

SNWA QL2 LBS 1.2 Checkpoint Report

Detailed USGS National Geospatial Program Lidar Base Specification Version 1.2 Report

Quality level tested: QL2

Report generated on 1/25/2017

This document reports on compliance with the USGS National Geospatial Program Lidar Base Specification Version 1.2. The complete specification, which also contains a list of abbreviations, acronyms, and a glossary of related terms, can be found [here](#).



DPH-11.2 Report on Check Points

The USGS Lidar Base Specification Version 1.2 states: "The Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014) ties the required number of check points for vertical accuracy assessment to the areal extent of the project. Data producers are encouraged to carefully review the new and revised requirements in that document. Check points for NVA assessments shall be surveyed in clear, open areas (which typically produce only single lidar returns), devoid of vegetation and other vertical artifacts (such as boulders, large riser pipes, and vehicles). Ground that has been plowed or otherwise disturbed is not acceptable. The same check points may be used for NVA assessment of the point cloud and DEM. Check points for VVA assessments shall be surveyed in vegetated areas (typically characterized by multiple return lidar). Although the nature of vegetated areas makes absolute definition of a suitable test area difficult, these areas will meet the requirements below. As stated in the National Standards for Spatial Data Accuracy (NSSDA) (Federal Geographic Data Committee, 1998) and reiterated in the ASPRS Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014), it is unrealistic to prescribe detailed requirements for check point locations, as many unpredictable factors will affect field operations and decisions, and the data producer must often have the freedom to use their best professional judgment. The quantity and location of check points shall meet the following requirements, unless alternative criteria are approved by the USGS–NGP in advance:

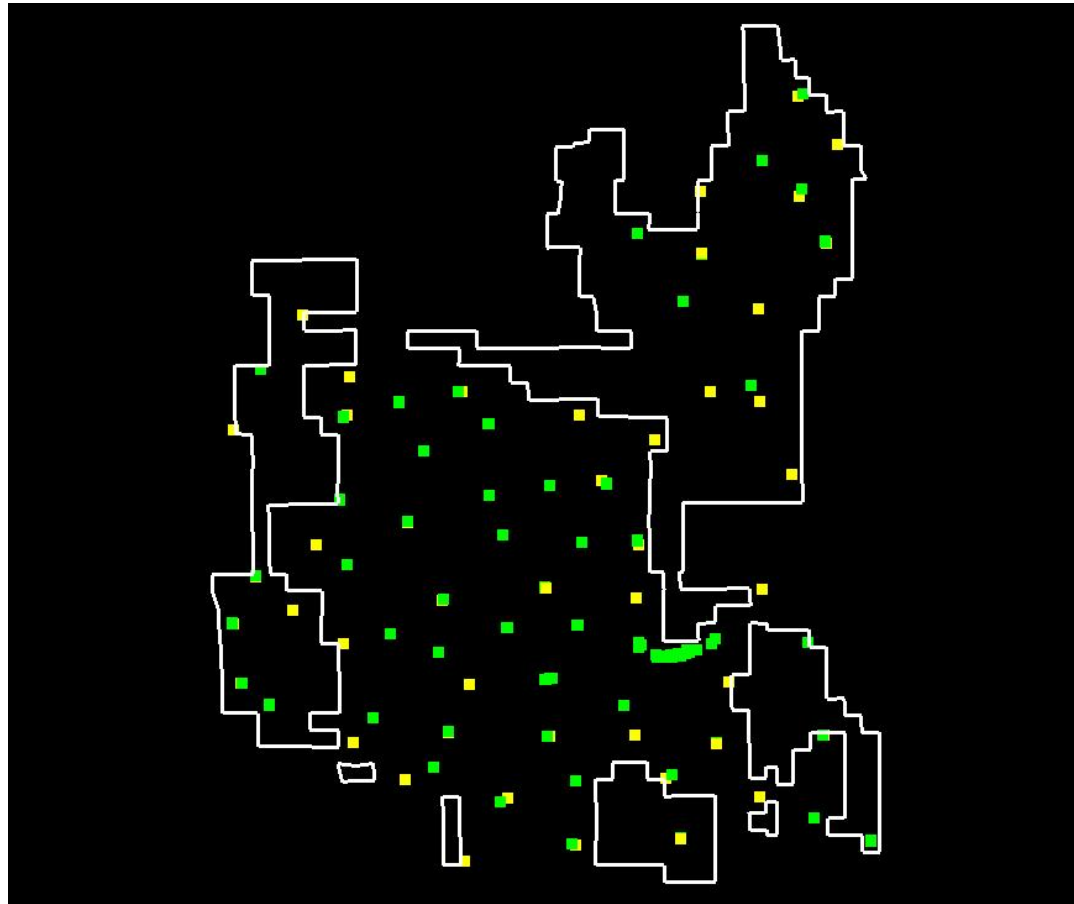
- The ASPRS-recommended total number of check points for a given project size shall be met.
- The ASPRS-recommended distribution of the total number of check points between NVA and VVA assessments shall be met.
- Check points within each assessment type (NVA and VVA) will be well-distributed across the entire project area. See the glossary at the end of this specification for a definition of "well-distributed."
- Within each assessment type, check points will be distributed among all constituent land cover types in approximate proportion to the areas of those land cover types (American Society for Photogrammetry and Remote Sensing, 2014)."

The purpose of this section is to show check points (NVA and VVA).

DPH-11.2 Report on Check Points - continued

[Data Source - Y:\Mapping\Projects\65219059_SNWA_LiDAR_Digital_Elevation_Data\Survey_Control\Laser_Control\Checkptpoint_Stuff\GroundPoints_Client_NVAandVVA.csv](#)

[Check Point Path - W:\QL2\Only_Checkpoint_Report\DPH_11_2\CheckPoints.jpg](#)



Yellow points are NVA, green points are VVA.
White polygon is defined project area (DPA) boundary

DPH-11.2 Report on Check Points - continued

Total check points: 266

Total NVA check points: 62

Total VVA check points: 204

Check points in project boundary: 59

Total boundary area: 1438.524 square KM

Number of points per project area: 0.041 points per square KM

TABLE C.1 RECOMMENDED NUMBER OF CHECKPOINTS BASED ON AREA

Project Area (Square Kilometers)	Horizontal Accuracy Testing of Orthoimagery and Planimetrics	Vertical and Horizontal Accuracy Testing of Elevation Data sets		
	Total Number of Static 2D/3D Checkpoints (clearly-defined points)	Number of Static 3D Checkpoints in NVA*	Number of Static 3D Checkpoints in VVA	Total Number of Static 3D Checkpoints
≤500	20	20	5	25
501-750	25	20	10	30
751-1000	30	25	15	40
1001-1250	35	30	20	50
1251-1500	40	35	25	60
1501-1750	45	40	30	70
1751-2000	50	45	35	80
2001-2250	55	50	40	90
2251-2500	60	55	45	100

*Although vertical check points are normally not well defined, where feasible, the horizontal accuracy of lidar data sets should be tested by surveying approximately half of all NVA check points at the ends of point stripes or other point features that are visible and can be measured on lidar intensity returns.

Source: ASPRS Positional Accuracy Standards for Digital Geospatial Data (Edition 1, Version 1.0. - November 2014)

DPH-11.3 Report on Absolute Vertical Accuracy

The USGS Lidar Base Specification Version 1.2 states: "Absolute vertical accuracy of the lidar data and the derived DEM will be assessed and reported in accordance with the ASPRS Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014). Two broad land cover types shall be assessed: vegetated and nonvegetated. Three absolute accuracy values shall be assessed and reported: NVA for the point cloud, NVA for the DEM, and VVA for the DEM. The minimum NVA and VVA requirements for all data, using the ASPRS methodology, are listed in the tables 'Absolute vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3' (table 4) and 'Absolute vertical accuracy for digital elevation models, Quality Level 0–Quality Level 3' (table 5). Both the NVA and VVA required values shall be met. For projects dominated by dense forests, the USGS–NGP may accept higher VVA values."

Table 4. Absolute vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3.

[RMSE_z, root mean square error in z; cm, centimeter; NVA, nonvegetated vertical accuracy; ≤, less than or equal to]

Quality Level (QL)	RMSE _z (nonvegetated) (cm)	NVA at 95-percent confidence level (cm)
QL0	≤5.0	≤9.8
QL1	≤10.0	≤19.6
QL2	≤10.0	≤19.6
QL3	≤20.0	≤39.2

Table 5. Absolute vertical accuracy for digital elevation models, Quality Level 0–Quality Level 3.

[RMSE_z, root mean square error in z; cm, centimeter; NVA, nonvegetated vertical accuracy; VVA, vegetated vertical accuracy; ≤, less than or equal to]

Quality Level (QL)	RMSE _z (nonvegetated) (cm)	NVA at 95-percent confidence level (cm)	VVA at 95th percentile (cm)
QL0	≤5.0	≤9.8	≤14.7
QL1	≤10.0	≤19.6	≤29.4
QL2	≤10.0	≤19.6	≤29.4
QL3	≤20.0	≤39.2	≤58.8

The purpose of this section is to report on the absolute vertical accuracy of the lidar data by testing for NVA (Nonvegetated Vertical Accuracy) and VVA (Vegetated Vertical Accuracy) against surveyed ground check points.

DPH-11.3 Report on Absolute Vertical Accuracy - continued

[Y:\Mapping\Projects\65219059_SNWA LiDAR Digital Elevation Data\Survey_Control\Laser_Control\Checkpoint_Stuff\G_roundPoints_Client_NVAandVVA.csv](Y:\Mapping\Projects\65219059_SNWA_LiDAR_Digital_Elevation_Data\Survey_Control\Laser_Control\Checkpoint_Stuff\G_roundPoints_Client_NVAandVVA.csv)

Units: Meter (/US Survey Feet)

Vertical Accuracy Class tested: 10-cm

Check Points	266
Check Points with Lidar Coverage	157
Check Points with Lidar Coverage (NVA)	35
Check Points with Lidar Coverage (VVA)	122
Average Z Error (NVA)	-0.013/-0.042
Maximum Z Error (NVA)	0.039/0.129
Median Z Error (NVA)	-0.007/-0.024
Minimum Z Error (NVA)	-0.086/-0.282
Standard deviation of Vertical Error (NVA)	0.035/0.115
Skewness of Vertical Error (NVA)	-0.643
Kurtosis of Vertical Error (NVA)	-0.420
Non-vegetated Vertical Accuracy (NVA) RMSE(z)	0.037/0.121 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/-	0.072/0.237 PASS
FGDC/NSSDA Vertical Accuracy at the 95% Confidence Level +/-	0.072/0.237
Non-vegetated Vertical Accuracy (NVA) RMSE(z) (DEM)	0.039/0.127 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level (DEM) +/-	0.076/0.248 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (DEM) +/-	0.195/0.638 PASS

This data set was tested to meet ASPRS Positional Accuracy Standard for Digital Geospatial Data (2014) for a 10-cm RMSEz Vertical Accuracy Class. Actual NVA accuracy was found to be RMSEz = 3.693cm, equating to +/- 7.239cm at the 95% confidence level. Actual VVA accuracy was found to be +/- 19.461cm at the 95th percentile.

DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the lidar point cloud swath data against surveyed ground NVA (nonvegetated vertical accuracy) check points. All XY coordinates and Z values reported are in the selected data units.

NVA (lidar swath data)

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description
2	718636.87	26839375.53	Yes	2956.01	2956.047	0.037	2956.007	2956.048	2956.049	2956	2956	1,1,1	NVA
4	732311.13	26808495.35	Yes	2959.06	2959.016	-0.044	2958.995	2959.034	2959.081	2959	2959	1,1,1	NVA
8	827588.74	26800920.5	Yes	1983.82	1983.783	-0.037	1983.762	1983.819	1983.823	1984	1984	1,1,1	NVA
9	822534.55	26768595.73	Yes	1990.7	1990.626	-0.074	1990.421	1990.508	1990.724	1991	1991	1,1,1	NVA
10	733155.02	26820495.56	Yes	2902.44	2902.158	-0.282	2902.105	2902.18	2902.216	2902	2902	1,1,1	NVA
11	860631.71	26754875.81	Yes	1396.85	1396.837	-0.013	1396.812	1396.869	1396.876	1397	1397	1,1,1	NVA
12	705653.59	26822712.61	Yes	3691.98	3691.775	-0.205	3691.746	3691.747	3691.796	3692	3692	1,1,1	NVA
15	731305.43	26738057.6	Yes	2853.81	2853.808	-0.002	2853.782	2853.814	2853.824	2854	2854	1,1,1	NVA
16	850320.16	26726259.36	Yes	1937.31	1937.315	0.005	1937.296	1937.33	1937.352	1937	1937	1,1,1	NVA
18	831092.06	26696248.06	Yes	2616.86	2616.726	-0.134	2616.639	2616.656	2616.77	2617	2617	1,1,1	NVA
20	803132.26	26675799.34	Yes	3099.96	3099.723	-0.237	3099.588	3099.695	3099.735	3100	3100	1,1,1	NVA
23	704397.69	26758789.24	Yes	3708.94	3708.9	-0.040	3708.84	3708.971	3709.009	3709	3709	1,1,1	NVA
24	859996.78	26812871.65	Yes	2485.64	2485.768	0.128	2485.686	2485.775	2485.815	2486	2486	1,1,1	NVA
25	697269.85	26744261.87	Yes	3828.8	3828.776	-0.024	3828.745	3828.769	3828.813	3829	3829	1,1,1	NVA
27	844802.74	26815875.26	Yes	2356.05	2356.179	0.129	2356.155	2356.177	2356.181	2356	2356	1,1,1	NVA
28	869705.39	26790125.68	Yes	2009.23	2009.231	0.001	2009.159	2009.246	2009.349	2009	2009	1,1,1	NVA
29	699819.48	26725710.63	Yes	3544.09	3543.835	-0.255	3543.573	3543.606	3543.916	3544	3544	1,1,1	NVA
30	894264.79	26677359.06	Yes	2120.67	2120.554	-0.116	2120.474	2120.579	2120.615	2121	2121	1,1,1	NVA
32	697499.37	26804112.67	Yes	4465.86	4465.731	-0.129	4465.676	4465.745	4465.846	4466	4466	1,1,1	NVA
34	859545.76	26841381.82	Yes	2201.7	2201.768	0.068	2201.762	2201.817	2201.831	2202	2202	1,1,1	NVA
35	880656.1	26861582.06	Yes	2279.04	2279.012	-0.028	2279.009	2279.009	2279.078	2279	2279	1,1,1	NVA
36	872291.27	26876242.71	Yes	2012.8	2012.862	0.062	2012.818	2012.887	2012.902	2013	2013	1,1,1	NVA
37	871739.45	26906957.72	Yes	2607.83	2607.901	0.071	2607.843	2607.867	2607.94	2608	2608	1,1,1	NVA
38	884169.44	26892253.51	Yes	2247.72	2247.788	0.068	2247.769	2247.804	2247.813	2248	2248	1,1,1	NVA
42	841493.81	26877544.72	Yes	2746.24	2746.314	0.074	2746.297	2746.314	2746.519	2746	2746	1,1,1	NVA
2124	730328.18	26782494.33	Yes	2923.52	2923.555	0.035	2923.489	2923.52	2923.636	2924	2924	1,1,1	NVA
3101	715670.09	26748285.19	Yes	3362.47	3362.423	-0.047	3362.393	3362.398	3362.442	3362	3362	1,1,1	NVA
4112	803120.08	26695479.96	Yes	2555.98	2555.895	-0.085	2555.85	2555.866	2555.928	2556	2556	1,1,1	NVA
4120	874797	26738346.79	Yes	1469.07	1469.057	-0.013	1468.745	1469.094	1469.108	1469	1469	1,1,1	NVA
4123	879645.33	26709878.94	Yes	1970	1970.003	0.003	1969.884	1970.038	1970.136	1970	1970	1,1,1	NVA

Check Points Vertical Accuracy - continued

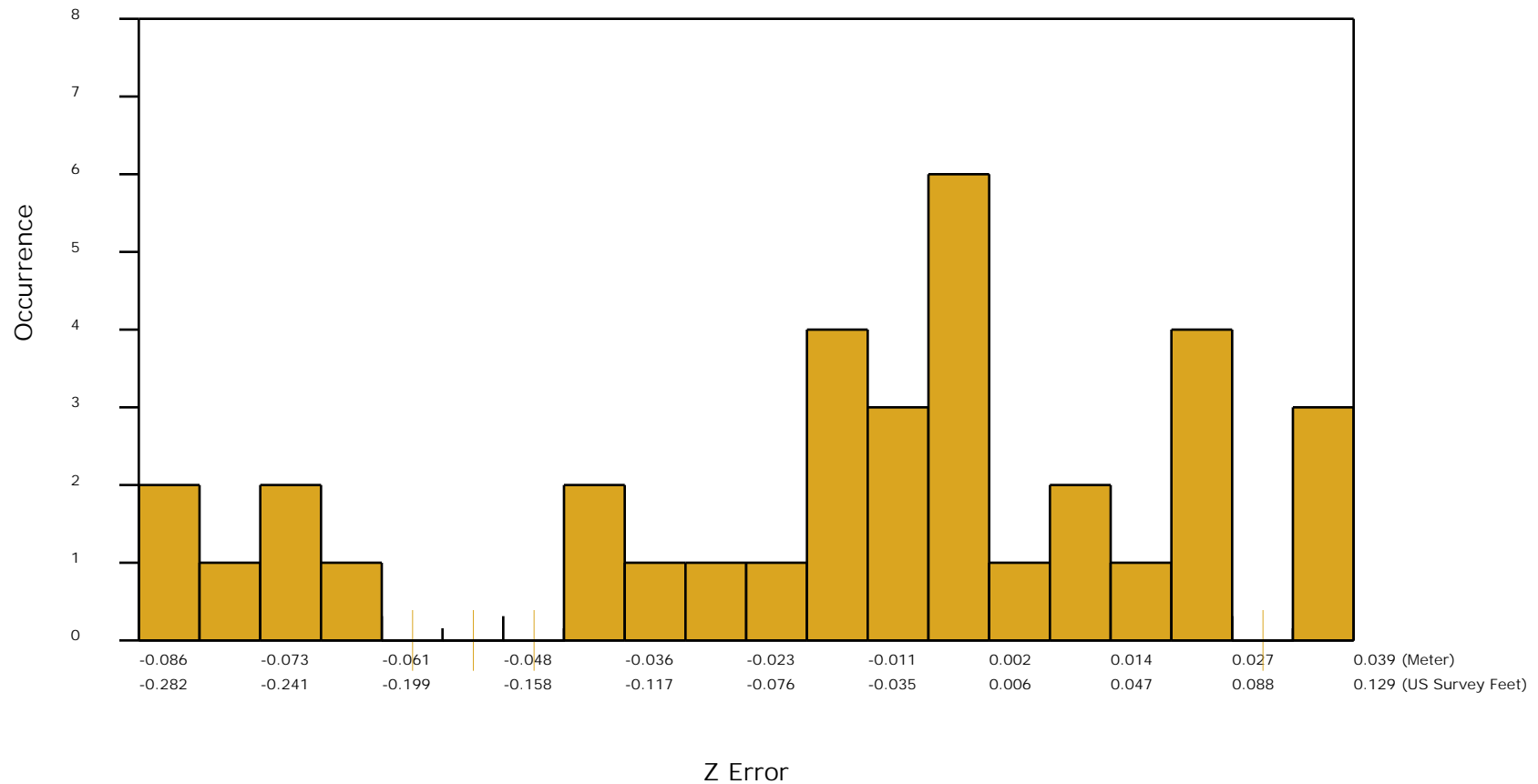
ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description
4208	835406.41	26677899.05	Yes	2374.1	2373.825	-0.275	2373.749	2373.817	2373.841	2374	2374	1,1,1	NVA
4217	859982.13	26690873.91	Yes	2341.77	2341.546	-0.224	2341.523	2341.591	2341.596	2342	2342	1,1,1	NVA
5201	822123.65	26864798.08	Yes	3568.05	3568.176	0.126	3568.076	3568.132	3568.271	3568	3568	1,1,1	NVA
5207	842148.54	26858440.25	Yes	2577.84	2577.846	0.006	2577.726	2577.858	2577.874	2578	2578	1,1,1	NVA
5208	836148.11	26843658.72	Yes	2556.58	2556.546	-0.034	2556.522	2556.554	2556.558	2557	2557	1,1,1	NVA

DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a frequency distribution chart of the non-vegetated vertical accuracy (NVA) of the lidar point cloud data measured against surveyed ground check points.

[Data Source - Y:\Mapping\Projects\65219059 SNWA LiDAR Digital Elevation Data\Production\LiDAR\01 Boresight\SNWA_QL2](#)

NVA (lidar swath data)



DPH-11.3 Report on Absolute Vertical Accuracy - continued

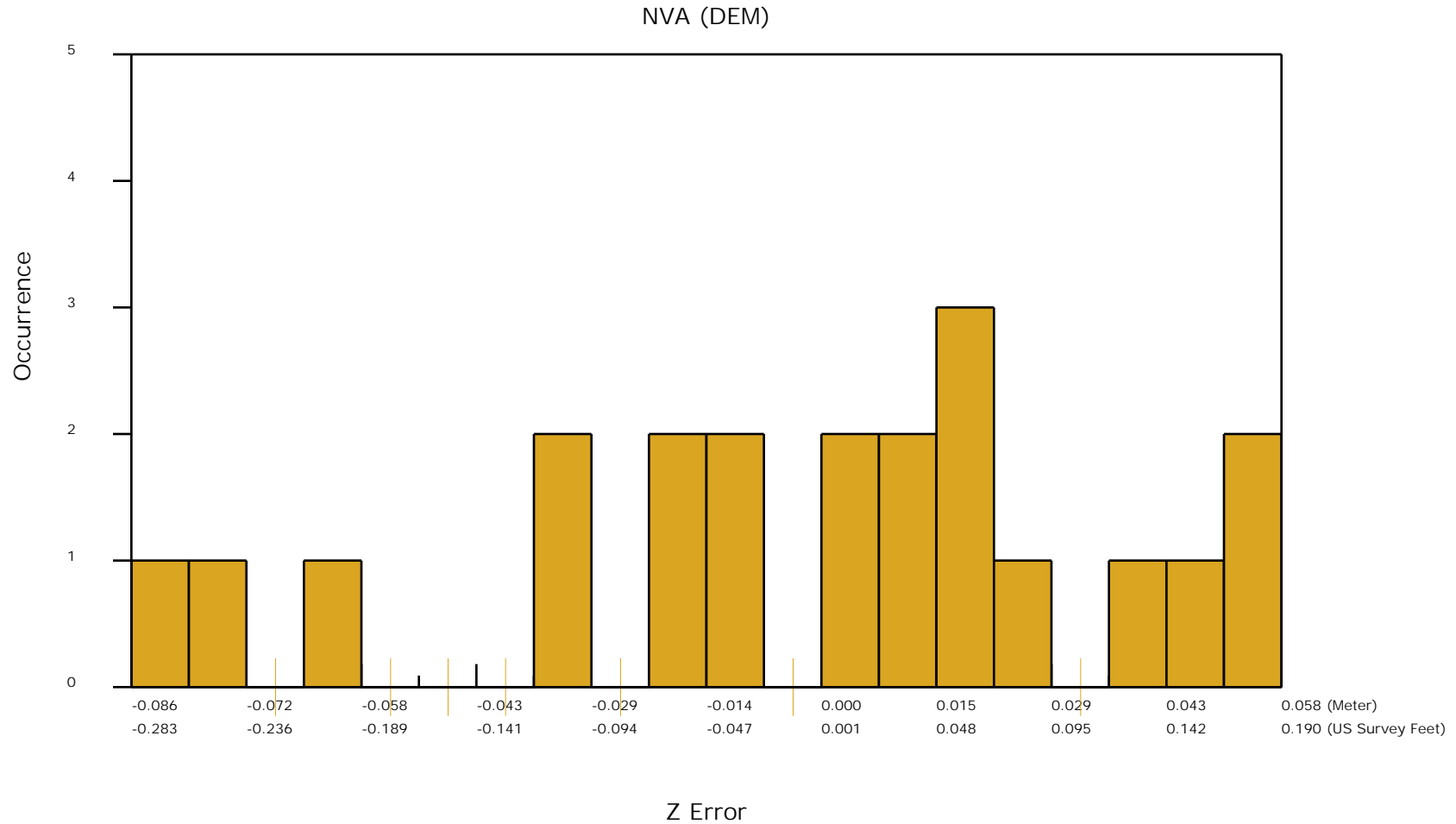
The purpose of this section is to report the results of measuring the classified (tiled) DEM data against surveyed ground NVA (nonvegetated vertical accuracy) check points. All XY coordinates and Z values reported are in the selected data units.

NVA (DEM)							
ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description
2	718636.87	26839375.53	Yes	2956.01	2956.018	0.008	NVA
12	705653.59	26822712.61	Yes	3691.98	3691.786	-0.194	NVA
23	704397.69	26758789.24	Yes	3708.94	3708.841	-0.099	NVA
24	859996.78	26812871.65	Yes	2485.64	2485.792	0.152	NVA
25	697269.85	26744261.87	Yes	3828.8	3828.813	0.012	NVA
27	844802.74	26815875.26	Yes	2356.05	2356.172	0.122	NVA
28	869705.39	26790125.68	Yes	2009.23	2009.189	-0.041	NVA
29	699819.48	26725710.63	Yes	3544.09	3543.807	-0.283	NVA
30	894264.79	26677359.06	Yes	2120.67	2120.563	-0.107	NVA
34	859545.76	26841381.82	Yes	2201.7	2201.752	0.052	NVA
35	880656.1	26861582.06	Yes	2279.04	2278.990	-0.050	NVA
36	872291.27	26876242.71	Yes	2012.8	2012.847	0.047	NVA
37	871739.45	26906957.72	Yes	2607.83	2607.920	0.090	NVA
38	884169.44	26892253.51	Yes	2247.72	2247.787	0.067	NVA
42	841493.81	26877544.72	Yes	2746.24	2746.418	0.178	NVA
3101	715670.09	26748285.19	Yes	3362.47	3362.401	-0.069	NVA
4120	874797	26738346.79	Yes	1469.07	1469.095	0.025	NVA
4208	835406.41	26677899.05	Yes	2374.1	2373.853	-0.247	NVA
5201	822123.65	26864798.08	Yes	3568.05	3568.240	0.190	NVA
5207	842148.54	26858440.25	Yes	2577.84	2577.898	0.058	NVA
5208	836148.11	26843658.72	Yes	2556.58	2556.552	-0.028	NVA

DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a frequency distribution chart of the non-vegetated vertical accuracy (NVA) of the DEM data measured against surveyed ground check points.

[Data Source - W:\QL2](#)



DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the classified (tiled) DEM data against surveyed ground VVA (vegetated vertical accuracy) check points. All XY coordinates and Z values reported are in the selected data units.

								VVA (DEM)
ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	
2121	705643.48	26822704.67	Yes	3692.99	3692.959	-0.031	VVA	
2122	705626.14	26822693.42	Yes	3692.82	3693.086	0.266	VVA	
2123	705678.58	26822795.83	Yes	3684	3683.379	-0.621	VVA	
3103	699908.04	26725689.08	Yes	3539.21	3538.960	-0.250	VVA	
3104	699871.98	26725729.41	Yes	3540.08	3540.112	0.032	VVA	
3105	708443.48	26719358.54	Yes	3378.71	3378.338	-0.372	VVA	
3106	708453.58	26719381.56	Yes	3378.12	3378.207	0.087	VVA	
3107	708397.54	26719042	Yes	3385.77	3385.428	-0.342	VVA	
4101	697156.72	26744319.44	Yes	3832.74	3833.132	0.392	VVA	
4102	697142.72	26744291.17	Yes	3832.75	3832.996	0.246	VVA	
4105	704353.26	26758858.44	Yes	3712.64	3712.777	0.137	VVA	
4106	704331.18	26758868.83	Yes	3713.64	3713.662	0.022	VVA	
4121	874733.32	26738292.69	Yes	1472.37	1472.891	0.521	VVA	
4122	874725.93	26738299.41	Yes	1472.32	1472.468	0.148	VVA	
4207	835414.64	26677940.71	Yes	2374.24	2374.531	0.291	VVA	
4214	894437.32	26677177.76	Yes	2111.14	2111.187	0.047	VVA	
4215	894444.96	26677187.84	Yes	2111.34	2111.261	-0.079	VVA	
4216	894469.97	26677132.05	Yes	2111.55	2111.613	0.063	VVA	
5101	873109.09	26878395.11	Yes	2028.03	2028.155	0.125	VVA	
5102	873090.23	26878427.95	Yes	2028.52	2028.450	-0.070	VVA	
5103	860845.12	26887297.36	Yes	2056.24	2057.452	1.212	VVA	
5104	860883.04	26887276.96	Yes	2057.36	2057.565	0.205	VVA	
5105	873224.01	26907779.7	Yes	2588.55	2588.801	0.251	VVA	
5106	873225.79	26907707.54	Yes	2588.59	2588.834	0.244	VVA	
5107	873192.88	26907699.73	Yes	2589.68	2589.794	0.114	VVA	
5108	880232.21	26862285.18	Yes	2274.32	2274.459	0.139	VVA	
5109	880162.91	26862270.67	Yes	2276.12	2276.434	0.314	VVA	
5110	880158.54	26862174.33	Yes	2275.4	2275.814	0.414	VVA	
5202	822048.82	26864797.04	Yes	3569.51	3569.646	0.136	VVA	
5203	822055.93	26864823.87	Yes	3570.96	3571.257	0.297	VVA	

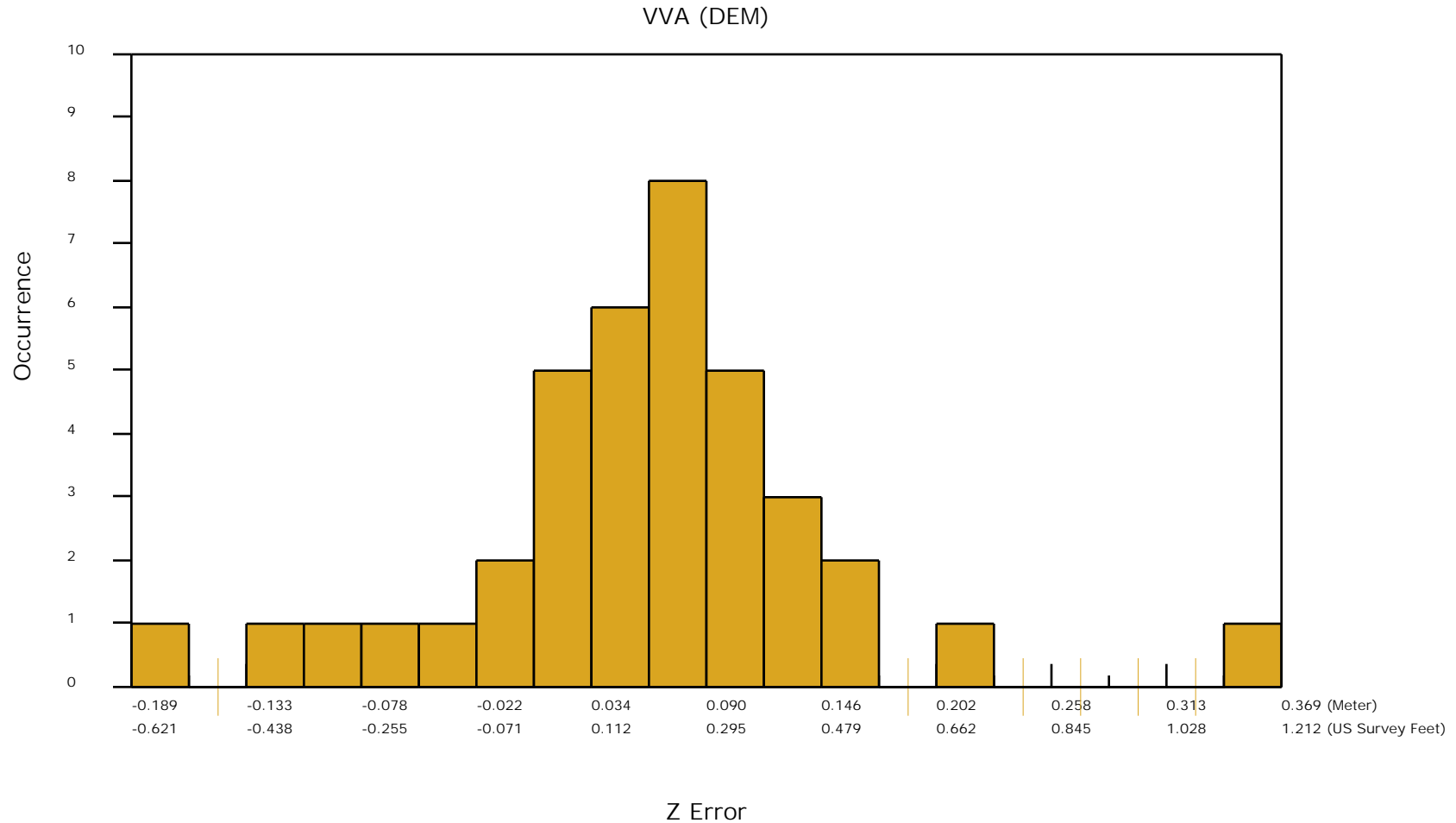
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description
5204	822114.06	26864805.38	Yes	3568.83	3569.278	0.448	VVA
5205	842046.72	26858160.13	Yes	2576.45	2576.780	0.330	VVA
5206	842060.78	26858182.24	Yes	2576.24	2576.562	0.322	VVA
5209	836195.81	26843708.25	Yes	2553.79	2554.067	0.277	VVA
5210	836255.87	26843679.16	Yes	2551.42	2551.629	0.209	VVA
5211	857216.27	26817863.73	Yes	2571.81	2572.547	0.737	VVA
5212	857167.97	26817900.64	Yes	2571.98	2572.531	0.551	VVA
5213	857187.47	26817900	Yes	2572.53	2572.904	0.374	VVA

DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a frequency distribution chart of the vegetated vertical accuracy (VVA) of the DEM data measured against surveyed ground check points.

[Data Source - W:\QL2](#)

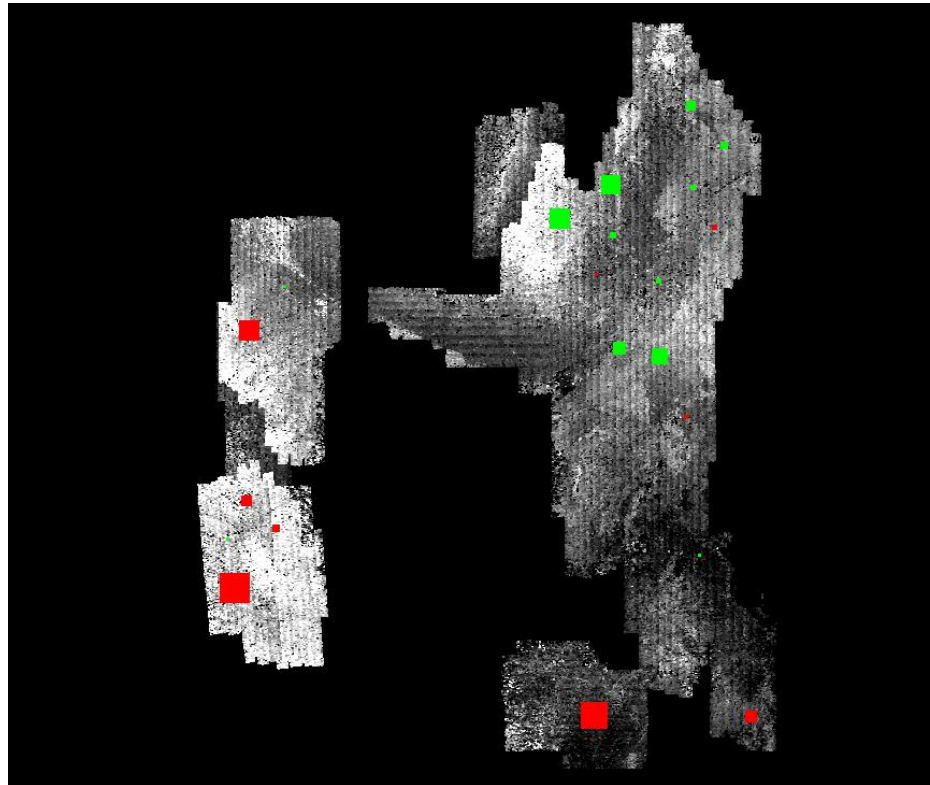



DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a graphic of lidar swath data points colored by intensity with NVA check points rendered "thematically" showing the green and red squares sized by Z error.

[Data Source - Y:\Mapping\Projects\65219059_SNWA_LiDAR_Digital_Elevation_Data\Production\LiDAR\01_Boresight\SNWA_QL2](Y:\Mapping\Projects\65219059_SNWA_LiDAR_Digital_Elevation_Data\Production\LiDAR\01_Boresight\SNWA_QL2)

[Result Path - W:\QL2\Only_Checkpoint_Report\DPH_11_3\ColorByIntensity_ControlPoints_NVA.jpg](W:\QL2\Only_Checkpoint_Report\DPH_11_3\ColorByIntensity_ControlPoints_NVA.jpg)



 Green represents where the lidar surface is above the check point (positive elevation error).

 Red represents where the lidar surface is below the check point (negative elevation error).

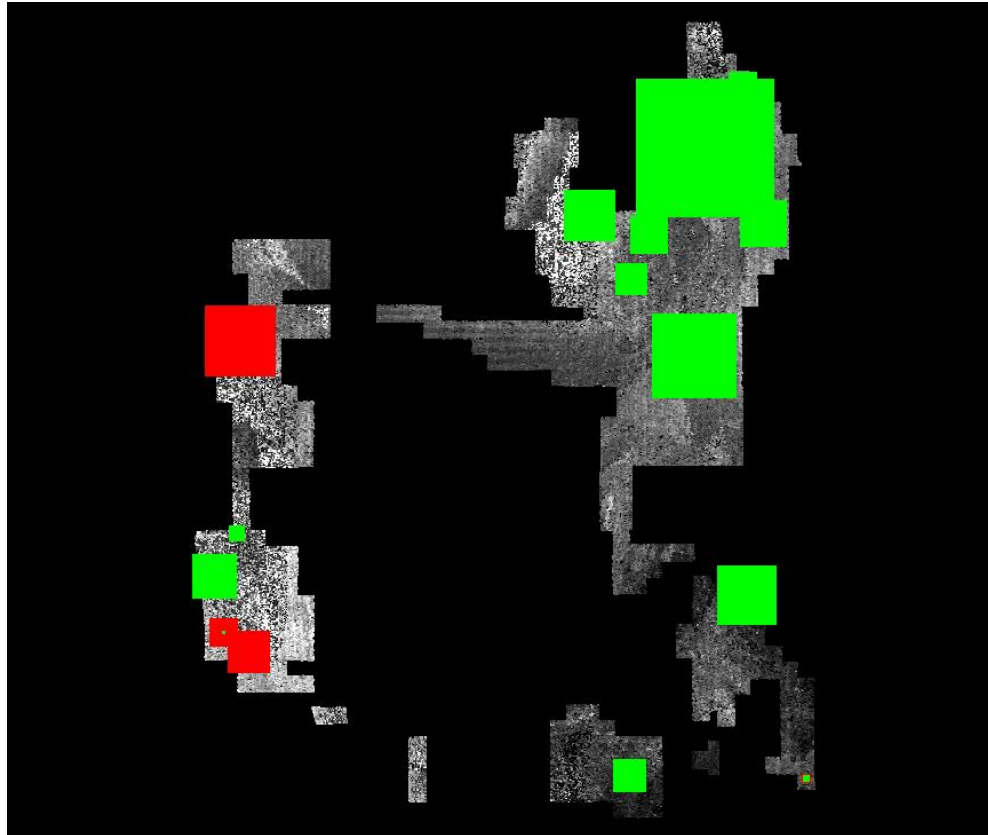
The size of the square symbol represents the absolute value magnitude of error.

DPH-11.3 Report on Absolute Vertical Accuracy - continued


The purpose of this section is to show a graphic of lidar classified (tiled) data points colored by intensity with VVA check points rendered "thematically" showing the green and red squares sized by Z error.

[Data Source - W:\QL2](#)

[Result Path - W:\QL2\Only_Checkpoint_Report\DPH_11_3\ColorByIntensity_ControlPoints_VVA.jpg](#)



 Green represents where a DEM of the lidar surface is above the check point (positive elevation error).

 Red represents where a DEM of the lidar surface is below the check point (negative elevation error).

The size of the square symbol represents the absolute value magnitude of error.

Skipped Tests

C-1 Report on Collection Area
C-2 Report on Returns
C-3 Report on Intensity
C-4 Report on Point Density and NPS per Flight Line
C-5 Report on Data Void
C-6 Overview of Spatial Distribution Verification
C-7 Report on Collection Conditions
DPH-1 Report on LAS Format
DPH-2 Report on Waveform Data
DPH-3 Report on GPS Time Type
DPH-4 Report on Datums
DPH-5 Report on Projections
DPH-6 Report on Units
DPH-7 Report on File Source ID
DPH-8 Report on Point Families
DPH-9 Report on LAS File Size
DPH-10 Flight Line Coverage
DPH-11.1.1 Smooth Surface Repeatability
DPH-11.1.2 Overlap consistency (interswath)
DPH-12 Use of the LAS Withheld Flag
DPH-13 Use of the LAS Overlap Flag
DPH-14 Point Classification
DPH-15/DPH-16 Reports on Classification Accuracy and Consistency
DPH-17 Report on Tiles

USGS LBS 1.2 QC Module Input Requirements Matrix

Test number	Boresighted LAS (Swath Data)	Classified LAS (Tiled Data)	Tile Scheme Shapefile	Project Boundary Shapefile	LiDAR Check Points
C-1	X	X		X	
C-2	X	X			
C-3	X	X			
C-4	X			O	
C-5	X			O	
C-6	X			O	
C-7	X	X			
DPH-1	X	X			
DPH-2	X	X			
DPH-3	X	X			
DPH-4	X	X			
DPH-5	X	X			
DPH-6	X	X			
DPH-7	X				
DPH-8	X				
DPH-9	X				
DPH-10	X			X	
DPH-11.1.1	X				
DPH-11.1.2	X			X	
DPH-11.2				X	X
DPH-11.3	X	X			X
DPH-12	X	X			
DPH-13	X	X			
DPH-14		X			
DPH-15		X			
DPH-16		X			
DPH-17		X	X		

X = Required

X = Will use Boresighted (Swath) LAS if available, else Classified LAS

O = Optional

O = Optional for single-area density reporting, but required for multi-area (multiple boundary) reporting of individual and aggregate areas