

September 10, 2019



**ENTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, CO 80907  
PHONE (719) 531-5599  
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Tech Contractors  
3575 Kenyon Street, Ste 200  
San Diego, California 92110

Attn: Raul Guzman

Re: Soil, Geology and Geologic Hazard Evaluation  
The Estates at Rolling Hills Ranch, Filing 1 & 2  
Sunrise Ridge Drive and Rex Road  
El Paso County, Colorado PUD 19-007, SF 19-019

Dear Mr. Guzman:

As requested, personnel of Entech Engineering, Inc. have investigated the above referenced site to evaluate the conditions with respect to geology and geologic hazards affecting development of the site. The subsurface soil conditions were investigated by Entech Engineering, Inc., Test Boring Logs (Appendix A) and Summary of Laboratory Testing Results are included with this report.

The project consists of single-family residential development on an approximate 170-acre site. The site lies in El Paso County, Colorado, approximately 4 miles north of Falcon, Colorado. The approximate location of the site is shown on the Vicinity Location Map, Figure 1.

The topography of the site is gently to moderately sloping rolling hills that generally slope in a southeasterly direction. Minor drainages exist on the site that trend in south-southeasterly directions. The drainages were dry at the time of this investigation. The site lies in portions of NE  $\frac{1}{4}$  of Section 19, NW  $\frac{1}{4}$  of Section 20, Township 12 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. The site is currently vacant. The Site Plan/Test Boring Location Map is presented in Figure 3.

Twelve test borings were drilled on the site as a part of a Preliminary Subsurface Soil Investigation dated September 10, 2019, was used to evaluate the subsurface soil conditions (Reference 1). The Test Boring Logs are included in Appendix A. Laboratory Test Results are summarized in Table 1. Information from this report was used evaluating the site.

The scope of this report will include a geologic analysis evaluation of the site utilizing published geologic data, available subsurface soils information and site-specific mapping of major geologic features, and identification of geologic hazards with respect to the development with recommended mitigation techniques. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) Survey was also reviewed to evaluate the site.

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## SOIL AND GEOLOGIC CONDITIONS

### Soil Survey

The Natural Resource Conservation Service (NRCS) (Reference 2, Figure 3), previously the Soil Conservation Service (Reference 3) has mapped two soil types on the site. Complete descriptions of the soils are presented in Appendix B. In general, the soils consist of gravelly, sandy loam and sandy loam. The soils are described as follows:

<u>Type</u>	<u>Description</u>
19	Columbine gravelly sand loam, 0-3% slopes
83	Stapleton sandy loam, 3-8% slopes

### Soils

The soils encountered in the test borings from Subsurface Soil Investigation consisted of silty to clayey sand with layers of sandy clay overlying silty to clayey sandstone with layers of claystone. The upper soils were encountered at medium dense to dense states and moist conditions. The upper sands have low expansion potential, however, the clays, claystone and very clayey sandstone have moderate to high expansion potential.

### Groundwater

Groundwater was encountered at depths ranging from 12 to 17 feet in five of the test borings drilled on this site (Reference 1). Areas of potentially seasonal shallow and seasonal shallow groundwater have been mapped on the site and are discussed later in this report. Fluctuations in groundwater conditions may occur due to variations in rainfall or other factors not readily apparent at this time. Isolated sand layers within the soil profile can carry water in the subsurface. Contractors should be cognizant of the potential for the occurrence of subsurface water features during construction.

### Geology

Approximately 16 miles west of the site is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within a large structural feature known as the Denver Basin. Bedrock in the area is typically gently dipping in a northwesterly direction (Reference 4). The bedrock underlying the site consists of the Dawson Arkose Formation of Tertiary Age. The Dawson Formation typically consists of coarse-grained arkosic sandstone with interbedded layers of fine-grained sandstone, siltstone or claystone. Overlying the Dawson are deposits of alluvial, residual, and man-made soils.

The geology of the site was evaluated using the *Geologic Map of the Falcon Quadrangle*, by Morgan and White in 2012, (Reference 5, Figure 4). The geology of the site is indicated in Figure 5. Four mappable units were identified on this site which are described as follows:

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- Qaf**            **Artificial Fill of Quaternary Age:** These are man-made fill deposits associated with recent on-site grading and stockpiles.
- Qal**            **Recent Alluvium of Quaternary Age:** These are recent stream deposits associated with the defined drainages on site. They generally consist of silty to clayey sands and may contain highly organic soil.
- Qa<sub>3</sub>**          **Alluvium Three of Quaternary Age:** These are water deposited as stream terrace deposits that typically consist of silty to clayey sands and may contain clay layers. The Alluvium Three correlates with the Broadway Alluvium.
- Tda**            **Dawson Arkose Formation of Tertiary Age:** The Dawson Formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils consisted of silty sands and may contain layers of sandy clays.

## **ENGINEERING GEOLOGIC HAZARDS**

Mapping has been performed on this site to identify areas where various geologic conditions exist of which developers should be cognizant during the planning, design and construction stages should new construction be proposed. The engineering geologic hazards identified on this site include artificial fill, potentially seasonal shallow groundwater areas, and shallow groundwater areas (Figure 6). Areas of shallow bedrock will also be encountered on this site. These hazards and recommended mitigation techniques are discussed as follows:

### **Artificial Fill**

An area of fill was mapped on the site in the southwestern corner that is associated with a road and a dam embankment. Other minor areas not mapped are associated with small fill piles that are considered uncontrolled, and areas of fill may exist that are not mapped due to on-going site grading.

**Mitigation:** It is anticipated the uncontrolled fill piles will be removed during site grading. Any uncontrolled fill encountered beneath foundations should be removed and recompacted at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

### **Loose Soils**

Loose soils were not encountered in the borings drilled on site. Loose soils if encountered beneath the foundation or floor slabs will require mitigation.

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Mitigation: Should loose soils be encountered beneath foundations or floor slabs, mitigation will be necessary. Overexcavation and recompaction at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. An overexcavation depth of 2 to 3 feet is anticipated.

### **Expansive Soils**

Expansive soils were encountered in some of the test borings drilled on-site. These occurrences are typically sporadic; therefore, none have been indicated on the maps. These clays, if encountered beneath foundations, can cause differential movement in the structure foundation. These occurrences should be identified and dealt with on an individual basis.

Mitigation: Should expansive soils be encountered beneath the foundation, mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 20 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

### **Potentially Seasonal Shallow and Seasonal Shallow Groundwater Area**

In these areas, we should anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. In these areas, the potential exists for shallow groundwater during high moisture periods. The minor drainages will likely be regraded during site development, and the seasonal shallow groundwater area will be avoided by the proposed development.

Mitigation: Foundations must have a minimum 30-inch depth for frost protection. In areas where high subsurface moisture conditions are anticipated periodically, subsurface perimeter drains are recommended to help prevent the intrusion of water into areas below grade. It is anticipated much of these areas would be filled during site grading further raising foundations above the groundwater level. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. All organic material would be completely removed prior to fill placement. Specific recommendations concerning the affects of groundwater on site grading and construction are included in the Subsurface Soil Investigation (Reference 1). Further investigation will be necessary to determine the groundwater depth after final grading. The site does not lie within any floodplain zones according to the FEMA Map No. 08041CO552G, dated December 7, 2018 (Figure 7, Reference 6). Exact locations of floodplain and specific drainage studies are beyond the scope of this report. Finished floor levels must be located a minimum of one foot above floodplain levels.

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## **RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING**

As mentioned, the proposed development will be single-family residential. The existing geologic and engineering geologic conditions will impose some constraints on development and construction. The geologic conditions on the site include artificial fill, expansive or loose soils, and potentially seasonal shallow groundwater areas which can be satisfactorily mitigated through proper engineering design and construction practices or regrading and avoidance.

The upper granular soils encountered in the borings drilled on the site were encountered at medium dense to very dense states. Loose or uncontrolled fill soils, if encountered in roads or beneath foundations, will require recompaction. Expansive layers may also be encountered in the soil on this site. Expansive soils, if encountered, will require special foundation design. These soils will not prohibit development.

An area of fill was mapped on the site in the southwestern corner that is associated with the road and pond embankment. Other minor areas associated with small fill piles that are considered uncontrolled, and areas of fill may exist. It is anticipated the fill piles would be removed during site grading. Any uncontrolled fill encountered beneath foundations and floor slabs will require removal and recompaction at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

Areas of shallow bedrock will be encountered on this site. Shallow bedrock will likely be encountered in those areas mapped as Tda-Dawson Formation, or Soil Types 2 or 3 on Figure 2. Bedrock depths are indicated on Table 2 and in Figures 3 and 6. Difficult excavation should be anticipated in areas of shallow bedrock. Higher allowable bearing capacities will also be expected in areas of shallow bedrock.

Groundwater was encountered at 12 to 17 feet in the five of the twelve test borings. Groundwater depths are indicated on Table 2. Areas of potentially seasonal shallow and seasonally shallow groundwater have been mapped on this site. (Figure 6). These areas can be avoided by construction or are being regraded. Specific recommendations concerning the effects of groundwater on site grading and construction are discussed in the Preliminary Subsurface Soil Investigation (Reference 1). The site should not be affected by any delineated 100-year FEMA floodplains (Figure 7, Reference 6).

In summary, the site granular soils will likely provide suitable support for roads and shallow foundations. The geologic conditions encountered on site can be mitigated with proper engineering and construction practices. Specific recommendations have been made in the Subsurface Soil Investigation (Reference 1).

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**CLOSURE**

It should be pointed out that because of the nature of data obtained by random sampling of such variable nonhomogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Construction and design personnel should be made familiar with the contents of this report. Specific site recommendations have been made in the Preliminary Subsurface Soil Investigation (Reference 1). Specific construction and foundation recommendations will be provided when investigations are completed for new construction after overlot grading.


This report has been prepared for Tech Contractors for application to the proposed development in accordance with generally accepted geologic, soil and engineering practices. No other warranty expresses or implied is made.

We trust that this report has provided you with all the information that you required. Should you have any questions or require additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Reviewed by:

  
Logan L. Langford, P. G.  
Engineering Geologist

  
Joseph C. Goode, Jr.  
President



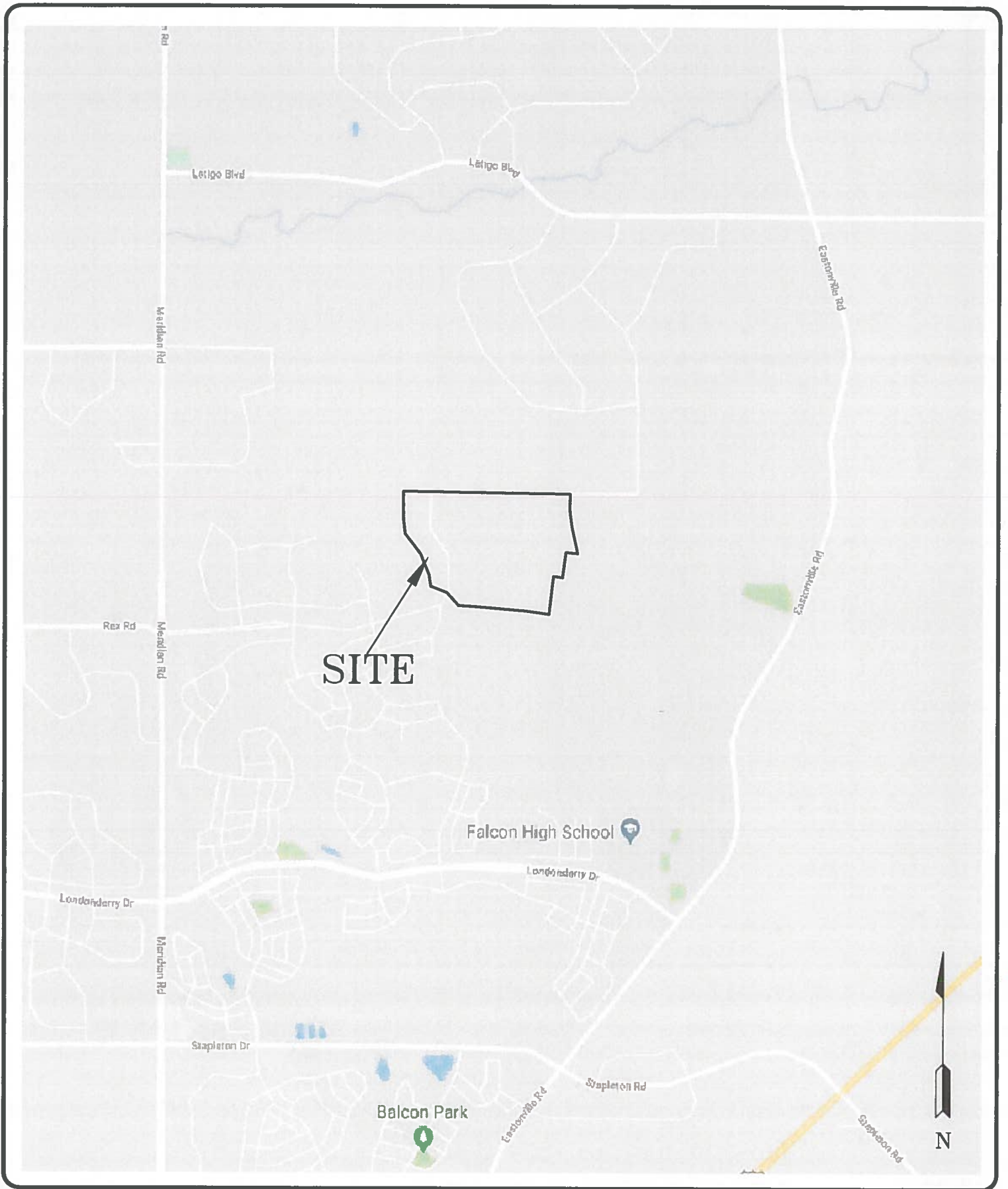
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AAprojects/2019/191234 sg&ghs

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El Paso County, Colorado

## BIBLIOGRAPHY

1. Entech Engineering, Inc., September 10, 2019. *Preliminary Subsurface Soil Investigation, The Estates at Rolling Hills Ranch, Filing No. 1 & 2, El Paso County, Colorado*. Entech Job No. 191234.
2. Natural Resources Conservation Service. September 23, 2016. *Web Soil Survey*. United States Department of Agriculture. <http://websoilsurvey.sc.egov.usda.gov>.
3. United States Department of Agriculture Soil Conservation Service. June, 1981. *Soil Survey of El Paso County Area, Colorado*.
4. Scott, Glenn R.; Taylor, Richard B.; Epis, Rudy C. and Wobus, Reinhard A. 1978. *Geologic Structure Map of the Pueblo 1° x 2° Quadrangle, South-Central Colorado*. Sheet 2. US Geological Survey. Map I-1022.
5. Morgan, Matthew L. and White, Jonathan L. 2012. *Falcon Quadrangle Geologic Map, El Paso County, Colorado*. Colorado Geological Survey. Open-File Report 12-05.
6. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado*. Map Number 08041CO552G.



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VICINITY MAP  
 THE ESTATES AT ROLLING HILLS RANCH  
 FILING 1 & 2  
 EL PASO COUNTY, CO.  
 FOR: TECH CONTRACTORS

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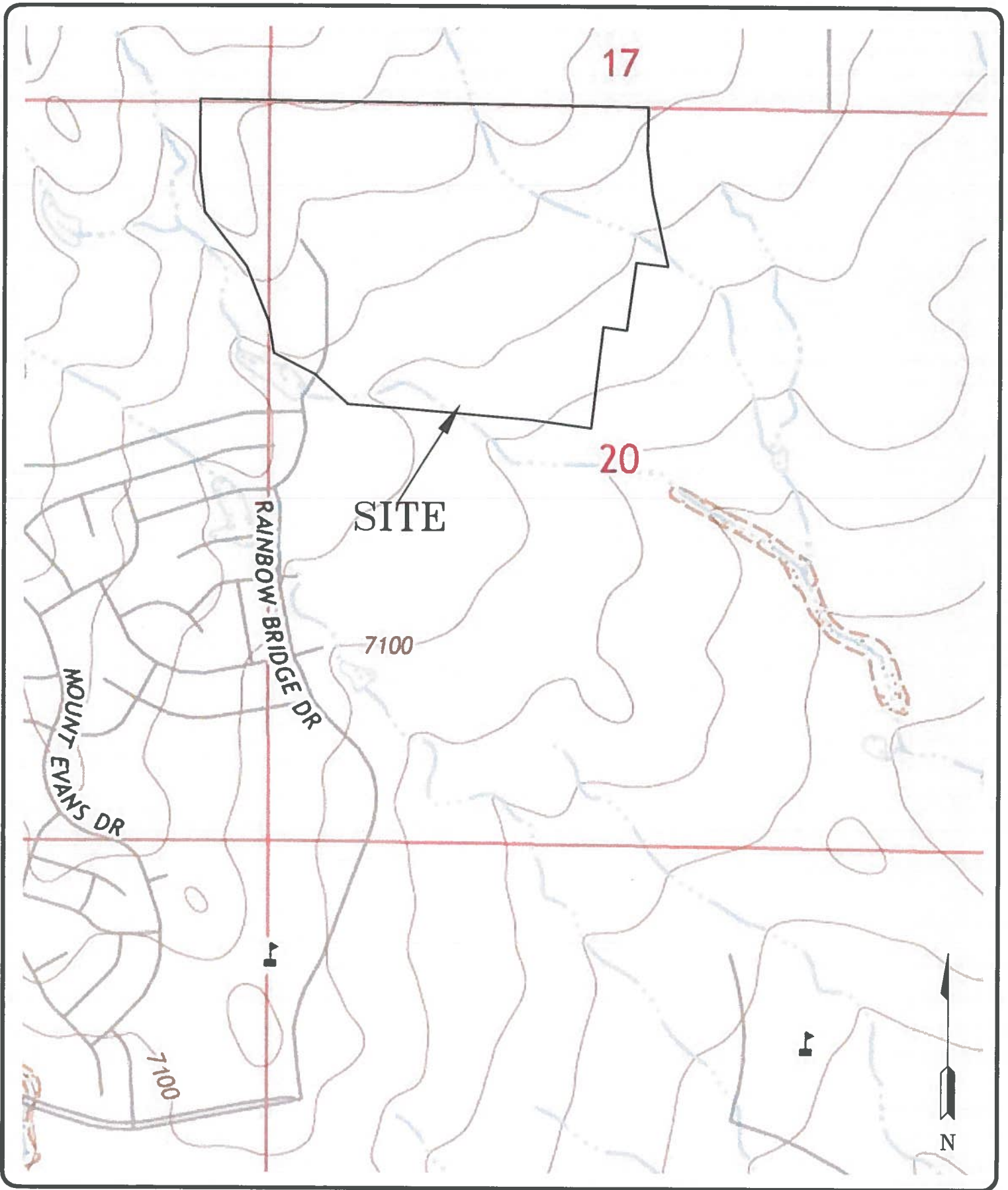
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 1





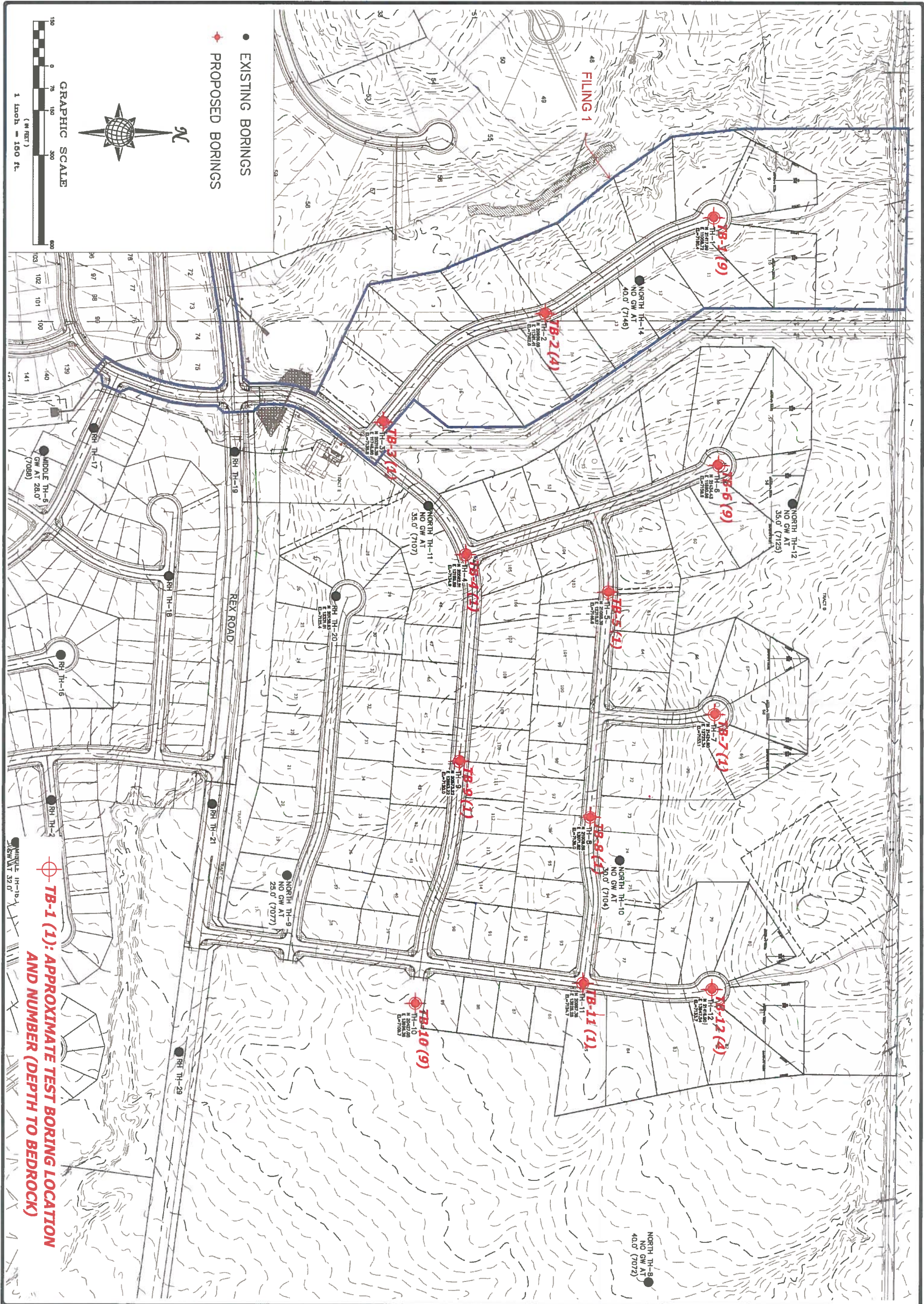
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USGS MAP  
THE ESTATES AT ROLLING HILLS RANCH  
FILING 1 & 2  
EL PASO COUNTY, CO.  
FOR: TECH CONTRACTORS

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FIG NO.:  
2




● EXISTING BORINGS  
 ◆ PROPOSED BORINGS



◆ **TB-1 (1): APPROXIMATE TEST BORING LOCATION AND NUMBER (DEPTH TO BEDROCK)**


SITE PLAN/TEST BORING MAP  
 THE ESTATES AT ROLLING HILLS RANCH  
 FILING 1 & 2  
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FIGURE NO.	3

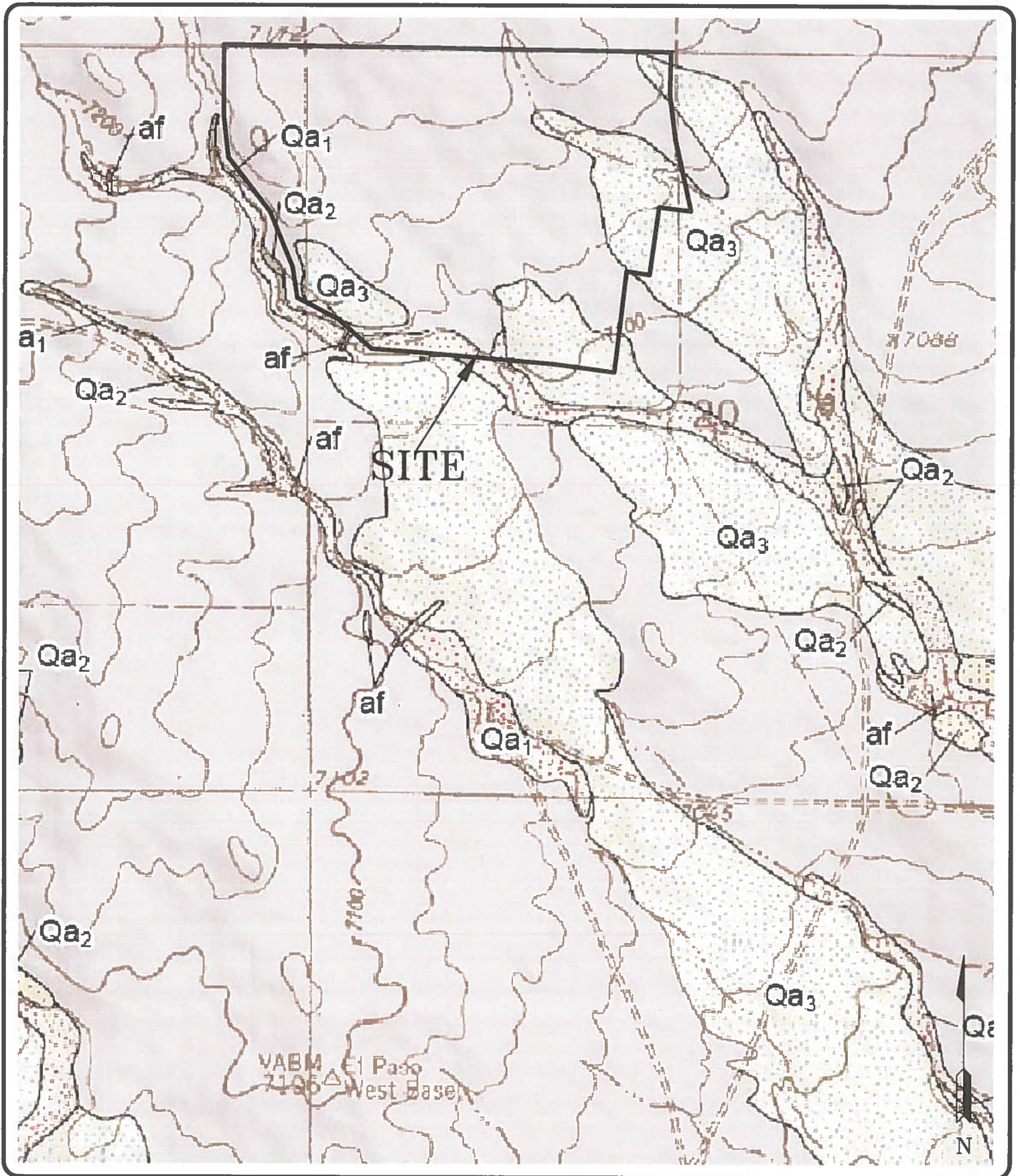
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**SOIL SURVEY MAP**  
**THE ESTATES AT ROLLING HILLS RANCH**  
**FILING 1 & 2**  
**EL PASO COUNTY, CO.**  
**FOR: TECH CONTRACTORS**

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FIG NO.:  
**4**



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FALCON QUADRANGLE GEOLOGIC MAP  
 THE ESTATES AT ROLLING HILLS RANCH  
 FILING 1 & 2  
 EL PASO COUNTY, CO.  
 FOR: TECH CONTRACTORS

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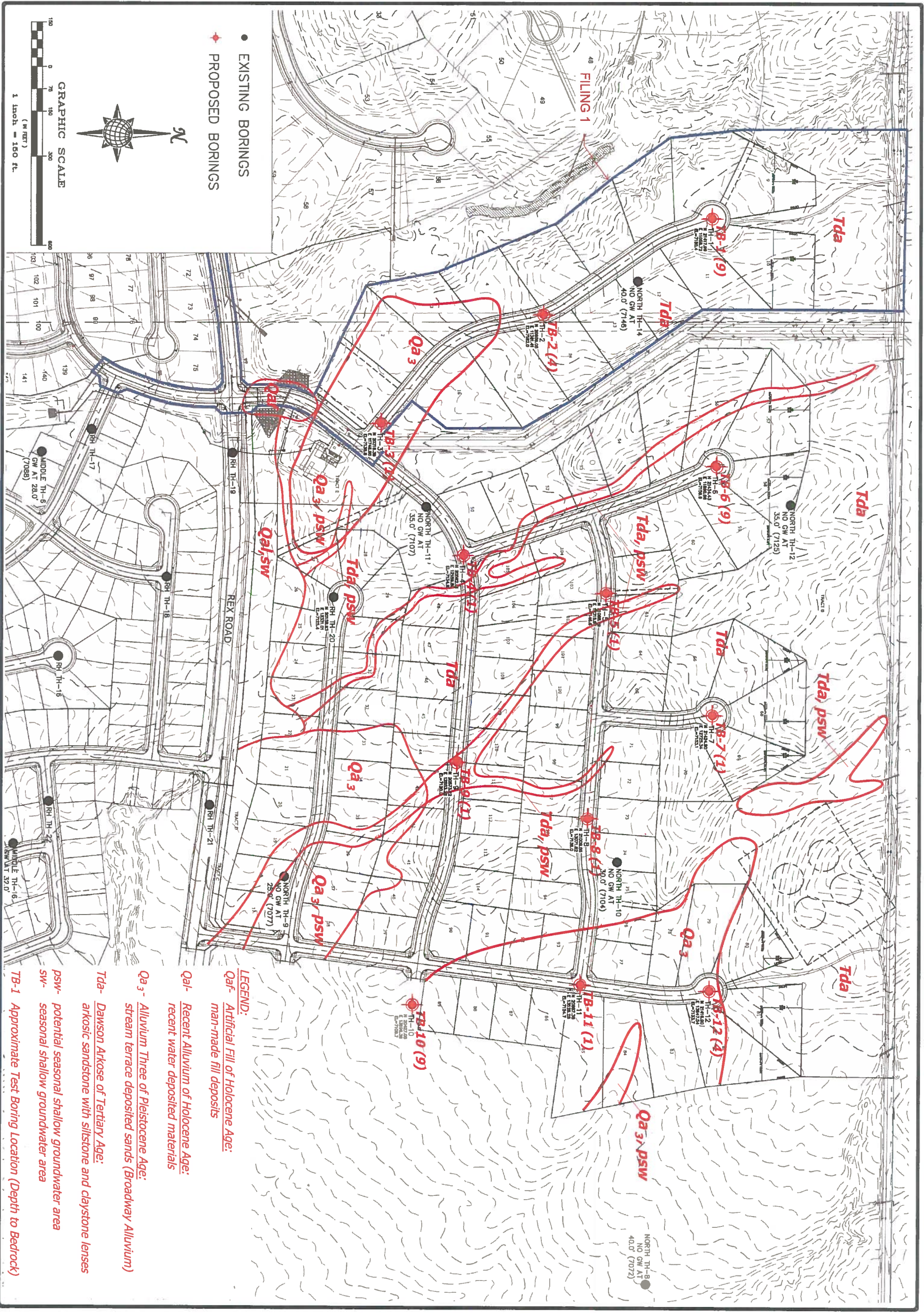
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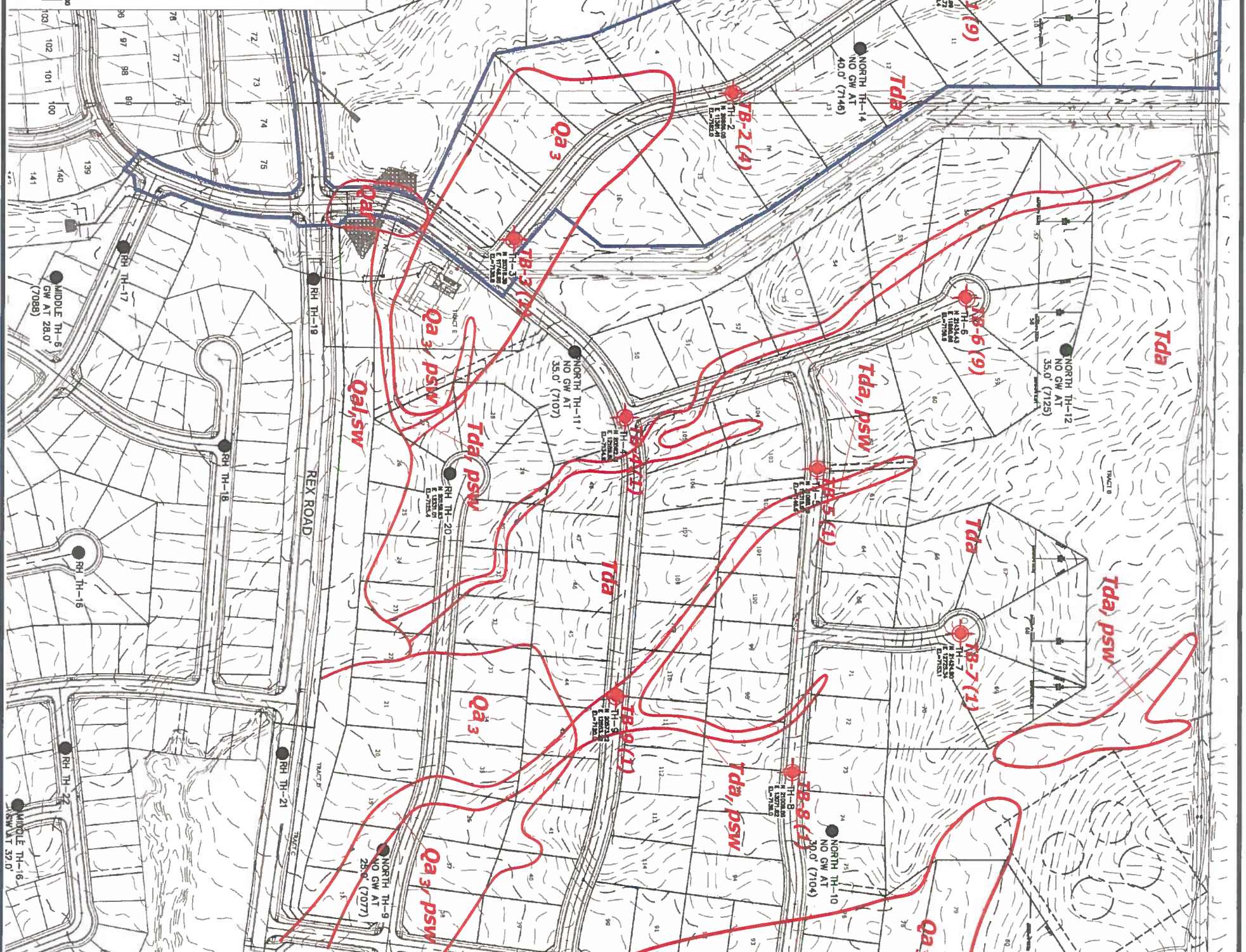
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FIG NO.:  
 5



- EXISTING BORINGS
- ◆ PROPOSED BORINGS



- LEGEND:**
- Qaf- Artificial Fill of Holocene Age: man-made fill deposits
  - Qal- Recent Alluvium of Holocene Age: recent water deposited materials
  - Qa3 - Alluvium Three of Pleistocene Age: stream terrace deposited sands (Broadway Alluvium)
  - Tda- Dawson Arkose of Tertiary Age: arkosic sandstone with siltstone and claystone lenses
  - psw- potential seasonal shallow groundwater area
  - sw- seasonal shallow groundwater area
  - TB-1 Approximate Test Boring Location (Depth to Bedrock)

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AS SHOWN	SCALE	1" = 150'
JOB NO. 181234	FIGURE NO.	6

ENGINEERING GEOLOGY MAP  
 THE ESTATES AT ROLLING HILLS  
 RANCH FILING 1 & 2  
 EL PASO COUNTY, CO.  
 FOR: TECH CONTRACTORS

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FEMA FLOODPLAIN MAP  
 THE ESTATES AT ROLLING HILLS RANCH  
 FILING 1 & 2  
 EL PASO COUNTY, CO.  
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**7**

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## TABLES

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**TABLE 1**  
**SUMMARY OF LABORATORY TEST RESULTS**

CLIENT: TECH CONTRACTORS  
 PROJECT: ESTATES AT ROLLING HILLS  
 JOB NO.: 191234

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	AASHTO CLASS.	FHA SWELL (PSF)	SWELL/CONSOL (%)	UNIFIED CLASS.	SOIL DESCRIPTION
1	1	5			22.3	33	16	<0.01	A-2-6			SC	SAND, CLAYEY
1	2	2-3			18.8			<0.01		30		SM	SAND, SILTY
1	6	5			17.0					130		SM	SAND, SILTY
1	10	2-3			8.0	NV	NP		A-1-b			SM-SW	SAND, SLIGHTLY SILTY
2	3	5			34.5	29	12	<0.01	A-2-6			SC	SANDSTONE, CLAYEY
2	4	10			23.5							SM	SANDSTONE, SILTY
2	5	2-3			17.6							SM	SANDSTONE, SILTY
2	7	10			9.8	NV	NP		A-1-b			SM-SW	SANDSTONE, SLIGHTLY SILTY
2	8	15			8.4							SM-SW	SANDSTONE, SLIGHTLY SILTY
2	10	15	13.7	119.0	48.4						0.5	SC	SANDSTONE, VERY CLAYEY
3	12	5	14.5	119.7	58.3						3.1	CL	CLAYSTONE, VERY SANDY



**Table 2: Summary of Test Borings and Water Measurements\***

<b>Test Boring No.</b>	<b>Depth of Boring (ft.)</b>	<b>Depth to Bedrock (ft.)</b>	<b>Depth to Groundwater (ft.)</b>	<b>Estimated Ground Elevation</b>	<b>Estimated Groundwater Elevation</b>
1	20.0	9.0	dry	7180.4	dry
2	20.0	4.0	dry	7162.0	dry
3	20.0	1.0	16.0	7138.8	7017.3
4	20.0	1.0	dry	7134.9	dry
5	20.0	1.0	13.0	7146.6	7030.8
6	20.0	9.0	17.0	7159.9	7044.7
7	20.0	1.0	dry	7153.1	dry
8	20.0	1.0	dry	7136.0	dry
9	20.0	1.0	dry	7120.0	dry
10	20.0	9.0	12.0	7109.7	7063.5
11	20.0	1.0	14.0	7124.7	7062.6
12	20.0	4.0	dry	7133.7	dry

- \* - Measurement taken subsequent to drilling
- Elevations provided by client

## FIGURES

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## **APPENDIX A: Test Boring Logs**

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TEST BORING NO. 1  
 DATE DRILLED 7/30/2019  
 Job # 191234

TEST BORING NO. 2  
 DATE DRILLED 7/30/2019  
 CLIENT TECH CONTRACTORS  
 LOCATION ESTATES AT ROLLING HILLS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 19', 8/7/19							DRY TO 19', 8/7/19						
SAND, CLAYEY, FINE TO COARSE GRAINED, TAN TO BROWN, DENSE, MOIST	0-5	[Symbol]		40	7.7	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	0-5	[Symbol]	18	9.7	1	
	5-10	[Symbol]		32	11.9	1	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	5-10	[Symbol]	50 10"	7.9	2	
SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST	10-15	[Symbol]		50 6"	6.2	2		10-15	[Symbol]	50 8"	7.4	2	
CLAYSTONE, VERY SANDY, BROWN, HARD, MOIST	15-20	[Symbol]		50 10"	14.6	3	CLAYEY LENSES	15-20	[Symbol]	50 8"	13.3	2	
SANDSTONE, CLAYEY TO SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST	20-24	[Symbol]		50 4"	7.7	2		20-24	[Symbol]	50 6"	5.8	2	



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**TEST BORING LOG**

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DATE

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DATE

JOB NO.:  
 191234

FIG NO.:  
 A- 1

TEST BORING NO. 3  
 DATE DRILLED 7/30/2019  
 Job # 191234

TEST BORING NO. 4  
 DATE DRILLED 7/30/2019  
 CLIENT TECH CONTRACTORS  
 LOCATION ESTATES AT ROLLING HILLS

REMARKS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 16', 8/7/19							DRY TO 20', 7/30/19 CAVED TO 17', 8/7/19, DRY						
SAND, SILTY, BROWN WEATHERED TO FORMATIONAL SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY BROWN, DENSE TO VERY DENSE, MOIST	5	⋮		38	8.7	1	SAND, SILTY, BROWN WEATHERED SANDSTONE, SILTY TO CLAYEY, FINE TO MEDIUM GRAINED, TAN, DENSE TO VERY DENSE, MOIST	5	⋮		50 10"	3.0	2
				50 7"	8.8	2					45	11.3	2
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	10	⋮		50 7"	6.9	2	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	10	⋮		50 4"	5.5	2
				50 7"	10.1	2					50 7"	6.8	2
	20	⋮		50 5"	7.9	2	CLAYEY LENSES	20	⋮		50 7"	7.0	2



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TEST BORING LOG

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DATE

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DATE 8/22/19

JOB NO.  
191234

FIG NO.  
A- 2

TEST BORING NO. 5  
 DATE DRILLED 7/30/2019  
 Job # 191234

TEST BORING NO. 6  
 DATE DRILLED 7/30/2019  
 CLIENT TECH CONTRACTORS  
 LOCATION ESTATES AT ROLLING HILLS

REMARKS

WATER @ 13', 8/7/19

SAND, SILTY, BROWN  
 SANDSTONE, SILTY, FINE TO  
 COARSE GRAINED, TAN, VERY  
 DENSE, MOIST

CLAYEY LENSES

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					1
1			50	4.0	2
2			7"		
3			50	10.1	2
4			11"		
5					
6			50	11.5	2
7			7"		
8					
9			50	8.2	2
10			5"		
11					
12			50	5.3	2
13			7"		
14					
15					
16					
17					
18					
19					
20					



REMARKS

WATER @ 17', 8/7/19

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, DENSE, MOIST

SANDSTONE, SILTY, FINE TO  
 COARSE GRAINED, TAN, VERY  
 DENSE, MOIST

CLAYEY LENSES

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					
1					
2			34	4.7	1
3					
4			42	7.7	1
5					
6			50	7.2	2
7			7"		
8					
9			50	12.4	2
10			6"		
11					
12			50	6.8	2
13			8"		
14					
15					
16					
17					
18					
19					
20					



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE: 8/22/19

JOB NO:  
 191234

FIG NO:  
 A-3

TEST BORING NO. 7  
 DATE DRILLED 7/30/2019  
 Job # 191234

TEST BORING NO. 8  
 DATE DRILLED 7/30/2019  
 CLIENT TECH CONTRACTORS  
 LOCATION ESTATES AT ROLLING HILLS

REMARKS

DRY TO 19', 8/7/19

SAND, SILTY, BROWN  
 SANDSTONE, SILTY, FINE  
 GRAINED, TAN, VERY DENSE,  
 MOIST  
 SANDSTONE, SLIGHTLY SILTY,  
 FINE TO COARSE GRAINED,  
 TAN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
1					1
2			50 6"	6.4	2
5			50 6"	7.4	2
10			50 6"	6.8	2
15			50 7"	7.8	2
20			50 8"	8.6	2

REMARKS

DRY TO 20', 7/30/19  
 CAVED TO 15', 8/7/19, DRY

SAND, SILTY, BROWN  
 SANDSTONE, SLIGHTLY SILTY,  
 FINE TO COARSE GRAINED,  
 TAN, VERY DENSE, MOIST  
 SANDSTONE, VERY CLAYEY,  
 FINE GRAINED, GRAY BROWN,  
 VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
1					1
2			50 10"	4.3	2
5			50 10"	8.5	2
10			50 8"	9.1	2
15			50 6"	9.1	2
20			50 10"	11.2	2



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN

DATE

CHECKED: *W*

DATE: 8/22/19

JOB NO:  
 191234

FIG NO:  
 A- 4





TEST BORING NO. 11  
 DATE DRILLED 7/30/2019  
 Job # 191234

TEST BORING NO. 12  
 DATE DRILLED 7/30/2019  
 CLIENT TECH CONTRACTORS  
 LOCATION ESTATES AT ROLLING HILLS

REMARKS

WATER @ 14', 8/7/19

SAND, SILTY, BROWN  
 SANDSTONE, SILTY, FINE TO  
 COARSE GRAINED, TAN, VERY  
 DENSE, DRY TO MOIST

CLAYSTONE, VERY SANDY,  
 GRAY BROWN TO BROWN,  
 HARD, MOIST



Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
1					1
2					2
5			50 11"	1.6	
6.8			50 8"	6.8	2
7.9			50 10"	7.9	2
9.5			50 5"	9.5	3
8.2			50 7"	8.2	3

REMARKS

DRY TO 19', 8/7/19

SAND, CLAYEY, FINE TO COARSE  
 GRAINED, BROWN, MEDIUM  
 DENSE, MOIST

CLAYSTONE, VERY SANDY, TAN,  
 HARD, MOIST

SANDSTONE, SILTY, FINE TO  
 COARSE GRAINED, TAN, VERY  
 DENSE, MOIST

CLAYSTONE, VERY SANDY, TAN,  
 HARD, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
1					1
15			15	12.3	1
5			50 11"	11.9	3
9.1			50 5"	9.1	3
3.8			50 7"	3.8	2
12.7			50 6"	12.7	3



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE: 8/22/19

JOB NO:  
191234

FIG NO:  
A- 6

## **APPENDIX B: Soil Survey Descriptions**

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## El Paso County Area, Colorado

### 19—Columbine gravelly sandy loam, 0 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* 367p  
*Elevation:* 6,500 to 7,300 feet  
*Mean annual precipitation:* 14 to 16 inches  
*Mean annual air temperature:* 46 to 50 degrees F  
*Frost-free period:* 125 to 145 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Columbine and similar soils:* 85 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Columbine

##### Setting

*Landform:* Flood plains, fan terraces, fans  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium

##### Typical profile

*A - 0 to 14 inches:* gravelly sandy loam  
*C - 14 to 60 inches:* very gravelly loamy sand

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Well drained  
*Runoff class:* Very low  
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Very low (about 2.5 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 4e  
*Land capability classification (nonirrigated):* 6e  
*Hydrologic Soil Group:* A  
*Ecological site:* Gravelly Foothill (R049BY214CO)  
*Hydric soil rating:* No

#### Minor Components

##### Fluvaquentic haplaquolls

*Percent of map unit:*  
*Landform:* Swales

*Hydric soil rating: Yes*

**Pleasant**

*Percent of map unit:*

*Landform: Depressions*

*Hydric soil rating: Yes*

**Other soils**

*Percent of map unit:*

*Hydric soil rating: No*

## Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 16, Sep 10, 2018

## El Paso County Area, Colorado

### 83—Stapleton sandy loam, 3 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369z  
*Elevation:* 6,500 to 7,300 feet  
*Mean annual precipitation:* 14 to 16 inches  
*Mean annual air temperature:* 46 to 48 degrees F  
*Frost-free period:* 125 to 145 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Stapleton and similar soils:* 80 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Stapleton

##### Setting

*Landform:* Hills  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Sandy alluvium derived from arkose

##### Typical profile

*A - 0 to 11 inches:* sandy loam  
*Bw - 11 to 17 inches:* gravelly sandy loam  
*C - 17 to 60 inches:* gravelly loamy sand

##### Properties and qualities

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* More than 80 inches  
*Natural drainage class:* Well drained  
*Runoff class:* Low  
*Capacity of the most limiting layer to transmit water (Ksat):* High  
(2.00 to 6.00 in/hr)  
*Depth to water table:* More than 80 inches  
*Frequency of flooding:* None  
*Frequency of ponding:* None  
*Available water storage in profile:* Low (about 4.7 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3e  
*Hydrologic Soil Group:* B  
*Ecological site:* Gravelly Foothill (R049BY214CO)  
*Hydric soil rating:* No

### **Minor Components**

#### **Pleasant**

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

#### **Fluvaquentic haplaquolls**

*Percent of map unit:*

*Landform:* Swales

*Hydric soil rating:* Yes

#### **Other soils**

*Percent of map unit:*

*Hydric soil rating:* No

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## **Data Source Information**

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 16, Sep 10, 2018