

# Ground Control Report

## WISCONSIN WROC – 3DEP | WAUPACA COUNTY LIDAR 2018

### 1.1 GROUND CONTROL DESIGN AND METHODOLOGY

The ground control network and design used for the Waupaca 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 17 locations in and around the Waupaca 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 County Coordinate System-Waupaca County, NAD83 (2011), US survey feet; NAVD88 (Geoid 12B), US survey feet. The field work was conducted by Ayres Associates surveyors. All field work was completed between May 16, 2018, and June 1, 2018.

### CONTROL SUMMARY AND METHODOLOGY

#### Control Summary

Horizontal Datum:	NAD83 (2011)
Vertical Datum:	NAVD88 (2012), Wisconsin GEOID12B
Rectangular Coordinate System:	WCCS – Waupaca County
Used NGS Control?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
List any NGS control points used:	DJ4329,DK4999,DJ4359,DJ4326,DK4962,DF6056,PN0762
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 under canopy, etc
Equipment Used:	GPS Trimble R10 GNSS S/N 5731470616 – (Ayres #70.57) Total station Trimble S 6 S/N 93410182 – (Ayres #75.38) Data Collector Trimble TSC 3 S/N RS0AC0216 (Ayres #74.58)

#### Crew Chief Notes

Set mag nails or hubs at control points used for total station measurements and for calibration points.

Recorded appropriate: NVA (Bare Earth & Urban) and VVA (Forested, Swamp/Wetland, Tall Weed/Crop). Took (4) pictures of each point – one from each cardinal direction.

**Survey Methods (continued)**

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.

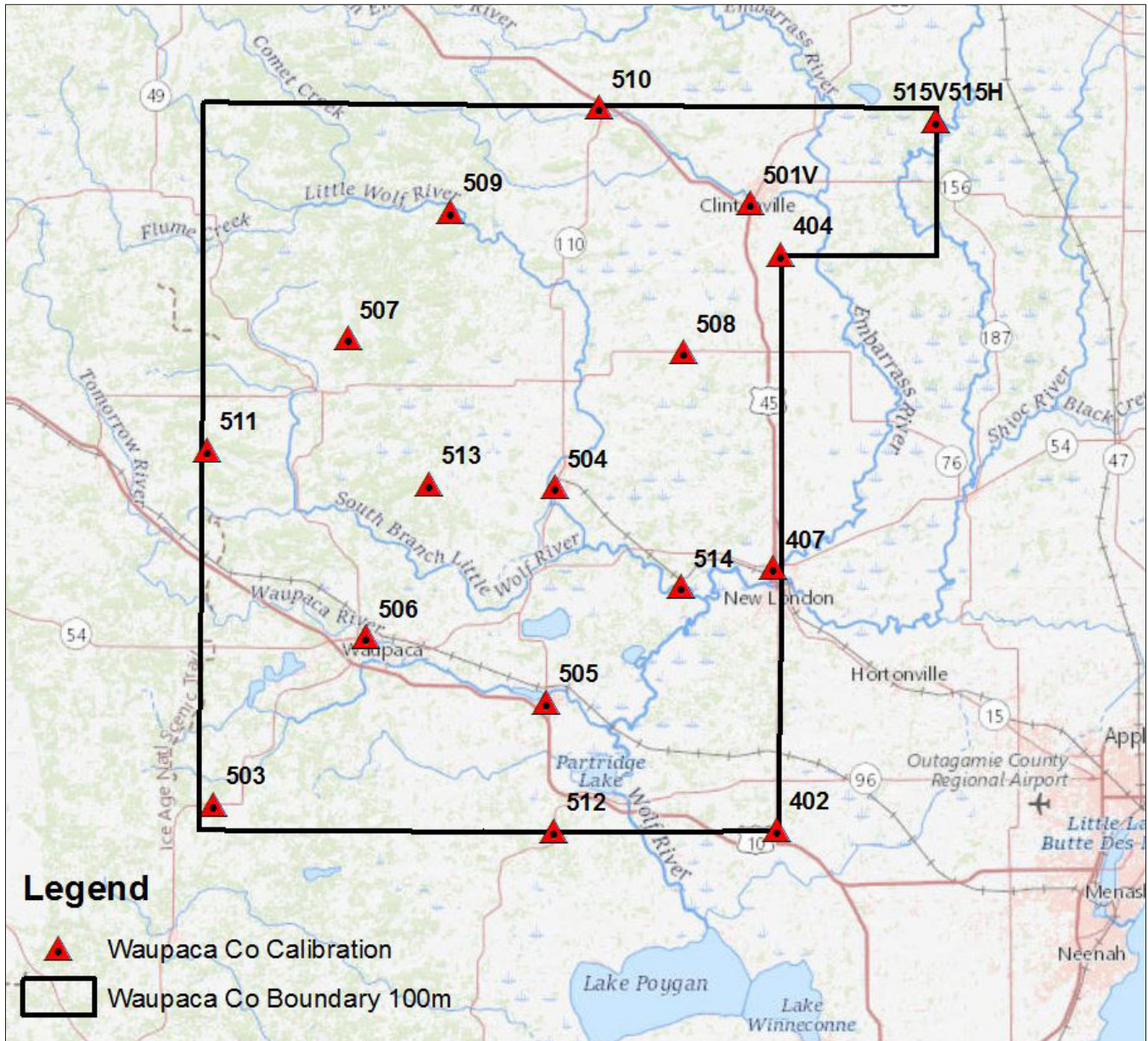
Check shots were taken on numerous NGS control points (see field notes) to verify that the values obtained are consistent with the datum/adjustment as described herein and meet the  $\pm 3$  centimeter vertical accuracy requirement at the 95% confidence level.

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 WAUPACA COUNTY CALIBRATION POINTS



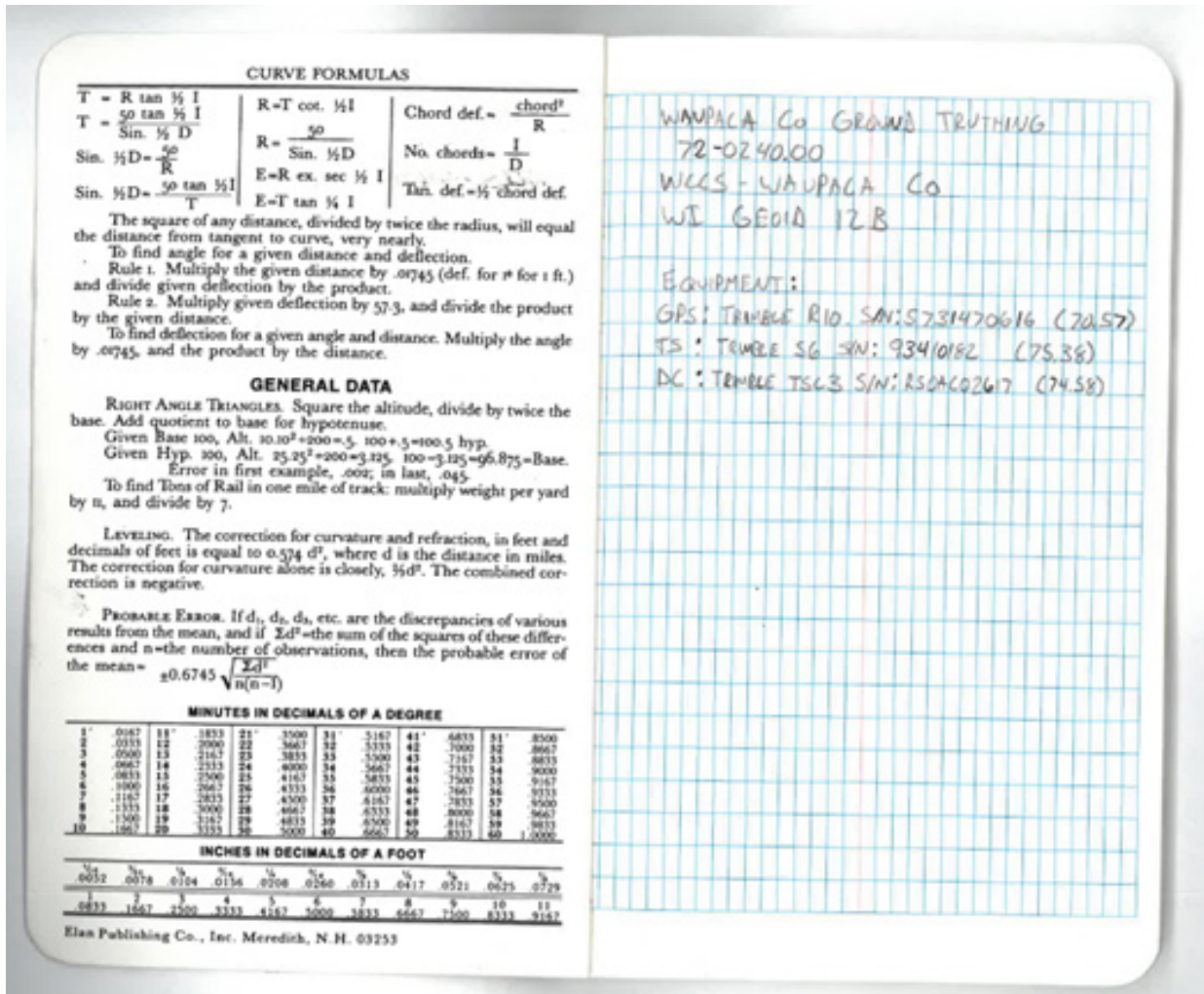
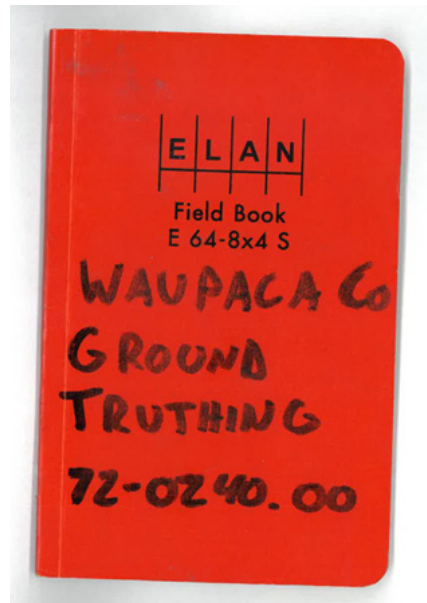
### 1.1.3 WAUPACA COUNTY LIDAR, CALIBRATION POINT STATISTICS

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 follow results indicate that the overall RMSEz of the calibration points is 0.088'. 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
402	627171.877	300113.477	836.322	836.310	-0.012
404	627806.380	426657.539	800.667	800.550	-0.117
407	626188.870	357717.893	759.577	759.650	+0.073
501V	621129.006	437904.410	817.420	817.410	-0.010
503	502911.279	305613.747	932.910	933.050	+0.140
504	578119.886	375478.946	827.620	827.510	-0.110
505	576250.451	328186.047	798.130	798.120	-0.010
506	536503.034	342482.908	852.370	852.490	+0.120
507	532503.206	408281.208	977.250	977.190	-0.060
508	606509.196	405247.050	886.450	886.510	+0.060
509	555071.407	436155.331	896.440	896.260	-0.180
510	587994.207	459130.989	884.560	884.440	-0.120
511	501494.724	383739.399	975.000	975.090	+0.090
512	578022.402	299759.545	796.520	796.530	+0.010
513	550520.864	376155.024	853.990	854.090	+0.100
515H	662069.843	456221.469	817.810	817.790	-0.020
515V	662044.789	456201.956	818.140	818.190	+0.050
Average Dz		-0.000			
Minimum Dz		-0.180			
Maximum Dz		+0.140			
Root Mean Square		0.088			
Std Deviation		0.091			

1.1.4 FIELD NOTES



1.1.4 FIELD NOTES (CONTINUED)

NGS CHECKS				
PT#	NGS MONUMENT	ΔN	ΔE	ΔZ
300	HARRISON GPS	0.019	0.000	
301	LOLA W GPS	0.074	-0.036	-0.003
302	WAUPACA C GPS	0.000	-0.022	
303	UNION S GPS	-0.021	-0.010	-0.045
304	X 219	0.002	-0.002	-0.012
305	BEAR CREEK GPS	-0.032	0.018	0.013
306	WEYAUWEGA N GPS	-0.042	-0.019	

402	PID	2M	TIP, N, S	HONEY SUCCLE AND S MILL ST, EASTERN MOST MH.
				• AT THE CHANGE OF PAYEMENT ON THE NORTH SIDE OF DRIVEWAY AT HOUSE # N106

404	PID	2M	TIP, N, W	CHANGEL TO THE NORTH, ON EAST SIDE OF ROAD.
				• CENTER OF WHITE CROSS IN INTERSECTION OF WALNUT RD AND CTH D.

407	PID	2M	TIP, N, S	NE CORNER OF STORM PRAN ON SOUTH SIDE OF AUSTIN CT.
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501 V	PID	2M	TIP, N, E, S, W	100 E OF CTH G + STUECK RD INTERSECTION
501 H	PID	2M	TIP, N, E, S, W	6 1/2 CTH C + DRIVEWAY TO ASE # W7295
				AVERAGED SHOTS ON E + W SIDE OF POOL # 25-16-6 0/31

1.1.4 FIELD NOTES (CONTINUED)

503	PID	2M	TIP, N.E.S.W	SE CORNER END OF CURB NE QUAD WEST RD + STH 22
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504	PID	2M	TIP, N.E.S.W	NE QUAD CTH N + FLAT RD CENTER OF MH STH 110 ± 200' N OF CTH B
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505	PID	2M	TIP, N.E.S.W	100' E OF OWA PAVES RD CENTER OF MH W SIDE OF MIL ST ± 200' S OF ALFORD ST
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506	PID	2M	TIP, N.E.S.W	± GURHOLT RD ± 100' N OF CTH V CENTER OF MH ON N WASHINGTON ST ± 100' S OF GRANITE ST.
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507	PID	2M	TIP, N.E.S.W	SE CORNER END OF CURB ON N SIDE OF CTH GG AT CTH G INTERSECTION
CREW: TG				
DATE: 5-17-18				
WEATHER: AM - SUNNY 53°				
PM - PARTLY CLOUD 66°				

508	PID	2M	TIP, N.E.S.W	SE CORNER OF CURB NE QUAD CTH T + STH 22
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1.1.4 FIELD NOTES (CONTINUED)

				OF CENTER ST
509	PID	2M	TIP,N,E,S,W	CORNER OF CONCRETE NE QUAD CTH E + CENTER ST

510	PID	2M	TIP,N,E,S,W	CENTER OF RR AT INTERSECTION OF MAVIS RD + STH 110
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511	PID	2M	TIP,N,E,S,W	± 151' N OF STP 161 ± 1500' W OF HARRIS RD SW CORNER 3 <sup>RD</sup> STRIPE E OF DRIVEWAY TO HSE # E 119 CTH R
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CREW:	TC			
DATE:	5-23-18			
WEATHER:	AM - 55° SUNNY			
	PM - 78° SUNNY			
PT #	CODE	HEIGHT	PHOTOS	DESCRIPTION
512	PID	2M	TIP,N,E,S,W	NE CORNER FOG LINE IN SW QUAD STH 49 + TRI COUNTY RD.

513	PID	2M	TIP,N,E,S,W	SW CORNER INLET N SIDE CTH B ± 150' E OF SPRING ST OGDENSBURG
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PT #	CODE	HEIGHT	PHOTO	DESCRIPTION
514	PID	2M	TIP,N,E,S,W	SW CORNER CONCRETE ± 150' N OF PLEASE RD

515H	PID	2M	TIP,N,E,S,W	SIDEWALK IN NE QUAD, STA 45 + REINKE RD S MH AT INTERSECTION OF 9 <sup>TH</sup> ST + 15 <sup>TH</sup> ST
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515V	PID	2M	TIP,N,E,S,W	SIDEWALK IN NE QUAD, STA 45 + REINKE RD S MH AT INTERSECTION OF 9 <sup>TH</sup> ST + 15 <sup>TH</sup> ST
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1.15 FIELD PHOTOS



**Point 402**



**Point 404**



**Point 407**



**Point 501**



**Point 502**



**Point 503**

**FIELD PHOTOS (CONTINUED)**



**Point 504**



**Point 505**



**Point 506**



**Point 507**



**Point 508**



**Point 509**

FIELD PHOTOS (CONTINUED)



**Point 510**



**Point 511**



**Point 512**



**Point 513**



**Point 514**



**Point 515**