

Check Point Survey Report
“WV FEMA HQ QL2 2018 LiDAR”
USGS Contract: G16PC00020
Task Order Number: 140G0218F0174

Prepared for:
United States Geological Survey (USGS)



WV FEMA HQ QL2
2018 LiDAR GCP Rep



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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 Engineers Inc is under contract to the United States Geological Survey to provide 170 Check Points in the State of West 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 Ground Control Point surveys that will be used to evaluate vertical and horizontal accuracy. The ground survey was conducted November 23, 2018 thru January 17, 2019.

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 Albers Equal Area, NAD83 (2011) in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2012B (Geoid12B).

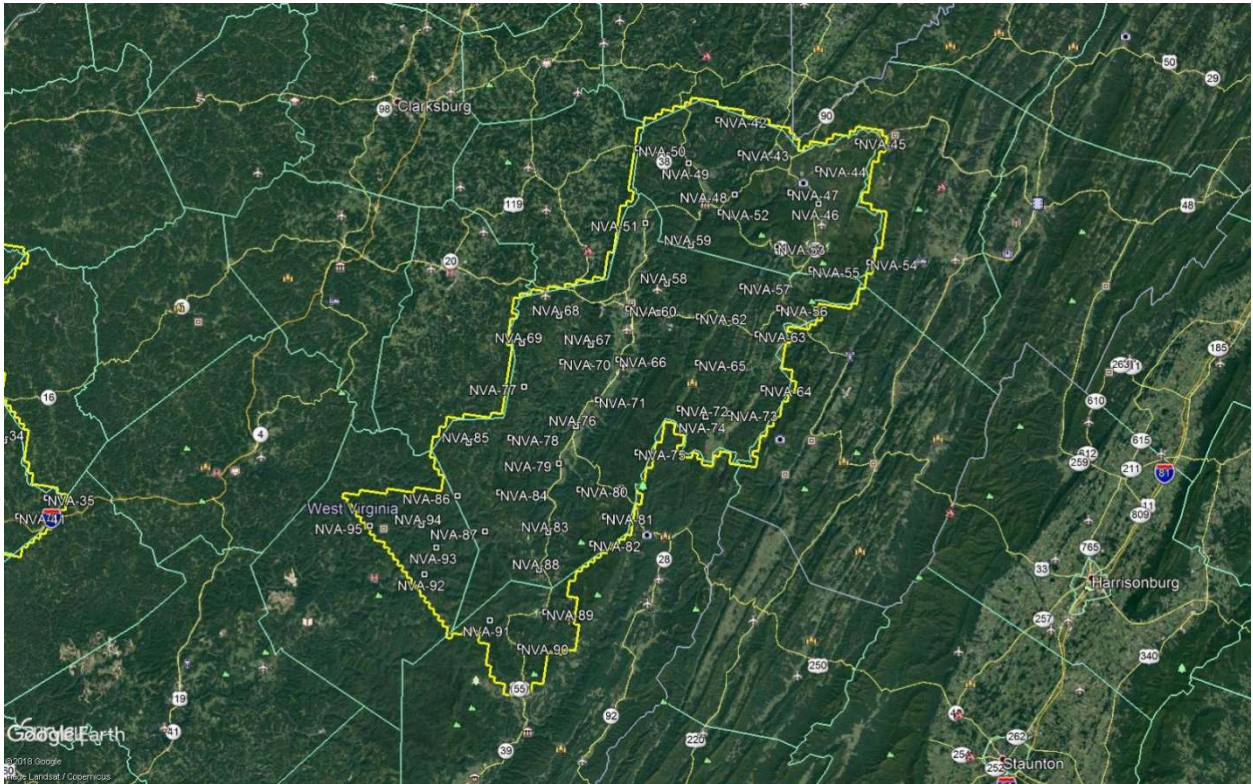
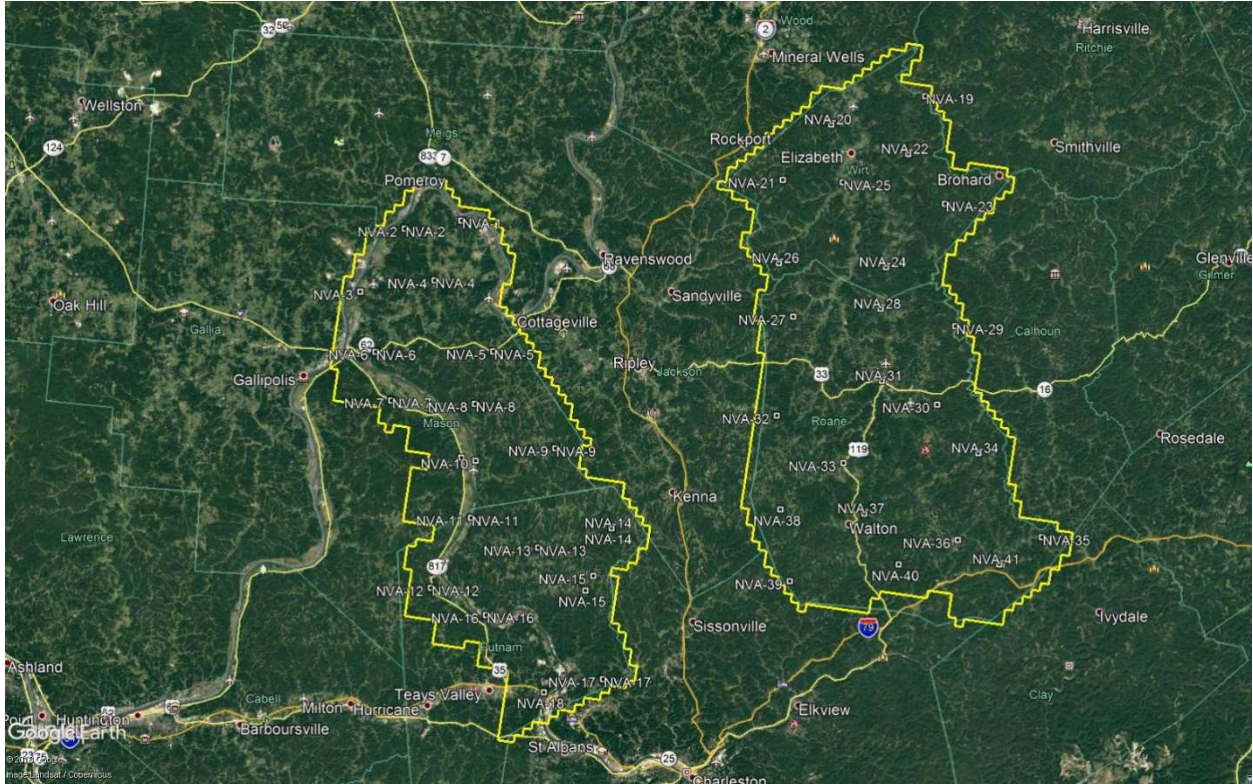
1.2 *Points of Contact*

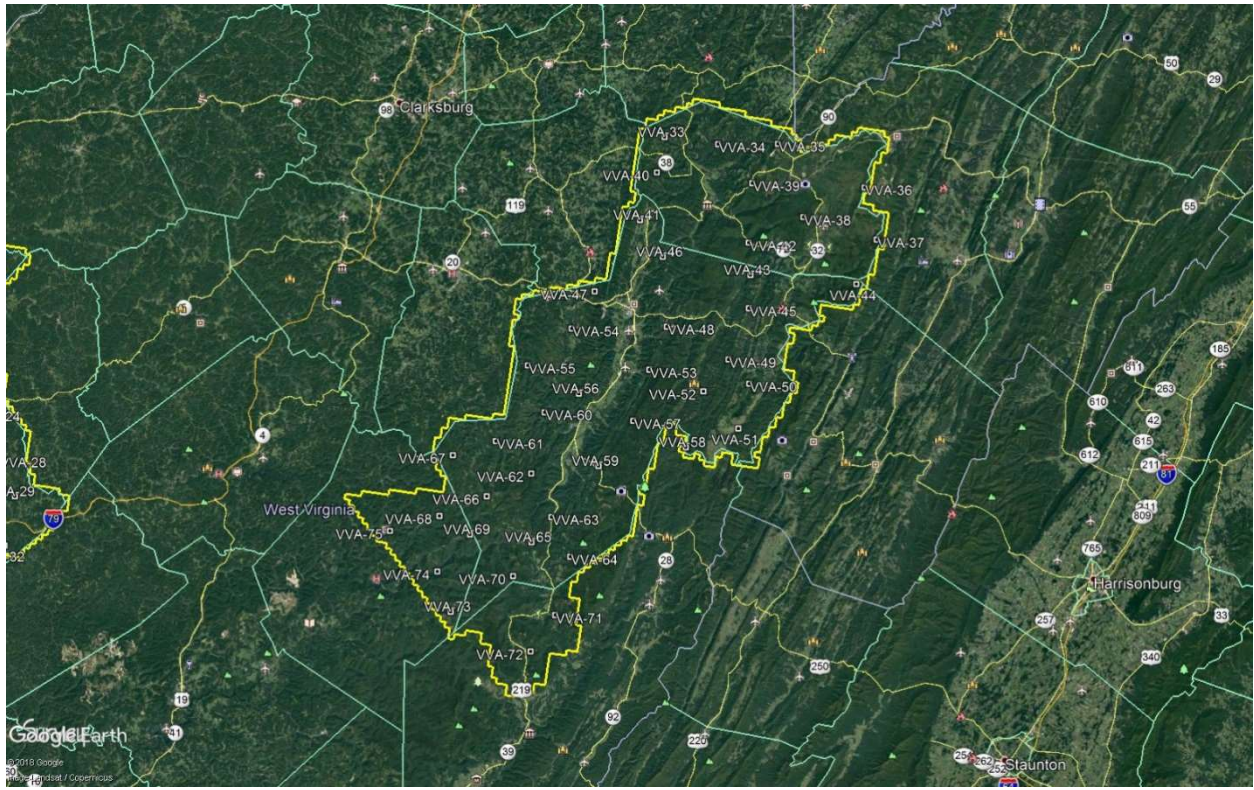
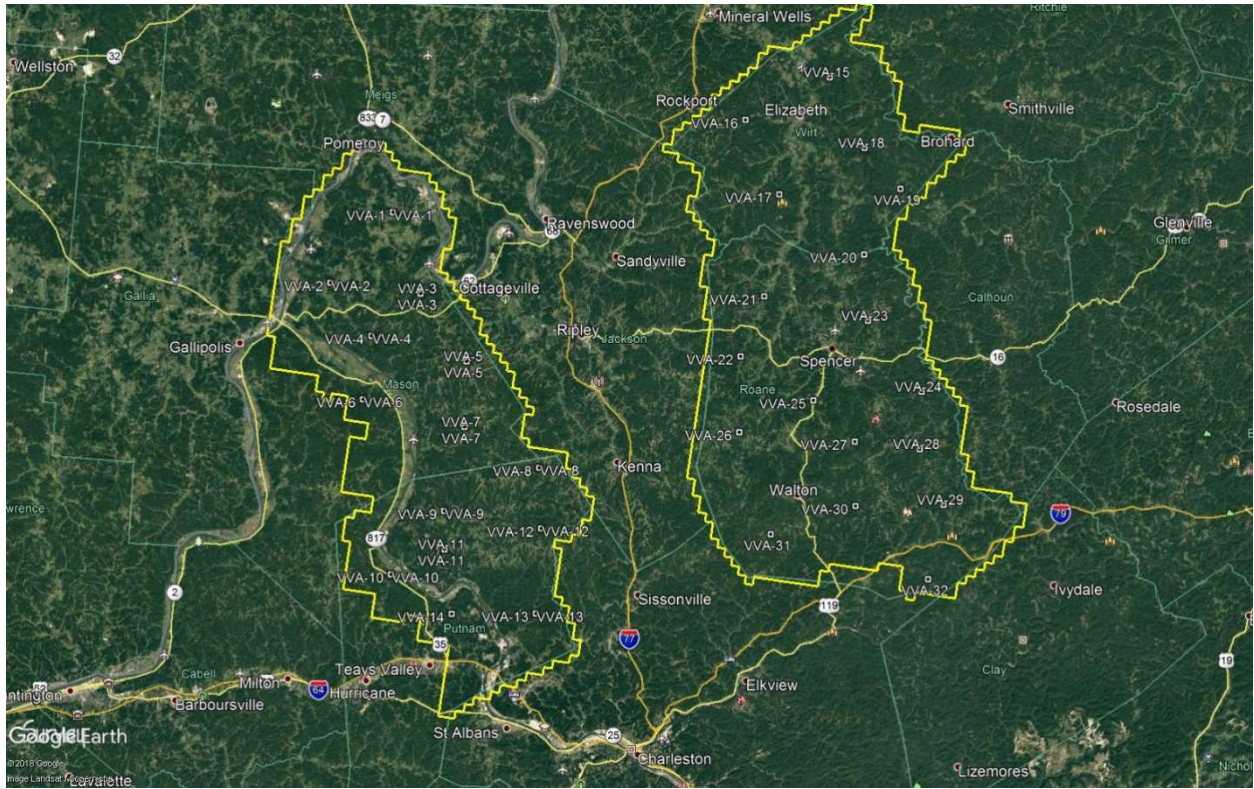
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1.3 Project Area





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 170 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 “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 KEYNT. 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 $\pm 5\text{cm}$ 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 20 and 30 minutes. Field GPS observations are detailed on the “Control Point Documentation Reports” submitted as part of this report.

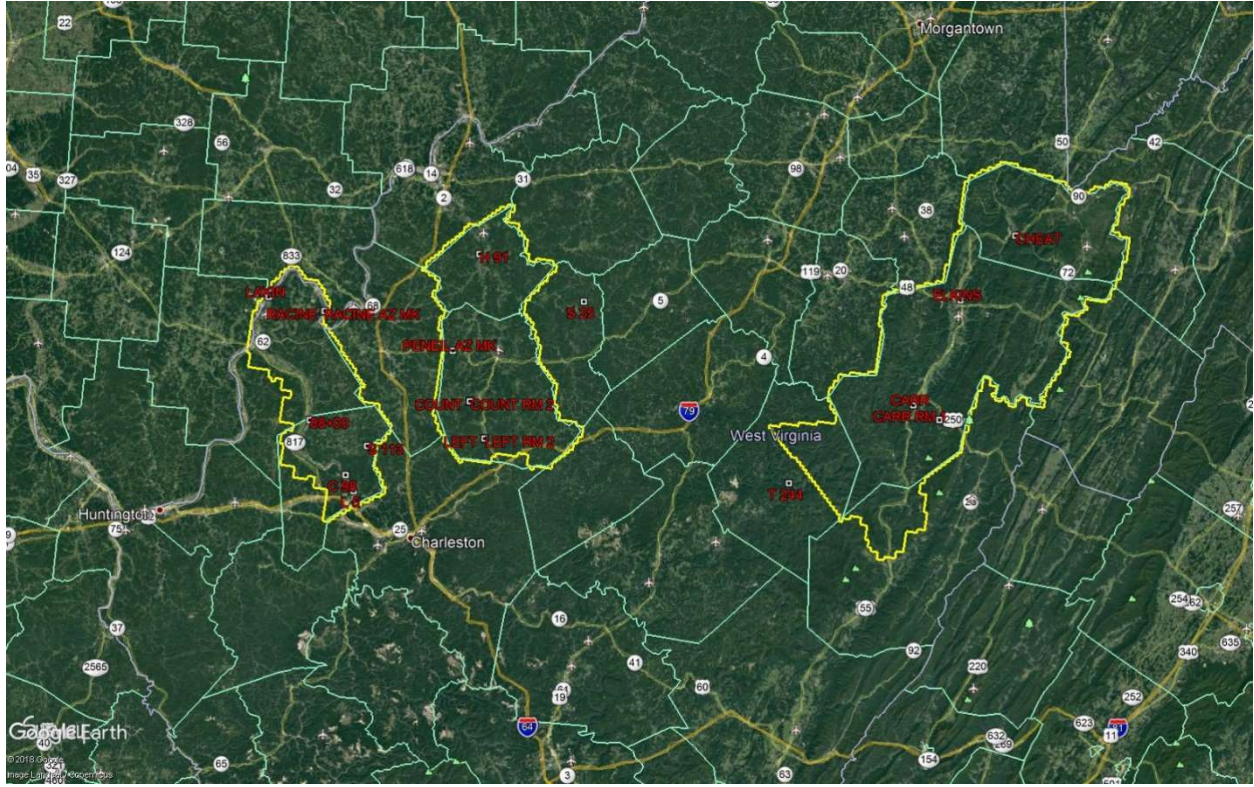
Ten (10) existing NGS monument listed in the NSRS database were located as an additional QA/QC method to check the horizontal and vertical accuracy of the VRS network as well as being the primary project control monuments designated as JX0995, HX1776, HX1744, HX2269, HX2413, HX2816, HX2541, HW3677, HX0525, and JW1754. The results are as follows:

(*) Indicates a vertical NGS Mark (**) Indicates a horizontal NGS Mark

UTM 17 North									
	Observed Values			Data Sheet Values					
PT. #	NORTHING (m)	EASTING (m)	ELEV. (m)	NORTHING (m)	EASTING (m)	ELEV. (m)	ΔX	ΔY	ΔZ
H-91	4324066.343	465047.473	189.819	N/A	N/A	189.86	N/A	N/A	-0.041
LEFT RM 2	4272539.274	465916.252	339.614	N/A	N/A	339.576	N/A	N/A	0.038
PENIEL AZ MK	4297136.430	457289.928	302.492	4297136.380	457289.926	302.481	0.050	0.002	0.011
C98	4262789.571	426720.583	178.717	N/A	N/A	178.752	N/A	N/A	-0.035
D113	4279257.791	428753.105	285.425	N/A	N/A	285.429	N/A	N/A	-0.004
RACINE	4308706.782	421300.303	182.070	4308706.803	421300.318	182.087	-0.021	-0.015	-0.017
S113	4270816.913	432865.621	305.705	N/A	N/A	305.656	N/A	N/A	0.049
GPS 1	4276335.041	593578.042	1159.863	4276335.011	593578.077	1159.910	0.030	-0.035	-0.047
T 244	4259169.72	551142.53	445.871	4259169.709	551142.530	445.836	0.011	0.000	0.035
CHEAT	4327608.873	615697.707	506.48	4327608.840	615697.755	506.480	0.033	-0.048	0.000

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 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 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 2018) 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/ELEVATIONS***

Albers Equal Area, NAD83 (2011), NAVD88, Meters			
NVA			
Point ID	Northing	Easting	Elevation
NVA-1	1862276.232	1199667.984	181.617
NVA-2	1860194.408	1192722.861	179.561
NVA-3	1851378.119	1188358.137	180.873
NVA-4	1854199.762	1197445.339	196.594
NVA-5	1846271.619	1206146.137	276.670
NVA-6	1844024.746	1191407.318	173.651
NVA-7	1838152.063	1194299.829	196.879
NVA-8	1839281.827	1204843.200	184.505
NVA-9	1835166.670	1215739.373	296.056
NVA-10	1832226.916	1204148.594	173.352
NVA-11	1824757.512	1206489.401	171.916
NVA-12	1815135.709	1202784.601	197.213
NVA-13	1822252.124	1215439.249	194.952
NVA-14	1826085.755	1224258.618	212.360
NVA-15	1819693.124	1222885.376	293.082
NVA-16	1812716.750	1210194.353	178.905
NVA-17	1806761.672	1225972.938	187.088
NVA-18	1804005.354	1218885.253	211.531
NVA-19	1886723.892	1255386.192	198.377
NVA-20	1881333.010	1244095.576	205.822
NVA-21	1873400.031	1239111.292	216.989
NVA-22	1879047.513	1254294.165	228.429
NVA-23	1873907.672	1260934.491	314.801
NVA-24	1864272.772	1253658.241	263.384
NVA-25	1874239.871	1246644.227	204.955
NVA-26	1862814.827	1240178.143	226.413
NVA-27	1856259.295	1242971.567	224.334
NVA-28	1858888.333	1253757.044	211.811
NVA-29	1858095.231	1263442.211	203.973
NVA-30	1847795.625	1262641.954	241.300
NVA-31	1849779.632	1255268.440	224.138
NVA-32	1843449.245	1242507.822	250.500
NVA-33	1838652.681	1252012.322	246.977
NVA-34	1842415.145	1268730.751	233.330

NVA-35	1832914.781	1278362.613	250.414
NVA-36	1831020.743	1267783.939	226.935
NVA-37	1832631.406	1255585.363	220.166
NVA-38	1831597.603	1245014.478	304.993
NVA-39	1822679.410	1247539.656	206.408
NVA-40	1827055.411	1261004.368	240.227
NVA-41	1828682.263	1273463.740	237.348
NVA-42	1921670.508	1391668.236	852.451
NVA-43	1916089.670	1396680.142	521.052
NVA-44	1915161.938	1411299.156	945.777
NVA-45	1921361.445	1417805.386	995.564
NVA-46	1908693.518	1412292.419	1072.238
NVA-47	1910030.465	1406876.811	951.114
NVA-48	1908193.102	1396701.149	788.811
NVA-49	1912815.662	1387400.837	472.106
NVA-50	1914170.980	1377629.225	595.325
NVA-51	1900488.808	1381113.125	607.733
NVA-52	1904530.470	1394638.663	525.619
NVA-53	1899278.768	1405639.515	757.602
NVA-54	1899209.655	1423232.922	1210.277
NVA-55	1896350.655	1412839.699	844.031
NVA-56	1888249.796	1407956.298	724.572
NVA-57	1891307.687	1400637.878	709.894
NVA-58	1889789.850	1386697.099	608.650
NVA-59	1897501.066	1390122.498	538.148
NVA-60	1884109.083	1380358.716	587.842
NVA-61	1884148.670	1385955.840	790.919
NVA-62	1884547.425	1393476.496	683.014
NVA-63	1882829.883	1404698.985	1027.182
NVA-64	1872936.489	1407299.665	897.062
NVA-65	1875940.732	1394563.801	874.361
NVA-66	1874410.125	1379917.526	597.007
NVA-67	1876364.088	1374477.902	935.240
NVA-68	1880867.586	1367842.901	741.654
NVA-69	1874818.981	1361778.550	593.479
NVA-70	1871926.304	1368887.300	664.681
NVA-71	1866350.583	1377304.434	616.022
NVA-72	1867624.108	1392382.783	923.732
NVA-73	1867793.649	1397084.536	1111.062

NVA-74	1866105.230	1397452.912	943.950
NVA-75	1859312.480	1382162.216	1187.719
NVA-76	1860867.993	1373960.113	623.267
NVA-77	1866768.957	1363399.648	760.919
NVA-78	1856934.466	1362323.780	894.247
NVA-79	1853434.683	1371885.034	644.981
NVA-80	1849184.680	1376387.817	753.054
NVA-81	1845180.773	1381716.031	1098.949
NVA-82	1839532.387	1380234.563	1176.824
NVA-83	1840398.443	1371850.124	713.066
NVA-84	1846492.798	1361772.766	1132.331
NVA-85	1854849.852	1354814.325	682.133
NVA-86	1844697.820	1354203.854	963.063
NVA-87	1838840.601	1360226.642	1167.967
NVA-88	1833213.764	1371204.923	821.415
NVA-89	1825340.328	1373695.496	902.524
NVA-90	1818411.785	1369900.571	896.099
NVA-91	1822527.669	1363600.537	1258.895
NVA-92	1829192.127	1350282.114	553.894
NVA-93	1834507.509	1351728.052	961.279
NVA-94	1838423.506	1348387.205	626.210
NVA-95	1836706.475	1338887.889	455.186
VVA			
Point ID	Northing	Easting	Elevation
VVA-1	1858579.177	1199134.427	234.573
VVA-2	1848766.437	1192836.058	214.612
VVA-3	1849079.553	1204066.370	268.516
VVA-4	1842910.017	1198847.984	262.039
VVA-5	1841515.865	1210953.739	277.075
VVA-6	1834852.873	1198966.616	188.763
VVA-7	1833335.442	1211892.249	215.004
VVA-8	1829510.537	1221837.426	325.621
VVA-9	1822551.343	1211014.881	175.223
VVA-10	1813942.433	1205575.733	186.241
VVA-11	1817831.627	1211741.919	267.083
VVA-12	1822250.602	1223109.685	215.204
VVA-13	1811571.856	1224066.093	184.191
VVA-14	1809994.630	1213811.207	184.154
VVA-15	1883329.358	1249871.110	318.550

VVA-16	1876332.363	1240512.668	204.160
VVA-17	1868155.387	1246294.553	348.340
VVA-18	1875181.755	1255699.395	247.647
VVA-19	1870805.355	1260863.765	231.976
VVA-20	1861928.457	1257610.953	338.729
VVA-21	1854901.087	1246020.399	217.804
VVA-22	1847154.239	1244348.393	236.936
VVA-23	1853848.418	1259267.117	249.397
VVA-24	1844772.417	1262681.984	307.951
VVA-25	1842983.722	1254055.188	236.774
VVA-26	1837710.034	1245601.993	226.244
VVA-27	1832589.885	1254195.989	217.504
VVA-28	1838310.136	1265881.412	330.672
VVA-29	1832440.076	1271901.200	247.274
VVA-30	1830685.428	1261169.873	252.632
VVA-31	1825679.004	1251276.783	342.007
VVA-32	1822969.420	1271383.631	244.115
VVA-33	1917076.928	1381929.206	549.476
VVA-34	1916563.955	1391515.264	700.068
VVA-35	1918914.001	1402800.066	1006.806
VVA-36	1913156.911	1419925.030	1089.264
VVA-37	1903768.504	1423584.635	1181.131
VVA-38	1905933.504	1409484.064	1112.006
VVA-39	1910913.851	1399235.418	1050.781
VVA-40	1910531.997	1381268.122	780.098
VVA-41	1901023.310	1379654.312	624.945
VVA-42	1899363.241	1400659.121	556.913
VVA-43	1892695.217	1400688.867	695.090
VVA-44	1895030.581	1421328.435	1197.362
VVA-45	1887586.054	1402020.970	995.536
VVA-46	1894775.191	1384823.105	831.076
VVA-47	1886545.914	1373303.997	649.139
VVA-48	1881944.344	1387523.436	773.476
VVA-49	1877482.649	1399681.714	900.223
VVA-50	1875867.026	1404662.933	861.747
VVA-51	1864962.433	1403375.716	1058.692
VVA-52	1870896.172	1395972.031	890.869
VVA-53	1873463.519	1385497.390	668.990
VVA-54	1879014.889	1370140.175	664.537

VVA-55	1870933.918	1362492.457	642.501
VVA-56	1864795.502	1372204.355	865.397
VVA-57	1863525.110	1383957.912	1122.506
VVA-58	1860009.458	1394295.843	1159.113
VVA-59	1854157.313	1378804.123	800.004
VVA-60	1862704.014	1367498.348	688.764
VVA-61	1856080.497	1359353.329	932.019
VVA-62	1851253.441	1366715.693	912.556
VVA-63	1843509.081	1371709.326	684.429
VVA-64	1836634.327	1376154.663	1146.151
VVA-65	1838250.442	1368659.771	896.354
VVA-66	1845574.337	1359144.997	1076.221
VVA-67	1852253.688	1351854.365	714.020
VVA-68	1840609.658	1351051.552	963.356
VVA-69	1837984.131	1357149.346	1067.181
VVA-70	1830401.637	1366415.744	767.816
VVA-71	1825362.704	1374999.408	940.481
VVA-72	1817879.544	1371537.098	942.744
VVA-73	1823183.338	1354750.532	812.044
VVA-74	1830194.622	1352177.550	572.469
VVA-75	1836448.036	1342379.389	521.179

4. GPS OBSERVATIONS

NVA					
POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
NVA-1	1/11/2019	11	7:22	1/13/2019	8:40
NVA-2	1/11/2019	11	9:40	N/A	N/A
NVA-3	1/11/2019	11	8:35	1/13/2019	7:25
NVA-4	1/11/2019	11	12:05	1/13/2019	9:20
NVA-5	1/11/2019	11	14:45	1/13/2019	10:00
NVA-6	1/11/2019	11	19:40	N/A	N/A
NVA-7	1/12/2019	12	19:00	N/A	N/A
NVA-8	1/12/2019	12	16:30	1/13/2019	10:30
NVA-9	1/12/2019	12	14:45	1/13/2019	12:00
NVA-10	1/12/2019	12	8:45	N/A	N/A
NVA-11	1/12/2019	12	13:10	1/15/2019	13:30
NVA-12	1/12/2019	12	11:00	1/15/2019	11:15
NVA-13	1/14/2019	14	9:20	1/15/2019	15:00
NVA-14	1/13/2019	13	14:50	N/A	N/A
NVA-15	1/14/2019	14	11:45	N/A	N/A
NVA-16	1/12/2019	12	12:10	1/15/2019	12:35
NVA-17	1/15/2019	15	7:00	N/A	N/A
NVA-18	1/15/2019	15	8:30	1/15/2019	15:45
NVA-19	1/14/2019	14	9:45	1/17/2019	8:46
NVA-20	1/14/2019	14	13:20	1/16/2019	11:50
NVA-21	1/14/2019	14	17:35	N/A	N/A
NVA-22	1/14/2019	14	11:03	1/17/2019	9:23
NVA-23	1/14/2019	14	12:10	1/14/2019	12:13
NVA-24	1/14/2019	14	16:56	1/14/2019	16:59
NVA-25	1/14/2019	14	14:24	N/A	N/A
NVA-26	1/15/2019	15	11:41	1/16/2019	13:16
NVA-27	1/15/2019	15	22:10	1/16/2019	13:54
NVA-28	1/14/2019	14	15:50	1/15/2019	17:15
NVA-29	1/15/2019	15	15:56	N/A	N/A
NVA-30	1/15/2019	15	11:08	1/15/2019	11:11
NVA-31	1/15/2019	15	14:57	1/16/2019	16:38
NVA-32	1/15/2019	15	16:38	N/A	N/A
NVA-33	1/17/2019	17	12:13	1/17/2019	12:16
NVA-34	1/15/2019	15	14:18	1/15/2019	14:21
NVA-35	1/16/2019	16	17:51	1/16/2019	17:54

NVA-36	1/16/2019	16	13:51	N/A	N/A
NVA-37	1/16/2019	16	9:23	1/16/2019	9:38
NVA-38	1/15/2019	15	16:55	1/16/2019	8:29
NVA-39	1/15/2019	15	15:33	N/A	N/A
NVA-40	1/16/2019	16	12:00	1/17/2019	15:11
NVA-41	1/17/2019	17	12:49	1/17/2019	12:52
NVA-42	11/25/2018	329	15:12	11/25/2018	15:15
NVA-43	1/23/2019	23	10:25	N/A	N/A
NVA-44	11/23/2018	327	13:07	11/23/2018	13:15
NVA-45	11/23/2018	327	12:29	11/23/2018	12:34
NVA-46	11/23/2018	327	14:26	11/23/2018	14:31
NVA-47	11/23/2018	327	13:45	1/23/2019	11:34
NVA-48	11/23/2018	327	16:24	11/23/2018	16:27
NVA-49	11/25/2018	329	13:00	11/25/2018	13:03
NVA-50	11/25/2018	329	11:57	11/25/2018	12:00
NVA-51	11/24/2018	328	16:17	11/24/2018	16:20
NVA-52	11/23/2018	327	16:47	N/A	N/A
NVA-53	1/18/2019	18	12:41	1/23/2019	15:40
NVA-54	11/24/2018	328	17:18	N/A	N/A
NVA-55	11/23/2018	327	3:34	11/24/2018	15:37
NVA-56	1/24/2019	24	11:39	N/A	N/A
NVA-57	1/24/2019	24	8:12	N/A	N/A
NVA-58	11/25/2018	329	8:39	11/5/2018	8:42
NVA-59	11/30/2018	334	17:27	N/A	N/A
NVA-60	11/24/2018	328	7:30	N/A	N/A
NVA-61	1/17/2019	17	7:50	N/A	N/A
NVA-62	11/23/2018	327	13:09	N/A	N/A
NVA-63	1/24/2019	24	13:10	N/A	N/A
NVA-64	12/2/2018	336	8:15	12/2/2018	8:23
NVA-65	1/24/2019	24	14:00	N/A	N/A
NVA-66	11/23/2018	327	15:40	N/A	N/A
NVA-67	1/25/2019	25	8:30	N/A	N/A
NVA-68	11/24/2018	328	10:52	N/A	N/A
NVA-69	1/16/2019	16	15:50	N/A	N/A
NVA-70	12/2/2018	336	14:50	N/A	N/A
NVA-71	11/23/2018	327	14:40	N/A	N/A
NVA-72	11/24/2018	338	14:13	N/A	N/A
NVA-73	12/2/2018	336	11:58	N/A	N/A
NVA-74	1/26/2019	26	10:30	N/A	N/A

NVA-75	1/26/2019	26	14:33	1/26/2019	14:37
NVA-76	1/25/2019	25	13:25	N/A	N/A
NVA-77	1/25/2019	25	11:45	N/A	N/A
NVA-78	1/27/2019	27	14:05	N/A	N/A
NVA-79	2/6/2019	37	12:05	N/A	N/A
NVA-80	1/26/2019	26	17:00	N/A	N/A
NVA-81	1/26/2019	26	9:53	N/A	N/A
NVA-82	1/26/2019	26	8:21	N/A	N/A
NVA-83	1/25/2019	25	12:53	N/A	N/A
NVA-84	1/25/2019	25	16:26	N/A	N/A
NVA-85	1/27/2019	27	17:14	N/A	N/A
NVA-86	1/27/2019	27	10:44	N/A	N/A
NVA-87	1/23/2019	23	15:40	1/23/2019	15:44
NVA-88	1/24/2019	24	11:34	1/24/2019	11:38
NVA-89	1/24/2019	24	16:24	1/24/2019	16:27
NVA-90	1/24/2019	24	13:53	N/A	N/A
NVA-91	1/24/2019	24	15:31	1/24/2019	15:34
NVA-92	1/22/2019	22	16:37	N/A	N/A
NVA-93	1/23/2019	23	7:55	1/23/2019	14:18
NVA-94	1/22/2019	22	13:54	N/A	N/A
NVA-95	1/22/2019	22	11:21	1/22/2019	15:29
VVA					
VVA-1	1/11/2019	11	11:05	N/A	N/A
VVA-2	1/11/2019	11	8:15	N/A	N/A
VVA-3	1/11/2019	11	14:20	1/13/2019	9:40
VVA-4	1/11/2019	11	17:00	N/A	N/A
VVA-5	1/12/2019	12	16:00	N/A	N/A
VVA-6	1/12/2019	12	8:00	N/A	N/A
VVA-7	1/12/2019	12	14:20	N/A	N/A
VVA-8	1/13/2019	13	13:40	N/A	N/A
VVA-9	1/14/2019	14	8:40	N/A	N/A
VVA-10	1/12/2019	12	11:30	1/15/2019	11:00
VVA-11	1/14/2019	14	8:30	N/A	N/A
VVA-12	1/14/2019	14	15:29	N/A	N/A
VVA-13	1/14/2019	14	14:45	N/A	N/A
VVA-14	1/14/2019	14	7:00	N/A	N/A
VVA-15	1/15/2019	15	9:09	1/17/2019	9:54
VVA-16	1/15/2019	15	9:58	1/15/2019	10:01
VVA-17	1/14/2019	14	14:59	1/16/2019	12:34

VVA-18	1/14/2019	14	11:30	1/17/2019	10:28
VVA-19	1/14/2019	14	13:24	1/14/2019	13:27
VVA-20	1/14/2019	14	15:26	1/17/2019	11:16
VVA-21	1/15/2019	15	14:01	N/A	N/A
VVA-22	1/15/2019	15	16:08	1/16/2019	15:40
VVA-23	1/15/2019	15	10:35	1/15/2019	10:38
VVA-24	1/15/2019	15	14:56	1/15/2019	14:59
VVA-25	1/17/2019	17	12:32	1/17/2019	12:35
VVA-26	1/17/2019	17	11:36	1/17/2019	11:39
VVA-27	1/15/2019	15	13:06	1/15/2019	13:09
VVA-28	1/15/2019	15	13:56	1/15/2019	14:00
VVA-29	1/16/2019	16	14:20	1/16/2019	14:23
VVA-30	1/17/2019	17	13:53	N/A	N/A
VVA-31	1/15/2019	15	17:47	1/15/2019	17:50
VVA-32	1/17/2019	17	10:25	1/17/2019	10:28
VVA-33	11/25/2018	329	12:33	11/25/2018	12:36
VVA-34	11/30/2018	334	15:20	N/A	N/A
VVA-35	11/30/2018	334	12:03	N/A	N/A
VVA-36	11/25/2018	329	12:59	11/25/2018	13:02
VVA-37	11/25/2018	329	8:52	N/A	N/A
VVA-38	11/23/2018	327	14:53	11/23/2018	14:58
VVA-39	11/23/2018	327	16:00	11/23/2018	16:04
VVA-40	11/25/2018	329	11:07	11/25/2018	11:10
VVA-41	11/24/2018	328	16:00	11/24/2018	16:03
VVA-42	1/23/2019	23	16:22	N/A	N/A
VVA-43	2/6/2019	37	16:35	2/6/2019	16:39
VVA-44	12/1/2018	335	11:14	N/A	N/A
VVA-45	11/24/2018	328	11:17	N/A	N/A
VVA-46	11/25/2018	329	9:20	N/A	N/A
VVA-47	1/22/2019	22	7:11	1/22/2019	7:26
VVA-48	1/17/2019	17	8:30	N/A	N/A
VVA-49	1/26/2019	26	7:15	N/A	N/A
VVA-50	1/26/2019	26	15:00	N/A	N/A
VVA-51	12/2/2018	336	9:04	N/A	N/A
VVA-52	1/24/2019	24	15:25	N/A	N/A
VVA-53	11/23/2018	327	14:50	N/A	N/A
VVA-54	1/16/2019	16	14:10	1/16/2019	14:21
VVA-55	1/25/2019	25	10:00	N/A	N/A
VVA-56	1/25/2019	25	14:45	N/A	N/A

VVA-57	11/24/2018	328	9:15	1/24/2019	8:14
VVA-58	2/6/2019	37	14:00	N/A	N/A
VVA-59	2/6/2019	37	12:40	2/6/2019	12:51
VVA-60	11/23/2018	327	9:00	N/A	N/A
VVA-61	1/27/2019	27	14:30	1/27/2019	14:35
VVA-62	1/25/2019	25	14:46	N/A	N/A
VVA-63	2/6/2019	37	11:30	2/6/2019	11:39
VVA-64	1/24/2019	24	10:03	N/A	N/A
VVA-65	1/23/2019	23	16:12	1/23/2019	16:15
VVA-66	1/27/2019	27	8:57	N/A	N/A
VVA-67	1/27/2019	27	11:34	1/27/2019	11:37
VVA-68	1/22/2019	22	13:16	1/22/2019	13:20
VVA-69	1/23/2019	23	14:42	1/23/2019	15:11
VVA-70	1/25/2019	25	9:49	N/A	N/A
VVA-71	1/24/2019	24	16:59	1/24/2019	17:03
VVA-72	1/24/2019	24	12:31	N/A	N/A
VVA-73	1/23/2019	23	11:58	N/A	N/A
VVA-74	2/6/2019	37	8:50	2/6/2019	8:59
VVA-75	2/6/2019	37	10:15	2/6/2019	10:28

5. POINT COMPARISON

Point ID	Point CK	Delta North (M)	Delta East (M)	Vertical Difference (M)
NVA				
NVA-1	NVA-1 CK	-0.007	0.001	0.004
NVA-3	NVA-3 CK	0.003	0.002	0.023
NVA-4	NVA-4 CK	-0.010	0.005	0.006
NVA-5	NVA-5 CK	-0.007	0.004	-0.006
NVA-8	NVA-8 CK	0.009	0.022	-0.005
NVA-9	NVA-9 CK	0.000	-0.032	0.010
NVA-11	NVA-11 CK	-0.003	0.003	0.009
NVA-12	NVA-12 CK	0.022	0.002	0.012
NVA-13	NVA-13 CK	0.002	0.009	-0.014
NVA-16	NVA-16 CK	0.005	-0.009	0.018
NVA-18	NVA-18 CK	-0.017	-0.004	0.005
NVA-19	NVA-19 CK	-0.004	0.015	0.018
NVA-20	NVA-20 CK	-0.009	0.001	0.005
NVA-22	NVA-22 CK	0.001	-0.005	-0.020
NVA-23	NVA-23 CK	-0.004	0.002	0.022
NVA-24	NVA-24 CK	0.005	-0.010	-0.013
NVA-26	NVA-26 CK	0.008	0.016	-0.002
NVA-27	NVA-27 CK	0.001	-0.003	-0.023
NVA-28	NVA-28 CK	-0.008	-0.020	0.040
NVA-30	NVA-30 CK	0.014	0.006	-0.010
NVA-31	NVA-31 CK	-0.001	0.005	-0.001
NVA-33	NVA-33 CK	-0.016	-0.012	0.024
NVA-34	NVA-34 CK	0.006	-0.003	-0.003
NVA-35	NVA-35 CK	0.009	0.003	-0.044
NVA-37	NVA-37 CK	0.003	0.003	0.005
NVA-38	NVA-38 CK	-0.004	-0.001	-0.010
NVA-40	NVA-40 CK	0.011	0.006	-0.008
NVA-41	NVA-41 CK	-0.013	-0.010	0.015
NVA-42	NVA-42 CK	-0.004	-0.003	-0.012
NVA-44	NVA-44 CK	0.005	0.006	-0.013
NVA-45	NVA-45 CK	0.002	-0.013	0.000
NVA-46	NVA-46 CK	0.002	-0.008	-0.010
NVA-47	NVA-47 CK	-0.003	-0.014	0.012
NVA-48	NVA-48 CK	0.008	0.011	-0.048
NVA-49	NVA-49 CK	0.003	-0.021	-0.019
NVA-50	NVA-50 CK	0.011	-0.020	-0.044
NVA-52	NVA-52 CK	-0.009	0.015	-0.012
NVA-53	NVA-53 CK	0.003	-0.008	0.004

NVA-55	NVA-55 CK	0.015	0.003	0.010
NVA-58	NVA-58 CK	0.007	-0.036	-0.012
NVA-64	NVA-64 CK	0.009	0.002	-0.005
NVA-75	NVA-75 CK	0.005	-0.003	0.012
NVA-87	NVA-87 CK	-0.003	0.014	0.002
NVA-88	NVA-88 CK	-0.007	0.009	0.027
NVA-89	NVA-89 CK	0.000	-0.001	-0.001
NVA-91	NVA-91 CK	0.006	0.003	0.003
NVA-93	NVA-93 CK	-0.048	-0.010	-0.010
NVA-95	NVA-95 CK	0.010	0.002	0.023
VVA				
VVA-3	VVA-3 CK	-0.026	-0.003	-0.007
VVA-10	VVA-10 CK	0.029	0.004	-0.007
VVA-15	VVA-15 CK	-0.015	-0.011	-0.018
VVA-16	VVA-16 CK	0.012	-0.008	-0.023
VVA-17	VVA-17 CK	0.009	-0.008	0.004
VVA-18	VVA-18 CK	-0.004	0.003	0.016
VVA-19	VVA-19 CK	-0.003	-0.018	0.017
VVA-20	VVA-20 CK	0.038	0.022	-0.002
VVA-22	VVA-22 CK	0.022	-0.010	-0.002
VVA-23	VVA-23 CK	0.019	-0.011	-0.005
VVA-24	VVA-24 CK	-0.003	-0.008	0.027
VVA-25	VVA-25 CK	-0.007	0.004	-0.002
VVA-26	VVA-26 CK	0.001	-0.011	-0.003
VVA-27	VVA-27 CK	0.003	-0.013	-0.010
VVA-28	VVA-28 CK	-0.002	-0.008	0.018
VVA-29	VVA-29 CK	0.015	0.000	-0.022
VVA-31	VVA-31 CK	0.000	0.042	-0.021
VVA-32	VVA-32 CK	-0.009	-0.004	-0.004
VVA-33	VVA-33CK	-0.008	-0.004	-0.008
VVA-36	VVA-36 CK	-0.012	-0.004	-0.049
VVA-38	VVA-38 CK	0.001	-0.002	-0.002
VVA-39	VVA-39 CK	0.027	-0.008	0.017
VVA-40	VVA-40 CK	0.018	-0.021	0.015
VVA-41	VVA-41 CK	0.007	-0.020	0.009
VVA-43	VVA-43 CK	0.008	-0.001	-0.016
VVA-47	VVA-47 CK	-0.009	-0.014	-0.028
VVA-54	VVA-54 CK	0.000	-0.002	-0.008
VVA-57	VVA-57 CK	0.006	-0.033	-0.015
VVA-59	VVA-59 CK	0.015	-0.035	-0.042
VVA-61	VVA-61 CK	0.019	-0.005	-0.020

VVA-63	VVA-63 CK	-0.014	-0.001	-0.040
VVA-65	VVA-65 CK	0.002	0.007	0.008
VVA-67	VVA-67 CK	0.000	0.005	-0.008
VVA-68	VVA-68 CK	0.011	0.019	0.005
VVA-69	VVA-69 CK	0.006	0.001	0.013
VVA-71	VVA-71 CK	0.003	-0.016	0.031
VVA-74	VVA-74 CK	0.012	-0.006	0.008
VVA-75	VVA-75 CK	0.019	0.024	0.012