

Introduction:

This control report documents the establishment of new panel control for 2023 Orthoimagery for the City of Lubbock. Control from the following previous projects was utilized where possible.

- BHI project number 20150378 dated June 2, 2015
- BHI project number 20170064 dated August 5, 2016
- BHI project number 20170363 dated January 30, 2017
- BHI project number 20180325 dated May 17, 2018
- BHI project number 20190538 dated June 10, 2019
- BHI project number 20220440 dated August 19, 2022

In this control dataset, BHI set new control monument consisting of either a 2" aluminum cap on 5/8" x 18" rebar or a PK nail with a 2" aluminum washer. Monument Control was established with Real Time Kinematic GPS double observations, fast static observations, or OPUS observations.

Project Control Specifications:

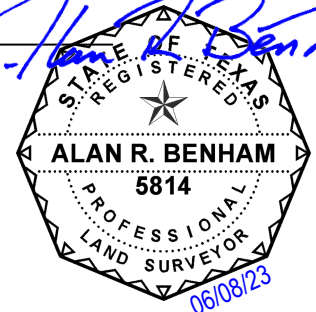
Units:	US Survey Foot
Horizontal Datum:	NAD_83(2011)(EPOCH:2010.0000)
Vertical Datum:	NAVD88
Geoid Model:	GEOID18
Projection:	Lambert Conformal Conic
State Plane and/or UTM Zone:	4202 - Texas North Central Zone
Basis of Bearing:	Grid Bearings
Project Combined Factor:	NA
Modification Method Used:	NA
Field Methodology:	OPUS Solution & RTK
Equipment Used:	Trimble GPS Equipment
Control Set Date:	April 24-26, 2023
Observation Date:	April 24-26, 2023
Publication Date:	June 8, 2023

I, Alan R. Benham, Texas Registered Professional Land Surveyor No. 5814, do hereby certify that this Control Survey Report was prepared by me or under my direct supervision based on an actual survey on the ground as described herein; that I am responsible for this survey.

Alan R. Benham, RPLS, CFedS
 TX RPLS 5814
 For and on Behalf of
 Bohannon Huston, Inc.
 7500 Jefferson St. NE
 Albuquerque, NM 87109-4335
 505.823.1000

June 08, 2023

Date



Adjusted Coordinate Listing:

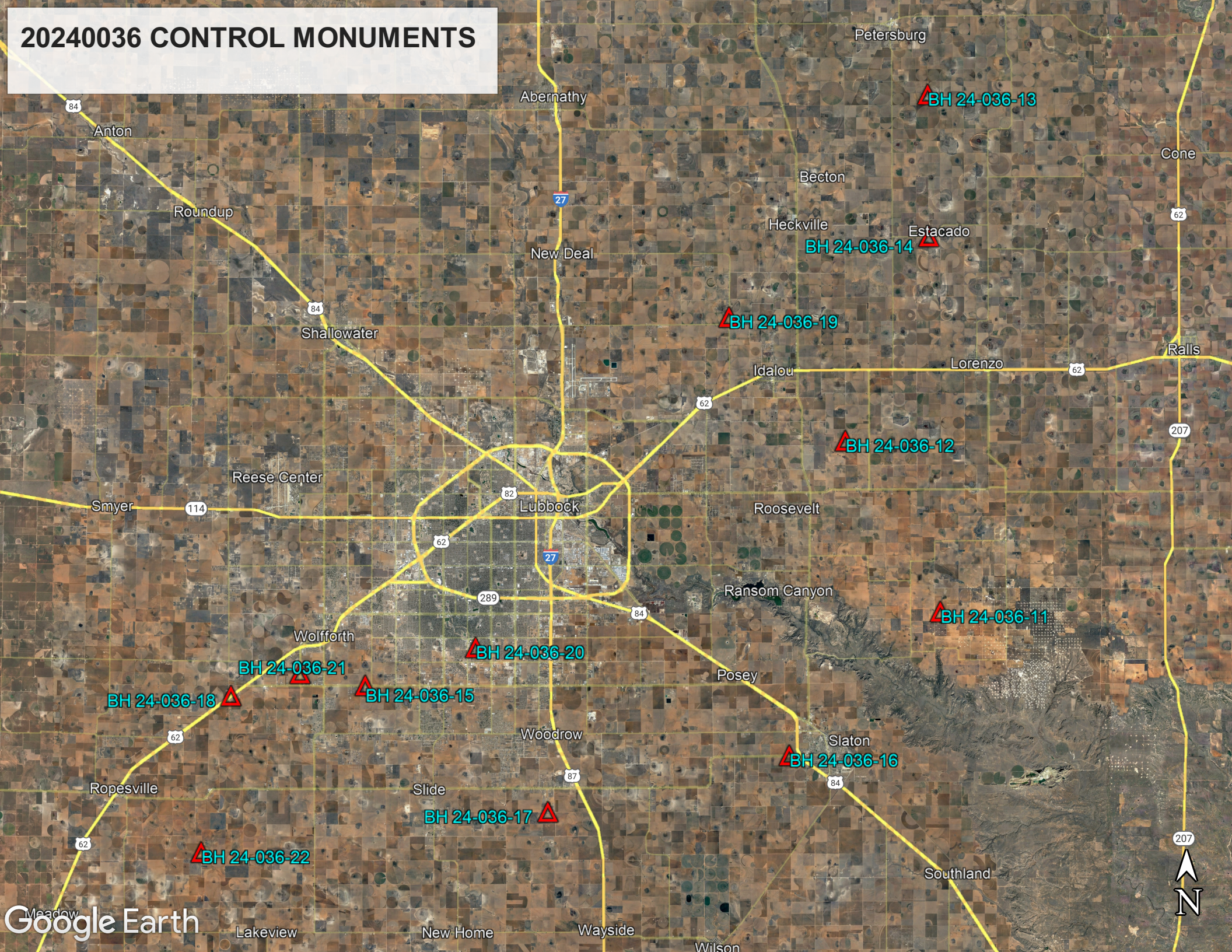
POINT	LATITUDE	LONGITUDE	ELLIPSOID HEIGHT (US FT)	ORTHOMETRIC HEIGHT (US FT)	GRID NORTHING	GRID EASTING	DESCRIPTION
BH 24-036-11	N 33° 31' 14.22754"	W 101° 33' 42.99358"	2986.431	3069.122	7249763.180	1035467.003	2" ALUMINUM CAP
BH 24-036-12	N 33° 37' 26.74799"	W 101° 37' 50.42990"	3074.841	3157.770	7288015.359	1015650.951	2" ALUMINUM CAP
BH 24-036-13	N 33° 50' 00.60673"	W 101° 34' 12.39068"	3113.783	3198.524	7363637.374	1036306.115	2" ALUMINUM CAP
BH 24-036-14	N 33° 44' 51.05584"	W 101° 34' 10.26305"	3108.182	3192.245	7332355.965	1035571.412	1.5" WASHER
BH 24-036-15	N 33° 28' 34.30328"	W 101° 58' 44.16384"	3210.575	3290.906	7237564.057	907910.072	1.5" WASHER
BH 24-036-16	N 33° 26' 02.02844"	W 101° 40' 18.03183"	3028.172	3110.103	7219215.758	1001086.776	2" ALUMINUM CAP
BH 24-036-17	N 33° 23' 59.47917"	W 101° 50' 47.59220"	3118.684	3199.479	7208491.030	947369.226	2" ALUMINUM CAP
BH 24-036-18	N 33° 28' 11.22431"	W 102° 04' 34.87769"	3255.834	3335.559	7236230.121	878142.323	1.5" WASHER
BH 24-036-19	N 33° 41' 56.13451"	W 101° 42' 54.20632"	3139.533	3222.697	7316006.676	990809.506	1.5" WASHER
BH 24-036-20	N 33° 29' 57.25259"	W 101° 53' 56.16628"	3158.588	3239.513	7245144.986	932561.300	2" ALUMINUM CAP
BH 24-036-21	N 33° 29' 00.32928"	W 102° 01' 34.40928"	3230.718	3310.805	7240673.688	893586.748	2" ALUMINUM CAP
BH 24-036-22	N 33° 22' 30.01166"	W 102° 05' 52.17067"	3221.030	3300.284	7201988.147	870418.211	2" ALUMINUM CAP

Geospatial Positional Accuracy Report:

POINT	HORIZONTAL POSITIONAL ACCURACY	VERTICAL POSITIONAL ACCURACY
BH 24-036-11	0.013	0.025
BH 24-036-12	0.031	0.060
BH 24-036-13	0.029	0.056
BH 24-036-14	0.022	0.048
BH 24-036-15	0.017	0.032
BH 24-036-16	0.023	0.032
BH 24-036-17	0.149	0.117
BH 24-036-18	0.020	0.042
BH 24-036-19	0.031	0.065
BH 24-036-20	0.063	0.101
BH 24-036-21	0.043	0.226
BH 24-036-22	0.028	0.051

BSTProjectNo	20240036
BSTProjName	Lubbock 2023 Orthophotography
Survey PM Initials	ARB
PLS of Responsible Charge Initials	ARB
Originator	SRVABQ
Units	US Survey Ft
HorizDatum	NAD83
VertDatum	NAVD88
GeoidModel	GEOID12B
Zone	4202 - Texas North Central
CF	1.000000000000000
CF_Mon	LIST SOURCE OF THE CF
1/CF	1.000000000000000
ModMethod	0.0 Origin
Scale Monument	0.00 , 0.00
Scale Coordinate Northing (Proj Units)	0.000
Scale Coordinate Easting (Proj Units)	0.000
TruncNorthing	0.000
TruncEasting	0.000
Minimum Elevation (meters)	
Maximum Elevation (meters)	
Projection	LC
Scale Factor	N/A
Central Meridain	-98.5000000000000°
Origin(Latitude)	31.6666666666667°
False Northing	1968500.000000000000
False Easting	6561666.6667
Southern Std Parallel 1st Standard Parallel	32.1333333333333°
Northern Std Parallel 2nd Standard Parallel	33.9666666666667°
Condition	Lambert Conformal with Affine Post-Processor
Scale Reduction False Northing	N/A
Scale Reduction False Easting	N/A
Scale Reduction	N/A
Affine A0 Coefficient	0.000000000000000
Affine B0 Coefficient	0.000000000000000
Affine A1 Coefficient	1.000000000000000
Affine B1 Coefficient	0.000000000000000
Affine A2 Coefficient	0.000000000000000
Affine B2 Coefficient	1.000000000000000

20240036 CONTROL MONUMENTS



BH 24-036-21

FILE: 09791170.23o OP1685049946877

NGS OPUS SOLUTION REPORT

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All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: <https://www.ngs.noaa.gov/OPUS/about.jsp#accuracy>

USER: wmcmarlin@bhinc.com DATE: May 25, 2023
RINEX FILE: 0979117m.23o TIME: 21:27:20 UTC

SOFTWARE: page5 2008.25 master273.pl 160321 START: 2023/04/27 12:11:00
EPHEMERIS: igs22594.eph [precise] STOP: 2023/04/27 14:39:00
NAV FILE: brdc1170.23n OBS USED: 5965 / 6371 : 94%
ANT NAME: TRMR10-2 NONE # FIXED AMB: 39 / 39 : 100%
ARP HEIGHT: 1.4317 OVERALL RMS: 0.014 (m)

REF FRAME: NAD_83(2011) (EPOCH:2010.0000) ITRF2014 (EPOCH:2023.3193)

X:	-1109702.315 (m)	0.005 (m)	-1109703.226 (m)	0.005 (m)
Y:	-5209014.161 (m)	0.010 (m)	-5209012.762 (m)	0.010 (m)
Z:	3499344.386 (m)	0.013 (m)	3499344.191 (m)	0.013 (m)
LAT:	33 29 0.32928	0.013 (m)	33 29 0.34508	0.013 (m)
E LON:	257 58 25.59072	0.003 (m)	257 58 25.54493	0.003 (m)
W LON:	102 1 34.40928	0.003 (m)	102 1 34.45507	0.003 (m)
EL HGT:	984.725 (m)	0.009 (m)	983.634 (m)	0.009 (m)
ORTHO HGT:	1009.136 (m)	0.069 (m)	[NAVD88 (Computed using GEOID18)]	

	UTM COORDINATES	STATE PLANE COORDINATES
	UTM (Zone 13)	SPC (4202 TXNC)
Northing (Y) [meters]	3708839.819	2206961.754
Easting (X) [meters]	776321.770	272365.785
Convergence [degrees]	1.64165833	-1.92318333
Point Scale	1.00054145	0.99990093
Combined Factor	1.00038680	0.99974637

US NATIONAL GRID DESIGNATOR: 13SGT7632208840 (NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE (m)
DO9608	TXP1 POST CORS ARP	N331057.072	W1012247.633	68817.8
DO9484	TXL1 LITTLEFIELD CORS ARP	N335618.226	W1022058.275	58701.1
DP4773	TXM1 MORTON CORS ARP	N334416.169	W1024534.816	73695.4

NEAREST NGS PUBLISHED CONTROL POINT

DQ0700	HILL	N332833.428	W1020211.331	1263.2
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This position and the above vector components were computed without any knowledge by the National Geodetic Survey regarding the equipment or field operating procedures used.

Control Station Data

Name of Station: **BH 24-036-11**

Establishing Group: Bohannon Huston, Inc.

Observation Date: 26-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023

Orthophotography

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2403611

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 31' 14.22754"	7,249,763.180 US Ft	7,249,763.180 US Ft
Longitude Easting X:	W 101° 33' 42.99358"	1,035,467.003 US Ft	1,035,467.003 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	910.266 m	2,986.431 US Ft	3,069.122 US Ft

Location

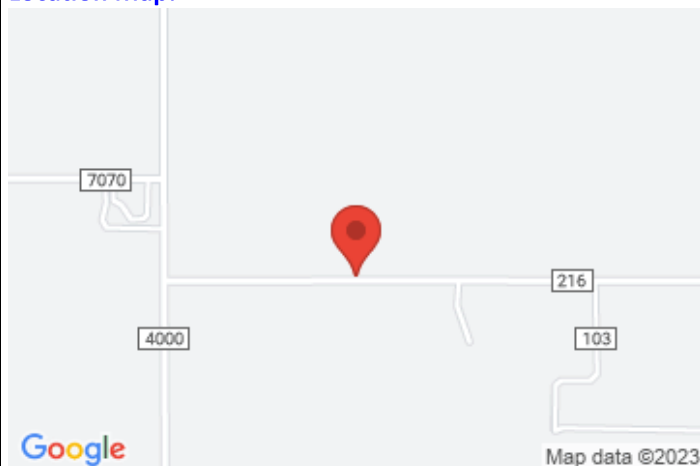
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

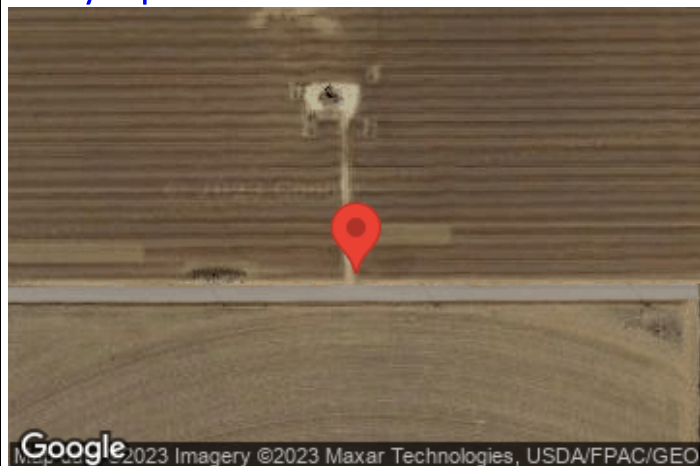
Location Map:



Vicinity Photo (Looking North):



Vicinity Map:



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-12

Establishing Group: Bohannon Huston, Inc.

Observation Date: 25-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023

Orthophotography

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2403612

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 37' 26.74799"	7,288,015.359 US Ft	7,288,015.359 US Ft
Longitude Easting X:	W 101° 37' 50.42990"	1,015,650.951 US Ft	1,015,650.951 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	937.213 m	3,074.841 US Ft	3,157.770 US Ft

Location

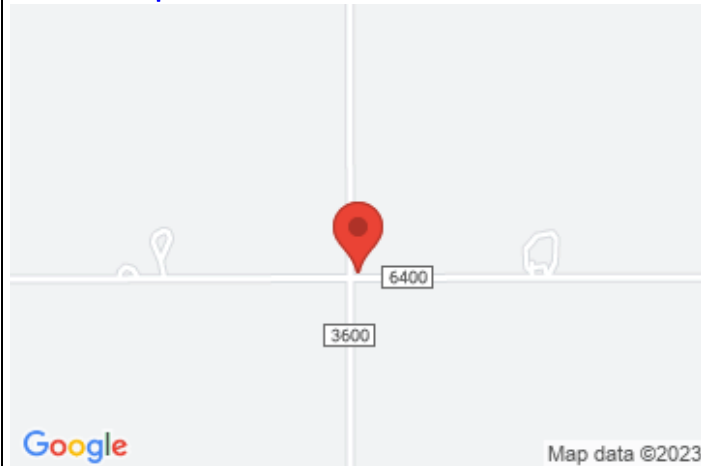
County & State: Lubbock, TX

Land Grant(s): None

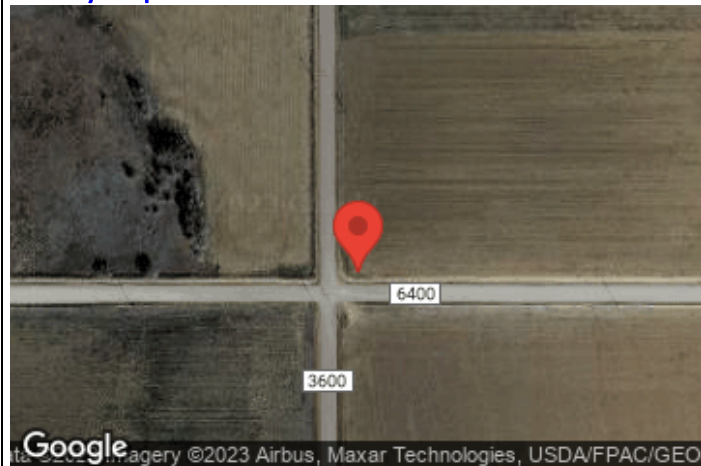
Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking North):



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-13

Establishing Group: Bohannon Huston, Inc.

Observation Date: 25-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023
Orthophotography

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2403613

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 50' 00.60673"	7,363,637.374 US Ft	7,363,637.374 US Ft
Longitude Easting X:	W 101° 34' 12.39068"	1,036,306.115 US Ft	1,036,306.115 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	949.083 m	3,113.783 US Ft	3,198.524 US Ft

Location

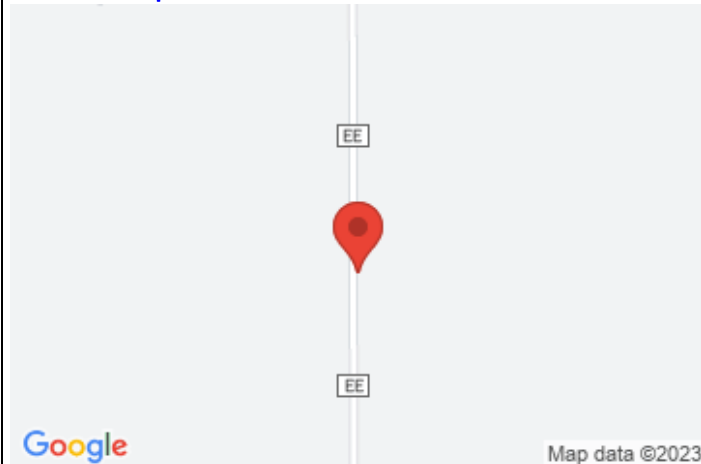
County & State: Hale, TX

Land Grant(s): None

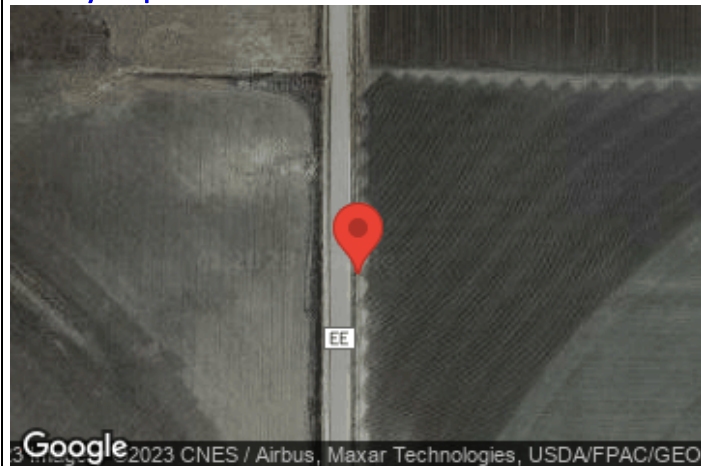
Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking East):



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-14

Establishing Group: Bohannon Huston, Inc.

Observation Date: 25-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023
Orthophotography

Station Data

Type/Composition: 1.5" Washer

Station Height: 0.00 US Ft

Stamping: 2403614

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 44' 51.05584"	7,332,355.965 US Ft	7,332,355.965 US Ft
Longitude Easting X:	W 101° 34' 10.26305"	1,035,571.412 US Ft	1,035,571.412 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	947.376 m	3,108.182 US Ft	3,192.245 US Ft

Location

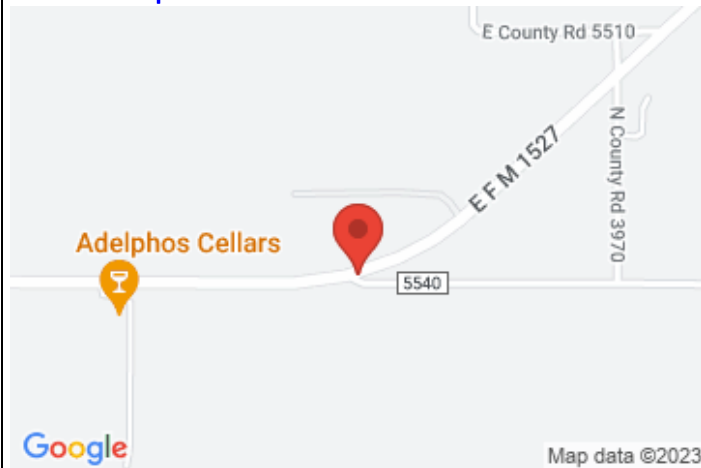
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking West):



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-15

Establishing Group: Bohannon Huston, Inc.

Observation Date: 27-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023
Orthophotography

Station Data

Type/Composition: 1.5" Washer

Station Height: 0.00 US Ft

Stamping: 2303615

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 28' 34.30328"	7,237,564.057 US Ft	7,237,564.057 US Ft
Longitude Easting X:	W 101° 58' 44.16384"	907,910.072 US Ft	907,910.072 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	978.585 m	3,210.575 US Ft	3,290.906 US Ft

Location

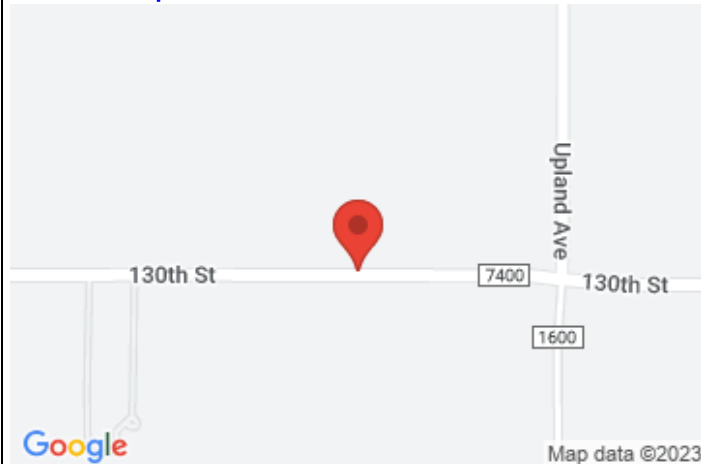
County & State: Lubbock, TX

Land Grant(s): None

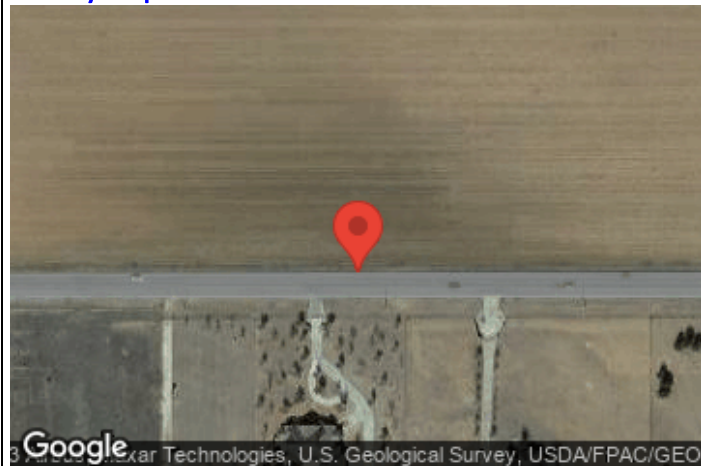
Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking South):



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-16

Establishing Group: Bohannon Huston, Inc.

Observation Date: 26-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023
Orthophotography

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2303616

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 26' 02.02844"	7,219,215.758 US Ft	7,219,215.758 US Ft
Longitude Easting X:	W 101° 40' 18.03183"	1,001,086.776 US Ft	1,001,086.776 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	922.989 m	3,028.171 US Ft	3,110.103 US Ft

Location

County & State: Lubbock, TX

Land Grant(s): None

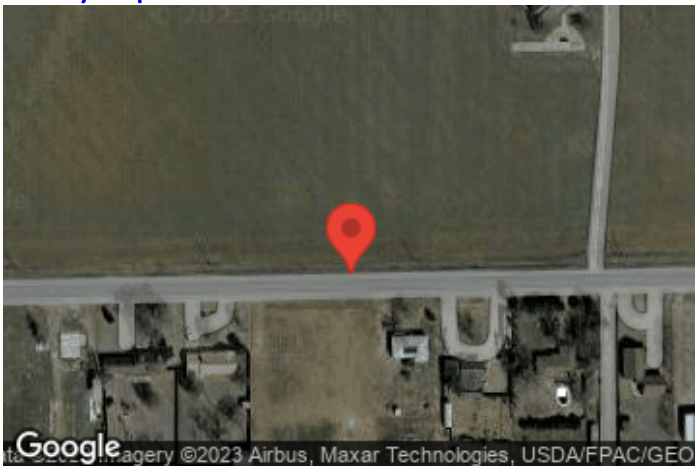
Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking North):



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-17

Establishing Group: Bohannon Huston, Inc.

Observation Date: 26-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023
Orthophotography

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2303617

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 23' 59.47917"	7,208,491.030 US Ft	7,208,491.030 US Ft
Longitude Easting X:	W 101° 50' 47.59220"	947,369.226 US Ft	947,369.226 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	950.577 m	3,118.684 US Ft	3,199.479 US Ft

Location

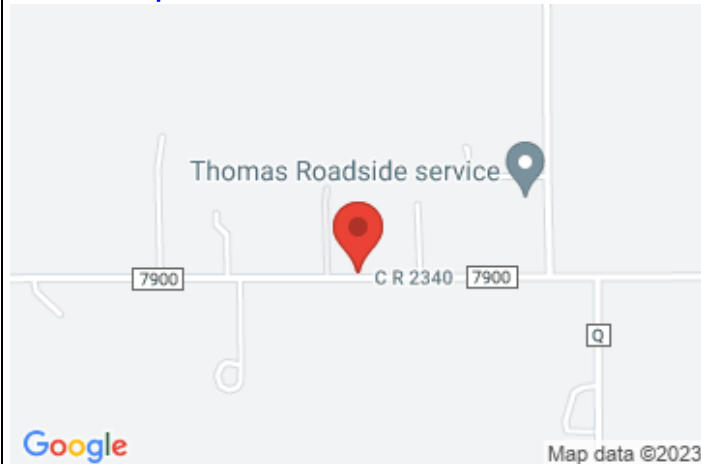
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking North):



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-18

Establishing Group: Bohannon Huston, Inc.

Observation Date: 27-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023
Orthophotography

Station Data

Type/Composition: 1.5" Washer

Station Height: 0.00 US Ft

Stamping: 2303618

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 28' 11.22431"	7,236,230.121 US Ft	7,236,230.121 US Ft
Longitude Easting X:	W 102° 04' 34.87769"	878,142.323 US Ft	878,142.323 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	992.380 m	3,255.834 US Ft	3,335.559 US Ft

Location

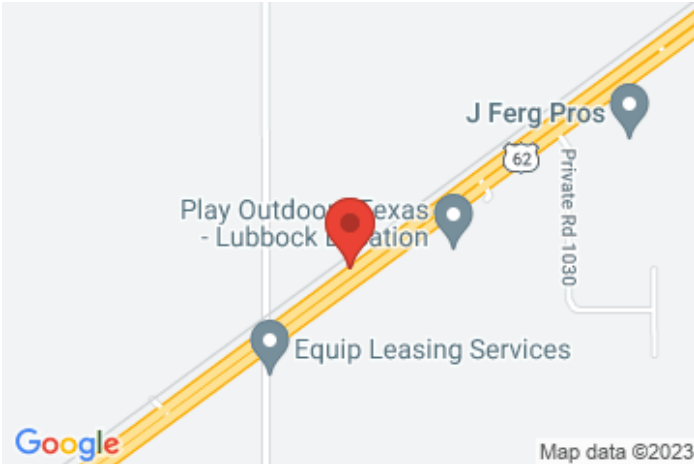
County & State: Lubbock, TX

Land Grant(s): None

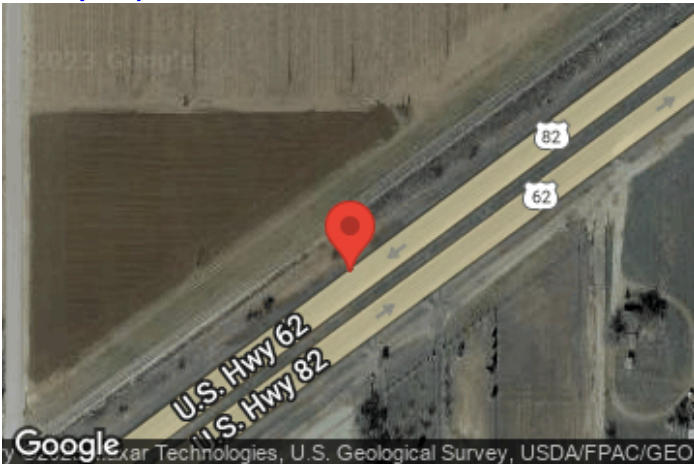
Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking East):



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-19

Establishing Group: Bohannon Huston, Inc.

Observation Date: 25-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023

Orthophotography

Station Data

Type/Composition: 1.5" Washer

Station Height: 0.00 US Ft

Stamping: 2403619

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 41' 56.13451"	7,316,006.676 US Ft	7,316,006.676 US Ft
Longitude Easting X:	W 101° 42' 54.20632"	990,809.506 US Ft	990,809.506 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	956.931 m	3,139.532 US Ft	3,222.697 US Ft

Location

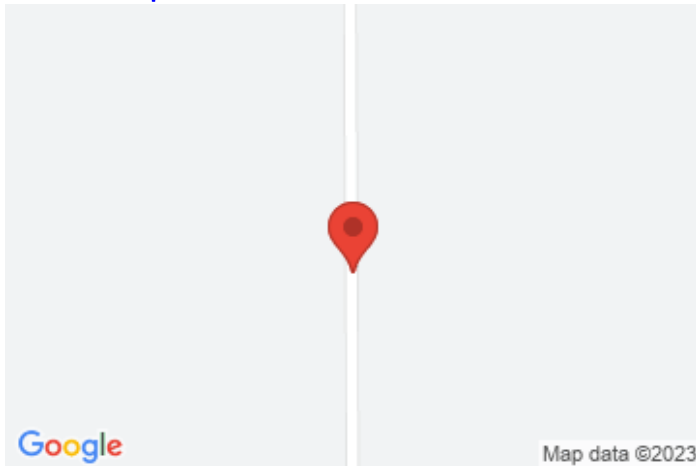
County & State: Lubbock, TX

Land Grant(s): None

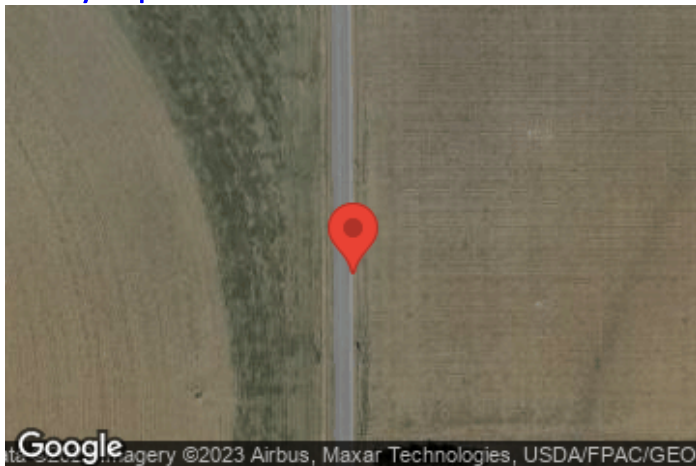
Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking West):



Close Up Photo:



Control Station Data

Name of Station: **BH 24-036-20**

Establishing Group: Bohannon Huston, Inc.

Observation Date: 26-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023

Orthophotography

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2403620

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 29' 57.25259"	7,245,144.986 US Ft	7,245,144.986 US Ft
Longitude Easting X:	W 101° 53' 56.16628"	932,561.300 US Ft	932,561.300 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	962.740 m	3,158.588 US Ft	3,239.513 US Ft

Location

County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking South):



Close Up Photo:



Control Station Data

Name of Station: **BH 24-036-21**

Establishing Group: Bohannon Huston, Inc.

Observation Date: 27-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023
Orthophotography

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2403621

Horizontal Method: OPUS

Vertical Method: OPUS

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 29' 00.32928"	7,240,673.688 US Ft	7,240,673.688 US Ft
Longitude Easting X:	W 102° 01' 34.40928"	893,586.748 US Ft	893,586.748 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	984.725 m	3,230.718 US Ft	3,310.805 US Ft

Location

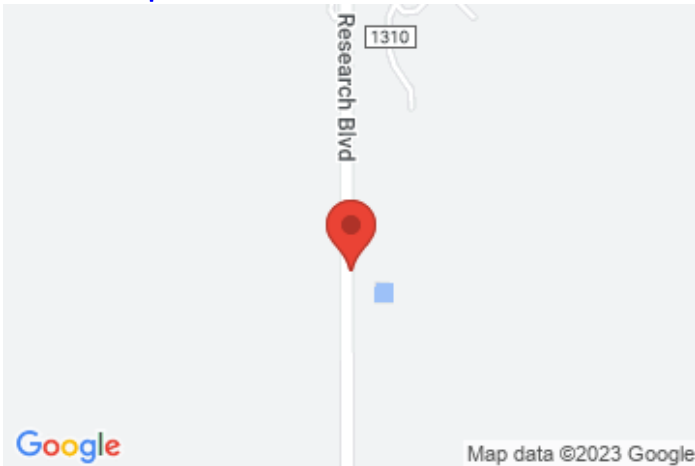
County & State: Lubbock, TX

Land Grant(s): None

Note(s):

Section:

Location Map:



Vicinity Map:



Vicinity Photo (Looking South):



Close Up Photo:



Control Station Data

Name of Station: BH 24-036-22

Establishing Group: Bohannon Huston, Inc.

Observation Date: 27-Apr-2023

BST Project #: 20240036

Project Name: Lubbock 2023
Orthophotography

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2403622

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (TX83-NCF)	Alternate (TX83-NCF)
Latitude Northing Y:	N 33° 22' 30.01166"	7,201,988.147 US Ft	7,201,988.147 US Ft
Longitude Easting X:	W 102° 05' 52.17067"	870,418.211 US Ft	870,418.211 US Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	981.772 m	3,221.030 US Ft	3,300.284 US Ft

Location

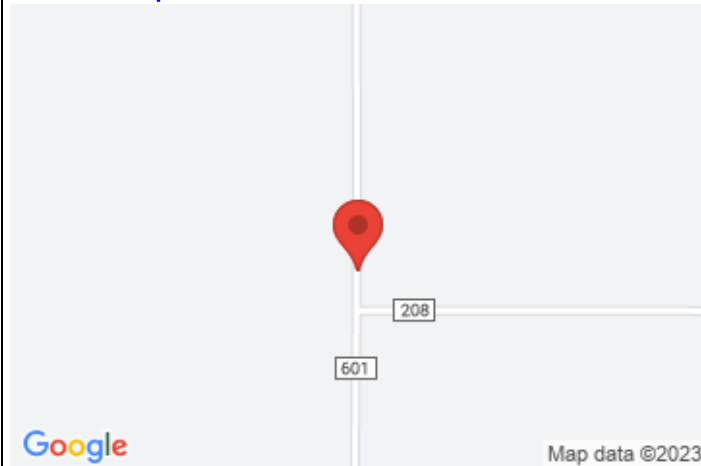
County & State: Terry, TX

Land Grant(s): None

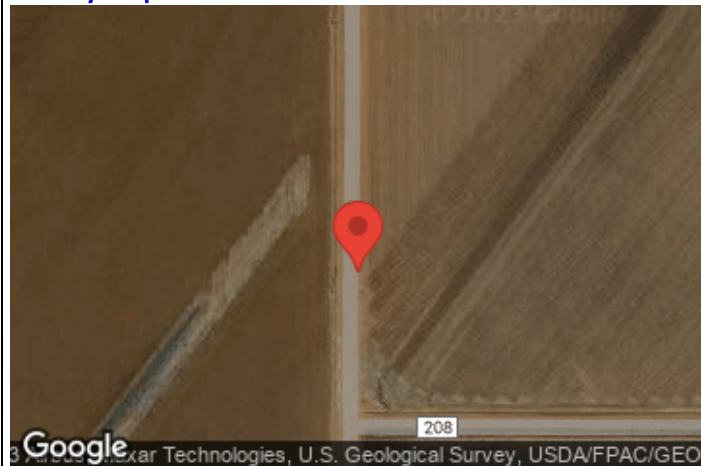
Note(s):

Section:

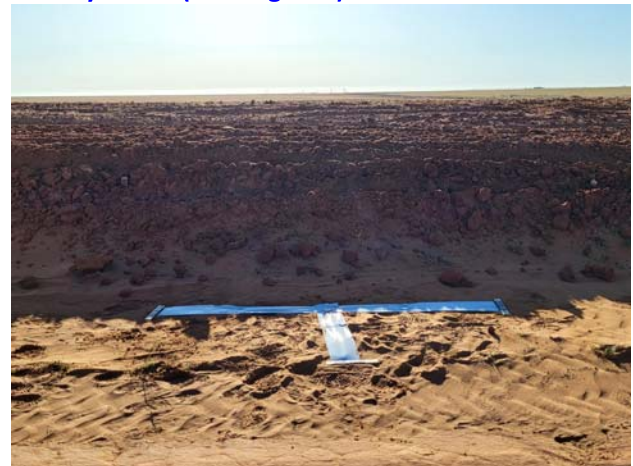
Location Map:



Vicinity Map:



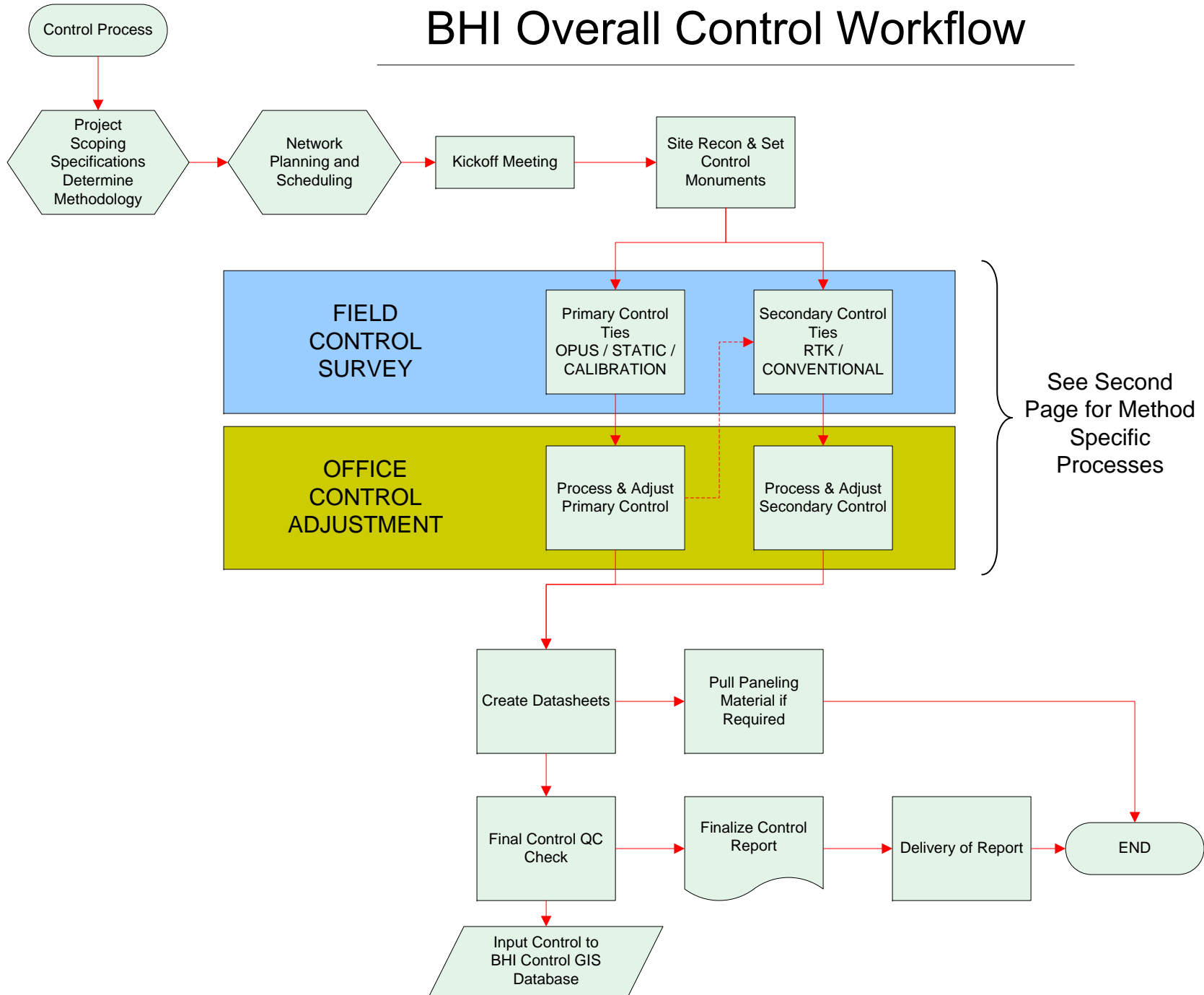
Vicinity Photo (Looking East):



Close Up Photo:



BHI Overall Control Workflow



OPUS - RTK PROCESS

