ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

**SOIL, GEOLOGY, GEOLOGIC HAZARD,
AND WASTEWATER STUDY,
JUDGE ORR ROAD RV PARK AND STORAGE
14010 JUDGE ORR ROAD
PARCEL NO. 42330-00-027
EL PASO COUNTY, COLORADO**

Per Chapter 11 Section 11.3.3 of the El Paso County Drainage Criteria Manual recommendations for the foundation preparation and embankment construction shall be submitted with the complete design analysis for all permanent detention facilities.

Prepared for

WILLIAM GUMAN AND ASSOCIATIES, LTD.
731 North Weber Street, Suite 10
Colorado Springs, Colorado 80903

Attn: Bill Guman

December 12, 2016

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford
Geologist

LLL/rm

Encl.

Entech Job No. 160533
AAprojects/2016/160533 countysoil/geo/ww

Reviewed by:

Joseph C. Goode, Jr., P.E.
President

COLORADO LICENSED
JOSEPH COLLIN GOODE JR.
23725
12/12/16
PROFESSIONAL ENGINEER

Add "PCD File No. PPR-16-040"

TABLE OF CONTENTS

1.0 INTRODUCTION 1
2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION 2
3.0 SCOPE OF THE REPORT 3
4.0 FIELD INVESTIGATION 3
5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY 4
5.1 General Geology 4
5.2 Soil Conservation Survey 4
5.3 Site Stratigraphy 5
5.4 Soil Conditions 6
5.5 Groundwater 6
6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS 7
6.1 Relevance of Geologic Conditions to Land Use Planning 9
7.0 ON-SITE WASTEWATER TREATMENT 10
9.0 EROSION CONTROL 13
10.0 CLOSURE 14
BIBLIOGRAPHY 15

TABLES
Table 1: Summary of Laboratory Test Results
Table 2: Summary of Percolation Test Results

FIGURES
Figure 1: Vicinity Map
Figure 2: USGS Map
Figure 3: Development Plan/Test Boring Location Map
Figure 4: Soil Survey Map
Figure 5: Black Forest Quadrangle Geology Map
Figure 6: Geology Map/Engineering Geology
Figure 7: Floodplain Map
Figure 8: Perimeter Drain Detail
Figure 9: Septic Suitablity Map

APPENDIX A: Site Photographs
APPENDIX B: Test Pit Logs and Profile Hole Logs
APPENDIX C: Laboratory Test Results
APPENDIX D: Soil Survey Descriptions
APPENDIX E: Percolation Test Results

**SOIL, GEOLOGY, GEOLOGIC HAZARD,
AND WASTEWATER STUDY,
JUDGE ORR ROAD RV PARK AND STORAGE
14010 JUDGE ORR ROAD
PARCEL NO. 42330-00-027
EL PASO COUNTY, COLORADO**

1.0 INTRODUCTION

Project Location

The project lies in a portion of the SW ¼ of Section 33, Township 12 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado at 14010 Judge Orr Road, Parcel No. 42330-00-027. The site is located approximately 2½ miles northeast of Falcon, Colorado.

Project Description

Total acreage involved in the project is approximately 40 acres. The proposed site development consists of six hundred and thirty-one (631) boat/trailer storage bays, forty (40) RV camp spaces, and associated site improvements. The RV Park is anticipated to be serviced by an individual well and on-site wastewater treatment system. Future phases will include additional RV camp spaces.

Scope of Report

This report presents the results of our geologic evaluation, treatment of engineering geologic hazard study and wastewater study for an on-site wastewater treatment system.

Land Use and Engineering Geology

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of seasonal shallow groundwater areas, potentially seasonal shallow groundwater, ponded water, drainage areas, flood plain, and artificial fill. Based on the proposed development plan, it appears that these areas will have some impact on the development. These conditions will be discussed in greater detail in the report.

In general, it is our opinion that the development can be achieved if the observed geologic conditions on site are either avoided or properly mitigated. All recommendations are subject to the limitations discussed in the report.

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the SW ¼ of Section 33, Township 12 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 2½ miles northeast of Falcon, Colorado, on Judge Orr Road, east of Highway 24. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site is gently sloping generally to the southeast. The drainages on site flow in southerly and easterly direction through the property, and easterly in the flood plain located in the northeast corner of the site. Water was not observed flowing in drainages at the time of this investigation, a small pool of water was observed in the pond located in the southeast portion of the site. A single-story house and barn are present in the southwest portion the property and are to remain. Several travel trailers are currently parked in the southwest portion of the property in the area of the existing house and barn. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. The site contains primarily field grasses, weeds, yuccas, cacti, scattered shrubs, and scattered trees along the southern portion of the property and around the existing house and barn. Site photographs, taken December 5, 2016, are included in Appendix A.

Total acreage involved in the proposed development is approximately 40 acres. The proposed site development consists of six hundred and thirty-one (631) boat/trailer storage bays, forty (40) RV camp spaces, and associated site improvements. The RV Park is anticipated to be serviced by an individual well and on-site wastewater treatment system. The proposed Development Plan is presented in Figure 3. Future phases will have additional RV camp spaces.

3.0 SCOPE OF THE REPORT

The scope of the report will include the following:

- A general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.

- The site will be evaluated for an on-site wastewater treatment system in accordance with El Paso Land Development Code.

4.0 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on December 5, 2016.

One (1) percolation test, and four (4) tactile test pits were performed on the site to determine general suitability of the site for the use of an on-site wastewater treatment system. The locations of the profile hole boring, and test pits are indicated on the Development Plan/Test Boring Location Map, Figure 3. Percolation test holes were placed adjacent to the test pits. The Profile Hole and Test Pit Logs are presented in Appendix B. Results of this testing will be discussed later in this report.

Laboratory testing was also performed on some of the soils to classify and determine the soils engineering characteristics. Laboratory tests included grain-size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Results of the laboratory testing are included in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province. Approximately 16 miles to the west 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 the southeastern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northeasterly direction (Reference 1). The rocks in the area of the site are sedimentary in nature and typically Tertiary to Upper Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual, man-made fill, and alluvial soils of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. The alluvial soils were deposited by water in the major drainages on site and as stream terraces on some of the ridge lines. Man-made soils exist as earthen dams and erosion berms. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has mapped two soil types on the site (Figure 4). In general, they vary from gravelly sandy loam to very gravelly loamy sand. The soils are described as follows:

Type	Description
19	Columbine Gravelly Sandy Loam, 0-3% slopes

Complete description of the soil type is presented in Appendix D. The soils have generally been described to have moderate to moderately rapid permeabilities. Roads may need to be designed to minimize frost-heave potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have slight to moderate erosion hazards.

5.3 Site Stratigraphy

The Falcon Quadrangle Geology Map showing the site is presented in Figure 5 (Reference 4). The Geology Map prepared for the site is presented in Figure 6. Four mappable units were identified on this site, which are described as follows:

Qal **Alluvium of recent Holocene Age:** These are recent deposits that have been deposited along the drainages that exist on-site. These materials typically consist of silty to clayey sands and sandy clays. Some of these alluviums contain highly organic soils.

Qaf **Artificial Fill of Holocene Age:** These are man-made fill deposits associated with erosion berms and earthen dam on-site.

Qp **Piney Creek Alluvium of Holocene Age:** This material is a water-deposited alluvium, typically classified as a silty to well-graded sand, brown to dark brown in color and of moderate density. The Piney Creek Alluvium can sometimes be very highly stratified containing thin layers of very silty and clayey soil.

Qb **Broadway Alluvium of Late Pleistocene Age:** These materials consist of lower stream terrace deposits. The Broadway Alluvium typically consists of silty to clayey gravelly sands. This deposit is usually highly stratified and may contain lenses of silt, clay or cobbles.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Falcon Quadrangle* distributed by the Colorado Geological Survey in 2012 (Reference 4), the *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1979 (Reference 5), and the *Geologic Map of the Denver $1^0 \times 2^0$ Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 6). The Test Borings and Profile Holes were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

The soils encountered in the Profile Hole and Tactile Test Pits can be grouped into four general soil and rock types. The profile hole soils were classified using the Unified Soil Classification System (USCS). The test pit soils were classified using the USDA Textural Soil Classification.

Soil Type 1 is a clayey sand (SC), was encountered in the upper soil profile in the profile hole and test pits. These soils were encountered at medium dense states and at moist conditions. An expansion pressure of 430 psf was determined from a sample of the clayey sand, which indicates a low expansion potential. Samples tested had 19 to 34 percent passing the No. 200 Sieve.

Soil Type 2 is a sandy clay and clay (CL), was encountered in the profile hole and it Test Pit Nos. 1 and 2. The soils were encountered at firm consistencies and moist conditions. Samples tested had 66 to 90 percent passing the No. 200. Sieve.

Soil Type 3 is a sandy claystone (CL), was encountered in all of the test pits at depths ranging from 1 to 8 feet below the surface. The claystone was encountered at hard to consistencies and moist conditions.

Soil Type 4 is a very clayey sandstone (SC), was encountered in the profile hole at depths ranging from 8 feet below the surface and extended to the termination of the boring (20 feet). The claystone was encountered at hard to very hard consistencies and moist conditions. The sample tested had 46 percent passing the No. 200 sieve.

The Test Boring Logs and the Profile Hole Logs are presented in Appendix B. Laboratory Test Results are presented in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

5.5 Groundwater

Groundwater was not encountered in the profile hole or test pits which was drilled to 20 feet and excavated to 8 feet. Signs of seasonally shallow groundwater were observed in the test pits at depths ranging from 3½ to 6 feet. Areas of seasonal shallow groundwater and ponded water have been mapped in the pond, low-lying areas and in the drainages on-site. These areas are

discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

It should be noted that in the sandy materials on site, some groundwater conditions might be encountered due to the variability in the soil profile. Isolated sand and gravel layers within the soils, sometimes only a few feet in thickness and width, can carry water in the subsurface. Groundwater may also flow on top of the underlying bedrock. Planners should be cognizant of the potential for the occurrence of such subsurface water features during construction on-site and deal with each individual problem as necessary at the time of construction.

6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

As mentioned previously, detailed mapping has been performed on this site to produce an Engineering Geology Map (Figure 6). This map shows the location of various geologic conditions of which the developers should be cognizant during the planning, design and construction stages of the project. These hazards and the recommended mitigation techniques are as follows:

Groundwater and Floodplain Areas

Areas within the drainages on-site have been identified as areas of seasonally high groundwater areas, potentially seasonally high groundwater areas and floodplains. Additionally, areas of ponded water also exist on-site. Water was not flowing in the any of the drainages at the time of this investigation. The drainage located in the northeast corner of the property has been mapped as a floodplain zone according to the FEMA Map No. 08041CO575F Figure 7 (Reference 7). These areas are discussed as follows:

Floodplain: It is anticipated that the proposed improvements will not be within the floodplain zone at the northeast corner of the site. Development within the floodplain would require approval of the Drainage Plan prior to construction. Building areas within the floodplain will require filling to raise the building area above floodplain and seasonally high groundwater levels. Mitigation for Seasonally High Groundwater levels discussed in the following sections is recommended for construction in the floodplain zone. Finished floor levels must

be one foot above the floodplain level. Exact floodplain locations and drainage studies are beyond the scope of this report.

Potentially Seasonal High Groundwater: In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and possible frost heave potential, depending on the soil conditions. It is our understanding that the areas will be regraded.

Mitigation: Due to the proposed use as RV Storage and camp sites the regrading will mitigate these areas. Foundations if installed in these areas are subject to severe frost heave potential should penetrate sufficient depth so as to discourage the formation of ice lenses beneath foundations. At this location and elevation, a foundation depth for frost protection of 30-inch is recommended. In areas where high subsurface moisture conditions are anticipated periodically, a subsurface perimeter drain will be necessary to help prevent the intrusion of water into areas located below grade. A typical perimeter drain detail is presented in Figure 8. Additionally, swales should be created to intercept surface runoff and carry it safely around and away from structures. It is anticipated that the site grading may mitigate the drainages on the property. The water table may be of sufficient depth to minimize the effects on buildings in some areas.

Seasonally High Groundwater Area: In these areas, high subsurface moisture condition, frost heave potential and highly organic soils may exist, particularly on a seasonal basis. The majority of the areas will be mitigated with site grading.

Mitigation: In areas where development is planned, overlot grading will mitigate the drainages. All organic material, soft or wet soils should be removed prior to any filling. The same mitigation recommendations for potentially high groundwater areas as discussed previously should be followed in these areas of seasonally high groundwater. In some areas, it may be necessary to dewater the excavation. Any grading should be done in a manner that directs surface flow around construction to avoid areas of ponded water. Structures should not block drainages, but swales should be created to intercept surfacerunoff and carry it safely around and away from structures. Additional investigation will be necessary to determine the water depth and its affect on development. Other areas than those mapped could encounter groundwater that could affect shallow foundations on-site.

Areas of Ponded Water: This the area where water is ponded behind earthen dam on-site. This area will likely be removed during site grading. Should construction be considered in these areas, regrading will be necessary in order to fill the area above the groundwater level. All soft or organic soils should be removed prior to filling. The same mitigation techniques for seasonally high groundwater areas are recommended for these ponded areas as well.

6.1 Relevance of Geologic Conditions to Land Use Planning

As mentioned earlier in this report, we understand that the development will be recreational vehicle park and storage. It is our opinion that the existing geologic and engineering geologic conditions will impose some constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the drainages on site that may be satisfactorily mitigated through site grading, engineering design, and construction practices.

The upper materials are typically at medium dense states. The granular soils encountered in the upper soil profiles of the profile hole and tactile test pits should provide good support for foundations. Expansive soils were encountered in the area tested for the on-site wastewater treatment system. It is anticipated that overlot grading will be used to mitigate the drainage area where the expansive soils were encountered. Expansive layers may also be encountered in the soils in other areas on this site. Areas of expansive soils encountered on site are sporadic; therefore, none have been indicated on the maps. These soils will not prohibit development.

Areas of seasonal shallow groundwater and areas of ponded water were encountered on site. These areas will require overlot grading to mitigate the drainage areas and the pond located on this site. Absorption fields should not be located in these areas without site grading due to the potential for periodic high groundwater conditions.

In summary, development of the site can be achieved if the items mentioned above are mitigated. These items can be mitigated through proper design and construction or through avoidance.

7.0 ON-SITE WASTEWATER TREATMENT

The site was evaluated for an on-site wastewater treatment system for the RV camp area in accordance with El Paso Land Development Code. Due to the commercial project a designed system will be required. One (1) percolation test and four (4) tactile test pits were performed on the property. Percolation test and tactile test pits were located in anticipated location of the proposed on-site wastewater treatment system (OWTS) for the RV Park at the southeast corner of the site. The approximate locations of the test pits are indicated on Figure 3 and on the Septic Suitability Map, Figure 9. It should be noted that other areas of the site are likely suitable for OWTS systems. The proposed location was to maintain gravity flow. A table showing the results of the test pits and percolation test is presented in Table 2. The specific test results are presented in Appendix E of this report

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has been mapped with one soil descriptions. The Soil Survey Map (Reference 2) is presented in Figure 4, and the Soil Survey Descriptions are presented in Appendix D. The soils are described as having moderate to moderately rapid percolation rates.

The percolation rate was 80 minutes per inch. The percolation rate is not suitable for conventional on-site wastewater treatment systems. The percolation rate is slower than 60 minutes per inch which will require designed systems. Shallow bedrock was also encountered in the profile holes and test pits, and will also required a designed system. Additional drilling may identify areas where faster rates are encountered that are suitable for conventional systems.

Standard penetration testing, ASTM D-1586, was performed in each profile hole to evaluate the density of the soil and the presence of bedrock. Bedrock was encountered in The Profile Hole at 8 feet. Designed systems are required in areas of shallow bedrock.

Soils encountered in the tactile test pits consisted of sandy loam to gravelly sandy loam, gravelly sandy clay loam, sandy clay and clay with underlying sandy claystone. The limiting layer encountered in the test pits is the clay and sandy claystone, which corresponds to an LTAR value of 0.10 gallons per day per square foot. The bedrock was encountered at 3½ to 6½ feet in the test pits. The conditions encountered in the test pits will require a designed system.

Signs of seasonal shallow groundwater were observed at depths ranging from 3½ to 6 feet in the test pits.

Absorption fields must be maintained a minimum of 4 feet above groundwater or bedrock. Groundwater was encountered at 17 feet in the profile hole which was drilled to 20 feet. Signs of seasonally shallow groundwater were observed in Test Pit Nos. 1, 3, and 4 at depths ranging from 3½ to 6 feet. Shallow bedrock was encountered in the profile holes and test pits at depths ranging from 3½ to 6 feet.

The percolation rates measured are not suitable for conventional systems. Both tests had rates of slower than 60 minutes per inch. El Paso County guidelines require designed systems for percolation rates exceed 60 minutes per inch. Additional drilling may identify areas where conventional systems can be used. Bedrock was encountered in the profile hole and test pits at depths that would affect conventional systems. Due to the commercial use a designed system will be required.

In summary, it is our opinion the site is suitable for a on-site wastewater treatment system (OWTS) and that contamination of surface and subsurface water resources should not occur provided the OWTS sites are evaluated and installed according to El Paso County and State Guidelines and properly maintained. It is anticipated that a low pressure drip system, may be appropriate for this site. In addition, some pretreatment to lower BOD and nitrogen levels may be warranted. Based on the testing performed as part of this investigation and the type of project a designed system will be required. For design purposes a LTAR value of 0.10 gallons per day per square foot should be used. A Septic Suitability Map is presented in Figure 9. Absorption fields must be located a minimum of 180 feet from any well for the proposed design flow, including those on adjacent properties. Absorption fields must also be located a minimum of 130 feet from any ponded areas and 25 feet from dry gulches. It should be noted that additional testing will be required once overlot grading is completed.

8.0 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on-site could be considered a low grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 8), the area is not mapped with any aggregate deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 9), areas of the site are not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 10), the area of the site has been mapped as "Good" for industrial minerals. However, considering the silty nature of much of these materials and abundance of similar materials through the region and the close proximity to developed land, they would be considered to have little significance as an economic resource.

According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 10), the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped as "Poor" for coal resources. No active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site (Reference 10).

The site has been mapped as "Fair" for oil and gas resources (Reference 10). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

9.0 EROSION CONTROL

The soil types observed on the site are mildly to highly susceptible to wind erosion, and moderately to highly susceptible to water erosion. A minor wind erosion and dust problem may be created for a short time during and immediately after construction. Should the problem be considered severe enough during this time, watering of the cut areas or the use of chemical palliative may be required to control dust. However, once construction has been completed and vegetation re-established, the potential for wind erosion should be considerably reduced.

With regard to water erosion, loosely compacted soils will be the most susceptible to water erosion, residually weathered soils and weathered bedrock materials become increasingly less susceptible to water erosion. For the typical soils observed on site, allowable velocities or unvegetated and unlined earth channels would be on the order of 3 to 4 feet/second, depending upon the sediment load carried by the water. Permissible velocities may be increased through the use of vegetation to something on the order of 4 to 7 feet/second, depending upon the type of vegetation established. Should the anticipated velocities exceed these values, some form of channel lining material may be required to reduce erosion potential. These might consist of some of the synthetic channel lining materials on the market or conventional riprap. In cases where ditch-lining materials are still insufficient to control erosion, small check dams or sediment traps may be required. The check dams will serve to reduce flow velocities, as well as provide small traps for containing sediment. The determination of the amount, location and placement of ditch linings, check dams and of the special erosion control features should be performed by or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

Cut and fill slope areas will be subjected primarily to sheetwash and rill erosion. Unchecked rill erosion can eventually lead to concentrated flows of water and gully erosion. The best means to combat this type of erosion is, where possible, the adequate re-vegetation of cut and fill slopes. Cut and fill slopes having gradients more than three (3) horizontal to one (1) vertical become increasingly more difficult to revegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

10.0 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some constraints on development and construction of the site. The majority of these conditions can be mitigated through site grading, proper engineering design and construction practices. The proposed development and use is consistent with anticipated geologic and engineering geologic conditions.

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous 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. Additional investigations for OWTS systems will be required after the anticipated overlot grading is completed. Construction and design personnel should be made familiar with the contents of this report. Reporting such discrepancies to Entech Engineering, Inc. soon after they are discovered would be greatly appreciated and could possibly help avoid construction and development problems.

This report has been prepared for William Guman and Associates, LTD. for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty expressed or implied is made.

We trust that this report has provided you with all the information that you required. Should you require additional information, please do not hesitate to contact Entech Engineering, Inc.

BIBLIOGRAPHY

1. Bryant, Bruce; McGrew, Laura W, and Wabus, Reinhard A. 1981. *Geologic Structure Map of the Denver 1° x 2° Quadrangle, North-Central Colorado.* Sheet 2. U.S. Geologic Survey. Map I-1163.

2. Natural Resource Conservation *Service,* September 22, 2015. *Web Soil Survey.* United States Department Agriculture, http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

3. United States Department of Agriculture Soil Conservation Service. June 1981. *Soil Survey of El Paso County Area, Colorado.*

4. Morgan, Mathew L, and White, Jonathan L. 2012. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado.* Colorado Geological Survey. Open-File Report 12-05D.

5. Trimble, Donald E. and Machette, Michael N. 1979. *Geologic Map of the Colorado Springs-Castle Rock Area, Front Range Urban Corridor, Colorado.* USGS, Map I-857-F.

6. Bryant, Bruce; McGrew, Laura W. and Wobus, Reinhard A. 1981. *Geologic Map of the Denver 1° x 2° Quadrangle, North-Central Colorado.* U.S. Geologic Survey. Map 1-1163.

7. Federal Emergency Management Agency. March 17, 1997. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado.* Map Number 08041CO315F

8. El Paso County Planning Development. December 1995. *El Paso County Aggregate Resource Evaluation Maps.*

9. Schwochow, S.D.; Shroba, R.R. and Wicklein, P.C. 1974. *Atlas of Sand, Gravel, and Quarry Aggregate Resources, Colorado Front Range Counties.* Colorado Geological Survey. Special Publication 5-B.

10. Keller, John W.; TerBest, Harry and Garrison, Rachel E. 2003. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered by the Colorado State Land Board.* Colorado Geological Survey. Open-File Report 03-07.

TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT WILLIAM GUMAN & ASSOC.
PROJECT JUDGE ORR ROAD RV PARK
JOB NO. 160533

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	5			34.1				430		SC	SAND, CLAYEY
1	P-1	GRAB			27.0						SC	SAND, CLAYEY
1	P-2	GRAB			29.9						SC	SAND, CLAYEY
1	P-3	GRAB			18.5						SC	SAND, CLAYEY
1	P-4	GRAB			16.0						SC	SAND, CLAYEY
2	TP-1	5-6			66.2						CL	CLAY, SANDY
2	TP-2	2-3			90.3						CL	CLAY, SANDY
4	1	15			46.3						SC	SANDSTONE, VERY CLAYEY

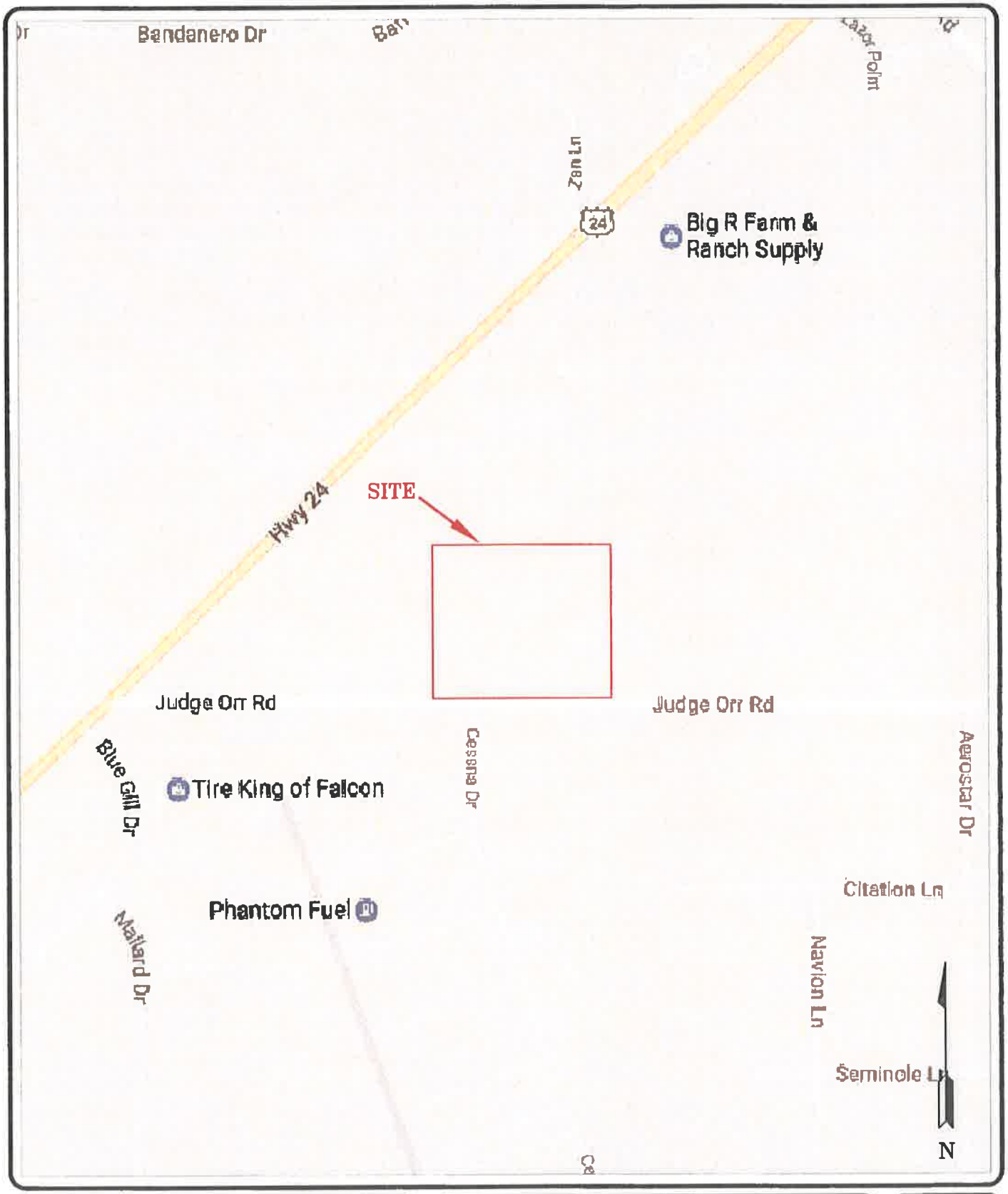
Table 2: Summary of Test Pits and Percolation Test Results

Test Pit No.	USDA Soil Type of Limiting Layer	LTAR Value (1)	Depth to Bedrock (ft.)
1	5	0.10	5
2	5	0.10	6
3	5	0.10	5.5
4	5	0.10	3.5

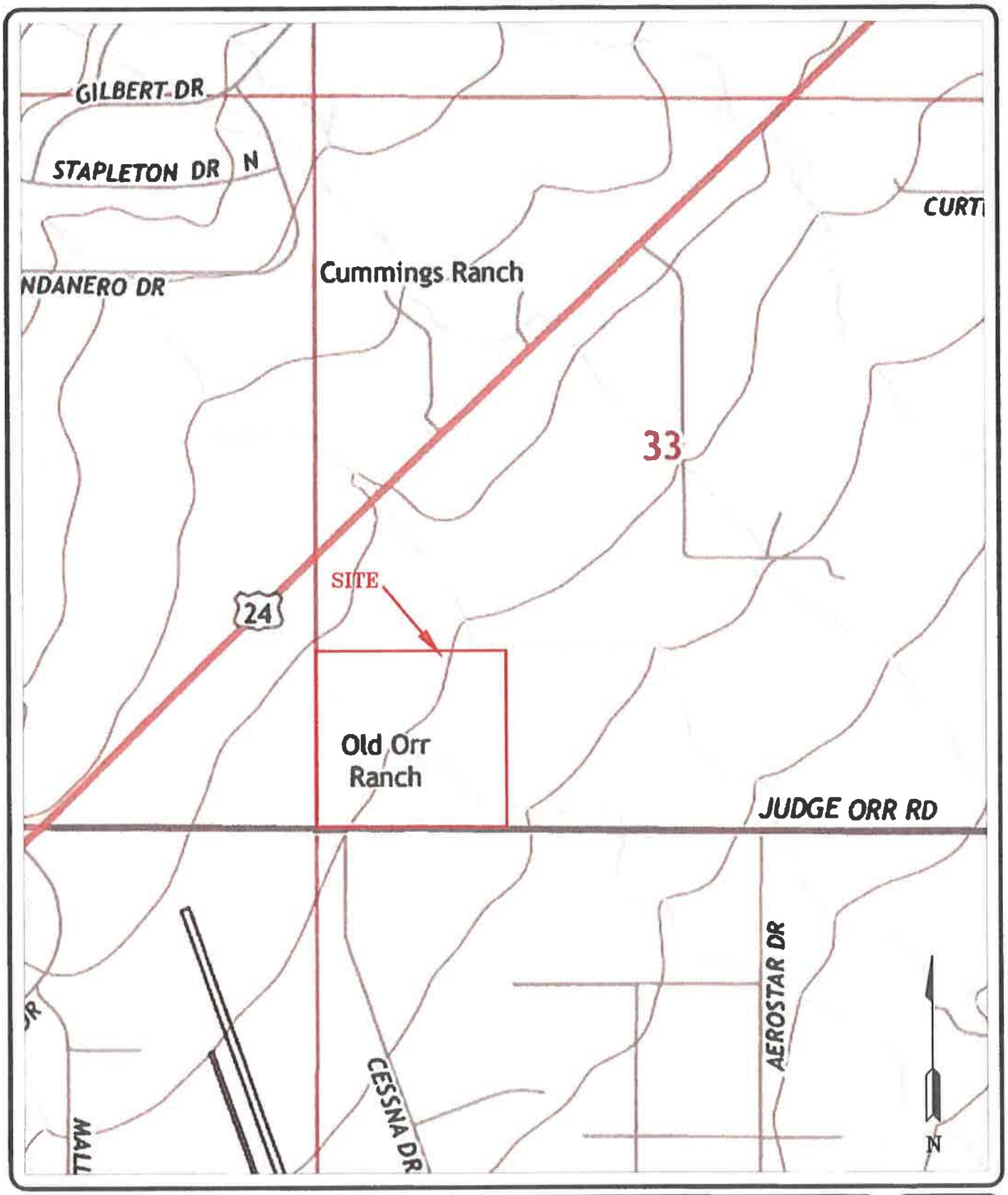
Profile Hole No.	Average Percolation Rate (1) (min/in)	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
1	70	8	17

(1) – Designed system required due to soil conditions and commercial use.

FIGURES



ENTECH ENGINEERING, INC. 505 ELKTON DRIVE COLORADO SPRINGS, CO. 80907 (719) 531-5599	VICINITY MAP JUDGE ORR ROAD RV PARK 14010 JUDGE ORR ROAD EL PASO COUNTY, COLORADO FOR: WILLIAM GUMAN & ASSOCIATES, LTD				JOB NO.: 160533 FIG NO.: 1
	DRAWN: LLL	DATE: 12/7/16	CHECKED:	DATE:	



ENTECH ENGINEERING, INC.
525 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

USGS MAP
JUDGE ORR ROAD RV PARK
14010 JUDGE ORR ROAD
EL PASO COUNTY, COLORADO
FOR: WILLIAM GUMAN & ASSOCIATES, LTD

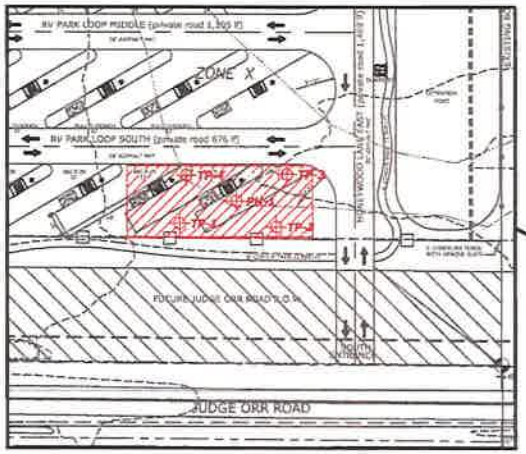
DRAWN:	DATE:	CHECKED:	DATE:
LLL	12/7/16		

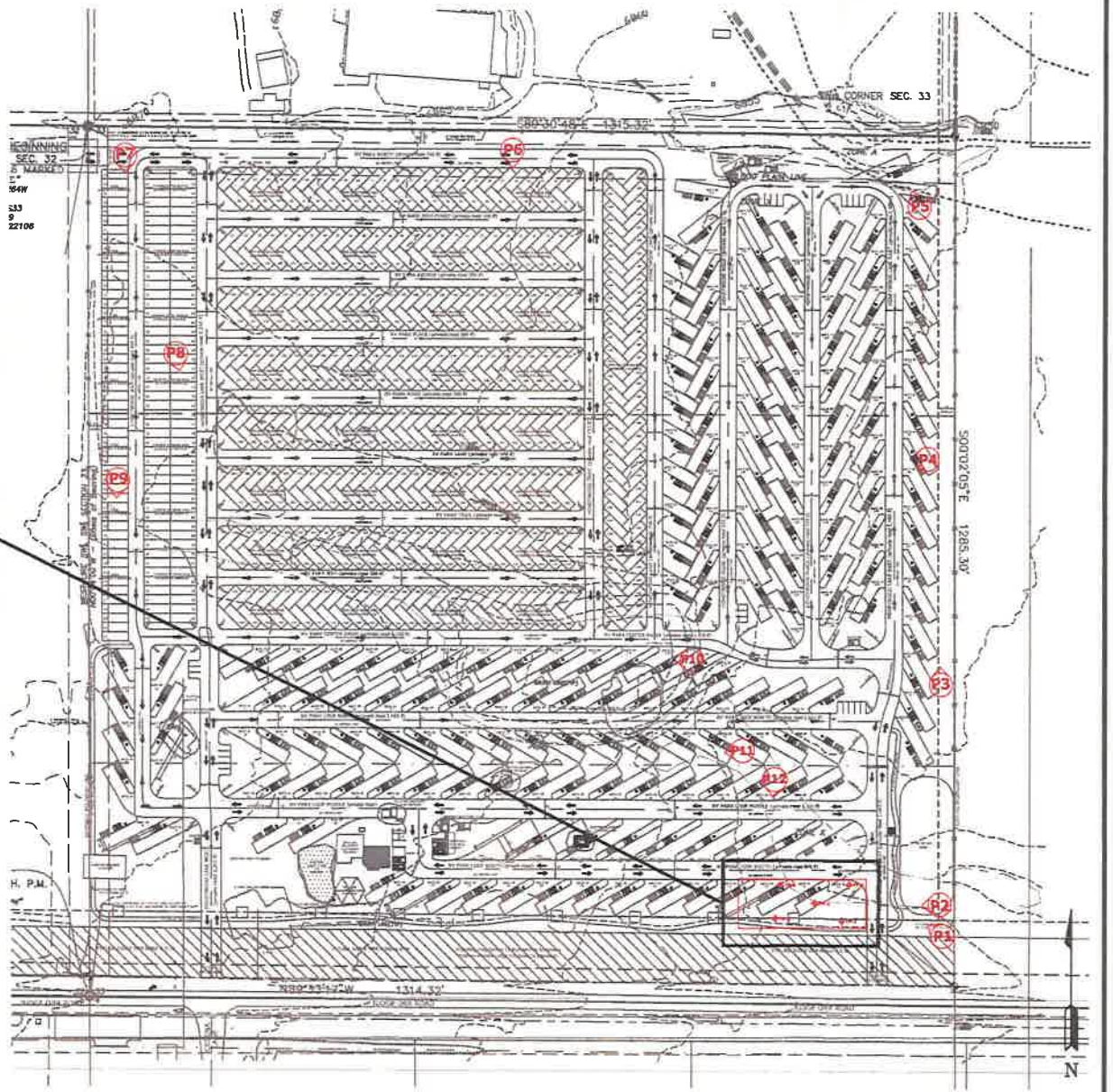
JOB NO.: 160533

FIG NO.: 2

LEGEND:

- APPROXIMATE TEST PIT LOCATION AND NUMBER
- APPROXIMATE PROFILE HOLE LOCATION AND NUMBER
- P2 - PHOTOGRAPH NUMBER AND DIRECTION





REVISION	BY

ENTECH ENGINEERING, INC.
305 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907
(719) 531-5599

DEVELOPMENT MAP
JUDGE ORR ROAD RV PARK
14010 JUDGE ORR ROAD
EL PASO COUNTY, COLORADO
FOR: WILLIAM GUMAN & ASSOCIATES, LTD

DRAWN	
CHECKED	
DATE	12/15/16
SCALE	AS SHOWN
JOB NO.	160535
FIGURE No.	3

N

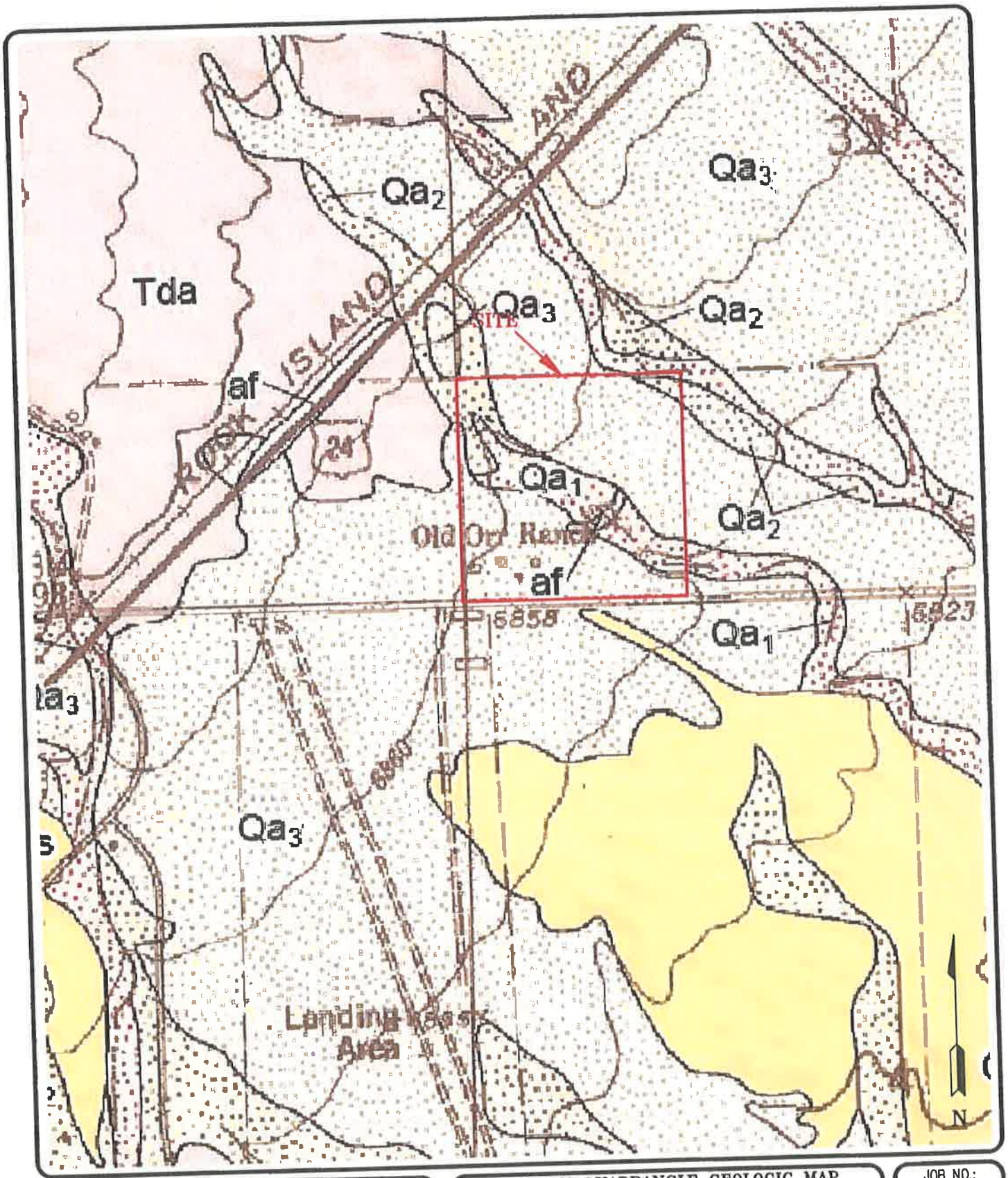
ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

SCS MAP
JUDGE ORR ROAD RV PARK
14010 JUDGE ORR ROAD
EL PASO COUNTY, COLORADO
FOR: WILLIAM GUMAN & ASSOCIATES, LTD

DRAWN:	DATE:	CHECKED:	DATE:
LLL	12/7/16		

JOB NO.: 160533

FIG NO.: 4



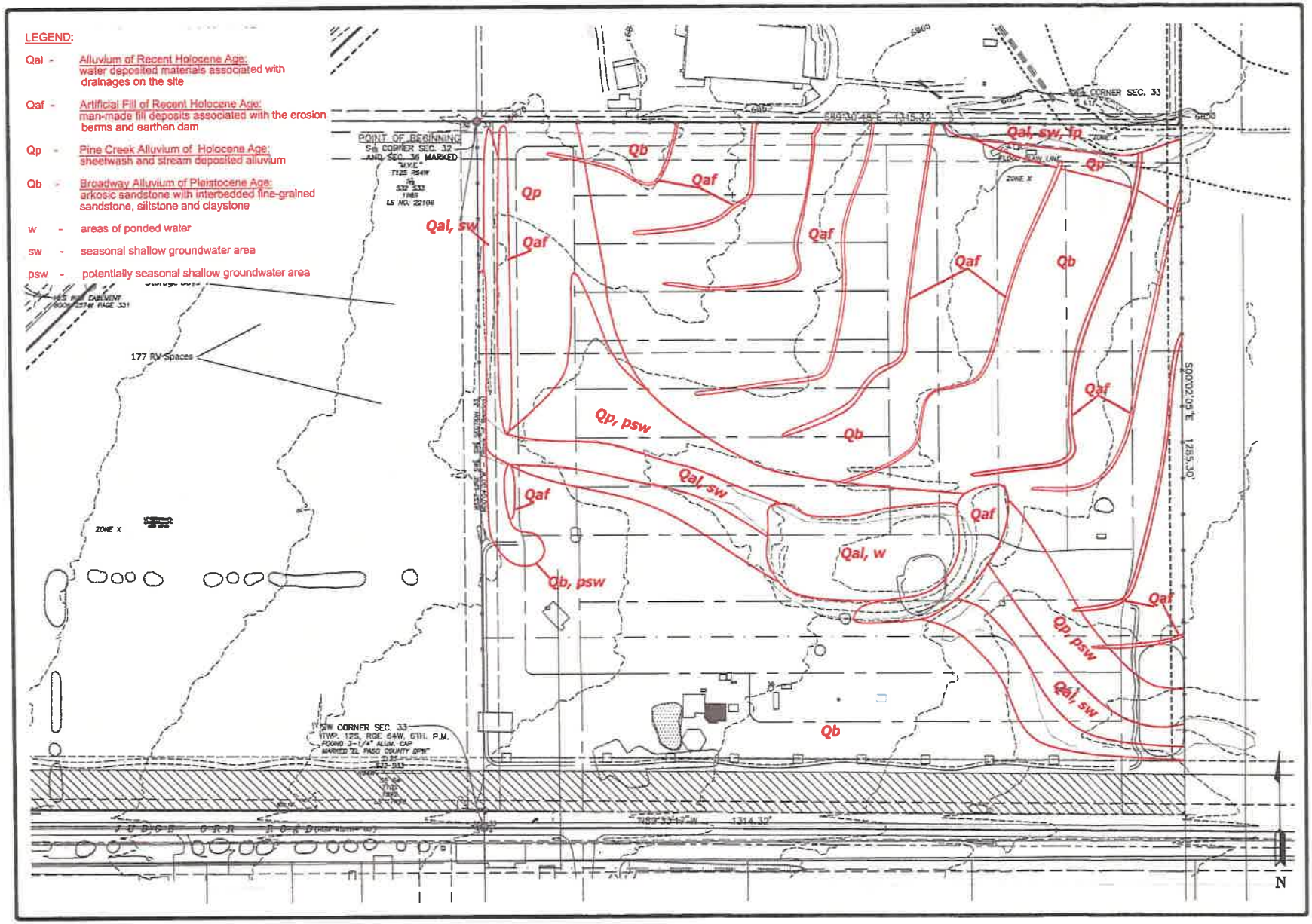
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

FALCON QUADRANGLE GEOLOGIC MAP
JUDGE ORR ROAD RV PARK
14010 JUDGE ORR ROAD
EL PASO COUNTY, COLORADO
FOR: WILLIAM GUMAN & ASSOCIATES, LTD

DRAWN:	DATE:	CHECKED:	DATE:
LLL	12/7/16		

JOB NO.: 160533

FIG NO.: 5



REVISION	BY

ENTECH ENGINEERING, INC.
1957 ELKTON DRIVE, COLORADO SPRINGS, COLORADO 80907 (719) 531-5599

GEOLOGY/ENGINEERING GEOLOGY MAP
JUDGE ORR ROAD RV PARK
14010 JUDGE ORR ROAD
EL PASO COUNTY, COLORADO
FOR: WILLIAM GUMAN & ASSOCIATES, LTD

DRAWN BY: CHECKED	
DATE	12/19/16
SCALE	AS SHOWN
JOB NO.	160533
FIGURE No.	6

LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** — No Base Flood Elevations determined.
- **ZONE AE** — Base Flood Elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** — Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** — Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the National Geodetic Vertical Datum of 1929

- A — A — Cross section line
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4276000 M — 1000-meter Universal Transverse Mercator grid tick values, zone 4
- 600000 FT — 5000-foot grid tick values: Hawaii State Plane coordinate system, zone 3 (FIPSZONE 5103), Transverse Mercator projection
- DX5610 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M 2 — Coastal Mile marker

MAP REPOSITORY

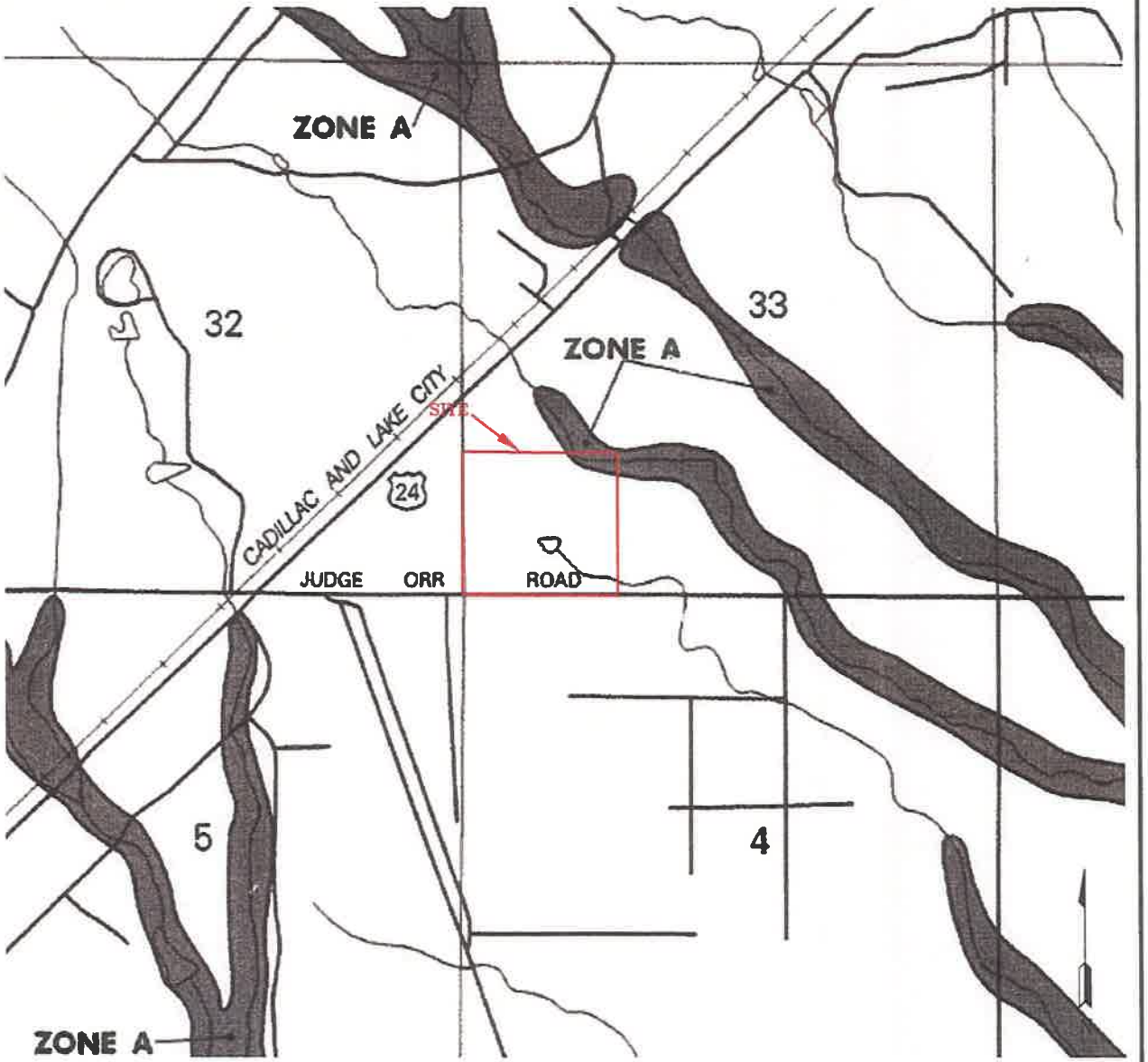
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

November 20, 2000

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 30, 2004 – to change Special Flood Hazard Areas, to update map format, to reflect revised shorelines and to incorporate previously issued Letters of Map Revision.

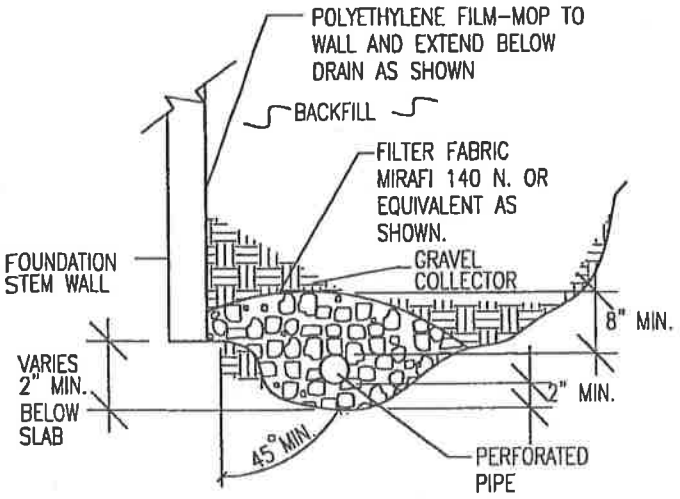


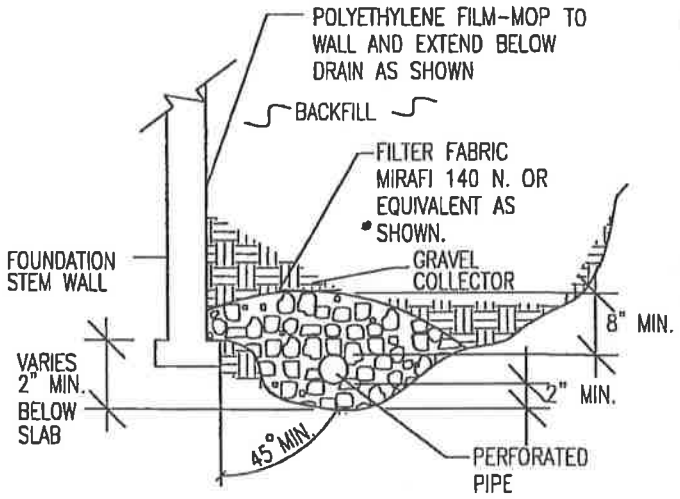
REVISION	BY

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE (719) 531-5599
COLORADO SPRINGS, CO. 80907

FLOODPLAIN MAP
JUDGE ORR ROAD RV PARK
14010 JUDGE ORR ROAD
EL PASO COUNTY, COLORADO
FOR: WILLIAM GUMAN & ASSOCIATES, LTD

DESIGNED	T.T.
DRAWN	C.H.S.B.
DATE	12/5/18
SCALE	AS SHOWN
JOB NO.	1810046
SHEET NO.	7





NOTES:

–GRAVEL SIZE IS RELATED TO DIAMETER OF PIPE PERFORATIONS–85% GRAVEL GREATER THAN 2x PERFORATION DIAMETER.

–PIPE DIAMETER DEPENDS UPON EXPECTED SEEPAGE. 4–INCH DIAMETER IS MOST OFTEN USED.

–ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON–PERFORATED PIPE.

–FLEXIBLE PIPE MAY BE USED UP TO 8 FEET IN DEPTH, IF SUCH PIPE IS DESIGNED TO WITHSTAND THE PRESSURES. RIGID PLASTIC PIPE WOULD OTHERWISE BE REQUIRED.

–MINIMUM GRADE FOR DRAIN PIPE TO BE 1% OR 3 INCHES OF FALL IN 25 FEET.

–DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.

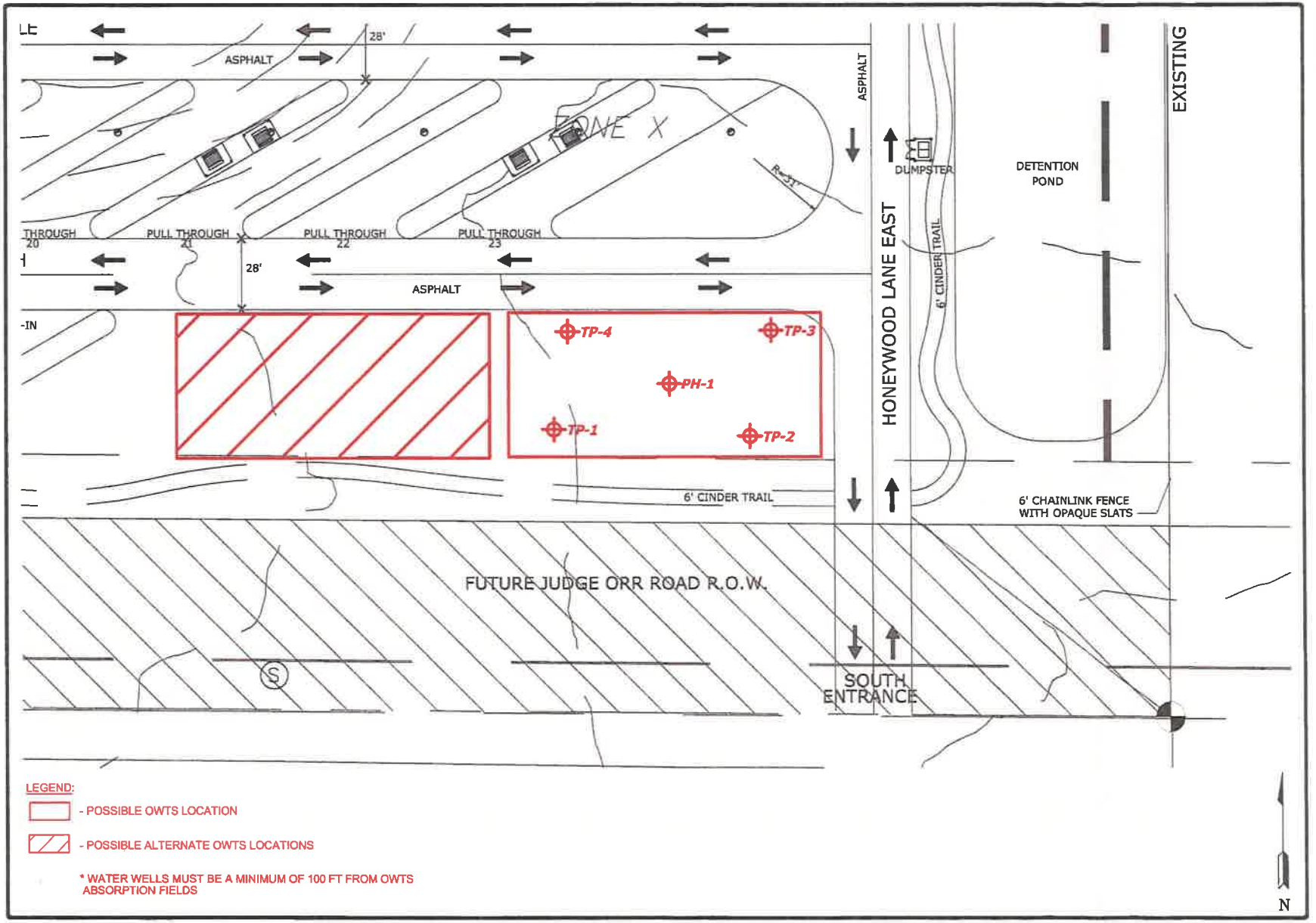
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:
		DS	LLL

JOB NO.: 160533

FIC NO.: 8



REVISION	BY

ENTECH ENGINEERING, INC.
595 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907
(719) 531-5599

SEPTIC SUITABILITY MAP
JUDGE ORR ROAD RV PARK
14010 JUDGE ORR ROAD
EL PASO COUNTY, COLORADO
FOR: WILLIAM GUMAN & ASSOCIATES, LTD

DRAWN	LLL
CHECKED	
DATE	12/7/16
SCALE	AS SHOWN
JOB NO.	160535
PAGE NO.	9

APPENDIX A: Site Photographs

1

Looking northwest from the southeast portion of the property.

December 5, 2016

2

Looking west towards proposed OWTS area along drainage.

December 5, 2016

Job No. 160533

3

Looking north from the eastern portion of the property.

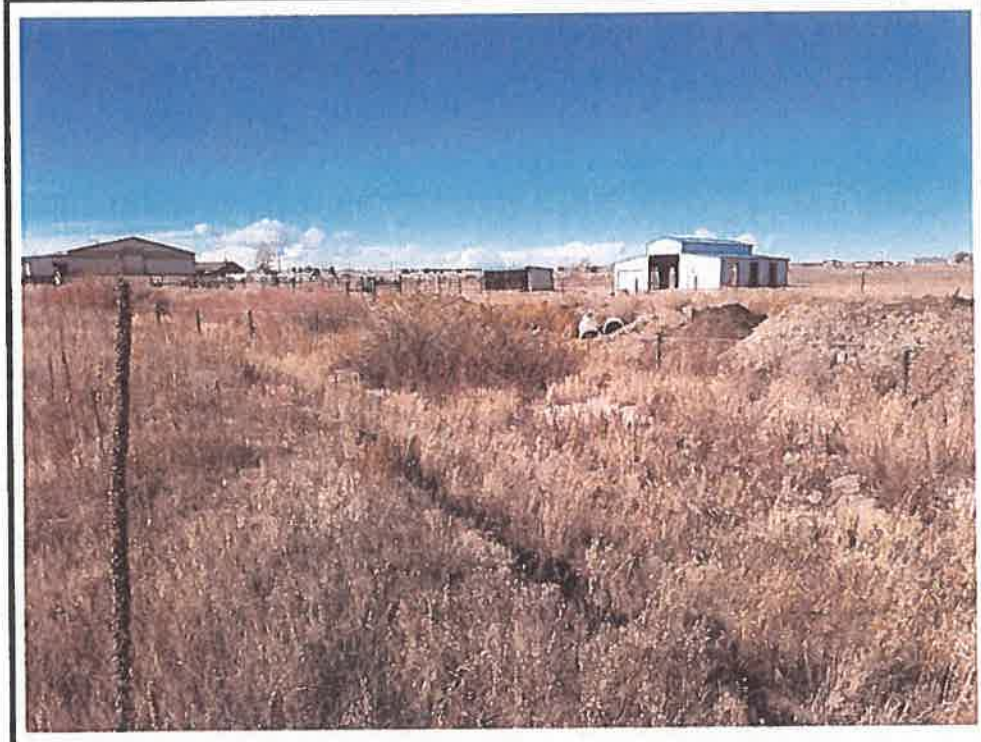
December 5, 2016

4

Looking west from the eastern portion of the property.

December 5, 2016

Job No. 160533



5

Flood zone and drainage northeast corner of the property.

December 5, 2016

6

Looking south from northern portion of the property.

December 5, 2016

Job No. 160533

7

Looking south along the berm and drainage from the northwest corner of the property.

December 5, 2016

8

Looking south from the northwest portion of the property.

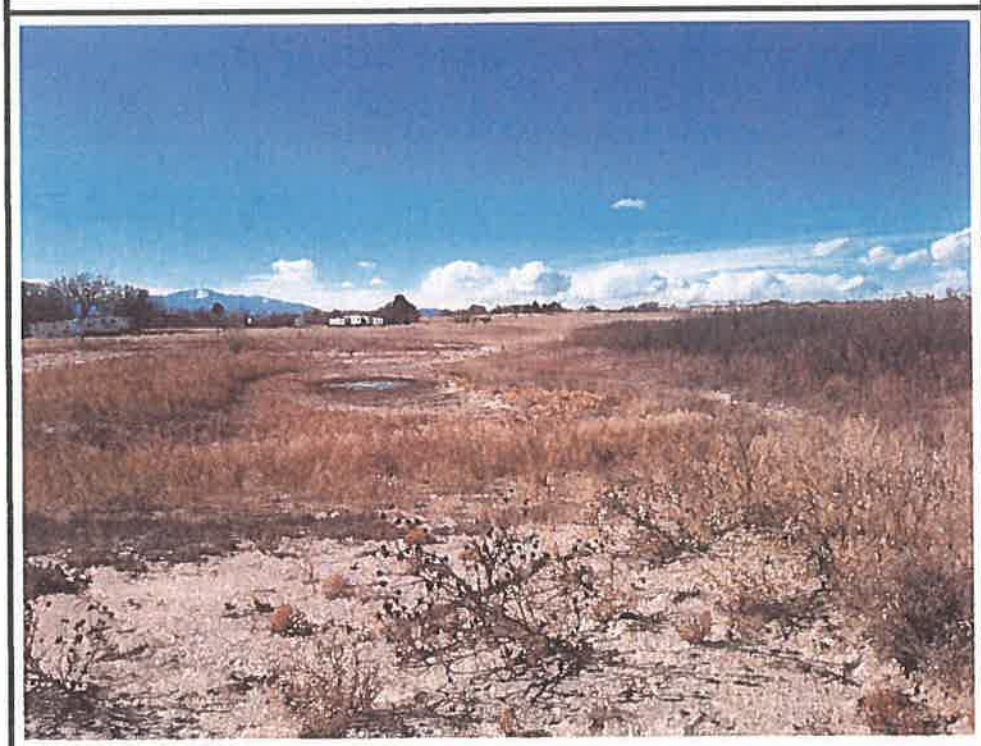
December 5, 2016

Job No. 160533

9

Looking south along berm and drainage on the west side of the property.

December 5, 2016



10

Looking west from the dam towards the pond.

December 5, 2016

Job No. 160533

11

Looking southwest from the east side of the dam towards existing house and travel trailers.

December 5, 2016

12

Looking southeast from the east side of the dam towards the proposed OWTS area.

December 5, 2016

Job No. 160533

APPENDIX B: Test Pit Logs and Test Boring Log from the Profile Hole

TEST PIT NO. 1
DATE EXCAVATED 12/5/2016
Job #

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil, sandy loam, dark brown	1			gr	m	2
gravelly sandy loam, fine to coarse grained, brown	2			gr	m	2
	3					
sandy clay, black-brown	4			gr	w	3A
	5					
weathered to formational sandy claystone, light gray brown	6			pl	s	5
	7					
	8					
	9					
	10					

TEST PIT NO. 2
DATE EXCAVATED 12/5/2016
CLIENT WILLIAM GUMAN & ASSOCIATES, LTD
LOCATION JUDGE ORR ROAD RV PARK

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil, sandy loam, dark brown	1			gr	m	2
gravelly sandy clay loam, fine to coarse grained, brown, with 1 - 2" sand lenses	2			gr	m	3
	3					
clay, olive gray	4			ma		4A
	5					
weathered to formational sandy claystone	6			pl	s	5
	7					
	8					
	9					
	10					

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST PIT LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/8/16

JOB NO.: 160533
FIG NO.: B-1

TEST PIT NO. 3
DATE EXCAVATED 12/5/2016
Job # 161944

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil, sandy loam, dark brown	1			gr	m	2
gravelly sandy loam, fine to coarse grained, brown	2			gr	m	2
	3					
	4					
	5					
weathered to formational sandy claystone, light gray brown	6			pl	s	5
	7					
	8					
	9					
	10					

TEST PIT NO. 4
DATE EXCAVATED 12/5/2016
CLIENT WILLIAM GUMAN & ASSOCIATES, LTD
LOCATION JUDGE ORR ROAD RV PARK

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil, sandy loam, dark brown	1					
gravelly sandy loam, fine to coarse grained, brown	2			gr	m	2
	3					
weathered to formational sandy claystone, light gray brown	4			pl	s	5
	5					
	6					
	7					
	8					
	9					
	10					

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST PIT LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/8/16

JOB NO.: 160533
FIG NO.: B-2

TEST BORING NO. 1
DATE DRILLED 12/5/2016
Job # 160533

TEST BORING NO.
DATE DRILLED
CLIENT WILLIAM GUMAN & ASSOC.
LOCATION JUDGE ORR ROAD RV PARK

REMARKS

WATER @ 17', 12/6/16

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			26	8.4	1	SAND, CLAYEY, FINE GRAINED, BROWN, MEDIUM DENSE TO DENSE, MOIST
5			35	11.5	1	
10			50/7"	11.3	4	SANDSTONE, VERY CLAYEY, FINE GRAINED, BROWN, VERY DENSE, MOIST
15			50/6"	12.5	4	
20			50/6"	9.8	4	

REMARKS

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5					
10					
15					
20					

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

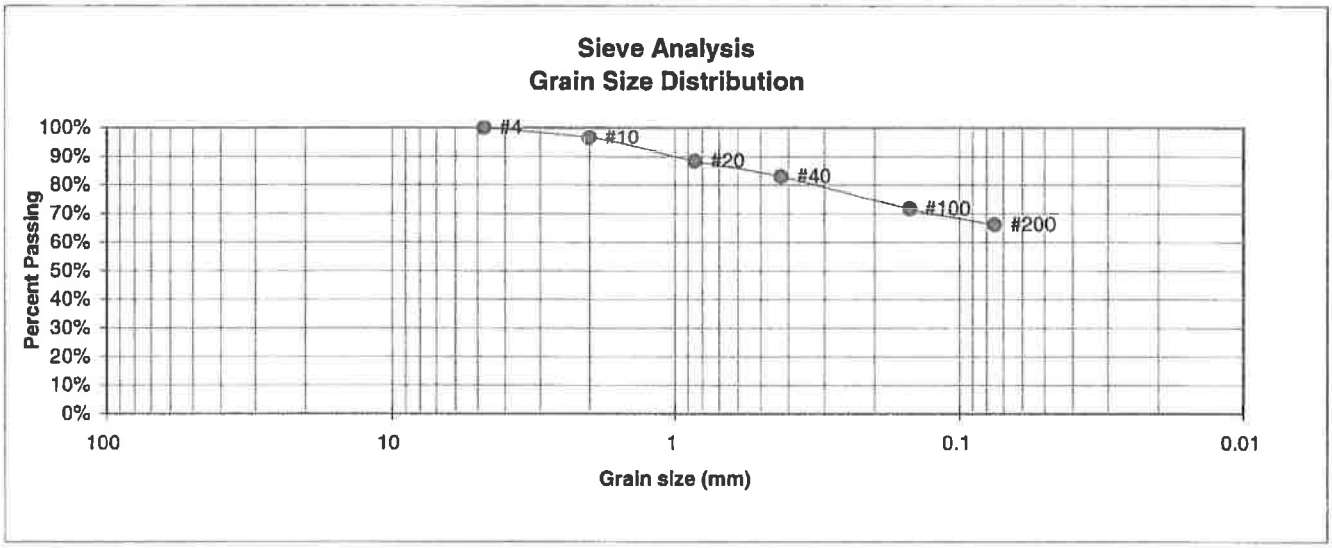
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: B-3

APPENDIX C: Laboratory Test Results

BORING NO.	TP-1	UNIFIED CLASSIFICATION	CL	TEST BY	BL
DEPTH(ft)	5-6	AASHTO CLASSIFICATION		JOB NO.	160533
CLIENT	WILLIAM GUMAN & ASSOC.				
PROJECT	JUDGE ORR ROAD RV PARK				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	96.5%
20	88.3%
40	83.0%
100	71.6%
200	66.2%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

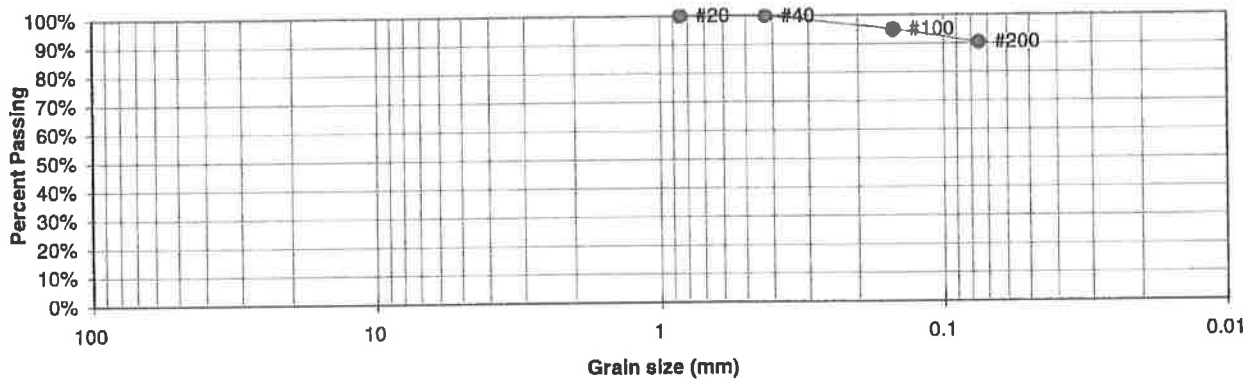
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/14

JOB NO.: 160533
FIG NO.: C-1

BORING NO.	TP-2	UNIFIED CLASSIFICATION	CL	TEST BY	BL
DEPTH(ft)	3-4	AASHTO CLASSIFICATION		JOB NO.	160533
CLIENT	WILLIAM GUMAN & ASSOC.				
PROJECT	JUDGE ORR ROAD RV PARK				

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	99.8%
100	94.8%
200	90.3%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

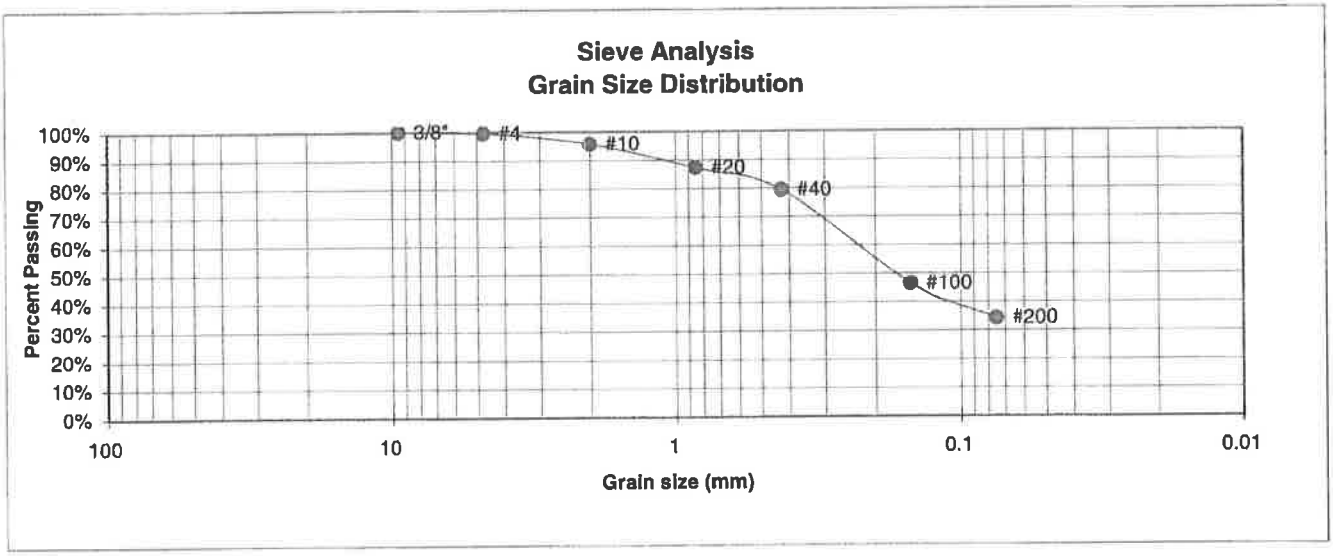
ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: L-2

BORING NO.	1	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	5	AASHTO CLASSIFICATION		JOB NO.	160533
CLIENT	WILLIAM GUMAN & ASSOC.				
PROJECT	JUDGE ORR ROAD RV PARK				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.6%
10	95.7%
20	87.3%
40	79.4%
100	46.4%
200	34.1%

Atterberg Limits

Plastic Limit	
Liquid Limit	
Plastic Index	

Swell

Moisture at start	7.7%
Moisture at finish	22.0%
Moisture increase	14.3%
Initial dry density (pcf)	103
Swell (psf)	430

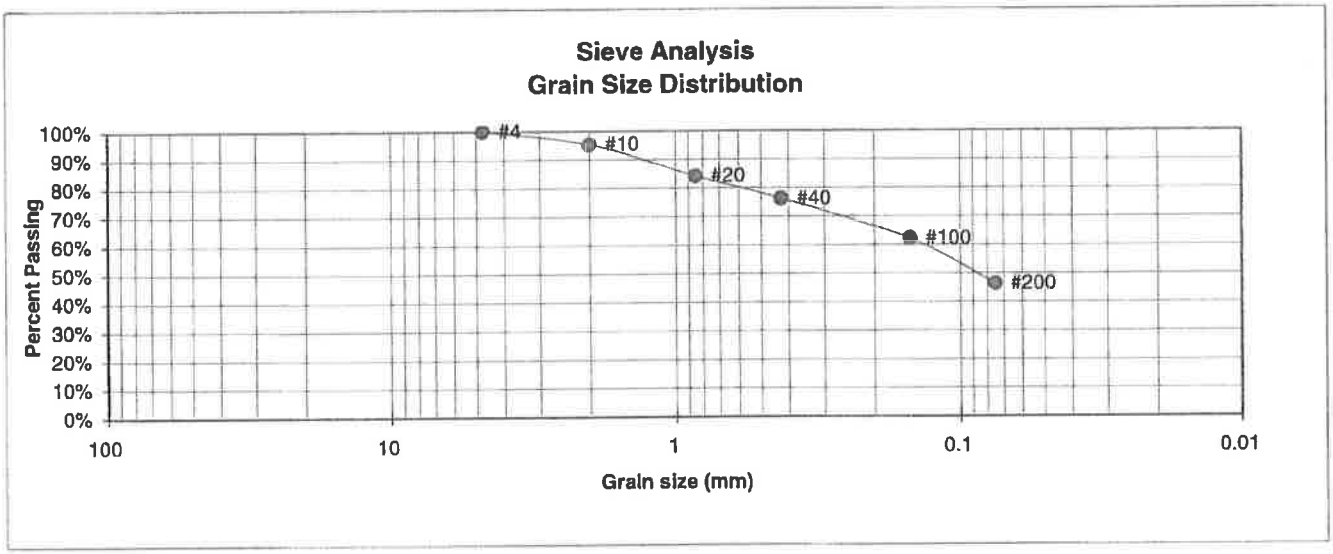
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: C-3

BORING NO.	1	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	15	AASHTO CLASSIFICATION		JOB NO.	160533
CLIENT	WILLIAM GUMAN & ASSOC.				
PROJECT	JUDGE ORR ROAD RV PARK				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	95.3%
20	84.1%
40	76.2%
100	62.0%
200	46.3%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

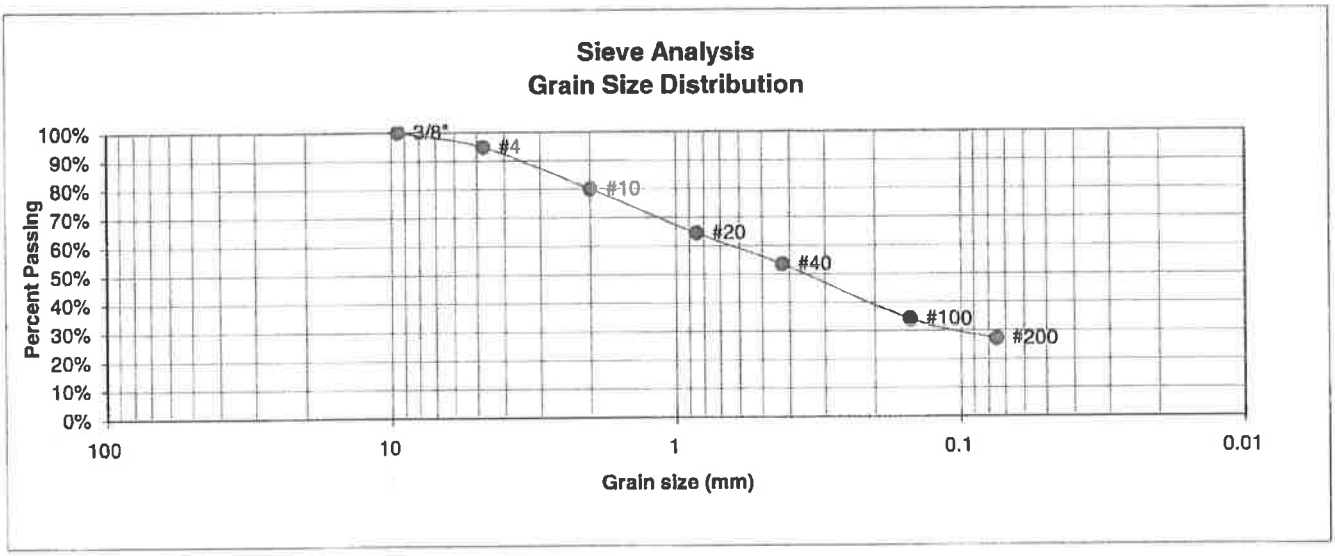
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: C-4

BORING NO.	P-1	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	GRAB	AASHTO CLASSIFICATION		JOB NO.	160533
CLIENT	WILLIAM GUMAN & ASSOC.				
PROJECT	JUDGE ORR ROAD RV PARK				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.8%
10	80.0%
20	64.4%
40	53.4%
100	33.9%
200	27.0%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

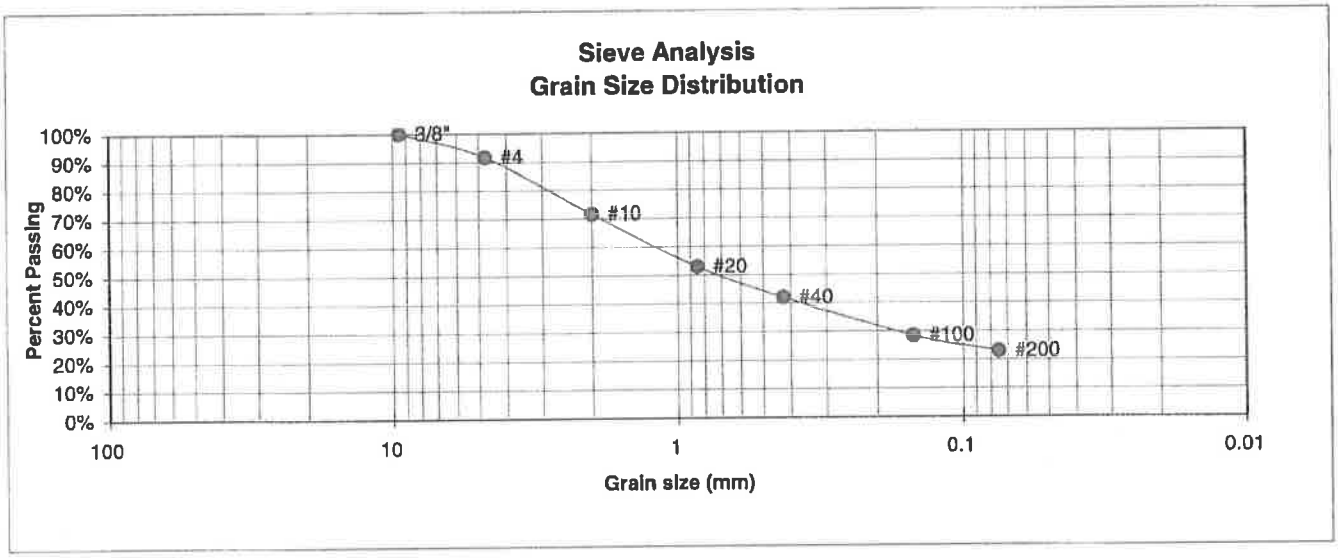
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: C-5

BORING NO.	P-2	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	GRAB	AASHTO CLASSIFICATION		JOB NO.	160533
CLIENT	WILLIAM GUMAN & ASSOC.				
PROJECT	JUDGE ORR ROAD RV PARK				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	91.7%
10	71.5%
20	52.9%
40	42.0%
100	28.4%
200	22.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

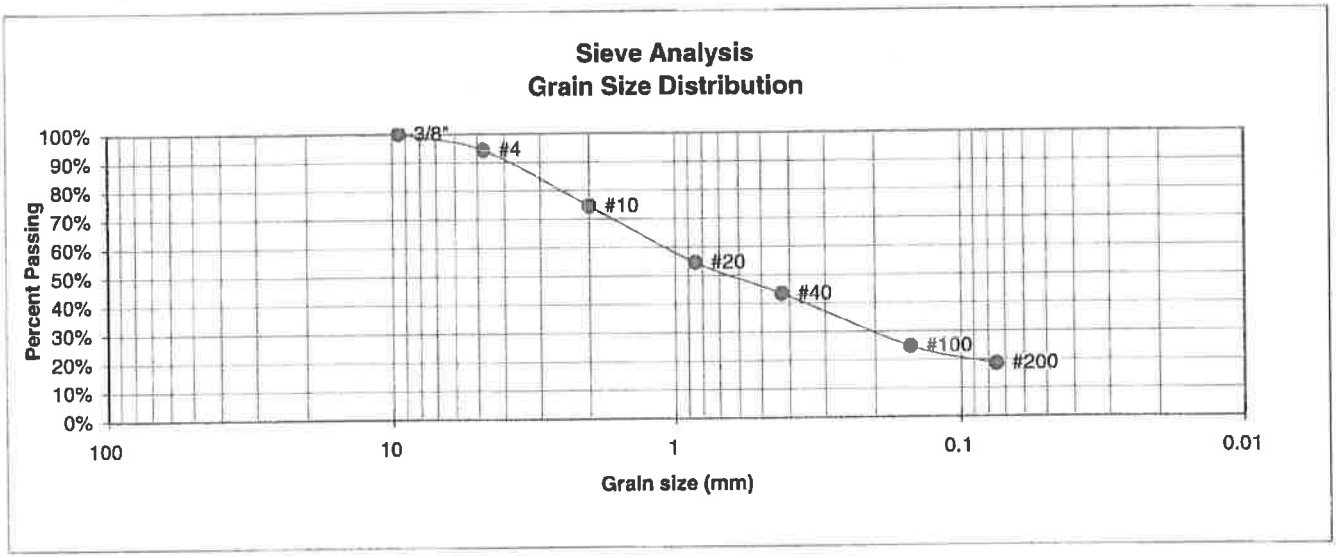
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: C-6

BORING NO.	P-3	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	GRAB	AASHTO CLASSIFICATION		JOB NO.	160533
CLIENT	WILLIAM GUMAN & ASSOC.				
PROJECT	JUDGE ORR ROAD RV PARK				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.1%
10	74.4%
20	54.5%
40	43.4%
100	24.7%
200	18.5%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

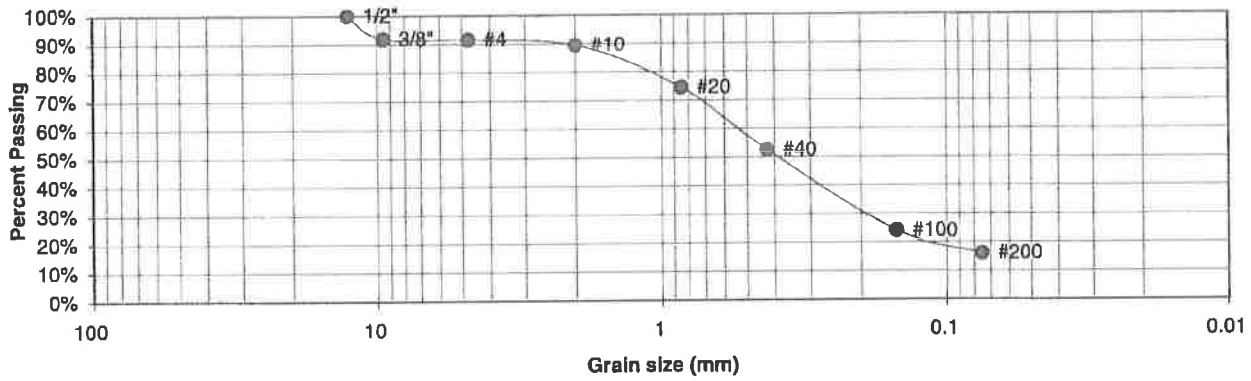
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: C-7

BORING NO.	P-4	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	GRAB	AASHTO CLASSIFICATION		JOB NO.	160533
CLIENT	WILLIAM GUMAN & ASSOC.				
PROJECT	JUDGE ORR ROAD RV PARK				

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	91.8%
4	91.5%
10	89.3%
20	74.4%
40	52.3%
100	23.8%
200	16.0%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: C-8

APPENDIX D: Soil Survey Descriptions

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

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

APPENDIX E: Percolation Test Results

Client: William Guman and Associates
Job Number: 160533
Test Location: Judge Orr Road RV Park

PERCOLATION HOLES

Date Holes Prepared: 12/5/2016
Date Hole Completed: 12/6/2016

Hole No. 1
Depth: 38"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 2
Depth: 42"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	1/8
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 3
Depth: 44"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/8
2	10	0
3	10	1/8

Perc Rate (min./in.): 80

Hole No. 4
Depth: 42"

Trial	Time (min.)	Water Level Change (in.)
1	10	1/4
2	10	3/8
3	10	1/4

Perc Rate (min./in.): 40

Average Perc Rate (min./in.) 70

PROFILE HOLE

Date Profile Hole Completed: 12/5/2016

Depth	Visual Classification	Remarks
0-8'	Sand, clayey, fine grained, brown	
8-20'	Sandstone, very clayey, fine grained, brown	Sandstone Bedrock at 8' Groundwater at 17'

26 Blows / ft. @ 2'
35 Blows / ft. @ 4'
50 Blows / 7" @ 9'

LTAR = 0.20 gallons per square foot per day.

Remarks: Designed system required due soil conditions and commercial use.

Observer: Graham Espenlaub
By:

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	12/13/16

JOB NO.: 160533
FIG NO.: E-1

Markup Summary

dsdlaforce (2)

Subject: Text Box
Page Label: 1
Author: dsdlaforce
Date: 6/28/2018 4:23:53 PM
Color:

Add "PCD File No. PPR-16-040"

Subject: Text Box
Page Label: 1
Author: dsdlaforce
Date: 6/28/2018 4:28:03 PM
Color:

Per Chapter 11 Section 11.3.3 of the El Paso County Drainage Criteria Manual recommendations for the foundation preparation and embankment construction shall be submitted with the complete design analysis for all permanent detention facilities.