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Survey Report

NEIL 4/WI Survey Task Order G16PD00498 / G17PD00315

April 2017

1.0 Survey Report

The Dewberry team utilized Ayres Associates to perform the acquisition of survey data to assist Harris Corporation in establishing and verifying positional accuracy of Harris' Geiger-mode LiDAR data. The survey data includes the acquisition of LiDAR-identifiable Ground Control Points (GCPs) to calibrate the LiDAR data, and the acquisition of Check Points to verify / validate the positional accuracy of the LiDAR data. In addition to the survey outlined below, Dewberry will also be acquiring ~50 additional Check Points distributed across the 2 project AOI to independently verify the data against.

1.01 Project Summary

This project comprises two contiguous Task Orders G16PD00498 and G17PD00315 and had the following minimal number of survey points to be measured.

Site Name	AOI Size (SqMi)	PRI	Point Types	Land Cover Class		
				Total	NVA-Non-vegetated Vertical Accuracy (includes bare-earth, open terrain and urban areas)	VVA-Vegetated Vertical Accuracy (includes tall weeds, crops, brush-land, trees and forested land covers)
G16PD00498 & G17PD00315	3,816	1	Calibration Control Points (GCPs)	62	62	N/A
			ASPRS Vertical Accuracy Check Points	115	32	52
			ASPRS Vertical Accuracy Check Points (*PIDs)		32	
			ASPRS Horizontal Accuracy Check Points (*PIDs)	28	28	N/A
			Additional Horizontal Check Points (NVA), as req. for certification (i.e. Surveyor)	N/A	N/A	
			Total	205	154	52

1.02 Point of Contact and Professional Certification

Ayres Associates had a 5-person team, including one project manager, one technical lead, and three crew chiefs. Todd Mrochek, PLS, PE, is the technical lead and surveyor of record certifying information in this report. The primary point of contacts are as follows:

Ayres Project Manager

Jason Ingram, WI PLS
Ayres Project Manager
3376 Packerland Drive
Ashwaubenon, WI 54115
Phone: 920.498.1200
Office Ext: 7857
Cell: 920.366.4434
E-mail: IngramJ@AyresAssociates.com

Ayres Technical Lead/Surveyor of Record

Todd Mrochek, WI/IL PLS, PE
3433 Oakwood Hills Parkway
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Office Ext: 7615
Fax: 715.831.7500
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E-mail: MrochekT@AyresAssociates.com



Todd G. Mrochek
EXPIRES 11/30/2019



Todd G. Mrochek

1.03 Project Area

The project area encompasses approximately 3,816 square miles throughout Upper Northeast Illinois and Lower South East Wisconsin as identified in the following diagram.



1.04 Survey Equipment

Equipment used for the execution of the ground control survey includes Trimble GNSS/GPS receivers and Trimble Robotic Total Station. Each GNSS setup included a rod and bipod setup. Total Station setups included an instrument and backsight setup on a tripod, and the point of measurement was occupied by a rod and bipod. Both methods of measurements used the Trimble TSC3 Data Collector to record observations. The following images represent the typical instrument setup:



Specific instrument details are as follows:

GNSS/GPS Receivers

75.23 Trimble R8 GNSS SN5126468515
74.58 Trimble R8-3 GNSS 2010 SN5004413097
75.50 Trimble R10 GNSS 2013 SN5304424243

Total Station

74.77 Trimble S6 Total Station SN92722266
75.38 Trimble S6 Total Station SN93410182
75.41 Trimble S6 Total Station SN93410052

1.05 Survey Point Detail

The measured location of each point was marked at ground level with a survey nail in non-vegetative areas and by a wooden hub in vegetative locations. When possible a 3" reflector was secured at these locations. The following images represent a typical survey point.



1.06 Network Design

Established Virtual Reference Systems (VRS) and Continually Operating Reference Stations (CORS) proven to be reliable within this project area were used for the control network. Two specific networks were used. Wisconsin Continuously Operating Reference Station Network (WISCORS) was used in Wisconsin, and Trimble's VRS Now Network was used in Illinois. Both networks state they can achieve accuracy better than project requirements. Information on each network can be found at the following locations:

WISCORS <http://wisconsin.gov/Pages/doing-business/eng-consultants/cnslt-rsrcs/tools/wiscors/default.aspx>

VRS Now <http://www.trimble.com/positioning-services/vrs-now.aspx>.

1.07 Field Survey Procedures and Analysis

The field survey effort was executed over 4 weeks. The first week focused on the placement of the Calibration Control Points (GCPs). The second week's effort entailed taking the second set of observations on the GCPs. Once the GCPs were complete, the non-vegetated (NVA) and vegetated (VVA) check points were established and measured.

VVA points land cover category is recorded as an abbreviation on the photos taken of the point. The

following abbreviations indicate the corresponding land cover:

- W = Tall Weeds
- C = Crops
- B = Brush
- F = Forested Areas/Trees

The measurement procedure for all points included performing up to four (4) individual, 90 second Real Time Kinematic (RTK) observations from the identified VRS Networks. Measurements were only accepted by field staff if the Positional Dilution of Precision (PDOP) was below 6.0 and the elevation mask was set at 15 degrees. At least one (1) measurement on each point was observed during a different satellite constellation.

The set of measurements for each point was evaluated within Trimble Business Center (TBC) software to ensure Local Network accuracy of 5 cm at the 95% confidence level both horizontally and vertically where achieved.

National Geodetic Survey (NGS) monuments were researched and measured throughout the project area. In cases where a monument was near the Wisconsin/Illinois border, NGS monuments were measured with both VRS Networks to ensure consistency between networks and NGS ground control. Analysis of these observations proved that the networks were within the accuracy requirements of this project.

The following NGS monuments were measured. It was found that the Wisconsin-based NGS control was more consistently accurate than Illinois. Primary reason is that Wisconsin has had extensive NGS Height Modernization efforts that has restored most aging ground-based monuments, whereas Illinois has not completed its efforts, and many of the NGS monuments found were older and more likely to have moved over time or have not recently been adjusted. The difference indicated next to the NGS Permanent Identification (PID) shows the difference in values between the NGS Data Sheets and our observations. Values are only shown if there was a survey grade value on the datasheet.

NGS PID	ΔNorthing	ΔEasting	ΔElevation	NGS PID	ΔNorthing	ΔEasting	ΔElevation
NG0793	0.01	-0.03	-0.02	ME2498	-0.05	-0.17	0.12
DG4959	0.04	-0.04	-0.01	ME1825	-0.08	-0.08	0.13
DE7312	-0.02	-0.01	0.13	ME1604	0.01	0.09	
AE2581	-0.02	-0.01	0.10	ME1944			0.04
ME1440	0.07	0.07		AE2559	0.01	0.05	
ME2498	-0.06	-0.20	0.00	ME2724	0.12	0.03	0.12
AJ2766	-0.05	0.05	0.12	DG4988	0.04	-0.02	0.11

DP5459			0.15	DF9473	-0.01	-0.03	0.07
MF1248	0.03	0.02		AJ2897	-0.04	0.03	0.04
MF1257			0.07	DM3884			0.01
NGO793	0.00	-0.04		AJ2864	0.01	-0.02	0.10
AJ2862	0.01	-0.01	-0.04	ME1695	0.05	0.02	0.00
ME1657	0.02	0.01	0.04	NG0793	0.01	-0.03	0.05
DF7926	0.00	0.05	0.11	AJ2897	-0.04	0.04	0.06
DF0963			0.09	ME1921	0.02	0.01	0.05
DF9847	0.02	-0.01	0.04	DF9473	0.01	-0.02	0.03
AJ2823	0.02	-0.04	0.00	DG4988	-0.03	-0.02	0.15
				DF9472	0.01	-0.07	0.04

1.08 Adjustment

Network adjustments were not required for this project since the stated VRS Networks were used. Redundant RTK measurements on each point were evaluated to ensure the project accuracies were achieved.

1.09 Quality Control Procedures

Ayres Associates implemented procedures that have been proved on previous projects to provide consistent and accurate measurements within the accuracy requirements of this project. Quality control procedures include the following:

- Consistent team throughout the execution of the work.
- Nightly download of data and review, including the updating of a spreadsheets showing which points were observed the first and final time.
- Daily technical lead and team review of the work to be completed for that day to ensure all observations are made.
- Ayres Associates technical lead, Todd Mrochek, who is professional land surveyor (PLS) in Wisconsin and Illinois, was in the field for the first two weeks of observations to ensure proper procedures and VRS Network checks were made. Evaluation of these checks were made in real time.
- Our technical lead met Terry Hammarquist of Harris Corporation in the field to go over proper point evaluation and procedures. Other Ayres crew chiefs also met with Terry to go over the project requirements.
- Survey points were measured with a rigid setup, including a leveled survey rod and tripod for stability.
- Photos were taken of each point setup with information placed on a dry erase board next to the point in the photo documenting the observation setup and surrounding areas.
- Office evaluation of each point ensuring project requirements are met.

- Project PLS review of deliverables and content with additional review from another team member of photos and point values to confirm correct matching of data sets.

1.10 Final Coordinates

Final coordinate values are reported in two Spatial Reference Data Systems as indicated as follows. Note that the reported elevations are the elevation at ground level. Measure ups to objects above ground are reported in the field notes.

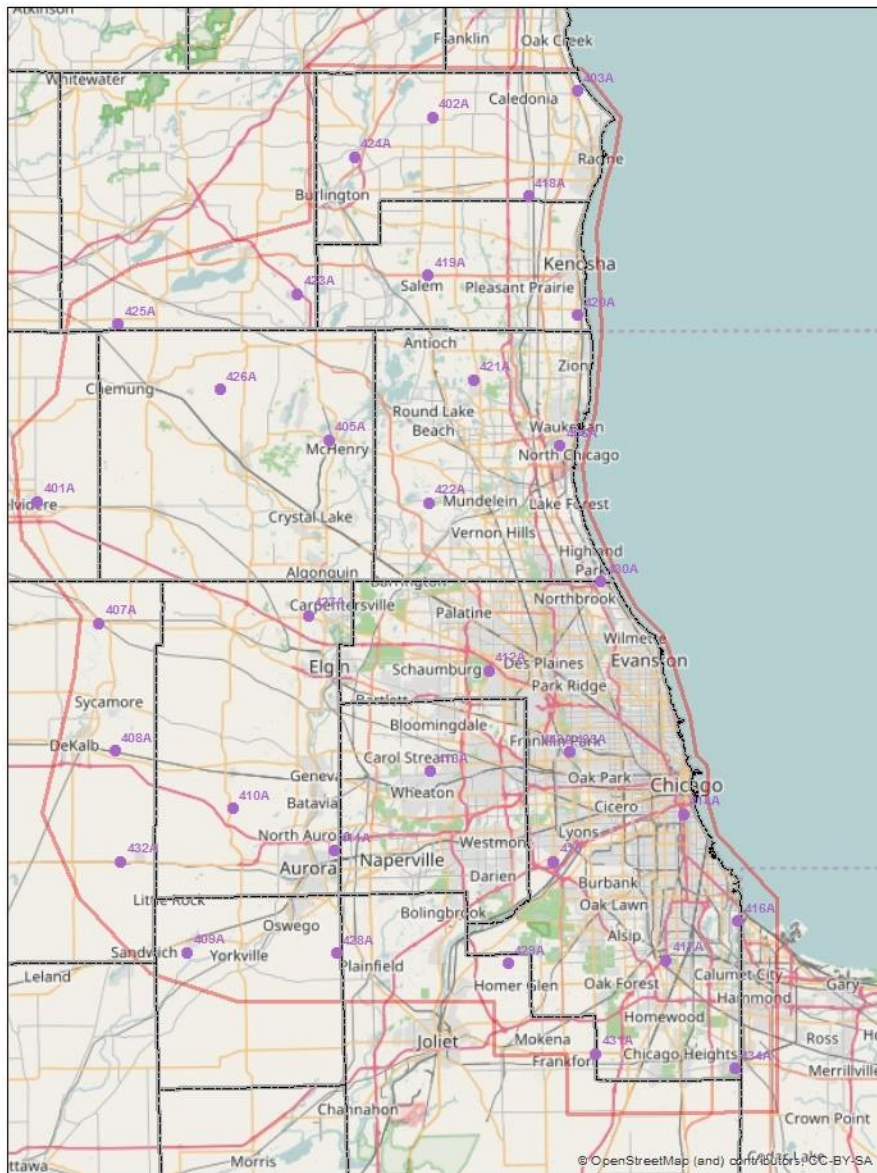
Spatial Reference Data - Illinois	
Coordinate Reference System	Illinois East State Plane Coordinate System
Unit of Reference	US Survey Foot
Horizontal Datum	EPSG 6455: North American Datum of 1983, 2011 Adjustment
Vertical Datum	EPSG 6360: North American Vertical Datum of 1988 (NAVD 88)
Geoid Model	GEOID 12B
Spatial Reference Data - Wisconsin	
Coordinate Reference System	Wisconsin South State Plane Coordinate System
Unit of Reference	US Survey Foot
Horizontal Datum	EPSG 6609: North American Datum of 1983, 2011 Adjustment
Vertical Datum	EPSG 6360: North American Vertical Datum of 1988 (NAVD 88)
Geoid Model	GEOID 12B

The final coordinate locations are represented on the following diagrams:

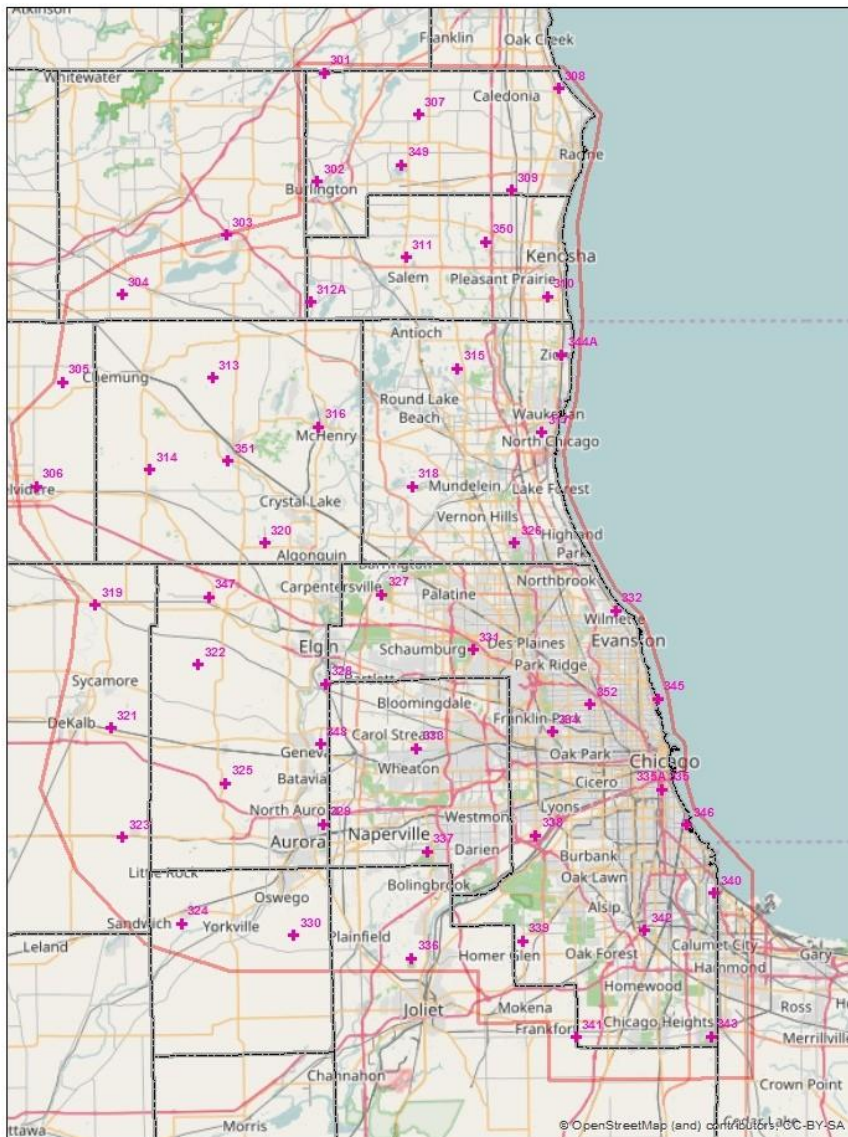
Calibration Control Points (GCPs) Locations (point number range is 1-63)



Vertical Non-vegetated Vertical Accuracy (NVA) Check Point Locations (point number range is 401-434)



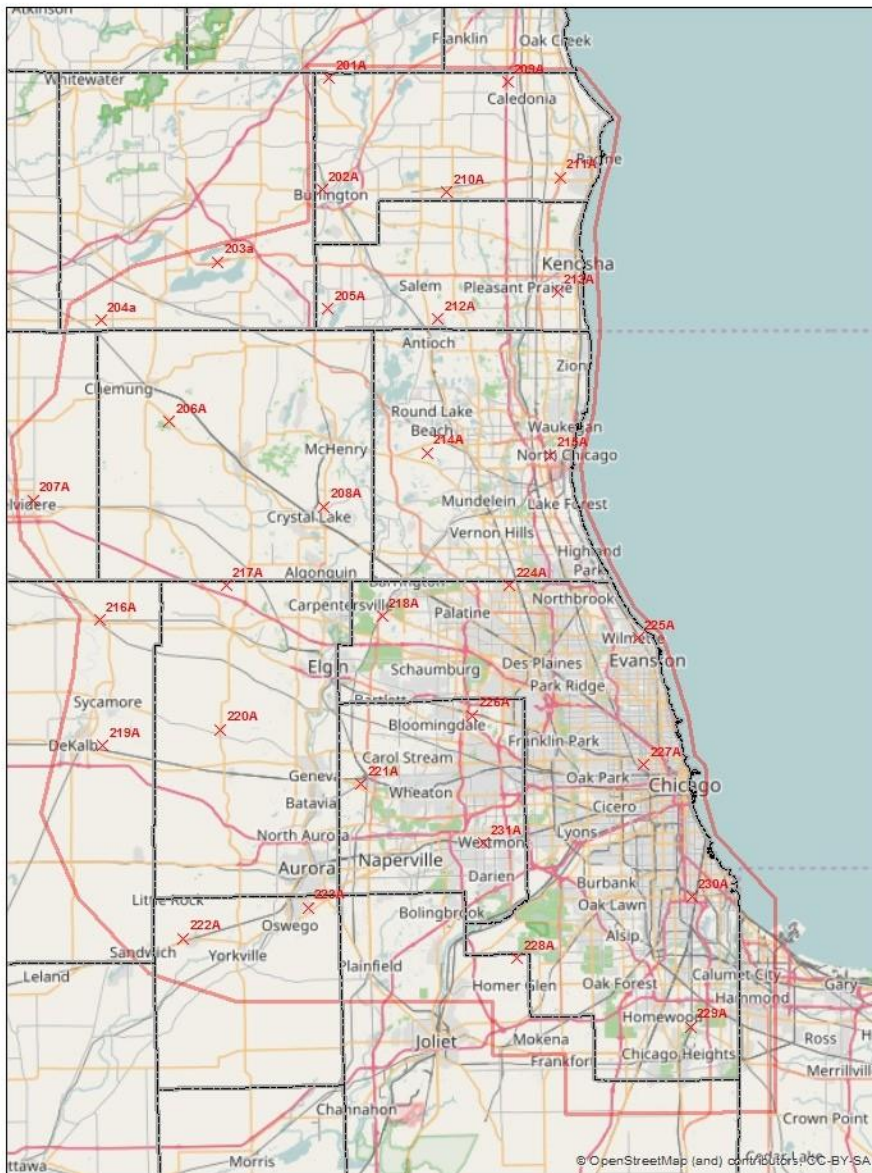
Vertical Vegetated Vertical Accuracy (VVA) Check Point Locations (point number range is 301-352)



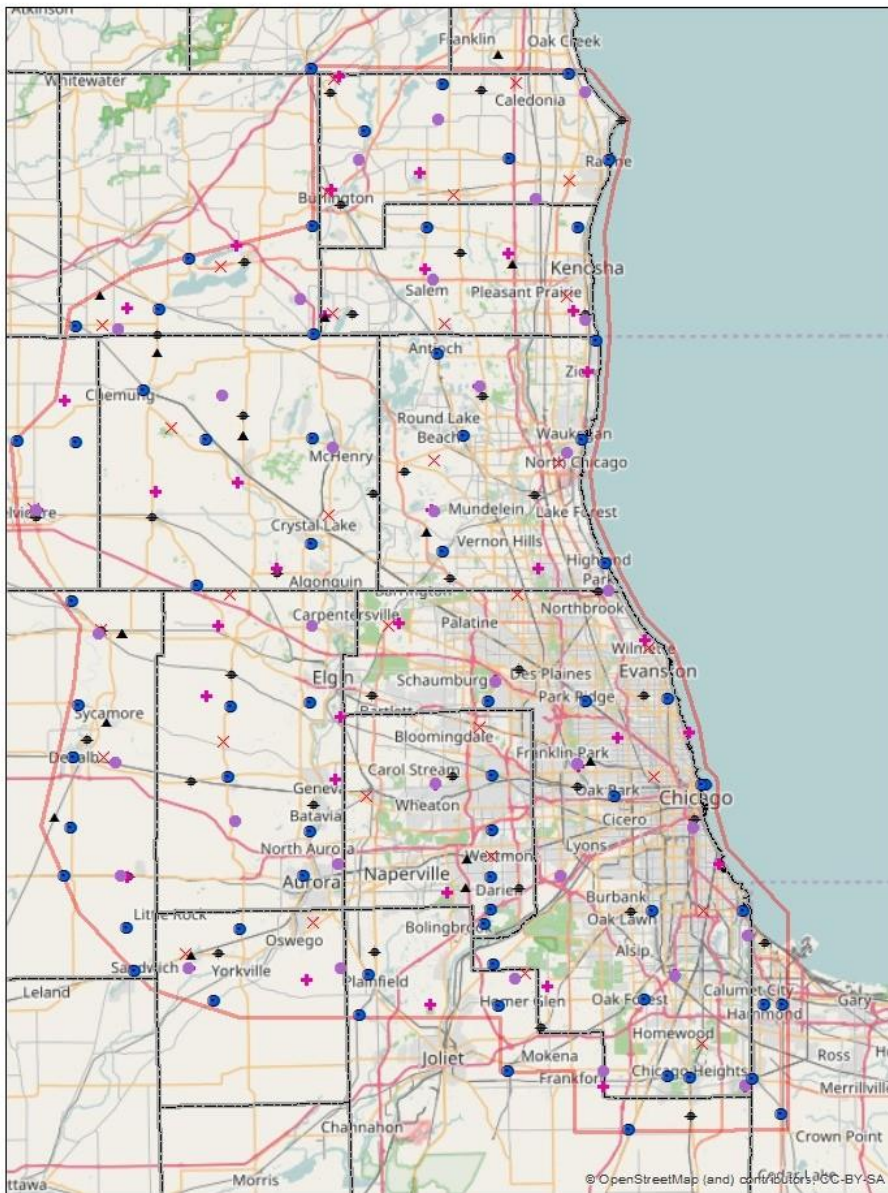
Vertical Non-vegetated Vertical Accuracy Photo/LiDAR Identifiable (NVA-PID) Check Point Locations
(point number range is 101-138)



Horizontal Non-vegetated Vertical Accuracy Photo/LiDAR Identifiable (NVA-PID) Check Point Locations
(point number range is 201-231)



All Control and Check Point Locations



The final values in Illinois East State Plane Coordinate System are represented in the following spreadsheet:

NEIL4_IL_WI_Survey		Ground Control PID and Targeting for Geiger-Mode LiDAR Collection	
Ayres Associates Inc 3376 Packerland Drive Ashwaubenon, WI 54115 USA		Phone: 920-498-1200 Fax: http://www.ayresassociates.com/ ingramj@ayresassociates.com	
Project file data		Coordinate System	
Name:	V:\Survey\GB\Illinois 2017 Targeting\74-0295.00 NEIL4_IL_WI_Survey\Survey\TBC\NEIL4_IL_WI_Survey.vce	Name:	United States/State Plane 1983
Size:	917 KB	Datum:	NAD 1983 (Conus) (2011)
Modified:	4/26/2017 11:27:51 AM (UTC:-5)	Zone:	Illinois East 1201
Time zone:	Central Standard Time	Geoid:	GEOID12B (Conus)
Reference number:	74-0295.00	Vertical datum:	NAVD88
Description:	Ground Control PID and Targeting for Geiger-Mode LiDAR Collection		
Comment 1:			
Comment 2:			
Comment 3:			

Point List

ID	Northing (US survey foot)	Easting (US survey foot)	Elevation (US survey foot)	Feature Code
1A	2251993.669	988101.778	828.16	GCP01
1REFLECTOR	2175915.605	988872.682	806.13	REFLECTOR1
2A	2244957.836	1052188.747	826.30	GCP02



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2REFLECTOR	2072457.131	936457.026	908.67	REFLECTOR2
3A	2250046.422	1113249.684	696.90	GCP03
3REFLECTOR	2120701.643	1127362.185	590.20	
4A	2221711.180	1014193.064	800.42	GCP04
4REFLECTORA	1993427.896	870953.919	857.92	
5A	2209025.425	1084178.414	774.67	GCP05
5REFLECTORA	1941692.798	948849.459	988.10	REFLECTOR05
6A	2208382.274	1133230.314	586.44	GCP06
06REFLECTORA	1943998.343	987759.113	804.47	REFLECTOR06
7A	2175714.973	1044328.731	840.31	GCP07
07REFLECTORA	1882656.553	869606.149	882.17	REFLECTOR07
8A	2175729.450	1118281.123	620.64	GCP08
08REFLECTORA	1833073.607	897075.264	721.91	REFLECTOR08
9A	2160292.906	928373.843	1021.97	GCP09
09REFLECTORA	1797430.231	939899.424	769.34	REFLECTOR09
10A	2135396.194	914175.220	991.64	GCP10
10REFLECTORA	2071299.922	873344.061	828.92	REFLECTOR10
11A	2123719.579	989616.372	847.95	GCP11
12A	2127705.672	873448.201	971.85	GCP12
13A	2096693.929	905948.212	924.76	GCP13
14A	2072633.542	988762.885	894.37	GCP14
15A	2071792.966	844162.830	913.27	GCP15
16A	2114230.835	1049852.349	779.89	GCP16
17A	2074032.302	1062504.942	775.31	GCP17
18A	2072853.130	1120426.661	628.08	GCP18
19A	2001267.113	932062.371	929.34	GCP19
20A	2021605.523	988249.652	897.44	GCP20
21A	1942584.666	873747.251	846.54	GCP21
22A	2017445.252	1052894.673	863.96	GCP22
23A	2012464.290	1132212.812	586.10	GCP23
24A	1944427.811	1075628.148	685.72	GCP24
25A	1946111.530	1163493.287	605.39	GCP25
26A	1917302.886	870942.260	879.84	GCP26
27A	1907293.163	946962.211	899.27	GCP27



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28A	1908198.559	1077506.765	707.54	GCP28
29A	1880541.752	987568.177	698.51	GCP29
30A	1881339.840	1077689.082	699.12	GCP30
31A	1858747.750	865930.567	808.24	GCP31
32A	1858776.981	984527.389	688.73	GCP32
33A	1858336.414	1076875.254	758.58	GCP33
34A	1832772.328	953060.682	646.03	GCP34
35A	1834960.074	1073517.580	752.41	GCP35
36A	1812188.952	900759.836	675.31	GCP36
37A	1810346.275	1016317.976	629.12	GCP37
38A	1815182.697	1078666.346	705.97	GCP38
39A	1789882.110	1012235.208	612.12	GCP39
40A	1794968.458	1081357.247	787.13	GCP40
41A	1944604.412	1123434.356	659.21	GCP41
42A	1898340.684	1137761.276	617.17	GCP42
43A	1904164.504	1182410.687	586.52	GCP43
44A	1904113.087	1180742.994	590.19	GCP44
45A	1842545.381	1076833.040	733.91	GCP45
46A	1842088.951	1156516.216	623.65	GCP46
47A	1842641.468	1201693.129	591.09	GCP47
48A	1798603.626	1152855.403	626.86	GCP48
49A	1796612.608	1221266.973	597.68	GCP49
50A	1762936.868	1085630.848	688.41	GCP50
51A	1759835.991	1175712.031	688.38	GCP51
52A	1742689.717	1221579.166	711.42	GCP52
53A	1734370.810	1146033.916	792.89	GCP53
54A	1796431.653	1212410.026	603.08	GCP54
55A	1759480.485	1206715.177	634.27	GCP55
63A	1760782.909	1164780.466	698.90	GCP63
101A	2240124.858	997117.191	839.70	NVA101
102A	2186118.418	1002110.087	764.76	NVA102
103A	2133223.697	1007806.450	860.66	NVA-PID
104A	2158337.100	955013.677	873.91	NVA-PID
105A	2123110.668	912525.892	954.00	NVA-PID



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106A	2083901.880	954637.131	858.22	NVA-PID
107A	2045263.606	1018198.937	758.80	NVA-PID
108A	2034247.491	909750.938	820.64	NVA-PID
109A	2004462.250	1055779.949	815.61	NVA109
110A	1998403.838	1128623.131	638.40	NVA110
111a	2056107.707	1033421.673	784.46	NVA111
112a	2044982.322	1097023.783	704.11	NVA112
113A	2093582.545	1071701.282	753.54	NVA113
114A	2133212.282	1121590.300	628.94	NVA114
115A	2163060.360	1060291.786	733.73	NVA115
116A	2227865.735	1138516.437	592.20	NVA116
117A	2241736.504	1070363.122	752.18	NVA117
118A	2034487.381	852992.625	803.85	NVA-PID
119A	2006930.038	971322.359	894.27	NVA-PID
120A	1979107.686	884947.980	826.52	NVA-PID
121A	1925589.068	877659.907	881.47	NVA-PID
122A	1858396.944	897516.118	745.16	NVA-PID
123A	1957443.779	948688.970	966.85	NVA-PID
124A	1904854.178	928880.764	870.12	NVA-PID
125A	1820299.914	941948.147	637.66	NVA-PID
126A	1946847.004	1017916.068	797.12	NVA-PID
127A	1960162.287	1089704.152	664.66	NVA127
128A	1947594.089	1151351.341	600.42	NVA128
129A	1893051.966	988854.431	714.25	NVA-PID
130A	1907348.171	1057212.403	727.17	NVA130
131A	1902446.250	1118859.108	627.23	NVA PID
132A	1887116.964	1176811.102	592.54	NVA PID
133A	1820977.303	1018956.194	644.78	NVA-PID
134A	1852621.529	1090257.996	720.37	NVA PID
135A	1841358.056	1146008.280	617.50	NVA PID
136A	1784039.068	1101605.674	678.32	NVA PID
137A	1826852.981	1211834.490	584.38	NVA PID
138A	1740969.514	1176441.995	729.75	NVA PID
201A	2246962.485	999256.332	846.89	NVA201



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202A	2192255.582	995535.629	780.79	NVA202
203a	2156418.920	944124.901	1043.81	NVA-PID
204a	2128067.183	885987.158	979.16	NVA-PID
205A	2133456.197	998488.551	867.44	NVA-PID
206A	2077949.564	919652.358	1022.53	NVA-PID
207A	2039035.113	851766.709	761.58	NVA-PID
208A	2035505.724	996841.862	905.02	NVA-PID
209A	2245253.088	1087467.519	730.77	NVA209
210A	2191060.077	1057343.829	800.92	NVA210
211A	2198495.586	1113674.584	713.01	NVA211
212A	2128647.715	1053189.035	837.24	NVA212
213A	2142166.810	1112313.246	656.39	NVA213
214A	2062269.121	1047942.882	816.68	NVA214
215A	2061352.383	1109389.063	723.26	NVA215
216A	1979557.692	884459.402	819.87	NVA-PID
217A	1996459.727	948026.413	881.64	NVA-PID
218A	1981344.232	1025840.413	868.37	NVA-PID
219A	1916976.066	885987.525	892.46	NVA-PID
220A	1924848.865	944927.669	956.92	NVA-PID
221A	1897740.913	1015412.703	752.15	NVA-PID
222A	1820440.491	926039.657	656.08	NVA-PID
223A	1835941.451	988822.363	662.15	NVA-PID
224A	1996638.468	1089455.625	676.19	NVA224
225A	1971112.125	1153878.120	611.40	NVA225
226A	1932021.764	1070972.111	683.75	NVA226
227A	1907886.056	1157152.044	597.08	NVA PID
228A	1810957.600	1094109.172	682.29	NVA PID
229A	1777131.967	1181627.461	629.43	NVA PID
230A	1842108.724	1181846.453	590.34	NVA PID
231A	1868383.830	1077022.483	744.62	NVA231
301	2248738.135	1001257.715	820.96	NVA301
302	2193486.786	998042.107	777.21	VVA302
303	2166257.526	951302.905	847.47	VVA303
304	2136305.031	898073.210	945.07	VVA-B



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305	2091511.771	867348.923	936.23	VVA-C
306	2038451.287	853474.570	755.63	VVA-F
307	2227733.933	1049237.947	786.63	VVA307
308	2241060.701	1120675.635	669.48	VVA308
309	2189380.981	1096961.849	712.87	VVA309
310	2135429.619	1115631.342	652.08	VVA310
311	2155101.760	1043201.065	815.80	VVA311
312A	2132299.675	994532.547	858.69	
313	2093698.257	944216.640	977.30	VVA-C
314	2046709.005	911860.912	914.53	VVA-F
315	2098382.613	1069890.443	771.65	VVA315
316	2068534.322	998470.648	751.79	VVA-F
317	2066083.969	1113167.221	673.35	VVA317
318	2038233.461	1046762.893	845.90	VVA318
319	1977687.200	883504.011	791.34	VVA-F
320	2009145.047	970763.543	882.36	VVA-W
321	1914385.043	891453.099	876.67	VVA-F
322	1946765.217	936686.063	906.69	VVA-C
323	1858131.760	897086.994	746.84	VVA-W
324	1813426.602	927573.728	625.31	VVA-F
325	1885667.943	950585.735	781.82	VVA-F
326	2009396.174	1099429.724	656.85	VVA326
327	1982709.423	1031155.745	875.56	VVA-W
328	1936930.310	1002046.258	756.29	VVA-W
329	1864649.576	1001314.009	718.25	VVA-F
330	1807195.953	986020.268	709.16	VVA330
331	1954457.037	1078373.441	706.41	VVA331
332	1975023.543	1151593.466	613.05	VVA332
333	1903884.347	1049394.301	747.88	VVA333
334	1912654.801	1119409.173	626.99	VVA334
335	1883239.361	1176472.474	593.68	VVA-F
335A	1883252.619	1176325.275	595.47	VVA
336	1795452.848	1047068.228	662.47	VVA336
337	1850769.476	1055087.008	656.88	VVA337



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338	1859218.520	1111078.454	648.11	VVA-F
339	1804761.270	1104835.358	699.25	VVA-C
340	1830184.926	1203954.525	584.96	VVA-F
341	1755250.208	1132587.147	744.70	VVA-B
342	1810485.828	1168152.983	595.85	VVA-F
343	1756054.246	1202907.799	645.51	VVA-B
344A	2105752.510	1123147.720	594.16	
345	1930081.888	1173837.062	588.81	VVA345
346	1865349.250	1189589.799	583.89	VVA-B
347	1981412.229	942131.201	992.22	VVA-W
348	1905803.013	999735.846	794.50	VVA-C
349	2201991.876	1040957.265	819.08	VVA349
350	2163128.609	1084089.747	740.71	VVA350
351	2051165.347	952039.364	934.90	VVA-W
352	1927014.539	1139070.112	614.74	VVA352
401A	2038522.218	853393.954	757.33	NVVA
402A	2227757.655	1049297.184	785.83	NVVA402
403A	2241156.146	1120666.546	674.65	NVVA403
405A	2068525.887	998400.902	752.80	NVVA
406A	2066036.704	1113316.659	671.35	NVVA406
407A	1978009.046	883560.288	793.42	NVVA
408A	1914493.569	891344.881	879.40	NVVA
409A	1813623.034	927403.049	630.78	NVVA
410A	1885365.843	950346.107	785.39	NVVA
411A	1864468.095	1001338.367	719.44	NVVA
412A	1954345.533	1078417.632	709.13	NVVA412
413A	1904026.109	1049458.747	749.51	NVVA413
414A	1883264.210	1176204.336	592.34	NVVA
415	1859113.908	1111052.784	644.26	NVVA
416A	1830213.300	1203858.729	585.71	NVVA
417A	1810308.351	1168146.275	595.65	NVVA
418A	2189339.003	1096908.247	720.51	NVVA418
419A	2150023.218	1047332.902	819.49	NVVA419
420A	2130769.956	1121683.032	628.25	NVVA420



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421A	2098474.461	1069954.466	773.92	NVVA421
422A	2037662.213	1047867.489	877.21	NVVA422
423A	2140859.578	982721.036	855.58	NVVA423
424A	2208151.489	1010992.348	830.91	NVVA424
425A	2125923.644	893906.514	957.07	NVVA
426A	2093634.729	944164.077	980.15	NVVA
427A	1981471.528	988335.255	860.51	NVVA
428A	1813030.555	1002265.465	685.28	NVVA428
429A	1808303.164	1088464.868	729.33	NVVA
430A	1998816.491	1134069.904	647.18	NVVA430
430A	1998816.552	1134069.968	647.13	NVVA430
431A	1763331.708	1132875.101	726.52	NVVA
432A	1859201.300	894090.939	745.94	NVVA
433A	1914022.629	1118880.879	624.20	NVVA433
434A	1756189.582	1202866.431	654.19	NVVA
900A	2046410.914	911873.255	910.55	NVVA
901A	2046556.688	911859.673	910.74	NVVA
902A	2038532.225	853727.801	759.63	NVVA
903A	1977745.773	883945.271	800.48	NVVA
904A	2068345.731	998112.138	758.55	NVVA
905A	1864333.690	1001571.217	720.95	CP
906A	1885537.550	950547.854	785.11	CP
907A	1813866.193	927497.919	639.92	CP
908A	1914461.764	890741.207	878.88	CP
914A	1883642.495	1176209.270	592.89	CP PK
915A	1858855.877	1110722.922	642.24	CP PK
916A	1830590.380	1203852.145	585.93	CP
917A	1810109.283	1168170.670	595.48	CP PK
CP307	2228273.647	1049307.084	783.46	CP
CP308	2241126.922	1120510.890	677.43	CP
CP317	2066427.414	1113391.061	673.78	CP
CP331	1954150.196	1078429.185	709.47	CP
CP345	1929951.008	1173957.987	588.23	CP
CP345A	1930046.000	1173913.353	588.17	CP



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CP349	2201943.592	1040890.393	813.72	CP
CP349-1	2202066.560	1040820.052	815.50	CP
CP352	1927266.925	1139139.786	615.60	CP
CP352A	1927087.930	1139096.267	615.05	CP
CP413	1904030.675	1049628.286	746.81	CP

The final values in Wisconsin South State Plane Coordinate System are represented in the following spreadsheet:

NEIL4_IL_WI_Survey		Ground Control PID and Targeting for Geiger-Mode LiDAR Collection	
Ayres Associates Inc 3376 Packerland Drive Ashwaubenon, WI 54115 USA		Phone: 920-498-1200 Fax: http://www.ayresassociates.com/ ingramj@ayresassociates.com	
Project file data		Coordinate System	
Name:	V:\Survey\GB\Illinois 2017 Targeting\74-0295.00 NEIL4_IL_WI_Survey\Survey\TBC\NEIL4_IL_WI_WISPS_Survey.vc e	Name:	United States/State Plane 1983
Size:	917 KB	Datum:	NAD 1983 (Conus) (2011)
Modified:	4/26/2017 12:58:28 PM (UTC:-5)	Zone:	Wisconsin South 4803
Time zone:	Central Standard Time	Geoid:	GEOID12B (Conus)
Reference number:	74-0295.00	Vertical datum:	NAVD88
Description	Ground Control PID and Targeting for Geiger-Mode LiDAR Collection		
Comment 1:			
Comment 2:			

Comment

3:

Point List

ID	Northing (US survey foot)	Easting (US survey foot)	Elevation (US survey foot)	Feature Code
1A	313981.342	2419272.519	828.16	GCP01
1REFLECTOR	237932.116	2421563.971	806.13	REFLECTOR1
2A	308228.796	2483487.623	826.30	GCP02
2REFLECTOR	133439.153	2371220.611	908.67	REFLECTOR2
3A	314539.481	2544434.036	696.90	GCP03
3REFLECTOR	185501.411	2561139.826	590.20	
4A	284226.265	2445964.344	800.42	GCP04
4REFLECTORA	53109.407	2307294.151	857.92	
5A	272944.038	2516190.824	774.67	GCP05
5REFLECTORA	2924.083	2386221.292	988.10	REFLECTOR05
6A	273284.750	2565246.145	586.44	GCP06
06REFLECTORA	6006.867	2425086.967	804.47	REFLECTOR06
7A	238841.022	2477015.356	840.31	GCP07
07REFLECTORA	-57694.025	2308145.998	882.17	REFLECTOR07
8A	240338.060	2550955.113	620.64	GCP08
08REFLECTORA	-106738.986	2336603.842	721.91	REFLECTOR08
9A	221103.611	2361386.215	1021.97	GCP09
09REFLECTORA	-141537.861	2380146.525	769.34	REFLECTOR09
10A	195927.211	2347686.095	991.64	GCP10
10REFLECTORA	131024.868	2308135.938	828.92	REFLECTOR10
11A	185758.124	2423350.978	847.95	GCP11
12A	187426.388	2307117.678	971.85	GCP12
13A	157065.539	2340231.412	924.76	GCP13
14A	134660.070	2423518.871	894.37	GCP14
15A	130937.766	2278947.599	913.27	GCP15
16A	177476.079	2483769.791	779.89	GCP16



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17A	137535.304	2497226.920	775.31	GCP17
18A	137519.319	2555166.907	628.08	GCP18
19A	62164.824	2368245.801	929.34	GCP19
20A	83624.583	2424025.844	897.44	GCP20
21A	2320.981	2311097.631	846.54	GCP21
22A	80758.944	2488752.155	863.96	GCP22
23A	77372.195	2568167.220	586.10	GCP23
24A	8197.710	2512951.552	685.72	GCP24
25A	11651.571	2600785.068	605.39	GCP25
26A	-23017.942	2308794.536	879.84	GCP26
27A	-31515.755	2385020.098	899.27	GCP27
28A	-27995.991	2515558.524	707.54	GCP28
29A	-57459.243	2426164.870	698.51	GCP29
30A	-54853.710	2516280.972	699.12	GCP30
31A	-81678.861	2304944.266	808.24	GCP31
32A	-79287.940	2423558.830	688.73	GCP32
33A	-77876.527	2515929.748	758.58	GCP33
34A	-105925.615	2392605.951	646.03	GCP34
35A	-101324.223	2513041.799	752.41	GCP35
36A	-127554.646	2340704.186	675.31	GCP36
37A	-127091.546	2456324.883	629.12	GCP37
38A	-121001.796	2518589.551	705.97	GCP38
39A	-147642.410	2452651.215	612.12	GCP39
40A	-141166.311	2521688.040	787.13	GCP40
41A	9336.320	2560755.811	659.21	GCP41
42A	-36640.845	2576016.453	617.17	GCP42
43A	-29914.277	2620551.023	586.52	GCP43
44A	-29999.443	2618884.285	590.19	GCP44
45A	-93670.893	2516205.224	733.91	GCP45
46A	-92519.754	2595910.095	623.65	GCP46
47A	-91051.833	2641081.802	591.09	GCP47
48A	-136086.738	2593128.636	626.86	GCP48
49A	-136689.831	2661593.754	597.68	GCP49
50A	-173120.084	2526608.044	688.41	GCP50



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51A	-174400.049	2616776.274	688.38	GCP51
52A	-190618.063	2663003.859	711.42	GCP52
53A	-200474.156	2587606.142	792.89	GCP53
54A	-137050.950	2652738.903	603.08	GCP54
55A	-174125.715	2647794.327	634.27	GCP55
63A	-173674.637	2605822.694	698.90	GCP63
101A	302295.043	2428523.443	839.70	NVA101
102A	248397.977	2434595.294	764.76	NVA102
103A	195624.839	2441348.762	860.66	NVA-PID
104A	219679.778	2388061.210	873.91	NVA-PID
105A	183610.371	2346281.889	954.00	NVA-PID
106A	145245.733	2389170.819	858.22	NVA-PID
107A	107880.839	2453500.524	758.80	NVA-PID
108A	94699.615	2345277.847	820.64	NVA-PID
109A	67834.170	2491897.783	815.61	NVA109
110A	63240.041	2564860.823	638.40	NVA110
111a	119029.136	2468505.166	784.46	NVA111
112a	109180.508	2532326.202	704.11	NVA112
113A	157268.118	2506030.253	753.54	NVA113
114A	197894.271	2555117.433	628.94	NVA114
115A	226508.139	2493229.388	733.73	NVA115
116A	292870.255	2570140.207	592.20	NVA116
117A	305372.003	2501722.872	752.18	NVA117
118A	93810.513	2288517.781	803.85	NVA-PID
119A	68611.154	2407392.233	894.27	NVA-PID
120A	39067.435	2321572.787	826.52	NVA-PID
121A	-14597.796	2315348.083	881.47	NVA-PID
122A	-81402.587	2336541.498	745.16	NVA-PID
123A	18672.570	2385746.561	966.85	NVA-PID
124A	-34315.414	2366985.537	870.12	NVA-PID
125A	-118622.152	2381739.892	637.66	NVA-PID
126A	9459.169	2455188.404	797.12	NVA-PID
127A	24215.600	2526711.679	664.66	NVA127
128A	12889.021	2588613.056	600.42	NVA128



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129A	-44921.790	2427201.111	714.25	NVA-PID
130A	-29254.242	2495279.518	727.17	NVA130
131A	-32916.242	2557030.008	627.23	NVA PID
132A	-47076.204	2615296.080	592.54	NVA PID
133A	-116405.349	2458750.604	644.78	NVA-PID
134A	-83322.912	2529429.503	720.37	NVA PID
135A	-93463.258	2585415.410	617.50	NVA PID
136A	-151690.221	2542161.615	678.32	NVA PID
137A	-106636.466	2651545.030	584.38	NVA PID
138A	-193256.794	2617889.404	729.75	NVA PID
201A	309174.120	2430525.471	846.89	NVA201
202A	254402.682	2427899.195	780.79	NVA202
203a	217544.494	2377212.290	1043.81	NVA-PID
204a	188037.500	2319647.774	979.16	NVA-PID
205A	195670.943	2432027.391	867.44	NVA-PID
206A	138596.051	2354307.810	1022.53	NVA-PID
207A	98333.610	2287201.606	761.58	NVA-PID
208A	97696.079	2432339.769	905.02	NVA-PID
209A	309230.487	2518753.355	730.77	NVA209
210A	254444.248	2489720.985	800.92	NVA210
211A	263007.604	2545892.597	713.01	NVA211
212A	191958.044	2486817.183	837.24	NVA212
213A	206661.149	2545661.955	656.39	NVA213
214A	125481.102	2482901.886	816.68	NVA214
215A	125797.776	2544361.540	723.26	NVA215
216A	39507.728	2321075.260	819.87	NVA-PID
217A	57675.871	2384305.575	881.64	NVA-PID
218A	44116.064	2462421.920	868.37	NVA-PID
219A	-23045.942	2323847.401	892.46	NVA-PID
220A	-13999.152	2382635.238	956.92	NVA-PID
221A	-39700.781	2453668.448	752.15	NVA-PID
222A	-118798.477	2365825.263	656.08	NVA-PID
223A	-102041.549	2428311.179	662.15	NVA-PID
224A	60686.751	2525729.878	676.19	NVA224



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225A	36458.020	2590665.291	611.40	NVA225
226A	-4302.489	2508544.585	683.75	NVA226
227A	-26703.259	2595215.762	597.08	NVA PID
228A	-124916.730	2534120.675	682.29	NVA PID
229A	-156979.865	2622342.112	629.43	NVA PID
230A	-91987.103	2621243.415	590.34	NVA PID
231A	-67824.744	2515874.884	744.62	NVA231
301	310989.439	2432490.963	820.96	NVA301
302	255683.796	2430380.642	777.21	VVA302
303	227524.953	2384192.841	847.47	VVA303
304	196515.002	2331568.119	945.07	VVA-B
305	151115.488	2301739.338	936.23	VVA-C
306	97783.749	2288920.955	755.63	VVA-F
307	290949.167	2480882.195	786.63	VVA307
308	305704.563	2552038.543	669.48	VVA308
309	253559.459	2529365.745	712.87	VVA309
310	199991.597	2549114.829	652.08	VVA310
311	218208.374	2476300.653	815.80	VVA311
312A	194435.462	2428095.011	858.69	
313	154833.225	2378555.761	977.30	VVA-C
314	107202.495	2347139.476	914.53	VVA-F
315	162031.352	2504123.330	771.65	VVA315
316	130755.281	2433307.864	751.79	VVA-F
317	130604.877	2548044.252	673.35	VVA317
318	101423.310	2482203.792	845.90	VVA318
319	37618.232	2320157.053	791.34	VVA-F
320	70814.962	2406789.179	882.36	VVA-W
321	-25528.537	2329364.896	876.67	VVA-F
322	7754.184	2373956.120	906.69	VVA-C
323	-81676.342	2336117.579	746.84	VVA-W
324	-125783.322	2367499.320	625.31	VVA-F
325	-53071.045	2389075.379	781.82	VVA-F
326	73644.594	2535447.249	656.85	VVA326
327	45587.768	2467709.933	875.56	VVA-W



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328	-775.772	2439516.290	756.29	VVA-W
329	-73078.637	2440230.555	718.25	VVA-F
330	-130849.107	2426083.361	709.16	VVA330
331	18282.445	2515495.391	706.41	VVA331
332	40323.288	2588301.771	613.05	VVA332
333	-32875.345	2487530.251	747.88	VVA333
334	-22695.871	2557374.334	626.99	VVA334
335	-50960.960	2615035.901	593.68	VVA-F
335A	-50950.680	2614888.421	595.47	VVA
336	-141371.464	2487381.108	662.47	VVA336
337	-85882.644	2494290.264	656.88	VVA337
338	-76305.451	2550120.026	648.11	VVA-F
339	-130898.111	2544974.055	699.25	VVA-C
340	-103464.087	2643596.316	584.96	VVA-F
341	-179860.828	2573732.759	744.70	VVA-B
342	-123892.429	2608188.558	595.85	VVA-F
343	-177630.233	2644055.711	645.51	VVA-B
344A	170469.608	2557226.346	594.16	
345	-4169.339	2611452.890	588.81	VVA345
346	-68587.005	2628516.684	583.89	VVA-B
347	42510.748	2378710.529	992.22	VVA-W
348	-31951.727	2437828.594	794.50	VVA-C
349	265046.032	2473118.352	819.08	VVA349
350	227053.396	2517022.261	740.71	VVA350
351	112459.755	2387226.704	934.90	VVA-W
352	-7938.893	2576746.750	614.74	VVA352
401A	97853.073	2288838.935	757.33	NVVA
402A	290974.071	2480940.945	785.83	NVVA402
403A	305799.805	2552027.542	674.65	NVVA403
405A	130745.452	2433238.292	752.80	NVVA
406A	130560.621	2548194.626	671.35	NVVA406
407A	37941.199	2320206.933	793.42	NVVA
408A	-25422.153	2329254.511	879.40	NVVA
409A	-125590.246	2367324.692	630.78	NVVA



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410A	-53377.962	2388841.748	785.39	NVVA
411A	-73259.657	2440258.549	719.44	NVVA
412A	18171.826	2515541.824	709.13	NVVA412
413A	-32732.276	2487591.857	749.51	NVVA413
414A	-50941.536	2614767.239	592.34	NVVA
415	-76410.596	2550096.462	644.26	NVVA
416A	-103437.654	2643499.930	585.71	NVVA
417A	-124070.074	2608185.444	595.65	NVVA
418A	253516.413	2529312.996	720.51	NVVA418
419A	213213.319	2480533.608	819.49	NVVA419
420A	195454.169	2555259.210	628.25	NVVA420
421A	162124.474	2504185.504	773.92	NVVA421
422A	100874.236	2483319.782	877.21	NVVA422
423A	202758.151	2416113.899	855.58	NVVA423
424A	270604.978	2443035.414	830.91	NVVA424
425A	186051.971	2327608.795	957.07	NVVA
426A	154768.655	2378504.471	980.15	NVVA
427A	43492.723	2424913.869	860.51	NVVA
428A	-124688.146	2442215.481	685.28	NVVA428
429A	-127685.454	2528528.666	729.33	NVVA
430A	63762.442	2570299.158	647.13	NVVA430
431A	-171771.293	2573857.324	726.52	NVVA
432A	-80666.182	2333099.813	745.94	NVVA
433A	-21338.602	2556818.436	624.20	NVVA433
434A	-177495.705	2644011.580	654.19	NVVA