

LiDAR Check Point Survey Report

“SCHOHARIE COUNTY NY QL2 LiDAR & SCHOHARIE CREEK WATERSHED EXPANSION QL2 LiDAR”

USGS Contract: G10PC00013

Task Order Number: G13PD00848 and G14PD00015

Prepared for:

United States Geological Survey



Prepared By:

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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 Consultants, LLC is under contract to the United States Geological Survey to provide 110 Check Points for USGS in the State of New York. Under the above referenced USGS Task Order, Dewberry is tasked to complete the quality assurance of high resolution LiDAR-derived elevation products. As part of this work Dewberry staff will complete checkpoint surveys that will be used to evaluate vertical accuracy on the bare-earth terrain derived from the LiDAR.

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 LiDAR 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 meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2012A (Geoid12A).

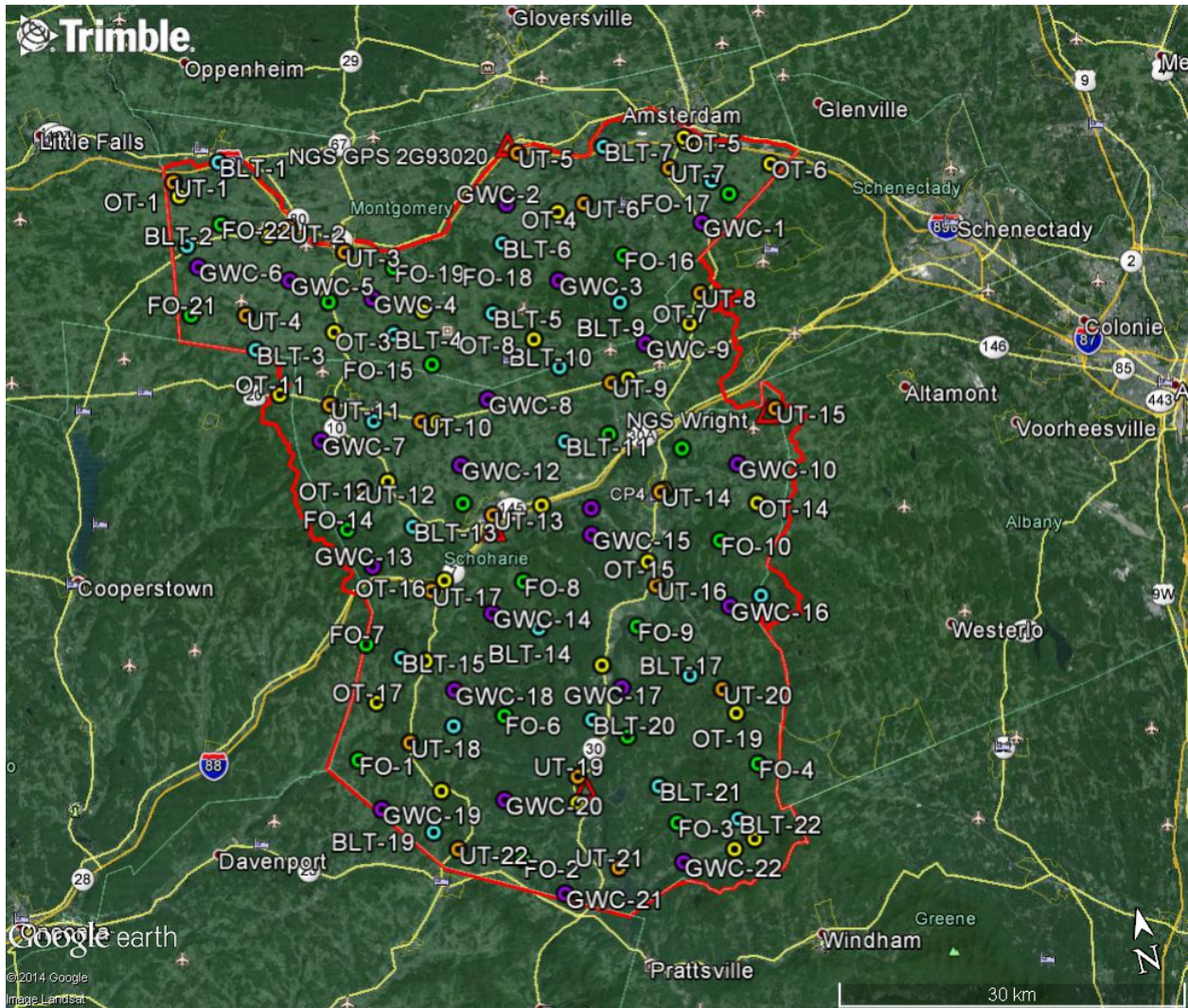
1.2 *Points of Contact*

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

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1.3 Project Areas



USGS – Schoharie County and Schoharie Watershed

PROJECT DETAILS

2.1 *Survey Equipment*

In performing the GPS observations, Trimble R-8 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 LiDAR Check Point locations are detailed on the “Ground 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-8 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 18 and 20 minutes.

Field GPS observations are detailed on the “Ground Control Point Documentation Reports” submitted as part of this report.

Three (3) existing NGS monument listed in the NSRS database 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 PID AA7904, AA7916 and, AA7916. The results are as follows:

NGS PT. ID	As Surveyed (M)			Published (M)			Differences (M)		
	Northing(M)	Easting(M)	Elev.(M)	Northing(M)	Easting(M)	Elev. (M)	ΔN	ΔE	$\Delta Elev.$
COBLESKILL	4724027.695	542002.775	291.846	4,724,027.695	542,002.782	291.812	0.000	0.007	0.034
GPS2G93020	4755848.427	550539.105	89.316	4,755,848.443	550,539.106	89.351	0.016	0.001	0.035
WRIGHT	4728583.464	567197.903	409.879	4,728,583.476	567,197.915	409.70	0.012	0.012	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 GPSNet 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*

POINT #	NORTHING (M)	EASTING (M)	ELEV. (M)
Brush & Low Trees Points			
BLT-001	4760022.301	526040.928	100.313
BLT-002	4753603.324	521824.369	180.975
BLT-003	4743583.043	525622.850	225.373
BLT-004	4742233.851	537467.913	298.791
BLT-005	4742310.659	546091.501	304.480
BLT-006	4747776.827	548264.533	198.889
BLT-007	4753919.356	558623.998	87.716
BLT-008	4748965.560	567010.827	220.449
BLT-009	4740589.839	556985.413	305.440
BLT-010	4736328.240	550698.955	309.693
BLT-011	4729563.250	549641.272	352.387
BLT-012	4734221.122	533680.354	461.980
BLT-013	4726522.488	535087.265	339.562
BLT-014	4713898.035	543639.763	374.506
BLT-015	4715603.440	531120.242	650.775
BLT-016	4713489.649	563122.741	495.326
BLT-017	4708188.311	555687.432	453.564
BLT-018	4708595.001	534990.870	505.832
BLT-019	4700098.106	530463.669	700.703
BLT-020	4706350.085	546677.641	284.792
BLT-021	4699580.610	550927.141	547.505
BLT-022	4694946.566	556796.963	543.165
Grass, Weeds & Crops Points			
GWC-001	4745047.540	565665.666	228.563
GWC-002	4750952.073	549401.492	151.912
GWC-003	4743580.475	552280.184	351.696
GWC-004	4745837.778	536375.999	213.765
GWC-005	4748012.014	528993.339	256.105
GWC-006	4751570.649	522440.509	190.873
GWC-007	4734788.232	529396.122	400.268
GWC-008	4735338.609	543956.113	348.487
GWC-009	4736664.556	558318.793	377.067
GWC-010	4724874.601	563697.863	264.917
GWC-011	4724017.223	550590.911	366.371
GWC-012	4730036.939	540546.049	421.846

GWC-013	4723264.413	531291.645	461.926
GWC-014	4716863.150	540118.894	570.863
GWC-015	4721724.658	549975.246	346.797
GWC-016	4713475.613	560566.296	359.810
GWC-017	4708476.774	549837.899	318.772
GWC-018	4711664.562	535905.631	540.226
GWC-019	4702808.273	527770.245	496.551
GWC-020	4700838.007	537828.674	605.092
GWC-021	4692879.815	541382.047	555.225
GWC-022	4692509.008	551563.038	453.700
Open Terrain Points			
OT-001	4757922.987	522096.858	206.049
OT-002	4752833.242	528898.991	112.938
OT-003	4743552.539	532514.818	210.881
OT-004	4749326.515	553525.978	209.501
OT-005	4752962.660	565169.626	127.426
OT-006	4749292.630	572277.930	203.165
OT-007	4737479.138	562401.189	276.076
OT-008	4739124.267	549068.571	329.708
OT-009	4734077.855	554758.677	207.511
OT-010	4734086.494	539366.452	329.696
OT-011	4739362.506	526798.299	429.603
OT-012	4730265.322	534169.310	370.940
OT-013	4725159.581	546574.298	346.821
OT-014	4721470.337	564180.532	309.183
OT-015	4718445.007	554359.892	190.072
OT-016	4720752.049	536991.504	321.296
OT-017	4711777.157	528952.808	513.277
OT-018	4710702.465	548515.079	221.986
OT-019	4704169.250	558713.170	331.123
OT-020	4693446.202	558417.913	588.515
OT-021	4699733.197	543839.521	341.117
OT-022	4703295.511	532314.012	570.075
Urban Terrain Points			
UT-001	4759203.098	521874.403	233.481
UT-002	4753475.350	530981.187	93.766
UT-003	4750222.414	534974.773	102.333
UT-004	4747077.396	525745.190	296.305
UT-005	4754892.144	551599.465	98.818

UT-006	4749545.140	555891.057	212.819
UT-007	4750884.718	563723.465	186.878
UT-008	4739872.643	564156.752	342.966
UT-009	4733999.462	554127.961	215.565
UT-010	4734350.557	538247.373	360.522
UT-011	4737543.980	530766.174	397.663
UT-012	4728977.011	530877.435	356.724
UT-013	4725274.268	542302.834	282.790
UT-014	4723915.762	556497.530	185.088
UT-015	4727748.799	569566.667	382.798
UT-016	4716327.775	554571.798	194.442
UT-017	4720119.551	535719.312	348.730
UT-018	4714450.086	533910.887	636.442
UT-019	4701928.885	544376.024	257.209
UT-020	4706425.742	558112.465	361.865
UT-021	4693561.830	546091.953	390.632
UT-022	4697933.296	533116.949	601.223
Forest Points			
FO-001	4707422.962	526279.025	489.232
FO-002	4696055.129	538402.924	605.752
FO-003	4696252.537	551765.078	528.086
FO-004	4699631.254	559668.434	376.658
FO-005	4704286.093	549211.816	503.417
FO-006	4708377.413	539455.110	517.601
FO-007	4716905.688	529300.349	634.455
FO-008	4719137.163	543595.767	516.687
FO-009	4713259.932	552225.174	250.485
FO-010	4718818.456	560745.390	497.162
FO-011	4727196.542	559382.575	353.287
FO-012	4729764.322	553516.249	255.674
FO-013	4726799.421	539992.655	469.603
FO-014	4726830.312	529855.901	403.079
FO-015	4738989.734	540074.128	326.536
FO-016	4744463.696	558191.448	204.595
FO-017	4747553.277	568220.050	229.590
FO-018	4746185.676	544296.057	285.624
FO-019	4747820.019	538714.522	178.144
FO-020	4746170.313	532624.119	200.804
FO-021	4747693.043	520864.533	303.617

FO-022	4754750.239	525054.193	179.459
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4. GPS OBSERVATIONS

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY	RE-OBSERV. DATE	RE-OBSERV. TIME
Brush & Low Trees Points					
BLT-001	5/16/2014	125	8:22	5/17/2014	5:18
BLT-002	5/16/2014	125	12:08	5/17/2014	5:37
BLT-003	5/17/2014	126	9:53	N/A	N/A
BLT-004	5/18/2014	127	11:29	5/20/2014	5:08
BLT-005	5/18/2014	127	13:21	5/20/2014	5:28
BLT-006	5/18/2014	127	15:02	N/A	N/A
BLT-007	5/18/2014	127	18:40	N/A	N/A
BLT-008	5/19/2014	128	11:30	5/20/2014	7:18
BLT-009	5/19/2014	128	14:07	N/A	N/A
BLT-010	5/20/2014	129	7:57	N/A	N/A
BLT-011	5/20/2014	129	8:24	5/20/2014	8:51
BLT-012	5/17/2014	126	11:22	N/A	N/A
BLT-013	5/17/2014	126	15:00	N/A	N/A
BLT-014	5/17/2014	126	18:26	5/20/2014	9:41
BLT-015	5/22/2014	131	14:25	N/A	N/A
BLT-016	5/20/2014	129	10:23	5/20/2014	10:59
BLT-017	5/20/2014	129	11:21	5/20/2014	10:28
BLT-018	5/22/2014	131	15:43	N/A	N/A
BLT-019	5/22/2014	131	13:04	N/A	N/A
BLT-020	5/20/2014	129	12:45	5/20/2014	10:03
BLT-021	5/22/2014	131	20:00	N/A	N/A
BLT-022	5/22/2014	131	10:58	N/A	N/A
ForestPoints					
FO-001	5/23/2014	132	11:00	5/20/2014	11:45
FO-002	5/23/2014	132	10:09	N/A	N/A
FO-003	5/23/2014	132	16:00	N/A	N/A
FO-004	5/23/2014	132	14:29	N/A	N/A
FO-005	5/23/2014	132	13:22	N/A	N/A
FO-006	5/23/2014	132	12:30	N/A	N/A
FO-007	5/23/2014	132	11:35	N/A	N/A
FO-008	5/17/2014	126	17:45	5/20/2014	11:01
FO-009	5/20/2014	129	22:00	N/A	N/A
FO-010	5/20/2014	129	21:23	5/20/2014	11:21

FO-011	5/19/2014	128	17:15	N/A	N/A
FO-012	5/19/2014	128	16:31	N/A	N/A
FO-013	5/17/2014	126	13:00	N/A	N/A
FO-014	5/17/2014	126	15:41	N/A	N/A
FO-015	5/18/2014	127	12:00	N/A	N/A
FO-016	5/19/2014	128	14:30	5/20/2014	8:21
FO-017	5/19/2014	128	11:45	5/20/2014	8:44
FO-018	5/18/2014	127	14:30	N/A	N/A
FO-019	5/18/2014	127	10:12	N/A	N/A
FO-020	5/17/2014	126	19:50	N/A	N/A
FO-021	5/16/2014	125	13:20	5/17/2014	6:38
FO-022	5/16/2014	125	11:00	5/17/2014	6:11
Grass, Weeds & Crops Points					
GWC-001	5/19/2014	128	12:33	5/20/2014	7:45
GWC-002	5/18/2014	127	17:30	5/20/2014	5:59
GWC-003	5/19/2014	128	15:35	N/A	N/A
GWC-004	5/19/2014	128	10:01	N/A	N/A
GWC-005	5/16/2014	125	14:31	5/17/2014	6:20
GWC-006	5/16/2014	125	12:30	5/17/2014	5:51
GWC-007	5/18/2014	127	8:44	N/A	N/A
GWC-008	5/19/2014	128	8:51	N/A	N/A
GWC-009	5/19/2014	128	13:40	N/A	N/A
GWC-010	5/19/2014	128	19:02	N/A	N/A
GWC-011	5/15/2014	124	15:49	5/17/2014	7:01
GWC-012	5/17/2014	126	12:14	N/A	N/A
GWC-013	5/17/2014	126	16:12	N/A	N/A
GWC-014	5/17/2014	126	17:20	5/20/2014	9:13
GWC-015	5/15/2014	124	15:23	5/17/2014	7:33
GWC-016	5/20/2014	129	10:05	5/20/2014	10:48
GWC-017	5/20/2014	129	11:59	N/A	N/A
GWC-018	5/17/2014	126	18:53	5/20/2014	9:29
GWC-019	5/22/2014	131	13:38	N/A	N/A
GWC-020	5/22/2014	131	21:04	N/A	N/A
GWC-021	5/22/2014	131	12:06	N/A	N/A
GWC-022	5/22/2014	131	11:26	N/A	N/A
Open Terrain Points					
OT-001	5/16/2014	125	9:10	5/17/2014	5:10
OT-002	5/16/2014	125	10:16	5/17/2014	5:28
OT-003	5/17/2014	126	9:28	N/A	N/A

OT-004	5/18/2014	127	15:30	5/20/2014	6:25
OT-005	5/19/2014	128	10:41	5/20/2014	7:05
OT-006	5/19/2014	128	12:14	5/20/2014	7:31
OT-007	5/19/2014	128	13:06	5/20/2014	8:13
OT-008	5/18/2014	127	12:56	5/20/2014	5:41
OT-009	5/19/2014	128	16:11	N/A	N/A
OT-010	5/17/2014	126	11:54	N/A	N/A
OT-011	5/17/2014	126	10:29	N/A	N/A
OT-012	5/18/2014	127	8:23	N/A	N/A
OT-013	5/15/2014	124	16:11	5/17/2014	7:05
OT-014	5/19/2014	128	18:38	N/A	N/A
OT-015	5/15/2014	124	14:53	5/17/2014	7:44
OT-016	5/17/2014	126	16:54	5/21/2014	8:28
OT-017	5/22/2014	131	14:06	N/A	N/A
OT-018	5/20/2014	129	12:15	5/21/2014	9:15
OT-019	5/20/2014	129	14:58	5/21/2014	9:49
OT-020	5/20/2014	129	16:49	5/21/2014	10:15
OT-021	5/22/2014	131	20:33	N/A	N/A
OT-022	5/22/2014	131	13:20	N/A	N/A
Urban Terrain Points					
UT-001	5/16/2014	125	8:43	5/17/2014	5:01
UT-002	5/16/2014	125	9:36	5/17/2014	5:41
UT-003	5/18/2014	127	9:38	N/A	N/A
UT-004	5/16/2014	125	13:57	5/17/2014	6:30
UT-005	5/18/2014	127	16:27	5/20/2014	6:13
UT-006	5/18/2014	127	18:06	5/20/2014	6:37
UT-007	5/18/2014	127	19:25	5/20/2014	6:51
UT-008	5/19/2014	128	12:52	5/20/2014	7:59
UT-009	5/19/2014	128	15:55	5/20/2014	8:33
UT-010	5/17/2014	126	11:41	N/A	N/A
UT-011	5/17/2014	126	10:48	N/A	N/A
UT-012	5/17/2014	126	15:23	N/A	N/A
UT-013	5/15/2014	124	16:36	5/17/2014	6:52
UT-014	5/19/2014	128	18:08	N/A	N/A
UT-015	5/22/2014	131	18:10	N/A	N/A
UT-016	5/15/2014	124	14:33	5/21/2014	7:33
UT-017	5/17/2014	126	16:40	5/21/2014	8:13
UT-018	5/22/2014	131	14:49	N/A	N/A
UT-019	5/22/2014	131	20:25	N/A	N/A

UT-020	5/20/2014	129	14:49	5/21/2014	9:38
UT-021	5/22/2014	131	11:44	N/A	N/A
UT-022	5/22/2014	131	12:44	N/A	N/A

5. ***POINT COMPARISON***

LiDAR QA				
POINT ID	POINT CK	DELTA NORTH (M)	DELTA EAST (M)	VERT. DIFF (M)
Brush & Low Trees Points				
BLT-001	BLT-001CK	0.001	0.006	0.009
BLT-002	BLT-002CK	0.001	0.006	0.009
BLT-004	BLT-004CK	0.005	0.005	0.001
BLT-005	BLT-005CK	0.003	0.003	0.008
BLT-008	BLT-008CK	0.001	0.004	0.006
BLT-011	BLT-011CK	0.004	0.006	0.001
BLT-014	BLT-014CK	0.001	0.003	0.005
BLT-016	BLT-016CK	0.022	0.004	0.030
BLT-017	BLT-017CK	0.007	0.002	0.038
BLT-020	BLT-020CK	0.017	0.010	0.005
Forest Points				
FO-001	FO-001CK	0.025	0.024	0.023
FO-008	FO-008CK	0.006	0.025	0.042
FO-010	FO-010CK	0.012	0.018	0.011
FO-016	FO-016CK	0.010	0.009	0.033
FO-017	FO-017CK	0.007	0.000	0.004
FO-021	FO-021CK	0.004	0.028	0.023
FO-022	FO-022CK	0.022	0.003	0.038
Grass, Weeds & Crops Points				
GWC-001	GWC-001CK	0.014	0.004	0.069
GWC-002	GWC-002CK	0.002	0.000	0.003
GWC-005	GWC-005CK	0.002	0.003	0.003
GWC-006	GWC-006CK	0.002	0.003	0.001
GWC-011	GWC-011CK	0.005	0.007	0.002
GWC-014	GWC-014CK	0.021	0.011	0.020
GWC-015	GWC-015CK	0.007	0.006	0.015
GWC-016	GWC-016CK	0.007	0.006	0.004
GWC-018	GWC-018CK	0.005	0.003	0.009
Open Terrain Points				
OT-001	OT-001CK	0.020	0.013	0.001
OT-002	OT-002CK	0.000	0.010	0.013
OT-004	OT-004CK	0.002	0.001	0.011
OT-005	OT-005CK	0.013	0.008	0.004

OT-006	OT-006CK	0.000	0.001	0.001
OT-007	OT-007CK	0.001	0.001	0.008
OT-008	OT-008CK	0.004	0.006	0.012
OT-013	OT-013CK	0.002	0.000	0.019
OT-015	OT-015CK	0.009	0.005	0.027
OT-016	OT-016CK	0.000	0.002	0.007
OT-018	OT-018CK	0.003	0.001	0.010
OT-019	OT-019CK	0.000	0.006	0.006
OT-020	OT-020CK	0.005	0.004	0.011
Urban Terrain Points				
UT-001	UT-001CK	0.004	0.007	0.012
UT-002	UT-002CK	0.005	0.003	0.004
UT-004	UT-004CK	0.006	0.024	0.002
UT-005	UT-005CK	0.002	0.001	0.004
UT-006	UT-006CK	0.000	0.000	0.000
UT-007	UT-007CK	0.008	0.005	0.001
UT-008	UT-008CK	0.000	0.001	0.006
UT-009	UT-009CK	0.004	0.002	0.002
UT-013	UT-013CK	0.002	0.004	0.000
UT-016	UT-016CK	0.002	0.002	0.042
UT-017	UT-017CK	0.001	0.002	0.000
UT-020	UT-020CK	0.002	0.001	0.005