AMERICAN GEOSERVICES

Geotechnical & Geologic Hazards Evaluation Report

2150 Mulligan drive, Colorado Springs, CO 80920

Parcel 6228305004, Lot 1, Lot 2, Lot 3

Date: July 22, 2020; Project No: 0208-CS20

AMERICAN GEOSERVICES

GEOTECHNICAL & MATERIALS
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888-276-4027

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PROJECT NO: 0208-CS20

Mr. Barry Farah

Re: Geotechnical and Geologic Hazards Evaluation Report, 2150 Mulligan drive, Colorado Springs, CO 80920, **Parcel 6228305004, Lot 1, Lot 2, Lot 3**

Dear Mr. Farah,

At your request, we have completed the geotechnical and geologic hazards evaluation for the referenced project in accordance with the American GeoServices, LLC (AGS) Proposal. Results of our evaluation and design recommendations are summarized below.

PROJECT INFORMATION

The site is located as shown in attached figures. The proposed development will consist of dividing the referenced parcel into three residential lots and new residential construction. We do not anticipate significant site grading for this project. We anticipate proposed structures will be constructed with light to moderate foundation loads.

SCOPE OF WORK

Our scope of services included the geologic literature review, soil explorations, engineering geology and geologic hazards evaluation, geotechnical evaluation, and the preparation of this report. Evaluation of any kind of existing structures on and adjacent to the site was beyond our scope of services.

In April 2020, we performed three soil explorations (B1 through B3) at approximate locations that were accessible, as shown in Figure 2. Our soil exploration included logging of soils from soil boring. Our explorations extended to a maximum depth of 25 feet below existing ground surface (BGS) where refusal to drilling was encountered, most likely on pebbles. All soil/rock samples were identified in the field and were placed in sealed containers and transported to the laboratory

for further testing and classification. Logs of all soil explorations showing details of subsurface soil conditions encountered at the site are included in an appendix. The Legend and Notes necessary to interpret our Exploration Logs are also included in an appendix.

Data obtained from site observations, subsurface exploration, laboratory evaluation, and previous experience in the area was used to perform engineering analyses. Results of engineering analyses were then used to reach conclusions and recommendations presented in this report.

SURFACE CONDITIONS

The site is roughly an irregularly shaped parcel of undeveloped land as shown in Figure 2. Currently the site topography is gently to moderately sloping (5%-15% slopes) downwards to the south. Site surface conditions are shown in attached photographs. Further details are discussed in the following paragraphs.

GEOLOGY

Bedrock Geology: The site is located in the western portion of the Great Plains Physiographic Province. The site is located near the western edge of an asymmetrical, oval-shaped, structural depression known as the Denver Basin, which lies just east of the Front Range and covers most of eastern Colorado. Bedrock in this area dips gently northeast towards the axis of this basin. The bedrock in the site vicinity area are the Dawson Arkose Formation which is sedimentary in nature and typically Tertiary to Upper Cretaceous in age (TKda). At the time of deposition of this unit during the early Paleocene age, the uplift of the Front Range was well underway. Energetic braided streams were delivering to the basin a mixture of coarse gravel, sand, and finer silt and clay derived from weathering and erosion mostly of the Precambrian Pikes Peak Granite. The source area for these granitic arkosic materials was immediately to the west across the mountain-front fault system called the Rampart Range Fault. Stream flow was generally towards the east. The pebble conglomerate and arkosic sand beds of unit TKda are cross-bedded and fill broad channels generally cut into finer-grained deposits of clayey sandstones and sandy claystones.

Surficial Geology: Most of the surficial units in the site vicinity area consist of eolian sand (Qes) in upper upto 5 feet followed by TKda2-3, a thick-bedded to massive, cross-bedded, light-colored arkoses and gravelly arkoses, which can be as deep as 500 feet.

Structural Geology: The structural geology of the site vicinity area is not complex. Bedrock units dip gently to the northeast at 3°–5°. Measurement of strike and dip in the Dawson Formation is difficult and questionable because of the coarse-grained, lenticular and cross-bedded character of most of the beds.

Stratigraphy: The site is underlain by the following geologic units as shown in Figure 3.

Dawson Formation of Upper Cretaceous to Eocene Age, Tkda: Surficial alluvial deposit is typically underlain by the Dawson formation which typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and very little of claystone. The Dawson Formation is divided into upper and lower parts. The lower part, composed almost exclusively of andesitic debris, is not exposed in the site vicinity area. The upper part of the Dawson Formation is divided into facies unit one (TKda1), facies unit two (TKda2), and facies unit three (TKda3). These facies units are differentiated on the relative proportions of andesitic and arkosic material, on the thickness and style of coarse-grained bedding units, and on the relative proportion of fine-grained claystone and siltstone versus coarser-grained beds of sandstone, arkose, pebbly arkose, and pebble conglomerate. The site vicinity area is mostly underlain by TKda5 as described earlier.

Mineral Resources: Sand and gravel are probably the most significant mineral resources in the site vicinity area. Thin coal beds occur in facies three of the upper part of the Dawson Formation, but there is no recorded mining of these beds in the site vicinity area. Test wells for oil and gas reported no shows and were abandoned. No metallic or radioactive mineral resources are known in the site vicinity area. Clay has been mined from pits in the Monument area, but none are currently active or permitted.

On-site sandy alluvium materials derived from arkose can be considered a low-grade sand resource. According to the El Paso County Aggregate Resource Evaluation Map, the site is not mapped as containing aggregate deposits. According to the Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties published by the Colorado Geological Survey, the site is not mapped as having any resources. According to the Evaluation of Mineral and Mineral Fuel Potential Maps, the site is mapped as having "poor" industrial minerals. In our opinion, considering the sandy nature of much of the on-site materials and abundance of similar materials in the site vicinity area and through the region, and considering the proximity to developed land, on-site mineral resources are considered as having little significance as an economic resource.

According to the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands, 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 coal mines have been mapped in the site vicinity. No metallic mineral resources have been mapped in the site vicinity. The site has been mapped as "Fair" for oil and gas resources, however, no oil or gas fields have been discovered in the site vicinity, most likely because the sedimentary bedrock in the site vicinity lack the geologic structure for trapping oil or gas. The site vicinity has not been explored for hydraulic fracturing to determine whether bedrock underlying the site is a commercially viable resource for

oil and gas. Moreover, the method of hydraulic fracturing has come under review due to environmental, health and safety concerns.

GEOLOGIC HAZARDS

Based on the results of our site reconnaissance and detailed geologic literature review, we have prepared an engineering geology map as shown in Figure 4A. The site should be developed considering the geologic conditions illustrated in Figure 4A and all the geologic hazards should be understood and mitigated as discussed below.

Landslides: Our review of available geologic maps and landslide hazard maps did not indicate that landslides had occurred at the site or in the site vicinity area, and the site is not located within the existing known landslide area. During our site reconnaissance and in the available geologic and geologic hazards maps. landslide features were not mapped within the site boundary area. In general, the site and the vicinity area are not close to the zone designated as having landslide potential. The site itself and the immediate vicinity area has not been subjected to the deep-seated landslides or slope failures. The closest landslide hazard area of concern is located several miles away from the site to the west.

Our site reconnaissance did not reveal any significant potential for slope failures, shallow slumps, or existing severe erosion at the site. At present, there are no visual signs of slope failures such as tension cracks, several bent trees, unusual drainage patterns and vegetation, leaning retaining walls, or significant settlements or movements in any existing structures.

Slope Stability: Using the results of subsurface exploration, laboratory evaluation, and site reconnaissance data, we analyzed on-site slopes by performing preliminary slope stability analyses. We used the software SLOPE/W to model on-site slopes, subsurface soil conditions, and the impact of proposed construction on the stability of the site. Based on the results of our preliminary evaluation, we make following recommendations.

- There is a very low potential for shallow slumps or slope failures or surficial erosion provided proper geotechnical design and well-monitored construction activities are used to develop the site. Provided proper geotechnical design is done, and all our recommendations are strictly followed, the site will remain stable after proposed construction. Although the potential is low, minor localized and shallow slumps may occur in areas steeper than 2.5H(Horizontal):1V(Vertical); however, their occurrence will not impact the stability of the proposed structures provided they are properly located and designed in accordance with our recommendations given in the following paragraphs.

- All proposed structures should be located beyond **the setback line shown in attached Figure 2A.** This setback line can be further modified based on any future modifications to the construction plans and subject to the results of any additional analyses required by us. At the time of construction, AGS should inspect the foundation locations and confirm the presence of adequate slope setback.
- Storm water disposal regulations of El Paso County, and general drainage recommendations given in following sections should be strictly followed.
- In general, areas with moderate to steep slopes present greater construction difficulties. These areas can easily become unstable as the result of poorly planned or non-engineered construction activities such as cuts and fill. Therefore, these areas should not be considered for development or disturbed without a detailed review of site grading plans and house plans by the project geotechnical engineer, and slope stability analysis and foundation design as required once the site grading plans and house plans are completed.

Earthquakes: Based on site geology, topography, and our preliminary evaluation, in our opinion, the site is generally not considered to be located within highly active seismic area. Therefore, anticipated ground motions in the region due to seismic activity are relatively low and do not pose a significant hazard. Ground accelerations more than 0.1g to -0.2g are not anticipated to occur at the site.

Based on the results of our subsurface explorations and review of available literature (Current international Building Code), in our opinion, a site classification “D” may be used for this project. However, this site classification may be revised by performing a site-specific shear wave velocity study.

Subsurface soil conditions at the site are not susceptible to liquefaction. Seismically induced slope instability may occur on a localized scale in the steep slope areas; however, such an evaluation was beyond our scope of services. A detailed seismic hazards evaluation of the site was beyond our scope of services

Expansive Soils and Bedrock: The site is not underlain by expansive clayey soils or clayey sedimentary bedrock materials (Figure 5 & 5A). In any case, if expansive soil pockets are encountered, mitigation of expansive soils will require over-excavation and replacement with non-expansive soils placed and compacted at a minimum of 95% of its maximum Standard Proctor Dry Density, ASTM D-698. As an option, the use of drilled pier foundation may be considered. Floor slabs on expansive soils should be expected to experience movement. Over-excavation and replacement has been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. Final

recommendations should be determined after an open-hole inspection is performed by AGS during construction.

Collapsible Soils: The site is most likely underlain by loess or wind-blown deposit which are collapsible soils, however, they are most likely not thicker than 5 feet. In any case, if collapsible soil pockets are encountered, they will require surficial densification or over-excavation and replacement with non-collapsible soils placed and compacted a minimum of 95% of its maximum Standard Proctor Dry Density, ASTM D-698. As an option, the use of drilled pier foundation may be considered. Final recommendations should be determined after an open-hole inspection is performed by AGS during construction.

Man-made soils or Artificial Fill: These consist of man-made fill deposits associated with erosion berms and earthen dams. These areas were not present at the time of site reconnaissance. Any earthen dam should be avoided during development unless significant grading is required in the drainage areas. Mitigation of drainage areas is discussed in the following paragraphs.

Seasonal & Potentially Seasonal Shallow Groundwater Areas: These areas have periodically high subsurface moisture conditions and frost-heave potential. In general, these areas lie within the drainages and low-lying areas. These areas are not present at the site. The site is not located within any mapped floodplain zones according to the FEMA Maps. A detailed flood hazard evaluation, or the determination of exact locations of floodplain and specific drainage studies were beyond our scope of services. In any case, as a minimum, finished floor elevations must be at least one foot above the 100-year floodplain elevations. If seasonal shallow groundwater areas are noted during construction, following mitigation measures should be implemented.

Foundations should be placed at least 36 inches below the finished exterior grade for frost protection. In areas where high subsurface moisture conditions are anticipated periodically, subsurface perimeter drains should be installed to mitigate water intrusion into areas below grade. Proper grading (minimum 2%) should be done to direct surface water run-off around construction to avoid soil saturation or ponding.

Any organic material (including topsoil) should be completely removed from the construction area prior to the placement of fill.

Any potentially seasonal shallow groundwater areas may experience high subsurface moisture conditions and frost-heave potential. These lie within the drainages and low-lying areas and should be avoided using proper development methods or properly mitigated as discussed above. At the site, the potential does not exist for high groundwater during high moisture periods.

Flooding: Our review of available flood hazards map and literature did not indicate that the site is susceptible to flooding due to river, or due to any perennial and intermittent tributaries across the project area. Notwithstanding, a detailed flood hazard evaluation was beyond our scope of services.

Erosion & Gullying: The areas that are undergoing severe erosion by water and sheetwash producing gullies and rill erosion were not noted during reconnaissance. Only minor areas of erosion were observed on site at random isolated locations. Notwithstanding, due to the nature of on-site soils, majority of the site is subject to erosion by wind and water, unless proper geotechnical measures are implemented during construction. The presence of vegetation generally reduces the potential for erosion. Prior to or during construction, if eroding areas are identified, they should be mitigated using check dams, regrading, and revegetation using channel lining mats and erosion mats to anchor vegetation and promote vegetation. Specific recommendations pertaining to revegetation should be provided by a qualified landscape architect and/or the Natural Resource Conservation Service (previously Soil Conservation Service) officials.

Erosion Control: On-site soils are mildly to moderately susceptible to wind erosion, and moderately to highly susceptible to water erosion. During and immediately after construction, minor wind erosion and dust may occur. This minor hazard may be mitigated by watering exposed and cut areas or the use of a chemical palliative may be considered to control dust. In our opinion, after the completion of construction and re-vegetation at the site, the wind erosion hazard will be significantly reduced.

Any exposed or loosely compacted soils will be the most susceptible to water erosion. In general, residually weathered soils and weathered bedrock materials are significantly less susceptible to water erosion than alluvial soils. For on-site alluvial soils derived from arkose, water erosion hazard can be minimized by limiting velocities for unvegetated and unlined earth channels to 3 to 4 feet/second, depending upon the sediment load carried by water. Allowable velocities can be increased to 4 to 7 feet/second provided adequate vegetation is used; final numbers depending upon the type of vegetation established. If anticipated velocities exceed these values, channel lining material or conventional riprap may be used to reduce erosion potential. In areas where ditch-lining materials are inadequate to control erosion, small check dams or sediment traps may be used. Check dams generally reduce flow velocities as well as provide small traps for containing sediment. A drainage engineer or civil engineer should determine the amount and location for the placement of ditch linings, check dams, and any special erosion control features.

We anticipate sheetwash and rill erosion in the proposed cut and fill slope areas, unless these areas are properly re-vegetated. It should be noted that the unchecked rill erosion eventually

leads to concentrated flows of water, which result in gully erosion. Therefore, adequate re-vegetation of cut and fill slope area is important. Cut and fill slope areas steeper than 3H:1V are increasingly more difficult to revegetate. Such areas should be revegetated based on the specific recommendations given by a qualified landscape architect and/or the Soil Conservation Service official.

Land Use Planning: The proposed development is residential. Based on the results of our geologic hazards evaluation, in our opinion, the existing geologic and engineering geologic conditions at the site will impose minor constraints on the proposed residential development and construction. The primary issues affecting development will be drainage and erosion related which can be avoided or mitigated through proper engineering design and the use of good construction means and methods.

The near-surface soils at the site are typically loose to medium dense in relative density and should provide adequate foundation support as discussed in the following paragraphs. Considering lightly loaded proposed structures, we anticipate the use of standard shallow spread footings. Expansive soils or collapsible soils were not encountered in our explorations. Expansive clayey sandstone and claystone are not expected to be encountered due to their significant depth below existing grades and proposed excavations, thus not requiring any mitigation measures. Difficult excavations or excavations in hard materials is not anticipated due to the absence of shallow bedrock.

Seasonal shallow groundwater and potentially seasonal shallow groundwater area were not encountered at the site. Due to the large size of the lot and the proposed residential development, any such areas, if encountered, can be easily avoided by not disturbing during construction. In general, any proposed structures should not block drainage pathways. Septic fields should not be located in these areas.

In conclusion, residential development of the site can be achieved provided all the above-mentioned hazards are mitigated through proper engineering design and good construction means and methods, and through non-disturbance of hazard areas.

SOIL HAZARDS

Based on our review of the Natural Resource Conservation Service, previously known as the Soil Conservation Service, the site has been mapped as having one soil type, “Tomah-Crowfoot complex, 8 to 15 percent slopes,” as shown in Figure 4, and as described in an appendix. These soils have high permeabilities and classified as somewhat excessively drained. Limitations on

development does not include frost action potential. Development may occur without the frost-heave or expansive soils concerns.

Possible hazards with moderate soil erosion are possible for the site, however, erosion potential can be controlled with vegetation, drainage and surface run-off management, and adequate erosion control measures during construction. In order to mitigate the soil hazards, AGS should be contacted to provide following additional services once the project plans are completed.

- Develop and implement stormwater management plan and drainage plan to minimize surface water run-off in steep slope areas and in the proposed cut/fill areas.

- Develop and implement a grading plan and erosion control plan for the proposed construction area including the access roads (especially in steep slope area) for maintaining slope stability during and after construction, and for minimizing erosion control during and after construction.

SUBSURFACE EXPLORATION

Subsurface conditions encountered in our explorations and noted in our literature research are described in detail in the Exploration Log provided in an Appendix and in the following paragraphs. Soil classification and identification is based on commonly accepted methods employed in the practice of geotechnical engineering. In some cases, the stratigraphic boundaries shown on Exploration Logs represent transitions between soil types rather than distinct lithological boundaries. It should be recognized that subsurface conditions often vary both with depth and laterally between individual exploration locations. The following is a summary of the subsurface conditions encountered at the site at the proposed house location.

Surface Conditions: Approximately 3-6 inches mixtures of topsoil, loam, sand, and root mass is present at the surface.

Eolian Deposit or Alluvium derived from Arkose: Below topsoil, site is underlain by possibly eolian deposit mixed with alluvium derived from Arkose, generally loose or medium dense or dense mixtures of sands, gravels and silts (SP, SM, SC) extending to the maximum explored depth of 25 feet, where refusal to exploration was encountered. Based on the results of our geologic literature review (Figure 3) and our local knowledge, this alluvium is known to extend to a few feet, about 12-15 feet, below the ground surface (BGS) where it is known to be underlain by local completely weathered Arkose bedrock formation.

Groundwater: Groundwater was not encountered during or at the completion of our soil explorations which extended to a maximum explored depth of 6.5 feet. This observation may not

be indicative of other times or at locations other than the site. Some variations in the groundwater level may be experienced in the future. The magnitude of the variation will largely depend upon the duration and intensity of precipitation, temperature and the surface and subsurface drainage characteristics of the surrounding area.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our geotechnical evaluation, in our opinion, the site is suitable for the proposed construction provided following recommendations are strictly followed. It should be noted that our conclusions and recommendations are intended as design guidance. They are based on our interpretation of the geotechnical data obtained during our evaluation and following assumptions:

- Proposed/Final site grades will not differ significantly from the current site grades;
- Proposed foundations will be constructed on level ground; and
- Structural loads will be static in nature.

Construction recommendations are provided to highlight aspects of construction that could affect the design of the project. Entities requiring information on various aspects of construction must make their own interpretation of the subsurface conditions to determine construction methods, cost, equipment, and work schedule.

SHALLOW FOUNDATIONS

We recommend that the proposed structure be supported on shallow spread footings designed and constructed in accordance with following criteria:

- Excavate foundation subgrades, then surficially compact any loose sandy subgrades using a vibratory compactor. Backfill (if necessary) with granular free-draining structural fill (or onsite sandy soils) compacted to at least 95% of ASTM D698 maximum dry density in order to achieve a “uniform subgrade” and to facilitate the placement of foundation drain. If eolian sands are encountered, over-excavation can be performed based on the results of open-hole inspection or foundation subgrade inspection performed by AGS. Onsite materials may be used as structural fill provided they are approved by AGS.
- Foundations bearing upon properly prepared and approved subgrade should be designed for a maximum allowable bearing pressure of **2,000** pounds per square foot (psf).
- Estimated final structural loads will dictate the final form and size of foundations to be constructed. However, as a minimum, we recommend bearing walls be supported by

continuous footings of at least 18 inches in width. Isolated columns should be supported on pads with minimum dimensions of 24 inches square.

- Exterior footings and footings in unheated areas should extend below design/preferred frost depth of 36 inches.
- Continuous foundation walls should be reinforced in the top and bottom to span an unsupported length of at least 8 feet to further aid in resisting differential movement. As a minimum, additional reinforcement as shown in Figure 6 should be placed.
- Foundation/stem walls should be adequately designed as retaining walls and adequate drainage measures should be implemented as shown in Figure 7.

We estimate total settlement for foundations designed and constructed as discussed in this section will be one inch or less, with differential settlements on the order of one-half to three-fourths of the total settlement.

STRUCTURAL FLOOR & CRAWL SPACE

The grade beams (if used) and floor system should be physically isolated from the underlying soil materials with crawl-space type construction. The void or crawl space of minimum of 6 inches or whatever minimum current Uniform Building Code (UBC) requirement is.

For crawl-space construction, various items should be considered in the design and construction that are beyond the scope of geotechnical scope of work for this project and require specialized expertise. Some of these include design considerations associated with clearance, ventilation, insulation, standard construction practice, and local building codes. If not properly drained and constructed, there is the potential for moisture to develop in crawl-spaces through transpiration of the moisture/groundwater within native soils underlying the structure, water intrusion from snowmelt and precipitation, and surface runoff or infiltration of water through irrigation of lawns and landscaping. In crawl space, excessive moisture or sustained elevated humidity can increase the potential for mold to develop on organic building materials. A qualified professional engineer in building systems should address moisture and humidity issues.

CRAWL SPACE PERIMETER/UNDERDRAIN SYSTEM

For the crawl space to remain free of moisture, it is important that drainage recommendations are properly implemented, and adequate inspections are performed prior to the placement of concrete.

- As a minimum, subgrade beneath a structural floor system should be graded so that water does not pond. Perimeter drains, and under-slab drains should be installed in conjunction with a sump pump system to eliminate the potential for ponding and any subsequent damage to foundation and slab elements. The lot-specific perimeter dewatering and underdrain systems should be properly designed and connected to the area underdrain system or a sump-pump system for suitable discharge from the lot.

- Drainage recommendations illustrated in Figure 11 should be implemented. The subsurface drainage system should consist typically of 4-inch minimum diameter perforated rigid PVC or flexible pipe (rigid preferred due to depth of placement) surrounded by at least one pipe diameter of free draining gravel. The pipe should be wrapped in a geosynthetic to prevent fine soils from clogging the system in the future. The pipe should drain by gravity to a suitable all-weather outlet or a sump-pit. Surface cleanouts of the perimeter drain should be installed at minimum serviceability distances around the structure. A properly constructed drain system can result in a reduction of moisture infiltration of the subsurface soils. Drains which are improperly installed can introduce settlement or heave of the subsurface soils and could result in improper surface grading only compounding the potential issues.

- The underdrain system should consist of adequate lateral drains and a main drain, regular clean out and inspection locations, and proper connections to the sump-pump system for discharge into suitable receptacles located away from the site.

- The entire design and construction team should evaluate, within their respective field of expertise, the current and potential sources of water throughout the life of the structure and provide any design/construction criteria to alleviate the potential for moisture changes. If recommended drain systems are used, the actual design/layout, outlets, locations, and construction means, and methods should be observed by a representative of AGS.

SLAB-ON-GRADE AND PERIMETER/UNDERDRAIN SYSTEM

Groundwater is not expected to be at depths below the proposed foundation levels if excavation is performed during dry seasons and if basement is proposed in the area of borehole locations B1 through B3. In any case, during construction, AGS should be contacted to evaluate the site conditions for moisture conditions at the slab level. To assure proper slab-on-grade construction (if used), following recommendations should be strictly followed:

- A perimeter dewatering system should be installed to reduce the potential for groundwater entering slab-on-grade areas. The lot-specific perimeter dewatering should be properly designed and connected to the area underdrain system or a sump-pump system for suitable discharge from the lot.

- As a minimum, drainage recommendations illustrated in Figure 11 should be implemented. The subsurface drainage system should consist typically of 4-inch minimum diameter perforated rigid PVC or flexible pipe (rigid preferred due to depth of placement) surrounded by at least one pipe diameter of free draining gravel. The pipe should be wrapped in a geosynthetic to prevent fine soils from clogging the system in the future. The pipe should drain by gravity to a suitable all-weather outlet or a sump-pit. Surface cleanouts of the perimeter drain should be installed at minimum serviceability distances around the structure. A properly constructed drain system can result in a reduction of moisture infiltration of the subsurface soils. Drains which are improperly installed can introduce settlement or heave of the subsurface soils and could result in improper surface grading only compounding the potential issues.
- The entire design and construction team should evaluate, within their respective field of expertise, the current and potential sources of water throughout the life of the structure and provide any design/construction criteria to alleviate the potential for moisture changes. If recommended drain systems are used, the actual design/layout, outlets, locations, and construction means, and methods should be observed by a representative of AGS.

The “Slab Performance Risk” associated with native soils is “Low”. All slab subgrades should be prepared in similar fashion as described under foundation section. All slab subgrades must be surficially compacted using a vibratory compactor, and then the subgrades should be inspected and approved by AGS.

The actual slab movements that will occur on a project site are very difficult, if not impossible, to predict accurately because these movements depend on loads, evapo-transpiration cycles, surface and subsurface drainage, consolidation characteristics, swell index, swell pressures and soil suction values. The actual time of year during which the slab-on-grade is constructed has been found to have a large influence on future slab-on-grade movements.

Slab heaves or settlements are normally defined in terms of "total" and "differential" movement. "Total" movement refers to the maximum amount of heave or settlement that the slab may experience as a whole. "Differential" movement refers to unequal heave or settlement that different points of the same slab may experience, sometimes over relatively short horizontal distances. Differential movements are arbitrarily determined to be one-half of the total movement in soils exhibiting Low Slab Performance Risk. Greater differential movements can occur in areas where expansive soils have been encountered and where the natural soils abruptly transition to fill material.

Provided slab subgrades are surficially compacted, for design of floor slabs, a modulus of subgrade reaction of 200 pounds per cubic inch (pci) may be used. Based on the results of our analyses, we believe that interior floor slabs designed as recommended above and constructed as recommended in following paragraphs could result in “total” movement of approximately up to 1-inch with “differential” movement on the order of half the total movement.

We recommend that the construction measures outlined in the following paragraphs be followed to reduce potential damage to floor slabs, should excessive wetting of the subsurface soils occur:

- Design and construct the floor slab to move independently of bearing members (floating slab construction). Provide slip joints around exterior.
- Frequent control joints should be provided at about 10 feet spacing in the floor slab to reduce problems with shrinkage and cracking according to ACI specifications. Control joint spacing is a function of slab thickness, aggregate size, slump and curing conditions. The requirements for concrete slab thickness, joint spacing, and reinforcement should be established by the designer, based on experience, recognized design guidelines and the intended slab use. Placement and curing conditions will have a strong impact on the final concrete slab integrity. Floor slabs should be adequately reinforced with welded wire mesh *and* steel rebar. Structural engineer should include steel rebar in addition to welded wire mesh in order to reduce the risk of differential movement due to bending over 8 feet of unsupported length.
- The need for a vapor barrier will depend on the sensitivity of floor coverings to moisture. If moisture sensitive floor coverings are proposed for portions of the proposed structure, a capillary break material, typically consisting of a “clean” gravel, should be considered. We can provide additional recommendations if this is the case.
- Provided gravel is desired below the slab, a layer of 4 to 6 inches can be used. Plumbing passing through slabs should be isolated from the slabs and provided with flexible connections to allow for movement. Under slab plumbing should be avoided if possible and should be brought above the slab as soon as possible.
- Where mechanical equipment and HVAC equipment are supported on slabs, we recommend provision of a flexible connection between the furnace and ductwork with a minimum of 2 inches of vertical movement.

RETAINING WALL

Retaining walls for at-rest conditions can be designed to resist an equivalent fluid density of 55 pcf for on-site fill materials if needed only imported granular backfill meeting CDOT Class 1 structural backfill should be used. Retaining walls for unrestrained conditions (free lateral

movement) can be designed to resist an equivalent fluid density of 35 pcf for on-site fill materials and 35 pcf for imported granular backfill or CDOT Class 1 structural backfill. For passive resistance of unrestrained walls, we recommend passive resistance of 300 psf per foot of wall height. A coefficient of friction value of 0.35 may be used for contact between the prepared soil surface and concrete base.

The above recommended values do not include a factor of safety or allowances for surcharge loads such as adjacent foundations, sloping backfill, vehicle traffic, or hydrostatic pressure. We should be contacted to provide additional recommendations for any specific site retaining conditions.

Retaining wall backfill should be placed in strict accordance with our earthwork recommendations given below and as illustrated in Figure 4. Backfill should not be over-compacted in order to minimize excessive lateral pressures on the walls. As a precautionary measure, a drainage collection system (drains or geosynthetic drains) should be included in the wall design in order to minimize hydrostatic pressures. A prefabricated drainage composite or drain board such as the MiraDrain 2000 or an engineer-approved equivalent may be installed along the backfilled side of the basement foundation wall.

EARTHWORK CONSTRUCTION

Site grading should be carefully planned so that positive drainage away from all structures is achieved. Following earthwork recommendations should be followed for all aspects of the project.

Fill material should be placed in uniform horizontal layers (lifts) not exceeding 8 inches before compacting to the required density and before successive layers are placed. If the contractor's equipment is not capable of properly moisture conditioning and compacting 8-inch lifts, then the lift thickness shall be reduced until satisfactory results are achieved.

Clays or weathered sandstone/claystone bedrock (if encountered) should not be re-used onsite except in landscaped areas. Import soils should be approved by AGS prior to placement. *Fill placement observations and fill compaction tests should be performed by AGS Engineering in order to minimize the potential for future problems.* Fill material should not be placed on frozen ground. Vegetation, roots, topsoil, the existing fill materials, and other deleterious material to depth of approximately 6 inches should be removed before new fill material is placed.

On-site fill to be placed should be moisture treated to within 2 percent of optimum moisture content (OMC) for sand fill and from OMC to 3-4 percent above OMC for clay and weathered bedrock.

Fill to be placed in wall backfill areas and driveway areas and all other structural areas should be compacted to 95% of Standard Proctor (ASTM D 698) dry density or greater. Compaction in landscape areas should be 85% or greater.

Imported structural fill should consist of sand or gravel material with a maximum particle size of 3 inches or less. In addition, this material shall have a liquid limit less than 30 and a plasticity index of 15 or less. Structural fill should also have a percent fine between 15 to 30 percent passing the No. 200 sieve. Structural fill should be moisture conditioned to within 2 percent of OMC and compacted to at least 95 percent of Standard Proctor (ASTM D698) dry density.

In our opinion, the materials encountered at this site may be excavated with conventional mechanical excavating equipment. For deeper excavations, heavier equipment with toothed bucket may be required. Although our soil explorations did not reveal “buried” foundation elements or other structures or debris within the building footprint, these materials may be encountered during excavation activities. Debris materials such as brick, wood, concrete, and abandoned utility lines, if encountered, should be removed from structural areas when encountered in excavations and either wasted from the site or placed in landscaped areas.

Temporary excavations should comply with OSHA and other applicable federal, state, and local safety regulations. In our opinion, OSHA Type C soils should be encountered at this site during excavation. OSHA recommends maximum allowable unbraced temporary excavation slopes of 1.5:1(H:V) for Type C soils for excavations up to 15 feet deep. Permanent cut and fill slopes are anticipated to be stable at slope ratios as steep as 2H:1V (horizontal to vertical) under dry conditions. New slopes should be revegetated as soon as possible after completion to minimize erosion.

We recommend a minimum of 12 feet of clearance between the top of excavation slopes and soil stockpiles or heavy equipment or adjacent structures. This setback recommendation may be revised by AGS once the project plans are available for review. If braced excavations or shoring systems are to be used or needed, they should be reviewed and designed by AGS. It should be noted that near-surface soils encountered at the site will be susceptible to some sloughing and excavations should be periodically monitored by AGS’s representative.

The proposed excavation should not adversely impact any existing structures. Proper shoring and/or underpinning should be used to maintain the stability of existing structure as well as the excavated faces of the new construction area.

It should be noted that the above excavation recommendations are commonly provided by local consultants. The evaluation of site safety during construction, stability of excavated slopes and

cuts, and overall stability of the adjacent areas during and after construction is beyond our scope of services. At your request, we can provide these services at an additional cost.

During construction in wet or cold weather, grade the site such that surface water can drain readily away from the building areas. Promptly pump out or otherwise remove any water that may accumulate in excavations or on subgrade surfaces and allow these areas to dry before resuming construction. Berms, ditches and similar means may be used to prevent storm water from entering the work area and to convey any water off-site efficiently.

If earthwork is performed during the winter months when freezing is a factor, no grading fill, structural fill or other fill should be placed on frosted or frozen ground, nor should frozen material be placed as fill. Frozen ground should be allowed to thaw or be completely removed prior to placement of fill. A good practice is to cover the compacted fill with a “blanket” of loose fill to help prevent the compacted fill from freezing overnight. The “blanket” of loose fill should be removed the next morning prior to resuming fill placement.

During cold weather, foundations, concrete slabs-on-grade, or other concrete elements should not be constructed on frozen soil. Frozen soil should be completely removed from beneath the concrete elements, or thawed, scarified and re-compacted. The amount of time passing between excavation or subgrade preparation and placing concrete should be minimized during freezing conditions to prevent the prepared soils from freezing. Blankets, soil cover or heating as required may be utilized to prevent the subgrade from freezing.

GENERAL DRAINAGE

Proper drainage is critical for achieving long-term stability and overall success. In general, where interior floor elevations are situated at an elevation below proposed exterior grades, we recommend installation of a perimeter drains around the exterior grade beam and foundations as illustrated in Figure 11. In addition, drain laterals that span the crawl space are recommended to prevent ponding of water within the crawlspace (if used). If necessary, AGS can provide further recommendations for the exterior drain system and a typical drain detail.

Groundwater was not encountered at the time of our explorations. However, based on the weather and surface water run-off conditions in the site vicinity area during construction, site may require pumping and other dewatering methods during construction.

Proper surface drainage should be maintained at this site during and after completion of construction operations. The ground surface adjacent to buildings should be sloped to promote rapid run-off of surface water. We recommend a minimum slope of six inches in the first five

horizontal feet for landscaped or graveled areas. These slopes should be maintained during the service life of buildings. If necessary, adequate interceptor drains should be installed on uphill sides to intercept any surface water run-off towards the site.

Landscaping should be limited around building areas to either xeri-scaping, landscaping gravel, or plants with low moisture requirements. No trees should be planted or present within 15 feet of the foundations. Irrigation should be minimal and limited to maintain plants. Roof downspouts should discharge on splash-blocks or other impervious surfaces and directed away from the building. Ponding of water should not be allowed immediately adjacent to the building.

It is important to follow these recommendations to minimize wetting or drying of the foundation elements throughout the life of the facility. Construction means and methods should also be utilized which minimize improper increases/decreases in the moisture contents of the soils during construction.

Again, positive drainage away from the new structures is essential to the successful performance of foundations and flatwork, and should be provided during the life of the structure. Paved areas and landscape areas within 10 feet of structures should slope at a minimum grade of 10H:1V away from foundations. Downspouts from all roof drains, if any, should cross all backfilled areas such that they discharge all water away from the backfill zones and structures. Drainage should be created such that water is diverted away from building sites and away from backfill areas of adjacent buildings.

CONCRETE CONSTRUCTION

Concrete sidewalks and any other exterior concrete flatwork around the proposed structure may experience some differential movement and cracking. While it is not likely that the exterior flatworks can be economically protected from distress, we recommend following techniques to reduce the potential long-term movement:

- Scarify and re-compact at least 12 inches of subgrade material located immediately beneath structures.
- Avoid landscape irrigation and moisture holding plants adjacent to structures. No trees should be planted or present within 15 feet of the foundations.
- Thicken or structurally reinforce the structures.

We recommend Type I-II cement for all concrete in contact with the soil on this site. Calcium chloride should not be added. Concrete should not be placed on frost or frozen soil. Concrete must be protected from low temperatures and properly cured.

LIMITATIONS

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory evaluation, and our present knowledge of the proposed construction. It is possible that soil conditions could vary between or beyond the points explored. If soil conditions are encountered during construction that differ from those described herein, we should be notified so that we can review and make any supplemental recommendations necessary. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, our recommendations should also be reviewed and revised by AGS.

Our Scope of Work for this project did not include research, testing, or assessment relative to past or present contamination of the site by any source. If such contamination were present, it is very likely that the exploration and testing conducted for this report would not reveal its existence. If the Owner is concerned about the potential for such contamination, additional studies should be undertaken. We are available to discuss the scope of such studies with you. No tests were performed to detect the existence of mold or other environmental hazards as it was beyond Scope of Work.

Local regulations regarding land or facility use, on and off-site conditions, or other factors may change over time, and additional work may be required with the passage of time. Based on the intended use of the report within one year from the date of report preparation, AGS may recommend additional work and report updates. Non-compliance with any of these requirements by the client or anyone else will release AGS from any liability resulting from the use of this report by any unauthorized party. Client agrees to defend, indemnify, and hold harmless AGS from any claim or liability associated with such unauthorized use or non-compliance.

In this report, we have presented judgments based partly on our understanding of the proposed construction and partly on the data we have obtained. This report meets professional standards expected for reports of this type in this area. Our company is not responsible for the conclusions, opinions or recommendations made by others based on the data we have presented. Refer to American Society of Foundation Engineers (ASFE) general conditions included in an appendix.

This report has been prepared exclusively for the client, its' engineers and subcontractors for the purpose of design and construction of the proposed structure. No other engineer, consultant, or contractor shall be entitled to rely on information, conclusions or recommendations presented in this document without the prior written approval of AGS.

We appreciate the opportunity to be of service to you on this project. If we can provide additional assistance or observation and testing services during design and construction phases, please call us at 1 888 276 4027.

Sincerely,

Sam Adettiwar, MS, PE, GE, P.Eng, M.ASCE
Senior Engineer

Attachments

COLORADO SPRINGS
OLYMPIC CITY USA

Geologic Hazard Study Report

Applicant:	Lot 2150/ Barry Farah	Telephone:	719-510-9222
Address:	2150 Mulligan Drive	Email:	barryfarah@gmail.com
City/State:	Colorado Springs/CO	Fax:	
Zip Code:	80920		

The following documents have been included and considered as part of this report (checked off by individual(s) preparing the geologic report):

- ☐ Development Plan
- ☐ Landscape Plan (if applicable)
- ☐ Grading Plan
- ☐ Drainage Report (necessary if debris and/or mud flow hazard is present)

ENGINEER'S STATEMENT

I hereby attest that I am qualified to prepare a Geologic Hazard Study in accordance with the provisions of Section 504 of the Geologic Hazards Ordinance of Colorado Springs. I am qualified as:

- ☐ A Professional Geologist as defined by CRS 34-1-201(3); or,
- ☒ A Professional Engineer as defined by Board Policy Statement 50.2 - "Engineers in Natural Hazard Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. Board authority as defined by CRS 12-25-107(1).

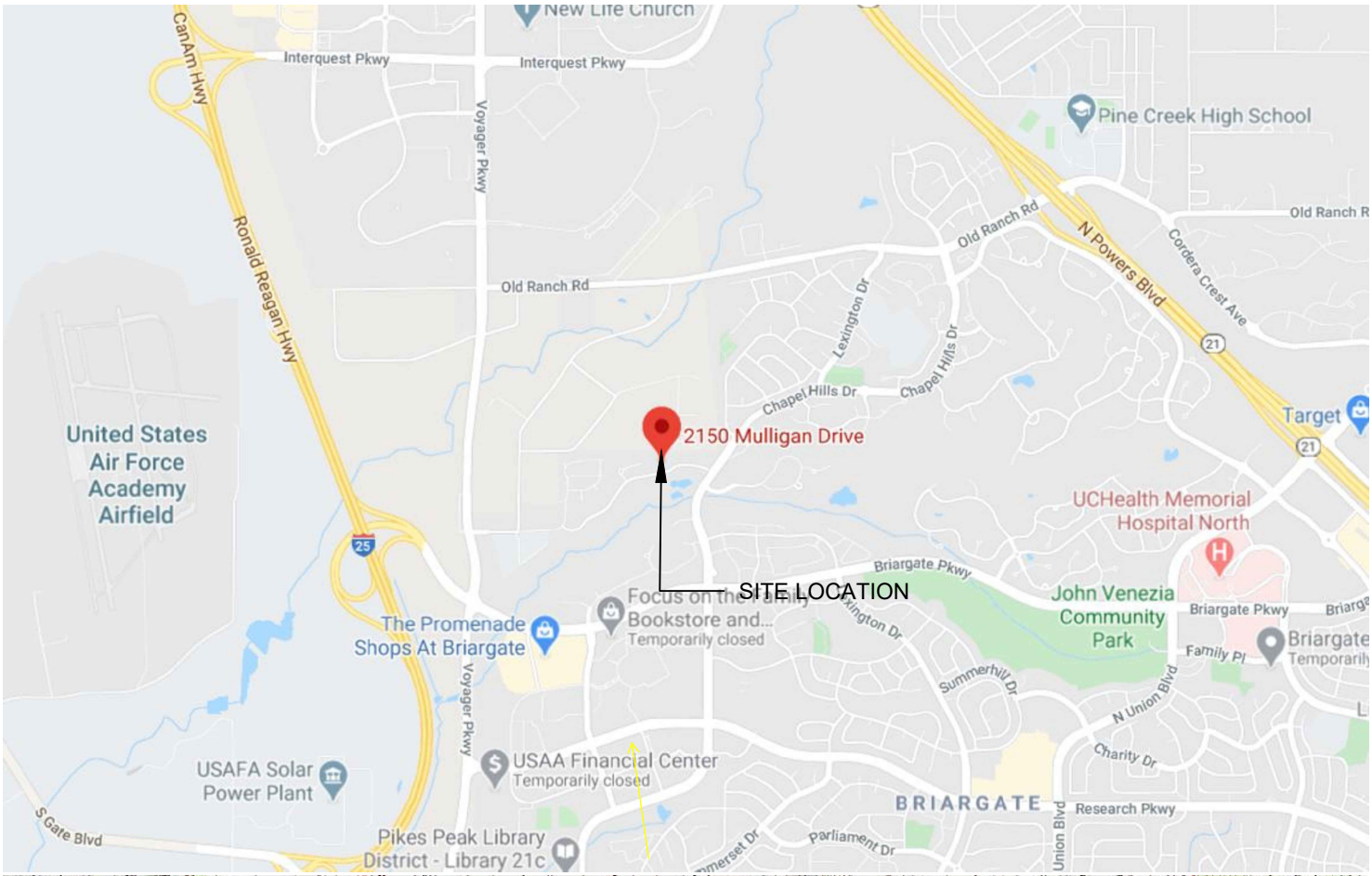
COLORADO REGISTERED PROFESSIONAL ENGINEER SAMSHIR ADDETTIWAR 41370

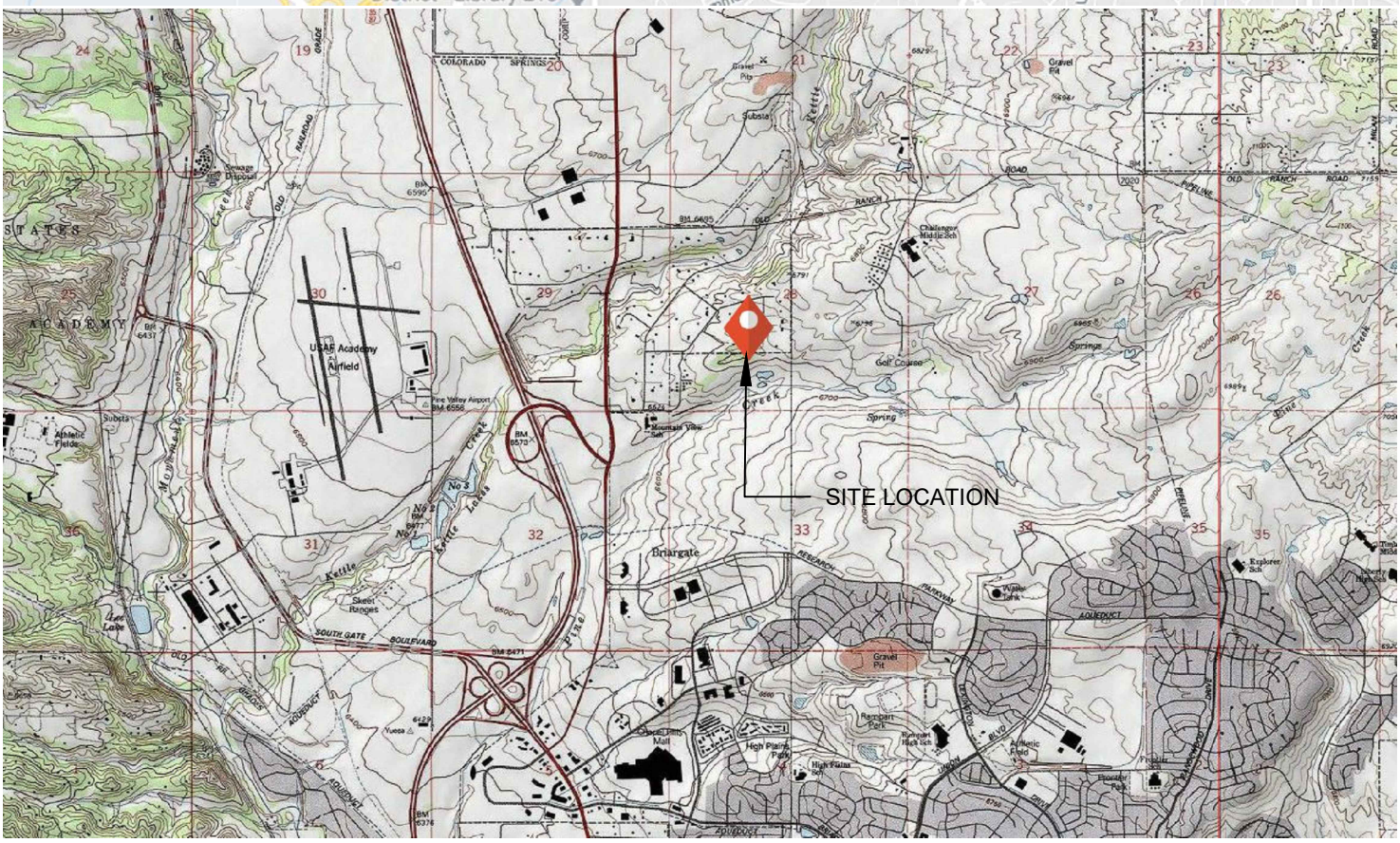
Submitted by:	Sam Addettiwar	Date:	5/26/2020

This Geologic Hazard Study is filed in accordance with the Zoning Code of Colorado Springs, 2001, as amended.

City Engineer	**Date**	**Planning & Development Manager**	**Date**

FIGURES



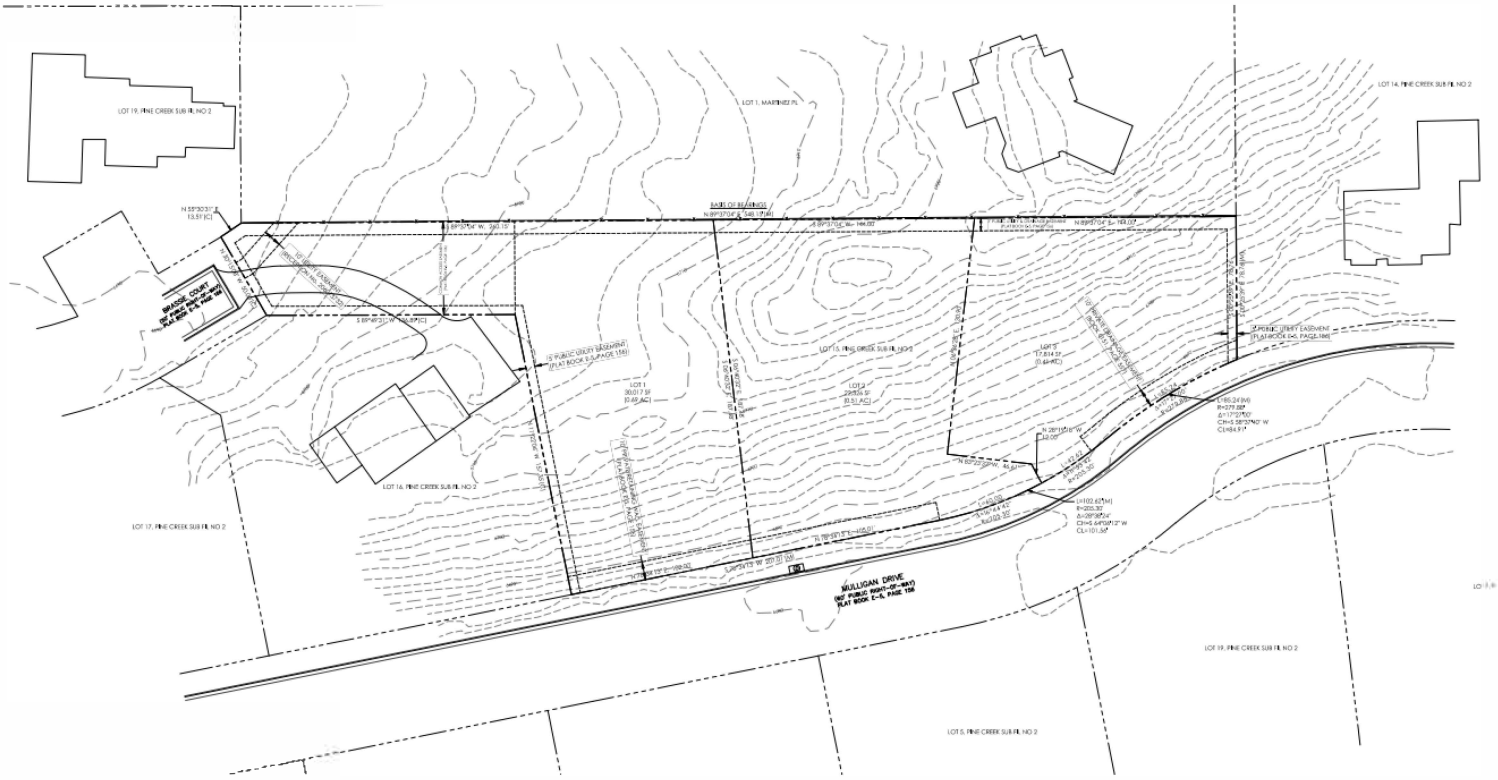


REFERENCE:
GOOGLE MAPS
USGS TOPOGRAPHIC MAPS

N

AMERICAN GEOSERVICES
888.276.4027 - americangeoservices.com

FIGURE 1: SITE LOCATION MAP



NOTE:
SCHEMATIC PLAN TO SHOW APPROXIMATE SUBSURFACE EXPLORATION LOCATION ONLY; NOT SURVEYED.

N

LEGEND:

DESIGNATES SUBSURFACE EXPLORATION LOCATION, BY AMERICAN GEOSERVICES, LLC. , APRIL 2020 SEE EXPLORATION LOG IN APPENDIX FOR FURTHER DETAILS.

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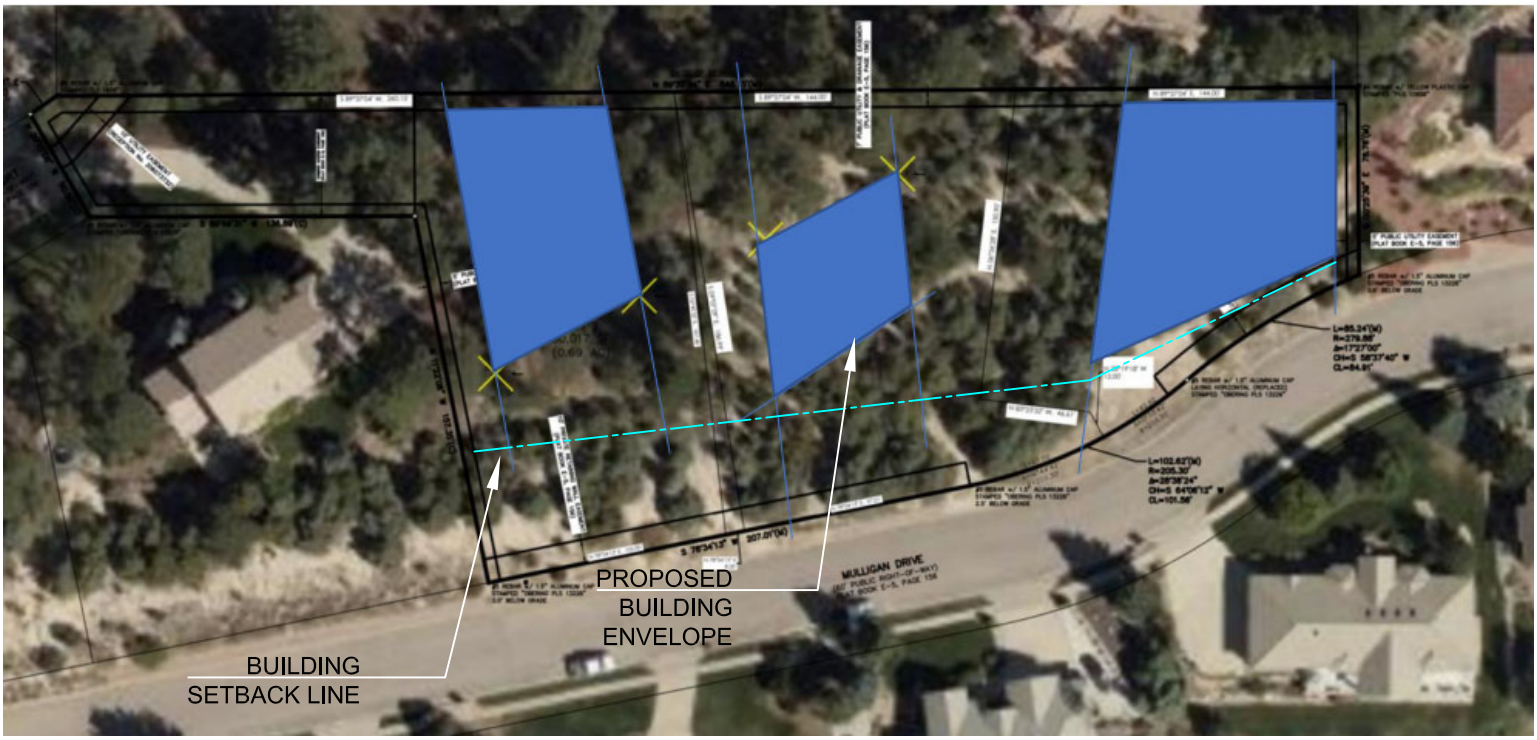
FIGURE 2: SCHEMATIC SITE PLAN



NOTE:

1. SETBACK SHOULD BE CONFIRMED IN THE FIELD BY AGS AT THE TIME OF CONSTRUCTION.
2. ALL FOUNDATION SUBGRADES MUST BE INSPECTED AND APPROVED BY A GEOTECHNICAL ENGINEER PRIOR TO THE PLACEMENT OF CONCRETE.
3. IT IS CONTRACTOR'S RESPONSIBILITY TO ASSURE SITE STABILITY DURING CONSTRUCTION.

N

REFERENCE:
CLIENT MAPS

AMERICAN GEOSERVICES
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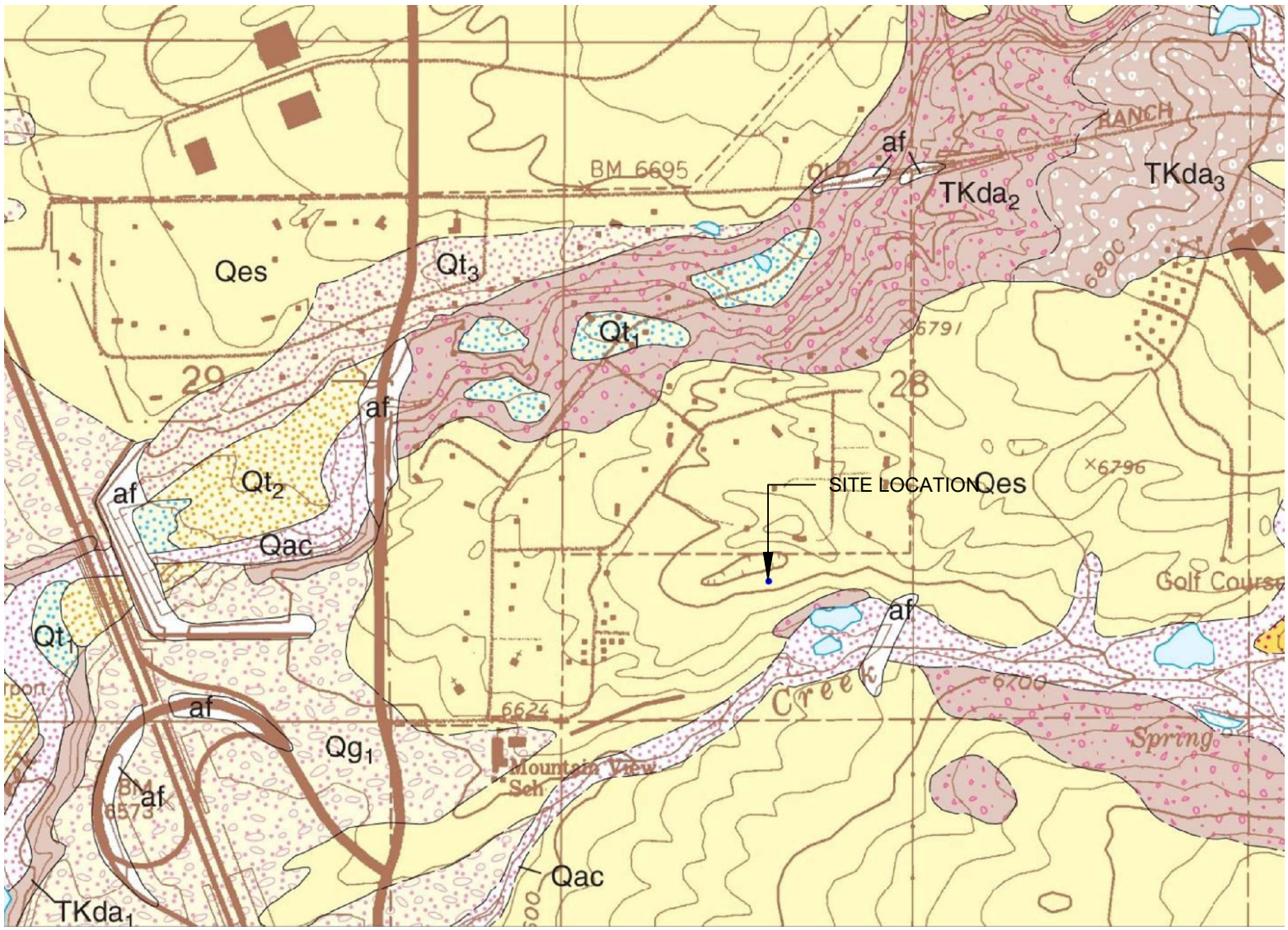
FIGURE 2A: BUILDING SETBACK



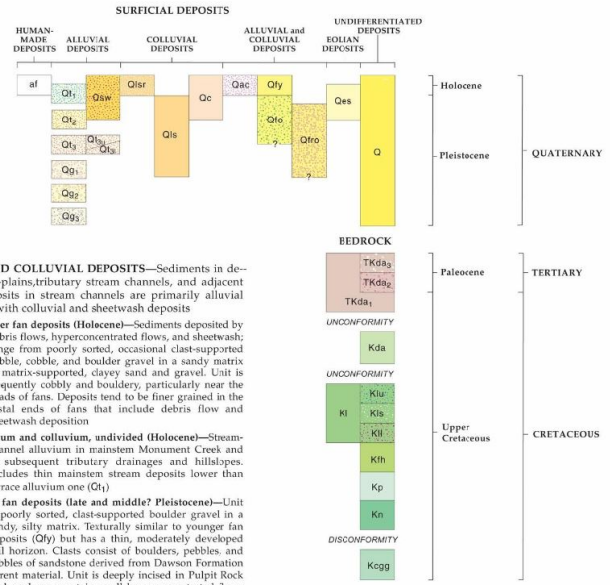
LEGEND

OPEN-FILE MAP 01-3
GEOLOGIC MAP OF THE PIKEVIEW
QUADRANGLE, EL PASO COUNTY, COLORADO
Booklet accompanies map

EOLIAN DEPOSITS—Sediments deposited by wind processes

Qes **Eolian sand (Holocene to late Pleistocene)**—Fine- to coarse-grained silty sand deposited by wind and preserved on surfaces downwind (east) of Monument Creek. Sand is carried to Monument Creek by alluvial processes and then blown east of the creek. Coarse-grained sand is located nearest Monument Creek and Dawson Formation bedrock

CORRELATION OF MAP UNITS



ALLUVIAL AND COLLUVIAL DEPOSITS—Sediments in debris fans, flood-plains,tributary stream channels, and adjacent hillslopes. Deposits in stream channels are primarily alluvial but interfinger with colluvial and sheetwash deposits

Qfy **Younger fan deposits (Holocene)**—Sediments deposited by debris flows, hyperconcentrated flows, and sheetwash; range from poorly sorted, occasional clast-supported pebble, cobble, and boulder gravel in a sandy matrix to matrix-supported, clayey sand and gravel. Unit is frequently cobbly and bouldery, particularly near the heads of fans. Deposits tend to be finer grained in the distal ends of fans that include debris flow and sheetwash deposition

Qac **Alluvium and colluvium, undivided (Holocene)**—Stream-channel alluvium in mainstem Monument Creek and in subsequent tributary drainages and hillslopes. Includes thin mainstem stream deposits lower than terrace alluvium one (Qt_1)

Qfo **Older fan deposits (late and middle? Pleistocene)**—Unit is poorly sorted, clast-supported boulder gravel in a sandy, silty matrix. Texturally similar to younger fan deposits (Qfy) but has a thin, moderately developed soil horizon. Clasts consist of boulders, pebbles, and cobbles of sandstone derived from Dawson Formation parent material. Unit is deeply incised in Pulpit Rock Park and may contain small hyperconcentrated flows and debris flows in active channels

N

REFERENCE:
U.S. GEOLOGICAL MAPS

AMERICAN GEOSERVICES
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FIGURE 3: GEOLOGIC MAP

LEGEND

EOLIAN DEPOSITS—Sediments deposited by wind processes

Qes **Eolian sand (Holocene to late Pleistocene)**—Fine- to coarse-grained silty sand deposited by wind and preserved on surfaces downwind (east) of Monument Creek. Sand is carried to Monument Creek by alluvial processes and then blown east of the creek. Coarse-grained sand is located nearest Monument Creek and Dawson Formation bedrock

N

REFERENCE:
COLORADO SPRINGS GIS

AMERICAN GEOSERVICES
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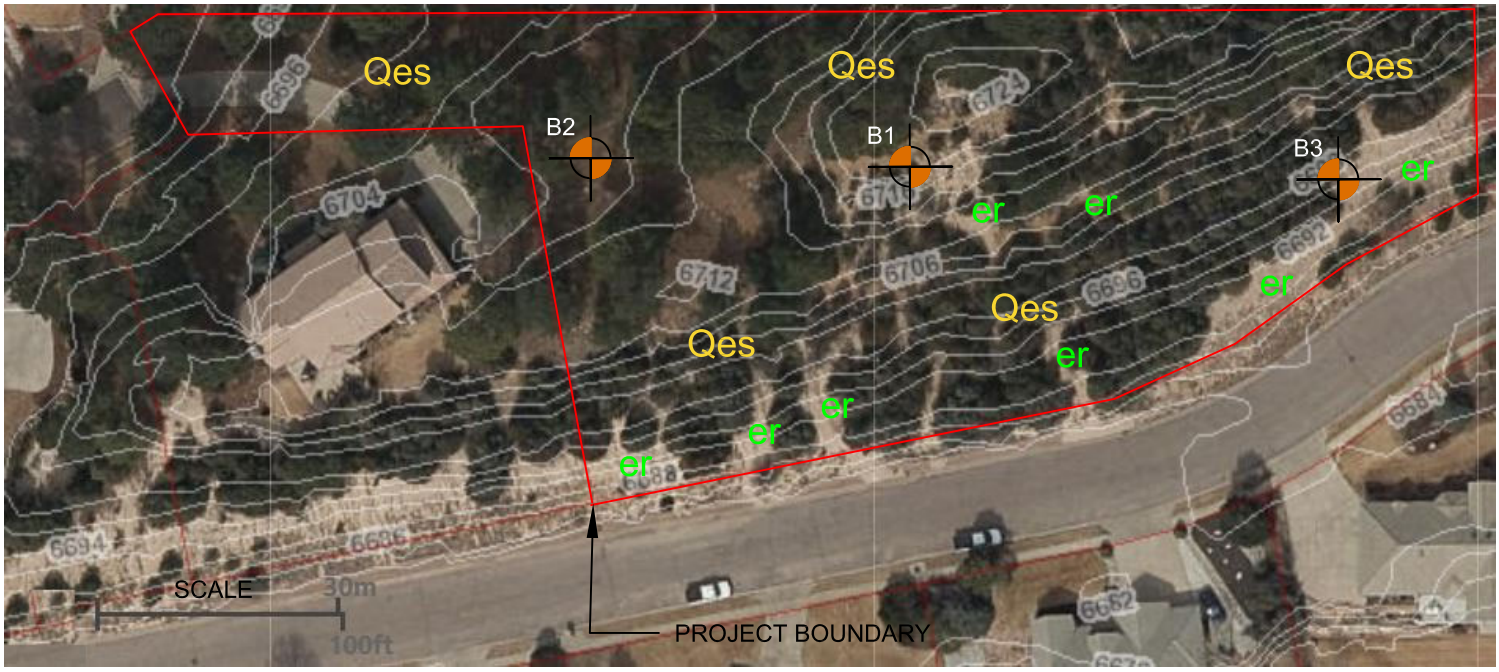
FIGURE 3A:
SURFICIAL GEOLOGY MAP



NOTE:
ARTIFICIAL FILL, MAN-MADE FILL, SEASONAL SHALLOW GROUNDWATER AREAS, PONDED AREAS, OR AREAS OF EROSION WERE NOT PRESENT AT THE TIME OF SITE VISIT IN APRIL 2020.

LEGEND:

DESIGNATES SUBSURFACE EXPLORATION LOCATION, BY AMERICAN GEOSERVICES, LLC. , JUNE 2018 SEE EXPLORATION LOG IN APPENDIX FOR FURTHER DETAILS.

Qes EOLIAN SAND, HOLOCENE TO LATE PLEISTOCENE. OPEN HOLE INSPECTION MUST BE PERFORMED TO CONFIRM THE ABSENCE OF COLLAPSIBLE SOILS IN THE FOUNDATION AREAS.

er AREAS OF POSSIBLE SURFICIAL EROSION HAZARD. PROVIDE ADEQUATE EROSION PROTECTION DURING DEVELOPMENT AND DO NOT DISTURB WITHOUT GEOTECHNICAL OVERSIGHT.

N

REFERENCE:
COLORADO SPRINGS GIS

AMERICAN GEOSERVICES
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FIGURE 3B:
ENGINEERING GEOLOGY MAP

LEGEND

El Paso County Area, Colorado (CO625)

El Paso County Area, Colorado (CO625)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	39.5	73.3%
93	Tomah-Crowfoot complex, 8 to 15 percent slopes	14.4	26.7%

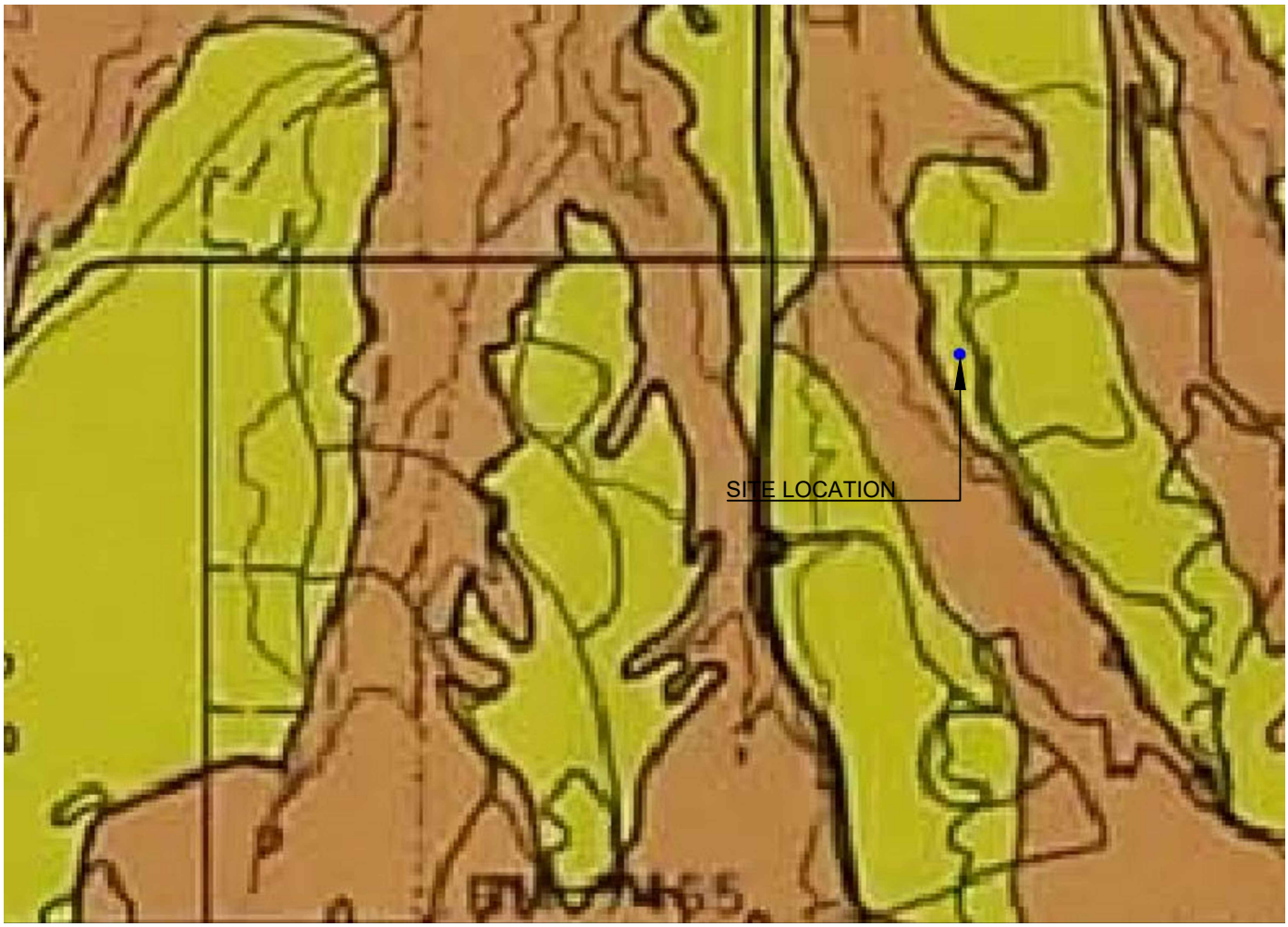
N

REFERENCE:

WEB SOIL SURVEY

AMERICAN GEOSERVICES
888.276.4027 - americangeoservices.com

FIGURE 4: SOIL SURVEY MAP



LEGEND:

RED ZONE: VERY HIGH SWELL POTENTIAL: THIS CATEGORY INCLUDES ONLY BEDROCK OR WEATHERED BEDROCK. THE PRECAUTIONS LISTED BELOW UNDER "HIGH SWELL POTENTIAL" MUST BE UTILIZED.

BROWN ZONE: HIGH SWELL POTENTIAL: THIS CATEGORY GENERALLY INCLUDES ONLY BEDROCK, WEATHERED BEDROCK, AND COLLUVIUM. CAREFUL SITE INVESTIGATION, SPECIAL FOUNDATION DESIGN, AND PROPER POST-CONCTRUCTION LANDSCAPING AND MAINTENANCE ARE REQUIRED TO PREVENT OR MINIMIZE DAMAGE.

PALE BROWN ZONE: MODERATE SWELL POTENTIAL: THIS CATEGORY INCLUDES SEVERAL BEDROCK FORMATION AND A FEW SURFICIAL DEPOSITS OF VARIABLE THICKNESS. SPECIAL FOUNDATION DESIGNS ARE GENERALLY NESSARY TO PREVENT DAMAGE.

YELLOW ZONE: LOW SWELL POTENTIAL: THIS CATEGORY INCLUDES SEVERAL BEDROCK FORMATIONS AND MANY SURFICIAL DEPOSITS. THE THICKNESS OF THE SURFICIAL DEPOSITS MAY BE VARIABLE, THEREFORE, BEDROCK WITH A HIGHER SWELL POTENTIAL MAY LOCALLY BE LESS THAN 10 FT. BELOW THE SURFACE.

YELLOW HATCHED ZONE: WINDBLOWN SAND OR SILT: ALTHOUGH THIS MATERIAL GENERALLY HAS LOW SWELL POTENTIAL, THE UPPER 6 INCHES TO 12 INCHES MAY LOCALLY HAVE MODERATE SWELL POTENTIAL. WINDBLOWN MATERIAL MAY BE SUBJECT TO SEVERE SETTLEMENT OR HYDROCOMPACTION WHEN WATER IS ALLOWED TO SATURATE THE DEPOSITS. THE THICKNESS OF WINDBLOWN MATERIAL MAY BE VERY VARIABLE, THEREFORE, BEDROCK WITH HIGHER SWELL POTENTIAL MAY LOCALLY BE LESS THAN 10 FT BELOW THE SURFACE.

N

REFERENCE:
COLORADO
GEOLOGICAL
SURVEY

AMERICAN GEOSERVICES
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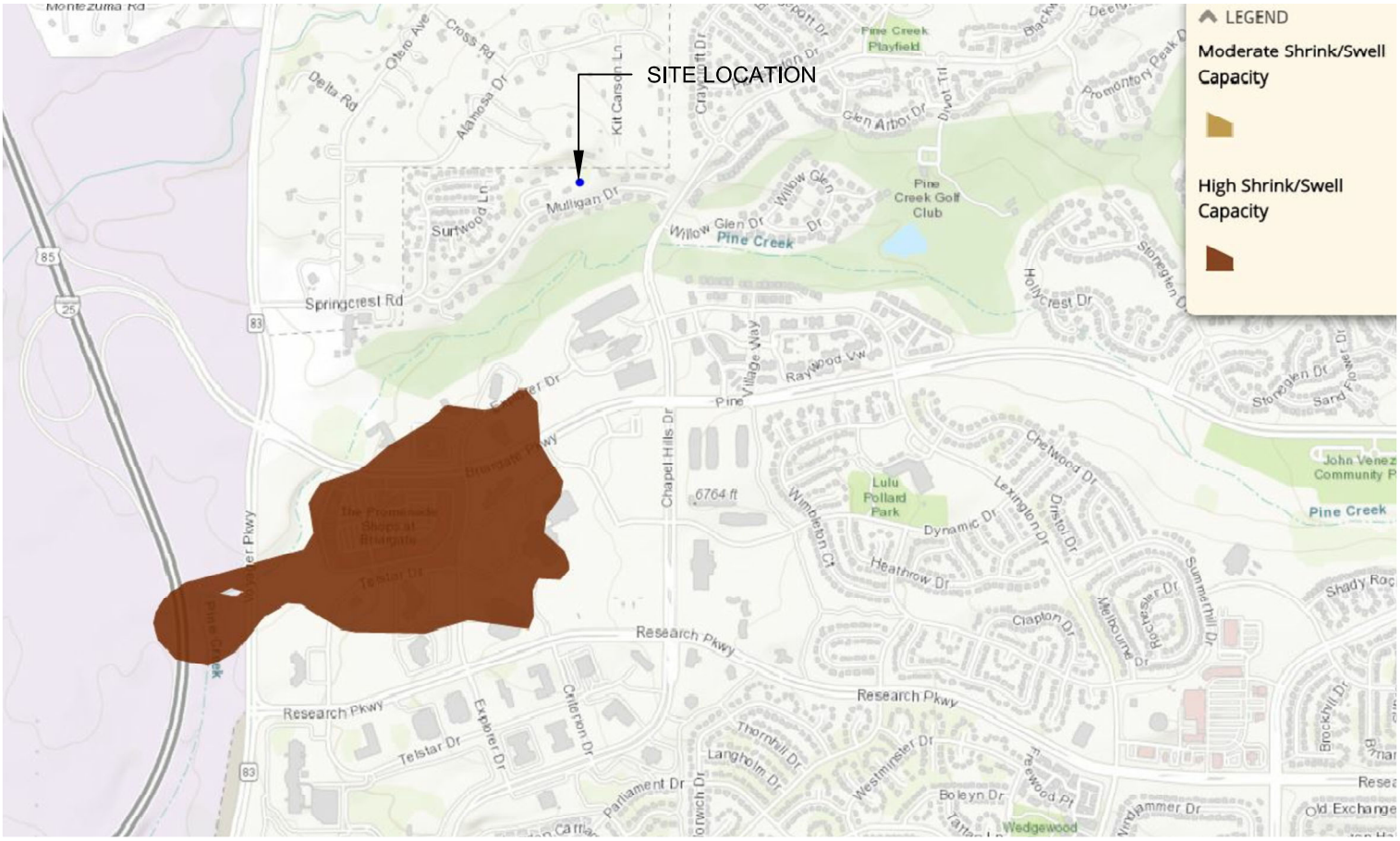
FIGURE 5: SWELLING SOILS MAP



N

REFERENCE:
COLORADO SPRINGS GIS

AMERICAN GEOSERVICES
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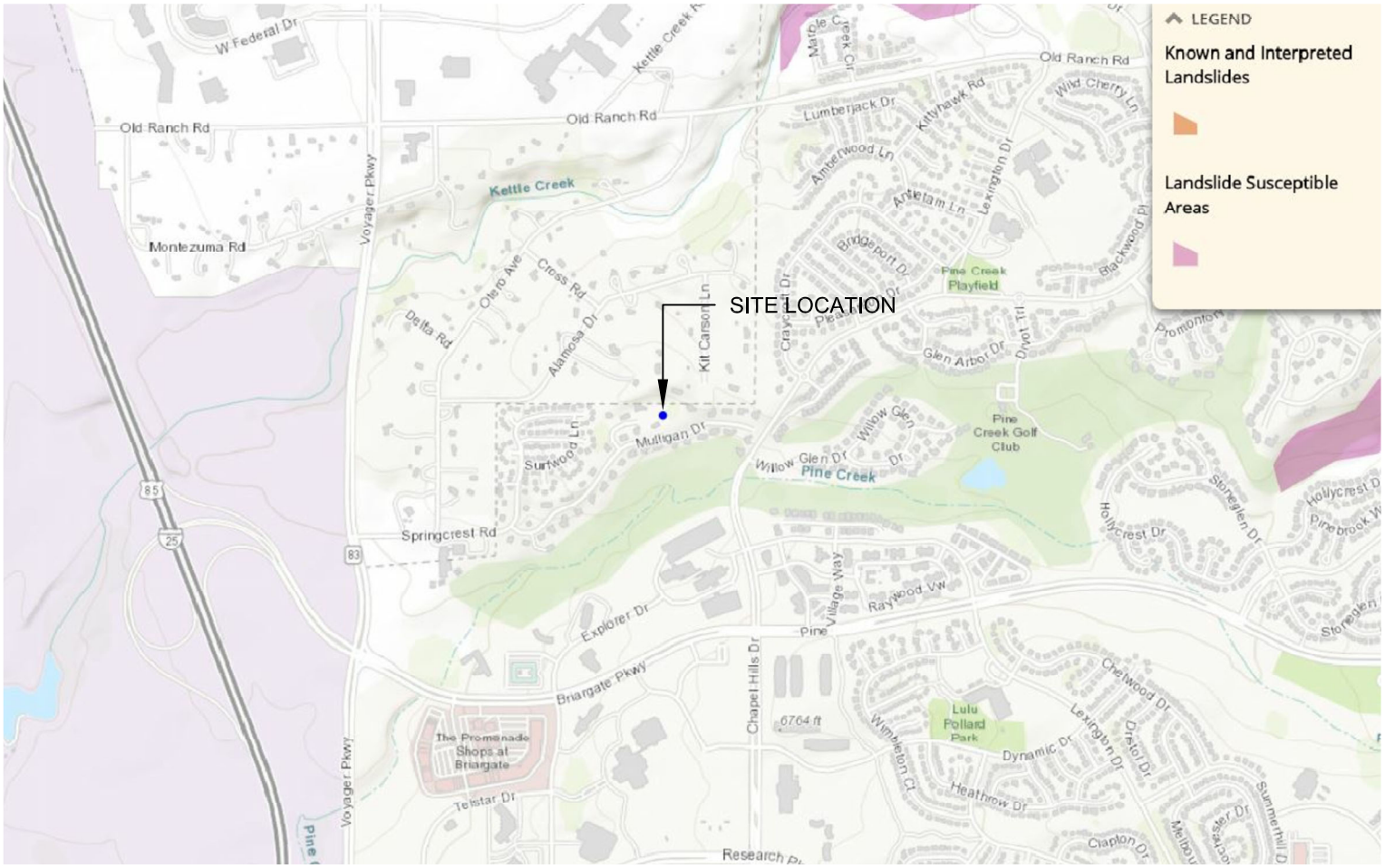
FIGURE 5A:
SWELLING SOIL MAP



N

REFERENCE:
COLORADO SPRINGS GIS

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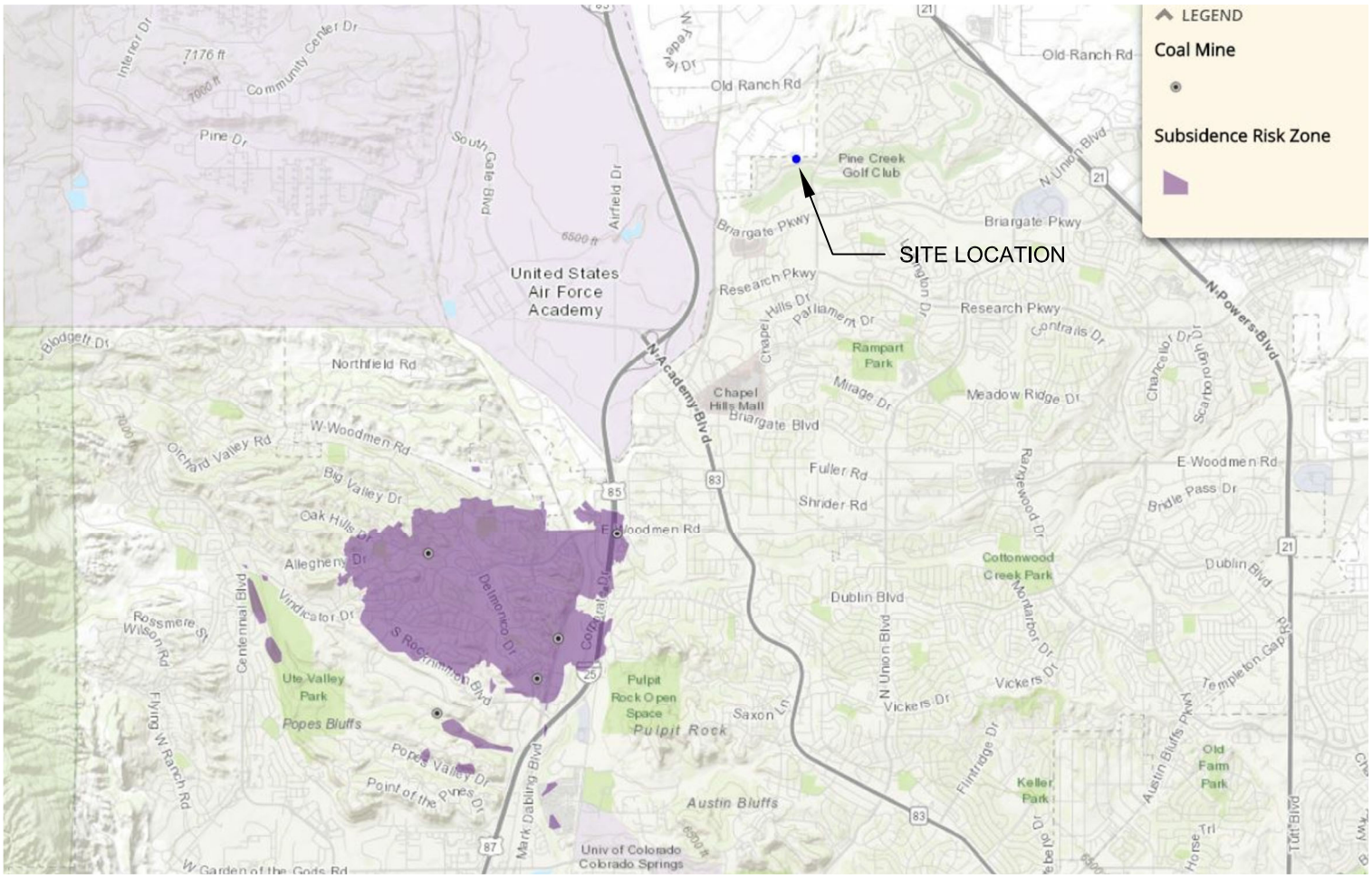
FIGURE 6
LANDSLIDE HAZARD MAP



N

REFERENCE:
COLORADO SPRINGS GIS

AMERICAN GEOSERVICES
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FIGURE 7
COAL MINE SUBSIDENCE MAP

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REFERENCE:
COLORADO SPRINGS GIS

AMERICAN GEOSERVICES
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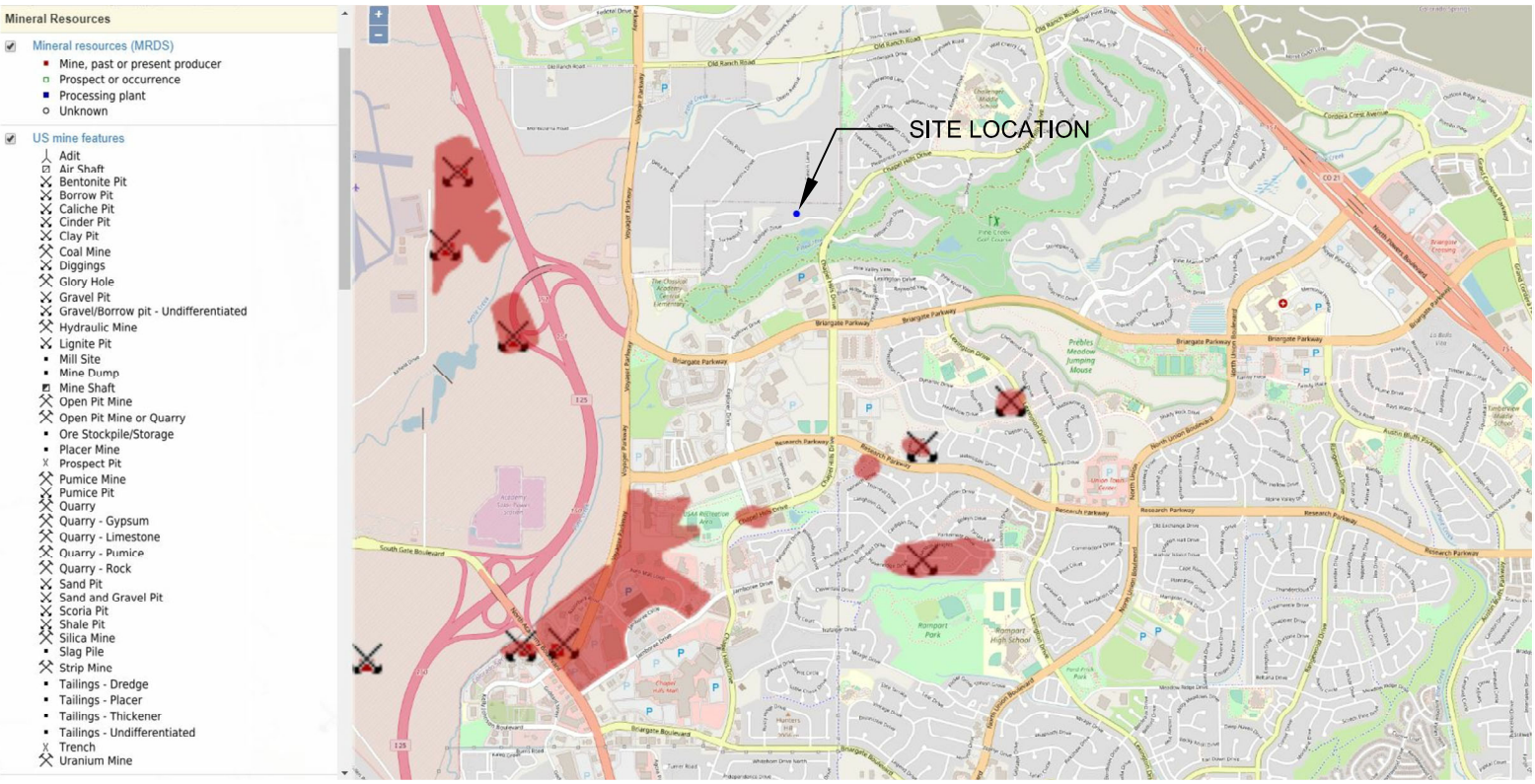
FIGURE 8
FLOOD HAZARD MAP



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REFERENCE:
COLORADO SPRINGS GIS

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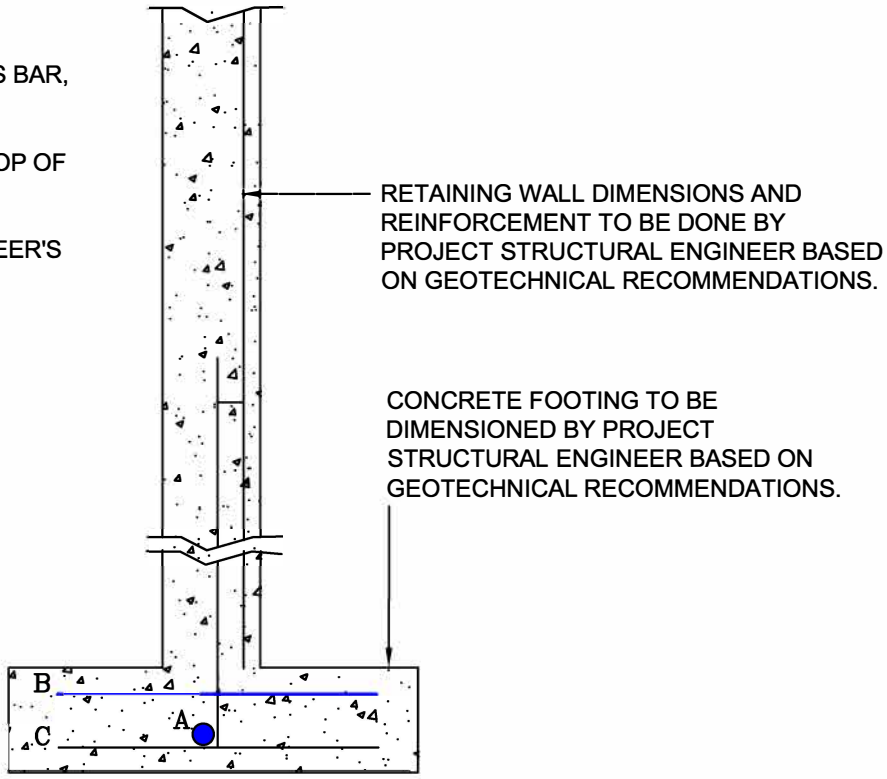
FIGURE 9
MINERAL RESOURCES MAP

NOTES:

A. ADDITIONAL REINFORCEMENT, #4 CONTINUOUS BAR, BOTTOM OF FOOTING.

B. ADDITIONAL REINFORCEMENT, #4 AT 48" C/C, TOP OF FOOTING.

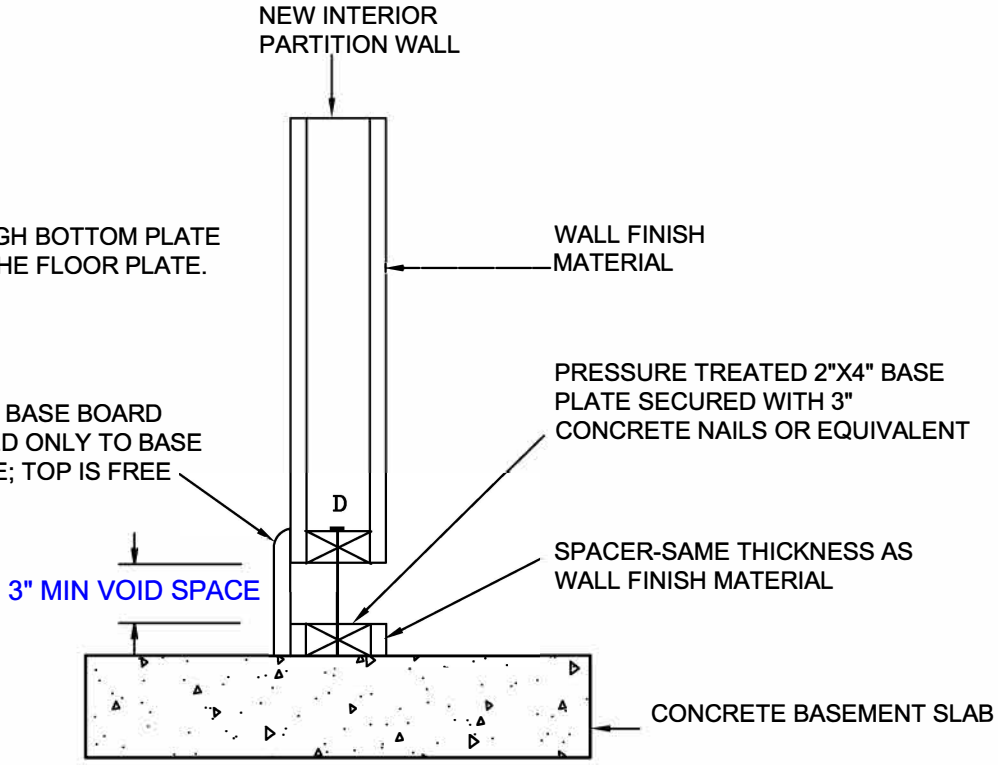
C. REINFORCEMENT AS PER STRUCTURAL ENGINEER'S DESIGN. AS A MINIMUM, USE #4 AT 48" C/C.



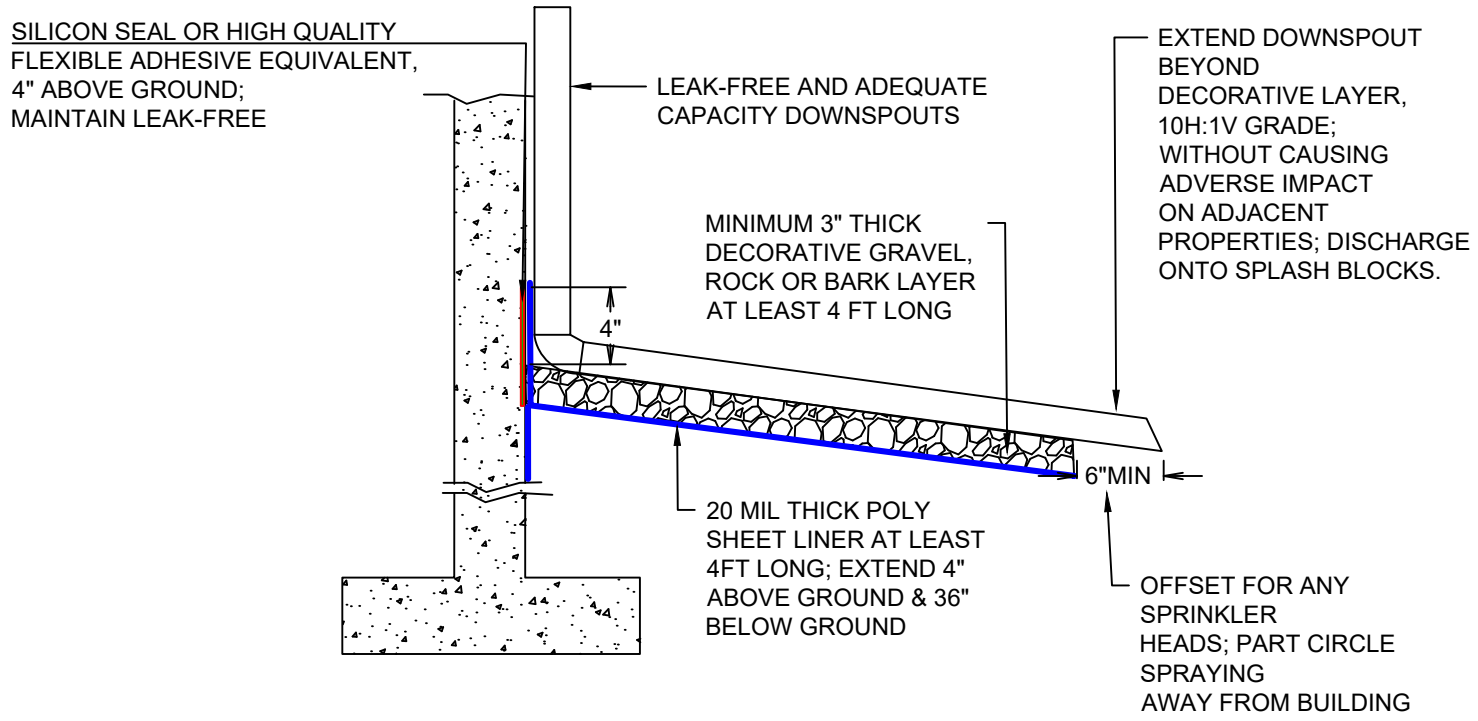
ADDITIONAL FOOTING REINFORCEMENT DETAIL

NOTES:

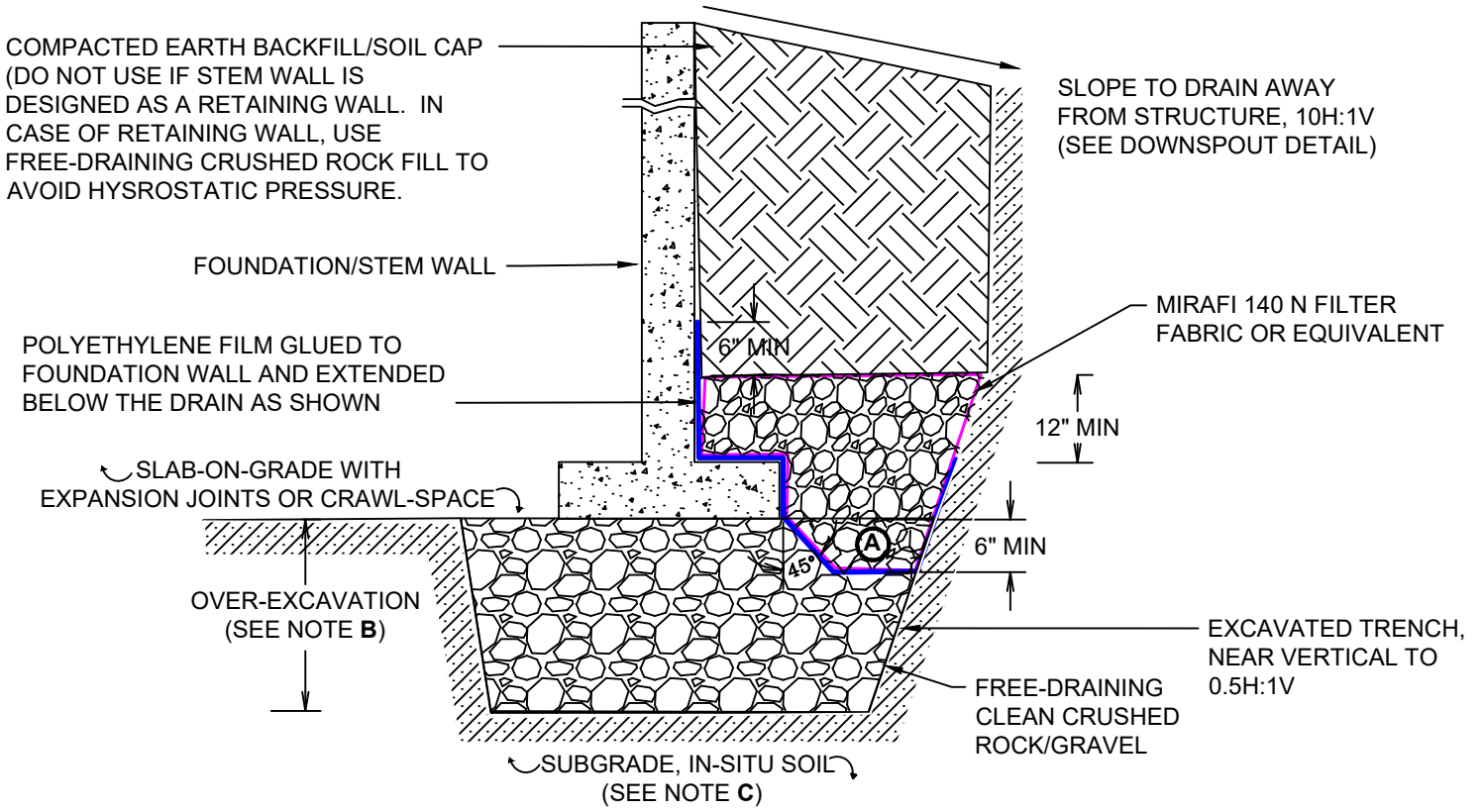
D. 40d NAILS EVERY 24" THROUGH BOTTOM PLATE INTO PRE-DRILLED HOLES OF THE FLOOR PLATE.



"FLOAT" (FLOATING WALL DETAIL)



DOWNSPOUT & MOISTURE BARRIER DETAIL



PERIMETER OR FOUNDATION DRAIN DETAIL

NOTES: **A**. 4-INCH DIAMETER PERFORATED PIPE PLACED 2" ABOVE DRAIN SUBGRADE EMBEDDED IN FREE-DRAINING GRAVEL OR CRUSHED ROCK ENVELOPE WITH 2% GRADE TO SUMP PIT OR DISCHARGED TO A SUITABLE RECEPTACLE SUCH THAT ON-SITE AS WELL AS OFF-SITE STABILITY IS NOT ADVERSELY IMPACTED. **B**. DEPTH BASED ON OPEN HOLE INSPECTION, FOR SHALLOW FOUNDATION OPTION. **C**. ALL FOUNDATION OR OVER-EXCAVATED SUBGRADES MUST BE INSPECTED AND APPROVED BY A GEOTECHNICAL ENGINEER.

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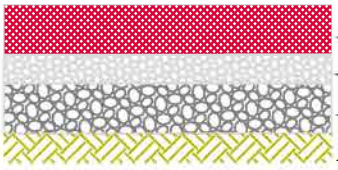
FIGURE 11: DRAINAGE DETAILS

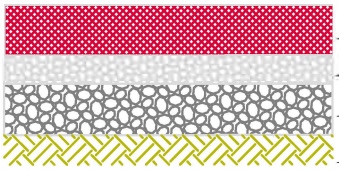
BITUMINOUS PAVEMENT SECTIONS

PARKING AREA
(LIGHTLY LOADED)



3.5" AC
2" 3/4"-0" BASE ROCK W/95% COMPACTION
4" 1 1/2"-0" BASE ROCK W/95% COMPACTION
SUBGRADE TO BE AT 95% COMPACTION (ASTM D698)

DRIVEWAYS, ETC
(HEAVILY LOADED)



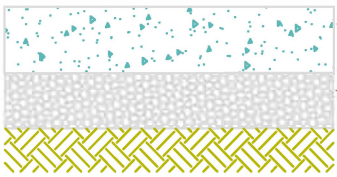
4.5" AC CLASS 'C'
2" 3/4"-0" BASE ROCK W/95% COMPACTION
4" 1 1/2"-0" BASE ROCK W/95% COMPACTION
SUBGRADE TO BE AT 95% COMPACTION (ASTM D698)

CONCRETE PAVEMENT SECTIONS

PARKING AREA
(LIGHTLY LOADED)

5.5" REINFORCED CONCRETE. 3500 PSI @ 28 DAYS
6X6W1.4X1.4WWM
4" OF 3/4"-0" BASE ROCK W/95% COMPACTION
SUBGRADE TO BE AT 95% COMPACTION (ASTM D698)

DRIVEWAYS, ETC
(HEAVILY LOADED)



6" REINFORCED CONCRETE. 3500 PSI @ 28 DAYS
6X6W1.4X1.4WWM
4" OF 3/4"-0" BASE ROCK W/95% COMPACTION
SUBGRADE TO BE AT 95% COMPACTION (ASTM D698)

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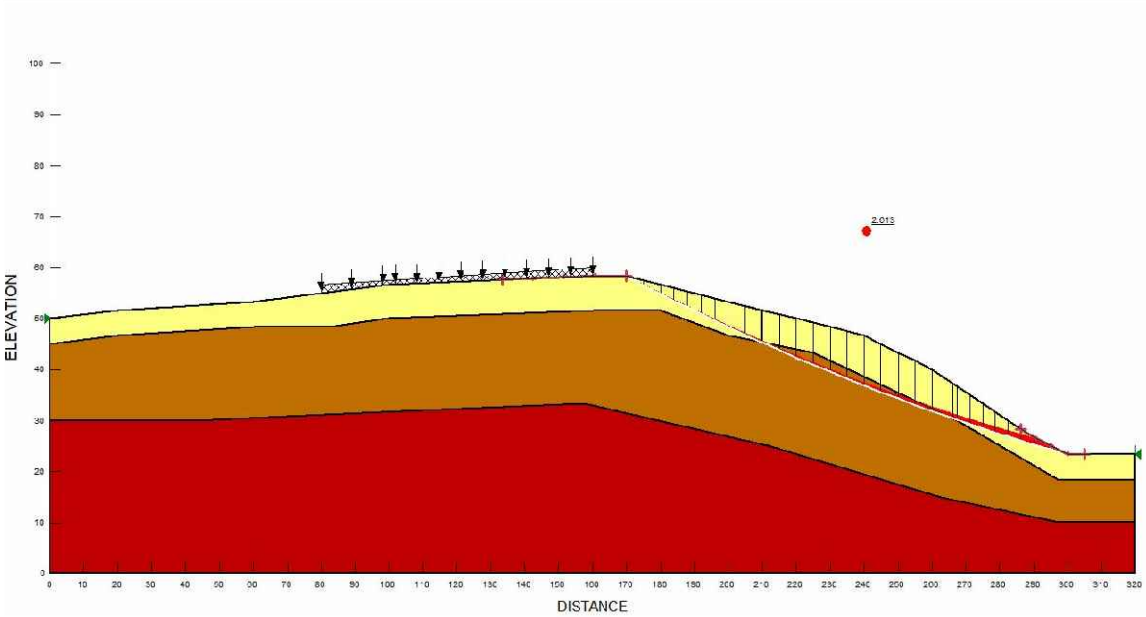
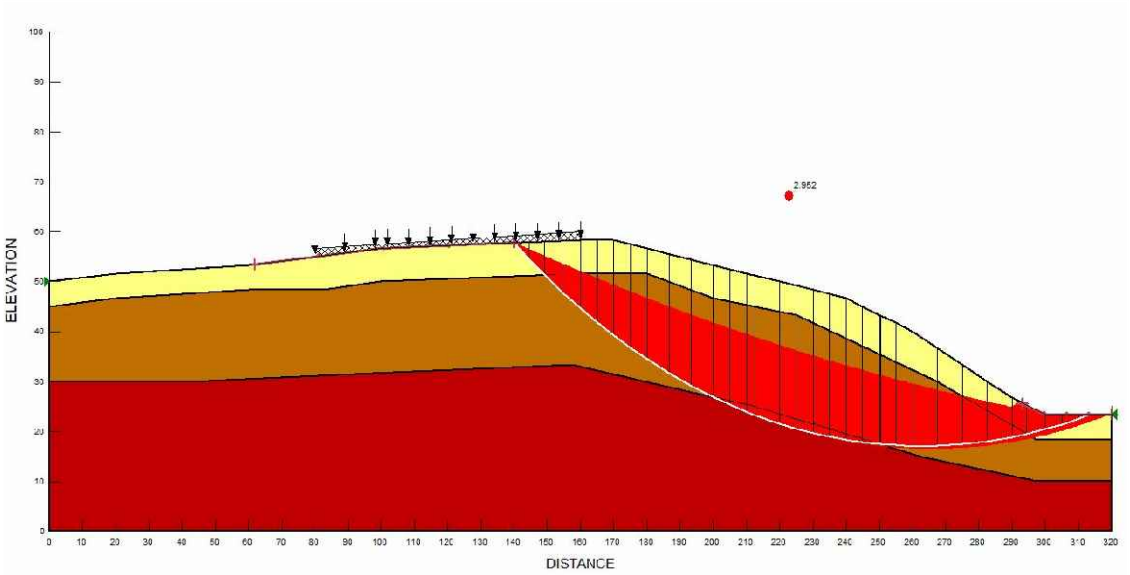
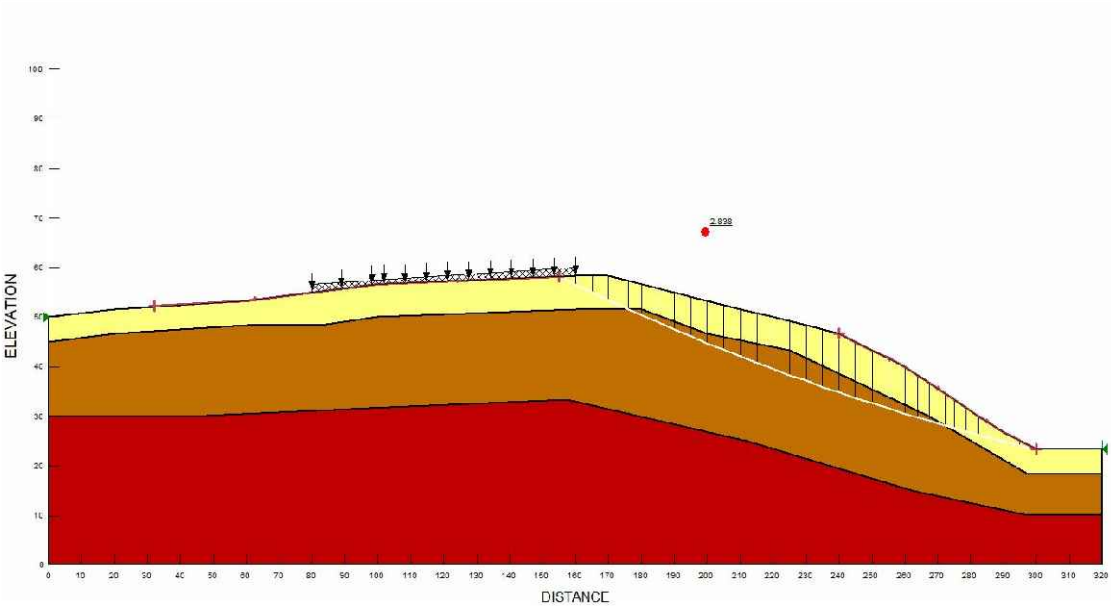
FIGURE 12: PAVEMENT DETAIL

SLOPE STABILITY ANALYSIS LOT 1







N

REFERENCE:
SLOPE/W SOFTWARE

AMERICAN GEOSERVICES
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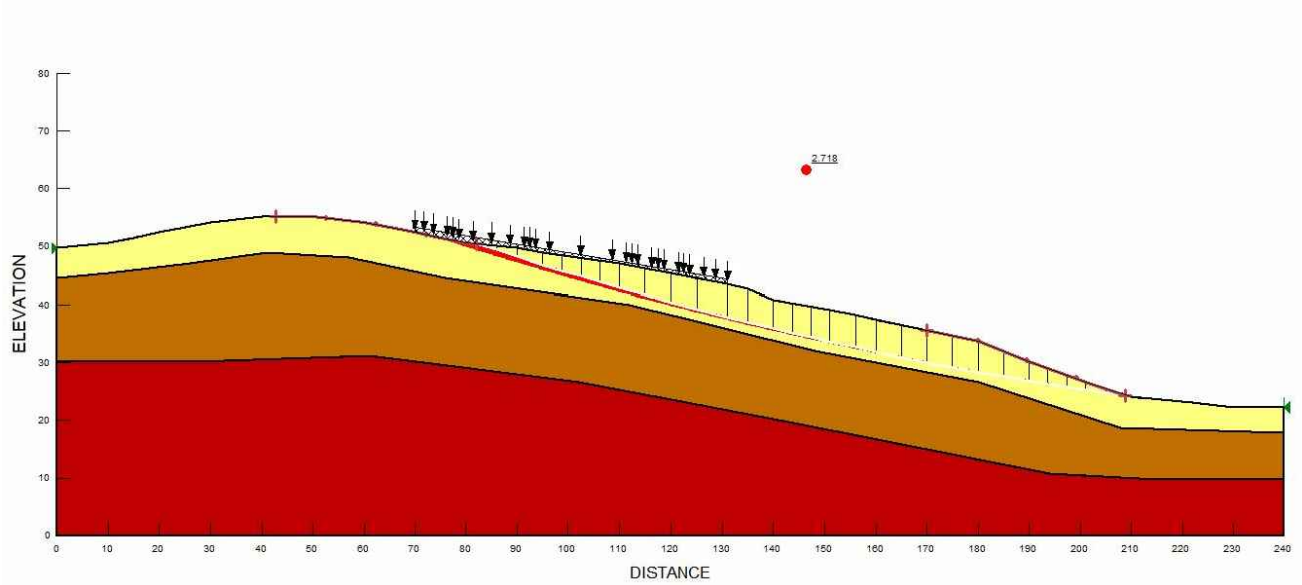
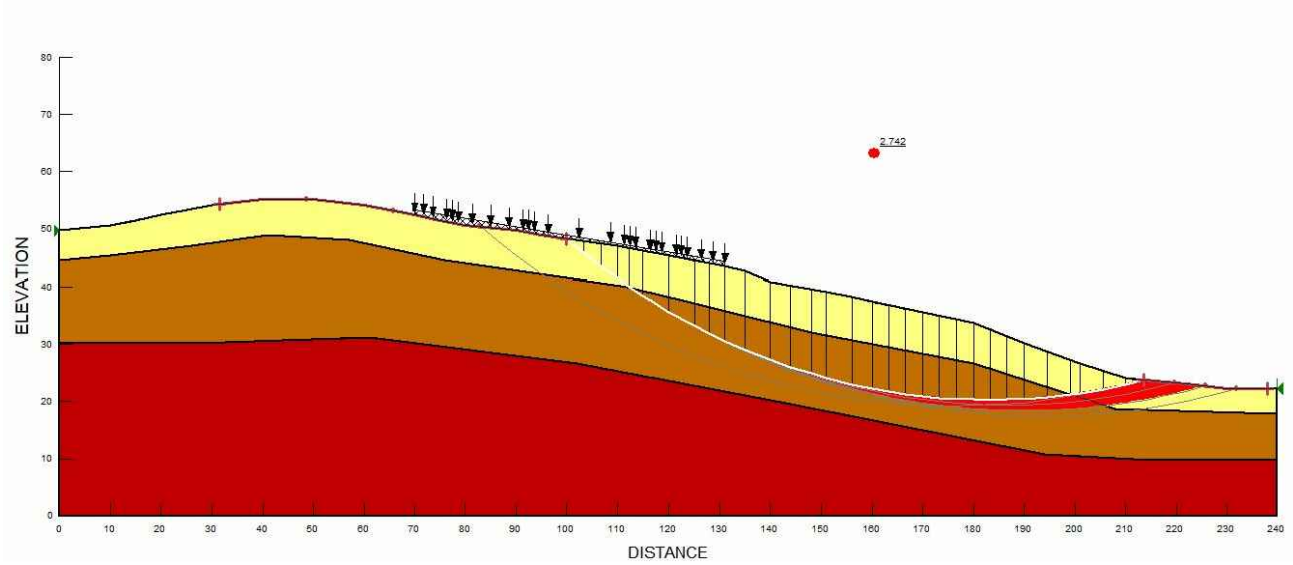
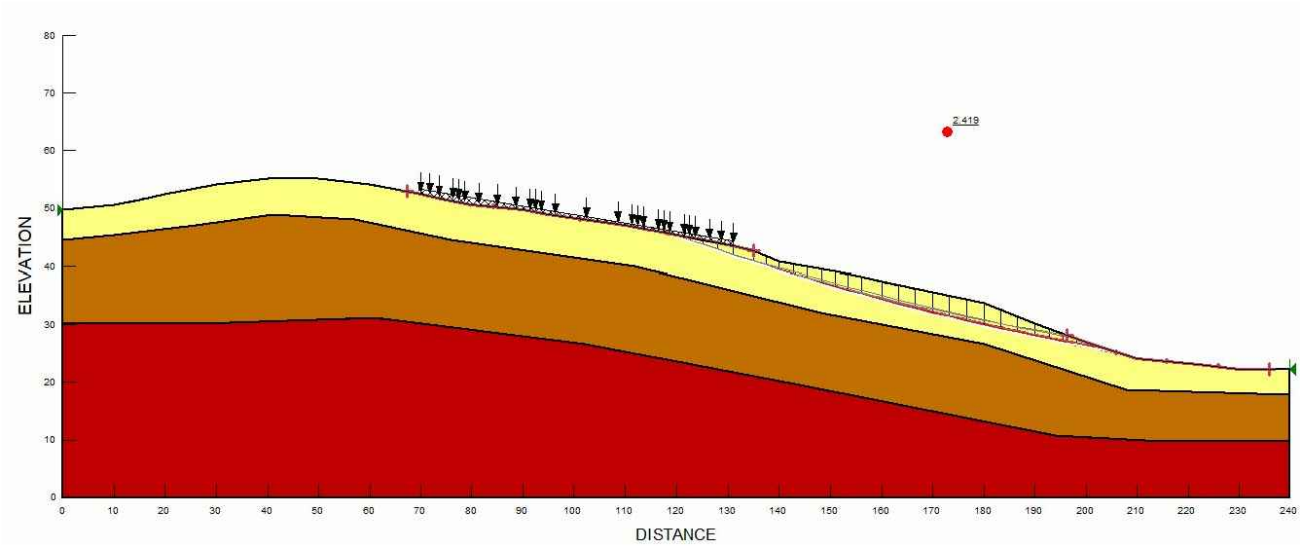
FIGURE 1: SLOPE STABILITY ANALYSIS
LOT 1

SLOPE STABILITY ANALYSIS LOT 2







N

REFERENCE:
SLOPE/W SOFTWARE

AMERICAN GEOSERVICES
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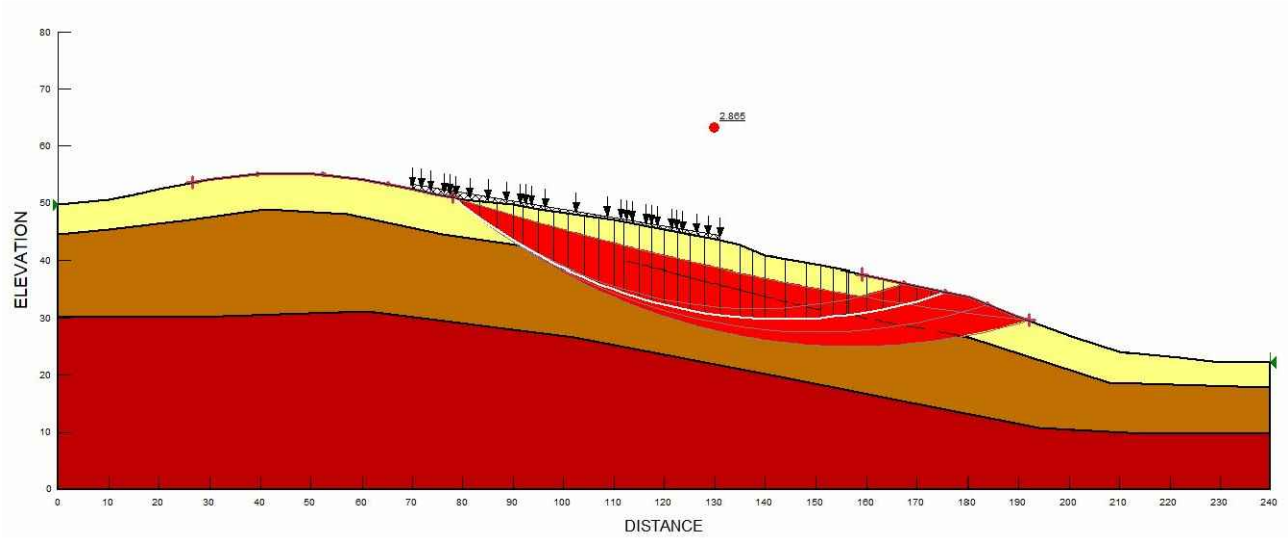
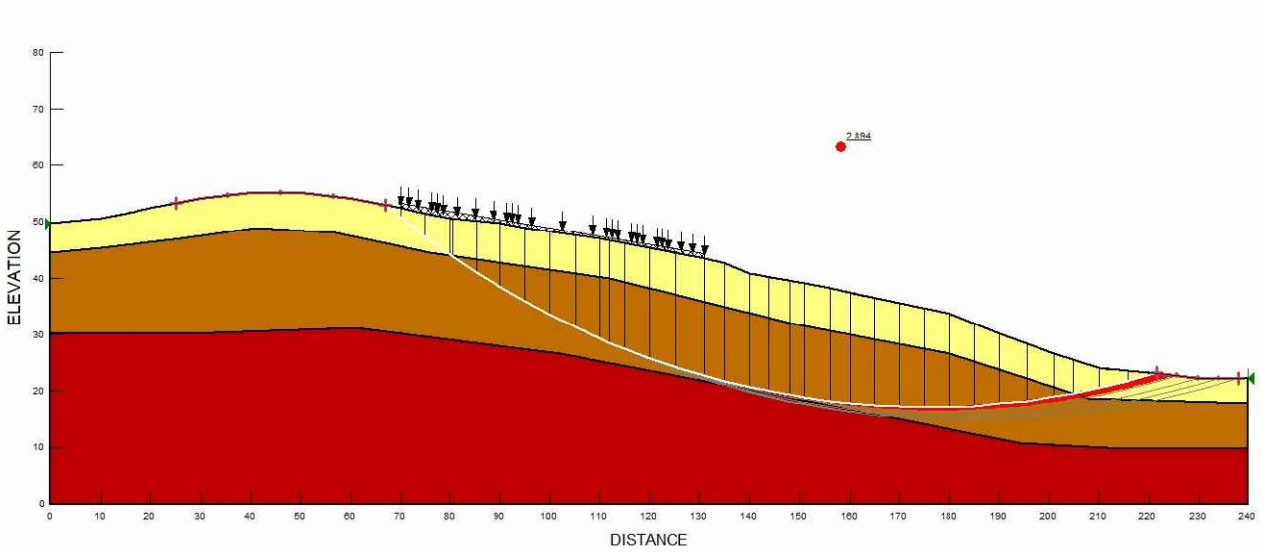
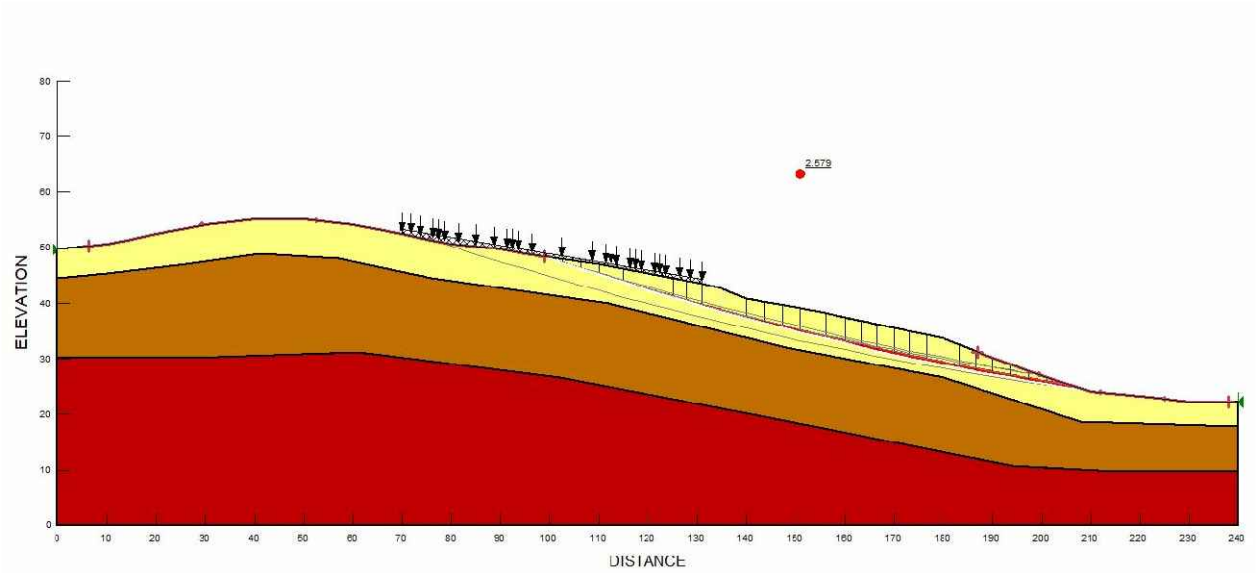
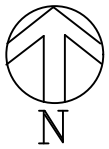
FIGURE 1: SLOPE STABILITY ANALYSIS
LOT 2







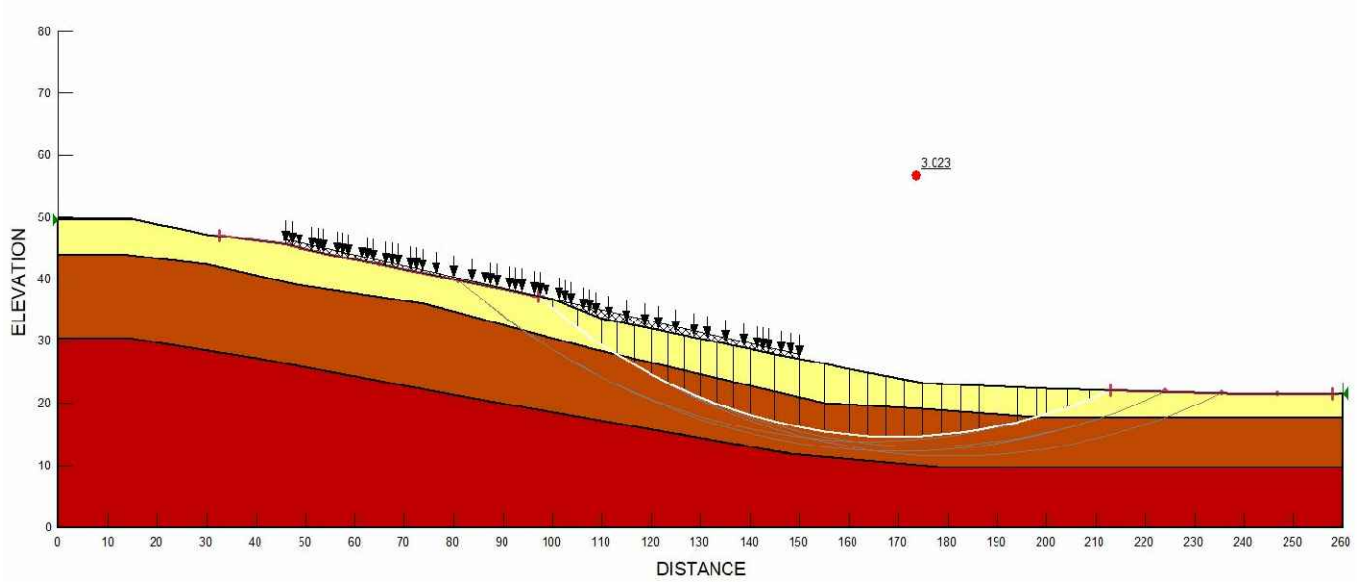


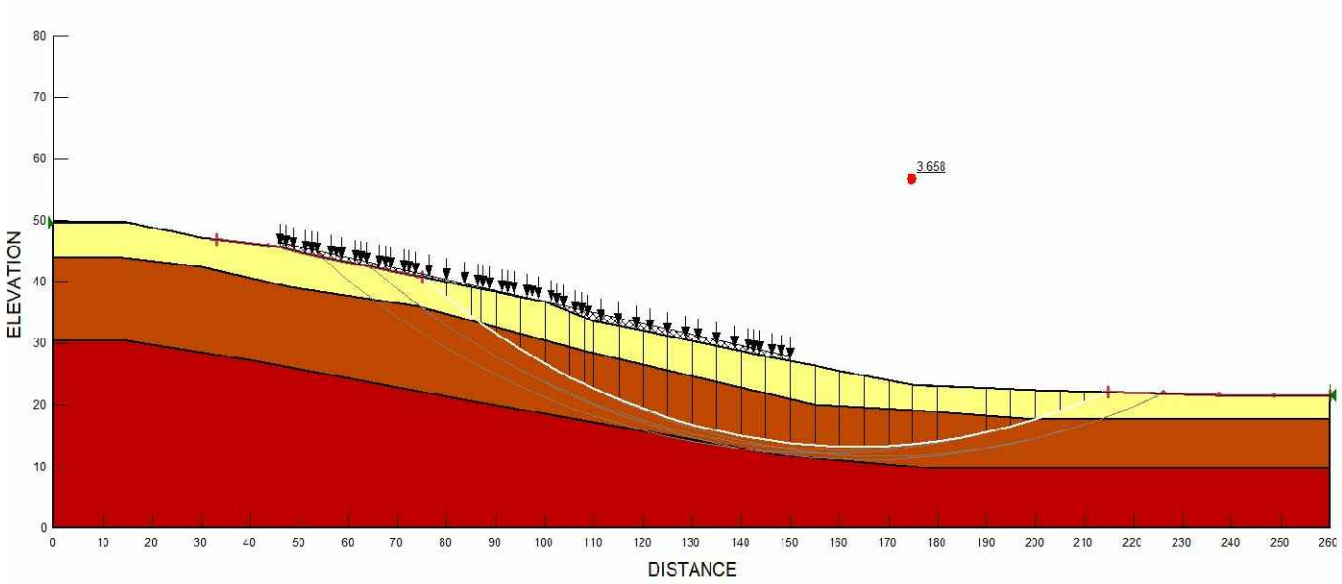
REFERENCE:
SLOPE/W SOFTWARE

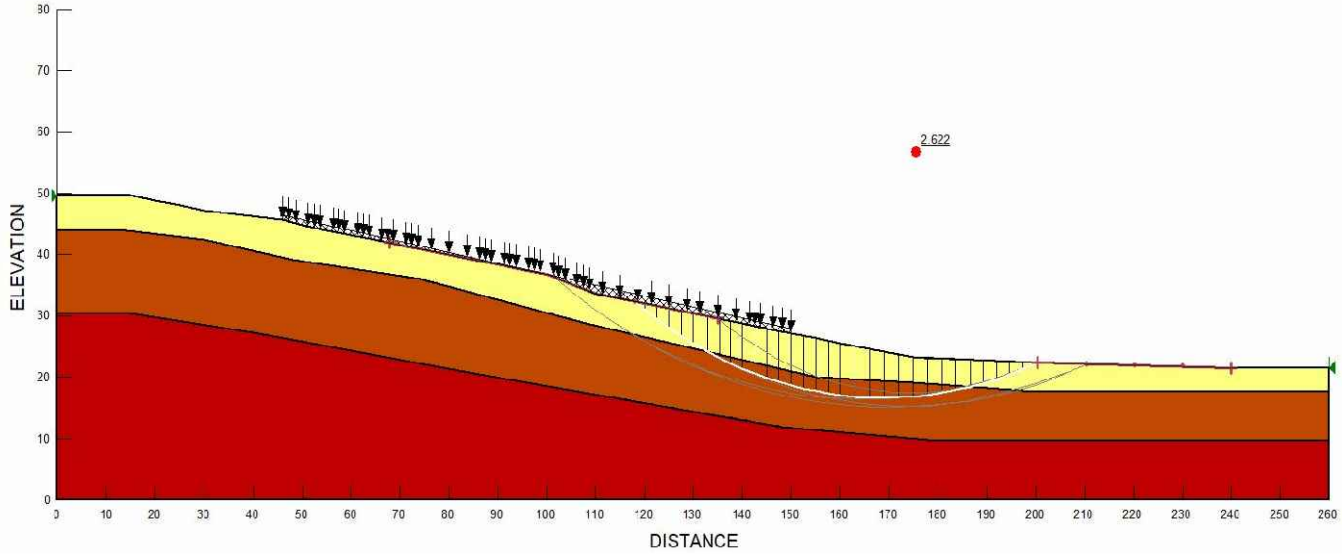
AMERICAN GEOSERVICES
888.276.4027 - americangeoservices.com

FIGURE 3: SLOPE STABILITY ANALYSIS
LOT 2

SLOPE STABILITY ANALYSIS LOT 3







N

REFERENCE:
SLOPE/W SOFTWARE

AMERICAN GEOSERVICES
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FIGURE 1: SLOPE STABILITY ANALYSIS
LOT 3

APPENDIX

B1

2150 Mulligan drive, Parcel 6228305004, Lot 1, Lot 2, Lot 3, Colorado Springs, CO

Project Number	0208-CS20	Drill Rig: CME55 Solid Stem Auger, 4" Diameter	
Geologist/Engineer	SMA	Ground Elevation	See Figures
Date Drilled	04-29-2020	Total Depth of Borehole	22 Feet
Borehole Diameter	4 OD Inches	Depth to Water	Not encountered

Graphic Log		Description / Lithology	Depth (feet)	Sample	SPT Blow Count	Recovery (%)	Moisture (%)	DD (pcf)	LL (%), PL (%)	Swell (%)	Completion
	SP	SAND, pale brown to brown, medium to coarse grained, medium dense, damp to moist, trace gravel, trace clay (Possible Alluvium)									
	SP/SM	SAND to SILTY SAND,pale brown to brown, medium to coarse grained, medium dense to dense, damp to moist, trace gravel, trace clay (Residuum)	5		8-12-14		11		NP		
			10		18-22-23		9		NP		
	SP-SM-SC	Possibly completely weathered ARKOSE, non-expansive	15		50+						
			20								
		End of Borehole. Groundwater was not encountered during or at the completion of drilling. At completion, borehole was backfilled with soil cuttings.									

B2

2150 Mulligan drive, Parcel 6228305004, Lot 1, Lot 2, Lot 3, Colorado Springs, CO

Project Number	0208-CS20	Drill Rig: CME55 Solid Stem Auger, 4" Diameter	
Geologist/Engineer	SMA	Ground Elevation	See Figures
Date Drilled	04-29-2020	Total Depth of Borehole	15 Feet
Borehole Diameter	4 OD Inches	Depth to Water	Not encountered

Graphic Log		Description / Lithology	Depth (feet)	Sample	SPT Blow Count	Recovery (%)	Moisture (%)	DD (pcf)	LL (%), PL (%)	Swell (%)	Completion
	SP	SAND, pale brown to brown, medium to coarse grained, medium dense, damp to moist, trace gravel, trace clay (Possible Alluvium/residuum)	5		8-12-14		10		NP		
	SP/ SM	SAND to SILTY SAND,pale brown to brown, medium to coarse grained, medium dense to dense, damp to moist, trace gravel, trace clay (Residuum)	10		15-20-31		11		NP		
		Possibly completely weathered ARKOSE, non-expansive	15		50+						
		End of Borehole. Groundwater was not encountered during or at the completion of drilling. At completion, borehole was backfilled with soil cuttings.	20								

B3

2150 Mulligan drive, Parcel 6228305004, Lot 1, Lot 2, Lot 3, Colorado Springs, CO

Project Number	0208-CS20	Drill Rig: CME55 Solid Stem Auger, 4" Diameter	
Geologist/Engineer	SMA	Ground Elevation	See Figures
Date Drilled	04-29-2020	Total Depth of Borehole	15 Feet
Borehole Diameter	4 OD Inches	Depth to Water	Not encountered

Graphic Log		Description / Lithology	Depth (feet)	Sample	SPT Blow Count	Recovery (%)	Moisture (%)	DD (pcf)	LL (%), PL (%)	Swell (%)	Completion
	SP	SAND, pale brown to brown, medium to coarse grained, medium dense, damp to moist, trace gravel, trace clay (Possible Alluvium/residuum)	5		10-10-12		14		NP		
	SP/ SM	SAND to SILTY SAND,pale brown to brown, medium to coarse grained, medium dense to dense, damp to moist, trace gravel, trace clay (Residuum)	10		19-25-29		10		NP		
		Possibly completely weathered ARKOSE, non-expansive	15		50+						
		End of Borehole. Groundwater was not encountered during or at the completion of drilling. At completion, borehole was backfilled with soil cuttings.	20								

AMERICAN GEOSERVICES

DESCRIPTIVE TERMINOLOGY & SOIL CLASSIFICATION
UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	
	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

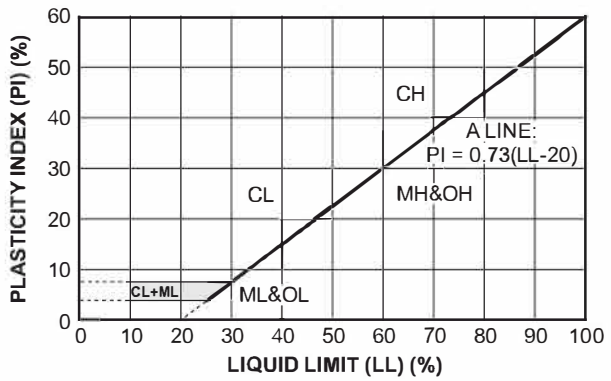
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



DESCRIPTIVE TERMINOLOGY & SOIL CLASSIFICATION

LABORATORY/FIELD TESTING DEFINITIONS FOR EXPLORATION LOGS

DD = DRY DENSITY (PCF)

WD = WET DENSITY (PCF)

MC = MOISTURE CONTENT (%)

PL = PLASTIC LIMIT (%)

LL = LIQUID LIMIT (%)

PI = PLASTICITY INDEX

OC = ORGANIC CONTENT (%)

S = SATURATION PERCENT (%)

SG = SPECIFIC GRAVITY

C = COHESION

Φ = ANGLE OF INTERNAL FRICTION

QU = UNCONFINED COMPRESSION STRENGTH

#200 = PERCENT PASSING THE #200 SIEVE

CBR = CALIFORNIA BEARING RATIO

VS = VANE SHEAR

PP = POCKET PENETROMETER

DP = DRIVE PROBE

SPT = STANDARD PENETRATION TEST

BPF = BLOWS PER FOOT (N VALUE)

SH = SHELBY TUBE SAMPLE

GW = GROUND WATER

RQD = ROCK QUALITY DESIDNATION

TP = TEST PIT

B = BORING

HA = HAND AUGER

▽ GROUNDWATER LEVEL/SEEPAGE ENCOUNTERED DURING EXPLORATION

▼ STATIC GROUNDWATER LEVEL WITH DATE MEASURED

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	STP (BPF)	PP (TSF)
VERY SOFT	0-1	LESS THAN 0.25
SOFT	2 - 4	0.25 - 0.5
MEDIUM STIFF	5 - 8	0.5 - 1.0
STIFF	9 - 15	1.0 - 2.0
VERY STIFF	16 - 30	2.0 - 4.0
HARD	30+	OVER 4.0

RELATIVE DENSITY OF COHESIONLESS SOILS

DENSITY	SPT (BPF)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	50+

PARTICLE SIZE IDENTIFICATION

NAME	DIAMETER (INCHES)	SIEVE NO.
ROCK BLOCK	>120	
BOULDER	12-120	
COBBLE	3-12	
GRAVEL		
COURSE	3/4 - 3	
FINE	1/4 – 3/4	NO. 4
SAND		
COARSE	4.75 MM	NO. 10
MEDIUM	2.0MM	NO. 40
FINE	.425 MM	NO. 200
SILT	.075 MM	
CLAY	<0.005 MM	

GRAIN SIZE

FINE GRAINED	<0.04 INCH	FEW GRAINS ARE DISTINGUISHABLE IN THE FIELD OR WITH HAND LENS.
MEDIUM GRAINED	0.04-0.2 INCH	GRAINS ARE DISTINGUISHABLE WITH THE AID OF A HAND LENS.
COARSE GRAINED	0.04-0.2 INCH	MOST GRAINS ARE DISTINGUISHABLE WITH THE NAKED EYE.

DESCRIPTIVE TERMINOLOGY & SOIL CLASSIFICATION

SPT EXPLORATIONS:

STANDARD PENETRATION TESTING IS PERFORMED BY DRIVING A 2 – INCH O.D. SPLIT-SPOON INTO THE UNDISTURBED FORMATION AT THE BOTTOM OF THE BORING WITH REPEATED BLOWS OF A 140 – POUND PIN GUIDED HAMMER FALLING 30 INCHES. NUMBER OF BLOWS (N VALUE) REQUIRED TO DRIVE THE SAMPLER A GIVEN DISTANCE WAS CONSIDERED A MEASURE OF SOIL CONSISTENCY.

SH SAMPLING:

SHELBY TUBE SAMPLING IS PERFORMED WITH A THIN WALLED SAMPLER PUSHED INTO THE UNDISTURBED SOIL TO SAMPLE 2.0 FEET OF SOIL.

AIR TRACK EXPLORATION:

TESTING IS PERFORMED BY MEASURING RATE OF ADVANCEMENT AND SAMPLES ARE RETRIEVED FROM CUTTINGS.

HAND AUGUR EXPLORATION:

TESTING IS PREFORMED USING A 3.25" DIAMETER AUGUR TO ADVANCE INTO THE EARTH AND RETRIEVE SAMPLES.

DRIVE PROBE EXPLORATIONS:

THIS "RELATIVE DENSITY" EXPLORATION DEVICE IS USED TO DETERMINE THE DISTRIBUTION AND ESTIMATE STRENGTH OF THE SUBSURFACE SOIL AND DECOMPRESSED ROCK UNITS. THE RESISTANCE TO PENETRATION IS MEASURED IN BLOWS-PER-1/2 FOOT OF AN 11-POUND HAMMER WHICH FREE FALLS ROUGHLY 3.5 FEET DRIVING THE 0.5 INCH DIAMETER PIPE INTO THE GROUND. FOR A MORE DETAILED DESCRIPTION OF THIS GEOTECHNICAL EXPLORATION METHOD, THE SLOPE STABILITY REFERENCE GUIDE FOR NATIONAL FORESTS IN THE UNITED STATES, VOLUME I, UNITED STATES DEPARTMENT OF AGRICULTURE, EM-7170-13, AUGUST 1994, P. 317-321.

CPT EXPLORATION:

CONE PENETROMETER EXPLORATIONS CONSIST OF PUSHING A PROBE CONE INTO THE EARTH USING THE REACTION OF A 20-TON TRUCK. THE CONE RESISTANCE (QC) AND SLEEVE FRICTION (FS) ARE MEASURED AS THE PROBE WAS PUSHED INTO THE EARTH. THE VALUES OF QC AND FS (IN TSF) ARE NOTED AS THE LOCALIZED INDEX OF SOIL STRENGTH.

ANGULARITY OF GRAVEL & COBBLES

ANGULAR	COARSE PARTICLES HAVE SHARP EDGES AND RELATIVELY PLANE SIDES WITH UNPOLISHED SURFACES.
SUBANGULAR	COARSE GRAINED PARTICLES ARE SIMILAR TO ANGULAR BUT HAVE ROUNDED EDGES.
SUBROUNDED	COARSE GRAINED PARTICLES HAVE NEARLY PLANE SIDES BUT HAVE WELL ROUNDED CORNERS AND EDGES.
ROUNDED	COARSE GRAINED PARTICLES HAVE SMOOTHLY CURVED SIDES AND NO EDGES.

SOIL MOISTURE MODIFIER

DRY	ABSENCE OF MOISTURE; DUSTY, DRY TO TOUCH
MOIST	DAMP BUT NO VISIBLE WATER
WET	VISIBLE FREE WATER

WEATHERED STATE

FRESH	NO VISIBLE SIGN OF ROCK MATERIAL WEATHERING; PERHAPS SLIGHT DISCOLORATION IN MAJOR DISCONTINUITY SURFACES.
SLIGHTLY WEATHERED	DISCOLORATION INDICATES WEATHERING OF ROCK MATERIAL AND DISCONTINUITY SURFACES. ALL THE ROCK MATERIAL MAY BE DISCOLORED BY WEATHERING AND MAY BE SOMEWHAT WEAKER EXTERNALLY THAN ITS FRESH CONDITION.
MODERATELY WEATHERED	LESS THAN HALF OF THE ROCK MATERIAL IS DECOMPOSED AND/OR DISINTEGRATED TO SOIL. FRESH OR DISCOLORED ROCK IS PRESENT EITHER AS A CONTINUOUS FRAMEWORK OR AS CORE STONES.
HIGHLY WEATHERED	MORE THAN HALF OF THE ROCK MATERIAL IS DECOMPOSED AND/OR DISINTEGRATED TO SOIL. FRESH OR DISCOLORED ROCK IS PRESENT EITHER AS DISCONTINUOUS FRAMEWORK OR AS CORE STONE.
COMPLETELY WEATHERED	ALL ROCK MATERIAL IS DECOMPOSED AND/OR DISINTEGRATED TO SOIL. THE ORIGINAL MASS STRUCTURE IS STILL LARGELY INTACT.
RESIDUAL SOIL	ALL ROCK MATERIAL IS CONVERTED TO SOIL. THE MASS STRUCTURE AND MATERIAL FABRIC IS DESTROYED. THERE IS A LARGE CHANGE IN VOLUME, BUT THE SOIL HAS NOT BEEN SIGNIFICANTLY TRANSPORTED.

El Paso County Area, Colorado

93—Tomah-Crowfoot complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 36bb
Elevation: 7,300 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Tomah and similar soils: 50 percent
Crowfoot and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tomah

Setting

Landform: Alluvial fans, hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from arkose and/or residuum weathered from arkose

Typical profile

A - 0 to 10 inches: loamy sand
E - 10 to 22 inches: coarse sand
C - 48 to 60 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 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 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Alluvial fans, hills

Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 12 inches: loamy sand
E - 12 to 23 inches: sand
Bt - 23 to 36 inches: sandy clay loam
C - 36 to 60 inches: coarse sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: Sandy Divide (R049BY216CO)
Hydric soil rating: No

Minor Components

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 17, Sep 13, 2019

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 4
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 11:30:42
File Name: ANALYSIS LOT 1.gsz
Directory: F:\LD\Project 2020\Project 0208\
Last Solved Date: 10-07-2020
Last Solved Time: 11:30:44

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007

Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (133.41691, 57.59491) ft
Left-Zone Right Coordinate: (170, 58.33333) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (286.31642, 28.30381) ft
Right-Zone Right Coordinate: (305, 23.33333) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 50) ft
Right Coordinate: (320, 23.33333) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	80	56.66667
	160	60

Points

	X (ft)	Y (ft)
Point 1	0	50
Point 2	20	51.66667
Point 3	60	53.33333
Point 4	80	55

Point 5	100	56.66667
Point 6	160	58.33333
Point 7	170	58.33333
Point 8	180	56.66667
Point 9	200	53.33333
Point 10	210	51.66667
Point 11	220	50
Point 12	230	48.33333
Point 13	240	46.66667
Point 14	245	45
Point 15	250	43.33333
Point 16	255	41.66667
Point 17	260	40
Point 18	310	23.33333
Point 19	317.5	23.33333
Point 20	290	26.66667
Point 21	282.5	30
Point 22	275	33.33333
Point 23	267.5	36.66667
Point 24	300	23.33333
Point 25	0	45
Point 26	20	46.66667
Point 27	60	48.33333
Point 28	82.5	48.33333
Point 29	100	50
Point 30	160	51.66667
Point 31	180	51.66667
Point 32	200	46.66667
Point 33	225	43.33333
Point 34	267.5	30
Point 35	297.5	18.33333
Point 36	320	18.33333
Point 37	320	23.33333
Point 38	0	30
Point 39	42.5	30
Point 40	97.5	31.66667
Point 41	157.5	33.33333
Point 42	212.5	25
Point 43	262.5	15
Point 44	297.5	10
Point 45	320	10
Point 46	0	0
Point 47	320	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,25,26,27,28,29,30,31,32,33,34,35,36,37,19,18,24,20,21,22,23,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,956.2
Region 2	SOIL 2	25,38,39,40,41,42,43,44,45,36,35,34,33,32,31,30,29,28,27,26	5,464.6
Region 3	SOIL 3	38,46,47,45,44,43,42,41,40,39	8,187.5

Current Slip Surface

Slip Surface: 116
F of S: 2.613
Volume: 713.14752 ft^3
Weight: 79,202.437 lbs
Resisting Moment: 4,69,21,255 lbs-ft
Activating Moment: 1,79,56,667 lbs-ft
Resisting Force: 51,493.423 lbs
Activating Force: 19,706.458 lbs
F of S Rank: 1

Exit: (299.86072, 23.379757) ft
Entry: (170, 58.33333) ft
Radius: 880.12413 ft
Center: (463.01621, 888.24898) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	172.5	57.459113	0	46.261093	28.907139	0
Slice 2	177.5	55.727512	0	136.62906	85.375314	0
Slice 3	182	54.196271	0	214.76866	134.20235	0
Slice 4	186	52.859212	0	281.59155	175.95793	0
Slice 5	190	51.543411	0	346.22847	216.34756	0
Slice 6	194	50.24877	0	408.82284	255.46087	0
Slice 7	198	48.97519	0	469.50883	293.38168	0
Slice 8	202.41611	47.594668	0	534.3195	333.87988	0
Slice 9	207.24832	46.11188	0	603.03822	376.8201	0
Slice 10	209.83221	45.32768	0	638.54138	430.7016	50
Slice 11	212.5	44.53498	0	679.18046	458.11301	50
Slice 12	217.5	43.066456	0	753.96706	508.5572	50
Slice 13	222.5	41.630008	0	825.8893	557.06937	50
Slice 14	227.5	40.225473	0	890.71688	600.79612	50
Slice 15	232.5	38.852693	0	948.31013	639.64326	50
Slice 16	237.5	37.511514	0	1,002.6924	676.32457	50
Slice 17	242.5	36.201787	0	1,010.7268	681.74382	50
Slice 18	247.5	34.923368	0	971.77932	655.47343	50
Slice 19	252.5	33.676115	0	928.49371	626.27692	50
Slice 20	257.5	32.459892	0	880.74852	594.07238	50
Slice 21	263.06696	31.144046	0	786.46959	530.48044	50
Slice 22	266.81696	30.272377	0	701.47541	438.33048	0
Slice 23	269.375	29.693289	0	643.90639	402.35737	0
Slice 24	273.125	28.856097	0	557.86876	348.59509	0
Slice 25	276.875	28.036067	0	469.57818	293.42502	0
Slice 26	280.625	27.23315	0	379.11127	236.89501	0
Slice 27	284.375	26.447299	0	286.5603	179.06275	0
Slice 28	288.125	25.678466	0	192.03034	119.99387	0
Slice 29	292.46518	24.811363	0	108.96355	68.087983	0
Slice 30	297.39554	23.852092	0	36.814484	23.004242	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 5
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 11:35:38
File Name: ANALYSIS LOT 1.gsz
Directory: F:\LD\Project 2020\Project 0208\
Last Solved Date: 10-07-2020
Last Solved Time: 11:35:41

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007

Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (61.66256, 53.47188) ft
Left-Zone Right Coordinate: (140, 57.77778) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (293.18898, 25.60368) ft
Right-Zone Right Coordinate: (320, 23.33333) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 50) ft
Right Coordinate: (320, 23.33333) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	80	56.66667
	160	60

Points

	X (ft)	Y (ft)
Point 1	0	50
Point 2	20	51.66667
Point 3	60	53.33333
Point 4	80	55

Point 5	100	56.66667
Point 6	160	58.33333
Point 7	170	58.33333
Point 8	180	56.66667
Point 9	200	53.33333
Point 10	210	51.66667
Point 11	220	50
Point 12	230	48.33333
Point 13	240	46.66667
Point 14	245	45
Point 15	250	43.33333
Point 16	255	41.66667
Point 17	260	40
Point 18	310	23.33333
Point 19	317.5	23.33333
Point 20	290	26.66667
Point 21	282.5	30
Point 22	275	33.33333
Point 23	267.5	36.66667
Point 24	300	23.33333
Point 25	0	45
Point 26	20	46.66667
Point 27	60	48.33333
Point 28	82.5	48.33333
Point 29	100	50
Point 30	160	51.66667
Point 31	180	51.66667
Point 32	200	46.66667
Point 33	225	43.33333
Point 34	267.5	30
Point 35	297.5	18.33333
Point 36	320	18.33333
Point 37	320	23.33333
Point 38	0	30
Point 39	42.5	30
Point 40	97.5	31.66667
Point 41	157.5	33.33333
Point 42	212.5	25
Point 43	262.5	15
Point 44	297.5	10
Point 45	320	10
Point 46	0	0
Point 47	320	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,25,26,27,28,29,30,31,32,33,34,35,36,37,19,18,24,20,21,22,23,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,956.2
Region 2	SOIL 2	25,38,39,40,41,42,43,44,45,36,35,34,33,32,31,30,29,28,27,26	5,464.6
Region 3	SOIL 3	38,46,47,45,44,43,42,41,40,39	8,187.5

Current Slip Surface

Slip Surface: 117
F of S: 2.952
Volume: 3,187.0467 ft^3
Weight: 3,72,571.78 lbs
Resisting Moment: 6,11,17,230 lbs-ft
Activating Moment: 2,07,04,806 lbs-ft
Resisting Force: 2,82,873.71 lbs
Activating Force: 95,851.48 lbs
F of S Rank: 1

Exit: (313.20514, 23.33333) ft
Entry: (140, 57.777777) ft
Radius: 205.57696 ft
Center: (262.81246, 222.63828) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	142.27875	56.12823	0	1,987.3028	1,241.8046	0
Slice 2	146.83625	52.921495	0	2,353.5	1,470.63	0
Slice 3	151.83625	49.618874	0	2,721.6054	1,835.746	50
Slice 4	157.27875	46.245349	0	3,154.8935	2,128.0025	50
Slice 5	162.5	43.219517	0	1,379.0353	930.17106	50
Slice 6	167.5	40.513436	0	1,658.8989	1,118.9414	50
Slice 7	172.5	37.982383	0	1,887.717	1,273.2812	50
Slice 8	177.5	35.619246	0	2,066.9132	1,394.1505	50
Slice 9	183.33174	33.081827	0	2,255.9254	1,521.6409	50
Slice 10	189.99523	30.422666	0	2,453.7807	1,655.096	50
Slice 11	196.66348	28.02641	0	2,637.9598	1,779.3264	50
Slice 12	202.5	26.125039	0	2,793.1603	1,884.0104	250
Slice 13	207.5	24.659293	0	2,923.9508	1,972.2297	250
Slice 14	211.25	23.636946	0	3,016.8416	2,034.8854	250
Slice 15	216.25	22.440878	0	3,124.3428	2,107.3958	250
Slice 16	222.5	21.068711	0	3,247.9002	2,190.7364	250
Slice 17	227.5	20.132785	0	3,324.2087	2,242.2071	250
Slice 18	232.5	19.324111	0	3,379.5019	2,279.5028	250
Slice 19	237.5	18.641176	0	3,416.1238	2,304.2046	250
Slice 20	242.5	18.082719	0	3,385.3928	2,283.4763	250
Slice 21	247.5	17.647722	0	3,283.7283	2,214.9027	250
Slice 22	250.14114	17.452259	0	3,221.7822	2,173.1195	250
Slice 23	252.64114	17.326683	0	3,137.2889	2,116.1281	50
Slice 24	257.5	17.145193	0	2,990.2677	2,016.961	50
Slice 25	263.75	17.097667	0	2,712.9916	1,829.9359	50
Slice 26	271.25	17.26884	0	2,285.9132	1,541.8679	50
Slice 27	278.75	17.714556	0	1,799.0253	1,213.4579	50
Slice 28	286.25	18.436617	0	1,262.8444	851.7993	50
Slice 29	292.23333	19.189994	0	838.09629	565.30309	50
Slice 30	297.23333	19.982875	0	515.62526	322.19843	0
Slice 31	302.5	20.94472	0	286.11841	178.78662	0
Slice 32	307.5	21.993447	0	158.59664	99.102181	0
Slice 33	311.60257	22.941788	0	45.836614	28.641895	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 6
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 11:37:10
File Name: ANALYSIS LOT 1.gsz
Directory: F:\LD\Project 2020\Project 0208\
Last Solved Date: 10-07-2020
Last Solved Time: 11:37:12

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007

Starting Optimization Points: 8
Ending Optimization Points: 16
Complete Passes per Insertion: 1
Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (32.0732, 52.16972) ft
Left-Zone Right Coordinate: (155, 58.19444) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (240.14646, 46.61785) ft
Right-Zone Right Coordinate: (300, 23.33333) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 50) ft
Right Coordinate: (320, 23.33333) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	80	56.66667
	160	60

Points

	X (ft)	Y (ft)
Point 1	0	50
Point 2	20	51.66667
Point 3	60	53.33333
Point 4	80	55

Point 5	100	56.66667
Point 6	160	58.33333
Point 7	170	58.33333
Point 8	180	56.66667
Point 9	200	53.33333
Point 10	210	51.66667
Point 11	220	50
Point 12	230	48.33333
Point 13	240	46.66667
Point 14	245	45
Point 15	250	43.33333
Point 16	255	41.66667
Point 17	260	40
Point 18	310	23.33333
Point 19	317.5	23.33333
Point 20	290	26.66667
Point 21	282.5	30
Point 22	275	33.33333
Point 23	267.5	36.66667
Point 24	300	23.33333
Point 25	0	45
Point 26	20	46.66667
Point 27	60	48.33333
Point 28	82.5	48.33333
Point 29	100	50
Point 30	160	51.66667
Point 31	180	51.66667
Point 32	200	46.66667
Point 33	225	43.33333
Point 34	267.5	30
Point 35	297.5	18.33333
Point 36	320	18.33333
Point 37	320	23.33333
Point 38	0	30
Point 39	42.5	30
Point 40	97.5	31.66667
Point 41	157.5	33.33333
Point 42	212.5	25
Point 43	262.5	15
Point 44	297.5	10
Point 45	320	10
Point 46	0	0
Point 47	320	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,25,26,27,28,29,30,31,32,33,34,35,36,37,19,18,24,20,21,22,23,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,956.2
Region 2	SOIL 2	25,38,39,40,41,42,43,44,45,36,35,34,33,32,31,30,29,28,27,26	5,464.6
Region 3	SOIL 3	38,46,47,45,44,43,42,41,40,39	8,187.5

Current Slip Surface

Slip Surface: 121
F of S: 2.838
Volume: 1,047.4413 ft^3
Weight: 1,17,791.52 lbs
Resisting Moment: 8,41,40,560 lbs-ft
Activating Moment: 2,96,52,159 lbs-ft
Resisting Force: 86,131.741 lbs
Activating Force: 30,353.862 lbs
F of S Rank: 1

Exit: (300, 23.33333) ft
Entry: (155, 58.194442) ft
Radius: 947.64832 ft
Center: (448.33582, 959.30012) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	157.5	57.388277	0	2,367.3322	1,479.2733	0
Slice 2	162.5	55.791207	0	251.65262	157.25001	0
Slice 3	167.5	54.224578	0	410.59219	256.56647	0
Slice 4	172.93386	52.557761	0	529.40213	330.80717	0
Slice 5	177.93386	51.051542	0	599.47114	404.34839	50
Slice 6	182.5	49.705771	0	666.77449	449.74507	50
Slice 7	187.5	48.259364	0	732.75328	494.24833	50
Slice 8	192.5	46.842648	0	796.08158	536.9638	50
Slice 9	197.5	45.455485	0	856.81857	577.93142	50
Slice 10	202.5	44.09774	0	917.70493	618.99979	50
Slice 11	207.5	42.769284	0	978.74469	660.17163	50
Slice 12	212.5	41.469988	0	1,037.1764	699.58434	50
Slice 13	217.5	40.19973	0	1,092.9152	737.18064	50
Slice 14	222.5	38.958388	0	1,145.8411	772.87958	50
Slice 15	227.5	37.745847	0	1,191.5384	803.7028	50
Slice 16	232.5	36.561991	0	1,229.7906	829.50422	50
Slice 17	237.5	35.406712	0	1,264.6546	853.02027	50
Slice 18	242.5	34.279902	0	1,252.2007	844.62001	50
Slice 19	247.5	33.181458	0	1,191.8881	803.93865	50
Slice 20	252.5	32.111277	0	1,127.2269	760.32417	50
Slice 21	257.5	31.069264	0	1,058.1711	713.74539	50
Slice 22	261.875	30.179002	0	972.27814	655.80988	50
Slice 23	265.625	29.434295	0	870.57876	587.21279	50
Slice 24	269.8693	28.611543	0	750.69347	506.34914	50
Slice 25	273.6193	27.898214	0	644.54521	402.75654	0
Slice 26	276.875	27.294272	0	555.03103	346.82188	0
Slice 27	280.625	26.612177	0	450.21979	281.32855	0
Slice 28	284.375	25.945647	0	343.5671	214.68455	0
Slice 29	288.125	25.294648	0	235.18872	146.96222	0
Slice 30	292.5	24.55624	0	136.10791	85.049663	0
Slice 31	297.5	23.736391	0	45.802358	28.62049	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 1
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 12:18:21
File Name: ANALYSIS LOT 2.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 2\
Last Solved Date: 10-07-2020
Last Solved Time: 12:18:23

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (42.80446, 55.11111) ft
Left-Zone Right Coordinate: (82, 50.48889) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (170.00918, 35.55393) ft
Right-Zone Right Coordinate: (209, 24.2963) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.77778) ft
Right Coordinate: (240, 22.22222) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	70	53.33333
	131	44.44444

Points

	X (ft)	Y (ft)
Point 1	0	49.77778
Point 2	10	50.66667
Point 3	15	51.55556
Point 4	20	52.44444
Point 5	25	53.33333
Point 6	30	54.22222
Point 7	40	55.11111
Point 8	50	55.11111
Point 9	60	54.22222
Point 10	65	53.33333
Point 11	70	52.44444
Point 12	75	51.55556
Point 13	80	50.66667
Point 14	90	49.77778
Point 15	95	48.88889
Point 16	110	47.11111
Point 17	115	46.22222
Point 18	120	45.33333
Point 19	125	44.44444
Point 20	131	43.55556
Point 21	135	42.66667
Point 22	140	40.88889
Point 23	151	39.11111
Point 24	156	38.22222

Point 25	160	37.33333
Point 26	170	35.55556
Point 27	180	33.77778
Point 28	190	30.22222
Point 29	201	26.66667
Point 30	210	24
Point 31	222	23.11111
Point 32	230	22.22222
Point 33	240	22.22222
Point 34	240	0
Point 35	0	44.44444
Point 36	10	45.33333
Point 37	26	47.11111
Point 38	41	48.88889
Point 39	57	48
Point 40	76	44.44444
Point 41	112	40
Point 42	148	32
Point 43	180	26.66667
Point 44	208	18.66667
Point 45	240	17.77778
Point 46	0	30.22222
Point 47	27	30.22222
Point 48	61	31.11111
Point 49	102	26.66667
Point 50	144	19.55556
Point 51	194	10.66667
Point 52	215	9.77778
Point 53	240	9.77778
Point 54	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,35,36,37,38,39,40,41,42,43,44,45,33,32,31,30,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,553.8
Region 2	SOIL 2	46,47,48,49,50,51,52,53,45,44,43,42,41,40,39,38,37,36,35	3,305.8
Region 3	SOIL 3	54,46,47,48,49,50,51,52,53,34	5,228.4

Current Slip Surface

Slip Surface: 121
F of S: 2.718
Volume: 511.30479 ft^3
Weight: 56,243.527 lbs
Resisting Moment: 5,23,26,077 lbs-ft
Activating Moment: 1,92,48,769 lbs-ft
Resisting Force: 63,929.563 lbs
Activating Force: 23,517.295 lbs
F of S Rank: 1
Exit: (209, 24.296297) ft
Entry: (82, 50.488892) ft
Radius: 797.04989 ft
Center: (305.9624, 815.42639) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	84	49.90899	0	1,420.4365	887.58723	0
Slice 2	88	48.760491	0	1,180.6598	737.75815	0
Slice 3	92.5	47.496964	0	1,198.2817	748.76951	0
Slice 4	96.875	46.292321	0	1,294.1182	808.65482	0
Slice 5	100.625	45.28269	0	1,209.0908	755.52378	0
Slice 6	104.375	44.292617	0	1,122.5524	701.44857	0
Slice 7	108.125	43.322026	0	1,034.3969	646.36294	0
Slice 8	112.5	42.216075	0	1,123.1381	701.81458	0
Slice 9	117.5	40.982179	0	1,389.2662	868.10987	0
Slice 10	122.5	39.782477	0	1,653.9898	1,033.5275	0
Slice 11	128	38.503972	0	1,826.1092	1,141.0797	0
Slice 12	133	37.372187	0	598.25532	373.83142	0
Slice 13	137.5	36.386975	0	564.70595	352.86744	0
Slice 14	141.83333	35.460576	0	540.27744	337.60281	0
Slice 15	145.5	34.697982	0	560.57297	350.28487	0
Slice 16	149.16667	33.953336	0	578.96902	361.78	0
Slice 17	153.5	33.098287	0	593.67468	370.96911	0

Slice 18	158	32.233236	0	593.55842	370.89646	0
Slice 19	162.5	31.397939	0	589.8797	368.59775	0
Slice 20	167.5	30.499482	0	592.66675	370.33929	0
Slice 21	172.5	29.633867	0	591.33386	369.5064	0
Slice 22	177.5	28.800986	0	585.82739	366.06558	0
Slice 23	182.5	28.000734	0	528.41585	330.19087	0
Slice 24	187.5	27.233013	0	419.21078	261.95197	0
Slice 25	191.83333	26.592025	0	328.09715	205.01785	0
Slice 26	195.5	26.07022	0	256.12978	160.04765	0
Slice 27	199.16667	25.565782	0	182.39556	113.9734	0
Slice 28	203	25.057357	0	109.27561	68.282982	0
Slice 29	207	24.546556	0	36.708115	22.937776	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 3
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 12:20:16
File Name: ANALYSIS LOT 2.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 2\
Last Solved Date: 10-07-2020
Last Solved Time: 12:20:18

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (31.54584, 54.35963) ft
Left-Zone Right Coordinate: (100, 48.2963) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (213.66048, 23.72885) ft
Right-Zone Right Coordinate: (238, 22.22222) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.77778) ft
Right Coordinate: (240, 22.22222) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	70	53.33333
	131	44.44444

Points

	X (ft)	Y (ft)
Point 1	0	49.77778
Point 2	10	50.66667
Point 3	15	51.55556
Point 4	20	52.44444
Point 5	25	53.33333
Point 6	30	54.22222
Point 7	40	55.11111
Point 8	50	55.11111
Point 9	60	54.22222
Point 10	65	53.33333
Point 11	70	52.44444
Point 12	75	51.55556
Point 13	80	50.66667
Point 14	90	49.77778
Point 15	95	48.88889
Point 16	110	47.11111
Point 17	115	46.22222
Point 18	120	45.33333
Point 19	125	44.44444
Point 20	131	43.55556
Point 21	135	42.66667
Point 22	140	40.88889
Point 23	151	39.11111
Point 24	156	38.22222

Point 25	160	37.33333
Point 26	170	35.55556
Point 27	180	33.77778
Point 28	190	30.22222
Point 29	201	26.66667
Point 30	210	24
Point 31	222	23.11111
Point 32	230	22.22222
Point 33	240	22.22222
Point 34	240	0
Point 35	0	44.44444
Point 36	10	45.33333
Point 37	26	47.11111
Point 38	41	48.88889
Point 39	57	48
Point 40	76	44.44444
Point 41	112	40
Point 42	148	32
Point 43	180	26.66667
Point 44	208	18.66667
Point 45	240	17.77778
Point 46	0	30.22222
Point 47	27	30.22222
Point 48	61	31.11111
Point 49	102	26.66667
Point 50	144	19.55556
Point 51	194	10.66667
Point 52	215	9.77778
Point 53	240	9.77778
Point 54	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,35,36,37,38,39,40,41,42,43,44,45,33,32,31,30,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,553.8
Region 2	SOIL 2	46,47,48,49,50,51,52,53,45,44,43,42,41,40,39,38,37,36,35	3,305.8
Region 3	SOIL 3	54,46,47,48,49,50,51,52,53,34	5,228.4

Current Slip Surface

Slip Surface: 102
F of S: 2.742
Volume: 1,168.4082 ft^3
Weight: 1,33,143.78 lbs
Resisting Moment: 1,55,06,137 lbs-ft
Activating Moment: 56,54,181 lbs-ft
Resisting Force: 1,07,011.08 lbs
Activating Force: 39,030.6 lbs
F of S Rank: 1
Exit: (213.66048, 23.728853) ft
Entry: (100, 48.296297) ft
Radius: 137.45618 ft
Center: (183.14455, 157.7549) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	101.66667	47.069428	0	882.60882	551.5152	0
Slice 2	105	44.690641	0	940.16594	587.48088	0
Slice 3	108.33333	42.457299	0	986.33202	616.32865	0
Slice 4	111.18737	40.646301	0	1,101.4037	688.23339	0
Slice 5	113.68737	39.148037	0	1,285.5355	867.10466	50
Slice 6	117.5	37.020076	0	1,586.939	1,070.4039	50
Slice 7	122.5	34.431425	0	1,973.522	1,331.1574	50
Slice 8	126.5	32.523566	0	2,224.8159	1,500.6573	50
Slice 9	129.5	31.209215	0	2,341.6705	1,579.4767	50
Slice 10	133	29.789622	0	1,276.6937	861.14077	50
Slice 11	137.5	28.12561	0	1,344.4771	906.86122	50
Slice 12	142	26.617816	0	1,413.4324	953.37221	50
Slice 13	146	25.428901	0	1,506.4656	1,016.1238	50
Slice 14	149.5	24.488799	0	1,581.0759	1,066.4492	50
Slice 15	153.5	23.557849	0	1,650.0471	1,112.9708	50
Slice 16	158	22.633414	0	1,702.8621	1,148.595	50
Slice 17	161.66667	21.997557	0	1,729.8517	1,166.7997	50

Slice 18	165	21.511914	0	1,750.5156	1,180.7377	50
Slice 19	168.33333	21.109299	0	1,758.6187	1,186.2033	50
Slice 20	171.66667	20.788978	0	1,753.1115	1,182.4887	50
Slice 21	175	20.550375	0	1,733.0452	1,168.9537	50
Slice 22	178.33333	20.393064	0	1,697.6309	1,145.0665	50
Slice 23	181.66667	20.316766	0	1,609.8398	1,085.8507	50
Slice 24	185	20.321345	0	1,468.8114	990.72581	50
Slice 25	188.33333	20.40681	0	1,311.344	884.51272	50
Slice 26	192.2636	20.620296	0	1,113.2747	750.91328	50
Slice 27	196.79079	20.996689	0	869.52858	586.50443	50
Slice 28	200.02719	21.342955	0	679.77572	424.77101	0
Slice 29	203.25	21.79608	0	504.19956	315.05885	0
Slice 30	207.75	22.538241	0	252.6202	157.85462	0
Slice 31	211.83024	23.338264	0	61.731857	38.574345	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 4
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 12:22:34
File Name: ANALYSIS LOT 2.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 2\
Last Solved Date: 10-07-2020
Last Solved Time: 12:22:36

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (67.38589, 52.90917) ft
Left-Zone Right Coordinate: (135, 42.66667) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (196.27037, 28.19544) ft
Right-Zone Right Coordinate: (236, 22.22222) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.77778) ft
Right Coordinate: (240, 22.22222) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	70	53.33333
	131	44.44444

Points

	X (ft)	Y (ft)
Point 1	0	49.77778
Point 2	10	50.66667
Point 3	15	51.55556
Point 4	20	52.44444
Point 5	25	53.33333
Point 6	30	54.22222
Point 7	40	55.11111
Point 8	50	55.11111
Point 9	60	54.22222
Point 10	65	53.33333
Point 11	70	52.44444
Point 12	75	51.55556
Point 13	80	50.66667
Point 14	90	49.77778
Point 15	95	48.88889
Point 16	110	47.11111
Point 17	115	46.22222
Point 18	120	45.33333
Point 19	125	44.44444
Point 20	131	43.55556
Point 21	135	42.66667
Point 22	140	40.88889
Point 23	151	39.11111
Point 24	156	38.22222

Point 25	160	37.33333
Point 26	170	35.55556
Point 27	180	33.77778
Point 28	190	30.22222
Point 29	201	26.66667
Point 30	210	24
Point 31	222	23.11111
Point 32	230	22.22222
Point 33	240	22.22222
Point 34	240	0
Point 35	0	44.44444
Point 36	10	45.33333
Point 37	26	47.11111
Point 38	41	48.88889
Point 39	57	48
Point 40	76	44.44444
Point 41	112	40
Point 42	148	32
Point 43	180	26.66667
Point 44	208	18.66667
Point 45	240	17.77778
Point 46	0	30.22222
Point 47	27	30.22222
Point 48	61	31.11111
Point 49	102	26.66667
Point 50	144	19.55556
Point 51	194	10.66667
Point 52	215	9.77778
Point 53	240	9.77778
Point 54	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,35,36,37,38,39,40,41,42,43,44,45,33,32,31,30,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,553.8
Region 2	SOIL 2	46,47,48,49,50,51,52,53,45,44,43,42,41,40,39,38,37,36,35	3,305.8
Region 3	SOIL 3	54,46,47,48,49,50,51,52,53,34	5,228.4

Current Slip Surface

Slip Surface: 81
F of S: 2.419
Volume: 207.16061 ft^3
Weight: 22,787.668 lbs
Resisting Moment: 1,32,79,422 lbs-ft
Activating Moment: 54,89,743.3 lbs-ft
Resisting Force: 22,591.048 lbs
Activating Force: 9,339.2093 lbs
F of S Rank: 1
Exit: (205.92754, 25.206656) ft
Entry: (118.16204, 45.660079) ft
Radius: 568.56211 ft
Center: (290.68232, 587.41614) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	119.08102	45.369148	0	961.09189	600.55687	0
Slice 2	121.25	44.687984	0	1,086.0077	678.61294	0
Slice 3	123.75	43.913824	0	1,229.1402	768.05206	0
Slice 4	126.5	43.07747	0	1,328.5334	830.15978	0
Slice 5	129.5	42.181612	0	1,384.2642	864.9843	0
Slice 6	133	41.160861	0	191.91491	119.92175	0
Slice 7	136.25	40.230752	0	196.82956	122.99276	0
Slice 8	138.75	39.531331	0	178.16951	111.33266	0
Slice 9	141.375	38.81048	0	184.5688	115.33139	0
Slice 10	144.125	38.069434	0	216.05331	135.00509	0
Slice 11	146.875	37.343134	0	246.28897	153.89843	0
Slice 12	149.625	36.631523	0	275.27139	172.00866	0
Slice 13	152.25	35.96559	0	299.69342	187.26923	0
Slice 14	154.75	35.344022	0	319.61695	199.71884	0
Slice 15	158	34.556259	0	334.33274	208.91428	0
Slice 16	161.66667	33.687949	0	350.07186	218.74918	0
Slice 17	165	32.921856	0	370.40145	231.45252	0

Slice 18	168.33333	32.176832	0	388.45027	242.73067	0
Slice 19	171.66667	31.452791	0	404.1133	252.51802	0
Slice 20	175	30.749651	0	417.28983	260.75162	0
Slice 21	178.33333	30.067334	0	427.88987	267.37527	0
Slice 22	181.66667	29.405764	0	404.37278	252.68016	0
Slice 23	185	28.764865	0	346.64129	216.60552	0
Slice 24	188.33333	28.144568	0	286.28672	178.8918	0
Slice 25	191.375	27.595649	0	233.88004	146.14447	0
Slice 26	194.125	27.11478	0	189.94771	118.69251	0
Slice 27	196.875	26.64781	0	144.53551	90.315808	0
Slice 28	199.625	26.194704	0	97.743865	61.077146	0
Slice 29	202.23189	25.777607	0	55.753358	34.838565	0
Slice 30	204.69566	25.395129	0	18.734203	11.706429	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 5
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 12:24:04
File Name: ANALYSIS LOT 2.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 2\
Last Solved Date: 10-07-2020
Last Solved Time: 12:24:06

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (26.64447, 53.62568) ft
Left-Zone Right Coordinate: (78, 51.02223) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (159.15405, 37.52132) ft
Right-Zone Right Coordinate: (192, 29.57576) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.77778) ft
Right Coordinate: (240, 22.22222) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	70	53.33333
	131	44.44444

Points

	X (ft)	Y (ft)
Point 1	0	49.77778
Point 2	10	50.66667
Point 3	15	51.55556
Point 4	20	52.44444
Point 5	25	53.33333
Point 6	30	54.22222
Point 7	40	55.11111
Point 8	50	55.11111
Point 9	60	54.22222
Point 10	65	53.33333
Point 11	70	52.44444
Point 12	75	51.55556
Point 13	80	50.66667
Point 14	90	49.77778
Point 15	95	48.88889
Point 16	110	47.11111
Point 17	115	46.22222
Point 18	120	45.33333
Point 19	125	44.44444
Point 20	131	43.55556
Point 21	135	42.66667
Point 22	140	40.88889
Point 23	151	39.11111
Point 24	156	38.22222

Point 25	160	37.33333
Point 26	170	35.55556
Point 27	180	33.77778
Point 28	190	30.22222
Point 29	201	26.66667
Point 30	210	24
Point 31	222	23.11111
Point 32	230	22.22222
Point 33	240	22.22222
Point 34	240	0
Point 35	0	44.44444
Point 36	10	45.33333
Point 37	26	47.11111
Point 38	41	48.88889
Point 39	57	48
Point 40	76	44.44444
Point 41	112	40
Point 42	148	32
Point 43	180	26.66667
Point 44	208	18.66667
Point 45	240	17.77778
Point 46	0	30.22222
Point 47	27	30.22222
Point 48	61	31.11111
Point 49	102	26.66667
Point 50	144	19.55556
Point 51	194	10.66667
Point 52	215	9.77778
Point 53	240	9.77778
Point 54	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,35,36,37,38,39,40,41,42,43,44,45,33,32,31,30,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,553.8
Region 2	SOIL 2	46,47,48,49,50,51,52,53,45,44,43,42,41,40,39,38,37,36,35	3,305.8
Region 3	SOIL 3	54,46,47,48,49,50,51,52,53,34	5,228.4

Current Slip Surface

Slip Surface: 112
F of S: 2.865
Volume: 841.73537 ft^3
Weight: 95,061.756 lbs
Resisting Moment: 1,17,84,887 lbs-ft
Activating Moment: 41,12,926.7 lbs-ft
Resisting Force: 99,735.284 lbs
Activating Force: 34,819.378 lbs
F of S Rank: 1
Exit: (175.83284, 34.518609) ft
Entry: (77.999999, 51.022226) ft
Radius: 112.4519 ft
Center: (143.70337, 142.28283) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	79	50.318654	0	1,569.0377	980.44355	0
Slice 2	81.666667	48.512448	0	1,610.8908	1,006.5963	0
Slice 3	85	46.389523	0	1,522.8241	951.56614	0
Slice 4	88.333333	44.426187	0	1,426.4618	891.35227	0
Slice 5	90.940303	42.983507	0	1,446.9028	904.12519	0
Slice 6	93.440303	41.70443	0	1,623.021	1,094.7415	50
Slice 7	96.5	40.231171	0	1,750.7168	1,180.8734	50
Slice 8	99.5	38.896025	0	1,760.2302	1,187.2902	50
Slice 9	102.5	37.663932	0	1,763.6513	1,189.5978	50
Slice 10	105.5	36.531284	0	1,760.7423	1,187.6357	50
Slice 11	108.5	35.494915	0	1,751.0711	1,181.1123	50
Slice 12	111	34.696457	0	1,813.6735	1,223.3382	50
Slice 13	113.5	33.974188	0	1,984.3884	1,338.4869	50
Slice 14	116.25	33.24118	0	2,170.2858	1,463.8763	50
Slice 15	118.75	32.641978	0	2,336.9114	1,576.2667	50
Slice 16	121.25	32.102753	0	2,501.1515	1,687.048	50
Slice 17	123.75	31.622629	0	2,662.4092	1,795.8177	50

Slice 18	126.5	31.165007	0	2,774.0351	1,871.1103	50
Slice 19	129.5	30.741769	0	2,831.5517	1,909.9057	50
Slice 20	133	30.3595	0	1,502.0367	1,013.1365	50
Slice 21	136.25	30.0852	0	1,458.4187	983.71586	50
Slice 22	138.75	29.947043	0	1,388.5725	936.60396	50
Slice 23	142	29.861622	0	1,324.7398	893.54829	50
Slice 24	146	29.872181	0	1,257.9897	848.52478	50
Slice 25	149.5	29.990473	0	1,178.8895	795.17102	50
Slice 26	152.25	30.16319	0	1,099.8885	741.88414	50
Slice 27	154.75	30.381872	0	1,013.8141	683.82627	50
Slice 28	156.28894	30.537812	0	955.028	644.17452	50
Slice 29	158.28894	30.794205	0	857.38334	535.75257	0
Slice 30	161.66667	31.287787	0	710.87871	444.20632	0
Slice 31	165	31.879014	0	561.08494	350.60478	0
Slice 32	168.33333	32.574684	0	398.9581	249.29669	0
Slice 33	171.45821	33.320292	0	237.7393	148.556	0
Slice 34	174.37463	34.105168	0	80.034506	50.01111	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 6
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 12:25:13
File Name: ANALYSIS LOT 2.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 2\
Last Solved Date: 10-07-2020
Last Solved Time: 12:25:16

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (25.1314, 53.35669) ft
Left-Zone Right Coordinate: (67, 52.97777) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (221.58942, 23.14152) ft
Right-Zone Right Coordinate: (238, 22.22222) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.77778) ft
Right Coordinate: (240, 22.22222) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	70	53.33333
	131	44.44444

Points

	X (ft)	Y (ft)
Point 1	0	49.77778
Point 2	10	50.66667
Point 3	15	51.55556
Point 4	20	52.44444
Point 5	25	53.33333
Point 6	30	54.22222
Point 7	40	55.11111
Point 8	50	55.11111
Point 9	60	54.22222
Point 10	65	53.33333
Point 11	70	52.44444
Point 12	75	51.55556
Point 13	80	50.66667
Point 14	90	49.77778
Point 15	95	48.88889
Point 16	110	47.11111
Point 17	115	46.22222
Point 18	120	45.33333
Point 19	125	44.44444
Point 20	131	43.55556
Point 21	135	42.66667
Point 22	140	40.88889
Point 23	151	39.11111
Point 24	156	38.22222

Point 25	160	37.33333
Point 26	170	35.55556
Point 27	180	33.77778
Point 28	190	30.22222
Point 29	201	26.66667
Point 30	210	24
Point 31	222	23.11111
Point 32	230	22.22222
Point 33	240	22.22222
Point 34	240	0
Point 35	0	44.44444
Point 36	10	45.33333
Point 37	26	47.11111
Point 38	41	48.88889
Point 39	57	48
Point 40	76	44.44444
Point 41	112	40
Point 42	148	32
Point 43	180	26.66667
Point 44	208	18.66667
Point 45	240	17.77778
Point 46	0	30.22222
Point 47	27	30.22222
Point 48	61	31.11111
Point 49	102	26.66667
Point 50	144	19.55556
Point 51	194	10.66667
Point 52	215	9.77778
Point 53	240	9.77778
Point 54	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,35,36,37,38,39,40,41,42,43,44,45,33,32,31,30,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,553.8
Region 2	SOIL 2	46,47,48,49,50,51,52,53,45,44,43,42,41,40,39,38,37,36,35	3,305.8
Region 3	SOIL 3	54,46,47,48,49,50,51,52,53,34	5,228.4

Current Slip Surface

Slip Surface: 102
F of S: 2.894
Volume: 2,113.4162 ft^3
Weight: 2,43,949.32 lbs
Resisting Moment: 3,94,17,582 lbs-ft
Activating Moment: 1,36,18,278 lbs-ft
Resisting Force: 2,05,891.99 lbs
Activating Force: 71,153.58 lbs
F of S Rank: 1
Exit: (221.58942, 23.141523) ft
Entry: (67.000001, 52.977774) ft
Radius: 182.33008 ft
Center: (175.46093, 199.53999) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	68.5	51.891133	0	77.416799	48.375385	0
Slice 2	72.5	49.093568	0	1,516.2294	947.44525	0
Slice 3	77.5	45.789786	0	1,933.066	1,207.9137	0
Slice 4	80.251942	44.042666	0	2,130.1988	1,331.0959	0
Slice 5	82.877913	42.488894	0	2,043.5519	1,378.3932	50
Slice 6	87.625971	39.784124	0	1,926.9316	1,299.7318	50
Slice 7	92.5	37.201276	0	2,058.944	1,388.7753	50
Slice 8	97.5	34.741018	0	2,264.6263	1,527.5097	50
Slice 9	102.5	32.466602	0	2,279.6484	1,537.6422	50
Slice 10	107.5	30.37052	0	2,282.4707	1,539.546	50
Slice 11	111	28.988233	0	2,352.2529	1,586.6146	50
Slice 12	113.5	28.068256	0	2,527.963	1,705.1325	50
Slice 13	117.5	26.687931	0	2,804.5576	1,891.698	50
Slice 14	122.5	25.090656	0	3,148.032	2,123.3744	50
Slice 15	128	23.522769	0	3,404.8107	2,296.5738	50
Slice 16	133	22.234896	0	2,260.8755	1,524.9798	50
Slice 17	137.5	21.223724	0	2,271.0867	1,531.8673	50

Slice 18	142	20.318108	0	2,282.1013	1,539.2968	50
Slice 19	146	19.617221	0	2,325.59	1,568.6302	50
Slice 20	149.5	19.073955	0	2,355.835	1,589.0308	50
Slice 21	153.5	18.55482	0	2,373.6459	1,601.0444	50
Slice 22	158	18.05904	0	2,367.4004	1,596.8317	50
Slice 23	162.5	17.688433	0	2,341.2429	1,579.1883	50
Slice 24	167.5	17.400982	0	2,301.5919	1,552.4433	50
Slice 25	172.5	17.251105	0	2,236.8941	1,508.8041	50
Slice 26	177.5	17.23846	0	2,146.1766	1,447.6144	50
Slice 27	182.5	17.363019	0	1,973.73	1,331.2977	50
Slice 28	187.5	17.625065	0	1,719.0805	1,159.5345	50
Slice 29	192.75	18.052488	0	1,434.313	967.45632	50
Slice 30	198.25	18.660936	0	1,119.0729	754.82422	50
Slice 31	202.89449	19.295756	0	840.78525	567.11681	50
Slice 32	207.39449	20.047649	0	568.53841	355.26223	0
Slice 33	212.89736	21.119121	0	318.24467	198.86134	0
Slice 34	218.69207	22.434285	0	108.79295	67.981381	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 7
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 12:26:29
File Name: ANALYSIS LOT 2.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 2\
Last Solved Date: 10-07-2020
Last Solved Time: 12:26:31

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1
- Driving Side Maximum Convex Angle: 5 °
- Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (6.24342, 50.33275) ft
Left-Zone Right Coordinate: (99, 48.41482) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (187.10374, 31.252) ft
Right-Zone Right Coordinate: (238, 22.22222) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.77778) ft
Right Coordinate: (240, 22.22222) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	70	53.33333
	131	44.44444

Points

	X (ft)	Y (ft)
Point 1	0	49.77778
Point 2	10	50.66667
Point 3	15	51.55556
Point 4	20	52.44444
Point 5	25	53.33333
Point 6	30	54.22222
Point 7	40	55.11111
Point 8	50	55.11111
Point 9	60	54.22222
Point 10	65	53.33333
Point 11	70	52.44444
Point 12	75	51.55556
Point 13	80	50.66667
Point 14	90	49.77778
Point 15	95	48.88889
Point 16	110	47.11111
Point 17	115	46.22222
Point 18	120	45.33333
Point 19	125	44.44444
Point 20	131	43.55556
Point 21	135	42.66667
Point 22	140	40.88889
Point 23	151	39.11111
Point 24	156	38.22222

Point 25	160	37.33333
Point 26	170	35.55556
Point 27	180	33.77778
Point 28	190	30.22222
Point 29	201	26.66667
Point 30	210	24
Point 31	222	23.11111
Point 32	230	22.22222
Point 33	240	22.22222
Point 34	240	0
Point 35	0	44.44444
Point 36	10	45.33333
Point 37	26	47.11111
Point 38	41	48.88889
Point 39	57	48
Point 40	76	44.44444
Point 41	112	40
Point 42	148	32
Point 43	180	26.66667
Point 44	208	18.66667
Point 45	240	17.77778
Point 46	0	30.22222
Point 47	27	30.22222
Point 48	61	31.11111
Point 49	102	26.66667
Point 50	144	19.55556
Point 51	194	10.66667
Point 52	215	9.77778
Point 53	240	9.77778
Point 54	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,35,36,37,38,39,40,41,42,43,44,45,33,32,31,30,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,553.8
Region 2	SOIL 2	46,47,48,49,50,51,52,53,45,44,43,42,41,40,39,38,37,36,35	3,305.8
Region 3	SOIL 3	54,46,47,48,49,50,51,52,53,34	5,228.4

Current Slip Surface

Slip Surface: 111
F of S: 2.579
Volume: 358.15027 ft^3
Weight: 39,396.529 lbs
Resisting Moment: 3,08,17,611 lbs-ft
Activating Moment: 1,19,50,291 lbs-ft
Resisting Force: 41,641.824 lbs
Activating Force: 16,147.678 lbs
F of S Rank: 1
Exit: (209.21309, 24.233159) ft
Entry: (98.999999, 48.414815) ft
Radius: 718.6764 ft
Center: (307.65105, 736.13606) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)
Slice 1	100.83333	47.86392	0	931.42012	582.01588	0
Slice 2	104.5	46.772753	0	857.88396	536.06539	0
Slice 3	108.16667	45.702783	0	782.77087	489.12953	0
Slice 4	112.5	44.467721	0	883.49805	552.07085	0
Slice 5	117.5	43.076446	0	1,159.891	724.78035	0
Slice 6	122.5	41.723959	0	1,434.2524	896.22036	0
Slice 7	126.5	40.666675	0	1,595.0575	996.70257	0
Slice 8	129.5	39.892153	0	1,642.294	1,026.2192	0
Slice 9	133	39.007283	0	419.49245	262.12798	0
Slice 10	137.5	37.89701	0	398.63751	249.09636	0
Slice 11	141.83333	36.853066	0	386.27716	241.37276	0
Slice 12	145.5	35.993741	0	416.19546	260.06779	0
Slice 13	149.16667	35.154649	0	444.19548	277.56414	0
Slice 14	153.5	34.191138	0	470.24832	293.84376	0
Slice 15	158	33.216325	0	482.01196	301.1945	0
Slice 16	161.66667	32.444768	0	487.32682	304.51559	0
Slice 17	165	31.761474	0	498.62608	311.57616	0

Slice 18	168.33333	31.094601	0	507.99733	317.43196	0
Slice 19	171.66667	30.444103	0	515.39112	322.05212	0
Slice 20	175	29.809935	0	520.765	325.41009	0
Slice 21	178.33333	29.192053	0	524.08537	327.48489	0
Slice 22	181.66667	28.590414	0	493.70017	308.49811	0
Slice 23	185	28.004977	0	429.58018	268.43149	0
Slice 24	188.33333	27.435702	0	363.45105	227.10942	0
Slice 25	191.83333	26.855736	0	298.25866	186.3727	0
Slice 26	195.5	26.266728	0	233.91607	146.16698	0
Slice 27	199.16667	25.697131	0	167.52967	104.68416	0
Slice 28	203.05327	25.115125	0	100.92205	63.063098	0
Slice 29	207.15982	24.523114	0	33.981808	21.234191	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 2
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 13:02:06
File Name: ANALYSIS LOT 3.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 3\
Last Solved Date: 10-07-2020
Last Solved Time: 13:02:07

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1

Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (32.63634, 46.93637) ft
Left-Zone Right Coordinate: (97, 37.28) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (213.0112, 22.13978) ft
Right-Zone Right Coordinate: (258, 21.6) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.6) ft
Right Coordinate: (260, 21.6) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	46	46.4
	150	28

Points

	X (ft)	Y (ft)
Point 1	0	49.6
Point 2	15	49.6
Point 3	20	48.8
Point 4	25	48
Point 5	30	47.2
Point 6	46	45.6
Point 7	50	44.8
Point 8	55	44
Point 9	60	43.2
Point 10	65	42.4

Point 11	70	41.6
Point 12	75	40.8
Point 13	85	39.2
Point 14	90	38.4
Point 15	95	37.6
Point 16	100	36.8
Point 17	105	35.2
Point 18	110	33.6
Point 19	120	32
Point 20	130	30.4
Point 21	140	28.8
Point 22	145	28
Point 23	150	27.2
Point 24	155	26.4
Point 25	160	25.6
Point 26	175	23.2
Point 27	200	22.4
Point 28	240	21.6
Point 29	260	21.6
Point 30	260	0
Point 31	0	44
Point 32	14	44
Point 33	30	42.4
Point 34	48	39.2
Point 35	74	36
Point 36	108	28.8
Point 37	155	20
Point 38	175	19.2
Point 39	200	17.6
Point 40	260	17.6
Point 41	0	30.4
Point 42	15	30.4
Point 43	41	27.2
Point 44	84	20.8
Point 45	148	12
Point 46	180	9.6
Point 47	208	9.6
Point 48	260	9.6
Point 49	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,31,32,33,34,35,36,37,38,39,40,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,337.6
Region 2	SOIL 2	31,41,42,43,44,45,46,47,48,40,39,38,37,36,35,34,33,32	2,775.6
Region 3	SOIL 3	41,49,30,48,47,46,45,44,43,42	4,400

Current Slip Surface

Slip Surface: 102
F of S: 3.023
Volume: 835.10817 ft^3
Weight: 94,889.484 lbs
Resisting Moment: 1,54,75,796 lbs-ft
Activating Moment: 51,19,234.9 lbs-ft
Resisting Force: 1,15,252.44 lbs
Activating Force: 38,128.522 lbs
F of S Rank: 1
Exit: (213.0112, 22.139776) ft
Entry: (97, 37.28) ft
Radius: 128.20345 ft
Center: (169.76856, 142.83028) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

Slice 1	98.5	36.276722	0	166.87581	104.27558	0
Slice 2	102.5	33.731978	0	745.0903	465.58409	0
Slice 3	107.5	30.800952	0	1,810.8749	1,131.5602	0
Slice 4	111.52719	28.632521	0	2,357.7899	1,473.3107	0
Slice 5	114.79078	27.029272	0	2,379.097	1,604.7212	50
Slice 6	118.26359	25.443026	0	2,421.1956	1,633.1171	50
Slice 7	121.66667	24.006463	0	2,454.6682	1,655.6946	50
Slice 8	125	22.710602	0	2,479.8797	1,672.7	50
Slice 9	128.33333	21.520162	0	2,497.627	1,684.6707	50
Slice 10	131.66667	20.432064	0	2,507.6605	1,691.4384	50
Slice 11	135	19.443598	0	2,509.5743	1,692.7292	50
Slice 12	138.33333	18.552384	0	2,502.8201	1,688.1735	50
Slice 13	142.5	17.586503	0	2,479.5341	1,672.4669	50
Slice 14	147.5	16.601159	0	2,432.0325	1,640.4266	50
Slice 15	152.5	15.820219	0	1,235.0578	833.05703	50
Slice 16	157.5	15.239925	0	1,244.1065	839.16041	50
Slice 17	161.875	14.883858	0	1,234.8904	832.94411	50
Slice 18	165.625	14.707543	0	1,208.5196	815.15674	50
Slice 19	169.375	14.641148	0	1,165.2498	785.97089	50
Slice 20	173.125	14.684503	0	1,104.3471	744.89152	50
Slice 21	176.90345	14.839722	0	1,052.556	709.95799	50
Slice 22	180.71034	15.108897	0	1,009.8113	681.12634	50
Slice 23	184.51724	15.492428	0	948.36397	639.67957	50
Slice 24	188.32414	15.991352	0	868.10136	585.54176	50
Slice 25	192.13103	16.607038	0	769.20412	518.83473	50
Slice 26	195.93793	17.341208	0	652.14136	439.8749	50
Slice 27	198.92069	17.990188	0	544.4615	340.2173	0
Slice 28	202.16853	18.808742	0	432.93902	270.53033	0
Slice 29	206.5056	20.023968	0	271.88598	169.89321	0
Slice 30	210.84267	21.406226	0	93.240995	58.26344	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 6
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 13:04:38
File Name: ANALYSIS LOT 3.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 3\
Last Solved Date: 10-07-2020
Last Solved Time: 13:04:39

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1

Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (33.1906, 46.88094) ft
Left-Zone Right Coordinate: (75, 40.8) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (214.87314, 22.10254) ft
Right-Zone Right Coordinate: (260, 21.6) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.6) ft
Right Coordinate: (260, 21.6) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	46	46.4
	150	28

Points

	X (ft)	Y (ft)
Point 1	0	49.6
Point 2	15	49.6
Point 3	20	48.8
Point 4	25	48
Point 5	30	47.2
Point 6	46	45.6
Point 7	50	44.8
Point 8	55	44
Point 9	60	43.2
Point 10	65	42.4

Point 11	70	41.6
Point 12	75	40.8
Point 13	85	39.2
Point 14	90	38.4
Point 15	95	37.6
Point 16	100	36.8
Point 17	105	35.2
Point 18	110	33.6
Point 19	120	32
Point 20	130	30.4
Point 21	140	28.8
Point 22	145	28
Point 23	150	27.2
Point 24	155	26.4
Point 25	160	25.6
Point 26	175	23.2
Point 27	200	22.4
Point 28	240	21.6
Point 29	260	21.6
Point 30	260	0
Point 31	0	44
Point 32	14	44
Point 33	30	42.4
Point 34	48	39.2
Point 35	74	36
Point 36	108	28.8
Point 37	155	20
Point 38	175	19.2
Point 39	200	17.6
Point 40	260	17.6
Point 41	0	30.4
Point 42	15	30.4
Point 43	41	27.2
Point 44	84	20.8
Point 45	148	12
Point 46	180	9.6
Point 47	208	9.6
Point 48	260	9.6
Point 49	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,31,32,33,34,35,36,37,38,39,40,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,337.6
Region 2	SOIL 2	31,41,42,43,44,45,46,47,48,40,39,38,37,36,35,34,33,32	2,775.6
Region 3	SOIL 3	41,49,30,48,47,46,45,44,43,42	4,400

Current Slip Surface

Slip Surface: 102
F of S: 3.658
Volume: 1,283.7568 ft^3
Weight: 1,47,238.36 lbs
Resisting Moment: 2,55,86,190 lbs-ft
Activating Moment: 69,94,209.1 lbs-ft
Resisting Force: 1,59,063.54 lbs
Activating Force: 43,482.96 lbs
F of S Rank: 1
Exit: (214.87314, 22.102537) ft
Entry: (75, 40.8) ft
Radius: 155.06967 ft
Center: (163.23256, 168.32105) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

Slice 1	77.5	39.140834	0	692.87438	432.95597	0
Slice 2	82.5	35.95685	0	807.2918	504.4519	0
Slice 3	86.051411	33.828658	0	876.40621	547.63938	0
Slice 4	88.551411	32.429194	0	909.14887	613.22865	50
Slice 5	92.5	30.351433	0	972.54468	655.98967	50
Slice 6	97.5	27.899492	0	1,036.3514	699.02781	50
Slice 7	102.5	25.664903	0	1,581.8714	1,066.9858	50
Slice 8	106.5	24.010892	0	2,415.0834	1,628.9943	50
Slice 9	109	23.047883	0	2,934.3955	1,979.2747	50
Slice 10	112.5	21.808897	0	3,148.4334	2,123.6452	50
Slice 11	117.5	20.171496	0	3,154.3231	2,127.6178	50
Slice 12	122.5	18.719084	0	3,145.0723	2,121.3781	50
Slice 13	127.5	17.446312	0	3,119.5593	2,104.1693	50
Slice 14	132.5	16.348661	0	3,076.3396	2,075.0172	50
Slice 15	137.5	15.422354	0	3,013.7179	2,032.7784	50
Slice 16	142.5	14.664289	0	2,929.8338	1,976.1979	50
Slice 17	147.5	14.071983	0	2,822.7607	1,903.9761	50
Slice 18	152.5	13.64353	0	1,543.6256	1,041.1886	50
Slice 19	157.5	13.377569	0	1,505.6816	1,015.5951	50
Slice 20	162.5	13.273263	0	1,447.7431	976.51506	50
Slice 21	167.5	13.330285	0	1,365.0134	920.71318	50
Slice 22	172.5	13.548814	0	1,256.6894	847.64768	50
Slice 23	177.47616	13.926946	0	1,159.3542	781.99426	50
Slice 24	182.42847	14.46432	0	1,073.7142	724.22934	50
Slice 25	187.38078	15.163671	0	963.00898	649.55776	50
Slice 26	192.33309	16.027233	0	827.52816	558.17479	50
Slice 27	197.40462	17.086817	0	663.93921	447.83265	50
Slice 28	202.47886	18.321831	0	482.10906	301.25518	0
Slice 29	207.43657	19.707726	0	302.38813	188.95307	0
Slice 30	212.39428	21.273791	0	103.67294	64.782045	0

SLOPE/W Analysis

File Information

Created By: Admin
Last Edited By: Admin
Revision Number: 7
File Version: 8.3
Tool Version: 8.13.4.13430
Date: 10-07-2020
Time: 13:06:00
File Name: ANALYSIS LOT 3.gsz
Directory: F:\LD\Project 2020\Project 0208\SLOPE STABILITY ANALYSIS\LOT 3\
Last Solved Date: 10-07-2020
Last Solved Time: 13:06:02

Project Settings

Length(L) Units: Feet
Time(t) Units: Seconds
Force(F) Units: Pounds
Pressure(p) Units: psf
Strength Units: psf
Unit Weight of Water: 62.4 pcf
View: 2D
Element Thickness: 1

Analysis Settings

SLOPE/W Analysis

Kind: SLOPE/W
Method: Morgenstern-Price
Settings
- Side Function
  - Interslice force function option: Half-Sine
- Lambda
  - Lambda 1: -1
  - Lambda 2: -0.8
  - Lambda 3: -0.6
  - Lambda 4: -0.4
  - Lambda 5: -0.2
  - Lambda 6: 0
  - Lambda 7: 0.2
  - Lambda 8: 0.4
  - Lambda 9: 0.6
  - Lambda 10: 0.8
  - Lambda 11: 1
- PWP Conditions Source: (none)

Slip Surface
- Direction of movement: Left to Right
- Use Passive Mode: No
- Slip Surface Option: Entry and Exit
- Critical slip surfaces saved: 1
- Optimize Critical Slip Surface Location: No
- Tension Crack
  - Tension Crack Option: (none)

F of S Distribution
- F of S Calculation Option: Constant

Advanced
- Number of Slices: 30
- F of S Tolerance: 0.001
- Minimum Slip Surface Depth: 0.1 ft
- Optimization Maximum Iterations: 2,000
- Optimization Convergence Tolerance: 1e-007
- Starting Optimization Points: 8
- Ending Optimization Points: 16
- Complete Passes per Insertion: 1

Driving Side Maximum Convex Angle: 5 °
Resisting Side Maximum Convex Angle: 1 °

Materials

SOIL 1

Model: Mohr-Coulomb
Unit Weight: 110 pcf
Cohesion': 0 psf
Phi': 32 °
Phi-B: 0 °

SOIL 2

Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 50 psf
Phi': 34 °
Phi-B: 0 °

SOIL 3

Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 250 psf
Phi': 34 °
Phi-B: 0 °

Slip Surface Entry and Exit

Left Projection: Range
Left-Zone Left Coordinate: (67.8315, 41.94696) ft
Left-Zone Right Coordinate: (135, 29.6) ft
Left-Zone Increment: 4
Right Projection: Range
Right-Zone Left Coordinate: (200.36562, 22.39269) ft
Right-Zone Right Coordinate: (240, 21.6) ft
Right-Zone Increment: 4
Radius Increments: 4

Slip Surface Limits

Left Coordinate: (0, 49.6) ft
Right Coordinate: (260, 21.6) ft

Surcharge Loads

Surcharge Load 1

Surcharge (Unit Weight): 1,500 pcf
Direction: Vertical

Coordinates

	X (ft)	Y (ft)
	46	46.4
	150	28

Points

	X (ft)	Y (ft)
Point 1	0	49.6
Point 2	15	49.6
Point 3	20	48.8
Point 4	25	48
Point 5	30	47.2
Point 6	46	45.6
Point 7	50	44.8
Point 8	55	44
Point 9	60	43.2
Point 10	65	42.4

Point 11	70	41.6
Point 12	75	40.8
Point 13	85	39.2
Point 14	90	38.4
Point 15	95	37.6
Point 16	100	36.8
Point 17	105	35.2
Point 18	110	33.6
Point 19	120	32
Point 20	130	30.4
Point 21	140	28.8
Point 22	145	28
Point 23	150	27.2
Point 24	155	26.4
Point 25	160	25.6
Point 26	175	23.2
Point 27	200	22.4
Point 28	240	21.6
Point 29	260	21.6
Point 30	260	0
Point 31	0	44
Point 32	14	44
Point 33	30	42.4
Point 34	48	39.2
Point 35	74	36
Point 36	108	28.8
Point 37	155	20
Point 38	175	19.2
Point 39	200	17.6
Point 40	260	17.6
Point 41	0	30.4
Point 42	15	30.4
Point 43	41	27.2
Point 44	84	20.8
Point 45	148	12
Point 46	180	9.6
Point 47	208	9.6
Point 48	260	9.6
Point 49	0	0

Regions

	Material	Points	Area (ft^2)
Region 1	SOIL 1	1,31,32,33,34,35,36,37,38,39,40,29,28,27,26,25,24,23,22,21,20,19,18,17,16,15,14,13,12,11,10,9,8,7,6,5,4,3,2	1,337.6
Region 2	SOIL 2	31,41,42,43,44,45,46,47,48,40,39,38,37,36,35,34,33,32	2,775.6
Region 3	SOIL 3	41,49,30,48,47,46,45,44,43,42	4,400

Current Slip Surface

Slip Surface: 77
F of S: 2.622
Volume: 471.32009 ft^3
Weight: 52,886.057 lbs
Resisting Moment: 63,78,674.4 lbs-ft
Activating Moment: 24,32,956.4 lbs-ft
Resisting Force: 66,969.648 lbs
Activating Force: 25,562.126 lbs
F of S Rank: 1
Exit: (200.36562, 22.392688) ft
Entry: (118.11596, 32.301446) ft
Radius: 89.981297 ft
Center: (168.79501, 106.65377) ft

Slip Slices

	X (ft)	Y (ft)	PWP (psf)	Base Normal Stress (psf)	Frictional Strength (psf)	Cohesive Strength (psf)

Slice 1	119.05798	31.676546	0	1,747.9785	1,092.2582	0
Slice 2	121.25	30.273549	0	1,790.2986	1,118.7027	0
Slice 3	123.75	28.772476	0	1,833.2115	1,145.5177	0
Slice 4	126.25	27.378657	0	1,870.6618	1,168.9192	0
Slice 5	128.75	26.086515	0	1,903.3786	1,189.363	0
Slice 6	131.45846	24.799962	0	1,933.7249	1,208.3254	0
Slice 7	134.09743	23.641274	0	1,948.8635	1,314.5251	50
Slice 8	136.45846	22.693179	0	1,975.7708	1,332.6743	50
Slice 9	138.81949	21.821381	0	1,998.4144	1,347.9475	50
Slice 10	141.25	21.002254	0	2,016.9201	1,360.4298	50
Slice 11	143.75	20.237987	0	2,030.6647	1,369.7006	50
Slice 12	146.25	19.552167	0	2,038.3346	1,374.874	50
Slice 13	148.75	18.942954	0	2,039.1751	1,375.441	50
Slice 14	151.25	18.408758	0	905.67972	610.88869	50
Slice 15	153.75	17.948223	0	935.31744	630.87958	50
Slice 16	156.25	17.560207	0	958.74107	646.67902	50
Slice 17	158.75	17.243763	0	975.32505	657.86506	50
Slice 18	161.5	16.981301	0	982.17483	662.48529	50
Slice 19	164.5	16.787584	0	975.98791	658.31216	50
Slice 20	167.5	16.694301	0	953.71847	643.29123	50
Slice 21	170.5	16.701139	0	914.21041	616.64271	50
Slice 22	173.5	16.808122	0	856.56853	577.76277	50
Slice 23	176.4528	17.010779	0	803.73426	542.1256	50
Slice 24	179.3584	17.306648	0	756.64399	510.36282	50
Slice 25	182.26401	17.698384	0	692.34774	466.99445	50
Slice 26	185.16961	18.187261	0	611.14865	412.22497	50
Slice 27	187.96017	18.747823	0	512.06221	319.97198	0
Slice 28	190.63569	19.374238	0	419.59298	262.19079	0
Slice 29	193.3112	20.087861	0	316.16301	197.56058	0
Slice 30	195.98672	20.890872	0	202.76063	126.69891	0
Slice 31	198.66224	21.78581	0	80.40578	50.243108	0
Slice 32	200.18281	22.324645	0	8.6747371	5.4205774	0

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

As the client of a consulting geotechnical engineer, you should know that site subsurface conditions cause more construction problems than any other factor. ASFE/the Association of Engineering Firms Practicing in the Geosciences offers the following suggestions and observations to help you manage your risks.

A GEOTECHNICAL ENG.NEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS Your geotechnical engineering report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. These factors typically include: the general nature of the structure involved, its size, and configuration; the location of the structure on the site; other improvements, such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask your geotechnical engineer to evaluate how factors that change subsequent to the date of the report may affect the report's recommendations.

Unless your geotechnical engineer indicates otherwise, do not use your geotechnical engineering report:

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL JUDGMENTS
Site exploration identifies actual subsurface conditions only at those points where samples are taken. The data were extrapolated by your geotechnical engineer who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates, Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations. you and your geotechnical engineer can work together to help minimize their impact. Retaining your geotechnical engineer to observe construction can be particularly beneficial in this respect.

- when the nature of the proposed structure is changed. for example, if an office building will be erected instead of a parking garage, or a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size, elevation. or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership; or .for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems that may occur if they are not consulted after factors considered in their report's development have changed.

A REPORT'S RECOMMENDATIONS CAN ONLY BE PRELIMINARY
The construction recommendations included in your geotechnical engineer's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site.

Because actual subsurface conditions can be discerned only during earthwork, you should retain your geo- technical engineer to observe actual conditions and to finalize recommendations. Only the geotechnical engineer who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations are valid and whether or not the contractor is abiding by applicable recommendations. The geotechnical engineer who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

SUBSURFACE CONDITIONS CAN CHANGE A geotechnical engineering report is based on conditions that existed at the time of subsurface exploration. Do not base construction decisions on a geotechnical engineering report whose adequacy may have been affected by time. Speak with your geotechnical consult- ant to learn if additional tests are advisable before construction starts. Note, too, that additional tests may be required when subsurface conditions are affected by construction operations at or adjacent to the site, or by natural events such as floods, earthquakes, or ground water fluctuations. Keep your geotechnical consultant apprised of any such events.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS
Consulting geotechnical engineers prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your geotechnical engineer prepared your report expressly for you and expressly for purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the geotechnical engineer. No party should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.

GEOENVIRONMENTAL CONCERNS ARE NOT AT ISSUE
Your geotechnical engineering report is not likely to relate any findings, conclusions, or recommendations

about the potential for hazardous materials existing at the site. The equipment, techniques, and personnel used to perform a geoenvironmental exploration differ substantially from those applied in geotechnical engineering. Contamination can create major risks. If you have no information about the potential for your site being contaminated. you are advised to speak with your geotechnical consultant for information relating to geoenvironmental issues.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid misinterpretations, retain your geotechnical engineer to work with other project design professionals who are affected by the geotechnical report. Have your geotechnical engineer explain report implications to design professionals affected by them. and then review those design professionals' plans and specifications to see how they have incorporated geotechnical factors. Although certain other design professionals may be fam- iliar with geotechnical concerns, none knows 'as much about them as a competent geotechnical engineer.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE REPORT Geotechnical engineers develop final boring logs based upon their interpretation of the field logs (assembled by site personnel) and laboratory evaluation of field samples. Geotechnical engineers customarily include only final boring logs in their reports. Final boring logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs. delays. disputes. and unanticipated costs ara the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, give contractors ready access to the complete geotechnical engineering report prepared or authorized for their use. (If access is provided only to the report prepared for you, you should advise contractors of the report's limitations. assuming that a contractor was not one of the specific persons for whom the report was prepared and that developing construction cost estimates was not one of the specific purposes for which it was prepared. In other words. while a contractor may gain important knowledge from a report prepared for another party, the contractor would be well-advised to discuss the report with your geotechnical engineer and to perform the additional or alternative work that the contractor believes may be needed to obtain the data specifically appropriate for construction cost estimating purposes.) Some clients believe that it is unwise or unnecessary to give contractors access to their geo- technical engineering reports because they hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems. It also helps reduce the adversarial attitudes that can aggravate problems to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical engineers. To help prevent this problem, geotechnical engineers have developed a number of clauses for use in their contracts, reports, and other documents. Responsibility clauses are not exculpatory clauses designed to transfer geotechnical engineers' liabilities to other parties. Instead, they are definitive clauses that identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report. Read them closely. Your geotechnical engineer will be pleased to give full and frank answers to any questions.

RELY ON THE GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE Most ASFE-member consulting geotechnical engineering firms are familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a construction project, from design through construction. Speak with your geotechnical engineer not only about geotechnical issues, but others as well, to learn about approaches that may be of genuine benefit. You may also wish to obtain certain ASFE publications. Contact a member of ASFE of ASFE for a complimentary directory of ASFE publications.

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