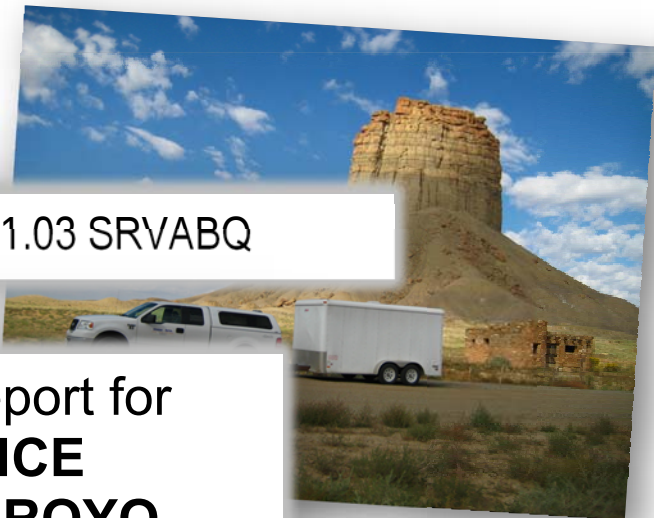




BHI Project No. 20220396.001.03 SRVABQ

**Survey Control Report for
FORT DEFIANCE
SEWER LINE ARROYO
CROSSING REHAB**

Alan R. Benham, PE, PLS, CFedS



March 23, 2022



Introduction:

This control was established for the purposes of providing construction control for the Fort Defiance Sewer Line Arroyo Crossing Rehab Project. Monuments were established with OPUS observations with secondary control established with RTK. Datasheets provide the specific metadata for each monument established.

Project Control Specifications:

Units:	International Foot
Horizontal Datum:	NAD 83
Vertical Datum:	NAVD88
Geoid Model:	GEOID18
Projection:	Transverse Mercator
State Plane and/or UTM Zone:	Arizona Zone East (AZ83-EIF)
Basis of Bearing:	Grid Bearings
Project Combined Factor:	0.99969978 based on BH 22-396-01
Modification Method Used:	Scaled State Plane coordinates about origin (0,0) no truncation
Field Methodology:	OPUS & RTK Solution
Equipment Used:	Trimble GPS Equipment (R8 and R10 Dual Frequency Receivers)
Control Set Date:	February 8, 2022
Observation Date:	February 8, 2022
Adjustment/ Publication Date:	March 23, 2022

I, Alan Benham, Arizona Professional Land Surveyor No. 47283, 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, PE, PLS, CFedS
 AZ PLS 47283
 For and on Behalf of
 Bohannon Huston, Inc.
 Courtyard I / 7500 Jefferson St. NE
 Albuquerque, NM 87109-4335
 505.823.1000

March 23, 2022

Date



Adjusted Coordinate Listing:

See Attached Control Datasheets

POINT	LATITUDE	LONGITUDE	ELLIPSOID (I_FT)	ORTHOMETRIC HEIGHT	MODIFIED NORTHING	MODIFIED EASTING	DESCRIPTION
BH 22-396-01	N 35° 44' 10.10868"	W 109° 04' 10.09056"	6723.573	6791.302	1725564.048	1025924.294	2" ALUMINUM CAP STAMPED BH 22-396-01
BH 22-396-02	N 35° 44' 11.32913"	W 109° 04' 07.03873"	6720.935	6788.664	1725690.304	1026174.579	2" ALUMINUM CAP STAMPED BH 22-396-02
BH 22-396-03	N 35° 44' 07.29782"	W 109° 04' 09.48605"	6719.413	6787.147	1725280.305	1025977.325	2" ALUMINUM CAP STAMPED BH 22-396-03

Geospatial Positional Accuracy Report:

POINT	HORIZONTAL POSITIONAL ACCURACY	VERTICAL POSITIONAL ACCURACY
BH 22-396-01	0.0000	0.0000
BH 22-396-02	0.0100	0.0180
BH 22-396-03	0.0100	0.0190

Trimble
20220396

Fort Defiance Sewer Line Arroyo Crossing Rehab

Legend

-  20220396 Fort Defiance Sewer Line Arroyo Crossing Rehab
-  BH
-  Fort Defiance Potters House Church
-  Rio Puerco Acres # 224
-  That's A Burger

112

112

110

Fort Defiance Potters House Church

Old N-112

BIA-113

BH 22-396-01

BH 22-396-02

BH 22-396-03

Rio Puerco Acres # 224

Thomas Ct

Black Creek Dr

Pinehill Blvd

Black Rock Dr

Slick Rock Wash

Bonito Creek

Google Earth

Slick Rock Wash

1000 ft



BSTProjectNo	20220396
BSTProjName	Fort Defiance Sewer Line Arroyo Crossing Rehab
Survey PM Initials	ARB
PLS of Responsible Charge Initials	ARB
Originator	SRVABQ
Units	International Ft
HorizDatum	NAD83
VertDatum	NAVD88
GeoidModel	GEOID18
Zone	201 - Arizona East
CF	0.99969978
CF_Mon	OPUS SOLUTION FOR BH 22-396-01
1/CF	1.00030031015912
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)	1600 m
Maximum Elevation (meters)	2200 m
Projection	TM
Scale Factor	0.999900000000
Central Meridain	-110.1666666666670°
Origin(Latitude)	31.0000000000000°
False Northing	0.000000000000
False Easting	700000.0000
Southern Std Parallel 1st Standard Parallel	N/A
Northern Std Parallel 2nd Standard Parallel	N/A
Condition	Transverse Mercator
Scale Reduction False Northing	0.00000
Scale Reduction False Easting	700210.21711
Scale Reduction	1.00020028012810
Affine A0 Coefficient	N/A
Affine B0 Coefficient	N/A
Affine A1 Coefficient	N/A
Affine B1 Coefficient	N/A
Affine A2 Coefficient	N/A
Affine B2 Coefficient	N/A

BH 22-396-01

FILE: 07400390.22o OP1644959384244

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: abenham@bhinc.com DATE: February 15, 2022
RINEX FILE: 0740039r.22o TIME: 21:10:42 UTC

SOFTWARE: page5 2008.25 master294.pl 16032 START: 2022/02/08 17:18:00
EPHEMERIS: igr21962.eph [rapid] STOP: 2022/02/08 20:54:00
NAV FILE: brdc0390.22n OBS USED: 8516 / 8817 : 97%
ANT NAME: TRMR8-4 NONE # FIXED AMB: 46 / 47 : 98%
ARP HEIGHT: 1.5485 OVERALL RMS: 0.010(m)

REF FRAME: NAD_83(2011)(EPOCH:2010.0000) ITRF2014 (EPOCH:2022.1063)

X:	-1693953.744(m)	0.004(m)	-1693954.666(m)	0.004(m)
Y:	-4900289.725(m)	0.003(m)	-4900288.374(m)	0.003(m)
Z:	3705663.591(m)	0.002(m)	3705663.427(m)	0.002(m)

LAT:	35 44 10.10868	0.002(m)	35 44 10.12286	0.002(m)
E LON:	250 55 49.90944	0.004(m)	250 55 49.85724	0.004(m)
W LON:	109 4 10.09056	0.004(m)	109 4 10.14276	0.004(m)
EL HGT:	2049.345(m)	0.003(m)	2048.457(m)	0.003(m)
ORTHO HGT:	2069.989(m)	0.068(m)	[NAVD88 (Computed using GEOID18)]	

UTM COORDINATES STATE PLANE COORDINATES

UTM (Zone 12) SPC (0201 AZ E)

Northing (Y) [meters]	3956401.509	525794.021
Easting (X) [meters]	674582.459	312607.845
Convergence [degrees]	1.12781667	0.64087500
Point Scale	0.99997559	1.00002134
Combined Factor	0.99965405	0.99969978

US NATIONAL GRID DESIGNATOR: 12SXE7458256401(NAD 83)

BASE STATIONS USED

PID	DESIGNATION	LATITUDE	LONGITUDE	DISTANCE(m)
DH5816	P028 CHACOCNHP_NM2005 CORS ARP	N360154.048	W1075430.227	109880.7
AF9512	PIE1 PIETOWN CORS ARP	N341805.403	W1080708.095	181322.6
DI2245	P011 SPIDERROCKAZ2005 CORS ARP	N360859.363	W1093109.175	61285.7

NEAREST NGS PUBLISHED CONTROL POINT

FP0185	A 35	N353948.000	W1090259.000	8273.6
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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 22-396-01

Establishing Group: Bohannon Huston, Inc.

Observation Date:

BST Project #: 20220396

Project Name: Fort Defiance Sewer Line Arroyo
Crossing Rehab

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: BH 22-396-01

Horizontal Method: Total Station

Vertical Method: Total Station

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (AZ SP East Zone)	** Modified ** (MODIFIED_20220396)
Latitude Northing Y:	N 35° 44' 10.10868"	1,725,045.999 Ft	1,725,564.048 Ft
Longitude Easting X:	W 109° 04' 10.09056"	1,025,616.291 Ft	1,025,924.294 Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	2,049.345 m	6,723.573 Ft	6,791.302 Ft

Location

County & State: Apache, AZ

Land Grant(s): None

Note(s):

Section: sec 18 T27N R31E

Location Map:



Vicinity Photo (Looking North):



Vicinity Map:



Close Up Photo:



Control Station Data

Name of Station: BH 22-396-02

Establishing Group: Bohannon Huston, Inc.

Observation Date: 8-Feb-2022

BST Project #: 20220396

Project Name: Fort Defiance Sewer Line Arroyo
Crossing Rehab

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2239602

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (AZ SP East Zone)	** Modified ** (MODIFIED_20220396)
Latitude Northing Y:	N 35° 44' 11.32913"	1,725,172.218 Ft	1,725,690.304 Ft
Longitude Easting X:	W 109° 04' 07.03873"	1,025,866.501 Ft	1,026,174.579 Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	2,048.541 m	6,720.935 Ft	6,788.664 Ft

Location

County & State: Apache, AZ

Land Grant(s): None

Note(s):

Section: sec 18 T27N R31E

Location Map:



Vicinity Photo (Looking East):



Vicinity Map:



Close Up Photo:



Control Station Data

Name of Station: BH 22-396-03

Establishing Group: Bohannon Huston, Inc.

Observation Date: 8-Feb-2022

BST Project #: 20220396

Project Name: Fort Defiance Sewer Line Arroyo
Crossing Rehab

Station Data

Type/Composition: 2" Aluminum Cap

Station Height: 0.00 US Ft

Stamping: 2239603

Horizontal Method: Real-Time Kinematic

Vertical Method: Real-Time Kinematic

Coordinate Data

Horizontal Datum:	Geodetic (NAD83)	Grid (AZ SP East Zone)	** Modified ** (MODIFIED_20220396)
Latitude Northing Y:	N 35° 44' 07.29782"	1,724,762.342 Ft	1,725,280.305 Ft
Longitude Easting X:	W 109° 04' 09.48605"	1,025,669.306 Ft	1,025,977.325 Ft
Vertical Datum:	Ellipsoid (GRS80)	Ellipsoid (GRS80)	Orthometric (NAVD88, GEOID18)
Elevation:	2,048.077 m	6,719.413 Ft	6,787.147 Ft

Location

County & State: Apache, AZ

Land Grant(s): None

Note(s):

Section: sec 19 T27N R31E

Location Map:



Vicinity Photo (Looking East):



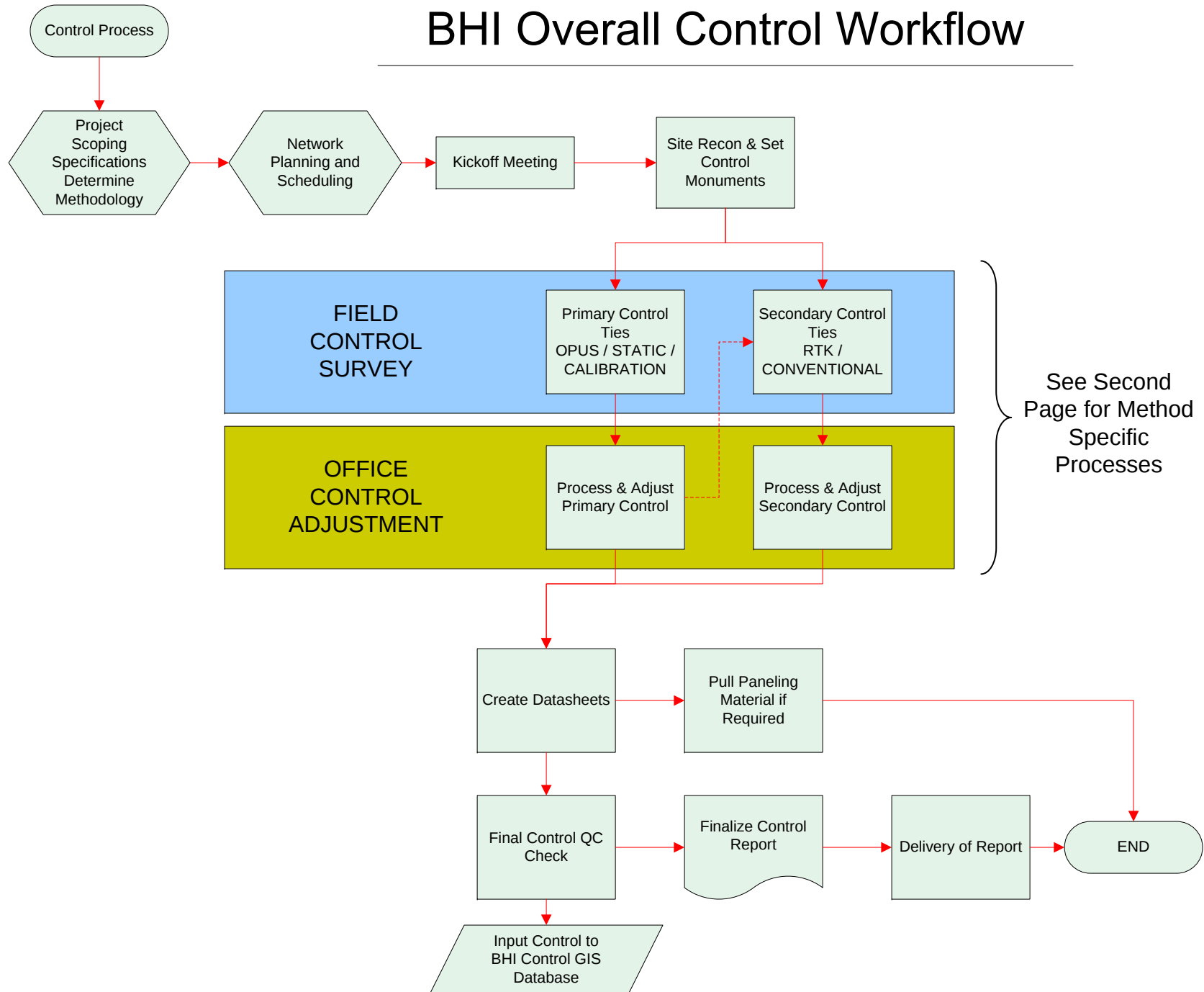
Vicinity Map:



Close Up Photo:



BHI Overall Control Workflow



OPUS - RTK PROCESS

