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Per Section 8.4.8.C.2,  
a minimum of 2 OWTS  
locations are required to  
be depicted on the  
OWTS study.

GEOLOGY AND SOILS STUDY  
MOUNTAINS EDGE DEVELOPMENT  
EL PASO COUNTY, COLORADO

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## SUMMARY

1. Below a thin layer of topsoil, overburden soils encountered in the borings generally consisted of silty and clayey sand and poorly- to well-graded sand with silt to depths ranging from approximately 1.5 to 18 feet in two borings and to the maximum 20-foot depth of two other borings. Sandy lean clay was encountered to a depth of approximately 6 feet in one of the borings. Beneath the overburden soils in two borings, noncemented sandstone bedrock was encountered at a depth of approximately 1.5 and 18 feet and extended to the 20-foot depth of the borings.
2. Ground water was not encountered in the borings at the time of drilling or when checked three days later. Iron staining was observed at a depth of approximately 9 feet in Boring 4 and suggests the ground-water level has been higher in this area in the past. Fluctuations in the ground-water level may occur with time.
3. In our opinion, the geologic hazards that potentially affect the proposed development are those related to flooding, shallow ground water and man-placed fill. We have mapped potential flood prone areas on the subject site as no-build areas. A hydrologic study of the subject site should be performed by a qualified hydrologist or civil engineer to evaluate the limits of the 100-year floodplain.
4. We believe that spread footing foundations and floor slabs bearing on the nonexpansive native overburden soils or sandstone bedrock will be suitable for use on the property.
5. Conditions that may impact the construction of onsite waste disposal systems include the proximity to water sources, potentially shallow ground water, shallow bedrock and slow percolation rates associated with some of the soils.
6. The average percolation rates for the test holes adjacent to Borings 1 through 4 are 55, 55, 39 and 122 minutes per inch, respectively.

## PURPOSE AND SCOPE OF STUDY

This report presents the results of a geology and soils study for the development of the proposed approximately 39-acre property, Parcel Number 3200000639, located east of McClelland Road and north of Scott Road in El Paso County, Colorado. This study was performed in accordance with our proposal dated October 8, 2008, to fulfill the requirements of a Geology and Soils Report as outlined in Chapter V, Section 51.4 of the El Paso County Land Development Code. The project site is shown on Fig. 1.

This report has been prepared to summarize the data obtained during this study, to provide our conclusions and recommendations regarding geologic conditions which could potentially affect the proposed development.

## PROPOSED DEVELOPMENT

The project site is situated in a portion of the southwest quarter of Section 13, Township 12 South, Range 63 West of the Sixth Principal Meridian, El Paso County, Colorado. We understand the proposed development will consist of subdividing the existing property into approximately 5 residential lots serviced by individual water and sewer systems. A grading plan for the site was not available at the time of this report; however, we anticipate that construction will occur at or near existing grades. If the proposed development is significantly different from that described above or depicted in this report, we should be notified to reevaluate the recommendations provided.

## SITE CONDITIONS

The subject site is bounded to the west by McClelland Road, and to the north, east and south by sparse rural development and grazing land. At the time of our visits in October 2008, the site was vacant and appeared to be used for livestock grazing. An apparent water well was mapped by LDC-Inc. near the northern edge of the property. We did not observe this water well during our site visit, nor did we find evidence of a well permit for the subject property when we searched the Colorado Department of Water Resources Online Mapping web site.

The subject site generally consists of two, south-southeast-trending ephemeral drainages separated by a southeast-trending ridge. Topography east and west of the ridge generally ranges from nearly level to moderately sloping (1% to 6%) to the east and southeast. The flanks of the southeast-trending ridge slope moderately to strongly (5% to 11%). Vegetation on the property consists of sparse grass, weeds and cactus.

On the western half of the property, a shallow v-shaped gully enters the northern edge of the property and abruptly opens to a poorly-defined channel near the middle of the property. Then, the poorly-defined channel coalesces into a well-defined shallow v-shaped gully near the southern edge of the property. The drainage at the eastern edge of the property was occupied by a braided channel of an unnamed creek. The channel banks of this creek range in height from approximately 2 to 5 feet. An earthen dam was observed in the channel of the creek at the southeast corner of the property. We also observed a shallow excavation and berm within the channel of the creek, near the northern edge of the property. Although no water was observed within the creek or at any other location on the subject site, we observed evidence of prior standing water north of the dam and within the excavation.

## SUBSURFACE CONDITIONS

Information regarding subsurface conditions was obtained by drilling four exploratory borings at the approximate locations shown on Figs. 1 and 2. Logs of the exploratory borings are presented on Fig. 4. The results of laboratory tests performed on selected samples obtained from the borings are presented on Figs. 4 through 7, and are summarized in Table I. The following subsurface descriptions are of a generalized nature to highlight the major stratification features encountered in the borings. The boring logs should be referenced for more detailed information.

Beneath a thin layer of topsoil, sandy lean clay was encountered to a depth of approximately 6 feet in Boring 2. Sampler penetration blow counts within the sandy lean clay suggest the clay is very stiff in consistency. A swell-consolidation test performed on a sample of the sandy lean clay indicates the clay consolidated slightly when wetted under a constant 1-ksf load.

Beneath the topsoil in Borings 1, 3 and 4, and the clay soils in Boring 2, the overburden soils generally consisted of silty sand, clayey sand and poorly- to well-graded sand with silt to depths ranging from approximately 1.5 feet in Boring 1 to the maximum depth explored of 20 feet in Borings 3 and 4. Sampler penetration blow counts indicate the silty sand and poorly- to well-graded sand with silt is loose to dense and the clayey sand is very stiff.

Noncemented clayey sandstone bedrock was encountered beneath the overburden soils in Borings 1 and 2 at depths of approximately 1.5 and 18 feet, respectively. The sandstone bedrock extended to the maximum 20-foot depth explored in Boring 1 and 2. Sampler penetration blow counts indicate the sandstone is medium hard to hard.

Ground water was not encountered in the borings at the time of drilling or when checked three days later. Iron staining observed at a depth of approximately 9 feet in Boring 4 suggests ground-water levels have been higher in this area in the past. Fluctuations in the water level may occur with time.

## GEOLOGIC CONDITIONS

Soils: The U.S. Soil Conservation Service (SCS)(1981) maps five soil units on the property as reproduced on Fig. 1. The Blakeland loamy sand formed in alluvium and eolian (windblown)

material derived from arkosic sedimentary rock on uplands. The Blendon sandy loam formed in sandy arkosic alluvium on alluvial fans and terraces. The Columbine gravelly sandy loam formed on alluvial terraces, fans and floodplains. The Truckton sandy loam (on both the 0% to 3% and 3% to 9% slopes) formed in alluvium and residuum derived from arkosic sedimentary rock on uplands.

According to the SCS (1981), the hazard of erosion is moderate for the soil units mapped on the site. The SCS (1981) also notes that restrictive features affecting the building of dwellings with or without basements are slight for these soils, with the exception of the Columbine gravelly sand loam which is at risk of flooding. Restrictive features affecting the construction of absorption fields are also reported to be slight, but again, the Columbine gravelly sandy loam is reported to be at risk of flooding.

Geology: The attached Surficial Geology Map, Fig. 2, depicts the surficial geology at the site. The map is based on a review of published geologic maps and literature, and the results of our field reconnaissance.

The property is located near the western edge of the Colorado Piedmont within the Great Plains Physiographic Province. Structurally this region is located east of the Rocky Mountain Front Range and the Rampart Range reverse fault. This area is located near the southern edge of the Denver Basin, a structural depression centered to the north. Sedimentary rocks in this area generally slope gently to the northeast. The regional geology in this area consists of the eolian (windblown) and various alluvial deposits over the eroded surface of Paleocene interbedded arkosic sandstone, siltstone and claystone bedrock of the Dawson Formation.

Our field reconnaissance indicates man-placed fill consisting of silty sand with occasional gravel is present within a berm (north) and dam (south) constructed in the creek on the eastern side of the property. The exact vertical and lateral extent of this fill was not determined during this study.

The geologic units within the approximate western half and eastern edge of the property consist of colluvium, alluvium and occasional exposed bedrock of the Dawson Formation, map unit Col/Al/TKda. The southeast-trending ridge crossing the middle portion of the property appears to consist of eolian or alluvial terrace deposits that have been incised by the modern

drainages, map unit Es/AI. Alluvial and slopewash deposits were observed along the drainage channel on the western-central portion of the property, map unit AI/SW. Alluvium was also observed within the creek on the eastern side of the property, map unit AIc. Adjacent to the creek are alluvial terrace deposits located approximately 2 to 5 feet above the existing creek bottom, map unit AIr.

In general, the colluvial and alluvial deposits on the site consist of clayey and silty sand or poorly- to well-graded sand with silt and occasional gravel. The alluvium/slopewash in the area of Boring 2 also consists of sandy lean clay. The eolian deposits generally consist of silty sand and are free of gravel.

Hydrogeology: Surficial water on the property will generally drain towards the south-southeast-trending drainages on the property. The two drainages are unnamed tributaries of Brackett Creek, located south of the site. As indicated in our proposal, we have not performed a hydrologic study for site to determine the expected volume of flow within the creek and drainages on the site. A qualified hydrologist or civil engineer should perform a hydrologic study.

In general, bedrock topography is assumed to mimic the surface topography; therefore, shallow unconfined ground water perched on the bedrock is generally expected to flow in a southerly or easterly direction following the bedrock topography. Ground water within the bedrock is part of the Dawson Aquifer and is generally expected to flow to the northeast following the dip of bedding. Fractures, other discontinuities, underground structures or drawdown from nearby wells may alter the direction of ground-water flow.

#### PERCOLATION TESTING

Four percolation tests were performed to provide preliminary information on individual sewage disposal system absorption rates. At the percolation test sites selected for this study, three percolation test holes, shown on Fig. 1, were drilled at a spacing of approximately 30-feet on-center with a 6-inch diameter auger to depths of approximately 36 inches. The percolation test holes were presoaked with water for approximately 24 hours, then were wetted again for an additional approximately 16 hours prior to performing the percolation tests. On the day of the tests, no standing water remained in the test holes. The test holes were cleaned of slough and refilled to a water depth of approximately 14 inches prior to starting the tests.

After the percolation rate had stabilized in each of the test holes, we recorded the average percolation rate in the bottom 6 inches of the test hole. Due to slow percolation rates in the test holes adjacent to Boring 4, we bailed the remaining water to a depth of approximately 6 inches after the percolation rate had stabilized in the upper 14 inches of the test holes. The percolation test results are presented in Table II. The percolation tests adjacent to Boring 1 were performed in the sandstone bedrock. The percolation rate in the percolation holes adjacent to Boring 1 ranged from approximately 51 to 60 minutes per inch. Percolation tests adjacent to Borings 2, and 3 and 4 were performed within the sandy lean clay soil and silty sand soils, respectively. Percolation rates for the test holes adjacent to Boring 2 ranged from approximately 25 to 79 minutes per inch. The percolation rates for the test holes adjacent to Boring 3 ranged from approximately 12 to 86 minutes per inch. Percolation rates for the test holes adjacent to Boring 4 ranged from approximately 112 to 133 minutes per inch. The average percolation rates for the test holes adjacent to Borings 1 through 4 are 55, 55, 39 and 122 minutes per inch, respectively.

We believe that the range in percolation rates measured at each site is due to variations in the percentage of fine-grained material at each respective test hole.

#### POTENTIAL MINERAL RESOURCES

According to the El Paso County Master Plan for Mineral Extraction (El Paso County, 1995), this property contains sand and gravel aggregate resources. Schwochow, Shrioba, and Wicklein (1974) indicate the site is within an area of upland deposits consisting of stream and windblown sand. Schwochow (1981), maps several active and inactive sand and/or gravel pits within a mile north and west of the subject property. The subject property, especially the middle and eastern portion, contains sand aggregate resources. The sand deposits forming the southeast-trending ridge are relatively clean and may be suitable for use as borrow material, but are generally too fine-grained for use as concrete aggregate or road base. Determining the actual economic value and feasibility of mining the sand deposits at this site is beyond the scope of the study.

#### GEOLOGIC HAZARDS

Geologic hazards considered for this property are presented below. Recommendations for the mitigation of these hazards are discussed in the "Development Considerations" section below.

Flooding: The Federal Emergency Management Agency (1997) "Flood Insurance Rate Map", map number 08041C0375F indicates a portion of the eastern part of the property, is within Zone A, a flood hazard area inundated by the 100-year flood. The general limits of the FEMA 100-year floodplain is shown on Fig. 3 and were provided by LDC, Inc. Based on our field observations, we believe the floodplain may extend beyond the limits suggested by FEMA. The channel morphology of the drainages suggests that in addition to the mapped FEMA floodplain, other areas on the subject site may be prone to flooding. Based on our observations we have mapped potential flood-prone areas, in addition to the FEMA floodplain, on Fig. 3.

Erosion and Sedimentation: We anticipate that erosion of the banks and channel of the creek on the eastern edge of the site may occur during flow events within the creek. Bank or channel erosion is more likely during flood events. The potential for erosion is also present within the gullies on the western half of the site, especially near the southern edge of the property. Sedimentation is a hazard in the channel of the creek and other drainages. Sedimentation within the pond area north of the dam (at the southeast corner of the property) will eventually infill this area. Periodic maintenance may be required to clean out the pond area for it to maintain its function. Areas which are at risk of erosion and sedimentation, as presented herein, are those sites within or adjacent to the areas mapped as flood-prone areas or the Fema 100-year floodplain on Fig. 3.

Moisture Sensitive Soil and Bedrock: Although expansive clay or claystone bedrock were not encountered in our exploratory borings, occasional layers or lenses of potentially expansive clay or claystone may be present in other areas of the site.

Potentially Shallow Ground Water: Iron-staining observed in Boring 4 suggests the ground-water elevation in that area has been higher in this area in the past. Based on this, seasonally shallow ground water may be present in the low-lying eastern portion of the property. We anticipate that potentially shallow ground water may also develop within the area mapped as flood prone on the western portion of the site. Areas anticipated to potentially develop shallow ground water are mapped on Fig. 3.

Man-placed Fill: Areas of man-placed fill, approximately shown on Figs. 2 and 3, were observed on the site during our field reconnaissance. The condition and method of placement

of the fill is unknown. Structures placed on uncontrolled fill may experience differential settlement causing structural distress; however, considering the fill is within the creek, we consider the potential for a proposed structure to encounter the observed fill to be low.

Mine Subsidence: The Colorado Department of Natural Resources Mined Land Reclamation Division (1982) does not indicate the presence of subsurface mining on or adjacent to the subject site. The nearest mapped subsurface-mine related hazard, the Kurie Mine, is located approximately 17 miles southwest of the subject site (Turney and Murray-Williams, 1983). Several sand and gravel pits are mapped by the SCS (1981) and Schowochow (1981) in the vicinity of the property. The nearest pit is located approximately 1,000 feet north of the property. Our understanding of sand and gravel pit operations is they are typically mined from the surface and are not below-ground mines. We believe that the potential for subsidence related to sand and gravel pits to be low.

Seismic Hazards: The Rampart-Range Fault, a high-angle generally north-south trending reverse fault, and the Ute Pass Fault, generally characterized by several northwest-southeast trending reverse faults, are mapped approximately 21 miles west and 24 miles southwest, respectively, of the site. According to the "Preliminary Quaternary Fault and Fold Map and Database of Colorado" by Widmann, Kirkham and Rogers (1998), there is evidence that the Rampart Range Fault may have moved between 600,000 and 30,000 years ago, and the Ute Pass Fault may have ruptured during the last 750,000 years. The subject site is in Zone 1 of the Uniform Building Code (UBC) scheme of seismic zonation.

Radon Gas: According to the Environmental Protection Agency (EPA) and the El Paso County Department of Health, elevated levels of radon gas (4 pCi/L or more) have been found in buildings in El Paso County. Radon is a radioactive gas that forms from the natural breakdown of uranium in soil, rock and water. Radon tends to accumulate in poorly ventilated areas below ground level; however, radon may accumulate inside any above- or below-grade construction. According to the EPA, elevated radon levels in buildings can be reduced by several methods, including pressurization of the building using a heating, ventilating and air conditioning system, sealing of cracks in foundation walls and floor slabs which may allow entry of radon, and using active soil depressurization (ASD) systems.

## DEVELOPMENT CONSIDERATIONS

Presented below is a discussion of geologic and geotechnical engineering related development considerations, including identified geologic hazards.

Flooding: It appears that the FEMA floodplain map is too general and may not adequately depict the 100-year floodplain on the subject site. A hydrologic study of the property should be performed by a qualified hydrologist or civil engineer to determine the limits of the 100-year floodplain and other flood-prone areas. At this time, we recommend the mapped FEMA 100-year floodplain and the low-lying areas mapped as potentially flood prone be considered no-build areas. It may be feasible to develop building sites within the area mapped as potentially flood prone on the western portion of the property or on the alluvial terraces adjacent to the ephemeral creek if they are determined to be outside the floodplain, or if they can be raised by grading to mitigate the hazards related to flooding and be protected from erosion.

Erosion and Sedimentation: Mitigation measures to protect the development from erosion include armoring the banks of the creek. Another alternative is to allow a buffer between the existing banks and the proposed development. We recommend a buffer or set back of at least 100 feet from the creek be observed, if bank protection is not provided. If erosion of the buffer encroaches on the proposed development, maintenance of the banks or armoring may be required.

Potential mitigation against accelerated erosion or headward progression of the gullies on the site include infilling the gullies with rip rap or soil, and aggressive revegetation. Grading for the proposed development should prevent increased run off to the existing gullies.

Because sedimentation will be limited to within the creek channels and flood prone areas, we recommend that development not occur within these areas. The FEMA floodplain and the other flood-prone areas are presented on Fig. 3

Potentially Shallow Ground Water: If shallow ground water is encountered in the area of proposed building construction, methods to mitigate this hazard include raising the proposed construction above the influence of the ground water or lowering the ground-water level by the use of subsurface drains. All below-grade construction, including crawl spaces and basements, should be protected by underdrain systems graded to drain to a sump or gravity outlet. Water

levels can be expected to fluctuate through the study area, due to both natural and man-induced changes.

Foundations: We anticipate conventional spread-footing foundations may be used in areas underlain by the native silty and clayey sand, poorly- to well-graded sand, nonexpansive sandy lean clay or sandstone bedrock. Any uncontrolled man-placed fill present below the foundation level should be removed and replaced with nonexpansive structural fill. If encountered, expansive soils and bedrock can generally be mitigated by overexcavation and replacement with nonexpansive structural fill.

For shallow foundations bearing on the native nonexpansive overburden soils, recommended bearing pressures are expected to be on the order of 2,000 to 3,000 psf. Recommendations for the allowable bearing pressure of shallow foundations supported on properly compacted nonexpansive structural fill are expected to be on the order of 1,500 psf. For shallow foundations bearing on the sandstone bedrock, recommended bearing pressures are expected to be on the order of 3,000 psf. Higher bearing pressures for the sandstone bedrock may be possible if needed.

Floor Slabs: The native silty and clayey sand, poorly- to well-graded sand, nonexpansive sandy lean clay or sandstone bedrock should be suitable for support of slab-on-grade construction. Any uncontrolled man-placed fill present below the floor-slab level, should be removed and replaced with properly compacted nonexpansive structural fill. If encountered, expansive soils and bedrock can generally be mitigated by overexcavation and replacement with nonexpansive structural fill or the use of a structural floor over a well-ventilated crawl space.

Excavation Considerations: We anticipate the overburden soils and bedrock can be excavated using conventional heavy-duty excavation equipment. Excavation of the hard bedrock may require the use of rippers.

Site Grading and Surface Drainage: We recommend the following criteria be used when preparing the site grading plans. Permanent cut and fill slopes should not be steeper than 3:1 (horizontal to vertical) and should not exceed 20 feet in height. If steeper or higher slopes are desired, they should be studied on an individual basis. The risk of slope instability will be significantly increased if seepage is encountered in permanent cuts. If seepage is encountered,

an investigation should be conducted to determine if it would adversely affect the cut stability. Fills should be benched into hillsides exceeding 4:1.

Good surface drainage should be provided for all permanent slopes. Cut and fill slopes and other areas stripped of vegetation should be protected against erosion by revegetation or other means. Site grading should be planned to provide positive drainage away from all cut and fill slopes and building sites.

Wastewater Disposal: Adverse conditions presenting limitations to the location of absorption fields for individual sewage disposal systems identified in the development include those related to the proximity to surface water sources, potentially shallow ground water, shallow bedrock, and slow percolation rates.

- *Proximity to Surface Water Sources:* Adequate setbacks from the ephemeral creek and gullies should be considered prior to placement of absorption fields. The minimum setbacks should conform to the guidance presented in Section 8.5 of the El Paso County Department of Health and Environment, Onsite Wastewater System Regulations. For the purpose of determining setbacks, the creek on the east side of the site should be considered a stream and the gullies and channel on the west side of the site should be considered a dry gulch.
- *Potentially Shallow Ground Water:* Shallow ground water may occasionally be present on the subject site. We believe these conditions will be more common in the low-lying portions of the drainages, as shown on Fig 3. Engineered absorption fields will be required where the maximum seasonal ground-water level is less than 48 inches below the bottom the proposed absorption system.
- *Shallow Bedrock:* Shallow bedrock was encountered in Boring 1. Shallow bedrock is expected to be more prevalent on the western portion of the property. Based on this, we anticipate engineered absorption fields will be required on the western portion of the development.
- *Slow Percolation Rates:* One of the percolation test holes adjacent to each of Borings 2 and 3 were slower than 60 minutes per inch; however, the average of the

three test holes adjacent to each of Borings 2 and 3 were faster than 60 min/in. All three test holes at Boring 4 were slower than 60 minutes per inch. Based on this data, we anticipate engineered absorption fields will be required within SCS soil unit 19.

#### LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practices in this area for use by the client for preliminary planning purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from the widely spaced exploratory borings drilled at the locations indicated on Fig. 1 and the proposed type of development. Additional study must be conducted once building locations, floor elevations and grading plans have been determined to provide final recommendations for site grading, including degree of compaction, and for individual structures.

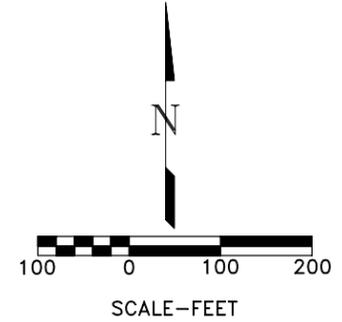
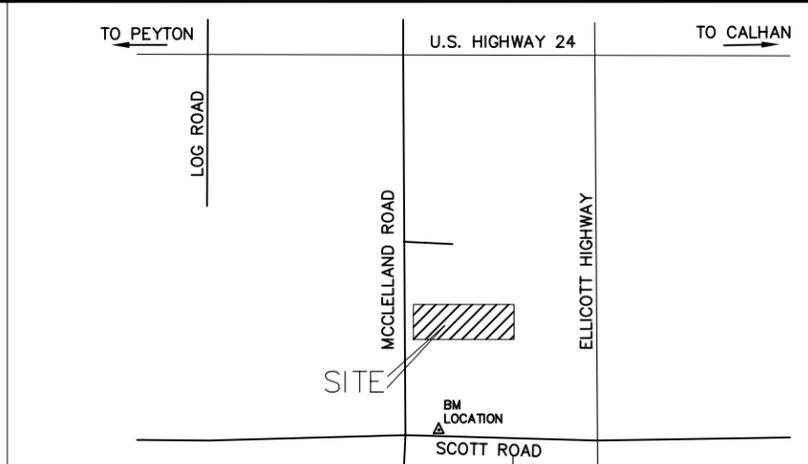
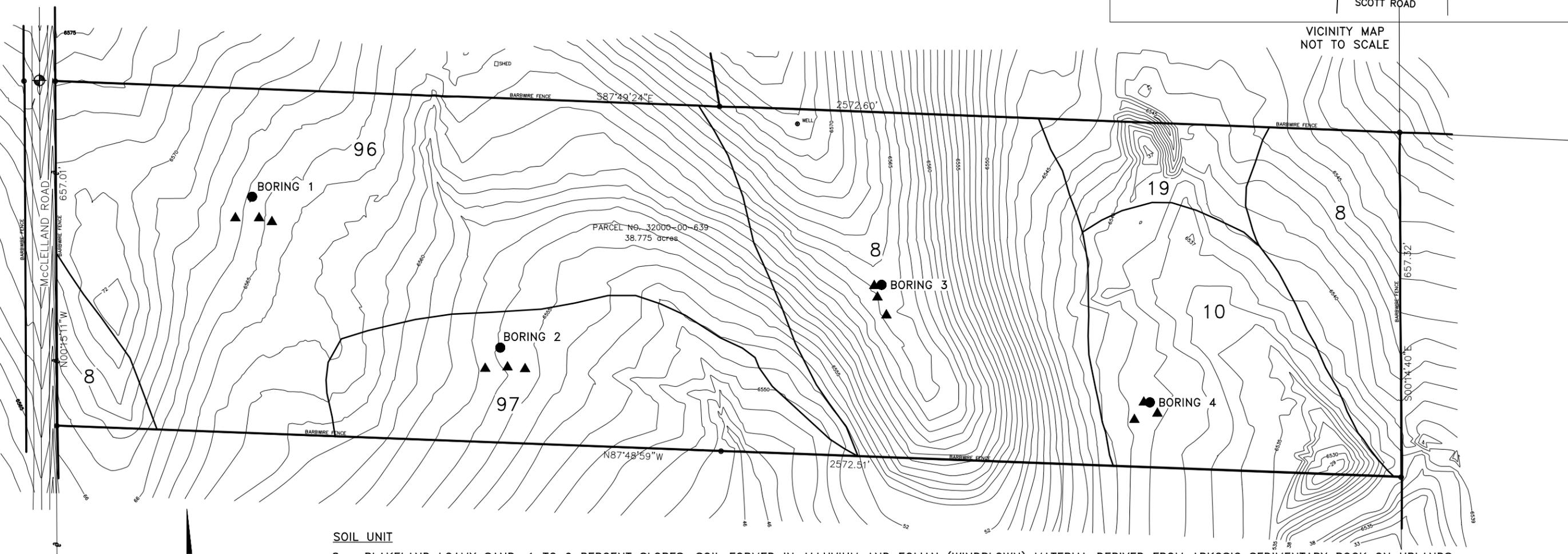
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cc: LDC, Inc.; Attn: Ms. Pam Cherry

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**SOIL UNIT**

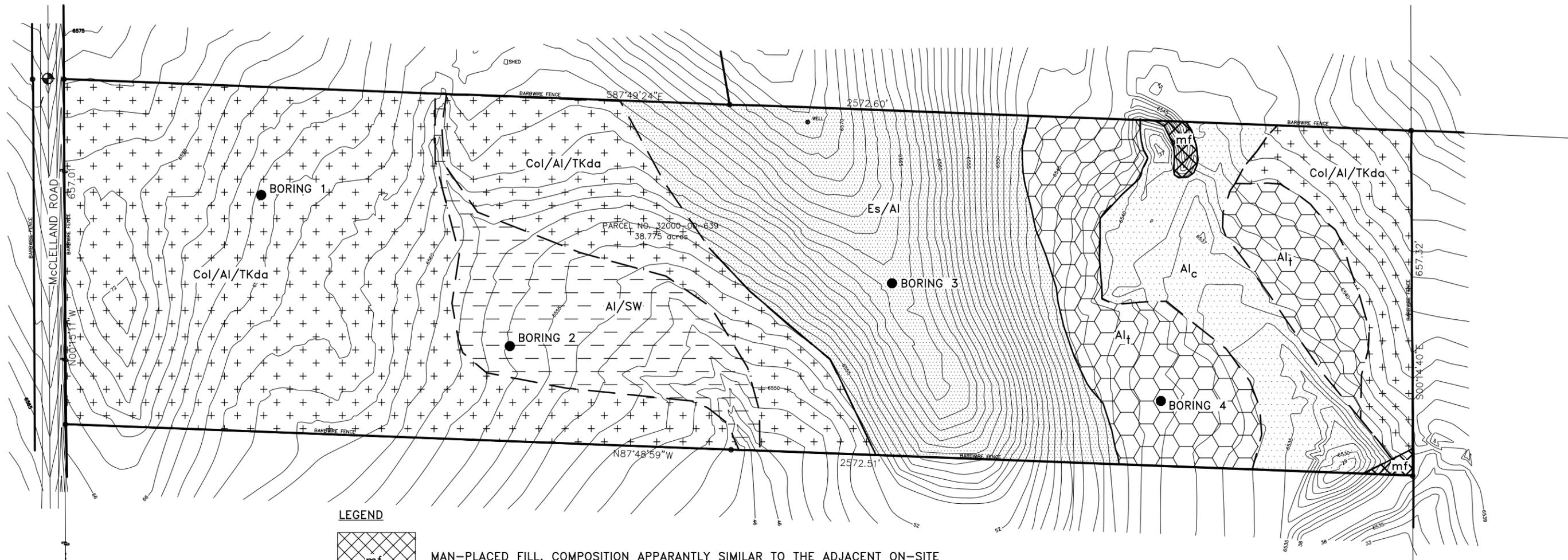
- 8 - BLAKELAND LOAMY SAND, 1 TO 9 PERCENT SLOPES. SOIL FORMED IN ALLUVIUM AND EOLIAN (WINDBLOWN) MATERIAL DERIVED FROM ARKOSIC SEDIMENTARY ROCK ON UPLANDS.
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- 96 - TRUCKTON SANDY LOAM, 0 TO 3 PERCENT SLOPES. SOIL FORMED IN ALLUVIUM AND RESIDUUM DERIVED FROM ARKOSIC SEDIMENTARY ROCK ON UPLANDS.
- 97 - TRUCKTON SANDY LOAM, 3 TO 9 PERCENT SLOPES. SOIL FORMED IN ALLUVIUM AND RESIDUUM DERIVED FROM ARKOSIC SEDIMENTARY ROCK ON UPLANDS.

- EXPLORATORY BORING.
- ▲ PERCOLATION TEST HOLE.

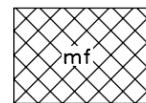
**NOTES:**

1. BASE MAP AND VICINITY MAP PROVIDED BY LDC, INC.
2. SOIL UNITS FROM SCS (1981).

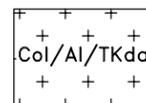
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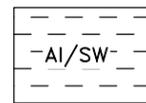
**LEGEND**



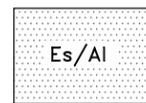
MAN-PLACED FILL. COMPOSITION APPARANTLY SIMILAR TO THE ADJACENT ON-SITE SOILS.



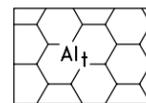
COLUVIUM, ALLUVIUM AND DAWSON FORMATION BEDROCK (PALEOCENE), UNDIFFERENTIATED. THE COLUVIUM AND ALLUVIUM GENERALLY CONSIST OF CLAYEY AND SILTY SAND. THE DAWSON FORMATION CONSISTS OF CLAYEY ARKOSIC SANDSTONE. THE DAWSON FORMATION IS TYPICALLY DESCRIBED AS INTERBEDDED WITH OCCASIONAL LAYERS OF SILTSTONE OR CLAYSTONE; HOWEVER, OUR BORINGS DID NOT ENCOUNTER THESE LAYERS.



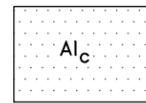
ALLUVIAL AND SLOPEWASH DEPOSITS CONSISTING OF SANDY LEAN CLAY AND SILTY SAND. OVERBURDEN DEPOSITS ARE GENERALLY THICKER THAN THAT OF THE Col/AI/TKda UNIT TO THE WEST.



EOLIAN (WINDBLOWN) AND ALLUVIUM DEPOSITS ABOVE THE MODERN DRAINAGE. GENERALLY CONSISTS OF SILTY SAND.



ALLUVIAL TERRACE DEPOSITS. APPROXIMATELY 2 TO 5 FEET ABOVE THE EXISTING CREEK CHANNEL. GENERALLY CONSISTS OF INTERBEDDED DEPOSITS OF SILTY SAND, CLAYEY SAND AND POORLY- TO WELL-GRADED SAND.



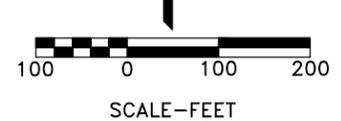
ALLUVIUM WITHIN THE CREEK CHANNEL. GENERALLY CONSISTS OF SILTY SAND AND POORLY- TO WELL-GRADED SAND AND GRAVEL.

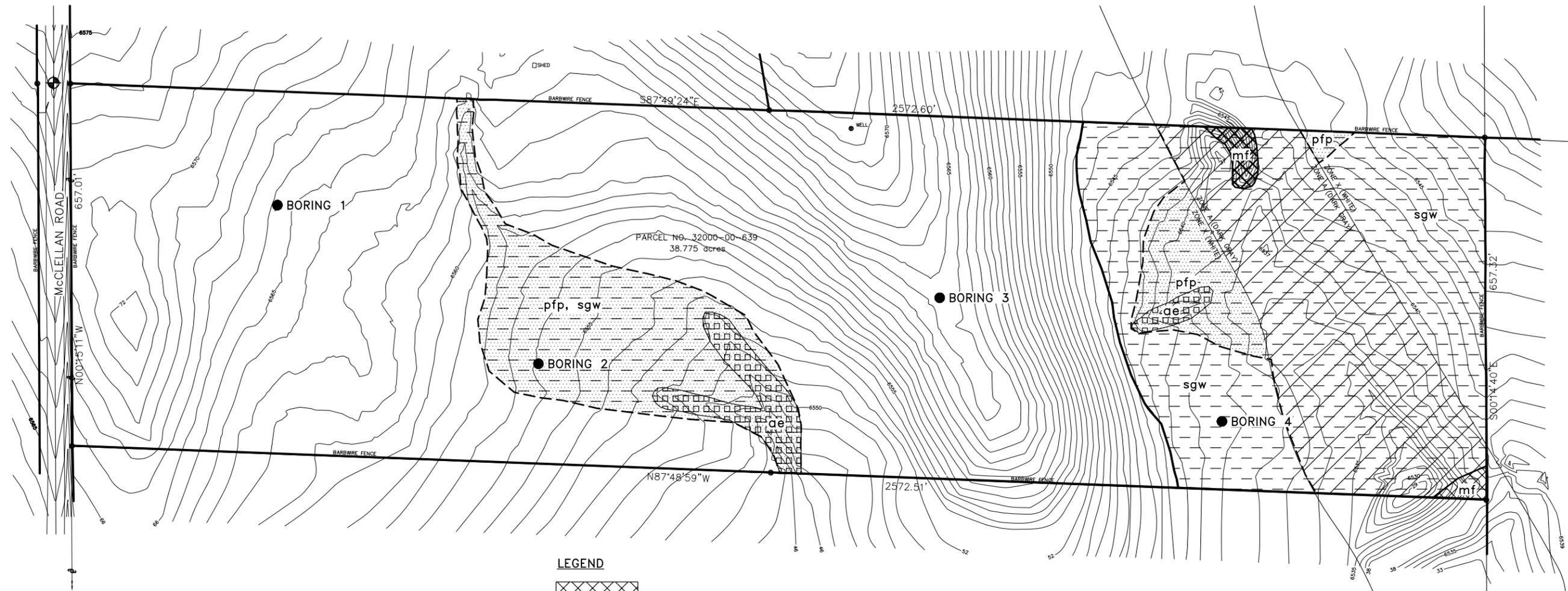
GEOLOGIC UNIT BOUNDARY. DASHED WHERE APPROXIMATE.

EXPLORATORY BORING.

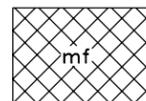
**NOTES:**

1. BASE MAP PROVIDED BY LDC.-INC.
2. SURFICIAL GEOLOGY IS BASED ON CONDITIONS ENCOUNTERED DURING OUR FIELD RECONNAISSANCE AND DURING THE SUBSURFACE EXPLORATION.





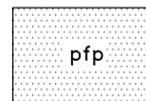
**LEGEND**



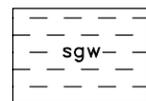
MAN-PLACED FILL.



FEMA 100-YEAR FLOODPLAIN. THIS AREA SHOULD BE CONSIDERED A NO BUILD AREA UNLESS IT IS DETERMINED TO BE OUTSIDE OF THE 100-YEAR FLOODPLAIN DETERMINED BY A QUALIFIED HYDROLOGIST OR CIVIL ENGINEER.



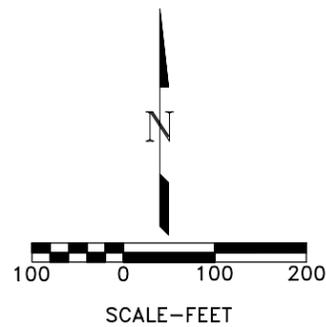
POTENTIALLY FLOOD PRONE AREAS. THIS AREA SHOULD BE CONSIDERED A NO BUILD AREA UNLESS DETERMINED OTHERWISE BY A QUALIFIED HYDROLOGIST OR CIVIL ENGINEER.



AREA OF POTENTIALLY SHALLOW, GROUND-WATER TABLE.



AREAS OF ACCELERATED EROSION AND ADVANCING GULLY HEADS.

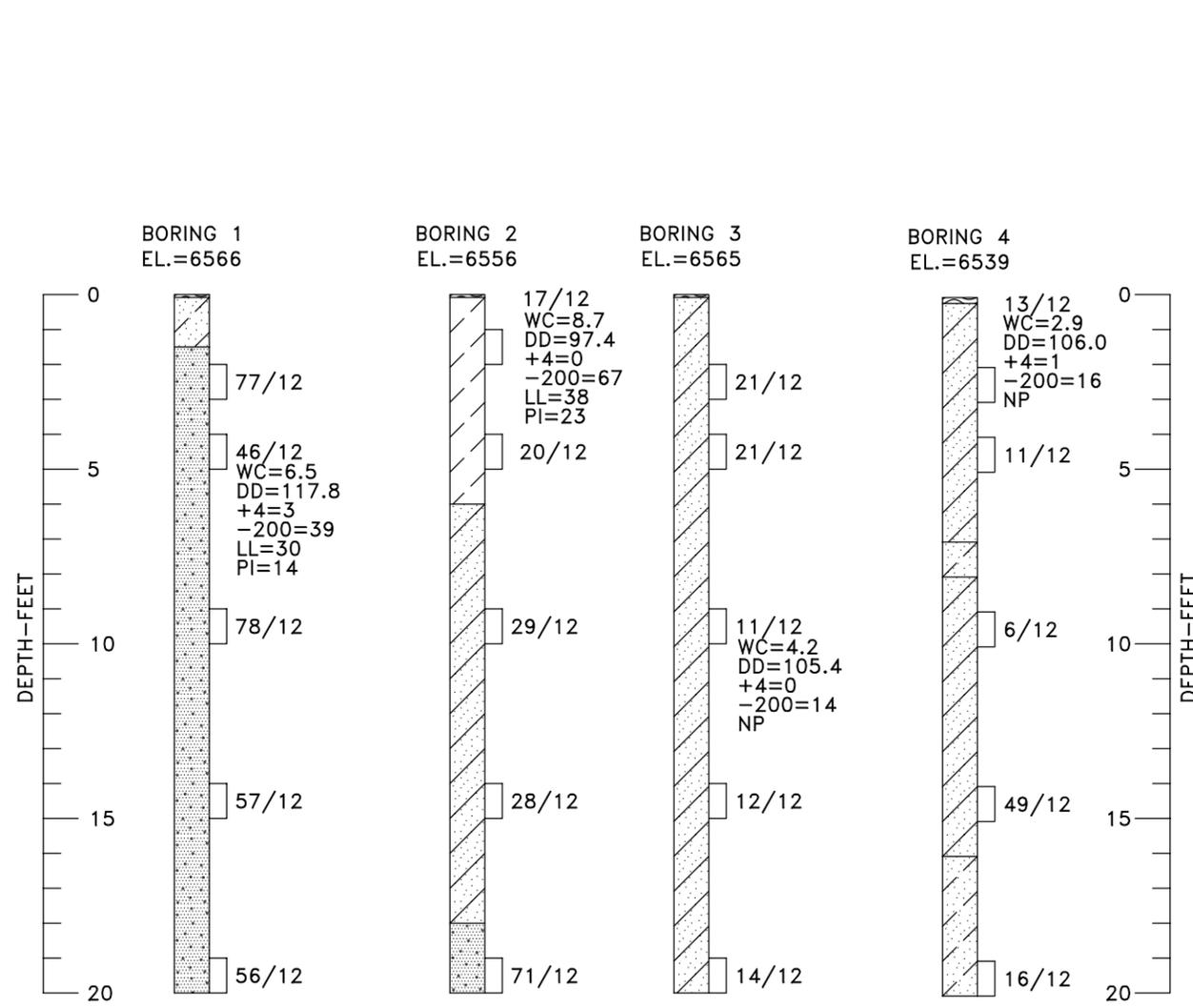


**NOTES:**

1. BASE MAP AND FEMA FLOODPLAIN BOUNDARIES PROVIDED BY LDC-INC.
2. GEOLOGIC HAZARD MAP BASED ON CONDITIONS ENCOUNTERED DURING OUR FIELD RECONNAISSANCE AND OUR SUBSURFACE EXPLORATION.

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**LEGEND**

- TOPSOIL.
- CLAYEY SAND (SC), VERY STIFF, DRY TO MOIST, BROWN TO DARK BROWN.
- SILTY SAND (SM), OCCASIONAL LAYERS OF POORLY- TO WELL-GRADED SAND WITH SILT (SP-SM, SW-SM), LOOSE TO DENSE, DRY TO MOIST, LIGHT BROWN TO BROWN.
- SANDY LEAN CLAY (CL), OCCASIONALLY POROUS, VERY STIFF, DRY, LIGHT BROWN TO BROWN.
- SANDSTONE BEDROCK, CLAYEY, NONCEMENTED, MEDIUM HARD TO HARD, DRY TO MOIST, LIGHT GRAYISH BROWN.
- DRIVE SAMPLE, 2-INCH I.D. CALIFORNIA LINER SAMPLER.

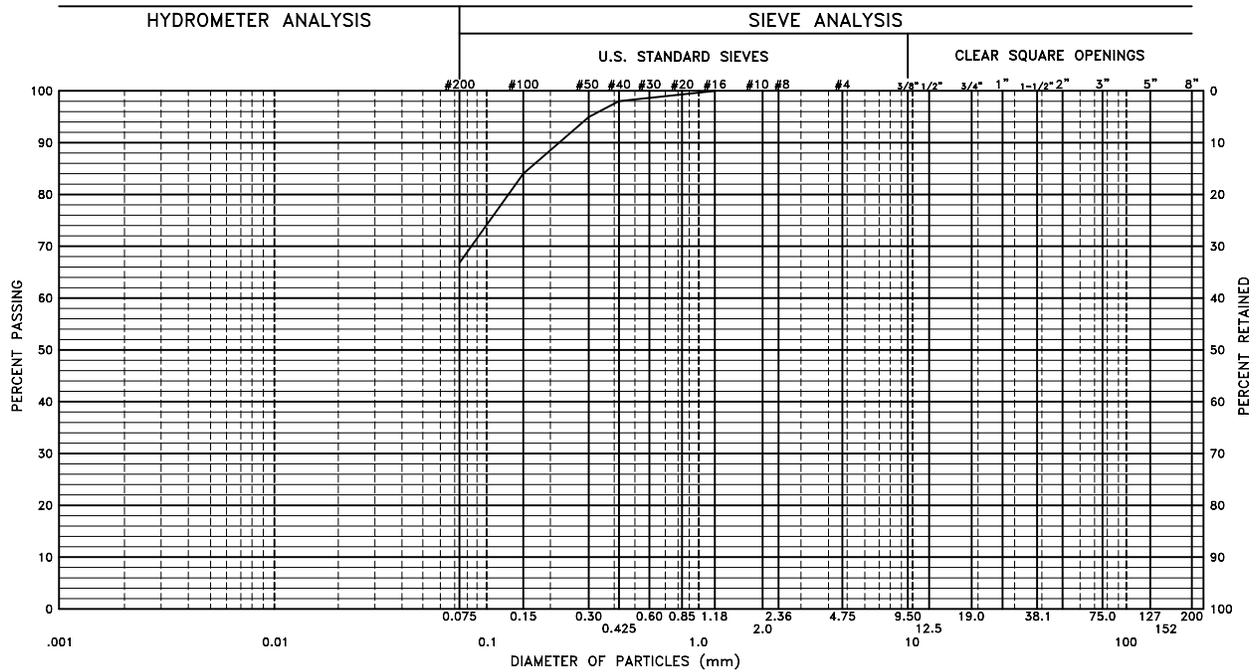
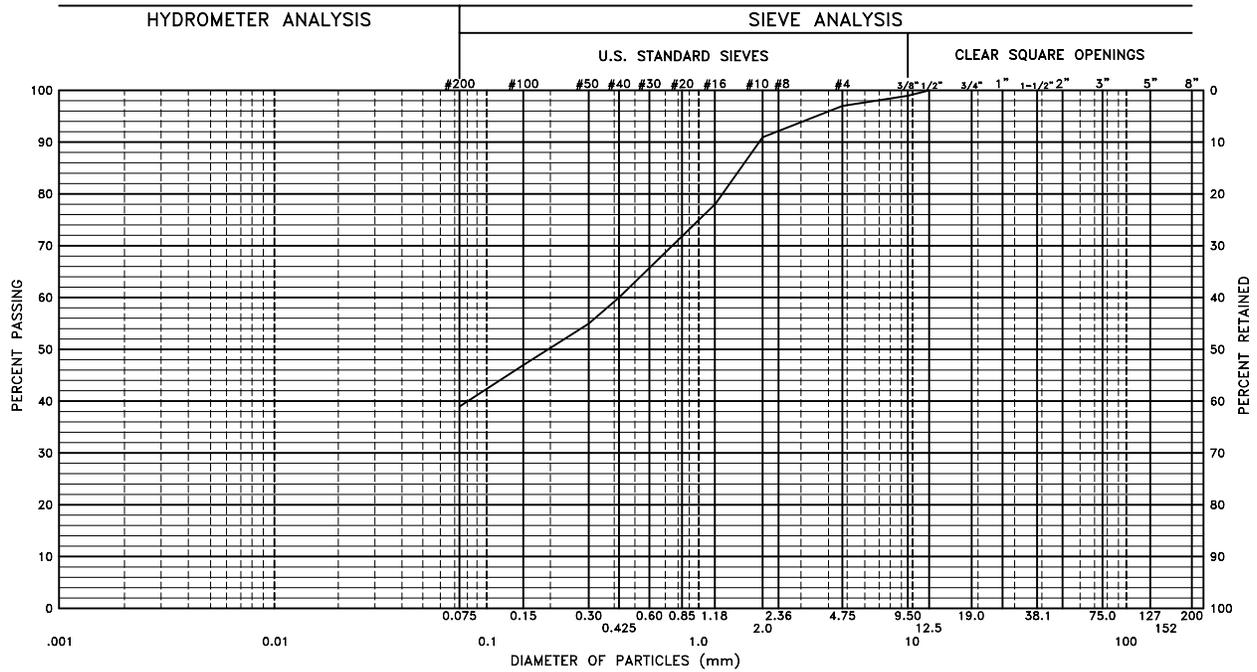
77/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 77 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

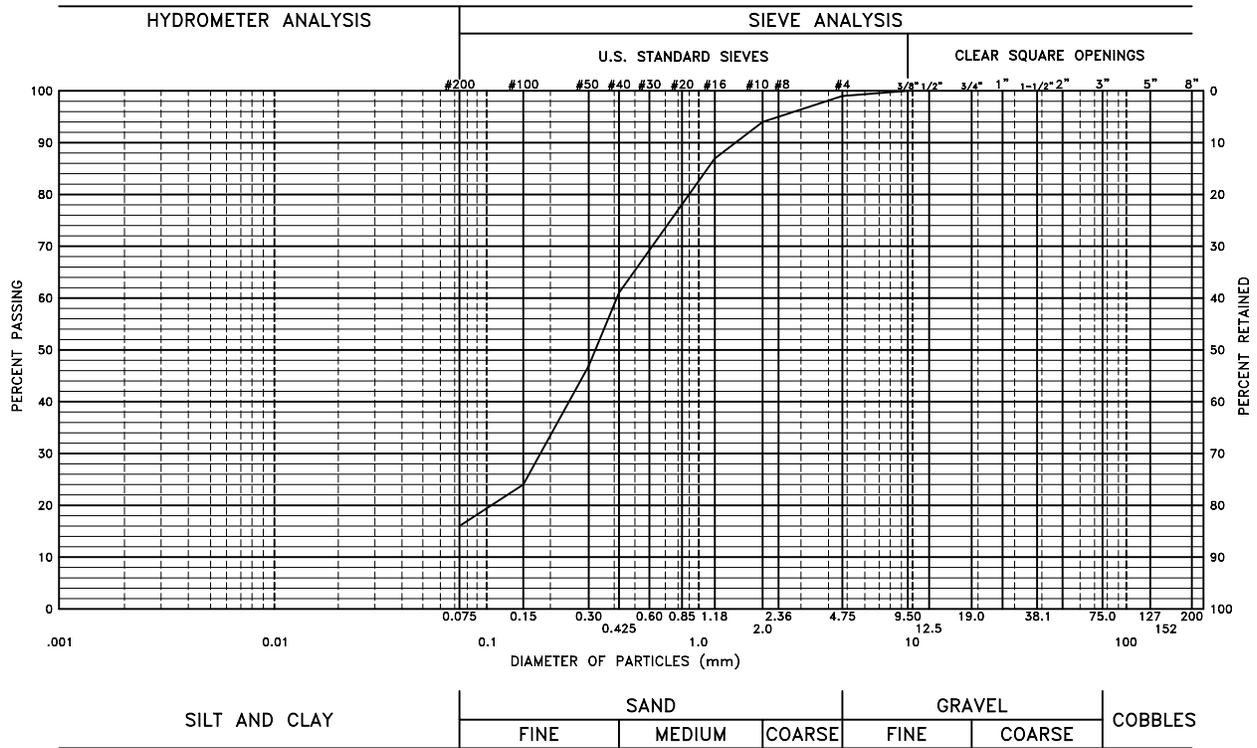
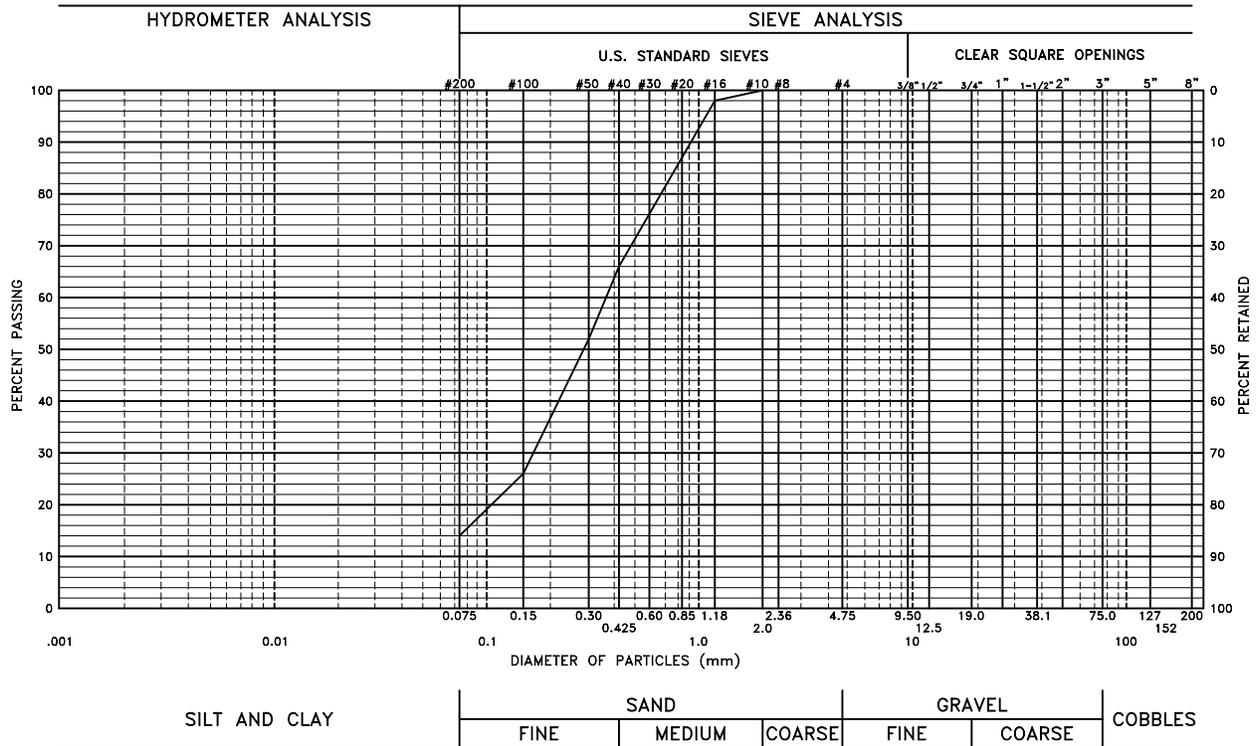
**LABORATORY TEST RESULTS**

- WC = WATER CONTENT (%) (ASTM D 2216);
- DD = DRY DENSITY (pcf) (ASTM D 2216);
- +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D 422);
- 200 = PERCENTAGE PASSING NO. 200 SIEVE (ASTM D 1140);
- LL = LIQUID LIMIT (ASTM D 4318);
- PI = PLASTICITY INDEX (ASTM D 4318);
- NP = NONPLASTIC (ASTM D 4318).

**NOTES**

1. THE EXPLORATORY BORINGS WERE DRILLED ON OCTOBER 21, 2008, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATIONS OF THE EXPLORATORY BORINGS WERE MEASURED BY INSTRUMENT SURVEY PRIOR TO DRILLING AND WERE PROVIDED BY LDC-INC.
3. THE ELEVATIONS OF THE EXPLORATORY BORINGS WERE OBTAINED BY INTERPOLATION BETWEEN CONTOURS ON THE PLAN PROVIDED. THE LOGS OF THE EXPLORATORY BORINGS ARE PLOTTED TO DEPTH.
4. THE EXPLORATORY BORING LOCATIONS AND ELEVATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
5. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
6. GROUND WATER WAS NOT ENCOUNTERED IN THE BORINGS AT THE TIME OF DRILLING, OR WHEN CHECKED THREE DAYS LATER. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.





**Kumar & Associates, Inc.**

**TABLE I**

**SUMMARY OF LABORATORY TEST RESULTS**

Project No.: 082-222

Project Name: Mountains Edge Development

Date Sampled: 10/21/08

Date Received: 10/21/08

SAMPLE LOCATION		DATE TESTED	NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		SOIL OR BEDROCK TYPE (Unified Soil Classification)
BORING	DEPTH (ft)				GRAVEL (%)	SAND (%)		LIQUID LIMIT	PLASTICITY INDEX	
1	4	10/22/08	6.5	117.8	3	58	39	30	14	Clayey sandstone
2	1	10/22/08	8.7	97.4	0	33	67	38	23	Sandy lean clay (CL)
3	9	10/22/08	4.2	105.4	0	86	14		NP	Silty sand (SM)
4	2	10/22/08	2.9	106.0	1	83	16		NP	Silty sand (SM)

**Kumar & Associates, Inc.**  
**TABLE II**  
**PERCOLATION TEST RESULTS**

Project No. 082-222

Page 1 of 2

BORING NO.	PERC. HOLE/ LOCATION	HOLE DEPTH (in.)	INTERVAL (min.)	WATER DEPTH (in.)	DROP IN WATER LEVEL (in.)	PERC. RATE (min./in.)
1	A N 39.00441° W104.403329°	37 ½	60 60	7 5 7/8 4 3/4	1 1/8 1 1/8	54
	B N 39.00438° W104.40319°	36 1/8	60 60	6 1/8 4 7/8 3 3/4	1 1/4 1 1/8	51
	C N 39.00435° W104.40307°	36 ¼	60 60	6 1/2 5 1/2 4 1/2	1 1	60
2	A N 39.00367° W104.40162°	36 ½	60 60 30	8 3/8 5 5/8 3 1/8 2	2 3/4 2 1/2 1 1/8	25
	B N 39.00362° W104.40151°	36	43 45	5 7/8 5 3/8 4 3/4	1/2 5/8	79
	C N 39.00360° W104.40159°	38 1/8	43 45	6 5 1/4 4 1/2	3/4 3/4	59

**Kumar & Associates, Inc.**  
**TABLE II**  
**PERCOLATION TEST RESULTS**

Project No. 082-222

Page 2 of 2

BORING NO.	PERC. HOLE/ LOCATION	HOLE DEPTH (in.)	INTERVAL (min.)	WATER DEPTH	DROP IN WATER LEVEL (in.)	PERC. RATE (min./in.)
3	A N 39.00403° W104.39906°	36	20 20 20 15	6 7/8 5 5/8 4 3/8 3 1/4 2 3/8	1 1/4 1 1/4 1 1/8 7/8	17
	B N 39.00395° W104.39901°	37 1/2	20 20 5	6 1/2 4 5/8 2 7/8 2 1/2	1 7/8 1 3/4 3/8	12
	C N 39.00383° W104.39893°	36 3/4	63 55	6 5 1/4 4 5/8	3/4 5/8	86
4	A N 39.00331° W104.39729°	36 1/4	60 60 60	6 5 1/2 5 4 1/2	1/2 1/2 1/2	120
	B N 39.00334° W104.39716°	36 5/8	60 60 60	5 7/8 5 3/8 5 4 1/2	1/2 3/8 1/2	133
	C N 39.00343° W104.39727°	35 7/8	60 60 60	6 5 3/8 4 7/8 4 3/8	5/8 1/2 1/2	112