

# Emmet County Iowa

## Countywide G.P.S. Survey Control Network

2006

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Dan Corbin, Inc.  
28 River Ridge Lane  
Cedar Falls, IA 50613

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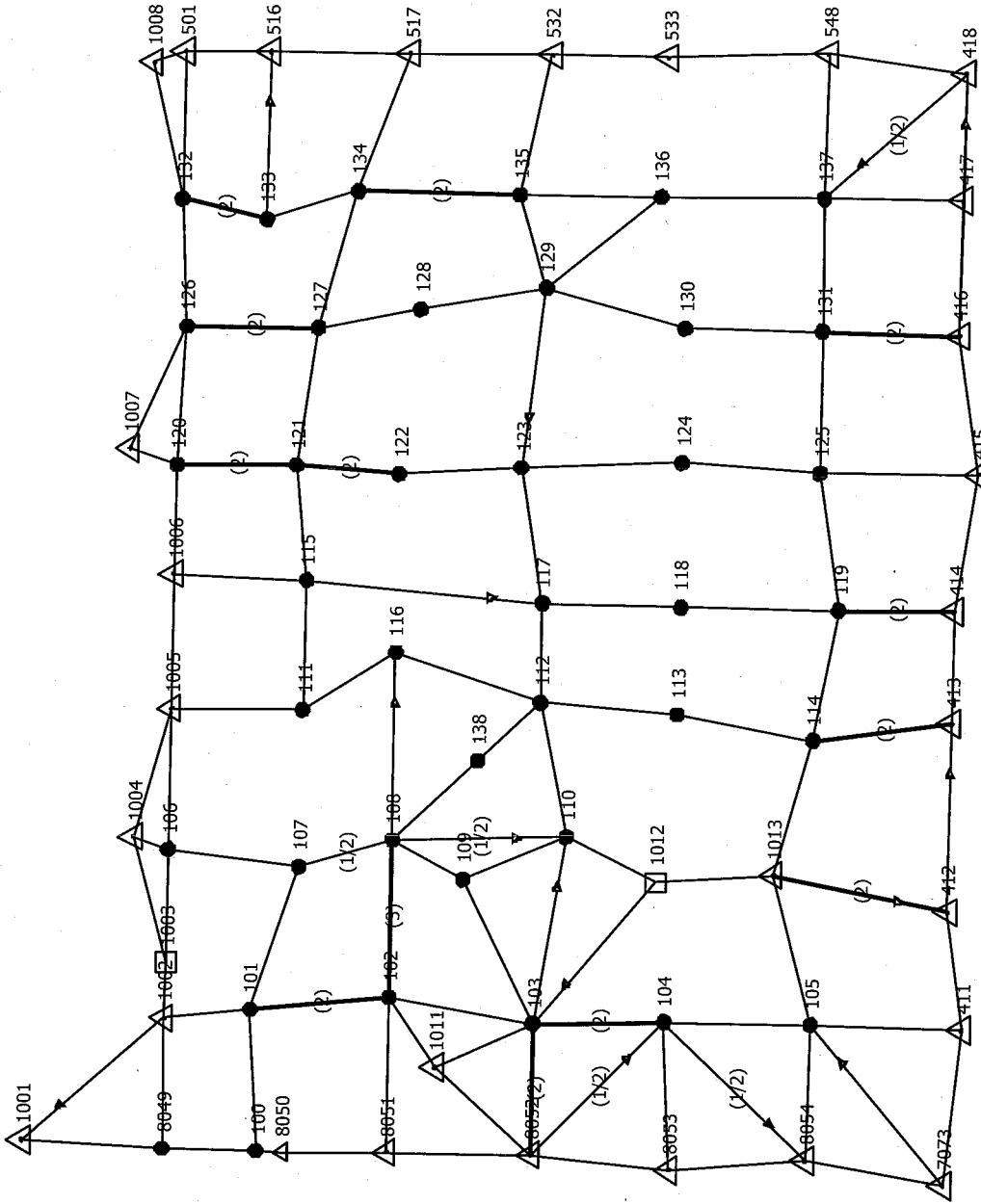
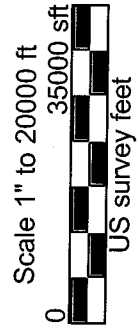
Cell: (319) 231-7047  
Fax: (319) 266-3398  
E-Mail: dcorbin@cfu.net

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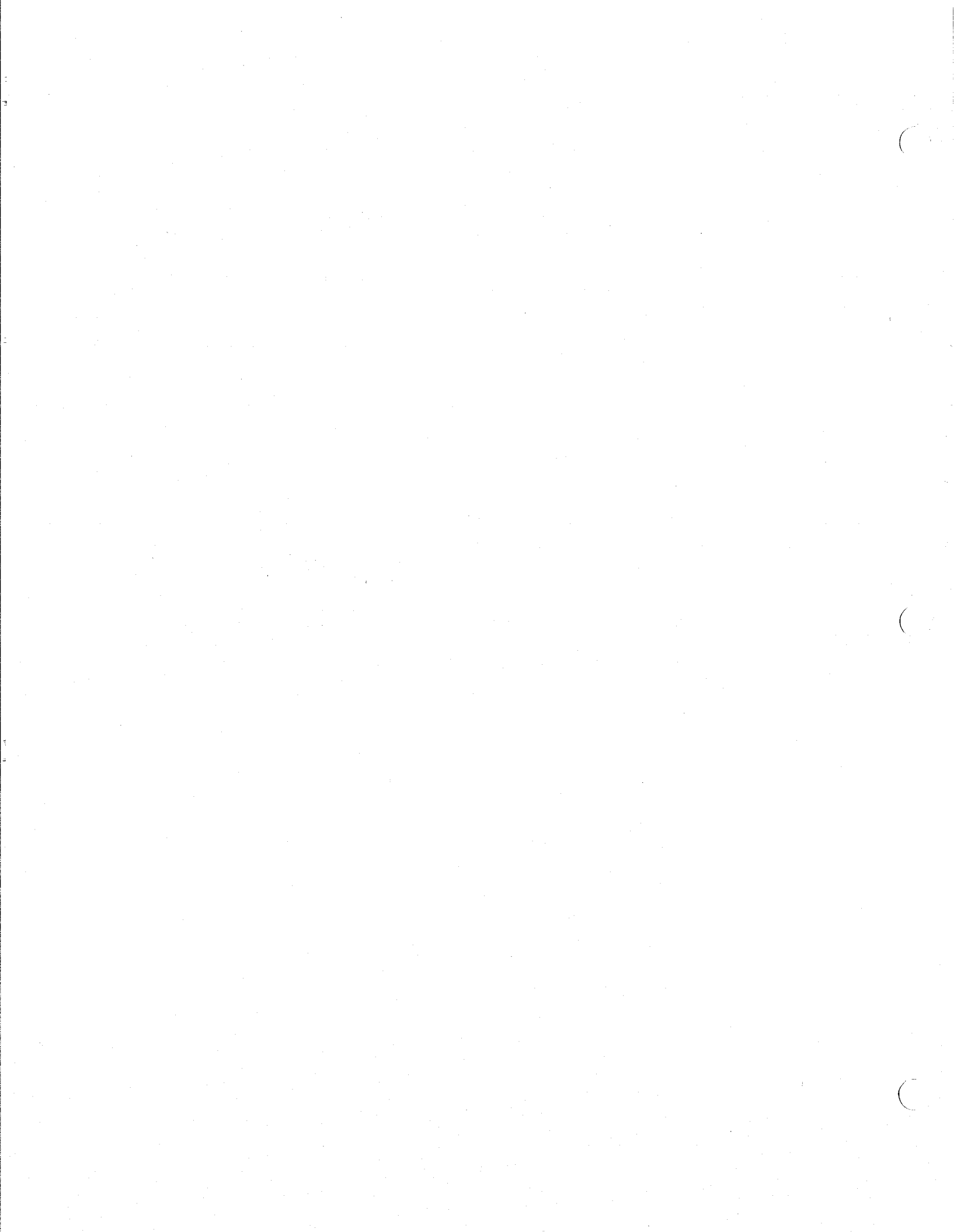
Field surveyor:  
GGB & DBC  
Computer operator:  
GGB  
Reference:



Site: Not selected, System: US State Plane 1983  
Zone: Iowa North 1401, Datum: NAD 1983 (Conus)  
Project: Emmet Co. Survey  
USFeet Template

Plot Scale: 1" to 20000 ft  
Printed on 10/18/2006, at 1:18:11 AM  
Printed from Trimble Geomatics Office





## **INTRODUCTION**

In 2006, the Emmet County Secondary Road Department contracted with the team of DC Inc. and GB Consulting to complete a high accuracy GPS control survey in Emmet County, Iowa for the purpose of establishing a county-wide survey control system and for future use in a county-wide GIS system.

Thirty eight (38) new control stations were added within Emmet County along with, six (6) existing Kossuth County GPS control points, eight (8) existing Palo Alto County GPS control points and seven (7) Dickenson County GPS control points were recovered and tied into the GPS network. One (1) third order point at the Estherville Airport (ESTHPORT) was measured with new horizontal and vertical positions established on this point. An additional eleven (11) control stations consisting of two (2) USGS second and third order benchmarks, nine (9) existing HARN positions with first order vertical control. A total of seventy one (71) points were measured and included in the network.

## **PROJECT REQUIREMENTS**

The purpose of this survey was to establish new state plane control throughout the project area, using a new horizontal and vertical control network with GPS survey equipment and techniques. This network was horizontally referenced to the Iowa High Accuracy Reference Network (HARN) of 1996. Vertically the network was referenced to the North American Vertical Datum of 1988 (NAVD88). Because this control would be utilized for many different purposes, it was important that the network geometry be ideal for a strong GPS survey. All new point locations for control were selected with the needs of future multiple uses and GPS survey requirements in mind. In some instances, it was necessary to adjust locations because of physical obstructions or existing land features. In these instances, the network was constructed with the coverage of the county held as primary and the GPS survey needs satisfied secondly. Because both of these philosophies support good geometry the network structure was not compromised.

## **MONUMENTATION BY EMMET COUNTY**

To perpetuate the GPS control measurements, 38 new permanent monuments were set in Emmet County for this survey by the County. BERNTSEN driven aluminum rod monuments were selected for the permanent monuments. Each BERNTSEN station monument consists of one three-foot smooth rod section and one three-foot top security fluted rod section with a stamped cap fastened to the top, all constructed of aluminum material. There is a permanent magnet mounted on the underside of the monument cap for future recovery with a magnetic locator. These monuments were driven to approximately 6" below the existing ground surface. For easy access and protection, a 24" long 5" diameter PVC pipe was placed over each rod monument along with a pre-cast aluminum access cover and backfilled with sand to facilitate drainage and to minimize frost movement. A steel fence post with a plastic sleeve was placed as a witness point at each new permanent monument position.

The County Engineer's office handled the One Call coordination for marking the various underground utility locations for each new permanent monument site.

## **RECONNAISSANCE**

The most important criterion for GPS observations at any given location is a clear view to the sky. In terms of network design, it is desirable that the horizontal control be located near the perimeter and also throughout the project site if possible. With this in mind, existing HARN horizontal stations were recovered in and/or near Emmet County along with other control that has been adjusted to the HARN. All positions in and near the county were chosen to be included in the network.

Vertical control was selected to provide as much coverage as possible, both at the periphery and in the interior of the project area.

## **FIELD SURVEY**

Five Trimble dual frequency Geodetic GPS receivers with Everest multi-path mitigation and high performance low elevation satellite tracking were used in this survey. GPS observations were made during daylight hours from Wednesday, October 11, 2006, through Friday, October 13, 2006.

Rapid static GPS techniques were utilized to minimize the time and cost of the survey. The satellite "window", where at least six satellites were observable, was open for much of the day with only a short period of unacceptable coverage because of the number of satellites or bad geometry. Each measurement period during which all receivers observe satellites simultaneously lasted from a minimum of 15 minutes to 100 minutes, depending on the distance being measured and the geometry of the satellite constellation.

## **DATA ADJUSTMENT**

A total of 265 vectors were observed and processed. Based on statistical indicators from the Trimble Geomatics Office processing software, there were 2 vectors flagged as outliers. After the re-measuring of these vectors and the removal of trivial vectors the final network is comprised of 71 stations and 137 baselines. All data adjustment was performed using the Trimble Geomatics Office least squares adjustment software. An initial free adjustment was performed in NAD83 to check the overall quality of the GPS data and the nature of the control. The initial unconstrained (free) adjustment yielded baseline precisions which ranged from 1:217,000 to 1:3,156,000 with the 3 mile baselines falling in the 1:800,000 to 1:2,400,000 range. Once the horizontal and vertical control was verified, subsequent adjustments were performed to arrive at the optimal solutions for each datum.

## **NAD83 (1996)**

The initial free adjustment was performed holding HARN point Petersburg C (1001) fixed horizontally with the vertical adjustment disabled. Coordinate values on the other HARN control stations were then checked against the published values. The network fit the published HARN values within a few hundredths of a foot. Because all of the horizontal data fit so well, the HARN-referenced stations were added to the network and a new adjustment performed. After each adjustment a comparison of adjusted coordinates vs. published values was made. By holding all of

the existing HARN stations fixed, and the control that was adjusted to the HARN, the precision of the adjustment degraded very little as compared to the unconstrained adjustment.

Once we were satisfied with the horizontal adjustment, we locked the horizontal positions and concentrated on the vertical adjustment. The Geoid 03 Conus was utilized to provide a model of the height of the Geoid. Adjustments were then performed locking on to the orthometric vertical control stations one at a time beginning with Petersburg C (1001). Vertical control was added station by station with the elevations on the benchmarks being then checked against the published values. All vertical control fit extremely well. Two existing Dickenson County stations 8049 and 8050 were not held in the vertical because of the use of a long baseline to control the vertical and horizontal in this area. Point 8049 was not held in horizontal for this same reason. Station ESTHPORT was re-measured to tie to higher order control so new horizontal and vertical data is being published for this point.

A final adjustment of both horizontal and vertical was then performed. All of the horizontal control points were held fixed in x and y and all vertical control were held fixed in z. This fully constrained adjustment solved for scale and rotation. Because of the large number of constrained control points (31) the network precision was reduced. In the final adjusted network, 100% of the adjusted vectors have an estimated error of x, y and z baseline precision between 1:107,000 to 1:1,189,000, with the 3 mile baselines again falling in the 1:400,000 range or better. All of the processed data and error factors were computed using a 95% confidence level factor.

## **CONCLUSION**

The results are well in excess of Order C class 1 (first-order precision) on short baselines (less than 3 miles) and between Order C class 1 and Order B on longer baselines (3 to 4 miles in length). On long baselines (over 6 miles) the precision is better than Order B. The control point locations are within  $\pm 0.03$  ft horizontal position and within  $\pm 0.08$  ft. vertically for benchmark use.

# Network Adjustment Report

**Project : EmmetAdj**

<b>User name</b>	Gary Brown	<b>Date &amp; Time</b>	1:10:31 AM 10/18/2006
<b>Coordinate System</b>	US State Plane 1983/1996 HARN	<b>Zone</b>	Iowa North 1401
<b>Project Datum</b>	NAD 1983 (Conus)		
<b>Vertical Datum</b>	NAVD88	<b>Geoid Model</b>	Geoid 03 (Conus)
<b>Coordinate Units</b>	US survey feet		
<b>Distance Units</b>	US survey feet		
<b>Height Units</b>	US survey feet		

## Adjustment Style Settings - 95% Confidence Limits

### Residual Tolerances

To End Iterations : 0.000033sft  
Final Convergence Cutoff : 0.016404sft

### Covariance Display

#### Horizontal

Propagated Linear Error [E] : U.S.  
Constant Term [C] : 0.00000000sft  
Scale on Linear Error [S] : 1.96

#### Three-Dimensional

Propagated Linear Error [E] : U.S.  
Constant Term [C] : 0.00000000sft  
Scale on Linear Error [S] : 1.96

Elevation Errors were used in the calculations.

### Adjustment Controls

Compute Correlations for Geoid : True

Horizontal and Vertical adjustment performed

### Set-up Errors

#### GPS

Error in Height of Antenna : 0.015sft  
Centering Error : 0.015sft

# Statistical Summary

## Successful Adjustment in 1 iteration(s)

Network Reference Factor : 1.03

Chi Square Test ( $\alpha=95\%$ ) : PASS

Degrees of Freedom : 282.00

## GPS Observation Statistics

Reference Factor : 1.03

Redundancy Number (r) : 265.06

## Geoid Model Statistics

Reference Factor : 1.00

Redundancy Number (r) : 16.94

## Weighting Strategies

### GPS Observations

Alternative Scalar Applied to All Observations

Scalar : 1.43

### Geoid Observations

Alternative Scalar Applied to All Observations

Scalar : 0.11

# Adjusted Coordinates

## Adjustment performed in NAD 1983 (Conus)

**Number of Points** : 71  
**Number of Constrained Points** : 31  
**Horizontal Only** : 1  
**Elevation Only** : 2  
**Horizontal and Elevation Only** : 28

## Adjusted Grid Coordinates

Errors are reported using 1.96σ.

Point Name	Northing	N error	Easting	E error	Elevation	e error	Fix
1011	3981986.432sft	0.000sft	4555247.494sft	0.000sft	1443.030sft	0.000sft	N E e
102	3987255.470sft	0.020sft	4563166.111sft	0.020sft	1305.601sft	0.041sft	
104	3955749.952sft	0.020sft	4560480.877sft	0.019sft	1439.876sft	0.041sft	
8054	3939456.030sft	0.000sft	4544752.390sft	0.000sft	1431.130sft	0.000sft	N E e
1012	3956836.463sft	0.028sft	4576342.991sft	0.028sft	1271.360sft	0.000sft	e
1013	3943308.670sft	0.000sft	4577213.670sft	0.000sft	1272.270sft	0.000sft	N E e
110	3967044.951sft	0.026sft	4581488.656sft	0.026sft	1311.271sft	0.047sft	
107	3997696.278sft	0.030sft	4577978.953sft	0.029sft	1355.499sft	0.051sft	
106	4012647.916sft	0.024sft	4579980.265sft	0.024sft	1348.809sft	0.034sft	
1002	4012969.990sft	0.000sft	4560764.290sft	0.000sft	1387.400sft	0.000sft	N E e
1001	4029176.280sft	0.000sft	4546914.150sft	0.000sft	1406.990sft	0.000sft	N E e
8050	3999479.070sft	0.000sft	4545599.260sft	0.000sft	1421.866sft	0.051sft	N E
100	4002476.110sft	0.028sft	4545740.834sft	0.028sft	1437.804sft	0.050sft	
8052	3970877.450sft	0.000sft	4545349.240sft	0.000sft	1446.580sft	0.000sft	N E e
105	3938909.013sft	0.020sft	4560208.523sft	0.020sft	1478.843sft	0.041sft	
103	3970831.922sft	0.018sft	4560231.032sft	0.017sft	1446.953sft	0.038sft	
108	3986980.798sft	0.023sft	4581110.254sft	0.023sft	1316.529sft	0.052sft	
101	4003199.728sft	0.023sft	4561773.608sft	0.023sft	1364.156sft	0.041sft	
411	3921539.820sft	0.000sft	4559645.630sft	0.000sft	1517.670sft	0.000sft	N E e
8051	3987464.770sft	0.000sft	4545571.560sft	0.000sft	1517.870sft	0.000sft	N E e

7073	3923604.030sft	0.000sft	4541989.730sft	0.000sft	1418.750sft	0.000sft	N E e
412	3923201.630sft	0.000sft	4573085.890sft	0.000sft	1391.930sft	0.000sft	N E e
109	3978884.841sft	0.031sft	4576607.385sft	0.030sft	1328.861sft	0.053sft	
8049	4013187.330sft	0.027sft	4545969.185sft	0.027sft	1386.493sft	0.047sft	
1004	4016636.511sft	0.000sft	4581386.762sft	0.000sft	1362.620sft	0.000sft	N E e
116	3986706.432sft	0.032sft	4602518.877sft	0.032sft	1307.794sft	0.060sft	
112	3970122.070sft	0.028sft	4596786.392sft	0.028sft	1317.107sft	0.058sft	
138	3977271.280sft	0.037sft	4590145.001sft	0.037sft	1314.569sft	0.062sft	
114	3938792.373sft	0.021sft	4592567.807sft	0.021sft	1308.593sft	0.043sft	
413	3922864.760sft	0.000sft	4594525.140sft	0.000sft	1302.590sft	0.000sft	N E e
115	3997006.283sft	0.026sft	4610665.652sft	0.026sft	1291.168sft	0.051sft	
111	3997369.000sft	0.029sft	4595865.012sft	0.029sft	1326.385sft	0.052sft	
129	3969740.711sft	0.028sft	4644174.883sft	0.028sft	1273.229sft	0.058sft	
130	3953828.651sft	0.036sft	4639609.129sft	0.036sft	1268.217sft	0.063sft	
126	4010903.261sft	0.024sft	4639694.795sft	0.024sft	1250.829sft	0.048sft	
1007	4017227.399sft	0.000sft	4625705.270sft	0.000sft	1244.910sft	0.000sft	N E e
132	4011514.009sft	0.023sft	4654280.951sft	0.023sft	1254.124sft	0.047sft	
135	3972851.792sft	0.025sft	4654757.990sft	0.025sft	1256.857sft	0.050sft	
418	3921787.440sft	0.000sft	4668834.180sft	0.000sft	1239.210sft	0.000sft	N E e
417	3922011.460sft	0.000sft	4654270.550sft	0.000sft	1278.650sft	0.000sft	N E e
1005	4012360.666sft	0.000sft	4596052.481sft	0.000sft	1308.984sft	0.000sft	N E e
113	3954482.328sft	0.036sft	4595501.401sft	0.036sft	1299.966sft	0.059sft	
137	3937942.687sft	0.021sft	4654461.760sft	0.021sft	1265.268sft	0.045sft	
121	3998282.606sft	0.026sft	4623843.906sft	0.026sft	1274.072sft	0.051sft	
124	3954067.474sft	0.038sft	4624236.839sft	0.038sft	1273.251sft	0.066sft	
125	3938206.895sft	0.026sft	4623089.961sft	0.025sft	1258.235sft	0.051sft	
127	3995877.259sft	0.026sft	4639535.756sft	0.026sft	1266.801sft	0.054sft	
1006	4012183.890sft	0.000sft	4611410.490sft	0.000sft	1278.280sft	0.000sft	N E e
123	3972471.438sft	0.030sft	4623614.679sft	0.030sft	1272.516sft	0.063sft	
117	3970015.264sft	0.029sft	4608157.437sft	0.029sft	1289.791sft	0.063sft	
414	3922701.180sft	0.000sft	4607290.980sft	0.000sft	1299.530sft	0.000sft	N E e
415	3920044.880sft	0.000sft	4622984.400sft	0.000sft	1296.180sft	0.000sft	N E e
416	3922257.770sft	0.000sft	4638814.520sft	0.000sft	1264.820sft	0.000sft	N E e

134	3991345.472sft	0.024sft	4655147.071sft	0.024sft	1229.154sft	0.049sft	
131	3938060.655sft	0.022sft	4639312.055sft	0.022sft	1279.861sft	0.048sft	
1003	4012863.467sft	0.026sft	4567122.206sft	0.026sft	1378.140sft	0.000sft	e
119	3935971.090sft	0.022sft	4607436.568sft	0.022sft	1288.978sft	0.045sft	
128	3984080.371sft	0.037sft	4641675.225sft	0.037sft	1257.341sft	0.063sft	
120	4011888.359sft	0.023sft	4623851.027sft	0.023sft	1244.708sft	0.037sft	
133	4001865.276sft	0.026sft	4651897.620sft	0.026sft	1260.717sft	0.051sft	
136	3956679.665sft	0.031sft	4654632.631sft	0.031sft	1277.769sft	0.055sft	
118	3954122.722sft	0.037sft	4607706.026sft	0.037sft	1286.738sft	0.065sft	
122	3986424.807sft	0.034sft	4622854.733sft	0.034sft	1272.891sft	0.062sft	
532	3969248.070sft	0.000sft	4670730.340sft	0.000sft	1223.910sft	0.000sft	N E e
533	3955939.100sft	0.000sft	4670508.810sft	0.000sft	1211.190sft	0.000sft	N E e
1008	4014866.440sft	0.000sft	4669803.070sft	0.000sft	1210.810sft	0.000sft	N E e
8053	3955141.170sft	0.000sft	4543674.420sft	0.000sft	1437.960sft	0.000sft	N E e
548	3937538.840sft	0.000sft	4670995.970sft	0.000sft	1240.100sft	0.000sft	N E e
517	3985466.780sft	0.000sft	4670932.150sft	0.000sft	1209.390sft	0.000sft	N E e
501	4011232.050sft	0.000sft	4671080.180sft	0.000sft	1222.030sft	0.000sft	N E e
516	4001547.150sft	0.000sft	4671039.350sft	0.000sft	1213.770sft	0.000sft	N E e

### Adjusted Geodetic Coordinates

Errors are reported using  $1.96\sigma$ .

Point Name	Latitude	N error	Longitude	E error	Height	h error	Fix
1011	43°24'56.62463"N	0.000sft	94°52'38.86019"W	0.000sft	1350.506sft	0.097sft	Lat Long e
102	43°25'49.91609"N	0.020sft	94°50'52.72976"W	0.020sft	1213.098sft	0.093sft	
104	43°20'38.37502"N	0.020sft	94°51'22.26487"W	0.019sft	1346.760sft	0.094sft	
8054	43°17'54.92420"N	0.000sft	94°54'51.39000"W	0.000sft	1337.799sft	0.105sft	Lat Long e
1012	43°20'51.56244"N	0.028sft	94°47'47.86386"W	0.028sft	1178.131sft	0.090sft	e
1013	43°18'38.10275"N	0.000sft	94°47'33.28316"W	0.000sft	1178.800sft	0.092sft	Lat Long e
110	43°22'33.14725"N	0.026sft	94°46'40.32293"W	0.026sft	1218.208sft	0.088sft	
107	43°27'35.30209"N	0.030sft	94°47'34.18268"W	0.029sft	1263.083sft	0.093sft	
106	43°30'03.24704"N	0.024sft	94°47'10.13629"W	0.024sft	1256.679sft	0.098sft	
1002	43°30'03.45908"N	0.000sft	94°51'30.87326"W	0.000sft	1295.542sft	0.101sft	Lat Long e
1001	43°32'41.24508"N	0.000sft	94°54'42.42172"W	0.000sft	1315.649sft	0.111sft	Lat Long e

8050	43°27'47.78572"N	0.000sft	94°54'53.52336"W	0.000sft	1329.904sft	0.108sft	Lat Long
100	43°28'17.40356"N	0.028sft	94°54'52.28398"W	0.028sft	1345.913sft	0.107sft	
8052	43°23'05.31103"N	0.000sft	94°54'50.42677"W	0.000sft	1353.947sft	0.100sft	Lat Long e
105	43°17'52.02349"N	0.020sft	94°51'22.29416"W	0.020sft	1385.418sft	0.098sft	
103	43°23'07.27103"N	0.018sft	94°51'28.92386"W	0.017sft	1354.138sft	0.092sft	
108	43°25'49.95857"N	0.023sft	94°46'49.53368"W	0.023sft	1223.860sft	0.088sft	
101	43°28'27.14173"N	0.023sft	94°51'15.05855"W	0.023sft	1272.044sft	0.098sft	
411	43°15'00.40632"N	0.000sft	94°51'26.13410"W	0.000sft	1423.961sft	0.105sft	Lat Long e
8051	43°25'49.14423"N	0.000sft	94°54'51.17398"W	0.000sft	1425.620sft	0.101sft	Lat Long e
7073	43°15'17.92323"N	0.000sft	94°55'25.13287"W	0.000sft	1325.111sft	0.110sft	Lat Long e
412	43°15'18.90919"N	0.000sft	94°48'24.90086"W	0.000sft	1298.193sft	0.101sft	Lat Long e
109	43°24'29.33323"N	0.031sft	94°47'48.86351"W	0.030sft	1236.053sft	0.090sft	
8049	43°30'03.20901"N	0.027sft	94°54'51.61778"W	0.027sft	1294.844sft	0.109sft	
1004	43°30'42.84387"N	0.000sft	94°46'51.87671"W	0.000sft	1270.556sft	0.099sft	Lat Long e
116	43°25'50.35068"N	0.032sft	94°41'59.39405"W	0.032sft	1215.042sft	0.089sft	
112	43°23'05.76688"N	0.028sft	94°43'13.82456"W	0.028sft	1224.068sft	0.085sft	
138	43°24'15.40986"N	0.037sft	94°44'45.17479"W	0.037sft	1221.663sft	0.090sft	
114	43°17'55.76878"N	0.021sft	94°44'04.74806"W	0.021sft	1215.043sft	0.091sft	
413	43°15'18.75499"N	0.000sft	94°43'35.15841"W	0.000sft	1208.837sft	0.097sft	Lat Long e
115	43°27'33.18989"N	0.026sft	94°40'10.93568"W	0.026sft	1198.582sft	0.090sft	
111	43°27'34.70113"N	0.029sft	94°43'31.64814"W	0.029sft	1233.849sft	0.091sft	
129	43°23'08.26413"N	0.028sft	94°32'32.10553"W	0.028sft	1180.230sft	0.092sft	
130	43°20'30.56283"N	0.036sft	94°33'31.22952"W	0.036sft	1175.026sft	0.095sft	
126	43°29'54.20539"N	0.024sft	94°33'39.76358"W	0.024sft	1158.409sft	0.099sft	
1007	43°30'54.87868"N	0.000sft	94°36'50.66386"W	0.000sft	1152.618sft	0.099sft	Lat Long e
132	43°30'01.99768"N	0.023sft	94°30'21.99599"W	0.023sft	1161.678sft	0.103sft	
135	43°23'40.25176"N	0.025sft	94°30'09.30415"W	0.025sft	1163.865sft	0.096sft	
418	43°15'17.55169"N	0.000sft	94°26'50.92515"W	0.000sft	1145.687sft	0.111sft	Lat Long e
417	43°15'18.10554"N	0.000sft	94°30'07.74317"W	0.000sft	1185.182sft	0.106sft	Lat Long e
1005	43°30'02.76839"N	0.000sft	94°43'32.05324"W	0.000sft	1216.721sft	0.095sft	Lat Long e
113	43°20'31.13588"N	0.036sft	94°43'28.15581"W	0.036sft	1206.664sft	0.090sft	
137	43°17'55.46442"N	0.021sft	94°30'07.71144"W	0.021sft	1171.923sft	0.100sft	
121	43°27'47.55621"N	0.026sft	94°37'12.51416"W	0.026sft	1181.490sft	0.091sft	
124	43°20'30.96824"N	0.038sft	94°36'59.27003"W	0.038sft	1180.025sft	0.092sft	
125	43°17'54.18485"N	0.026sft	94°37'11.94483"W	0.025sft	1164.816sft	0.092sft	
127	43°27'25.80211"N	0.026sft	94°33'39.36284"W	0.026sft	1174.159sft	0.093sft	
1006	43°30'03.16958"N	0.000sft	94°40'03.68051"W	0.000sft	1185.938sft	0.095sft	Lat Long e

123	43°23'32.63489"N	0.030sft	94°37'10.98675"W	0.030sft	1179.555sft	0.087sft	
117	43°23'06.30503"N	0.029sft	94°40'39.84017"W	0.029sft	1196.759sft	0.086sft	
414	43°15'18.93287"N	0.000sft	94°40'42.64071"W	0.000sft	1205.860sft	0.096sft	Lat Long e
415	43°14'54.80624"N	0.000sft	94°37'10.12004"W	0.000sft	1202.602sft	0.099sft	Lat Long e
416	43°15'18.67614"N	0.000sft	94°33'36.62384"W	0.000sft	1171.354sft	0.100sft	Lat Long e
134	43°26'42.93052"N	0.024sft	94°30'07.00348"W	0.024sft	1136.408sft	0.098sft	
131	43°17'54.80542"N	0.022sft	94°33'32.57628"W	0.022sft	1186.509sft	0.095sft	
1003	43°30'03.40732"N	0.026sft	94°50'04.60418"W	0.026sft	1286.156sft	0.100sft	e
119	43°17'30.00293"N	0.022sft	94°40'43.17356"W	0.022sft	1195.449sft	0.091sft	
128	43°25'29.56867"N	0.037sft	94°33'08.36907"W	0.037sft	1164.534sft	0.095sft	
120	43°30'01.91412"N	0.023sft	94°37'14.86325"W	0.023sft	1152.336sft	0.096sft	
133	43°28'26.43368"N	0.026sft	94°30'52.75670"W	0.026sft	1168.131sft	0.100sft	
136	43°21'00.52720"N	0.031sft	94°30'08.40501"W	0.031sft	1184.599sft	0.098sft	
118	43°20'29.29776"N	0.037sft	94°40'42.95209"W	0.037sft	1193.457sft	0.091sft	
122	43°25'50.32900"N	0.034sft	94°37'23.78856"W	0.034sft	1180.133sft	0.090sft	
532	43°23'06.47740"N	0.000sft	94°26'32.45292"W	0.000sft	1130.805sft	0.104sft	Lat Long e
533	43°20'55.01724"N	0.000sft	94°26'33.44309"W	0.000sft	1117.946sft	0.106sft	Lat Long e
1008	43°30'36.87476"N	0.000sft	94°26'51.93390"W	0.000sft	1118.335sft	0.111sft	Lat Long e
8053	43°20'29.63858"N	0.000sft	94°55'09.52546"W	0.000sft	1344.959sft	0.102sft	Lat Long e
548	43°17'53.35182"N	0.000sft	94°26'24.08172"W	0.000sft	1146.702sft	0.108sft	Lat Long e
517	43°25'46.66861"N	0.000sft	94°26'32.16818"W	0.000sft	1116.489sft	0.105sft	Lat Long e
501	43°30'01.12559"N	0.000sft	94°26'34.05602"W	0.000sft	1129.493sft	0.110sft	Lat Long e
516	43°28'25.48035"N	0.000sft	94°26'33.14503"W	0.000sft	1121.095sft	0.108sft	Lat Long e

## Control Coordinate Comparisons

Values shown are control coord minus adjusted coord.

Point Name	ΔNorthing	ΔEasting	ΔElevation	ΔHeight
8050	N/A	N/A	-0.076sft	N/A
8049	-0.070sft	0.065sft	-0.123sft	N/A