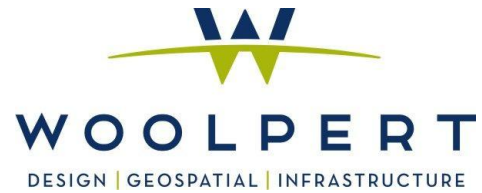


GROUND CONTROL SURVEY REPORT



ANIMAS RIVER, NEW MEXICO LIDAR

12/3/2014





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Table of Contents

Section 1: Survey Report	
Introduction	1-1
Project Area	1-1
Purpose.....	1-1
Date of Survey	1-1
Monumentation	1-1
Accuracy	1-1
GPS Equipment.....	1-1
Methodology.....	1-1
GPS Data Analysis and Processing	1-1
Datum Reference and Final Coordinates	1-1
Quality Assurance.....	1-1
Section 2: Ground/Geodetic Control Coordinates Listings	2-1
Section 3: Ground/Geodetic Control Logs and Photos	3-1
Section 4: Existing NGS Datasheets	4-1
Section 5: GPS Control Diagram	5-1

SECTION 1: SURVEY REPORT

INTRODUCTION

Report Date: 12/3/2014

Project Name: Animas River, New Mexico LiDAR
Client Information: USGS / NGTOC
Contract Number: G10PC00057
Requisition/Reference Number: 0040183081
Date of Contract: 10/30/2014
Delivery Date: 05/15/2015

Prepared By: David Kuxhausen, PLS
Woolpert Project Number: 74753

This report contains a comprehensive outline of the LiDAR Ground Control Survey that supported the Animas River, New Mexico LiDAR. All surveys were performed in such a way as to achieve ground control accuracies that meet or exceed the National Mapping Accuracy Standards.

PROJECT AREA

The project area consists of approximately 100 square miles encompassing a section of the Animas river and its' watershed near Farmington, NM.

PURPOSE

The purpose of this survey was to establish three-dimensional coordinates for 12 ground control points (GCPs) and a minimum of 20 quality control (QC) points in each of the land cover classifications in Bare Earth and Weeds and Crops.

The GCPs were located on open, bare earth surfaces with a level slope to enable effective assessment of swath-to-swath reproducibility and absolute accuracy. The QC points were collected uniformly dispersed over the project area in the appropriate land cover categories to verify fundamental, supplemental, and consolidated vertical accuracies throughout the task order AOI.

DATE OF SURVEY

Ground control field operations took place between November 18th 2014 and November 21st 2014.

MONUMENTATION

Prior to aerial imagery acquisition, Woolpert field crews performed a field reconnaissance to verify the existence and suitability of pre-selected existing National Geodetic Survey (NGS) control stations. These existing bench marks were utilized as checks to ensure that quality x, y, and z coordinate values were computed for each of the newly established photogrammetric control stations. Recovery information sheets for the existing NGS control stations can be found in Section 5 of this report. A control diagram showing the ground control stations used to support this LiDAR mapping project can be found in Section 6 of this report.

ACCURACY STANDARDS

The data collected under this task order shall meet the National Standard for spatial Database Accuracy (NSSDA) standards. The NSSDA standards specify that vertical accuracy be reported at the 95 percent confidence level for data tested by an independent source of higher accuracy.

The Fundamental Vertical Accuracy (FVA): 18.13 cm at a 95% confidence level, derived according to NSSDA, i.e., based on $RMSE_z$ of 9.25 cm in the “open terrain” land cover category.

The Supplemental Vertical Accuracy (SVA): The SVA will be reported for each of the land cover classes within the task order AOI. The target SVA is 26.9 cm at a 95th percentile level, derived according to ASPRS Guidelines, Vertical Accuracy Reporting for LiDAR Data, i.e., based on the 95th percentile error for each required land cover class.

The Consolidated Vertical Accuracy (CVA): 26.9 cm at a 95th percentile level, derived according to ASPRS Guidelines, Vertical Accuracy Reporting for LiDAR Data, i.e., based on the 95th percentile error in all land cover categories combined.

Automated and manual filtering for LiDAR products shall use the following minimum performance for artifact/feature removal from the bare earth model: The bare earth surface model shall have a minimum of 95% of surface canopy artifacts, including buildings, vegetation, bridges or overpass structures removed.

GPS EQUIPMENT

Woolpert utilized 2 Trimble Navigation R8 Model 3 GNSS dual-frequency GPS receivers with a Trimble TDL-450 radio as dual base stations. Additionally, Woolpert utilized a Trimble Navigation R8 Model 3 GNSS dual-frequency GPS receiver and a TSC2 data collector as a rover for this project.

METHODOLOGY

REAL-TIME KINEMATIC (RTK) GPS

The field crew utilized Real-Time Kinematic (RTK) GPS surveying throughout most of the ground control data collection process. Using RTK GPS techniques, observations were performed on a total of 12 LiDAR control points and 66 ground control quality check points. The survey was conducted using a 1-second epoch rate, in a fixed solution RTK mode, with each observation lasting between 60 to 180 seconds. Each station was occupied twice to insure the necessary horizontal and vertical accuracies were being met for this photogrammetric project.

FAST-STATIC GPS

In addition to the RTK GPS techniques, the project field crew utilized Fast-static GPS surveying techniques on the three temporary survey marks that were established within the project area using a 5-second epoch collection rate.

Using Fast-Static GPS techniques, observations were performed on three (3) Temporary control points. The survey was conducted at a 5-second sync rate with each observation lasting between 2-10 hours.

GPS DATA ANALYSIS AND PROCESSING

The field crew chief processed all session baselines each day using Trimble Navigation's Trimble Business Center (TBC) Version 3.40 baseline processor with the accompanying broadcast ephemeris. Daily processing ensured the integrity of the network as it was constructed, and allowed the field crews to immediately reschedule observations of poor baselines. Once the field work was complete, the processed baselines were then run through a rigorous loop closure analysis. As a result of this analysis, unacceptable GPS vectors were removed and field blunders, if any, were detected and eliminated. Once this process was completed, both unconstrained and constrained adjustments were conducted in order to effectively incorporate the static observation data.

The GPS base stations and constrained geodetic control stations consisted of the following:

Point Designation	NGS PID	Type	Constrained
CP 101	N/A	TSM	3d
CP 102	N/A	TSM	3d
CP 103	N/A	TSM	3d

Stations 101, 102, and 103 were used as temporary control base stations. These points were established by utilizing the 5-second epoch static data that was collected over a four day period. Multiple raw data files associated with each point were sent to the NGS program

"OPUS" and the results were then averaged to establish the final coordinates.

DATUM REFERENCE AND FINAL COORDINATES

New horizontal GPS control within the Little Bighorn Battlefield National Monument project area was based on the UTM Coordinate System Zone 13 North, referenced to North American Datum 1983, national re-adjustment of 2011 (NAD83/2011) epoch 2010.00, expressed in meters. All vertical control was based on the North American Vertical Datum of 1988 (NAVD88), also expressed in meters. These coordinates for the LiDAR control survey can be found in Section 2 of this report.

QUALITY ASSURANCE

Existing NGS published bench marks were surveyed to assure that there were no discrepancies in the field observation data. Close examinations of the residuals showed no distortions in orientation or scale.

The ground control data meets positional accuracies necessary to support 1.0 point per 0.3 meters squared (1' GSD) data at 95% confidence level as outlined in the *Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy (NSSDA)*, published by the Federal Geographic Data Committee (FGDC-STD-007.3-1998).

SECTION 2: GROUND/GEODETIC CONTROL COORDINATE LISTINGS

COORDINATE SYSTEM: GRID

HORIZONTAL DATUM: NAD83 2011 UTM Zone 13-N

VERTICAL DATUM: NAVD88

ZONE: 13-North

GEOID MODEL: GEOID 12A

UNITS: Meters

LiDAR GROUND CONTROL

Point	UTM Zone 13-North		Elevation (m)	Description
	Northing (m)	Easting (m)		
1101	4076484.719	243267.623	1903.17	LIDAR CHECK
1102	4090698.97	242749.512	1816.073	LIDAR CHECK
1103	4100793.591	244155.016	1827.952	LIDAR CHECK
1104	4107742.004	245109.353	1941.563	LIDAR CHECK
1105	4100414.978	233350.555	2004.799	LIDAR CHECK
1106	4087779.941	226198.081	1917.516	LIDAR CHECK
1107	4111069.359	235426.368	2296.576	LIDAR CHECK
1108	4104105.639	244241.342	1839.714	LIDAR CHECK
1109	4072543.867	214707.271	1680.129	LIDAR CHECK
1110	4072175.756	220713.329	1719.243	LIDAR CHECK
1111	4080064.428	234288.091	1744.648	LIDAR CHECK
1112	4100620.901	252198.168	2168.705	LIDAR CHECK

QUALITY CONTROL POINTS

Point	UTM Zone 13-North		Elevation (m)	Description
	Northing (m)	Easting (m)		
2001	4110243.235	234264.557	2065.716	BARE EARTH
2002	4108909.345	238695.625	2050.492	BARE EARTH
2003	4106233.213	243126.900	1872.804	BARE EARTH
2004	4105459.193	250957.161	2225.256	BARE EARTH
2005	4097952.744	252695.250	2093.884	BARE EARTH
2006	4098493.666	244152.540	1877.685	BARE EARTH
2007	4098394.189	235774.112	1942.652	BARE EARTH
2008	4093424.907	233774.282	1881.711	BARE EARTH
2009	4090692.847	242810.145	1814.701	BARE EARTH

Point	UTM Zone 13-North		Elevation (m)	Description
	Northing (m)	Easting (m)		
2010	4090433.803	250491.423	2034.751	BARE EARTH
2011	4083494.630	244812.864	1910.837	BARE EARTH
2012	4084455.563	237632.951	1768.711	BARE EARTH
2013	4087786.471	226204.937	1917.548	BARE EARTH
2014	4083734.852	221439.607	1833.412	BARE EARTH
2015	4080171.506	224264.261	1750.416	BARE EARTH
2016	4084282.613	229296.465	1809.880	BARE EARTH
2017	4077651.531	239920.565	1955.828	BARE EARTH
2018	4074149.333	234071.574	1800.079	BARE EARTH
2019	4074767.594	228876.816	1743.479	BARE EARTH
2020	4071520.604	222816.338	1761.945	BARE EARTH
2021	4077120.605	218235.231	1798.891	BARE EARTH
2022	4070155.687	217055.172	1626.664	BARE EARTH
4001	4110261.313	234233.663	2062.542	SAGE/STEPPE
4002	4108887.452	238655.588	2048.725	SAGE/STEPPE
4003	4106245.872	243103.405	1874.221	SAGE/STEPPE
4004	4105480.451	250946.913	2223.535	SAGE/STEPPE
4005	4097985.032	252674.006	2096.343	SAGE/STEPPE
4006	4098506.199	244188.570	1876.044	SAGE/STEPPE
4007	4098424.601	235735.888	1942.805	SAGE/STEPPE
4008	4093582.464	233716.485	1884.568	SAGE/STEPPE
4009	4090737.348	242822.007	1815.062	SAGE/STEPPE
4010A	4090449.230	250516.640	2035.195	SAGE/STEPPE
4011	4083521.248	244805.630	1909.442	SAGE/STEPPE
4012	4084441.506	237604.205	1770.194	SAGE/STEPPE
4013	4087820.224	226228.939	1919.039	SAGE/STEPPE
4014	4083762.148	221433.789	1832.446	SAGE/STEPPE
4015	4080178.119	224280.301	1749.922	SAGE/STEPPE
4016	4084046.628	229163.987	1825.961	SAGE/STEPPE
4017	4077625.645	239908.742	1954.538	SAGE/STEPPE
4018	4074188.203	234075.021	1800.892	SAGE/STEPPE
4019	4074764.252	228861.286	1742.649	SAGE/STEPPE
4020	4071522.888	222833.379	1762.523	SAGE/STEPPE
4021	4077131.189	218235.805	1798.438	SAGE/STEPPE
4022	4070189.012	217093.377	1626.821	SAGE/STEPPE
5001	4110188.322	234234.186	2063.026	BRUSH/TREES

Point	UTM Zone 13-North		Elevation (m)	Description
	Northing (m)	Easting (m)		
5002	4108894.048	238724.586	2051.390	BRUSH/TREES
5003	4106208.238	243091.639	1876.282	BRUSH/TREES
5004	4105461.470	250978.083	2229.267	BRUSH/TREES
5005	4097949.529	252632.480	2100.751	BRUSH/TREES
5006	4098462.871	244178.579	1874.857	BRUSH/TREES
5007	4098445.130	235666.570	1944.132	BRUSH/TREES
5008	4093630.028	233748.327	1885.308	BRUSH/TREES
5009	4090712.244	242832.321	1815.314	BRUSH/TREES
5010A	4090468.497	250554.143	2036.950	BRUSH/TREES
5011	4083498.880	244791.205	1910.639	BRUSH/TREES
5012	4084406.993	237572.072	1771.915	BRUSH/TREES
5013	4087849.109	226250.015	1920.411	BRUSH/TREES
5014	4083761.098	221461.562	1833.132	BRUSH/TREES
5015	4080191.616	224239.632	1752.587	BRUSH/TREES
5016	4084033.436	229192.978	1827.891	BRUSH/TREES
5017	4077599.695	239882.314	1953.269	BRUSH/TREES
5018	4074199.091	234138.902	1806.275	BRUSH/TREES
5019	4074720.614	228850.095	1744.784	BRUSH/TREES
5020	4071489.489	222816.096	1762.969	BRUSH/TREES
5021	4077172.043	218232.128	1795.956	BRUSH/TREES
5022	4070163.133	217099.348	1627.057	BRUSH/TREES

CONTROL BASE STATIONS

Point	UTM Zone 13-North		Elevation (m)	Description
	Northing (m)	Easting (m)		
101	4078372.568	225541.831	1763.679	TSM 101
102	4094536.186	241893.494	1891.730	TSM 102
103	4104947.959	251140.537	2228.981	TSM 103

NGS CONTROL BASE STATION CHECK POINTS

NGS Datasheet Published Values				
Designation	NAD83 2011 UTM-13N		Elev. NAVD88 (m)	NGS PID
	Northing (m)	Easting (m)		
E 431	N/A	N/A	1725.912	GO0234
G 404	N/A	N/A	1942.428	HL0346
J 404	4104432.691	244349.836	1836.951	HL0344
Y 430	4085674.524	238455.736	1767.173	GN0389
Z 430	4084478.020	237162.963	1761.446	GN0388

Grid Deltas		
Δ North (m)	Δ East (m)	Δ Elev. (m)
N/A	N/A	0.027
N/A	N/A	0.027
0.003	-0.019	0.067
0.000	0.010	-0.002
0.003	-0.001	0.013

Woolpert Field Check Shots				
Designation	NAD83 2011 UTM-13N		Elev. NAVD88 (m)	NGS PID
	Northing (m)	Easting (m)		
E 431	4079640.221	228981.709	1725.885	GO 0234
G 404	4108536.953	245186.173	1942.401	HL0346
J 404	4104432.688	244349.855	1836.884	HL0344
Y 430	4085674.524	238455.726	1767.175	GN0389
Z 430	4084478.017	237162.964	1761.433	GN0387

COORDINATE SYSTEM: GEODETIC

HORIZONTAL DATUM: NAD83 (2011) Epoch 2010.00

VERTICAL DATUM: NAVD88

UNITS: Meters

DATE: 7/9/2014

LiDAR GROUND CONTROL

Point	NAD83 (2011) Epoch 2010.00		Ellipsoid Ht. (m)	Description
	Latitude	Longitude		
1101	36°47'57.89054"	-107°52'39.08219"	1882.387	LIDAR CHECK
1102	36°55'38.08860"	-107°53'17.30242"	1795.576	LIDAR CHECK
1103	37°01'06.64402"	-107°52'32.87391"	1807.728	LIDAR CHECK
1104	37°04'52.78253"	-107°52'02.77608"	1921.513	LIDAR CHECK
1105	37°00'43.56013"	-107°59'49.06530"	1984.559	LIDAR CHECK
1106	36°53'46.71434"	-108°04'21.61540"	1896.864	LIDAR CHECK
1107	37°06'30.95653"	-107°58'38.67452"	2276.768	LIDAR CHECK
1108	37°02'54.07474"	-107°52'33.43522"	1819.559	LIDAR CHECK
1109	36°45'20.78048"	-108°11'44.63075"	1658.977	LIDAR CHECK

Point	NAD83 (2011) Epoch 2010.00		Ellipsoid Ht. (m)	Description
	Latitude	Longitude		
1110	36°45'15.28607"	-108°07'42.27844"	1698.124	LIDAR CHECK
1111	36°49'44.98945"	-107°58'45.46599"	1723.824	LIDAR CHECK
1112	37°01'08.80745"	-107°47'07.55569"	2148.562	LIDAR CHECK

QUALITY CONTROL POINTS

Point	NAD83 (2011) Epoch 2010.00		Ellipsoid Ht. (m)	Description
	Latitude	Longitude		
2001	37°06'03.00019"	-107°59'24.63131"	2045.872	BARE EARTH
2002	37°05'24.25786"	-107°56'23.67934"	2030.536	BARE EARTH
2003	37°04'01.93437"	-107°53'21.11353"	1852.703	BARE EARTH
2004	37°03'44.44913"	-107°48'03.48373"	2205.232	BARE EARTH
2005	36°59'42.79432"	-107°46'44.31110"	2073.673	BARE EARTH
2006	36°59'52.09889"	-107°52'30.16381"	1857.406	BARE EARTH
2007	36°59'40.53409"	-107°58'08.57541"	1922.341	BARE EARTH
2008	36°56'57.46029"	-107°59'23.06700"	1861.247	BARE EARTH
2009	36°55'37.94970"	-107°53'14.84713"	1794.205	BARE EARTH
2010	36°55'36.98526"	-107°48'04.42784"	2014.336	BARE EARTH
2011	36°51'46.60135"	-107°51'45.27174"	1890.216	BARE EARTH
2012	36°52'10.66628"	-107°56'36.07237"	1748.029	BARE EARTH
2013	36°53'46.93312"	-108°04'21.34727"	1896.896	BARE EARTH
2014	36°51'30.62378"	-108°07'28.25429"	1812.600	BARE EARTH
2015	36°49'38.13400"	-108°05'29.69267"	1729.504	BARE EARTH
2016	36°51'56.59447"	-108°02'12.10840"	1789.133	BARE EARTH
2017	36°48'32.42034"	-107°54'55.41214"	1935.039	BARE EARTH
2018	36°46'33.06815"	-107°58'46.75895"	1779.141	BARE EARTH
2019	36°46'47.80683"	-108°02'16.82667"	1722.486	BARE EARTH
2020	36°44'56.27596"	-108°06'16.73136"	1740.842	BARE EARTH
2021	36°47'52.88001"	-108°09'28.64853"	1777.866	BARE EARTH
2022	36°44'05.92638"	-108°10'06.89675"	1605.482	BARE EARTH
4001	37°06'03.55447"	-107°59'25.90430"	2042.698	SAGE/STEPPE
4002	37°05'23.50814"	-107°56'25.27156"	2028.769	SAGE/STEPPE
4003	37°04'02.32149"	-107°53'22.07937"	1854.120	SAGE/STEPPE
4004	37°03'45.12835"	-107°48'03.92357"	2203.511	SAGE/STEPPE
4005	36°59'43.82078"	-107°46'45.20769"	2076.133	SAGE/STEPPE
4006	36°59'52.54038"	-107°52'28.72322"	1855.761	SAGE/STEPPE
4007	36°59'41.48103"	-107°58'10.15812"	1922.495	SAGE/STEPPE

Point	NAD83 (2011) Epoch 2010.00		Ellipsoid Ht. (m)	Description
	Latitude	Longitude		
4008	36°57'02.50756"	-107°59'25.60052"	1864.109	SAGE/STEPPE
4009	36°55'39.40367"	-107°53'14.42269"	1794.566	SAGE/STEPPE
4010A	36°55'37.50933"	-107°48'03.42807"	2014.780	SAGE/STEPPE
4011	36°51'47.45706"	-107°51'45.59574"	1888.821	SAGE/STEPPE
4012	36°52'10.18198"	-107°56'37.21444"	1749.511	SAGE/STEPPE
4013	36°53'48.05198"	-108°04'20.42273"	1898.388	SAGE/STEPPE
4014	36°51'31.50212"	-108°07'28.52494"	1811.636	SAGE/STEPPE
4015	36°49'38.36513"	-108°05'29.05471"	1729.011	SAGE/STEPPE
4016	36°51'48.81025"	-108°02'17.14852"	1805.206	SAGE/STEPPE
4017	36°48'31.56966"	-107°54'55.85687"	1933.749	SAGE/STEPPE
4018	36°46'34.33136"	-107°58'46.66888"	1779.955	SAGE/STEPPE
4019	36°46'47.68253"	-108°02'17.44804"	1721.656	SAGE/STEPPE
4020	36°44'56.36790"	-108°06'16.04813"	1741.421	SAGE/STEPPE
4021	36°47'53.22358"	-108°09'28.63950"	1777.415	SAGE/STEPPE
4022	36°44'07.04722"	-108°10'05.40308"	1605.639	SAGE/STEPPE
5001	37°06'01.18959"	-107°59'25.79006"	2043.179	BRUSH/TREES
5002	37°05'23.79118"	-107°56'22.48856"	2031.433	BRUSH/TREES
5003	37°04'01.09016"	-107°53'22.50894"	1856.180	BRUSH/TREES
5004	37°03'44.54293"	-107°48'02.64028"	2209.243	BRUSH/TREES
5005	36°59'42.63068"	-107°46'46.84383"	2080.539	BRUSH/TREES
5006	36°59'51.12628"	-107°52'29.07405"	1854.572	BRUSH/TREES
5007	36°59'42.07619"	-107°58'12.98466"	1923.823	BRUSH/TREES
5008	36°57'04.08140"	-107°59'24.37507"	1864.850	BRUSH/TREES
5009	36°55'38.60015"	-107°53'13.97561"	1794.819	BRUSH/TREES
5010A	36°55'38.16955"	-107°48'01.93682"	2016.536	BRUSH/TREES
5011	36°51'46.71805"	-107°51'46.15054"	1890.018	BRUSH/TREES
5012	36°52'09.03126"	-107°56'38.46767"	1751.231	BRUSH/TREES
5013	36°53'49.01001"	-108°04'19.60993"	1899.762	BRUSH/TREES
5014	36°51'31.49757"	-108°07'27.40358"	1812.322	BRUSH/TREES
5015	36°49'38.75983"	-108°05'30.71171"	1731.675	BRUSH/TREES
5016	36°51'48.41264"	-108°02'15.96232"	1807.135	BRUSH/TREES
5017	36°48'30.70247"	-107°54'56.89020"	1932.478	BRUSH/TREES
5018	36°46'34.74874"	-107°58'44.10890"	1785.339	BRUSH/TREES
5019	36°46'46.25680"	-108°02'17.84305"	1723.790	BRUSH/TREES
5020	36°44'55.26740"	-108°06'16.70047"	1741.866	BRUSH/TREES
5021	36°47'54.54346"	-108°09'28.84205"	1774.933	BRUSH/TREES

Point	NAD83 (2011) Epoch 2010.00		Ellipsoid Ht. (m)	Description
	Latitude	Longitude		
5022	36°44'06.21506"	-108°10'05.12820"	1605.875	BRUSH/TREES

CONTROL BASE STATIONS



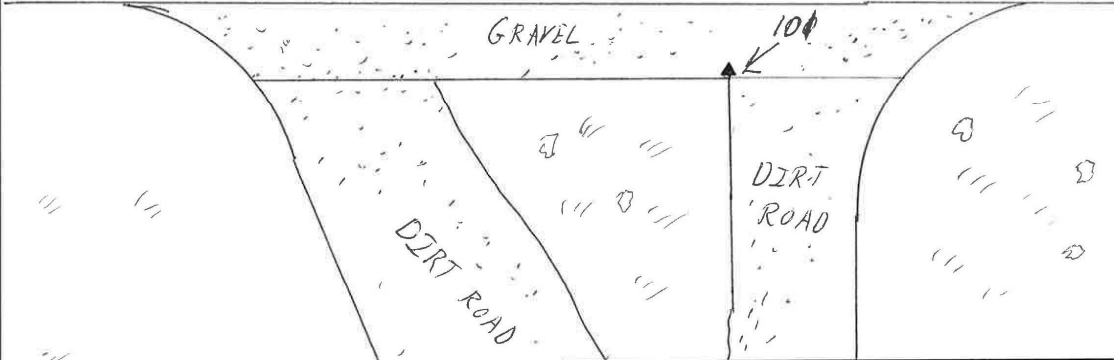
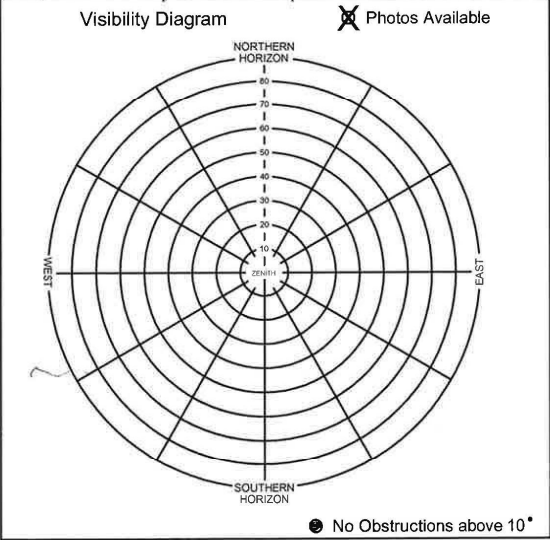
Point	NAD83 (2011) Epoch 2010.00		Ellipsoid Ht. (m)	Description
	Latitude	Longitude		
101	36°48'41.17480"	-108°04'35.85712"	1742.723	TSM 101
102	36°57'41.61282"	-107°53'56.57495"	1871.326	TSM 102
103	37°03'28.05380"	-107°47'55.45793"	2208.943	TSM 103

SECTION 3: GROUND CTL / GEODETIC CONTROL LOGS AND PHOTOS

This section contains the station recovery information sheets and photographs for the ground control, geodetic control and checkpoint stations established for the project. The stations appear as they are ordered in the final coordinate listing of Section 2.

The data is assembled on the following pages.

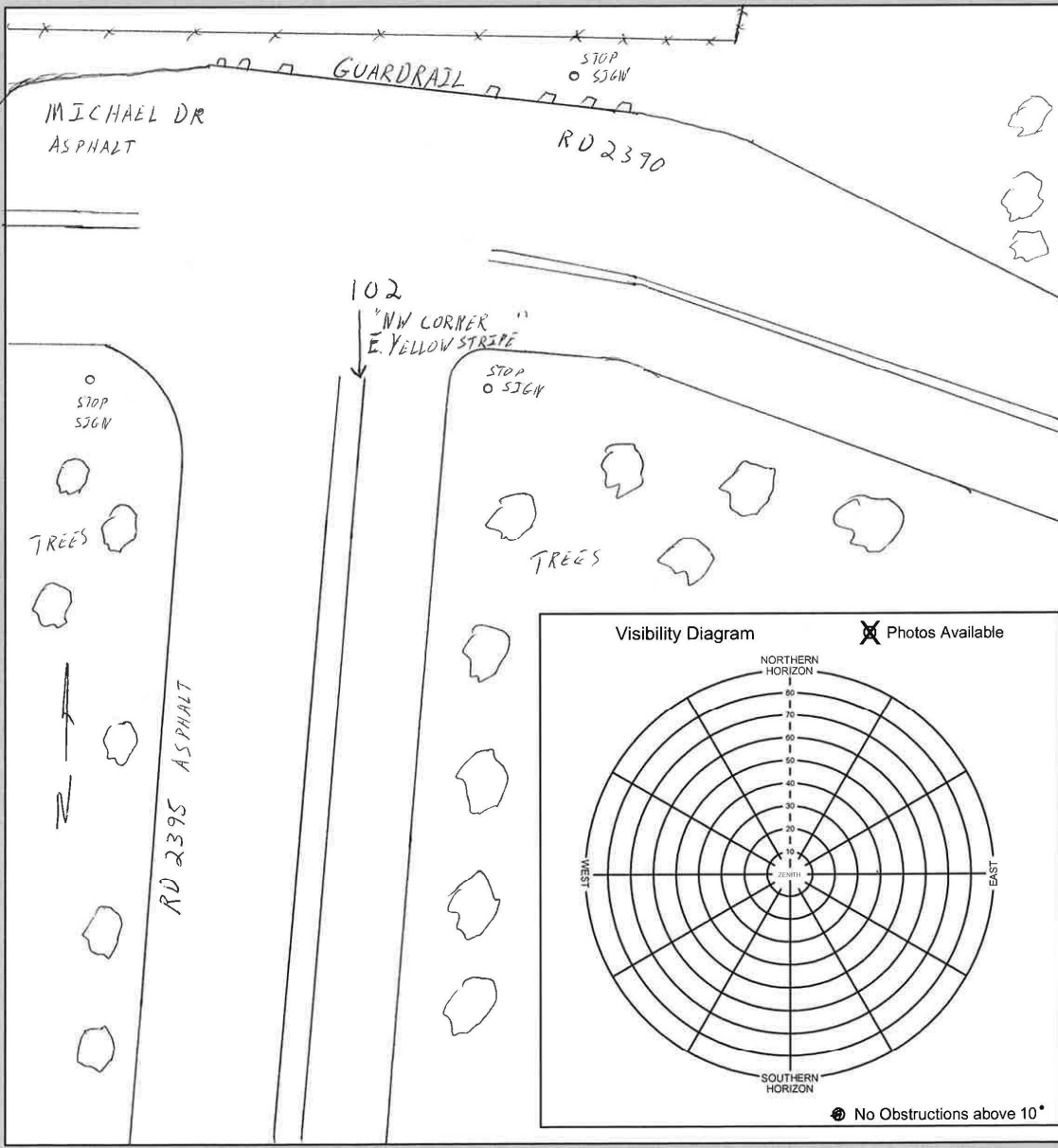
LiDAR Control Point Field Sketches:

LiDAR Survey - LiDAR Control				 WOOLPERT <small>BEYOND BORDERS. BEYOND LIMITS.</small>
LiDAR Control point #	General location	Ground Class		
101	AZTEC, NM			
Latitude	Longitude	Calendar Date	Observer Initials	
N36°47'58.03"	W107°52'39.36"	11/20/2014	CPR	
				
				
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Visibility Diagram</p>  </div> <div style="width: 50%;"> <p><input checked="" type="checkbox"/> Photos Available</p> <p><input type="checkbox"/> No Obstructions above 10°</p> </div> </div>				

LiDAR Survey - LiDAR Control



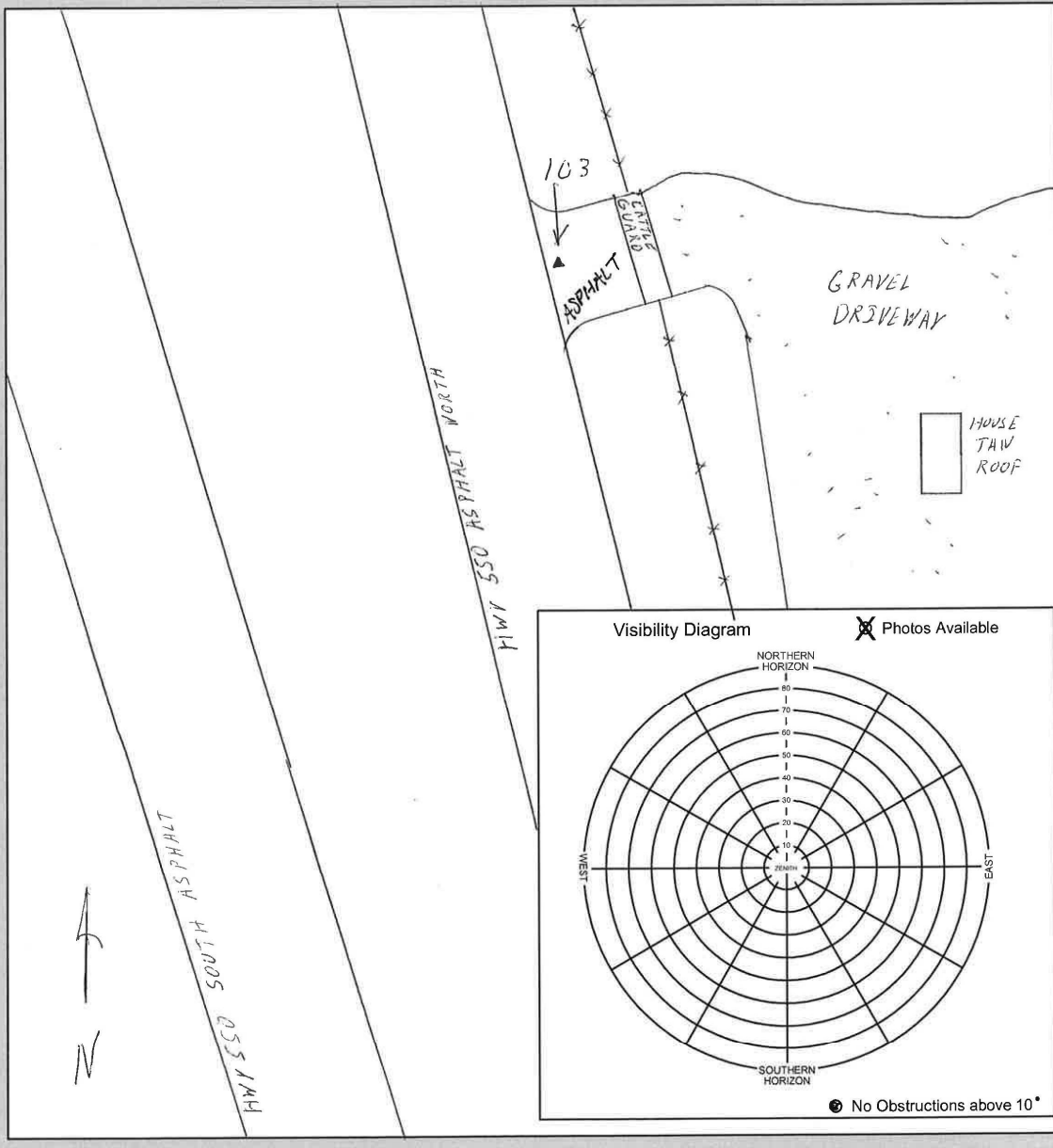
LiDAR Control point # 102	General location AZTEC, NM	Ground Class	
Latitude N36°55'38.22"	Longitude W107°53'17.80"	Calendar Date 11/18/2014	Observer Initials CPR



LiDAR Survey - LiDAR Control



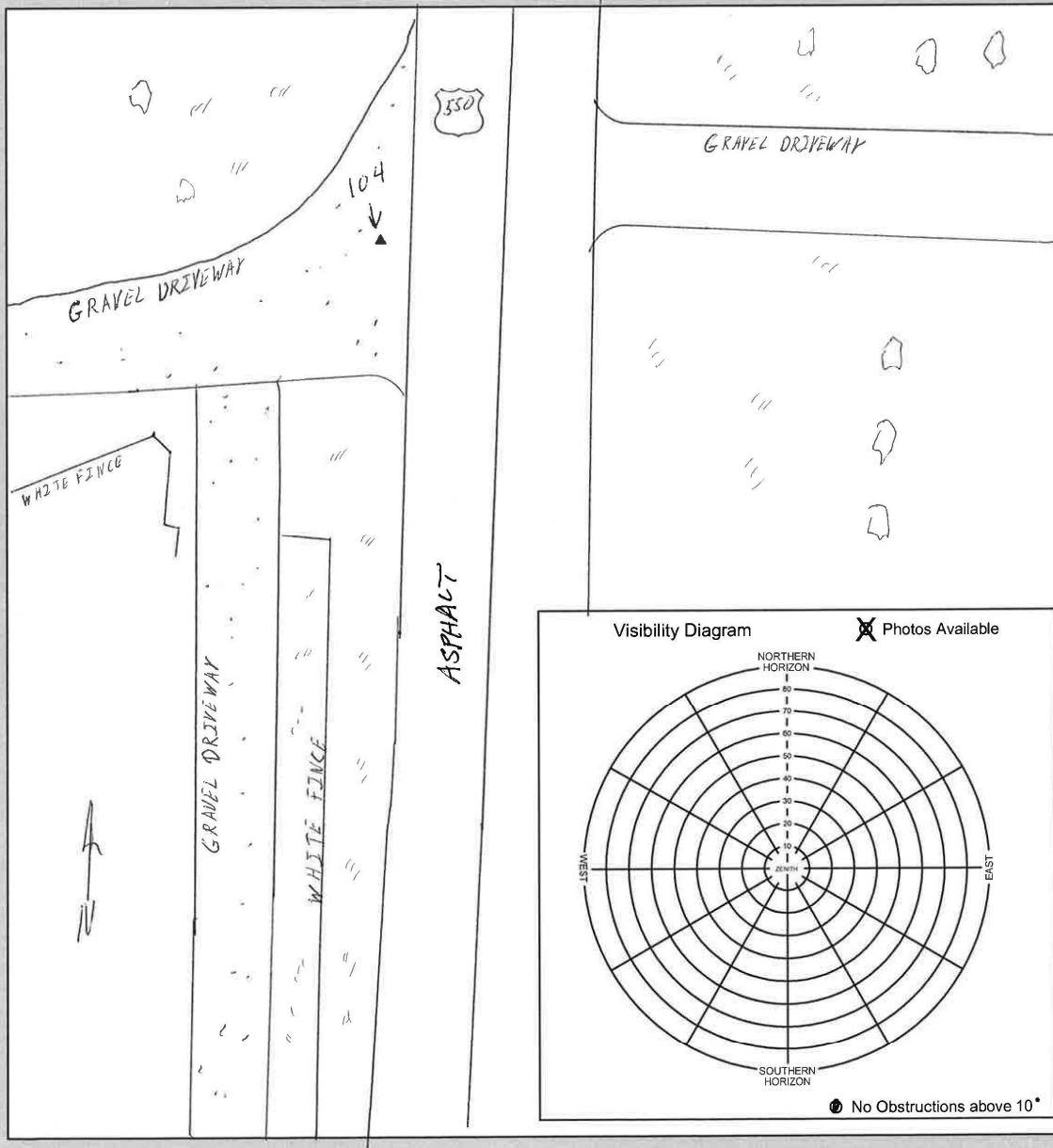
LiDAR Control point # 103	General location BONDAD, CO	Ground Class	
Latitude N 37° 1' 5.99 "	Longitude W 107° 52' 32.63 "	Calendar Date 11/21/2014	Observer Initials CPR



LiDAR Survey - LiDAR Control



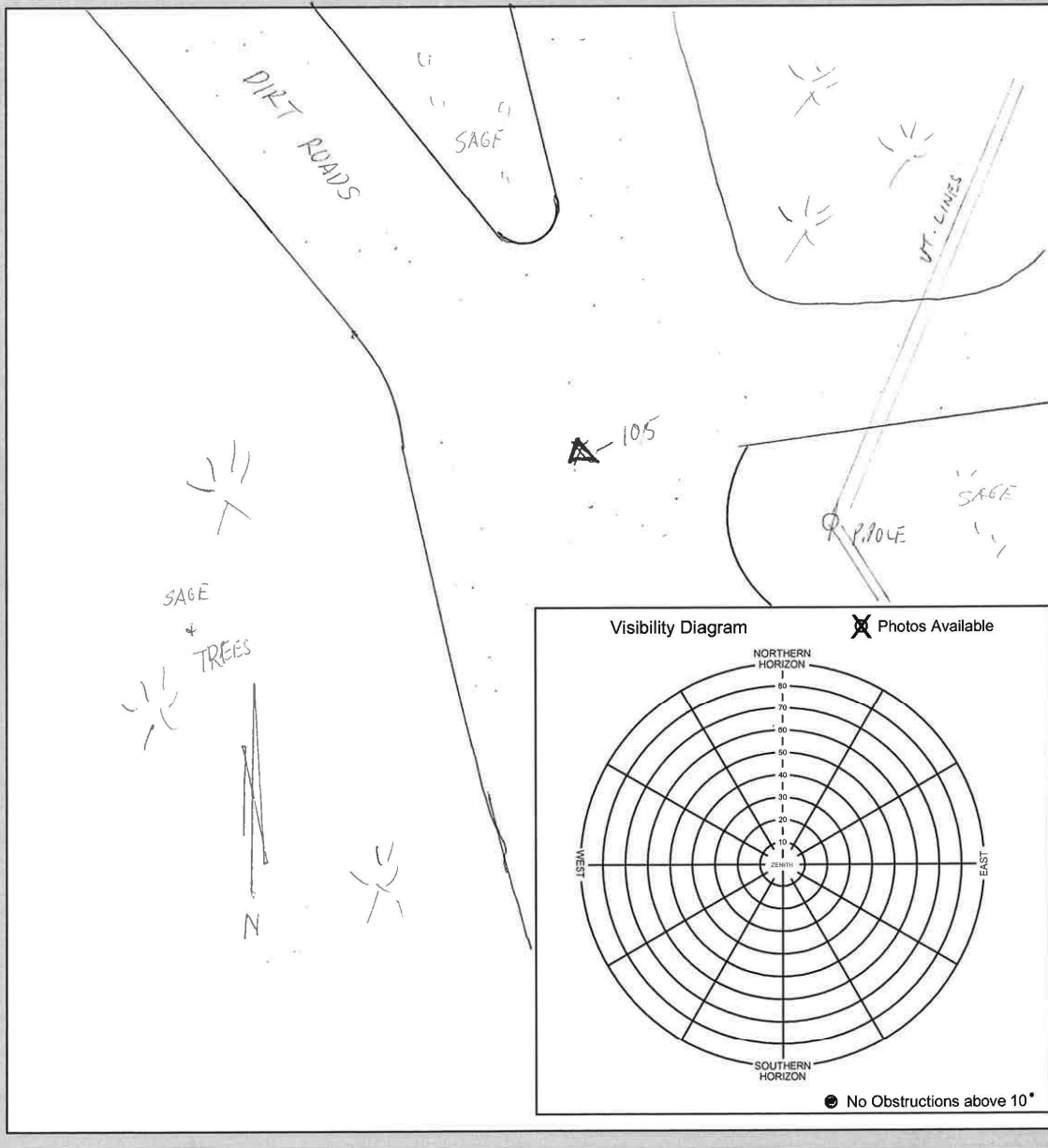
LiDAR Control point #	104	General location	AZTEC, NM	Ground Class	
Latitude	N 37° 4 '52.60"	Longitude	W 107° 52 '2.80 "	Calendar Date	11/21/2014
				Observer Initials	CPR



LiDAR Survey - LiDAR Control



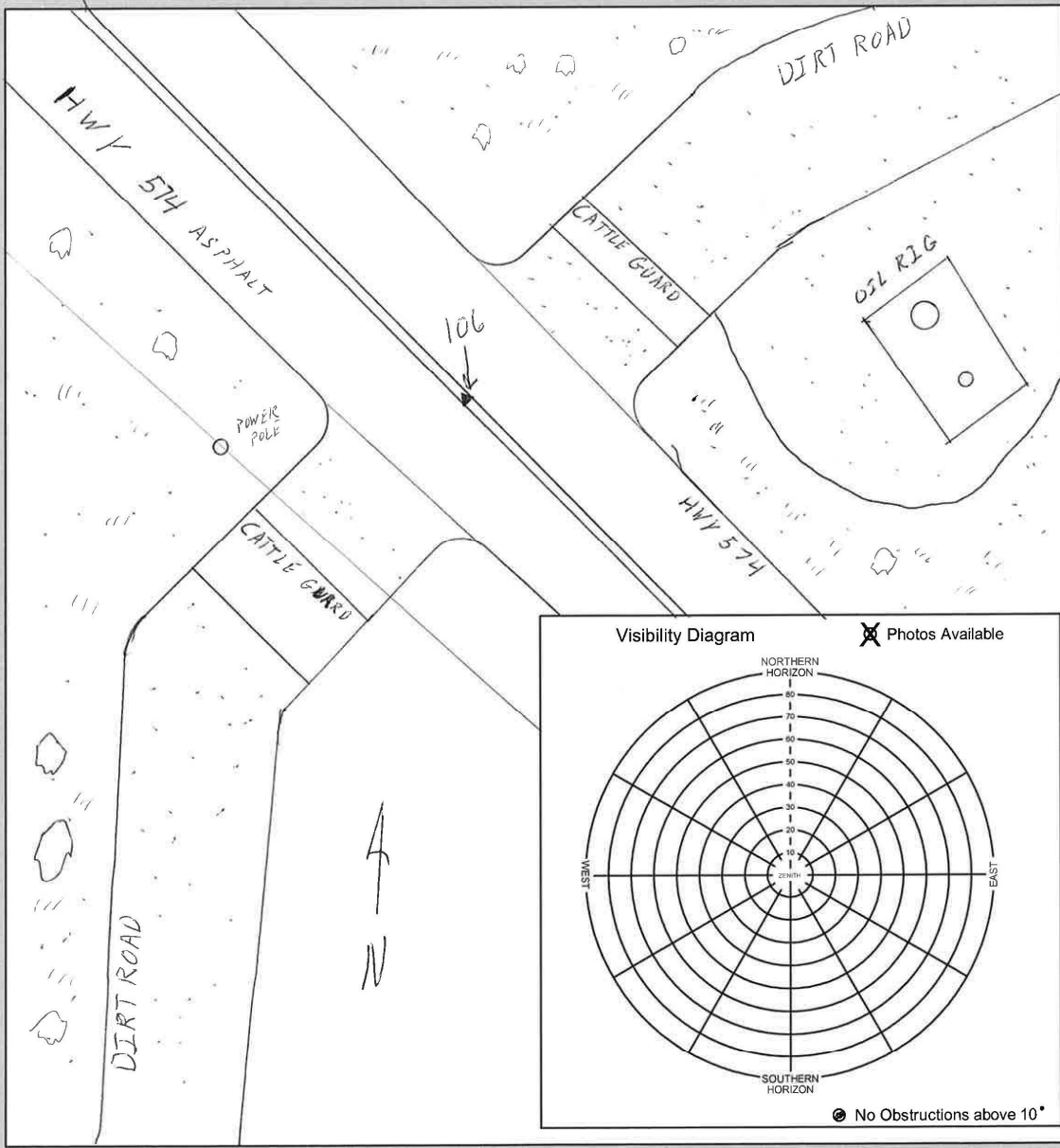
LiDAR Control point # 105	General location AZTEC, NM	Ground Class	
Latitude N 37° 0' 43.39"	Longitude W 107° 59' 48.90"	Calendar Date 11/18/2014	Observer Initials CPR



LiDAR Survey - LiDAR Control



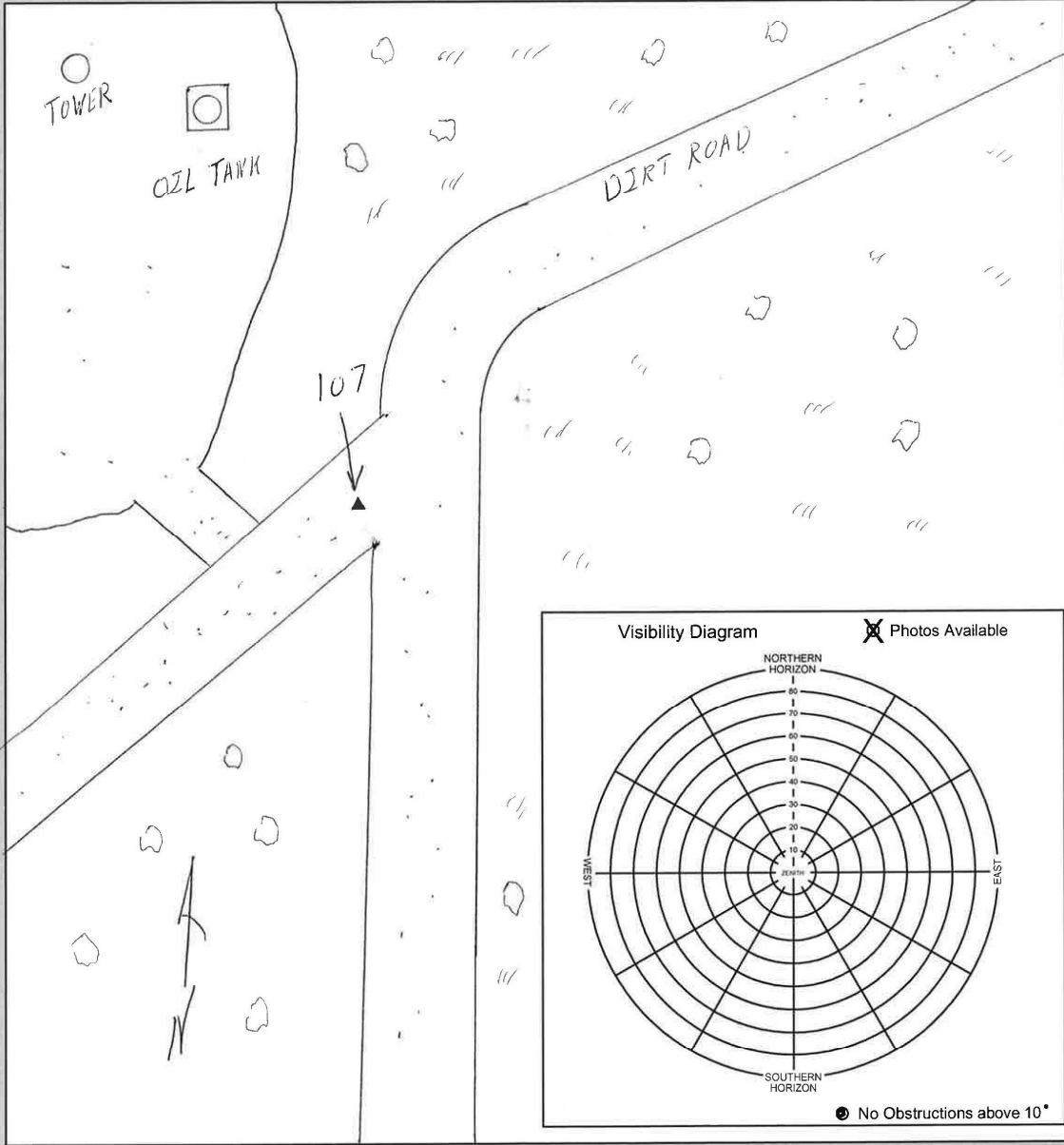
LiDAR Control point # 106	General location AZTEC	Ground Class	
Latitude N 36° 53' 47.58"	Longitude W 108° 4' 20.88"	Calendar Date 11/19/2014	Observer Initials CPR



LiDAR Survey - LiDAR Control



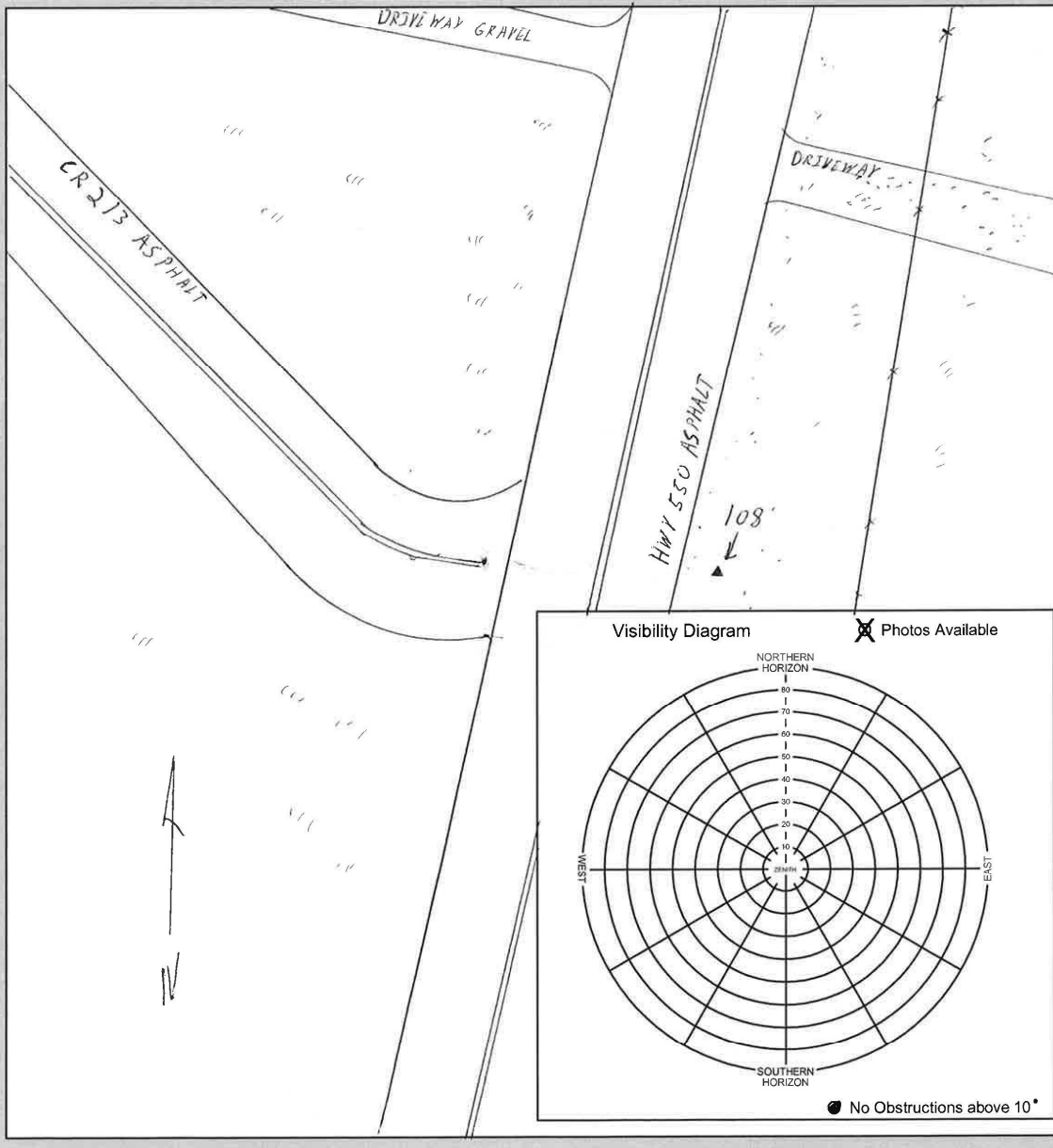
LiDAR Control point #	General location	Ground Class	
107	BONDAD, CO		
Latitude	Longitude	Calendar Date	Observer Initials
N 37° 6' 31.25"	W 107° 58' 38.60"	11/21/2014	CPR



LiDAR Survey - LiDAR Control



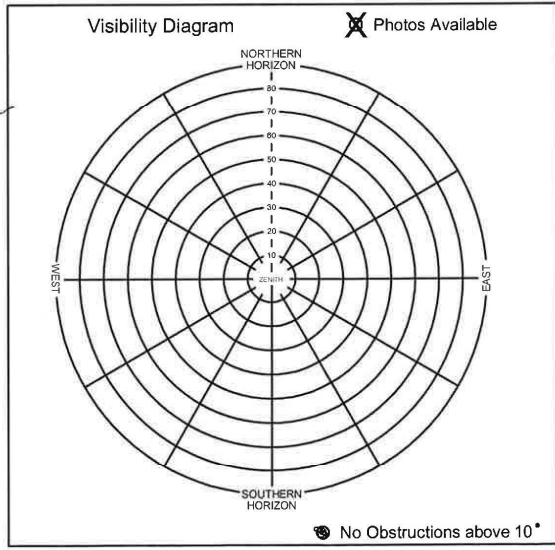
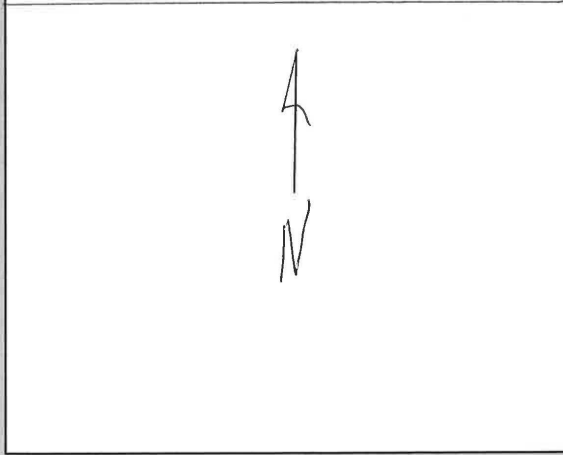
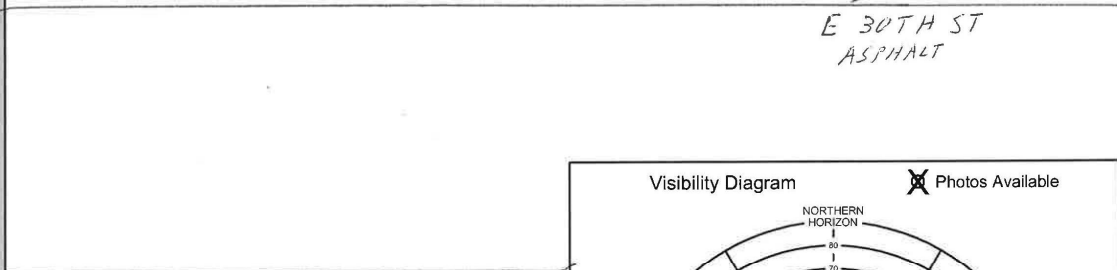
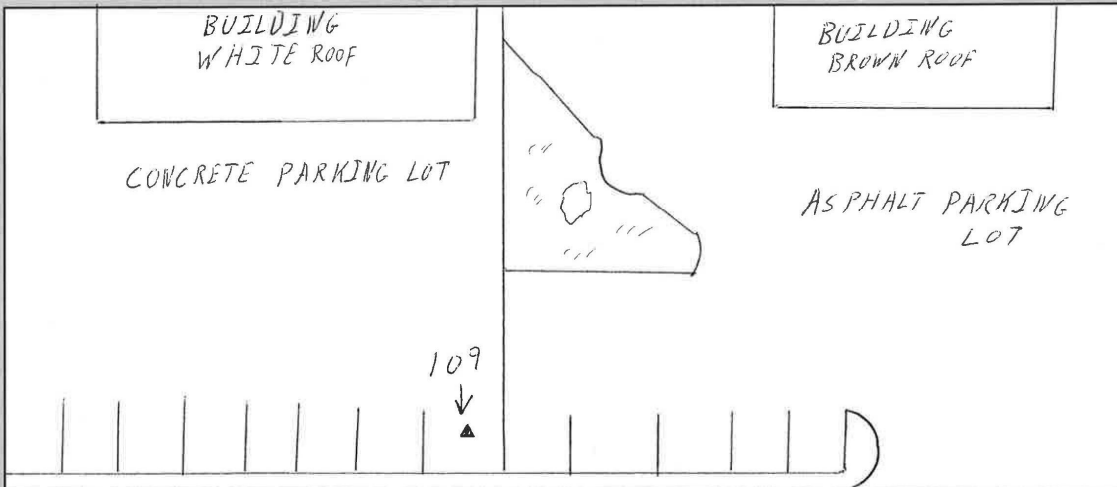
LiDAR Control point #	108	General location	BONDAD, CO	Ground Class	
Latitude	N 37° 2' 56.25"	Longitude	W 107° 52' 33.38"	Calendar Date	11/21/2014
				Observer Initials	CPR



LiDAR Survey - LiDAR Control



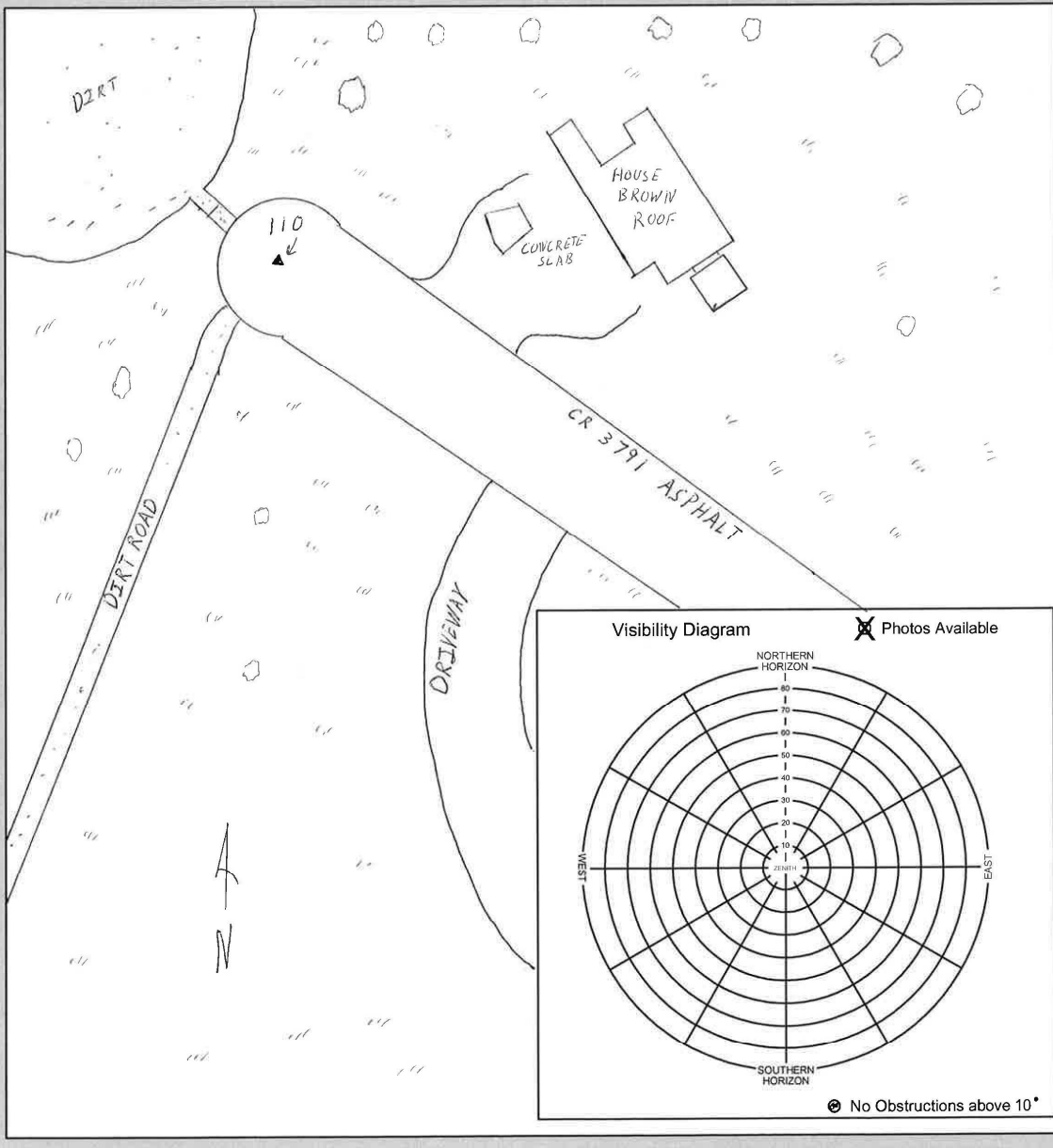
LiDAR Control point # 109	General location FARMINGTON, NM	Ground Class
Latitude N 36° 45' 20.91"	Longitude W 108° 11' 44.19"	Calendar Date 11/19/2014
		Observer Initials CPR



LiDAR Survey - LiDAR Control



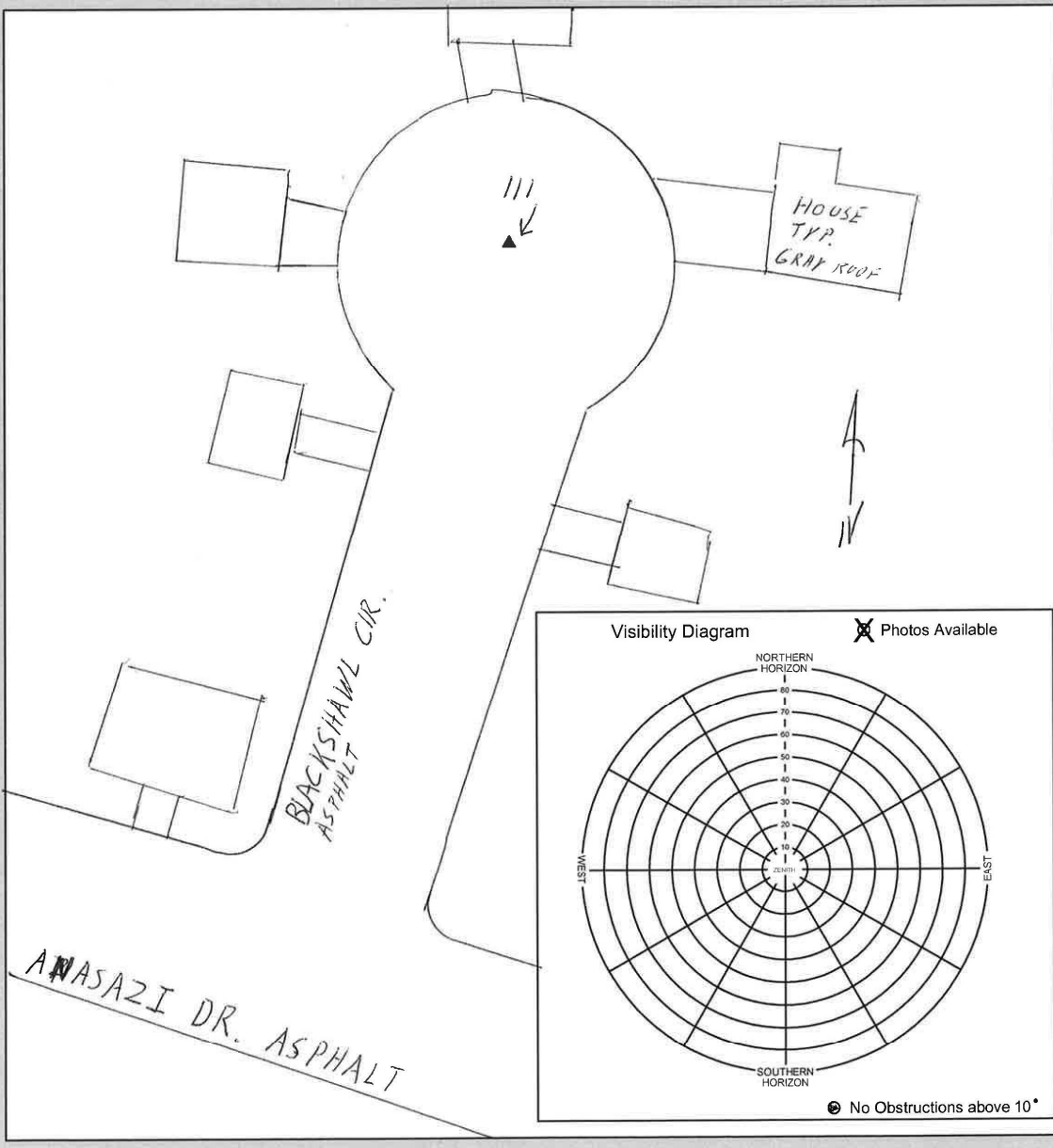
LiDAR Control point # 110	General location AZTEC, NM	Ground Class
Latitude N 36° 45' 15.69"	Longitude W 108° 7' 42.16"	Calendar Date 11/20/2014
		Observer Initials CPR



LiDAR Survey - LiDAR Control



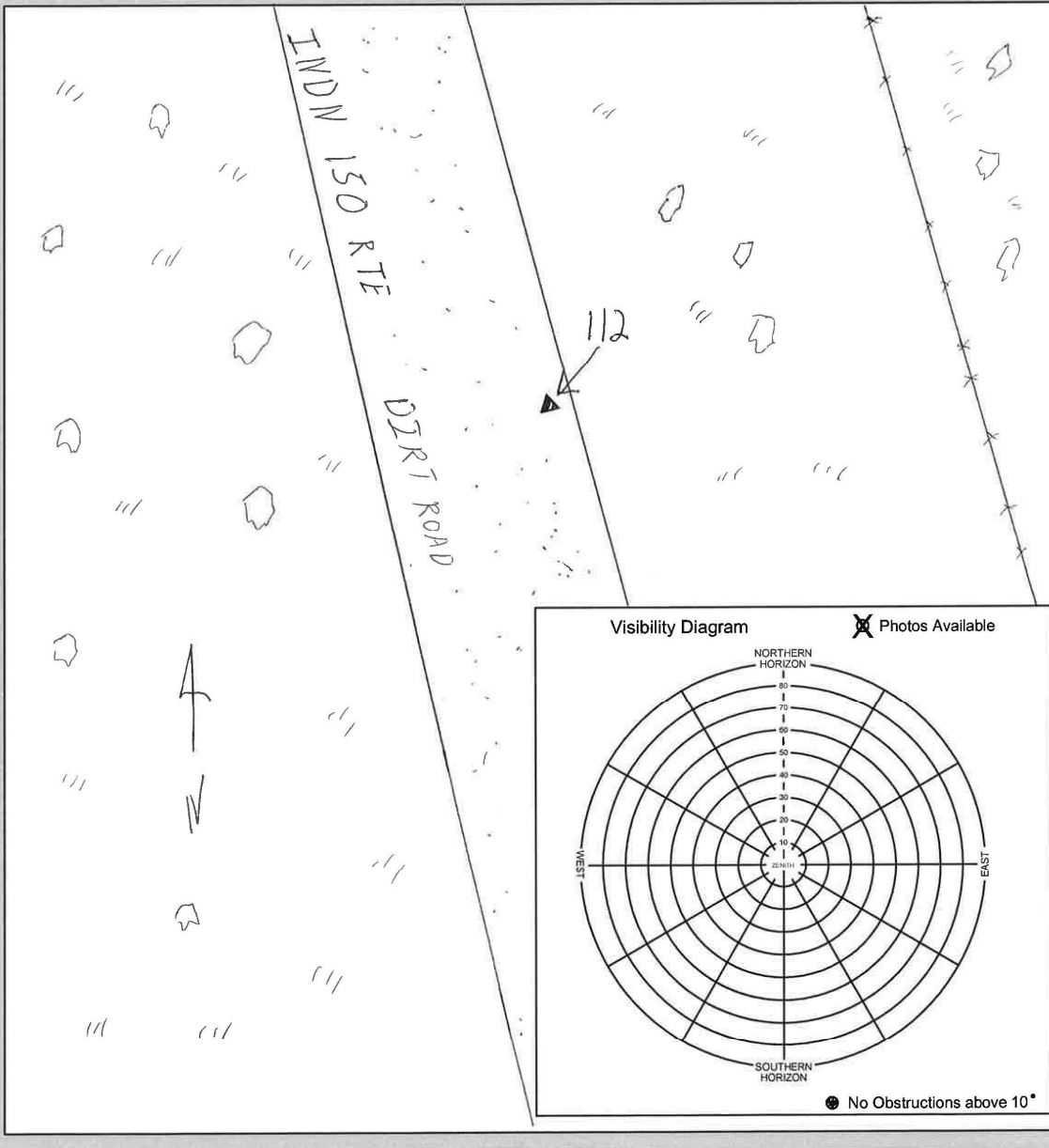
LiDAR Control point # 111	General location AZTEC, NM	Ground Class	
Latitude N 36° 49' 44.38"	Longitude W 107° 58' 46.01"	Calendar Date 11/19/2014	Observer Initials CPR



LiDAR Survey - LiDAR Control



LiDAR Control point #	112	General location	AZTEC, NM	Ground Class	
Latitude	N 37° 1' 9.21 "	Longitude	W 107° 47' 7.61 "	Calendar Date	11/20/2014
				Observer Initials	CPR



LiDAR Control Point Photos:



1001, 2, 20NOV2014



1002, 2, 18NOV2014



1003, 2, 21NOV2014



1004, 2, 21NOV2014



1005, 2, 18NOV2014



1006, 2, 19NOV2014



1007, 2, 21NOV2014



1008, 2, 21NOV2014



1009, 2, 19NOV2014



1010, 2, 20NOV2014



1011, 2, 19NOV2014



1012, 2, 20NOV2014

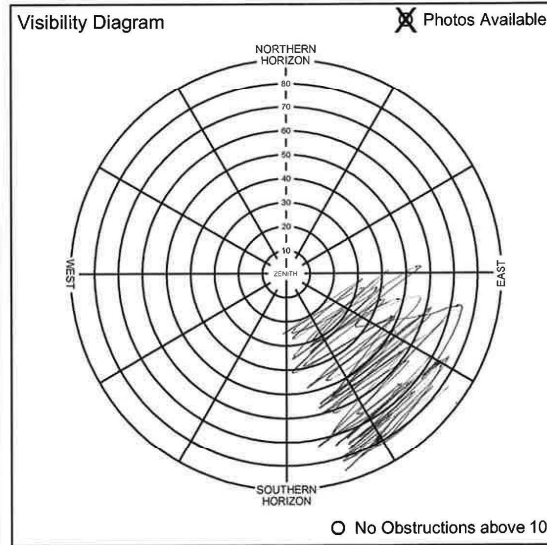
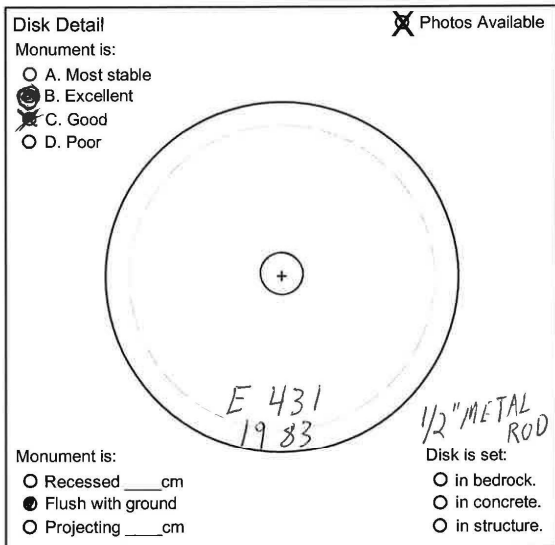
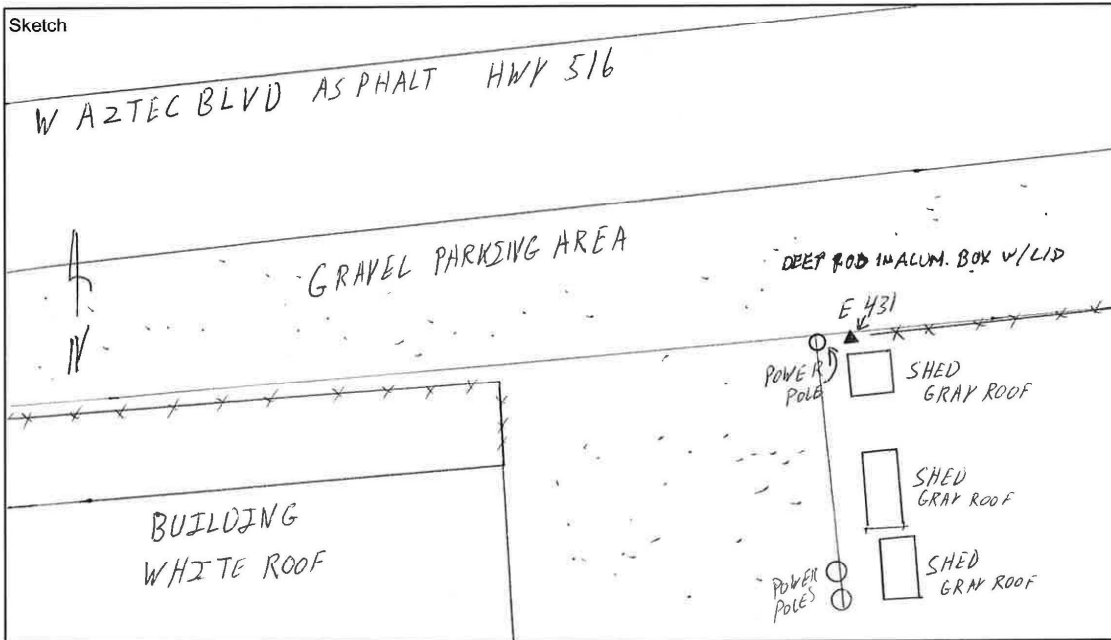
Geodetic Control Field Sketches:

LiDAR Survey - Station Recovery Log				 <small>WOLPERT</small> <small>www.woolpert.com</small>
Station Designation 1001	PID —	Location FARMINGTON, NM	Date 11/18/14	
<input type="checkbox"/> PACS <input type="checkbox"/> SACS <input type="checkbox"/> TACS <input type="checkbox"/> OBM <input type="checkbox"/> OFBN <input type="checkbox"/> CBN <input type="checkbox"/> Other <u>TSM</u>		Observer Chris Rodenburg	Organization Woolpert	
<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;">Sketch</div> </div>				
Disk Detail <input checked="" type="checkbox"/> Photos Available Monument is: <input type="checkbox"/> A. Most stable <input type="checkbox"/> B. Excellent <input checked="" type="checkbox"/> C. Good <input type="checkbox"/> D. Poor				
Monument is: <input type="checkbox"/> Recessed ___ cm <input type="checkbox"/> Flush with ground <input checked="" type="checkbox"/> Projecting <u>3</u> cm		Disk is set: <input type="checkbox"/> in bedrock. <input type="checkbox"/> in concrete. <input type="checkbox"/> in structure.		
Visibility Diagram <input checked="" type="checkbox"/> Photos Available				

LiDAR Survey - Station Recovery Log



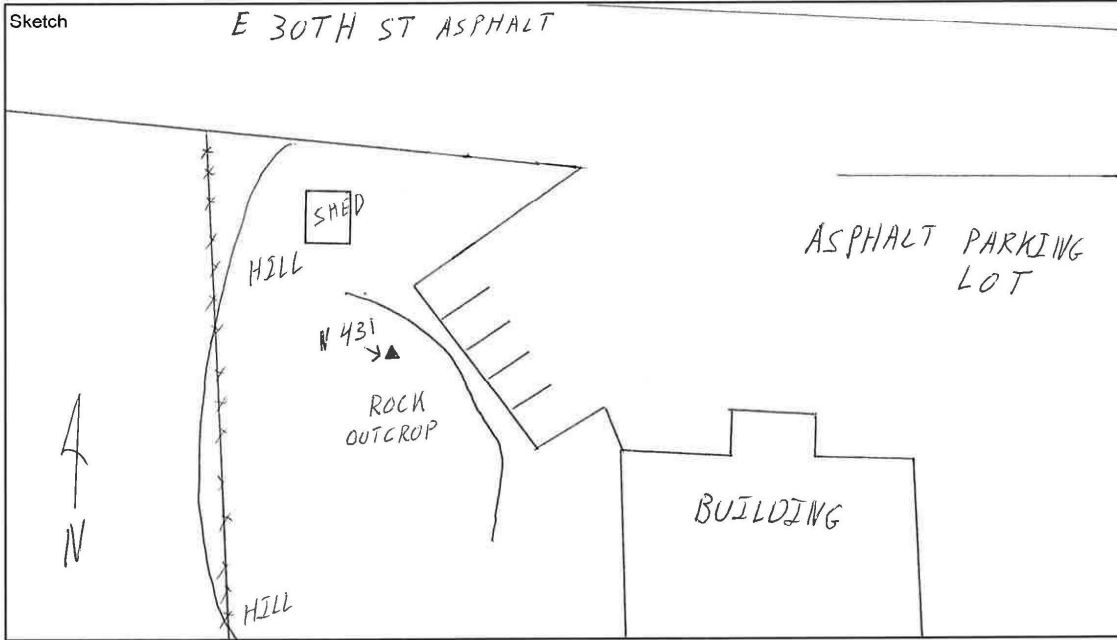
Station Designation	PID	Location	Date
E 431	G00234	AZTEC, NM	11/19/14
<input type="checkbox"/> OPACS <input type="checkbox"/> OFBN	<input type="checkbox"/> SACS <input type="checkbox"/> CBN	<input type="checkbox"/> TACS <input type="checkbox"/> Other	<input checked="" type="checkbox"/> BM
Observer		Organization	
Chris Rodenburg		Woolpert	



LiDAR Survey - Station Recovery Log



Station Designation N 431	PID G00226	Location FARMINGTON, NM	Date 11/19/14
<input type="checkbox"/> PACS <input type="checkbox"/> SACS <input type="checkbox"/> TACS <input checked="" type="checkbox"/> BM <input type="checkbox"/> FBN <input type="checkbox"/> CBN <input type="checkbox"/> Other _____	Observer Chris Rodenburg	Organization Woolpert	



Disk Detail

Monument is: **3 1/2" BRONZE DISC CEMENTED IN TO ROCK OUTCROP**

Photos Available

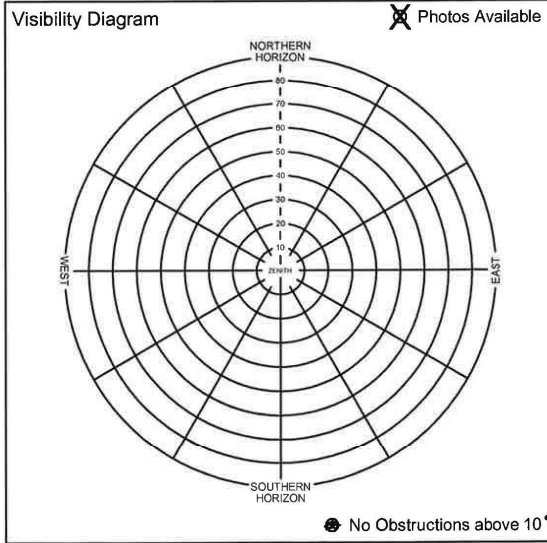
A. Most stable
 B. Excellent
 C. Good
 D. Poor

Monument is:

Recessed ____ cm
 Flush with ground
 Projecting ____ cm

Disk is set:

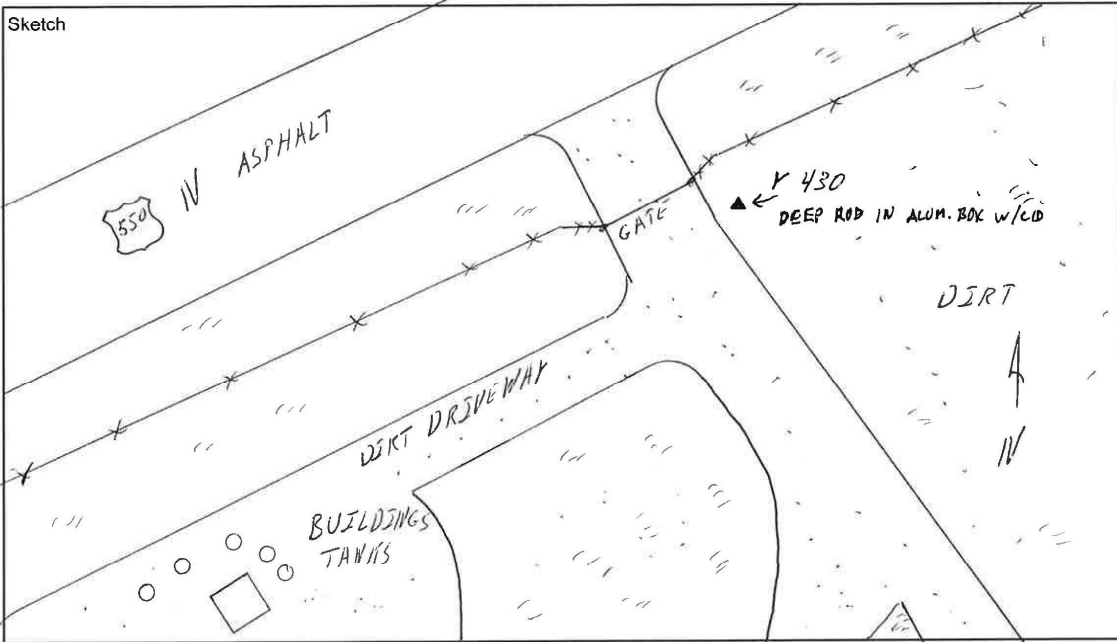
in bedrock.
 in concrete.
 in structure.



LiDAR Survey - Station Recovery Log



Station Designation Y 430	PID GNO389	Location AZTEC, NM	Date 11/18/14
<input type="radio"/> PACS <input type="radio"/> SACS <input type="radio"/> TACS <input checked="" type="radio"/> BM <input type="radio"/> OFBN <input type="radio"/> CBN <input type="radio"/> Other _____	Observer Chris Rodenburg	Organization Woolpert	



Photos Available

Disk Detail
Monument is:

- A. Most stable
- B. Excellent
- C. Good
- D. Poor

Monument is:

- Recessed 6 cm
- Flush with ground
- Projecting _____ cm

Disk is set:

- in bedrock.
- in concrete.
- in structure.

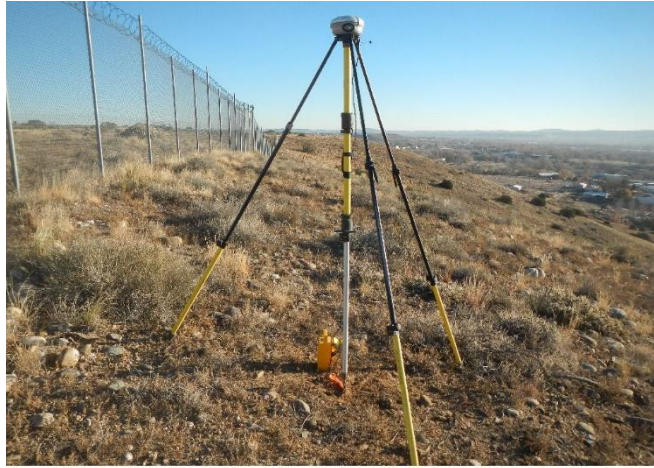
1/2" METAL ROD

Photos Available

Visibility Diagram

● No Obstructions above 10°

Geodetic Control Photos:



101, 2, 18NOV2014



102, 2, 18NOV2014



103, 3N, 20NOV2014



E 431, 2, 19NOV2014



G 404, 2, 21NOV2014



J 404, 2, 21NOV 2014



N 431, 2, 19NOV2014



Y 430, 2, 18NOV2014



Z 430, 2, 18NOV2014

SECTION 5: EXISTING NGS DATA SHEETS

This section contains the published National Geodetic Survey (NGS) Data Sheets used in the final control network for this project.

THE NGS DATA SHEET

See file [dsdata.txt](#) for more information about the datasheet.

```
PROGRAM = datasheet95, VERSION = 8.5
1      National Geodetic Survey,  Retrieval Date = DECEMBER  3, 2014
GO0234
*****
GO0234 DESIGNATION - E 431
GO0234 PID - GO0234
GO0234 STATE/COUNTY- NM/SAN JUAN
GO0234 COUNTRY - US
GO0234 USGS QUAD - FLORA VISTA (1979)
GO0234
GO0234 *CURRENT SURVEY CONTROL
GO0234
-----
GO0234* NAD 83(1986) POSITION- 36 49 26. (N) 108 02 19. (W) SCALED
GO0234* NAVD 88 ORTHO HEIGHT - 1725.912 (meters) 5662.43 (feet)
ADJUSTED
GO0234
-----
GO0234 GEOID HEIGHT - -20.89 (meters)
GEOID12A
GO0234 DYNAMIC HEIGHT - 1723.749 (meters) 5655.33 (feet) COMP
GO0234 MODELED GRAVITY - 979,318.0 (mgal) NAVD
88
GO0234
GO0234 VERT ORDER - FIRST CLASS II
GO0234
GO0234.The horizontal coordinates were scaled from a topographic map and
have
GO0234.an estimated accuracy of +/- 6 seconds.
GO0234.
GO0234.The orthometric height was determined by differential leveling and
GO0234.adjusted by the NATIONAL GEODETIC SURVEY
GO0234.in June 1991.
GO0234
GO0234.The dynamic height is computed by dividing the NAVD 88
GO0234.geopotential number by the normal gravity value computed on the
GO0234.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
GO0234.degrees latitude (g = 980.6199 gals.).
GO0234
GO0234.The modeled gravity was interpolated from observed gravity values.
GO0234
GO0234; North East Units Estimated Accuracy
GO0234;SPC NM W - 645,960. 811,690. MT (+/- 180 meters)
```

Scaled)

GO0234
 GO0234 SUPERSEDED SURVEY CONTROL
 GO0234
 GO0234.No superseded survey control is available for this station.
 GO0234
 GO0234_U.S. NATIONAL GRID SPATIAL ADDRESS: 12SYF641794(NAD 83)
 GO0234
 GO0234_MARKER: I = METAL ROD
 GO0234_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
 GO0234_SP_SET: STAINLESS STEEL ROD
 GO0234_STAMPING: E 431 1983
 GO0234_MARK LOGO: NGS
 GO0234_PROJECTION: FLUSH
 GO0234_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
 GO0234_ROD/PIPE-DEPTH: 7.3 meters
 GO0234

GO0234	HISTORY	- Date	Condition	Report By
GO0234	HISTORY	- 1983	MONUMENTED	NGS

 GO0234
 GO0234 STATION DESCRIPTION
 GO0234
 GO0234'DESCRIBED BY NATIONAL GEODETIC SURVEY 1983
 GO0234'20.0 KM (12.4 MI) NE FROM FARMINGTON.
 GO0234'20.0 KM (12.4 MI) NORTHEASTERLY ALONG U.S. HIGHWAY 550 FROM ITS
 GO0234'JUNCTION WITH STATE HIGHWAY 371 (LAKE STREET) IN FARMINGTON,
 GO0234'24.0 METERS (78.7 FT) WEST OF THE NORTHWEST CORNER OF CARLEYS MARINE,
 GO0234'21.6 METERS (70.9 FT) SOUTH OF THE CENTERLINE OF THE NORTHEAST BOUND
 GO0234'LANES OF THE HIGHWAY, 0.7 METER (2.3 FT) NORTHWEST OF THE NORTHWEST
 GO0234'CORNER OF A CHAIN LINK FENCE, AND 0.7 METERS (2.3 FT) NORTHEAST OF
 GO0234'UTILITY POLE NUMBER 84. NOTE=ACCESS TO THE DATUM POINT IS THROUGH A
 GO0234'5-INCH LOGO CAP.
 GO0234'THE MARK IS 0.3 METERS E FROM A WITNESS POST.
 GO0234'THE MARK IS 0.3 M ABOVE THE HIGHWAY.
 1 National Geodetic Survey, Retrieval Date = DECEMBER 3, 2014
 HL0346

 HL0346 DESIGNATION - G 404
 HL0346 PID - HL0346
 HL0346 STATE/COUNTY- CO/LA PLATA
 HL0346 COUNTRY - US
 HL0346 USGS QUAD - BONDAD HILL (1968)
 HL0346
 HL0346 *CURRENT SURVEY CONTROL
 HL0346

 HL0346* NAD 83(1986) POSITION- 37 05 19. (N) 107 52 01. (W) SCALED
 HL0346* [NAVD 88](#) ORTHO HEIGHT - 1942.428 (meters) 6372.78 (feet)
 ADJUSTED
 HL0346

 HL0346 GEOID HEIGHT - -20.02 (meters)
 GEOID12A
 HL0346 DYNAMIC HEIGHT - 1939.930 (meters) 6364.59 (feet) COMP
 HL0346 MODELED GRAVITY - 979,276.4 (mgal) NAVD

88

HL0346

HL0346 VERT ORDER - FIRST CLASS II

HL0346

HL0346.The horizontal coordinates were scaled from a topographic map and have

HL0346.an estimated accuracy of +/- 6 seconds.

HL0346.

HL0346.The orthometric height was determined by differential leveling and

HL0346.adjusted by the NATIONAL GEODETIC SURVEY

HL0346.in June 1991.

HL0346

HL0346.The dynamic height is computed by dividing the NAVD 88

HL0346.geopotential number by the normal gravity value computed on the

HL0346.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45

HL0346.degrees latitude ($g = 980.6199$ gals.).

HL0346

HL0346.The modeled gravity was interpolated from observed gravity values.

HL0346

HL0346; North East Units Estimated Accuracy

HL0346;SPC CO S - 354,300. 703,980. MT (+/- 180 meters

Scaled)

HL0346

HL0346

SUPERSEDED SURVEY CONTROL

HL0346

HL0346.No superseded survey control is available for this station.

HL0346

HL0346_U.S. NATIONAL GRID SPATIAL ADDRESS: 13SBB451085(NAD 83)

HL0346

HL0346_MARKER: I = METAL ROD

HL0346_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)

HL0346_SP_SET: STAINLESS STEEL ROD

HL0346_STAMPING: G 404 1984

HL0346_MARK LOGO: NGS

HL0346_PROJECTION: FLUSH

HL0346_MAGNETIC: I = MARKER IS A STEEL ROD

HL0346_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

HL0346_ROD/PIPE-DEPTH: 4.1 meters

HL0346

HL0346 HISTORY - Date Condition Report By

HL0346 HISTORY - 1984 MONUMENTED NGS

HL0346 HISTORY - 19920421 GOOD NGS

HL0346

HL0346 STATION DESCRIPTION

HL0346

HL0346'DESCRIBED BY NATIONAL GEODETIC SURVEY 1984

HL0346'23.0 KM (14.3 MI) SOUTH FROM DURANGO.

HL0346'23.0 KM (14.3 MI) SOUTHERLY ALONG U.S. HIGHWAY 550 FROM ITS NORTH

HL0346'JUNCTION WITH U.S. HIGHWAY 160 IN DURANGO, 0.9 KM (0.55 MI) SOUTH OF

HL0346'THE INTERSECTION OF COUNTY ROAD 214 LEADING EAST, 44.8 METERS

HL0346'(147.0 FT) NORTH OF A UTILITY POLE, 18.7 METERS (61.4 FT) EAST OF THE

HL0346'CENTERLINE OF THE HIGHWAY, AND 5.6 METERS (18.4 FT) SOUTH OF THE

HL0346'CENTER OF A GATE AND TRACK ROAD LEADING EAST. NOTE=ACCESS TO THE

HL0346'DATUM POINT IS THROUGH A 5-INCH LOGO CAP.

HL0346'THE MARK IS 0.3 METERS W FROM A WITNESS POST AND FENCE

HL0346 'THE MARK IS ABOVE LEVEL WITH THE HIGHWAY.
HL0346
HL0346 STATION RECOVERY (1992)
HL0346
HL0346 'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1992
HL0346 'RECOVERED IN GOOD CONDITION.
1 National Geodetic Survey, Retrieval Date = DECEMBER 3, 2014
HL0344

HL0344 DESIGNATION - J 404
HL0344 PID - HL0344
HL0344 STATE/COUNTY- CO/LA PLATA
HL0344 COUNTRY - US
HL0344 USGS QUAD - BONDAD HILL (1968)
HL0344
HL0344 *CURRENT SURVEY CONTROL
HL0344

HL0344* NAD 83(2011) POSITION- 37 03 04.78114(N) 107 52 29.44839(W)
ADJUSTED
HL0344* NAD 83(2011) ELLIP HT- 1816.817 (meters) (06/27/12)
ADJUSTED
HL0344* NAD 83(2011) EPOCH - 2010.00
HL0344* [NAVD 88](#) ORTHO HEIGHT - 1836.951 (meters) 6026.73 (feet)
ADJUSTED
HL0344

HL0344 NAD 83(2011) X - -1,564,778.143 (meters) COMP
HL0344 NAD 83(2011) Y - -4,851,928.018 (meters) COMP
HL0344 NAD 83(2011) Z - 3,823,035.575 (meters) COMP
HL0344 LAPLACE CORR - 1.39 (seconds)
DEFLEC12A
HL0344 GEOID HEIGHT - -20.15 (meters)
GEOID12A
HL0344 DYNAMIC HEIGHT - 1834.601 (meters) 6019.02 (feet) COMP
HL0344 MODELED GRAVITY - 979,287.6 (mgal) NAVD
88
HL0344
HL0344 VERT ORDER - FIRST CLASS II
HL0344
HL0344 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)
HL0344 Type Horiz Ellip Dist(km)
HL0344 -----
HL0344 NETWORK 0.75 1.49
HL0344 -----
HL0344 MEDIAN LOCAL ACCURACY AND DIST (007 points) 0.83 1.67 16.81
HL0344 -----
HL0344 NOTE: Click [here](#) for information on individual local accuracy
HL0344 values and other accuracy information.
HL0344
HL0344
HL0344.The horizontal coordinates were established by GPS observations
HL0344.and adjusted by the National Geodetic Survey in June 2012.
HL0344
HL0344.NAD 83(2011) refers to NAD 83 coordinates where the reference

HL0344.frame has been affixed to the stable North American tectonic plate.
See

HL0344.[NA2011](#) for more information.

HL0344

HL0344.The horizontal coordinates are valid at the epoch date displayed
above

HL0344.which is a decimal equivalence of Year/Month/Day.

HL0344

HL0344.The orthometric height was determined by differential leveling and
HL0344.adjusted by the NATIONAL GEODETIC SURVEY

HL0344.in June 1991.

HL0344

HL0344.The X, Y, and Z were computed from the position and the ellipsoidal
ht.

HL0344

HL0344.The Laplace correction was computed from DEFLEC12A derived
deflections.

HL0344

HL0344.The ellipsoidal height was determined by GPS observations
HL0344.and is referenced to NAD 83.

HL0344

HL0344.The dynamic height is computed by dividing the NAVD 88
HL0344.geopotential number by the normal gravity value computed on the
HL0344.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
HL0344.degrees latitude (g = 980.6199 gals.).

HL0344

HL0344.The modeled gravity was interpolated from observed gravity values.

HL0344

HL0344. The following values were computed from the NAD 83(2011) position.

HL0344

HL0344;		North	East	Units	Scale Factor	
Converg.						
HL0344;SPC CO S	-	350,177.602	703,169.650	MT	1.00003802	-1 27
24.0						
HL0344;SPC CO S	-	1,148,874.35	2,306,982.43	sFT	1.00003802	-1 27
24.0						
HL0344;UTM 13	-	4,104,432.691	244,349.836	MT	1.00040521	-1 43
59.2						
HL0344						
HL0344!	-	Elev Factor	x	Scale Factor	=	Combined Factor
HL0344!SPC CO S	-	0.99971497	x	1.00003802	=	0.99975298
HL0344!UTM 13	-	0.99971497	x	1.00040521	=	1.00012006

HL0344

HL0344

SUPERSEDED SURVEY CONTROL

HL0344

HL0344 NAD 83(2007)- 37 03 04.78079(N) 107 52 29.44863(W) AD(2002.00) 0
HL0344 ELLIP H (02/10/07) 1816.842 (m) GP(2002.00)
HL0344 ELLIP H (12/03/02) 1816.837 (m) GP() 4

2

HL0344 NAD 83(1992)- 37 03 04.78040(N) 107 52 29.44804(W) AD() 1
HL0344 ELLIP H (07/06/97) 1816.835 (m) GP() 3

1

HL0344 NAVD 88 (07/06/97) 1836.95 (m) 6026.7 (f) LEVELING 3

HL0344

HL0344.Superseded values are not recommended for survey control.

HL0344
 HL0344.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
 HL0344.[See file dsdata.txt](#) to determine how the superseded data were derived.
 HL0344
 HL0344_U.S. NATIONAL GRID SPATIAL ADDRESS: 13SBB4434904432(NAD 83)
 HL0344
 HL0344_MARKER: DB = BENCH MARK DISK
 HL0344_SETTING: 66 = SET IN ROCK OUTCROP
 HL0344_SP_SET: ROCK OUTCROP
 HL0344_STAMPING: J 404 1984
 HL0344_MARK LOGO: NGS
 HL0344_MAGNETIC: O = OTHER; SEE DESCRIPTION
 HL0344_STABILITY: A = MOST RELIABLE AND EXPECTED TO HOLD
 HL0344+STABILITY: POSITION/ELEVATION WELL
 HL0344_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 HL0344+SATELLITE: SATELLITE OBSERVATIONS - April 21, 1992
 HL0344

HL0344	HISTORY	- Date	Condition	Report By
HL0344	HISTORY	- 1984	MONUMENTED	NGS
HL0344	HISTORY	- 19920421	GOOD	NGS
HL0344	HISTORY	- 19920421	GOOD	NGS

 HL0344
 HL0344
 HL0344 STATION DESCRIPTION
 HL0344
 HL0344'DESCRIBED BY NATIONAL GEODETIC SURVEY 1984
 HL0344'27.3 KM (16.95 MI) SOUT FROM DURANGO.
 HL0344'27.3 KM (16.95 MI) SOUTHERLY ALONG U.S. HIGHWAY 550 FROM ITS NORTH
 HL0344'JUNCTION WITH U.S. HIGHWAY 160 IN DURANGO, NEAR THE WEST END OF A
 HL0344'LARGE EXPOSED AREA OF BEDROCK ALONG THE NORTH BANK OF THE ANIMAS
 HL0344'RIVER, 18.9 METERS (62.0 FT) EAST OF THE CENTER LINE OF THE HIGHWAY,
 HL0344'AND 13.7 METERS (44.9 FT) EAST OF THE NORTHEAST CORNER OF A BRIDGE
 HL0344'SPANNING THE RIVER.
 HL0344'THE MARK IS 0.3 METERS W FROM A WITNESS POST.
 HL0344'THE MARK IS ABOVE LEVEL WITH THE HIGHWAY.
 HL0344
 HL0344
 HL0344 STATION RECOVERY (1992)
 HL0344
 HL0344'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1992
 HL0344'RECOVERED IN GOOD CONDITION.
 HL0344
 HL0344
 HL0344 STATION RECOVERY (1992)
 HL0344
 HL0344'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1992 (RSC)
 HL0344'THE STATION IS LOCATED ABOUT 16 MI (25.7 KM) SOUTH OF DURANGO, 14 MI
 HL0344'(22.5 KM) SOUTHWEST OF IGNACIO, 3.5 MI (5.6 KM) NORTH OF THE
 HL0344'COLORADO-NEW MEXICO STATE LINE, IT IS IN THE NORTHWEST 1/4 OF SECTION
 HL0344'6, T 32 N, R 9 W, AT U. S. HIGHWAY 550 MILEPOST 3.7.
 HL0344'OWNERSHIP--COLORADO DEPARTMENT OF TRANSPORTATION TO REACH THE
 STATION
 HL0344'FROM THE JUNCTION OF U. S. HIGHWAY 160 AND U. S. HIGHWAY 550
 HL0344'SOUTHEAST OF DURANGO, GO SOUTH ON U. S. HIGHWAY 550 FOR 12.6 MI
 HL0344'(20.3 KM) TO THE STATION ON THE LEFT, JUST NORTH OF A BRIDGE OVER THE
 HL0344'ANIMAS RIVER THE STATION MARK IS A STANDARD DISK SET IN A DRILL HOLE
 HL0344'NEAR THE WEST END OF A LARGE EXPOSED AREA OF BEDROCK ALONG THE NORTH
 HL0344'BANK OF THE ANIMAS RIVER, 62.0 FT (18.9 M) EAST OF THE HIGHWAY, 44.9

HL0344'FT (13.7 M) EAST OF THE NORTHEAST CORNER OF A BRIDGE OVER THE RIVER,
HL0344'ABOUT LEVEL WITH THE HIGHWAY AND 1 FT (0.3 M) WEST OF A WITNESS POST.
1 National Geodetic Survey, Retrieval Date = DECEMBER 3, 2014

GN0389

GN0389 DESIGNATION - Y 430
GN0389 PID - GN0389
GN0389 STATE/COUNTY- NM/SAN JUAN
GN0389 COUNTRY - US
GN0389 USGS QUAD - CEDAR HILL (1985)
GN0389
GN0389 *CURRENT SURVEY CONTROL
GN0389

GN0389* NAD 83(2011) POSITION- 36 52 50.99412(N) 107 56 04.39525(W)
ADJUSTED
GN0389* NAD 83(2011) ELLIP HT- 1746.530 (meters) (06/27/12)
ADJUSTED
GN0389* NAD 83(2011) EPOCH - 2010.00
GN0389* [NAVD 88](#) ORTHO HEIGHT - 1767.173 (meters) 5797.80 (feet)
ADJUSTED
GN0389

GN0389 NAD 83(2011) X - -1,573,320.798 (meters) COMP
GN0389 NAD 83(2011) Y - -4,861,069.568 (meters) COMP
GN0389 NAD 83(2011) Z - 3,807,871.214 (meters) COMP
GN0389 LAPLACE CORR - 2.51 (seconds)
DEFLEC12A
GN0389 GEOID HEIGHT - -20.65 (meters)
GEOID12A
GN0389 DYNAMIC HEIGHT - 1764.943 (meters) 5790.48 (feet) COMP
GN0389 MODELED GRAVITY - 979,307.8 (mgal) NAVD

88
GN0389
GN0389 VERT ORDER - FIRST CLASS II
GN0389
GN0389 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)
GN0389 Type Horiz Ellip Dist(km)
GN0389 -----
GN0389 NETWORK 1.53 2.31
GN0389 -----
GN0389 MEDIAN LOCAL ACCURACY AND DIST (002 points) 1.26 1.69 3.39
GN0389 -----

GN0389 NOTE: Click [here](#) for information on individual local accuracy
GN0389 values and other accuracy information.

GN0389
GN0389
GN0389.The horizontal coordinates were established by GPS observations
GN0389.and adjusted by the National Geodetic Survey in June 2012.
GN0389
GN0389.NAD 83(2011) refers to NAD 83 coordinates where the reference
GN0389.frame has been affixed to the stable North American tectonic plate.
See
GN0389.[NA2011](#) for more information.
GN0389

GN0389.The horizontal coordinates are valid at the epoch date displayed above

GN0389.which is a decimal equivalence of Year/Month/Day.

GN0389

GN0389.The orthometric height was determined by differential leveling and GN0389.adjusted by the NATIONAL GEODETIC SURVEY

GN0389.in June 1991.

GN0389

GN0389.The X, Y, and Z were computed from the position and the ellipsoidal ht.

GN0389

GN0389.The Laplace correction was computed from DEFLEC12A derived deflections.

GN0389

GN0389.The ellipsoidal height was determined by GPS observations GN0389.and is referenced to NAD 83.

GN0389

GN0389.The dynamic height is computed by dividing the NAVD 88 GN0389.geopotential number by the normal gravity value computed on the GN0389.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45 GN0389.degrees latitude (g = 980.6199 gals.).

GN0389

GN0389.The modeled gravity was interpolated from observed gravity values.

GN0389

GN0389. The following values were computed from the NAD 83(2011) position.

GN0389

GN0389;	North	East	Units	Scale Factor	
Converg.					
GN0389;SPC NM W	- 652,262.191	820,976.868	MT	0.99991767	-0 03
38.7					
GN0389;SPC NM W	- 2,139,963.54	2,693,488.27	sFT	0.99991767	-0 03
38.7					
GN0389;UTM 13	- 4,085,674.524	238,455.736	MT	1.00044280	-1 45
43.8					
GN0389;UTM 12	- 4,086,041.544	773,213.136	MT	1.00051969	+1 50
27.1					

GN0389

GN0389!
- Elev Factor x Scale Factor = Combined Factor

GN0389!SPC NM W - 0.99972599 x 0.99991767 = 0.99964368

GN0389!UTM 13 - 0.99972599 x 1.00044280 = 1.00016866

GN0389!UTM 12 - 0.99972599 x 1.00051969 = 1.00024553

GN0389

SUPERSEDED SURVEY CONTROL

GN0389

GN0389 NAD 83(2007)- 36 52 50.99378(N) 107 56 04.39638(W) AD(2002.00) 0

GN0389 ELLIP H (02/10/07) 1746.531 (m) GP(2002.00)

GN0389 NAD 83(1992)- 36 52 50.99338(N) 107 56 04.39572(W) AD() A

GN0389 ELLIP H (06/28/00) 1746.553 (m) GP() 4

1

GN0389 NAVD 88 (06/28/00) 1767.17 (m) 5797.8 (f) LEVELING 3

GN0389

GN0389.Superseded values are not recommended for survey control.

GN0389

GN0389.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.

GN0389.[See file dsdata.txt](#) to determine how the superseded data were derived.

GN0389
 GN0389_U.S. NATIONAL GRID SPATIAL ADDRESS: 13SBA3845585674(NAD 83)
 GN0389
 GN0389_MARKER: I = METAL ROD
 GN0389_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)
 GN0389_SP_SET: STAINLESS STEEL ROD
 GN0389_STAMPING: Y 430 1983
 GN0389_MARK LOGO: NGS
 GN0389_PROJECTION: FLUSH
 GN0389_MAGNETIC: O = OTHER; SEE DESCRIPTION
 GN0389_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
 GN0389_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
 GN0389+SATELLITE: SATELLITE OBSERVATIONS - July 08, 1999
 GN0389_ROD/PIPE-DEPTH: 4.9 meters

GN0389	HISTORY	- Date	Condition	Report By
GN0389	HISTORY	- 1983	MONUMENTED	NGS
GN0389	HISTORY	- 19990708	GOOD	NGS

GN0389
 STATION DESCRIPTION

GN0389'DESCRIBED BY NATIONAL GEODETIC SURVEY 1983
 GN0389'32.4 KM (20.1 MI) NE FROM FARMINGTON.
 GN0389'32.4 KM (20.1 MI) NORTHEASTERLY ALONG U.S. HIGHWAY 550 FROM ITS
 GN0389'JUNCTION WITH STATE HIGHWAY 371 (LAKE STREET) IN FARMINGTON, 1.3 KM
 GN0389'(0.8 MI) NORTHEAST OF THE INTERSECTION OF COUNTY ROAD A 133,
 GN0389'61.3 METERS (201.1 FT) SOUTHEAST OF THE CENTERLINE OF THE HIGHWAY,
 AND
 GN0389'5.4 METERS (17.7 FT) NORTHEAST OF THE CENTER OF A DIRT ROAD LEADING
 GN0389'SOUTHEAST. NOTE=ACCESS TO THE DATUM POINT IS THROUGH A 5-INCH LOGO
 GN0389'CAP.
 GN0389'THE MARK IS 0.3 METERS NW FROM A WITNESS POST AND FENCE
 GN0389'THE MARK IS 2.0 M ABOVE THE HIGHWAY.

GN0389
 STATION RECOVERY (1999)

GN0389'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1999 (CSM)
 GN0389'RECOVERED AS DESCRIBED.

1 National Geodetic Survey, Retrieval Date = DECEMBER 3, 2014

GN0388

GN0388 DESIGNATION - Z 430
 GN0388 PID - GN0388
 GN0388 STATE/COUNTY- NM/SAN JUAN
 GN0388 COUNTRY - US
 GN0388 USGS QUAD - AZTEC (1985)

GN0388
 GN0388 *CURRENT SURVEY CONTROL
 GN0388

GN0388* NAD 83(2011) POSITION- 36 52 10.92378(N) 107 56 55.05872(W)
 ADJUSTED
 GN0388* NAD 83(2011) ELLIP HT- 1740.769 (meters) (06/27/12)
 ADJUSTED
 GN0388* NAD 83(2011) EPOCH - 2010.00

GN0388* [NAVD 88](#) ORTHO HEIGHT - 1761.446 (meters) 5779.01 (feet)
 ADJUSTED
 GN0388

GN0388 NAD 83(2011) X - -1,574,741.806 (meters) COMP
 GN0388 NAD 83(2011) Y - -4,861,383.941 (meters) COMP
 GN0388 NAD 83(2011) Z - 3,806,879.373 (meters) COMP
 GN0388 LAPLACE CORR - 2.44 (seconds)

DEFLEC12A
 GN0388 GEOID HEIGHT - -20.69 (meters)

GEOID12A
 GN0388 DYNAMIC HEIGHT - 1759.232 (meters) 5771.75 (feet) COMP
 GN0388 MODELED GRAVITY - 979,312.3 (mgal) NAVD

88
 GN0388
 GN0388 VERT ORDER - FIRST CLASS II
 GN0388
 GN0388 FGDC Geospatial Positioning Accuracy Standards (95% confidence, cm)
 GN0388 Type Horiz Ellip Dist(km)
 GN0388 -----
 GN0388 NETWORK 1.36 2.20
 GN0388 -----
 GN0388 MEDIAN LOCAL ACCURACY AND DIST (021 points) 1.38 2.21 351.85
 GN0388 -----
 GN0388 NOTE: Click [here](#) for information on individual local accuracy
 GN0388 values and other accuracy information.
 GN0388
 GN0388
 GN0388.The horizontal coordinates were established by GPS observations
 GN0388.and adjusted by the National Geodetic Survey in June 2012.
 GN0388
 GN0388.NAD 83(2011) refers to NAD 83 coordinates where the reference
 GN0388.frame has been affixed to the stable North American tectonic plate.
 See
 GN0388.[NA2011](#) for more information.
 GN0388
 GN0388.The horizontal coordinates are valid at the epoch date displayed
 above
 GN0388.which is a decimal equivalence of Year/Month/Day.
 GN0388
 GN0388.The orthometric height was determined by differential leveling and
 GN0388.adjusted by the NATIONAL GEODETIC SURVEY
 GN0388.in June 1991.
 GN0388
 GN0388.The X, Y, and Z were computed from the position and the ellipsoidal
 ht.
 GN0388
 GN0388.The Laplace correction was computed from DEFLEC12A derived
 deflections.
 GN0388
 GN0388.The ellipsoidal height was determined by GPS observations
 GN0388.and is referenced to NAD 83.
 GN0388
 GN0388.The dynamic height is computed by dividing the NAVD 88
 GN0388.geopotential number by the normal gravity value computed on the

GN0388.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
GN0388.degrees latitude (g = 980.6199 gals.).
GN0388
GN0388.The modeled gravity was interpolated from observed gravity values.
GN0388
GN0388. The following values were computed from the NAD 83(2011) position.
GN0388

GN0388;	North	East	Units	Scale Factor	
Converg.					
GN0388;SPC NM W	- 651,028.489	819,720.850	MT	0.99991797	-0 04
09.0					
GN0388;SPC NM W	- 2,135,915.97	2,689,367.49	sFT	0.99991797	-0 04
09.0					
GN0388;UTM 13	- 4,084,478.020	237,162.963	MT	1.00045116	-1 46
12.7					
GN0388;UTM 12	- 4,084,766.085	771,998.017	MT	1.00051153	+1 49
55.0					
GN0388					
GN0388!	- Elev Factor	x Scale Factor	=	Combined Factor	
GN0388!SPC NM W	- 0.99972689	x 0.99991797	=	0.99964488	
GN0388!UTM 13	- 0.99972689	x 1.00045116	=	1.00017793	
GN0388!UTM 12	- 0.99972689	x 1.00051153	=	1.00023828	
GN0388					
GN0388	SUPERSEDED SURVEY CONTROL				
GN0388					
GN0388	NAD 83(2007)-	36 52 10.92348(N)	107 56 55.05972(W)	AD(2002.00)	0
GN0388	ELLIP H (02/10/07)	1740.771 (m)		GP(2002.00)	
GN0388	NAD 83(1992)-	36 52 10.92305(N)	107 56 55.05917(W)	AD()	A
GN0388	ELLIP H (06/28/00)	1740.792 (m)		GP()	4
1					
GN0388	NAVD 88 (06/28/00)	1761.45 (m)	5779.0 (f)	LEVELING	3
GN0388					
GN0388	Superseded values are not recommended for survey control.				
GN0388					
GN0388	NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.				
GN0388	See file dsdata.txt to determine how the superseded data were derived.				
GN0388					
GN0388	U.S. NATIONAL GRID SPATIAL ADDRESS: 13SBA3716284478(NAD 83)				
GN0388					
GN0388	_MARKER: I = METAL ROD				
GN0388	_SETTING: 49 = STAINLESS STEEL ROD W/O SLEEVE (10 FT.+)				
GN0388	_SP_SET: STAINLESS STEEL ROD				
GN0388	_STAMPING: Z 430 1983				
GN0388	_MARK LOGO: NGS				
GN0388	_PROJECTION: FLUSH				
GN0388	_MAGNETIC: O = OTHER; SEE DESCRIPTION				
GN0388	_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL				
GN0388	_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR				
GN0388	+SATELLITE: SATELLITE OBSERVATIONS - July 31, 2001				
GN0388	_ROD/PIPE-DEPTH: 36.6 meters				
GN0388					
GN0388	HISTORY	- Date	Condition	Report By	
GN0388	HISTORY	- 1983	MONUMENTED	NGS	
GN0388	HISTORY	- 19990708	GOOD	NGS	
GN0388	HISTORY	- 20010731	GOOD	COMPA	

GN0388

GN0388

STATION DESCRIPTION

GN0388

GN0388'DESCRIBED BY NATIONAL GEODETIC SURVEY 1983

GN0388'30.6 KM (19.0 MI) NE FROM FARMINGTON.

GN0388'30.6 KM (19.0 MI) NORTHEASTERLY ALONG U.S. HIGHWAY 550 FROM ITS

GN0388'JUNCTION WITH STATE HIGHWAY 371 (LAKE STREET) IN FARMINGTON, 0.5 KM

GN0388'(0.3 MI) SOUTHWEST OF THE INTERSECTION OF COUNTY ROAD A 133,

GN0388'63.7 METERS (209.0 FT) SOUTHEAST OF THE CENTERLINE OF THE HIGHWAY,

AND

GN0388'6.5 METERS (22.6 FT) NORTHEAST OF THE CENTER OF A DIRT ROAD LEADING

GN0388'EAST. NOTE=ACCESS TO THE DATUM POINT IS THROUGH A 5-INCH LOGO CAP.

GN0388'THE MARK IS 0.3 METERS NW FROM A WITNESS POST AND FENCE

GN0388'THE MARK IS 1.5 M ABOVE THE HIGHWAY.

GN0388

GN0388

STATION RECOVERY (1999)

GN0388

GN0388'RECOVERY NOTE BY NATIONAL GEODETIC SURVEY 1999 (CSM)

GN0388'RECOVERED AS DESCRIBED.

GN0388

GN0388

STATION RECOVERY (2001)

GN0388

GN0388'RECOVERY NOTE BY COMPASSCOM INC 2001 (RL)

GN0388'RECOVERED IN GOOD CONDITION.

*** retrieval complete.

Elapsed Time = 00:00:06

