



AYRES

Ground Control Report

Wisconsin WROC - 3DEP

Vernon County Lidar 2020

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1.1 Ground Control Design and Methodology

The ground control network and design used for the Vernon County lidar acquisition was made up of calibration points, GPS base stations, NGS base stations, and independent check points from the vertical accuracy ground control survey. This report will focus on the lidar calibration points that were collected at 19 locations in and around the Vernon County project area. The control points are used for QC checks and calibration of the raw point cloud and for additional vertical checks against the processed bare earth surface.

The ground control calibration survey was done in Wisconsin Coordinate Reference System-Vernon Zone, NAD83 (2011), U.S. survey feet; NAVD88 (Geoid 12B), U.S. survey feet. The field work was conducted by Ayres surveyors. All field work was completed between February 18 and February 26, 2020.

Control Summary and Methodology

Control Summary

Horizontal Datum:	NAD83 (2011)
Vertical Datum:	NAVD88 (2012), GEOID12B (CONUS)
Rectangular Coordinate System:	WISCRS – Vernon County
Used NGS Control?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
List any NGS control points used:	DJ4312, DH5434
Summary of control checks and calibration (if applicable):	(See Field Notes for control checks on NGS monuments – No calibration was needed)
Survey Methods Used:	RTK-GPS using WISCORS Network through VRS connection were used for direct observations and to set control pairs for Robotic Total Station shots on power poles if needed.
Equipment Used:	GPS Trimble R10 GNSS S/N 5736470271– (Ayres #70.58) Total station Trimble S6 S/N 93410505 – (Ayres #75.53) Data Collector Trimble TSC 3 S/N RS17C22013 (Ayres #75.37)

Survey Methods (continued)

All work was performed in and referenced to NAD83 (2011), NAVD 88(2012), Geoid 12B, Wisconsin Coordinate Reference System-Vernon Zone in U.S. Survey Feet.

Established horizontal and vertical coordinate values on the points by a minimum of two – 90 epoch observations with separate initializations using RTK GPS and the WISCORS network. The resultant coordinates and elevations provided in the deliverables are an average of the two observations. OPUS observations of a 30 minute minimum were taken on control points when necessary.

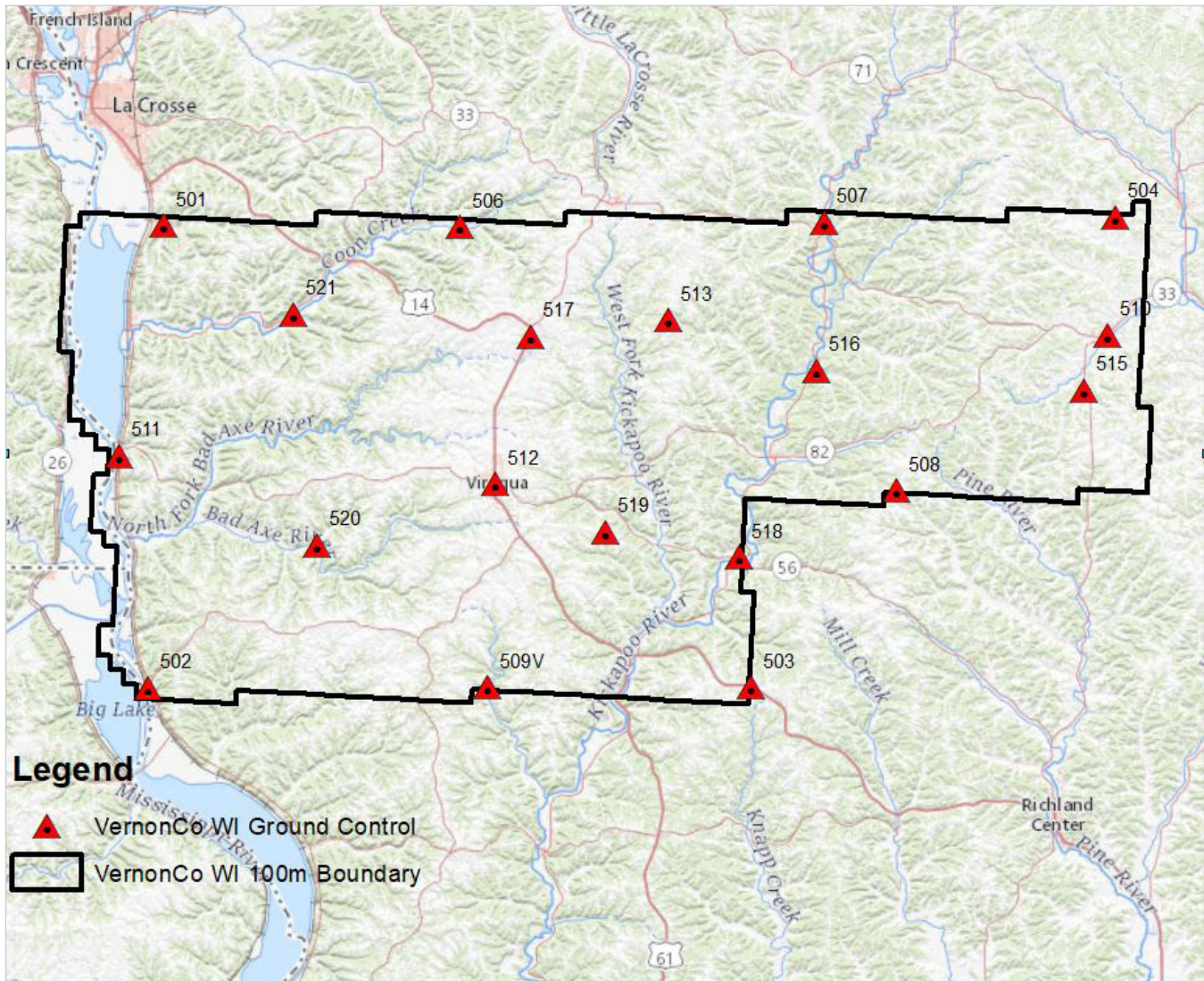
Check shots were taken on numerous NGS control points (see above and field notes) to verify that the values obtained are consistent with the datum/adjustment as described herein and meet the ± 3 centimeter vertical accuracy requirement at the 95% confidence level.

Points not able to be directly occupied by GPS means were measured using Total Station methods from control point pairs set utilizing GPS methods outlined above.

1.1.2 Control Layout

The locations were selected around the outer geometry of the project boundary and on major roads within the project area. This layout design is preferred when the calibration points will be used to check different areas across a large flight block. The control survey was conducted with a Trimble R-8 GPS receiver and a VRS connection with a TSC3 data collector.

1.1.2.1 Map of Vernon County Calibration Points



1.1.3 Vernon County Lidar, Calibration Point Statistics

The final step in using the calibration points is to run a statistical comparison against the bare earth ground surface to confirm that the vertical accuracy is within specification. The following results indicate that the overall RMSEz of the calibration points is 0.081'. This is a separate check as compared to the Vertical Accuracy Survey QA/QC report. These points are used in the calibration of the raw point cloud, and therefore are not an independent set of checkpoints like those used in the vertical accuracy testing.

1.1.3.1 Statistical Report for Calibration Points

NUMBER	EASTING	NORTHING	KNOWN Z	LASER Z	DZ
501	623136.746	211020.171	727.526	727.51	-0.016
502	619402.349	100851.43	640.048	640.21	0.162
503	763345.733	100946.646	1249.127	1249.17	0.043
504	850282.779	213056.883	1035.185	1035.11	-0.075
506	693828.679	210747.332	823.896	823.97	0.074
507	780788.197	211898.087	910.262	910.17	-0.092
508	797938.984	147939.76	1284.65	1284.68	0.03
509V	700486.01	101013.041	853.455	853.49	0.035
510	848321.858	184979.131	951.191	951.05	-0.141
511	612465.84	156107.921	639.706	639.81	0.104
512	702205.542	149421.36	1262.747	1262.8	0.053
513	743539.123	188602.642	1218.014	1217.94	-0.074
515	842783.365	171867.802	1009.369	1009.41	0.041
516	778847.66	176482.256	873.898	873.78	-0.118
517	710719.726	184594.784	1306.465	1306.5	0.035
518	760464.151	132015.575	770.08	770.08	0
519	728712.106	137986.23	1187.489	1187.41	-0.079
520	659831.784	134982.209	702.709	702.82	0.111
521	654142.965	189873.887	697.446	697.42	-0.026

Average Dz	0.004
Minimum Dz	-0.141
Maximum Dz	0.162
Average Magnitude	0.069
Root Mean Square	0.081
Std Deviation	0.083

1.1.4 Field Notes

501 CP 2M TNS EAST END
OF FOG LINE, SW QUAD CTH K
+ LUX LN.

502 CP 2M TNS MH, MILL
PARK DR, 150' NW/0 MAIN ST.

503 CP 2M TNS EAST END OF
TURN LANE STRIPE, SW QUAD OF
DS 14 + HIGH POINT DR.

504 CP 2M TNS NE END OF
FOG LINE ON NW SIDE OF CTH
NW @ COUNTY LINE.

506 CP 2M TNS EAST END OF
THE 3RD DASHED & STRIPE TO
THE WEST OF THE COUNTY LINE

507 CP 2M TNS MH @ PARK
ST + DIVISION ST,

508 CP 2M TNS NE END OF
NW CENTER LINE @ COUNTY
LINE

1.1.4 Field Notes (Continued)

509V CP 500 TNS E OF TAINTER
HOLLOW RD, 175' N $\frac{1}{2}$ COUNTY LINE

510 CP 2M TNS SW END OF
FOG LINE, NORTH QUAD STH 80
+ CTH HH

511 CP 2M TNS MH, E OF
OTTER + WATER ST

512 CP 2M TNS MH, SE QUAD OF
DECKER ST + CENTER AVE

513 CP 2M TNS NE END OF
FOG LINE, SOUTH QUAD OF CTH D
+ CTH P

515 CP 2M TNS SE END OF FOG
LINE, NW QUAD OF CTH C +
STH 80

516 CP 2M TNS NE END OF
FOG LINE, SOUTH QUAD OF STH 131
+ JUG CREEK RD

1.1.4 Field Notes (Continued)

517 CP 2M TNS MH, IN. SIDEWALK,
NW QUAD. STATE ST + BEKKEDAL
AVE

518 CP 2M TNS MH @ MAIN
ST + YORK ST

519 CP 2M TNS SE END OF FOG
LINE @ CHANGE IN PAVEMENT
ON NE SIDE OF CTH 55

520 CP 2M TNS OPUS N QUAD
OF BRIDGE, INTERSECTION OF FOG LINE
+ DECK JOINT

521 CP 2M TNS SW END
OF FOG LINE, EAST QUAD OF
STH 162 + DODSON HOLLOW RD.

1.1.5 Field Photos



Point 501



Point 502



Point 503



Point 504

1.1.5 Field Photos (Continued)



Point 506



Point 507



Point 508



Point 509V

1.1.5 Field Photos (Continued)



Point 510



Point 511



Point 512



Point 513

1.1.5 Field Photos (Continued)



Point 515



Point 516



Point 517



Point 518

1.1.5 Field Photos (Continued)



Point 519



Point 520



Point 521