

# Ground Control Report

## Wisconsin WROC – 3DEP | Forest County Lidar 2017

### 1.1 Ground Control Design and Methodology

The ground control network and design used for the Forest 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 22 locations in and around the Forest 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-Forest 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 8, 2017, and May 17, 2017.

### Control Summary and Methodology

#### Control Summary

Horizontal Datum:	NAD83 (2011)
Vertical Datum:	NAVD88 (2011), Wisconsin GEOID12B
Rectangular Coordinate System:	Wisconsin County Coordinate System-Forest County
Used NGS Control?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
List any NGS control points used:	DP8267, DP8722, DP6652, DP8724, DP2636, DP2755, QMO774
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 R8-3 GNSS S/N 5220487439 – (Ayres # 75.37) Trimble R10 GNSS S/N 5304424243 – (Ayres # 75.50) Total station: Trimble S6 S/N 93410182 – (Ayres # 75.38) Trimble S6 S/N 93410071—(Ayres # 74.11) Data Collector: Trimble TSC 3 S/N RSOAC02617 (Ayres #74.48) Trimble TSC 3 S/N RSONC10855

#### Crew Chief Notes

Set Hubs at control points used for total station measurements. Set PK nails for calibration points and at horizontal accuracy 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)**

All work was performed in and referenced to NAD83 (2011), NAVD 88(2011), Geoid 12B, Wisconsin County Coordinate System – Forest County Zone in US 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.

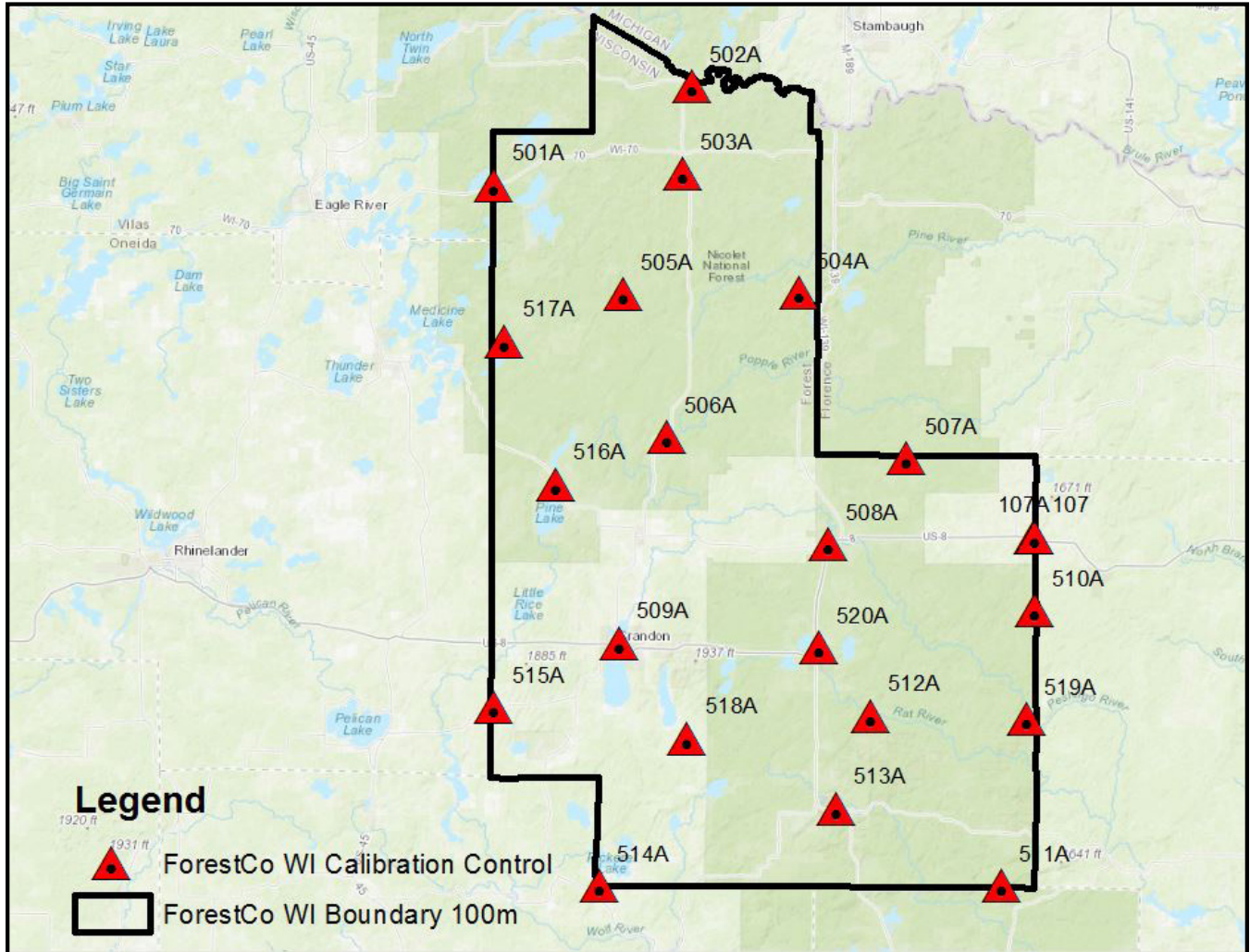
Check shots were taken on numerous NGS control points (see field notes) to verify that the values obtained are consistent with the datum/adjustment as described herein and meet the  $\pm 3$  centimeter vertical accuracy requirement at the 95% confidence level.

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 Forest County Calibration Points



### 1.1.3 Forest 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 0.138'. 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
501A	799903.393	705420.803	1750.95	1750.95	0.01
502A	857944.310	734310.319	1565.104	1564.83	-0.274
503A	855160.033	708721.785	1717.35	1717.48	0.13
504A	889151.025	673887.673	1568.85	1568.88	0.03
505A	837581.789	673484.131	1646.00	1645.83	-0.17
506A	850582.180	631618.764	1650.89	1651.05	0.16
507A	920766.105	625417.629	1472.26	1472.48	0.22
508A	897717.247	600143.495	1507.44	1507.38	-0.06
509A	836493.699	571294.345	1620.14	1620.18	0.04
510A	958085.400	580790.357	1437.96	1437.82	-0.14
511A	948618.505	500321.623	1331.99	1331.84	-0.15
512A	910267.236	550119.585	1478.73	1478.85	0.13
513A	900116.969	522896.087	1534.30	1534.29	-0.01
514A	830563.540	500326.138	1559.88	1559.90	0.02
515A	799941.628	552477.310	1701.44	1701.26	-0.18
516A	817932.829	617817.173	1641.55	1641.72	0.17
517A	803002.547	659762.763	1683.55	1683.58	0.03
518A	856445.249	543514.034	1639.06	1638.94	-0.12
519A	955866.270	549139.810	1267.98	1267.93	-0.05
520A	894972.610	569919.004	1575.92	1576.09	0.17
107	958052.648	602464.359	1438.75	1438.53	-0.22
107A	958075.423	602457.632	1438.28	1438.22	-0.06

**Average Dz**                -0.015 ft  
**Minimum Dz**               -0.274 ft  
**Maximum Dz**               0.220 ft  
**Root Mean Square**        0.138 ft  
**Std Deviation**               0.141 ft



1.1.4 Field Notes

PNT	CODE	TH	LOCATION
107	CP	2M	NE END OF CURB @ HWY 8
107A	CP	2M	NW END OF CURB @ COUNTY LINE RD.
510	CP	2M	♀ OF PESHINGO RIVER RD @ ♀ OF N+S DROVEWAY @ Co LINE, 100B NAIL
512	CP	2M	SW CORNER OF INLET ON N SIDE OF CHT, E. OF CTH H
503	CP	2M	END OF FOG LINE ON STH SS S. SIDE OF INT. W/ FIRE TOWER RD. PK NAIL
501	CP	2M	E. END OF 1 <sup>ST</sup> YELLOW STRIP E. OF Co LINE FOR E. BOUND STA 70. PK NAIL

Field Notes (Continued)

PNT	CODE	TA	LOCATION
502	CP	1.83M	END OF FOG LINE ON E. SIDE OF STH 55 @ SPENSED LN. S. SIDE
504	CP	1.83M	221' E OF OLD 139 RD @ S. EOA ON LONG LAKE RD TAR STRIPE
507	CP	2M	E FOREST RD 2386/NEWALA TOWER RD
506	CP	2M	TAR STRIPE @ CENTER OF FOG LINE ON S. SIDE STH 55 8' W. OF CULVERT CROSSING. 1 MAG NAIL
505	CP	1.83M	CENTER OF CONC. BRIDGE ABCK ON AVINE RD OVER PINE RIVER
517	CP	2M	E SHELTER VALLEY RD @ E OF FOREST RD 3861 - MOVED DUE TO HEAVY TREE COVER

Field Notes (Continued)

<u>PNT</u>	<u>CODE</u>	<u>TH</u>	<u>LOCATION</u>
516	CP	2M	N. EOA TM JOINT ON 9032 HWY 32
515	CP	2M	W. CORNER OF DRIVEWAY @ 12054 CTH R. 1 <sup>ST</sup> DRIVEWAY E OF CTH M. FT NAIL
509	CP	2M	SANITARY MH SLIGHTLY S OF E GLEN ST E @ E OF N PARK AVE. -MOVED DUE TO STORM GRATE
508	CP	2M	END OF CURB FLANGE IN SE QUAD HWY 8 + CTH G

Field Notes (Continued)

CALCULATION		POINTS	
PNT	CODE	HEIGHT	LOCATION
S14A	CP	2M	SE CORNER CONCRETE DRIVE USE # N9678
S18A	CP	2M	E / E N SHORE DR + BRADLEY LAKE RD
S13A	CP	2M	CENTER NW MANHOLE
S11A	CP	2M	E / E FOREST RD 2141 + TRAIL
S19A	CP	2M	SE CORNER BRIDGE DECK
S20A	CP	2M	SE CORNER OF SIDEWALK

1.15 Field Photos



**Point 501A**



**Point 502A**



**Point 503A**



**Point 504A**



Field Photos (Continued)



Point 505A



Point 506A



Point 507A



Point 508A



Field Photos (Continued)



**Point 509A**



**Point 510A**



**Point 511A**



**Point 512A**



Field Photos (Continued)



**Point 513A**



**Point 514A**



**Point 515A**



**Point 516A**



Field Photos (Continued)



**Point 517A**



**Point 518A**



**Point 519A**



**Point 520A**

Field Photos (Continued)



**Point 107**



**Point 107A**