

# REPORT OF SURVEY – GROUND AND QUALITY CONTROL POINTS S. PLATTE RIVER, COLORADO FLOOD LIDAR

January 31, 2014

Prepared exclusively for:



USGS Contract: G10PC00026  
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Photo Science Project No. 7505-087

Prepared by:



Under Contract to:

PHOTO SCIENCE A  quantum SPATIAL COMPANY

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**Project:** LiDAR Acquisition for the Flooding in Central and Northern Colorado  
Ground Control Project Report for Photo Science  
P.O. Number: 7505087, signed 10/18/2013.

### Project Information

CDI Project Number: 2461

Geographic Location: Colorado Rocky Mountain Front Range and Platte River  
Counties: Adams, Arapahoe, Broomfield, Boulder, Clear Creek,  
Denver, Douglas, Gilpin, Jefferson, Larimer, Logan,  
Morgan, Sedgwick, and Weld County.

### Project Specification

Accuracy: 3 cm RMSEz (6 cm LE95)  
0.1 ft RMSEz (0.2 ft LE95)

Coordinate System: NAD83 (2011)

Vertical Datum: NAVD88 (Geoid 12A)

Projections: UTM and Colorado State Plane

Zone: 13 North and Colorado Central

Units: Meters and U.S. Survey Feet

Survey Methodology: Differential GPS (Static and Trimble VRS)

Field Work: October 2013 – January 2014

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## 1. SURVEY WORK CONTRIBUTION

CompassData supplies ground survey work. CompassData sent surveyors to the affected areas to survey Ground Control Points (GCPs) and Vertical Assessment Points (FVAs, SVAs, and CVAs). These points are integrated into the 3D modeling process by Photo Science that is based on Lidar acquisition as well performed by Photo Science.

This report contains coordinate and accuracy reports. The first part is the Network Adjustment Report from all points collected in static GPS mode. Collecting in static mode was necessary in mountainous and forested areas (Pages 2 – 23). The second part holds points surveyed with VRS (Pages 24 – 33). The third part is the VRS report from the points collected by Photo Science (Pages 34 – 37).



Figure 1. The photo shows one of many residences destroyed by the floods.

## 2. STATIC GPS AND VRS GPS

All Ground Control Points for this project were collected within the boundaries of the state of Colorado. In the Rocky Mountain Foot Hills the survey points were collected with 45 minute static GPS observation and



later calculated with a network adjustment that is based on CORS stations by the NGS. The points in the high plains urban areas and along the South Plate River were surveyed with the Trimble Now VRS network. These points were observed for 90 epochs to determine a coordinate to support subsequent LiDAR post-processing and bare earth deliverables generation.

### 3. EQUIPMENT

CompassData used Trimble R6 antennas and Trimble R8 antennas to perform the survey. This device is accurate to within 1 cm on a position-by-position basis per Trimble specifications. Operating within the VRS network provided accurate coordinate values better than 3 cm H/V with 90 second observation times. Specifications for the Trimble R6 and R8 antennas are available upon request.

### 4. SURVEY METHODOLOGY

CompassData has met the required accuracy for this project by using a high-quality GPS receiver with differential corrections provided by a GPS base station close to the project area. The GPS antenna sat atop a bubble-leveled, fixed-height range pole that was placed over the center of the desired GCP.

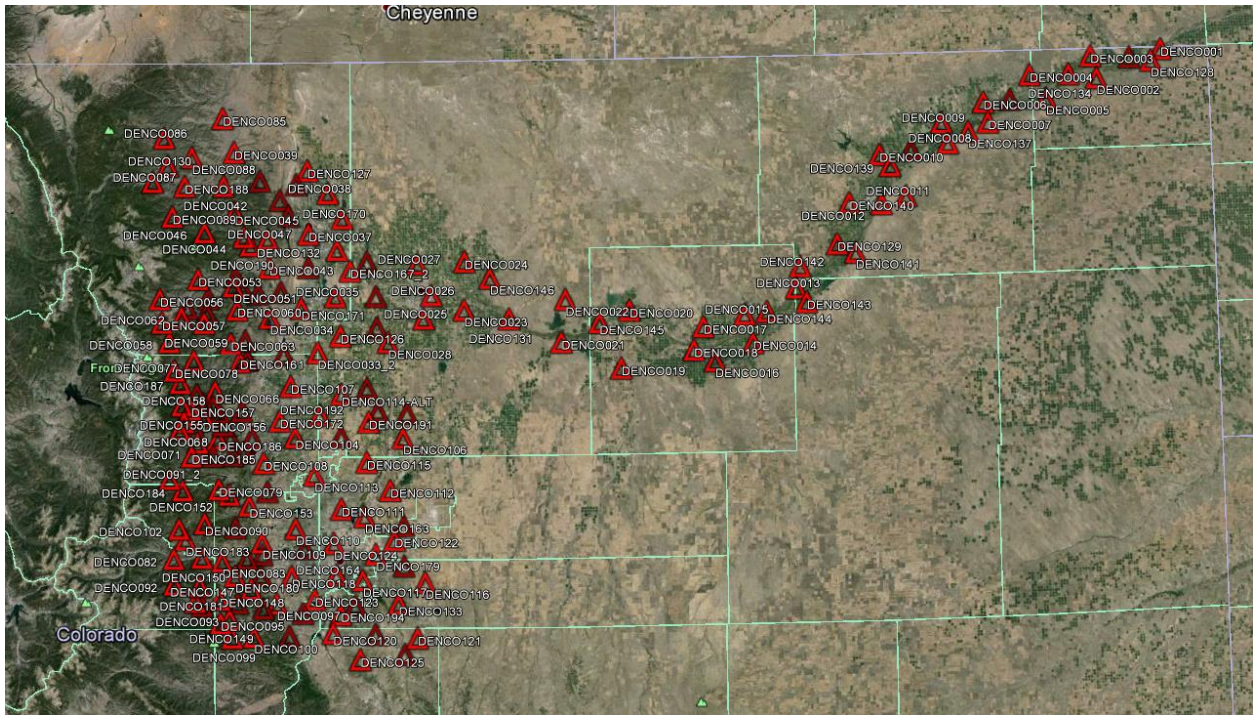
### 5. DISTRIBUTION OF CONTROL & QUALITY CHECK POINTS

CompassData followed the distribution of points provided by Photo Science. The points for ground control are evenly distributed over the entire AOI and so are the bare earth quality test points (FVA). All other quality test points are distributed according to available land classes.



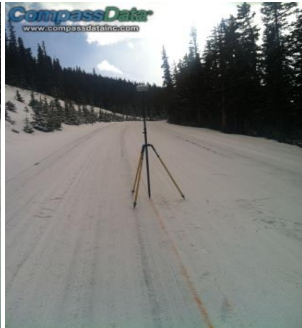


## 6. DISTRIBUTION OF GROUND CONTROL POINTS (GCP)



Below are two examples of Ground Control Points. Depending on the surveyor and/ or background the pictures are taken either in landscape or portrait format.

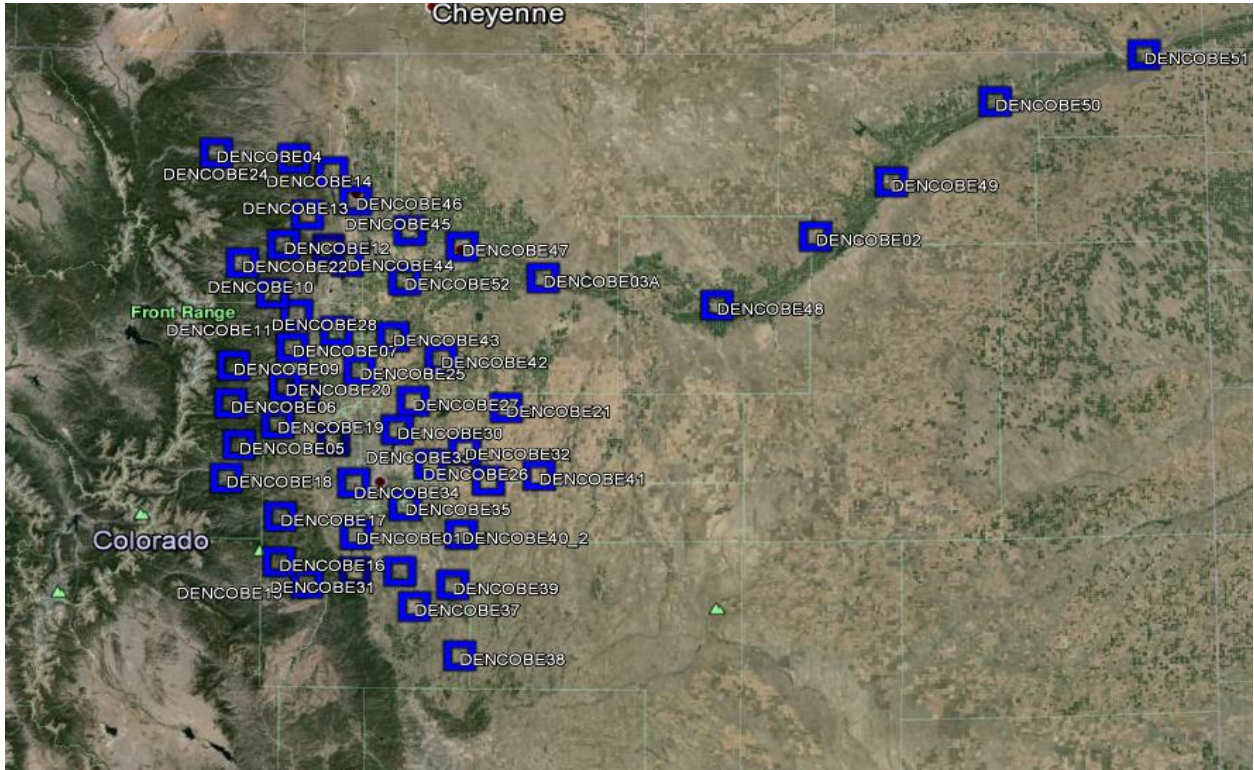








7. DISTRIBUTION OF QUALITY CHECK POINTS – LAND CLASS: OPEN LAND (FVA)



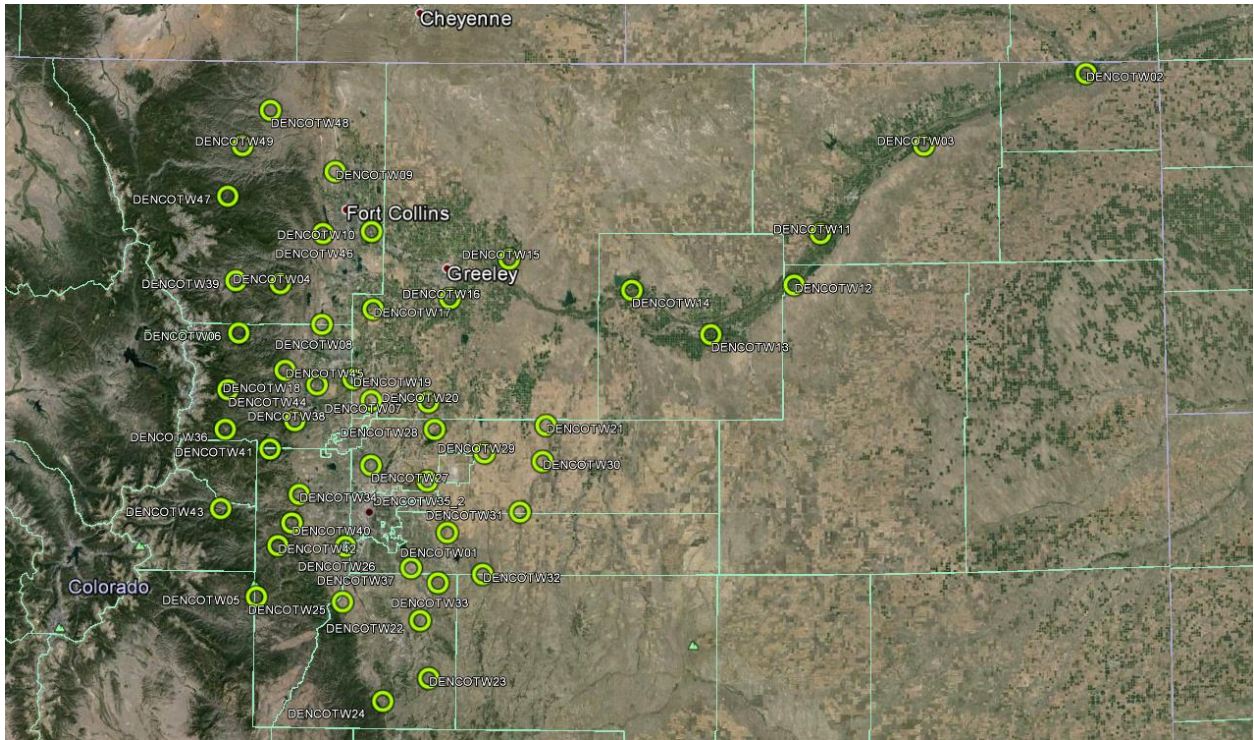
Example of an Open Land / Bare Earth Quality Check Point:







8. DISTRIBUTION OF QUALITY CHECK POINTS – LAND CLASS: TALL WEEDS (SVA)



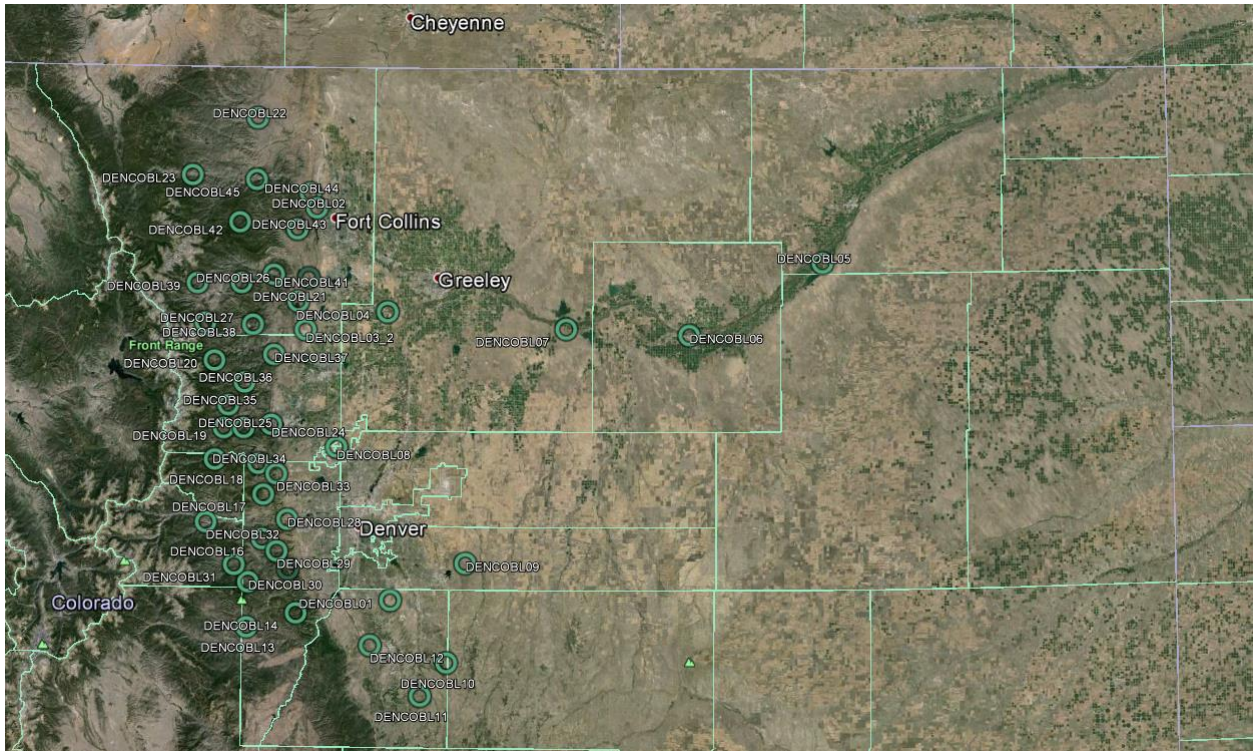
Example of a Tall Weed Quality Check Point:







9. DISTRIBUTION OF QUALITY CHECK POINTS – LAND CLASS: BRUSH LAND (SVA)



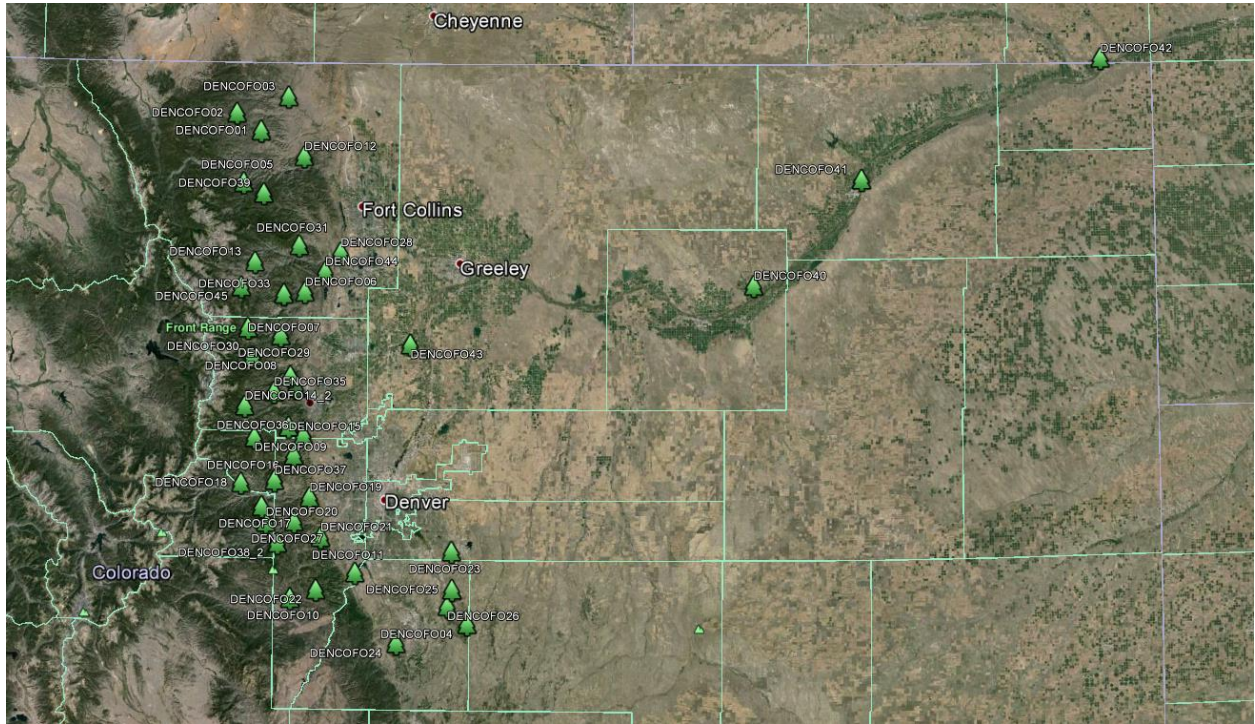
Example of a Brush Land Quality Check Point:







## 10. DISTRIBUTION OF QUALITY CHECK POINTS – LAND CLASS: FOREST (SVA)



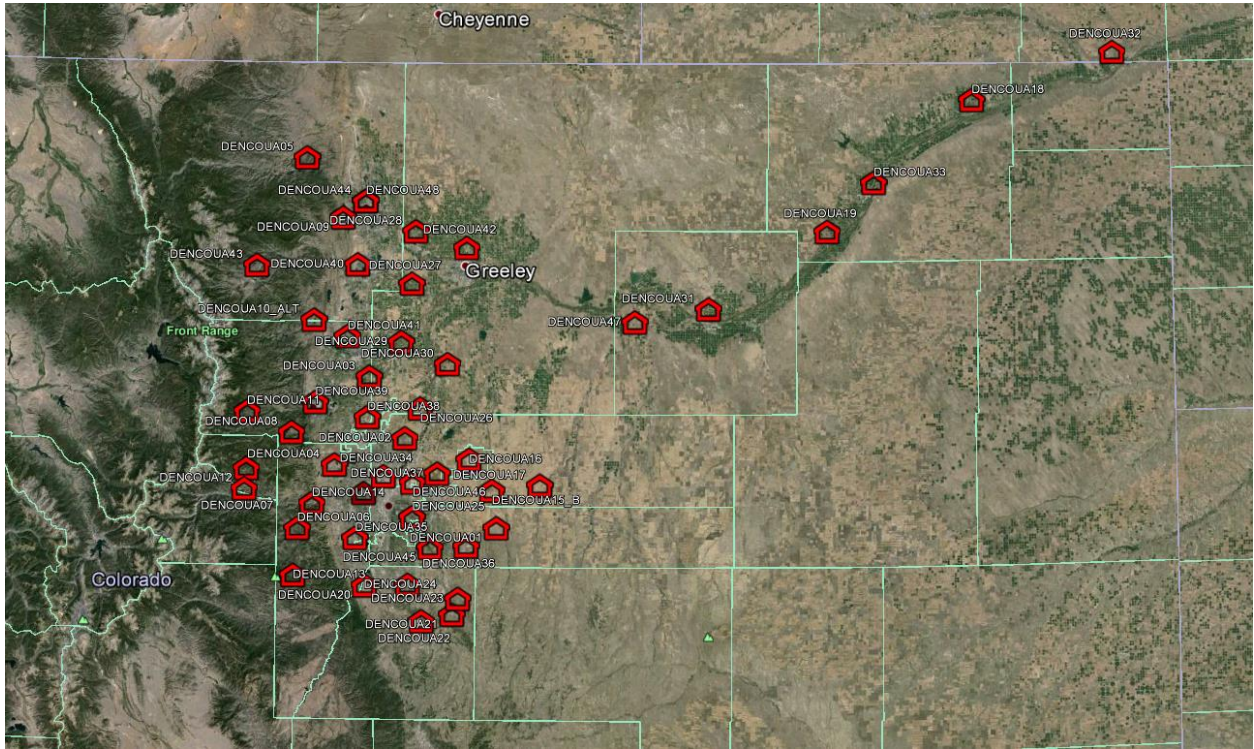
Example of a Forest Quality Check Point:







# 11. DISTRIBUTION OF QUALITY CHECK POINTS – LAND CLASS: URBAN (SVA)



Example of an Urban Quality Check Point:





## 12. DELIVERABLES

Deliverables for this project include:

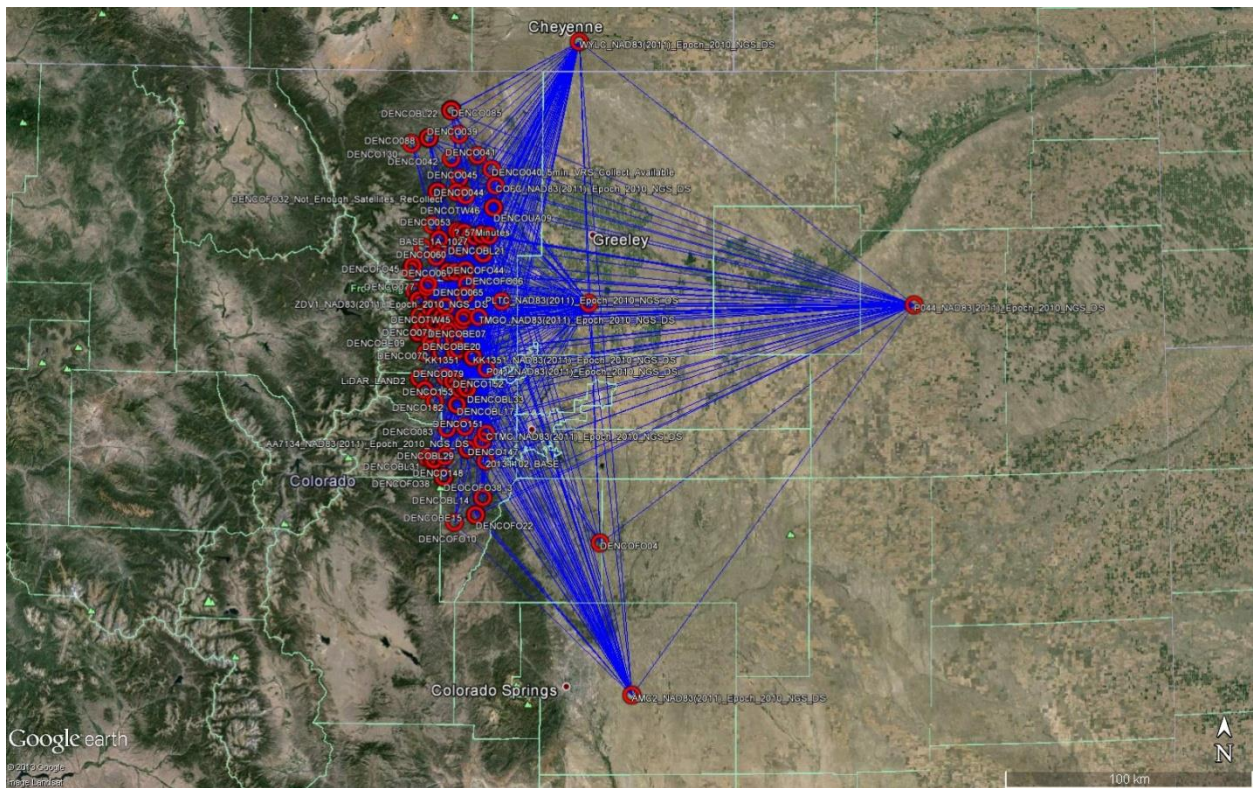
- Coordinate lists with Latitude, Longitude, Height above Ellipsoid, Northing, Easting in UTM Zone 13 and meters, and Northing, Easting in Colorado State Plane Central and U.S. Survey Feet, and MSL based on Geoid 12B.
- 4 Digital Photos of the GPS equipment on each point.
- ArcGIS Shape Files
- Report





### 13. STATIC GPS REPORT (PART 1)

Project Information		Coordinate System	
Name:	2461_CO_Flood	Name:	US State Plane 1983
Size:	17 MB	Datum:	NAD 1983 (Conus)
Modified:	1/15/2014 10:16:04 AM (UTC:-7)	Zone:	Colorado North 0501
Time zone:	Mountain Standard Time	Geoid:	GEOID12A (Conus)







## NETWORK ADJUSTMENT REPORT

### 1. Adjustment Settings

#### Set-Up Errors

#### GNSS

Error in Height of Antenna: 0.016 ft

Centering Error: 0.016 ft

#### Covariance Display

#### Horizontal:

Propagated Linear Error [E]: U.S.

Constant Term [C]: 0.000 ft

Scale on Linear Error [S]: 1.960

#### Three-Dimensional

Propagated Linear Error [E]: U.S.

Constant Term [C]: 0.000 ft

Scale on Linear Error [S]: 1.960

### 2. Adjustment Statistics

Number of Iterations for Successful Adjustment: 2

Network Reference Factor: 1.00

Chi Square Test (95%): Passed

Precision Confidence Level: 95%

Tolerance for LE95% 0.2 ft

Degrees of Freedom: 3953

#### Post Processed Vector Statistics

Reference Factor: 1.00

Redundancy Number: 3953.00

A Priori Scalar: 1.29



### 3. Control Point Constraints

Point ID	Type	East $\sigma$ (US survey foot)	North $\sigma$ (US survey foot)	Height $\sigma$ (US survey foot)
<a href="#">COFC NAD83(2011) Epoch 2010 NGS DS</a>	Global	Fixed	Fixed	Fixed
<a href="#">P041 NAD83(2011) Epoch 2010 NGS DS</a>	Global	Fixed	Fixed	Fixed
<a href="#">PLTC NAD83(2011) Epoch 2010 NGS DS</a>	Global	Fixed	Fixed	Fixed

### 4. Adjusted Grid Coordinates

Point ID	Easting Error (US survey foot)	Northing Error (US survey foot)	Elevation Error (US survey foot)
<a href="#">20131102 BASE</a>	0.020	0.020	0.027
<a href="#">AE8116</a>	0.023	0.028	0.032
<a href="#">AMC2 NAD83(2011) Epoch 2010 NGS DS</a>	0.013	0.013	0.018
<a href="#">BASE 1A</a>	0.009	0.009	0.012
<a href="#">BASE 1A 1027</a>	0.016	0.016	0.026
<a href="#">BASE 1B</a>	0.011	0.011	0.013
<a href="#">CTMC NAD83(2011) Epoch 2010 NGS DS</a>	0.007	0.007	0.009
<a href="#">DENCO039</a>	0.021	0.021	0.025
<a href="#">DENCO041</a>	0.037	0.036	0.119
<a href="#">DENCO042</a>	0.022	0.024	0.063
<a href="#">DENCO044</a>	0.023	0.023	0.030
<a href="#">DENCO045</a>	0.027	0.026	0.053
<a href="#">DENCO046</a>	0.055	0.062	0.119



Point ID	Easting Error (US survey foot)	Northing Error (US survey foot)	Elevation Error (US survey foot)
<a href="#">DENCO049</a>	0.034	0.035	0.076
<a href="#">DENCO050</a>	0.023	0.023	0.028
<a href="#">DENCO051</a>	0.019	0.019	0.030
<a href="#">DENCO053</a>	0.027	0.024	0.033
<a href="#">DENCO054</a>	0.019	0.023	0.026
<a href="#">DENCO058</a>	0.061	0.048	0.067
<a href="#">DENCO059</a>	0.019	0.020	0.026
<a href="#">DENCO060</a>	0.025	0.024	0.040
<a href="#">DENCO061</a>	0.019	0.023	0.025
<a href="#">DENCO063</a>	0.017	0.018	0.028
<a href="#">DENCO064</a>	0.020	0.020	0.028
<a href="#">DENCO065</a>	0.021	0.021	0.024
<a href="#">DENCO066</a>	0.020	0.020	0.033
<a href="#">DENCO067</a>	0.025	0.027	0.035
<a href="#">DENCO068</a>	0.019	0.020	0.024
<a href="#">DENCO069</a>	0.021	0.024	0.029
<a href="#">DENCO070</a>	0.019	0.019	0.033
<a href="#">DENCO071</a>	0.033	0.032	0.047
<a href="#">DENCO072</a>	0.020	0.020	0.032
<a href="#">DENCO073</a>	0.020	0.019	0.032
<a href="#">DENCO076</a>	0.026	0.026	0.034





Point ID	Easting Error (US survey foot)	Northing Error (US survey foot)	Elevation Error (US survey foot)
<a href="#">DENCO077</a>	0.023	0.024	0.038
<a href="#">DENCO078</a>	0.021	0.021	0.026
<a href="#">DENCO079</a>	0.018	0.019	0.024
<a href="#">DENCO083</a>	0.021	0.022	0.026
<a href="#">DENCO085</a>	0.034	0.031	0.042
<a href="#">DENCO087</a>	0.024	0.027	0.036
<a href="#">DENCO088</a>	0.021	0.021	0.027
<a href="#">DENCO089</a>	0.045	0.038	0.053
<a href="#">DENCO090</a>	0.019	0.021	0.027
<a href="#">DENCO093</a>	0.027	0.028	0.049
<a href="#">DENCO094</a>	0.020	0.023	0.028
<a href="#">DENCO130</a>	0.039	0.034	0.045
<a href="#">DENCO147</a>	0.022	0.022	0.028
<a href="#">DENCO148</a>	0.027	0.026	0.038
<a href="#">DENCO151</a>	0.022	0.022	0.027
<a href="#">DENCO152</a>	0.020	0.022	0.046
<a href="#">DENCO153</a>	0.024	0.022	0.031
<a href="#">DENCO154</a>	0.021	0.021	0.026
<a href="#">DENCO155</a>	0.023	0.024	0.031
<a href="#">DENCO156</a>	0.023	0.023	0.031
<a href="#">DENCO157</a>	0.021	0.021	0.032



Point ID	Easting Error (US survey foot)	Northing Error (US survey foot)	Elevation Error (US survey foot)
<a href="#">DENCO158</a>	0.022	0.022	0.030
<a href="#">DENCO159</a>	0.019	0.020	0.025
<a href="#">DENCO160</a>	0.018	0.019	0.029
<a href="#">DENCO162</a>	0.025	0.025	0.060
<a href="#">DENCO182</a>	0.022	0.023	0.030
<a href="#">DENCO185</a>	0.022	0.023	0.027
<a href="#">DENCO186</a>	0.027	0.026	0.035
<a href="#">DENCO187</a>	0.017	0.018	0.023
<a href="#">DENCO188</a>	0.026	0.021	0.030
<a href="#">DENCOBE04</a>	0.022	0.022	0.030
<a href="#">DENCOBE07</a>	0.025	0.025	0.037
<a href="#">DENCOBE09</a>	0.025	0.025	0.031
<a href="#">DENCOBE10</a>	0.020	0.021	0.026
<a href="#">DENCOBE12</a>	0.022	0.032	0.036
<a href="#">DENCOBE15</a>	0.202	0.064	0.077
<a href="#">DENCOBE19</a>	0.036	0.035	0.040
<a href="#">DENCOBE20</a>	0.021	0.025	0.029
<a href="#">DENCOBE24</a>	0.021	0.020	0.025
<a href="#">DENCOBL14</a>	0.064	0.039	0.078
<a href="#">DENCOBL17</a>	0.023	0.025	0.030
<a href="#">DENCOBL19</a>	0.020	0.021	0.030



Point ID	Easting Error (US survey foot)	Northing Error (US survey foot)	Elevation Error (US survey foot)
<a href="#">DENCOBL20</a>	0.040	0.038	0.051
<a href="#">DENCOBL21</a>	0.028	0.037	0.042
<a href="#">DENCOBL22</a>	0.021	0.022	0.028
<a href="#">DENCOBL23</a>	0.021	0.025	0.034
<a href="#">DENCOBL25</a>	0.036	0.036	0.064
<a href="#">DENCOBL26</a>	0.042	0.036	0.052
<a href="#">DENCOBL29</a>	0.021	0.020	0.029
<a href="#">DENCOBL31</a>	0.043	0.034	0.049
<a href="#">DENCOBL33</a>	0.023	0.025	0.029
<a href="#">DENCOBL34</a>	0.019	0.022	0.024
<a href="#">DENCOBL35</a>	0.089	0.055	0.100
<a href="#">DENCOBL36</a>	0.023	0.022	0.029
<a href="#">DENCOBL38</a>	0.022	0.026	0.029
<a href="#">DENCOBL42</a>	0.044	0.038	0.062
<a href="#">DENCOBL45</a>	0.048	0.040	0.061
<a href="#">DENCOFO01</a>	0.040	0.046	0.055
<a href="#">DENCOFO03</a>	0.038	0.032	0.043
<a href="#">DENCOFO04</a>	0.023	0.023	0.030
<a href="#">DENCOFO05</a>	0.116	0.062	0.078
<a href="#">DENCOFO06</a>	0.024	0.023	0.032
<a href="#">DENCOFO07</a>	0.059	0.105	0.145





Point ID	Easting Error (US survey foot)	Northing Error (US survey foot)	Elevation Error (US survey foot)
<a href="#">DENCOFO08</a>	0.022	0.021	0.032
<a href="#">DENCOFO09</a>	0.096	0.071	0.232
<a href="#">DENCOFO10</a>	0.028	0.026	0.035
<a href="#">DENCOFO12</a>	0.041	0.044	0.068
<a href="#">DENCOFO15</a>	0.085	0.047	0.137
<a href="#">DENCOFO16</a>	0.042	0.039	0.065
<a href="#">DENCOFO20</a>	0.036	0.036	0.044
<a href="#">DENCOFO29</a>	0.023	0.024	0.040
<a href="#">DENCOFO30</a>	0.058	0.127	0.137
<a href="#">DENCOFO31</a>	0.022	0.024	0.033
<a href="#">DENCOFO33</a>	0.022	0.023	0.026
<a href="#">DENCOFO34</a>	0.031	0.038	0.068
<a href="#">DENCOFO35</a>	0.061	0.061	0.073
<a href="#">DENCOFO36</a>	0.062	0.049	0.121
<a href="#">DENCOFO39</a>	0.200	0.155	0.214
<a href="#">DENCOFO44</a>	0.023	0.023	0.040
<a href="#">DENCOFO45</a>	0.031	0.026	0.036
<a href="#">DENCOTW04</a>	0.035	0.035	0.046
<a href="#">DENCOTW44</a>	0.022	0.023	0.034
<a href="#">DENCOTW45</a>	0.022	0.022	0.034
<a href="#">DENCOTW46</a>	0.020	0.021	0.025



Point ID	Easting Error (US survey foot)	Northing Error (US survey foot)	Elevation Error (US survey foot)
<a href="#">DENCOTW47</a>	0.023	0.023	0.038
<a href="#">DENCOTW48</a>	0.026	0.025	0.032
<a href="#">DENCOTW49</a>	0.020	0.021	0.025
<a href="#">DENCOUA05</a>	0.020	0.019	0.026
<a href="#">DENCOUA08</a>	0.021	0.021	0.027
<a href="#">DENCOUA09</a>	0.021	0.022	0.026
<a href="#">DSRC NAD83(2011) Epoch 2010 NGS DS</a>	0.005	0.005	0.007
<a href="#">KK1351</a>	0.022	0.025	0.027
<a href="#">LiDAR LAND2</a>	0.025	0.026	0.030
<a href="#">P044 NAD83(2011) Epoch 2010 NGS DS</a>	0.012	0.012	0.025
<a href="#">TMGO NAD83(2011) Epoch 2010 NGS DS</a>	0.005	0.005	0.006
<a href="#">WYLC NAD83(2011) Epoch 2010 NGS DS</a>	0.009	0.009	0.012
<a href="#">ZDV1 NAD83(2011) Epoch 2010 NGS DS</a>	0.005	0.005	0.006

## 5. Error Ellipse Components

Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">20131102 BASE</a>	0.025	0.025	177°
<a href="#">AE8116</a>	0.034	0.028	0°
<a href="#">AMC2 NAD83(2011) Epoch 2010 NGS DS</a>	0.016	0.016	153°
<a href="#">BASE 1A</a>	0.011	0.011	168°



Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">BASE 1A 1027</a>	0.02	0.02	163°
<a href="#">BASE 1B</a>	0.014	0.014	1°
<a href="#">CTMC NAD83(2011) Epoch 2010 NGS DS</a>	0.009	0.008	167°
<a href="#">CTMC NAD83(2011) Epoch 2010 NGS DS</a>	0.013	0.013	48°
<a href="#">DENCO039</a>	0.027	0.026	175°
<a href="#">DENCO041</a>	0.048	0.043	124°
<a href="#">DENCO042</a>	0.03	0.027	165°
<a href="#">DENCO044</a>	0.029	0.028	46°
<a href="#">DENCO045</a>	0.034	0.032	122°
<a href="#">DENCO046</a>	0.079	0.067	160°
<a href="#">DENCO049</a>	0.043	0.042	158°
<a href="#">DENCO050</a>	0.029	0.028	140°
<a href="#">DENCO051</a>	0.024	0.023	133°
<a href="#">DENCO053</a>	0.034	0.03	101°
<a href="#">DENCO054</a>	0.029	0.024	170°
<a href="#">DENCO058</a>	0.076	0.059	92°
<a href="#">DENCO059</a>	0.026	0.023	143°
<a href="#">DENCO060</a>	0.032	0.029	121°
<a href="#">DENCO061</a>	0.029	0.023	174°
<a href="#">DENCO063</a>	0.022	0.021	170°
<a href="#">DENCO064</a>	0.025	0.025	32°
<a href="#">DENCO065</a>	0.027	0.026	168°





Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">DENCO066</a>	0.026	0.025	130°
<a href="#">DENCO067</a>	0.035	0.029	147°
<a href="#">DENCO068</a>	0.026	0.023	148°
<a href="#">DENCO069</a>	0.03	0.026	167°
<a href="#">DENCO070</a>	0.024	0.024	154°
<a href="#">DENCO071</a>	0.042	0.038	124°
<a href="#">DENCO072</a>	0.026	0.025	119°
<a href="#">DENCO073</a>	0.025	0.023	108°
<a href="#">DENCO076</a>	0.032	0.032	49°
<a href="#">DENCO077</a>	0.03	0.028	175°
<a href="#">DENCO078</a>	0.027	0.025	50°
<a href="#">DENCO079</a>	0.023	0.023	4°
<a href="#">DENCO083</a>	0.027	0.026	173°
<a href="#">DENCO085</a>	0.043	0.038	74°
<a href="#">DENCO087</a>	0.034	0.03	15°
<a href="#">DENCO088</a>	0.026	0.026	142°
<a href="#">DENCO089</a>	0.056	0.047	100°
<a href="#">DENCO090</a>	0.026	0.024	8°
<a href="#">DENCO093</a>	0.035	0.033	21°
<a href="#">DENCO094</a>	0.029	0.025	22°
<a href="#">DENCO130</a>	0.049	0.042	77°
<a href="#">DENCO147</a>	0.028	0.026	136°



Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">DENCO148</a>	0.034	0.032	75°
<a href="#">DENCO151</a>	0.028	0.027	9°
<a href="#">DENCO152</a>	0.028	0.025	1°
<a href="#">DENCO153</a>	0.03	0.027	93°
<a href="#">DENCO154</a>	0.027	0.026	62°
<a href="#">DENCO155</a>	0.03	0.029	153°
<a href="#">DENCO156</a>	0.029	0.029	57°
<a href="#">DENCO157</a>	0.026	0.026	113°
<a href="#">DENCO158</a>	0.028	0.027	174°
<a href="#">DENCO159</a>	0.025	0.024	167°
<a href="#">DENCO160</a>	0.024	0.023	24°
<a href="#">DENCO162</a>	0.032	0.03	144°
<a href="#">DENCO182</a>	0.028	0.028	175°
<a href="#">DENCO185</a>	0.028	0.027	7°
<a href="#">DENCO186</a>	0.034	0.032	63°
<a href="#">DENCO187</a>	0.022	0.021	178°
<a href="#">DENCO188</a>	0.032	0.026	79°
<a href="#">DENCOBE04</a>	0.028	0.027	171°
<a href="#">DENCOBE07</a>	0.032	0.03	150°
<a href="#">DENCOBE09</a>	0.031	0.03	45°
<a href="#">DENCOBE10</a>	0.026	0.025	5°
<a href="#">DENCOBE12</a>	0.04	0.028	173°



Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">DENCOBE15</a>	0.257	0.06	78°
<a href="#">DENCOBE19</a>	0.046	0.042	123°
<a href="#">DENCOBE20</a>	0.031	0.027	177°
<a href="#">DENCOBE24</a>	0.026	0.025	86°
<a href="#">DENCOBL14</a>	0.081	0.048	96°
<a href="#">DENCOBL17</a>	0.031	0.029	0°
<a href="#">DENCOBL19</a>	0.026	0.026	171°
<a href="#">DENCOBL20</a>	0.051	0.046	113°
<a href="#">DENCOBL21</a>	0.047	0.035	172°
<a href="#">DENCOBL22</a>	0.027	0.026	18°
<a href="#">DENCOBL23</a>	0.031	0.026	2°
<a href="#">DENCOBL25</a>	0.046	0.044	145°
<a href="#">DENCOBL26</a>	0.056	0.041	121°
<a href="#">DENCOBL29</a>	0.026	0.025	122°
<a href="#">DENCOBL31</a>	0.056	0.039	65°
<a href="#">DENCOBL33</a>	0.031	0.029	169°
<a href="#">DENCOBL34</a>	0.027	0.024	174°
<a href="#">DENCOBL35</a>	0.111	0.067	96°
<a href="#">DENCOBL36</a>	0.029	0.027	91°
<a href="#">DENCOBL38</a>	0.032	0.027	176°
<a href="#">DENCOBL42</a>	0.056	0.047	72°
<a href="#">DENCOBL45</a>	0.06	0.051	91°





Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">DENCOFO01</a>	0.058	0.049	15°
<a href="#">DENCOFO03</a>	0.049	0.038	110°
<a href="#">DENCOFO04</a>	0.029	0.028	152°
<a href="#">DENCOFO05</a>	0.145	0.076	93°
<a href="#">DENCOFO06</a>	0.031	0.028	116°
<a href="#">DENCOFO07</a>	0.132	0.073	3°
<a href="#">DENCOFO08</a>	0.028	0.026	111°
<a href="#">DENCOFO09</a>	0.12	0.088	80°
<a href="#">DENCOFO10</a>	0.035	0.033	114°
<a href="#">DENCOFO12</a>	0.057	0.048	145°
<a href="#">DENCOFO15</a>	0.107	0.058	96°
<a href="#">DENCOFO16</a>	0.052	0.048	75°
<a href="#">DENCOFO20</a>	0.046	0.044	61°
<a href="#">DENCOFO29</a>	0.031	0.028	150°
<a href="#">DENCOFO30</a>	0.158	0.072	176°
<a href="#">DENCOFO31</a>	0.03	0.028	11°
<a href="#">DENCOFO33</a>	0.028	0.027	177°
<a href="#">DENCOFO34</a>	0.048	0.039	177°
<a href="#">DENCOFO35</a>	0.08	0.072	45°
<a href="#">DENCOFO39</a>	0.26	0.179	113°
<a href="#">DENCOFO44</a>	0.029	0.028	50°
<a href="#">DENCOFO45</a>	0.04	0.031	114°



Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">DENCOTW04</a>	0.045	0.042	134°
<a href="#">DENCOTW44</a>	0.029	0.027	13°
<a href="#">DENCOTW45</a>	0.028	0.027	173°
<a href="#">DENCOTW46</a>	0.026	0.025	4°
<a href="#">DENCOTW47</a>	0.03	0.027	39°
<a href="#">DENCOTW47_2</a>	0.03	0.028	168°
<a href="#">DENCOTW48</a>	0.034	0.03	114°
<a href="#">DENCOTW49</a>	0.027	0.025	179°
<a href="#">DENCOUA05</a>	0.025	0.024	56°
<a href="#">DENCOUA08</a>	0.027	0.026	113°
<a href="#">DENCOUA09</a>	0.028	0.026	13°
<a href="#">DSRC NAD83(2011) Epoch 2010 NGS DS</a>	0.007	0.007	170°
<a href="#">KK1351</a>	0.031	0.027	170°
<a href="#">LiDAR LAND2</a>	0.032	0.031	2°
<a href="#">P044 NAD83(2011) Epoch 2010 NGS DS</a>	0.016	0.016	82°
<a href="#">TMGO NAD83(2011) Epoch 2010 NGS DS</a>	0.006	0.006	176°
<a href="#">WYLC NAD83(2011) Epoch 2010 NGS DS</a>	0.011	0.011	178°
<a href="#">ZDV1 NAD83(2011) Epoch 2010 NGS DS</a>	0.007	0.007	164°

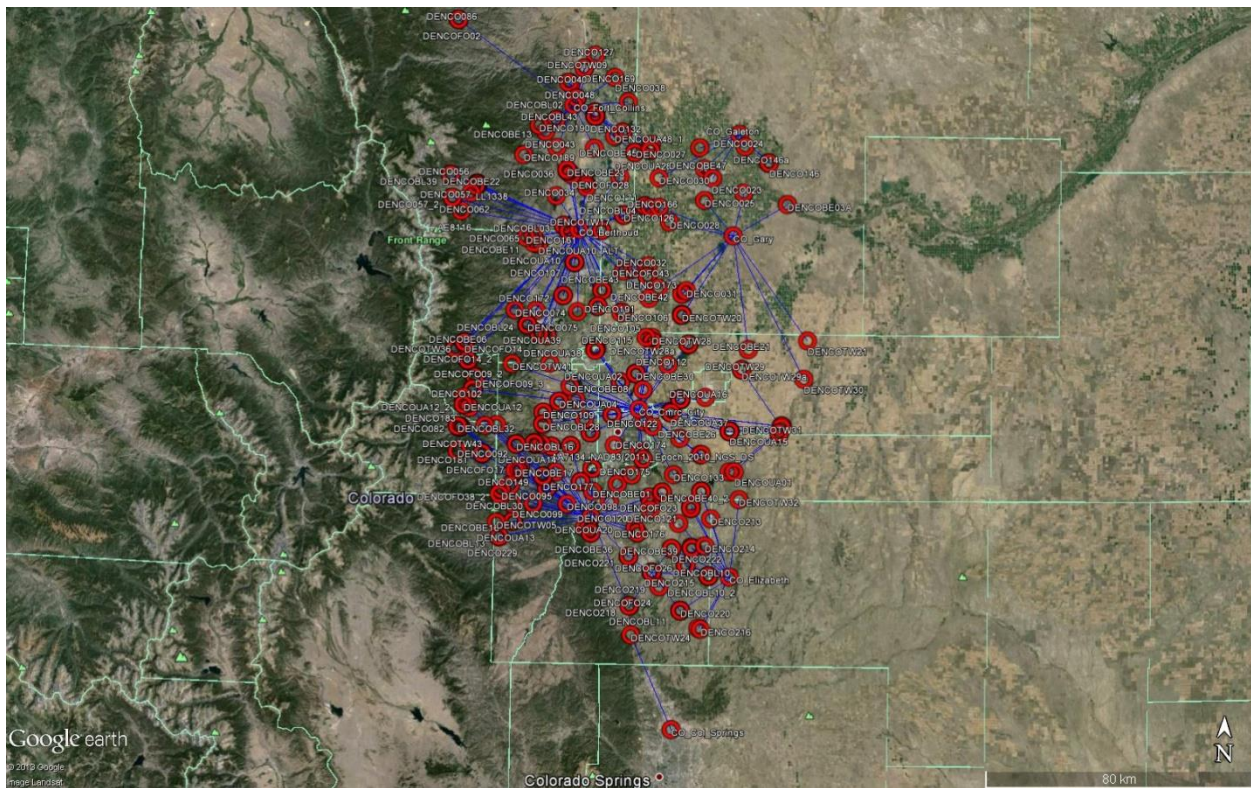
## CompassData

Compass Data Inc  
12353 E Easter Ave  
Centennial, CO 80112  
[www.compassdatainc.com](http://www.compassdatainc.com) | [solutions@compassdatainc.com](mailto:solutions@compassdatainc.com)



## 14. VRS REPORT (PART 2)

Project Information		Coordinate System	
Name:	2461_CO_Flood	Name:	US State Plane 1983
Size:	2 MB	Datum:	NAD 1983 (Conus)
Modified:	1/16/2014 12:00:41 PM (UTC:-7)	Zone:	Colorado North 0501
Time zone:	Mountain Standard Time	Geoid:	GEOID12A (Conus)



**Precision Confidence Level:** 95%  
**Tolerance for LE95%** 0.2 ft





Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCO023	1379115.946	3260031.704	4670.584	0.062	0.081
DENCO024	1423549.415	3260249.06	4812.362	0.074	0.088
DENCO025	1370991.962	3222593.598	4679.18	0.095	0.126
DENCO026	1392517.974	3229706.722	4649.412	0.067	0.09
DENCO027	1421410.075	3216609.575	4755.68	0.078	0.1
DENCO028	1349184.305	3189419.703	4753.893	0.078	0.103
DENCO029	1423468.122	3169658.351	4816.608	0.091	0.136
DENCO030	1391417.869	3178152.887	4958.984	0.092	0.111
DENCO031	1284087.841	3207264.606	5025.932	0.061	0.082
DENCO032	1307139.232	3169979.281	4874.843	0.089	0.132
DENCO033_2	1339622.364	3124180.561	4986.129	0.069	0.084
DENCO034	1371605.873	3079782.115	5770.672	0.082	0.094
DENCO035	1391299.397	3140536.496	4928.359	0.1	0.157
DENCO036	1395605.085	3089943.97	5113.448	0.063	0.084
DENCO037	1449061.694	3115343.505	5007.878	0.024	0.03
DENCO038	1486622.668	3133312.812	5161.588	0.041	0.05
DENCO040	1480328.517	3088886.69	5160.862	0.033	0.046
DENCO043	1417815.923	3079262.32	5322.037	0.041	0.049
DENCO047	1444507.242	3077780.928	5799.919	0.047	0.068
DENCO048	1465746.343	3096847.469	5122.072	0.029	0.048
DENCO055	1380396.414	3003667.807	7458.55	0.066	0.082
DENCO056	1388648.669	2978474.901	8059.287	0.099	0.128



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCO057	1366818.449	2980574.925	7982.821	0.059	0.073
DENCO062	1372114.017	2998412.767	7772.239	0.078	0.146
DENCO065	1333017.683	3058814.564	5514.064	0.056	0.111
DENCO074	1261441.278	3043461.54	7073.972	0.09	0.108
DENCO075	1247557.77	3055496.126	5473.966	0.091	0.115
DENCO081	1211545.192	3077981.972	6019.341	0.053	0.088
DENCO082	1149449.059	2991589.086	7597.269	0.068	0.093
DENCO084	1153288.711	3072972.425	5768.962	0.065	0.098
DENCO086	1537575.473	2981674.874	8113.017	0.106	0.133
DENCO091_2	1223059.951	2987632.213	8526.781	0.068	0.085
DENCO092	1125767.959	2992048.685	10916.365	0.109	0.135
DENCO095	1090077.948	3034885.707	7947.109	0.085	0.157
DENCO096	1134075.952	3071960.829	6951.743	0.058	0.086
DENCO097	1107941.022	3086454.366	6184.325	0.046	0.051
DENCO098	1077688.424	3098014.738	5936.884	0.034	0.04
DENCO099	1076771.869	3045577.445	8567.289	0.062	0.083
DENCO100	1077492.566	3065531.76	7861.87	0.045	0.051
DENCO101	1108860.982	3050509.157	7062.433	0.072	0.089
DENCO102	1177112.115	2996319.987	8439.471	0.091	0.109
DENCO103	1261480.362	3063478.269	5450.044	0.067	0.095
DENCO104	1261471.101	3103265.512	5055.45	0.07	0.092
DENCO105	1262412.855	3146115.411	5086.62	0.096	0.13



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCO106	1261102.687	3203491.246	5044.577	0.074	0.09
DENCO107	1308547.759	3099093.98	5039.383	0.081	0.129
DENCO108	1237703.318	3074295.903	5352.408	0.07	0.073
DENCO109	1164446.366	3072905.678	6163.85	0.062	0.08
DENCO110	1177380.942	3103881.425	5473.495	0.073	0.095
DENCO111	1195404.73	3146317.394	5394.218	0.089	0.122
DENCO112	1212708.001	3191520.954	5086.964	0.11	0.172
DENCO113	1226491.143	3121180.437	5442.173	0.092	0.108
DENCO114_2	1301294.168	3146280.634	4857.583	0.077	0.104
DENCO115	1238575.939	3169861.199	5169.317	0.07	0.096
DENCO116	1128041.422	3224249.535	5668.608	0.079	0.082
DENCO117	1129652.765	3166204.397	5398.073	0.117	0.183
DENCO118	1133220.864	3100097.276	5944.185	0.076	0.091
DENCO119	1079976.8	3178076.637	5919.261	0.066	0.08
DENCO120	1080637.906	3138492.488	5635.381	0.062	0.075
DENCO121	1076564.719	3217100.533	6110.177	0.119	0.175
DENCO122	1166905.393	3195544.104	5335.465	0.075	0.099
DENCO123	1111949.6	3121482.499	5543.393	0.06	0.073
DENCO124	1163669.028	3139234.72	5241.617	0.062	0.075
DENCO125	1056416.175	3163923.639	6482.306	0.062	0.072
DENCO126	1354875.65	3145270.643	4888.227	0.07	0.096
DENCO127	1507508.587	3114096.17	5292.769	0.056	0.062



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCO132	1434308.914	3142030.843	4850.437	0.07	0.075
DENCO133	1108079.072	3199503.004	5815.6	0.076	0.099
DENCO146	1408471.68	3283854.386	4636.473	0.06	0.068
DENCO149	1094134.783	3043137.175	7628.539	0.072	0.093
DENCO150	1150476.273	3017468.434	7232.703	0.071	0.095
DENCO161	1331133.118	3051914.903	5687.3	0.089	0.123
DENCO163	1188479.846	3168029.256	5135.546	0.069	0.076
DENCO164	1134738.149	3141908.441	5229.515	0.072	0.083
DENCO165_2	1338189.008	3092664.991	5142.415	0.062	0.071
DENCO166	1363234.71	3179215.389	4752.591	0.102	0.093
DENCO167_2	1415046.133	3154150.238	4805.23	0.083	0.118
DENCO168	1418192.563	3115286.194	5108.378	0.044	0.046
DENCO169	1494735.09	3103831.791	5174.561	0.038	0.038
DENCO170	1463459.854	3146821.314	5054.572	0.068	0.077
DENCO171	1380651.515	3108802.495	5036.576	0.087	0.117
DENCO172	1276639.039	3088907.157	5132.756	0.064	0.077
DENCO173	1285916.846	3180269.822	4944.898	0.08	0.096
DENCO174	1143022.639	3204642.922	5531.995	0.097	0.142
DENCO175	1106808.291	3159437.406	5523.664	0.081	0.109
DENCO176	1061731.164	3205557.91	5855.422	0.081	0.111
DENCO177	1103579.087	3074304.432	6815.296	0.069	0.074
DENCO178	1158734.877	3112453.884	5473.649	0.088	0.119





Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCO179	1153634.353	3178399.174	5326.334	0.078	0.103
DENCO180	1133709.731	3048117.241	7666.799	0.062	0.074
DENCO181	1124098.356	3015547.053	9202.692	0.054	0.073
DENCO183	1167301.761	3002341.48	8628.953	0.056	0.069
DENCO184	1212518.662	2999613.926	8429.847	0.069	0.092
DENCO189	1409651.117	3047802.671	6969.324	0.043	0.05
DENCO190	1438451.841	3061815.722	6072.672	0.038	0.047
DENCO191	1275746.858	3171600.555	4999.949	0.087	0.156
DENCO192	1282320.252	3126268.132	4983.198	0.073	0.085
DENCO193_2	1180199.19	3204219.895	5315.927	0.07	0.1
DENCO194	1097927.036	3145685.766	5501.944	0.063	0.074
DENCO195	1099082.779	3110602.722	5638.103	0.065	0.087
DENCOBE01	1090287.263	3122178.024	5507.001	0.064	0.09
DENCOBE03A	1369255.459	3302435.783	4537.007	0.059	0.08
DENCOBE05	1184960.341	3005102.283	9218.486	0.076	0.088
DENCOBE06	1229170.988	2996153.86	8268.313	0.067	0.084
DENCOBE08	1190091.448	3098076.03	5595.684	0.071	0.08
DENCOBE11	1325989.212	3059297.125	5436.446	0.112	0.148
DENCOBE13	1432844.835	3068045.669	5603.153	0.041	0.041
DENCOBE14	1479668.71	3091081.585	5151.96	0.035	0.036
DENCOBE16	1060240.658	3046683.212	8572.167	0.055	0.081
DENCOBE17	1108736.514	3047325.729	7080.422	0.055	0.057



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCOBE18	1149028.106	2993185.875	7567.836	0.058	0.067
DENCOBE21	1229462.891	3268279.131	5246.767	0.092	0.136
DENCOBE22	1380037.868	3004728.296	7437.094	0.056	0.067
DENCOBE23	1396821.687	3089567.44	5139.535	0.079	0.114
DENCOBE25	1267049.605	3122515.523	4992.417	0.065	0.077
DENCOBE26	1150796.689	3252109.251	5531.639	0.083	0.13
DENCOBE27	1234606.513	3176081.151	5078.063	0.086	0.107
DENCOBE28	1308409.567	3098822.468	5027.013	0.095	0.122
DENCOBE29	1239536.753	3066953.251	5443.43	0.061	0.083
DENCOBE30	1203766.601	3160877.531	5154.3	0.058	0.076
DENCOBE31	1051850.718	3166162.226	6566.784	0.068	0.09
DENCOBE32	1182817.508	3328093.084	5362.06	0.062	0.079
DENCOBE33	1167746.844	3194422.683	5333.243	0.078	0.123
DENCOBE34	1145918.764	3118817.548	5408.447	0.099	0.146
DENCOBE35	1122277.31	3169932.765	5504.815	0.061	0.083
DENCOBE36	1050570.722	3121443.512	5722.105	0.025	0.032
DENCOBE37	1014325.523	3181188.727	6201.602	0.109	0.149
DENCOBE38	962434.53	3226904.061	6833.239	0.066	0.082
DENCOBE39	1038331.571	3218721.92	6291.55	0.076	0.079
DENCOBE40_2	1092798.049	3226469.429	6106.343	0.089	0.157
DENCOBE41	1157415.599	3302142.883	5477.636	0.07	0.097
DENCOBE42	1280859.26	3202956.167	4992.992	0.074	0.098



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCOBE43	1303539.697	3154984.233	4850.908	0.075	0.094
DENCOBE44	1383243.092	3108140.914	5027.4	0.045	0.077
DENCOBE45	1417688.088	3169453.422	4800.804	0.086	0.126
DENCOBE46	1449307.966	3115252.561	5012.512	0.044	0.079
DENCOBE47	1401366.305	3221705.9	4660.141	0.088	0.137
DENCOBE52	1364119.155	3165315.793	4801.923	0.088	0.137
DENCOBL01	1073939.275	3177829.777	5992.387	0.048	0.064
DENCOBL02	1465675.621	3096912.793	5118.879	0.031	0.05
DENCOBL03_2	1343482.894	3087744.489	5308.207	0.066	0.077
DENCOBL04	1362628.471	3170095.215	4793.89	0.07	0.083
DENCOBL08	1226470.18	3121025.898	5444.334	0.094	0.148
DENCOBL09	1112240.932	3252911.66	5923.631	0.058	0.062
DENCOBL10	1012268.859	3235452.595	6711.406	0.116	0.164
DENCOBL11	978519.188	3209311.028	6826.708	0.06	0.08
DENCOBL12	1028554.656	3158150.459	6052.721	0.062	0.066
DENCOBL13	1044870.079	3033676.29	8332.432	0.079	0.112
DENCOBL15_2	1103458.328	3074335.842	6807.943	0.061	0.099
DENCOBL16	1133521.366	3048028.314	7671.854	0.057	0.076
DENCOBL18	1212302.848	2999347.828	8422.624	0.072	0.091
DENCOBL24	1247956.447	3055314.427	5572.962	0.069	0.094
DENCOBL28	1153275.701	3072882.748	5767.607	0.074	0.076
DENCOBL30	1090098.904	3034692.76	7957.084	0.071	0.095



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCOBL32	1149462.591	2991356.46	7602.414	0.054	0.071
DENCOBL39	1388538.623	2978536.674	8031.617	0.06	0.081
DENCOBL40	1395520.99	3090011.377	5111.149	0.079	0.109
DENCOBL43	1444216.441	3077791.033	5796.252	0.06	0.076
DENCOBL44	1480403.678	3089978.282	5223.535	0.036	0.036
DENCOFO02	1537689.628	2981444.473	8108.414	0.101	0.124
DENCOFO11	1055578.826	3115218.726	5556.523	0.023	0.028
DENCOFO13	1380992.215	3003849.086	7497.012	0.076	0.098
DENCOFO14_2	1229168.648	2995987.225	8293.286	0.1	0.129
DENCOFO17	1123928.947	3015651.188	9204.656	0.121	0.164
DENCOFO18	1148414.915	2993471.867	7635.185	0.074	0.089
DENCOFO19	1134217.121	3065910.779	7356.356	0.067	0.116
DENCOFO21	1092331.382	3078269.153	7111.047	0.059	0.069
DENCOFO23	1079533.59	3217035.905	6194.023	0.114	0.153
DENCOFO24	981916.5	3160132.658	6595.806	0.228	0.206
DENCOFO25	1039470.888	3218210.197	6237.418	0.092	0.146
DENCOFO26	1021973.098	3213709.148	6238.847	0.099	0.126
DENCOFO27	1108472.746	3049992.958	7105.562	0.066	0.077
DENCOFO28	1392361.366	3093900.814	5066.058	0.08	0.112
DENCOFO37	1151508.765	3028725.954	7018.885	0.059	0.074
DENCOFO38_2	1085696	3032850.564	8369.016	0.073	0.093
DENCOFO43	1296770.402	3169562.88	4982.208	0.089	0.093





Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCOTW01	1127934.674	3225716.504	5674.833	0.112	0.192
DENCOTW05	1058701.696	3030950.568	8146.528	0.068	0.094
DENCOTW07	1261313.643	3145019.72	5108.679	0.074	0.104
DENCOTW08	1338205.156	3092825.454	5140.146	0.063	0.071
DENCOTW09	1494739.298	3103308.693	5168.794	0.052	0.054
DENCOTW10	1434132.629	3141998.152	4850.702	0.07	0.075
DENCOTW17	1354668.905	3145181.148	4871.997	0.068	0.093
DENCOTW18	1276364.234	3089034.634	5135.157	0.078	0.125
DENCOTW19	1283032.351	3125893.624	4973.031	0.067	0.085
DENCOTW20	1260724.236	3203624.856	5055.79	0.061	0.07
DENCOTW21	1239236.965	3325074.822	4999.455	0.087	0.156
DENCOTW22	1037548.181	3199453.278	6185.844	0.072	0.1
DENCOTW23	978592.718	3209340.391	6824.504	0.08	0.106
DENCOTW24	954286.608	3162449.838	6890.676	0.077	0.095
DENCOTW25	1054987.688	3119240.318	5604.133	0.025	0.027
DENCOTW26	1111905.845	3121126.644	5541.47	0.082	0.127
DENCOTW27	1195093.249	3145956.929	5356.283	0.106	0.16
DENCOTW28	1233090.166	3210665.617	5075.552	0.063	0.08
DENCOTW29	1209999.719	3262397.231	5306.142	0.09	0.138
DENCOTW30	1202440.014	3322330.889	5204.878	0.081	0.097
DENCOTW31	1150372.667	3299986.886	5514.486	0.081	0.103
DENCOTW32	1085995.186	3262910.717	6142.321	0.062	0.067



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCOTW33	1076447.621	3217084.548	6093.973	0.09	0.136
DENCOTW34	1164139.11	3072943.065	6150.354	0.059	0.077
DENCOTW35_2	1180187.101	3204112.858	5317.412	0.07	0.093
DENCOTW36	1229321.631	2996130.555	8265.681	0.065	0.094
DENCOTW37	1091120.909	3189133.206	5730.91	0.09	0.134
DENCOTW38	1239319.466	3066918.672	5452.223	0.06	0.074
DENCOTW39	1381212.774	3003919.154	7525.019	0.058	0.083
DENCOTW40	1134804.585	3065863.608	7354.894	0.062	0.103
DENCOTW41	1209992.996	3042142.693	7919.323	0.07	0.092
DENCOTW42	1111432.12	3052091.347	7077.26	0.073	0.077
DENCOTW43	1148333.973	2992925.214	7752.961	0.065	0.072
DENCOUA01	1112362.737	3257676.815	5980.098	0.076	0.096
DENCOUA02	1203747.774	3160743.308	5159.771	0.062	0.081
DENCOUA03	1266950.565	3122443.91	4998.762	0.095	0.186
DENCOUA04	1175199.582	3087819.966	5644.079	0.068	0.096
DENCOUA06	1108837.816	3050454.922	7063.175	0.052	0.064
DENCOUA07	1149031.108	2994830.141	7557.349	0.058	0.074
DENCOUA10_ALT	1324916.606	3063929.336	5368.426	0.092	0.135
DENCOUA11	1229091.824	2996399.575	8262.2	0.082	0.091
DENCOUA12	1170016.59	2996586.883	8421.494	0.115	0.148
DENCOUA13	1060083.927	3046656.745	8579.485	0.095	0.152
DENCOUA14	1134858.229	3065192.932	7389.453	0.063	0.093



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCOUA15_B	1151095.019	3252325.322	5530.946	0.074	0.104
DENCOUA16	1182714.788	3228009.318	5362.461	0.077	0.1
DENCOUA17	1157201.207	3302222.095	5478.699	0.09	0.124
DENCOUA20	1050464.758	3121418.629	5734.112	0.034	0.047
DENCOUA21	1021710.078	3212934.169	6205.363	0.075	0.08
DENCOUA22	1014403.26	3181139.125	6202.755	0.081	0.106
DENCOUA23	1038343.073	3218714.406	6291.244	0.066	0.091
DENCOUA24	1051871.689	3166240.421	6566.497	0.061	0.07
DENCOUA25	1122113.612	3169773.766	5511.285	0.058	0.078
DENCOUA26	1234840.536	3176066.797	5072.421	0.077	0.113
DENCOUA27	1364107.166	3165129.538	4807.044	0.08	0.159
DENCOUA28	1418452.144	3168251.599	4792.151	0.081	0.1
DENCOUA29	1303480.851	3155177.681	4850.644	0.09	0.129
DENCOUA30	1281337.625	3203725.338	4989.285	0.06	0.07
DENCOUA34	1163921.666	3138957.147	5246.233	0.081	0.096
DENCOUA35	1099519.442	3110557.697	5647.074	0.071	0.09
DENCOUA36	1092781.918	3226589.845	6099.216	0.069	0.088
DENCOUA37	1167679.651	3194915.13	5331.747	0.058	0.073
DENCOUA38	1224932.987	3121123.138	5401.905	0.09	0.123
DENCOUA39	1239536.968	3066777.206	5451.804	0.052	0.062
DENCOUA40	1383108.093	3108177.5	5030.028	0.042	0.075
DENCOUA41	1308501.171	3098998.45	5034.448	0.116	0.155



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCOUA43	1380578.389	3003615.019	7465.712	0.064	0.066
DENCOUA44	1449092.391	3115344.782	5008.79	0.031	0.043
DENCOUA45	1090903.434	3188841.818	5739.576	0.066	0.088
DENCOUA46	1158024.21	3169574.805	5296.282	0.07	0.085
DENCOUA48	1449061.334	3115340.963	5007.881	0.033	0.033
DENCOUA49	1146155.537	3118634.389	5414.848	0.12	0.176

## CompassData

Compass Data Inc  
12353 E Easter Ave  
Centennial, CO 80112

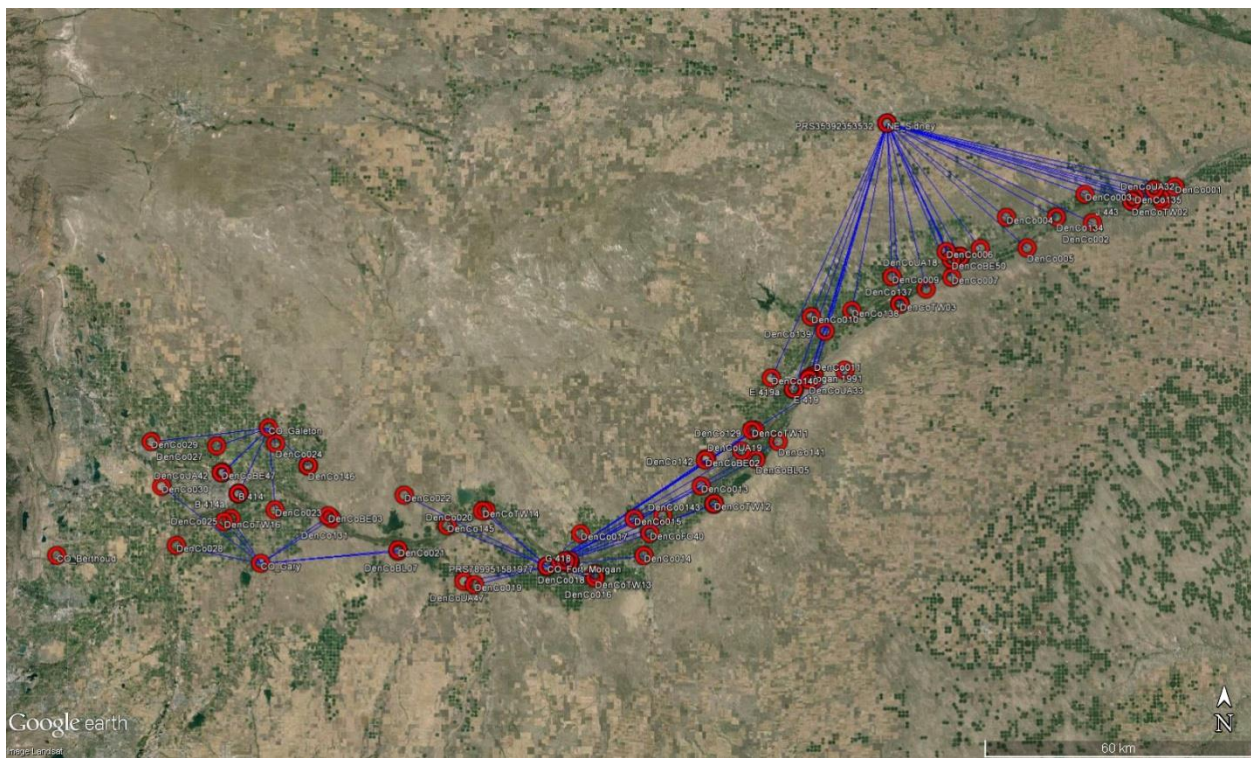
[www.compassdatainc.com](http://www.compassdatainc.com) | [solutions@compassdatainc.com](mailto:solutions@compassdatainc.com)





### 15. VRS REPORT (PART 3) COLLECTED BY PHOTO SCIENCE

Project Information		Coordinate System	
Name:	2461_CO_Flood	Name:	US State Plane 1983
Size:	578 KB	Datum:	NAD 1983 (Conus)
Modified:	12/19/2013 8:49:34 AM (UTC:-7)	Zone:	Colorado North 0501
Time zone:	Mountain Standard Time	Geoid:	GEOID12A (Conus)



**Precision Confidence Level:** 95%  
**Tolerance for LE95%** 0.2 ft



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCO001	1622386.656	3907598.632	3451.173	0.065	0.091
DENCO002	1595082.089	3847657.796	3695.146	0.054	0.087
DENCO003	1615417.893	3841880.406	3629.115	0.05	0.064
DENCO004	1597453.212	3784909.572	3714.491	0.075	0.091
DENCO005	1575811.957	3800275.203	3699.721	0.062	0.068
DENCO006	1571866.28	3741685.552	3741.412	0.097	0.146
DENCO007	1553380.006	3745947.061	3768.494	0.052	0.058
DENCO008	1533959.116	3708777.409	3854.136	0.047	0.068
DENCO009	1552848.095	3702727.706	3838.292	0.045	0.073
DENCO010	1522962.476	3644905.568	3951.074	0.065	0.084
DENCO011	1485030.752	3669764.116	4166.369	0.069	0.099
DENCO012	1477615.555	3646900.209	3976.918	0.088	0.102
DENCO013	1399861.071	3567909.053	4099.534	0.048	0.063
DENCO014	1349154.235	3527655.314	4220.771	0.042	0.053
DENCO143	1386918.863	3577418.726	4117.517	0.068	0.088
DENCO015	1375482.732	3520039.475	4269.884	0.053	0.076
DENCO016	1332514.022	3492613.08	4294.962	0.04	0.061
DENCO017	1363947.656	3481635.036	4454.649	0.036	0.045
DENCO018	1342561.945	3472991.848	4324.524	0.021	0.028
DENCO019	1325731.279	3405835.311	4566.294	0.043	0.046
DENCO020	1379090.089	3413199.497	4370.952	0.054	0.069
DENCO021	1349533.902	3350200.405	4491.735	0.054	0.057



Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCO022	1388914.695	3353866.07	4620.33	0.049	0.054
DENCO128	1611575.13	3898486.785	3516.533	0.085	0.152
DENCO129	1440618.761	3605777.348	4016.847	0.066	0.091
DENCO131	1370950.787	3301743.73	4523.535	0.182	0.246
DENCO134	1598512.822	3821321.436	3590.573	0.069	0.081
DENCO135	1614425.44	3878174.134	3520.053	0.06	0.08
DENCO136	1574586.889	3766367.159	3676.136	0.078	0.087
DENCO137	1544561.177	3727518.736	3832.095	0.059	0.082
DENCO138	1528054.528	3674079.994	3836.233	0.063	0.083
DENCO139	1512853.016	3655007.262	3874.436	0.065	0.073
DENCO140	1478342.861	3616868.842	4064.801	0.051	0.065
DENCO141	1432857.663	3622782.063	4038.392	0.069	0.105
DENCO142	1419531.021	3571414.106	4274.621	0.054	0.071
DENCO144	1377964.247	3540670.984	4168.051	0.044	0.065
DENCO145	1367688.088	3385432.98	4406.099	0.047	0.055
DENCOBE02	1418552.38	3570551.936	4266.973	0.069	0.09
DENCOBE48	1342929.289	3474408.164	4319.911	0.021	0.034
DENCOBE49	1478312.176	3644268.018	3939.08	0.081	0.094
DENCOBE50	1566593.383	3745644.277	3709.318	0.12	0.168
DENCOBE51	1620087.98	3892643.666	3483.854	0.087	0.111
DENCOBL05	1419732.239	3606958.121	4045.488	0.086	0.096
DENCOBL06	1344618.733	3474016.325	4272.292	0.03	0.039



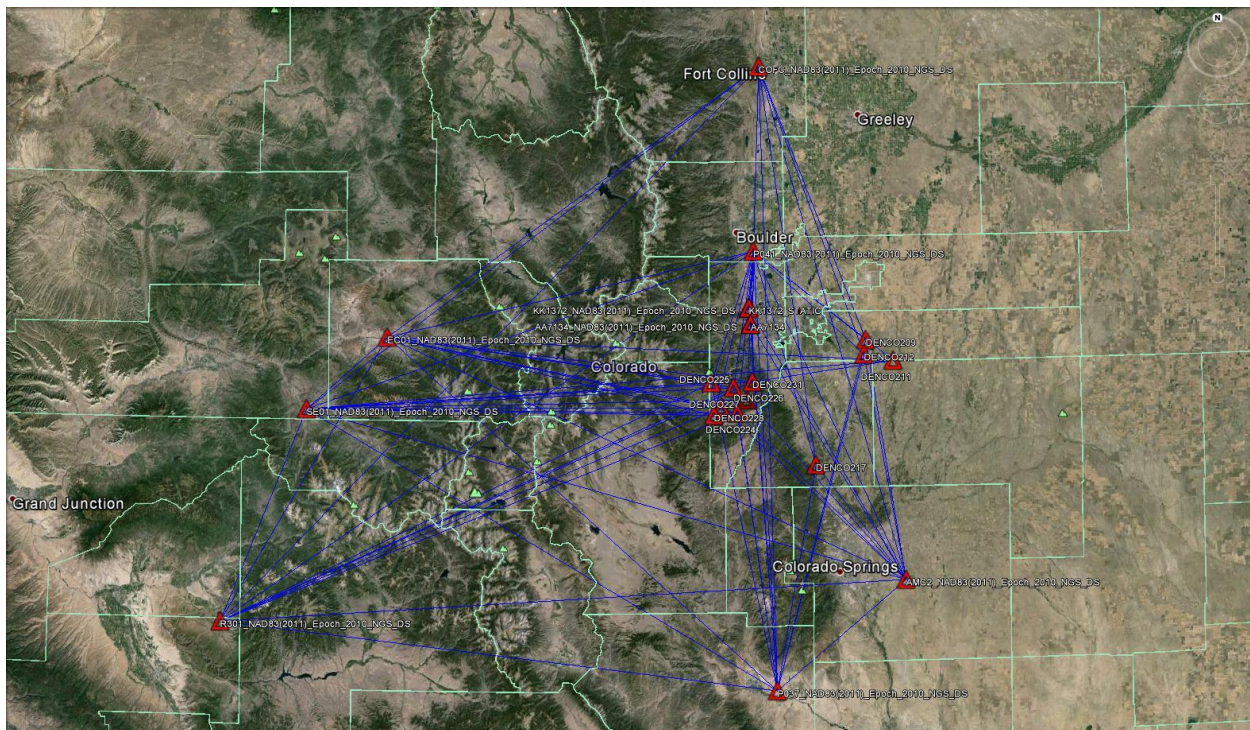
Point ID	Northing	Easting	Elevation	H. Precision	V. Precision
DENCOBL07	1348502.595	3350139.732	4503.736	0.052	0.056
DENCOFO40	1365227.314	3531662.706	4175.692	0.058	0.071
DENCOFO41	1479455.807	3644041.76	3929.604	0.111	0.135
DENCOFO42	1614242.269	3897002.39	3456.681	0.201	0.222
DENCOTW02	1611114.389	3876147.786	3518.187	0.051	0.068
DENCOTW03	1533243.045	3708756.353	3854.73	0.049	0.067
DENCOTW11	1440546.504	3603565.112	4064.198	0.062	0.081
DENCOTW12	1387482.248	3577434.463	4116.397	0.06	0.077
DENCOTW13	1335146.775	3492649.298	4285.639	0.032	0.049
DENCOTW14	1378825.479	3410612.541	4369.729	0.06	0.077
DENCOTW15	1408477.596	3283968.484	4636.427	0.103	0.119
DENCOTW16	1367071.265	3223949.41	4690.396	0.044	0.072
DENCOUA18	1566179.295	3745330.17	3710.396	0.047	0.07
DENCOUA19	1425761.227	3596436.78	4040.793	0.088	0.114
DENCOUA31	1342988.634	3474313.527	4318.012	0.026	0.042
DENCOUA32	1620053.757	3892427.833	3484.015	0.067	0.079
DENCOUA33	1477681.669	3644139.339	3939.299	0.074	0.109
DENCOUA42	1402166.632	3221461.931	4658.23	0.039	0.064
DENCOUA47	1328037.133	3398027.29	4549.93	0.063	0.071





16. STATIC GPS REPORT (PART 4)

Project Information		Coordinate System	
Name:	DRCOG	Name:	US State Plane 1983
Size:	2 MB	Datum:	NAD 1983 (Conus)
Modified:	1/30/2014 8:56:57 AM (UTC:-7)	Zone:	Colorado Central 0502
Time zone:	Mountain Standard Time	Geoid:	GEOID12A (Conus)





## NETWORK ADJUSTMENT REPORT

### 6. Adjustment Settings

Set-Up Errors

GNSS

Error in Height of Antenna: 0.016 ft

Centering Error: 0.016 ft

Covariance Display

Horizontal:

Propagated Linear Error [E]: U.S.

Constant Term [C]: 0.000 ft

Scale on Linear Error [S]: 1.960

Three-Dimensional

Propagated Linear Error [E]: U.S.

Constant Term [C]: 0.000 ft

Scale on Linear Error [S]: 1.960

### 7. Adjustment Statistics

Number of Iterations for Successful Adjustment: 2

Network Reference Factor: 1.00

Chi Square Test (95%): Passed

Precision Confidence Level: 95%

Degrees of Freedom: 227

Post Processed Vector Statistics

Reference Factor: 1.00

Redundancy Number: 227.00

A Priori Scalar: 1.15



## 8. Control Point Constraints

Point ID	Type	East $\sigma$ (US survey foot)	North $\sigma$ (US survey foot)	Height $\sigma$ (US survey foot)
<a href="#">AMC2 NAD83(2011) Epoch 2010 NGS DS</a>	Global	Fixed	Fixed	Fixed
<a href="#">EC01 NAD83(2011) Epoch 2010 NGS DS</a>	Global	Fixed	Fixed	Fixed
<a href="#">P041 NAD83(2011) Epoch 2010 NGS DS</a>	Global	Fixed	Fixed	Fixed

## 9. Adjusted Grid Coordinates

Point ID	Easting (US survey foot)	Easting Error (US survey foot)	Northing (US survey foot)	Northing Error (US survey foot)	Elevation (US survey foot)	Elevation Error (US survey foot)
<a href="#">AA7134</a>	3081653.903	0.052	1678525.518	0.051	6516.408	0.154
<a href="#">COFC NAD83(2011) Epoch 2010 NGS DS</a>	3094330.658	0.018	2005515.284	0.018	5286.094	0.029
<a href="#">DENCO209</a>	3228116.162	0.031	1658426.406	0.031	5816.152	0.047
<a href="#">DENCO211</a>	3262831.313	0.029	1632138.379	0.031	6141.816	0.036
<a href="#">DENCO212</a>	3225721.778	0.030	1639895.974	0.032	6053.669	0.035
<a href="#">DENCO217</a>	3163313.199	0.091	1500560.657	0.044	6846.475	0.116
<a href="#">DENCO224</a>	3064158.337	0.022	1566418.836	0.023	6676.974	0.026
<a href="#">DENCO225</a>	3031031.357	0.029	1604947.893	0.027	8141.823	0.038
<a href="#">DENCO226</a>	3059195.775	0.025	1598757.997	0.026	8588.091	0.030
<a href="#">DENCO227</a>	3043475.262	0.045	1573627.472	0.034	6897.537	0.048
<a href="#">DENCO228</a>	3034140.998	0.033	1563841.433	0.035	7786.831	0.038
<a href="#">DENCO230</a>	3076225.602	0.089	1583141.172	0.103	6517.144	0.133



Point ID	Easting (US survey foot)	Easting Error (US survey foot)	Northing (US survey foot)	Northin g Error (US survey foot)	Elevation (US survey foot)	Elevation Error (US survey foot)
<a href="#">DENCO231</a>	3083286.683	0.029	1605904.417	0.033	7682.818	0.040
<a href="#">KK1372_STATIC</a>	3079549.095	0.044	1699169.021	0.057	5689.500	0.157
<a href="#">P037_NAD83(2011)_E poch_2010_NGS_DS</a>	3113263.966	0.017	1214546.725	0.017	5363.407	0.025
<a href="#">R301_NAD83(2011)_E poch_2010_NGS_DS</a>	2402953.305	0.020	1306699.758	0.021	6694.444	0.035
<a href="#">SE01_NAD83(2011) Epoch_2010_NGS_DS</a>	2516219.888	0.017	1575264.724	0.017	6215.893	0.023

## 10. Error Ellipse Components

Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">AA7134</a>	0.065	0.064	61°
<a href="#">COFC_NAD83(2011)_Epoch_2010_NGS_DS</a>	0.023	0.023	78°
<a href="#">DENCO209</a>	0.039	0.038	79°
<a href="#">DENCO211</a>	0.039	0.037	177°
<a href="#">DENCO212</a>	0.040	0.038	178°
<a href="#">DENCO217</a>	0.114	0.055	94°
<a href="#">DENCO224</a>	0.029	0.028	173°
<a href="#">DENCO225</a>	0.036	0.034	90°
<a href="#">DENCO226</a>	0.032	0.031	10°
<a href="#">DENCO227</a>	0.057	0.042	74°



Point ID	Semi-major axis (US survey foot)	Semi-minor axis (US survey foot)	Azimuth
<a href="#">DENCO228</a>	0.044	0.041	173°
<a href="#">DENCO230</a>	0.159	0.059	40°
<a href="#">DENCO231</a>	0.041	0.036	180°
<a href="#">KK1372_STATIC</a>	0.073	0.053	164°
<a href="#">P037_NAD83(2011)_Epoch_2010_NGS_DS</a>	0.021	0.021	99°
<a href="#">R301_NAD83(2011)_Epoch_2010_NGS_DS</a>	0.026	0.025	44°
<a href="#">SE01_NAD83(2011)_Epoch_2010_NGS_DS</a>	0.022	0.022	49°

## CompassData

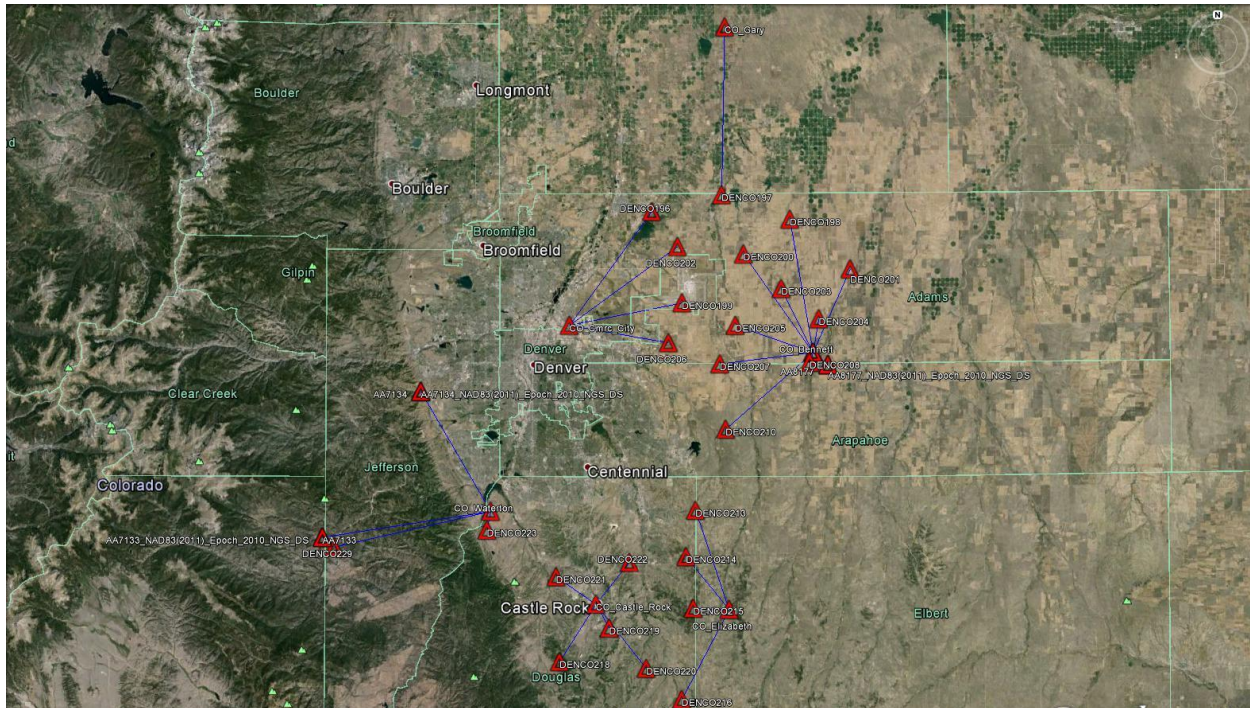
Compass Data Inc  
12353 E Easter Ave  
Centennial, CO 80112  
[www.compassdatainc.com](http://www.compassdatainc.com) | [solutions@compassdatainc.com](mailto:solutions@compassdatainc.com)





17. VRS REPORT (PART 5)

Project Information		Coordinate System	
Name:	DRCOG	Name:	US State Plane 1983
Size:	346 KB	Datum:	NAD 1983 (Conus)
Modified:	1/30/2014 8:57:02 AM (UTC:-7)	Zone:	Colorado Central 0502
Time zone:	Mountain Standard Time	Geoid:	GEOID12A (Conus)



Precision Confidence Level: 95%  
Tolerance for LE95% 0.2 ft



Point ID	Northing	Easting	H. Precision	V. Precision
DENCO196	1780043.912	3210652.779	0.048	0.059
DENCO197	1789757.056	3249938.091	0.058	0.06
DENCO198	1776345.673	3288485.574	0.055	0.056
DENCO199	1729097.181	3228008.166	0.047	0.067
DENCO200	1756612.502	3262443.132	0.062	0.072
DENCO201	1748752.001	3322651.113	0.05	0.058
DENCO202	1760578.787	3225285.568	0.078	0.089
DENCO203	1737483.358	3283831.272	0.039	0.043
DENCO204	1720694.847	3305062.197	0.029	0.041
DENCO205	1716683.856	3258081.08	0.047	0.042
DENCO206	1706753.529	3220583.605	0.059	0.059
DENCO207	1695144.487	3249547.829	0.058	0.07
DENCO208	1696418.121	3300084.5	0.021	0.022
DENCO210	1658643.625	3252989.952	0.047	0.065
DENCO213	1613272.308	3236334.169	0.09	0.126
DENCO214	1587343.196	3231219.026	0.09	0.118
DENCO215	1558537.362	3235420.802	0.107	0.156
DENCO216	1507599.504	3229289.737	0.114	0.164
DENCO218	1528239.982	3160555.226	0.041	0.045
DENCO219	1547218.697	3188327.616	0.076	0.098
DENCO220	1524832.13	3209277.632	0.102	0.137
DENCO221	1575508.083	3158253.939	0.072	0.104



Point ID	Northing	Easting	H. Precision	V. Precision
DENCO222	1583910.426	3199403.684	0.108	0.172
DENCO223	1601306.448	3119220.085	0.134	0.098
DENCO229	1591557.439	3033900.781	0.051	0.061

## CompassData

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12353 E Easter Ave  
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