Ground Control Point Survey Report

"WV FEMA R3 SouthCentral 2018 QL2 LiDAR"
USGS Contract: G16PC00020
Task Order Number: 140G0219F0019

Prepared for:
United States Geological Survey (USGS)

Prepared By:
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6. Deliverables ....Sent via Electronic Transfer

   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 178 Ground Control 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 January 21, 2019 thru March 5, 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 Ground Control 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).
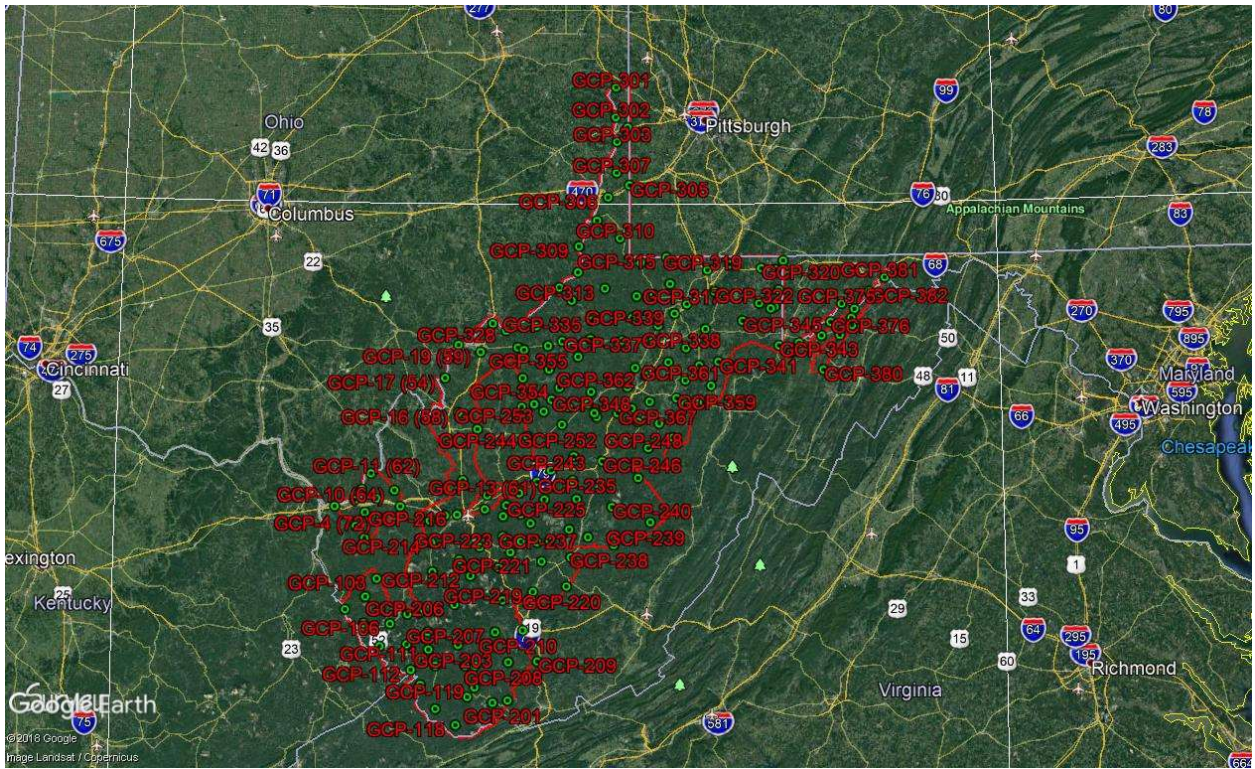
1.2 *Points of Contact*

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

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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 178 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. 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 "Control Point Documentation Reports" submitted as part of this report.
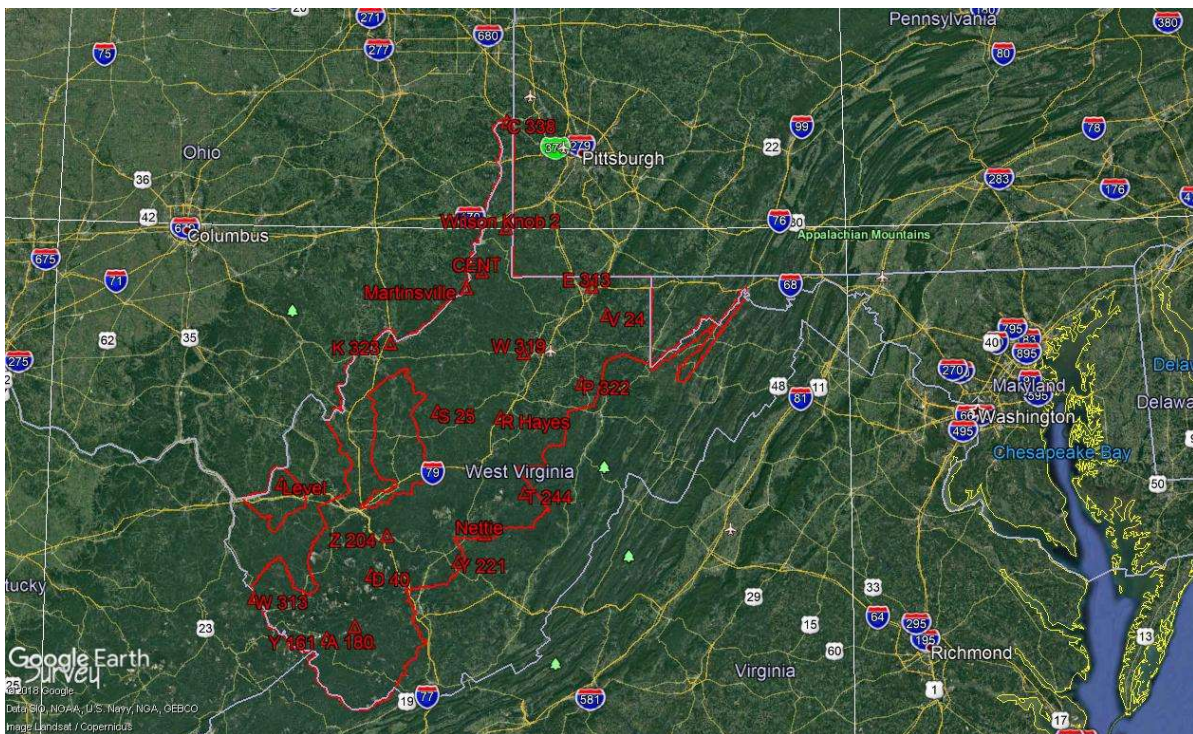
Eighteen (18) existing NGS monument listed in the NSRS database were located as an additional QA/QC method to check the horizontal and vertical accuracy of the VRS network as well as being the primary project control monuments designated as KY2952, JW1512, JW1043, JW0338, JW1091, JX1767, JW0969, AA9347, HX1183, HX1904, AA9351, HY0047, GY0228, GX3470, GX1344, HY0481 and HY0481 The results are as follows:

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

UTM 17									
	Observed Values			Data Sheet Values					
PT. #	NORTHING	EASTING	ELEVS.	NORTHING	EASTING	ELEVS.	Δ X	Δ Y	Δ Z
C338	4496955.807	536805.362	230.101	4,496,955.801	536,805.346	230.135	0.006	0.016	-0.034
DAN	4383446.366	680574.560	881.926	4,383,446.368	680,574.568	881.892	-0.002	-0.008	0.034
E313	4391652.859	592696.042	377.934	4,391,652.836	592,696.054	377.956	0.023	-0.012	-0.022
L18	4357382.700	673135.190	313.896	4,357,382.697	673,135.197	313.893	0.003	-0.007	0.003
P322	4329537.571	586885.569	556.886	4,329,537.569	586,885.572	556.874	0.002	-0.003	0.012
W319	4348724.127	549560.532	365.151	4,348,724.117	549,560.521	365.178	0.010	0.011	-0.027
V 24	4373647.420	602833.165	523.991	4,373,647.415	602,833.163	524.016	0.005	0.002	-0.025
R HAYES	4307214.159	535046.749	368.648	4,307,214.164	535,046.750	368.610	-0.005	-0.001	0.038
W319RC	4348724.113	549560.536	365.171	4,348,724.117	549,560.521	365.178	-0.004	0.015	-0.007
Y-221	4214550.149	508764.378	688.545	4,214,550.160	508,764.353	688.519	-0.011	0.025	0.026
Z-204	4230316.127	462268.355	188.167	4,230,316.117	462,268.347	188.181	0.010	0.008	-0.014
12V_A	4255341.768	395133.072	172.957	4,255,341.786	395,133.073	173.000	-0.018	-0.001	-0.043
** J116	4269200.777	388234.914	178.195	N/A	N/A	178.174	N/A	N/A	0.021
** K144	4188116.310	409505.653	209.100	N/A	N/A	209.094	N/A	N/A	0.006
*KEEPORT	4161624.900	450697.193	533.525	4,161,624.900	450,697.185	N/A	0.000	0.008	N/A
**L182	4133190.789	460996.407	507.949	N/A	N/A	507.900	N/A	N/A	0.049
**R38	4252139.855	388114.406	175.079	N/A	N/A	175.087	N/A	N/A	-0.008
**Y161	4163323.376	423506.539	252.500	N/A	N/A	252.478	N/A	N/A	0.022

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 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/ELEVATIONS_

Point ID	Northing	Easting	Elevation
GCP's Albers Equal Area NAD83 (2011), NAVD88 (METERS)			
GCP-1	1791587.486	1164657.227	168.373
GCP-2	1782197.061	1178639.527	183.962
GCP3	1776005.681	1185121.096	211.519
GCP-4	1788648.156	1192388.577	191.480
GCP-5	1790993.568	1182623.415	174.372
GCP-6	1797039.488	1175468.899	172.239
GCP-7	1804000.658	1178734.112	166.210
GCP-8	1800061.505	1188016.480	196.441
GCP-9	1797664.516	1202408.462	221.180
GCP-10	1806480.072	1197545.296	280.435
GCP-11	1814184.320	1182542.714	171.557
GCP-12	1796647.188	1228837.551	186.570
GCP-13	1812475.557	1251092.547	219.143
GCP-14	1818697.817	1235755.733	194.187
GCP-15	1849757.289	1239341.410	206.865
GCP-16	1857599.521	1226902.087	189.227
GCP-17	1876357.226	1215973.587	180.999
GCP-18	1896781.370	1220574.069	196.775
GCP-19	1894678.694	1233890.039	188.178
GCP-20	1912336.411	1238148.080	204.819
GCP-21	1900775.948	1254719.712	341.176
GCP-101	1732486.958	1180184.502	189.467
GCP-102	1741917.924	1190673.037	244.673
GCP-103	1753466.609	1195579.559	330.891
GCP-104	1736040.299	1200324.241	297.569
GCP-105	1726217.250	1192081.068	197.081
GCP-106	1724509.756	1207487.825	487.955
GCP-107	1735730.116	1216572.633	208.118
GCP-108	1714253.322	1203561.630	249.769
GCP-109	1718031.354	1218802.499	341.818
GCP-110	1727376.695	1229831.209	238.411
GCP-111	1717111.732	1231887.749	234.131
GCP-112	1703516.990	1223630.463	259.554
GCP-113	1708383.490	1237306.300	319.377
GCP-114	1711236.960	1254422.306	369.388
GCP-115	1693126.360	1258494.380	401.092
GCP-116	1695634.078	1230454.694	288.241
GCP-117	1683066.225	1241346.066	357.470

GCP-118	1675529.907	1254397.404	450.196
GCP-119	1699381.815	1261802.806	525.812
GCP-120	1692227.182	1273577.444	571.460
GCP-201	1694955.574	1282307.696	933.217
GCP-202	1712097.899	1259998.078	391.691
GCP-203	1722789.783	1248438.228	378.814
GCP-204	1737510.936	1223269.035	505.766
GCP-205	1762758.651	1226912.430	209.853
GCP-206	1745850.651	1242616.581	291.480
GCP-207	1733697.526	1268474.150	604.054
GCP-208	1717416.415	1278799.479	495.792
GCP-209	1720688.031	1295287.404	918.274
GCP-210	1737347.709	1284109.640	771.657
GCP-211	1753006.843	1269841.813	416.876
GCP-212	1764038.579	1249077.806	225.900
GCP-213	1772239.557	1241173.220	214.069
GCP-214	1779583.185	1223531.528	227.379
GCP-215	1792314.529	1220603.710	184.530
GCP-216	1798301.792	1235682.658	181.263
GCP-217	1781734.029	1251765.800	187.899
GCP-218	1771567.052	1264595.135	232.810
GCP-219	1760740.812	1286268.022	597.104
GCP-220	1767013.917	1304930.043	701.413
GCP-221	1779099.433	1288419.887	407.879
GCP-222	1781530.196	1269728.816	194.691
GCP-223	1789997.816	1263955.814	259.052
GCP-224	1804028.277	1251102.445	232.651
GCP-225	1808333.418	1262969.673	308.109
GCP-226	1804594.171	1271961.580	368.267
GCP-227	1788719.342	1274796.133	451.979
GCP-228	1801703.530	1262185.195	294.546
GCP-229	1789848.023	1284072.029	214.634
GCP-230	1784311.414	1304694.794	611.826
GCP-231	1791819.587	1291143.421	319.895
GCP-232	1800233.807	1278485.202	299.461
GCP-233	1816670.669	1269188.244	196.550
GCP-234	1815294.215	1284133.195	215.115
GCP-235	1824851.362	1278236.558	241.338
GCP-236	1800280.010	1301122.415	465.653
GCP-237	1797677.447	1312512.548	657.863
GCP-238	1795616.287	1328031.167	879.306
GCP-239	1813220.632	1342404.589	695.187

GCP-240	1817318.346	1323301.432	755.186
GCP-241	1818592.055	1302511.438	342.886
GCP-242	1828921.991	1298464.754	249.085
GCP-243	1832848.007	1285208.846	291.891
GCP-244	1850176.645	1268717.260	233.635
GCP-245	1843017.238	1296917.057	283.421
GCP-246	1842882.646	1313495.217	255.977
GCP-247	1836564.814	1335558.814	377.286
GCP-248	1854812.314	1338504.155	390.851
GCP-249	1863039.668	1351535.351	565.134
GCP-250	1869126.348	1330013.629	330.321
GCP-251	1867951.880	1306193.459	230.420
GCP-252	1860292.506	1287151.934	220.476
GCP-253	1866169.476	1275527.987	211.209
GCP-254	1866713.054	1262545.779	309.855
GCP-301	2060889.010	1286111.780	227.431
GCP-302	2043452.031	1288746.511	219.221
GCP-303	2029233.349	1291834.106	217.493
GCP-304	2038490.353	1296579.185	366.829
GCP-305	2005086.877	1302956.923	399.664
GCP-306	1996087.087	1291963.695	209.652
GCP-307	2011180.604	1294546.648	365.568
GCP-308	1981491.493	1287836.534	207.774
GCP-309	1964975.718	1279991.884	192.706
GCP-310	1973550.814	1302697.324	318.443
GCP-311	1949865.958	1281901.684	191.209
GCP-312	1961393.137	1316731.929	327.569
GCP-313	1942959.991	1298771.061	218.040
GCP-314	1941469.062	1317613.982	324.871
GCP-315	1966726.982	1330955.580	294.360
GCP-316	1951673.169	1335495.227	302.761
GCP-317	1941597.124	1346981.434	308.626
GCP-318	1943847.158	1327405.444	298.231
GCP-319	1963215.522	1355459.589	293.657
GCP-320	1969300.783	1385916.812	549.915
GCP-321	1951425.604	1361564.124	466.602
GCP-322	1948976.546	1388113.512	373.641
GCP-323	1968633.796	1367692.209	387.479
GCP-324	1948298.312	1397221.431	797.526
GCP-325	1958357.800	1398066.356	805.786
GCP-326	1969937.004	1394501.009	624.732
GCP-327	1975790.493	1397793.025	688.512

GCP-328	1909050.436	1246072.422	190.474
GCP-329	1908487.667	1279419.404	278.281
GCP-330	1939308.907	1272766.042	254.704
GCP-331	1914760.806	1263028.405	326.524
GCP-332	1932883.431	1280970.307	227.730
GCP-333	1914407.173	1313455.444	327.073
GCP-334	1912351.061	1295216.973	255.381
GCP-335	1923286.357	1294401.519	226.468
GCP-336	1928454.428	1317001.970	308.518
GCP-337	1917251.745	1330992.125	305.303
GCP-338	1915684.267	1350153.486	328.962
GCP-339	1934945.974	1340821.753	290.479
GCP-340	1926603.625	1332555.166	286.506
GCP-341	1911186.650	1370361.334	430.513
GCP-342	1928861.628	1359881.152	378.850
GCP-343	1926292.355	1403327.491	764.023
GCP-344	1946952.794	1395142.993	791.107
GCP-345	1937090.227	1380199.105	557.354
GCP-346	1904569.801	1271769.913	254.909
GCP-347	1869535.930	1269399.077	207.896
GCP-348	1873692.777	1278837.760	332.354
GCP-349	1883481.192	1260406.638	202.058
GCP-350	1890981.790	1274618.615	230.850
GCP-351	1899945.356	1258471.511	224.187
GCP-352	1888154.277	1320936.587	319.378
GCP-353	1874780.740	1299971.552	231.957
GCP-354	1881449.292	1282189.972	253.394
GCP-355	1901011.319	1289944.841	259.637
GCP-356	1881921.342	1300603.551	229.424
GCP-357	1899819.830	1323508.151	304.015
GCP-358	1881692.407	1334948.879	387.349
GCP-359	1886254.517	1349888.064	468.847
GCP-360	1906014.870	1340718.111	309.763
GCP-361	1897389.580	1353300.689	429.027
GCP-362	1896376.690	1330151.370	308.355
GCP-363	1886333.154	1365855.991	646.800
GCP-364	1907229.095	1359802.756	397.523
GCP-365	1896660.685	1368450.344	552.932
GCP-366	1870893.442	1289290.548	220.054
GCP-367	1872104.738	1317773.092	351.598
GCP-368	1869930.225	1304466.870	248.937
GCP-369	1876113.124	1325265.982	337.092

GCP-370	1883361.746	1355307.064	516.961
GCP-371	1870022.455	1342424.315	541.452
GCP-372	1923324.305	1410888.717	817.554
GCP-373	1929659.403	1414581.674	715.034
GCP-374	1935959.308	1426743.296	702.766
GCP-375	1956384.101	1435262.323	317.766
GCP-376	1944691.129	1430587.834	696.478
GCP-377	1948987.115	1442211.542	273.078
GCP-378	1944855.753	1443369.085	425.302
GCP-379	1938127.135	1437219.699	394.218
GCP-380	1916430.283	1431066.748	477.136
GCP-381	1975799.618	1457563.139	216.742
GCP-382	1966029.324	1449795.807	243.326
GCP-383	1954459.813	1443138.512	254.906

4. *GPS OBSERVATIONS*

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
GCP					
GCP-1	1/21/2019	21	11:37	1/21/2019	11:40
GCP-2	1/25/2019	25	13:35	2/11/2019	13:33
GCP-3	2/15/2019	46	11:19	N/A	N/A
GCP-4	1/28/2019	28	12:47	1/28/2019	13:02
GCP-5	1/24/2019	24	16:00	1/24/2019	16:05
GCP-6	1/18/2019	18	12:30	N/A	N/A
GCP-7	1/18/2019	18	13:00	N/A	N/A
GCP-8	1/18/2019	18	15:50	N/A	N/A
GCP-9	1/21/2019	21	15:55	1/21/2019	16:00
GCP-10	1/22/2019	22	10:00	1/22/2019	10:03
GCP-11	1/24/2019	24	13:10	1/24/2019	13:15
GCP-12	1/23/2019	23	10:57	2/2/2019	17:31
GCP-13	1/24/2019	24	11:40	N/A	N/A
GCP-14	1/24/2019	24	10:30	N/A	N/A
GCP-15	2/16/2019	47	14:30	2/17/2019	12:30
GCP-16	2/16/2019	47	15:45	2/17/2019	13:35
GCP-17	2/15/2019	46	17:35	N/A	N/A
GCP-18	2/14/2019	45	15:14	N/A	N/A
GCP-19	2/15/2019	46	7:00	N/A	N/A
GCP-20	2/14/2019	45	13:43	N/A	N/A
GCP-21	1/14/2019	14	9:11	1/15/2019	12:22
GCP-101	1/23/2019	23	18:00	N/A	N/A
GCP-102	2/15/2019	46	17:04	N/A	N/A
GCP-103	2/15/2019	46	14:22	N/A	N/A
GCP-104	1/24/2019	24	8:30	N/A	N/A
GCP-105	1/23/2019	23	14:10	1/28/2019	17:15
GCP-106	2/14/2019	45	18:00	N/A	N/A
GCP-107	1/22/2019	22	10:00	1/28/2019	19:15
GCP-108	2/15/2019	46	12:00	N/A	N/A
GCP-109	2/14/2019	45	14:30	N/A	N/A
GCP-110	1/29/2019	29	13:05	2/21/2019	12:30
GCP-111	1/29/2019	29	17:25	N/A	N/A
GCP-112	2/5/2019	36	9:20	N/A	N/A
GCP-113	2/14/2019	45	8:22	N/A	N/A
GCP-114	2/11/2019	43	11:45	2/18/2019	15:15

GCP-115	2/8/2019	39	8:00	2/8/2019	8:05
GCP-116	2/6/2019	37	12:20	2/20/2019	9:35
GCP-117	2/14/2019	45	11:20	N/A	N/A
GCP-118	2/13/2019	44	10:00	N/A	N/A
GCP-119	2/8/2019	39	10:46	2/13/2019	13:00
GCP-120	2/7/2019	38	10:41	N/A	N/A
GCP-201	3/1/2019	60	12:00	3/14/2019	15:50
GCP-202	3/1/2019	60	13:40	N/A	N/A
GCP-203	3/1/2019	60	12:21	N/A	N/A
GCP-204	3/12/2019	71	18:00	N/A	N/A
GCP-205	1/23/2019	23	14:32	2/3/2019	13:21
GCP-206	1/26/2019	26	16:33	2/3/2019	17:32
GCP-207	3/1/2019	60	14:23	3/1/2019	14:31
GCP-208	3/1/2019	60	15:30	3/15/2019	9:00
GCP-209	3/1/2019	60	10:40	3/15/2019	10:30
GCP-210	3/1/2019	60	10:00	N/A	N/A
GCP-211	1/27/2019	27	11:25	N/A	N/A
GCP-212	1/26/2019	26	12:00	N/A	N/A
GCP-213	1/26/2019	26	11:03	N/A	N/A
GCP-214	1/23/2019	23	13:42	2/3/2019	10:27
GCP-215	1/23/2019	23	12:17	2/3/2019	9:35
GCP-216	1/23/2019	23	10:32	N/A	N/A
GCP-217	1/25/2019	25	9:50	2/2/2019	16:30
GCP-218	1/27/2019	27	9:32	N/A	N/A
GCP-219	1/27/2019	27	14:10	N/A	N/A
GCP-220	2/4/2019	35	11:33	N/A	N/A
GCP-221	1/27/2019	27	15:24	2/4/2019	9:26
GCP-222	1/25/2019	25	12:14	2/4/2019	8:35
GCP-223	1/25/2019	25	11:14	N/A	N/A
GCP-224	1/24/2019	24	13:03	N/A	N/A
GCP-225	1/29/2019	29	10:07	N/A	N/A
GCP-226	1/25/2019	25	16:27	N/A	N/A
GCP-227	1/25/2019	25	13:11	N/A	N/A
GCP-228	1/24/2019	24	16:08	N/A	N/A
GCP-229	1/28/2019	28	11:12	N/A	N/A
GCP-230	1/27/2019	27	16:28	N/A	N/A
GCP-231	1/28/2019	28	11:37	N/A	N/A
GCP-232	1/25/2019	25	14:14	N/A	N/A
GCP-233	1/29/2019	29	9:26	N/A	N/A
GCP-234	1/29/2019	29	11:33	N/A	N/A

GCP-235	1/29/2019	29	10:56	N/A	N/A
GCP-236	2/4/2019	35	12:54	2/4/2019	12:57
GCP-237	1/28/2019	28	14:07	1/28/2019	14:10
GCP-238	1/28/2019	28	15:09	1/28/2019	15:12
GCP-239	1/28/2019	28	15:44	N/A	N/A
GCP-240	2/4/2019	35	14:10	2/4/2019	14:13
GCP-241	1/28/2019	28	16:18	1/28/2019	16:21
GCP-242	1/29/2019	29	12:31	N/A	N/A
GCP-243	2/12/2019	43	9:40	2/18/2019	11:40
GCP-244	2/18/2019	49	7:30	2/19/2019	7:30
GCP-245	2/12/2019	43	12:20	2/18/2019	14:05
GCP-246	2/7/2019	38	22:35	N/A	N/A
GCP-247	1/29/2019	29	16:30	1/29/2019	16:33
GCP-248	2/4/2019	35	12:45	2/5/2019	12:35
GCP-249	2/3/2019	34	15:00	N/A	N/A
GCP-250	2/4/2019	35	8:40	2/5/2019	8:10
GCP-251	2/11/2019	42	15:35	N/A	N/A
GCP-252	2/18/2019	49	9:25	N/A	N/A
GCP-253	2/14/2019	45	11:15	2/19/2019	10:20
GCP-254	2/14/2019	45	13:20	2/19/2019	12:20
GCP-301	2/5/2019	36	16:13	N/A	N/A
GCP-302	2/5/2019	36	17:21	N/A	N/A
GCP-303	2/5/2019	36	12:42	N/A	N/A
GCP-304	2/5/2019	36	13:30	N/A	N/A
GCP-305	2/6/2019	37	9:46	2/7/2019	9:27
GCP-306	2/6/2019	37	9:20	2/7/2019	9:07
GCP-307	2/5/2019	36	10:47	N/A	N/A
GCP-308	2/6/2019	37	15:52	N/A	N/A
GCP-309	2/16/2019	47	9:15	2/16/2019	9:18
GCP-310	2/6/2019	37	12:43	2/18/2019	11:06
GCP-311	2/16/2019	47	15:53	2/17/2019	22:13
GCP-312	2/3/2019	34	13:08	N/A	N/A
GCP-313	2/16/2019	47	11:37	N/A	N/A
GCP-314	2/4/2019	35	12:19	2/4/2019	12:22
GCP-315	2/3/2019	34	12:01	2/3/2019	12:04
GCP-316	1/22/2019	22	15:20	2/3/2019	10:30
GCP-317	1/23/2019	23	9:20	1/24/2019	9:54
GCP-318	2/3/2019	34	12:02	2/3/2019	12:05
GCP-319	1/22/2019	22	10:41	1/24/2019	12:25
GCP-320	1/23/2019	23	10:56	N/A	N/A

GCP-321	1/23/2019	23	9:53	N/A	N/A
GCP-322	1/22/2019	22	15:12	N/A	N/A
GCP-323	1/22/2019	22	12:46	1/24/2019	12:58
GCP-324	1/22/2019	22	13:23	1/24/2019	23:03
GCP-325	1/22/2019	22	13:52	N/A	N/A
GCP-326	1/23/2019	23	12:44	1/24/2019	14:49
GCP-327	1/22/2019	22	12:10	1/24/2019	14:06
GCP-328	2/14/2019	45	12:02	N/A	N/A
GCP-329	2/2/2019	33	12:33	2/2/2019	12:36
GCP-330	2/16/2019	46	15:00	2/17/2019	10:55
GCP-331	2/14/2019	45	11:08	2/15/2019	13:37
GCP-332	2/16/2019	47	14:00	2/17/2019	13:34
GCP-333	1/23/2019	23	15:01	2/2/2019	10:52
GCP-334	2/2/2019	33	11:20	2/4/2019	10:27
GCP-335	2/2/2019	33	16:20	N/A	N/A
GCP-336	2/4/2019	35	10:30	N/A	N/A
GCP-337	1/23/2019	23	12:47	2/2/2019	10:26
GCP-338	2/1/2019	32	10:31	2/1/2019	10:34
GCP-339	1/22/2019	22	17:17	N/A	N/A
GCP-340	1/23/2019	23	11:56	N/A	N/A
GCP-341	2/1/2019	32	12:30	2/1/2019	12:33
GCP-342	1/22/2019	22	9:35	1/24/2019	9:03
GCP-343	1/22/2019	22	12:06	N/A	N/A
GCP-344	1/22/2019	22	14:47	N/A	N/A
GCP-345	1/22/2019	22	16:18	N/A	N/A
GCP-346	2/14/2019	45	9:48	2/14/2019	9:51
GCP-347	2/14/2019	45	13:55	2/19/2019	11:45
GCP-348	2/14/2019	45	10:00	N/A	N/A
GCP-349	2/15/2019	46	9:33	N/A	N/A
GCP-350	2/15/2019	46	11:00	2/19/2019	14:00
GCP-351	2/14/2019	45	9:26	2/15/2019	12:35
GCP-352	2/3/2019	34	8:40	N/A	N/A
GCP-353	2/11/2019	42	16:30	2/21/2019	12:35
GCP-354	2/13/2019	44	14:15	N/A	N/A
GCP-355	2/13/2019	44	9:45	N/A	N/A
GCP-356	2/2/2019	33	13:30	2/21/2019	13:35
GCP-357	2/2/2019	33	8:25	N/A	N/A
GCP-358	2/3/2019	34	21:25	N/A	N/A
GCP-359	1/31/2019	31	11:13	2/2/2019	13:50
GCP-360	2/2/2019	33	11:13	N/A	N/A

GCP-361	2/2/2019	33	12:15	N/A	N/A
GCP-362	2/2/2019	33	7:30	N/A	N/A
GCP-363	1/31/2019	31	12:36	N/A	N/A
GCP-364	1/31/2019	31	15:51	N/A	N/A
GCP-365	1/31/2019	31	14:13	2/2/2019	15:02
GCP-366	2/14/2019	45	8:10	2/21/2019	8:55
GCP-367	2/7/2019	48	7:50	N/A	N/A
GCP-368	2/11/2019	42	15:15	N/A	N/A
GCP-369	2/4/2019	35	7:20	2/5/2019	7:00
GCP-370	2/3/2019	34	11:25	2/5/2019	16:45
GCP-371	2/4/2019	35	9:25	2/5/2019	15:10
GCP-372	1/30/2019	30	16:35	N/A	N/A
GCP-373	1/30/2019	30	16:04	N/A	N/A
GCP-374	1/30/2019	30	14:44	N/A	N/A
GCP-375	1/30/2019	30	10:12	N/A	N/A
GCP-376	1/30/2019	30	13:41	N/A	N/A
GCP-377	1/29/2019	29	13:47	2/13/2019	11:23
GCP-378	1/29/2019	29	14:16	2/13/2019	12:20
GCP-379	1/29/2019	29	15:06	2/13/2019	12:36
GCP-380	1/29/2019	29	16:36	N/A	N/A
GCP-381	1/24/2019	24	16:04	2/13/2019	9:49
GCP-382	1/24/2019	24	16:06	N/A	N/A
GCP-383	1/30/2019	30	9:40	2/13/2019	11:08

5.   *POINT COMPARISON*

GCP-1	GCP CK-1	0.019	-0.012	-0.020
GCP-2	GCP CK-2	-0.022	-0.013	0.008
GCP-4	GCP CK-4	-0.010	-0.018	0.021
GCP-5	GCP CK-5	-0.004	-0.004	0.002
GCP-9	GCP CK-9	-0.016	-0.014	-0.010
GCP-10	GCP CK-10	-0.003	0.000	-0.001
GCP-11	GCP CK-11	0.005	0.018	0.012
GCP-12	GCP CK-12	-0.011	0.000	0.036
GCP-15	GCP CK-15	0.000	0.012	0.010
GCP-16	GCP CK-16	0.017	-0.011	-0.039
GCP-21	GCP CK-21	-0.025	0.002	0.032
GCP-105	GCP CK-105	-0.004	0.013	0.010
GCP-107	GCP CK-107	0.011	-0.003	-0.010
GCP-110	GCP CK-110	0.005	0.001	0.022
GCP-114	GCP CK-114	0.031	0.017	-0.003
GCP-115	GCP CK-115	-0.005	0.002	0.024
GCP-116	GCP CK-116	0.034	0.013	0.034
GCP-119	GCP CK-119	0.008	0.002	0.008
GCP-201	GCP CK-201	0.000	0.005	0.008
GCP-205	GCP CK-205	-0.036	-0.009	0.027
GCP-206	GCP CK-206	0.013	0.029	-0.017
GCP-207	GCP CK-207	-0.004	0.000	-0.002
GCP-208	GCP CK-208	0.017	0.010	-0.015
GCP-209	GCP CK-209	0.003	0.002	0.001
GCP-214	GCP CK-214	0.017	-0.001	-0.009
GCP-215	GCP CK-215	-0.021	-0.031	0.001
GCP-217	GCP CK-217	0.002	-0.032	0.009
GCP-221	GCP CK-221	-0.033	-0.035	-0.004
GCP-222	GCP CK-222	-0.008	-0.009	0.000
GCP-236	GCP CK-236	-0.004	-0.002	0.021
GCP-237	GCP CK-237	0.012	0.001	0.015
GCP-238	GCP CK-238	0.004	0.001	0.003
GCP-240	GCP CK-240	0.010	-0.002	-0.022
GCP-241	GCP CK-241	0.012	-0.003	0.014
GCP-243	GCP CK-243	-0.022	0.007	0.026
GCP-244	GCP CK-244	-0.005	0.010	-0.010
GCP-245	GCP CK-245	-0.016	-0.009	0.001
GCP-247	GCP CK-247	0.002	0.002	0.002
GCP-248	GCP CK-248	-0.001	0.009	-0.039
GCP-250	GCP CK-250	0.005	0.006	-0.036
GCP-253	GCP CK-253	-0.011	-0.001	0.009

GCP-254	GCP CK-254	0.000	0.004	-0.035
GCP-305	GCP CK-305	-0.001	0.004	0.015
GCP-306	GCP CK-306	-0.005	0.013	-0.009
GCP-309	GCP CK-309	0.001	-0.008	-0.024
GCP-310	GCP CK-310	-0.004	0.002	-0.010
GCP-311	GCP CK-311	-0.011	0.013	0.007
GCP-314	GCP CK-314	-0.007	0.003	-0.004
GCP-315	GCP CK-315	0.013	-0.005	0.001
GCP-316	GCP CK-316	-0.001	0.028	-0.018
GCP-317	GCP CK-317	0.007	-0.012	0.032
GCP-318	GCP CK-318	-0.003	0.000	0.007
GCP-319	GCP CK-319	0.008	-0.010	0.010
GCP-323	GCP CK-323	-0.002	-0.014	0.009
GCP-324	GCP CK-324	-0.010	-0.003	0.006
GCP-326	GCP CK-326	-0.008	-0.027	0.015
GCP-327	GCP CK-327	-0.012	0.004	0.033
GCP-329	GCP CK-329	-0.007	0.005	-0.004
GCP-330	GCP CK-330	-0.004	0.010	-0.003
GCP-331	GCP CK-331	0.003	0.007	0.008
GCP-332	GCP CK-332	0.003	0.008	0.025
GCP-333	GCP CK-333	0.010	-0.022	-0.015
GCP-334	GCP CK-334	-0.011	-0.002	-0.005
GCP-337	GCP CK-337	0.003	0.000	-0.008
GCP-338	GCP CK-338	0.001	0.000	-0.006
GCP-341	GCP CK-341	-0.007	-0.019	0.010
GCP-342	GCP CK-342	-0.009	0.012	0.037
GCP-346	GCP CK-346	0.000	-0.001	-0.001
GCP-347	GCP CK-347	0.000	0.001	-0.006
GCP-350	GCP CK-350	0.023	0.000	-0.006
GCP-351	GCP CK-351	-0.005	-0.002	0.015
GCP-353	GCP CK-353	-0.011	0.001	-0.027
GCP-356	GCP CK-356	0.009	0.015	0.002
GCP-359	GCP CK-359	-0.004	0.006	-0.034
GCP-365	GCP CK-365	0.006	-0.010	-0.028
GCP-366	GCP CK-366	-0.020	0.000	0.017
GCP-369	GCP CK-369	0.021	-0.013	0.005
GCP-370	GCP CK-370	0.010	-0.004	0.008
GCP-371	GCP CK-371	0.012	-0.004	0.009
GCP-377	GCP CK-377	0.004	0.007	-0.010
GCP-378	GCP CK-378	0.002	0.001	0.001
GCP-379	GCP CK-379	0.005	-0.004	-0.012
GCP-381	GCP CK-381	-0.003	-0.003	-0.003

GCP-383	GCP CK-383	0.001	-0.004	0.005