

# EASTERN ARAPAHOE COUNTY VERTICAL CONTROL

PHASE 4- BRICK CENTER / QUINCY TO I-70  
PHASE 5- I 70 / BRICK CENTER TO WATKINS

## PHASE 2

R65W  
R64W

R64W  
R63W

MARK ID	LATITUDE	LONGITUDE	ELEV (m)	ELEV (ft)	GRAVITY (kgal)	GEOPOTENTIAL (gpu)	LOCATION
J 259	39°44'41" N	104°37'00" W	1682.047	5518.52	0.9796180 kgal	1647.88348 gpu	0.6 MILES WEST ALONG THE UPRR FROM THE TRAIN STATION
5513=C2	39°44'47" N	104°36'11" W	1682.027	5518.45	0.9796184 kgal	1647.88473 gpu	250' NORTH OF THE INT OF THE UPRR & WATKINS ROAD
U 374	39°38'18" N	104°34'58" W	1823.441	5982.41	0.9795939 kgal	1786.37248 gpu	1.1 MILES EAST OF INT WATKINS & QUINCY, NORTH SIDE OF ROAD
LOWRY	39°38'13" N	104°30'04" W	1839.271	6034.34	0.9796013 kgal	1801.89570 gpu	5.6 MILES EAST OF INT WATKINS & QUINCY, NORTH SIDE OF ROAD
BM010315	39°38'11" N	104°27'14" W	1756.008	5761.17	0.9796070 kgal	1720.32882 gpu	SE CORNER OF INTERSECTION BRICK CENTER & QUINCY
0401	39°38'37" N	104°27'14" W	1759.992	5774.24	0.9796086 kgal	1724.23457 gpu	0.5 MI N. OF INT OF BRICK CENTER & QUINCY, WEST SIDE OF ROAD
0402	39°39'06" N	104°27'13" W	1731.755	5661.60	0.9796104 kgal	1696.57277 gpu	1.0 MI N. OF INT,  OF BOX CULVERT ON E. SIDE OF RD
0403	39°39'24" N	104°27'12" W	1745.187	5725.67	0.9796115 kgal	1709.73464 gpu	1.38 MI N. OF INT OF BRICK CENTER & QUINCY, EAST SIDE OF ROAD
0404	39°39'55" N	104°27'11" W	1735.923	5695.27	0.9796133 kgal	1700.66088 gpu	2.0 MI N. OF INT OF BRICK CENTER & QUINCY, EAST SIDE OF ROAD
0405	39°40'01" N	104°27'12" W	1735.632	5694.32	0.9796147 kgal	1700.37831 gpu	2.45 MI N. OF INT OF BRICK CENTER & QUINCY, WEST SIDE OF ROAD
0406	39°40'48" N	104°27'11" W	1714.015	5623.40	0.9796163 kgal	1679.20195 gpu	3.0 MI N. OF INT OF BRICK CENTER & QUINCY, EAST SIDE OF ROAD
0407	39°41'13" N	104°27'11" W	1727.718	5668.35	0.9796176 kgal	1692.62949 gpu	3.5 MI N. OF INT OF BRICK CENTER & QUINCY, WEST SIDE OF ROAD
E 374	39°41'39" N	104°27'10" W	1738.567	5703.95	0.9796191 kgal	1703.26203 gpu	3.95 MI N. OF INT OF BRICK CENTER & QUINCY, EAST SIDE OF ROAD
0408	39°41'40" N	104°27'10" W	1738.483	5703.67	0.9796191 kgal	1703.17975 gpu	4.0 MI N. OF INT OF BRICK CENTER & QUINCY, EAST SIDE OF ROAD
0409	39°42'05" N	104°27'10" W	1727.590	5667.93	0.9796204 kgal	1692.50888 gpu	4.5 MI N. OF INT OF BRICK CENTER & QUINCY, WEST SIDE OF ROAD
0410	39°42'30" N	104°27'09" W	1715.761	5629.12	0.9796217 kgal	1680.92120 gpu	5.0 MI N. OF INT, AT N. ENTRANCE TO WALHALLA RANCH, EAST SIDE OF RD
D 374	39°42'32" N	104°27'10" W	1715.593	5628.57	0.9796218 kgal	1680.75708 gpu	5.05 MI N. OF INT, AT N. ENTRANCE TO WALHALLA RANCH, WEST SIDE OF RD
0411	39°42'58" N	104°27'09" W	1704.331	5591.63	0.9796231 kgal	1669.72553 gpu	5.5 MI N. OF INT OF BRICK CENTER & QUINCY, WEST SIDE OF ROAD
0412	39°43'23" N	104°27'08" W	1694.768	5560.25	0.9796244 kgal	1660.35767 gpu	SE CORNER INT OF BRICK CENTER AND ROAD 6, EAST SIDE OF ROAD
0413	39°43'49" N	104°27'08" W	1690.145	5545.08	0.9796257 kgal	1655.83024 gpu	6.5 MI N. OF INT OF BRICK CENTER & QUINCY, EAST SIDE OF ROAD
0501	39°44'16" N	104°27'08" W	1683.119	5522.03	0.9796272 kgal	1648.94959 gpu	25' WEST OF THE WEST ROW FENCE FOR BRICK CENTER AT I-70 INT
0502	39°44'16" N	104°27'42" W	1685.879	5531.09	0.9796285 kgal	1651.65189 gpu	AT I-70 MP 302.84, SOUTH SIDE OF ROAD AT ROW FENCE
0503	39°44'17" N	104°28'16" W	1695.759	5563.50	0.9796259 kgal	1661.33167 gpu	AT I-70 MP 302.32, TOP OF SW BRIDGE ABUTMENT AT HARBACK RD
0504	39°44'17" N	104°28'52" W	1690.036	5544.73	0.9796252 kgal	1655.72338 gpu	AT I-70 MP 301.80, TOP W. SIDE OF BOX CULVERT ON S. SIDE OF RD
0505	39°44'16" N	104°29'21" W	1703.651	5589.40	0.9796246 kgal	1669.06175 gpu	AT I-70 MP 301.35, SOUTH SIDE OF THE ROAD AT ROW FENCE
0506	39°44'16" N	104°29'51" W	1697.969	5570.75	0.9796240 kgal	1663.49373 gpu	AT I-70 MP 300.90, SOUTH SIDE OF THE ROAD AT ROW FENCE
0507	39°44'17" N	104°30'28" W	1697.656	5569.73	0.9796226 kgal	1663.18464 gpu	AT I-70 MP 300.37, TOP W. SIDE OF BOX CULVERT ON S. SIDE OF RD
0508	39°44'17" N	104°31'03" W	1700.639	5579.51	0.9796218 kgal	1666.10574 gpu	AT I-70 MP 299.85, SOUTH SIDE OF THE ROAD AT ROW FENCE
0509	39°44'19" N	104°31'36" W	1706.525	5598.82	0.9796210 kgal	1671.87079 gpu	AT I-70 MP 299.35, TOP OF SE BRIDGE ABUTMENT AT MANILA MILE RD
0510	39°44'19" N	104°32'08" W	1700.740	5579.85	0.9796200 kgal	1666.20194 gpu	AT I-70 MP 298.88, TOP W. SIDE OF BOX CULVERT ON S. SIDE OF RD
0511	39°44'19" N	104°32'43" W	1702.910	5586.96	0.9796190 kgal	1668.32584 gpu	AT I-70 MP 298.38, SOUTH SIDE OF THE ROAD AT ROW FENCE
0512	39°44'20" N	104°33'18" W	1710.696	5612.51	0.9796180 kgal	1675.95265 gpu	AT I-70 MP 297.85, SOUTH SIDE OF THE ROAD AT ROW FENCE
0513	39°44'21" N	104°33'51" W	1713.781	5622.63	0.9796172 kgal	1678.97408 gpu	AT I-70 MP 297.35, TOP OF SE BRIDGE ABUTMENT AT SECONDARY RD
0514	39°44'21" N	104°34'26" W	1696.488	5565.89	0.9796170 kgal	1662.03048 gpu	AT I-70 MP 296.85, SOUTH SIDE OF THE ROAD AT ROW FENCE
0515	39°44'22" N	104°35'01" W	1693.299	5555.43	0.9796170 kgal	1658.90622 gpu	AT I-70 MP 296.25, TOP OF SW BRIDGE ABUTMENT AT BOX ELDER CREEK
0516	39°44'22" N	104°35'34" W	1690.739	5547.03	0.9796170 kgal	1656.39791 gpu	0.5 MI E. OF I-70 & WATKINS, S. SIDE OF I-70 AT END OF SERVICE RD
(1 & 3) BM010101	39°44'15" N	104°36'11" W	1688.093	5538.35	0.9796166 kgal	1653.80510 gpu	300' SOUTH OF I-70 & WATKINS, EAST SIDE OF ROAD

### LEGEND

- DENOTES THAT THIS POINT WAS NOT USED AS PROJECT CONTROL. MOVEMENT HAS BEEN DETECTED AT THESE NGS POINTS. THE ELEVATION REPORTED HEREON IS BASED UPON THIS SURVEY, AN UPDATED ELEVATION.
- DENOTES THAT THIS POINT WAS USED AS PROJECT CONTROL.
- (1 & 3) DENOTES THAT THIS POINT WAS OBSERVED DURING PHASES 1 AND 3 OF THE EASTERN ARAPAHOE VERTICAL CONTROL NETWORK. THE MONUMENT CAPS WILL BE REPRESENTATIVE OF WHAT WAS SET DURING PHASES 1 AND 3 PERFORMED IN SPRING OF 2000.
- DENOTES LOCATION OF BENCHMARK.
- KGAL DENOTES THE "KILO GAL" UNIT OF GRAVITATIONAL ACCELERATION
- GPU DENOTES THE "GEOPOTENTIAL UNIT" UNIT OF GRAVITY POTENTIAL
- NGS DENOTES NATIONAL GEODETIC SURVEY
- ROW DENOTES RIGHT-OF-WAY
- m DENOTES THE "METER" LINEAR UNIT OF MEASURE
- ft DENOTES THE "US SURVEY FOOT" LINEAR UNIT OF MEASURE; BEING DEFINED AS (3937/1200)(VALUE IN METERS)
- INT DENOTES INTERSECTION
- N DENOTES NORTH
- W DENOTES WEST
- NE DENOTES NORTHEAST
- NW DENOTES NORTHWEST
- SE DENOTES SOUTHEAST
- SW DENOTES SOUTHWEST
- UPRR DENOTES THE UNION PACIFIC RAILROAD
- MP DENOTES INTERSTATE MILEPOST
- RD DENOTES ROAD

### SURVEY NOTES

- THE ELEVATIONS REPORTED HEREON ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAV88), THIS SURVEY BEING CLASSIFIED AS A SECOND ORDER CLASS 0 SURVEY AS DEFINED BY NGS.
- ALL MONUMENTS SET BY ZYLSTRA BAKER SURVEYING, INC ARE EITHER COLORADO DEPARTMENT OF TRANSPORTATION TYPE 2 OR TYPE 5 CONTROL MONUMENTS. A TYPE 2 CONSISTS OF BERNSTEIN TOP SECURITY ROD MONUMENTS BEING 3 FOOT SMOOTH ALUMINUM ROD SECTIONS WITH A 3 FOOT FINNED ROD AT THE TOP SECTION CONNECTED BY FLOATING THREADS AND SELF LOCKING WASHERS. A SPIRAL DRIVE POINT ATTACHED TO THE BOTTOM AND A 3 1/4 INCH ALUMINUM CAP AFFIXED TO THE TOP. ADDITIONAL 3 FOOT SMOOTH ROD SECTIONS WERE ATTACHED TO THE BOTTOM SECTION UNTIL THE MONUMENT REACHED A STABLE DEPTH; MONUMENT DEPTHS RANGE FROM 6 TO 18 FEET. A TYPE 5 MONUMENT CONSISTS OF A 3 1/4 INCH ALUMINUM ROCK CAP DRILL SET AND ANCHORED WITH EPOXY INTO A CONCRETE STRUCTURE SUCH AS A BRIDGE ABUTMENT OR DRAINAGE CULVERT.
- ALL GEODETIC POSITIONS LISTED HEREON ARE BASED UPON AUTONOMOUS GLOBAL POSITIONING SYSTEM (GPS) MEASUREMENTS AND HAVE A POSITIONAL TOLERANCE OF 30 FEET ±. POSITIONS ARE RELATIVE TO THE NORTH AMERICAN DATUM OF 1983, 1992 REALIZATION.
- THE EQUIPMENT USED IN THIS PROJECT CONSIST OF FIRST ORDER DIFFERENTIAL LEVELING EQUIPMENT AS OUTLINED BY NGS. A ZEISS DINI 11 AUTOMATIC PRECISE DIGITAL LEVEL (SERIAL No. 103281) WITH A SET OF (2) 3m PRECISE DIGITAL BAR CODE INVAR RODS (SERIAL No.'s 13512, 13513), CALIBRATED IN MUNICH GERMANY, WERE USED. STEEL TURNING PINS OR STEEL "TURTLES" WERE USED AS TURNING POINTS.
- THE ELEVATION DIFFERENCE DATA WAS CORRECTED FOR SYSTEMATIC ERRORS BY APPLYING CORRECTIONS THAT ACCOUNTED FOR ROD SCALE ERRORS, ROD INVAR TEMPERATURE, REFRACTION AND COLLIMATION ERROR. DUE TO THE SMALL EXTENTS OF THIS PROJECT IT WAS NOT NECESSARY TO APPLY CORRECTIONS THAT ACCOUNTED FOR EARTH TIDES AND CRUSTAL MOTION. THE MAGNETIC FIELD CORRECTION WAS NOT NECESSARY BECAUSE THE INSTRUMENTATION USED DURING OBSERVATIONS IS NOT SUSCEPTIBLE TO MAGNETIC EFFECTS. GRAVITY EFFECTS WERE ACCOUNTED FOR USING NAVD88 MODELED GRAVITY AS PROVIDED BY NGS. AVAILABLE FOR DOWNLOAD AT WWW.NGSDATA.COM. THE MODELED GRAVITY VALUES WERE USED TO COMPUTE NAVD88 GEOPOTENTIAL NUMBERS AT EACH BENCHMARK. THE HELMERT ORTHOMETRIC REDUCTION EQUATION WAS USED TO REDUCE THE POTENTIAL VALUES TO NAVD88 HELMERT ORTHOMETRIC HEIGHTS. THIS IS THE CURRENT METHOD IN USE BY NGS TO DATE. REFERENCE THE REPORT FOR PHASES 4 AND 5 FOR DETAILED CALCULATION METHODS.
- NOTICE: ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT, MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE CERTIFICATION SHOWN HEREON.
- THE DATA SHOWN HEREON IS A RESULT OF A SIMULTANEOUS ADJUSTMENT OF DIFFERENTIAL LEVELING AND GRAVITY DATA FROM PHASES 1, 3, 4 AND 5. THE CONTROL VERIFIED DURING PHASES 1 AND 3 WERE HELD FIXED IN THE FULL CONSTRAINT LEAST SQUARES ADJUSTMENT.
- NO GUARANTEE AS TO THE ACCURACY OF THE INFORMATION CONTAINED ON THE ATTACHED DRAWING IS EITHER STATED OR IMPLIED UNLESS THIS COPY BEARS AN ORIGINAL SIGNATURE OF THE PROFESSIONAL LAND SURVEYOR NAMED HEREON.



TYPICAL MONUMENT CAP

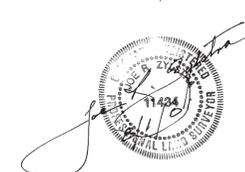
### SURVEYOR'S CERTIFICATION

I, LAWRENCE DEVRIES, A PROFESSIONAL LAND SURVEYOR PRACTICING IN THE STATE OF COLORADO, BASED UPON MY PROFESSIONAL OPINION, DO HEREBY CERTIFY THAT THIS SURVEY WAS MADE TO THE STANDARD OF A PROFESSIONAL LAND SURVEYOR PRACTICING IN THE STATE OF COLORADO, I FIND THAT THE INFORMATION CONTAINED HEREON IS ACCURATE AND A REPRESENTATION OF SAID SURVEY.



7-31-01  
DATE ISSUED

LAWRENCE DEVRIES, PROFESSIONAL LAND SURVEYOR  
COLORADO PLS No. 35592



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