



Geological Evaluation of the Bocquet Property Bexar County, Texas



Prepared by:

Brent Doty, P.G. and Brennan Romero, G.I.T.

January 3, 2025

Purpose of Evaluation

Edwards Aquifer Authority (EAA) staff performed a cursory geologic evaluation of the Bocquet Property (the Property), a 151-acre tract located within Bexar County, Texas. This evaluation was performed at the request of Mr. Phillip Covington, Special Projects Manager with the City of San Antonio (CoSA) in support of CoSA's Edwards Aquifer Protection Program (EAPP). The Property may be considered by CoSA for preservation through a fee simple purchase of the tract. The purpose of this document is to offer an opinion regarding the value of maintaining the Property in its generally undeveloped condition as a means of protecting Edwards Aquifer (the Aquifer) water quality and quantity. In concept, funding to preserve the Property would be provided by CoSA; therefore, the value of preserving the Property for the benefit of the City's water supply is of particular interest.

EAA staff visited the Bocquet Property on December 20, 2024. EAA staff members Brent Doty and Brennan Romero performed the fieldwork for this evaluation, spending approximately five staff hours on the property. Weather conditions during the visit were in the low-50's °F to mid-60's °F with clear skies.

Scope of Work

To aid in forming an opinion regarding the value of preserving the property, the following work items were performed:

- The approximate property boundary was superimposed on geologic base maps, topographic base maps, and on an aerial photograph. Data for the maps were obtained from the following sources:
 - The approximate property boundary was provided by Mr. Phillip Covington with CoSA;
 - Geologic data were compiled from the following sources:
 - U.S. Geologic Survey (USGS) SIM 3510;
 - Topographic data were obtained from 10 ft Contour Interval USGS 7.5' Helotes quadrangle map; and
 - The aerial photo used as a base map for the geology and topographic overlays in Figures 3, 4, and 5 was obtained from Texas Nearmap Imagery (2024-12-20).
- The site visit included an examination of various geologic features and outcrops located on the property and within drainage channels.

During the site visits, limited observations were made to evaluate the accuracy of published geologic information, observe significant recharge features, and make other limited geologic observations as time allowed. The opinions offered herein are based on the limited scope of work and limited time available for the site visits. This document should not be considered a comprehensive geologic evaluation of the property.

Background Information for the Bocquet Property

The 151-acre Bocquet Property (Figure 1) is located within Bexar County, Texas off the intersection of Indian Trail and Wagon Pass, approximately two and a half miles northwest of North Loop 1604 West and sixteen and a half miles northwest of downtown San Antonio (straight line distance). Two unnamed ephemeral streams transect the Property with a northwest to the southeast alignment and flow direction. The Bocquet Property drains into the Upper Culebra Creek watershed and the Lower Culebra Creek watershed. The Property is minimally developed with a homestead and a small hunting cabin. The Property is currently occupied and was historically used for recreation and wildlife management. Most of the Bocquet Property is a mixed live oak and ashe juniper woodland with a densely vegetated understory. Several mechanically cleared pathways have been cut on the Property. The surrounding land use consists of undeveloped land belonging to Government Canyon State Natural Area to the northwest and low density single family residential neighborhoods to the northeast, southeast, and southwest of the Property.

Maps included in this report reflect approximate property boundaries. Approximately 115 acres of the Property are located within the Recharge Zone of the Edwards Aquifer and the remaining 36 acres are within the Artesian Zone of the Aquifer. The Property's topography is gradually sloping, steepening to the northwest, with surface elevations ranging from a high of 1220 feet above mean sea level (msl) in the northwest corner of the Property to a low of 1060 feet msl in the southeast of the Property (Figures 2 and 3). Approximately less than one quarter of the Property's area is within the 100-year floodplain of the two unnamed ephemeral streams (Figure 5).

Phase I ESA Items of Interest

During the field investigation portion of the Geologic Evaluation, EAA staff routinely note items of interest that may prove helpful to any subsequent Phase I Environmental Site Assessment (ESA) process. While this report is not in any way intended to replace a Phase I ESA evaluation of the property, it is intended to provide a cursory listing of items of interest noted during the EAA's field investigation that may assist the City of San Antonio and land acquisition teams in their efforts to complete a Phase I ESA for the property. Items of interest noted by the EAA are generally limited to the following:

- Apparent/observed property use (ranching/hunting/developed/undeveloped).
- Observed water bodies (stock tanks, springs, non-ephemeral creeks, rivers).
- Observed waste dumps/landfills or burn pits.
- Observed hydrocarbon or hazardous materials storage tanks.
- Observed wells and well type (domestic, irrigation, monitoring) if known.
- Observed and/or published site geology (formation, group, faults, solution features).

As part of the field investigation, staff collected locational data and recorded observations of various points of interest. Items of interest are listed in Appendix A of this report and include a short description and locational data. Each item of interest is also located on the geologic map (Figure 4) and photographs of select features are included in Appendix B of this report.

This section provides a more succinct summary for convenience. Any additional detail regarding items of interest (if known) is discussed in the report body. The scope of the Geologic Evaluation is not intended to provide significant detail related to an environmental assessment. EAA staff's failure to observe items of significance does not necessarily mean those items do not exist on the property. A more thorough evaluation performed in conjunction with the Phase I ESA may be required to ensure the presence of any potentially hazardous items. During the Geologic Evaluation, the following Phase I ESA items of interest were noted:

- The property is densely vegetated, and predominantly a mixed live oak and ashe juniper woodland.
- Development on the Property is limited to one homestead and a small hunting cabin.
- Two residential wells were observed on the Property.
- The Property is bounded by an undeveloped state park to the northwest and low density single family residential neighborhoods to the northeast, southeast, and southwest.
- No waste or dump areas were noted during the investigation.
- No landfills or burn pits were observed.
- No quarries were observed.
- No above ground storage tanks were observed during the investigation.
- The field geologic observations on the property indicate the presence of Edwards Group Limestone outcropping in limited exposures throughout the Property, confirming the USGS mapped geology.
- Several faults are mapped on the Property and signs of faulting were observed through the stratigraphic position of exposed units.
- A sinkhole feature with an approximate 0.5 meter by 0.25 meter opening was observed at the southern portion of the Property near the boundary between the Recharge Zone and the Artesian Zone of the Aquifer.

Figure 5 shows the 100-year floodplain transecting the Property. The 100-year floodplain of the unnamed ephemeral streams cover approximately less than one quarter of the Property's area. The unnamed streams are ephemeral such that they only flow during storm events.

Figure 6 provides a watershed analysis of the property indicating drainage patterns and flow paths of the local tributaries. Approximately two thirds of the Property (97-acres) drain to the Upper Culebra Creek watershed, and approximately one third of the Property (54-acres) drains to the Lower Culebra Creek watershed. Both previously stated watersheds contribute to the San Antonio River southeast of the Edwards Aquifer Recharge Zone.

Figure 7 indicates the proximity of existing conservation easements to the property. There are five properties with conservation easements held by CoSA within three miles of the Property. Government Canyon is located approximately 0.81 miles northwest of the Property. Iron Horse, Mabe Canyon and SA MUD are located approximately 0.37, 1.34 and 1.86 miles north of the Property, respectively. Pack is located approximately 2.09 miles northeast of the Property.

General Surface Geology of the Bocquet Property

Figure 4 presents the surface geology of the Property from the USGS SIM 3510. The Texas Commission on Environmental Quality (TCEQ) has placed most of the Bocquet Property within the Recharge Zone of the Edwards Aquifer and the remainder being located within the Artesian Zone of the Aquifer.

The USGS geologic map (figure 4) indicates most of the Property is underlain by the Dolomitic and Basal Nodular members of the lower Kainer formation of the Edwards Group, and the southernmost area of the Property is underlain by upper confining units to the Aquifer including the Austin Group and the Buda Limestone. Four normal faults were mapped within the Property boundary and evidence of faulting was observed through the stratigraphic position of exposed units. Units such as the Austin Group and Buda Limestone were observed juxtaposed with Edwards Group Limestone, suggesting the presence of normal faulting. The mapped presence and extent of the geologic units and the orientation and placement of the faulting is generally consistent with field observations of the Property.

A sinkhole feature with an approximate 0.5 meter by 0.25 meter opening was observed in the southern portion of the Property near the boundary between the Recharge Zone and the Artesian Zone of the Aquifer. No other significant karst features were observed.

Apparent Edwards Aquifer Recharge Potential at Bocquet Property

The TCEQ places most of the Bocquet Property within the Recharge Zone of the Edwards Aquifer and the remainder being located within the Artesian Zone of the Aquifer. Approximately two thirds of the Property (97-acres) drain to the Upper Culebra Creek watershed, and approximately one third of the Property (54-acres) drains to the Lower Culebra Creek watershed. Two unnamed ephemeral streams transect the Property from the northwest to the southeast. Respectively, these creeks reach their confluence Helotes Creek and Culebra Creek outside of the Property's boundary eventually contributing to the San Antonio River far outside of the Recharge Zone. Where flow occurs within the Recharge Zone, both unnamed creeks can potentially contribute discrete recharge to the Aquifer during significant rain events.

The Property's exposures of Edwards Limestone also provide areas for diffuse recharge potential. The sinkhole feature observed near the boundary between the Recharge Zone and the Artesian Zone has the potential to capture runoff.

The direct recharge potential of the property is considered moderate for the following reasons:

- The Property is mostly within the Recharge Zone of the Edwards Aquifer and has the potential to contribute both diffuse and discrete recharge to the Aquifer.
- Areas of fractured Edwards Group Limestone units and soil cover provide opportunities for diffuse recharge.
- A sinkhole feature observed near the boundary between the Recharge Zone and the Artesian Zone has the potential to capture runoff and provide additional recharge.

Apparent Edwards Water Quality from the Bocquet Property

Water quality from Bocquet Property is expected to be high. The property has limited development and was historically used for recreation and wildlife management. Most overland flow contributions to the Property originate from the undeveloped State Natural Area. Future development is a concern as the water quality may be adversely impacted from dense urban development north of the Property.

Summary of Geologic Evaluation

- The Bocquet Property is 151 acres in size, located in Bexar County, Texas.
- Approximately 115 acres of the Property are located within the Recharge Zone of the Edwards Aquifer, while the remaining 36 acres are within the Artesian Zone of the Aquifer..
- The property is generally undeveloped with one homestead, a hunting cabin, and two domestic water wells.
- The surrounding land use consists of undeveloped land belonging to Government Canyon State Natural Area to the northwest and low density single family residential neighborhoods to the northeast, southeast, and southwest of the Property.
- Five CoSA-held conservation easements are located within 3 miles of the Property.
- Flow from the property enters the Culebra Creek watershed, a losing system over the Edwards Aquifer Recharge Zone.
- Approximately two thirds of the Property (97-acres) drain to the Upper Culebra Creek watershed, and approximately one third of the Property (54-acres) drains to the Lower Culebra Creek watershed. Both previously stated watersheds contribute to the San Antonio River southeast of the Edwards Aquifer Recharge Zone.
- The Property has the potential to contribute both diffuse and discrete recharge to the Edwards Aquifer.
- USGS geologic maps published for the area generally concur with field observations, indicating the occurrence of Edwards Limestone throughout the Property and upper confining units outcropping along the southern third of the Property.

Conclusions

Based on our review of the properties and published information, preserving the Bocquet Property would provide moderate water quantity benefit and high water quality benefit for the City of San Antonio. The value of protecting this property is through protection of water quality and quantity in the Recharge Zone of the Edwards Aquifer.

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Research Manager
Edwards Aquifer Authority



Brennan Romero, G.I.T.

**Brennan Romero, G.I.T.
Geoscientist I
Edwards Aquifer Authority**

Appendix A

Station Identification Bocquet Property Bexar County, Texas

Table A-1 Notable Features/Observations

**Table A-1
Bocquet Property
Features/Observations**

Point	Latitude (NAD83)	Longitude (NAD83)	Comments
BB-01	29.564	-98.716	Kkd outcrop with solution enhanced fractures and in-situ chert. Lms and chert float.
BB-02	29.561	-98.715	Lms outcrop with blue dendrites and porcelain texture. Lms and limonite nodule float.
BB-03	29.561	-98.716	Domestic well located in well shed.
BB-04	29.560	-98.716	Upper confining lms. Limonite nodule float.
BB-05	29.559	-98.716	Kb. Drainage of the southernmost unnamed ephemeral stream.
BB-06	29.557	-98.718	No exposed bedrock at the southernmost property corner. Lms float.
BB-07	29.558	-98.719	Ka float. Dense woodland cover.
BB-08	29.560	-98.719	Kb outcrop.
BB-09	29.562	-98.720	Kkbn with massively bedded lms.
BB-10	29.563	-98.720	Kkd outcrop with solution enhanced fractures.
BB-11	29.566	-98.718	Kkd outcrop.
BB-12	29.566	-98.717	Kkd drainage. Dense vegetation.
BB-13	29.561	-98.717	Sinkhole feature. Opening is approximately 0.5 meter by 0.25 meter.

Abbreviations:

Ka	=	Austin Group
Kb	=	Buda Limestone
Kkd	=	Kainer, Dolomitic member
Kkbn	=	Kainer, Basal Nodular member
Lms	=	Limestone
NAD83	=	Horizontal map datum

Appendix B

Bocquet Property Bexar County, Texas

Photographs of Select Features And Site Characteristics



Photo 1 – Location BB-01 – Kkd outcrop with solution enhanced fractures and in-situ chert. Lms and chert float.



Photo 2 – Location BB-02 – Lms outcrop with blue dendrites and porcelain texture. Lms and limonite nodule float.



Photo 3 – Location BB-03 – Domestic well located in well shed.



Photo 4 – Location BB-05 – Kb. Drainage of the southernmost unnamed ephemeral stream.



Photo 5 – Location BB-08 – Kb outcrop.



Photo 6 – Location BB-09 – Kkbn with massively bedded lms.



Photo 7 – Location BB-10 – Kkd outcrop with solution enhanced fractures.



Photo 8 – Location BB-12 – Kkd drainage. Dense vegetation.

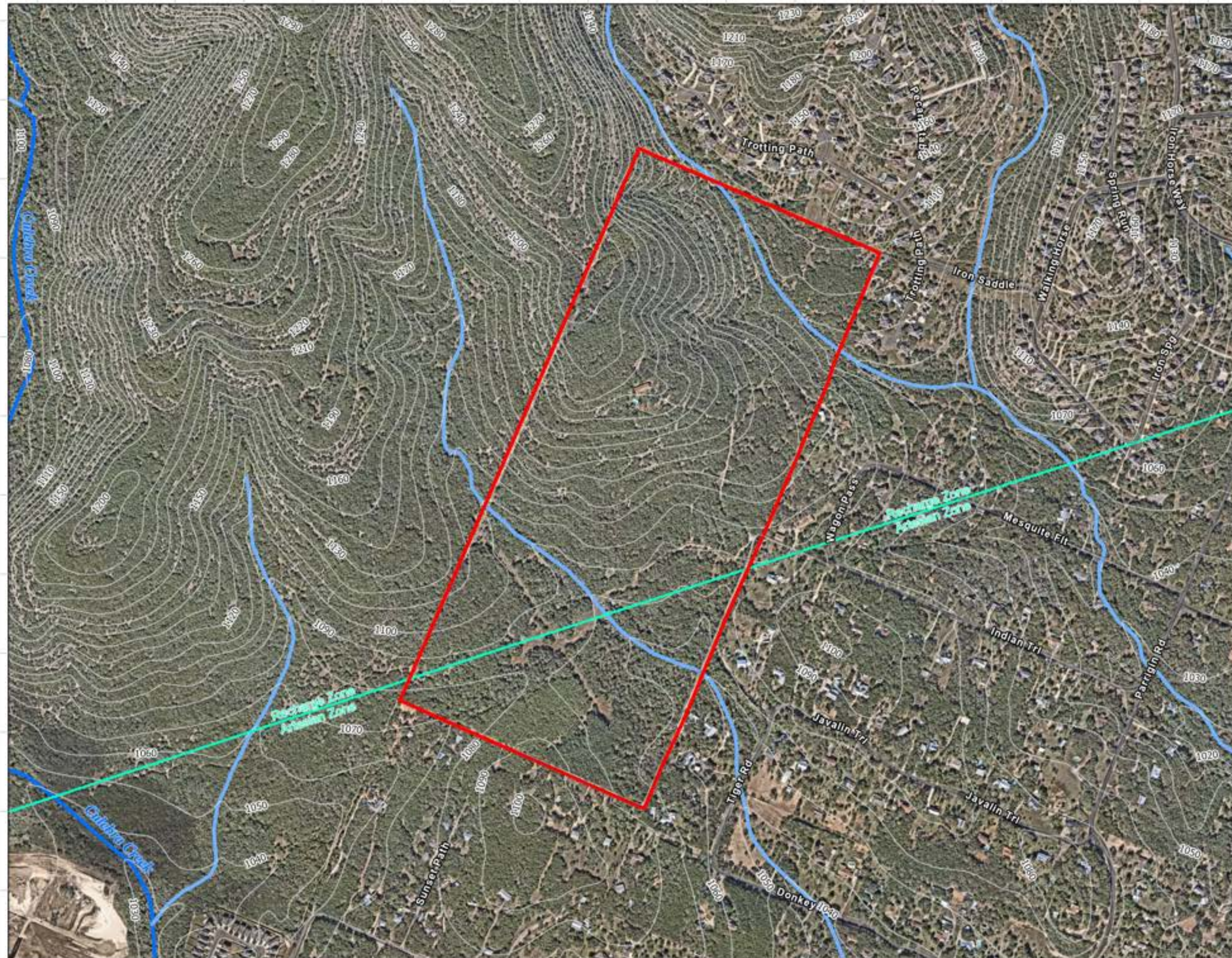


Photo 9 – Location BB-13 – Sinkhole feature. Opening is approximately 0.5 meter by 0.25 meter.

**Figure 3:
Aerial Imagery
Bocquet Property
(151 Acres)
Bexar County, Texas**

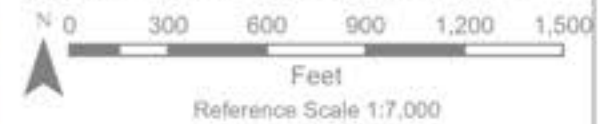


- ▭ Bocquet Property (151 acres)
- ▭ Aquifer Zones
- ▭ Helotes 10ft Contours (USGS 7.5' Quads)
- ▭ Named Streams
- ▭ Unnamed Streams



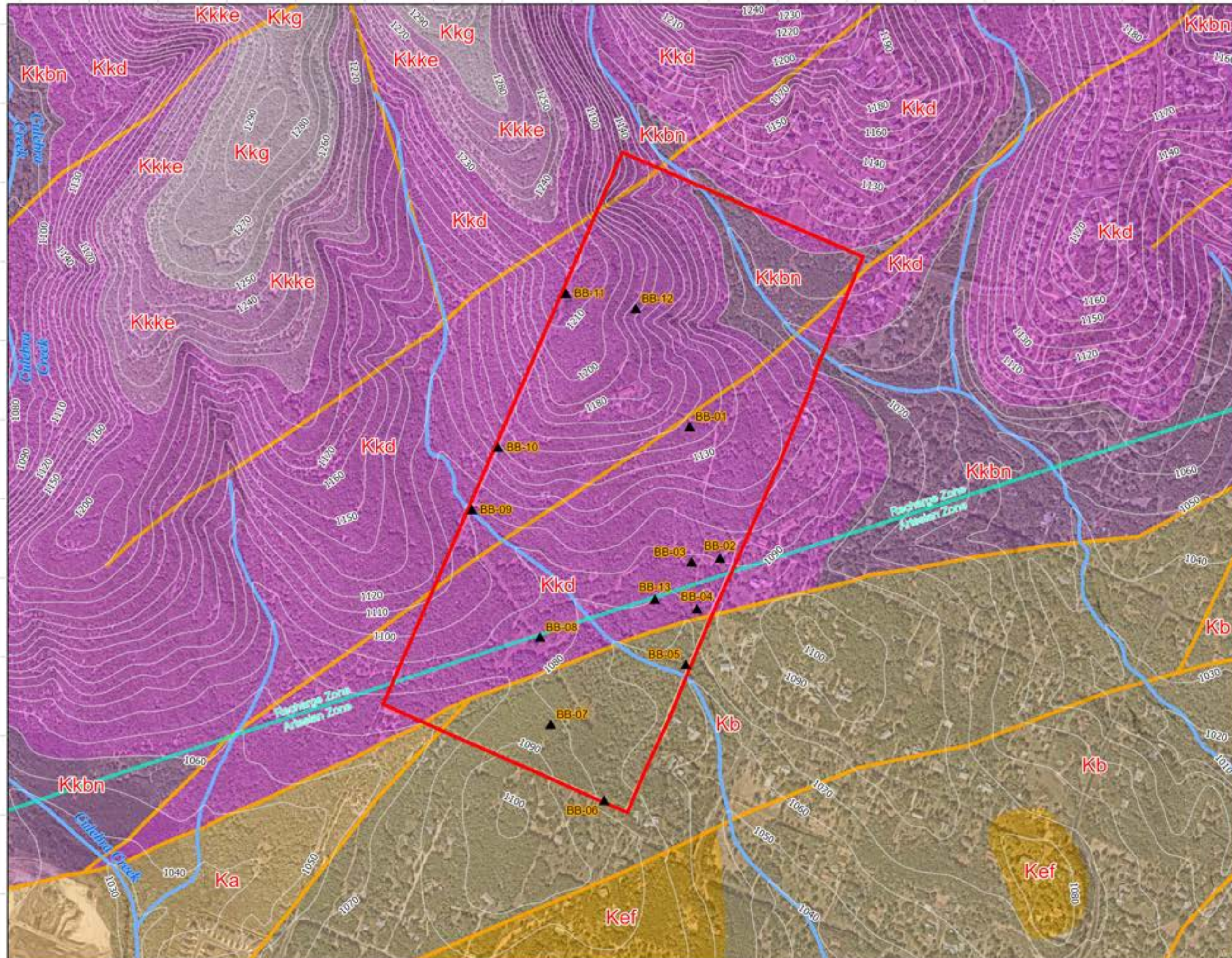
Nearmap Imagery: 2024-12-20.
 Airbus, USGS, NGA, NASA, CGIAR, NCEAS, NLS, OS, NMA,
 Geodastystreisen, GSA, GSI and the GIS User Community,
 Esri Community Maps Contributors, Texas Parks & Wildlife,
 © OpenStreetMap, Microsoft, CONANP, Esri, TomTom,
 Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc.,
 METI, NASA, USGS, EPA, NPS, US Census Bureau, USDA,
 USFWS, BCAD, Texas Parks & Wildlife, Esri, HERE,
 Garmin, GeoTechnologies, Inc., Intermap, USGS, EPA

Disclaimer: This map was created for demonstrative use by the Edwards
 Aquifer Authority (EAA) and not intended for other purposes. This
 map is to be used as an informational tool only. It is not suitable
 for projects requiring survey accuracy; data accuracy is not guaranteed.



Spatial Reference
 PCS: NAD 1983 NRS2007 Texas
 Centric Mapping System Altens
 Datum: NAD 1983 NRS2007
 Projection: Altens
 Central Meridian: -100.0000
 Latitude of Origin: 18.0000
 False Easting: 1,500,000.0000
 False Northing: 0.0000
 Central Parallel: 0.0000
 Standard Parallel: 27.5000
 Units: Meter

Figure 4:
USGS Geology
Bocquet Property
(151 Acres)
Bexar County, Texas



- ▲ Bocquet Features/Observations
- ▭ Bocquet Property (151 acres)
- ▭ Aquifer Zones
- Helotes 10ft Contours (USGS 7.5' Quads)
- Streams

- USGS Surface Geology**
 (Per US Geological Survey SIM3510)
- Ka - Austin Group
 - Kef - Eagle Ford Group
 - Kb - Buda Limestone
 - Kkg - Kainer, Grainstone, V
 - Kkke - Kainer, Kirschberg evaporite, VI
 - Kkd - Kainer, Dolomitic, VII
 - Kkbn - Kainer, Basal nodular, VIII

Faults

Neatmap Imagery: 2024-12-20
 Airbus, USGS, NGA, NASA, CGIAR, NCEAS, NLS, OS, NMA, Geodastyleisen, GSA, GSI and the GIS User Community, Esri Community Maps Contributors, Texas Parks & Wildlife, © OpenStreetMap, Microsoft, CONANP, Esri, TomTom, Garmin, FourSquare, SafeGraph, GeoTechnologies, Inc., METINASA, USGS, EPA, NPS, US Census Bureau, USDA, USFWS, BCAD, Texas Parks & Wildlife, Esri, HERE, Garmin, GeoTechnologies, Inc., Intermap, USGS, EPA

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Spatial Reference
 PCS: NAD 1983 NRS2007 Texas
 Centric Mapping System Albers
 Datum: NAD 1983 NRS2007
 Projection: Albers
 Central Meridian: -100.0000
 Latitude of Origin: 18.2000
 False Easting: 1,500,000.0000
 False Northing: 6,000,000.0000
 Central Parallel: 0.0000
 Standard Parallel: 27.5000
 Units: Meter

EDWARDS AQUIFER AUTHORITY

**Figure 5:
100 Year Flood Plain
Bocquet Property
(151 Acres)
Bexar County, Texas**



- 100 Year Flood Plain
- Bocquet Property (151 acres)
- Aquifer Zones
- Helotes 10ft Contours (USGS 7.5' Quads)
- Named Streams
- Unnamed Streams

Nearmap Imagery: 2024-12-20.
 Airbus, USGS, NGA, NASA, CGIAR, NCEAS, NLS, OS, NMA,
 Geodastystreisen, GSA, GSI and the GIS User Community,
 Esri Community Maps Contributors, Texas Parks & Wildlife,
 © OpenStreetMap, Microsoft, CONANP, Esri, TomTom,
 Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc.,
 METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA,
 USFWS, BCAD, Texas Parks & Wildlife, Esri, HERE, FEMA,
 Garmin, GeoTechnologies, Inc., Intermap, USGS, EPA,

Disclaimer: This map was created for demonstrative use by the Edwards Aquifer Authority (EAA) and not intended for other purposes. This map is to be used as an informational tool only; it is not suitable for projects requiring survey accuracy; data accuracy is not guaranteed.

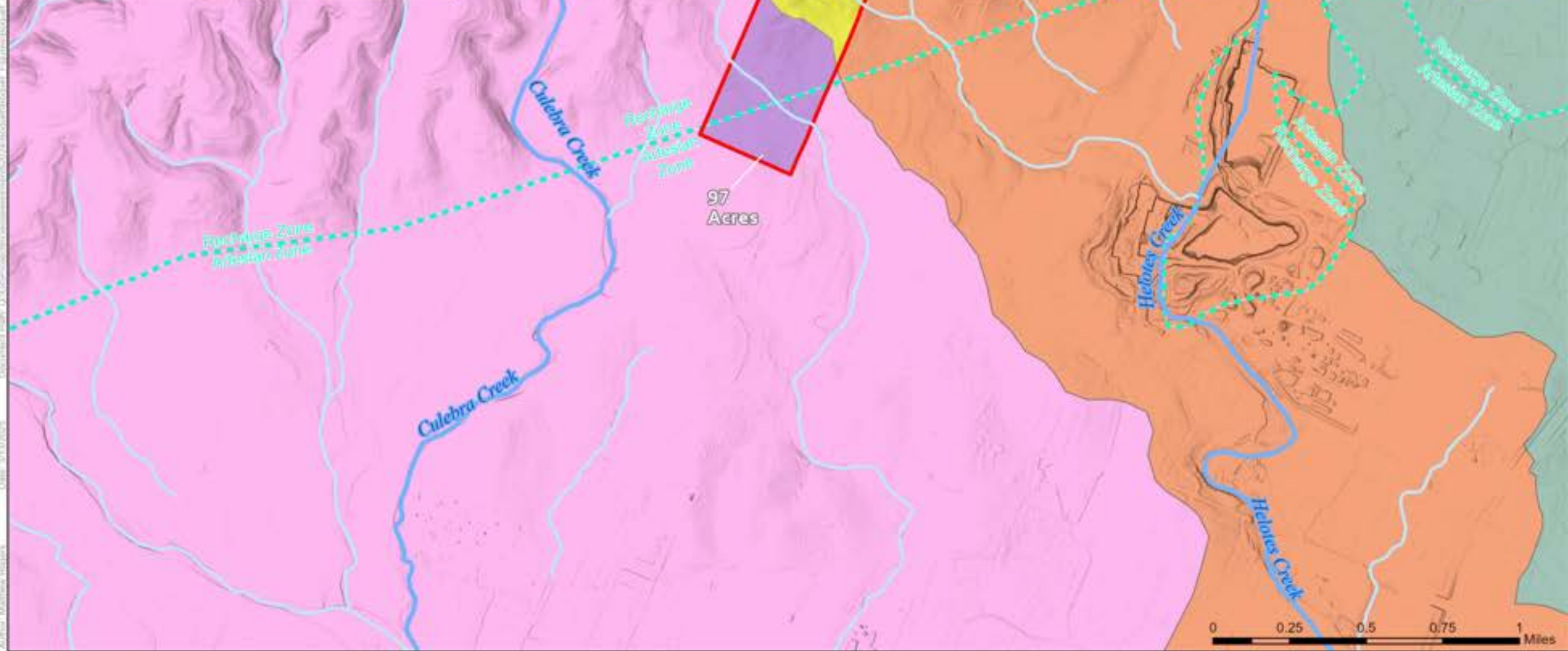


Reference Scale 1:7,000

Spatial Reference
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 Centric Mapping System Altens
 Datum: NAD 1983 NSRS2007
 Projection: Altens
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 Latitude of Origin: 18.0000
 False Easting: 1,500,000.0000
 False Northing: 0.0000,0000
 Central Parallel: 0.0000
 Standard Parallel: 27.5000
 Units: Meter



**Figure 6:
Watershed Analysis
Bocquet Property
(151 Acres)
Bexar County, Texas**



- Bocquet Property (151 acres)
 - Aquifer Zones
 - Named Streams
 - Unnamed Streams
 - Downstream Trace at Bocquet Property
- Watershed Analysis at Bocquet Property**
- 97 acres drains into Upper Culebra Creek Watershed
 - 54 acres drains into Lower Culebra Creek Watershed
 - Upper Culebra Creek Watershed
 - Lower Culebra Creek Watershed
 - Upper Leon Creek Watershed

Credits: Airbus, USGS, NGA, NASA, CGIAR, NCEAS, NLS, OS, NMA, Geodatasbyreisen, GSA, GSI, NHD, and the GIS User Community

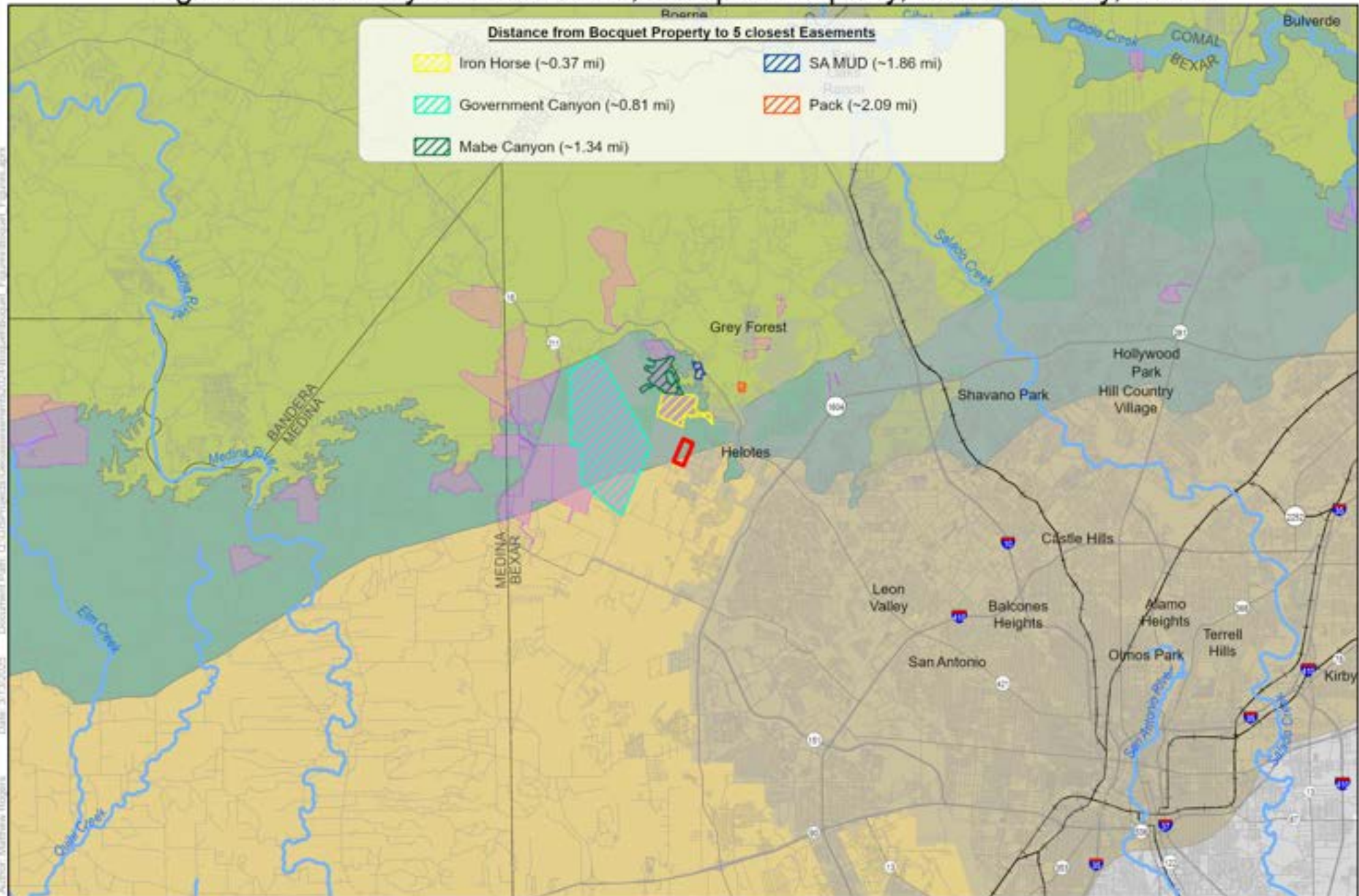
Disclaimer: This map was created for demonstrative use by the Edwards Aquifer Authority (EAA) and not intended for other purposes. This map is to be used as an informational tool only. It is not suitable for projects requiring survey accuracy; data accuracy is not guaranteed.

1 inch = 0.4 miles
Reference Scale: 1:24,000

Spatial Reference
PCS: NAD 1983 NAD83 Texas
Centric Mapping System Albers
Datum: NAD 1983 NAD83
Projection: Albers
Central Meridian: -100.0000
Latitude of Origin: 18.0000
False Easting: 1,500,000.0000
False Northing: 6,000,000.0000
Central Parallel: 0.0000
Standard Parallel: 27.5000
Units: Meter

Date: 8/13/2023
 Author: Matthew Rogers
 Document Path: D:\GIS\Projects\2023\Bocquet\Bocquet_Figure_6.mxd

Figure 7: Proximity to Easements, Bocquet Property, Bexar County, Texas



Author: Matthew Hoopes
 Date: 3/13/2025
 Document Path: G:\GIS\Projects\Compass\2024\Bocquet\Bocquet_Figures\Bocquet_Figures.docx

Spatial Reference
 PCS: NAD 1983 NAD83
 Datum: NAD 1983
 Spheroid: GRS 1980
 Projection: Albers
 Central Meridian: -100.0000
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 Central Parallel: 6.0000
 Standard Parallel: 27.9000
 Page units: Meter

- Contributing Zone
- Recharge Zone
- Artesian Zone
- Cities
- Counties
- Roads
- Railroads
- Rivers
- Bocquet Property (151 acres)
- COSA and EAA Conservation Easements

Reference Scale: 1:250,000
 Disclaimer: This map was created for demonstrative use by the Edwards Aquifer Authority (EAA) and not intended for other purposes. This map is to be used as an informational tool only; it is not suitable for projects requiring survey accuracy; data accuracy is not guaranteed.