



# Ground Survey Report (Control Network)

## USGS Brawley Rillito, AZ G16PC00051

April 2019

### Executive Summary

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U.S. Geological Survey (USGS) contracted with The Sanborn Map Company, Inc. (Sanborn) to provide ground survey in the support of aerial surveys of lidar for the Brawley Rillito, AZ project. A network of control and check points has been designed and implemented into the project process to establish common basis for geo-referencing of the lidar and photography data products. A total of twenty-seven (27) Ground Control Points (GCP), seventy-six (76) Non-vegetated Vertical Accuracy (NVA) check points, and fifty-nine (59) Vegetated Vertical Accuracy (VVA) check points were established. All GCP will serve for lidar calibration; NVA and VVA check points will be utilized to validate the accuracy of the lidar data.

The survey of ground control and check points meets a final adjusted RMS 1/3 of the required product accuracy for (USGS – QL2) Lidar.

The local network was designed, processed and adjusted using Trimble Business Center (TBC) version 5.00. Final horizontal coordinates are projected in NAD83 (2011), UTM Zone 12 North, NAVD88 (Geoid12B), Meters. A version of the coordinates will also be provided in NAD83 (2011), Albers Equal Area, NAVD88 (Geoid12B), Meters.

NGS CORS: P014

NGS Monuments: AI1931, AI1933, CG0402, CG0428, CG0516, CG0804, CG1173, CG1187, CG1224, CY0333, CZ1832, CZ2397, CZ2529, DH5763

Leica SmartNet: AZAM, AZCA, AZDT, AZMA, AZSM, AZWX, TUCS

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# Introduction

This report contains the technical write-up of the differential GPS surveys performed in support of lidar products.

Sanborn oversaw the survey team(s) for execution of the survey, all fieldwork including reconnaissance of existing control points, establishment of additional control points, GPS surveys. All GPS data processing and reductions were performed in support of the Brawley Rillito, AZ project. **Figure 1** illustrates the initial survey plan within the project Area of Interest (AOI).

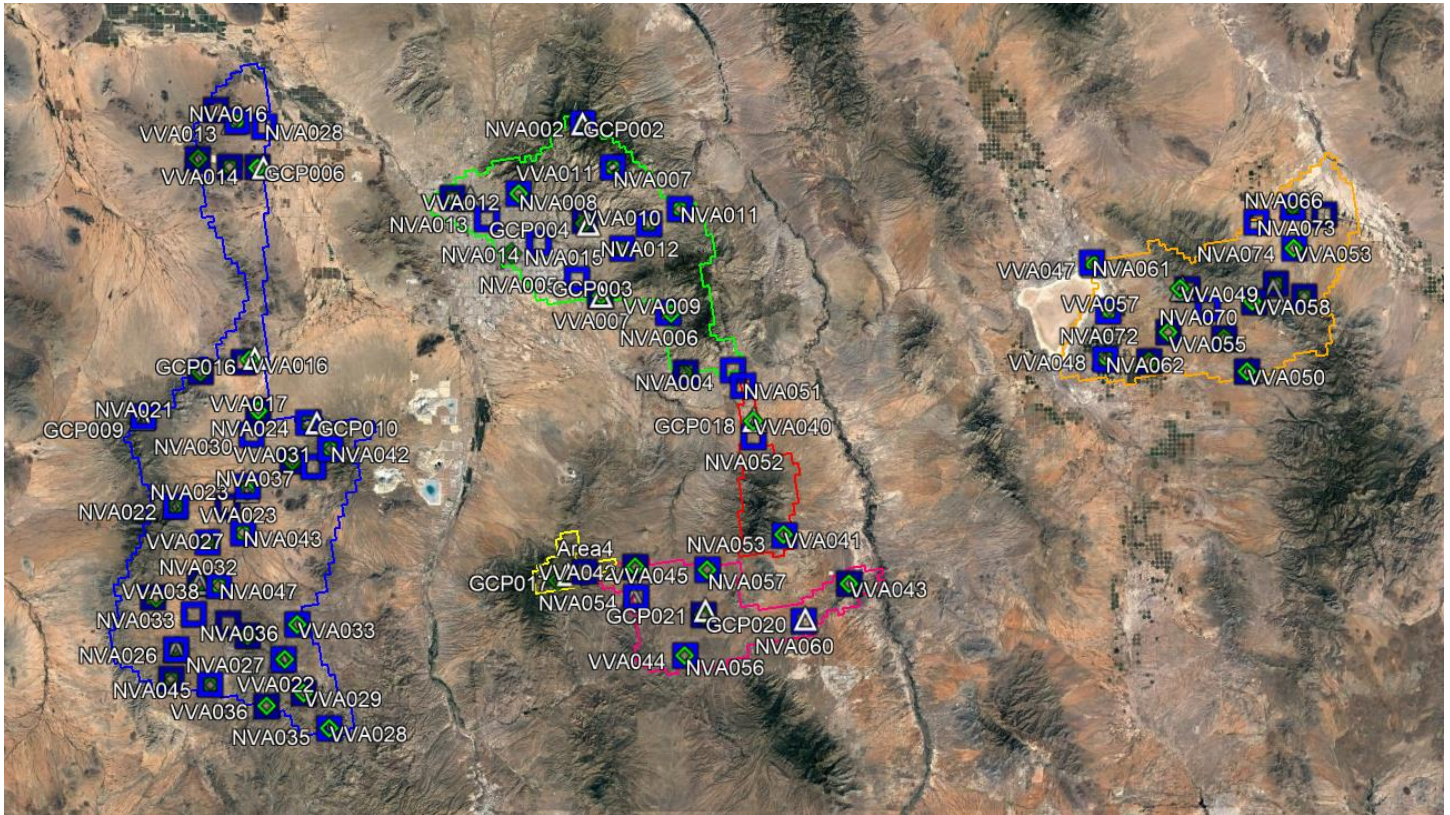


Figure 1: Survey Plan and AOI

# Survey Purpose

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The GPS Network Survey includes twenty-two (22) control point(s): NGS CORS (P014), NGS Monuments (AI1931, AI1933, CG0402, CG0428, CG0516, CG0804, CG1173, CG1187, CG1224, CY0333, CZ1832, CZ2397, CZ2529, DH5763), and Leica SmartNet (AZAM, AZCA, AZDT, AZMA, AZSM, AZWX, TUCS). The control points are tied to twenty-seven (27) Ground Control Points: GCP001 – GCP027; seventy-six (76) Non-vegetated Vertical Accuracy: NVA001 – NVA076; fifty-nine (59) Vegetated Vertical Accuracy: VVA001 – VVA059, for the GPS Log Sheets of the observed points see **Attachment A**. The NGS Data Sheets, OPUS Reports, and Trimble CenterPoint RTX Reports referenced for the control points can be found in **Attachment B**. **Attachment C** contains the TBC Baseline Processing Reports. **Attachment D** contains the photos of the observed points in the GPS Network Survey. The sketches of the observed points can be found in **Attachment E**. The ground control points were strategically positioned to satisfy aerial survey requirements for the area of interest (AOI).

# Duration/Time Period

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The ground control survey was performed from March 23<sup>rd</sup>, 2019 to April 3<sup>rd</sup>, 2019.

# Equipment

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The ground control survey was performed using survey grade Trimble R8 L1/L2 GPS Antennas attached to 2 meter fixed height rods, leveled over each point in the center of the targets.

# Field Procedures

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A careful reconnaissance was undertaken prior to the monumentation and subsequent GPS survey. The satellite window provided a minimum of 4 hour constellation coverage; GPS observation sessions were scheduled between 08:00 and 18:00 local time. All baseline processing, analysis, and preliminary reductions were performed upon receiving the data for quality control. No difficulties were experienced during this survey.

Personnel navigated to points using local maps, or GPS navigation. The field crews had approximate geodetic coordinates loaded for the required observation points. Upon arriving at the desired location the field personnel initiated a search for the point locations. The receiver was set on the 2 meter fixed height rod and leveled over the point. The GPS survey was set up as FastStatic connected via session to the established base station located at the NGS Monument. Field crew members followed a session schedule established by office personnel to facilitate observation location and duration.

The survey data sheet was produced with the following information: Point ID, Stamping (if available), Date, Observer Name, Antenna Height Measurement Point, Antenna Height, Start Time and End Time. Digital photographs were taken at each point showing the control point surveyed and its relationship to its surroundings.

# Processing

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All static baselines and vectors for the Brawley Rillito, AZ project were processed using Trimble Business Center (TBC) version 5.00 software. Fixed solutions were adopted for all baselines using the broadcast ephemeris.

NAD83 (2011) was utilized and incorporated into the reductions, thereby allowing rigorous interpolation of the geoidal undulation values at each point in the network. This provides a useful method of estimating the elevations at all points in the network. The Survey Network Diagrams (Appendix A) and the Final Adjusted Coordinates (Appendix B) can be found below.

# Accuracy

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Lidar Category	Value
RMSE <sub>z</sub> (m)	≤0.100
@ 95-Percent Confidence Level (m)	≤0.196

Table 1: Lidar Absolute Accuracy Requirements

The final survey networked coordinates yielded station levels of 0.013m horizontally (X, Y) and 0.044m vertically (Z) at 2σ or (95-Percent Confidence Level) meeting and/or exceeding project requirements.

## Coordinate Reference System

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<b>Horizontal Datum:</b>	North American Datum of 1983 (2011)
<b>Projection:</b>	Universal Transverse Mercator Zone 12 North
<b>Vertical Datum:</b>	North American Vertical Datum of 1988
<b>Geoid Model:</b>	Geoid12B
<b>Units:</b>	Meters

## Contact Information

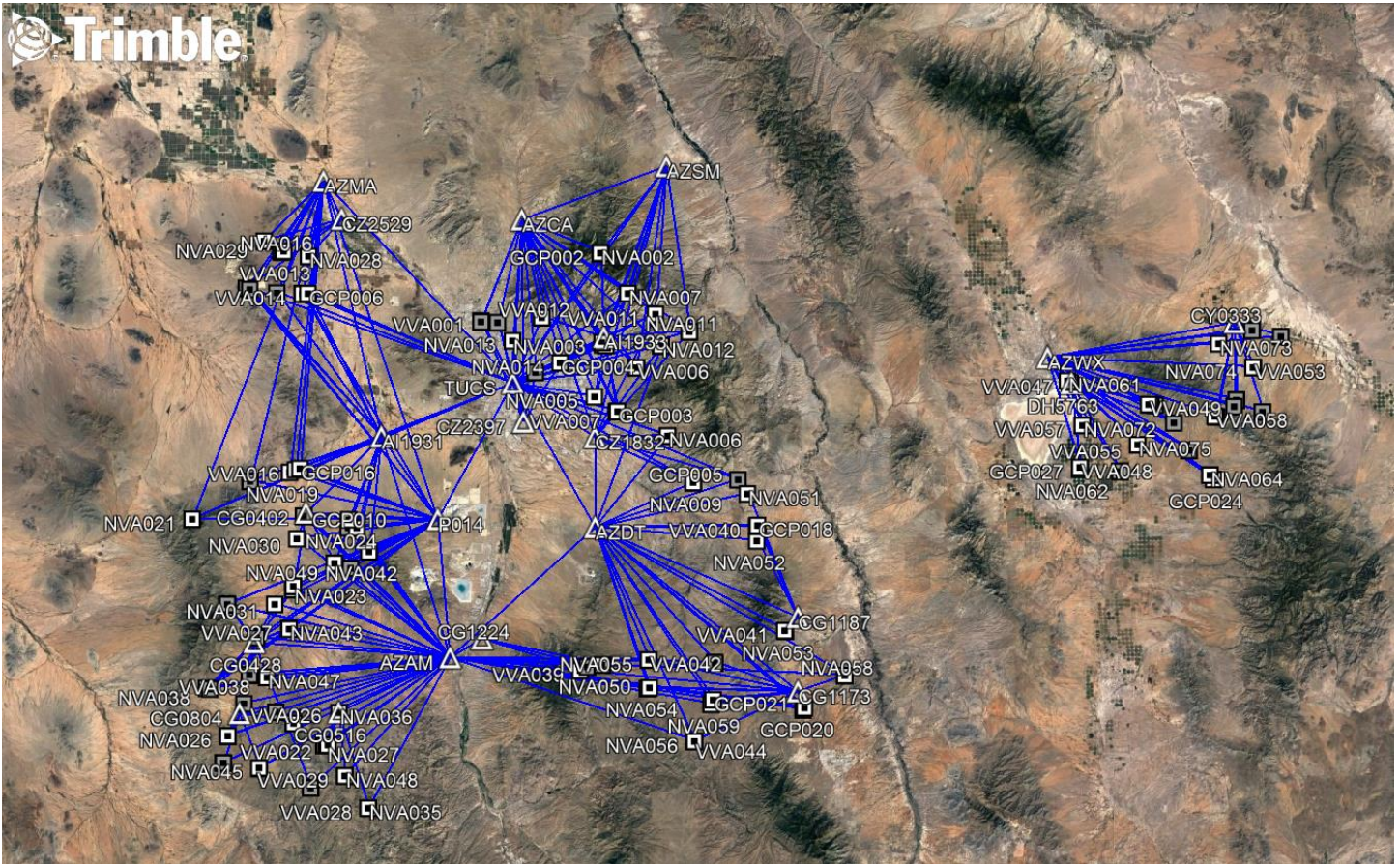
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Questions regarding technical aspects of this report should be addressed to:

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# Appendix A - Survey Network Diagram



# Appendix B – Adjusted Coordinates

ID	Easting (Meter)	Northing (Meter)	Elevation (Meter)	Feature Code	Projection Scale Factor	Height Scale Factor	Combined Scale Factor	Meridian convergence angle
AI1931	479510.764	3553563.109	743.804	BASE	0.9996051770	0.9998879214	0.9994931427	-0°06'56"
AI1933	523164.324	3573158.486	840.338	BASE	0.9996066169	0.9998725176	0.9994791846	0°07'53"
AZAM	493241.186	3510514.280	959.562	SmartNet	0.9996005634	0.9998540069	0.9994546286	-0°02'15"
AZCA	506873.958	3596010.871	962.002	SmartNet	0.9996005826	0.9998534562	0.9994540973	0°02'22"
AZDT	521626.571	3536072.777	1022.371	SmartNet	0.9996057679	0.9998440225	0.9994498519	0°07'16"
AZMA	467738.149	3603482.484	566.590	SmartNet	0.9996128342	0.9999157161	0.9995285830	-0°11'06"
AZSM	535238.822	3606560.148	1046.173	SmartNet	0.9996153120	0.9998401810	0.9994555545	0°12'08"
AZWX	610234.779	3569598.312	1276.943	SmartNet	0.9997498643	0.9998038035	0.9995537168	0°37'29"
CG0402	464703.881	3538596.239	850.160	BASE	0.9996153638	0.9998712404	0.9994866537	-0°11'52"
CG0428	454540.277	3513224.749	1056.038	BASE	0.9996254872	0.9998389306	0.9994644782	-0°15'09"
CG0516	471315.955	3499636.155	1156.588	BASE	0.9996101474	0.9998231095	0.9994333259	-0°09'31"
CG0804	451710.476	3499320.588	1064.197	BASE	0.9996287599	0.9998376638	0.9994664840	-0°16'01"
CG1173	561549.745	3504270.790	1338.985	BASE	0.9996467235	0.9997941916	0.9994409877	0°20'27"
CG1187	561488.371	3518715.578	1403.693	BASE	0.9996466291	0.9997840019	0.9994307073	0°20'32"
CG1224	499522.248	3514214.610	934.614	BASE	0.9996000028	0.9998579057	0.9994579654	-0°00'10"
CY0333	647001.698	3576683.113	1126.336	BASE	0.9998665237	0.9998274031	0.9996939498	0°50'06"
CZ1832	521491.158	3553614.779	901.194	BASE	0.9996056957	0.9998630476	0.9994687973	0°07'16"
CZ2397	507442.694	3556553.976	793.056	BASE	0.9996006831	0.9998801005	0.9994808315	0°02'31"
CZ2529	471410.226	3596035.793	577.509	BASE	0.9996100790	0.9999140015	0.9995241141	-0°09'49"
DH5763	614945.931	3564612.874	1276.035	BASE	0.9997629507	0.9998039361	0.9995669332	0°39'01"
GCP001	502409.845	3576080.383	758.235	GCP	0.9996000716	0.9998855191	0.9994856365	0°00'49"
GCP002	522531.636	3589665.488	2365.855	GCP	0.9996062602	0.9996330018	0.9992394065	0°07'43"
GCP003	526086.285	3558841.966	953.136	GCP	0.9996083917	0.9998548374	0.9994632859	0°08'50"
GCP004	523711.796	3571694.202	821.883	GCP	0.9996069334	0.9998754218	0.9994824041	0°08'04"
GCP005	540994.186	3545074.617	1127.049	GCP	0.9996207246	0.9998274638	0.9994482538	0°13'49"
GCP006	464985.922	3581625.605	633.242	GCP	0.9996151180	0.9999052776	0.9995204321	-0°11'57"
GCP007	468543.067	3493338.763	1109.923	GCP	0.9996122043	0.9998304445	0.9994427145	-0°10'25"
GCP008	449570.016	3494987.588	1082.275	GCP	0.9996313663	0.9998348323	0.9994662595	-0°16'42"
GCP009	442331.846	3537410.577	1472.475	GCP	0.9996410134	0.9997735512	0.9994146459	-0°19'23"
GCP010	474910.834	3535899.066	1119.823	GCP	0.9996077628	0.9998288602	0.9994366902	-0°08'26"
GCP011	453799.333	3507065.627	1059.029	GCP	0.9996263251	0.9998384670	0.9994648525	-0°15'22"
GCP012	462338.208	3523772.612	914.506	GCP	0.9996174928	0.9998611411	0.9994786870	-0°12'36"
GCP013	449232.921	3520751.503	1124.144	GCP	0.9996317855	0.9998282224	0.9994600711	-0°16'58"
GCP014	452850.934	3582655.791	795.656	GCP	0.9996274131	0.9998797910	0.9995072489	-0°16'06"
GCP015	459527.053	3589749.022	663.548	GCP	0.9996201992	0.9999005121	0.9995207490	-0°13'52"
GCP016	463620.813	3547426.820	806.087	GCP	0.9996163209	0.9998781578	0.9994945255	-0°12'17"
GCP017	520407.852	3509020.061	1666.157	GCP	0.9996051364	0.9997429063	0.9993481442	0°06'48"
GCP018	553649.226	3536758.721	1274.344	GCP	0.9996354960	0.9998043139	0.9994398813	0°18'02"
GCP019	532202.293	3504850.905	1487.653	GCP	0.9996127893	0.9997709077	0.9993837856	0°10'42"
GCP020	563031.971	3501241.929	1298.329	GCP	0.9996490013	0.9998005777	0.9994496489	0°20'56"
GCP021	545096.266	3502729.645	1442.940	GCP	0.9996250818	0.9997778952	0.9994030603	0°14'59"

GCP022	650647.706	3575628.593	1117.565	GCP	0.9998799118	0.9998287785	0.9997087108	0°51'19"
GCP023	647156.001	3560418.195	1347.537	GCP	0.9998670916	0.9997926223	0.9996597415	0°49'52"
GCP024	643169.230	3546158.425	1457.967	GCP	0.9998528195	0.9997753056	0.9996281582	0°48'17"
GCP025	630746.676	3560677.789	1547.514	GCP	0.9998108376	0.9997612524	0.9995721352	0°44'19"
GCP026	614780.621	3564829.911	1274.159	GCP	0.9997624822	0.9998042307	0.9995667594	0°38'58"
GCP027	616839.406	3548344.591	1285.238	GCP	0.9997683691	0.9998025058	0.9995709207	0°39'26"
NVA001	499144.940	3576217.477	713.877	NVA	0.9996000090	0.9998925044	0.9994925564	-0°00'17"
NVA002	522541.919	3589723.361	2369.063	NVA	0.9996062659	0.9996324985	0.9992389090	0°07'43"
NVA003	522977.703	3572268.617	826.243	NVA	0.9996065107	0.9998747376	0.9994812976	0°07'49"
NVA004	549780.044	3545642.777	1289.327	NVA	0.9996305601	0.9998019635	0.9994325968	0°16'47"
NVA005	521527.214	3561685.896	876.112	NVA	0.9996057148	0.9998669630	0.9994727303	0°07'18"
NVA006	535930.064	3554110.851	976.896	NVA	0.9996159202	0.9998510511	0.9994670285	0°12'09"
NVA007	527981.711	3581853.942	1916.194	NVA	0.9996096551	0.9997035743	0.9993133451	0°09'33"
NVA008	511042.607	3577071.821	959.787	NVA	0.9996015037	0.9998538057	0.9994553677	0°03'46"
NVA009	540971.738	3545029.612	1128.727	NVA	0.9996207019	0.9998272005	0.9994479680	0°13'49"
NVA010	525838.707	3558782.628	956.027	NVA	0.9996082332	0.9998543865	0.9994626767	0°08'45"
NVA011	540089.050	3574454.572	1327.476	NVA	0.9996198184	0.9997959856	0.9994158816	0°13'39"
NVA012	534555.174	3571709.861	1203.748	NVA	0.9996147246	0.9998154202	0.9994302159	0°11'46"
NVA013	505373.028	3572534.553	727.078	NVA	0.9996003560	0.9998904096	0.9994908094	0°01'50"
NVA014	514752.937	3568272.857	771.023	NVA	0.9996026839	0.9998834814	0.9994862116	0°05'01"
NVA015	529751.267	3567337.597	834.396	NVA	0.9996109152	0.9998734343	0.9994843987	0°10'07"
NVA016	460157.354	3589912.856	655.482	NVA	0.9996195749	0.9999017782	0.9995213905	-0°13'39"
NVA017	453467.405	3582397.761	780.201	NVA	0.9996267010	0.9998822158	0.9995089608	-0°15'54"
NVA018	463857.264	3581646.820	641.185	NVA	0.9996161084	0.9999040299	0.9995201751	-0°12'21"
NVA019	461591.710	3546673.237	811.674	NVA	0.9996181924	0.9998772819	0.9994955211	-0°12'57"
NVA020	464409.059	3538109.890	848.155	NVA	0.9996156216	0.9998715554	0.9994872263	-0°11'58"
NVA021	442337.377	3537426.748	1471.277	NVA	0.9996410055	0.9997737393	0.9994148261	-0°19'23"
NVA022	449400.368	3520806.521	1125.951	NVA	0.9996315762	0.9998279394	0.9994595789	-0°16'55"
NVA023	462411.140	3524425.516	911.964	NVA	0.9996174251	0.9998615391	0.9994790172	-0°12'35"
NVA024	473329.115	3536748.847	1071.216	NVA	0.9996087735	0.9998387626	0.9994475992	-0°08'58"
NVA025	453782.073	3506950.569	1057.803	NVA	0.9996263448	0.9998386597	0.9994650648	-0°15'23"
NVA026	449549.516	3495068.299	1083.290	NVA	0.9996313918	0.9998346730	0.9994661257	-0°16'43"
NVA027	469028.157	3493462.672	1111.706	NVA	0.9996118308	0.9998301638	0.9994420606	-0°10'15"
NVA028	465058.932	3588914.384	610.516	NVA	0.9996150548	0.9999088386	0.9995239286	-0°11'58"
NVA029	456264.317	3591883.075	699.714	NVA	0.9996235871	0.9998948375	0.9995184642	-0°14'59"
NVA030	463085.761	3533700.986	862.993	NVA	0.9996168050	0.9998692241	0.9994860792	-0°12'24"
NVA031	458756.116	3520870.673	947.967	NVA	0.9996209788	0.9998558973	0.9994769307	-0°13'47"
NVA032	455195.922	3514361.125	1038.949	NVA	0.9996247573	0.9998416134	0.9994664301	-0°14'57"
NVA033	452732.745	3501401.912	1055.721	NVA	0.9996275550	0.9998389918	0.9994666067	-0°15'42"
NVA034	465950.269	3485016.109	1256.688	NVA	0.9996142993	0.9998074095	0.9994217831	-0°11'14"
NVA035	477342.097	3481139.217	1286.612	NVA	0.9996063318	0.9998026943	0.9994091038	-0°07'28"
NVA036	471523.525	3499742.585	1158.433	NVA	0.9996100011	0.9998228196	0.9994328898	-0°09'27"
NVA037	473716.384	3528005.498	1174.331	NVA	0.9996085197	0.9998202905	0.9994288805	-0°08'49"
NVA038	445310.820	3504373.431	1187.878	NVA	0.9996368878	0.9998182438	0.9994551976	-0°18'11"
NVA039	459034.253	3499818.230	1048.373	NVA	0.9996206976	0.9998401308	0.9994608890	-0°13'36"
NVA040	462523.112	3497636.459	1056.829	NVA	0.9996173223	0.9998387908	0.9994561748	-0°12'26"



NVA041	453799.073	3544897.937	879.277	NVA	0.9996263236	0.9998666719	0.9994930453	-0°15'35"
NVA042	477321.172	3531251.624	1287.038	NVA	0.9996063429	0.9998025892	0.9994090099	-0°07'37"
NVA043	461635.936	3516045.942	945.927	NVA	0.9996181515	0.9998562160	0.9994744225	-0°12'48"
NVA044	463877.505	3581618.719	641.181	NVA	0.9996160903	0.9999040307	0.9995201579	-0°12'20"
NVA045	455746.468	3488851.782	1140.792	NVA	0.9996241537	0.9998256367	0.9994498560	-0°14'38"
NVA046	448688.058	3489761.281	1091.956	NVA	0.9996324733	0.9998333181	0.9994658527	-0°16'58"
NVA047	457290.982	3506566.420	1003.315	NVA	0.9996224964	0.9998472118	0.9994697658	-0°14'12"
NVA048	472701.719	3487417.746	1205.472	NVA	0.9996091909	0.9998154389	0.9994247019	-0°09'01"
NVA049	470526.603	3528961.225	1076.063	NVA	0.9996107130	0.9998357336	0.9994465106	-0°09'53"
NVA050	523304.793	3509425.779	1590.497	NVA	0.9996066982	0.9997547747	0.9993615693	0°07'46"
NVA051	551631.503	3542901.856	1259.167	NVA	0.9996328758	0.9998067016	0.9994396484	0°17'24"
NVA052	553518.916	3533749.711	1343.740	NVA	0.9996353240	0.9997934154	0.9994288147	0°17'58"
NVA053	559216.783	3516167.807	1470.058	NVA	0.9996432475	0.9997735838	0.9994169121	0°19'46"
NVA054	532578.058	3505007.249	1490.732	NVA	0.9996130895	0.9997704239	0.9993836022	0°10'50"
NVA055	532410.662	3510405.391	1448.217	NVA	0.9996129552	0.9997770954	0.9993901368	0°10'48"
NVA056	541471.894	3494593.476	1557.084	NVA	0.9996212124	0.9997599873	0.9993812907	0°13'44"
NVA057	545396.190	3509966.660	1497.888	NVA	0.9996254162	0.9997692519	0.9993947545	0°15'07"
NVA058	570896.316	3507599.171	1261.182	NVA	0.9996619915	0.9998063954	0.9994684523	0°23'35"
NVA059	544721.077	3501873.832	1448.489	NVA	0.9996246662	0.9997770272	0.9994017771	0°14'51"
NVA060	562731.558	3500845.401	1304.561	NVA	0.9996485353	0.9997995994	0.9994482051	0°20'49"
NVA061	614327.652	3565239.546	1275.724	NVA	0.9997612020	0.9998039861	0.9995652350	0°38'49"
NVA062	616819.175	3547986.561	1285.209	NVA	0.9997683109	0.9998025106	0.9995708673	0°39'25"
NVA063	631609.338	3560607.570	1570.315	NVA	0.9998136295	0.9997576699	0.9995713445	0°44'36"
NVA064	642448.677	3547011.852	1454.562	NVA	0.9998502803	0.9997758428	0.9996261566	0°48'03"
NVA065	647597.150	3561689.731	1305.590	NVA	0.9998686951	0.9997992110	0.9996679325	0°50'02"
NVA066	650649.837	3575325.510	1118.817	NVA	0.9998799198	0.9998285813	0.9997085217	0°51'19"
NVA067	638297.322	3551808.149	1446.492	NVA	0.9998359006	0.9997771161	0.9996130534	0°46'44"
NVA068	656352.006	3574165.412	1103.457	NVA	0.9999015163	0.9998309907	0.9997325237	0°53'14"
NVA069	643670.393	3558358.688	1528.738	NVA	0.9998545872	0.9997641790	0.9996188005	0°48'39"
NVA070	635288.266	3557168.785	1531.184	NVA	0.9998257431	0.9997638131	0.9995895974	0°45'48"
NVA071	624746.605	3547628.301	1324.293	NVA	0.9997919327	0.9997963487	0.9995883237	0°42'05"
NVA072	617300.544	3556573.815	1275.403	NVA	0.9997696983	0.9998040417	0.9995737851	0°39'42"
NVA073	644068.582	3572691.445	1168.552	NVA	0.9998559939	0.9998207602	0.9996767799	0°49'02"
NVA074	650946.152	3568065.652	1185.516	NVA	0.9998810260	0.9998180886	0.9996991363	0°51'17"
NVA075	628190.034	3552870.164	1383.960	NVA	0.9998026745	0.9997869591	0.9995896756	0°43'20"
NVA076	652753.002	3559397.543	1333.216	NVA	0.9998878001	0.9997948653	0.9996826884	0°51'45"
P014	490685.485	3537435.103	1098.461	CORS	0.9996010699	0.9998321937	0.9994333305	-0°03'08"
TUCS	505316.533	3564139.466	750.619	SmartNet	0.9996003486	0.9998867473	0.9994871411	0°01'48"
VVA001	499131.826	3576399.367	721.394	VVA	0.9996000093	0.9998913239	0.9994913767	-0°00'18"
VVA002	522505.633	3589685.396	2367.766	VVA	0.9996062457	0.9996327021	0.9992390925	0°07'42"
VVA003	523076.245	3571821.445	822.651	VVA	0.9996065667	0.9998753041	0.9994819199	0°07'51"
VVA004	509902.315	3566379.698	760.514	VVA	0.9996012092	0.9998851673	0.9994864223	0°03'22"
VVA005	540994.117	3545054.800	1127.124	VVA	0.9996207245	0.9998274520	0.9994482419	0°13'49"
VVA006	529714.184	3567387.801	832.729	VVA	0.9996108880	0.9998736962	0.9994846334	0°10'06"
VVA007	526038.944	3558817.155	950.097	VVA	0.9996083613	0.9998553149	0.9994637329	0°08'49"
VVA008	534475.416	3571659.717	1198.959	VVA	0.9996146567	0.9998161723	0.9994308998	0°11'44"

VVA009	535881.718	3554060.632	977.080	VVA	0.9996158774	0.9998510227	0.9994669573	0°12'08"
VVA010	540068.498	3574472.103	1327.172	VVA	0.9996197981	0.9997960334	0.9994159091	0°13'39"
VVA011	533430.419	3577836.027	3446.855	VVA	0.9996137815	0.9994634688	0.9990774575	0°11'24"
VVA012	511099.872	3577085.927	961.473	VVA	0.9996015193	0.9998535405	0.9994551182	0°03'47"
VVA013	459887.047	3589784.105	659.077	VVA	0.9996198414	0.9999012138	0.9995210928	-0°13'44"
VVA014	463919.463	3581555.294	641.274	VVA	0.9996160530	0.9999040161	0.9995201059	-0°12'19"
VVA015	452828.880	3582637.953	794.718	VVA	0.9996274388	0.9998799384	0.9995074219	-0°16'07"
VVA016	462749.689	3547179.389	810.011	VVA	0.9996171119	0.9998775421	0.9994947009	-0°12'34"
VVA017	464407.411	3538150.339	848.097	VVA	0.9996156230	0.9998715646	0.9994872370	-0°11'58"
VVA018	473216.379	3535907.686	1086.258	VVA	0.9996088468	0.9998341370	0.9994430486	-0°09'00"
VVA019	449397.411	3520777.891	1125.429	VVA	0.9996315798	0.9998280212	0.9994596645	-0°16'55"
VVA020	453804.930	3506976.909	1057.941	VVA	0.9996263188	0.9998386380	0.9994650170	-0°15'22"
VVA021	449515.558	3495096.749	1083.369	VVA	0.9996314341	0.9998346606	0.9994661556	-0°16'43"
VVA022	469344.174	3493438.165	1114.953	VVA	0.9996115906	0.9998296537	0.9994413105	-0°10'09"
VVA023	462384.721	3523754.397	917.286	VVA	0.9996174496	0.9998607044	0.9994782073	-0°12'35"
VVA024	458847.298	3581721.311	694.085	VVA	0.9996208837	0.9998957264	0.9995166497	-0°14'03"
VVA025	445933.247	3504223.200	1176.958	VVA	0.9996360529	0.9998199578	0.9994560763	-0°17'58"
VVA026	462561.697	3497623.786	1056.246	VVA	0.9996172867	0.9998388822	0.9994562305	-0°12'25"
VVA027	461561.953	3516154.620	945.163	VVA	0.9996182216	0.9998563361	0.9994746125	-0°12'50"
VVA028	477362.131	3481137.051	1286.514	VVA	0.9996063206	0.9998027096	0.9994091079	-0°07'28"
VVA029	472712.929	3487409.995	1204.534	VVA	0.9996091833	0.9998155861	0.9994248415	-0°09'01"
VVA030	448625.653	3489765.142	1092.725	VVA	0.9996325524	0.9998331974	0.9994658111	-0°16'59"
VVA031	477310.697	3531259.147	1286.423	VVA	0.9996063488	0.9998026858	0.9994091123	-0°07'37"
VVA032	470510.113	3529000.993	1074.087	VVA	0.9996107250	0.9998360438	0.9994468326	-0°09'53"
VVA033	471534.142	3499728.233	1158.694	VVA	0.9996099936	0.9998227785	0.9994328413	-0°09'27"
VVA034	453804.183	3544843.119	880.194	VVA	0.9996263177	0.9998665279	0.9994928955	-0°15'34"
VVA035	455172.561	3514332.559	1039.381	VVA	0.9996247831	0.9998415456	0.9994663882	-0°14'57"
VVA036	465964.669	3485037.708	1256.714	VVA	0.9996142872	0.9998074054	0.9994217669	-0°11'14"
VVA037	455794.889	3488707.180	1144.852	VVA	0.9996241009	0.9998249993	0.9994491660	-0°14'37"
VVA038	457180.794	3506606.762	1003.915	VVA	0.9996226126	0.9998471178	0.9994697881	-0°14'15"
VVA039	518985.277	3508316.042	1732.260	VVA	0.9996044453	0.9997325344	0.9993370854	0°06'19"
VVA040	553509.914	3536576.346	1279.952	VVA	0.9996353119	0.9998034335	0.9994388171	0°17'59"
VVA041	559065.161	3516287.418	1469.712	VVA	0.9996430263	0.9997736366	0.9994167438	0°19'43"
VVA042	532410.436	3510447.567	1447.249	VVA	0.9996129550	0.9997772472	0.9993902884	0°10'48"
VVA043	570878.843	3507579.861	1260.857	VVA	0.9996619609	0.9998064465	0.9994684728	0°23'35"
VVA044	541433.082	3494598.589	1555.621	VVA	0.9996211728	0.9997602171	0.9993814807	0°13'43"
VVA045	545356.052	3509962.663	1497.403	VVA	0.9996253713	0.9997693282	0.9993947859	0°15'06"
VVA046	544730.415	3501884.817	1448.511	VVA	0.9996246765	0.9997770237	0.9994017839	0°14'51"
VVA047	614768.244	3564890.855	1273.191	VVA	0.9997624471	0.9998043825	0.9995668761	0°38'57"
VVA048	616836.290	3548394.384	1284.397	VVA	0.9997683601	0.9998026377	0.9995710436	0°39'26"
VVA049	630302.014	3560733.726	1544.936	VVA	0.9998094057	0.9997616591	0.9995711102	0°44'10"
VVA050	642438.494	3547023.678	1454.751	VVA	0.9998502445	0.9997758132	0.9996260913	0°48'03"
VVA051	647630.041	3561698.873	1305.134	VVA	0.9998688149	0.9997992826	0.9996681238	0°50'03"
VVA052	650635.446	3575633.832	1117.370	VVA	0.9998798662	0.9998288090	0.9997086957	0°51'19"
VVA053	650866.136	3568079.550	1185.447	VVA	0.9998807281	0.9998180993	0.9996988491	0°51'16"
VVA054	652791.224	3559381.472	1333.817	VVA	0.9998879442	0.9997947709	0.9996827381	0°51'46"

VVA055	628188.589	3552882.711	1384.360	VVA	0.9998026699	0.9997868962	0.9995896082	0°43'20"
VVA056	624732.630	3547648.509	1324.162	VVA	0.9997918897	0.9997963693	0.9995883013	0°42'05"
VVA057	617300.412	3556610.883	1274.180	VVA	0.9997696979	0.9998042336	0.9995739766	0°39'42"
VVA058	643396.304	3558488.859	1550.567	VVA	0.9998536166	0.9997607532	0.9996144048	0°48'34"
VVA059	638306.295	3551849.261	1446.629	VVA	0.9998359312	0.9997770945	0.9996130623	0°46'44"

# Attachment A – GPS Log Sheets

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(Electronically Attached)

# Attachment B – Data Sheets

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(Electronically Attached)

# Attachment C – Baseline Processing Reports

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(Electronically Attached)

## Attachment D – Photos

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(Electronically Attached)

## Attachment E – Sketches

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(Electronically Attached)