

# DPH-11 Report on Absolute Vertical Accuracy

The USGS Lidar Base Specification 2023 rev. A states: "Absolute vertical accuracy of the lidar data and the derived DEM will be assessed and reported in accordance with ASPRS (2014). Vegetated and nonvegetated land cover types shall be assessed for absolute vertical accuracy. Federal Emergency Management Agency (2003) identifies seven land cover types; National Digital Elevation Program (2004) and ASPRS (2004) reiterate the first five of those types. The way in which each of the seven classes was reported under the previous standards and how they are reported under the new ASPRS standards and by this specification are shown in table 3. Four absolute accuracy values shall be assessed and reported:

1. NVA for the point data
2. VVA for the point data
3. NVA for the DEM
4. VVA for the DEM

The minimum NVA and VVA requirements for all data, using the ASPRS methodology, are listed in table 4. Both the NVA and VVA required values shall be met. NVA for the point data shall be assessed by comparing check points surveyed for NVA assessment to a triangulated irregular network (TIN) constructed from ground-classified lidar points in those areas. VVA for the point data shall be assessed by comparing check points surveyed for VVA assessment to a triangulated irregular network (TIN) constructed from ground-classified lidar points in those areas. NVA and VVA for the DEM are assessed by comparing check points to the final bare-earth surface. The minimum required thresholds for absolute and relative accuracy may be increased by the USGS–NGP when any of the following conditions are met:

- A demonstrable, substantial, and prohibitive increase in cost is needed to obtain this accuracy, which is often the case in heavily vegetated project areas.
- An alternate specification is needed to conform to previously contracted phases of a single larger overall collection effort such as for multiyear statewide collections
- The USGS–NGP agrees that the use of an alternate specification is reasonable and in the best interest of all stakeholders."

**Table 4. Absolute vertical accuracy for light detection and ranging data and digital elevation models.**

[QL, quality level, RMSE<sub>z</sub>, root mean square error in the z direction; NVA, nonvegetated vertical accuracy; VVA, vegetated vertical accuracy; m, meter; ≤, less than or equal to]

Quality level	RMSE <sub>z</sub> (nonvegetated) (m)	NVA at the 95-percent confidence level (m)	VVA at the 95th percentile (m)
QL0	≤0.050	≤0.098	≤0.15
QL1	≤0.100	≤0.196	≤0.30
QL2	≤0.100	≤0.196	≤0.30
QL3	≤0.200	≤0.392	≤0.60

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

# DPH-11 Report on Absolute Vertical Accuracy - continued

Data Source - [D:\00\\_MNWest\Client\\_Shapes\MN\\_RiverWest\\_3\\_B3\\_NVA\\_VVA\\_New.shp](#)

Units: Meter (/Feet)

Vertical Accuracy Class tested: 10-cm

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Check Points in defined project area (DPA):	84
Check Points with Lidar Coverage	79
Check Points with Lidar Coverage (NVA)	37
Check Points with Lidar Coverage (VVA)	47
Average Z Error (NVA)	-0.016/-0.052
Maximum Z Error (NVA)	0.033/0.107
Median Z Error (NVA)	-0.014/-0.046
Minimum Z Error (NVA)	-0.166/-0.545
Standard deviation of Vertical Error (NVA)	0.032/0.106
Skewness of Vertical Error (NVA)	-2.646
Kurtosis of Vertical Error (NVA)	10.739
Non-vegetated Vertical Accuracy (NVA) RMSE(z) <sup>1</sup>	0.036/0.117 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/- <sup>1</sup>	0.070/0.229 PASS
FGDC/NSSDA Vertical Accuracy at the 95% Confidence Level +/-	0.070/0.229
Non-vegetated Vertical Accuracy (NVA) RMSE(z) (DEM) <sup>2</sup>	0.036/0.118 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level (DEM) +/- <sup>2</sup>	0.071/0.232 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (TIN) +/- <sup>1</sup>	0.137/0.451 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (DEM) +/- <sup>2</sup>	0.223/0.730 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 = 3.6cm, equating to +/- 7.0cm at the 95% confidence level. Actual VVA accuracy was found to be +/- 22.3cm at the 95th percentile.

<sup>1</sup> This value is calculated from TIN-based testing of the lidar point cloud data.

<sup>2</sup> This value is calculated from RAM-based grid testing of the lidar data. The grid cells are sized according to the Quality Level selected, and are defined in the USGS NGP Lidar Base Specification 2023 rev. A (Table 6).

# DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the lidar point cloud 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 data)

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
NVA4006	221886.631	5035041.806	Yes	338.6	338.569	-0.031	338.561	338.58	338.603	661	212	1,1,1		
NVA4012	327919.115	5047154.228	Yes	401.918	401.934	0.016	401.908	401.937	401.957	427	-514	1,1,1		
NVA4022	248288.869	5067629.215	Yes	325.083	325.095	0.012	325.09	325.092	325.099	618	550	1,1,1		
NVA4027	302736.697	5057662.517	Yes	387.844	387.847	0.003	387.836	387.851	387.852	745	326	1,1,1		
NVA4036	279057.658	5071283.264	Yes	376.615	376.559	-0.056	376.558	376.558	376.56	402	1594	1,1,1		
NVA4043	277228.516	5035902.037	Yes	343.696	343.698	0.002	343.688	343.696	343.716	481	1359	1,1,1		
NVA4047	262316.374	5052515.693	Yes	339.225	339.214	-0.011	339.183	339.212	339.217	713	269	1,1,1		
NVA4048	261440.927	5070275.404	Yes	337.112	337.068	-0.044	337.058	337.061	337.087	400	1551	1,1,1		
NVA4058	221309.807	5054309.333	Yes	341.476	341.458	-0.018	341.446	341.458	341.46	192	-374	1,1,1		
NVA4064	319455.9	5052499.7	Yes	407.864	407.873	0.009	407.851	407.859	407.879	474	-1397	1,1,1		
NVA4067	253252.201	5043194.978	Yes	355.026	355.023	-0.003	355.019	355.036	355.046	352	1596	1,1,1		
NVA4070BS2	222632.538	5043088.378	Yes	350.889	350.922	0.033	350.907	350.921	350.932	676	1312	1,1,1		
NVA4077	299998.358	5046564.238	Yes	340.426	340.26	-0.166	340.237	340.251	340.262	315	-1829	1,1,1		
NVA4084	317049.429	5069970.243	Yes	440.287	440.256	-0.031	440.25	440.252	440.277	539	1228	1,1,1		
NVA4085	286802.037	5062465.82	Yes	352.876	352.845	-0.031	352.833	352.848	352.864	627	482	1,1,1		
NVA4085A	286794.002	5062471.16	Yes	353.113	353.079	-0.034	353.064	353.078	353.081	478	474	1,1,1		
NVA4088	332774.624	5053394.547	Yes	412.726	412.743	0.017	412.74	412.741	412.748	354	614	1,1,1		
NVA4090	283999.313	5038891.708	Yes	330.519	330.505	-0.014	330.5	330.502	330.537	590	1794	1,1,1		
NVA4091	200946.19	5055700.474	Yes	298.922	298.896	-0.026	298.821	298.897	298.898	383	-1096	1,1,1		
NVA4092	232671.368	5053702.644	Yes	337.495	337.471	-0.024	337.465	337.47	337.502	520	80	1,1,1		
NVA4099ABS2	276500.821	5047386.063	Yes	339.899	339.872	-0.027	339.859	339.881	339.896	623	630	1,1,1		
NVA4110	212292.035	5036011.423	Yes	326.178	326.161	-0.017	326.145	326.16	326.178	546	1515	1,1,1		
NVA4115	252542.402	5052896.463	Yes	344.458	344.432	-0.026	344.399	344.434	344.44	615	-12	1,1,1		
NVA4116	332000.993	5069532.667	Yes	419.998	420.019	0.021	420.016	420.017	420.027	537	830	1,1,1		
NVA4123TS	322534.228	5065062.391	Yes	412.225	412.213	-0.012	412.198	412.211	412.221	1083	1625	1,1,1		
NVA4129	319948.265	5041791.547	Yes	395.188	395.212	0.024	395.198	395.203	395.228	267	-1680	1,1,1		
NVA4139	260956.944	5034883.094	Yes	335.351	335.327	-0.024	335.306	335.309	335.329	542	1177	1,1,1		
NVA4145	331848.521	5040640.574	Yes	403.701	403.69	-0.011	403.685	403.69	403.693	570	436	1,1,1		
NVA4147	269275.666	5042663.442	Yes	346.138	346.132	-0.006	346.128	346.136	346.148	402	1862	1,1,1		
NVA4152	290298.712	5070888.688	Yes	387.811	387.786	-0.025	387.782	387.789	387.792	594	1663	1,1,1		

## 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	Comments
NVA4153	266854.997	5061229.086	Yes	341.107	341.079	-0.028	341.074	341.08	341.083	628	-1044	1,1,1		
NVA4157	310960.803	5062654.889	Yes	427.849	427.829	-0.020	427.82	427.831	427.833	617	-1191	1,1,1		
NVA4161	299734.785	5038362.857	Yes	381.021	381.015	-0.006	381.002	381.008	381.056	466	2001	1,1,1		
NVA4162	313667.851	5048385.873	Yes	396.384	396.356	-0.028	396.351	396.362	396.364	543	522	1,1,1		
NVA4171	244980.435	5038770.288	Yes	351.991	351.984	-0.007	351.979	351.987	351.992	329	1657	1,1,1		
NVA4172	303197.527	5070788.992	Yes	428.625	428.637	0.012	428.619	428.631	428.666	544	727	1,1,1		
NVA4177	288787.799	5050041.222	Yes	343.305	343.3	-0.005	343.298	343.3	343.305	409	-609	1,1,1		

# DPH-11 Report on Absolute Vertical Accuracy - continued

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

## VVA (lidar data)

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
VVA5006	221906.966	5035023.001	Yes	337.485	337.495	0.010	337.485	337.493	337.51	527	322	1,1,1		
VVA5006A	221893.834	5035031.599	Yes	337.712	337.803	0.091	337.801	337.803	337.814	685	302	1,1,1		
VVA5012	328795.888	5044980.244	Yes	403.491	403.603	0.112	403.577	403.597	403.644	412	1992	2,2,2		
VVA5021	248239.897	5067672.31	Yes	323.694	323.702	0.008	323.7	323.703	323.706	231	756	1,1,1		
VVA5026	300982.6	5059265.833	Yes	390.728	390.895	0.167	390.859	390.872	390.905	355	915	3,3,2		
VVA5026B	300972.822	5059300.472	Yes	390.331	390.241	-0.090	390.232	390.302	390.323	337	746	3,1,2		
VVA5045	261518.646	5050925.046	Yes	336.618	336.682	0.064	336.577	336.685	336.693	640	-79	1,1,2		
VVA5046	265533.269	5063791.94	Yes	343.433	343.467	0.034	343.447	343.456	343.482	802	907	1,1,1		
VVA5046A	261491.622	5070325.998	Yes	335.48	335.56	0.080	335.518	335.579	335.592	637	1778	1,1,1		
VVA5056	222088.385	5051235.524	Yes	336.65	336.579	-0.071	336.577	336.579	336.58	151	-1917	2,2,2		
VVA5056A	222192.943	5051497.11	Yes	337.961	337.965	0.004	337.939	337.946	337.978	731	-728	1,1,1		
VVA5061	315311.204	5057612.252	Yes	411.455	411.453	-0.002	411.441	411.444	411.465	670	1169	1,1,1		
VVA5064A	254800.305	5040900.498	Yes	356.011	356.035	0.024	356.017	356.045	356.07	118	-1368	2,4,3		
VVA5064C	254835.745	5040895.485	Yes	356.205	356.218	0.013	356.203	356.222	356.23	129	-1379	4,4,2		
VVA5067	222685.08	5043129.286	Yes	350.498	350.636	0.138	350.618	350.641	350.644	140	1044	2,2,3		
VVA5067B	222680.512	5043145.989	Yes	350.576	350.633	0.057	350.606	350.652	350.702	128	1002	3,3,4		
VVA5067C	222700.897	5043125.6	Yes	350.462	350.425	-0.037	350.39	350.424	350.427	310	1091	3,2,2		
VVA5074	302420.669	5050639.372	Yes	370.162	370.144	-0.018	370.135	370.141	370.15	670	1611	2,1,2		
VVA5074A	302404.321	5050643.472	Yes	370.274	370.254	-0.020	370.22	370.235	370.279	130	1636	4,3,3		
VVA5080	318464.419	5070901.251	Yes	435.64	435.626	-0.014	435.568	435.633	435.739	179	-2056	2,3,3		
VVA5080A	318432.38	5070913.136	Yes	435.001	435.053	0.052	434.99	435.043	435.061	121	-2098	3,2,3		
VVA5080B	318515.343	5070917.799	Yes	435.63	435.63	0.000	435.531	435.63	435.651	498	-2046	2,2,4		
VVA5080C	318512.508	5070896.999	Yes	435.124	435.178	0.054	435.144	435.202	435.246	248	-2058	3,2,2		
VVA5081	286728.911	5061807.12	Yes	348.683	348.793	0.110	348.766	348.79	348.798	578	-1189	1,1,1		
VVA5081A	290281.01	5070873.532	Yes	387.36	387.41	0.050	387.4	387.406	387.417	790	1568	1,1,1		
VVA5084	327450.638	5052404.023	Yes	409.897	409.992	0.095	409.972	410.002	410.003	1009	-1853	1,1,1		
VVA5086	282670.873	5042129.46	Yes	341.648	341.713	0.065	341.678	341.712	341.714	565	1611	2,1,1		
VVA5087	201335.149	5055915.263	Yes	307.844	307.764	-0.080	307.74	307.758	307.771	976	13	2,2,1		
VVA5088	230796.127	5051801.66	Yes	336.521	336.532	0.011	336.529	336.54	336.547	831	1650	1,1,1		
VVA5088A	200941.5	5055709.985	Yes	298.69	298.699	0.009	298.616	298.679	298.769	731	-1068	1,1,1		

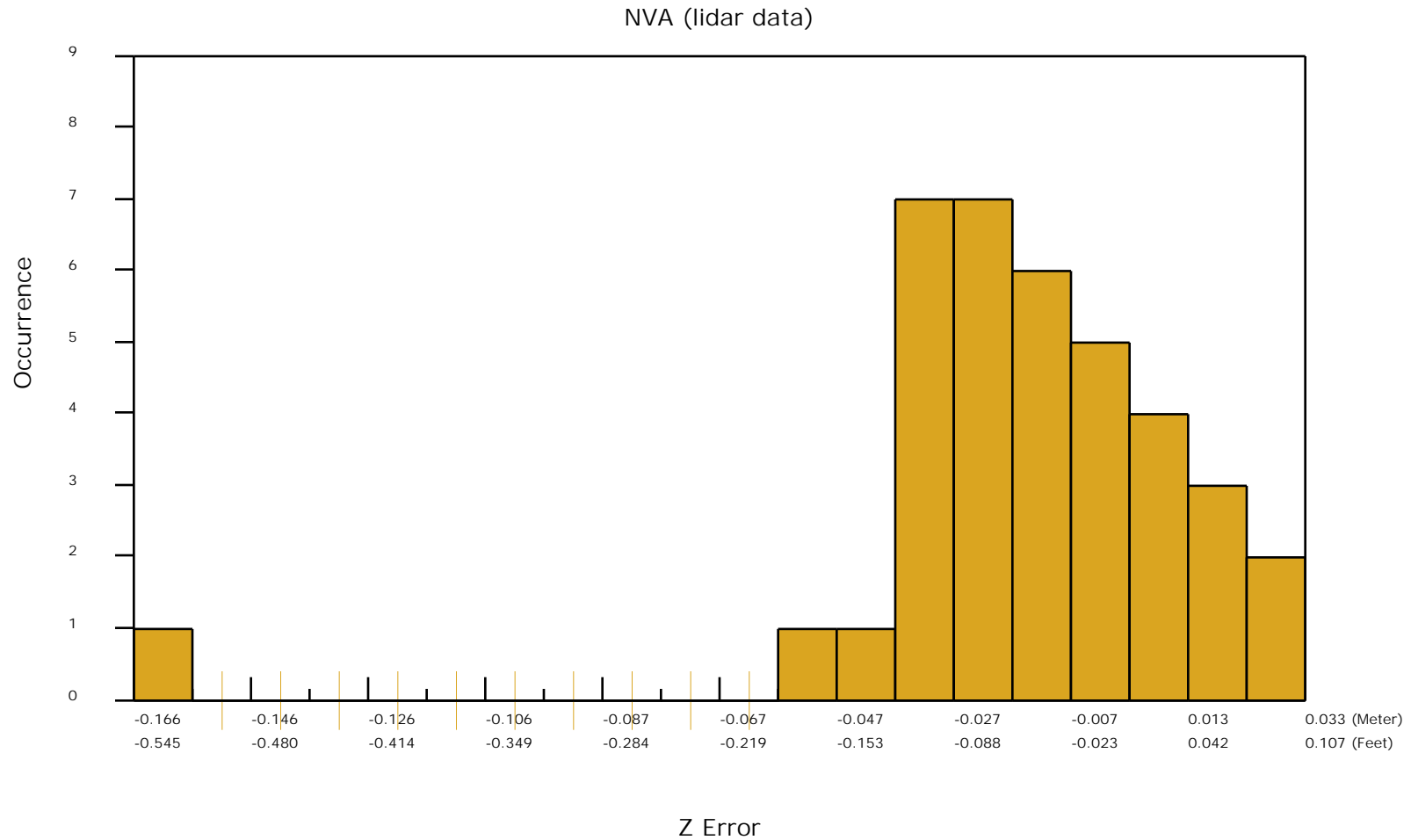
## Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
VVA5095	276419.627	5047301.655	Yes	340.773	340.719	-0.054	340.59	340.713	340.737	103	79	2,1,3		
VVA5095A	276421.778	5047282.266	Yes	341.277	341.252	-0.025	341.188	341.266	341.297	130	49	2,2,4		
VVA5095B	276405.007	5047289.254	Yes	341.533	341.411	-0.122	341.314	341.433	341.449	127	9	4,2,3		
VVA5095C	276367.092	5047334.855	Yes	341.824	341.694	-0.130	341.593	341.818	341.819	97	-174	3,2,3		
VVA5095D	276336.557	5047363.242	Yes	341.869	341.798	-0.071	341.794	341.796	341.8	128	-1922	2,2,2		
VVA5106	212445.733	5035722.71	Yes	299.048	299.043	-0.005	299.011	299.065	299.092	639	-1192	1,1,1		
VVA5110	252637.076	5052925.325	Yes	342.733	342.746	0.013	342.725	342.736	342.781	758	-169	1,1,1		
VVA5111	329792.115	5070427.198	Yes	416.858	416.897	0.039	416.868	416.933	416.942	638	-1305	1,1,1		
VVA5118	322545.257	5065102.539	Yes	412.022	411.991	-0.031	411.906	411.914	412.048	69	1425	4,3,3		
VVA5118B	322522.421	5065091.053	Yes	412.664	412.616	-0.048	412.573	412.622	412.631	144	1496	3,2,3		
VVA5127A	296309.108	5069729.793	Yes	407.035	407.092	0.057	407.074	407.095	407.099	83	-1058	3,2,4		
VVA8000	332697.206	5050204.679	Yes	410.058	410.372	0.314	410.345	410.441	410.469	787	-58	1,1,1		

# DPH-11 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.

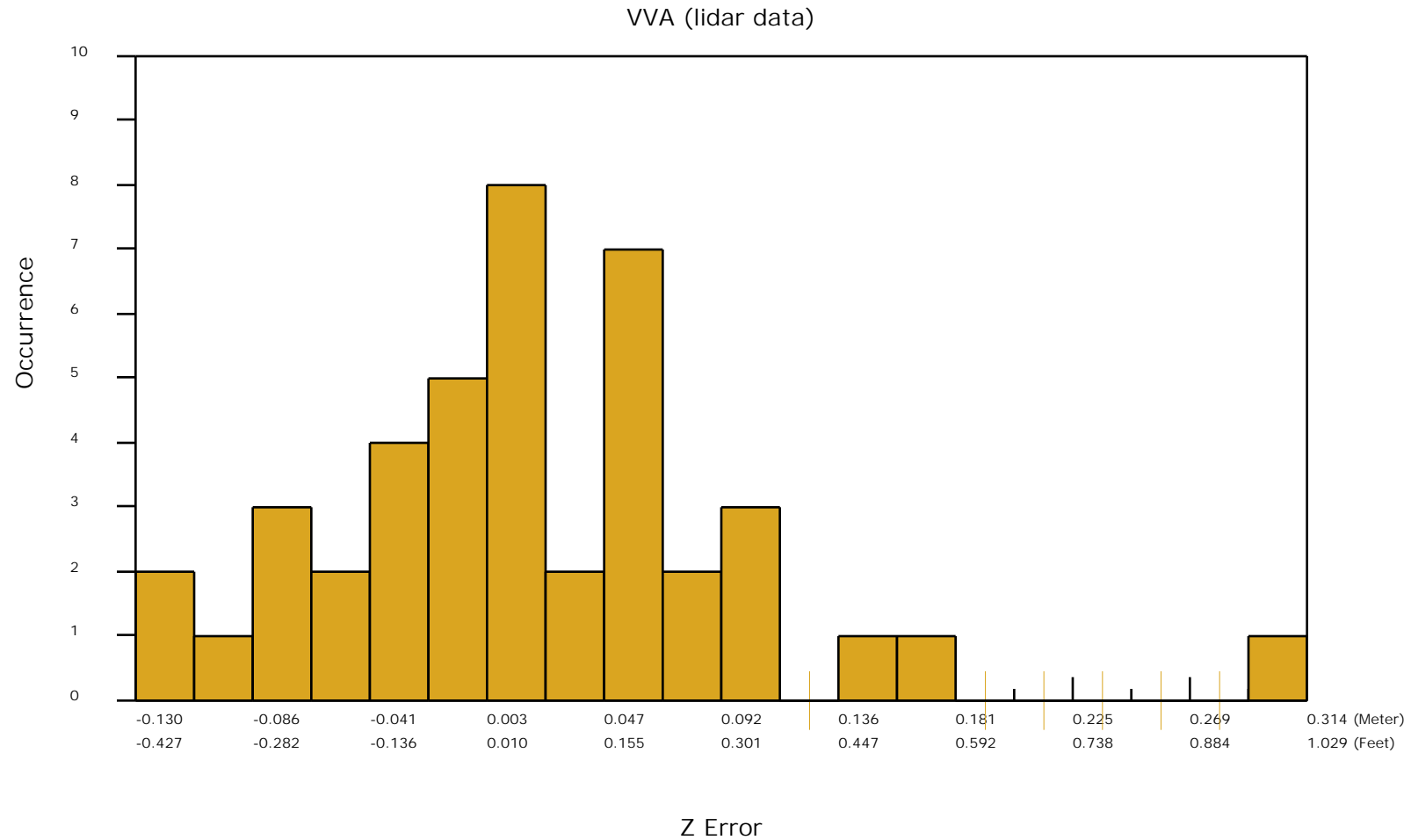
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## DPH-11 Report on Absolute Vertical Accuracy - continued

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

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## DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the 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	Comments
NVA4006	221886.631	5035041.806	Yes	338.6	338.566	-0.034		
NVA4012	327919.115	5047154.228	Yes	401.918	401.923	0.005		
NVA4022	248288.869	5067629.215	Yes	325.083	325.093	0.010		
NVA4027	302736.697	5057662.517	Yes	387.844	387.840	-0.004		
NVA4036	279057.658	5071283.264	Yes	376.615	376.559	-0.056		
NVA4043	277228.516	5035902.037	Yes	343.696	343.705	0.009		
NVA4047	262316.374	5052515.693	Yes	339.225	339.221	-0.004		
NVA4048	261440.927	5070275.404	Yes	337.112	337.082	-0.030		
NVA4058	221309.807	5054309.333	Yes	341.476	341.455	-0.021		
NVA4064	319455.9	5052499.7	Yes	407.864	407.873	0.009		
NVA4067	253252.201	5043194.978	Yes	355.026	355.011	-0.015		
NVA4070BS2	222632.538	5043088.378	Yes	350.889	350.906	0.017		
NVA4077	299998.358	5046564.238	Yes	340.426	340.259	-0.167		
NVA4084	317049.429	5069970.243	Yes	440.287	440.251	-0.036		
NVA4085	286802.037	5062465.82	Yes	352.876	352.832	-0.044		
NVA4085A	286794.002	5062471.16	Yes	353.113	353.076	-0.037		
NVA4088	332774.624	5053394.547	Yes	412.726	412.740	0.014		
NVA4090	283999.313	5038891.708	Yes	330.519	330.502	-0.017		
NVA4091	200946.19	5055700.474	Yes	298.922	298.875	-0.047		
NVA4092	232671.368	5053702.644	Yes	337.495	337.480	-0.015		
NVA4099ABS2	276500.821	5047386.063	Yes	339.899	339.882	-0.017		
NVA4110	212292.035	5036011.423	Yes	326.178	326.162	-0.016		
NVA4115	252542.402	5052896.463	Yes	344.458	344.423	-0.035		
NVA4116	332000.993	5069532.667	Yes	419.998	420.022	0.024		
NVA4123TS	322534.228	5065062.391	Yes	412.225	412.212	-0.013		
NVA4129	319948.265	5041791.547	Yes	395.188	395.203	0.015		
NVA4139	260956.944	5034883.094	Yes	335.351	335.322	-0.029		
NVA4145	331848.521	5040640.574	Yes	403.701	403.701	0.000		
NVA4147	269275.666	5042663.442	Yes	346.138	346.138	0.000		
NVA4152	290298.712	5070888.688	Yes	387.811	387.784	-0.027		

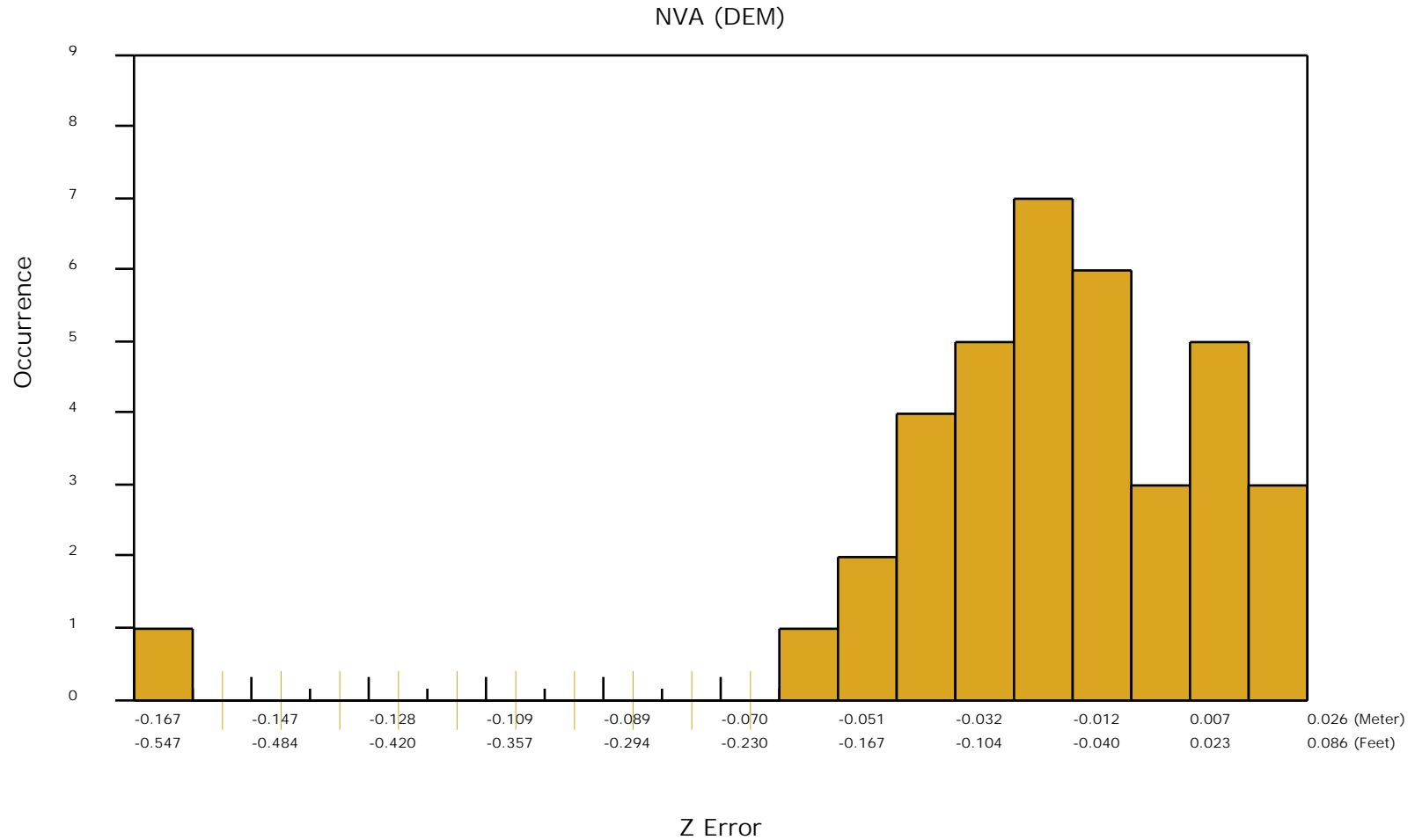
## Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
NVA4153	266854.997	5061229.086	Yes	341.107	341.080	-0.027		
NVA4157	310960.803	5062654.889	Yes	427.849	427.839	-0.010		
NVA4161	299734.785	5038362.857	Yes	381.021	381.012	-0.009		
NVA4162	313667.851	5048385.873	Yes	396.384	396.359	-0.025		
NVA4171	244980.435	5038770.288	Yes	351.991	351.987	-0.004		
NVA4172	303197.527	5070788.992	Yes	428.625	428.651	0.026		
NVA4177	288787.799	5050041.222	Yes	343.305	343.301	-0.004		

# DPH-11 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 - Y:\Mapping\Projects\100060\\_MN\\_RiverWest\Production\LiDAR\10\\_LiDAR\\_Reclass\Project\\_Wide\LAS\B3](#)



## DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the 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	Comments
VVA5006	221906.966	5035023.001	Yes	337.485	337.518	0.033		
VVA5006A	221893.834	5035031.599	Yes	337.712	337.799	0.087		
VVA5012	328795.888	5044980.244	Yes	403.491	403.593	0.102		
VVA5021	248239.897	5067672.31	Yes	323.694	323.702	0.008		
VVA5026	300982.6	5059265.833	Yes	390.728	390.882	0.154		
VVA5026B	300972.822	5059300.472	Yes	390.331	390.247	-0.084		
VVA5045	261518.646	5050925.046	Yes	336.618	336.695	0.077		
VVA5046	265533.269	5063791.94	Yes	343.433	343.463	0.030		
VVA5046A	261491.622	5070325.998	Yes	335.48	335.572	0.092		
VVA5056	222088.385	5051235.524	Yes	336.65	336.580	-0.070		
VVA5056A	222192.943	5051497.11	Yes	337.961	337.965	0.004		
VVA5061	315311.204	5057612.252	Yes	411.455	411.455	0.000		
VVA5064A	254800.305	5040900.498	Yes	356.011	356.047	0.036		
VVA5064C	254835.745	5040895.485	Yes	356.205	356.222	0.017		
VVA5067	222685.08	5043129.286	Yes	350.498	350.633	0.135		
VVA5067B	222680.512	5043145.989	Yes	350.576	350.610	0.034		
VVA5067C	222700.897	5043125.6	Yes	350.462	350.425	-0.037		
VVA5074	302420.669	5050639.372	Yes	370.162	370.141	-0.021		
VVA5074A	302404.321	5050643.472	Yes	370.274	370.246	-0.028		
VVA5080	318464.419	5070901.251	Yes	435.64	435.646	0.006		
VVA5080A	318432.38	5070913.136	Yes	435.001	435.053	0.052		
VVA5080B	318515.343	5070917.799	Yes	435.63	435.629	-0.001		
VVA5080C	318512.508	5070896.999	Yes	435.124	435.171	0.047		
VVA5081	286728.911	5061807.12	Yes	348.683	348.791	0.108		
VVA5081A	290281.01	5070873.532	Yes	387.36	387.446	0.086		
VVA5084	327450.638	5052404.023	Yes	409.897	409.982	0.085		
VVA5086	282670.873	5042129.46	Yes	341.648	341.704	0.056		
VVA5087	201335.149	5055915.263	Yes	307.844	307.759	-0.085		
VVA5088	230796.127	5051801.66	Yes	336.521	336.537	0.016		
VVA5088A	200941.5	5055709.985	Yes	298.69	298.713	0.023		

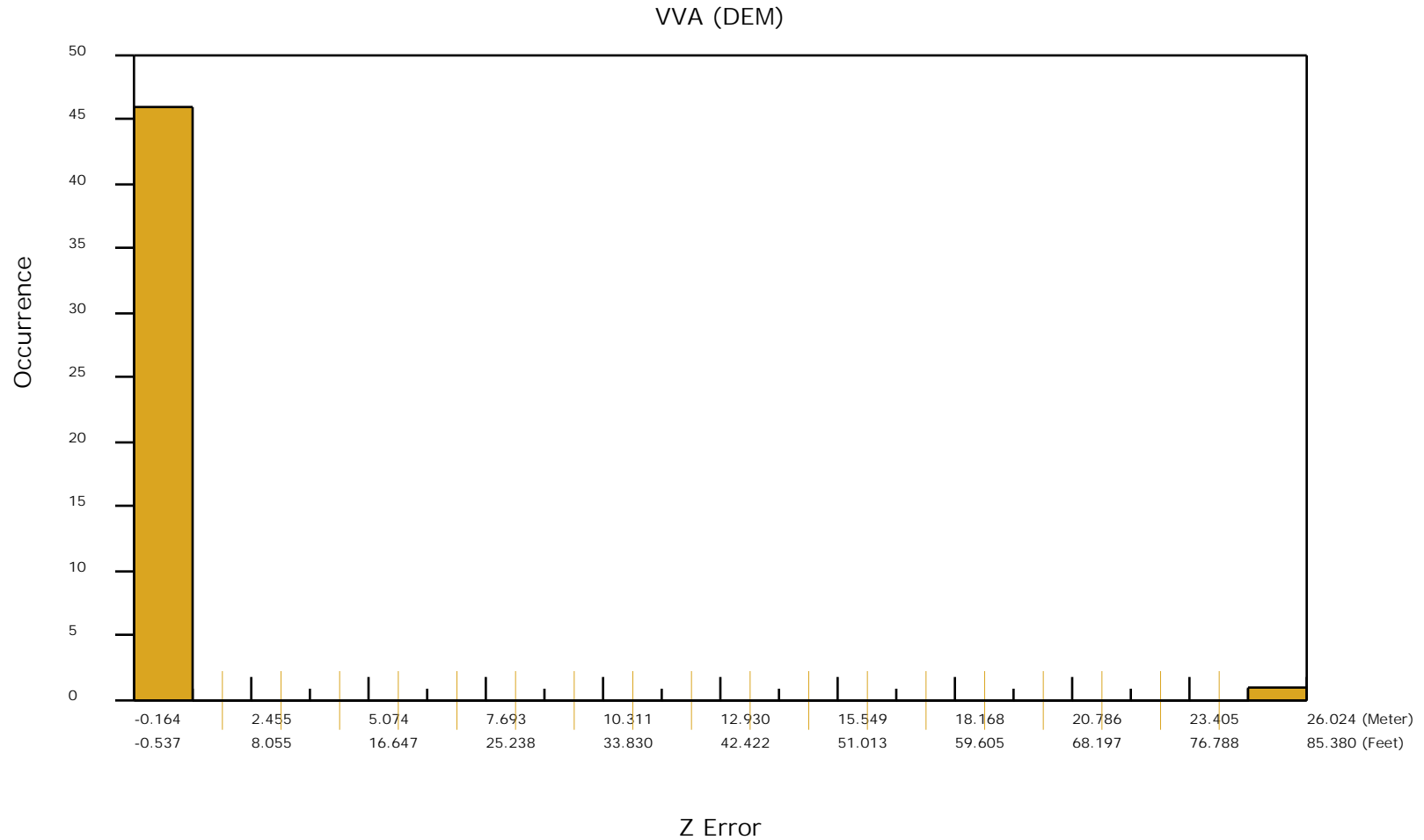
## Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
VVA5095	276419.627	5047301.655	Yes	340.773	340.709	-0.064		
VVA5095A	276421.778	5047282.266	Yes	341.277	341.250	-0.027		
VVA5095B	276405.007	5047289.254	Yes	341.533	341.369	-0.164		
VVA5095C	276367.092	5047334.855	Yes	341.824	341.670	-0.154		
VVA5095D	276336.557	5047363.242	Yes	341.869	341.813	-0.056		
VVA5106	212445.733	5035722.71	Yes	299.048	299.045	-0.003		
VVA5110	252637.076	5052925.325	Yes	342.733	342.731	-0.002		
VVA5111	329792.115	5070427.198	Yes	416.858	416.883	0.025		
VVA5118	322545.257	5065102.539	Yes	412.022	411.978	-0.044		
VVA5118B	322522.421	5065091.053	Yes	412.664	412.603	-0.061		
VVA5127A	296309.108	5069729.793	Yes	407.035	407.098	0.063		
VVA8000	332697.206	5050204.679	Yes	410.058	410.374	0.316		

# DPH-11 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.

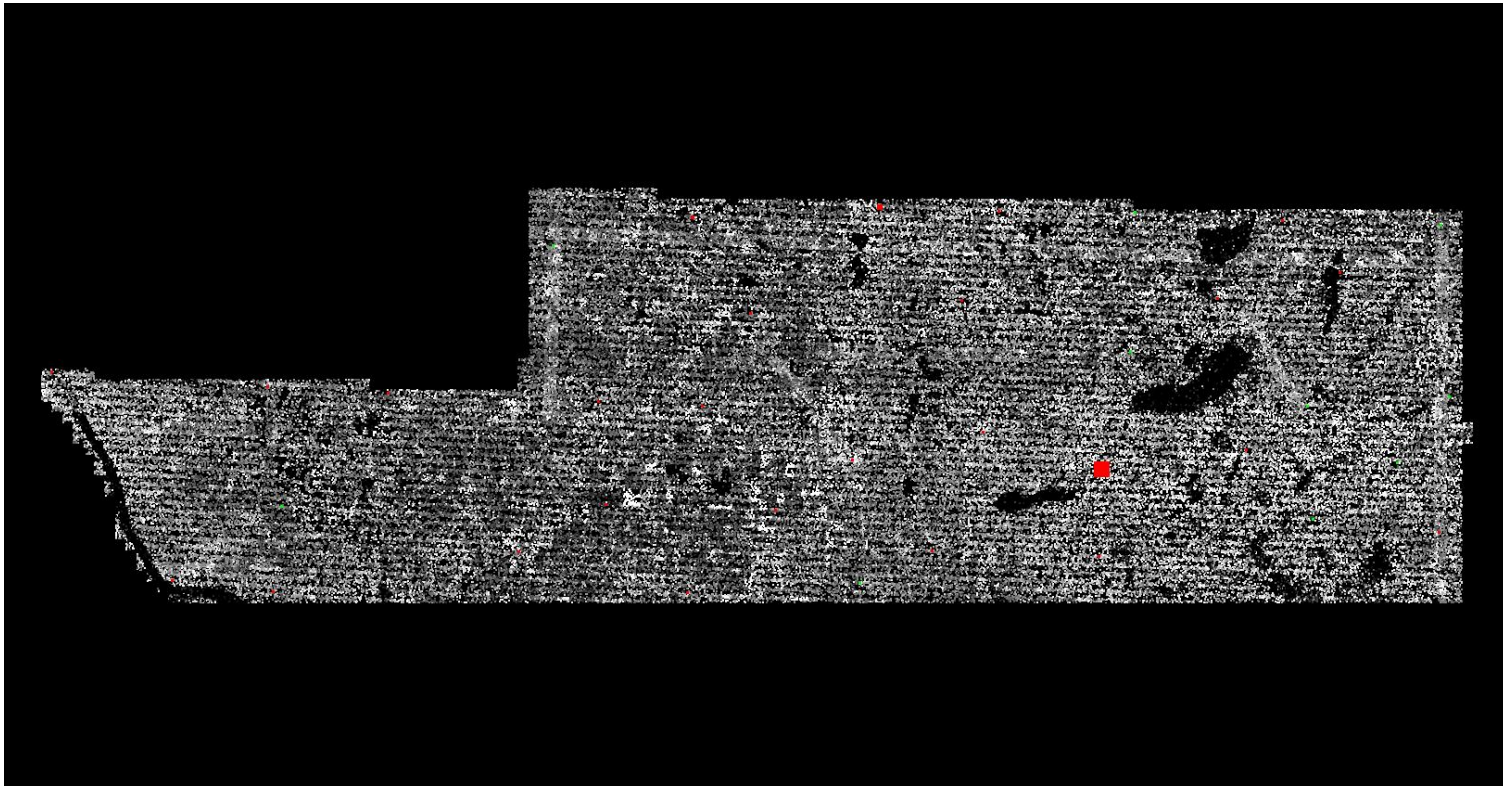
[Data Source - Y:\Mapping\Projects\100060\\_MN\\_RiverWest\Production\LiDAR\10\\_LiDAR\\_Reclass\Project\\_Wide\LAS\B3](#)



## *DPH-11 Report on Absolute Vertical Accuracy - continued*

The purpose of this section is to show a graphic of lidar 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\100060\\_MN\\_RiverWest\Production\LIDAR\10\\_LiDAR\\_Reclass\Project\\_Wide\LAS\B3](#)  
[Result Path - Y:\Mapping\Projects\100060\\_MN\\_RiverWest\Admin\QA\\_QC\MN\\_West\\_B3\\_QC\DPH\\_11\ColorByIntensity\\_CheckPoints\\_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).

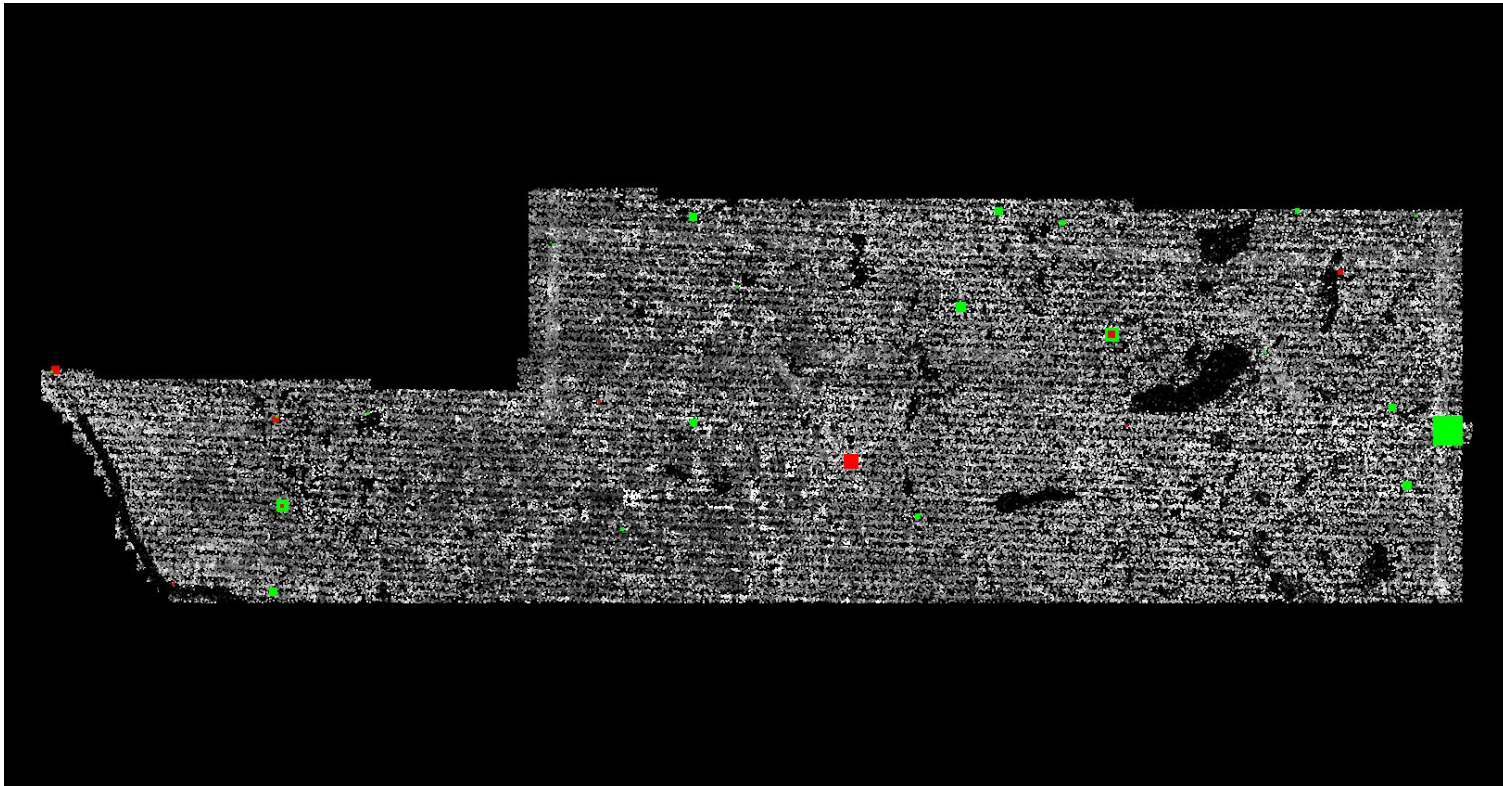
The size of the square symbol represents the absolute value magnitude of error.

## *DPH-11 Report on Absolute Vertical Accuracy - continued*

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

[Data Source - Y:\Mapping\Projects\100060\\_MN\\_RiverWest\Production\LIDAR\10\\_LiDAR\\_Reclass\Project\\_Wide\LAS\B3](#)

[Result Path - Y:\Mapping\Projects\100060\\_MN\\_RiverWest\Admin\QA\\_QC\MN\\_West\\_B3\\_QC\DPH\\_11\ColorByIntensity\\_CheckPoints\\_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.