Architectural
Structural
Geotechnical

RMG
Engineers / Architects

Materials Testing
Forensic
Civil/Planning

SOILS AND GEOLOGY STUDY

Winslow Drive
Estates at Cathedral Pines
El Paso County, Colorado

PREPARED FOR:

William Guman & Associates, Ltd
731 North Weber Street, Ste 10
Colorado Springs, CO 80903

JOB NO. 187749

June 24, 2022

Respectfully Submitted,

RMG – Rocky Mountain Group

Kelli Zigler

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Project Geologist

Reviewed by,

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Appendix A – Additional Reference Documents

Appendix B – *Geologic Hazards Evaluation and Wastewater Report, Parcel West of Winslow Drive North of Darr Drive, El Paso County, Colorado,* prepared by CTL Thompson, Project No. CS17101-105, dated May 2, 2008

Include a section in the GEOTECH report addressing the following section of the Drainage Criteria manual.

11.2.2 Detention Facility Construction

The construction of detention facilities which multi-use benefits can provide significant benefits when properly planned and designed. Controlled outlets for flood surcharge storage should be provided, and it is required that such outlets be designed to release at a rate that does not exceed the peak rate estimated under natural conditions for the design storms, or other discharge established by policy and/or the drainage basin planning study.

Report does not mention impoundment structure or design recommendations.

Adequate safety measures shall be provided with all detention facilities. A minimum 15-foot maintenance easement shall be provided around the perimeter of the impoundment and embankment areas. Access to the bottom of the pond from a public road shall be provided via a minimum 15-foot wide ramp at a slope no greater than twelve (12) percent.

The geologic conditions of the site shall be investigated in sufficient detail to determine the suitability for impoundment of surface water. Ground water level increases downstream of the geologic investigation should be consistent with the class of structure and the complexity of the local site geology.

Guidelines for conducting geotechnical investigations for State of Colorado jurisdictional dams are presented in the draft "Design Review Manual" for dams and dam safety (Colorado Office of the State Engineer, July 31, 1986).

A design engineer check list for State of Colorado jurisdictional dams is included as Attachment A of this chapter. For non-jurisdictional dams i.e., those that do not or would not fall under State of Colorado purview, the designer must evaluate the appropriate factors identified, in the engineer check list, for the hazard rating presented as Attachment A and as otherwise required by the City/County.

9/30/90

11.3.3 Embankment Structures

The width of the top of the embankment structure shall be a minimum of 12 feet for embankments less than 25 feet in height. Also, side slopes on embankment structures will vary with materials types used and shall be designed to produce a stable and easily maintained structure. A slope stability analysis shall be required on all Class 1 structures.

An allowance for settlement shall also be factored into the design for all embankment structures. Consideration shall also be given to limiting excessive seepage through the embankment and foundation that may lead to embankment erosion and structure instability for all Class 1 structures.

A geotechnical analysis and report prepared by a Colorado Professional Engineer with recommendations for the foundation preparation and embankment construction shall be submitted to the City/County Engineer with the complete design analysis for all permanent detention facilities.

11.4 Hydraulic Design Methods

1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in the SW ¼ of the SE ¼ of Section 2, Township 12 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado, and is generally located northwest of the intersection of Peregrine Way and Winslow Drive. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.1 Existing Land Use

The site currently consists of one parcel (per the El Paso County Assessor's website). It is approximately 35 acres. The parcel included is:

- Schedule No. 6200000411, current land use is classified as vacant land.

The current zoning is *"PUD, RR-5" – Planned Unit Development, Residential Rural.* The parcel is undeveloped land.

1.2 Project Description

The site consists of approximately 35 acres of undeveloped land. It is our understanding the existing 35 acres is to be subdivided into a total of eight new lots. The Proposed Lot Layout is presented in Figure 2.

Each new lot is to be serviced by an on-site wastewater treatment system (OWTS) and an individual domestic water supply well. The site is to be accessed from Winslow Drive.

2.0 QUALIFICATIONS OF PREPARERS

This Soils and Geology Study was prepared by a professional geologist as defined by Colorado Revised Statures section 34-1-201(3) and by a qualified geotechnical engineer as defined by policy statement 15, "Engineering in Designated Natural Hazards Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. (Ord. 96-74; Ord. 01-42)

The principle investigators for this study are Kelli Zigler P.G., and Tony Munger, P.E. Ms. Zigler is a Professional Geologist as defined by State Statute (C.R.S 34-1-201) with over 21 years of experience in the geological and geotechnical engineering field. Ms. Kelli Zigler holds a B.S. in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations throughout Colorado.

Tony Munger, P.E. is a licensed professional engineer with over 21 years of experience in the construction engineering (residential) field. Mr. Munger holds a B.S. in Architectural Engineering from the University of Wyoming.

3.0 STUDY OVERVIEW

The purpose of this investigation is to characterize the general geotechnical, geologic site conditions, and on-site wastewater treatment system (OWTS) feasibility and present our opinions of the potential effect of these conditions on the proposed development within El Paso County, Colorado. As such, our services exclude evaluation of the environmental and/or human, health related work products or recommendations previously prepared, by others, for this project.

Revisions to the conclusions presented in this report may be issued based upon submission of the Development Plan. This study has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC) specifically Chapter 8, last updated August 27, 2019. Applicable sections include 8.4.8 and 8.4.9, and the El Paso County Engineering Criteria Manual (ECM), specifically Appendix C last updated July 9, 2019.

3.1 Scope and Objective

The scope of this study is to include a physical reconnaissance of the site and a review of pertinent, publically available documents including, but not limited to, previous geologic and geotechnical reports, overhead and remote sensing imagery, published geology and/or hazard maps, design documents, etc.

The objectives of our study are to:

- Identify geologic conditions present on the site
- Analyze potential negative impacts of these conditions on the proposed site development
- Analyze potential negative impacts to surrounding properties and/or public services resulting from the proposed site development as it relates to existing geologic conditions
- Provide our opinion of suitable techniques that may be utilized to mitigate any potential negative impacts identified herein

This report presents the findings of the study performed by RMG-Rocky Mountain Group relating to the geologic conditions of the above-referenced site. Revisions and modifications to this report may be issued subsequently by RMG, based upon:

- Additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report
- Review of pertinent documents (development plans, plat maps, drainage reports/plans, etc.) not available at the time of this study
- Comments received from the governing jurisdiction and/or their consultants subsequent to submission of this document

3.2 Site Evaluation Techniques

The information included in this report has been compiled from several sources, including:

- Field reconnaissance
- Geologic and topographic maps
- Review of selected publicly available, pertinent engineering reports
- Available aerial photographs
- Subsurface exploration

- Visual and tactile characterization of representative site soil and rock samples
- Geologic research and analysis
- Proposed Development Plan provided by William Guman & Associates, Ltd.

Geophysical investigations were not considered necessary for characterization of the site geology. Monitoring programs, which typically include instrumentation and/or observations for changes in groundwater, surface water flows, slope stability, subsidence, and similar conditions, are not known to exist and were not considered applicable for the scope of this report.

3.3 Additional Documents

Additional documents reviewed during the performance of this study are included in Appendix A.

4.0 SITE CONDITIONS

4.1 Existing Site Conditions

The site is currently undeveloped. The site is generally located northwest of the intersection of Peregrine Way and Winslow Drive in El Paso County, Colorado and comprises approximately 35 acres. The site is zoned PUD, RR-5, Planned Unit Development, Residential Rural and is to be re-zoned RR-2.5. Adjacent properties to the north and east are zoned PUD, properties to the west are zoned PUD RR-5 and RR-5, and properties to the south are zoned RR-5.

4.2 Topography

Based on our site reconnaissance on March 21, 2022 and USGS 2019 topographic map of the Black Forest Quadrangle, the site generally slopes down from east to west with an elevation difference of approximately 52 feet across the site. There are three minor drainages that cross the site, from east to the west, as well as numerous smaller drainage swales that flow into the minor drainages. The drainages generally have moderately-defined channels and the majority of storm runoff is anticipated to be in the form of sheet flows along the lower portions of the drainage swales. The drainages discharge into Black Squirrel Creek approximately ¼ to ½-mile west of the site. The water levels in the drainage channel areas are anticipated to vary dependent upon local precipitation events. The drainage channel features can be seen in Figure 5, Engineering and Geology Map.

4.3 Vegetation

The site vegetation primarily consists of a dense stand of ponderosa pine forest traversing the property from north to south with native grasses, weeds, and small shrub undergrowth.

4.4 Aerial photographs and remote-sensing imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. Historically, the site has remained undeveloped, vacant land.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

It is our understanding the existing 35-acre site is to be subdivided into a total of eight new lots. Each new lot is to be serviced by an on-site wastewater treatment system (OWTS) and an individual water supply well. A previous *Geologic Hazards Investigation* was completed by CTL Thompson, Project No. CS17101-105, dated May 2, 2008, included in Appendix B, was reviewed and considered in the preparation of this study. The CTL report indicates the performance of two test holes on the site. Due to the age of the report, a new study has been requested. RMG did not perform additional test holes for this investigation.

Additionally, a *Wastewater Study* by RMG was performed in conjunction with this *Soils and Geology Study*. RMG performed four 8-foot deep test pits as part of the *Wastewater Study*.

The CTL test hole locations are presented on the Engineering and Geology Map, Figure 5. Additional descriptions of their findings are included below.

5.1 Test Holes (by others)

The *Geologic Hazards Investigation* report by CTL indicates approximately 1 foot of clayey sand overlying sandstone bedrock that extended to the 25-foot termination depth of the test holes.

5.2 Test Pit Excavations

Four test pits were performed by RMG to explore the subsurface soils for the proposed on-site wastewater treatment systems. The number of test pits is in accordance with the Regulations of the El Paso County Board of Health, Chapter 8, On-site Wastewater Treatment Systems (OWTS) as required by 8.5.D.3.a.

The test pits were excavated to 8 feet below the existing ground surface. Additional information is provided in Section 9.0, On-site Wastewater Treatment Systems. The Test Pit Logs are presented in Figure 4.

5.3 OWTS Visual and Tactile Evaluation

A visual and tactile evaluation was performed by RMG for the Wastewater Study. The soils information from the Wastewater Study was considered in the preparation of this study. The soils were evaluated to determine the soils types and structure for the use of the proposed OWTS for each lot. Bedrock was encountered in the test pits by RMG and in the test holes reported by CTL. Bedrock is anticipated to be encountered near the surface in the proposed locations of the treatment areas and foundation excavations. Bedrock as defined in the On-site Wastewater Treatment Systems Regulations, El Paso County, Chapter 8 is a *"continuous rock that underlies the soils or is exposed at the surface. Bedrock is generally considered impervious, but if fractured or deteriorated, it may allow effluent* (water/moisture) *to pass through without adequate treatment".* Therefore, some bedrock is acceptable for treatment areas, as long a "limiting condition" is not encountered. Limiting conditions are defined as, *"a layer with low permeability, groundwater surface or other condition that restricts the treatment capability or movement of wastewater* (water/moisture) *through the soil.*

5.4 Laboratory Testing (by others)

Soil laboratory testing was not performed as part of this study. However, the laboratory test results reported by CTL were considered in the preparation of this report and are included in Appendix B.

5.5 Groundwater

Groundwater or indications of redox conditions were not encountered in the test pits performed by RMG on March 31, 2022 or reported in the test holes performed by CTL around May 2008.

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

The site is located within the central portion of the Great Plains Physiographic Province. A major structural feature known as the Rampart Range Fault is located approximately 8.5 miles west of the site. The Rampart Range Fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southern portion of a large structural feature known as the Denver Basin. In general, the geology at the site consists of alluvial and colluvial deposits overlying the bedrock of the Upper part of the Dawson Formation. The alluvium generally consist of loam, sand, sandy clay and clayey sand. The upper part of the Dawson Formation is generally comprised of the arkosic sandstone, claystone, mudstone, conglomerate and localized coal beds.

6.1 Subsurface Soil Conditions

The subsurface soils encountered in the test pit excavations observed by RMG were classified using the United States Department of Agriculture (USDA). The on-site soils classified as sandy clay loam, clay loam, silty clay loam, clay, and sand. The subsurface soils encountered in the test holes performed by CTL were limited to approximately less than 1-foot of clayey sand.

The classifications shown on the test pit logs are based upon the engineer's classification of the samples at the depths indicated. Stratification lines shown on the logs represent the approximate boundaries between material types and the actual transitions may be gradual and vary with location.

6.2 Bedrock Conditions

Bedrock (as defined by USDA Soil Structure and Grade) was encountered in the test pit excavations performed for this investigation and within the test holes preformed previously by CTL. In general, the bedrock (as defined by Colorado Geologic Survey) beneath the site is considered to be part of the Upper Dawson Formation – facies unit four which consists of very thick bedded to massive, cross-bedded, light-colored arkose, pebbly arkose, and arkosic pebble conglomerate. Unit four also contains numerous beds of white to light-tan, fine- to medium-grained, feldspathic cross-bedded friable sandstone. The Dawson formation is thick-bedded to massive, generally light colored arkose, and pebbly. The sandstones are poorly sorted with high clay contents. The sandstone is generally permeable, well drained, and has good

foundation characteristics. The Dawson sandstone is generally not considered a restrictive layer for OWTS.

6.3 U.S. Soil Conservation Service

The U.S. Soil Conservation Service along with United States Department of Agriculture (USDA) identifies the site soils as:

- 41 – Kettle gravelly loamy sand, 8 to 40 percent slopes. Properties of the gravelly loamy sand include somewhat excessively drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and ponding is none, and landforms include hills.

The USDA Soils Survey Map is presented in Figure 6.

6.4 General Geologic Conditions

Based on our field observations and review of relevant geologic maps, a geologic map was prepared which identifies the geologic conditions affecting the development. The geologic conditions affecting the development are presented in the Engineering and Geology Map, Figure 5.

The site generally consists of alluvial and colluvial deposits overlying sandstone bedrock of the Upper Dawson Formation. Three geologic units were mapped at the site as:

- *TKda4 – Dawson Formation Facies Unit Four* – The unit is dominated by very thick bedded to massive, cross-bedded, light-colored arkose, pebbly arkose, and arkosic pebble conglomerate. Unit four contains numerous beds of white to light-tan, fine- to medium-grained, feldspathic cross-bedded friable sandstone. The sandstones are poorly sorted, have high clay content, and are commonly thin or medium bedded. The unit is about 400 feet thick at the southwestern edge of the quadrangle but appears to be thinning to the southeast. Facies unit four is generally permeable, well drained, and has good foundation characteristics.
- *cac – Arkosic loamy colluvium and sheetwash alluvium* – light-gray, reddish-brown, and olive-brown loam, sand, and sandy clay; locally gravelly, including large boulders. The unit includes remnants of intensely weathered, clayey and sandy gravel pediment and terrace alluvium at various high topographic levels above modern streams. Map unit includes channel and floodplain alluvium of intermittent streams, mostly sandy clay to clayey sand, gravelly at the base. Colluvium and sheetwash generally are 0.3-1.5 meters thick.
- *psw – Potentially Seasonally Wet area*. These areas should be avoided when selecting the locations of the proposed residence and OWTS for each lot.

6.5 Engineering Geology

Charles Robinson and Associates (1977) have mapped two environmental engineering units at the site as:

- *2A* – Stable alluvium, colluvium and bedrock on gentle to moderate slopes (5%-12%)
- *3A* – Stable alluvium, colluvium and bedrock on moderate to steep slopes (12%-24%)

6.6 Structural Features

Structural features such as schistocity, folds, zones of contortion or crushing, joints, shear zones or faults were not observed on the site, in the surrounding area, or in the soil samples collected for laboratory testing.

6.7 Surficial (Unconsolidated) Deposits

Lake and pond sediments, swamp accumulations, sand dunes, marine terrace deposits, talus accumulations, creep, or slope wash were not observed on the site. Slump and slide debris were also not observed on the site.

6.8 Features of Special Significance

Features of special significance such as accelerated erosion, (advancing gully head, badlands, or cliff reentrants) were not observed on the property. Erosion is present along the creek banks, but it appears to be gradual and slow due to the hard, shallow sandstone bedrock. Features indicating settlement or subsidence such as fissures, scarplets, and offset reference features were not observed on the study site or surrounding areas. Features indicating creep, slump, or slide masses in bedrock and surficial deposits were not observed on the property.

6.9 Drainage of Water and Groundwater

The overall topography of the site slopes down from the east to west. Multiple drainage channels also traverse the site from east to west. It is anticipated the direction of surface water and groundwater generally flow in the same direction. Groundwater was not encountered in the test pits performed for this study or indicated in the referenced report by CTL. Based on this information, groundwater is not anticipated to be encountered at depths that would restrict basement foundations.

6.10 Flooding and Surface Drainage

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0315G and the online ArcGIS El Paso County Risk Map, the entire site lies outside of identified 100 or 500-year floodplains. The site lies in Zone X. Zone X is defined by FEMA as an area of minimal flood hazard that is determined to be outside the Special Flood Hazard Area and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The FEMA Map is presented in Figure 7.

7.0 ECONOMIC MINERAL RESOURCES

Under the provision of House Bill 1529, it was made a policy by the State of Colorado to preserve for extraction commercial mineral resources located in a populous county. Review of the *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction*, *Map 1* indicates the site is not mapped within an aggregate mineral resource area. Extraction of the sand, gravel, silt or clay more than likely would not be considered to be economical compared to materials available elsewhere within the county.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the southern part of the Denver Basin Coal Region with the tract identifier 41-04. However, the area of the site has been mapped “Poor" for coal resources. The tract contains strata

that may contain coal but no coal occurrences are within five miles. The tract is not prospective for metallic mineral resources. No oil and gas wells are drilled on this tract, or within two miles of it. The sedimentary rocks in this area appear to contain all the essential elements; however, existing geological controls insufficient to determine the presence of a trap or reservoir. This tract is unlikely to host industrial minerals or construction materials. In this part of the Denver coal region, coal resources are present within the lower part of the Laramie Formation of Upper Cretaceous age. In the vicinity of this tract, the coal-bearing beds of the Laramie Formation lie at a depth of greater than 2,500 feet. It is possible that the tract contains coal resources at this depth. The coal seams in the Laramie Formation tend to be lenticular and discontinuous in comparison to areas currently being mined in western Colorado.

8.0 IDENTIFICATION AND MITIGATION OF POTENTIAL GEOLOGIC CONDITIONS

The El Paso County Engineering Criteria Manual recognizes and delineates the difference between geologic hazards and constraints. A *geologic hazard* is one of several types of adverse geologic conditions capable of causing significant damage or loss of property and life. Geologic hazards are defined in Section C.2.2 Sub-section E.1 of the ECM. A *geologic constraint* is one of several types of adverse geologic conditions capable of limiting or restricting construction on a particular site. Geologic constraints are defined in Section C.2.2 Sub-section E.2 of the ECM (1.15 Definitions of Specific Terms and Phrases). The following geologic conditions were considered in the preparation of this report. They are not are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow-Fans/Mudslides
- Floodplains
- Ground Subsidence
- Landslides
- Rockfall
- Ponding water
- Uncontrolled and Undocumented Fill
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Corrosive Minerals

The following section presents the geologic conditions that have been identified on the property:

8.1 Expansive Soils

Based on the test pits performed by RMG for this investigation, our review of the previous CTL investigation, and our experience with similar materials in this area, the upper silty to clayey sand possesses low swell potential. However, the underlying sandstone of the Dawson formation is known to have interbedded sandy claystone seams that exhibit moderate to high swell potential in some locations. It is anticipated that expansive materials may be encountered on some lots at depths that would affect residential foundations. If these materials are encountered in the excavations for the proposed residences, they can readily be mitigated with typical construction practices common to this region of El Paso County, Colorado.

Mitigation

Foundation design and construction are typically adjusted for expansive soils. This may include overexcavation and replacement with non-expansive structural fill and/or the use of an intermittent (voided) footing. Drilled piers are not anticipated to be required, but may be considered as an alternative to other mitigation measures. Floor slabs bearing directly on expansive soils are expected to experience movement. One form of mitigation to reduce this movement is to overexcavate the expansive materials below floor slabs and replace with compacted non-expansive soils. This method has been successful in reducing slab movement.

If expansive soils or bedrock are encountered during construction, mitigation of these expansive materials should follow the recommendations presented in a lot-specific subsurface soil investigation performed for each proposed structure.

8.2 Compressible Soils

Based on the test pits performed by RMG for this investigation, our review of the previous CTL investigation, and our experience with similar materials in this area, the site is anticipated to contain a limited upper layer of silty to clayey sand. Generally, these soils possess low compressibility potential. It's likely that most foundation components will bear at an elevation below these loose materials. However, if loose and/or compressible soils are encountered in the excavations for the proposed residences, they can readily be mitigated with typical construction practices common to this region of El Paso County, Colorado. Foundation design and construction are typically adjusted for loose and/or compressible soils.

Mitigation

Mitigation of loose and/or compressible soils may include overexcavation and replacement with non-expansive structural fill. Drilled piers are not anticipated to be required. Floor slabs bearing directly on loose and/or compressible soils are expected to experience movement. One form of mitigation to reduce this movement is to overexcavate the loose and/or compressible materials and replace and recompact the soils. This method has been successful in reducing slab movement.

If loose and/or compressible soils are encountered during construction, mitigation of these loose and/or compressible soils should follow the recommendations presented in a lot-specific subsurface soil investigation.

8.3 Faults and Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS located at http://dnrwebmapgdev.state.co.us/CGSOnline/ and the recorded information dating back to November of 1900, Colorado Springs has not experienced a recorded earthquake with a magnitude greater than 1.6 during that period. The nearest recorded earthquakes over 1.6 occurred in December of 1995 in Manitou Springs, which experienced magnitudes ranging between 2.8 to 3.5. Additional earthquakes over 1.6 occurred between 1926 and 2001 in Woodland Park, which experienced magnitudes ranging from 2.7 to 3.3. Both of these locations are located near the Ute Pass Fault, which is greater than 10 miles from the subject site.

Earthquakes felt at this site will most likely result from minor shifting of the granite mass within the Pikes Peak Batholith, which includes pull from minor movements along faults found in the Denver basin. It is

our opinion that ground motions resulting from minor earthquakes may affect structures (and the surrounding area) at this site if minor shifting were to occur.

Mitigation
The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.202g for a short period (S_s) and 0.057g for a 1-second period (S_1). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with average shear wave velocities ranging from 2,500 to 5,000 feet per second for the materials in the upper 100 feet.

8.4 Radon

***"Radon Act 51** passed by Congress set the natural outdoor level of radon gas (0.4 pCi/L) as the target radon level for indoor radon levels".*

Northern El Paso County and the 80908 zip code in which the site is located, has an EPA assigned Radon Zone of *1*. A radon Zone of *1* predicts an average indoor radon screening level greater than 0.4 pCi/L (picocuries per liter), which is above the recommended levels assigned by the EPA. *The EPA recommends corrective measures to reduce exposure to radon gas.*

All of the State of Colorado is considered EPA Zone 1 based on the information provided at https://county-radon.info/CO/El_Paso.html. Elevated hazardous levels of radon from naturally occurring sources are not anticipated at this site.

Mitigation
Radon hazards are best mitigated at the building design and construction phases. Providing increased ventilation of basements, crawlspaces, creating slightly positive pressures within structures, and sealing of joints and cracks in the foundations and below-grade walls can help mitigate radon hazards. Passive radon mitigation systems are also available.

Passive and active mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Measures that can be taken after the residence is enclosed during construction include installing a blower connected to the foundation drain and sealing the joints and cracks in concrete floors and foundation walls. If the occurrence of radon is a concern, it is recommended that the residence be tested after they are enclosed and commonly utilized techniques are in place to minimize the risk.

8.5 Scour, Erosion, Accelerated Erosion Along Drainageways

Scour generally refers to a localized loss of soil, often around a foundation element(s). Erosion generally refers to lowering the ground surface over a wide area.

Three apparent minor drainages cross the site from east to the west. The water levels within the drainage areas are anticipated to vary, depending upon local precipitation events. Visible evidence of significant and ongoing scour along the drainage areas were not observed, but slow localized erosion is anticipated along the drainage banks. With proper consideration to the home and OWTS placement, the drainageways can readily be avoided. As such, it is our opinion that additional improvements are not required within the drainage areas at this time.

Mitigation

Based on the location and alignment of the drainageways, it is anticipated that construction is to be located outside of the potentially seasonally wet areas. Significant care should be taken (both during construction and in the final grading of the lot) to divert surface drainage and downspout discharge water around the structure to a location that will not significantly alter the overall drainage of the development or result in the need for additional drainage mitigation measures at the time of construction on nearby lots.

Proposed drainage improvements should mitigate any potential localized surficial sloughing and erosion of the site.

8.6 Shallow Groundwater and/or Perched Groundwater on Shallow Bedrock

No obvious indications of shallow groundwater or perched groundwater were observed at or adjacent to the site at the time of our site reconnaissance, during our test pit observations, or reported within the test holes performed by CTL.

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

Mitigation

It is our opinion that at this time there is no evidence to raise the grade and/or limit the possibility of basement foundations. If shallow groundwater or perched groundwater conditions are encountered during the site-specific subsurface soil investigations and/or open excavation observations, mitigations may include a combination of surface and subsurface drainage systems, vertical drainboard, etc. Depending on the conditions encountered at that time, foundations may be limited to non-basement (crawlspace and/or main level slab-on-grade) construction. **The feasibility of basement construction should be re-evaluated at the time of the site-specific subsurface soil investigation for each lot and again at the open excavation observation for each proposed structure, based on conditions encountered at those times.**

In general, if underground water was encountered within 4 to 6 feet of the proposed foundation slab elevation, an underslab drain should be anticipated in conjunction with the perimeter drain. Perimeter drains are anticipated for each individual lot. It must be understood that the drain is designed to intercept some types of subsurface moisture and not others. Therefore, the drain could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement area.

8.7 Shallow Hard Bedrock

Shallow hard bedrock was not encountered in the test pits observed by RMG. However, as indicated in the two test holes by CTL, the sandstone bedrock was encountered near the surface. Based on our visual observations of the backhoe performance while excavating the test pits and the blow counts recorded by CTL in the two test holes, it is anticipated the upper 8 to 10 feet of sand and sandstone can be readily excavated with typical construction equipment.

Mitigation

Layers of cemented hard rock will likely be encountered at depths greater than 10 feet, but occasional more shallow hard layers of bedrock may also be encountered at shallower depths. Although the use of

specialized heavy equipment to facilitate rock removal and breakup is not anticipated to be required throughout, in some cases, rock teeth or rock buckets maybe needed to complete some excavations.

9.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in Section 8.0 of this report) found to be present at this site include faults/seismicity and radioactivity/radon. Geologic conditions (as described in section 8.0 of this report) found to be present at this site include expansive soils and compressible soils. It is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and construction practices.

10.0 ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site for future development. Unless indicated otherwise, the test pits, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction.

A lot-specific subsurface soil investigation will be required for all proposed structures including (but not limited to) residences, and retaining walls, etc.

11.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified are considered typical for the Front Range region of Colorado. Mitigation of geologic conditions is most effectively accomplished by avoidance. However, where avoidance is not a practical or acceptable alternative, geologic conditions should be mitigated by implementing appropriate planning, engineering, and suitable construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be considered. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. A typical perimeter drain detail is presented in Figure 8. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil.

We believe the sandy clay loam, silty clay loam, clay and clay loam will classify as Type A materials and the sand will classify as Type C materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type A and C materials be laid back at ratios no steeper than 3/4:1 (horizontal to vertical) and 1 1/2:1 (horizontal to vertical), respectively, unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer.

Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that long term fill slopes be no steeper than 3:1 (horizontal to vertical).

Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction, which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

It is important for the Owner(s) of the property to read and understand this report, and to carefully familiarize themselves with the geologic hazards associated with construction in this area. This report only addresses the geologic constraints contained within the boundaries of the site referenced above.

The foundation systems for the proposed single-family residential structures and any retention/detention facilities should be designed and constructed based upon recommendations developed in a site-specific subsurface soil investigation.

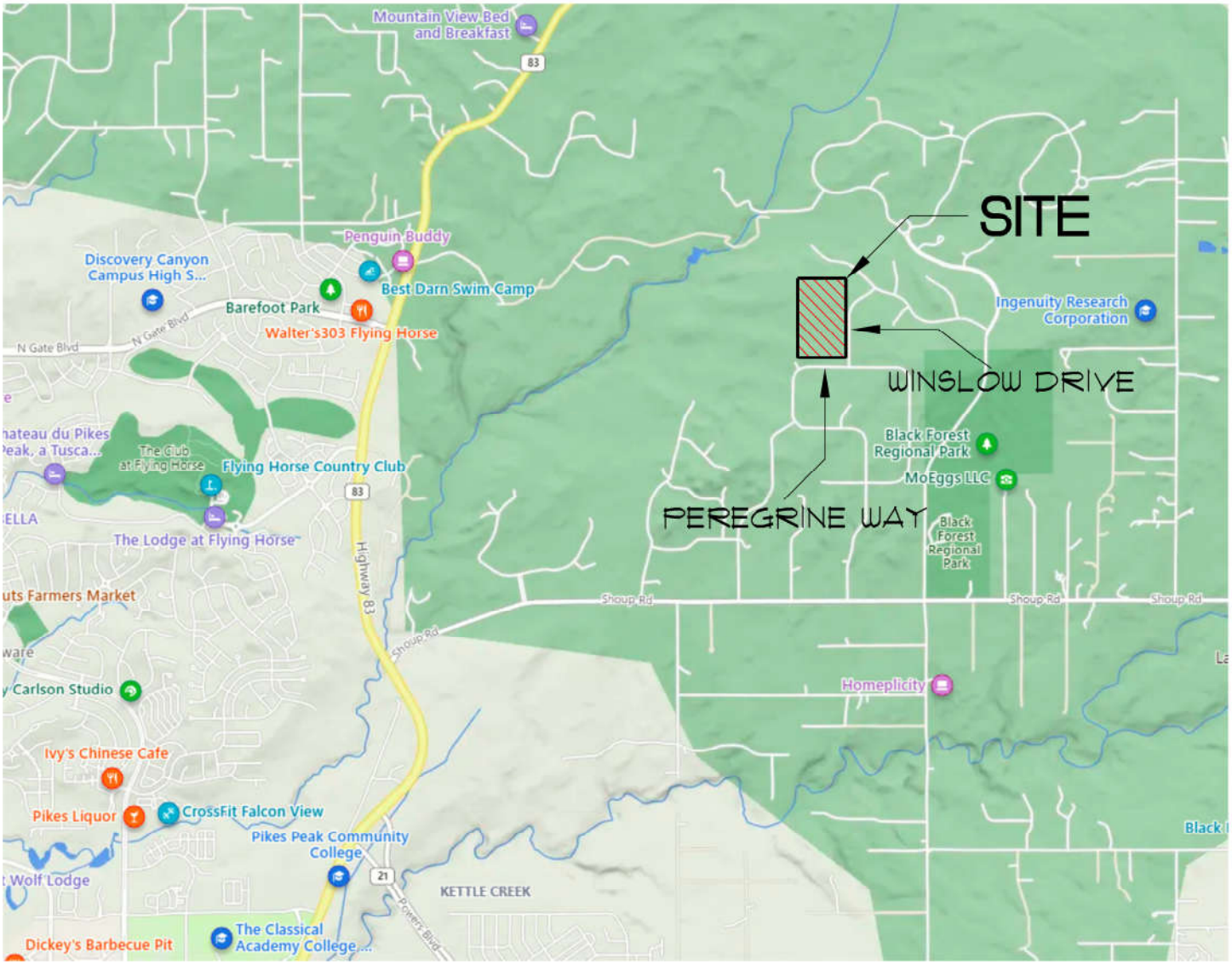
12.0 CLOSING

This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to, biological or toxicological issues, are beyond the scope of this report. If the owner is concerned about the potential for such contamination or conditions, other studies should be undertaken.

This report has been prepared for **William Guman & Associates, Ltd.** in accordance with generally accepted geotechnical engineering and engineering geology practices. The conclusions and recommendations in this report are based in part upon data obtained from review of available topographic and geologic maps, review of available reports of previous studies conducted in the site vicinity, a site reconnaissance, and research of available published information, soil test borings, soil laboratory testing, and engineering analyses. The nature and extent of variations may not become evident until construction activities begin. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers and engineering geologists practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied, is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

FIGURES



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SITE VICINITY MAP

ESTATES AT CATHEDRAL PINES
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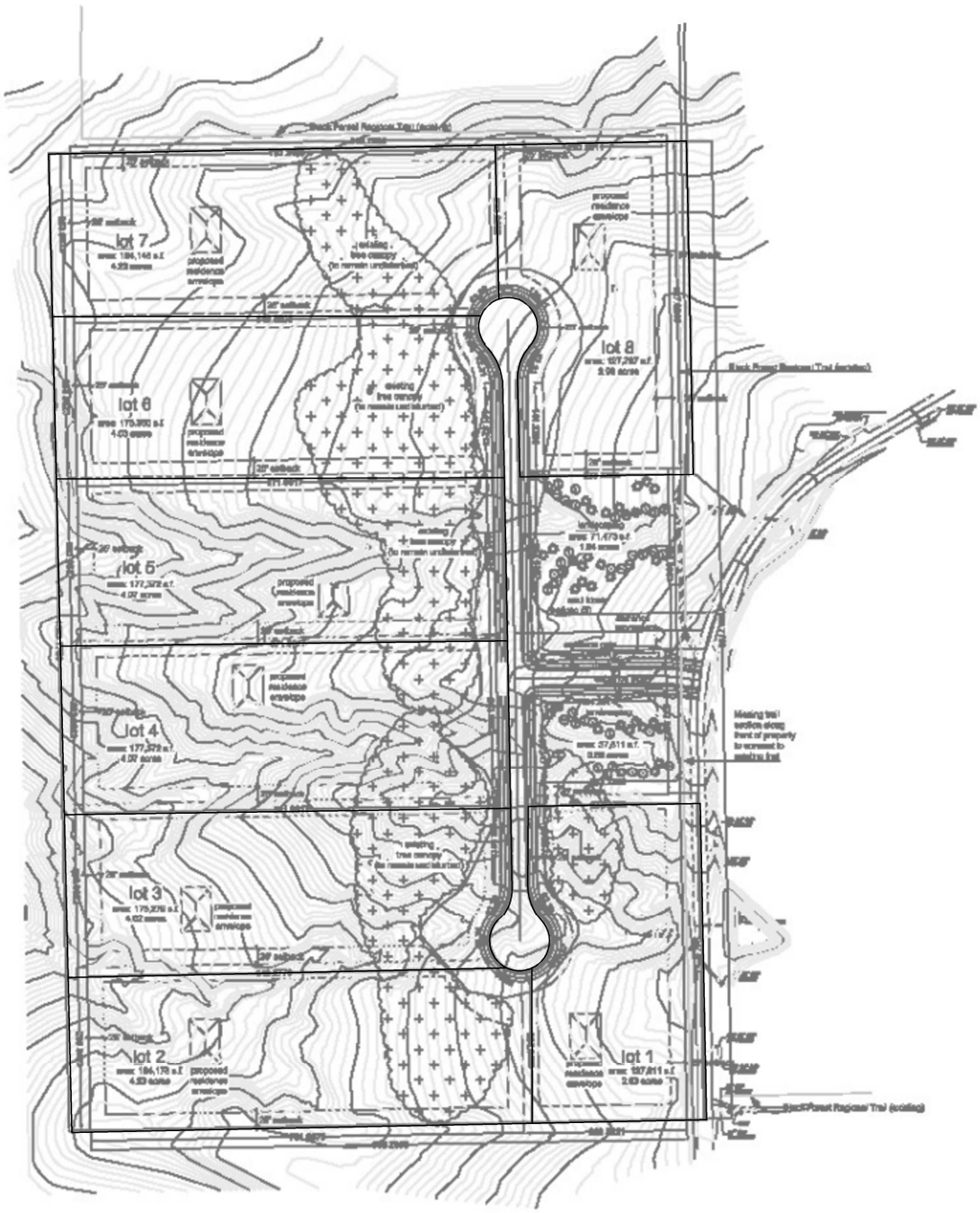
FIG No. 1

DATE 6-24-2022



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PROPOSED LOT LAYOUT

WINSLOW DRIVE
ESTATES AT CATHEDRAL PINES
EL PASO COUNTY, COLORADO
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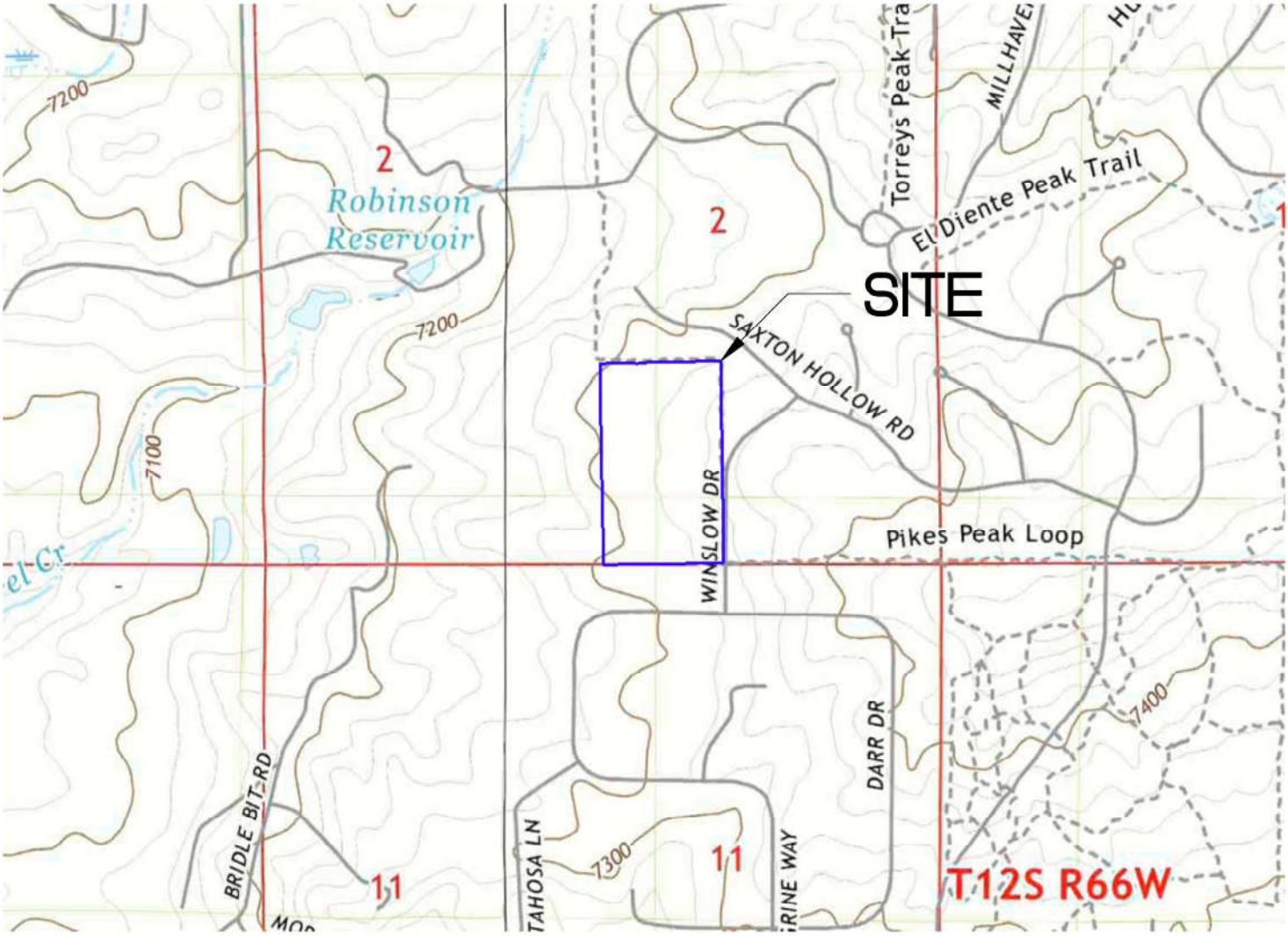
FIG No. 2

DATE 6-24-2022
REV 12-6-2022



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USGS TOPO MAP

WINSLOW DRIVE
ESTATES AT CATHEDRAL PINES
EL PASO COUNTY, COLORADO
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FIG No. 3

DATE 6-24-2022

TEST PIT TP-1

DATE OBSERVED: 3/31/22

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT SANDY CLAY LOAM (STRONG)	2ft 4ft 6ft 8ft		3

TEST PIT TP-2

DATE OBSERVED: 3/31/22

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 2.0 FT CLAY LOAM (STRONG)	2ft		3
2.0 - 8.0 FT SANDY CLAY LOAM (MODERATE)	4ft 6ft 8ft		3

SOIL DESCRIPTIONS

CLAY LOAM

SANDY CLAY LOAM

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TEST PIT LOGS

WINSLOW DRIVE
ESTATES AT CATHEDRAL PINES
EL PASO COUNTY, COLORADO
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FIG No. 4
pg. 1 of 2

DATE 6-24-2022

TEST PIT TP-3

DATE OBSERVED: 3/31/22

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 8.0 FT CLAY LOAM (MODERATE)	2ft 4ft 6ft 8ft		3

TEST PIT TP-4

DATE OBSERVED: 3/31/22

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 1.5 FT SILTY CLAY LOAM (STRONG)			4
1.5 - 5.5 FT CLAY (MODERATE)	2ft 4ft		4
5.5 FT - 8.0 FT SAND (STRUCTURELESS)	6ft 8ft		1

SOIL DESCRIPTIONS

- CLAY LOAM
- SAND
- SILTY CLAY LOAM
- CLAY

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TEST PIT LOGS

WINSLOW DRIVE
ESTATES AT CATHEDRAL PINES
EL PASO COUNTY, COLORADO
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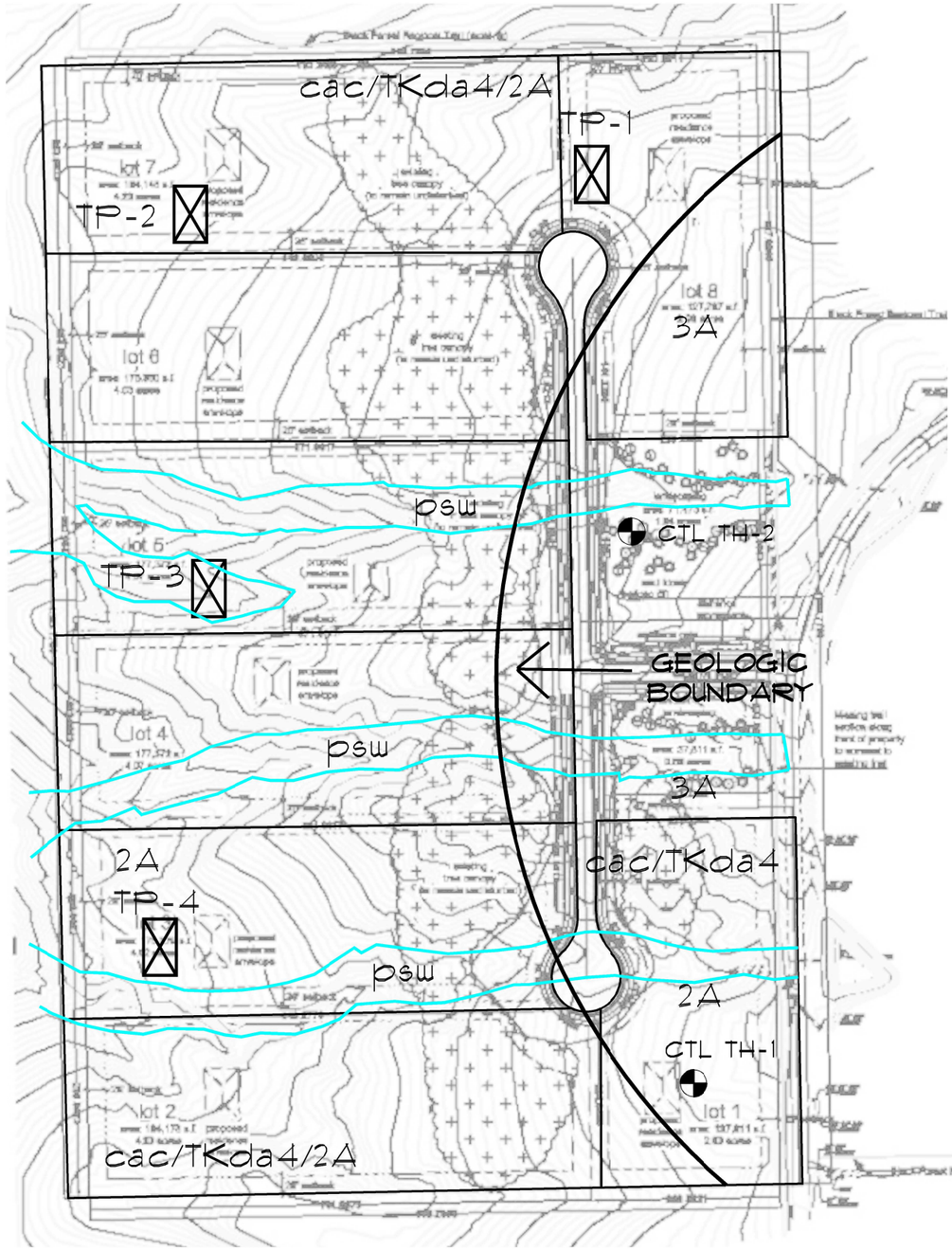
JOB No. 187749

FIG No. 4
pg. 1 of 2

DATE 6-24-2022



REFERENCE
NOT TO SCALE

Provide borings per ECM C.3.3.B. and C.3.3.D

B. Frequency of Borings.

The following represent the minimum number of borings that are required based on a typical improvements project. The number of borings may be increased based on the geotechnical engineer's recommendations or at the request of the ECM Administrator.

- A minimum of 2 borings for each project with public improvements shall be performed.
- A minimum 1 boring for each SCS (NRCS) soil type within a development shall be performed.
- A minimum of 1 boring shall be performed for each 10 acres of development up to 100 acres. One additional boring shall be performed for every 25 acres of development above the 100 acres.

C. Borings for Structures.

The boring frequency for transportation structures shall satisfy AASHTO Bridge Design requirements and CDOT Materials Testing requirements.

D. Depth of Borings.

Borings shall be performed to a minimum depth of 20 feet. In areas where the cut depths are expected to exceed 8 feet, borings shall be extended to a minimum of 15 feet below proposed finished grade. Borings shall extend deeper if needed to determine if bedrock or high groundwater levels are design concerns. Samples for structures shall be taken to a minimum depth of 10 feet below the footing elevation. Additional depth may be required for piers or piles.

It should be noted that boring depths will ultimately be determined by the geotechnical engineer based on site conditions. However, when depths different than those presented is performed, documentation as to the difference must be presented in the submitted report.

DENOTES APPROXIMATE LOCATION OF TEST PITS OBSERVED BY RMG FOR THIS STUDY

DENOTES APPROXIMATE LOCATION OF TEST HOLES PERFORMED BY CTL THOMPSON, PROJECT NO. CS11101-105 DATED MAY 2, 2008

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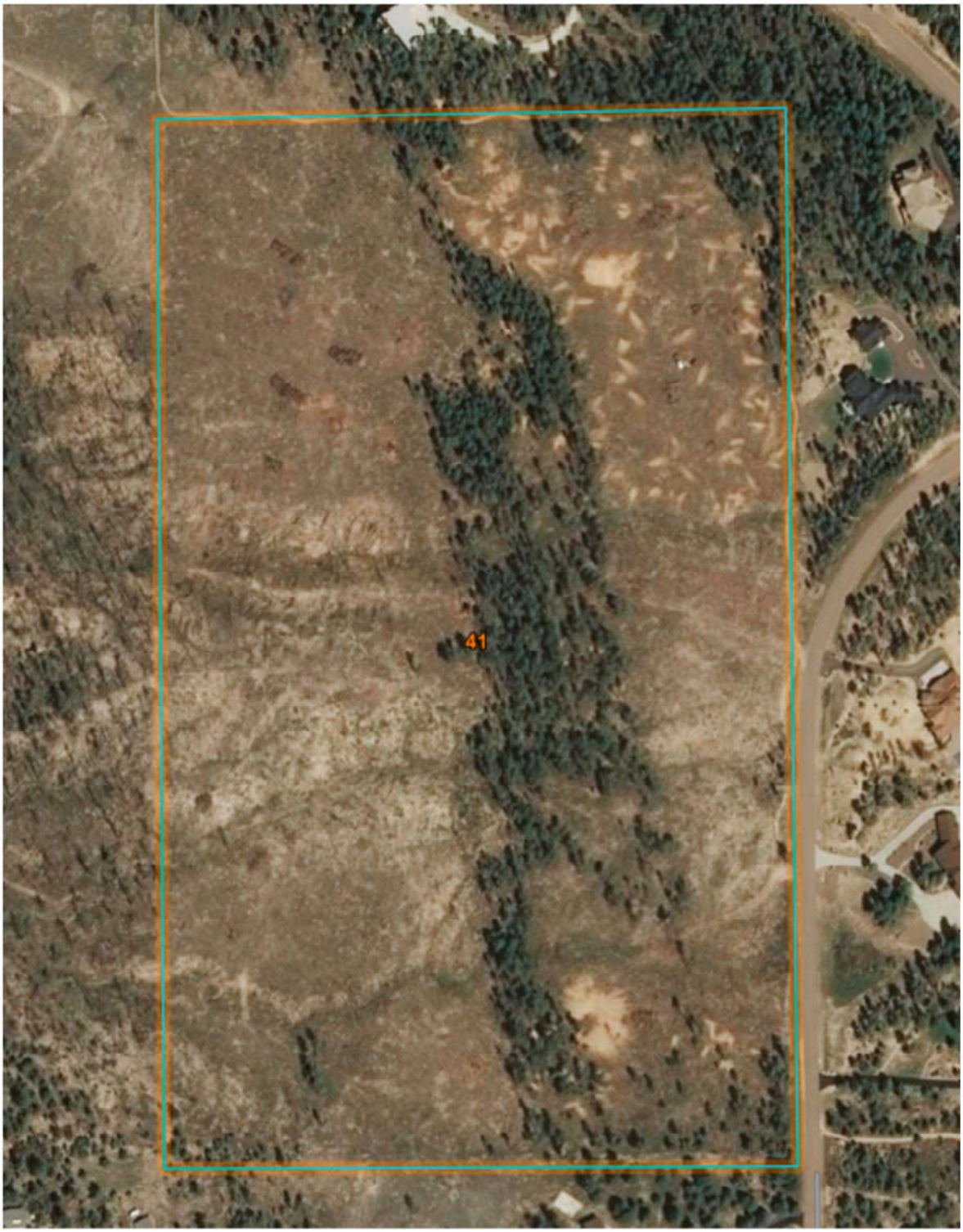
WINSLOW DRIVE
ESTATES AT CATHEDRAL PINES

EL PASO COUNTY, COLORADO
WILLIAM GUMAN AND ASSOCIATES, LTD

ENGINEER:	TPM
DRAWN BY:	NM
CHECKED BY:	TPM
ISSUED:	12-6-2022

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-5



41 - Kettle gravelly loamy sand, 8 to 40 percent slopes

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USDA SOIL SURVEY MAP

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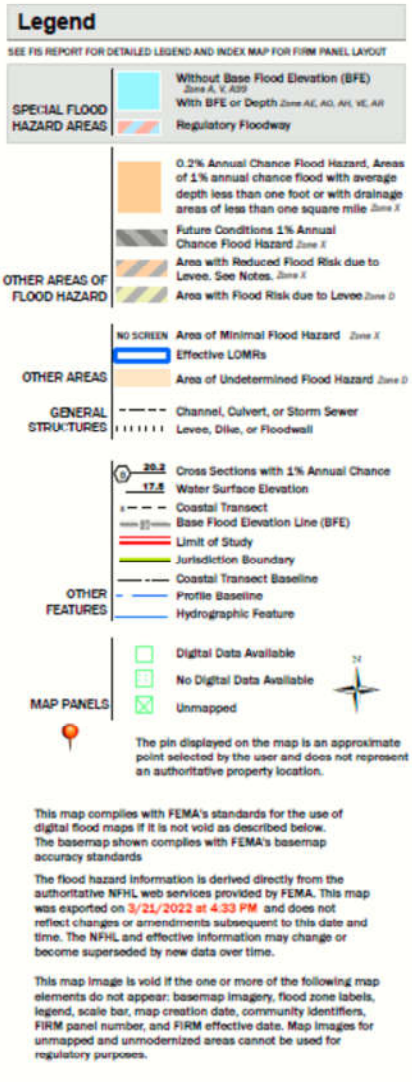
FIG No. 6

DATE 6-24-2022

National Flood Hazard Layer FIRMette



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FEMA MAP

WINSLOW DRIVE
ESTATES AT CATHEDRAL PINES
EL PASO COUNTY, COLORADO
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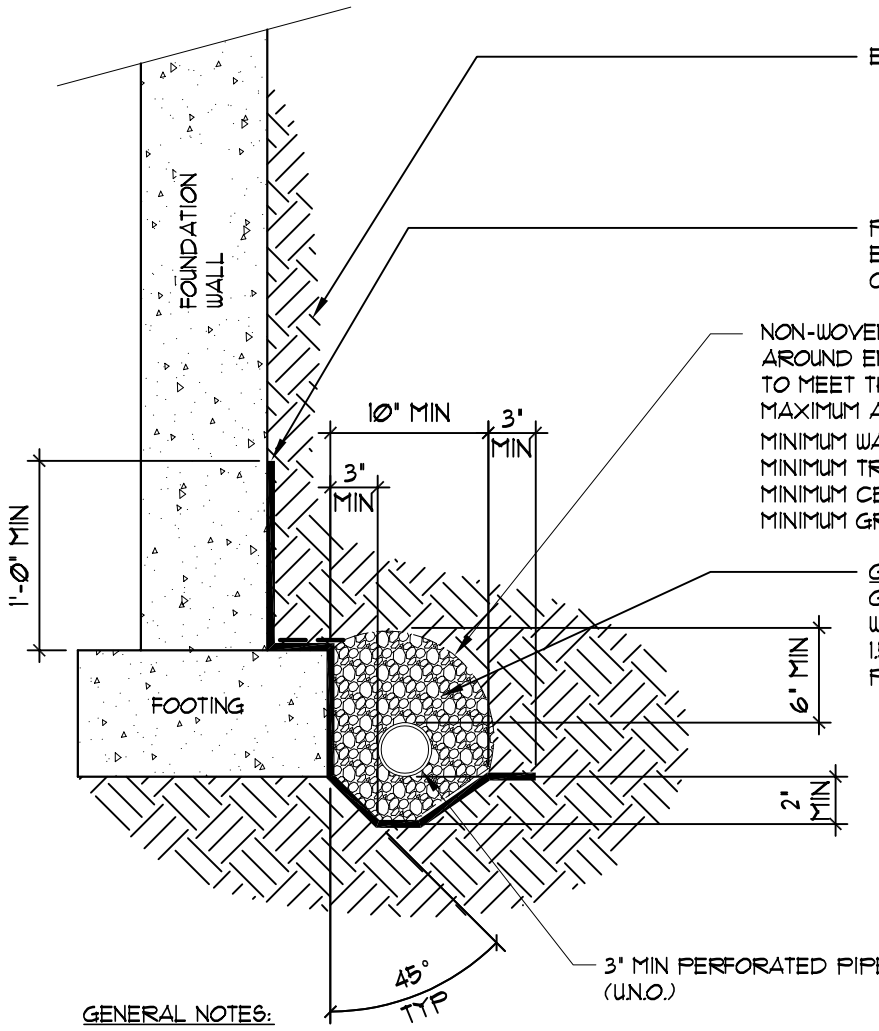
FIG No. 7

DATE 6-24-2022



GENERAL NOTES:

1. BOTTOM OF DRAIN PIPE SHALL BE AT OR BELOW BOTTOM OF FOOTING AT ALL LOCATIONS
2. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
3. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.
4. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.
5. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
6. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.
7. A VERTICAL SEGMENT OF PERFORATED DRAIN PIPE, CAPPED AT THE TOP, SHALL EXTEND TO FINISH GRADE WITHIN ALL WINDOW WELLS.

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PERIMETER DRAIN

FIG No. 8

APPENDIX A
Additional Reference Documents

1. *Proposed Development Plan, Winslow Drive, Estates at Cathedral Pines,* provided by William Guman & Associates, Ltd.
2. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0315G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
3. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado*, Madole, R.F., 2003, Colorado Geological Survey Open-File Report OF03-06.
4. *Cherry Valley and Black Forest Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
5. *Cherry Valley and Black Forest Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
6. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
7. El Paso County Assessor Website
   https://property.spatialest.com/co/elpaso/#/property/5100000447
   Schedule No. 6200000411
8. *Colorado Geological Survey, USGS Geologic Map Viewer*:
   http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
9. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1952, 1953, 1955, 1960, 1969, 1983, 1999, 2005, 2009, 2011, 2013, 2015, 2017, and 2019.
10. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs, Black Forest Quadrangle dated 1898, 1909, 1948, 1969, 1981 and 1989.
11. *Google Earth Pro*, Imagery dated 1999, 2003, 2004, 2005, 2006, 2011, 2013, 2015, 2017, 2019 and 2020.

APPENDIX B

Geologic Hazards Evaluation and Wastewater Report, Parcel West of Winslow Drive North of Darr Drive, El Paso County, Colorado, prepared by CTL Thomposon, Project No. CS17101-105, dated May 2, 2008

NEW DOC

PUD 08005
SF 08006

CTL | THOMPSON

VERSION # 1
DATE 10/7/08

GEOLOGIC HAZARDS EVALUATION AND WASTEWATER REPORT PARCEL WEST OF WINSLOW DRIVE NORTH OF DARR DRIVE EL PASO COUNTY, COLORADO

Prepared for:

INGELS COMPANY
P.O. Box 61659
Colorado Springs, Colorado 80960-1659

Project No. CS17101-105

May 2, 2008

5240 Mark Dabling Blvd | Colorado Springs, Colorado 80918 | Telephone: 719-528-8300 Fax: 719-528-5362

TABLE OF CONTENTS

SCOPE

This report presents the results of our Geologic Hazards Evaluation and Wastewater Report for development of the parcel west of Winslow Drive in El Paso County, Colorado. Our purpose was to evaluate the property for the occurrence of geologic hazards and their potential effect on site development and construction, and for the disposal of wastewater from individual sanitary sewer systems. This report includes our interpretation of site geology, Soil Conservation Service soil classification, local well permit locations, results of percolation testing, and our opinion of the potential influence of these conditions on site development. We believe this study was completed in general conformance with the requirements of El Paso County, Zoning Code, Chapter 8.4.9, Geology and Soils Standards and Reports, and Chapter 8.4.8, Wastewater Disposal Report (2007).

The report was prepared based on conditions interpreted from field reconnaissance mapping of the site, review of geologic maps, review of Soils Conservation Service Mapping, conditions encountered in exploratory borings, percolation tests, engineering analysis, and our experience. Site-specific subsurface investigations or observations made during grading and construction may indicate conditions that require revision or re-evaluation of some of the criteria presented in this report. The criteria presented are for the development as described. Revision in the scope of the project could influence our recommendations. If changes occur, we should review the development plans and their effect on our recommendations. Environmental site assessments for occurrence of potentially hazardous materials, erosion problems, and flooding are beyond the scope of this investigation.

SUMMARY

1. The primary conditions we identified that pose hazards or constraints to development include the occurrence of shallow bedrock and potential for expansive soils and bedrock. It is our opinion the property can be developed as proposed.

2. Subsurface conditions encountered in our borings consisted of slightly silty to clayey sand to a depth of about 6 inches overlying slightly silty to silty sandstone bedrock.

3. Ground water was not encountered during drilling or when water levels were checked three days after the completion of drilling.

4. Our widely-spaced borings suggest shallow foundations will likely be appropriate for the site.

5. Slab-on-grade floors will probably be appropriate in basement areas where the near-surface soils consist of granular soils or sandstone.

6. The profile borings indicate that engineered, on-site sewage disposal systems may be needed because of the shallow depth of bedrock. The percolation test results varied from 40 to over 240 minutes per inch, which also indicates that some of the systems will need to be engineered.

7. Ponding of water near residences and roads should be avoided. Vegetation species native to a semi-arid climate are recommended. Overall plans should provide for rapid conveyance of surface runoff to centralized drainageways.

SITE CONDITIONS

The approximately 35-acre Winslow Drive Parcel site is located west of Winslow Drive and north of Darr Drive in El Paso County, Colorado. The parcel is zoned Rural Residential. The general shape and location of the site are shown on Fig. 1.

The site is surrounded primarily by forested, rural residential developments. The site slopes primarily to the west at grades of about 4 to 30 percent, with the steeper slopes along the drainages. There area three minor drainages that cross the site. The flows are intermittent from east to west. There are numerous smaller drainage swales that flow into the minor drainages. The drainages generally have moderately-defined channels and most storm flows are sheet flows along the lower portions of the drainage swales. The drainages discharge into Black Squirrel Creek about 1/4 to 1/2-mile west of the site.

The majority of the site is vegetated with Ponderosa Pine forest with grass and small shrub undergrowth. There is a small meadow area near the northern edge. The meadow area is vegetated with natural upland grasses and small shrubs.

PROPOSED DEVELOPMENT

The preliminary plan for the site shows seven lots of about 4.5 acres in size, with open space along the eastern and northern perimeters. The access will be from Winslow Drive off of Darr Drive. We understand that the residences will have individual wells and on-site wastewater systems.

PREVIOUS GEOLOGIC MAPPING

The site was mapped by the United States Geological Survey (USGS) in 1979 by Trimble and Machette as part of the Geologic Map of the Colorado Springs-Castle Rock Area, Front Range Urban Corridor, Colorado. Thorson mapped the area as part of the Black Forest Quadrangle for the Colorado Geological Survey in 2003. Charles Robinson & Associates, Inc. mapped the area for El Paso County in 1977. Thorson, Trimble and Machette, and Charles Robinson & Associates, Inc. each mapped the site as Dawson Formation. The site was also covered by the Aggregate Resource Evaluation of El Paso County performed by Empire Laboratories in 1991.

SITE GEOLOGY

The site lies within the Front Range topographic province. The landforms that cover the majority of the site are bedrock slopes thinly covered with colluvium, with moderately-defined drainages. Our interpretation of the site geology is shown on Fig. 2. The relatively thin cover of colluvium is underlain by arkosic sandstone of the Dawson Formation. The geologic units are described further in the following paragraphs.

Colluvium (Qc)

Areas mapped as colluvium generally consist of 5 or more feet of silty to clayey sand. Areas mapped as "c" have a relatively thin alluvial cover of less than 5 feet. The deposit is the result of in-place weathering deposited by sheet flow and gravity. The areas are subject to deposition and erosion.

Dawson Formation (Tkd)

The upper portion of the Dawson Formation exposed and near the surface is an Eocene-aged, coarse-grained arkosic sandstone, with scattered siltstone, claystone and shale. The Dawson Formation is at the surface or below the colluvium deposits across the site. The slightly silty to silty sandstone may have low swell potential.

NRCS SOIL SURVEY

The Natural Resource Conservation Service (NRCS) Soil Survey for this part of El Paso County is presented in Fig. 2. The soil survey identifies one mapped soil unit within the site. The Kettle gravelly loamy sand soil covers the site. The soil is rated as very limited for on-site wastewater disposal.

WATER RESOURCES

The locations of permitted wells in the vicinity of the parcel as of April 2007 were obtained from the Colorado Division of Water Resources web page. The nearby well locations are shown on Fig.3. The drainages on-site and nearby are all intermittent drainages. No water was observed in the drainages, nor were any lakes or ponds observed during our site visits. Black Squirrel Creek flows to the southwest about 1/4-mile to the west of the northwest corner of the site.

SUBSURFACE INVESTIGATION

Subsurface conditions for the property were explored by drilling two very widely-spaced borings at the approximate locations presented on Fig. 1. Boring locations were limited to areas accessible through the trees from Winslow Drive. Graphic logs of the conditions found in our borings are presented on Fig. 4.

Soil samples obtained during drilling were returned to our laboratory and visually examined by the geotechnical engineer for this project. Laboratory testing was then assigned and included moisture content and dry density, gradation, and water-soluble sulfate content tests. Results of laboratory tests are presented on Fig. 5 and summarized in Table I and on the boring logs on Fig. 4.

SUBSURFACE CONDITIONS

Our exploratory borings on the property encountered less than 1-foot of clayey sand, overlying slightly silty to silty sandstone bedrock. Ground water was not encountered in the borings at the time of drilling or when water levels were checked three days after the completion of drilling.

Soils

The sand was clayey, moist and medium brown. No samples of the sand were obtained because of its limited depth.

Bedrock

Slightly silty to silty sandstone bedrock was encountered below the surficial soils. The sandstone was hard to very hard based upon field penetration resistance tests. The sandstone samples tested had 11 to 19 percent silt and clay-size particles (passing the No. 200 sieve). Based upon laboratory test results and our experience, we

judge the sandstone will typically exhibit low measured swell values or be non-expansive.

Ground Water

Ground water was not encountered in the borings at the time of drilling or when water levels were checked three days after the completion of drilling. Our investigation occurred in the early spring when the water levels are near their seasonal lows. Ground water level fluctuations of 3 to 5 feet are typical in normal precipitation years. The presence and amount of ground water may change seasonally and after development in response to precipitation, irrigation, septic systems, and changes in surface drainage patterns.

PERCOLATION TEST RESULTS

Two percolation tests were performed on the site to meet the El Paso County Land Development Code. The percolation test results indicate a relatively slow percolation rate for the near-surface materials. Percolation rates in the range of 5 to 60 minutes per inch are acceptable rates for "non-engineered systems". The tests performed indicated percolation rates of 40 to over 240 minutes per inch. The results are provided in Appendix A. The percolation test results indicate that some of the systems will likely need to be engineered because of percolation rates over 60 minutes per inch. Additionally, the bedrock encountered in our two borings was less than 4 feet below grade, which would require an engineered system at these locations.

We did not encounter any geotechnical or geological conditions that we believe would preclude the use of on-site, wastewater systems for the planned lot sites. Percolation testing should be performed at the actual locations of proposed leach fields for design of individual systems. Locations of the systems should conform to the El Paso County Department of Health and Environment requirements with two locations made available on each lot. These locations should be selected to ensure proper setbacks for the planned lot sizes.

POTENTIAL GEOLOGIC HAZARDS AND ENGINEERING CONSTRAINTS

The primary geologic hazards we identified are the occurrence of shallow hard bedrock and the regional hazards of seismic activity and the potential for radon gas. Expansive soils and bedrock were not encountered in our borings, but can occur in lenses and may impact foundation construction and floor system selection on some lots. We believe these conditions can be mitigated with engineering design and construction methods commonly employed in this area. Figure 2 shows our interpretation of the engineering geology modified from the system used by Charles Robinson & Associates (1977). The following subsections discuss our assessment of the potential geologic hazards recognized at this site and our recommendations for mitigation or risk reduction.

Hard Bedrock

Layers of hard bedrock were encountered in the borings. The zones of hard bedrock were generally encountered at depths greater than 10 feet, but occasional, more shallow layers of hard bedrock could be encountered. Where layers of shallow hard bedrock are encountered, rock buckets and rock teeth may be required for the excavation of foundations.

Expansive Soils

Lenses of clayey sand and clayey sandstone can occur in the Dawson Formation underlying the area. The clayey lenses exhibit low volume change characteristics with variations in water content. Scattered zones within the sand and sandstone may be rated as moderate risk. Foundation and floor slab design for moderate to very high rated swell sites is not uncommon in El Paso County. Foundation and floor slab alternatives and mitigation are discussed briefly in the SITE DEVELOPMENT CONSIDERATIONS section of the report.

Flooding

The site is within Zone X, which is outside the 100-year flood zone, as shown on Flood Insurance Rate Map (FIRM) Number 08041C0315F, with an effective date of March 17, 1997. The drainage report for the proposed development should address flooding and surface drainage issues and possible mitigation methods.

Subsurface and Surface Mining

We reviewed coal mine location mapping available through the Colorado Geological Survey for the area. There are no records that we know of that indicate the presence of coal mining activity within or below the site, or known economic coal reserves. Bituminous coal beds are mapped as being between 150 and 1,000 feet below the ground surface in the area. Coal mining leases are documented further south and east in areas where lignite coal is generally less than 150 feet below the ground surface. We did not observe evidence of subsurface mining at the site or nearby.

Aggregate resource deposits are not mapped on the site based on the aggregate resource evaluation performed by Empire Laboratories for El Paso County. The aggregate resource evaluation indicates that surface mining of aggregate deposits has occurred at a few locations within a few miles of the site. The majority of the local aggregate pits were likely used for either road construction or structural fill using pit-run material. No large scale aggregate mining operations have occurred in this part of the county. The use of this land for residential development will have a minor impact on the availability of aggregates for mining in the future in this part of the county.

Seismic Hazard (Seismicity)

The Rampart Range Fault, located about 8.5 miles west of the site, is one of the major structural geologic features of the region. Evidence for movement during the last two million years (Quaternary) exists for some Front Range faults, including the Rampart Range Fault. The Rampart Range Fault is considered to be potentially active

by the Colorado Geological Survey. This area, like most of central Colorado, is subject to a degree of seismic activity. The Colorado Geological Survey considers this area of Colorado to be in Seismic Zone 2 of the Uniform Building Code (UBC), 1997. We understand El Paso County has adopted the 2003 International Residential Code (IRC) and International Building Code (IBC) and that current practice in structural engineering in this area is to utilize the 2003 IRC and IBC criteria.

NATURALLY OCCURRING RADIOACTIVE MATERIALS (NORM)

Naturally occurring radioactive materials (NORM), including rocks containing uranium, have been recognized in the Black Forest Region. The two principal hazards associated with uranium-bearing rock are the gamma radiation emitted by the decay of uranium and generation of radon gas, which is a radioactive by-product. Radioactivity can be dangerous if the human body is exposed to large amounts. Radon gas can be a hazard if the radioactive gas should accumulate in an enclosed residential dwelling. Radon gas can usually be controlled through mitigation measures included with the house construction.

Low-Level Gamma Radiation Survey

The level of gamma radiation was measured at the ground surface, including cuttings from the borings, using a hand-held scintillometer. A LUDLUM Micro R Meter (Model 19) was used to measure the level of gamma radiation. The meter provides readings of low-level gamma radiation in terms of micro R/Hr (micro Roentgens per hour).

The level of gamma radiation measured at the ground surface during this investigation ranged from 15 to 17 microR/Hr. The average "background" reading at the site was 17 microR/Hr. Typical readings in the Colorado Springs area are 15 to 20 microR/Hr. The radiation levels recorded on the site do not exceed the accepted level for concern and special construction is not likely warranted for the site. However, it is

possible that radiation levels from some of the bedrock underlying the site may exceed the accepted level for concern.

Radon Mitigation

Passive and active radon mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Passive mitigation includes provision of a gravel layer below basement or crawl space floors connected to the standard foundation drain. A ventilation riser pipe is also connected to the foundation drain pipe. Active measures that can be taken after building construction include installing a blower on the ventilation riser pipe, and sealing the joints and cracks in concrete floors and foundation walls. Many variables influence whether or not high levels of radon develop. If the occurrence of radon is a concern, we believe buildings should be tested after they are constructed and closed in to get a more accurate determination of the levels.

SITE DEVELOPMENT CONSIDERATIONS

From a geotechnical engineering point-of-view, the more significant subsurface conditions found are the hard bedrock. The following sections discuss the impacts of these conditions on development of this property.

Hard Bedrock

Hard bedrock could impact the depth of excavation for individual residences and related improvements. In most cases, rock teeth or rock buckets on excavation equipment will suffice to perform the excavations. Zone of cemented sandstone that will require rock breaking or light blasting could occur.

Expansive Soils

Our investigation did not encounter any clayey soils or clayey sandstone bedrock. However, clayey soils and bedrock with low measured swell can occur within and overlying the Dawson Formation at various locations and depths across the site. Commonly used mitigation techniques for expansive soils will likely be appropriate. We anticipate these techniques to include the use of minimum deadload footings or sub-excavation to a specified depth below foundations and replacement of the excavated material as controlled fill. For moderate expansive soil conditions, drilled pier foundations bottomed in the underlying bedrock may be appropriate. Slab-on-grade floors will probably be appropriate in basement areas where the near-surface soils consist of granular soils or sandstone. Sub-excavation can be performed or structural floors can be installed if moderately to highly expansive materials are encountered at basement slab elevations. Site-specific Soils and Foundation Investigations will be needed to provide design and construction criteria for proposed structures.

Site Grading

Preliminary plans indicate most grading activity will be confined to the access road right-of-way. We believe grading can be accomplished using conventional construction techniques and heavy-duty equipment. We recommend plans consider permanent cut and fill slopes no steeper than 3:1 (horizontal to vertical). This ratio considers that no seepage of ground water is present. If ground water seepage does occur, flatter slopes and individually engineered drain systems may be appropriate.

Vegetation and organic topsoil should be removed from the ground surface where fill is to be placed. We anticipate most stripping will require about 4 to 6-inch cuts or less. Soft or loose soils, if encountered, should be stabilized or removed to stable material prior to placement of fill. Organic soils should be wasted in landscaped areas and in the back of residential lots, outside of potential building footprints.

Soft or loose soils may be encountered during grading. While we do not expect widespread stabilization will be required, it is possible some isolated areas of softer subgrade soils may need to be mitigated during grading. Potential stabilization techniques include installation of a geotextile or stabilization fabric and a layer of granular soil or crushed rock, or crowding angular rock into soft subgrade areas. The need for stabilization of soft areas will have to be determined in the field during grading.

The ground surface in areas to be filled should be scarified, moisture conditioned, and compacted. The on-site natural soils and bedrock mechanically broken to less than 2 inches in diameter can be used as site grading fill. We recommend granular fill be compacted to at least 92 percent of maximum modified Proctor dry density (ASTM D 1557) at moisture contents within 2 percent of optimum moisture content.

Pavements

Based on our understanding of the proposed construction, subgrade soils will consist predominantly of silty to clayey sand. Where at least 2 feet of sand is present below pavements, we anticipate full-depth asphalt concrete pavement sections on the order of 4 to 5 inches will be appropriate for residential streets. A Subgrade Investigation and Pavement Design should be performed after grading is complete if a non-soil pavement is desired.

SEPTIC SYSTEMS

Septic system locations should avoid the minor drainages and steeper slopes. The intermittent drainages swales are identified on Fig. 1.

SURFACE DRAINAGE AND IRRIGATION

The high plains region is considered to be sensitive to the addition of supplemental moisture. Landscaping concepts should concentrate on the use of native

plants that require little or no supplemental irrigation after the establishment period. Generally, surface drainage should be designed to eliminate ponding of water and provide for the rapid removal of runoff.

CONCRETE

Concrete in contact with soils can be subject to sulfate attack. We measured the water-soluble sulfate concentration in one sample from this site at less than 0.1 percent. Sulfate concentrations less than 0.1 percent indicate Class 0 exposure to sulfate attack for concrete in contact with the subsoils according to ACI 201.2R-01, as published in the 2005 ACI Manual of Concrete Practice. For this level of sulfate concentration, the American Concrete Institute (ACI) indicates Type I cement can be used for concrete in contact with the subsoils. In our experience, superficial damage may occur to the exposed surfaces of highly permeable concrete, even though sulfate levels are relatively low. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious material ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high water tables. Concrete exposed to freeze-thaw cycles should be air entrained. Additional testing of soils and bedrock for soluble sulfates is recommended.

ADDITIONAL INVESTIGATIONS

We recommend the following additional investigations as the property is developed.

1. Site-specific Soils and Foundation Investigations for residences and other structures.
2. Subgrade Investigation and Pavement Design for non-soil pavement systems.
3. Percolation testing for septic systems to meet the county regulations.
4. Construction observation and testing of site grading fills and pavements.

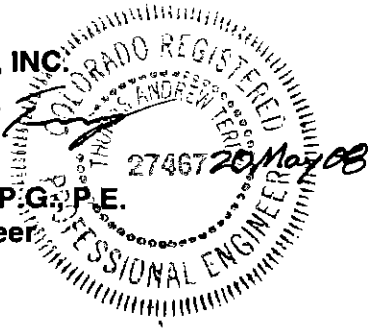
LIMITATIONS

The recommendations and conclusions presented in this report were prepared based upon conditions disclosed by exploratory borings, our geologic reconnaissance, and our experience. Variations in the subsurface conditions not indicated by the borings are possible and should be expected.

We believe this report was prepared using the standard of care normally used by geotechnical engineers and geologists practicing in this area at this time. No warranty, express or implied, is made.

If we can be of further service in discussing the contents of this report or the project from a geotechnical point-of-view, please call.

CTL | THOMPSON, INC.



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Geological Engineer

Reviewed by:

Richard A. Phillips, P.E.
Principal

TAT:RAP:kis
(6 copies sent)

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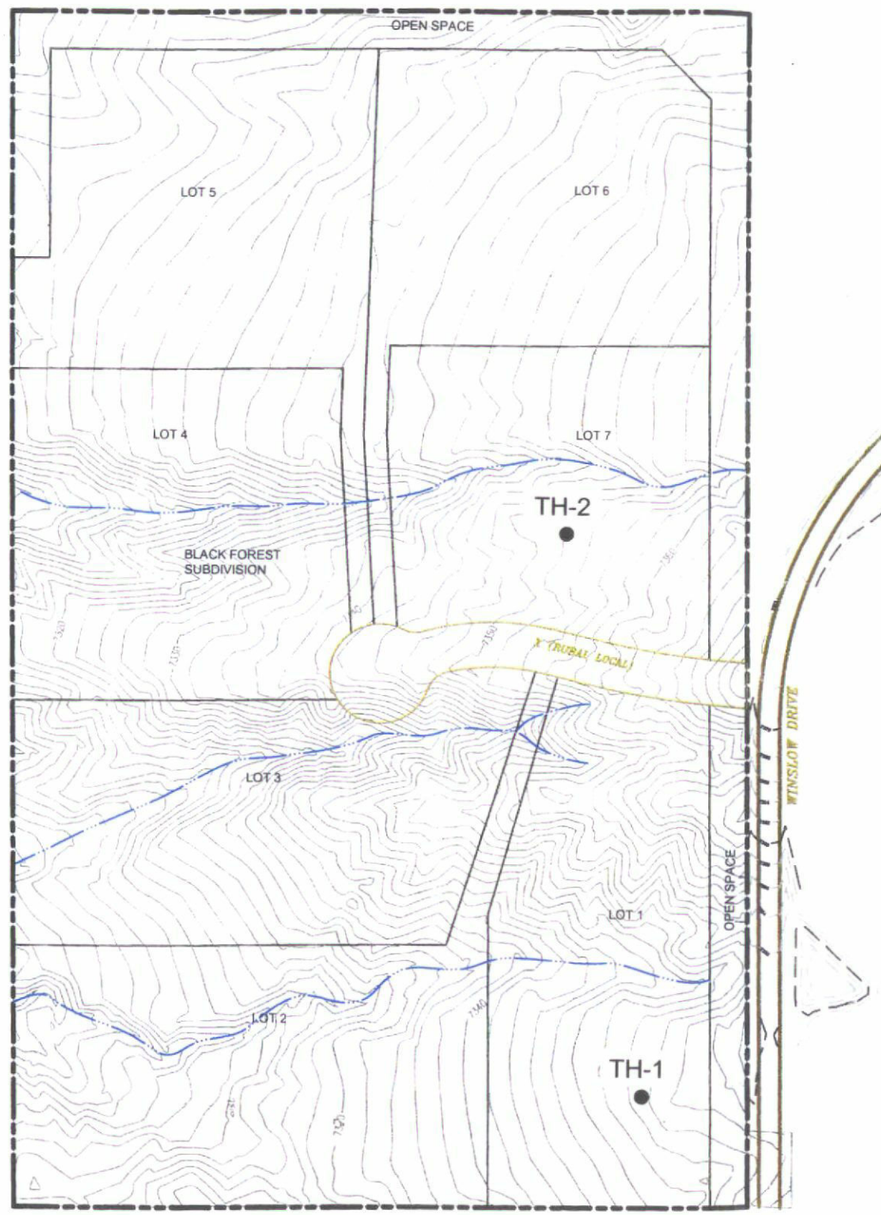
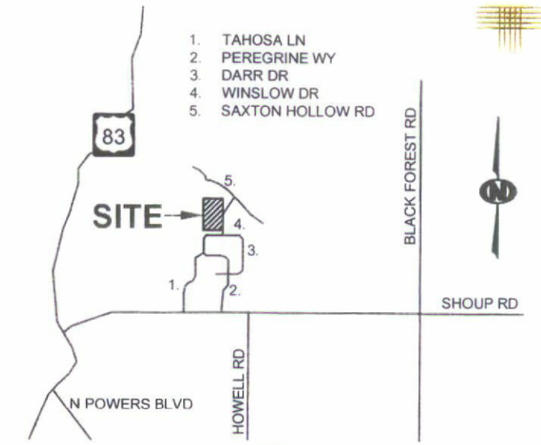




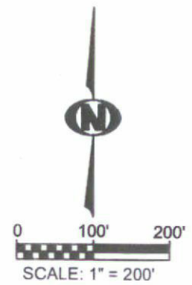
VICINITY MAP

(NOT TO SCALE)

LEGEND:

TH-1 ●	INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING.
———	INDICATES APPROXIMATE LOCATION OF PROPERTY BOUNDARY.
~ ~ ~	INDICATES EXISTING TOPOGRAPHY.
~ ~ ~	INDICATES INTERMITTENT DRAINAGES.

NOTE:
BASE DRAWING WAS PROVIDED BY JR ENGINEERING (JOB NO. 29390.05, RECEIVED APRIL 7, 2008).



SCALE: 1" = 200'

Location of Exploratory Borings

FIG. 1

INGELS COMPANY
PARCEL WEST OF WINSLOW DRIVE
PROJECT NO. CS17101-105
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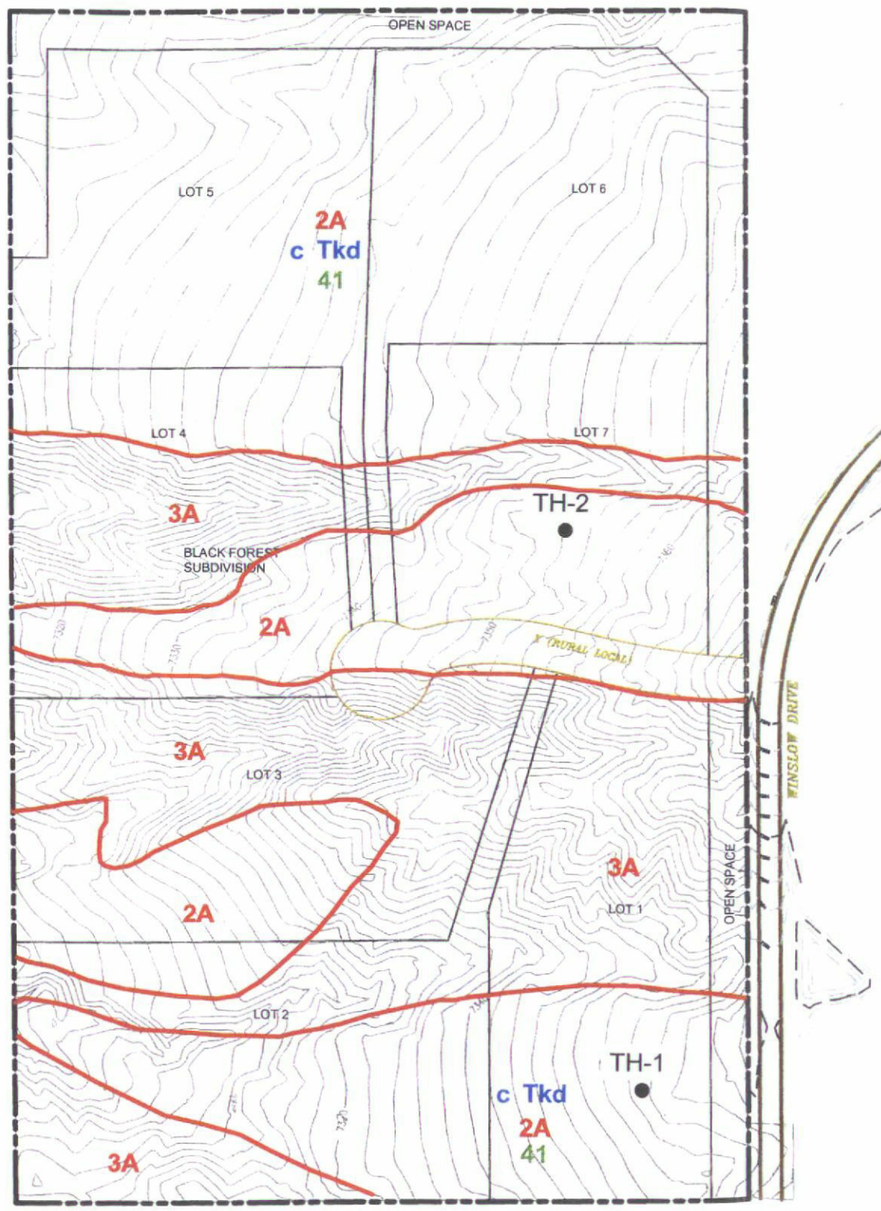

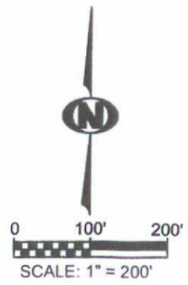

LEGEND:

TH-1 ● INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING.

INDICATES APPROXIMATE LOCATION OF PROPERTY BOUNDARY.

INDICATES EXISTING TOPOGRAPHY.

GEOLOGIC UNITS AND MODIFIERS

Tkd DAWSON FORMATION (TERTIARY AND UPPER CRETACEOUS) COARSE-GRAINED ARKOSIC SANDSTONE, SILTSTONE, CLAYSTONE AND SHALE. MAY HAVE A LOW TO VERY HIGH SWELL POTENTIAL.

c COLLUVIUM (c) INDICATES LESS THAN 5 FEET. THIS UNIT IS QUATERNARY IN AGE AND CONSISTS OF ERRATIC MIXTURES OF MATERIAL FROM SILT TO GRAVEL IN SIZE WITH SCATTERED COBBLES. THE DEPOSITS CONSIST OF LOCALLY DERIVED MATERIALS DEPOSITED BY SLOPE WASH AND SOIL CREEP, AND GENERALLY OCCUR ON GENTLE TO MODERATE SLOPES.

ENGINEERING UNITS AND MODIFIERS

2A STABLE ALLUVIUM, COLLUVIUM AND BEDROCK ON GENTLE TO MODERATE SLOPES (5-12%). EMPHASIS ON SURFACE AND SUBSURFACE DRAINAGE.

3A STABLE ALLUVIUM, COLLUVIUM AND BEDROCK ON MODERATE TO STEEP SLOPES (12-24%). INCLUDES SOME OLD ALLUVIAL FANS ALONG MOUNTAIN FRONT THAT HAVE BEEN DISSECTED BY MODERN STREAMS. EMPHASIS ON DRAINAGE, SLOPE, BEDROCK STRUCTURE AND DESIGN OF CUTS.

INDICATES ENGINEERING UNITS.

NATIONAL RESOURCE CONSERVATION SERVICE

41 KETTLE GRAVELLY LOAMY SAND

NOTES:

1. BASE DRAWING WAS PROVIDED BY JR ENGINEERING (JOB NO. 29390.05, RECEIVED APRIL 7, 2008).
2. ALL BOUNDARIES SHOWN SHOULD BE CONSIDERED APPROXIMATE. THEY ARE BASED UPON A SUBJECTIVE INTERPRETATION OF PUBLISHED GEOLOGIC MAPS, AERIAL PHOTOGRAPHS AND AN INITIAL FIELD RECONNAISSANCE. CHANGES IN THE MAPPED BOUNDARIES SHOWN ARE POSSIBLE AND SHOULD BE EXPECTED WITH MORE DETAILED WORK AND FURTHER INFORMATION. ALL INTERPRETATIONS AND CONDITIONS SHOWN ARE PRELIMINARY AND FOR INITIAL LAND-USE PLANNING ONLY.

Surficial Geologic Conditions, Engineering Conditions and NRCS Soil Survey

FIG. 2

INGELS COMPANY
PARCEL WEST OF WINSLOW DRIVE
PROJECT NO. CS17101-105
S:\CS17000-17499\CS17101.000\105\2. Reports\CS17101-105_CADD_FIGS.dwg

LEGEND:

TH-1 ● INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING.

INDICATES APPROXIMATE LOCATION OF PROPERTY BOUNDARY.

INDICATES EXISTING TOPOGRAPHY.

▲ INDICATES APPROXIMATE LOCATION OF EXISTING WELL.

NOTE:
BASE DRAWING WAS PROVIDED BY JR ENGINEERING (JOB NO. 29390.05, RECEIVED APRIL 7, 2008).

N

0 150' 300'

SCALE: 1" = 300'

INGELS COMPANY
PARCEL WEST OF WINSLOW DRIVE
PROJECT NO. CS17101-105
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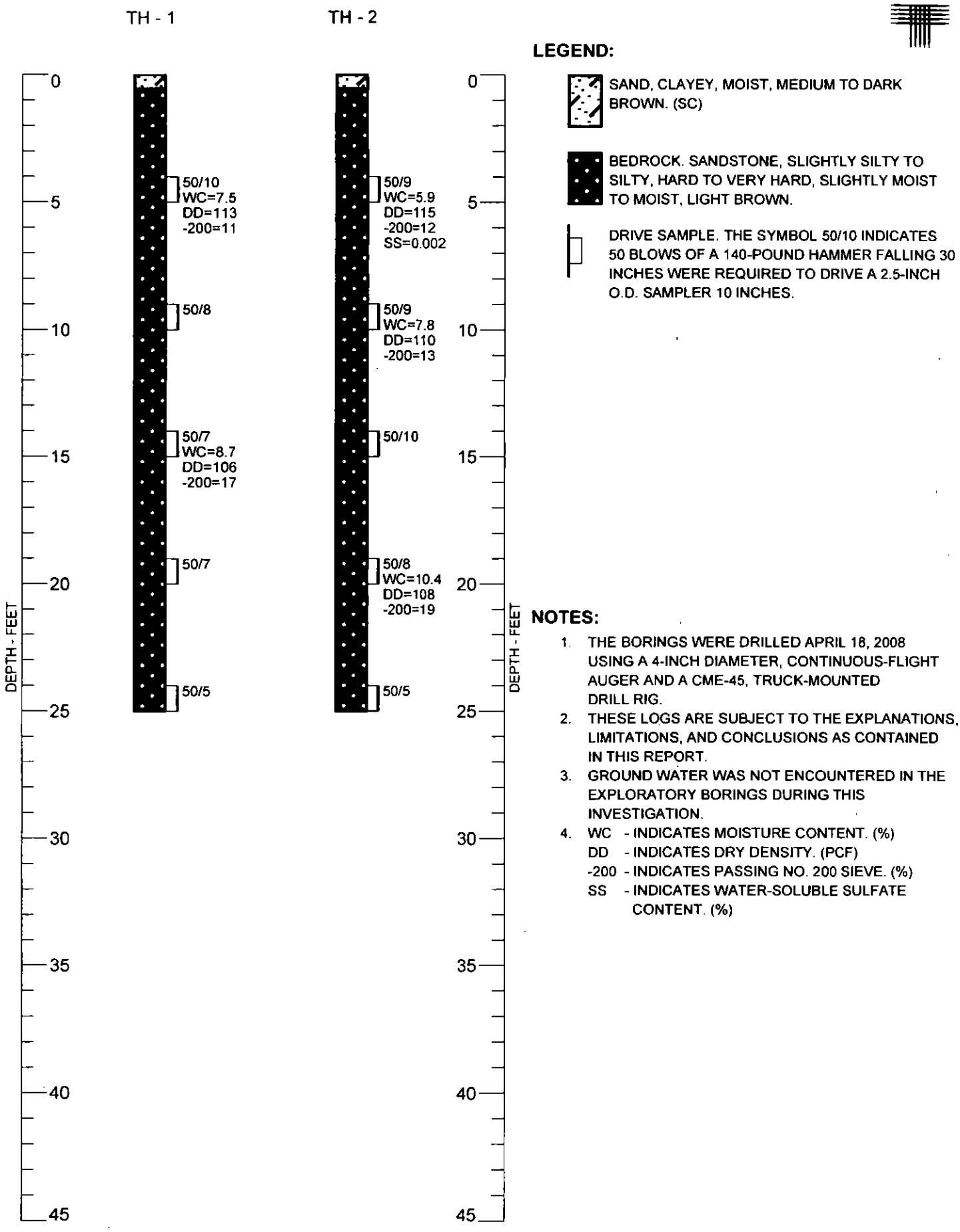
Existing Well Locations

FIG. 3



LEGEND:

SAND, CLAYEY, MOIST, MEDIUM TO DARK BROWN. (SC)

BEDROCK. SANDSTONE, SLIGHTLY SILTY TO SILTY, HARD TO VERY HARD, SLIGHTLY MOIST TO MOIST, LIGHT BROWN.

DRIVE SAMPLE. THE SYMBOL 50/10 INDICATES 50 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 10 INCHES.

NOTES:

1. THE BORINGS WERE DRILLED APRIL 18, 2008 USING A 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND A CME-45, TRUCK-MOUNTED DRILL RIG.
2. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS, AND CONCLUSIONS AS CONTAINED IN THIS REPORT.
3. GROUND WATER WAS NOT ENCOUNTERED IN THE EXPLORATORY BORINGS DURING THIS INVESTIGATION.
4. WC - INDICATES MOISTURE CONTENT. (%)
   DD - INDICATES DRY DENSITY. (PCF)
   -200 - INDICATES PASSING NO. 200 SIEVE. (%)
   SS - INDICATES WATER-SOLUBLE SULFATE CONTENT. (%)

INGELS COMPANY
PARCEL WEST OF WINSLOW DRIVE
PROJECT NO. CS17101-105
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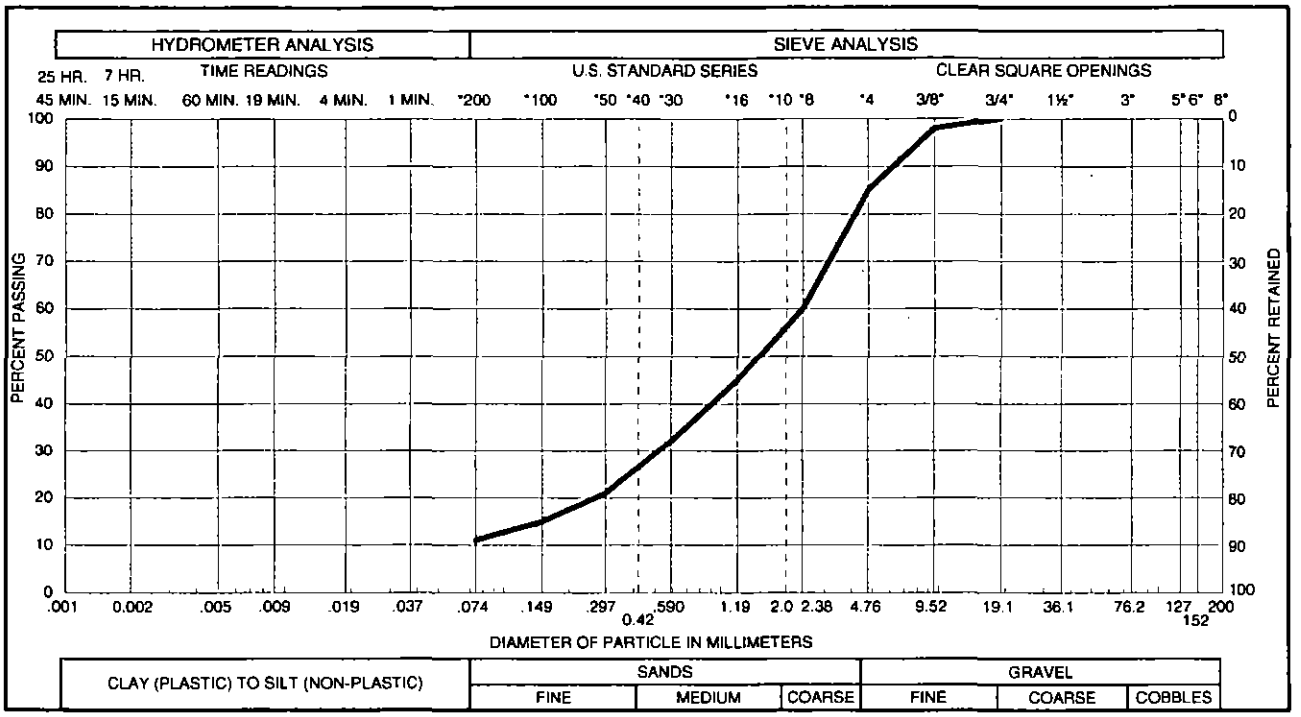
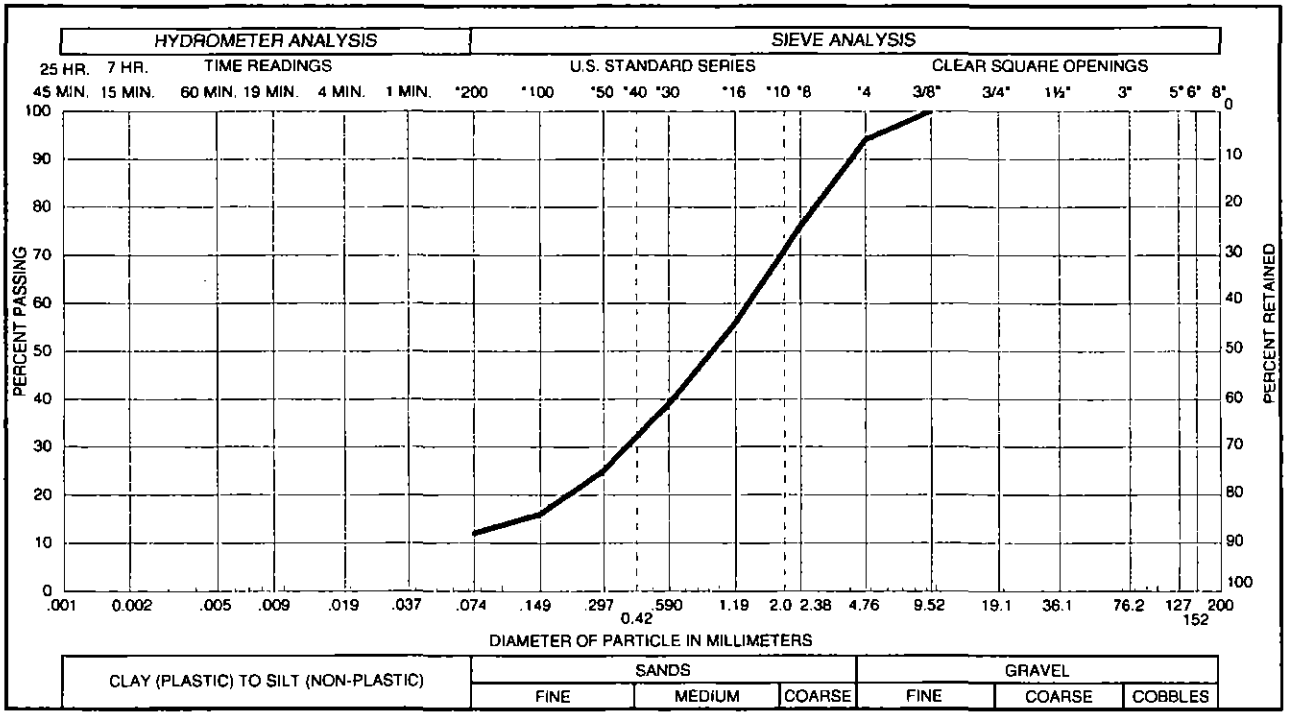
Summary Logs of Exploratory Borings

FIG. 4



Sample of SANDSTONE, SL. SILTY, GRAVELLY
From TH - 1 AT 4 FEET

GRAVEL 15 % SAND 74 %
SILT & CLAY 11 % LIQUID LIMIT %
PLASTICITY INDEX %



Sample of SANDSTONE, SILTY
From TH - 2 AT 4 FEET

GRAVEL 6 % SAND 82 %
SILT & CLAY 12 % LIQUID LIMIT %
PLASTICITY INDEX %

INGELS COMPANY
PARCEL WEST OF WINSLOW DRIVE
PROJECT NO. CS17101-105
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Gradation Test Results

FIG. 5

TABLE I

SUMMARY OF LABORATORY TESTING
PROJECT NO. CS17101-105

BORING	DEPTH (FEET)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	ATTERBERG LIMITS		SWELL TEST RESULTS*		PASSING NO. 200 SIEVE (%)	WATER SOLUBLE SULFATES (%)	DESCRIPTION
				LIQUID LIMIT (%)	PLASTICITY INDEX (%)	SWELL (%)	SWELL PRESSURE (PSF)			
TH-1	4	7.5	113					11		SANDSTONE, SL. SILTY, GRAVELLY
TH-1	14	8.7	106					17		SANDSTONE, SILTY
TH-2	4	5.9	115					12	0.002	SANDSTONE, SILTY
TH-2	9	7.8	110					13		SANDSTONE, SILTY
TH-2	19	10.4	108					19		SANDSTONE, SILTY

* SWELL MEASURED WITH 1000 PSF APPLIED PRESSURE, OR ESTIMATED IN-SITU OVERBURDEN PRESSURE. NEGATIVE VALUE INDICATES COMPRESSION.

APPENDIX A

PERCOLATION TEST RESULTS

Table A-1
PERCOLATION TEST DATA

CTL | THOMPSON

Project: Winslow Drive Parcel
Location: TH-1
Pre-Soaked: Date: 4/21/05 Time: 4:30 PM

Project No: CS17101-105
Technician/Engineer: SS
Date of Test: 4/22/2008

Percolation Test Hole: 1
Depth of Hole: 39.5 **Pipe Length: 50.875**

Time (hrs:min)	Time Interval (hrs:min)	Depth to Water (in)	Change in Water Depth (in)	Perc. Rate (min/in)
1:05 PM	-------	36 5/8		
1:15 PM	0:10	40 5/8	4	3
1:25 PM	0:10	47 1/4	6 5/8	2
1:35 PM	0:10	39 1/8	-------	-------
1:45 PM	0:10	42 1/2	3 3/8	3
1:55 PM	0:10	48 5/8	6 1/8	2
2:05 PM	0:10	39 1/2	-------	-------
2:15 PM	0:10	44 1/8	4 5/8	2
2:25 PM	0:10	49 1/8	5	2
2:35 PM	0:10	39 3/4	-------	-------
2:45 PM	0:10	44 5/8	4 7/8	2
2:57 PM	0:12	45 1/8		-------
2:59 PM	0:02	45 5/8	1/2	4
3:01 PM	0:02	46 1/2	7/8	2
3:03 PM	0:02	47 1/2	1	2
3:05 PM	0:02	48 1/4	3/4	3
3:07 PM	0:02	49	3/4	3
3:09 PM	0:02	49 3/4	3/4	3

3

Percolation Test Hole: 2
Depth of Hole: 40.5 **Pipe Length: 59**

Time (hrs:min)	Time Interval (hrs:min)	Depth to Water (in.)	Change in Water Depth (in)	Perc. Rate (min/in)
1:06 PM	-------	45 1/2		
1:16 PM	0:10	46 1/4	3/4	13
1:26 PM	0:10	46 7/8	5/8	16
1:36 PM	0:10	47 1/4	3/8	27
1:46 PM	0:10	47 3/4	1/2	20
1:56 PM	0:10	48 1/4	1/2	20
2:06 PM	0:10	48 1/2	1/4	40
2:16 PM	0:10	48 3/4	1/4	40
2:26 PM	0:10	49 1/8	3/8	27
2:36 PM	0:10	49 3/8	1/4	40
2:46 PM	0:10	49 5/8	1/4	40
2:56 PM	0:10	49 7/8	1/4	40
3:16 PM	0:20	50 3/8	1/2	40
3:36 PM	0:20	50 7/8	1/2	40
3:56 PM	0:20	51 3/8	1/2	40

40

Percolation Test Hole: 3
Depth of Hole: 44 **Pipe Length: 58.5**

Time (hrs:min)	Time Interval (hrs:min)	Depth to Water (in.)	Change in Water Depth (in)	Perc. Rate (min/in)
1:07 PM	---------	44 1/8		
1:17 PM	0:10	45 1/8	1	10
1:27 PM	0:10	46 1/4	1 1/8	9
1:37 PM	0:10	47	3/4	13
1:47 PM	0:10	47 5/8	5/8	16
1:57 PM	0:10	48 3/8	3/4	13
2:07 PM	0:10	48 7/8	1/2	20
2:17 PM	0:10	49 3/8	1/2	20
2:27 PM	0:10	50	5/8	16
2:37 PM	0:10	50 3/8	3/8	27
2:47 PM	0:10	50 7/8	1/2	20
2:57 PM	0:10	51 1/8	1/4	40
3:17 PM	0:20	51 7/8	3/4	27
3:27 PM	0:10	52 1/4	3/8	27
3:37 PM	0:10	52 1/2	1/4	40
3:47 PM	0:10	52 3/4	1/4	40
3:57 PM	0:10	53	1/4	40
4:07 PM	0:10	53 1/4	1/4	40

40

Depth to water in Profile Hole: None

Depth of Profile Hole: 25

Table A-2
PERCOLATION TEST DATA

CTL | THOMPSON

Project: Winslow Drive Parcel
Location: TH-2
Pre-Soaked: Date: 4/21/05 Time: 4:30 PM

Project No: CS17101-105
Technician/Engineer: SS
Date of Test: 4/22/2008

Percolation Test Hole: 1
Depth of Hole: 48.25 in. **Pipe Length: 60.25**

Time (hrs:min)	Time Interval (hrs:min)	Depth to Water (in)	Change in Water Depth (in)	Perc. Rate (min/in)
12:30 PM	-------	46 1/8		
12:40 PM	0:10	46 3/8	1/4	40
12:50 PM	0:10	46 1/2	1/8	80
1:20 PM	0:30	46 1/2	0	-------
1:50 PM	0:30	46 5/8	1/8	240
2:20 PM	0:30	46 5/8	0	-------
2:50 PM	0:30	46 5/8	0	-------
3:20 PM	0:30	46 5/8	0	-------
3:50 PM	0:30	46 5/8	0	-------
4:20 PM	0:30	46 3/4	1/8	240
4:30 PM	0:10	46 7/8	1/8	80
			240	

Percolation Test Hole: 2
Depth of Hole: 46.5 in. **Pipe Length: 54.5**

Time (hrs:min)	Time Interval (hrs:min)	Depth to Water (in.)	Change in Water Depth (in)	Perc. Rate (min/in)
12:31 PM	-------	40 1/4		
12:41 PM	0:10	40 5/8	3/8	27
12:51 PM	0:10	40 3/4	1/8	80
1:21 PM	0:30	41 1/2	3/4	40
1:51 PM	0:30	41 7/8	3/8	80
2:21 PM	0:30	42 1/2	5/8	48
2:51 PM	0:30	42 3/4	1/4	120
3:21 PM	0:30	43	1/4	120
3:51 PM	0:30	43 1/4	1/4	120
4:21 PM	0:30	43 1/2	1/4	120
			120	

Percolation Test Hole: 3
Depth of Hole: 48.625 **Pipe Length: 61.625**

Time (hrs:min)	Time Interval (hrs:min)	Depth to Water (in.)	Change in Water Depth (in)	Perc. Rate (min/in)
12:32 PM	---------	45 1/4		
12:42 PM	0:10	45 1/2	1/4	40
12:52 PM	0:10	45 1/2	0	-------
1:22 PM	0:30	45 1/2	0	-------
1:52 PM	0:30	45 3/4	1/4	120
2:22 PM	0:30	45 3/4	0	-------
2:52 PM	0:30	46	1/4	120
3:22 PM	0:30	46 1/8	1/8	240
3:52 PM	0:30	46 1/4	1/8	240
4:22 PM	0:30	46 1/4	0	-------
4:32 PM	0:10	46 1/4	0	-------
			240	

Depth to water in Profile Hole: None

Depth of Profile Hole: 25 ft