Ground Control Point Survey Report

VA West Chesapeake Bay Watershed QL2
Virginia/West Virginia QL2 LiDAR Project

Contract # G16PC00020
Task Order Number: G17PD00327

Prepared for:
USGS – United States Geological Survey

TABLE OF CONTENTS

1. INTRODUCTION

1.1 *Project Summary*

Dewberry Engineers Inc. is under contract to USGS United States Geological Survey to provide 24 Ground Control Points in the States of Virginia and West Virginia. Under the above referenced USGS Task Order, Dewberry is tasked to complete the quality assurance of LiDAR mapping products. As part of this work Dewberry staff will complete Ground Control Point surveys that will be used to evaluate the mapping accuracy. The ground survey was conducted between the dates of December 22, 2017 and January 29, 2018.

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 17, NAD83 (2011) in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2012B (Geoid12B).
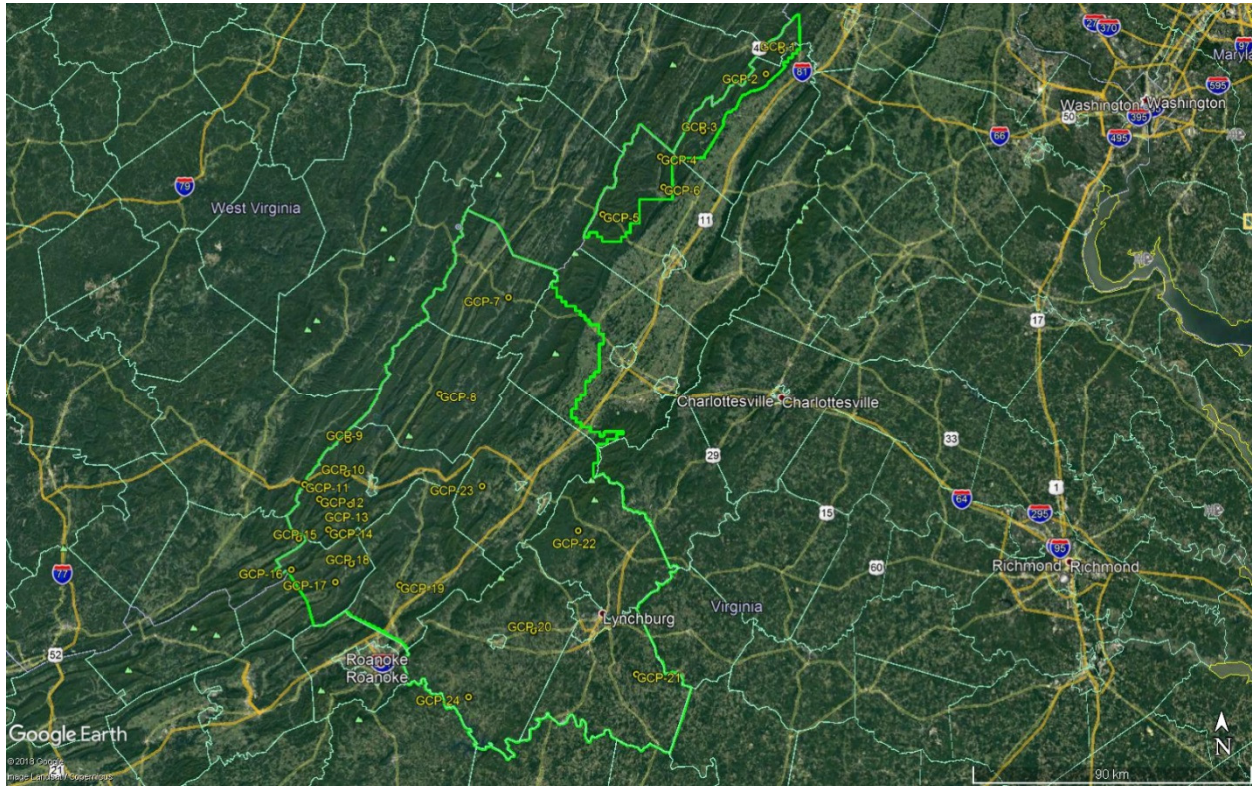
1.2 *Points of Contact*

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

Dewberry Engineers Inc.

Gary D. Simpson, L.S.
Senior Associate
4601 Forbes Boulevard
Suite 300
Lanham, Maryland 20706
(301) 364-1855 direct

1.3   *Project Areas*

PROJECT DETAILS

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 24 Ground Control 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 Ground Control Point locations are detailed on the "Check Point Documentation Report" sheets attached to this report.

2.3 *Network Design*

The GPS survey performed by Dewberry Engineers Inc. office located in Lanham, MD was tied to a Real Time Network operated 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 ± 5cm 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 20 and 30 minutes.

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

Four (4) existing NGS monument listed in the NSRS database were located for the Virginia and West Virginia areas as an additional QA/QC method to check the horizontal and vertical accuracy of the VRS network as well as being the primary project control monuments designated as HW3523, HW3420, HW1545 & HW3674. The results are as follows:

PT. #	Observed Values			Data Sheet Values					
	NORTHING	EASTING	ELEVS.	NORTHING	EASTING	ELEVS.	Δ X	Δ Y	Δ Z
MUSTOE	4237006.608	616456.340	682.599	4237006.591	616456.335	682.600	0.017	0.005	0.001
NGS GRAVEY	N/A	N/A	400.606	4291820.691	695204.139	400.600	N/A	N/A	0.006
U-99	4237130.677	648008.781	575.752	4237130.667	648008.790	575.702	0.010	0.009	0.050
VA-22	4215370.452	641188.807	476.109	4215370.436	641188.805	476.100	0.016	0.002	0.009

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

NGS Monuments
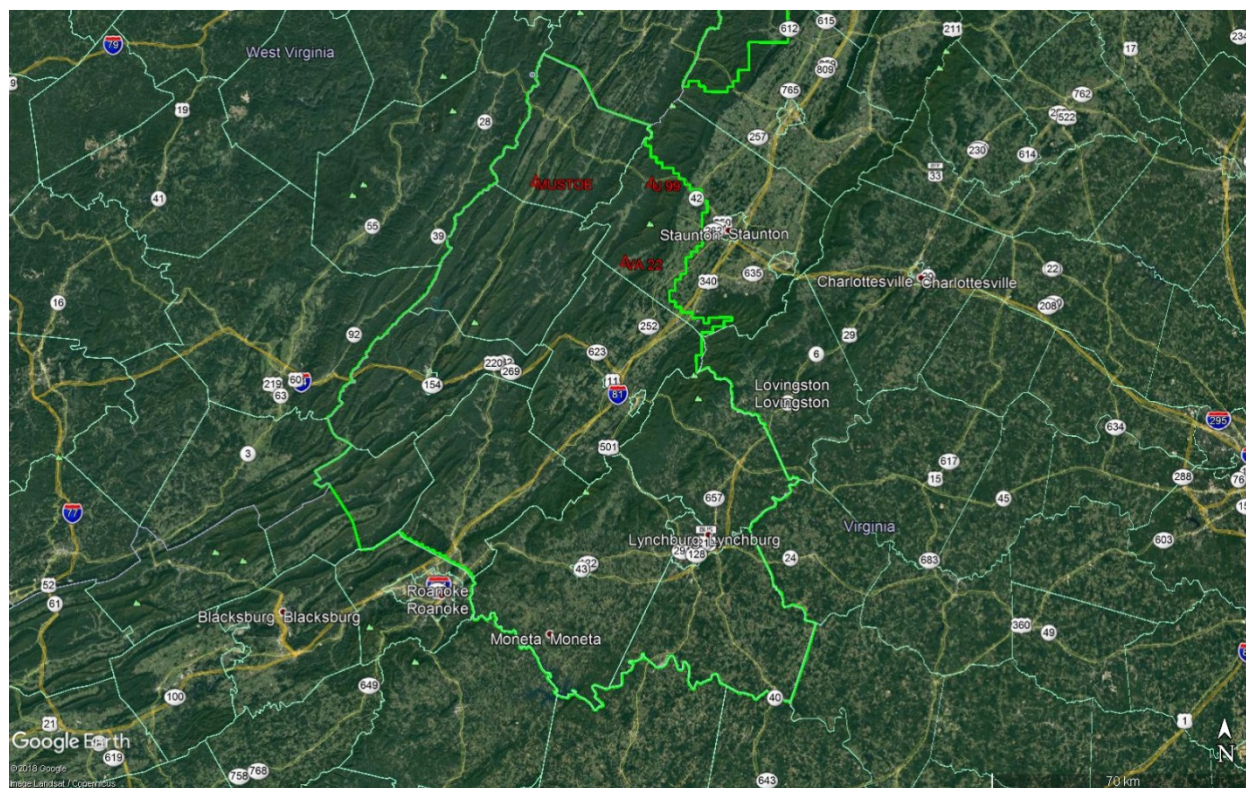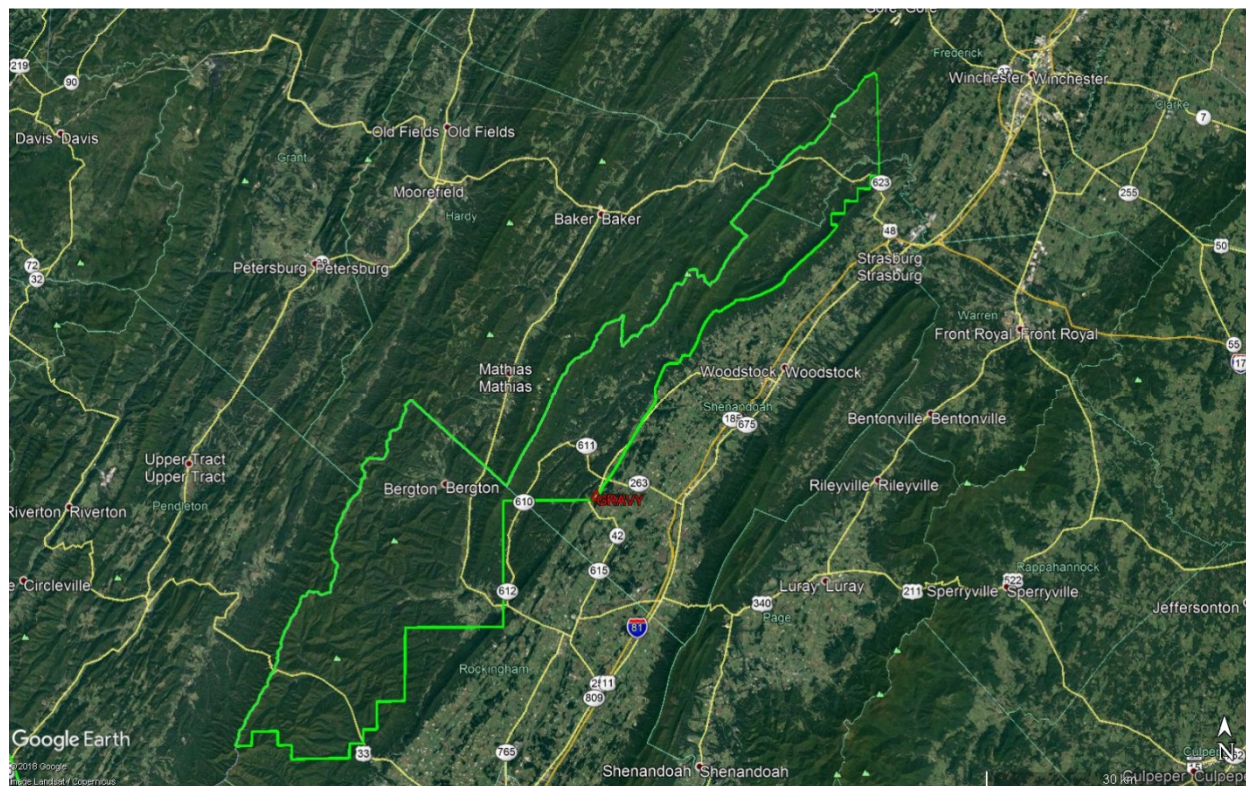
2.5   *Adjustment*

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 KEYNET GPS, Inc 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 2017) 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*

POINT ID	NORTHING (m)	EASTING (m)	ELEV. (m)
UTM Zone 17 North NAD83 (2011), Meters			
Ground Control Points			
GCP-1	4328333.032	721162.315	262.597
GCP-2	4320124.351	715928.280	350.446
GCP-3	4300339.977	695128.542	367.905
GCP-4	4291327.886	681044.395	416.559
GCP-5	4271671.852	662304.545	831.966
GCP-6	4281201.632	682243.764	362.899
GCP-7	4243749.108	632068.991	636.416
GCP-8	4211841.285	610390.670	566.775
GCP-9	4196424.794	581241.683	680.635
GCP-10	4185534.473	581173.660	429.962
GCP-11	4181887.002	567615.697	707.795
GCP-12	4177289.247	572539.004	483.076
GCP-13	4175721.219	582629.410	404.229
GCP-14	4167634.806	575817.834	464.927
GCP-15	4164624.076	566424.337	617.541
GCP-16	4154791.960	564390.168	822.506
GCP-17	4151068.262	578600.383	399.095
GCP-18	4156924.216	583616.025	403.536
GCP-19	4150499.313	599294.543	380.701
GCP-20	4136780.044	642573.629	269.135
GCP-21	4123736.011	675668.305	238.110
GCP-22	4168563.316	656299.602	303.419
GCP-23	4182233.816	625034.067	372.981
GCP-24	4115793.994	622319.302	278.002

4. *GPS OBSERVATIONS*

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
GCP-1	12/31/2017	365	13:47	N/A	N/A
GCP-2	12/31/2017	365	15:31	1/1/2018	13:10
GCP-3	1/1/2018	1	11:37	1/1/2018	11:40
GCP-4	12/22/2017	356	18:01	N/A	N/A
GCP-5	12/22/2017	356	12:27	N/A	N/A
GCP-6	12/22/2017	356	18:45	1/1/2018	9:08
GCP-7	1/15/2018	15	13:48	1/16/2018	9:33
GCP-8	1/16/2018	16	14:26	1/16/2018	14:28
GCP-9	1/20/2018	20	10:29	N/A	N/A
GCP-10	1/20/2018	20	8:27	1/28/2018	10:12
GCP-11	1/20/2018	20	9:21	1/28/2018	10:47
GCP-12	1/18/2018	18	11:31	1/28/2018	11:34
GCP-13	1/28/2018	28	16:40	1/28/2018	16:43
GCP-14	1/28/2018	28	15:30	1/29/2018	0:49
GCP-15	1/28/2018	28	12:05	N/A	N/A
GCP-16	1/28/2018	28	13:47	N/A	N/A
GCP-17	1/29/2018	29	11:36	1/29/2018	18:28
GCP-18	1/29/2018	29	12:18	N/A	N/A
GCP-19	1/29/2018	29	11:15	N/A	N/A
GCP-20	1/23/2018	23	9:50	N/A	N/A
GCP-21	1/21/2018	21	13:09	N/A	N/A
GCP-22	1/22/2018	22	16:30	1/22/2018	16:33
GCP-23	1/27/2018	27	15:49	N/A	N/A
GCP-24	1/29/2018	29	12:06	N/A	N/A

5.   *POINT COMPARISON*

Point ID	Point CK	Delta North (M)	Delta East (M)	Vertical Difference (M)
GCP-2	GCP-2 CK	0.016	0.002	0.005
GCP-3	GCP-3 CK	0.003	0.002	0.001
GCP-6	GCP-6 CK	0.005	0.003	0.023
GCP-7	GCP-07CK	-0.006	-0.012	0.018
GCP-8	GCP-08CK	0.003	0.006	0.010
GCP-10	GCP-10CK	0.005	0.000	-0.004
GCP-11	GCP-11CK	0.002	-0.004	0.004
GCP-12	GCP-12CK	0.005	0.006	-0.021
GCP-13	GCP-13CK	0.009	0.004	0.000
GCP-14	GCP-14CK	-0.001	0.001	-0.010
GCP-17	GCP-17CK	0.006	-0.002	-0.034
GCP-22	GCP-22CK	-0.001	-0.001	0.001