Z - 2,936,843.225 (meters) COMP
 AG6339 LAPLACE CORR- -1.01 (seconds) DEFLEC99
 AG6339 ELLIP HEIGHT- 13.565 (meters) (04/16/08) ADJUSTED
 AG6339 GEOID HEIGHT- -24.98 (meters) GEOID03
 AG6339 HORZ ORDER - FIRST
 AG6339 ELLP ORDER - THIRD CLASS I
 AG6339
 AG6339.The horizontal coordinates were established by GPS observations
 AG6339.and adjusted by the FL DEPT OF ENV PRO in April 2008.
 AG6339
 AG6339.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).
 AG6339.See National Readjustment for more information.
 AG6339.The horizontal coordinates are valid at the epoch date displayed above.
 AG6339.The epoch date for horizontal control is a decimal equivalence
 AG6339.of Year/Month/Day.
 AG6339
 AG6339.The orthometric height was determined by GPS observations and a
 AG6339.high-resolution geoid model.
 AG6339.The orthometric height was determined by GPS observations and a
 AG6339.high-resolution geoid model using precise GPS observation and
 AG6339.processing techniques. It supersedes the leveled height previously
 AG6339.determined for this station.
 AG6339
 AG6339.The X, Y, and Z were computed from the position and the ellipsoidal ht.
 AG6339
 AG6339.The Laplace correction was computed from DEFLEC99 derived deflections.
 AG6339
 AG6339.The ellipsoidal height was determined by GPS observations
 AG6339.and is referenced to NAD 83.
 AG6339
 AG6339.The geoid height was determined by GEOID03.
 AG6339
 AG6339;
 AG6339;SPC FL W - 361,369.181 195,311.710 MT 0.99994145 -0 01 19.2
 AG6339;SPC FL W - 1,185,592.05 640,785.17 sFT 0.99994145 -0 01 19.2

AG6339;UTM 17 - 3,052,814.735 396,622.626 MT 0.99973191 -0 29 07.0
AG6339

AG6339! - Elev Factor x Scale Factor = Combined Factor
AG6339!SPC FL W - 0.99999787 x 0.99994145 = 0.99993932
AG6339!UTM 17 - 0.99999787 x 0.99973191 = 0.99972978

AG6339

AG6339 SUPERSEDED SURVEY CONTROL

AG6339

AG6339 NAVD 88 (06/15/91) 38.434 (m) 126.10 (f) ADJUSTED 2 0

AG6339 NGVD 29 (??/??/92) 38.710 (m) 127.00 (f) ADJ UNCH 2 0

AG6339

AG6339.Superseded values are not recommended for survey control.

AG6339.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AG6339.See file dsdata.txt to determine how the superseded data were derived.

AG6339

AG6339_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RLL9662352815(NAD 83)

AG6339_MARKER: DB = BENCH MARK DISK

AG6339_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

AG6339_SP_SET: SET IN TOP OF CONCRETE MONUMENT

AG6339_STAMPING: G 66 1934

AG6339_MARK LOGO: NONE

AG6339_PROJECTION: PROJECTING 13 CENTIMETERS

AG6339_MAGNETIC: N = NO MAGNETIC MATERIAL

AG6339_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO

AG6339+STABILITY: SURFACE MOTION

AG6339_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AG6339+SATELLITE: SATELLITE OBSERVATIONS - April 23, 2007

AG6339

AG6339 HISTORY	- Date	Condition	Report By
AG6339 HISTORY	- 1934	MONUMENTED	CGS
AG6339 HISTORY	- 1954	GOOD	NGS
AG6339 HISTORY	- 20031001	GOOD	FL-105
AG6339 HISTORY	- 20070423	GOOD	PICKET

AG6339

AG6339 STATION DESCRIPTION

AG6339

AG6339'DESCRIBED BY NATIONAL GEODETIC SURVEY 1954

AG6339'6.4 MI W FROM FORT GREEN SPRINGS.

AG6339'6.4 MILES WEST ALONG STATE HIGHWAY 62 (FORMERLY 32) FROM THE
AG6339'CROSSING OF THE SEABOARD AIR LINE RAILROAD AT FORT GREEN SPRINGS,
AG6339'0.2 MILE WEST OF A 20-INCH CONCRETE CULVERT, 45 FEET NORTH OF
AG6339'THE CENTERLINE OF THE HIGHWAY, AND 34 FEET WEST OF THE CENTERLINE
AG6339'OF A WOODEN CATTLE GATE. A STANDARD DISK, STAMPED G 66 1934
AG6339'AND SET IN THE TOP OF A CONCRETE POST PROJECTING ABOUT 5 INCHES
AG6339'ABOVE GROUND.

AG6339

AG6339 STATION RECOVERY (2003)

AG6339

AG6339'RECOVERY NOTE BY POLK COUNTY FLORIDA 2003 (RWY)

AG6339'RECOVERED AS DESCRIBED. RECOVERY NOTE BY POLK COUNTY PROPERTY

AG6339'APPRAISER GIS DEPARTMENT.

AG6339
AG6339 STATION RECOVERY (2007)
AG6339
AG6339 RECOVERY NOTE BY PICKETT AND ASSOCIATES 2007 (JKR)
AG6339 RECOVERED AS DESCRIBED.
1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009
DK4256 *****
DK4256 HT_MOD - This is a Height Modernization Survey Station.
DK4256 DESIGNATION - HAR 02
DK4256 PID - DK4256
DK4256 STATE/COUNTY- FL/HARDEE
DK4256 USGS QUAD - WAUCHULA (1993)
DK4256
DK4256 *CURRENT SURVEY CONTROL
DK4256
DK4256 * NAD 83(2007)- 27 33 36.84706(N) 081 51 01.23250(W) ADJUSTED
DK4256 * NAVD 88 - 34.99 (meters) 114.8 (feet) GPS OBS
DK4256
DK4256 EPOCH DATE - 2002.00
DK4256 X - 802,136.339 (meters) COMP
DK4256 Y - -5,601,298.379 (meters) COMP
DK4256 Z - 2,933,393.849 (meters) COMP
DK4256 LAPLACE CORR- -1.75 (seconds) DEFLEC99
DK4256 ELLIP HEIGHT- 9.881 (meters) (04/16/08) ADJUSTED
DK4256 GEOID HEIGHT- -25.16 (meters) GEOID03
DK4256 HORZ ORDER - FIRST
DK4256 ELLP ORDER - THIRD CLASS I
DK4256
DK4256.The horizontal coordinates were established by GPS observations
DK4256.and adjusted by the FL DEPT OF ENV PRO in April 2008.
DK4256
DK4256.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).
DK4256.See National Readjustment for more information.
DK4256.The horizontal coordinates are valid at the epoch date displayed above.
DK4256.The epoch date for horizontal control is a decimal equivalence
DK4256.of Year/Month/Day.
DK4256
DK4256.The orthometric height was determined by GPS observations and a
DK4256.high-resolution geoid model.
DK4256.The orthometric height was determined by GPS observations and a
DK4256.high-resolution geoid model using precise GPS observation and
DK4256.processing techniques.
DK4256
DK4256.The X, Y, and Z were computed from the position and the ellipsoidal ht.
DK4256
DK4256.The Laplace correction was computed from DEFLEC99 derived deflections.
DK4256
DK4256.The ellipsoidal height was determined by GPS observations
DK4256.and is referenced to NAD 83.
DK4256
DK4256.The geoid height was determined by GEOID03.

DK4256
DK4256; North East Units Scale Factor Converg.
DK4256;SPC FL W - 357,487.854 214,779.073 MT 0.99994387 +0 04 09.3
DK4256;SPC FL W - 1,172,858.07 704,654.34 sFT 0.99994387 +0 04 09.3
DK4256;UTM 17 - 3,048,777.169 416,053.458 MT 0.99968698 -0 23 36.5

DK4256
DK4256! - Elev Factor x Scale Factor = Combined Factor
DK4256!SPC FL W - 0.99999845 x 0.99994387 = 0.99994232
DK4256!UTM 17 - 0.99999845 x 0.99968698 = 0.99968543

DK4256
DK4256 SUPERSEDED SURVEY CONTROL

DK4256
DK4256.No superseded survey control is available for this station.

DK4256
DK4256_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML1605348777(NAD 83)

DK4256_MARKER: DD = SURVEY DISK

DK4256_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

DK4256_STAMPING: HAR 02 2007

DK4256_MARK LOGO: FLDEP

DK4256_PROJECTION: RECESSED 15 CENTIMETERS

DK4256_MAGNETIC: N = NO MAGNETIC MATERIAL

DK4256_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

DK4256_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

DK4256+SATELLITE: SATELLITE OBSERVATIONS - April , 2007

DK4256

DK4256 HISTORY -Date Condition Report By

DK4256 HISTORY -200704 MONUMENTED PICKET

DK4256

DK4256 STATION DESCRIPTION

DK4256

DK4256'DESCRIBED BY PICKETT AND ASSOCIATES 2007

DK4256'THE MARK IS ABOUT 2.4 MI (3.9 KM) WEST-NORTHWEST OF WAUCHULA, 5.6 MI

DK4256'(9.0 KM) SOUTH-SOUTHWEST OF BOWLING GREEN AND 5.6 MI (9.0 KM)

DK4256'NORTHWEST OF ZOLFO SPRINGS, IN THE WEST RIGHT-OF-WAY OF HAMPTON ROAD.

DK4256'

DK4256'TO REACH FROM THE INTERSECTION OF SOUTHBOUND US HIGHWAY 17 AND MAIN

DK4256'STREET IN WAUCHULA, GO WEST ON MAIN STREET 1.3 MI (2.1 KM) TO THE

DK4256'INTERSECTION OF MAIN STREET AND TERRELL ROAD, TURN RIGHT ON TERRELL

DK4256'ROAD HEADING NORTH AND GO 0.8 MI (1.3 KM) TO THE INTERSECTION OF

DK4256'TERRELL ROAD AND KAZEN ROAD, TURN LEFT HEADING WEST ON KAZEN ROAD AND

DK4256'GO 1.0 MI (1.6 KM) TO THE INTERSECTION OF KAZEN ROAD AND HAMPTON ROAD,

DK4256'TURN RIGHT ON HAMPTON HEADING NORTH AND GO 0.1 MI (0.2 KM) TO THE MARK

DK4256'ON ON THE LEFT.

DK4256'

DK4256'THE MARK IS A CONCRETE MONUMENT AND IS LOCATED 19.2 FT (5.9 M) EAST OF DK4256'A CARSONITE WITNESS POST AND 4-STRAND BARBED WIRE FENCE AND 10.8 FT

DK4256(3.3 M) WEST OF THE WESTERNMOST EDGE OF PAVEMENT FOR HAMPTON ROAD.
DK4256'

DK4256'THE FOLLOWING THREE ACCESSORIES (PK NAIL AND BRASS DISK - LB364) HAVE
DK4256'BEEN SET IN REFERENCE TO THE MARK, 1 - FROM A PK NAIL AND DISK IN EDGE
DK4256'OF PAYMENT, GO NORTH 83D WEST 10.8 FT (3.3 M)TO THE MARK, 2 - FROM A
DK4256'PK NAIL AND DISK IN EDGE OF PAYMENT, GO SOUTH 21D WEST 43.7 FT (13.3
DK4256'M) TO THE MARK, 3 - FROM A PK NAIL AND DISK IN EDGE OF PAYMENT, GO
DK4256'NORTH 10D WEST, 45.3 FT (13.8 M) TO THE MARK.

1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009

DK4255 *****

DK4255 HT_MOD - This is a Height Modernization Survey Station.

DK4255 DESIGNATION - HAR 03

DK4255 PID - DK4255

DK4255 STATE/COUNTY- FL/HARDEE

DK4255 USGS QUAD - WAUCHULA (1993)

DK4255

DK4255 *CURRENT SURVEY CONTROL

DK4255

DK4255* NAD 83(2007)- 27 33 28.35273(N) 081 46 05.91404(W) ADJUSTED

DK4255* NAVD 88 - 22.77 (meters) 74.7 (feet) GPS OBS

DK4255

DK4255 EPOCH DATE - 2002.00

DK4255 X - 810,170.893 (meters) COMP

DK4255 Y - -5,600,253.069 (meters) COMP

DK4255 Z - 2,933,156.335 (meters) COMP

DK4255 LAPLACE CORR- -2.09 (seconds) DEFLEC99

DK4255 ELLIP HEIGHT- -2.473 (meters) (04/16/08) ADJUSTED

DK4255 GEOID HEIGHT- -25.30 (meters) GEOID03

DK4255 HORZ ORDER - FIRST

DK4255 ELLP ORDER - THIRD CLASS I

DK4255

DK4255.The horizontal coordinates were established by GPS observations

DK4255.and adjusted by the FL DEPT OF ENV PRO in April 2008.

DK4255

DK4255.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).

DK4255.See National Readjustment for more information.

DK4255.The horizontal coordinates are valid at the epoch date displayed above.

DK4255.The epoch date for horizontal control is a decimal equivalence

DK4255.of Year/Month/Day.

DK4255

DK4255.The orthometric height was determined by GPS observations and a

DK4255.high-resolution geoid model.

DK4255.The orthometric height was determined by GPS observations and a

DK4255.high-resolution geoid model using precise GPS observation and

DK4255.processing techniques.

DK4255

DK4255.The X, Y, and Z were computed from the position and the ellipsoidal ht.

DK4255

DK4255.The Laplace correction was computed from DEFLEC99 derived deflections.

DK4255

DK4255.The ellipsoidal height was determined by GPS observations

DK4255.and is referenced to NAD 83.

DK4255

DK4255.The geoid height was determined by GEOID03.

DK4255

DK4255; North East Units Scale Factor Converg.

DK4255;SPC FL W - 357,238.876 222,880.541 MT 0.99994764 +0 06 25.9

DK4255;SPC FL W - 1,172,041.21 731,233.91 sFT 0.99994764 +0 06 25.9

DK4255;UTM 17 - 3,048,462.862 424,150.491 MT 0.99967101 -0 21 19.7

DK4255

DK4255! - Elev Factor x Scale Factor = Combined Factor

DK4255!SPC FL W - 1.00000039 x 0.99994764 = 0.99994803

DK4255!UTM 17 - 1.00000039 x 0.99967101 = 0.99967140

DK4255

DK4255 SUPERSEDED SURVEY CONTROL

DK4255

DK4255.No superseded survey control is available for this station.

DK4255

DK4255_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML2415048463(NAD 83)

DK4255_MARKER: DD = SURVEY DISK

DK4255_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

DK4255_STAMPING: HAR 03 2007

DK4255_MARK LOGO: FLDEP

DK4255_PROJECTION: RECESSED 30 CENTIMETERS

DK4255_MAGNETIC: N = NO MAGNETIC MATERIAL

DK4255_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

DK4255_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

DK4255+SATELLITE: SATELLITE OBSERVATIONS - April , 2007

DK4255

DK4255 HISTORY - Date Condition Report By

DK4255 HISTORY - 200704 MONUMENTED PICKET

DK4255

DK4255 STATION DESCRIPTION

DK4255

DK4255'DESCRIBED BY PICKETT AND ASSOCIATES 2007

DK4255'THE MARK IS LOCATED ABOUT 2.9 MI (4.7 KM) EAST OF WAUCHULA, 4.9 MI

DK4255'(7.9 KM) NORTH-NORTHEAST OF ZOLFO SPRINGS AND 11.1 MI (17.9 KM)

DK4255'SOUTHEAST OF BOWLING GREEN IN THE WEST RIGHT OF WAY OF BOYD

COWART

DK4255'ROAD.

DK4255'

DK4255'TO REACH FROM THE INTERSECTION OF SOUTHBOUND US HIGHWAY 17 AND

MAIN

DK4255'STREET IN WAUCHULA, GO EAST ON MAIN STREET 2.65 MI (4.3 KM) TO THE

DK4255'INTERSECTION OF MAIN STREET AND BOYD COWART ROAD, TURN LEFT

HEADING

DK4255'NORTH ON BOYD COWART FOR 0.45 MI (0.7 KM) TO THE INTERSECTION OF BOYD

DK4255'COWART ROAD AND SUMMER ROAD AND THE MARK IN THE NORTHEAST

QUADRANT OF

DK4255'THE INTERSECTION.

DK4255'

DK4255'THE MARK IS A CONCRETE MONUMENT AND IS LOCATED 19.2 FT (5.9 M) EAST OF

DK4255'A CARSONITE WITNESS POST AND 8.7 FT (2.7 M) WEST OF THE THE WEST EDGE
DK4255'OF PAVEMENT OF BOYD COWART ROAD.

DK4255'

DK4255'THE FOLLOWING THREE ACCESSORIES (PK NAIL AND BRASS DISK - LB364) HAVE
DK4255'BEEN SET IN REFERENCE TO THE MARK, 1 - FROM A PK NAIL AND DISK IN EDGE
DK4255'OF PAYMENT, NORTH 61D WEST 8.7 FT (2.7 M)TO THE MARK, 2 - FROM A PK
DK4255'NAIL AND DISK IN EDGE OF PAYMENT, GO NORTH 31D EAST 63.8 FT (19.5 M)
DK4255'TO THE MARK, 3 - FROM A PK NAIL AND DISK IN THE FACE OF A POWER POLE
DK4255'NO. 24-88, GO SOUTH 55D EAST 20.6 FT (6.3 M) TO THE MARK.

1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009

AF7572 *****

AF7572 HT_MOD - This is a Height Modernization Survey Station.

AF7572 DESIGNATION - K018

AF7572 PID - AF7572

AF7572 STATE/COUNTY- FL/POLK

AF7572 USGS QUAD - BOWLING GREEN (1987)

AF7572

AF7572 *CURRENT SURVEY CONTROL

AF7572

AF7572* NAD 83(2007)- 27 38 46.29557(N) 081 51 31.71955(W) ADJUSTED

AF7572* NAVD 88 - 27.82 (meters) 91.3 (feet) GPS OBS

AF7572

AF7572 EPOCH DATE - 2002.00

AF7572 X - 800,682.504 (meters) COMP

AF7572 Y - -5,597,041.454 (meters) COMP

AF7572 Z - 2,941,831.546 (meters) COMP

AF7572 LAPLACE CORR- -1.87 (seconds) DEFLEC99

AF7572 ELLIP HEIGHT- 2.576 (meters) (04/16/08) ADJUSTED

AF7572 GEOID HEIGHT- -25.30 (meters) GEOID03

AF7572

AF7572 ----- Accuracy Estimates (at 95% Confidence Level in cm) -----

AF7572 Type PID Designation North East Ellip

AF7572 -----

AF7572 NETWORK AF7572 K018 0.76 0.78 1.67

AF7572 -----

AF7572 ELLP ORDER - THIRD CLASS I

AF7572

AF7572.The horizontal coordinates were established by GPS observations

AF7572.and adjusted by the National Geodetic Survey in February 2007.

AF7572

AF7572.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).

AF7572.See National Readjustment for more information.

AF7572.The horizontal coordinates are valid at the epoch date displayed above.

AF7572.The epoch date for horizontal control is a decimal equivalence

AF7572.of Year/Month/Day.

AF7572

AF7572.The orthometric height was determined by GPS observations and a

AF7572.high-resolution geoid model.

AF7572.The orthometric height was determined by GPS observations and a

AF7572.high-resolution geoid model using precise GPS observation and

AF7572.processing techniques.

AF7572_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
AF7572+SATELLITE: SATELLITE OBSERVATIONS - April 17, 2007

AF7572_ROD/PIPE-DEPTH: 13.4 meters

AF7572

AF7572 HISTORY	- Date	Condition	Report By
AF7572 HISTORY	- 1991	MONUMENTED	KEISCH
AF7572 HISTORY	- 19930511	GOOD	KEISCH
AF7572 HISTORY	- 19990216	GOOD	USPSQD
AF7572 HISTORY	- 20030710	GOOD	FL-105
AF7572 HISTORY	- 20070417	GOOD	PICKET

AF7572

AF7572 STATION DESCRIPTION

AF7572

AF7572'DESCRIBED BY KEITH AND SCHNARS - LAKELAND 1991

AF7572'THE STATION IS LOCATED ABOUT 3 MI (4.8 KM) WEST OF BOWLING GREEN IN
AF7572'THE SOUTH RIGHT-OF-WAY OF COUNTY LINE ROAD NEAR THE SOUTHWEST
CORNER

AF7572'OF SECTION 31, TOWNSHIP 32 SOUTH, RANGE 25 EAST, POLK COUNTY,
AF7572'FLORIDA.

AF7572'TO REACH THE STATION FROM THE INTERSECTION OF U.S. 17 AND COUNTY LINE
AF7572'ROAD IN BOWLING GREEN, GO WEST ON COUNTY LINE ROAD 3 MI (4.8 KM) TO
AF7572'THE INTERSECTION OF COUNTY LINE ROAD AND YATES TIGHMAN ROAD. THE
AF7572'STATION LIES IN THE SOUTH QUADRANT OF THE INTERSECTION, 28 FT
AF7572'(8.5 M) WEST OF A POWER POLE (NUMBER 29-2), AND 8 FT (2.4 M) SOUTH OF
AF7572'THE SOUTH EDGE OF PAVEMENT. ACCESS TO DATUM POINT--THE STATION IS
AF7572'RECESSED 0.5 FT BELOW GROUND INSIDE A NGS LOGO CAP WHICH IS MOUNTED
ON

AF7572'A 5 1/4 INCH DIAMETER PVC PIPE SET IN A CONCRETE COLLAR.

AF7572'REFERENCES--

AF7572'KEITH AND SCHNARS REFERENCE CAP, SET ON 5/8 INCH IRON ROD, SOUTH 76
AF7572'DEGREES WEST AT 28.78 FT (8.77 M).

AF7572'FOUND 3/4 INCH IRON PIPE IN CENTER OF 6 FEET PAINTED CROSS AERIAL
AF7572'TARGET, NORTH 41 DEGREES WEST AT 22.59 FT (6.89 M).

AF7572'KEITH AND SCHNARS NAIL AND DISC, SET IN POWER POLE (NUMBER 28-4),
AF7572'NORTH 17 DEGREES EAST AT 45.04 FT (13.73 M).

AF7572'KEITH AND SCHNARS NAIL AND DISC, SET IN POWER POLE (NUMBER 29-2),
AF7572'SOUTH 82 DEGREES EAST AT 28.05 FT (8.55 M).

AF7572'SET CARSONITE WITNESS POST, SOUTH 2 DEGREE WEST AT 9.36 FT (2.85 M).

AF7572

AF7572 STATION RECOVERY (1993)

AF7572

AF7572'RECOVERY NOTE BY KEITH AND SCHNARS - LAKELAND 1993

AF7572'THE STATION IS LOCATED ABOUT 3 MI (4.8 KM) WEST OF BOWLING GREEN IN
AF7572'THE SOUTH RIGHT-OF-WAY OF COUNTY LINE ROAD NEAR THE SOUTHWEST
CORNER

AF7572'OF SECTION 31, TOWNSHIP 32 SOUTH, RANGE 25 EAST, POLK COUNTY,
AF7572'FLORIDA.

AF7572'TO REACH THE STATION FROM THE INTERSECTION OF U.S. 17 AND COUNTY LINE
AF7572'ROAD IN BOWLING GREEN, GO WEST ON COUNTY LINE ROAD 2.2 MI (3.5 KM) TO
AF7572'THE INTERSECTION OF COUNTY LINE ROAD AND YATES TIGHMAN ROAD. THE
AF7572'STATION LIES IN THE SOUTH QUADRANT OF THE INTERSECTION, 28 FT

AF7572'(8.5 M) WEST OF A POWER POLE (NUMBER 29-2), AND 8 FT (2.4 M) SOUTH OF AF7572'THE SOUTH EDGE OF PAVEMENT. ACCESS TO DATUM POINT--THE STATION IS AF7572'RECESSED 0.5 FTBELOW GROUND INSIDE A NGS LOGO CAP WHICH IS MOUNTED ON

AF7572'A 5 1/4 INCH DIAMETER PVC PIPE SET IN A CONCRETE COLLAR.

AF7572'REFERENCES--

AF7572'KEITH AND SCHNARS REFERENCE CAP, SET ON 5/8 INCH IRON ROD, SOUTH 76 AF7572'DEGREES WEST AT 28.78 FT (8.77 M).

AF7572'FOUND 3/4 INCH IRON PIPE IN CENTER OF 6 FT PAINTED CROSS AERIAL TARGET AF7572'NORTH 41 DEGREES WEST AT 22.59 FT (6.89 M).

AF7572'KEITH AND SCHNARS NAIL AND DISC, SET IN POWER POLE (NUMBER 28-4), AF7572'NORTH 17 DEGREES EAST AT 45.04 FT (13.73 M).

AF7572'KEITH AND SCHNARS NAIL AND DISC, SET IN POWER POLE (NUMBER 29-2), AF7572'SOUTH 82 DEGREES EAST AT 28.05 FT (8.55 M).

AF7572'SET CARSONITE WITNESS POST, SOUTH 2 DEGREE WEST AT 9.36 FT (2.85 M). AF7572

AF7572 STATION RECOVERY (1999)

AF7572

AF7572'RECOVERY NOTE BY US POWER SQUADRON 1999

AF7572'RECOVERED IN GOOD CONDITION.

AF7572

AF7572 STATION RECOVERY (2003)

AF7572

AF7572'RECOVERY NOTE BY POLK COUNTY FLORIDA 2003 (JFO)

AF7572'RECOVERED AS DESCRIBED.RECOVERY NOTEBY POLK COUNTY PROPERTY APPRAISER

AF7572'GIS DEPARTMENT.

AF7572

AF7572 STATION RECOVERY (2007)

AF7572

AF7572'RECOVERY NOTE BY PICKETT AND ASSOCIATES 2007 (JKR)

AF7572'RECOVERED AS DESCRIBED.

l National Geodetic Survey, Retrieval Date = JUNE 19, 2009

AF7582 *****

AF7582 HT_MOD - This is a Height Modernization Survey Station.

AF7582 DESIGNATION - K029

AF7582 PID - AF7582

AF7582 STATE/COUNTY- FL/POLK

AF7582 USGS QUAD - BOWLING GREEN (1987)

AF7582

AF7582 *CURRENT SURVEY CONTROL

AF7582

AF7582* NAD 83(2007)- 27 38 46.43604(N) 081 45 37.41501(W) ADJUSTED

AF7582* NAVD 88 - 37.27 (meters) 122.3 (feet) GPS OBS

AF7582

AF7582 EPOCH DATE - 2002.00

AF7582 X - 810,296.342 (meters) COMP

AF7582 Y - -5,595,664.009 (meters) COMP

AF7582 Z - 2,941,839.686 (meters) COMP

AF7582 LAPLACE CORR- -2.13 (seconds) DEFLEC99

AF7582 ELLIP HEIGHT- 11.864 (meters) (04/16/08) ADJUSTED

AF7582 GEOID HEIGHT- -25.46 (meters) GEOID03

AF7582

AF7582 ----- Accuracy Estimates (at 95% Confidence Level in cm) -----

AF7582 Type PID Designation North East Ellip

AF7582 -----

AF7582 NETWORK AF7582 K029 0.76 0.80 1.65

AF7582 -----

AF7582 ELLP ORDER - THIRD CLASS I

AF7582

AF7582.The horizontal coordinates were established by GPS observations

AF7582.and adjusted by the National Geodetic Survey in February 2007.

AF7582

AF7582.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).

AF7582.See National Readjustment for more information.

AF7582.The horizontal coordinates are valid at the epoch date displayed above.

AF7582.The epoch date for horizontal control is a decimal equivalence

AF7582.of Year/Month/Day.

AF7582

AF7582.The orthometric height was determined by GPS observations and a

AF7582.high-resolution geoid model.

AF7582.The orthometric height was determined by GPS observations and a

AF7582.high-resolution geoid model using precise GPS observation and

AF7582.processing techniques.

AF7582

AF7582.The X, Y, and Z were computed from the position and the ellipsoidal ht.

AF7582

AF7582.The Laplace correction was computed from DEFLEC99 derived deflections.

AF7582

AF7582.The ellipsoidal height was determined by GPS observations

AF7582.and is referenced to NAD 83.

AF7582

AF7582.The geoid height was determined by GEOID03.

AF7582

AF7582; North East Units Scale Factor Converg.

AF7582;SPC FL W - 367,030.888 223,643.355 MT 0.99994807 +0 06 40.3

AF7582;SPC FL W - 1,204,167.17 733,736.57 sFT 0.99994807 +0 06 40.3

AF7582;UTM 17 - 3,058,245.668 424,992.232 MT 0.99966944 -0 21 10.3

AF7582

AF7582! - Elev Factor x Scale Factor = Combined Factor

AF7582!SPC FL W - 0.99999814 x 0.99994807 = 0.99994621

AF7582!UTM 17 - 0.99999814 x 0.99966944 = 0.99966758

AF7582

AF7582: Primary Azimuth Mark

Grid Az

AF7582:SPC FL W - K030

090 34 29.6

AF7582:UTM 17 - K030

091 02 20.2

AF7582

AF7582|-----|

AF7582| PID Reference Object Distance Geod. Az |

AF7582| dddmmss.s |

AF7582| AF7583 K030 APPROX. 0.5 KM 0904109.9 |

AF7582|-----|

AF7582

AF7582 SUPERSEDED SURVEY CONTROL

AF7582

AF7582 ELLIP H (02/10/07) 11.811 (m) GP()

AF7582 NAD 83(1999)- 27 38 46.43590(N) 081 45 37.41467(W) AD() 2

AF7582 ELLIP H (07/06/01) 11.774 (m) GP() 4 2

AF7582 NAD 83(1990)- 27 38 46.43469(N) 081 45 37.41429(W) AD() 2

AF7582 ELLIP H (12/04/92) 11.785 (m) GP() 3 2

AF7582 NGVD 29 (12/04/92) 37.6 (m) 123. (f) GPS OBS 3

AF7582

AF7582.Superseded values are not recommended for survey control.

AF7582.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AF7582.See file dsdata.txt to determine how the superseded data were derived.

AF7582

AF7582_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML2499258246(NAD 83)

AF7582_MARKER: F = FLANGE-ENCASED ROD

AF7582_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)

AF7582_SP_SET: STAINLESS STEEL ROD

AF7582_STAMPING: K029 1991

AF7582_MARK LOGO: NGS

AF7582_PROJECTION: RECESSED 21 CENTIMETERS

AF7582_MAGNETIC: N = NO MAGNETIC MATERIAL

AF7582_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

AF7582_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AF7582+SATELLITE: SATELLITE OBSERVATIONS - April 16, 2007

AF7582_ROD/PIPE-DEPTH: 11 meters

AF7582

AF7582 HISTORY	- Date	Condition	Report By
AF7582 HISTORY	- 1991	MONUMENTED	KEISCH
AF7582 HISTORY	- 19930511	GOOD	KEISCH
AF7582 HISTORY	- 19990216	GOOD	USPSQD
AF7582 HISTORY	- 20030710	GOOD	FL-105
AF7582 HISTORY	- 20070416	GOOD	PICKET

AF7582

AF7582 STATION DESCRIPTION

AF7582

AF7582'DESCRIBED BY KEITH AND SCHNARS - LAKELAND 1991

AF7582'THE STATION IS LOCATED ABOUT 4 MI (6.4 KM) EAST OF BOWLING GREEN IN

AF7582'THE NORTH RIGHT-OF-WAY OF COUNTY LINE ROAD NEAR THE SOUTHWEST CORNER

AF7582'OF SECTION 31, TOWNSHIP 32 SOUTH, RANGE 26 EAST, POLK COUNTY,

AF7582'FLORIDA.

AF7582'TO REACH THE STATION FROM THE INTERSECTION OF U.S. 17 AND COUNTY LINE

AF7582'ROAD IN BOWLING GREEN, GO EAST ON COUNTY LINE ROAD 3.7 MI (6.0 KM) TO

AF7582'THE STATION ON THE RIGHT. THE STATION LIES 0.2 MI (0.3 KM) WEST OF

AF7582'THE INTERSECTION OF COUNTY LINE ROAD AND MANLEY ROAD, 18 FT (5.5 M)

AF7582'EAST AND 49 FT (14.9 M) NORTH OF A POWER POLE (NUMBER 7-22), 3.6 FT

AF7582'(1.1 M) NORTH OF THE NORTH EDGE OF PAVEMENT, AND 14.4 FT (4.4 M)

AF7582'SOUTH OF A BARBWIRE FENCE. ACCESS TO DATUM POINT--THE STATION IS

AF7582'RECESSED 0.7 FT (0.2 M) BELOW GROUND INSIDE A NGS LOGO CAP WHICH IS

AF7582'MOUNTED ON A 5 1/4 INCH DIAMETER PVC PIPE SET IN A CONCRETE COLLAR.

AF7582'REFERENCES--

AF7582'KEITH AND SCHNARS NAIL AND DISC, SET IN POWER POLE (NUMBER 7-22),

AF7582'SOUTH 19 DEGREES WEST AT 51.92 FT (15.83 M).

AF7582'KEITH AND SCHNARS NAIL AND DISC, SET IN FENCE POST, NORTH 77 DEGREES

AF7582'WEST AT 67.22 FT (20.49 M).

AF7582'KEITH AND SCHNARS NAIL AND DISC, SET IN FENCE POST, NORTH 70 DEGREES

AF7582'EAST AT 39.31 FT (11.98 M).

AF7582'KEITH AND SCHNARS NAIL AND DISC, SET IN EDGE OF PAVEMENT, SOUTH 70

AF7582'DEGREES EAST AT 21.28 FT (6.49 M).

AF7582'SET CARSONITE WITNESS POST, NORTH 1 DEGREE WEST AT 14.34 FT (4.37 M).

AF7582

AF7582 STATION RECOVERY (1993)

AF7582

AF7582'RECOVERY NOTE BY KEITH AND SCHNARS - LAKELAND 1993

AF7582'THE STATION IS LOCATED ABOUT 4 MI (6.4 KM) EAST OF BOWLING GREEN IN

AF7582'THE NORTH RIGHT-OF-WAY OF COUNTY LINE ROAD NEAR THE SOUTHWEST CORNER

AF7582'OF SECTION 31, TOWNSHIP 32 SOUTH, RANGE 26 EAST, POLK COUNTY,

AF7582'FLORIDA.

AF7582'TO REACH THE STATION FROM THE INTERSECTION OF U.S. 17 AND COUNTY LINE

AF7582'ROAD IN BOWLING GREEN, GO EAST ON COUNTY LINE ROAD 3.7 MI (6.0 KM) TO

AF7582'THE STATION ON THE LEFT. THE STATION LIES 0.2 MI (0.3 KM) WEST OF THE

AF7582'INTERSECTION OF COUNTY LINE ROAD AND MANLEY ROAD, 18 FT (5.5 M) EAST

AF7582'AND 49 FT (14.9 M) NORTH OF A POWER POLE (NUMBER 7-22), 3.6 FT

AF7582'(1.1 M) NORTH OF THE NORTH EDGE OF PAVEMENT, AND 14.4 FT (4.4 M)

AF7582'SOUTH OF A BARBWIRE FENCE. ACCESS TO DATUM POINT--THE STATION IS

AF7582'RECESSED 0.7 FT (0.2 M) BELOW GROUND INSIDE A NGS LOGO CAP WHICH IS

AF7582'MOUNTED ON A 5 1/4 INCH DIAMETER PVC PIPE SET IN A CONCRETE COLLAR.

AF7582'REFERENCES--

AF7582'KEITH AND SCHNARS NAIL AND DISC, SET IN POWER POLE (NUMBER 7-22),

AF7582'SOUTH 19 DEGREES WEST AT 51.92 FT (15.83 M).

AF7582'KEITH AND SCHNARS NAIL AND DISC, SET IN FENCE POST, NORTH 77 DEGREES

AF7582'WEST AT 67.22 FT (20.49 M).

AF7582'KEITH AND SCHNARS NAIL AND DISC, SET IN FENCE POST, NORTH 70 DEGREES

AF7582'EAST AT 39.31 FT (11.98 M).

AF7582'KEITH AND SCHNARS NAIL AND DISC, SET IN EDGE OF PAVEMENT, SOUTH 70

AF7582'DEGREES EAST AT 21.28 FT (6.49 M).

AF7582'SET CARSONITE WITNESS POST, NORTH 1 DEGREE WEST AT 14.34 FT (4.37 M).

AF7582

AF7582 STATION RECOVERY (1999)

AF7582

AF7582'RECOVERY NOTE BY US POWER SQUADRON 1999

AF7582'RECOVERED IN GOOD CONDITION.

AF7582

AF7582 STATION RECOVERY (2003)

AF7582

AF7582'RECOVERY NOTE BY POLK COUNTY FLORIDA 2003 (JFO)

AF7582'RECOVERED AS DESCRIBED. RECOVERY NOTE BY POLK COUNTY PROPERTY

AF7582'APPRAISER GIS DEPARTMENT.

AF7582

AF7582 STATION RECOVERY (2007)

AF7582

AF7582'RECOVERY NOTE BY PICKETT AND ASSOCIATES 2007 (JKR)

AF7582'RECOVERED AS DESCRIBED.

1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009

DJ6160 *****

DJ6160 DESIGNATION - N 650

DJ6160 PID - DJ6160

DJ6160 STATE/COUNTY- FL/HARDEE

DJ6160 USGS QUAD - WAUCHULA (1993)

DJ6160

DJ6160 *CURRENT SURVEY CONTROL

DJ6160

DJ6160*NAD 83(1986)- 27 33 01. (N) 081 47 47. (W) SCALED

DJ6160*NAVD 88 - 17.596 (meters) 57.73 (feet) ADJUSTED

DJ6160

DJ6160 GEOID HEIGHT- -25.24 (meters) GEOID03

DJ6160 DYNAMIC HT - 17.570 (meters) 57.64 (feet) COMP

DJ6160 MODELED GRAV- 979,145.9 (mgal) NAVD 88

DJ6160

DJ6160 VERT ORDER - SECOND CLASS I

DJ6160

DJ6160.The horizontal coordinates were scaled from a topographic map and have

DJ6160.an estimated accuracy of +/- 6 seconds.

DJ6160

DJ6160.The orthometric height was determined by differential leveling

DJ6160.and adjusted in May 2008.

DJ6160

DJ6160.The geoid height was determined by GEOID03.

DJ6160

DJ6160.The dynamic height is computed by dividing the NAVD 88

DJ6160.geopotential number by the normal gravity value computed on the

DJ6160.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

DJ6160.degrees latitude (g = 980.6199 gals.).

DJ6160

DJ6160.The modeled gravity was interpolated from observed gravity values.

DJ6160

DJ6160; North East Units Estimated Accuracy

DJ6160;SPC FL W - 356,390. 220,110. MT (+/- 180 meters Scaled)

DJ6160

DJ6160 SUPERSEDED SURVEY CONTROL

DJ6160

DJ6160.No superseded survey control is available for this station.

DJ6160

DJ6160_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML213476(NAD 83)

DJ6160_MARKER: DD = SURVEY DISK

DJ6160_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

DJ6160_STAMPING: N 650 2006

DJ6160_MARK LOGO: FLDEP

DJ6160_PROJECTION: RECESSED 8 CENTIMETERS

DJ6160_MAGNETIC: M = MARKER EQUIPPED WITH BAR MAGNET

DJ6160_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO

DJ6160+STABILITY: SURFACE MOTION

DJ6160_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

DJ6160+SATELLITE: SATELLITE OBSERVATIONS - March 15, 2006

DJ6160

DJ6160 HISTORY - Date Condition Report By

DJ6160 HISTORY - 20060315 MONUMENTED FLDEP

DJ6160

DJ6160 STATION DESCRIPTION

DJ6160

DJ6160'DESCRIBED BY FL DEPT OF ENV PRO 2006 (BPJ)

DJ6160'THE MARK IS ABOUT 1.0 MI EAST OF WAUCHULA, IN SECTION 3, TOWNSHIP 34

DJ6160'SOUTH, RANGE 25 EAST.

DJ6160'

DJ6160'TO REACH THE MARK FROM THE NORTH SIDE OF THE HARDEE COUNTY COURT HOUSE

DJ6160'IN WAUCHULA, GO EAST ON COUNTY ROAD 64A (WEST MAIN STREET), BECOMING

DJ6160'STATE ROAD 636 (EAST MAIN STREET) FOR 1.2 MI TO THE JUNCTION OF

DJ6160'RIVERSIDE DRIVE ON THE LEFT AND THE MARK ON THE LEFT, SET IN THE TOP

DJ6160'OF A ROUND CONCRETE MONUMENT RECESSED 0.3 FT BELOW THE LEVEL OF THE

DJ6160'GROUND AND ABOUT 1.0 FT BELOW THE LEVEL OF RIVERSIDE DRIVE.

DJ6160'

DJ6160'LOCATED 96.9 FT NORTH OF THE APPROXIMATE CENTERLINE OF STATE ROAD 636

DJ6160'(EAST MAIN STREET), 47.1 FT NORTH OF A WOODEN POWER POLE WITH 1 GUY

DJ6160'WIRE ATTACHED, 43.4 FT EAST OF THE APPROXIMATE CENTERLINE OF

DJ6160'RIVERSIDE DRIVE, 3.0 FT SOUTH OF A FLDT SURVEY DISK SET IN A 4-INCH

DJ6160'SQUARE CONCRETE POST AND 1.3 FT WEST OF A CARSONITE WITNESS POST.

DJ6160'

DJ6160'NOTE A MAGNET WAS BURIED ON THE SOUTH SIDE OF THE MARK.

1 National Geodetic Survey, Retrieval Date = JUNE 19, 2009

DJ6161 *****

DJ6161 DESIGNATION - P 650

DJ6161 PID - DJ6161

DJ6161 STATE/COUNTY- FL/HARDEE

DJ6161 USGS QUAD - WAUCHULA (1993)

DJ6161

DJ6161 *CURRENT SURVEY CONTROL

DJ6161

DJ6161* NAD 83(1986)- 27 33 05. (N) 081 46 37. (W) SCALED

DJ6161* NAVD 88 - 20.018 (meters) 65.68 (feet) ADJUSTED

DJ6161

DJ6161 GEOID HEIGHT- -25.27 (meters) GEOID03

DJ6161 DYNAMIC HT - 19.988 (meters) 65.58 (feet) COMP

DJ6161 MODELED GRAV- 979,145.7 (mgal) NAVD 88

DJ6161

DJ6161 VERT ORDER - SECOND CLASS I

DJ6161

DJ6161.The horizontal coordinates were scaled from a topographic map and have

DJ6161.an estimated accuracy of +/- 6 seconds.

DJ6161

DJ6161.The orthometric height was determined by differential leveling
DJ6161.and adjusted in May 2008.

DJ6161

DJ6161.The geoid height was determined by GEOID03.

DJ6161

DJ6161.The dynamic height is computed by dividing the NAVD 88

DJ6161.geopotential number by the normal gravity value computed on the

DJ6161.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

DJ6161.degrees latitude (g = 980.6199 gals.).

DJ6161

DJ6161.The modeled gravity was interpolated from observed gravity values.

DJ6161

DJ6161; North East Units Estimated Accuracy

DJ6161;SPC FL W - 356,520. 222,030. MT (+/- 180 meters Scaled)

DJ6161

DJ6161 SUPERSEDED SURVEY CONTROL

DJ6161

DJ6161.No superseded survey control is available for this station.

DJ6161

DJ6161 _U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML232477(NAD 83)

DJ6161 _MARKER: F = FLANGE-ENCASED ROD

DJ6161 _SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)

DJ6161 _STAMPING: P 650 2006

DJ6161 _MARK LOGO: NGS

DJ6161 _PROJECTION: FLUSH

DJ6161 _MAGNETIC: M = MARKER EQUIPPED WITH BAR MAGNET

DJ6161 _STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

DJ6161 _SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

DJ6161+SATELLITE: SATELLITE OBSERVATIONS - March 14, 2006

DJ6161 _ROD/PIPE-DEPTH: 9.6 meters

DJ6161

DJ6161 HISTORY - Date Condition Report By

DJ6161 HISTORY - 20060314 MONUMENTED FLDEP

DJ6161

DJ6161 STATION DESCRIPTION

DJ6161

DJ6161'DESCRIBED BY FL DEPT OF ENV PRO 2006 (BPJ)

DJ6161'THE MARK IS ABOUT 2.2 MI EAST OF WAUCHULA, IN SECTION 2, TOWNSHIP 34

DJ6161'SOUTH, RANGE 25 EAST.

DJ6161'

DJ6161'TO REACH THE MARK FROM THE NORTH SIDE OF THE HARDEE COUNTY COURT
HOUSE

DJ6161'IN WAUCHULA, GO EAST ON COUNTY ROAD 64A (WEST MAIN STREET),
BECOMING

DJ6161'STATE ROAD 636 (EAST MAIN STREET) FOR 2.4 MI TO THE INTERSECTION OF

DJ6161'SHACKLEFORD ROAD ON THE RIGHT AND AIRPORT ROAD ON THE LEFT AND THE

DJ6161'MARK ON THE LEFT, A STAINLESS STEEL ROD DRIVEN TO REFUSAL AT A DEPTH

DJ6161'OF 31.5 FT WITH AN NGS LOGO CAP FLUSH WITH THE GROUND AND ABOUT 1.0 FT

DJ6161'BELOW THE LEVEL OF AIRPORT ROAD, THE DATUM POINT IS RECESSED 0.3 FT

DJ6161'BELOW THE LEVEL OF THE NGS LOGO CAP.

DJ6161'

DJ6161'LOCATED 85.8 FT NORTH OF THE APPROXIMATE CENTERLINE OF STATE ROAD 636
DJ6161'(EAST MAIN STREET), 57.1 FT WEST OF THE APPROXIMATE CENTERLINE OF
DJ6161'AIRPORT ROAD, 38.0 FT NORTHWEST OF POWER POLE NUMBER 24-93-6A, 2.2 FT
DJ6161'SOUTHEAST OF A HOG WIRE FENCE AND 2.1 FT SOUTHEAST OF A CARSONITE
DJ6161'WITNESS POST.

DJ6161'

DJ6161'NOTE A MAGNET WAS PLACED INSIDE OF THE NGS LOGO CAP.

DJ6161'

DJ6161'NOTE ACCESS TO THE DATUM POINT IS HAD THROUGH A 5-INCH NGS LOGO CAP.

l National Geodetic Survey, Retrieval Date = JUNE 19, 2009

DH3757 *****

DH3757 CORS - This is a GPS Continuously Operating Reference Station.

DH3757 DESIGNATION - WAUCHULA CORS ARP

DH3757 CORS_ID - WACH

DH3757 PID - DH3757

DH3757 STATE/COUNTY- FL/HARDEE

DH3757 USGS QUAD - FT GREEN (1987)

DH3757

DH3757 *CURRENT SURVEY CONTROL

DH3757

DH3757* NAD 83(CORS)- 27 30 51.04277(N) 081 52 56.61649(W) ADJUSTED

DH3757* NAVD 88 - *(meters) *(feet)

DH3757

DH3757 EPOCH DATE - 2002.00

DH3757 X - 799,336.149 (meters) COMP

DH3757 Y - -5,604,082.859 (meters) COMP

DH3757 Z - 2,928,868.779 (meters) COMP

DH3757 ELLIP HEIGHT- 10.728 (meters) (06/??/05) ADJUSTED

DH3757 GEOID HEIGHT- -25.04 (meters) GEOID03

DH3757 HORZ ORDER - SPECIAL (CORS)

DH3757 ELLP ORDER - SPECIAL (CORS)

DH3757

DH3757.ITRF positions are available for this station.

DH3757.The coordinates were established by GPS observations

DH3757.and adjusted by the National Geodetic Survey in June 2005.

DH3757.The coordinates are valid at the epoch date displayed above.

DH3757.The epoch date for horizontal control is a decimal equivalence

DH3757.of Year/Month/Day.

DH3757

DH3757

DH3757.The PID for the CORS L1 Phase Center is DH3758.

DH3757

DH3757.The XYZ, and position/ellipsoidal ht. are equivalent.

DH3757

DH3757.The ellipsoidal height was determined by GPS observations

DH3757.and is referenced to NAD 83.

DH3757

DH3757.The geoid height was determined by GEOID03.

DH3757

DH3757; North East Units Scale Factor Converg.

DH3757;SPC FL W - 352,381.091 211,618.784 MT 0.99994284 +0 03 15.6

DH3757;SPC FL W - 1,156,103.63 694,285.96 sFT 0.99994284 +0 03 15.6

DH3757

DH3757! - Elev Factor x Scale Factor = Combined Factor

DH3757!SPC FL W - 0.99999831 x 0.99994284 = 0.99994115

DH3757

DH3757 SUPERSEDED SURVEY CONTROL

DH3757

DH3757.No superseded survey control is available for this station.

DH3757

DH3757_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML1285343697(NAD 83)

DH3757_MARKER: STATION IS THE ANTENNA REFERENCE POINT OF THE GPS ANTENNA

DH3757

DH3757 STATION DESCRIPTION

DH3757

DH3757'DESCRIBED BY NATIONAL GEODETIC SURVEY 2005

DH3757'STATION IS A GPS CORS. LATEST INFORMATION INCLUDING POSITIONS AND

DH3757'VELOCITIES ARE AVAILABLE IN THE COORDINATE AND LOG FILES ACCESSIBLE

DH3757'BY ANONYMOUS FTP OR THE WORLDWIDE WEB.

DH3757' FTP CORS.NGS.NOAA.GOV: CORS/COORD AND CORS/STATION_LOG

DH3757' HTTP://WWW.NGS.NOAA.GOV UNDER PRODUCTS AND SERVICES.

I National Geodetic Survey, Retrieval Date = JUNE 19, 2009

AF7425 *****

AF7425 HT_MOD - This is a Height Modernization Survey Station.

AF7425 CBN - This is a Cooperative Base Network Control Station.

AF7425 DESIGNATION - WAUCPORT

AF7425 PID - AF7425

AF7425 STATE/COUNTY- FL/HARDEE

AF7425 USGS QUAD - FT GREEN (1987)

AF7425

AF7425 *CURRENT SURVEY CONTROL

AF7425

AF7425* NAD 83(2007)- 27 30 54.36942(N) 081 53 00.60893(W) ADJUSTED

AF7425* NAVD 88 - 30.96 (meters) 101.6 (feet) GPS OBS

AF7425

AF7425 EPOCH DATE - 2002.00

AF7425 X - 799,220.401 (meters) COMP

AF7425 Y - -5,604,047.316 (meters) COMP

AF7425 Z - 2,928,957.394 (meters) COMP

AF7425 LAPLACE CORR- -1.53 (seconds) DEFLEC99

AF7425 ELLIP HEIGHT- 5.964 (meters) (02/10/07) ADJUSTED

AF7425 GEOID HEIGHT- -25.04 (meters) GEOID03

AF7425

AF7425 ----- Accuracy Estimates (at 95% Confidence Level in cm) -----

AF7425 Type PID Designation North East Ellip

AF7425 -----

AF7425 NETWORK AF7425 WAUCPORT 0.88 0.88 8.86

AF7425 -----

AF7425

AF7425.This mark is at Wauchula Airport (FD06)

AF7425

AF7425.The horizontal coordinates were established by GPS observations

AF7425.and adjusted by the National Geodetic Survey in February 2007.

AF7425

AF7425.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).

AF7425.See National Readjustment for more information.

AF7425.The horizontal coordinates are valid at the epoch date displayed above.

AF7425.The epoch date for horizontal control is a decimal equivalence

AF7425.of Year/Month/Day.

AF7425

AF7425.The orthometric height was determined by GPS observations and a

AF7425.high-resolution geoid model.

AF7425.The orthometric height was determined by GPS observations and a

AF7425.high-resolution geoid model using precise GPS observation and

AF7425.processing techniques. It supersedes the leveled height previously

AF7425.determined for this station.

AF7425

AF7425.The X, Y, and Z were computed from the position and the ellipsoidal ht.

AF7425

AF7425.The Laplace correction was computed from DEFLEC99 derived deflections.

AF7425

AF7425.The ellipsoidal height was determined by GPS observations

AF7425.and is referenced to NAD 83.

AF7425

AF7425.The geoid height was determined by GEOID03.

AF7425

AF7425; North East Units Scale Factor Converg.

AF7425;SPC FL W - 352,483.379 211,509.125 MT 0.99994281 +0 03 13.8

AF7425;SPC FL W - 1,156,439.22 693,926.19 sFT 0.99994281 +0 03 13.8

AF7425;UTM 17 - 3,043,800.503 412,744.069 MT 0.99969398 -0 24 29.5

AF7425

AF7425! - Elev Factor x Scale Factor = Combined Factor

AF7425!SPC FL W - 0.99999906 x 0.99994281 = 0.99994187

AF7425!UTM 17 - 0.99999906 x 0.99969398 = 0.99969304

AF7425

AF7425: Primary Azimuth Mark Grid Az

AF7425:SPC FL W - WAUCPORT AZ MK 359 57 09.7

AF7425:UTM 17 - WAUCPORT AZ MK 000 24 53.0

AF7425

AF7425|-----|

AF7425| PID Reference Object Distance Geod. Az |

AF7425| dddmmss.s |

AF7425| AF7486 WAUCPORT AZ MK APPROX. 0.6 KM 0000023.5 |

AF7425|-----|

AF7425

AF7425 SUPERSEDED SURVEY CONTROL

AF7425

AF7425 NAD 83(1999)- 27 30 54.36943(N) 081 53 00.60906(W) AD() B

AF7425 ELLIP H (05/31/01) 5.911 (m) GP() 5 1

AF7425 NAD 83(1990)- 27 30 54.36807(N) 081 53 00.60854(W) AD() B

AF7425 ELLIP H (09/13/90) 5.916 (m) GP() 4 1

AF7425 NAVD 88 (05/30/08) 30.959 (m) 101.57 (f) ADJUSTED 2 1

AF7425 NGVD 29 (09/13/90) 31.3 (m) 103. (f) GPS OBS 3

AF7425

AF7425.Superseded values are not recommended for survey control.

AF7425.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AF7425.See file dsdata.txt to determine how the superseded data were derived.

AF7425

AF7425_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML1274443801(NAD 83)

AF7425_MARKER: F = FLANGE-ENCASED ROD

AF7425_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)

AF7425_SP_SET: STAINLESS STEEL ROD IN SLEEVE

AF7425_STAMPING: WAUCPORT 1989

AF7425_MARK LOGO: NGS

AF7425_PROJECTION: FLUSH

AF7425_MAGNETIC: M = MARKER EQUIPPED WITH BAR MAGNET

AF7425_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

AF7425_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AF7425+SATELLITE: SATELLITE OBSERVATIONS - April 23, 2007

AF7425_ROD/PIPE-DEPTH: 17.9 meters

AF7425_SLEEVE-DEPTH : 0.9 meters

AF7425

AF7425 HISTORY	- Date	Condition	Report By
AF7425 HISTORY	- 1989	MONUMENTED	NGS
AF7425 HISTORY	- 19970430	GOOD	USPSQD
AF7425 HISTORY	- 20020603	GOOD	USPSQD
AF7425 HISTORY	- 20060419	GOOD	FLDEP
AF7425 HISTORY	- 20070423	GOOD	PICKET

AF7425

AF7425 STATION DESCRIPTION

AF7425

AF7425'DESCRIBED BY NATIONAL GEODETIC SURVEY 1989

AF7425'THE STATION IS LOCATED ABOUT 7.24 KM (4.50 MI) WEST OF WAUCHULA, 0.8

AF7425'KM (0.50 MI) SOUTH OF VANDOLAH ROAD, AT THE WAUCHULA MUNICIPAL

AF7425'AIRPORT, ALONG THE EAST SIDE OF SONNY CLAVEL ROAD, NEAR THE

AF7425'SOUTH-SOUTHWEST END OF TURF RUNWAY 03-21. OWNERSHIP--CITY OF

AF7425'WAUCHULA, P.O. BOX 818, WAUCHULA FL 33873, WARREN MAY - AIRPORT

AF7425'MANAGER, PHONE 813-773-3131. NOTE--PERMISSION MUST BE OBTAINED BEFORE

AF7425'ENTERING AIRPORT.

AF7425'TO REACH THE STATION FROM THE JUNCTION OF U.S. HIGHWAY 17 AND STATE

AF7425'HIGHWAY 64A (MAIN STREET) IN WAUCHULA, GO WEST-SOUTHWEST FOR 5.6 KM

AF7425'(3.50 MI) ON STATE HIGHWAY 64A TO VANDOLAH ROAD ON RIGHT. TURN RIGHT

AF7425'AND GO WEST FOR 2.1 KM (1.30 MI) ON VANDOLAH ROAD TO A SIDE ROAD LEFT,

AF7425'JUST AFTER CROSSING THE BRIDGE OVER TROUBLESOME CREEK. TURN LEFT

AND

AF7425'GO SOUTH FOR 0.32 KM (0.20 MI) ON SONNY CLAVEL ROAD TO A SHARP TURN

AF7425'RIGHT. TURN RIGHT AND GO WEST FOR 0.32 KM (0.20 MI) ON SONNY CLAVEL

AF7425'ROAD TO A POINT WHERE THE ROAD TURNS LEFT AND WAUCPORT AZ MK ON

LEFT.

AF7425'CONTINUE AHEAD AND GO SOUTH FOR 0.5 KM (0.30 MI) ON SONNY CLAVEL

ROAD

AF7425'TO THE STATION ON LEFT.

AF7425'THE STATION IS RECESSED 10 CM BELOW GROUND. LOCATED 22.5 M (73.8 FT)

AF7425'EAST FROM A SIGN INDICATING CURVE IN ROAD, 18.3 M (60.0 FT) WEST FROM

AF7425'A METAL TURF RUNWAY END INDICATOR, 18.0 M (59.1 FT) EAST FROM THE
AF7425'APPROXIMATE CENTER OF SONNY CLAVEL ROAD AND 2.83 M (9.3 FT) EAST FROM
AF7425'A CARSONITE WITNESS POST. NOTE--ACCESS TO DATUM POINT IS HAD
THROUGH

AF7425'A 5-INCH LOGO CAP.

AF7425'DESCRIBED BY S.E. RANDALL.

AF7425

AF7425 STATION RECOVERY (1997)

AF7425

AF7425'RECOVERY NOTE BY US POWER SQUADRON 1997

AF7425'RECOVERED IN GOOD CONDITION.

AF7425

AF7425 STATION RECOVERY (2002)

AF7425

AF7425'RECOVERY NOTE BY US POWER SQUADRON 2002

AF7425'COVER GONE

AF7425

AF7425 STATION RECOVERY (2006)

AF7425

AF7425'RECOVERY NOTE BY FL DEPT OF ENV PRO 2006 (BPJ)

AF7425'RECOVERED IN GOOD CONDITION WITH A NEW TO REACH AS FOLLOWS, TO
REACH

AF7425'THE MARK FROM THE NORTH SIDE OF THE HARDEE COUNTY COURT HOUSE IN
AF7425'WAUCHULA, GO WEST ON COUNTY ROAD 64A (WEST MAIN STREET) FOR 3.2 MI
TO

AF7425'THE JUNCTION OF VANDOLAH ROAD ON THE RIGHT, TURN RIGHT ON
VANDOLAH

AF7425'ROAD AND GO WEST FOR 1.3 MI TO THE JUNCTION OF MAURICE SONNY CLAVEL
AF7425'ROAD ON THE LEFT, TURN LEFT ON MAURICE SONNY CLAVEL ROAD AND GO
AF7425'SOUTHEAST FOR 0.15 MI TO A 90 DEGREE BEND IN THE ROAD, TURN RIGHT ON
AF7425'MAURICE SONNY CLAVEL ROAD AND GO SOUTHWEST FOR 0.2 MI TO ANOTHER
BEND

AF7425'IN THE ROAD TO THE LEFT, TURN LEFT ON MAURICE SONNY CLAVEL ROAD AND
AF7425'GO SOUTH FOR 0.4 MI TO THE MARK ON THE LEFT.

AF7425'

AF7425'NOTE A MAGNET WAS PLACED INSIDE OF THE NGS LOGO CAP.

AF7425

AF7425 STATION RECOVERY (2007)

AF7425

AF7425'RECOVERY NOTE BY PICKETT AND ASSOCIATES 2007 (JKR)

AF7425'RECOVERED AS DESCRIBED.

l National Geodetic Survey, Retrieval Date = JUNE 19, 2009

AF6059 *****

AF6059 DESIGNATION - X 65

AF6059 PID - AF6059

AF6059 STATE/COUNTY- FL/HARDEE

AF6059 USGS QUAD - WAUCHULA (1993)

AF6059

AF6059 *CURRENT SURVEY CONTROL

AF6059

AF6059* NAD 83(2007)- 27 32 47.95522(N) 081 48 58.01559(W) ADJUSTED

AF6059* NAVD 88 - 35.353 (meters) 115.99 (feet) ADJUSTED
 AF6059

AF6059 EPOCH DATE - 2002.00
 AF6059 X - 805,581.396 (meters) COMP
 AF6059 Y - -5,601,507.552 (meters) COMP
 AF6059 Z - 2,932,059.739 (meters) COMP
 AF6059 LAPLACE CORR- -1.98 (seconds) DEFLEC99
 AF6059 ELLIP HEIGHT- 10.203 (meters) (04/16/08) ADJUSTED
 AF6059 GEOID HEIGHT- -25.20 (meters) GEOID03
 AF6059 DYNAMIC HT - 35.300 (meters) 115.81 (feet) COMP
 AF6059 MODELED GRAV- 979,146.0 (mgal) NAVD 88

AF6059

AF6059 HORZ ORDER - FIRST
 AF6059 VERT ORDER - SECOND CLASS I
 AF6059 ELLP ORDER - THIRD CLASS I

AF6059

AF6059.The horizontal coordinates were established by GPS observations
 AF6059.and adjusted by the FL DEPT OF ENV PRO in April 2008.

AF6059

AF6059.The datum tag of NAD 83(2007) is equivalent to NAD 83(NSRS2007).
 AF6059.See National Readjustment for more information.

AF6059.The horizontal coordinates are valid at the epoch date displayed above.

AF6059.The epoch date for horizontal control is a decimal equivalence

AF6059.of Year/Month/Day.

AF6059

AF6059.The orthometric height was determined by differential leveling
 AF6059.and adjusted in June 1991.

AF6059

AF6059.The X, Y, and Z were computed from the position and the ellipsoidal ht.

AF6059

AF6059.The Laplace correction was computed from DEFLEC99 derived deflections.

AF6059

AF6059.The ellipsoidal height was determined by GPS observations

AF6059.and is referenced to NAD 83.

AF6059

AF6059.The geoid height was determined by GEOID03.

AF6059

AF6059.The dynamic height is computed by dividing the NAVD 88

AF6059.geopotential number by the normal gravity value computed on the

AF6059.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

AF6059.degrees latitude (g = 980.6199 gals.).

AF6059

AF6059.The modeled gravity was interpolated from observed gravity values.

AF6059

AF6059;	North	East	Units	Scale	Factor	Converg.
AF6059;SPC FL W	- 355,987.541	218,161.309	MT	0.99994525	+0 05 06.1	
AF6059;SPC FL W	- 1,167,935.79	715,750.89	sFT	0.99994525	+0 05 06.1	
AF6059;UTM 17	- 3,047,249.996	419,422.590	MT	0.99968014	-0 22 38.8	

AF6059

AF6059! - Elev Factor x Scale Factor = Combined Factor

AF6059!SPC FL W - 0.99999840 x 0.99994525 = 0.99994365

AF6059!UTM 17 - 0.99999840 x 0.99968014 = 0.99967854

AF6059

AF6059 SUPERSEDED SURVEY CONTROL

AF6059

AF6059 NAVD 88 (04/16/08) 35.35 (m) 116.0 (f) LEVELING 3

AF6059 NGVD 29 (??/??/92) 35.653 (m) 116.97 (f) ADJ UNCH 2 0

AF6059

AF6059.Superseded values are not recommended for survey control.

AF6059.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

AF6059.See file dsdata.txt to determine how the superseded data were derived.

AF6059

AF6059_U.S. NATIONAL GRID SPATIAL ADDRESS: 17RML1942347250(NAD 83)

AF6059_MARKER: DB = BENCH MARK DISK

AF6059_SETTING: 7 = SET IN TOP OF CONCRETE MONUMENT

AF6059_SP_SET: SET IN TOP OF CONCRETE MONUMENT

AF6059_STAMPING: X 65 1934

AF6059_MARK LOGO: CGS

AF6059_PROJECTION: FLUSH

AF6059_MAGNETIC: N = NO MAGNETIC MATERIAL

AF6059_STABILITY: C = MAY HOLD, BUT OF TYPE COMMONLY SUBJECT TO

AF6059+STABILITY: SURFACE MOTION

AF6059_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR

AF6059+SATELLITE: SATELLITE OBSERVATIONS - April 23, 2007

AF6059

AF6059 HISTORY	- Date	Condition	Report By
AF6059 HISTORY	- 1934	MONUMENTED	CGS
AF6059 HISTORY	- 1959	GOOD	NGS
AF6059 HISTORY	- 1973	GOOD	NGS
AF6059 HISTORY	- 20031002	GOOD	FL-105
AF6059 HISTORY	- 20060419	GOOD	FLDEP
AF6059 HISTORY	- 20061103	GOOD	PICKET
AF6059 HISTORY	- 20070423	GOOD	PICKET

AF6059

AF6059 STATION DESCRIPTION

AF6059

AF6059'DESCRIBED BY NATIONAL GEODETIC SURVEY 1959

AF6059'AT WAUCHULA.

AF6059'AT WAUCHULA IN THE NORTHWEST CORNER OF THE COURTHOUSE LAWN,

AF6059'87 YARDS NORTH-NORTHWEST OF THE NORTHWEST CORNER OF THE

AF6059'COURTHOUSE, 31 FEET SOUTH OF THE CURBLINE OF WEST MAIN STREET,

AF6059'12.5 FEET SOUTH OF THE SOUTH CURB OF WEST MAIN STREET, 41 FEET

AF6059'EAST OF THE CENTERLINE OF SOUTH 10TH AVENUE, 23 FEET EAST OF THE

AF6059'EAST CURB OF SOUTH 10TH AVENUE, 017 FOOT SOUTH OF THE SOUTH

AF6059'EDGE OF AN EAST AND WEST SIDEWALK, SET IN THE TOP OF A CONCRETE

AF6059'POST WHICH IS FLUSH WITH THE GROUND.

AF6059

AF6059 STATION RECOVERY (1973)

AF6059

AF6059'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1973

AF6059'RECOVERED IN GOOD CONDITION.

AF6059

AF6059 STATION RECOVERY (2003)
AF6059
AF6059'RECOVERY NOTE BY POLK COUNTY FLORIDA 2003 (RWY)
AF6059'RECOVERED AS DESCRIBED. RECOVERY NOTE BY POLK COUNTY PROPERTY
AF6059'APPRAISER GIS DEPARTMENT.
AF6059
AF6059 STATION RECOVERY (2006)
AF6059
AF6059'RECOVERY NOTE BY FL DEPT OF ENV PRO 2006 (BPJ)
AF6059'RECOVERED AS DESCRIBED.
AF6059
AF6059 STATION RECOVERY (2006)
AF6059
AF6059'RECOVERY NOTE BY PICKETT AND ASSOCIATES 2006 (GAP)
AF6059'RECOVERED IN GOOD CONDITION.
AF6059
AF6059 STATION RECOVERY (2007)
AF6059
AF6059'RECOVERY NOTE BY PICKETT AND ASSOCIATES 2007 (JKR)
AF6059'RECOVERED AS DESCRIBED.

Florida Minimum Technical Standards for Mapping Projects

Survey and Map Report

Exhibit B

REPORT OF SPECIFIC PURPOSE SURVEY

FY 2009 Peace River Topographic Mapping (H024), REPORT OF SPECIFIC PURPOSE SURVEY
QUALITY CONTROL GROUND CHECK POINTS

**REPORT OF SPECIFIC PURPOSE SURVEY
FOR
2009 TOPOGRAPHIC MAPPING QUALITY CONTROL GROUND CHECK POINTS
IN HARDEE COUNTY, FLORIDA**

Southwest Florida
Water Management District

WATERMATTERS.ORG · 1-800-423-1476

PROJECT INFORMATION:

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
Mapping and GIS Section

PROJECT TITLE: FY 2009 Peace River Topographic Mapping (H024)
PURCHASE ORDER: 09POSOW0680
WORK ORDER NAME: Peace River South LiDAR Re-flight
WORK ORDER NUMBER: 1
CONSULTANT NAME: Merrick & Company
PROJECT MANAGERS: Al Karlin, District
Doug Jacoby, Consultant

FY 2009 Peace River Topographic Mapping (H024), REPORT OF SPECIFIC PURPOSE SURVEY
QUALITY CONTROL GROUND CHECK POINTS

INTRODUCTION:

The purpose of this survey is to establish ground elevations within the project area for the quality assurance and quality control of the topographic mapping information derived from LIDAR photogrammetry.

PROJECT AREA:

The project area for the LIDAR topographic mapping project consists of ten 5000 foot square tiles/cells (approximately 9.0 square miles) in Hardee County, Florida as shown in ATTACHMENT A – PROJECT AREA MAP.

HORIZONTAL DATUM: NAD 1983(2007), FLORIDA STATE PLANE COORDINATES, WEST ZONE (0902).

VERTICAL DATUM: North American Vertical Datum of 1988 (NAVD88), All vertical values are GPS Derived Orthometric Heights (elevations) using the GPS derived ellipse height and GEOID03.

UNITS: US SURVEY FEET.

SURVEYING EQUIPMENT & POSITIONING METHOD: LEICA GPS1200 / Florida Permanent Reference Network (FPRN) Continuously Operating Reference Stations (CORS) (<http://www.myfloridagps.com>); Leica Geosystems SpiderNET Network RTK GPS - MAX Solution.

DATES OF SURVEY: 10/30/2008, 11/5/2008, 12/12/2008, 2/3/2009, 2/10/2009, 2/16/2009, 3/2/2009, 3/4/2009, 3/5/2009, 4/7/2009.

FIELD PROCEDURES:

Fifteen existing National Geodetic Survey (NGS) control stations were recovered and occupied throughout the survey. Twelve ground elevations were observed for LIDAR topographic mapping control; Point ID 601A, 601B, 602A, 602B, 603A, 603B, 604A, 604B, 605A, 605B, 606A, 606B. See ATTACHMENT B – FINAL COORDINATE LIST; CONTROL POINT OCCUPATIONS.

One hundred twenty-six ground elevations were observed throughout the project area; Point ID PR5001 through PR5126. See ATTACHMENT C - FINAL COORDINATE LIST; GROUND ELEVATION CHECK POINTS.

FINAL COORDINATES:

The newly-established horizontal and vertical values are shown in the attached final coordinate lists; ATTACHMENT B – FINAL COORDINATE LIST; CONTROL POINT OCCUPATIONS, and ATTACHMENT C - FINAL COORDINATE LIST; GROUND ELEVATION CHECK POINTS.

The newly-established values are based on real-time kinematic GPS network solutions/measurements referenced to the FPRN base stations. The nearest FPRN base station is "WAUCHULA CORS ARP" as published by the National Geodetic Survey (NGS).

The horizontal accuracy of newly-established values is less than +/- 0.1 feet based on a comparison of the NAD83/2007 published value and the GPS derived value at eight existing NGS control stations.

The vertical accuracy of newly-established values is less than +/- 0.2 feet (standard deviation = 0.07 feet), based on a comparison of the NAVD88 published value and the GPS derived value at fifteen existing NGS control stations. See comparison of values in ATTACHMENT B – FINAL COORDINATE LIST; CONTROL POINT OCCUPATIONS.

FY 2009 Peace River Topographic Mapping (H024); REPORT OF SPECIFIC PURPOSE SURVEY
QUALITY CONTROL GROUND CHECK POINTS

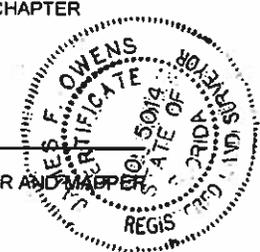
SURVEYOR'S CERTIFICATION:

THIS SPECIFIC PURPOSE 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 ADMINISTRATIVE CODE.

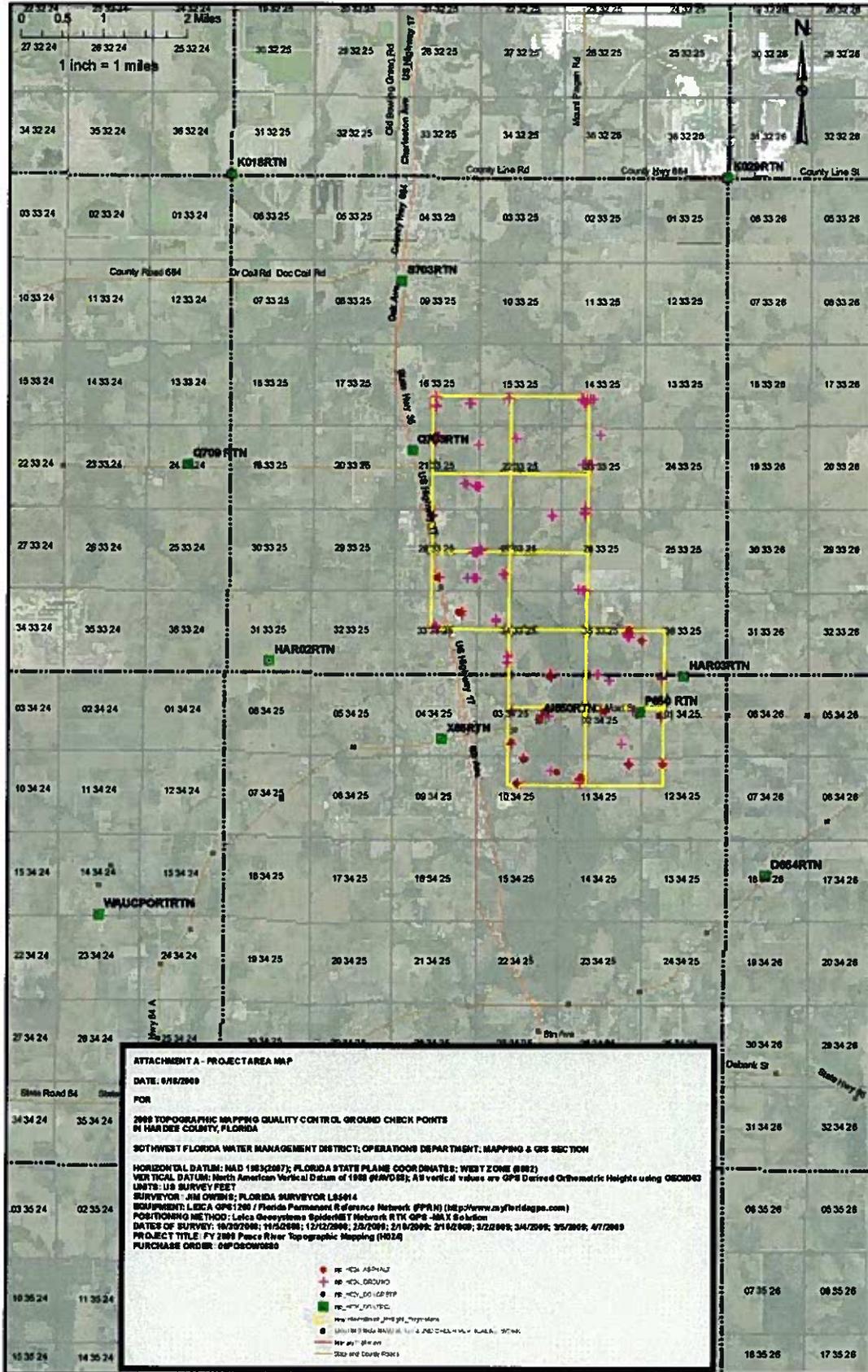
6/18/2009
SIGNATURE DATE



JAMES F. OWENS
FLORIDA PROFESSIONAL SURVEYOR AND MAPPER
LICENSE NUMBER LS5014



THIS REPORT OF SURVEY IS NOT VALID WITHOUT THE SIGNATURE AND ORIGINAL RAISED
SEAL OF THE FLORIDA REGISTERED SURVEYOR AND MAPPER.



LINE	DESCRIPTION	QTY	UNIT	PRICE	AMOUNT	TAX	TOTAL
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Florida Minimum Technical Standards for Mapping Projects

Survey and Map Report

Exhibit C

LiDAR Mapping Report

Southwest Florida Water Management District

FY 2009 Peace River Topographic Mapping (H024)

Peace River South LiDAR Re-flight

Work Order No. 1

LiDAR Mapping Report

Submitted to:



Mr. Al Karlin
Senior GIS Analyst
Southwest Florida Water Management District
Mapping & GIS Section
2379 Broad Street
Brooksville, FL 34604
Office: 352-796-7211, x-4204
Fax: 352-540-6018
al.karlin@swfwmd.state.fl.us

Prepared for:



Mr. Doug Jacoby, CMS, GISP
Director of Projects / Project Manager
Merrick & Company
2450 South Peoria Street
Aurora, CO 80014
Office: 303-353-3903
Fax: 303-745-0964
Cell: 303-521-6522
doug.jacoby@merrick.com

Merrick & Company Job Number: 02016178

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

EXECUTIVE SUMMARY

Early in the year of 2009, Merrick & Company (Merrick) was contracted by Representatives of Southwest Florida Water Management District to execute a LiDAR (Light Detection And Ranging) survey for an area in Hardee County, located near Wauchula, Florida. The purpose of the project is to produce accurate, high-resolution data for planning, analysis, and for use with other data sets. Merrick obtained LiDAR data over approximately 8.97 square miles covering an area near Wauchula, Florida. The LiDAR data has been processed to meet Vertical Accuracy (FVA) of 0.6 feet (0.3 feet RMSEz) in open terrain.

CONTRACT INFORMATION

Questions regarding this report should be addressed to:

Doug Jacoby, CMS, GISP
Director of Projects / Project Manager
Merrick & Company
GeoSpatial Solutions
2450 South Peoria Street
Aurora, CO 80014-5472
303-353-3903
303-745-0964 Fax
800-544-1714, x-3903
doug.jacoby@merrick.com
www.merrick.com/servicelines/gis

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

Project Completion Report for Peace River Topographic Mapping.

The contents of this report summarize the methods used to establish the GPS base station network, perform the LiDAR data collection and post-processing as well as the results of these methods for a part of Hardee County, Florida.

LiDAR FLIGHT and SYSTEM REPORT

Project Location

The project location for Hardee County is defined by the shapefiles "PRS_LiDARforUpdate".

Duration/Time Period

One LiDAR aircraft, a Cessna 402C (SN35) was used to collect LiDAR Data. The Cessna 402C (SN35) arrived on site Feb. 2, 2009 and the LiDAR data collection was accomplished Feb.3, 2009 thru Feb. 5, 2009. The Wauchula Municipal Airport (KCHN) was used as the airfield of operations.

Flight Diagrams

See Below

Mission Parameters for Peace River Cessna 402C (SN35)

LiDAR Sensor	Leica Geosystems ALS50 Phase 1
Nominal Ground Sample Distance	0.95 meters
Average Altitude	5,500 Feet MSL
Average Airspeed	~125 Knots
Scan Rate	29 Hertz
Scan FOV (scan angle)	30°
Pulse Rate	56,000 Hertz

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

Flight Mission Date and Times

Mission	Date	Plane	Start Time	End Time	Length Time
090203_A	Feb. 03, 2009	SN 35	243005 GPS sec.	248314 GPS sec.	5309 Sec.
090205_A	Feb. 05, 2009	SN 35	424126 GPS sec.	426968 GPS sec.	2842 Sec.

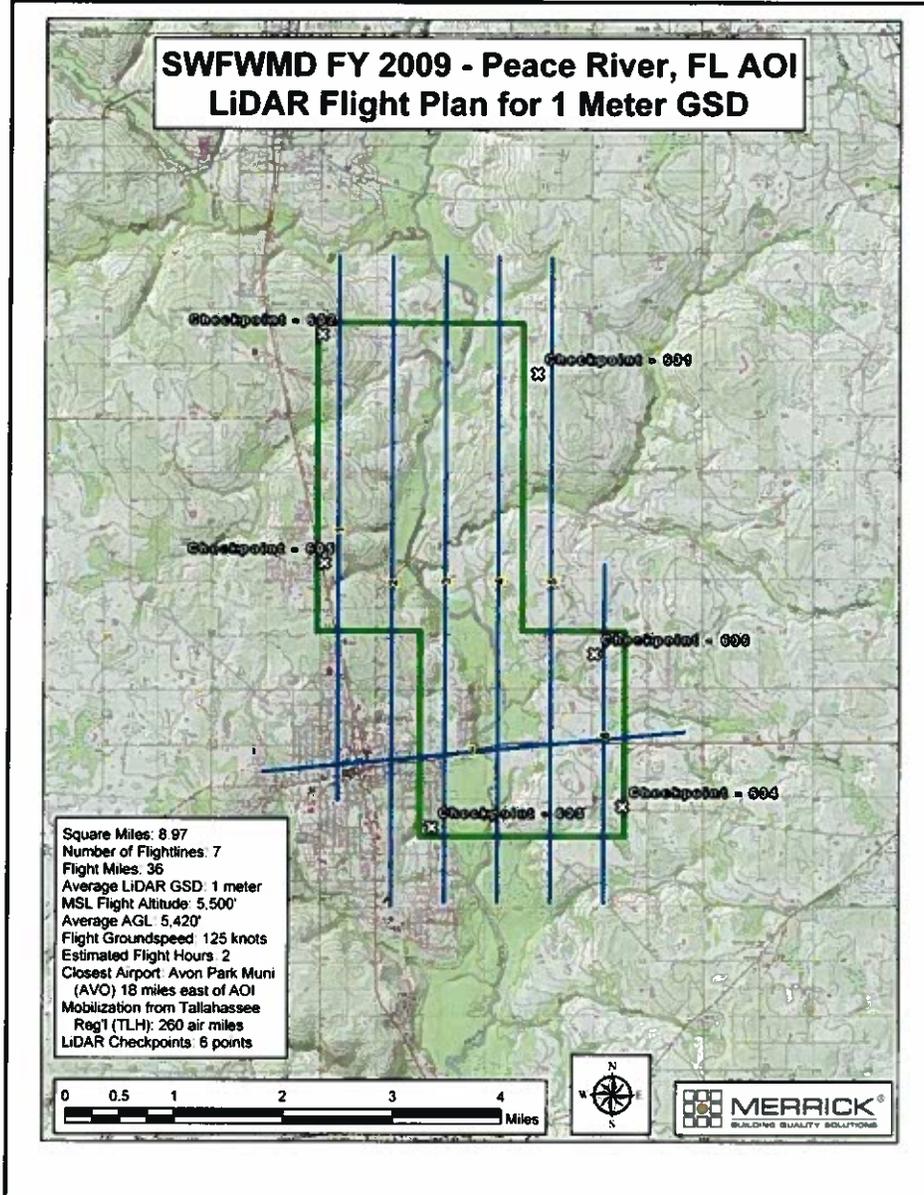
Field Work / Procedures

Two ground Airborne GPS Base Stations, for the LiDAR data collection, were set up every mission, one main ground GPS receiver located at Wauchula airport, and one auxiliary ground GPS receiver also located at the airport.

Pre-flight checks such as cleaning the sensor head glass are performed. A five minute INS initialization is conducted on the ground, with the aircraft engines running, prior to flight, to establish fine-alignment of the INS. GPS ambiguities are resolved by flying within ten kilometers of the base stations. During the data collection, the operator recorded information on log sheets which includes weather conditions, LiDAR operation parameters, and flight line statistics. Near the end of the mission, GPS ambiguities were again resolved by flying within ten kilometers of the base stations to aid in post-processing. Data was sent back to the main office and preliminary data processing was performed for quality control of GPS data and to ensure sufficient overlap between flight lines. Any problematic data could then be reflown immediately as required. Final data processing was completed in the Aurora, Colorado office.

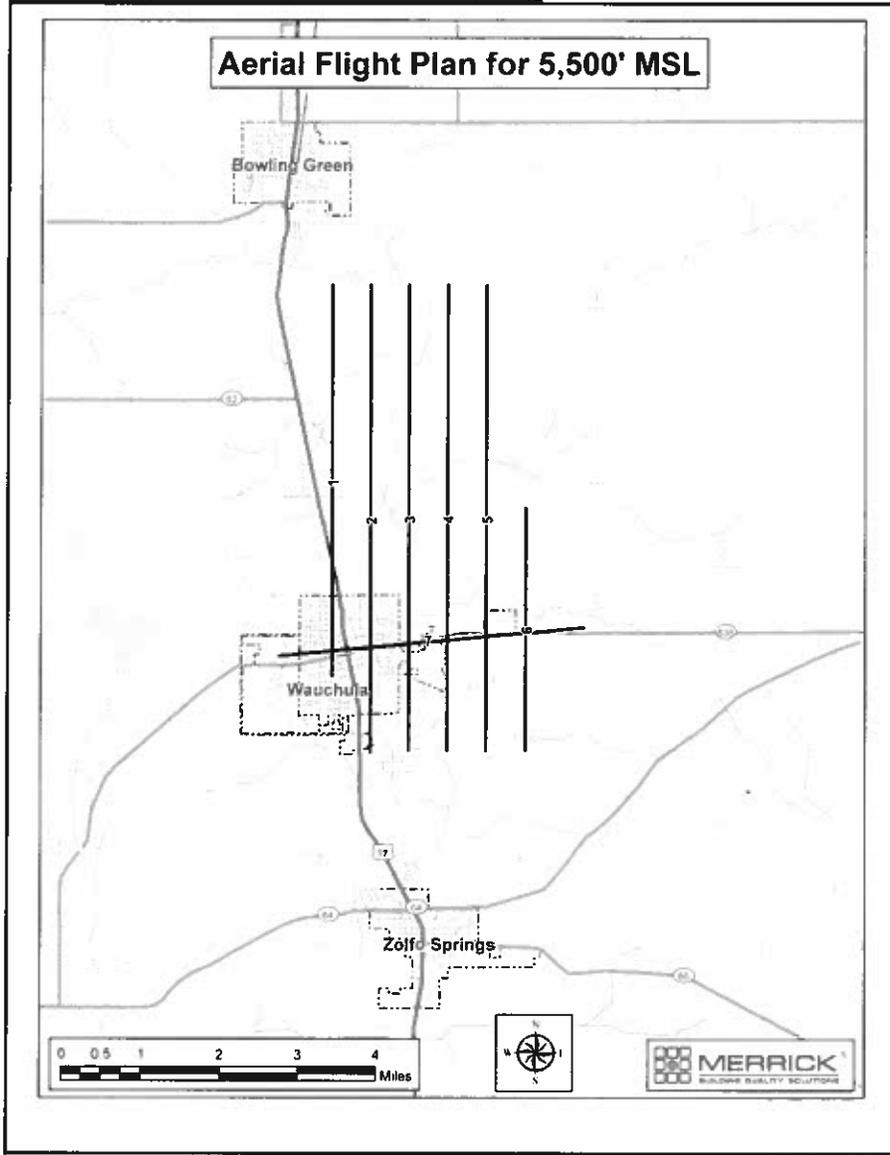
FY 2009 Peace River Topographic Mapping (H024)
LIDAR Report

Planned Flight Line Diagram 1 for Peace River



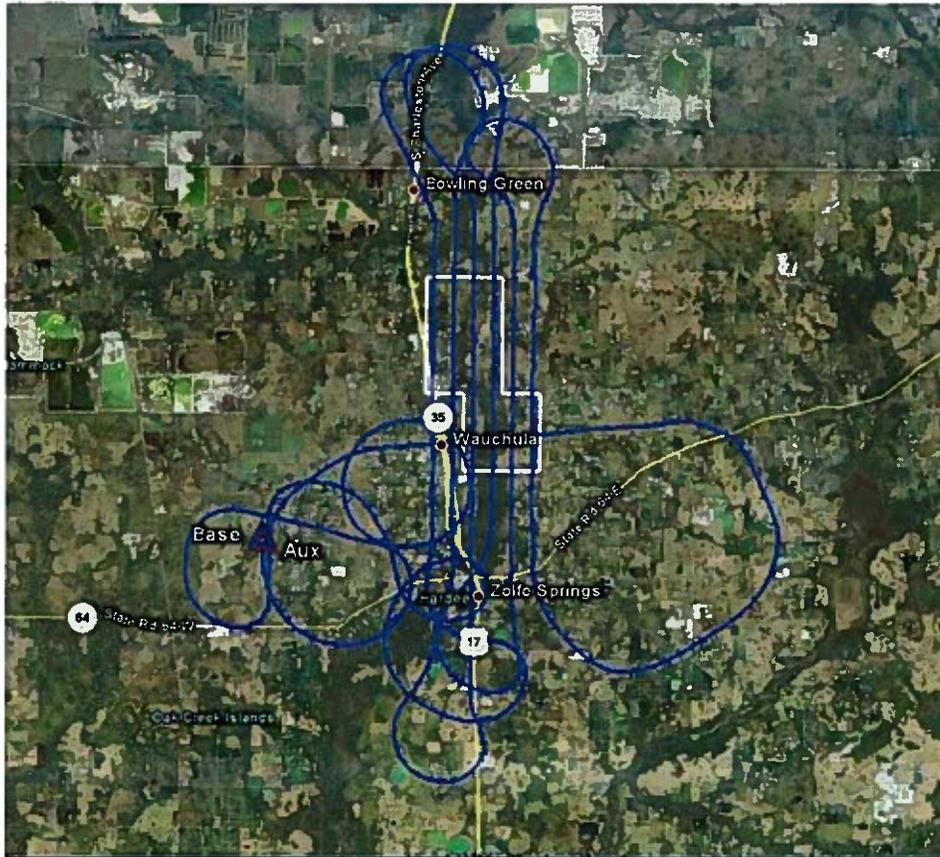
FY 2009 Peace River Topographic Mapping (H024)
LIDAR Report

Planned Flight Line Diagram 2 for Peace River



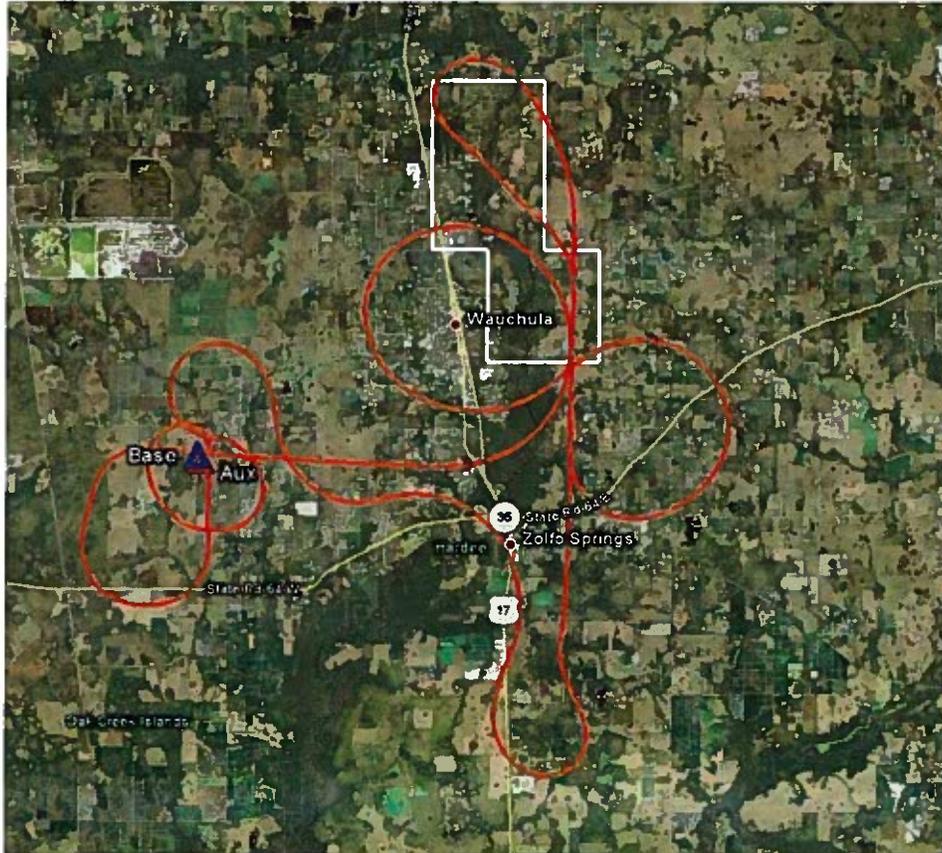
**FY 2009 Peace River Topographic Mapping (H024)
LIDAR Report**

Actual Flight Lines for Peace River Mission 090203A Showing Base Stations



FY 2009 Peace River Topographic Mapping (H024)
LIDAR Report

Actual Flight Lines for Peace River Mission 090205A Showing Base Stations



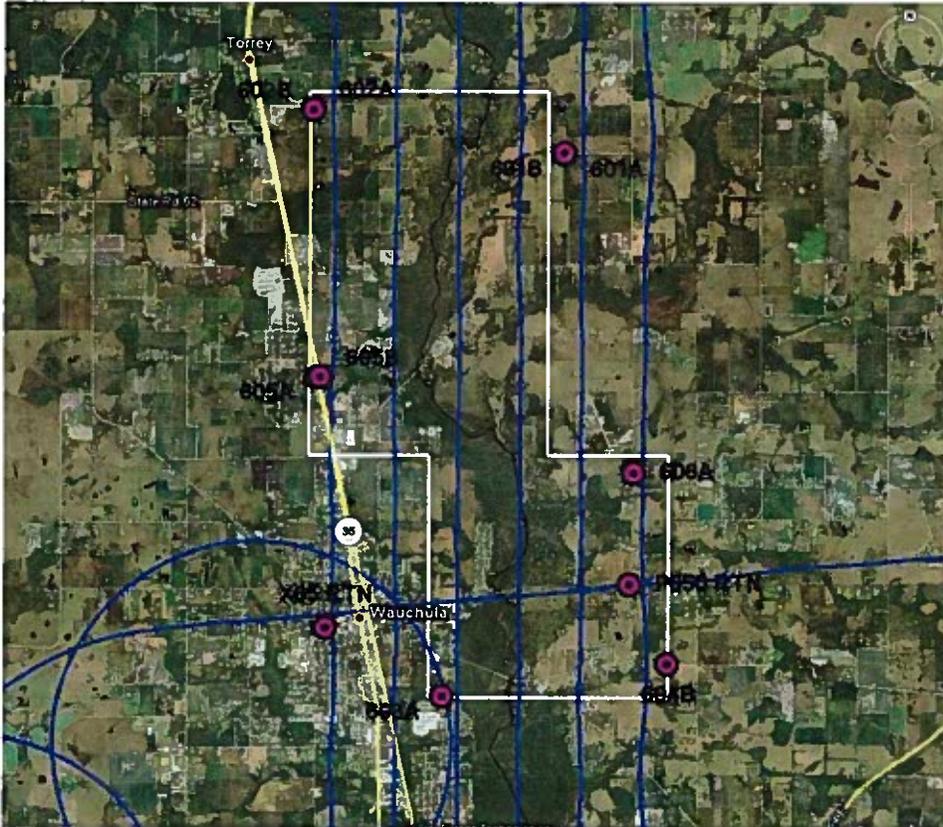
**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

Base Station Locations



**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

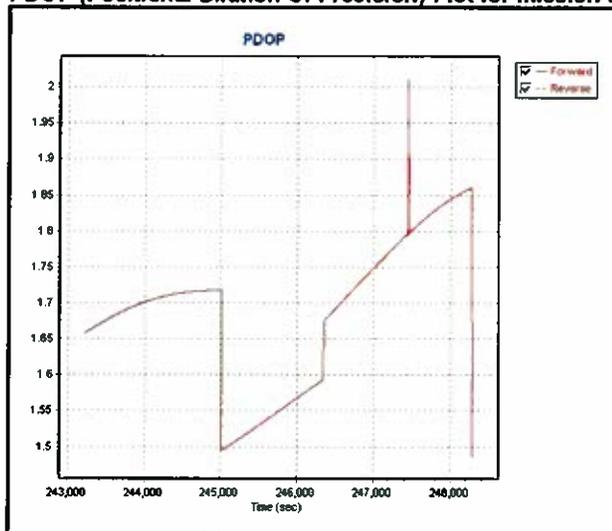
Actual Flight Lines for Peace River Mission 090203A Showing Ground Control



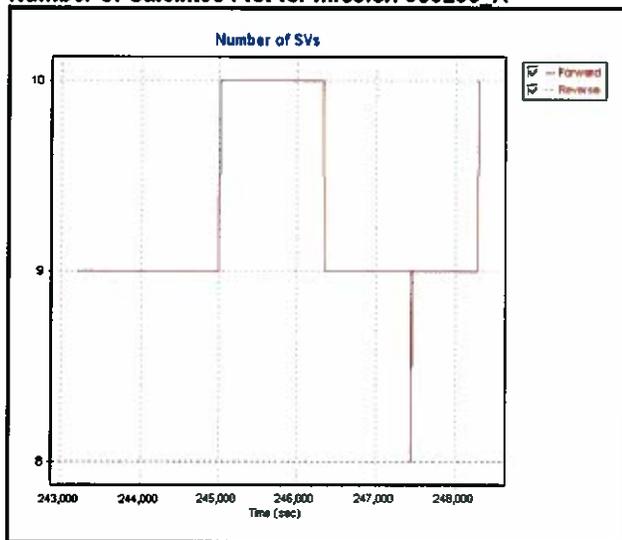
FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report

The following graphs show the mission by mission GPS PDOP (Positional Dilution Of Precision) Plots and Number of Satellites Plot.

PDOP (Positional Dilution Of Precision) Plot for mission 090203_A

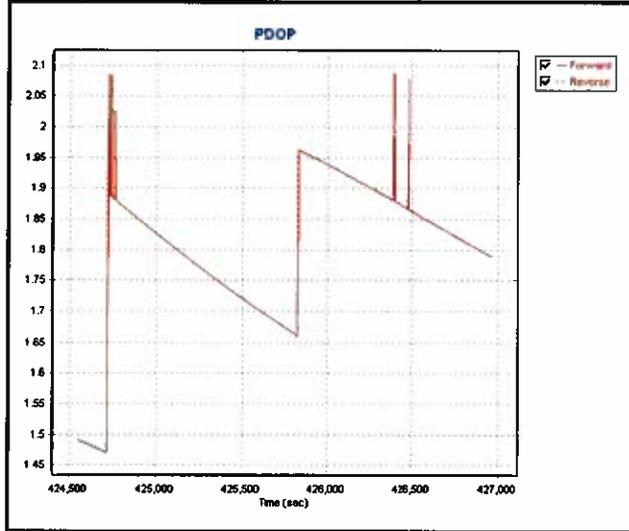


Number of Satellites Plot for mission 090203_A

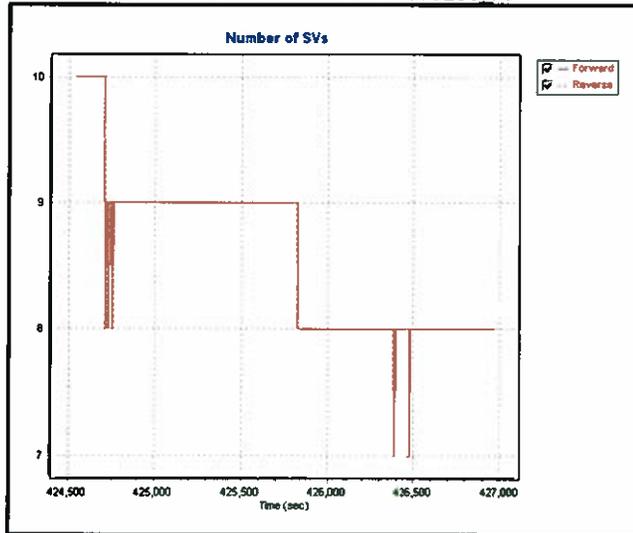


FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report

PDOP (Positional Dilution Of Precision) Plot for mission 090205_A



Number of Satellites Plot for mission 090205_A



FY 2009 Peace River Topographic Mapping (H024) LiDAR Report

The airborne GPS data was post-processed using Applanix POSPac Mobile Mapping Suite version 5.2. A fixed-bias carrier phase solution was computed in both the forward and reverse chronological directions. Whenever practical, LiDAR acquisition was limited to periods when the PDOP (Positional Dilution Of Precision) was less than 4.0. PDOP indicates satellite geometry relating to position. Generally PDOP's of 4.0 or less result in a good solution, however PDOP's between 4.0 and 5.0 can still yield good results most of the time. PDOP's over 6.0 are of questionable results and PDOP's of over 7.0 usually result in a poor solution. Other quality control checks used for the GPS include analyzing the combined separation of the forward and reverse GPS processing from one base station and the results of the combined separation when processed from two different base stations. Basically this is the difference between the two trajectories. An analysis of the number of satellites, present during the flight and data collection times, is also performed.

The GPS trajectory was combined with the raw IMU data and post-processed using Applanix POSPac Mobile Mapping Suite version 5.2. The smoothed best estimated trajectory (SBET) and refined attitude data are then utilized in the ALS Post Processor to compute the laser point-positions – the trajectory is combined with the attitude data and laser range measurements to produce the 3-dimensional coordinates of the mass points. Up to four return values are produced within the ALS Post Processor software for each pulse which ensures the greatest chance of ground returns in a heavily forested area.

Laser point classification was completed using Merrick Advanced Remote Sensing (MARS®) LiDAR processing and modeling software. Several algorithms are used when comparing points to determine the best automatic ground solution. Each filter is built based on the projects terrain and land cover to provide a surface that is 90% free of anomalies and artifacts. After the auto filter has been completed the datasets are then reviewed by an operator utilizing MARS® to remove any other anomalies or artifacts not resolved by the automated filter process. During these final steps the operator also verifies that the data sets are consistent and complete with no data voids.

GROUND CONTROL REPORT / CHECK POINT SURVEY RESULTS

GPS Controls

Two ground airborne GPS Base Stations, for the LiDAR collection, were set up every mission, one main GPS receiver located at the airport and one auxiliary airborne GPS receiver also located at the airport. The main airborne GPS base station was located at the Wauchula Municipal Airport (KCHN). The auxiliary airborne GPS base station was tied directly to the main airborne GPS base station by post processing using Trimble Geomatics Office Software version 1.63 and checked with OPUS solutions from NGS (National Geodetic Survey).

See Spreadsheet Below for Airborne GPS Base Station information.

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

Project: Peace River Florida				
Job#: 02016178				
Date: Feb. 2009				
Coordinate System: NAD83(2007) Florida West				
Zone: Florida West				
Project Datum: NAD1983(2007)				
Vertical Datum: NAVD88				
Units: USFeet				
Pt#	Geodetic NAD83(2007)		Ellipsoid	Description
Name	Latitude	Longitude	Height	
	North	West	Geoid03	
	Deg Min Sec	Deg Min Sec	USFeet	
Base	27°30'54.36942"N	81°53'00.60893"W	19.42	Base NGS WAUCPORT
Aux	27°30'50.65643"N	81°52'57.91858"W	21.97	Auxiliary Base
Pt#	NAD83(2007) Florida West		NAVD88	Description
Name	Northing	Easting	Elevation	
	Y	X	Z	
	USFeet	USFeet	USFeet	
Base	1156439.22	693926.19	101.58	Base NGS WAUCPORT
Aux	1156064.50	694168.77	104.14	Auxiliary Base

Ground Control Parameters

Horizontal Datum: The horizontal datum for the project is North American Datum of 1983 (NAD 83) NSRS 2007.

Coordinate System: Florida State Plane Coordinate System West Zone (0902).

Vertical Datum: The Vertical datum for the project is North American Vertical Datum of 1988 (NAVD88)

Geoid Model: Geoid03 (Geoid 03 will be used to convert ellipsoid heights to orthometric heights).

Units: Horizontal units are in US Survey Feet, Vertical units are in US Survey Feet.

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

Ground Survey Control Report

The following listing shows the newly established GPS ground control, collected for LiDAR checkpoints. The new ground control points (check points) were established and surveyed by: SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT; OPERATIONS DEPARTMENT; MAPPING & GIS SECTION.

Name	EastUSF_N83FLWest	NorthUSF_N83FLWest	ElevUSF_NAVD88
601A	725728.83	1187525.21	93.82
601B	725716.18	1187570.12	94.32
602A	715199.78	1189374.77	107.17
602B	715200.00	1189324.91	107.12
603A	720627.82	1165117.90	72.37
604B	730005.08	1166465.85	80.23
605A	715337.92	1178301.10	118.34
605B	715508.10	1178309.96	115.13
606A	728610.55	1174351.69	76.57
P650 RTN	728450.64	1169744.69	65.74
X65 RTN	715750.92	1167935.73	116.05

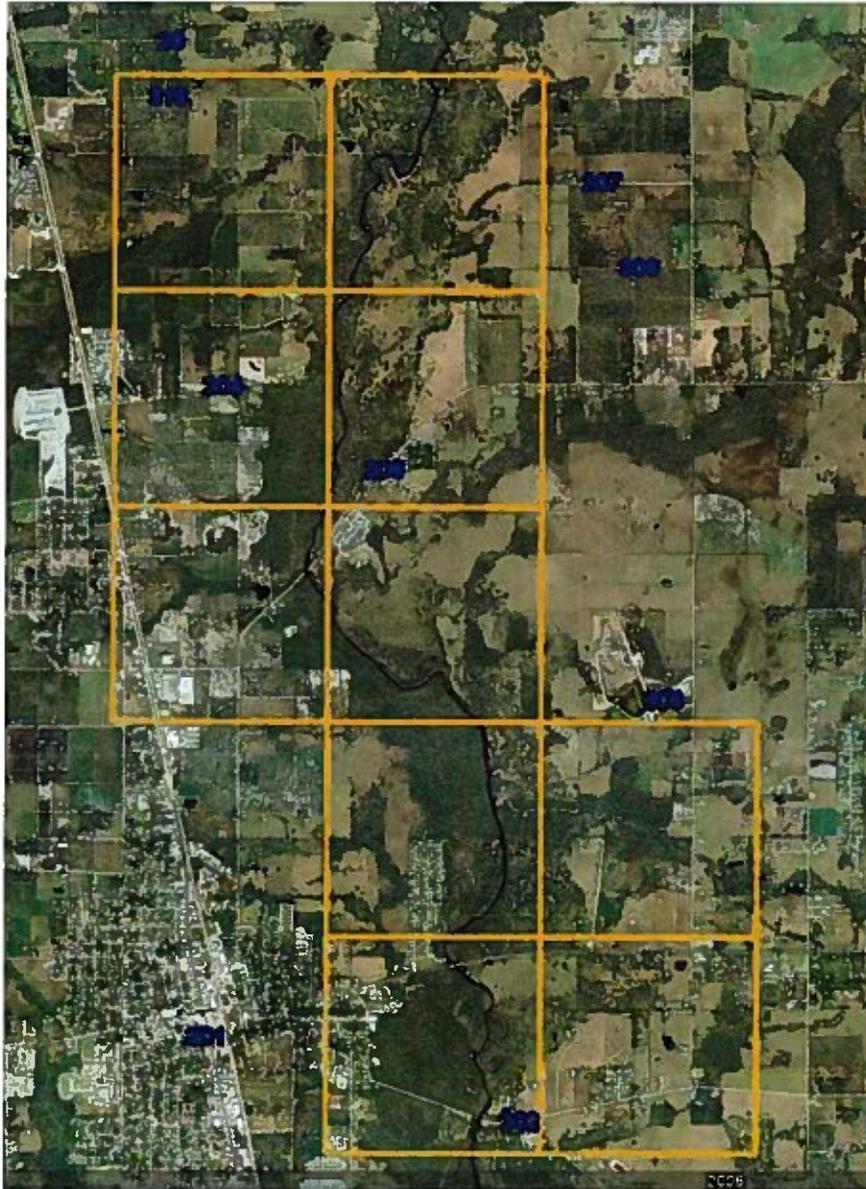
Additionally, Merrick GPS surveyed nine (9) independent checkpoints to use in the boresight task, and further validate the LiDAR Digital Surface Model (DSM). These surveyed points were placed in open terrain, and the coordinates are as follows:

Name	EastUSF_N83FLWest	NorthUSF_N83FLWest	ElevUSF_NAVD88
201	717221.82	1167669.62	107.36
202	724565.91	1165718.93	68.14
204	717533.02	1182804.05	94.30
206	721305.95	1180872.34	70.43
207	726380.66	1187513.73	103.13
208	716442.90	1190772.64	93.21
303	727836.40	1175513.99	82.73
306	727234.20	1185543.74	106.74
315	716230.05	1189473.36	94.20

See Figure 11 for the locations of the Merrick checkpoints.

**FY 2009 Peace River Topographic Mapping (H024)
LIDAR Report**

Figure 11



**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

LiDAR Control Report

The following listing shows the results of the LiDAR data compared to the GPS ground survey control data. The listing is sorted by the Z Error column showing, in ascending order, the vertical difference between the LiDAR points and the surveyed ground control points. The comparison is shown in State Plane Coordinates. See spreadsheet below.

Post-filter Control Report for Peace River (SWFWMD checkpoint coordinates):

Project File: MARSProjectPeaceRiver
 Date: March 23, 2009
 Vertical Accuracy Objective
 Requirement Type: Accuracy(z)
 Accuracy(z) Objective: 1.00
 Confidence Level: 95%
 Control Points in Report: 11
 Elevation Calculation Method: Interpolated from TIN
 Control Points with LiDAR Coverage: 11
 Control Points with Required Accuracy (+/- 1.00): 11
 Percent of Control Points with Required Accuracy (+/- 1.00): 100.00
 Average Control Error Reported: 0.01
 Maximum (highest) Control Error Reported: 0.23
 Median Control Error Reported: 0.05
 Minimum (lowest) Control Error Reported: -0.29
 Standard deviation (sigma) of Z for sample: 0.17
 RMSE of Z for sample (RMSE(z)): 0.16: PASS
 FGDC/NSSDA Vertical Accuracy (Accuracy(z)): 0.31: PASS
 NSSDA Achievable Contour Interval: 0.6
 ASPRS Class 1 Achievable Contour Interval: 0.5
 NMAS Achievable Contour Interval: 0.6

Control	Control Pt.	Control Pt.	Coverage	Control Pt.	from LiDAR	Z Error	Min Z	Median Z	Max Z
Point Id	X(East)	Y(North)		Z(Elev)	Z(Elev)				
	USFeet	USFeet		USFeet	USFeet	USFeet	USFeet	USFeet	USFeet
606A	728610.55	1174351.69	Yes	76.57	76.34	-0.23	76.30	76.37	76.50
601B	725716.18	1187570.12	Yes	94.32	94.14	-0.18	94.11	94.15	94.18
605A	715337.92	1178301.10	Yes	118.34	118.27	-0.07	118.14	118.27	118.38
601A	725728.83	1187525.21	Yes	93.82	93.76	-0.06	93.54	93.54	93.88
603A	720627.82	1165117.90	Yes	72.37	72.32	-0.05	72.29	72.31	72.36
602A	715199.78	1189374.77	Yes	107.17	107.14	-0.03	107.13	107.15	107.20

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

X65 RTN	715750.92	1167935.73	Yes	116.05	116.02	-0.03	115.98	116.11	116.21
604B	730005.08	1166465.85	Yes	80.23	80.23	0.00	79.97	80.31	80.34
602B	715200.00	1189324.91	Yes	107.12	107.26	0.14	107.20	107.29	107.36
605B	715508.10	1178309.96	Yes	115.13	115.34	0.21	115.08	115.26	115.40
P650 RTN	728450.64	1169744.69	Yes	65.74	65.99	0.25	65.95	66.15	66.51

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

Post-boresight (pre-filter) Control Report for Peace River (Merrick checkpoint coordinates):

Project File:
 Date: February 19, 2009
 Vertical Accuracy Objective
 Requirement Type: Accuracy(z)
 Accuracy(z) Objective: 1.00
 Confidence Level: 95%
 Control Points in Report: 9
 Elevation Calculation Method: Interpolated from TIN
 Control Points with LiDAR Coverage: 9
 Control Points with Required Accuracy (+/- 1.00): 9
 Percent of Control Points with Required Accuracy (+/- 1.00): 100.00
 Average Control Error Reported: -0.00
 Maximum (highest) Control Error Reported: 0.25
 Median Control Error Reported: -0.03
 Minimum (lowest) Control Error Reported: -0.23
 Standard deviation (sigma) of Z for sample: 0.15
 RMSE of Z for sample (RMSE(z)): 0.14: PASS
 FGDC/NSSDA Vertical Accuracy (Accuracy(z)): 0.28: PASS
 NSSDA Achievable Contour Interval: 0.5
 ASPRS Class 1 Achievable Contour Interval: 0.5
 NMAS Achievable Contour Interval: 0.5

Control	Control Pt.	Control Pt.	Coverage	Control Pt.	from LiDAR	Z Error	Min Z	Median Z	Max Z
Point Id	X(East)	Y(North)		Z(Elev)	Z(Elev)				
	USFeet	USFeet		USFeet	USFeet	USFeet	USFeet	USFeet	USFeet
201	717221.82	1167669.6	Yes	107.36	107.0695	-0.2905	106.941	107.191	107.32
202	724565.91	1165718.9	Yes	68.14	67.9865	-0.1535	67.672	67.988	68.068
204	717533.02	1182804.1	Yes	94.3	94.35	0.05	94.335	94.363	94.421
206	721305.95	1180872.3	Yes	70.43	70.5059	0.0759	70.305	70.514	70.616
207	726380.66	1187513.7	Yes	103.13	103.3552	0.2252	103.299	103.392	103.398
208	716442.9	1190772.6	Yes	93.21	93.3246	0.1146	93.24	93.294	93.382
303	727836.4	1175514	Yes	82.73	82.7138	-0.0162	82.484	82.744	82.807
306	727234.2	1185543.7	Yes	106.74	106.9415	0.2015	106.881	106.964	107.014
315	716230.05	1189473.4	Yes	94.2	94.1212	-0.0788	93.937	94.246	94.37

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

LiDAR CALIBRATION

Introduction

A LiDAR calibration or 'boresight' is performed on every mission to determine and eliminate systemic biases that occur within the hardware of the Leica ALS50 laser scanning system, the inertial measurement unit (IMU), and because of environmental conditions which affect the refraction of light. The systemic biases that are corrected for include roll, pitch, and heading.

Calibration Procedures

In order to correct the error in the data, misalignments of features in the overlap areas of the LiDAR flightlines must be detected and measured. At some point within the mission, a specific flight pattern must be flown which shows all the misalignments that can be present. Typically, Merrick flies a pattern of at least three opposing direction and overlapping lines, three of which provide all the information required to calibrate the system.

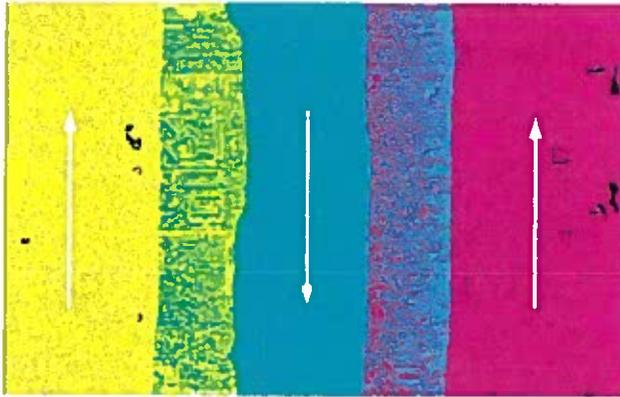


Figure 1: Flight pattern required for calibration

Correcting for Pitch and Heading Biases

There are many settings in the ALS40/50 post processor that can be used to manipulate the data; six are used for boresighting. They are roll, pitch, heading, torsion, range and atmospheric correction. The order in which each is evaluated is not very important and may be left to the discretion of the operator. For this discussion, pitch and heading will be evaluated first. It is important to remember that combinations of error can be very confusing, and this is especially true with pitch and heading. They affect the data in similar ways, so error attributed to pitch may be better blamed on heading and vice versa. To see a pitch/heading error, one must use the profile tool to cut along the flight path at a pitched roof or any elevation feature that is perpendicular to the flight path. View the data by elevation to locate these scenarios.

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

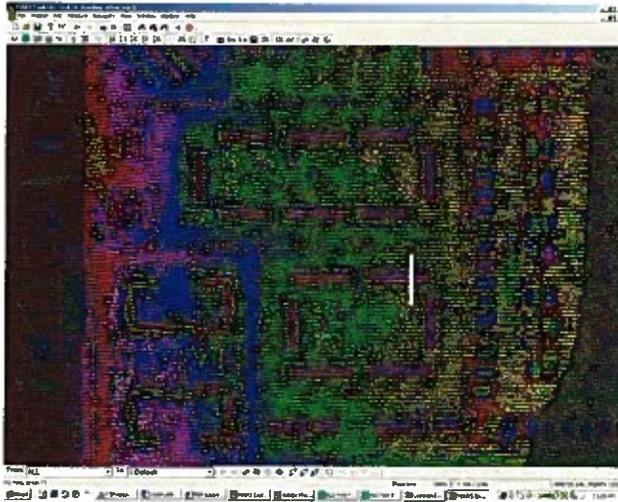


Figure 2: Orthographic view with profile line

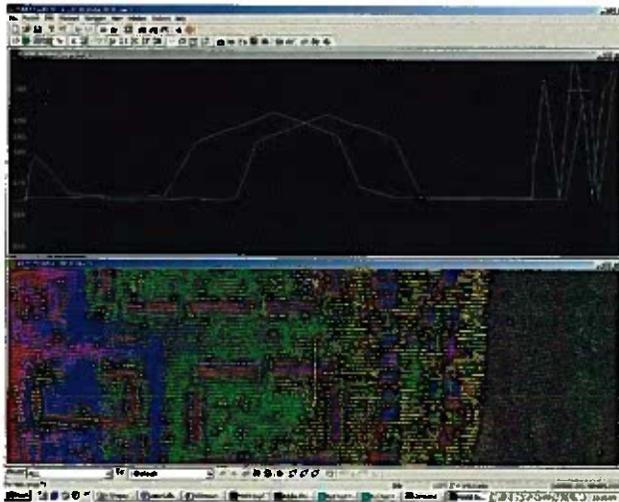


Figure 3: Profile view of misalignment

The profile line in figures 2 and 3 has an additional thin line perpendicular to the cut that shows the direction of the view. In this case, the line is pointing to the right, or east. In the profile window, we are looking through two separate TINs, so there are two lines

**FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report**

showing the location of the same building. The yellow line is from the flight line on the left (flown north); the light blue line is from the flight line in the middle (flown south).

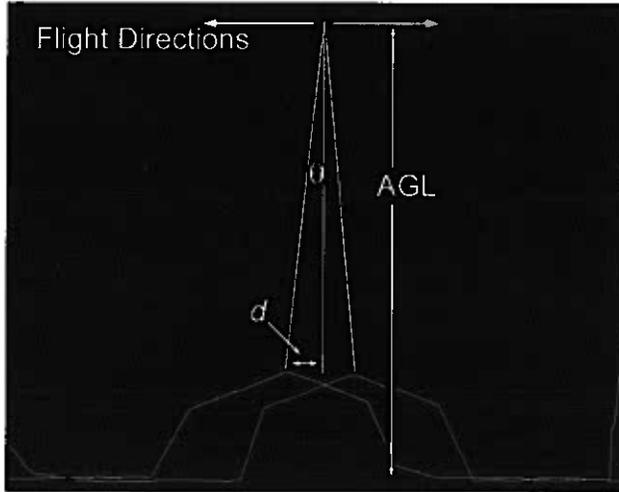


Figure 4: Adjusting pitch

The top arrows represent each respective flight direction. We are looking east, the yellow flight line was flown north, and the blue line is flown south. Adjusting pitch changes the relationship between the pitch from the IMU and the actual pitch of the plane. Increasing pitch sends the nose of the plane up and the data ahead in the flight direction. Lowering pitch does the opposite. In this example, pitch needs to decrease in order to bring these two roof lines together. The angle theta must be expressed in radians. The formula to arrive at this angle is...

$$\theta = \frac{\arctan\left(\frac{d}{AGL}\right)}{57.2958}$$

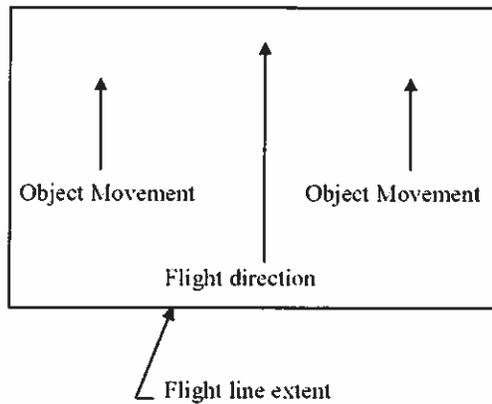
where d is the distance from nadir (directly under the plane) to the peak of the roof and AGL is the 'above ground level' of the plane. The conversion from degrees to radians is one radian equals 57.2958 degrees. This number is then subtracted from the pitch value that was used to create the data.

The next issue to resolve, before actually changing the pitch value, is to determine if this shift is at all due to an incorrect heading value, since heading will move data in the direction of flight also. The difference is that heading rotates the data, meaning that when heading is changed, objects on opposite sides of the swath move in opposite directions.

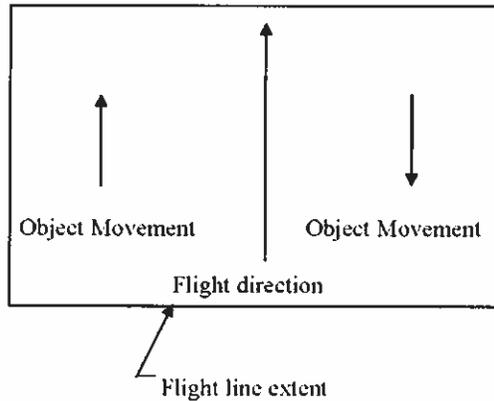
FY 2009 Peace River Topographic Mapping (H024)
LiDAR Report

Figures 5 and 6: Pitch and Heading movement

Pitch increases, objects throughout the data move forward.



Heading increases, objects move clockwise.



When heading changes, objects on the sides of the flight line move in opposite directions. If heading is increased, objects in the flight line move in a clockwise direction. If heading is decreased, objects move in a counter-clockwise direction.

To find out if heading is correct, a similar profile line must be made in the overlap area between the middle flight line and the one to the east, or right side. If the distance d (see figure 4) is different on the right versus the left, then heading is partially responsible

FY 2009 Peace River Topographic Mapping (H024) LiDAR Report

for the error. If the distance d is the same on both sides then heading or pitch is fully responsible.

Correcting for the Roll Bias

The purpose of a 'truth survey' is to evaluate roll and to ensure that the surface is accurate vertically. This survey is typically done in a localized area and the purpose is to provide a truth reference to every mission and to help in the calibration effort. Since every mission's data must be compared to this survey, it makes sense for this survey to be done at a place where the plane will be for every mission, i.e., the airport. The survey is done along a taxiway or runway, and the calibration flight lines are flown perpendicular to it, which makes it perfect for evaluating roll.

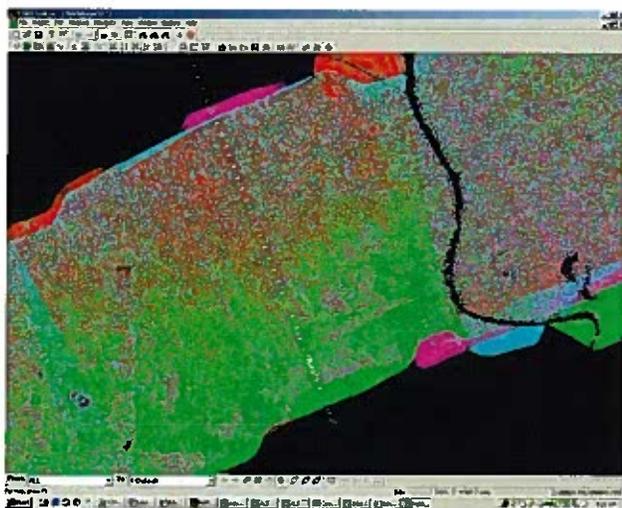


Figure 7: The truth survey

The white dots represent the survey, and four flight lines, two from the beginning of the mission and two from the end, have been flown. Each pair of flight lines was flown in opposite directions, and in this case the red and blue lines were flown east and the green and magenta lines were flown west. The first step is to make a profile line across the survey. It is important to create this cut on one side of the taxiway so as to avoid cutting through and over the crown. Once the profile is created, exaggeration of the elevation by 100 times is necessary to see the pattern. (figure 8)

FY 2009 Peace River Topographic Mapping (H024) LiDAR Report

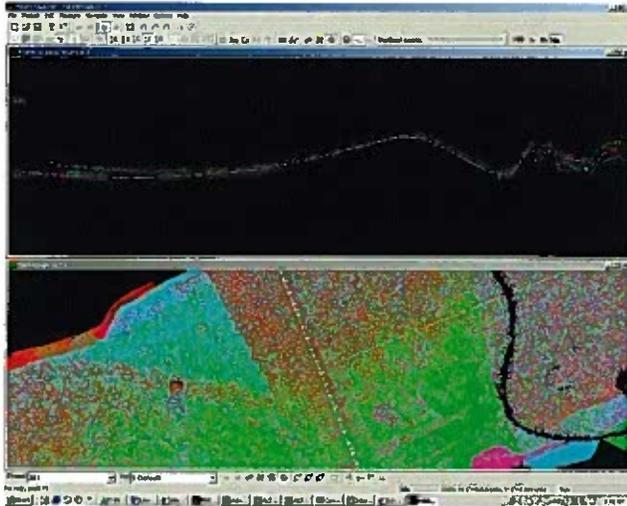


Figure 8: Profile view of calibration flight lines

Even without zooming in, a pattern is already apparent. The two east flown lines, red and blue, are high on the left compared to the west flown lines, and low on the right. Since the profile line was created with the view eastward, it is easiest to think about what the east lines are doing. The east lines are low on the right, which means the relationship between the IMU and the right wing of the plane must be adjusted up. As in heading adjustments, sending the data in a clockwise direction is positive. If the axis of the clock is the tail/nose axis of the plane, then it is obvious this data must go in a counter clock-wise, or negative direction. The method for determining the magnitude of the adjustment is similar to determining the magnitude of the adjustment for the pitch. The only difference is how the triangles are drawn in relationship to the data. (figures 9 and 10)

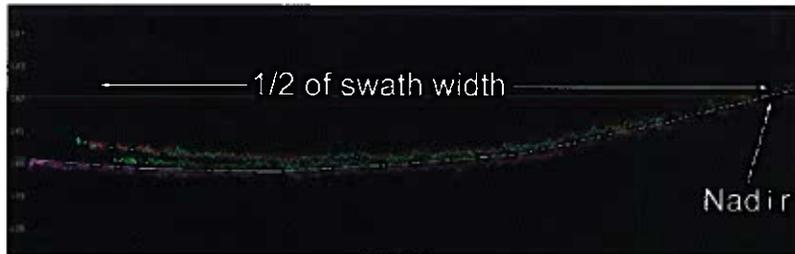


Figure 9: Half of calibration profile

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LiDAR Report

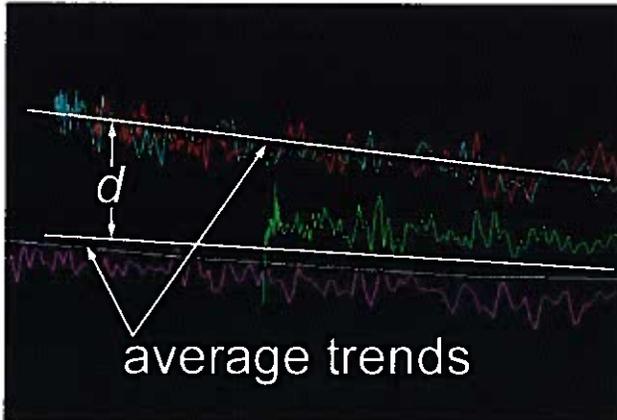


Figure 10: Differences in average roll trends

The important measurements for this formula are the distance from nadir to the edge of the swath, or $\frac{1}{2}$ swath width, and d , the distance from the two average trend lines for each group. Since any adjustments made to roll effect both east and west lines, we are really interested in $\frac{1}{2} d$; this will give the value that will bring both sets of lines together. The formula is:

$$\theta = \frac{\arctan\left(\frac{d/2}{\text{EdgeToNadir}}\right)}{57.2958}$$

Correcting the Final Elevation

The next step is to ensure that all missions have the same vertical offset. Two techniques are used to achieve this. The first is to compare all calibration flight lines and shift the missions appropriately. The second is to fly an extra 'cross flight' which touches all flight lines in the project. Each mission's vertical differences can then be analyzed and corrected. However, the result of this exercise is only proof of a high level of relative accuracy. Since many of the calibration techniques affect elevation, project wide GPS control must be utilized to place the surface in the correct location. This can be achieved by utilizing the elevation offset control in the post processor or by shifting the data appropriately in MARS®. The control network may be pre-existing or collected by a licensed surveyor. This is always the last step and is the only way to achieve the high absolute accuracy that is the overall goal.

Florida Minimum Technical Standards for Mapping Projects

Survey and Map Report

Exhibit D

Vertical Accuracy Report

Southwest Florida Water Management District

FY 2009 Peace River Topographic Mapping (H024)

Peace River South LiDAR Re-flight

Work Order No. 1

Vertical Accuracy Report

Submitted to:



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Merrick & Company Job Number: 02016178

**FY 2009 Peace River Topographic Mapping (H024)
Vertical Accuracy Report**

Southwest Florida Water Management District (District) provided Merrick & Company (Merrick) with additional ground measurements to further verify the accuracy of the LIDAR data acquired and processed in the late winter of 2009. The District's task was to set approximately twenty (20) ground measurements for each of the following ground cover classifications:

- Urban
- Bare ground / short grass
- Brush (e.g., palmetto shrub, cogon grass)
- Forest

The District collected a total of one hundred twenty-five (125) ground cover class checkpoints. Upon completion of the GPS survey and subsequent post-processing of such, the District provided Merrick with a shapefile (i.e., *SWFWMD_CheckpointsWithHeights_7Apr09*) that represented the ground cover classes collected. The following table illustrates the results of their field work:

POINTNAME	NORTHING	EASTING	HEIGHT	POINTTYPE	HABITAT	DESRIPTIO
PR5001	1189927.18	715160.87	107.91	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND IN ORANGE GROVE
PR5004	1186834.40	717951.44	73.32	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS
PR5005	1187273.37	720335.48	56.41	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS
PR5006	1169765.77	720233.72	69.05	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS
PR5007	1167646.40	720243.19	72.62	GND	SAND/ LOW GRASS/ MOWED GRASS	MOWED GRASS
PR5010	1166763.70	721073.32	55.80	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS COVERING CONCRETE
PR5013	1165455.99	724670.74	67.49	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LIME ROCK ROAD
PR5014	1165362.63	724664.94	68.16	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS
PR5017	1167683.89	727319.82	71.58	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS
PR5021	1169777.88	722411.06	56.48	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS/ VEHICLE PATH
PR5023	1169460.05	722596.14	49.76	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ GRAVEL
PR5026	1169241.34	722046.15	59.55	GND	SAND/ LOW GRASS/ MOWED GRASS	MOWED GRASS
PR5027	1169771.86	726263.49	61.24	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS IN PASTURE
PR5031	1171738.31	726424.52	65.89	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ GRADED ROAD
PR5036	1166427.75	727784.74	74.05	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5039	1172002.04	729873.40	69.29	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5045	1174560.39	727620.39	78.43	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS IN PASTURE
PR5056	1172837.97	719894.62	87.69	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND IN ORANGE

**FY 2009 Peace River Topographic Mapping (H024)
Vertical Accuracy Report**

PR5057	1173245.10	719917.27	90.11	GND	MOWED GRASS	GROVE
PR5059	1175565.45	719158.11	91.49	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND IN ORANGE GROVE
PR5062	1175565.50	719158.12	91.55	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND IN ORANGE GROVE
PR5063	1175620.74	719155.08	90.56	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND IN ORANGE GROVE AT PR5059
PR5064	1175649.30	719156.49	90.43	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND IN ORANGE GROVE
PR5065	1189867.31	725279.52	88.53	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS IN PASTURE
PR5067	1189878.35	724864.48	81.36	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS IN PASTURE
PR5077	1182775.22	724829.40	77.51	GND	SAND/ LOW GRASS/ MOWED GRASS	MOWED GRASS
PR5078	1182590.72	724788.64	76.35	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS AT FENCE LINE
PR5080	1182352.78	722657.25	76.12	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS 3 FEET NW OF FENCE LINE
PR5081	1182305.63	722707.23	75.31	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS 3 FEET SE OF FENCE LINE
PR5082	1178584.35	719647.00	54.98	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5083	1178538.49	719575.13	45.74	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5085	1182294.80	715045.64	108.14	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5087	1175059.84	715323.86	123.41	GND	SAND/ LOW GRASS/ MOWED GRASS	MOWED GRASS
PR5088	1175131.23	715324.20	123.21	GND	SAND/ LOW GRASS/ MOWED GRASS	MOWED GRASS
PR5089	1187172.63	715152.25	87.72	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5092	1187322.72	715247.32	89.97	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ TWO TRACK
PR5093	1187330.67	715320.32	88.97	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ TWO TRACK
PR5094	1187334.17	715398.41	88.96	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ TWO TRACK
PR5097	1189471.75	717329.15	80.19	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ ROAD
PR5098	1189470.32	717380.03	79.64	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ ROAD
PR5099	1189469.42	717430.74	79.20	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ ROAD
PR5100	1184180.35	717920.31	85.02	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ ROAD
PR5101	1184179.70	717975.24	84.52	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ ROAD
PR5103	1184229.30	717757.61	86.16	GND	SAND/ LOW GRASS/ MOWED GRASS	LOW GRASS

**FY 2009 Peace River Topographic Mapping (H024)
Vertical Accuracy Report**

PR5108	1179862.42	717880.79	84.02	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5109	1179936.70	717663.03	86.90	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5113	1179973.31	717934.00	76.87	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ CREEK BED
PR5120	1178293.24	717668.74	81.68	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5126	1175912.58	716977.53	111.06	GND	SAND/ LOW GRASS/ MOWED GRASS	SAND/ LOW GRASS
PR5043	1174788.37	727693.46	81.32	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5002	1189527.96	717328.88	79.78	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5003	1189889.22	719878.81	68.48	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5011	1165937.11	722800.04	49.34	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5015	1165129.98	724658.77	67.14	GND	MEDIUM GRASS	MEDIUM GRASS AND BRUSH
PR5019	1169698.95	722454.63	55.09	GND	MEDIUM GRASS	MEDIUM-HIGH GRASS
PR5024	1169315.01	722183.59	54.88	GND	MEDIUM GRASS	MEDIUM-HIGH GRASS
PR5033	1169831.97	728023.78	65.47	GND	MEDIUM GRASS	MEDIUM-LOW GRASS
PR5037	1166354.93	727795.82	72.51	GND	MEDIUM GRASS	MEDIUM-HIGH GRASS/ PASTURE
PR5047	1177568.95	724882.14	77.44	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5048	1177569.35	724689.32	76.53	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5049	1177608.04	724473.35	76.49	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5055	1171924.04	722749.34	57.26	GND	MEDIUM GRASS	MEDIUM GRASS
PR5058	1173264.33	719951.42	90.68	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5060	1175527.07	719157.43	90.60	GND	MEDIUM GRASS	MEDIUM GRASS
PR5061	1175476.76	719156.52	90.55	GND	MEDIUM GRASS	MEDIUM GRASS
PR5066	1189885.20	725073.49	85.21	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5068	1189779.05	724673.96	78.29	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5069	1189793.44	724563.82	77.66	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5072	1185621.39	725242.41	87.19	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5073	1185622.91	725033.84	85.54	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5074	1185622.76	724825.82	85.08	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5075	1185621.52	724621.57	83.76	GND	MEDIUM GRASS	MEDIUM GRASS IN PASTURE
PR5091	1187316.77	715146.73	89.72	GND	MEDIUM GRASS	MEDIUM GRASS IN ORANGE GROVE

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PR5096	1189496.85	717327.91	80.03	GND	MEDIUM GRASS	MEDIUM GRASS
PR5114	1180127.79	718106.24	78.58	GND	MEDIUM GRASS	MEDIUM GRASS
PR5125	1176105.38	716978.58	109.39	GND	MEDIUM GRASS	MEDIUM GRASS
PR5032	1171738.45	726510.91	66.52	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS
PR5035	1169413.37	729852.48	68.92	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS
PR5018	1169776.12	725914.67	56.28	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5020	1169746.69	722455.45	55.12	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5029	1172142.96	725724.62	54.74	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5030	1172186.22	725743.39	53.89	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5042	1174882.41	727692.70	81.94	GND	HIGH GRASS/ BRUSH/ TREES	MEDIUM-HIGH GRASS & BRUSH
PR5044	1174680.31	727655.39	80.14	GND	HIGH GRASS/ BRUSH/ TREES	MEDIUM-HIGH GRASS & BRUSH
PR5046	1174591.18	727760.59	78.08	GND	HIGH GRASS/ BRUSH/ TREES	BRUSH/ PALMETTO PATCH IN PASTURE
PR5051	1172168.53	722681.41	58.68	GND	HIGH GRASS/ BRUSH/ TREES	HIGH-THICK GRASS/ BRUSH
PR5052	1172169.14	722720.66	57.36	GND	HIGH GRASS/ BRUSH/ TREES	HIGH-THICK GRASS/ BRUSH
PR5054	1171976.14	722717.56	57.38	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5090	1187159.54	715184.87	87.77	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5095	1187218.91	715032.02	87.86	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS
PR5104	1184295.09	717191.01	87.17	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5117	1178291.81	717895.71	77.58	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5121	1178275.87	717312.86	83.75	GND	HIGH GRASS/ BRUSH/ TREES	HIGH GRASS AND BRUSH
PR5040	1171877.37	729864.79	68.01	GND	HIGH GRASS/ BRUSH/ TREES	BRUSH/ TREES
PR5070	1189616.24	724694.63	76.19	GND	HIGH GRASS/ BRUSH/ TREES	LOW BRUSH/ TREES
PR5071	1189663.70	724816.54	78.17	GND	HIGH GRASS/ BRUSH/ TREES	LOW BRUSH/ TREES
PR5079	1182458.62	724795.18	71.98	GND	HIGH GRASS/ BRUSH/ TREES	BRUSH/ TREES
PR5105	1184382.62	717063.89	89.01	GND	HIGH GRASS/ BRUSH/ TREES	HIGH BRUSH/ TREES
PR5106	1179895.42	717877.20	81.47	GND	HIGH GRASS/ BRUSH/ TREES	BRUSH/ TREES
PR5107	1179908.15	717879.78	80.65	GND	HIGH GRASS/ BRUSH/ TREES	BRUSH/ TREES
PR5110	1179991.31	717707.28	78.50	GND	HIGH GRASS/ BRUSH/ TREES	HIGH BRUSH/ TREES

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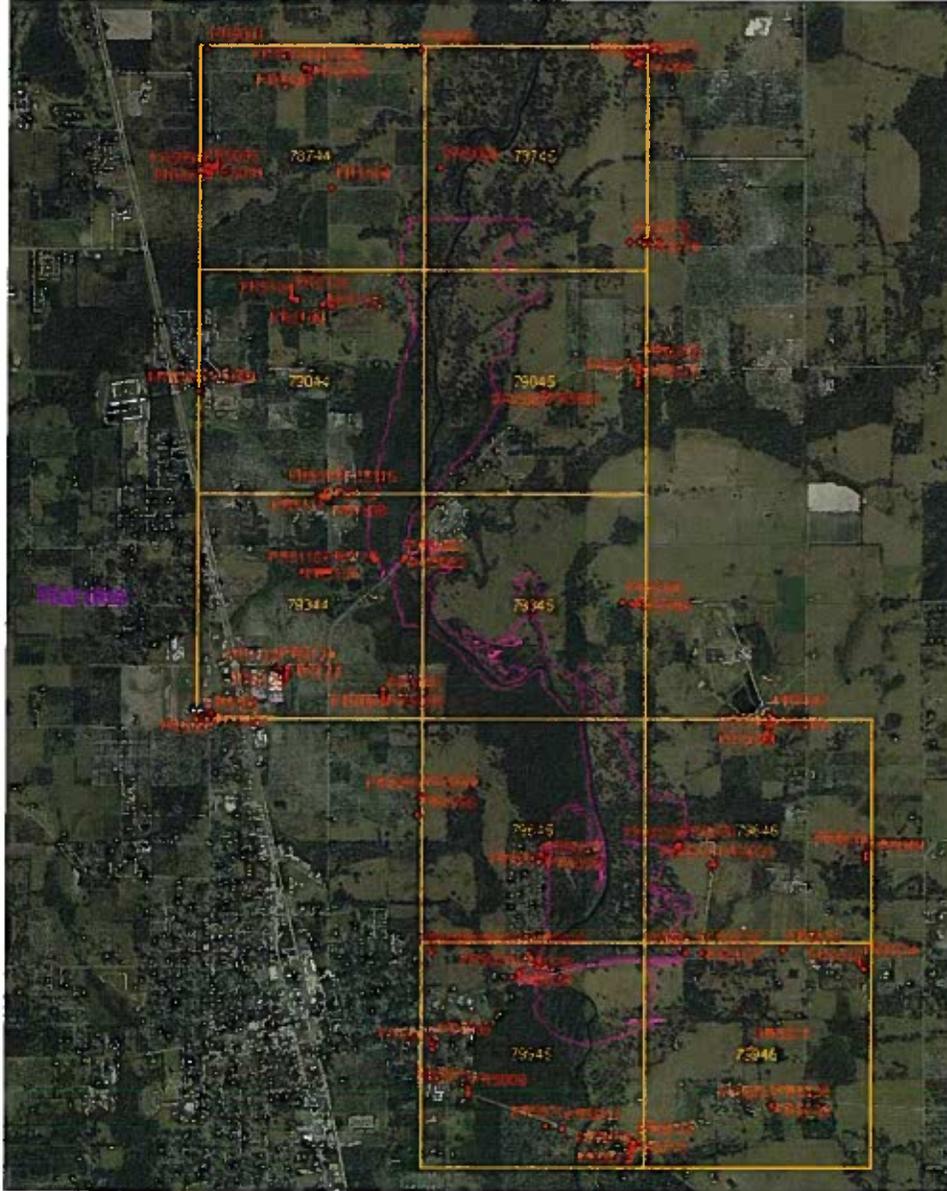
PR5111	1179991.96	717712.35	77.71	GND	HIGH GRASS/ BRUSH/ TREES	HIGH BRUSH/ TREES
PR5112	1179935.62	717749.92	81.91	GND	HIGH GRASS/ BRUSH/ TREES	HIGH BRUSH/ TREES
PR5115	1180095.00	718153.56	72.91	GND	HIGH GRASS/ BRUSH/ TREES	HIGH BRUSH/ TREES
PR5116	1180079.41	718172.38	71.68	GND	HIGH GRASS/ BRUSH/ TREES	HIGH BRUSH/ TREES
PR5118	1178282.40	717812.58	78.23	GND	HIGH GRASS/ BRUSH/ TREES	HIGH BRUSH
PR5119	1178276.54	717730.26	79.92	GND	HIGH GRASS/ BRUSH/ TREES	HIGH BRUSH
PR5008	1167769.67	720247.40	72.42	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5009	1166646.24	721072.60	55.46	ASPH	PAVED SURFACE	ASPHALT/ INTERSECTION OF ROADS
PR5012	1165881.36	723153.22	53.23	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF OLD ROAD
PR5016	1165556.96	724776.00	68.56	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5022	1169756.69	722367.63	58.88	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5025	1169235.14	722014.52	59.13	ASPH	PAVED SURFACE	ASPHALT PARKING LOT
PR5028	1169790.60	726217.08	60.21	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5034	1169543.54	729741.98	67.93	CONC	PAVED SURFACE	CONCRETE SLAB
PR5038	1166388.76	727789.19	74.29	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5041	1175102.80	727725.19	81.35	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5050	1172115.91	722669.39	59.09	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5053	1171978.54	722668.99	60.10	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5076	1182853.24	724841.62	79.90	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5084	1182307.20	714989.73	107.68	ASPH	PAVED SURFACE	ASPHALT/ CENTER OF ROAD
PR5086	1175039.93	715096.35	123.52	ASPH	PAVED SURFACE	ASPHALT PARKING LOT
PR5122	1176086.19	716891.99	116.34	ASPH	PAVED SURFACE	ASHPALT PAVEMENT/ PARKING LOT
PR5123	1176086.01	716853.31	116.41	ASPH	PAVED SURFACE	ASHPALT PAVEMENT/ PARKING LOT
PR5124	1176111.57	716764.74	115.58	ASPH	PAVED SURFACE	ASHPALT PAVEMENT/ PARKING LOT

The coordinate values illustrated above are in the District's project coordinate system.

See Figure 1 for the locations of the District's 125 ground cover class checkpoints.

**FY 2009 Peace River Topographic Mapping (H024)
Vertical Accuracy Report**

Figure 1



**FY 2009 Peace River Topographic Mapping (H024)
Vertical Accuracy Report**

Merrick used the descriptions listed under the heading **HABITAT** for the final ground cover classifications and accuracy assessment. Merrick performed an accuracy comparison using the abovementioned coordinates vs. the 2009 LiDAR bare-earth surface. The target accuracy testing and reports were performed in accordance with the specifications set forth by the FGDC Geospatial positioning Standards, Part 3; National Standard for Spatial Data Accuracy (NSSDA). The following table illustrates Merrick's findings:

Ground Cover Categories and Accuracy Criteria			Computed Accuracies		
Ground Cover HABITAT	RMSEz (Ft) <	ACCURACYz (Ft) <	RMSEz	95% Acc Z	95th Percentile
CAT 1 – Sand/ Low Grass/ Mowed Grass	0.30	0.60	0.20	0.39	0.34
CAT 2 – Medium Grass	0.30	0.60	0.21	0.41	0.33
CAT 3 – High Grass/ Brush/ Trees	0.61	1.19	0.61	1.20	1.01
CAT 4 – Paved Surfaces	0.30	0.60	0.29	0.58	0.43
COMBINED	0.61	1.19	0.36	0.71	0.79

The following accuracy statements were derived (tested with the ASPRS/NDEP method):

Tested **0.44'** Fundamental Vertical Accuracy (FVA) at 95-percent (95%) confidence level in open terrain using RMSEz x 1.9600 (whereas the aforementioned categories CAT 1, CAT 2, and CAT 4 are used to define open terrain [i.e., bare-earth]).

Tested **1.01'** Supplemental Vertical Accuracy (SVA) at 95th percentile in category CAT 3.

Points that exceeded the 95 th percentile for the SVA assessment				
POINTNAME	Ground Cover HABITAT	Control Point Z	Z from LiDAR	Z Difference
PR5052	CAT 3	57.36	58.70	1.34
PR5051	CAT 3	58.68	59.70	1.02

Tested **0.79'** Consolidated Vertical Accuracy (CVA) at 95th percentile in all categories combined (i.e., CAT 1, CAT 2, CAT 3 and CAT 4).

Points that exceeded the 95 th percentile for the CVA assessment				
POINTNAME	Ground Cover HABITAT	Control Point Z	Z from LiDAR	Z Difference
PR5052	CAT 3	57.36	58.70	1.34
PR5051	CAT 3	58.68	59.70	1.02
PR5030	CAT 3	53.89	54.88	0.99
PR5054	CAT 3	57.38	58.33	0.95
PR5111	CAT 3	77.71	78.65	0.94
PR5110	CAT 3	78.50	79.37	0.87

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PR5119	CAT 3	79.92	80.72	0.80
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The complete assessment of the elevation differences for all 125 District checkpoints is illustrated in the following table:

POINTNAME	HABITAT	Ground Cover Category	Z Difference
PR5052	HIGH GRASS/ BRUSH/ TREES	CAT 3	1.34
PR5051	HIGH GRASS/ BRUSH/ TREES	CAT 3	1.02
PR5030	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.99
PR5054	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.95
PR5111	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.94
PR5110	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.87
PR5119	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.8
PR5107	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.76
PR5029	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.65
PR5121	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.6
PR5042	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.59
PR5020	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.58
PR5019	MEDIUM GRASS	CAT 2	0.57
PR5046	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.55
PR5018	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.51
PR5044	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.5
PR5106	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.47
PR5117	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.44
PR5118	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.41
PR5115	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.36
PR5035	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.34
PR5104	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.33
PR5112	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.32
PR5015	MEDIUM GRASS	CAT 2	0.29
PR5011	MEDIUM GRASS	CAT 2	0.26
PR5060	MEDIUM GRASS	CAT 2	0.26
PR5037	MEDIUM GRASS	CAT 2	0.25
PR5055	MEDIUM GRASS	CAT 2	0.23
PR5120	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.22
PR5091	MEDIUM GRASS	CAT 2	0.22
PR5080	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.2
PR5087	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.2
PR5032	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.2
PR5061	MEDIUM GRASS	CAT 2	0.19
PR5040	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.16

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PR5096	MEDIUM GRASS	CAT 2	0.15
PR5100	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.14
PR5069	MEDIUM GRASS	CAT 2	0.14
PR5108	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.12
PR5021	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.11
PR5088	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.11
PR5090	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.11
PR5081	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.1
PR5101	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.1
PR5001	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.09
PR5095	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.09
PR5079	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.09
PR5116	HIGH GRASS/ BRUSH/ TREES	CAT 3	0.08
PR5031	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.06
PR5094	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.06
PR5033	MEDIUM GRASS	CAT 2	0.06
PR5058	MEDIUM GRASS	CAT 2	0.06
PR5045	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.05
PR5043	MEDIUM GRASS	CAT 2	0.04
PR5036	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	0.02
PR5048	MEDIUM GRASS	CAT 2	0.02
PR5114	MEDIUM GRASS	CAT 2	0.02
PR5012	PAVED SURFACE	CAT 4	0.01
PR5063	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.01
PR5085	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.01
PR5105	HIGH GRASS/ BRUSH/ TREES	CAT 3	-0.01
PR5006	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.02
PR5034	PAVED SURFACE	CAT 4	-0.02
PR5024	MEDIUM GRASS	CAT 2	-0.03
PR5004	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.04
PR5064	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.04
PR5109	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.04
PR5010	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.05
PR5093	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.05
PR5103	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.05
PR5007	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.06
PR5074	MEDIUM GRASS	CAT 2	-0.06
PR5049	MEDIUM GRASS	CAT 2	-0.07
PR5014	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.08
PR5017	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.08
PR5083	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.08

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PR5089	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.09
PR5002	MEDIUM GRASS	CAT 2	-0.09
PR5026	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.1
PR5082	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.1
PR5072	MEDIUM GRASS	CAT 2	-0.11
PR5025	PAVED SURFACE	CAT 4	-0.11
PR5023	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.12
PR5059	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.12
PR5092	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.12
PR5098	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.12
PR5075	MEDIUM GRASS	CAT 2	-0.13
PR5003	MEDIUM GRASS	CAT 2	-0.15
PR5073	MEDIUM GRASS	CAT 2	-0.17
PR5062	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.18
PR5086	PAVED SURFACE	CAT 4	-0.18
PR5084	PAVED SURFACE	CAT 4	-0.19
PR5126	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.2
PR5066	MEDIUM GRASS	CAT 2	-0.2
PR5039	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.21
PR5122	PAVED SURFACE	CAT 4	-0.21
PR5041	PAVED SURFACE	CAT 4	-0.22
PR5005	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.23
PR5013	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.23
PR5068	MEDIUM GRASS	CAT 2	-0.23
PR5027	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.24
PR5067	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.25
PR5099	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.25
PR5022	PAVED SURFACE	CAT 4	-0.25
PR5070	HIGH GRASS/ BRUSH/ TREES	CAT 3	-0.26
PR5009	PAVED SURFACE	CAT 4	-0.26
PR5078	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.27
PR5056	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.28
PR5057	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.28
PR5038	PAVED SURFACE	CAT 4	-0.28
PR5125	MEDIUM GRASS	CAT 2	-0.29
PR5008	PAVED SURFACE	CAT 4	-0.29
PR5123	PAVED SURFACE	CAT 4	-0.29
PR5097	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.33
PR5047	MEDIUM GRASS	CAT 2	-0.34
PR5065	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.35
PR5028	PAVED SURFACE	CAT 4	-0.35

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PR5050	PAVED SURFACE	CAT 4	-0.36
PR5124	PAVED SURFACE	CAT 4	-0.36
PR5077	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.39
PR5076	PAVED SURFACE	CAT 4	-0.4
PR5016	PAVED SURFACE	CAT 4	-0.42
PR5053	PAVED SURFACE	CAT 4	-0.51
PR5071	HIGH GRASS/ BRUSH/ TREES	CAT 3	-0.73
PR5113	SAND/ LOW GRASS/ MOWED GRASS	CAT 1	-0.77

These results provide statistical validation that the required accuracy specifications were met for the District's project. They also favor comparably with the findings stemming from the 2009 LIDAR bare-earth vs. the ground control checkpoints, which supported the LiDAR mission, and were set independently by both Merrick and the District. These results were illustrated in the *LiDAR Mapping Report* submitted via e-mail on March 27, 2009. To recap, the results from this previous analysis follow:

Ground Cover Categories and Accuracy Criteria			Computed Accuracies		
Checkpoint Coordinates Originator	RMSEz (Ft) ≤	ACCURACYz (Ft) ≤	RMSEz	95% Acc Z	95th Percentile
District	0.30	0.60	0.15	0.29	0.26
Merrick	0.30	0.60	0.16	0.31	0.26
COMBINED	0.30	0.60	0.15	0.30	0.28

Should you have any questions or comments regarding the content of this report, please feel free to contact me at 303-353-3903 or doug.jacoby@merrick.com.