

GROUND CONTROL SURVEY REPORT BAGLEY FIRE

GPS SURVEY FOR LIDAR CONTROL

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1. ABSTRACT

This report documents the GPS ground surveys conducted in support of LIDAR data collection for Bagley Fire Area. The surveyed ground control was established on August 25-30, 2013 for the aerial collection with the Optech ALTM Gemini LiDAR Sensor. The ground control stations were established utilizing the **Leica RX1205 XC** Survey receiver. There were no problems encountered during this survey. The survey was conducted at 21 sites utilizing the CORS stations identified on the **OPUS** Data sheets. These surveys established "Ground Truth" data at each site.

A Beechcraft Bonanza A36TC, based out of Chino Airport, CA was utilized on this project for the LiDAR Mission. This aircraft was outfitted with an Optech Gemini ALTM 167kHz system (s/n 07SEN204).

Mission planning parameters for the LiDAR noted below. These lines would be flown using the following settings:

Altitude:	800 m
Overlap:	60 %
Speed:	120 kts
System PRF:	70 kHz
Scan Freq:	64 Hz
Scan Half Angle:	10°
Cross Track Res.:	0.491 m
Down Track Res.:	0.482 m

The actual local flight times and duration of flights were controlled by fuel consumption of the aircraft, safety of flight operations in the particular airspace and during times when the GPS constellation was most favorable, producing the highest number of satellites visible in the best geometric configuration relative to the GPS receivers onboard the aircraft as well as at the master stations on the ground. A standard of flying with no less than 6 satellites visible and a PDOP (position dilution of precision) of less than 3.0 was adopted.

Statistical comparisons were made between ground truth points collected in the survey and airborne LIDAR points .

Comparisons were also made between the survey points and the LIDAR derived terrain surface. These comparisons provide an additional verification of the LIDAR data against the survey data.

The horizontal and vertical datum used for this project are listed below:

Vertical Datum:	NAVD88, Geoid12A
Horizontal Datum:	NAD83
Projection:	UTM Zone 10
Units:	METERS

Plan Survey Grid

☐ Lock Flight Lines

Add New Area Import Areas Remove Area

Create Plan from File Export to KML

Active Area

Area **1** of **1**

Draw Area Edit Corners Generate Box Load Area from File

Pass Orientation

Optimize 0 30 60 90 120 150 180 210 240 270 300 330 360

Flight Profile		LIDAR Settings	
Altitude (ft AGL)	2500	System PRF (kHz)	70
Pass Heading (deg)	210	Scan Freq (Hz)	64
Overlap (%)	60	Scan Angle +/-	10
Speed (kts)	120	Scan Offset	0
Turn Time (min)	5	Desired Res (m)	0.486
Passes	50	CT Res	0.491
Pass Spacing (m)	107.27	DT Res	0.482
Min DEM Altitude	1070	PPM^2	4.23
Max DEM Altitude	3173	Scan Cutoff (deg)	0.02
		Swath (m)	268.17

Survey Totals

Total Passes	50	Swath Area (km^2)	70.256
Total Length (km)	654.948	AOI Area (km^2)	58.789
Total Flight Time	07:14:38	Total Laser Time	02:56:49

Costs

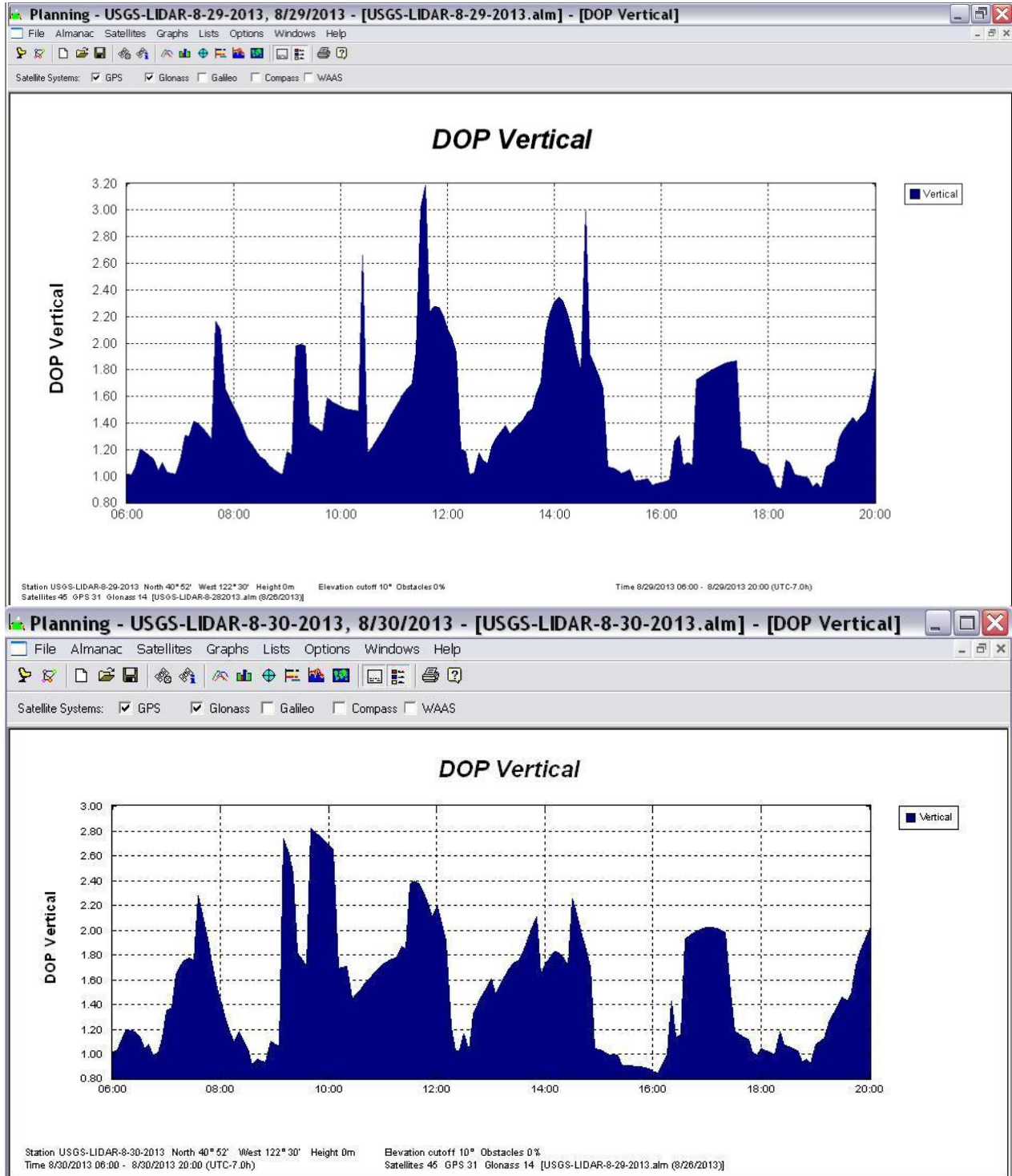
☐ Use Swath Area Cost per Acre 0 Area Cost \$0

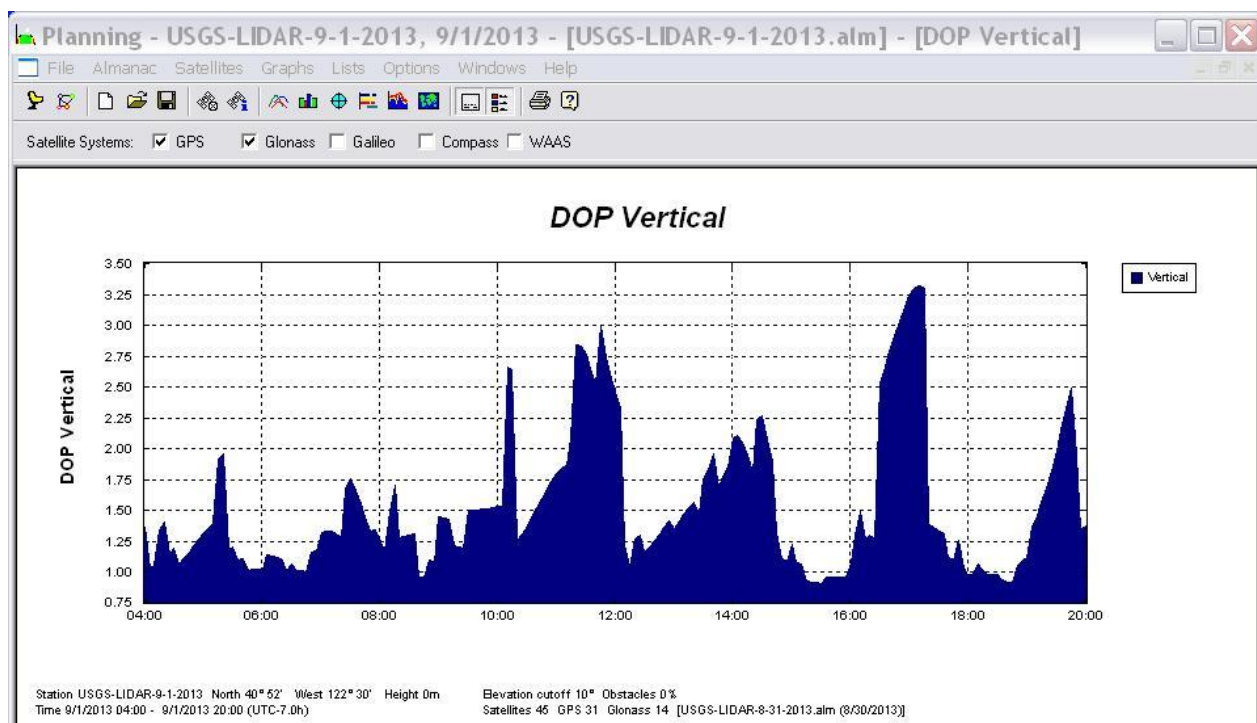
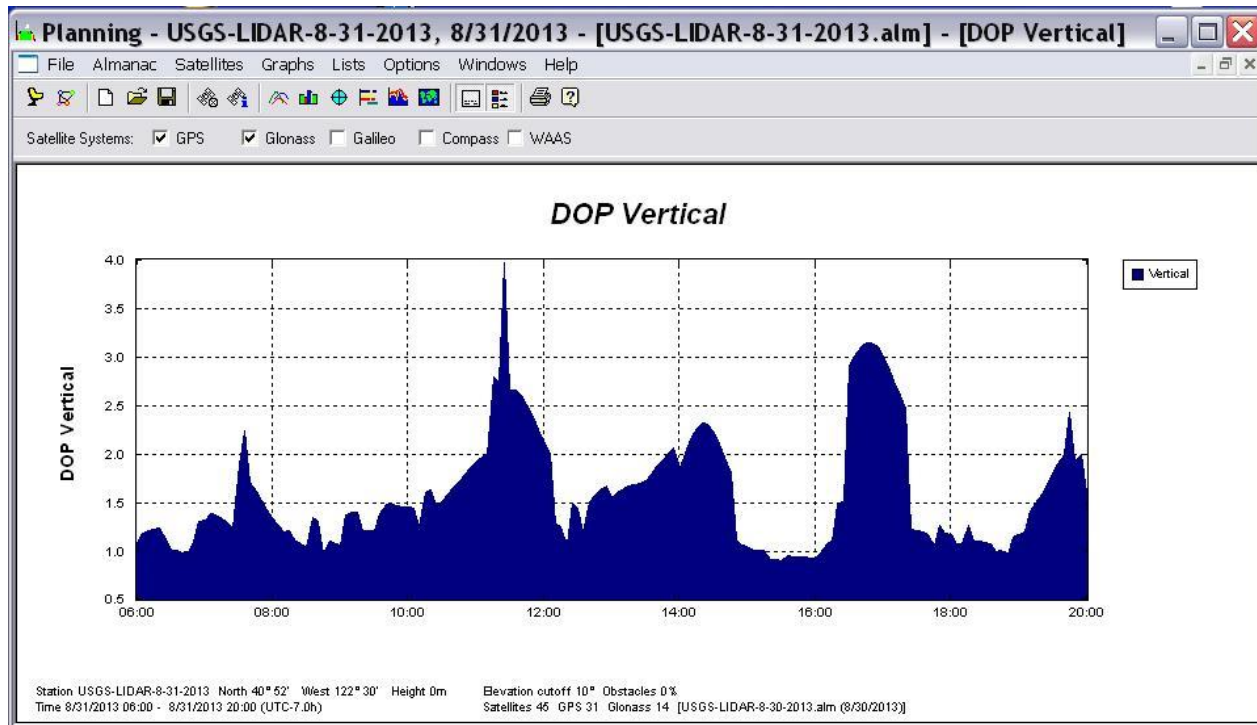
☒ Use AOI Area Cost per Hour 0 Time Cost \$0

Options Errors DEM Tools Apply Apply to All Areas Help Close

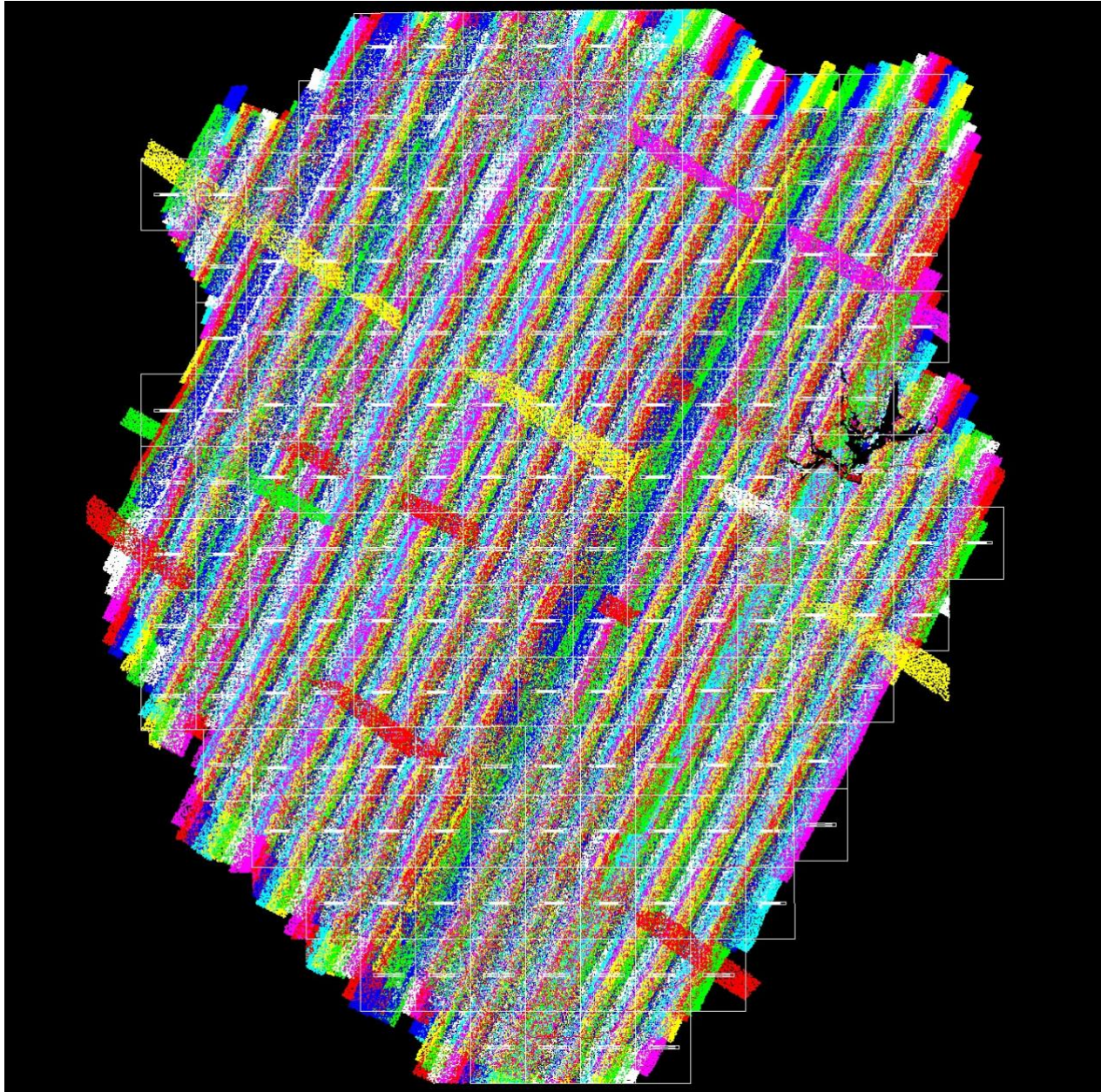
LiDAR MISSION PARAMETERS

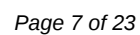
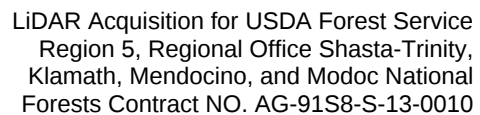
DMI always checked PDOP before commencing flight (weather permitting) – next page shows data collection and dates with PDOP report (August 29,30,31 aand Sept. 1, 2013)





SBET IMAGES and FLIGHT LINES/Tiling Algorithm





OPUS: Online Positioning User Service – Solution Report **@ ½ Second**

Ground Receiver UNIT 1 - 8/29/2013

START: 2013/08/29 12:33:00
STOP: 2013/08/29 17:48:30

ANT NAME: LEIAX1202 NONE # FIXED AMB: 61 / 62 : 98%

ARP HEIGHT: 1.7138

OVERALL RMS: 0.011(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6593)

X:	-2554859.096(m)	0.007(m)	-2554859.953(m)	0.007(m)
Y:	-4077350.352(m)	0.003(m)	-4077349.092(m)	0.003(m)
Z:	4173886.247(m)	0.005(m)	4173886.241(m)	0.005(m)
LAT:	41 7 50.27802	0.001(m)	41 7 50.29094	0.001(m)
E LON:	237 55 43.78434	0.004(m)	237 55 43.72453	0.004(m)
W LON:	122 4 16.21566	0.004(m)	122 4 16.27547	0.004(m)
EL HGT:	798.138(m)	0.008(m)	797.672(m)	0.008(m)
ORTHO HGT:	822.666(m)	0.026(m)	[NAVD88 (Computed using GEOID12A)]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 10)	SPC (0401 CA 1)
Northing (Y) [meters]	4553674.391	699570.988
Easting (X) [meters]	577961.973	1994024.402
Convergence [degrees]	0.61099402	-0.04653761
Point Scale	0.99967480	0.99990791
Combined Factor	0.99954966	0.99978274

US NATIONAL GRID DESIGNATOR: 10TEL7796153674(NAD 83)

		BASE STATIONS USED				
PID	DESIGNATION			LATITUDE	LONGITUDE	DISTANCE(m)
DM7548	P349 WONDERLANDCN2005	CORS	ARP	N404351.894	W1221909.609	49054.3
DN7515	P060 POLLARDFLTCN2005	CORS	ARP	N405951.462	W1222453.528	32451.3
DN7398	P348 HATCHETMTNCN2005	CORS	ARP	N405419.951	W1214940.756	32317.4

		NEAREST NGS PUBLISHED CONTROL POINT		
MW0899	GRIZZLY RM A	N410840.709	W1215843.369	7906.8

Ground Receiver UNIT 2 - 8/29/2013

START: 2013/08/29 12:26:00
STOP: 2013/08/29 17:53:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 49 / 49 : 100%
ARP HEIGHT: 1.7348 OVERALL RMS: 0.012(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6592)

X:	-2554753.309(m)	0.011(m)	-2554754.166(m)	0.011(m)
Y:	-4077288.572(m)	0.008(m)	-4077287.312(m)	0.008(m)
Z:	4174011.138(m)	0.010(m)	4174011.132(m)	0.010(m)
LAT:	41 7 55.64064	0.001(m)	41 7 55.65356	0.001(m)
E LON:	237 55 46.22096	0.005(m)	237 55 46.16115	0.005(m)
W LON:	122 4 13.77904	0.005(m)	122 4 13.83885	0.005(m)
EL HGT:	798.551(m)	0.016(m)	798.085(m)	0.016(m)
ORTHO HGT:	823.069(m)	0.035(m)	[NAVD88 (Computed using GEOID12A)]	

UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 10) SPC (0401 CA 1)

Northing (Y) [meters]	4553840.366	699736.358
Easting (X) [meters]	578017.020	1994081.364
Convergence [degrees]	0.61145750	-0.04609504
Point Scale	0.99967491	0.99990804
Combined Factor	0.99954971	0.99978281

US NATIONAL GRID DESIGNATOR: 10TEL7801753840(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DM7548 P349	WONDERLANDCN2005 CORS ARP	N404351.894	W1221909.609	49228.1
DN7515 P060	POLLARDFLTNCN2005 CORS ARP	N405951.462	W1222453.528	32577.2
DN7398 P348	HATCHETMTNCN2005 CORS ARP	N405419.951	W1214940.756	32409.6

NEAREST NGS PUBLISHED CONTROL POINT

MW0899	GRIZZLY RM A	N410840.709	W1215843.369	7819.8
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Ground Receiver UNIT 1 - 8/30/2013

START: 2013/08/30 12:26:00
STOP: 2013/08/30 20:01:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 74 / 74 : 100%

ARP HEIGHT: 1.6408 OVERALL RMS: 0.011(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6621)

X:	-2554859.098(m)	0.005(m)	-2554859.955(m)	0.005(m)
Y:	-4077350.360(m)	0.005(m)	-4077349.100(m)	0.005(m)
Z:	4173886.247(m)	0.006(m)	4173886.241(m)	0.006(m)
LAT:	41 7 50.27786	0.002(m)	41 7 50.29077	0.002(m)
E LON:	237 55 43.78445	0.001(m)	237 55 43.72464	0.001(m)
W LON:	122 4 16.21555	0.001(m)	122 4 16.27536	0.001(m)
EL HGT:	798.144(m)	0.009(m)	797.678(m)	0.009(m)
ORTHO HGT:	822.672(m)	0.027(m)	[NAVD88 (Computed using GEOID12A)]	

UTM COORDINATES STATE PLANE COORDINATES

	UTM (Zone 10)	SPC (0401 CA 1)
Northing (Y) [meters]	4553674.386	699570.983
Easting (X) [meters]	577961.976	1994024.405
Convergence [degrees]	0.61099404	-0.04653759
Point Scale	0.99967480	0.99990791
Combined Factor	0.99954966	0.99978274

US NATIONAL GRID DESIGNATOR: 10TEL7796153674(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DN7398 P348	HATCHETMTNCN2005 CORS ARP	N405419.951	W1214940.756	32317.4
DK6405 P341	WHISKYTOWNCN2005 CORS ARP	N403902.349	W1223624.785	69859.8
DN7515 P060	POLLARDFLTNCN2005 CORS ARP	N405951.462	W1222453.528	32451.3

NEAREST NGS PUBLISHED CONTROL POINT				
MW0899	GRIZZLY RM A	N410840.709	W1215843.369	7906.7

Ground Receiver UNIT 2 - 8/30/2013

START: 2013/08/30 12:27:00
STOP: 2013/08/30 20:03:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 60 / 60 : 100%

ARP HEIGHT: 1.6298 OVERALL RMS: 0.012(m)

<u>REF FRAME: NAD_83(2011)(EPOCH:2010.0000)</u>				<u>IGS08 (EPOCH:2013.6621)</u>	
X:	-2554753.300(m)	0.010(m)	-2554754.157(m)	0.010(m)	
Y:	-4077288.569(m)	0.001(m)	-4077287.309(m)	0.001(m)	
Z:	4174011.136(m)	0.003(m)	4174011.130(m)	0.003(m)	
LAT:	41 7 55.64075	0.002(m)	41 7 55.65367	0.002(m)	
E LON:	237 55 46.22122	0.008(m)	237 55 46.16141	0.008(m)	
W LON:	122 4 13.77878	0.008(m)	122 4 13.83859	0.008(m)	
EL HGT:	798.544(m)	0.007(m)	798.079(m)	0.007(m)	
ORTHO HGT:	823.062(m)	0.025(m)	[NAVD88 (Computed using GEOID12A)]		

	<u>UTM COORDINATES</u>	<u>STATE PLANE COORDINATES</u>
	<u>UTM (Zone 10)</u>	<u>SPC (0401 CA 1)</u>
Northing (Y) [meters]	4553840.369	699736.361
Easting (X) [meters]	578017.026	1994081.370
Convergence [degrees]	0.61145755	-0.04609499
Point Scale	0.99967491	0.99990804
Combined Factor	0.99954971	0.99978281

US NATIONAL GRID DESIGNATOR: 10TEL7801753840(NAD 83)

<u>BASE STATIONS USED</u>						
<u>PID</u>	<u>DESIGNATION</u>		<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>DISTANCE(m)</u>	
DN7398	P348	HATCHETMTNCN2005	CORS	ARP	N405419.951	W1214940.756 32409.6
DK6405	P341	WHISKYTOWNCN2005	CORS	ARP	N403902.349	W1223624.785 70022.6
DN5668	P663	SHWHALEBAKCN2007	CORS	ARP	N413154.969	W1220910.465 44969.8

<u>NEAREST NGS PUBLISHED CONTROL POINT</u>			
MW0899	GRIZZLY RM A	N410840.709	W1215843.369 7819.8

Ground Receiver UNIT 1 - 8/31/2013

START: 2013/08/31 12:26:00

STOP: 2013/08/31 17:39:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 61 / 61 : 100%

ARP HEIGHT: 1.7638 OVERALL RMS: 0.011(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000)

IGS08 (EPOCH:2013.6647)

X:	-2554859.097(m)	0.006(m)	-2554859.955(m)	0.006(m)
Y:	-4077350.358(m)	0.005(m)	-4077349.098(m)	0.005(m)
Z:	4173886.248(m)	0.004(m)	4173886.242(m)	0.004(m)
LAT:	41 7 50.27793	0.006(m)	41 7 50.29083	0.006(m)
E LON:	237 55 43.78444	0.005(m)	237 55 43.72459	0.005(m)
W LON:	122 4 16.21556	0.005(m)	122 4 16.27541	0.005(m)
EL HGT:	798.143(m)	0.006(m)	797.678(m)	0.006(m)
ORTHO HGT:	822.671(m)	0.024(m)	[NAVD88 (Computed using GEOID12A)]	

UTM COORDINATES STATE PLANE COORDINATES

	UTM (Zone 10)	SPC (0401 CA 1)
Northing (Y) [meters]	4553674.388	699570.985
Easting (X) [meters]	577961.975	1994024.405
Convergence [degrees]	0.61099404	-0.04653759
Point Scale	0.99967480	0.99990791
Combined Factor	0.99954966	0.99978274

US NATIONAL GRID DESIGNATOR: 10TEL7796153674(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DM7548 P349	WONDERLANDCN2005 CORS ARP	N404351.894	W1221909.609	49054.3
DN7515 P060	POLLARDFLTCN2005 CORS ARP	N405951.462	W1222453.528	32451.3
DN7398 P348	HATCHETMTNCN2005 CORS ARP	N405419.951	W1214940.756	32317.4

NEAREST NGS PUBLISHED CONTROL POINT

MW0899	GRIZZLY RM A	N410840.709	W1215843.369	7906.7
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Ground Receiver UNIT 2 - 8/31/2013

START: 2013/08/31 12:20:00
STOP: 2013/08/31 17:42:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 63 / 63 : 100%

ARP HEIGHT: 1.7128 OVERALL RMS: 0.011(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6647)

X:	-2554753.312(m)	0.008(m)	-2554754.170(m)	0.008(m)
Y:	-4077288.579(m)	0.016(m)	-4077287.319(m)	0.016(m)
Z:	4174011.143(m)	0.009(m)	4174011.137(m)	0.009(m)
LAT:	41 7 55.64061	0.006(m)	41 7 55.65351	0.006(m)
E LON:	237 55 46.22101	0.002(m)	237 55 46.16117	0.002(m)
W LON:	122 4 13.77899	0.002(m)	122 4 13.83883	0.002(m)
EL HGT:	798.560(m)	0.020(m)	798.095(m)	0.020(m)
ORTHO HGT:	823.078(m)	0.040(m)	[NAVD88 (Computed using GEOID12A)]	

UTM COORDINATES STATE PLANE COORDINATES

	<u>UTM (Zone 10)</u>	<u>SPC (0401 CA 1)</u>
Northing (Y) [meters]	4553840.365	699736.357
Easting (X) [meters]	578017.021	1994081.365
Convergence [degrees]	0.61145751	-0.04609503
Point Scale	0.99967491	0.99990804
Combined Factor	0.99954971	0.99978281

US NATIONAL GRID DESIGNATOR: 10TEL7801753840(NAD 83)

BASE STATIONS USED

<u>PID</u>	<u>DESIGNATION</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>DISTANCE(m)</u>
DN7515	P060 POLLARDFLTNCN2005 CORS ARP	N405951.462	W1222453.528	32577.2
DN7398	P348 HATCHETMTNCN2005 CORS ARP	N405419.951	W1214940.756	32409.6
DK6405	P341 WHISKYTOWNCN2005 CORS ARP	N403902.349	W1223624.785	70022.6

NEAREST NGS PUBLISHED CONTROL POINT

MW0899	GRIZZLY RM A	N410840.709	W1215843.369	7819.8
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Ground Receiver UNIT 1 - 9/01/2013

START: 2013/09/01 12:23:00

STOP: 2013/09/01 16:23:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 51 / 53 : 96%

ARP HEIGHT: 1.7528 OVERALL RMS: 0.012(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6674)

X:	-2554859.100(m)	0.014(m)	-2554859.958(m)	0.014(m)
Y:	-4077350.356(m)	0.015(m)	-4077349.096(m)	0.015(m)
Z:	4173886.247(m)	0.018(m)	4173886.241(m)	0.018(m)
LAT:	41 7 50.27791	0.003(m)	41 7 50.29081	0.003(m)
E LON:	237 55 43.78429	0.006(m)	237 55 43.72444	0.006(m)
W LON:	122 4 16.21571	0.006(m)	122 4 16.27556	0.006(m)
EL HGT:	798.142(m)	0.027(m)	797.677(m)	0.027(m)
ORTHO HGT:	822.670(m)	0.051(m)	[NAVD88 (Computed using GEOID12A)]	

UTM COORDINATES STATE PLANE COORDINATES

	UTM (Zone 10)	SPC (0401 CA 1)
Northing (Y) [meters]	4553674.388	699570.984
Easting (X) [meters]	577961.972	1994024.401
Convergence [degrees]	0.61099401	-0.04653762
Point Scale	0.99967480	0.99990791
Combined Factor	0.99954966	0.99978274

US NATIONAL GRID DESIGNATOR: 10TEL7796153674(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DM7548 P349	WONDERLANDCN2005 CORS ARP	N404351.894	W1221909.609	49054.3
DN7515 P060	POLLARDFLTCN2005 CORS ARP	N405951.462	W1222453.528	32451.3
DN7398 P348	HATCHETMTNCN2005 CORS ARP	N405419.951	W1214940.756	32317.4

NEAREST NGS PUBLISHED CONTROL POINT

MW0899	GRIZZLY RM A	N410840.709	W1215843.369	7906.8
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Ground Receiver UNIT 2 - 9/01/2013

START: 2013/09/01 12:25:00
STOP: 2013/09/01 16:27:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 39 / 40 : 98%

ARP HEIGHT: 1.6938 OVERALL RMS: 0.012(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6674)

X:	-2554753.315(m)	0.020(m)	-2554754.173(m)	0.020(m)
Y:	-4077288.584(m)	0.028(m)	-4077287.324(m)	0.028(m)
Z:	4174011.141(m)	0.011(m)	4174011.135(m)	0.011(m)
LAT:	41 7 55.64043	0.014(m)	41 7 55.65334	0.014(m)
E LON:	237 55 46.22102	0.003(m)	237 55 46.16117	0.003(m)
W LON:	122 4 13.77898	0.003(m)	122 4 13.83883	0.003(m)
EL HGT:	798.563(m)	0.033(m)	798.098(m)	0.033(m)
ORTHO HGT:	823.081(m)	0.060(m)	[NAVD88 (Computed using GEOID12A)]	

UTM COORDINATES STATE PLANE COORDINATES

	UTM (Zone 10)	SPC (0401 CA 1)
Northing (Y) [meters]	4553840.359	699736.352
Easting (X) [meters]	578017.021	1994081.365
Convergence [degrees]	0.61145751	-0.04609503
Point Scale	0.99967491	0.99990804
Combined Factor	0.99954971	0.99978281

US NATIONAL GRID DESIGNATOR: 10TEL7801753840(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DK6405 P341	WHISKYTOWNCN2005 CORS ARP	N403902.349	W1223624.785	70022.6
DN7515 P060	POLLARDFLTCN2005 CORS ARP	N405951.462	W1222453.528	32577.2
DN7398 P348	HATCHETMTNCN2005 CORS ARP	N405419.951	W1214940.756	32409.6

NEAREST NGS PUBLISHED CONTROL POINT

MW0899	GRIZZLY RM A	N410840.709	W1215843.369	7819.8
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2. GROUND TRUTH SUMMARY

Surveys were conducted to establish ground truth data at representative sites throughout the project area. These sites were selected on the basis of the optimizing visibility needed for the LIDAR survey over the area.

BAGLEY CREEK LIDAR 2013 / DIGITAL MAPPING INC./ UTM 10-Metric

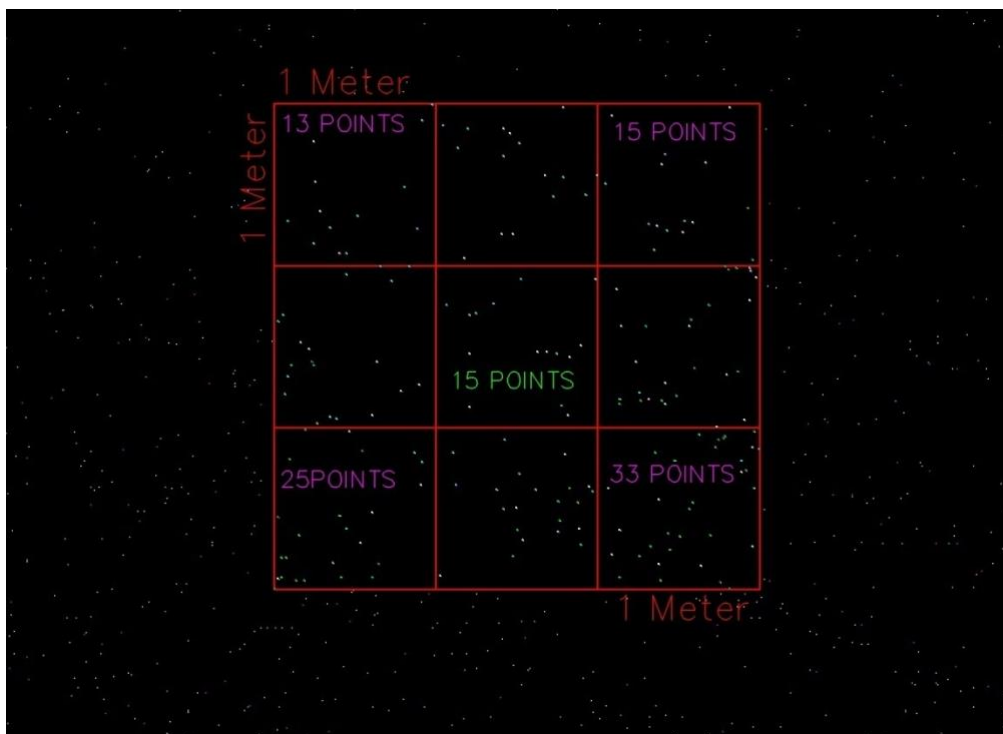
<u>AERIAL POINT#</u>	<u>LATITUDE</u>	<u>LONGITUDE</u>	<u>NORTH (M)</u>	<u>EAST (M)</u>	<u>TARGET ELEV.</u>	<u>DESCRIPTION</u>
BAG 1	40°56'56.92169" N	122°04'16.33686" W	4533526.976	578173.606	487.579	SET 60D SPIKE
BAG 2	40°57'30.18144" N	122°01'28.20957" W	4534595.401	582092.967	947.235	SET 60D SPIKE
BAG 3	40°59'56.74695" N	122°07'30.18156" W	4539025.371	573586.007	1135.723	SET 60D SPIKE
BAG 7	41°01'12.12774" N	122°08'10.26797" W	4541340.528	572626.501	1136.362	SET 60D SPIKE
BAG 8	41°01'50.71578" N	122°06'55.99693" W	4542547.823	574349.032	1263.455	SET 60D SPIKE
BAG 8A	41°03'48.30907" N	122°07'20.82200" W	4546168.163	573732.866	898.300	SET 60D SPIKE
BAG 9	41°02'10.65968" N	122°04'31.48322" W	4543197.802	577717.068	917.963	SET 60D SPIKE
BAG 10	41°01'22.07639" N	122°01'23.47483" W	4541747.478	582123.676	925.739	SET 60D SPIKE
BAG 11B	41°05'29.00629" N	122°07'48.89314" W	4549266.788	573046.725	599.149	SET 60D SPIKE
BAG 12	41°04'16.49676" N	122°05'15.19438" W	4547067.473	576655.861	1360.684	SET 60D SPIKE
BAG 13	41°02'34.35281" N	122°02'30.86569" W	4543958.803	580525.363	771.945	SET 60D SPIKE
BAG 14	41°01'03.42971" N	121°58'47.27297" W	4541214.206	585778.332	937.910	SET 60D SPIKE
BAG 15	41°05'24.08927" N	122°02'28.82043" W	4549193.478	580515.576	1160.567	SET 60D SPIKE
BAG 16	41°04'52.55706" N	122°02'26.82655" W	4548221.631	580572.793	1267.527	SET 60D SPIKE
BAG 17	41°02'50.95436" N	122°00'05.47710" W	4544508.803	583913.872	811.077	SET 60D SPIKE
BAG 19	41°02'47.47202" N	121°58'20.26644" W	4544429.940	586371.309	892.007	SET 60D SPIKE
BAG 20	41°07'03.06573" N	122°03'39.76396" W	4552227.609	578827.566	744.390	SET 60D SPIKE
BAG 20A	41°06'36.17038" N	122°06'01.08997" W	4551363.456	575540.350	655.570	SET 60D SPIKE
BAG 21	41°03'29.15274" N	121°58'59.48637" W	4545704.517	585440.713	870.095	SET 60D SPIKE
BAG 22	41°05'47.52139" N	122°00'10.12344" W	4549952.360	583743.137	1118.767	SET 60D SPIKE
BAG 23	41°05'59.32991" N	121°58'22.90017" W	4550345.547	586240.141	1182.147	SET 60D SPIKE

3. DATA ANALYSIS

Data analysis was accomplished by comparing ground truth checkpoints with LIDAR points from the edited data set. The only exception to this were the ground truth points collected under the tree/forest canopy, where comparisons were made with LIDAR pulses that fell near known positions. This is because fewer LIDAR pulses are able to reach the ground in heavily forested areas, so the point spacing is larger than in cleared areas.

The base stations used to collect survey data were included in the static GPS network, and were selected on the basis of their having an unobstructed view of the sky, as well as being in a location considered favorable for collecting ground truth data. The vertical and horizontal accuracy of each base station was determined by the statistical tests performed in the least squares adjustment process.

Note that the edited LIDAR points are simply a subset of the raw LIDAR points. The points that fell above the ground surface on vegetation canopies, buildings, or other obstructions were removed from the data set. Comparisons were also made between the survey points and the LIDAR derived terrain surface. These comparisons provide an additional verification of the LIDAR data against the survey data.



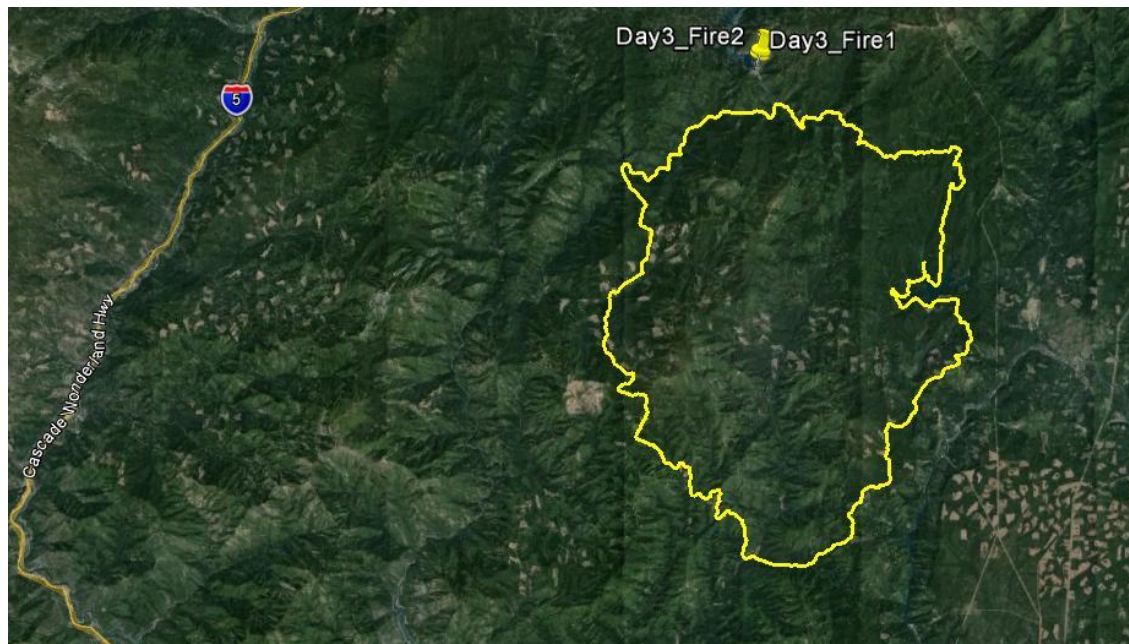
ONE METER SQUARE > 9 points

LIDAR POINT CHECK

Our ground control check from QA/QC supported in attached documents

4. GROUND TRUTH SURVEY

A. Map of Control Point Locations/ Base Station



B. Ground Truth Analysis of LIDAR Points

GROUND TRUTH ANALYSIS

Comparison of LIDAR Points to Ground Truth Points

GeoCue software was used to compare known , position established and occupied for twenty-minutes , control points versus identical position of LiDAR XYZ point data. The intensity image produced from the *LIDAR collection*, was used to pick areas where ground and truth data collection could be collected. In areas of flat terrain or areas where detail is important it can be used as areas to collect X,Y,Z ground truth data for accessing the accuracy of the LIDAR data. Ground truth data can be collected using conventional survey techniques or DGPS techniques.

SPATIAL REFERENCE FRAMEWORK

Vertical Datum **NAVD88, Geoid12A**
Horizontal Datum **NAD83**
Projection **UTM Zone 10**
Units **METERS**

Ground Control Z vs. Aerial Surveyed/ Laser Pointing Z (QA/QC)

Number	Easting	Northing	Known Z	Laser Z	Dz
BAG1	578173.606	4533526.976	487.579	487.530	-0.049
BAG2	582092.967	4534595.401	947.235	947.270	+0.035
BAG3	573586.007	4539025.371	1135.723	1135.750	+0.027
BAG7	572626.501	4541340.528	1136.362	1136.330	-0.032
BAG8	574349.032	4542547.823	1263.455	1263.610	+0.155
BAG8A	573732.866	4546168.163	898.300	898.190	-0.110
BAG9	577717.068	4543197.802	917.963	917.930	-0.033
BAG10	582123.676	4541747.478	925.739	925.660	-0.079
BAG11B	573046.725	4549266.788	599.149	599.080	-0.069
BAG12	576655.861	4547067.473	1360.684	1360.630	-0.054
BAG13	580525.363	4543958.803	771.945	771.860	-0.085
BAG14	585778.332	4541214.206	937.910	937.920	+0.010
BAG15	580515.576	4549193.478	1160.567	1160.590	+0.023
BAG16	580572.793	4548221.631	1267.527	1267.560	+0.033
BAG17	583913.872	4544508.803	811.077	811.030	-0.047
BAG19	586371.309	4544429.940	892.007	892.030	+0.023
BAG20	578827.566	4552227.609	744.390	744.380	-0.010
BAG20A	575540.350	4551363.456	655.570	655.470	-0.100
BAG23	586240.141	4550345.547	1182.147	1182.190	+0.043

Average dz -0.017
Minimum dz -0.110
Maximum dz +0.155
Average magnitude 0.054
Root mean square 0.065
Std deviation 0.064

