

Check Point Survey Report

Puerto Rico and USVI, QL1 Topographic LiDAR
USGS Contract: G16PC00020
Task Order Number: 140G0218F0146

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

1.1 *Project Summary*

Dewberry Engineers Inc. is under contract to the United States Geological Survey to provide 232 Check Points in the Commonwealth of Puerto Rico and US Virgin Islands. 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 July 5, 2018 thru August 15, 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 Puerto Rico State Plane, Zone 5200, 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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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 232 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 Engineers Inc. office located in Lanham, MD was tied to a Real Time Network operated by HLCM Group. 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.

Twenty five (23) 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 DI1789, AB9841, DE5485, AB9844, AB9846, DO1063, DE5532, AB9842, DE5470, DI1785, AB9838, DN8538, DN8632, DK7148, DK7153, TV1496, DK7160, DL3600, DL3633, DL3616, DL3609, DL3595, DL3914, DL3915 & DL3918. The results are as follows:

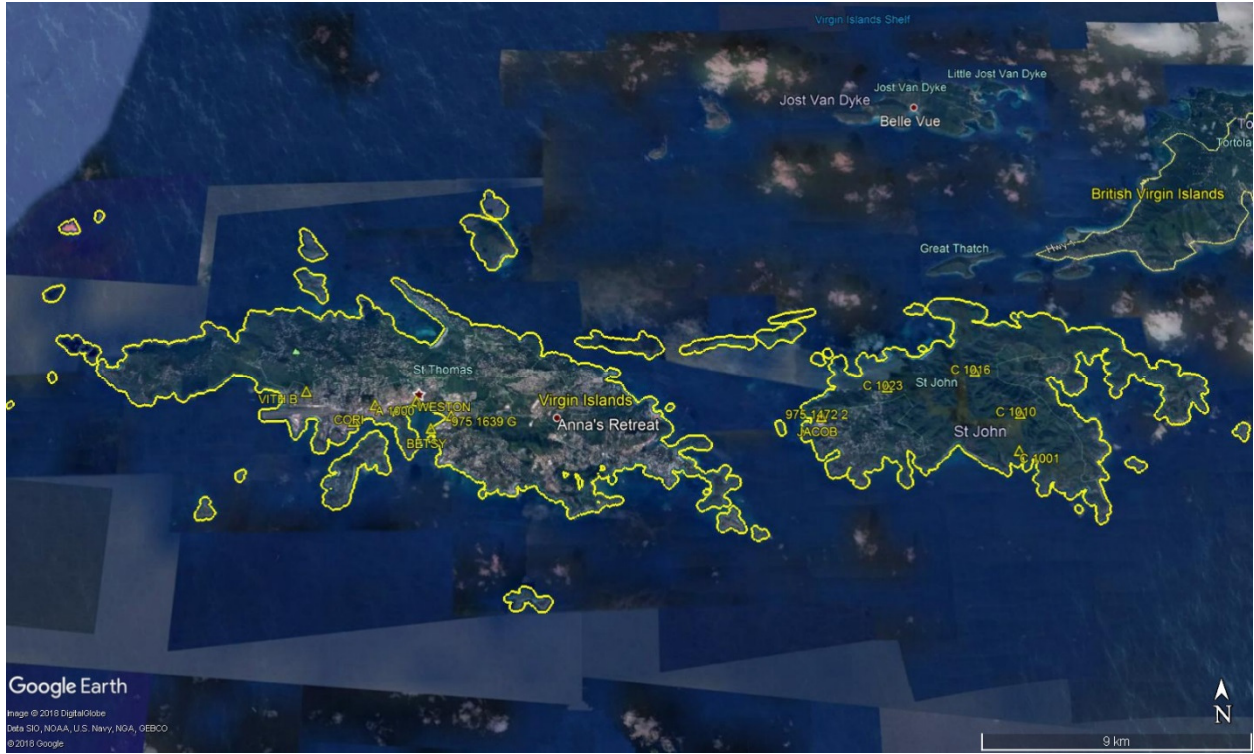
PT. #	Observed Values			Data Sheet Values			ΔX	ΔY	ΔZ
	NORTHING	EASTING	ELEVS.	NORTHING	EASTING	ELEVS.			
GPS-62	246946.52	123063.99	4.00	246946.52	123063.99	3.99	0.00	0.00	0.01
LAJAS 2	226494.73	144332.19	87.92	226494.70	144332.15	87.91	0.03	0.04	0.01
BERRIOS	267123.14	201085.70	43.39	267123.13	201085.71	43.37	0.01	-0.01	0.02
COCO	218681.52	219613.37	45.30	218681.52	219613.40	45.41	0.00	-0.03	-0.11
HUMACAO2	233305.13	264562.75	33.27	233305.10	264562.78	33.25	0.03	-0.04	0.02
L1017	255455.81	284113.29	3.45	N/A	N/A	3.39	N/A	N/A	0.06
M1005	270891.01	140261.24	108.21	270891.01	140261.24	108.20	0.00	-0.01	0.00
MAGAS	220084.48	164710.32	8.46	220084.46	164710.28	8.45	0.02	0.04	0.01
SANABRIA	265276.00	230024.22	3.91	265276.02	230024.23	3.93	-0.02	-0.01	-0.02
UPRM GPS13	242403.83	125328.97	18.05	242403.85	125328.96	18.28	-0.01	0.01	-0.23
UTUADO	248478.15	170061.98	166.46	248478.16	170061.92	166.48	0.00	0.06	-0.02
9752695H	229319.85	301787.86	3.68	N/A	N/A	3.65	N/A	N/A	0.02
B1018	253301.91	320807.78	0.99	N/A	N/A	1.01	N/A	N/A	-0.03
B1002	188765.36	377772.03	38.77	188765.38	377772.02	38.74	-0.02	0.01	0.03
B1012	190198.22	381702.32	69.98	190198.21	381702.32	69.96	0.01	0.00	0.02
975 1364 C	191304.12	383916.57	1.66	191304.12	383916.56	1.66	0.00	0.01	0.00
975 1472 2	256040.33	373353.46	0.75	N/A	N/A	0.79	N/A	N/A	-0.04
C 1016	257653.02	378975.89	284.12	N/A	N/A	284.14	N/A	N/A	-0.03
C 1023	257066.78	375772.29	176.89	N/A	N/A	176.89	N/A	N/A	0.00
JACOB	256029.05	373358.51	0.75	N/A	N/A	0.81	N/A	N/A	-0.06
A-1000	256555.01	357259.70	4.64	256555.00	357259.72	4.67	0.01	-0.01	-0.03

CORI	255955.17	356522.98	1.13	N/A	N/A	1.17	N/A	N/A	-0.04
VITH B	257072.10	354738.47	40.40	257072.08	354738.50	40.43	0.01	-0.03	-0.03

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 HLCM Group network 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 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/ELEVATIONS***

POINT ID	NORTHING (m)	EASTING (m)	ELEV. (m)
Puerto Rico USVI Zone 5200 NAD 83 (2011), Meters			
Check Points - NVA			
Puerto Rico, Vieques and Culebra			
NVA-001	216521.47	118857.83	12.06
NVA-002	215643.56	134951.85	0.74
NVA-003	215315.59	143719.43	30.42
NVA-004	222178.58	154289.93	58.37
NVA-005	219305.33	164551.37	1.58
NVA-006	231317.58	167707.58	896.44
NVA-007	230087.65	141709.24	208.02
NVA-008	229620.52	135309.31	40.96
NVA-009	232761.18	129543.83	31.66
NVA-010	227867.51	120082.28	11.42
NVA-011	240155.07	125438.65	11.89
NVA-012	240058.23	135386.52	354.18
NVA-013	234095.68	142816.98	831.05
NVA-014	239950.26	156350.09	602.12
NVA-015	237364.50	168904.61	485.48
NVA-016	252136.87	123560.13	28.31
NVA-017	247012.55	137606.29	373.76
NVA-018	247719.87	155164.94	517.48
NVA-019	250566.28	160985.47	399.42
NVA-020	248489.37	170081.49	166.72
NVA-021	257370.43	160469.37	341.01
NVA-022	262471.77	148136.25	199.84
NVA-023	259403.72	134591.59	75.37
NVA-024	255612.41	113653.90	4.48
NVA-025	272189.04	124468.96	75.83
NVA-026	266558.19	143571.24	186.12
NVA-027	269293.75	136469.87	146.55
NVA-028	269568.29	151002.92	103.70
NVA-029	265763.20	161893.68	135.38
NVA-030	270821.28	169951.60	10.58
NVA-031	272010.37	184700.60	3.35
NVA-032	267132.41	188399.43	9.66

NVA-033	267208.26	200976.29	30.41
NVA-034	269470.01	209284.85	9.27
NVA-035	264090.00	219073.65	9.56
NVA-036	251571.67	220515.54	100.34
NVA-037	255576.11	205981.99	149.18
NVA-038	258675.53	195579.71	99.71
NVA-039	257533.55	185209.89	187.30
NVA-040	255349.98	174137.03	324.14
NVA-041	248010.04	171661.78	137.08
NVA-042	246105.56	182210.95	660.21
NVA-043	248743.91	204075.87	610.03
NVA-044	245659.79	212863.19	538.11
NVA-045	242941.10	222240.00	207.00
NVA-046	239036.34	221555.15	506.61
NVA-047	239514.43	212054.57	629.75
NVA-048	236242.40	191970.92	805.56
NVA-049	236031.58	180951.30	874.29
NVA-050	233348.19	175453.27	579.71
NVA-051	225272.60	171872.52	87.52
NVA-052	225345.53	179526.73	190.64
NVA-053	227103.50	192873.90	74.03
NVA-054	232289.38	204835.48	577.37
NVA-055	227314.62	214393.35	206.24
NVA-056	218613.07	219572.59	43.58
NVA-057	215214.49	202205.25	10.39
NVA-058	218585.22	192748.72	6.68
NVA-059	215262.53	181927.41	2.40
NVA-060	215795.81	172695.53	5.86
NVA-061	215819.93	233491.99	46.47
NVA-062	216789.86	242594.41	11.33
NVA-063	219386.78	253550.79	19.22
NVA-064	222801.74	262912.92	12.36
NVA-065	224924.90	255668.17	24.37
NVA-066	227344.72	246788.27	336.42
NVA-067	224594.54	236169.63	567.59
NVA-068	228782.82	227144.54	536.80
NVA-069	234221.85	228295.92	369.50
NVA-070	232978.89	238317.58	510.09
NVA-071	234369.16	247995.50	169.45

NVA-072	234754.53	256908.52	297.75
NVA-073	230898.69	264780.45	27.12
NVA-074	236850.81	271995.44	1.27
NVA-075	241432.65	262524.51	106.18
NVA-076	242993.88	248115.52	99.63
NVA-077	244607.93	239750.49	76.97
NVA-078	245175.37	230745.75	294.16
NVA-079	254512.22	228465.37	80.25
NVA-080	253101.14	236302.86	120.14
NVA-081	252812.49	247284.58	210.01
NVA-082	253168.41	257208.51	109.56
NVA-083	251871.41	268481.25	642.91
NVA-084	243636.34	279640.61	17.55
NVA-085	255864.22	281607.87	13.64
NVA-086	259482.54	269831.55	13.61
NVA-087	265762.18	258196.28	2.80
NVA-088	265942.64	247673.43	1.88
NVA-089	261778.07	235799.58	31.28
NVA-090	267208.53	227063.26	2.14
NVA-091	233424.05	298155.57	1.87
NVA-092	229310.57	297991.33	27.25
NVA-093	229881.63	300972.42	21.52
NVA-094	235582.45	305623.58	12.33
NVA-095	232131.71	305384.07	29.62
NVA-096	250926.85	321076.77	20.08
NVA-097	253281.06	319415.15	2.89
NVA-098	252256.17	322386.82	3.32
St. Croix			
NVA-124	185170.65	366080.50	14.34
NVA-125	189209.86	364371.43	7.59
NVA-126	192759.22	363993.96	3.65
NVA-127	191693.73	367549.69	214.01
NVA-128	188388.19	367324.90	221.42
NVA-129	186692.31	368604.86	35.26
NVA-130	186410.63	371137.14	31.14
NVA-131	185694.90	373448.71	3.18
NVA-132	189494.04	371590.04	50.54
NVA-133	191469.68	371191.91	89.76
NVA-134	195140.72	374797.19	5.95

NVA-135	189969.16	375141.53	38.83
NVA-136	187865.06	376493.36	20.34
NVA-137	187901.61	380477.31	31.87
NVA-138	192025.50	376831.53	22.74
NVA-139	193176.88	379903.33	6.09
NVA-140	191267.75	382345.19	13.10
NVA-141	188030.19	384524.99	25.76
NVA-142	189609.39	387273.42	23.39
NVA-143	191986.92	386093.58	1.53
NVA-144	191457.62	390464.24	64.19
NVA-145	192333.92	393441.89	1.95
St. John			
NVA-112	254942.74	373392.23	58.61
NVA-113	254394.10	375162.31	43.46
NVA-114	256960.92	375377.63	214.92
NVA-115	257665.98	378986.20	285.44
NVA-116	256039.38	380524.06	327.95
NVA-117	258486.86	380658.60	152.86
NVA-118	253979.64	383149.05	7.44
NVA-119	255713.93	382639.25	11.20
NVA-120	257367.69	381538.72	1.82
NVA-121	259702.00	378847.74	7.56
NVA-122	258698.92	383124.44	2.05
NVA-123	257848.58	385954.92	29.81
NVA-146	255638.92	375650.16	234.04
St. Thomas			
NVA-099	258031.50	348664.40	138.44
NVA-100	259066.04	351229.50	113.30
NVA-101	258504.73	353651.69	272.59
NVA-102	256714.49	354952.78	4.84
NVA-103	259753.12	356452.70	42.86
NVA-104	257295.71	357504.23	137.97
NVA-105	259041.57	360499.94	58.82
NVA-106	255980.88	360005.52	3.17
NVA-107	253889.21	362749.44	3.46
NVA-108	256549.54	361966.49	72.78
NVA-109	256759.24	363862.16	115.51
NVA-110	256539.12	366521.82	6.58
NVA-111	254781.09	366270.97	14.49

Check Points - VVA			
Puerto Rico, Vieques and Culebra			
VVA-001	254636.77	319512.53	107.09
VVA-002	252634.51	323425.20	56.63
VVA-003	253486.46	320714.02	1.81
VVA-004	255150.39	317591.51	2.09
VVA-005	252243.84	320160.98	4.91
VVA-006	229616.14	299345.45	26.59
VVA-007	231476.17	309724.98	9.30
VVA-008	234079.55	304901.25	40.09
VVA-009	230831.68	299690.44	77.47
VVA-010	231544.79	293645.14	6.33
VVA-011	252768.49	283160.06	10.14
VVA-012	258764.96	266865.71	30.59
VVA-013	261575.46	255646.25	6.05
VVA-014	259543.03	241995.83	51.70
VVA-015	255023.53	231063.04	46.41
VVA-016	248641.16	234988.72	426.80
VVA-017	249119.99	247325.75	65.19
VVA-018	250579.73	254391.20	154.36
VVA-019	251398.75	268137.26	721.44
VVA-020	244586.13	273614.76	60.26
VVA-021	246720.58	280170.57	151.77
VVA-022	241189.68	264869.69	120.73
VVA-023	240396.47	253347.43	227.31
VVA-024	238646.06	243750.11	304.14
VVA-025	238200.16	233433.92	455.68
VVA-026	225321.78	228659.01	311.17
VVA-027	218276.68	233790.76	80.31
VVA-028	221617.28	242816.75	72.63
VVA-029	226022.78	251502.41	250.95
VVA-030	230424.41	244286.51	541.41
VVA-031	226605.79	266491.27	52.56
VVA-032	241874.98	221302.06	203.93
VVA-033	237420.19	201245.62	860.05
VVA-033A	237416.25	201197.68	860.98
VVA-034	237259.68	183439.76	1141.72
VVA-035	234825.23	173045.13	760.31
VVA-036	223878.08	175212.02	63.71

VVA-037	219004.74	185516.91	3.57
VVA-038	231851.42	196116.06	368.09
VVA-039	219683.18	201536.87	38.92
VVA-040	229669.18	211185.64	277.69
VVA-041	221738.31	222836.75	111.43
VVA-042	249220.10	225829.78	413.88
VVA-043	246902.06	210384.57	622.74
VVA-044	243523.73	194314.27	663.71
VVA-045	245872.24	175906.76	271.59
VVA-046	254424.91	181905.70	176.33
VVA-047	268236.61	176526.41	14.45
VVA-048	265077.76	195801.75	79.73
VVA-049	255784.71	199992.50	183.66
VVA-050	269596.62	206383.75	2.99
VVA-051	266753.12	217826.22	6.02
VVA-052	258303.20	223109.33	54.88
VVA-053	264723.86	168327.78	126.31
VVA-054	265748.45	154816.01	161.96
VVA-055	267205.29	136519.78	187.78
VVA-056	272512.53	130381.01	57.83
VVA-057	258924.25	118775.76	67.24
VVA-058	253392.77	133736.03	191.98
VVA-059	257033.43	143971.90	295.09
VVA-060	256293.75	163729.85	299.80
VVA-061	248078.01	162990.71	632.75
VVA-062	246539.35	145029.42	411.67
VVA-063	246204.19	130402.60	268.63
VVA-064	239767.99	130838.26	189.64
VVA-065	238544.58	147459.76	711.38
VVA-066	239544.56	164020.89	547.32
VVA-067	232095.91	162055.38	646.59
VVA-068	229397.25	144562.55	225.60
VVA-069	226218.35	125885.32	145.19
VVA-070	218962.35	124902.89	7.72
VVA-071	221483.39	136032.91	13.94
VVA-072	219321.26	149265.52	9.94
VVA-073	220872.15	165494.38	13.21
St. Croix			
VVA-080	191132.27	363504.32	17.80

VVA-081	189236.71	370239.23	76.98
VVA-082	188225.60	374075.28	24.58
VVA-083	192784.96	376629.68	17.26
VVA-084	188243.46	382339.25	35.09
VVA-085	190751.72	388150.86	33.83
St. John			
VVA-077	255874.65	374466.03	122.40
VVA-078	256681.23	379907.74	340.77
VVA-079	257855.68	381807.28	10.53
St. Thomas			
VVA-074	258460.22	351013.68	208.11
VVA-075	258169.28	357197.20	395.77
VVA-076	256247.00	361879.30	76.43

4. GPS OBSERVATIONS

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
NVA					
NVA-001	7/19/2018	200	12:56	7/18/2018	7:20
NVA-002	7/10/2018	191	8:21	7/10/2018	8:25
NVA-003	7/10/2018	191	8:51	7/10/2018	8:54
NVA-004	7/10/2018	191	10:10	7/11/2018	8:48
NVA-005	7/14/2018	195	5:58	7/14/2018	6:03
NVA-006	7/13/2018	194	14:44	7/13/2018	14:47
NVA-007	7/10/2018	191	12:03	7/13/2018	18:58
NVA-008	7/10/2018	191	13:22	7/13/2018	6:08
NVA-009	7/10/2018	191	14:13	7/11/2018	6:14
NVA-010	7/9/2018	190	12:04	7/18/2018	8:50
NVA-011	7/10/2018	191	15:00	7/10/2018	15:04
NVA-012	7/10/2018	191	16:17	N/A	N/A
NVA-013	7/13/2018	194	7:32	N/A	N/A
NVA-014	7/13/2018	194	10:33	N/A	N/A
NVA-015	7/13/2018	194	12:42	N/A	N/A
NVA-016	7/18/2018	199	16:09	N/A	N/A
NVA-017	7/18/2018	199	12:18	N/A	N/A
NVA-018	7/8/2018	189	10:28	N/A	N/A
NVA-019	7/8/2018	189	8:57	N/A	N/A
NVA-020	7/8/2018	189	7:37	N/A	N/A
NVA-021	7/7/2018	188	13:45	7/7/2018	13:48
NVA-022	7/5/2018	186	11:41	7/5/2018	11:44
NVA-023	7/7/2018	188	16:59	7/18/2018	11:54
NVA-024	7/9/2018	190	6:43	7/9/2018	6:47
NVA-025	7/9/2018	190	9:07	7/12/2018	8:06
NVA-026	7/6/2018	187	17:14	7/12/2018	11:03
NVA-027	7/6/2018	187	18:13	7/12/2018	12:20
NVA-028	7/5/2018	186	18:00	7/12/2018	10:19
NVA-029	7/6/2018	187	14:14	N/A	N/A
NVA-030	7/6/2018	187	11:58	N/A	N/A
NVA-031	7/6/2018	187	10:05	N/A	N/A
NVA-032	7/6/2018	187	8:49	N/A	N/A
NVA-033	7/11/2018	192	15:00	N/A	N/A

NVA-034	7/11/2018	192	12:46	N/A	N/A
NVA-035	7/9/2018	190	16:43	N/A	N/A
NVA-036	7/11/2018	192	9:55	7/11/2018	9:58
NVA-037	7/11/2018	192	10:58	7/11/2018	11:01
NVA-038	7/7/2018	188	7:29	7/11/2018	18:59
NVA-039	7/7/2018	188	9:20	7/7/2018	9:23
NVA-040	7/11/2018	192	11:48	7/16/2018	9:40
NVA-041	7/8/2018	189	8:14	7/14/2018	15:00
NVA-042	7/14/2018	195	13:10	N/A	N/A
NVA-043	7/17/2018	198	14:40	N/A	N/A
NVA-044	7/17/2018	198	12:24	N/A	N/A
NVA-045	7/17/2018	198	9:14	N/A	N/A
NVA-046	7/17/2018	198	10:00	N/A	N/A
NVA-047	7/17/2018	198	10:59	N/A	N/A
NVA-048	7/11/2018	192	14:58	N/A	N/A
NVA-049	7/14/2018	195	10:54	7/14/2018	10:57
NVA-050	7/13/2018	194	13:54	7/14/2018	9:45
NVA-051	7/14/2018	195	8:17	7/16/2018	6:33
NVA-052	7/13/2018	194	16:43	7/14/2018	9:30
NVA-053	7/11/2018	192	13:03	7/16/201	17:20
NVA-054	7/16/2018	197	10:33	7/16/2018	10:36
NVA-055	7/17/2018	198	9:02	N/A	N/A
NVA-056	7/17/2018	198	7:43	N/A	N/A
NVA-057	7/17/2018	198	6:54	N/A	N/A
NVA-058	7/11/2018	192	11:55	N/A	N/A
NVA-059	7/11/2018	192	10:52	N/A	N/A
NVA-060	7/11/2018	192	10:05	N/A	N/A
NVA-061	7/15/2018	196	14:17	7/16/2018	9:04
NVA-062	7/14/2018	195	15:02	7/16/2018	9:37
NVA-063	7/14/2018	195	14:20	7/16/2018	11:00
NVA-064	7/14/2018	195	13:28	7/16/2018	11:37
NVA-065	7/14/2018	195	12:39	7/16/2018	11:54
NVA-066	7/15/2018	196	11:23	7/18/2018	9:20
NVA-067	7/15/2018	196	15:05	7/15/2018	15:08
NVA-068	7/15/2018	196	16:45	7/15/2018	16:48
NVA-069	7/15/2018	196	17:28	7/15/2018	17:31
NVA-070	7/15/2018	196	9:05	7/15/2018	9:08
NVA-071	7/15/2018	196	8:20	7/15/2018	8:23
NVA-072	7/14/2018	195	9:25	N/A	N/A

NVA-073	7/14/2018	195	10:23	N/A	N/A
NVA-074	7/14/2018	195	8:26	N/A	N/A
NVA-075	7/11/2018	192	13:47	N/A	N/A
NVA-076	7/11/2018	192	16:39	N/A	N/A
NVA-077	7/10/2018	191	15:23	N/A	N/A
NVA-078	7/10/2018	191	17:11	N/A	N/A
NVA-079	7/10/2018	191	19:07	N/A	N/A
NVA-080	7/11/2018	192	7:55	N/A	N/A
NVA-081	7/11/2018	192	8:13	N/A	N/A
NVA-082	7/11/2018	192	9:12	7/11/2018	9:15
NVA-083	7/10/2018	191	16:21	N/A	N/A
NVA-084	7/13/2018	194	11:25	N/A	N/A
NVA-085	7/13/2018	194	8:12	N/A	N/A
NVA-086	7/10/2018	191	13:31	N/A	N/A
NVA-087	7/10/2018	191	10:53	7/10/2018	10:56
NVA-088	7/10/2018	191	9:51	7/12/2018	16:15
NVA-089	7/10/2018	191	7:40	N/A	N/A
NVA-090	7/9/2018	190	15:42	7/12/2018	11:21
NVA-091	8/12/2018	224	12:35	N/A	N/A
NVA-092	8/12/2018	224	12:02	N/A	N/A
NVA-093	8/12/2018	224	11:03	8/12/2018	11:06
NVA-094	8/12/2018	224	14:52	N/A	N/A
NVA-095	8/12/2018	224	15:28	N/A	N/A
NVA-096	8/14/2018	226	15:55	8/15/2018	8:26
NVA-097	8/14/2018	226	16:53	8/15/2018	9:06
NVA-098	8/14/2018	226	18:03	N/A	N/A
NVA-099	8/2/2018	214	16:49	N/A	N/A
NVA-100	8/2/2018	214	14:45	N/A	N/A
NVA-101	8/2/2018	214	14:13	N/A	N/A
NVA-102	8/1/2018	213	17:15	N/A	N/A
NVA-103	8/2/2018	214	13:19	N/A	N/A
NVA-104	8/2/2018	214	17:34	N/A	N/A
NVA-105	8/1/2018	213	11:11	8/4/2018	11:27
NVA-106	8/1/2018	213	14:22	8/3/2018	18:04
NVA-107	8/1/2018	213	12:54	8/3/2018	13:57
NVA-108	8/2/2018	214	10:22	8/4/2018	10:56
NVA-109	8/1/2018	213	9:56	8/4/2018	9:56
NVA-110	8/1/2018	213	11:10	8/3/2018	10:14
NVA-111	8/1/2018	213	12:30	8/3/2018	12:36

NVA-112	8/6/2018	218	9:04	8/8/2018	9:41
NVA-113	8/6/2018	218	9:52	8/8/2018	10:55
NVA-114	8/6/2018	218	11:48	8/8/2018	14:36
NVA-115	8/6/2018	218	13:38	N/A	N/A
NVA-116	8/6/2018	218	16:09	8/8/2018	11:23
NVA-117	8/7/2018	219	10:28	N/A	N/A
NVA-118	8/7/2018	219	14:38	N/A	N/A
NVA-119	8/7/2018	219	13:39	N/A	N/A
NVA-120	8/7/2018	219	13:14	N/A	N/A
NVA-121	8/7/2018	219	9:15	N/A	N/A
NVA-122	8/7/2018	219	11:42	N/A	N/A
NVA-123	8/7/2018	219	12:15	N/A	N/A
NVA-124	7/30/2018	211	11:46	N/A	N/A
NVA-125	7/30/2018	211	13:29	N/A	N/A
NVA-126	7/30/2018	211	15:01	N/A	N/A
NVA-127	7/30/2018	211	16:07	N/A	N/A
NVA-128	7/30/2018	211	11:23	N/A	N/A
NVA-129	7/30/2018	211	10:13	N/A	N/A
NVA-130	7/30/2018	211	9:50	N/A	N/A
NVA-131	7/30/2018	211	8:11	N/A	N/A
NVA-132	7/29/2018	210	14:26	7/30/2018	17:06
NVA-133	7/29/2018	210	16:52	N/A	N/A
NVA-134	7/29/2018	210	10:46	N/A	N/A
NVA-135	7/28/2018	209	16:30	7/29/2018	17:32
NVA-136	7/28/2018	209	14:05	N/A	N/A
NVA-137	7/28/2018	209	10:22	7/29/2018	11:55
NVA-138	7/29/2018	210	12:00	7/29/2018	18:45
NVA-139	7/29/2018	210	8:20	N/A	N/A
NVA-140	7/28/2018	209	6:52	7/29/2018	8:06
NVA-141	7/27/2018	208	18:41	7/28/2018	18:02
NVA-142	7/27/2018	208	17:29	7/28/2018	16:52
NVA-143	7/27/2018	208	10:57	N/A	N/A
NVA-144	7/27/2018	208	16:04	7/28/2018	15:25
NVA-145	7/27/2018	208	14:48	7/28/2018	14:09
NVA-146	8/6/2018	218	10:26	8/8/2018	12:11
VVA					
VVA-001	8/15/2018	227	10:55	N/A	N/A
VVA-002	8/14/2018	226	18:29	N/A	N/A
VVA-003	8/14/2018	226	17:26	N/A	N/A

VVA-004	8/15/2018	227	11:20	N/A	N/A
VVA-005	8/14/2018	226	16:31	N/A	N/A
VVA-006	8/12/2018	224	11:37	N/A	N/A
VVA-007	8/12/2018	224	16:18	N/A	N/A
VVA-008	8/12/2018	224	14:15	N/A	N/A
VVA-009	8/12/2018	224	11:19	N/A	N/A
VVA-010	8/12/2018	224	13:12	N/A	N/A
VVA-011	7/13/2018	194	9:13	7/13/2018	17:42
VVA-012	7/10/2018	191	13:02	7/10/2018	13:05
VVA-013	7/10/2018	191	11:54	7/10/2018	11:57
VVA-014	7/10/2018	191	8:42	7/10/2018	8:45
VVA-015	7/11/2018	192	8:37	N/A	N/A
VVA-016	7/10/2018	191	17:44	N/A	N/A
VVA-017	7/11/2018	192	17:44	N/A	N/A
VVA-018	7/11/2018	192	11:24	N/A	N/A
VVA-019	7/10/2018	191	16:58	N/A	N/A
VVA-020	7/13/2018	194	11:55	N/A	N/A
VVA-021	7/13/2018	194	10:43	N/A	N/A
VVA-022	7/11/2018	192	13:08	N/A	N/A
VVA-023	7/11/2018	192	15:37	N/A	N/A
VVA-024	7/15/2018	196	7:56	N/A	N/A
VVA-025	7/10/2018	191	16:10	N/A	N/A
VVA-026	7/15/2018	196	16:05	N/A	N/A
VVA-027	7/15/2018	196	14:37	N/A	N/A
VVA-028	7/14/2018	195	15:58	N/A	N/A
VVA-029	7/15/2018	196	10:58	N/A	N/A
VVA-030	7/15/2018	196	10:11	N/A	N/A
VVA-031	7/14/2018	195	11:44	N/A	N/A
VVA-032	7/17/2018	198	9:34	7/18/2018	11:41
VVA-033	7/17/2018	198	11:40	7/17/2018	11:43
VVA-033A	7/16/2018	197	11:03	N/A	N/A
VVA-034	7/14/2018	195	11:16	N/A	N/A
VVA-035	7/13/2018	194	13:39	7/14/2018	10:00
VVA-036	7/14/2018	195	8:41	7/14/2018	17:33
VVA-037	7/11/2018	192	11:28	N/A	N/A
VVA-038	7/11/2018	192	14:11	N/A	N/A
VVA-039	7/17/2018	198	6:39	N/A	N/A
VVA-040	7/17/2018	198	9:55	N/A	N/A
VVA-041	7/17/2018	198	8:30	N/A	N/A

VVA-042	7/10/2018	191	18:32	7/10/2018	18:35
VVA-043	7/17/2018	198	14:34	7/17/2018	14:37
VVA-044	7/11/2018	192	17:08	7/11/2018	17:11
VVA-045	7/14/2018	195	14:28	7/14/2018	14:32
VVA-046	7/7/2018	188	10:14	7/7/2018	10:18
VVA-047	7/6/2018	187	11:23	7/16/2018	11:05
VVA-048	7/6/2018	187	8:24	7/16/2018	13:50
VVA-049	7/11/2018	192	11:50	7/11/218	11:53
VVA-050	7/11/2018	192	13:09	7/11/2018	13:12
VVA-051	7/9/2018	190	16:21	7/12/2018	11:46
VVA-052	7/9/2018	190	17:39	7/9/2018	17:42
VVA-053	7/6/2018	187	13:07	7/6/2018	13:11
VVA-054	7/6/2018	187	16:15	7/6/2018	16:19
VVA-055	7/6/2018	187	18:45	7/6/2018	18:48
VVA-056	7/12/2018	193	8:48	7/18/2018	14:45
VVA-057	7/9/2018	190	19:42	7/12/218	6:56
VVA-058	7/8/2018	189	13:32	7/18/2018	11:27
VVA-059	7/7/2018	188	15:15	7/11/2018	12:58
VVA-060	7/11/2018	192	13:17	7/7/2018	13:20
VVA-061	7/8/2018	189	9:20	7/8/2018	9:24
VVA-062	7/8/2018	189	11:38	7/8/2018	11:42
VVA-063	7/8/2018	189	14:36	7/8/2018	10:50
VVA-064	7/10/2018	191	16:39	7/18/2018	9:45
VVA-065	7/13/2018	194	9:10	7/15/2018	9:00
VVA-066	7/13/2018	194	11:54	N/A	N/A
VVA-067	7/15/2018	196	13:41	N/A	N/A
VVA-068	7/10/2018	191	11:44	7/12/2018	6:45
VVA-069	7/10/2018	191	6:12	7/18/2018	8:13
VVA-070	7/9/2018	190	12:36	7/9/2018	7:43
VVA-071	7/10/2018	191	7:22	7/14/2018	15:45
VVA-072	7/10/2018	191	9:40	N/A	N/A
VVA-073	7/11/2018	192	9:27	7/14/2018	6:30
VVA-074	8/2/2018	214	15:36	N/A	N/A
VVA-075	8/1/2018	213	11:53	8/4/2018	12:48
VVA-076	8/2/2018	214	9:50	8/4/2018	10:11
VVA-077	8/6/2018	218	11:10	8/8/2018	13:24
VVA-078	8/6/2018	218	14:17	N/A	N/A
VVA-079	8/7/2018	219	10:52	N/A	N/A
VVA-080	7/30/2018	211	14:33	N/A	N/A

VVA-081	7/29/2018	210	15:39	N/A	N/A
VVA-082	7/28/2018	209	15:18	7/29/2018	16:05
VVA-083	7/29/2018	210	9:33	N/A	N/A
VVA-084	7/28/2018	209	9:12	7/29/2018	10:31
VVA-085	7/27/2018	208	12:13	7/28/2018	11:39

5. POINT COMPARISON

Point ID	Point CK	Delta North (M)	Delta East (M)	Vertical Difference (M)
NVA				
NVA-001	NVA-001CK	-0.01	0.01	0.00
NVA-002	NVA-002CK	0.00	0.00	0.00
NVA-003	NVA-003CK	0.00	0.00	-0.01
NVA-004	NVA-004CK	0.00	0.00	0.02
NVA-005	NVA-005CK	0.00	-0.01	0.00
NVA-006	NVA-006CK	0.00	0.01	0.00
NVA-007	NVA-007CK	0.01	0.00	0.01
NVA-008	NVA-008CK	0.00	0.00	0.01
NVA-009	NVA-009CK	0.00	0.00	0.00
NVA-010	NVA-010CK	-0.01	0.00	-0.01
NVA-011	NVA-011CK	0.00	0.00	-0.01
NVA-021	NVA-021CK	0.00	-0.01	-0.01
NVA-022	NVA-022CK	0.01	0.01	0.00
NVA-023	NVA-023CK	0.01	0.00	0.02
NVA-024	NVA-024CK	0.00	0.01	0.00
NVA-025	NVA-025CK	0.00	0.00	0.00
NVA-026	NVA-026CK	0.00	0.00	0.01
NVA-027	NVA-027CK	0.00	0.00	0.01
NVA-028	NVA-028CK	0.00	0.00	-0.01
NVA-036	NVA-036CK	0.01	0.00	0.00
NVA-037	NVA-037CK	-0.01	0.00	0.02
NVA-038	NVA-038CK	0.00	-0.01	0.00
NVA-039	NVA-039CK	-0.01	0.01	0.01
NVA-040	NVA-040CK	0.00	0.01	0.00
NVA-041	NVA-041CK	0.00	0.01	-0.01
NVA-049	NVA-049CK	0.00	0.00	0.01
NVA-050	NVA-050CK	-0.01	0.02	0.03
NVA-051	NVA-051CK	0.00	0.00	0.00
NVA-052	NVA-052CK	-0.01	0.00	0.00
NVA-053	NVA-053CK	-0.01	0.00	0.01
NVA-054	NVA-054CK	0.00	0.00	0.01
NVA-061	NVA-061CK	-0.01	0.00	0.00
NVA-062	NVA-062CK	0.00	0.02	0.01
NVA-063	NVA-063CK	0.01	0.01	0.00
NVA-064	NVA-064CK	0.01	-0.01	0.00

NVA-065	NVA-065CK	0.00	0.01	0.00
NVA-066	NVA-066CK	0.00	-0.01	0.02
NVA-067	NVA-067CK	-0.01	-0.01	0.03
NVA-068	NVA-068CK	0.00	0.00	0.02
NVA-069	NVA-069CK	0.01	0.01	0.01
NVA-070	NVA-070CK	0.00	0.00	-0.01
NVA-071	NVA-071CK	-0.01	0.00	0.00
NVA-082	NVA-082CK	0.01	-0.01	-0.01
NVA-087	NVA-087CK	-0.01	-0.01	-0.01
NVA-088	NVA-088CK	0.00	0.00	0.02
NVA-090	NVA-090CK	0.02	0.00	-0.01
NVA-093	NVA-093CK	0.00	0.02	0.02
NVA-096	NVA-096CK	0.00	0.01	0.00
NVA-097	NVA-097CK	0.01	0.00	-0.02
NVA-105	NVA-105CK	0.02	0.00	0.00
NVA-106	NVA-106CK	0.01	0.00	0.00
NVA-107	NVA-107CK	-0.01	-0.02	0.03
NVA-108	NVA-108CK	0.01	0.02	0.04
NVA-109	NVA-109CK	0.01	0.01	0.01
NVA-110	NVA-110CK	-0.01	0.01	-0.03
NVA-112	NVA-112CK	0.00	0.02	0.02
NVA-113	NVA-113CK	-0.02	0.00	0.04
NVA-114	NVA-114CK	0.00	-0.02	0.03
NVA-117	NVA-117CK	-0.02	0.00	-0.01
NVA-132	NVA-132CK	0.01	0.01	-0.04
NVA-135	NVA-135CK	0.00	0.00	-0.01
NVA-137	NVA-137K	-0.02	0.01	0.08
NVA-138	NVA-138CK	0.01	0.00	-0.05
NVA-140	NVA-140CK	0.01	-0.01	0.00
NVA-141	NVA-141CK	0.01	0.00	-0.06
NVA-142	NVA-142CK	-0.01	0.00	-0.01
NVA-144	NVA-144CK	0.00	0.00	0.02
NVA-145	NVA-145K	0.00	0.00	0.00
NVA-146	NVA-146CK	0.02	0.01	0.01
VVA				
VVA-011	VVA-011CK	0.00	0.00	-0.01
VVA-012	VVA-012CK	0.00	0.00	0.00
VVA-013	VVA-013CK	-0.01	0.00	-0.01
VVA-014	VVA-014CK	0.01	0.00	0.02
VVA-032	VVA-032CK	0.00	0.01	0.01
VVA-033	VVA-033CK	0.00	0.00	0.00

VVA-035	VVA-035CK	0.00	0.00	0.01
VVA-036	VVA-036CK	0.02	0.01	0.01
VVA-042	VVA-042CK	0.00	0.00	-0.01
VVA-043	VVA-043CK	0.00	0.00	0.00
VVA-044	VVA-044CK	0.00	-0.01	0.02
VVA-045	VVA-045CK	0.00	-0.01	-0.03
VVA-046	VVA-046CK	0.01	-0.01	0.01
VVA-047	VVA-047CK	-0.01	0.00	0.00
VVA-048	VVA-048CK	0.00	-0.01	0.00
VVA-049	VVA-049CK	0.01	0.01	0.02
VVA-050	VVA-050CK	-0.01	0.01	0.00
VVA-051	VVA-051CK	0.02	-0.02	0.00
VVA-052	VVA-052CK	-0.01	0.01	-0.02
VVA-053	VVA-053CK	0.00	-0.01	0.01
VVA-054	VVA-054CK	-0.02	-0.01	0.01
VVA-055	VVA-055CK	0.00	0.01	-0.03
VVA-056	VVA-056CK	0.00	0.00	-0.03
VVA-057	VVA-057CK	0.01	0.00	-0.03
VVA-058	VVA-058CK	0.00	0.00	0.00
VVA-059	VVA-059CK	0.00	0.00	0.00
VVA-060	VVA-060CK	0.01	0.00	-0.04
VVA-061	VVA-061CK	0.01	0.01	0.02
VVA-062	VVA-062CK	0.00	-0.01	0.00
VVA-063	VVA-063CK	0.00	0.02	-0.01
VVA-064	VVA-064CK	0.00	0.00	0.01
VVA-065	VVA-065CK	-0.01	0.01	0.02
VVA-068	VVA-068CK	0.00	0.00	0.00
VVA-069	VVA-069CK	-0.01	0.00	0.00
VVA-070	VVA-070CK	0.00	0.00	-0.02
VVA-071	VVA-071CK	0.00	0.01	0.01
VVA-073	VVA-073CK	0.00	0.00	0.00
VVA-075	VVA-075CK	0.02	-0.02	0.04
VVA-076	VVA-076CK	-0.01	0.01	-0.01
VVA-077	VVA-077CK	-0.01	0.02	0.02
VVA-082	VVA-082CK	-0.01	-0.01	0.04
VVA-084	VVA-084CK	-0.01	0.00	0.03
VVA-085	VVA-085CK	0.01	-0.01	-0.01