# *GROUND CONTROL SURVEY REPORT*
# *Squaw Creek*

## GPS SURVEY FOR LIDAR CONTROL

**CONTENTS**

# 1. ABSTRACT

This report documents the GPS ground surveys conducted in support of LIDAR data collection for Squaw Creek. The surveyed ground control was established on August 20, August 31 and September 1, 2013 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 8 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:** | **760 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** |
| **PPM2M.:** | **4.21** |

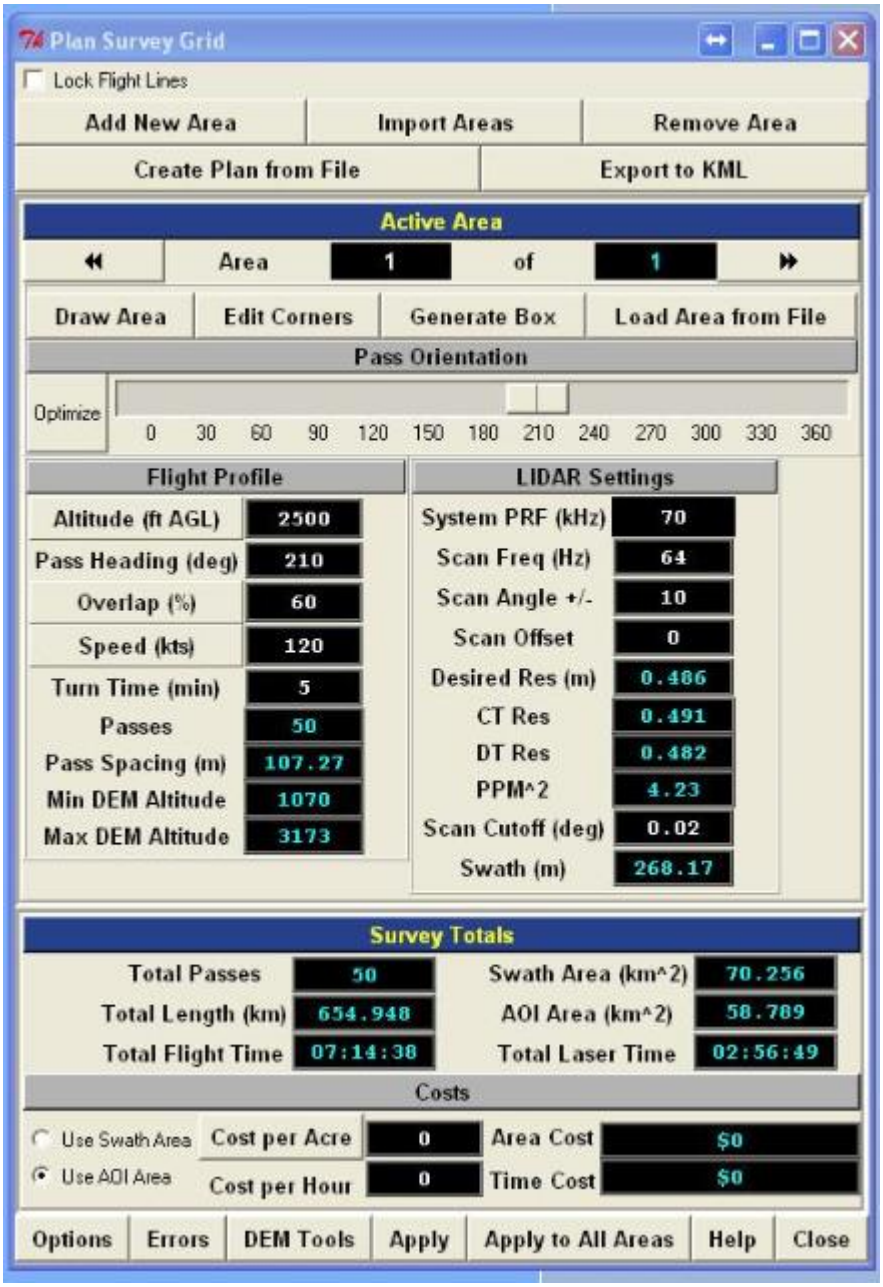
The actual local flight times and duration of flights were controlled by fuel consumption of the aircraft, safety of flight operations in the particular airspace and during times when the GPS constellation was most favorable, producing the highest number of satellites visible in the best geometric configuration 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 truths 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.

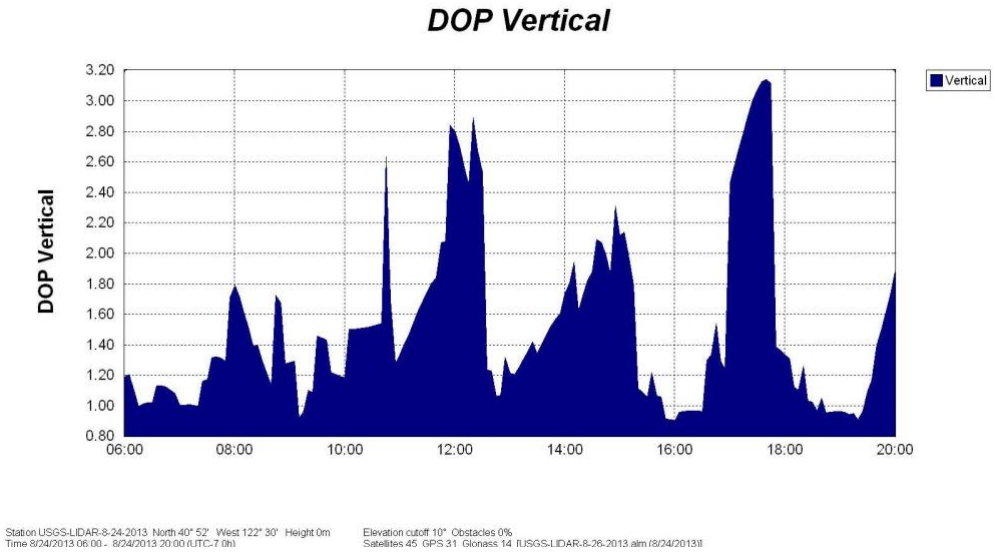
The horizontal and vertical data used for this project are listed below:

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




**LiDAR MISSION PARAMETERS**

**DMI always checked PDOP before commencing flight (weather permitting) – *next page* shows data collection and dates with PDOP report (August 24, 26, 27)**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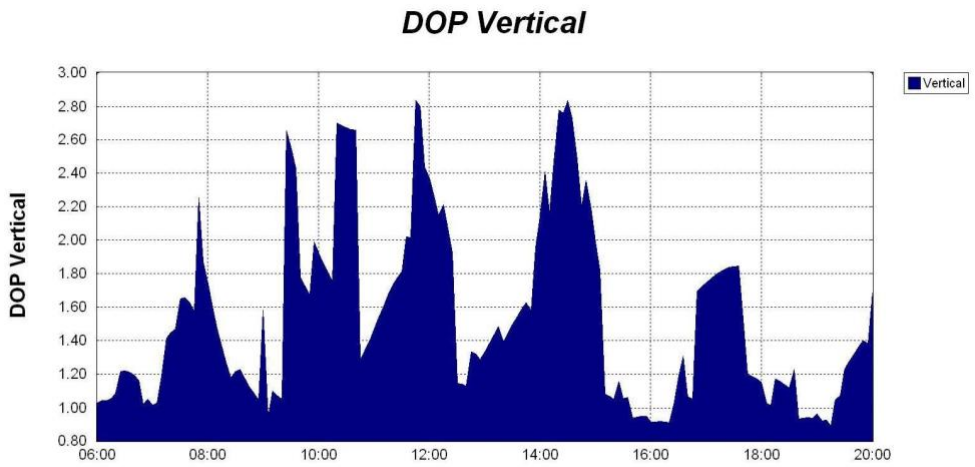
Station USGS-LIDAR-8-24-2013 North 40° 52' West 122° 30' Height 0m
Time 8/24/2013 06:00 - 8/24/2013 20:00 (UTC-7.0h)
Elevation cutoff 10° Obstacles 0%
Satellites 45 GPS 31 Glonass 14 [USGS-LIDAR-8-26-2013.alm (8/24/2013)]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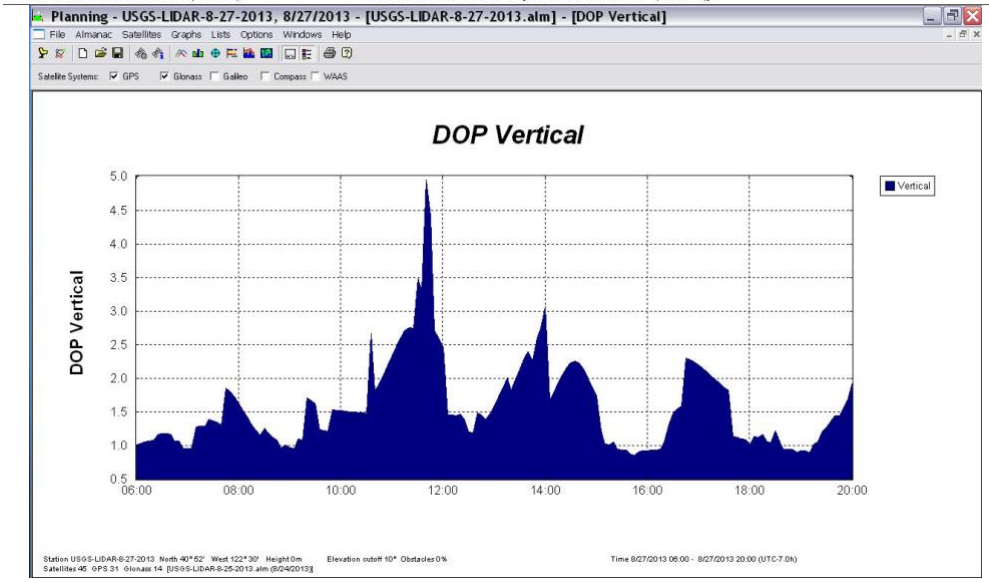
Station USGS-LIDAR-8-26-2013 North 40° 52' West 122° 30' Height 0m
Time 8/26/2013 06:00 - 8/26/2013 20:00 (UTC-7.0h)
Elevation cutoff 10° Obstacles 0%
Satellites 45 GPS 31 Glonass 14 [USGS-LIDAR-8-24-2013.alm (8/24/2013)]


Planning - USGS-LIDAR-8-27-2013, 8/27/2013 - [USGS-LIDAR-8-27-2013.alm] - [DOP Vertical]
File Almanac Satellites Graphs Lists Options Windows Help
Satellite Systems: GPS Glonass Galileo Compass WAAS
DOP Vertical
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06:00
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14:00
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20:00
Station USGS-LIDAR-8-27-2013 North 40° 52' West 122° 30' Height 0m
Satellites 45 GPS 31 Glonass 14 [USGS-LIDAR-8-25-2013.alm (8/24/2013)]
Elevation cutoff 10° Obstacles 0%
Time 8/27/2013 06:00 - 8/27/2013 20:00 (UTC-7.0h)

# SBET IMAGES and FLIGHT LINES/Tiling Algorithm


**FINAL TRAJECTOR COVERGES FLIGHTS DATE 8-24, 26AM AND 26PM, 2013 FLIGHTS**

# 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.

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

SQUAW CREEK LIDAR 2013 / DIGITAL MAPPING INC./ UTM 10

| AERIAL POINT# | LATITUDE | LONGITUDE | NORTH (M) | EAST (M) | TARGET ELEV. | DESCRIPTION |
|---|---|---|---|---|---|---|
| SQU 1 | 40°47'50.40653" N | 122°11'26.88610" W | 4516574.711 | 568263.181 | 327.987 | SET 60D SPIKE |
| SQU 2 | 40°48'59.25752" N | 122°08'54.26254" W | 4518731.631 | 571819.033 | 309.771 | SET 60D SPIKE |
| SQU 2A | 40°47'25.43317" N | 122°08'51.32665" W | 4515839.187 | 571915.939 | 537.935 | SET 60D SPIKE |
| SQU 3 | 40°48'45.65821" N | 122°09'47.88018" W | 4518300.193 | 570566.957 | 350.304 | SET 60D SPIKE |
| SQU 5 | 40°51'54.46428" N | 122°06'56.18226" W | 4524161.640 | 574530.715 | 374.368 | SET 60D SPIKE |
| SQU 6 | 40°52'25.13293" N | 122°07'59.17008" W | 4525092.587 | 573046.839 | 472.123 | SET 60D SPIKE |
| SQU 7 | 40°54'43.23503" N | 122°06'59.87592" W | 4529364.966 | 574391.722 | 443.121 | SET 60D SPIKE |
| BAG 1 | 40°56'56.92169" N | 122°04'16.33686" W | 4533526.976 | 578173.606 | 487.579 | SET 60D SPIKE |

**CORS SITES USED (PLEASE REFER TO OPUS DATA SHEETS)**

SQUAW CREEK LIDAR 2013 / DIGITAL MAPPING INC./ UTM 10/GROUND CONTROL DURING FLIGHT

| | | | | | | |
|---|---|---|---|---|---|---|
| 1AB HIRZ 1 | 40°51'51.19610" N | 122°15'15.95296" W | 4523951.975 | 562832.221 | 339.969 | SET CONCETE NAIL |
| 1AB HIRZ 2 | 40°51'49.76023" N | 122°15'17.68519" W | 4523907.354 | 562792.047 | 337.897 | SET CONCETE NAIL |
| 2AB HIRZ 1 AM | 40°51'51.19615" N | 122°15'15.95295" W | 4523951.977 | 562832.222 | 339.961 | SET CONCETE NAIL |
| 2AB HIRZ 2 AM | 40°51'49.76016" N | 122°15'17.68533" W | 4523907.352 | 562792.044 | 337.913 | SET CONCETE NAIL |
| 2AB HIRZ 1 PM | 40°51'51.19637" N | 122°15'15.95282" W | 4523951.984 | 562832.225 | 339.941 | SET CONCETE NAIL |
| 2AB HIRZ 2 PM | 40°51'49.76036" N | 122°15'17.68524" W | 4523907.358 | 562792.046 | 337.903 | SET CONCETE NAIL |

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

## Ground Receiver UNIT 1 - 8/25/2013

START: 2013/08/25 15:04:00
STOP: 2013/08/25 18:17:30

ANT NAME: LEIAX1202 NONE # FIXED AMB: 42 / 45 : 93%

ARP HEIGHT: 1.6648 OVERALL RMS: 0.012(m)

**REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6485)**

| | | | | |
|---|---|---|---|---|
| X: | -2578051.511(m) | 0.003(m) | -2578052.373(m) | 0.003(m) |
| Y: | -4085264.187(m) | 0.011(m) | -4085262.923(m) | 0.011(m) |
| Z: | 4151236.856(m) | 0.008(m) | 4151236.847(m) | 0.008(m) |
| LAT: | 40 51 51.19610 | 0.001(m) | 40 51 51.20879 | 0.001(m) |
| E LON: | 237 44 44.04704 | 0.004(m) | 237 44 43.98711 | 0.004(m) |
| W LON: | 122 15 15.95296 | 0.004(m) | 122 15 16.01289 | 0.004(m) |
| EL HGT: | 313.826(m) | 0.013(m) | 313.359(m) | 0.013(m) |
| ORTHO HGT: | 339.969(m) | 0.032(m) | [NAVD88 (Computed using GEOID12A)] | |

**UTM COORDINATES STATE PLANE COORDINATES**

| | UTM (Zone 10) | SPC (0401 CA 1) |
|---|---|---|
| Northing (Y) [meters] | 4523951.975 | 670016.631 |
| Easting (X) [meters] | 562832.221 | 1978551.787 |
| Convergence [degrees] | 0.48781813 | -0.16636868 |
| Point Scale | 0.99964859 | 0.99989477 |
| Combined Factor | 0.99959938 | 0.99984555 |

US NATIONAL GRID DESIGNATOR: 10TEL6283223951(NAD 83)

**BASE STATIONS USED**

| PID | DESIGNATION | LATITUDE | LONGITUDE | DISTANCE(m) |
|---|---|---|---|---|
| DN7515 | P060 POLLARDFLTCN2005 CORS ARP | N405951.462 | W1222453.528 | 20053.4 |
| DN7393 | P345 HOOKERDOMECN2005 CORS ARP | N401616.430 | W1221614.848 | 65865.8 |
| DM7548 | P349 WONDERLANDCN2005 CORS ARP | N404351.894 | W1221909.609 | 15767.9 |

NEAREST NGS PUBLISHED CONTROL POINT
DL9212 HIRZ N405149.437 W1221518.561 81.7

# Ground Receiver UNIT 2 - 8/25/2013

START: 2013/08/25 14:59:00
STOP: 2013/08/25 18:15:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 34 / 42 : 81%

ARP HEIGHT: 1.6778 OVERALL RMS: 0.012(m)

**REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6485)**

| | | |
|---|---|---|
| X: | -2578100.449(m) 0.004(m) | -2578101.311(m) 0.004(m) |
| Y: | -4085265.718(m) 0.004(m) | -4085264.454(m) 0.004(m) |
| Z: | 4151202.000(m) 0.006(m) | 4151201.991(m) 0.006(m) |
| LAT: | 40 51 49.76023 0.002(m) | 40 51 49.77292 0.002(m) |
| E LON: | 237 44 42.31481 0.002(m) | 237 44 42.25488 0.002(m) |
| W LON: | 122 15 17.68519 0.002(m) | 122 15 17.74512 0.002(m) |
| EL HGT: | 311.752(m) 0.008(m) | 311.285(m)0.008(m) |
| ORTHO HGT: | 337.897(m) 0.026(m) [NAVD88 (Computed using GEOID12A)] | |

| | UTM COORDINATES<br>UTM (Zone 10) | STATE PLANE COORDINATES<br>SPC (0401 CA 1) |
|---|---|---|
| Northing (Y) [meters] | 4523907.354 | 669972.461 |
| Easting (X) [meters] | 562792.047 | 1978511.096 |
| Convergence [degrees] | 0.48749936 | -0.16668332 |
| Point Scale | 0.99964853 | 0.99989476 |
| Combined Factor | 0.99959965 | 0.99984587 |

US NATIONAL GRID DESIGNATOR: 10TEL6279223907(NAD 83)

**BASE STATIONS USED**

| PID | DESIGNATION | LATITUDE | LONGITUDE | DISTANCE(m) |
|---|---|---|---|---|
| DN7515 | P060 POLLARDFLTCN2005 CORS ARP | N405951.462 | W1222453.528 | 20059.0 |
| DK6405 | P341 WHISKYTOWNCN2005 CORS ARP | N403902.349 | W1223624.785 | 37998.9 |
| DN7398 | P348 HATCHETMTNCN2005 CORS ARP | N405419.951 | W1214940.756 | 36309.9 |

NEAREST NGS PUBLISHED CONTROL POINT
DL9212 HIRZ N405149.437 W1221518.561 22.8

# Ground Receiver UNIT 1 - 8/26/2013

START: 2013/08/26 12:44:00
STOP: 2013/08/26 18:38:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 78 / 82 : 95%

ARP HEIGHT: 1.7278 OVERALL RMS: 0.014(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6511)

| | | |
|---|---|---|
| X: | -2578051.507(m) 0.009(m) | -2578052.369(m) 0.009(m) |
| Y: | -4085264.181(m) 0.004(m) | -4085262.917(m) 0.004(m) |
| Z: | 4151236.852(m) 0.010(m) | 4151236.843(m) 0.010(m) |
| LAT: | 40 51 51.19615 0.003(m) | 40 51 51.20884 0.003(m) |
| E LON: | 237 44 44.04705 0.007(m) | 237 44 43.98712 0.007(m) |
| W LON: | 122 15 15.95295 0.007(m) | 122 15 16.01288 0.007(m) |
| EL HGT: | 313.818(m) 0.012(m) | 313.351(m) 0.012(m) |
| ORTHO HGT: | 339.961(m) 0.030(m) [NAVD88 (Computed using GEOID12A)] | |

| | UTM COORDINATES<br>UTM (Zone 10) | STATE PLANE COORDINATES<br>SPC (0401 CA 1) |
|---|---|---|
| Northing (Y) [meters] | 4523951.977 | 670016.633 |
| Easting (X) [meters] | 562832.222 | 1978551.788 |
| Convergence [degrees] | 0.48781814 | -0.16636868 |
| Point Scale | 0.99964859 | 0.99989477 |
| Combined Factor | 0.99959938 | 0.99984555 |

US NATIONAL GRID DESIGNATOR: 10TEL6283223951(NAD 83)

BASE STATIONS USED

| PID | DESIGNATION | LATITUDE | LONGITUDE | DISTANCE(m) |
|---|---|---|---|---|
| DM7548 | P349 WONDERLANDCN2005 CORS ARP | N404351.894 | W1221909.609 | 15767.9 |
| DK6405 | P341 WHISKYTOWNCN2005 CORS ARP | N403902.349 | W1223624.785 | 38058.2 |
| DN7515 | P060 POLLARDFLTCN2005 CORS ARP | N405951.462 | W1222453.528 | 20053.4 |

NEAREST NGS PUBLISHED CONTROL POINT
DL9212 HIRZ N405149.437 W1221518.561 81.7

# Ground Receiver UNIT 2 - 8/26/2013

START: 2013/08/26 12:51:00
STOP: 2013/08/26 18:35:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 81 / 88 : 92%

ARP HEIGHT: 1.6738 OVERALL RMS: 0.014(m)

**REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6511)**

| | | |
|---|---|---|
| X: | -2578100.459(m) 0.017(m) | -2578101.321(m) 0.017(m) |
| Y: | -4085265.728(m) 0.009(m) | -4085264.464(m) 0.009(m) |
| Z: | 4151202.009(m) 0.010(m) | 4151202.000(m) 0.010(m) |
| LAT: | 40 51 49.76016 0.004(m) | 40 51 49.77285 0.004(m) |
| E LON: | 237 44 42.31467 0.010(m) | 237 44 42.25474 0.010(m) |
| W LON: | 122 15 17.68533 0.010(m) | 122 15 17.74526 0.010(m) |
| EL HGT: | 311.768(m) 0.017(m) | 311.301(m) 0.017(m) |
| ORTHO HGT: | 337.913(m) 0.036(m) | [NAVD88 (Computed using GEOID12A)] |

| | UTM COORDINATES | STATE PLANE COORDINATES |
|---|---|---|
| | UTM (Zone 10) | SPC (0401 CA 1) |
| Northing (Y) [meters] | 4523907.352 | 669972.459 |
| Easting (X) [meters] | 562792.044 | 1978511.093 |
| Convergence [degrees] | 0.48749934 | -0.16668334 |
| Point Scale | 0.99964853 | 0.99989476 |
| Combined Factor | 0.99959964 | 0.99984586 |

US NATIONAL GRID DESIGNATOR: 10TEL6279223907(NAD 83)

**BASE STATIONS USED**

| PID | DESIGNATION | LATITUDE | LONGITUDE | DISTANCE(m) |
|---|---|---|---|---|
| DN7393 | P345 HOOKERDOMECN2005 CORS ARP | N401616.430 | W1221614.848 | 65820.7 |
| DM7548 | P349 WONDERLANDCN2005 CORS ARP | N404351.894 | W1221909.609 | 15712.3 |
| DN7398 | P348 HATCHETMTNCN2005 CORS ARP | N405419.951 | W1214940.756 | 36309.9 |

NEAREST NGS PUBLISHED CONTROL POINT
DL9212 HIRZ N405149.437 W1221518.561 22.8

# Ground Receiver UNIT 1 - 8/27/2013

START: 2013/08/26 23:57:00
STOP: 2013/08/27 02:19:30

ANT NAME: LEIAX1202 NONE # FIXED AMB: 31 / 31 : 100%

ARP HEIGHT: 1.6358 OVERALL RMS: 0.013(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6522)

| | | |
|---|---|---|
| X: | -2578051.494(m) 0.008(m) | -2578052.356(m) 0.008(m) |
| Y: | -4085264.166(m) 0.009(m) | -4085262.902(m) 0.009(m) |
| Z: | 4151236.844(m) 0.001(m) | 4151236.835(m) 0.001(m) |
| LAT: | 40 51 51.19637 0.007(m) | 40 51 51.20906 0.007(m) |
| E LON: | 237 44 44.04718 0.007(m) | 237 44 43.98725 0.007(m) |
| W LON: | 122 15 15.95282 0.007(m) | 122 15 16.01275 0.007(m) |
| EL HGT: | 313.798(m) 0.008(m) | 313.331(m) 0.008(m) |
| ORTHO HGT: | 339.941(m) 0.026(m) | [NAVD88 (Computed using GEOID12A)] |

| | UTM COORDINATES<br>UTM (Zone 10) | STATE PLANE COORDINATES<br>SPC (0401 CA 1) |
|---|---|---|
| Northing (Y) [meters] | 4523951.984 | 670016.640 |
| Easting (X) [meters] | 562832.225 | 1978551.791 |
| Convergence [degrees] | 0.48781816 | -0.16636866 |
| Point Scale | 0.99964859 | 0.99989477 |
| Combined Factor | 0.99959939 | 0.99984555 |

US NATIONAL GRID DESIGNATOR: 10TEL6283223951(NAD 83)

BASE STATIONS USED

| PID | DESIGNATION | LATITUDE | LONGITUDE | DISTANCE(m) |
|---|---|---|---|---|
| DN7515 | P060 POLLARDFLTCN2005 CORS ARP | N405951.462 | W1222453.528 | 20053.4 |
| DK6405 | P341 WHISKYTOWNCN2005 CORS ARP | N403902.349 | W1223624.785 | 38058.3 |
| DM7548 | P349 WONDERLANDCN2005 CORS ARP | N404351.894 | W1221909.609 | 15767.9 |

NEAREST NGS PUBLISHED CONTROL POINT
DL9212 HIRZ N405149.437 W1221518.561 81.7

# Ground Receiver UNIT 2 - 8/27/2013

START: 2013/08/27 00:03:00
STOP: 2013/08/27 02:22:00

ANT NAME: LEIAX1202 NONE # FIXED AMB: 39 / 41 : 95%

ARP HEIGHT: 1.7188 OVERALL RMS: 0.014(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) IGS08 (EPOCH:2013.6522)

| | | | | |
|---|---|---|---|---|
| X: | -2578100.451(m) | 0.007(m) | -2578101.313(m) | 0.007(m) |
| Y: | -4085265.719(m) | 0.015(m) | -4085264.455(m) | 0.015(m) |
| Z: | 4151202.007(m) | 0.001(m) | 4151201.998(m) | 0.001(m) |
| LAT: | 40 51 49.76036 | 0.006(m) | 40 51 49.77305 | 0.006(m) |
| E LON: | 237 44 42.31476 | 0.014(m) | 237 44 42.25483 | 0.014(m) |
| W LON: | 122 15 17.68524 | 0.014(m) | 122 15 17.74517 | 0.014(m) |
| EL HGT: | 311.758(m) | 0.007(m) | 311.291(m) | 0.007(m) |
| ORTHO HGT: | 337.903(m) | 0.025(m) | [NAVD88 (Computed using GEOID12A)] | |

| | UTM COORDINATES | STATE PLANE COORDINATES |
|---|---|---|
| | UTM (Zone 10) | SPC (0401 CA 1) |
| Northing (Y) [meters] | 4523907.358 | 669972.465 |
| Easting (X) [meters] | 562792.046 | 1978511.095 |
| Convergence [degrees] | 0.48749935 | -0.16668333 |
| Point Scale | 0.99964853 | 0.99989476 |
| Combined Factor | 0.99959965 | 0.99984586 |

US NATIONAL GRID DESIGNATOR: 10TEL6279223907(NAD 83)

BASE STATIONS USED

| PID | DESIGNATION | LATITUDE | LONGITUDE | DISTANCE(m) |
|---|---|---|---|---|
| DK6405 | P341 WHISKYTOWNCN2005 CORS ARP | N403902.349 | W1223624.785 | 37998.9 |
| DN7398 | P348 HATCHETMTNCN2005 CORS ARP | N405419.951 | W1214940.756 | 36309.9 |
| DM7548 | P349 WONDERLANDCN2005 CORS ARP | N404351.894 | W1221909.609 | 15712.3 |

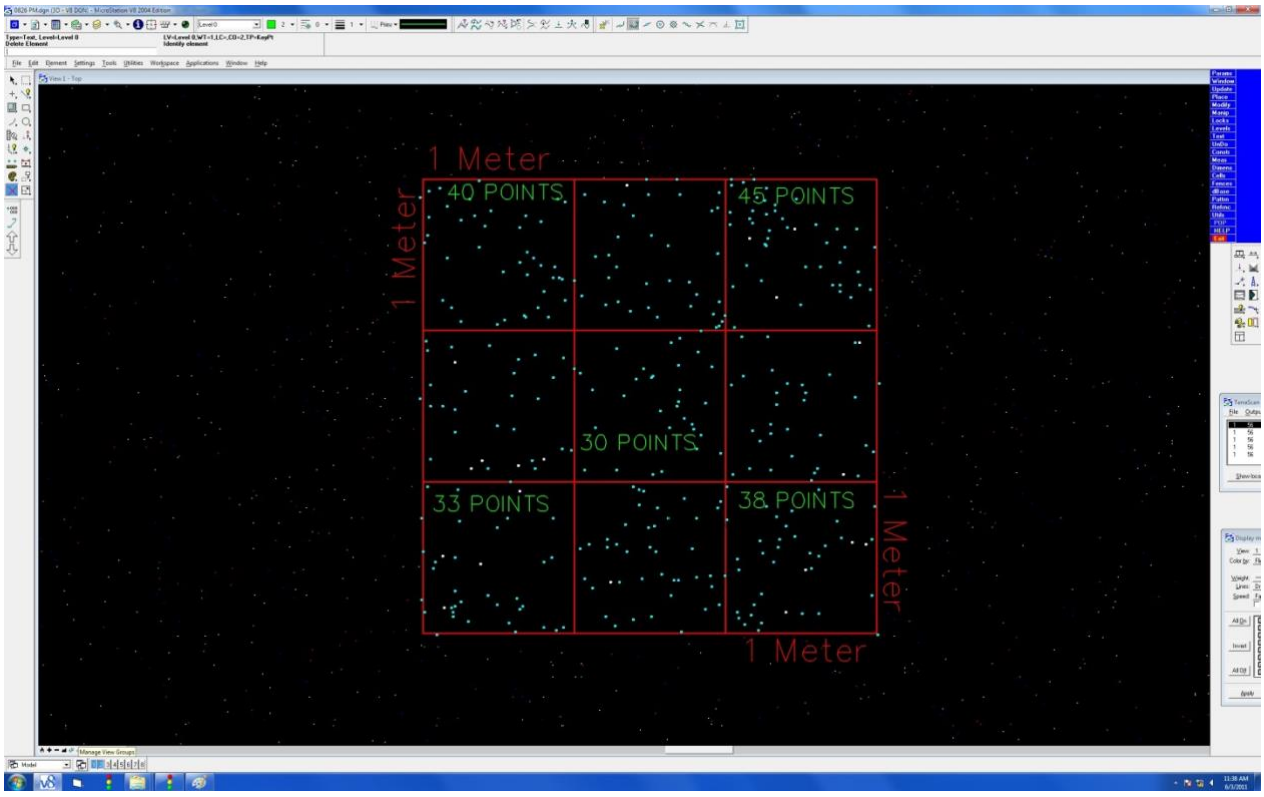
NEAREST NGS PUBLISHED CONTROL POINT
DL9212 HIRZ N405149.437 W1221518.561 22.8

# 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.

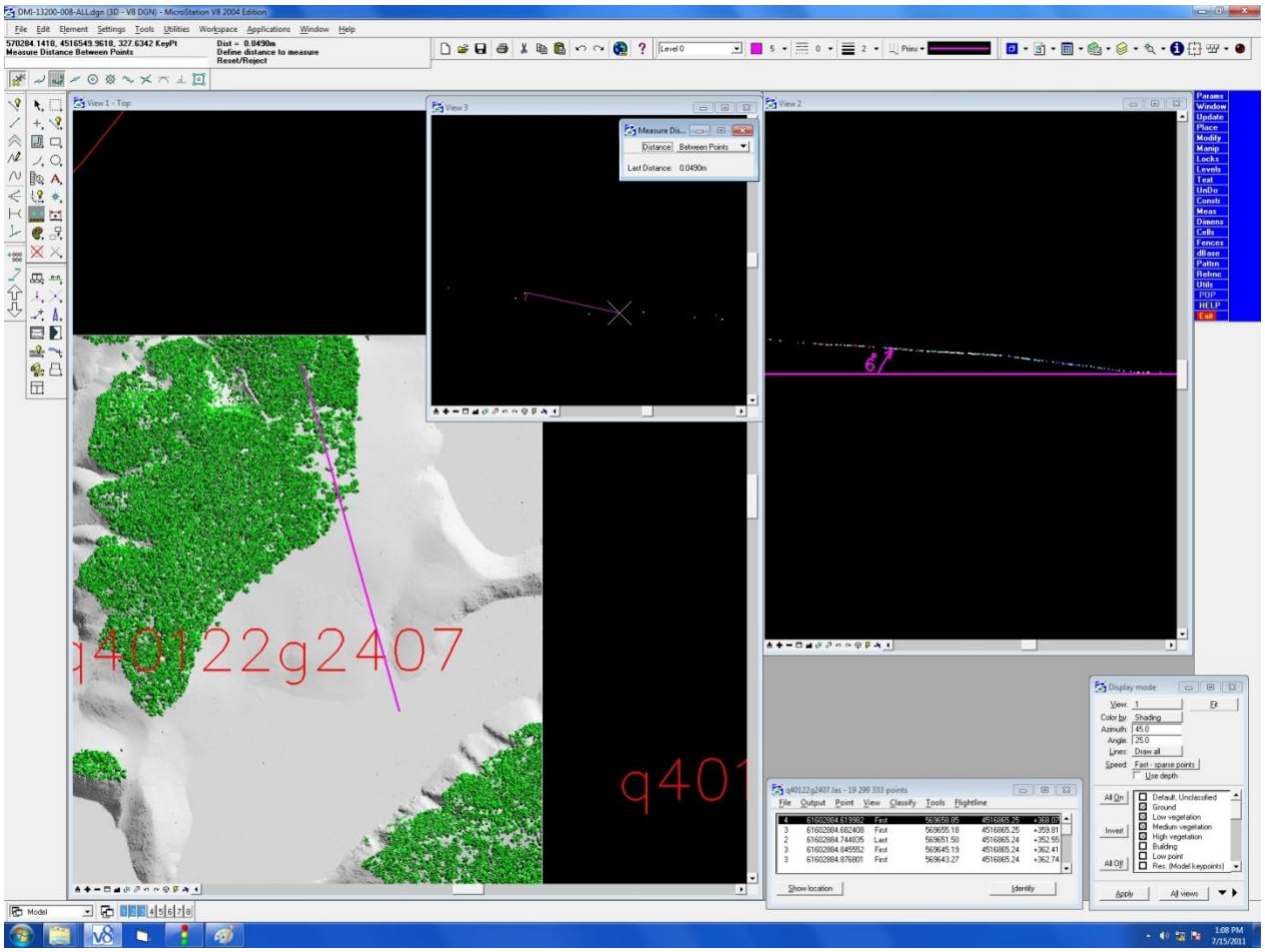
Note that the edited LIDAR points are simply a subset of the raw LIDAR points. The points that fell above the ground surface on vegetation canopies, buildings, or other obstructions were removed from the data set. Comparisons were also made between the survey points and the LIDAR derived terrain surface.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

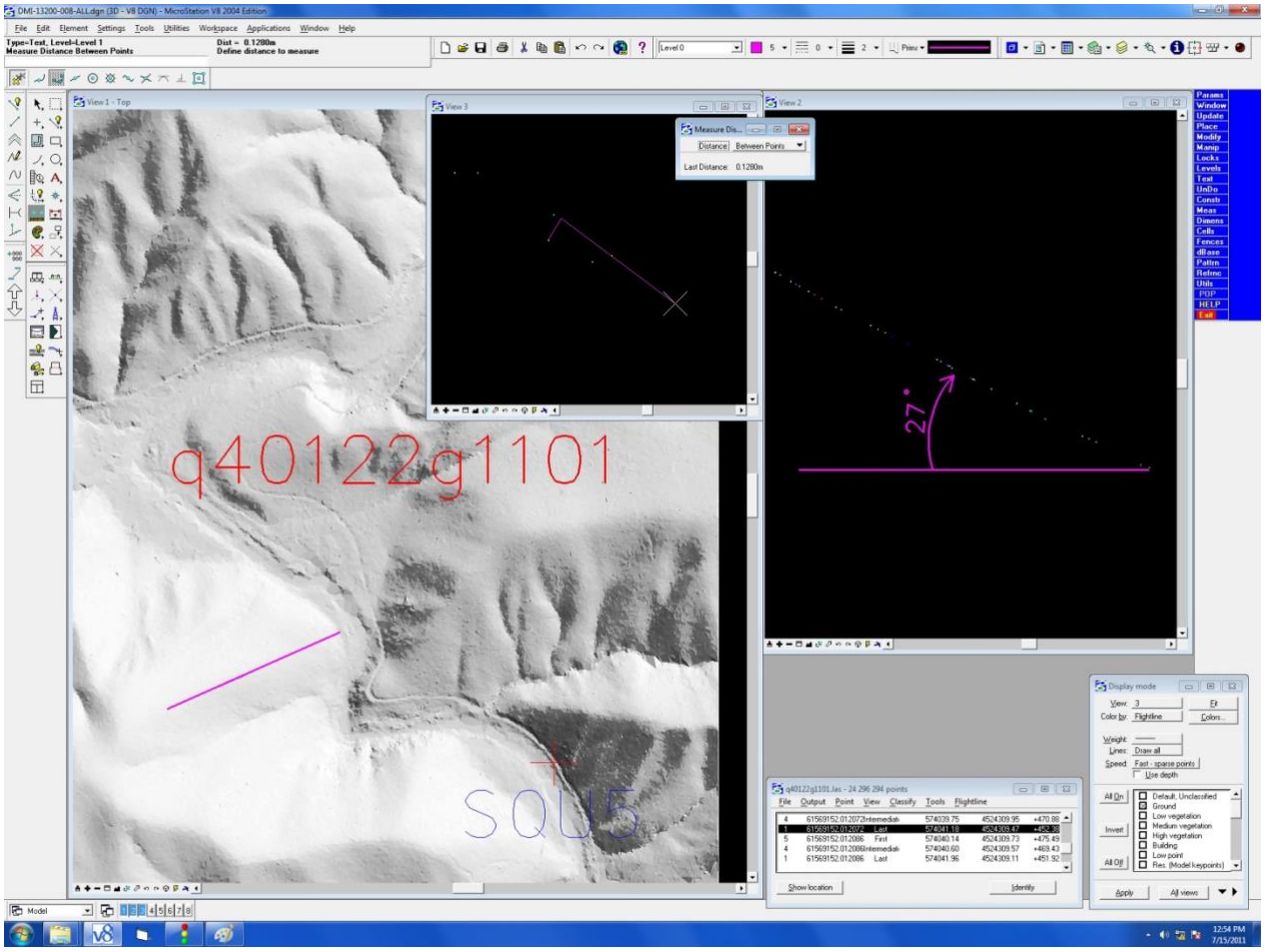


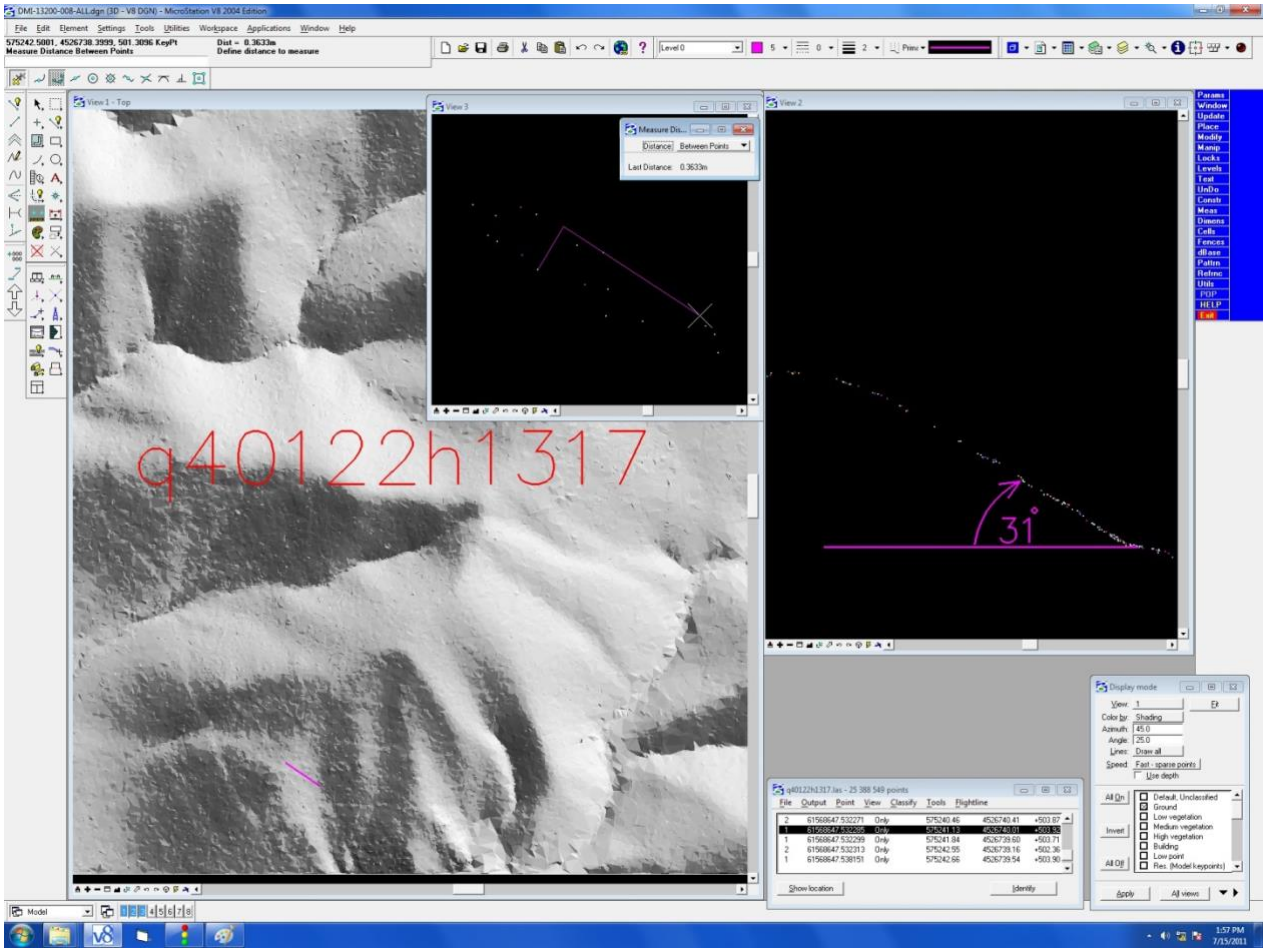
**ONE METER SQUARE > 9 points**

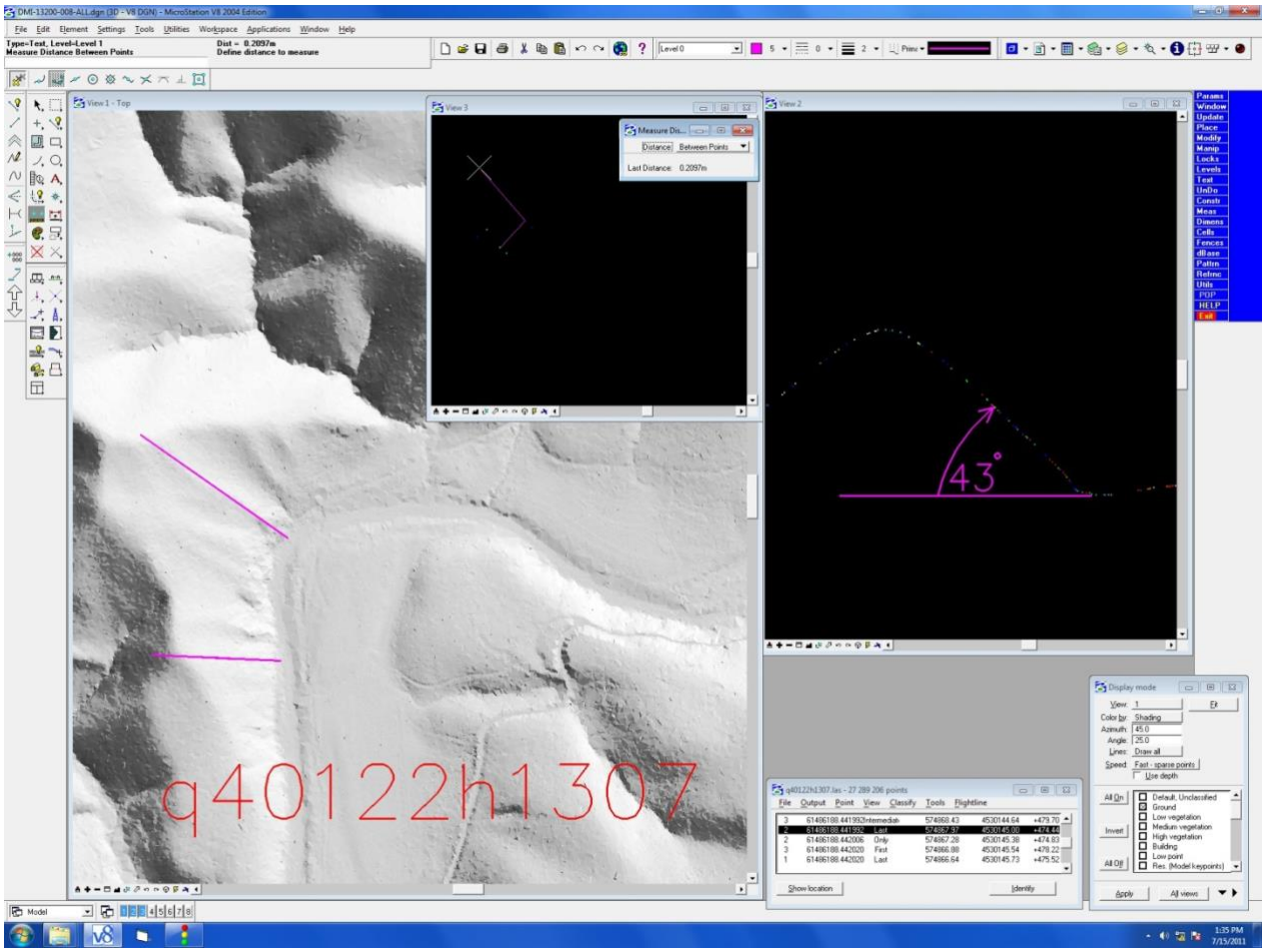
## LiDAR POINT CHECK

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




q40122g1101
SQU5


q40122h1317
31


43°
q40122h1307

## A. Map of Control Point Locations/ Base Station


| CONTROL POINT# | LATITUDE | LONGITUDE | NORTH (M) | EAST (M) | TARGET ELEV. | DESCRIPTION |
|---|---|---|---|---|---|---|
| SQU 1 | 40°47'50.40653" N | 122°11'26.88610" W | 4516574.711 | 568263.181 | 327.987 | SET 60D SPIKE |
| SQU 2 | 40°48'59.25752" N | 122°08'54.26254" W | 4518731.631 | 571819.033 | 309.771 | SET 60D SPIKE |
| SQU 2A | 40°47'25.43317" N | 122°08'51.32665" W | 4515839.187 | 571915.939 | 537.935 | SET 60D SPIKE |
| SQU 3 | 40°48'45.65821" N | 122°09'47.88018" W | 4518300.193 | 570566.957 | 350.304 | SET 60D SPIKE |
| SQU 5 | 40°51'54.46428" N | 122°06'56.18226" W | 4524161.640 | 574530.715 | 374.368 | SET 60D SPIKE |
| SQU 6 | 40°52'25.13293" N | 122°07'59.17008" W | 4525092.587 | 573046.839 | 472.123 | SET 60D SPIKE |
| SQU 7 | 40°54'43.23503" N | 122°06'59.87592" W | 4529364.966 | 574391.722 | 443.121 | SET 60D SPIKE |
| BAG 1 | 40°56'56.92169" N | 122°04'16.33686" W | 4533526.976 | 578173.606 | 487.579 | SET 60D SPIKE |

# 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

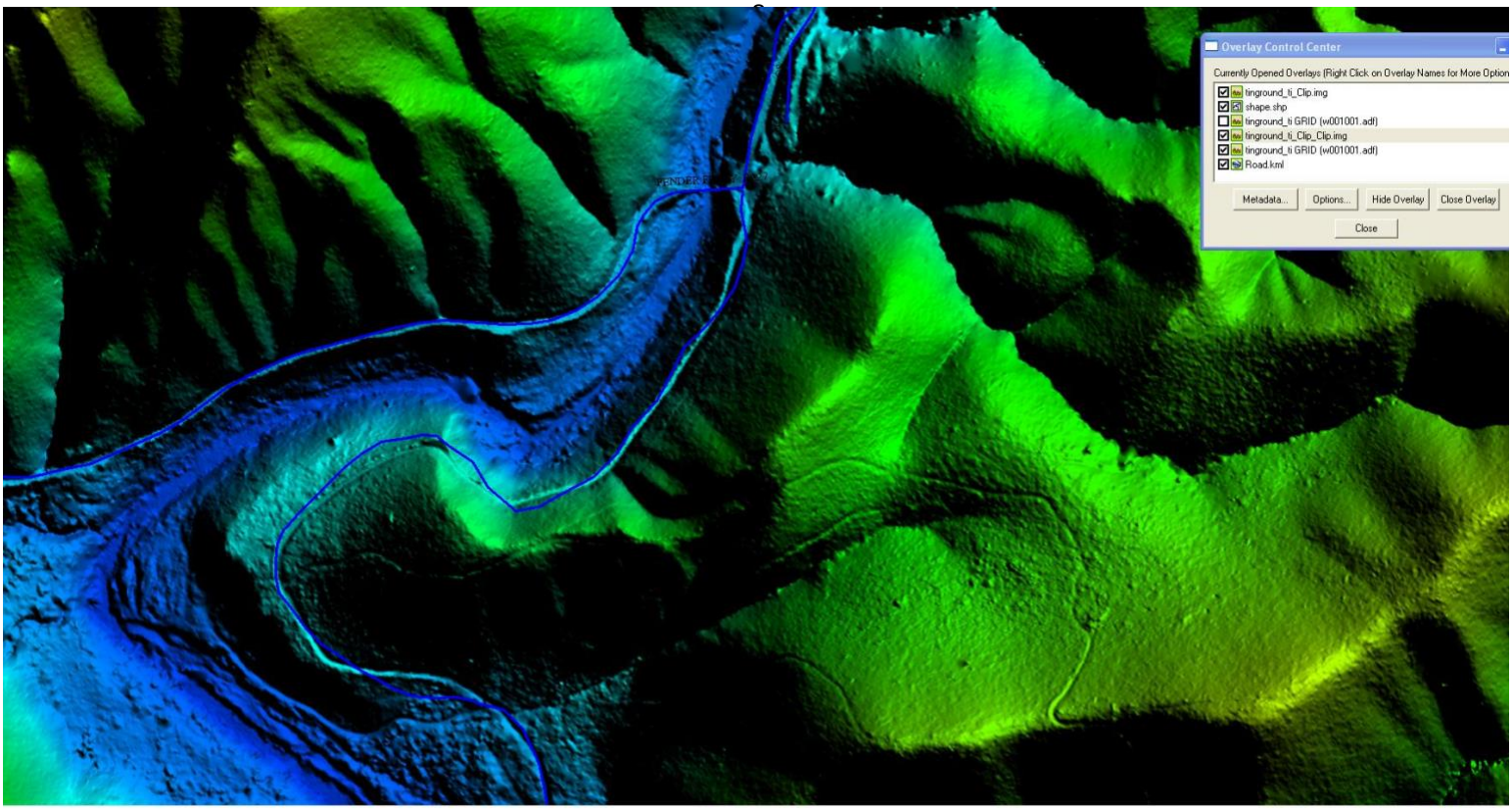
Vertical Datum **NAVD88, Geoid12A**
Horizontal Datum **NAD83**
Projection **UTM Zone 10**
Units **METERS**

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

**D:\DMI-13200-008\CONTROL POINTS\Squaw_Creek.txt**

| Number | Easting | Northing | Known Z | Laser Z | Dz |
|---|---|---|---|---|---|
| SQU1 | 568263.181 | 4516574.711 | 327.987 | 328.020 | +0.033 |
| SQU2 | 571819.033 | 4518731.631 | 309.771 | 309.710 | -0.061 |
| SQU2A | 571915.939 | 4515839.187 | 537.935 | 537.940 | +0.005 |
| SQU3 | 570566.957 | 4518300.193 | 350.304 | 350.430 | +0.126 |
| SQU5 | 574530.715 | 4524161.640 | 374.368 | 374.460 | +0.092 |
| SQU6 | 573046.839 | 4525092.587 | 472.123 | 472.070 | -0.053 |
| SQU7 | 574391.722 | 4529364.966 | 443.121 | 442.970 | -0.151 |
| BAG1 | 578173.606 | 4533526.976 | 487.579 | 487.580 | +0.001 |

| | |
|---|---|
| Average dz | -0.001 |
| Minimum dz | -0.151 |
| Maximum dz | +0.126 |
| Average magnitude | 0.065 |
| Root mean square | 0.083 |
| Std deviation | 0.088 |




**Horizontal Check USGS Quad/ Road Data against LiDAR Deliverable**