

**LiDAR Check Point Survey Report**  
**“Eastern Shore Virginia QL2 LiDAR”**  
**USGS Contract: G10PC0013**  
**Task Order Number: G13PD00284**

**Prepared for:**  
***United States Geological Survey (USGS)***



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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

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## 1.1 *Project Summary*

Dewberry Consultants LLC is under contract to the United States Geological Survey to provide 110 Check Points in the State of Virginia. Under the above referenced USGS Task Order, Dewberry is tasked to complete the quality assurance of LiDAR products. As part of this work Dewberry staff will complete Check Point surveys that will be used to evaluate vertical and horizontal accuracy. The ground survey was conducted May 11 to May 15, 2015.

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 approximately 50% of the points were re-observed and are shown in Section 5 of this report.

Final horizontal coordinates are referenced to UTM Zone 18, NAD83 in feet. Final Vertical elevations are referenced to NAVD88 in feet using Geoid model 2012A (Geoid12A).

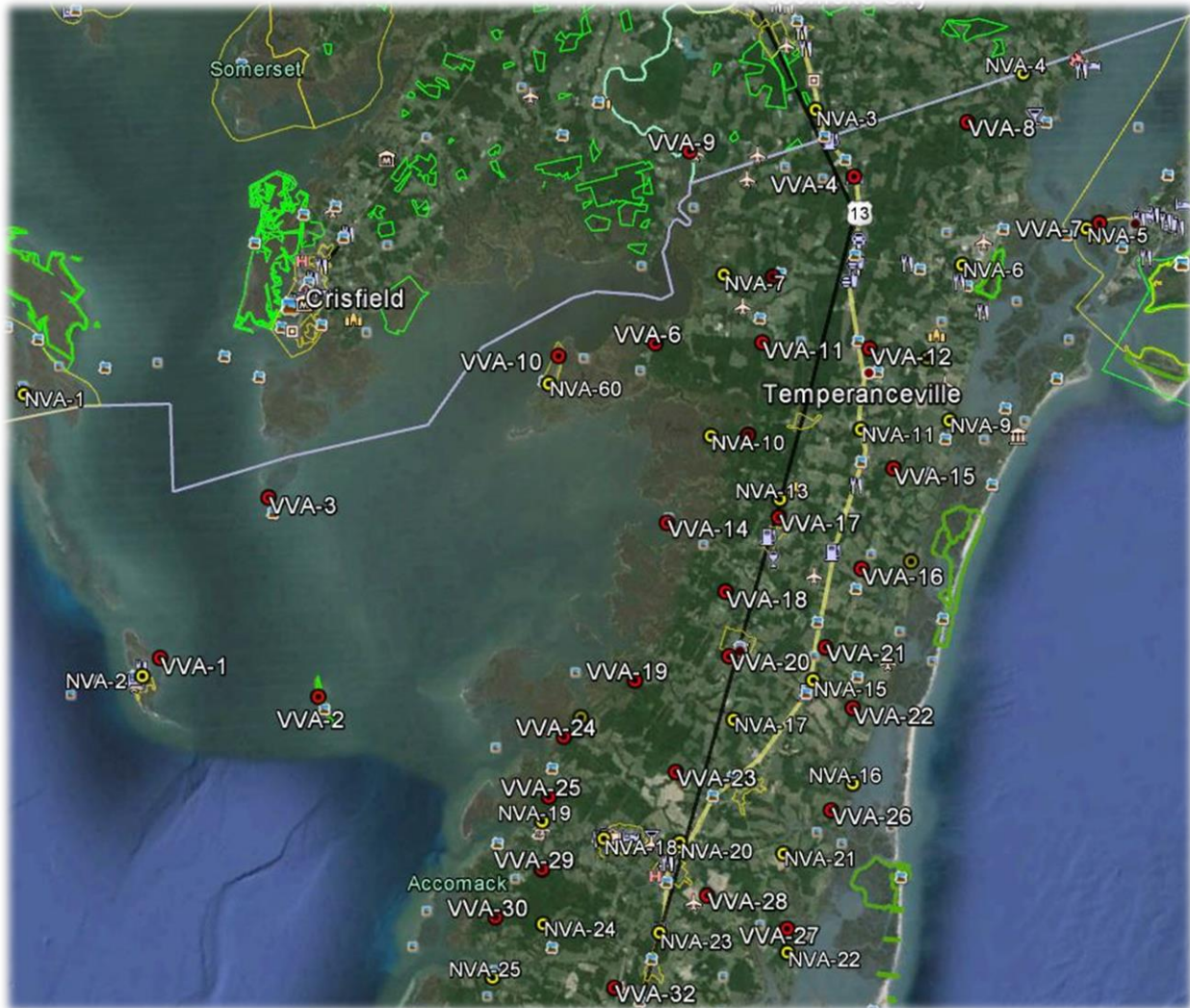
## 1.2 *Points of Contact*

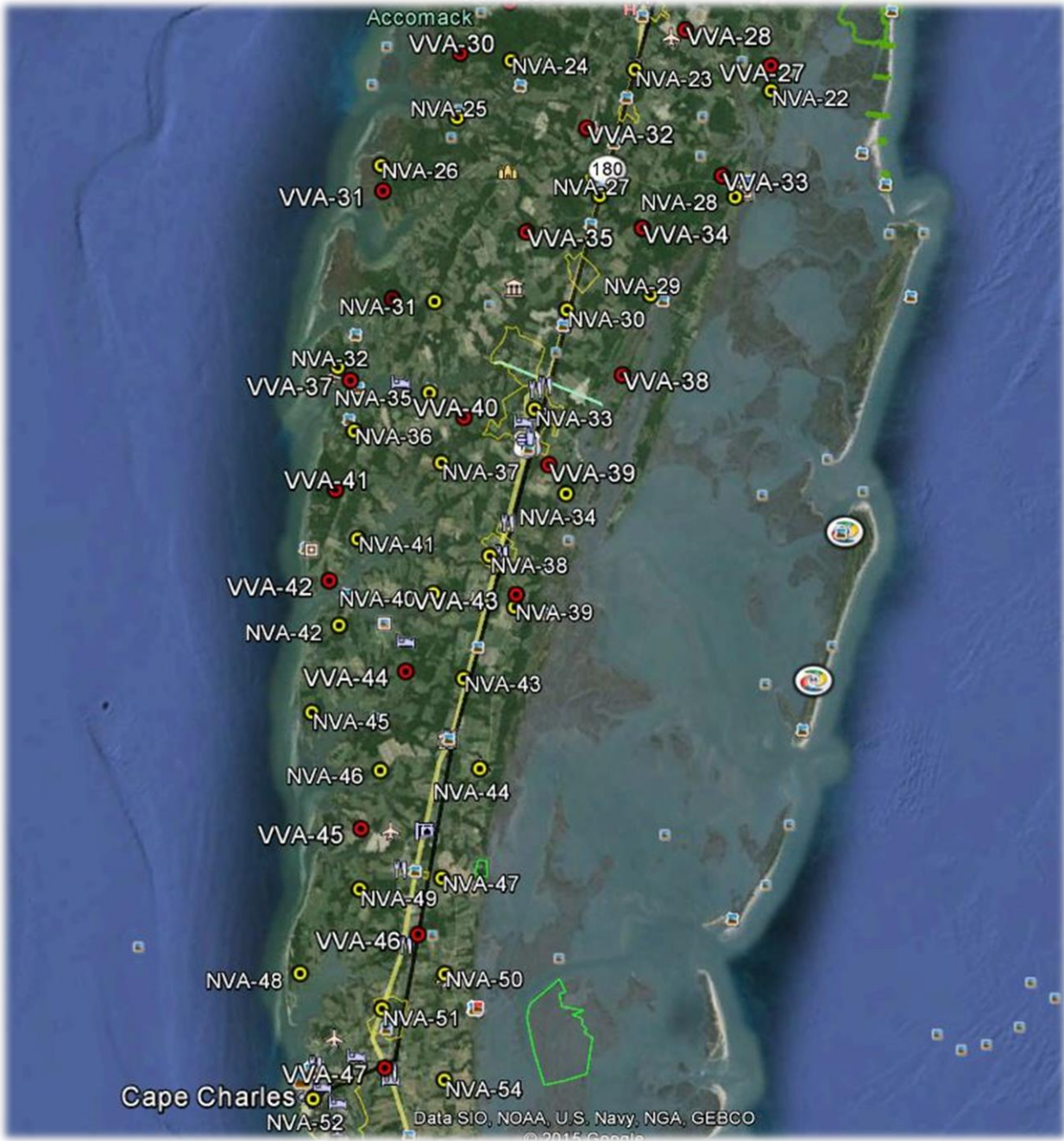
Questions regarding the technical aspects of this report should be addressed to:

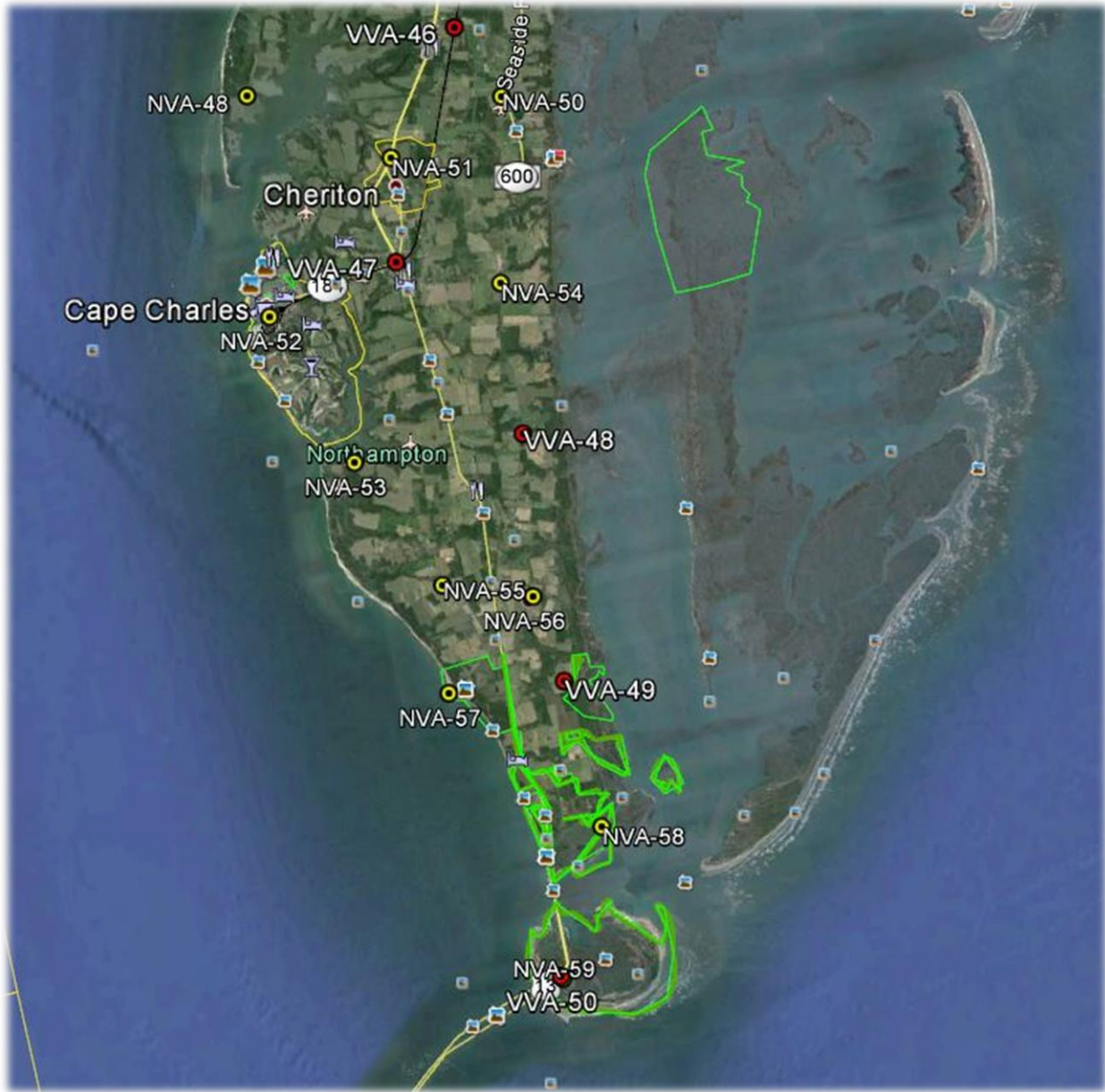
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### 1.3 Project Area







***USGS Eastern Shore Virginia QL2 LiDAR***

## **PROJECT DETAILS**

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### **2.1 *Survey Equipment***

In performing the GPS observations Trimble R-10 GNSS receiver/antenna attached to a two meter fixed height pole with a Trimble TSC3 Data Collector to collect GPS raw data were used to perform the field surveys.

### **2.2 *Survey Point Detail***

The 110 LiDAR Check Points were well distributed throughout the project area.

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 “Control Point Documentation Report” sheets attached to this report.

### **2.3 *Network Design***

The GPS survey performed by Dewberry Consultants LLC office located in Lanham, MD was tied to a Real Time Network (RTN) managed by KEYNET GPS, Inc. The network is a series of “real-time” 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 field surveyors used Trimble R-10 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 50% of the locations being re-observed. All re-observations matched the initially derived station positions within the allowable tolerance of  $\pm 5$ cm or within the 95% confidence level. Each occupation which utilized the VRS network was occupied for approximately three (3) minutes in duration and measured to 180 epochs.

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.

There (3) existing NGS monuments listed in the NSRS database and one (1) aerial acquisition firm control point 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 W 420, NELSON, ACCOMAC RESET and REBAR 1. The results are as follows:

NGS PT. ID	As Surveyed (ft)			Published (ft)			Differences (ft)		
	Northing(ft)	Easting(ft)	Elev.(ft)	Northing(ft)	Easting(ft)	Elev.(ft)	$\Delta$ N	$\Delta$ E	$\Delta$ Elev.
W420	N/A	N/A	3.08	N/A	N/A	3.13	N/A	N/A	0.05
NELSON	13799401.38	1484775.42	31.28	13799401.40	1484775.50	31.27	0.02	0.07	0.01
ACCOMAC RESET	13696368.85	1445299.97	N/A	13696368.85	1445299.92	44.25	0.01	0.05	N/A
REBAR 1	13544408.85	1369407.22	30.46	13544408.79	1369407.28	N/A	0.06	0.06	N/A

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 KEYNET 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 TBC or Trimble Business Center.

Downloaded data is run through the TBC 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 2014) 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***

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<b>POINT #</b>	<b>NORTHING (ft)</b>	<b>EASTING (ft)</b>	<b>ELEV. (ft)</b>
<b>NVA CHECK POINTS</b>			
NVA-1	13787544.72	1345061.37	1.34
NVA-2	13737576.97	1354141.25	3.40
NVA-3	13804535.78	1483754.54	20.50
NVA-4	13802938.37	1518716.14	31.45
NVA-5	13775338.62	1521649.52	4.06
NVA-6	13774225.72	1501825.31	32.15
NVA-7	13781284.79	1462880.68	6.35
NVA-8	13760385.06	1492788.87	32.21
NVA-9	13749645.45	1493971.62	16.79
NVA-10	13755749.08	1454915.20	1.99
NVA-11	13751688.65	1479341.61	46.07
NVA-12	13728349.88	1482757.49	15.68
NVA-13	13740538.80	1462405.07	22.50
NVA-14	13715068.25	1423672.01	3.29
NVA-15	13716376.57	1457539.03	41.11
NVA-16	13694591.10	1465288.41	4.25
NVA-17	13709144.25	1448301.98	38.90
NVA-18	13694709.28	1422978.56	13.77
NVA-19	13699849.12	1413593.59	4.44
NVA-20	13691366.38	1435139.99	42.81
NVA-21	13685801.16	1451522.49	18.91
NVA-22	13669719.87	1448584.00	8.15
NVA-23	13677530.24	1428586.66	49.83
NVA-24	13683206.34	1410161.85	9.54
NVA-25	13676039.67	1399787.10	5.85
NVA-26	13671648.26	1386750.83	3.58
NVA-27	13659633.88	1418965.56	41.39
NVA-28	13654573.59	1439881.17	7.60
NVA-29	13643047.34	1423396.80	8.54
NVA-30	13643465.21	1410046.59	32.98
NVA-31	13649231.57	1390298.90	22.64
NVA-32	13641526.45	1373079.19	2.88
NVA-33	13629535.20	1401795.83	36.71
NVA-34	13616989.25	1400880.55	28.94
NVA-35	13635649.31	1386370.80	3.69

NVA-36	13632340.72	1373626.86	4.39
NVA-37	13624607.26	1385808.85	23.50
NVA-38	13608870.92	1389982.92	34.41
NVA-39	13600301.49	1392043.70	31.47
NVA-40	13605115.06	1380143.36	20.84
NVA-41	13614694.74	1370379.71	18.86
NVA-42	13599588.29	1369827.79	17.69
NVA-43	13591096.27	1382010.54	38.61
NVA-44	13578066.06	1382513.43	28.84
NVA-45	13591275.12	1357653.54	10.57
NVA-46	13581277.83	1362330.87	17.97
NVA-47	13561751.38	1371720.52	33.42
NVA-48	13555468.16	1348538.92	7.50
NVA-49	13561564.46	1364642.16	28.07
NVA-50	13548074.67	1363682.22	37.85
NVA-51	13540793.69	1360795.58	34.49
NVA-52	13532703.53	1344629.83	6.56
NVA-53	13518511.52	1349412.03	7.97
NVA-54	13531314.14	1365213.32	32.54
NVA-55	13506310.57	1354342.76	34.74
NVA-56	13503572.78	1362045.54	26.16
NVA-57	13496860.40	1352829.53	8.20
NVA-58	13482536.60	1363344.19	4.48
NVA-59	13470126.21	1357158.95	11.88
NVA-60	13770426.82	1429938.34	5.57
<b>VVA CHECK POINTS</b>			
VVA-1	13739949.46	1357750.56	4.14
VVA-2	13725921.77	1382691.12	3.12
VVA-3	13761818.33	1381112.05	1.10
VVA-4	13792377.41	1487545.35	20.77
VVA-5	13779174.95	1470756.86	12.56
VVA-6	13772667.10	1449295.26	3.22
VVA-7	13776136.53	1525577.46	0.60
VVA-8	13797469.73	1507918.44	34.53
VVA-9	13802503.13	1461718.62	2.34
VVA-10	13774156.44	1433140.04	2.04
VVA-11	13769105.05	1466753.75	8.07
VVA-12	13764221.50	1483665.24	38.72
VVA-13	13755181.12	1461271.37	2.94

VVA-14	13743348.53	1444602.19	3.34
VVA-15	13752593.71	1490559.47	36.85
VVA-16	13728875.89	1474469.29	38.17
VVA-17	13741109.30	1466001.15	34.01
VVA-18	13730066.09	1451622.03	10.26
VVA-19	13718587.96	1434164.42	4.53
VVA-20	13719563.99	1449951.12	33.22
VVA-21	13717764.78	1465625.79	39.17
VVA-22	13707103.33	1467188.27	16.84
VVA-23	13702843.64	1436904.84	28.62
VVA-24	13713034.97	1420333.73	1.63
VVA-25	13705884.89	1415374.41	2.03
VVA-26	13690830.08	1460668.19	13.65
VVA-27	13673470.77	1449388.20	6.10
VVA-28	13681814.29	1437636.66	39.07
VVA-29	13692053.05	1411728.08	7.14
VVA-30	13685906.03	1402585.45	4.16
VVA-31	13667700.33	1386186.14	1.75
VVA-32	13671186.54	1418864.70	44.90
VVA-33	13658468.55	1438041.21	7.20
VVA-34	13653184.58	1424317.10	14.68
VVA-35	13656545.62	1406587.62	38.76
VVA-36	13651563.07	1383130.93	6.55
VVA-37	13641884.77	1379969.41	9.36
VVA-38	13631742.52	1416338.33	4.07
VVA-39	13620741.99	1402023.09	35.05
VVA-40	13630700.74	1390788.65	27.82
VVA-41	13624139.43	1368679.46	14.08
VVA-42	13610604.02	1364759.03	13.83
VVA-43	13602086.11	1392690.19	29.75
VVA-44	13594195.65	1373160.63	18.03
VVA-45	13571983.39	1360795.94	14.62
VVA-46	13554148.09	1366204.57	36.30
VVA-47	13536226.63	1357386.05	19.26
VVA-48	13518684.74	1364228.13	31.78
VVA-49	13495644.01	1359319.15	29.83
VVA-50	13470330.59	1357035.00	8.01

#### 4. GPS OBSERVATIONS

VIRGINIA EASTERN SHORE LiDAR QA					
POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (PST)	RE-OBSERV. DATE	RE-OBSERV. TIME
NVA-1	5/12/2015	132	17:12	N/A	N/A
NVA-2	5/12/2015	132	10:10	N/A	N/A
NVA-3	5/11/2015	131	6:40	5/11/2015	17:29
NVA-4	5/11/2015	131	16:20	N/A	N/A
NVA-5	5/13/2015	133	12:27	N/A	N/A
NVA-6	5/13/2015	133	12:46	N/A	N/A
NVA-7	5/11/2015	131	7:35	N/A	N/A
NVA-8	5/13/2015	133	14:34	N/A	N/A
NVA-9	5/13/2015	133	15:13	N/A	N/A
NVA-10	5/11/2015	131	8:35	5/11/2015	19:26
NVA-11	5/11/2015	131	9:15	5/11/2015	20:51
NVA-12	5/13/2015	133	17:12	5/14/2015	7:09
NVA-13	5/11/2015	131	10:45	5/14/2015	20:19
NVA-14	5/14/2015	134	10:39	N/A	N/A
NVA-15	5/11/2015	131	10:15	N/A	N/A
NVA-16	5/13/2015	133	18:31	5/14/2015	19:56
NVA-17	5/11/2015	131	12:20	5/14/2015	5:08
NVA-18	5/14/2015	134	12:03	N/A	N/A
NVA-19	5/14/2015	134	11:41	N/A	N/A
NVA-20	5/13/2015	133	20:06	5/14/2015	18:58
NVA-21	5/13/2015	133	19:10	5/14/2015	19:16
NVA-22	5/13/2015	133	19:40	N/A	N/A
NVA-23	5/14/2015	134	16:06	5/14/2015	18:10
NVA-24	5/14/2015	134	13:12	5/14/2015	18:33
NVA-25	5/14/2015	134	13:38	N/A	N/A
NVA-26	5/14/2015	134	14:19	5/15/2015	6:12
NVA-27	5/14/2015	134	15:29	5/15/2015	6:49
NVA-28	5/14/2015	134	17:01	N/A	N/A
NVA-29	5/14/2015	134	15:12	5/15/2015	7:51
NVA-30	5/14/2015	134	14:44	5/15/2015	7:19
NVA-31	5/13/2015	133	12:25	5/13/2015	20:29
NVA-32	5/13/2015	133	13:09	5/13/2015	20:51
NVA-33	5/13/2015	133	16:30	N/A	N/A
NVA-34	5/13/2015	133	17:25	5/14/2015	5:21

NVA-35	5/13/2015	133	14:22	5/13/2015	21:09
NVA-36	5/13/2015	133	14:55	5/13/2015	21:23
NVA-37	5/13/2015	133	14:39	N/A	N/A
NVA-38	5/13/2015	133	17:44	5/14/2015	5:41
NVA-39	5/13/2015	133	19:42	5/14/2015	6:28
NVA-40	5/13/2015	133	18:28	N/A	N/A
NVA-41	5/13/2015	133	15:43	5/13/2015	22:10
NVA-42	5/13/2015	133	18:45	5/14/2015	7:01
NVA-43	5/13/2015	133	19:28	5/14/2015	22:15
NVA-44	5/14/2015	134	7:45	N/A	N/A
NVA-45	5/13/2015	133	19:00	N/A	N/A
NVA-46	5/14/2015	134	8:18	5/14/2015	21:59
NVA-47	5/14/2015	134	9:24	5/14/2015	20:49
NVA-48	5/14/2015	134	10:25	N/A	N/A
NVA-49	5/14/2015	134	9:52	5/14/2015	21:10
NVA-50	5/14/2015	134	11:26	5/14/2015	20:07
NVA-51	5/14/2015	134	12:19	5/14/2015	19:49
NVA-52	5/14/2015	134	12:50	5/14/2015	19:33
NVA-53	5/14/2015	134	15:12	N/A	N/A
NVA-54	5/14/2015	134	14:05	5/14/2015	18:51
NVA-55	5/14/2015	134	15:40	N/A	N/A
NVA-56	5/14/2015	134	16:05	N/A	N/A
NVA-57	5/14/2015	134	16:36	N/A	N/A
NVA-58	5/14/2015	134	17:30	N/A	N/A
NVA-59	5/14/2015	134	18:23	N/A	N/A
NVA-60	5/11/2015	131	13:45	5/11/2015	18:51
VVA-1	5/12/2015	132	9:50	N/A	N/A
VVA-2	5/12/2015	132	11:35	N/A	N/A
VVA-3	5/12/2015	132	14:10	N/A	N/A
VVA-4	5/11/2015	131	6:56	5/11/2015	17:11
VVA-5	5/11/2015	131	7:22	N/A	N/A
VVA-6	5/11/2015	131	7:50	5/11/2015	18:15
VVA-7	5/13/2015	133	12:13	N/A	N/A
VVA-8	5/11/2015	131	16:45	N/A	N/A
VVA-9	5/11/2015	131	14:20	5/11/2015	17:43
VVA-10	5/11/2015	131	13:30	5/11/2015	18:39
VVA-11	5/11/2015	131	13:10	N/A	N/A
VVA-12	5/13/2015	133	14:19	5/14/2015	7:59
VVA-13	5/11/2015	131	12:55	N/A	N/A

VVA-14	5/14/2015	134	8:49	N/A	N/A
VVA-15	5/13/2015	133	15:27	5/14/2015	7:29
VVA-16	5/13/2015	133	15:54	5/14/2015	6:42
VVA-17	5/11/2015	131	12:45	5/11/2015	20:10
VVA-18	5/14/2015	134	9:37	N/A	N/A
VVA-19	5/14/2015	134	10:00	N/A	N/A
VVA-20	5/13/2015	133	17:02	5/14/2015	5:33
VVA-21	5/13/2015	133	16:37	5/14/2015	5:49
VVA-22	5/13/2015	133	17:25	5/14/2015	6:09
VVA-23	5/13/2015	133	17:46	N/A	N/A
VVA-24	5/14/2015	134	11:00	N/A	N/A
VVA-25	5/14/2015	134	11:24	N/A	N/A
VVA-26	5/13/2015	133	18:51	5/14/2015	19:31
VVA-27	5/13/2015	133	19:27	N/A	N/A
VVA-28	5/13/2015	133	16:31	5/14/2015	18:59
VVA-29	5/14/2015	134	12:26	N/A	N/A
VVA-30	5/14/2015	134	12:54	N/A	N/A
VVA-31	5/14/2015	134	13:58	5/15/2015	6:31
VVA-32	5/14/2015	134	15:49	5/14/2015	17:46
VVA-33	5/13/2015	133	10:48	N/A	N/A
VVA-34	5/13/2015	133	11:13	N/A	N/A
VVA-35	5/13/2015	133	11:50	N/A	N/A
VVA-36	5/13/2015	133	12:52	5/13/2015	20:10
VVA-37	5/13/2015	133	13:20	N/A	N/A
VVA-38	5/13/2015	133	16:56	N/A	N/A
VVA-39	5/13/2015	133	17:14	N/A	N/A
VVA-40	5/13/2015	133	13:54	N/A	N/A
VVA-41	5/13/2015	133	15:24	5/13/2015	21:46
VVA-42	5/13/2015	133	16:03	5/14/2015	6:10
VVA-43	5/13/2015	133	18:10	N/A	N/A
VVA-44	5/13/2015	133	19:16	N/A	N/A
VVA-45	5/14/2015	134	8:52	5/14/2015	21:29
VVA-46	5/14/2015	134	10:57	5/14/2015	20:31
VVA-47	5/14/2015	134	13:36	5/14/2015	19:13
VVA-48	5/14/2015	134	14:32	N/A	N/A
VVA-49	5/14/2015	134	17:01	N/A	N/A
VVA-50	5/14/2015	134	17:59	N/A	N/A

## 5. POINT COMPARISON

LiDAR QA				
POINT ID	POINT CK	DELTA NORTH (ft)	DELTA EAST (ft)	VERT. DIFF (ft)
NVA-3	NVA-3CK	0.00	0.01	0.00
NVA-10	NVA-10CK	0.02	0.03	0.10
NVA-11	NVA-11CK	0.02	0.00	0.03
NVA-12	NVA-12CK	0.01	0.01	0.04
NVA-13	NVA-13CK	0.01	0.01	0.01
NVA-16	NVA-16CK	0.03	0.01	0.01
NVA-17	NVA-17CK	0.01	0.03	0.04
NVA-20	NVA-20CK	0.02	0.00	0.00
NVA-21	NVA-21CK	0.01	0.00	0.05
NVA-23	NVA-23CK	0.02	0.02	0.04
NVA-24	NVA-24CK	0.01	0.01	0.01
NVA-26	NVA-26CK	0.01	0.01	0.03
NVA-27	NVA-27CK	0.02	0.04	0.02
NVA-29	NVA-29CK	0.01	0.00	0.03
NVA-30	NVA-30CK	0.01	0.03	0.01
NVA-31	NVA-31CK	0.01	0.01	0.03
NVA-32	NVA-32CK	0.02	0.00	0.01
NVA-34	NVA-34CK	0.01	0.01	0.03
NVA-35	NVA-35CK	0.00	0.00	0.00
NVA-36	NVA-36CK	0.03	0.03	0.01
NVA-38	NVA-38CK	0.02	0.02	0.04
NVA-39	NVA-39CK	0.01	0.00	0.05
NVA-41	NVA-41CK	0.00	0.00	0.03
NVA-42	NVA-42CK	0.01	0.03	0.00
NVA-43	NVA-43CK	0.00	0.02	0.01
NVA-46	NVA-46CK	0.03	0.04	0.04
NVA-47	NVA-47CK	0.01	0.03	0.03
NVA-49	NVA-49CK	0.04	0.04	0.05
NVA-50	NVA-50CK	0.07	0.06	0.04
NVA-51	NVA-51CK	0.04	0.05	0.05
NVA-52	NVA-52CK	0.06	0.04	0.07
NVA-54	NVA-54CK	0.07	0.07	0.04
NVA-60	NVA-60CK	0.01	0.00	0.01
VVA-4	VVA-4CK	0.00	0.01	0.01
VVA-6	VVA-6CK	0.01	0.01	0.02



VVA-9	VVA-9CK	0.00	0.02	0.05
VVA-10	VVA-10CK	0.01	0.00	0.03
VVA-12	VVA-12CK	0.00	0.00	0.00
VVA-15	VVA-15CK	0.01	0.02	0.01
VVA-16	VVA-16CK	0.02	0.03	0.01
VVA-17	VVA-17CK	0.03	0.03	0.01
VVA-20	VVA-20CK	0.04	0.01	0.04
VVA-21	VVA-21CK	0.01	0.01	0.04
VVA-22	VVA-22CK	0.00	0.01	0.02
VVA-26	VVA-26CK	0.01	0.01	0.04
VVA-28	VVA-28CK	0.00	0.01	0.03
VVA-31	VVA-31CK	0.00	0.03	0.03
VVA-32	VVA-32CK	0.02	0.02	0.02
VVA-36	VVA-36CK	0.02	0.02	0.05
VVA-41	VVA-41CK	0.01	0.04	0.06
VVA-42	VVA-42CK	0.02	0.03	0.04
VVA-45	VVA-45CK	0.03	0.05	0.06
VVA-46	VVA-46CK	0.09	0.08	0.09
VVA-47	VVA-47CK	0.05	0.09	0.05