UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Principal facts for gravity stations in parts of Grand, Clear Creek, and Summit Counties, Colorado

by

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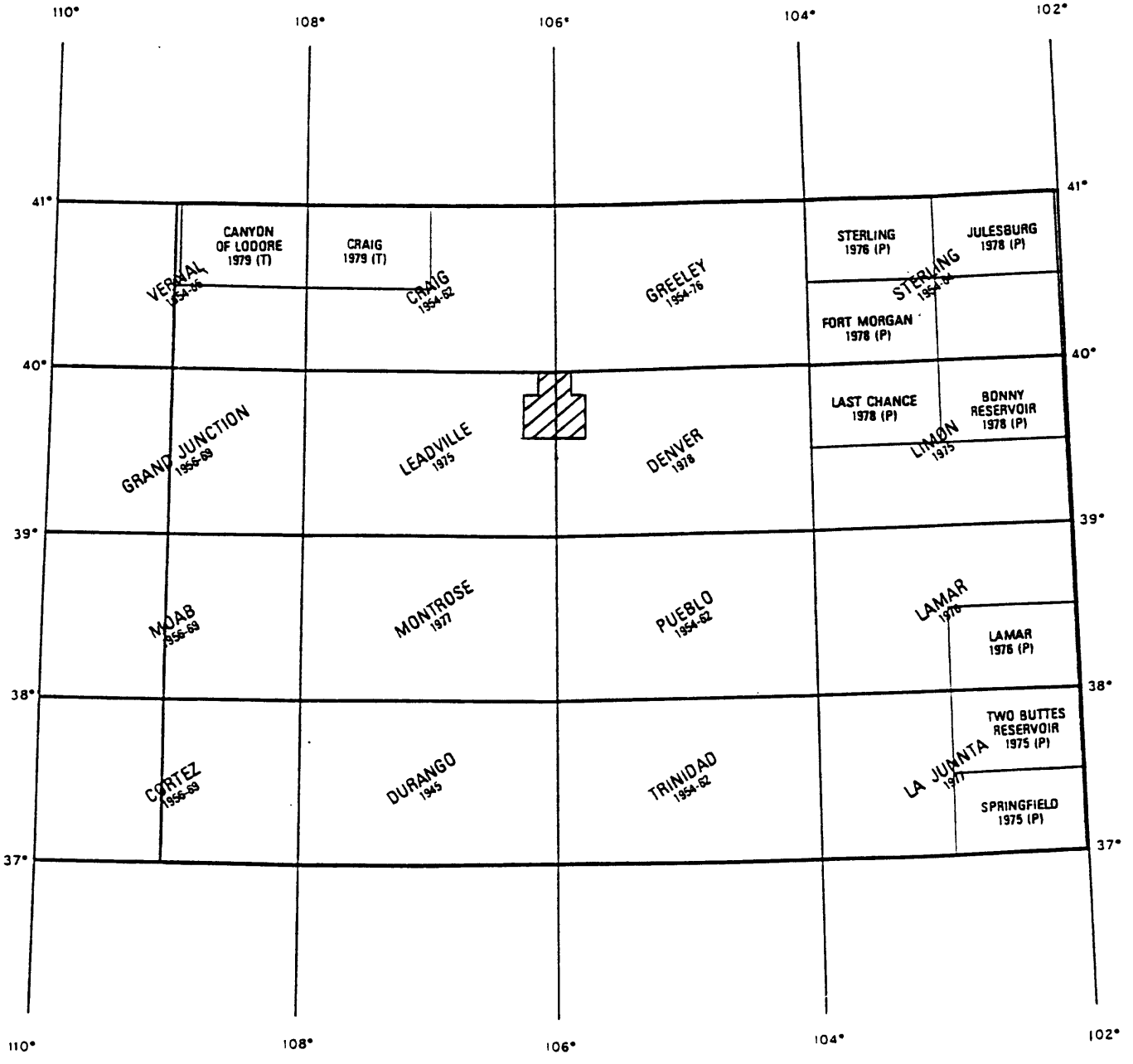
Introduction

During September 1980 ninety-seven gravity stations were established in the Williams Fork Area of Colorado (Fig. 1). These data were obtained as part of a U.S. Geological Survey program of mineral resource evaluation of the St. Louis Peak and Williams Fork Wilderness Study Areas. The data supplement those of the Department of Defense files for the areas. This report presents the principal facts for this data, and includes a station location map (Appendix 2).

Data Collection

The gravity observations were made using two LaCoste-Romberg gravity meters, G-551 and G-24. The gravity data were referenced to the Department of Defense (DOD) base ACIC 0555-3 at Kremmling, Colorado (Appendix 1), which is part of the International Gravity Standardization Net (IGSN) 1971, established by the Defense Mapping Agency Aerospace Center (1974). A secondary base was established at the junction of Big Gulch Road and State Highway 9 on the Squaw Creek, Colorado, 7 1/2-minute topographic map, T3S, R78W, SW corner section 17, which was tied to the Kremling base. Gravity loops were started and closed daily by observations at this secondary base.

COLORADO



Location Map

Fig. 1

Elevation Control

The U.S. Geological Survey 7 1/2-minute topographic maps of Bottle Pass, Dillon, Ute Peak, Byers Peak, Sylvan Reservoir, Loveland Pass, Grays Peak, Berthod Pass, Squaw Creek and Willow Lakes, Colorado, were used for station elevations.

Data Reduction

Computer programs for the USGS Honeywell Multics computer system were used to obtain principal facts and terrain corrected gravity values (Appendix 4). An unpublished program by D. Dansereau and R. Wahl (1968) calculated earth-tide and linear meter drift to correct the observed gravity values. The theoretical gravity value was calculated using the 1967 formula of the Geodetic Reference System (International Association of Geodesy, 1967).

Terrain corrections were computed using a program by R. H. Godson (USGS, unpublished program, 1978) for each station to a radius of 166.7 km using the method of Plouff (1977). The program uses elevation data on a 15-second grid for corrections from 0 to 5 km; 1 minute terrain data for corrections from 5 to 21 km, and 3 minute terrain data for corrections from 21 to 166.7 km. An assumed density of 2.67 g/cm^3 was used for terrain corrections. This program also calculates earth curvature corrections and complete (terrain-corrected) Bouguer anomaly values. Corrections for terrain ranged from 2.76 mgal to 36.65 mgal. Two complete Bouguer anomaly values for each station were obtained assuming average rock densities of 2.67 g/cm^3 and 2.45 g/cm^3.

References

Defense Mapping Agency Aerospace Center, 1974, World Relative Gravity Reference Network, North America, Part 2: DMAAC Reference Publication 25, with supplement updating gravity values to the International Gravity Standardization Net 1971, 1635 p.

International Association of Geodesy, 1967, Geodetic Reference System, 1967, International Association of Geodesy Special Publication 3, 74 p.

Plouff, D., 1977, Preliminary documentation for a FORTRAN program to compute gravity terrain corrections based on topography digitized on a geographic grid: U.S. Geological Survey Open-File Report 77-535.

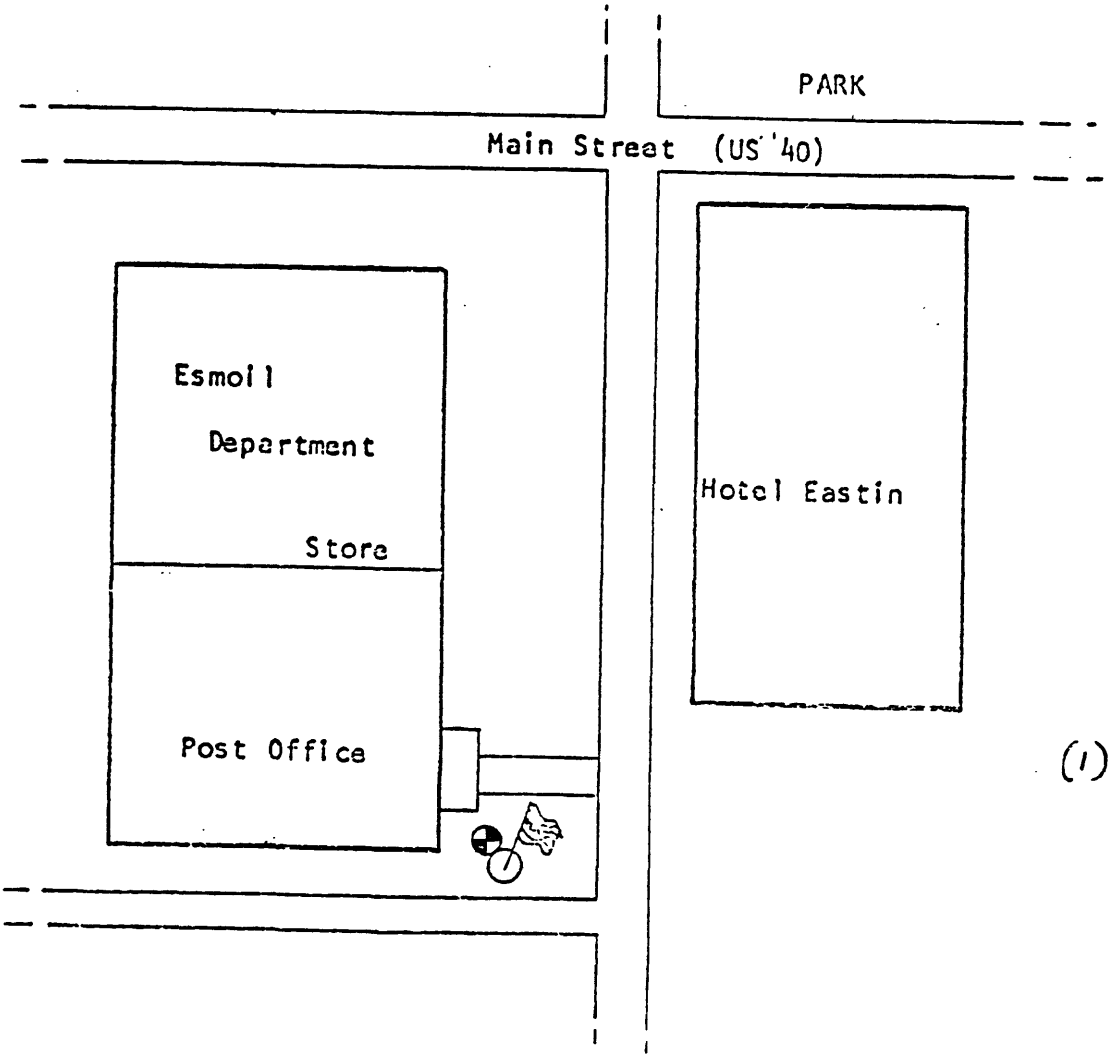
GRAVITY BASE STATION

LATITUDE: 40° 03.40'N (1)	STATION DESIGNATION: KREMMLING
LONGITUDE: 106° 23.46'W (1)	
ELEVATION: 2258.88 METERS (1)	COUNTRY/STATE: USA/Colorado

REFERENCE CODE NUMBERS		ADOPTED GRAVITY VALUE	
ACIC 0555-3		... g= ~~979-495.53~~ IGSN(71) 979 481.77 mgals	
IGB 15506D		ESTIMATED ACCURACY	DATE
		± 0.1 mgals	MONTH/YEAR 10/70

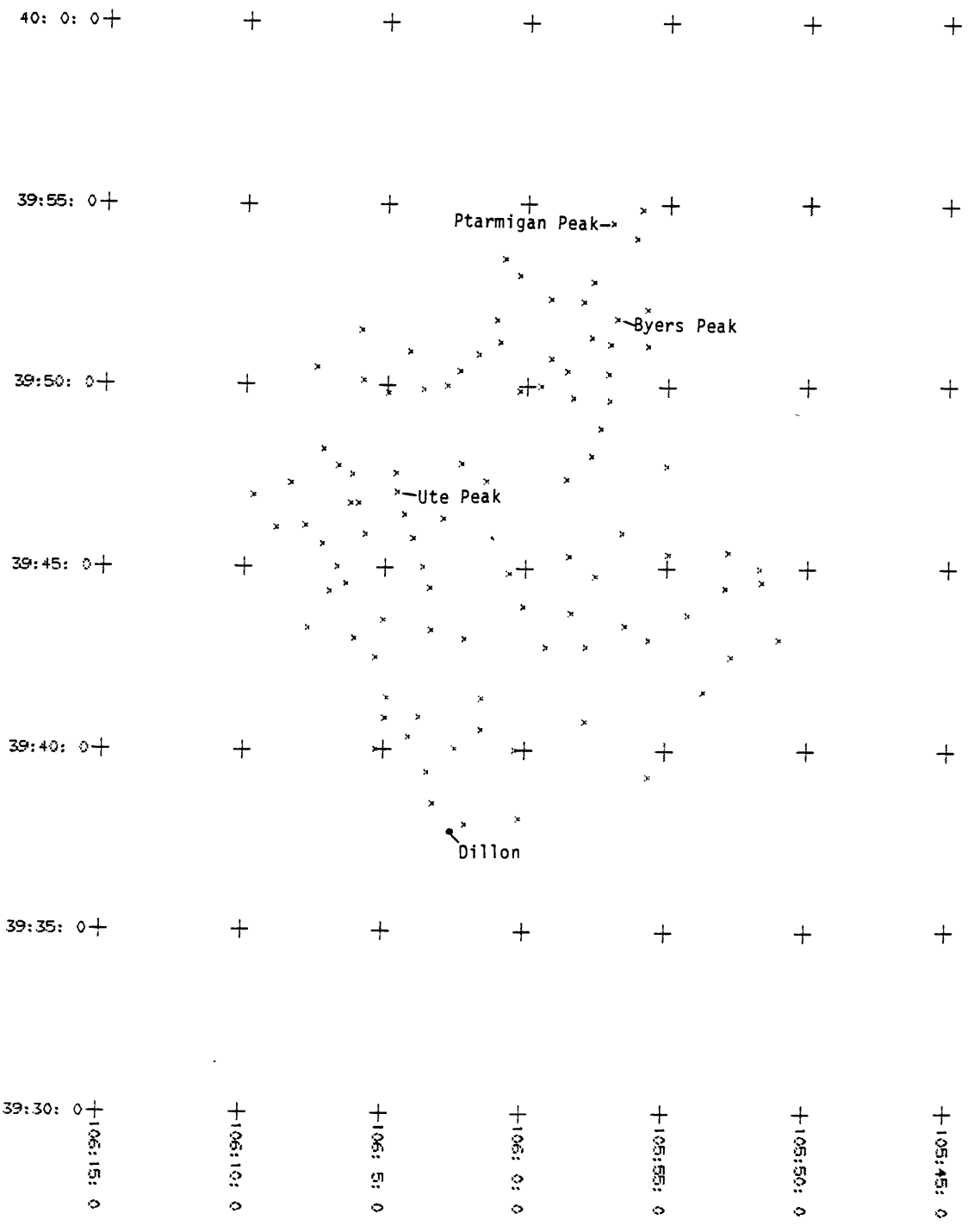
DESCRIPTION AND/OR SKETCH

The station is at the Post Office, Kremmling, Colorado, 200 feet south of US 40, 5 feet south of the centerline of the Post Office door, at the base of the flagpole. The station is marked with a standard USAF Gravity Disc. (1)



REFERENCE SOURCE

(1) 03405



Gravity Station Map

Appendix 2

Appendix 3: Principal Facts of Gravity Data

EXPLANATION OF HEADINGS:

STATION IDENTIFICATION

proj	Project name.
sta-id	Gravity station number.

LOCATIONS

LATITUDE	North latitude in degrees, minutes, and hundredths of minutes.
LONGITUDE	West longitude in degrees, minutes, and hundredths of minutes.
ELE (in ft)	Station elevation in feet.
ST	State in which station is located.

GRAVITY

OBSERVED	Observed gravity in milligals.
THEORETICAL	Theoretical gravity in milligals.

CORRECTIONS

TERRAIN	Terrain corrections for radius of 166.7 km in milligals.
BOUGUER	Bouguer correction in milligals.
CURV	Curvature correction in milligals.
SPECIAL	Not used.

ANOMALIES

FREE AIR	Free-air anomaly in milligals.
COMPLETE-BOUGUER	Complete Bouguer anomaly in milligals for assumed average density of 2.67 g/cm^3 and 2.45 g/cm^3.
SPEC FIELDS	Not used.

cal moss march 1981
st louis wilderness
Meter ID: a-24 Date: 01/12/82

STATION IDENTIFICATION proj	sta-id	LOCATIONS LATITUDE deg	min	LONGITUDE deg	min	ELE (in ft)	ST	GRAVITY OBSERVED	THEORETICAL	CORRECTIONS TERRAIN	BOUGUER	CURV	SPECIAL	ANOMALIES FREE AIR	COMPLETE-BOUGUER d1=2.67	d2=2.45	SPEC FIELDS
colo :	d-01	39	39.43	-106	3.45	9570.0	co	979257.72	980138.46	5.51	-326.41	-1.27	0.00	18.78	-303.38	-276.83	
colo :	a-02	39	40.07	-106	2.47	11456.0	co	979137.85	980139.41	15.07	-390.73	-0.81	0.00	75.10	-301.37	-270.35	
colo :	d-03	39	40.59	-106	1.55	12045.0	co	979104.03	980140.18	15.63	-410.82	-0.62	0.00	95.82	-299.79	-267.19	
colo :	d-04	39	40.05	-106	0.33	11431.0	co	979126.18	980139.38	10.59	-389.88	-0.81	0.00	61.11	-319.00	-287.68	
colo :	d-05	39	38.14	-106	0.17	11441.0	co	979139.31	980136.55	14.25	-390.22	-0.81	0.00	78.01	-298.77	-267.73	
colo :	d-06	39	40.82	-105	57.86	11826.0	co	979120.72	980140.52	12.37	-403.35	-0.69	0.00	91.60	-300.07	-267.80	
colo :	d-07	39	39.32	-105	55.60	11830.0	co	979122.10	980138.30	10.63	-403.49	-0.69	0.00	95.58	-297.97	-265.54	
colo :	d-08	39	41.64	-105	53.67	12304.0	co	979095.02	980141.73	16.14	-419.65	-0.52	0.00	109.57	-294.47	-261.18	
colo :	d-09	39	42.60	-105	52.68	12705.0	co	979061.07	980143.16	25.69	-433.33	-0.37	0.00	111.84	-296.17	-262.55	
colo :	d-10	39	43.08	-105	51.00	12396.0	co	979091.66	980143.87	15.65	-422.79	-0.49	0.00	112.71	-294.92	-261.33	
colo :	d-11	39	44.66	-105	51.63	11335.0	co	979161.98	980146.21	6.46	-386.60	-0.84	0.00	81.07	-299.92	-268.53	
colo :	d-12	39	45.04	-105	51.69	12109.0	co	979109.78	980146.77	10.80	-413.00	-0.59	0.00	100.98	-301.82	-268.63	
colo :	d-13	39	44.50	-105	52.89	13215.0	co	979030.48	980145.98	24.32	-450.73	-0.17	0.00	126.32	-300.25	-265.10	
colo :	d-14	39	43.72	-105	54.25	13553.0	co	978999.26	980144.82	33.29	-462.25	-0.02	0.00	127.98	-301.00	-265.66	
colo :	d-15	39	43.04	-105	55.60	12292.0	co	979094.46	980143.81	10.79	-419.24	-0.53	0.00	105.80	-303.18	-269.48	
colo :	d-16	39	41.44	-106	1.54	12498.0	co	979076.70	980141.44	19.09	-426.27	-0.45	0.00	109.76	-297.87	-264.29	
colo :	d-17	39	42.86	-105	57.86	12056.0	co	979108.95	980143.55	11.23	-411.20	-0.61	0.00	98.40	-302.17	-269.17	
colo :	d-18	39	42.86	-105	59.26	11490.0	co	979143.85	980143.55	10.85	-391.89	-0.80	0.00	80.15	-301.68	-270.22	
colo :	d-19	39	43.79	-105	58.35	11856.0	co	979125.67	980144.92	7.87	-404.37	-0.68	0.00	94.97	-302.22	-269.49	
colo :	d-20	39	43.44	-105	56.45	12355.0	co	979090.26	980144.41	11.85	-421.39	-0.51	0.00	106.92	-303.13	-269.34	
colo :	d-21	39	44.82	-105	57.51	12309.0	co	979095.76	980146.45	14.27	-419.82	-0.52	0.00	106.06	-300.02	-266.56	
colo :	a-22	39	45.37	-105	58.46	11581.0	co	979149.87	980147.27	8.43	-394.99	-0.77	0.00	91.00	-296.34	-264.42	
colo :	d-24	39	46.00	-105	56.59	12167.0	co	979104.13	980148.20	19.91	-414.98	-0.57	0.00	99.35	-296.29	-263.69	
colo :	d-25	39	45.41	-105	54.93	11926.0	co	979119.05	980147.32	12.09	-406.76	-0.66	0.00	92.51	-302.82	-270.24	
colo :	d-26	39	47.86	-105	55.01	12492.0	co	979094.46	980150.95	17.13	-426.07	-0.45	0.00	117.44	-291.95	-258.22	
colo :	d-27	39	54.90	-105	55.98	11122.0	co	979227.50	980161.40	14.95	-379.34	-0.90	0.00	111.39	-253.90	-223.81	
colo :	d-28	39	54.12	-105	56.15	11584.0	co	979194.11	980160.24	18.32	-395.10	-0.77	0.00	122.54	-255.00	-223.90	
colo :	d-29	39	54.52	-105	56.97	11613.0	co	979191.57	980160.83	19.97	-396.09	-0.76	0.00	122.13	-254.74	-223.69	
colo :	d-30	39	53.55	-106	0.81	10634.0	co	979255.87	980159.39	8.83	-362.69	-1.04	0.00	95.93	-258.97	-229.73	
colo :	d-31	39	53.08	-106	0.31	10714.0	co	979253.02	980158.70	5.97	-365.42	-1.01	0.00	101.30	-259.17	-229.47	
colo :	d-32	39	52.92	-105	57.68	11605.0	co	979187.62	980158.46	16.41	-395.81	-0.76	0.00	119.80	-260.36	-229.04	
colo :	a-33	39	52.36	-105	58.02	11829.0	co	979174.89	980157.63	13.90	-403.45	-0.69	0.00	128.94	-261.30	-229.15	
colo :	d-34	39	52.44	-105	59.19	11599.0	co	979190.16	980157.75	12.74	-395.61	-0.76	0.00	122.50	-261.13	-229.52	
colo :	d-35	39	51.35	-105	57.73	12703.0	co	979103.68	980156.13	27.93	-433.26	-0.37	0.00	141.29	-264.42	-230.99	
colo :	d-36	39	51.87	-105	56.81	12804.0	co	979094.06	980156.90	36.65	-436.71	-0.34	0.00	140.38	-260.01	-227.02	
colo :	d-37	39	51.18	-105	57.03	11460.0	co	979195.06	980155.88	8.47	-390.87	-0.81	0.00	116.21	-266.99	-235.42	
colo :	d-38	39	51.15	-105	55.71	11530.0	co	979181.39	980155.84	18.19	-393.25	-0.78	0.00	109.16	-266.69	-235.72	
colo :	d-39	39	52.14	-105	55.76	11619.0	co	979185.61	980157.30	18.87	-396.29	-0.76	0.00	120.26	-257.91	-226.75	
colo :	a-40	39	50.38	-105	57.10	12686.0	co	979098.07	980154.69	26.01	-432.68	-0.38	0.00	135.52	-271.53	-237.99	
colo :	d-41	39	49.65	-105	57.05	12420.0	co	979113.35	980153.61	20.86	-423.61	-0.48	0.00	126.91	-276.32	-243.09	

cal moss march 1981
st louis wilderness
Meter ID: g-24 Date: 01/12/82

STATION IDENTIFICATION proj	sta-id	LOCATIONS LATITUDE deg	min	LONGITUDE deg	min	ELE (in ft)	ST	GRAVITY OBSERVED	THEORETICAL	CORRECTIONS TERRAIN	BOUGUER	CURV	SPECIAL	ANOMALIES FREE AIR	COMPLETE-BOUGUER d1=2.67	d2=2.45	SPEC FIELD
colo :	d-42	39	48.88	-105	57.38	12099.0	co	979133.62	980152.47	13.28	-412.66	-0.60	0.00	118.18	-281.80	-248.84	
colo :	d-43	39	49.84	-106	4.93	9307.0	co	979316.84	980153.89	3.14	-317.43	-1.31	0.00	37.77	-277.83	-251.83	
colo :	d-44	39	50.53	-106	7.46	10504.0	co	979242.17	980154.91	9.69	-358.26	-1.07	0.00	74.51	-275.13	-246.32	
colo :	d-45	39	47.83	-106	6.67	9892.0	co	979271.20	980150.91	7.45	-337.39	-1.20	0.00	50.06	-281.08	-253.79	
colo :	d-46	39	47.59	-106	6.21	9976.0	co	979265.95	980150.55	6.18	-340.25	-1.19	0.00	53.06	-282.20	-254.58	
colo :	d-47	39	46.83	-106	6.22	9732.0	co	979274.68	980149.43	6.65	-331.93	-1.24	0.00	39.99	-286.52	-259.62	
colo :	d-48	39	46.80	-106	5.98	9864.0	co	979268.60	980149.38	6.38	-336.43	-1.21	0.00	46.36	-284.90	-257.61	
colo :	d-49	39	45.97	-106	5.69	9624.0	co	979278.31	980148.16	6.85	-328.25	-1.26	0.00	34.76	-287.89	-261.31	
colo :	d-50	39	47.62	-106	4.65	12104.0	co	979119.72	980150.60	26.07	-412.83	-0.59	0.00	106.62	-280.74	-248.82	
colo :	d-51	39	47.13	-106	4.60	12303.0	co	979098.41	980149.88	30.93	-419.62	-0.52	0.00	104.73	-284.49	-252.42	
colo :	d-52	39	46.52	-106	4.33	11902.0	co	979128.14	980148.97	24.55	-405.94	-0.66	0.00	97.71	-284.35	-252.87	
colo :	d-53	39	45.84	-106	4.01	11326.0	co	979167.98	980147.96	12.06	-386.30	-0.85	0.00	84.47	-290.61	-259.71	
colo :	d-54	39	45.07	-106	3.68	11782.0	co	979134.58	980146.82	15.90	-401.85	-0.70	0.00	95.02	-291.63	-259.77	
colo :	d-55	39	44.49	-106	3.39	11888.0	co	979122.54	980145.96	15.24	-405.47	-0.67	0.00	93.80	-297.09	-264.89	
colo :	d-56	39	43.07	-106	2.14	11903.0	co	979116.76	980143.86	14.17	-405.98	-0.66	0.00	91.53	-300.94	-268.60	
colo :	d-57	39	43.31	-106	3.34	12272.0	co	979092.75	980144.21	19.70	-418.56	-0.54	0.00	101.82	-297.58	-264.67	
colo :	d-58	39	43.58	-106	5.06	10111.0	co	979235.92	980144.61	7.43	-344.86	-1.16	0.00	41.65	-296.93	-269.04	
colo :	d-59	39	44.60	-106	6.37	9295.0	co	979295.88	980146.13	3.56	-317.03	-1.31	0.00	23.46	-291.32	-265.39	
colo :	d-60	39	44.37	-106	6.93	9290.0	co	979295.10	980145.78	4.26	-316.85	-1.31	0.00	22.54	-291.36	-265.50	
colo :	d-61	39	45.06	-106	6.69	9224.0	co	979302.03	980146.80	4.12	-314.60	-1.32	0.00	22.25	-289.56	-263.86	
colo :	d-62	39	42.57	-106	5.29	9850.0	co	979246.50	980143.12	6.49	-335.96	-1.21	0.00	29.21	-301.47	-274.22	
colo :	d-63	39	41.46	-106	4.91	9855.0	co	979242.56	980141.47	8.95	-336.13	-1.21	0.00	27.39	-301.00	-273.94	
colo :	d-64	39	40.39	-106	4.11	9641.0	co	979256.03	980139.88	6.13	-328.83	-1.25	0.00	22.34	-301.61	-274.91	
colo :	d-65	39	46.41	-106	2.93	10275.0	co	979239.58	980148.80	6.02	-350.45	-1.12	0.00	56.52	-289.04	-260.56	
colo :	d-66	39	43.95	-106	0.08	12111.0	co	979103.60	980145.16	18.00	-413.07	-0.59	0.00	96.60	-299.06	-266.46	
colo :	d-67	39	44.90	-106	0.60	11888.0	co	979127.38	980146.57	17.77	-405.47	-0.67	0.00	98.03	-290.33	-258.33	
colo :	d-68	39	50.44	-105	58.55	11950.0	co	979154.72	980154.78	14.46	-407.58	-0.65	0.00	122.98	-270.79	-238.34	
colo :	d-69	39	50.77	-105	59.15	11703.0	co	979173.93	980155.27	12.53	-399.16	-0.73	0.00	118.50	-268.85	-236.93	
colo :	d-70	39	50.03	-105	59.50	11625.0	co	979174.67	980154.17	14.99	-396.50	-0.75	0.00	113.02	-269.24	-237.74	
colo :	d-71	39	49.90	-106	0.26	11642.0	co	979172.03	980153.98	16.44	-397.07	-0.75	0.00	112.17	-269.21	-237.79	
colo :	d-72	39	49.72	-105	58.35	11540.0	co	979180.15	980153.71	10.38	-393.60	-0.78	0.00	110.98	-273.02	-241.38	
colo :	d-73	39	48.15	-105	57.67	12199.0	co	979119.93	980151.38	15.00	-416.07	-0.56	0.00	114.97	-286.67	-253.57	
colo :	d-74	39	47.50	-105	58.56	11325.0	co	979175.86	980150.42	9.77	-386.26	-0.85	0.00	89.79	-287.55	-256.46	
colo :	d-75	39	45.49	-105	52.81	12774.0	co	979064.37	980147.45	18.16	-435.68	-0.35	0.00	117.34	-300.54	-266.10	
colo :	ute1	39	51.56	-106	5.93	8746.0	co	979356.46	980156.44	2.76	-298.30	-1.39	0.00	22.14	-274.79	-250.33	
colo :	ute2	39	50.97	-106	4.16	8775.0	co	979354.91	980155.56	4.09	-299.29	-1.39	0.00	24.19	-272.40	-247.96	
colo :	ute4	39	50.02	-106	2.86	8940.0	co	979336.12	980154.16	6.72	-304.92	-1.37	0.00	22.30	-277.26	-252.58	
colo :	ute5	39	50.44	-106	2.40	9220.0	co	979323.48	980154.78	5.66	-314.47	-1.32	0.00	35.35	-274.78	-249.23	
colo :	ute6	39	50.89	-106	1.73	9462.0	co	979313.83	980155.45	5.85	-322.72	-1.28	0.00	47.76	-270.40	-244.18	
colo :	ute7	39	51.23	-106	0.97	9708.0	co	979302.80	980155.95	5.61	-331.11	-1.24	0.00	59.33	-267.41	-240.49	

cal moss march 1981
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Meter ID: g-24 Date: 01/12/82

STATION IDENTIFICATION proj sta-id	LOCATIONS LATITUDE deg min	LONGITUDE deg min	ELE (in ft)	ST	GRAVITY OBSERVED	GRAVITY THEORETICAL	CORRECTIONS TERRAIN	CORRECTIONS BOUGUER	CORR CURV	CORRECTIONS SPECIAL	ANOMALIES FREE AIR	ANOMALIES COMPLETE-BOUGUER d1=2.67	ANOMALIES BOUGUER d2=2.45	SPEC FIELDS
colo : ute8	39 51.86	-106 1.09	9980.0	co	979293.41	980156.88	5.23	-340.39	-1.19	0.00	74.56	-261.78	-234.07	
colo : ute9	39 47.90	-106 2.31	8982.0	co	979320.50	980151.02	7.44	-306.35	-1.36	0.00	13.78	-286.49	-261.75	
colo : ut10	39 47.42	-106 1.41	8970.0	co	979316.33	980150.30	8.46	-305.94	-1.36	0.00	9.19	-289.65	-265.03	
colo : ut11	39 50.19	-106 5.83	9211.0	co	979323.58	980154.41	4.00	-314.16	-1.33	0.00	34.97	-276.52	-250.85	
colo : ut12	39 46.30	-106 7.19	9310.0	co	979309.86	980151.61	4.81	-317.54	-1.31	0.00	33.35	-280.68	-254.81	
colo : sc13	39 47.38	-106 8.37	8413.0	co	979360.33	980150.24	3.64	-286.94	-1.43	0.00	0.92	-283.81	-260.35	
colo : sc14	39 47.01	-106 9.71	8193.0	co	979372.38	980149.70	4.96	-279.44	-1.45	0.00	-7.14	-283.07	-260.34	
colo : sc15	39 46.13	-106 8.86	8284.0	co	979364.26	980148.39	4.83	-282.54	-1.44	0.00	-5.41	-284.57	-261.57	
colo : sc16	39 46.21	-106 7.86	8422.0	co	979355.38	980148.51	4.36	-287.25	-1.43	0.00	-1.44	-285.76	-262.33	
colo : ut17	39 45.70	-106 7.20	8642.0	co	979339.60	980147.75	4.26	-294.75	-1.41	0.00	4.20	-287.70	-263.65	
colo : wl18	39 43.34	-106 7.70	8503.0	co	979335.72	980144.26	5.85	-290.01	-1.42	0.00	-9.24	-294.83	-271.30	
colo : di19	39 43.07	-106 6.06	8915.0	co	979307.73	980143.86	6.10	-304.06	-1.37	0.00	1.88	-297.46	-272.79	
colo : di20	39 40.92	-106 4.94	9025.0	co	979293.10	980140.67	5.64	-307.82	-1.35	0.00	0.76	-302.77	-277.76	
colo : di21	39 40.93	-106 3.78	9716.0	co	979251.97	980140.69	6.13	-331.39	-1.24	0.00	24.53	-301.97	-275.07	
colo : di22	39 40.04	-106 5.28	8640.0	co	979315.13	980139.37	5.79	-294.69	-1.41	0.00	-12.07	-302.37	-278.45	
colo : di23	39 38.57	-106 3.23	9710.0	co	979247.30	980137.19	7.32	-331.18	-1.24	0.00	22.79	-302.31	-275.53	
colo : di24	39 37.97	-106 2.09	9315.0	co	979272.08	980136.30	4.74	-317.71	-1.31	0.00	11.35	-302.93	-277.03	