Check Point Survey Report
"FEMA VIRGINIA LiDAR"
HOOPER'S ISLAND AND WORCESTER COUNTY, MARYLAND
USGS CONTRACT NUMBER: G10PC00013
TASK ORDER NUMBER: G11PD00089
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Prepared for:
United States Geological Survey

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   Including: a) Point Documentation Report & Photos of Survey Points
   b) Final Coordinate List in Excel Format
   c) NGS Data Sheets for Project Controls

1. INTRODUCTION

1.1 *Project Summary*

Dewberry & Davis, LLC is under contract to United States Geological Survey, USGS to provide 80 QA/QC Check Points for a portion of Maryland. These points will be used as an independent verification of the LiDAR to meet the minimum requirements of the NSSDA and as part of the FEMA requirement to verify LiDAR data.

Existing NGS Control Points were located and surveyed to check the accuracy of the RTK/GPS survey equipment with the results shown in Section 2.4 of this Report.

As an internal QA/QC procedure and to verify that the Check Points meet the 95% confidence level forty-three (43) points were re-observed and are shown in Section 5 of this report.

Final horizontal coordinates are referenced to Maryland State Plane, NAD83 (NSRS 2007) in Feet. Final Vertical elevations are referenced to NAVD 88 in Feet, orthometric heights, using Geoid 09.

1.2 *Points of Contact*

Questions regarding the technical aspects of this report should be addressed to:

Dewberry & Davis, LLC

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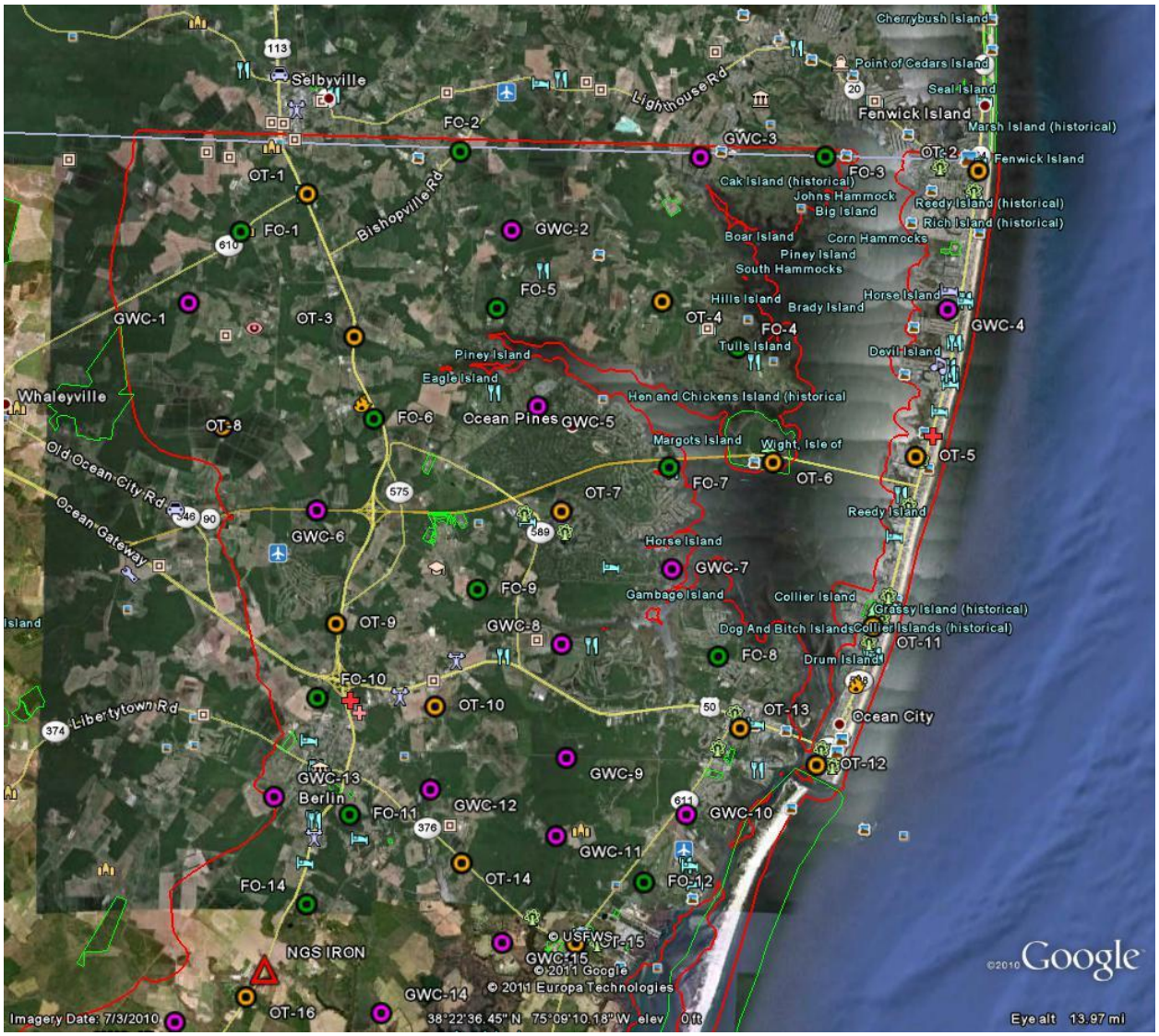
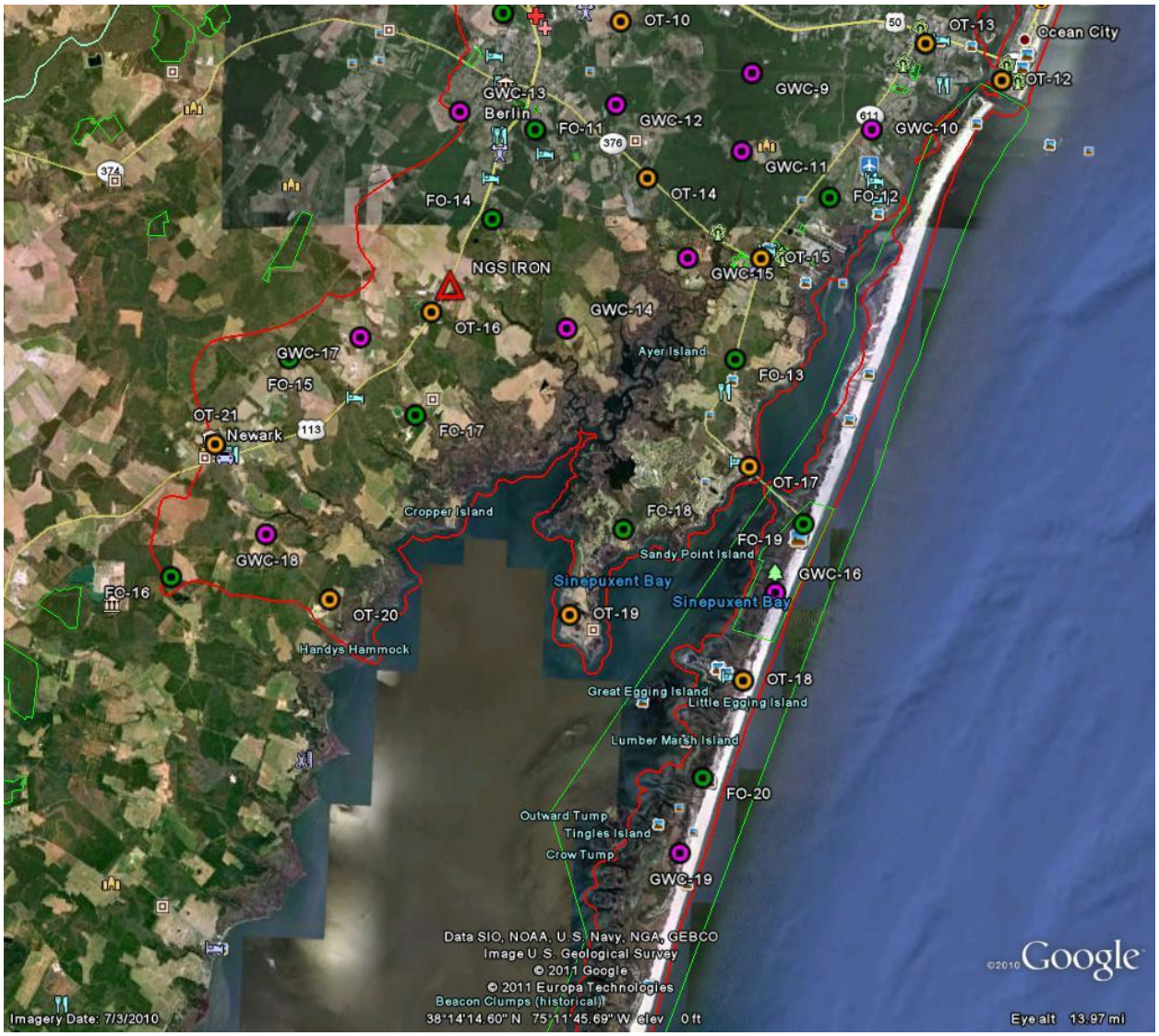
1.3 *Project Area's*


OT-40
OT-41
OT-42
OT-43
Hooper Islands
OT-44
Middle Hooper Island
OT-45
© USFWS
Image © 2011 TerraMetrics
© 2011 Google
Image U.S. Geological Survey
Swan Island
Google
Imagery Date: 1/31/2007
38°17'28.87" N 76°12'08.55" W elev 0 ft
Eye alt 16325 ft

HOOPER'S ISLAND


Cherrybush Island
Point of Cedars Island
Seal Island
Fenwick Island
Marsh Island (historical)
Fenwick Island
Selbyville
Lighthouse Rd
FO-2
GWC-3
OT-2
FO-3
OT-1
Cak Island (historical)
Johns Hammock
Big Island
Reedy Island (historical)
Rich Island (historical)
Bishopville Rd
FO-1
GWC-2
Boar Island
Corn Hammocks
Piney Island
South Hammocks
FO-5
Hills Island
Brady Island
Horse Island
GWC-1
OT-3
OT-4
FO-4
GWC-4
Tulls Island
Devil Island
Piney Island
Eagle Island
Whaleyville
Hen and Chickens Island (historical
FO-6
Ocean Pines
GWC-5
OT-8
Margots Island
Wight, Isle of
OT-5
Old Ocean City Rd
FO-7
OT-6
OT-7
Reedy Island
Ocean Gateway
GWC-6
Horse Island
GWC-7
FO-9
Gambage Island
Collier Island
Grassy Island (historical)
OT-9
GWC-8
Dog And Bitch Islands
Collier Islands (historical)
OT-11
FO-8
Drum Island
FO-10
OT-10
OT-13
Ocean City
Liberty town Rd
GWC-9
OT-12
GWC-13
Berlin
FO-11
GWC-12
GWC-10
GWC-11
OT-14
FO-12
FO-14
© USFWS
OT-15
NGS IRON
GWC-15
© 2011 Google
GWC-14
© 2011 Europa Technologies
OT-16
Imagery Date: 7/3/2010
38°22'36.45" N 75°09'10.18" W elev 0 ft
Eye alt 13.97 mi
©2010 Google



WORCESTER COUNTY

PROJECT DETAILS

2.1 *Survey Equipment*

In performing the GPS observations, Trimble R-8 GNSS receiver/antenna attached to a two meter fixed height pole with a Trimble TSC2 Data Collector to collect raw data were used to perform the field surveys.

2.2 *Survey Point Detail*

The 80 Check Points were well distributed throughout the project area so as to cover as many flight lines as possible using the "dispersed method" of placement.

A sketch was made for each location and a nail was set at the point where possible or at an identifiable point. The Check Point locations are detailed on the "Ground Control Point Documentation Report" sheets attached to this report.

2.3 *Network Design*

The GPS survey performed by Dewberry & Davis, LLC office located in Lanham, Maryland was tied to a Real Time Network (RTN) managed by KeyNet GPS. The network is a series of continuously operating, high precision GPS reference stations. All of the reference stations have been linked together using Trimble GPSNet software, creating a Virtual Reference Station System (VRS).

The Trimble NetR5 Reference Station is a multi-channel, multi-frequency GNSS (Global Navigation Satellite System) receiver designed for use as a stand-alone reference station or as part of a GNSS infrastructure solution. Trimble R-Track technology in the NetR5 receiver supports the modernized GPS L2C and L5 signals as well as GLONASS L1/L2 signals.

2.4 *Field Survey Procedures and Analysis*

Dewberry & Davis, LLC used Trimble R-8 GNSS receivers, which is a geodetic quality dual frequency GPS receiver, to collect data at each surveyed location.

All locations were occupied once with approximately 54% of the locations being re-observed. All re-observations matched the initially derived station positions within the allowable tolerance of ± 5cm or within the 95% confidence level. Each occupation which utilized the VRS network was occupied for three (3) minutes in duration.

Each occupation which utilized OPUS (if used) was occupied between 18 and 20 minutes.

Field GPS observations are detailed on the "Ground Control Point Documentation Reports" submitted as part of this report.

Two (2) existing NGS monuments listed in the NSRS database were located as an additional QA/QC method to check the accuracy of the VRS network as well as being the primary project control monuments designated as PID AJ7998, AJ8006. The results are as follows:

NGS PT. ID	As Surveyed (MD SPC)			Published (MD SPC)			Differences (FEET)		
	Northing(FT)	Easting(FT)	Elev.(FT)	Northing(FT)	Easting(FT)	Elev.(FT)	Δ N	Δ E	Δ Elev.
GIRDLE	166570.913	1775324.541	37.32	166570.89	1775324.52	37.41	0.023	0.021	0.09
IRON	229689.312	1820005.496	34.76	229689.31	1820005.50	34.84	0.002	0.004	0.008

The above results indicate that the VRS network is providing positional values within the 5cm parameters for this survey.

2.5 *Adjustment*

The survey data was collected using Virtual Reference Stations (VRS) methodology within a Virtual Reference System (VRS).

The system is designed to provide a true Network RTK performance, the RTKNet software enables high-accuracy positioning in real time across a geographic region. The RTKNet software package uses real-time data streams from the GPSNet system user and generates correction models for high-accuracy RTK GPS corrections throughout the network. Therefore, corrections were applied to the points as they were being collected, thus negating the need for a post process adjustment.

2.6 *Data Processing Procedures*

After field data is collected the information is downloaded from the data collectors into the office software. The Software program used is called TGO or Trimble Geomatics Office.

Downloaded data is run through the TGO program to obtain the following reports; points report, point comparison report and a point detail report. The reports are reviewed for point accuracy and precision.

After review of the point data an “ASCII” or “txt” file which is the industry standard is created. Point files are loaded into our CADD program (Carlson Survey 2010) to make a visual check of the point data (Pt. #, Coordinates, Elev. and Description). The data can now be imported into the final product.

3. FINAL COORDINATES

HOOPER'S ISLAND - MARYLAND			
	MARYLAND SPCS NAD83 - (FT)		NAVD88 - (FT)
POINT ID	NORTHING	EASTING	ELEVATION
OT-30	249048.906	1533920.021	5.187
OT-31	247609.620	1532853.899	3.902
OT-32	245689.730	1532229.760	3.038
OT-33	243828.736	1533709.238	3.688
OT-34	244405.802	1536993.526	1.608
OT-35	241361.485	1533797.466	2.391
OT-36	240829.404	1535438.461	1.853
OT-37	240429.340	1533090.937	1.535
OT-38	238826.421	1535995.985	2.640
OT-39	238024.281	1533706.246	1.867
OT-40	235208.182	1534657.439	2.152
OT-41	233499.167	1537193.508	3.364
OT-42	228379.471	1541417.905	3.440
OT-43	228631.313	1544050.369	1.835
OT-44	225985.545	1546011.390	2.750
OT-45	223385.860	1545091.526	2.008
OT-46	220656.255	1546825.900	1.902
OT-47	218955.008	1546961.915	1.394
OT-48	217874.905	1548592.118	2.188
OT-49	215329.452	1549434.122	1.953

WORCESTER COUNTY, MARYLAND			
	MARYLAND SPCS NAD83 - (FT)		NAVD88 - (FT)
POINT ID	NORTHING	EASTING	ELEVATION
OT-1	287009.488	1820601.827	37.853
OT-2	291000.831	1870102.690	6.476
OT-3	276661.801	1824570.465	20.767
OT-4	280379.409	1847163.640	5.772
OT-5	269805.385	1866428.119	4.382
OT-6	268789.105	1855896.425	6.298
OT-7	264565.125	1840365.138	10.928
OT-8	269605.467	1815174.319	38.784

OT-9	**255503.109**	**1824206.173**	**37.179**
OT-10	**249733.101**	**1831774.128**	**36.715**
OT-11	**257124.302**	**1863848.622**	**3.714**
OT-12	**246827.333**	**1860351.965**	**2.818**
OT-13	**249188.402**	**1854387.231**	**8.975**
OT-14	**238324.358**	**1834295.192**	**10.761**
OT-15	**232841.770**	**1842987.012**	**8.949**
OT-16	**227800.546**	**1818753.253**	**23.933**
OT-17	**217447.115**	**1842802.805**	**2.837**
OT-18	**201686.357**	**1843102.289**	**6.013**
OT-19	**205941.009**	**1830044.761**	**5.543**
OT-20	**206261.358**	**1812264.336**	**17.813**
OT-21	**217280.227**	**1803314.560**	**34.791**
GWC-1	**278101.968**	**1812698.688**	**36.651**
GWC-2	**284995.234**	**1835834.736**	**14.617**
GWC-3	**291031.262**	**1849570.563**	**2.395**
GWC-4	**280846.971**	**1867789.775**	**0.052**
GWC-5	**272162.069**	**1838338.565**	**13.567**
GWC-6	**263771.455**	**1822335.061**	**22.625**
GWC-7	**260678.975**	**1848830.631**	**3.138**
GWC-8	**254752.937**	**1840953.631**	**6.044**
GWC-9	**246382.068**	**1841619.606**	**10.611**
GWC-10	**240905.579**	**1852044.006**	**0.606**
GWC-11	**240635.367**	**1841140.513**	**2.430**
GWC-12	**243677.980**	**1831715.558**	**11.036**
GWC-13	**242554.184**	**1820218.368**	**38.720**
GWC-14	**227014.229**	**1828750.337**	**4.528**
GWC-15	**232594.506**	**1837551.084**	**3.100**
GWC-16	**208018.521**	**1845045.226**	**2.931**
GWC-17	**225644.380**	**1813695.723**	**35.669**
GWC-18	**210824.699**	**1807289.977**	**9.150**
GWC-19	**192561.133**	**1840342.846**	**3.986**
FO-1	**284093.250**	**1815784.274**	**44.082**
FO-2	**290837.236**	**1832101.545**	**20.991**
FO-3	**291491.425**	**1859025.397**	**4.567**
FO-4	**277056.109**	**1852921.660**	**2.334**
FO-5	**278909.971**	**1834922.995**	**4.851**
FO-6	**269946.650**	**1826802.607**	**10.266**
FO-7	**268129.187**	**1848279.303**	**1.927**

FO-8	**254388.261**	**1852474.202**	**5.668**
FO-9	**258472.014**	**1834501.939**	**11.558**
FO-10	**250258.172**	**1823072.021**	**27.653**
FO-11	**241473.959**	**1825897.140**	**20.412**
FO-12	**237553.624**	**1847841.408**	**5.181**
FO-13	**225415.656**	**1841439.960**	**4.957**
FO-14	**234832.294**	**1822998.125**	**38.685**
FO-15	**223822.197**	**1808494.920**	**32.270**
FO-16	**207355.177**	**1800507.439**	**38.201**
FO-17	**221918.352**	**1817897.445**	**12.556**
FO-18	**212348.409**	**1833696.121**	**3.694**
FO-19	**213369.325**	**1846992.618**	**1.514**
FO-20	**196061.788**	**1841156.222**	**3.721**

4. GPS OBSERVATION & RE-OBSERVATION SCHEDULE

FEMA VIRGINA LiDAR					
POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY	RE-OBSERV. DATE	RE-OBSERV. TIME
HOOPER'S ISLAND					
OT-30	6/4/2011	155	6:34	6/4/2011	17:41
OT-31	6/4/2011	155	7:05	N/A	N/A
OT-32	6/4/2011	155	7:30	N/A	N/A
OT-33	6/4/2011	155	7:55	N/A	N/A
OT-34	6/4/2011	155	8:23	N/A	N/A
OT-35	6/4/2011	155	8:51	6/4/2011	17:12
OT-36	6/4/2011	155	9:16	N/A	N/A
OT-37	6/4/2011	155	10:05	N/A	N/A
OT-38	6/4/2011	155	9:41	N/A	N/A
OT-39	6/4/2011	155	10:30	6/4/2011	16:39
OT-40	6/4/2011	155	10:57	N/A	N/A
OT-41	6/4/2011	155	11:21	N/A	N/A
OT-42	6/4/2011	155	11:49	6/4/2011	16:10
OT-43	6/4/2011	155	12:13	N/A	N/A
OT-44	6/4/2011	155	12:39	N/A	N/A
OT-45	6/4/2011	155	13:03	6/4/2011	15:41
OT-46	6/4/2011	155	13:28	N/A	N/A
OT-47	6/4/2011	155	13:54	6/4/2011	15:12
OT-48	6/4/2011	155	14:19	N/A	N/A
OT-49	6/4/2011	155	14:45	N/A	N/A
WORCESTER COUNTY					
OT-1	6/3/2011	154	17:17	6/4/2011	17:07
OT-2	6/3/2011	154	10:10	6/4/2011	18:18
OT-3	6/3/2011	154	19:13	6/4/2011	16:49
OT-4	6/3/2011	154	13:56	6/4/2011	17:38
OT-5	6/3/2011	154	9:13	6/4/2011	18:38
OT-6	6/3/2011	154	13:28	N/A	N/A
OT-7	6/4/2011	155	9:20	N/A	N/A
OT-8	6/3/2011	154	18:54	6/4/2011	16:20
OT-9	6/3/2011	154	20:34	6/4/2011	15:30

OT-10	**6/4/2011**	**155**	**8:06**	**6/4/2011**	**19:15**
OT-11	**6/3/2011**	**154**	**8:50**	**6/4/2011**	**18:59**
OT-12	**6/3/2011**	**154**	**7:50**	**6/4/2011**	**19:31**
OT-13	**6/4/2011**	**155**	**11:29**	**6/4/2011**	**20:02**
OT-14	**6/3/2011**	**154**	**8:40**	**6/4/2011**	**15:40**
OT-15	**6/3/2011**	**154**	**7:30**	**6/4/2011**	**16:20**
OT-16	**6/3/2011**	**154**	**13:20**	**6/4/2011**	**16:30**
OT-17	**6/4/2011**	**155**	**8:25**	**6/4/2011**	**16:05**
OT-18	**6/4/2011**	**155**	**10:40**	**N/A**	**N/A**
OT-19	**6/3/2011**	**154**	**17:30**	**6/4/2011**	**7:00**
OT-20	**6/3/2011**	**154**	**14:50**	**6/4/2011**	**17:10**
OT-21	**6/2/2011**	**153**	**13:45**	**6/3/2011**	**14:25**
GWC-1	**6/3/2011**	**154**	**18:27**	**6/4/2011**	**16:30**
GWC-2	**6/3/2011**	**154**	**16:05**	**6/4/2011**	**17:21**
GWC-3	**6/3/2011**	**154**	**11:50**	**6/4/2011**	**17:45**
GWC-4	**6/3/2011**	**154**	**9:45**	**N/A**	**N/A**
GWC-5	**6/4/2011**	**155**	**14:40**	**N/A**	**N/A**
GWC-6	**6/3/2011**	**154**	**20:08**	**6/4/2011**	**16:02**
GWC-7	**6/4/2011**	**155**	**13:10**	**N/A**	**N/A**
GWC-8	**6/4/2011**	**155**	**9:53**	**N/A**	**N/A**
GWC-9	**6/4/2011**	**155**	**10:24**	**6/4/2011**	**18:20**
GWC-10	**6/4/2011**	**155**	**10:54**	**N/A**	**N/A**
GWC-11	**6/3/2011**	**154**	**9:45**	**6/4/2011**	**15:50**
GWC-12	**6/3/2011**	**154**	**9:15**	**6/4/2011**	**16:00**
GWC-13	**6/3/2011**	**154**	**11:15**	**6/4/2011**	**16:15**
GWC-14	**6/3/2011**	**154**	**16:20**	**6/4/2011**	**16:50**
GWC-15	**6/3/2011**	**154**	**7:50**	**6/4/2011**	**15:30**
GWC-16	**6/4/2011**	**155**	**10:05**	**N/A**	**N/A**
GWC-17	**6/2/2011**	**153**	**16:00**	**6/3/2011**	**14:05**
GWC-18	**6/2/2011**	**153**	**12:55**	**6/3/2011**	**14:20**
GWC-19	**6/2/2011**	**153**	**13:10**	**N/A**	**N/A**
FO-1	**6/3/2011**	**154**	**17:50**	**N/A**	**N/A**
FO-2	**6/3/2011**	**154**	**16:45**	**N/A**	**N/A**
FO-3	**6/3/2011**	**154**	**11:15**	**6/5/2011**	**6:33**
FO-4	**6/3/2011**	**154**	**12:20**	**N/A**	**N/A**
FO-5	**6/3/2011**	**154**	**15:35**	**N/A**	**N/A**
FO-6	**6/3/2011**	**154**	**19:40**	**6/5/2011**	**7:15**
FO-7	**6/4/2011**	**155**	**13:53**	**N/A**	**N/A**
FO-8	**6/4/2011**	**155**	**12:20**	**N/A**	**N/A**

FO-9	**6/4/2011**	**155**	**8:40**	**6/5/2011**	**7:56**
FO-10	**6/4/2011**	**155**	**7:20**	**N/A**	**N/A**
FO-11	**6/3/2011**	**154**	**10:30**	**6/5/2011**	**8:20**
FO-12	**6/3/2011**	**154**	**6:35**	**N/A**	**N/A**
FO-13	**6/4/2011**	**155**	**14:10**	**N/A**	**N/A**
FO-14	**6/3/2011**	**154**	**11:50**	**6/5/2011**	**9:01**
FO-15	**6/2/2011**	**153**	**14:00**	**N/A**	**N/A**
FO-16	**6/2/2011**	**153**	**12:00**	**6/5/2011**	**9:33**
FO-17	**6/3/2011**	**154**	**15:15**	**N/A**	**N/A**
FO-18	**6/4/2011**	**155**	**7:15**	**N/A**	**N/A**
FO-19	**6/4/2011**	**155**	**9:00**	**6/5/2011**	**9:57**
FO-20	**6/4/2011**	**155**	**11:45**	**N/A**	**N/A**

5. POINT COMPARISON REPORT

FEMA VIRGINIA LiDAR				
POINT ID	POINT CK	DELTA NORTH (FT)	DELTA EAST (FT)	VERT. DIFF (FT)
OT-30	OT-30CK	0.022	0.030	0.008
OT-35	OT-35CK	0.018	0.080	0.020
OT-39	OT-39CK	0.019	0.020	0.006
OT-42	OT-42CK	0.023	0.056	0.071
OT-45	OT-45CK	0.081	0.056	0.075
OT-47	OT-47CK	0.056	0.041	0.011
OT-1	OT-1CK	0.014	0.037	0.009
OT-2	OT-2CK	0.004	0.011	0.041
OT-3	OT-3CK	0.090	0.058	0.105
OT-4	OT-4CK	0.025	0.051	0.134
OT-5	OT-5CK	0.029	0.001	0.041
OT-8	OT-8CK	0.043	0.033	0.140
OT-9	OT-9CK	0.023	0.029	0.142
OT-10	OT-10CK	0.022	0.015	0.009
OT-11	OT-11CK	0.007	0.021	0.013
OT-12	OT-12CK	0.015	0.015	0.006
OT-13	OT-13CK	0.011	0.005	0.009
OT-14	OT-14CK	0.022	0.042	0.021
OT-15	OT-15CK	0.005	0.143	0.126
OT-16	OT-16CK	0.131	0.065	0.022
OT-17	OT-17CK	0.008	0.055	0.036
OT-19	OT-19CK	0.022	0.060	0.036
OT-20	OT-20CK	0.070	0.064	0.079
OT-21	OT-21CK	0.076	0.034	0.022
GWC-1	GWC-1CK	0.023	0.061	0.123
GWC-2	GWC-2CK	0.002	0.011	0.088
GWC-3	GWC-3CK	0.057	0.086	0.140
GWC-6	GWC-6CK	0.047	0.057	0.074
GWC-9	GWC-9CK	0.051	0.042	0.081
GWC-11	GWC-11CK	0.015	0.008	0.075
GWC-12	GWC-12CK	0.028	0.010	0.117
GWC-13	GWC-13CK	0.060	0.029	0.099
GWC-14	GWC-14CK	0.049	0.014	0.126

GWC-15	**GWC-15CK**	**0.034**	**0.050**	**0.028**
GWC-17	**GWC-17CK**	**0.018**	**0.013**	**0.130**
GWC-18	**GWC-18CK**	**0.045**	**0.037**	**0.001**
FO-3	**FO-3CK**	**0.010**	**0.100**	**0.012**
FO-6	**FO-6CK**	**0.022**	**0.056**	**0.120**
FO-9	**FO-9CK**	**0.560**	**0.066**	**0.078**
FO-11	**FO-11CK**	**0.110**	**0.012**	**0.099**
FO-14	**FO-14CK**	**0.078**	**0.090**	**0.056**
FO-16	**FO-16CK**	**0.002**	**0.120**	**0.085**
FO-19	**FO-19CK**	**0.111**	**0.025**	**0.045**