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# GEOTECHNICAL ENGINEERING REPORT
# CHEROKEE METROPOLITAN DISTRICT
# PFAS WATER TREATMENT FACILITY
# NEAR ELLICOTT HIGHWAY & SH94
# EL PASO COUNTY, COLORADO

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TABLE I - SUMMARY OF LABORATORY TEST RESULTS

SUMMARY

1. Beneath a layer of topsoil, the generalized subsurface profile encountered in the borings consisted of granular overburden soil types, to include silty sand (SM), poorly-to well-graded sand with varied amounts of silt (SP, SW, SP-SM, SW-SM), clayey sand (SC), and silty-clayey sand (SM-SC). Infrequent lenses of lean clay with varied amounts of sand (CL), were encountered in five of the borings, and ranged from approximately 0.5 to 4 feet in thickness where encountered. The overburden soils extended to the maximum 4 to 60-foot depths explored.

2. Groundwater was not encountered in the borings at the time of drilling, or when the borings were checked 7 to 8 days later. The borings were backfilled with auger cuttings after performing the follow-up water level check. Groundwater is expected to fluctuate over time due to seasonal and climatic factors as well as the irrigation regimen of the developed area. Based on our understanding of the proposed construction and the anticipated depths of construction, we do not expect groundwater to be a design consideration for this project.

3. With proper site preparation, shallow spread footing foundations with slab-on-grade floors or mat foundations should be feasible. Because of the loose upper soils encountered, proper site preparation should include complete removal of topsoil and organic materials down to the natural granular soils, followed by overexcavation, moisture conditioning and recompaction of the native subgrade to a depth of at least 3 feet below foundation and floor slab bearing elevations. During the subgrade moisture conditioning and recompaction process, any clay soils encountered should be replaced with suitable structural fill. The intent of this recommendation is to provide an anticipated total settlement potential of approximately 1 inch or less.

4. With proper moisture conditioning, the on-site granular soils will be suitable for reuse as structural fill, including structural fill beneath foundations, floor slabs, exterior flatwork, and pavements. Clay materials should be considered unsuitable, and should be placed in nonstructural or landscape areas, or removed from the site. The “Site Grading and Earthwork” section of the report provides additional discussion on suitability of the on-site soils and imported fill requirements.

5. The following table presents the recommended pavement thicknesses based on assumed traffic loading as discussed herein.

| PAVEMENT SECTION THICKNESS (in.) | | |
|---|---|---|
| Asphalt Over Aggregate Base Course | Aggregate Base Surfaced | Unreinforced Concrete over Aggregate Base Course |
| 5 over 6 | 6 | 6 over 6 |

*: We recommend truck areas where truck turning movements are concentrated be paved with a Portland Cement Concrete (PCC) section or aggregate surfacing rather than the asphalt alternative. The use of a flexible pavement in these areas could result in pavement fatigue cracking and/or rutting/shoving of the pavement due to the concentrated wheel loads.

PURPOSE OF REPORT

This report presents the results of a geotechnical engineering study for the proposed PFAS water treatment facility to be located in the vicinity of North Ellicott Highway and State Highway 94 in El Paso County, Colorado. The project site is shown on the attached Fig. 1. The study was conducted for the purpose of developing recommendations for site grading, foundations, pavements, and other geotechnical considerations related to the proposed construction. The study was performed in general accordance with our Proposal No. C25-274R, dated March 10, 2026.

This report has been prepared to summarize the data obtained during this study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to the proposed construction are included in the report.

PROPOSED CONSTRUCTION

We understand the proposed construction will include the components summarized in the table below and as generally shown on Fig. 1. Overall, site grading is anticipated to consist of maximum cuts/fill of less than 2 feet.

| Item | Grade | Details |
|---|---|---|
| Finished water tanks (2) | At-grade | 105’ diameter, 1.5 M gallon, prestressed concrete |
| Raw water tanks (2) | At-grade | 60’ diameter, 0.5 M gallon, prestressed concrete |
| Treatment facility building | At-grade, no basement. Structure will include a wet well which extends 12’ below grade. | Pre-fab metal building, approximately16,300 sf |
| Leach field | Assumed minimum of 12” to maximum of 48” below grade. | 100’x100’ leach field |
| Buried piping | Assumed invert depths below grade in range of 6’ to 10’ for water and sewer, and 4’ for electric and other conduits. | 6” to 24” diameter water and sewer lines |
| Driveway and parking | At-grade | Gravel surfaced or asphalt paved |

SITE CONDITIONS

The subject site is located on vacant land north of State Highway 94, east of N Ellicott Highway in El Paso County, Colorado. The site is generally surrounded by vacant land and livestock

pastures, with a pumpkin patch and farm located beyond to the west of the proposed development. The site is nearly level with a slight slope down to the east and south, and is vegetated by native grasses, weeds, and cacti.

## SITE GEOLOGY

The project site is located within the Colorado Piedmont of the Great Plains physiographic province. Structurally, this area is east of the Ute Pass and Rampart Range Faults, which bound this portion of the Front Range. Regional uplift east of the Front Range has exposed Upper Cretaceous to Paleocene-age, gently northeast dipping claystone, siltstone, sandstone and thin coal beds representing a regressional sea sequence. The entirety of the subject site is mapped as Louviers Alluvium. This alluvium is described as thin reddish-brown gravel to yellowish-brown sand deposited on terraces 60 to 70 feet above streams on the plains, dating to the Pleistocene epoch. This alluvial deposit is expected to be underlain by early Tertiary to late Cretaceous-age deposits of the Denver Basin Group at an unknown depth, which consist of arkosic sandstone interbedded with claystone.

## FIELD EXPLORATION

The field exploration of subsurface conditions consisted of drilling nine 4-inch diameter borings (B1-B9) and three 8-inch diameter percolation test holes (P1-P3), and excavating two test pits (EX1, EX2). The borings and percolation test holes were drilled between April 20 and 21, 2026 and the test pits were excavated on April 27, 2026. The locations were approximated using a handheld GPS unit, and are shown on Fig. 1. Logs of the exploratory borings and test pits are presented on Figs. 2 thru 4, and corresponding legend and notes are presented on Fig. 5.

The borings and test pits were logged by representatives of Kumar & Associates, Inc. Samples of the soils were taken with a 2-inch I.D. California sampler. The sampler was driven into the various strata with blows from a 140-pound hammer falling 30 inches. Penetration resistance values, when properly evaluated, provide an indication of the relative density or consistency of the soils. Bulk disturbed samples were also collected. Depths at which the samples were taken and the penetration resistance values are shown on the boring logs.

## LABORATORY TESTING

Samples obtained from the exploratory borings and test pits were visually classified in the laboratory and samples were selected for laboratory testing. Laboratory testing included index property tests such as in-situ moisture content and dry unit weight, grain size analysis, and

Atterberg limits. Additional testing included in-situ swell-consolidation, electrical resistivity, concentration of water soluble sulfates and water soluble chlorides, and pH. The testing was conducted in general accordance with recognized test procedures, primarily those of the American Society for Testing of Materials (ASTM). Results of the laboratory testing program are shown on Figs. 2 thru 4, and 6 thru 19, and are summarized on Table I.

SUBSURFACE CONDITIONS

Beneath a layer of topsoil, the generalized subsurface profile encountered in the borings consisted of granular overburden soil types, to include silty sand (SM), poorly-to well-graded sand with varied amounts of silt (SP, SW, SP-SM, SW-SM), clayey sand (SC), and silty-clayey sand (SM-SC). Infrequent lenses of lean clay with varied amounts of sand (CL), were encountered in five of the borings, and ranged from approximately 0.5 to 4 feet in thickness where encountered. The overburden soils extended to the maximum 4 to 60-foot depths explored. The following subsurface descriptions are of a generalized nature to highlight the soil types encountered in the borings drilled for this study. The boring logs should be reviewed for more detailed information.

Native Granular Soils: Native granular soils encountered included silty sand (SM), poorly-to well-graded sand with varied amounts of silt (SP, SW, SP-SM, SW-SM), clayey sand (SC), and silty-clayey sand (SM-SC). Occasional gravel was encountered in each of these soil types. The native granular soils extended to the maximum 4 to 60-foot depths explored in each of borings. The native granular soils varied from slightly moist to moist, with color varying from tan, brown, gray-brown, tan-gray, and tan-orange. Sampler penetration blow counts indicate the granular soils are generally medium dense to very dense, with occasional loose zones in the upper approximately 5 feet in some of the borings.

The in-situ moisture content of the granular soils tested varied from 1.6% to 13.4%, with an average of 5.7%. The in-situ densities varied from 93.4 pcf to 129.4 pcf, with an average of 116.2 pcf.

Swell-consolidation test results presented on Figs. 6 thru 8 indicate the tested samples of silty sand were nonexpansive when wetted under a 1,000 psf surcharge. A tested sample clayey sand had a low swell potential.

Native Clay Soils: Infrequent lenses of lean clay with varied amounts of sand (CL), were encountered in five of the borings, and ranged from approximately 0.5 to 4 feet in thickness where

encountered. The clay was slightly moist to moist, and brown, gray, and gray-brown in color. Sampler penetration blow counts indicate the clay soils are medium stiff to very stiff.

In-situ moisture content of the clay soils tested varied from 12.1% to 22.5%, with an average of 17.8%. The in-situ densities varied from 96.7 pcf to 106.7 pcf, with an average of 101.2 pcf. Swell-consolidation test results presented on Figs. 6 thru 8 indicate the tested sample of clay had a nil to low swell potential when wetted under a 1,000 psf surcharge.

Groundwater: Groundwater was not encountered in the borings at the time of drilling, or when the borings were checked 7 to 8 days later. The borings were backfilled with auger cuttings after performing the follow-up water level check. Groundwater is expected to fluctuate over time due to seasonal and climatic factors as well as the irrigation regimen of the developed area. Based on our understanding of the proposed construction and the anticipated depths of construction, we do not expect groundwater to be a design consideration for this project.

## GEOTECHNICAL ENGINEERING CONSIDERATIONS

As discussed above, the subgrade soils encountered were found to be loose in the upper approximately 5 feet in some of the borings. Without densification of the loose soils, foundations and floor slabs placed on loose granular materials can experience excess total and/or differential settlement, which may lead to distress to the structure or slab.

With proper site preparation, shallow spread footing foundations with slab-on-grade floors or mat foundations should be feasible. Because of the loose upper soils encountered, proper site preparation should include complete removal of topsoil and organic materials down to the natural granular soils, followed by overexcavation, moisture conditioning and recompaction of the native subgrade to a depth of at least 3 feet below foundation and floor slab bearing elevations. During the subgrade moisture conditioning and recompaction process, any clay soils encountered should be replaced with suitable structural fill. The intent of this recommendation is to provide an anticipated total settlement potential of approximately 1 inch or less. If extreme wetting of the subgrade is allowed, settlement could be greater.

The on-site granular soils encountered are suitable for reuse as structural fill with proper moisture conditioning. The “Site Grading and Earthwork” section of the report provides additional discussion.

The foundation recommendations that follow include spread footing and mat foundations. If other foundation alternatives are preferred, we should be consulted.

FOUNDATION RECOMMENDATIONS

The design and construction criteria presented below should be observed for a spread footing or mat foundation system. The construction details should be considered when preparing project documents.

1. We recommend that spread footing and mat foundations be supported on the native granular soils, with overexcavation, moisture conditioning and recompaction of the native subgrade to a minimum depth of 3 feet below foundation bearing elevation. During the subgrade moisture conditioning and recompaction process, any clay soils encountered should be removed and replaced with suitable structural fill.

2. Structural fill should meet the material and placement requirements outlined in the "Site Grading and Earthwork" section of this report. New structural fill should extend down from the edges of the foundations at a 1 horizontal to 1 vertical projection.

3. Footings supported on properly compacted structural fill as recommended herein should be designed for a maximum allowable soil bearing pressure of 2,500 psf.

4. If the mat cannot be considered rigid, the soil pressure distribution should be computed using a method which models the soil-structure interaction, such as the beam on an elastic foundation procedure. A modulus of vertical subgrade reaction of 150 pci can be used for compacted on-site soils. This value is based on correlations to a 1 ft. x 1 ft. sample plate and should be decreased as appropriate to account for the actual foundation size and geometry.

5. Spread footings should have a minimum footing width of 16 inches for continuous footings and of 24 inches for isolated pads.

6. Exterior footings and footings beneath unheated areas should be provided with adequate soil cover above their bearing elevation for frost protection. Placement of foundations at least 30 inches below the exterior grade is typically used in this area.

7. Criteria for the lateral resistance of a spread footing placed on native granular materials or properly compacted structural fill is presented in the “Foundation Walls & Retaining Structures” section of this report.

8. Continuous foundation walls should be reinforced top and bottom to span an unsupported length of at least 10 feet.

9. Granular foundation soils should be densified with a smooth vibratory compactor prior to placement of formwork and reinforcing steel.

10. A representative of the geotechnical engineer should confirm proper subgrade preparations have been met prior to placing foundation formwork. Loose disturbed material should be removed from the foundation subgrade prior to placement of concrete. Placement of structural fill should be observed and tested by a representative of the geotechnical engineer. In addition, representatives of the geotechnical and/or structural engineer should check reinforcement placement prior to concrete placement.

SITE SEISMIC CRITERIA

Using estimated shear wave velocities for the subgrade materials encountered based on standard penetration testing, calculations for an assumed 100-foot profile indicate a design Site Class D per the 2021 International Building Code (IBC). Based on the subsurface profile and area seismicity, liquefaction is not a design consideration. Using an online 3rd party graphical user interface tool developed by the Office of Statewide Health and Planning Development (OSHPD) that references USGS seismic design maps and ASCE 7-16, the following probabilistic values are reported for the project site.

| Type | Value |
|---|---|
| $MCE_R$ Ground motion, 0.2s period $S_s$ | 0.165 |
| $MCE_R$ Ground motion, 1.0s period $S_1$ | 0.052 |

FLOOR SLABS

Excluding the occasional loose upper native soils, the native granular soils are suitable to support light to moderately loaded slab-on-grade construction. Proper site preparation should include overexcavation of the native soils to a minimum a depth 3 feet below the proposed floor slab elevation as detailed below. Assuming floor slabs are properly constructed as described in this

report, and that good surface drainage and irrigation practices are designed, constructed and maintained, we believe the risk of slab movements will be relatively low, with potential movements of about 1 inch or less anticipated. If extreme wetting of the subgrade is allowed, settlement could be greater. The following measures should be taken to reduce the damage which could result from movement should the underslab materials be subjected to moisture changes.

1. Floor slabs should be supported on a minimum 3 feet of moisture-conditioned fill. During the overexcavation, moisture conditioning and recompaction process, any clay soils encountered should be removed and replaced with suitable structural fill.

2. Structural fill should meet the material and placement requirements outlined in the "Site Grading and Earthwork" section of this report.

3. Floor slabs should be designed using a subgrade modulus (k) of 150 pci.

4. Floor slabs should be separated from all bearing walls and columns with expansion joints which allow unrestrained vertical movement.

5. Floor slabs should not extend beneath exterior doors or over foundation grade beams, unless saw cut at the beam after construction.

6. Floor slab control joints should be used to reduce damage due to shrinkage cracking. The appropriate joint spacing is dependent on slab thickness, concrete aggregate size and slump, and should be consistent with recognized guidelines such as those of the Portland Cement Association (PCA) or American Concrete Institute (ACI). The joint spacing and any requirements for slab reinforcement should be established by the designer based on experience and the intended slab use.

7. If moisture-sensitive floor coverings will be used, mitigation of moisture penetration into the slabs, such as by use of a vapor barrier, may be required. If an impervious vapor barrier membrane is used, special precautions will be required to reduce potential differential curing problems which could cause the slabs to warp. Section 302.1R of the ACI Manual of Concrete Practice addresses this topic.

8. All plumbing lines should be tested before operation. Where plumbing lines or other slab protrusions enter through the floor, a positive bond break should be provided. Flexible connections should be provided for slab-bearing mechanical equipment.

The precautions and recommendations listed above will not prevent the movement of floor slabs if the underlying expansive materials are subjected to alternate wetting and drying cycles. However, the precautions should reduce the damage if such movement occurs.

FOUNDATION WALLS & RETAINING STRUCTURES

Foundation walls and retaining structures which are laterally supported and that are expected to undergo a moderate amount of deflection should be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 55 pcf for backfill consisting of the on-site granular soils, or 50 pcf if imported CDOT Class I structural backfill is used. Cantilevered retaining structures that are expected to deflect sufficiently to mobilize the full active earth pressure condition should be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 45 pcf for backfill consisting of the on-site granular soils, or 40 pcf for CDOT Class I structural backfill.

All foundation and retaining structures should be designed for appropriate hydrostatic and surcharge pressures such as adjacent buildings, traffic, construction materials and equipment. The pressures recommended above assume drained conditions behind the walls and a horizontal backfill surface. The buildup of water behind a wall or an upward sloping backfill surface will increase the lateral pressure imposed on a foundation wall or retaining structure.

The lateral resistance of a foundation or retaining wall footing placed on properly compacted nonexpansive fill material will be a combination of the sliding resistance of the foundation on the foundation materials and passive earth pressure against the side of the footing. Resistance to sliding at the bottoms of the footings may be calculated based on an allowable coefficient of friction of 0.30. Passive pressure against the sides of the footings may be calculated using an allowable equivalent fluid unit weight of 180 pcf.

The onsite granular soils, minus any clay soils, are suitable for use as wall backfill. Imported granular wall back fill, if used, should meet the requirements of a CDOT Class I structural backfill with less than 20% passing the No. 200 sieve. Proposed material should be approved by the geotechnical engineer prior to use.

The granular backfill behind foundation and retaining walls should be sloped from the base of the wall at an angle of at least 45 degrees from the vertical. Backfill should be placed in uniform lifts and compacted to the criteria presented in the "Site Grading and Earthwork" section of the report. Care should be taken not to overcompact the backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfills will occur even if the material is placed properly.

EXTERIOR FLATWORK

We recommend subgrade preparation beneath exterior flatwork immediately adjacent to the building and within a 10-foot zone around the perimeter of the building including sidewalks where reduction of settlement potential is considered more important be prepared to the same requirement of overexcavation required for the structure, which includes providing a minimum 3-foot depth of overexcavation, moisture-conditioning and recompaction below the bearing elevation of the flatwork.

Fill placed for support of exterior flatwork should meet the material and compaction requirements for structural fill presented in the "Site Grading and Earthwork" section of this report.

Proper surface drainage measures as recommended in the "Surface Drainage" section of this report are also critical to reducing moisture or frost-related movement. Settlement of fill below exterior flatwork adjacent to the buildings may result in adverse drainage conditions with runoff directed toward the structure. Site grading and drainage design should consider those possibilities, particularly at entryways. Positive drainage and grades should be maintained throughout the life of the facility.

WATER SOLUBLE SULFATES

The concentration of water soluble sulfates measured in samples of the on-site soils obtained from the borings ranged from less than 0.01% to approximately 0.04%. These concentrations of water soluble sulfates represent Class S0 severity exposures to sulfate attack on concrete exposed to these materials. The degree of attack is based on a range of Class S0, Class S1, Class S2, and Class S3 severity exposure as presented in ACI 201. Based on the laboratory data and our experience, we believe special sulfate resistant cement will not be required for concrete exposed to the on-site soils.

BURIED METAL CORROSION CONSIDERATIONS

The potential for corrosion of buried metal placed beneath the ground surface at the site was evaluated based on the results of laboratory tests on samples of well graded sand with silt and gravel (SW-SM) and lean clay (CL) obtained from the borings. The samples were tested to determine pH, water soluble sulfates, chlorides, and electrical resistivity. The laboratory test results are summarized in Table I, and shown on the boring logs, Figs. 2 thru 4. Electrical resistivity test results are presented graphically on Fig. 19.

The pH test results indicate a value of 8.2, which suggest the site materials are slightly alkaline. The concentration of water soluble sulfates ranged from less than 0.01% to approximately 0.04% as discussed in the previous section, and the concentration of water soluble chlorides was 0.02%.

The electrical resistivity test results presented on Fig. 19 indicate minimum resistivity values (saturated) of 10,000 ohm-cm and 800 ohm-cm for tested samples of well graded sand with silt and gravel and lean clay, respectively, with corresponding values at the in-situ moisture content of 14,960 ohm-cm and 865 ohm-cm for the tested samples. These values suggest excellent corrosion resistance for the granular soil sample, and poor corrosion resistance for the clay soil sample.

Corrosion of buried metal is a complex process and requires an understanding of the combined effects of pH, soil moisture, and other conditions not evaluated as part of this report. We recommend the applicable pipe designer or qualified corrosion engineer review the information presented herein to ultimately determine the need for and appropriate level of corrosion protection for buried metals at the site.

PERCOLATION TESTING

The location of percolation test holes (P1 thru P3), and the corresponding profile test pits (EX1 and EX2) are shown on Fig. 1. The percolation test holes were drilled to a depth of 4 feet using 8-inch diameter continuous-flight augers, and the test pits were excavated to a depth of 8 feet using a min-excavator. Below a layer of topsoil, the subgrade soils encountered were granular, and generally included silty sand (SM) in the upper approximately 1.5 to 4 feet, followed by well-graded sand with varied amounts of silt and gravel (SW-SM, SW). Groundwater was not encountered during the excavation of test pits or when the percolation tests were conducted. Logs of the percolation test holes and test pits are included on Fig.4 for reference.

Percolation tests were performed on April 28, 2026, following the "Regulations of the El Paso County Board of Health – El Paso County, Colorado", Chapter 8, On-site Wastewater Treatment Systems (OWTS) criteria. The measured percolation rates of the soils tested are presented below. The measurements were made at 10-minute intervals for a total of 8 readings at each location. Tests were performed 24 hours after a presoak period. The values presented reflect the final reading made at each test hole. The field percolation rate, which is the average rate of the percolation rates determined for all percolation test holes within the proposed soil treatment area, is 2.83 minutes/inch.

| Percolation Test Hole | Depth to Groundwater (ft) | Final Percolation Rate (min./inch) | EPC OWTS Soil Type[1] | USDA Hydrologic Soil Group[2] |
|---|---|---|---|---|
| P1 | (none) | 3.33 | 1 | A |
| P2 | (none) | 2.67 | 1 | A |
| P3 | (none) | 2.50 | 1 | A |

[1] The soil type presented in the table above was determined in accordance with the criteria listed in Table 10-1 of the El Paso County OWTS regulations, which considers USDA criteria for classification and texture. In accordance with USDA, the soils encountered within the percolation test holes classified as loamy sand to sand, single-grain, and structureless.

[2] The hydrologic soil group presented in the table above was determined for the soils within the proposed infiltration area in accordance with the criteria listed in the United States Department of Agriculture's *National Engineering Handbook, Part 630: Hydrology*. Group A soils are considered to have a low runoff potential and water is transmitted freely through the soil.

Several factors can affect the rate of percolation, including soil density and moisture content, the percentage of silt and clay, as well as other environmental and construction influences. The designer should consider that actual percolation rates can be highly variable and may differ by an order of magnitude or more from those indicated. Although unlikely, shallow groundwater will result in a lower percolation rate than that reported above if it is within about 4 feet of the proposed infiltration zone.

UNDERDRAIN SYSTEM

We understand the pump wet well will extend approximately 12 feet below grade. Typically, where below grade construction is used, we recommend consideration be given to protect the space with an underdrain system. Although free water was not encountered during our field exploration, localized perched water conditions can sometimes develop within the structure backfill zone

during times of heavy precipitation after construction. Such a system will likely require a sump and pump.

However, considering the proposed construction and the subsurface conditions encountered, it is our opinion that the use of an underdrain can be optional, and it's inclusion should be ultimately decided by the designer. The designer should be aware that without an underdrain, there may be an increased potential for periodic wetting of the interior space during times of precipitation, depending on the construction type. Water proofing the space can be utilized to reduce the magnitude of potential wetting.

If used, the underdrain system should consist of a perimeter drain placed at least 12 inches below the vault floor elevation, and consist of a perforated pipe placed in the bottom of a trench and surrounded above the invert level with free-draining gravel. This free-draining gravel should extend up to the slab level and should be surrounded with filter fabric. Free-draining gravel used in the drain system should consist of minus 2-inch aggregate with less than 20% passing the No. 4 sieve and less than 5% passing the No. 200 sieve. The perimeter drain pipe should be at least 4 inches in diameter. and graded at a minimum ½% slope to a gravity outlet or sump where water may be removed by pumping.

SURFACE DRAINAGE

Proper surface drainage is very important for acceptable performance of the development during construction and after the construction has been completed. Drainage recommendations provided by local, state and national entities should be followed based on the intended use. The following recommendations should be used as guidelines and changes should be made only after consultation with the geotechnical engineer.

1. Excessive wetting or drying of foundation and slab subgrades should be avoided during construction.

2. The ground surface surrounding the exterior of the buildings and other structures should be sloped to drain away from the foundations in all directions. We recommend a minimum slope of 6 inches in the first 10 feet in unpaved areas. Site drainage beyond the 10-foot zone should be designed to promote runoff and reduce infiltration. A minimum slope of 3 inches in the first 10 feet is recommended in the paved areas. These slopes may be

changed as required for handicap access points in accordance with the Americans with Disabilities Act.

3. Ponding of water should not be allowed in backfill material or in a zone within 10 feet of foundations or foundation walls, whichever is greater.

4. Roof downspouts and drains should discharge well beyond the limits of all backfill.

5. Irrigated turf and other excessive landscape irrigation should be avoided within 10 feet of foundations.

PAVEMENT DESIGN

Subgrade Materials: Based on the results of the field exploration and laboratory testing, the pavement subgrade materials encountered at the site classify as A-1-a, A-1-b, A-2-4, A-2-6, A-4, and A-6 with group index of 0 to 13 in accordance with the American Association of State Highway and Transportation Officials (AASHTO) soil classification system. A-1 and A-2 soils were the predominant soil classification, and were assumed for the design. Based on our experience with similar soil types, an R-value of 15 and a resilient modulus value of 4,195 psi were assumed for design of flexible pavements, and a corrected subgrade modulus of 150 pci was assumed for design of rigid pavements.

Design Traffic: Traffic loading information for the planned pavement areas was not available to us at the time of our report preparation. We have assumed traffic will primarily consist of automobiles and pickup trucks, with occasional truck traffic, to include tractor trailers for media replacement and equipment maintenance. Based on our experience with similar facilities, for our pavement thickness design calculations we assumed an equivalent 18-kip daily load application (EDLA) of 20 for areas of combined auto and truck traffic. If it is determined that actual traffic is significantly different from that estimated, we should be contacted to reevaluate the pavement thickness design.

Pavement Sections: The recommended sections were determined using the DARWin 3.01 pavement design software based on the 1993 AASHTO pavement design procedures. Based on the subgrade conditions encountered and the assumed traffic loading, we recommend the following pavement sections:

| PAVEMENT SECTION THICKNESS (in.) | | |
|---|---|---|
| Asphalt Over Aggregate Base Course | Aggregate Base Surfaced | Unreinforced Concrete over Aggregate Base Course |
| 5 over 6 | 6 | 6 over 6 |

*: We recommend truck areas where truck turning movements are concentrated be paved with a Portland Cement Concrete (PCC) section or aggregate surfacing rather than the asphalt alternative. The use of a flexible pavement in these areas could result in pavement fatigue cracking and/or rutting/shoving of the pavement due to the concentrated wheel loads.

A full-depth asphalt section alternative was not included because it has been our experience it can be difficult to construct given the presence of occasionally clean sands. The clean sands will have a tendency to rut from pavement vehicles even if properly compacted, potentially contaminating the bottom lift of asphalt. The usage of an aggregate base course layer will reduce the magnitude of this potential issue.

Pavement Materials: The asphalt pavement mix should conform to specifications for Superpave Hot Mix Asphalt (HMA). A PG 58-28 asphalt binder should be suitable for the mix. In the event that a PG 64-22 asphalt binder is used in the mix, the asphalt section will provide adequate structural support but will be subject to a higher potential for low temperature related transverse cracking.

Class 6 aggregate base course should be used for the base layer of both asphalt and concrete pavement options, and also where aggregate surfaced areas will be utilized. Aggregate base course should be a Class 6 material conforming to the requirements presented in the CDOT Standard Specifications for Road and Bridge Construction.

Concrete pavement should meet the requirements of a Class P Mix, per Section 601 of the CDOT Standard Specifications, and should be based on a mix design established by a qualified engineer. The concrete should contain transverse joints not greater than 12 to 15 feet on centers and longitudinal joints no greater than 14 feet. Joint spacing and geometry should be established by a qualified designer/engineer. The joints should be hand formed, sawed or formed by premolded filler. The joints should be at least 1/4 of the slab thickness. Expansion joints should be provided at the end of each construction sequence and between the concrete slab and adjacent structures. Expansion joints where required, should be filled with a ½ inch-thick asphalt impregnated fiber. Concrete should be cured by protecting against loss of moisture, rapid temperature changes and mechanical injury for at least three days after placement. The concrete

sections presented above are assumed to be unreinforced. Providing dowels at construction joints will help reduce the risk of differential movements between panel sections. Providing a grid mat of deformed rebar or welded wire mesh within the concrete pavement section will assist in mitigating corner breaks and differential panel movements. If a rebar mat is installed, we recommend that the bars be placed in the lower half of the pavement section. Also, if reinforcing is used, we have commonly seen No. 4 rebar placed at 24-inch center in each direction, however, we recommend that a structural engineer evaluate the placement and spacing of rebar if needed.

Subgrade Preparation: Fill placed for support of pavements should meet the material and compaction requirements for structural fill presented in the "Site Grading and Earthwork" section of this report. Prior to placing compacted fill or pavement materials, the exposed subgrade soils should be scarified to a depth of at least 12 inches, moisture conditioned, and compacted according to the specifications in the "Site Grading and Earthwork" Section of this report.

Proof Roll: Before paving, the subgrade should be proof rolled with a heavily loaded, pneumatic-tired vehicle. The vehicle should have a gross vehicle weight of at least 50,000 pounds with a loaded single axle weight of 18,000 pounds and a tire pressure of 100 psi. Areas which deform excessively (> 1/2") under heavy wheel loads are not stable and should be removed and replaced with suitable material to achieve a stable subgrade prior to paving or placement of base course.

Drainage: The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of the pavement. Drainage design should provide for the removal of water from paved areas and prevent the wetting of the subgrade soils.

Maintenance: Periodic maintenance of paved areas is critical to achieve the design life of the pavement. Crack sealing should be performed annually as new cracks appear. Chip seals, fog seals, or slurry seals applied at approximate intervals of 3 to 5 years are usually necessary for asphalt. As conditions warrant, it may be necessary to perform patching and overlay at approximate 10-year intervals.

Aggregate Surfacing Option: For the pavement section presented, the owner should be aware that periodic maintenance will be required for the aggregate-surfaced areas. The majority of the maintenance will consist of periodic grading to remove ruts and potholes that will inevitably be created by the environment and traffic. Occasionally during the lifetime of the surface, the

aggregate base layer may have to be scarified, additional aggregate added to increase the thickness to that originally required, and the wearing surface recompacted to the specified density.

SITE GRADING AND EARTHWORK

Temporary Excavations: We recommend temporary excavation slopes be constructed in accordance with OSHA regulations. In accordance with OSHA criteria, the on-site native soils should be considered a Type C soil due to the variability. Temporary unretained excavations should have slopes no steeper than 1.5:1 (H:V) in Type C soils. A properly braced excavation or the use of a trench box should be used where the indicated unretained slopes cannot be accommodated. Flatter slopes will be required where groundwater seepage is encountered. OSHA regulations require that excavations greater than 20 feet in depth be designed by a professional engineer. If soils different from those indicated in this report are encountered, the OSHA soil type may vary and the required cut slopes may need to be adjusted. A contractor's competent person should make decisions regarding cut slopes.

Excavated slopes may soften or loosen due to construction traffic and erode from surface runoff. Measures to keep surface runoff from excavation slopes, including diversion berms, should be considered.

Excavation Considerations: In our opinion, the overburden soils encountered in the exploratory borings drilled for this study can be excavated with heavy-duty construction equipment. Groundwater was not encountered in our exploratory borings. Based on our understanding of the proposed construction and the anticipated depths of construction, we do not expect groundwater to be a design consideration for this project. If groundwater is encountered, we believe the excavation can be dewatered using perimeter and/or lateral trenches combined with sumps. The trenches should be sloped to sumps where water can be pumped from the excavation. The bottom and sides of the excavation may become unstable, especially in the granular soils if the groundwater level is not lowered in advance of excavation and maintained at a sufficient depth below the bottom of the excavation. Dewatering must be maintained through the time period the excavation is open. The dewatering system should be properly designed, installed, and maintained by an experienced dewatering contractor.

Cut and Fill Slopes: Permanent cut and fill slopes should not be steeper than 3:1 (horizontal to vertical). Slopes will generally be stable at 2:1; however, 2:1 slopes will be prone to increased surface erosion and it will be difficult to maintain vegetation on them. The risk of slope instability

will be significantly increased if seepage is encountered in cuts. If seepage is encountered in permanent excavations, an investigation should be conducted to determine if the seepage will adversely affect the cut stability.

We understand detention ponds may be constructed utilizing on-site soils and designed for infiltration, or lined and designed for detention. Evaluation of the pond slopes is beyond the scope of our study. The slopes recommended above are considered to be suitable for general embankment construction, however, in pond applications with rapid fill or drawdown considerations, the granular soils will have an increased potential for sloughing and erosion and flatter slopes in the range of 3:1 or 4:1 may be required.

No formal stability analyses were performed to evaluate the slopes recommended above. Published literature and our experience with similar cuts and fills indicate the recommended slopes should have adequate factors of safety. If a detailed stability analysis is required, we should be notified.

Good surface drainage should be provided for all permanent cuts and fills to direct the surface runoff away from the slope faces. Permanent cut and fill slopes and other stripped areas should be protected against erosion by revegetation or other means. Fills should be benched into any hillsides exceeding 4 horizontal to 1 vertical. Site grading should be planned to provide positive surface drainage away from all building and pavement areas.

Subgrade Stabilization: Unstable subgrade may be encountered during subgrade preparations. Unstable soils may be stabilized by scarifying/ripping the subgrade and allowing it to dry, or by overexcavation and replacement of the subgrade with suitable, imported, angular, well-graded materials. Other alternatives include the use of Type 2 biaxial geogrid reinforcement in combination with a layer of Class 6 aggregate base course. It has been our experience that the use of a crushed concrete product meeting a Class 6 gradation can perform well when trying to achieve stabilization. Specific stabilization requirements should be evaluated at the time of construction. We are unable to accurately predict or quantify areas where unstable subgrade conditions may occur, however, we recommend this work activity, if required, be included as a line item in the bid schedule to avoid cost overruns.

Fill Material: The following recommended material and compaction requirements are presented for fill placements on the project site. A geotechnical engineer should evaluate the suitability of all proposed fill materials for the project prior to placement.

1. *Structural Fill*: With proper moisture conditioning, the on-site granular soils (SP, SW, SP-SM, SW-SM, SM, SC-SM, and SC) will be suitable for reuse as structural fill, including structural fill beneath foundations, floor slabs, exterior flatwork, and pavements. Imported structural fill, if required, should consist of a nonexpansive soil material having a maximum particle size of 2 inches, a maximum of 40% passing the No. 200 sieve, and a maximum plasticity index of 10. (We recognize that some of the tested samples of the onsite granular soils do not meet the specification for gradation and/or plasticity index; however, given the properties, it is our opinion they will be acceptable for reuse, if properly moisture conditioned.)

2. *Reuse of Clay Soils*: Clay soils (CL, CH) should be considered unsuitable for use as structural fill, and should be placed in nonstructural or landscape areas, or removed from the site.

3. *Subgrade Preparation*: The ground surface shall be stripped of vegetation/organics down to the natural granular soils, followed by overexcavation, moisture conditioning and recompaction of the native subgrade to a depth of at least 3 feet below the foundation and floor slab bearing elevations. As discussed in the “Exterior Flatwork” section, the overexcavation zone should also include beneath exterior flatwork immediately adjacent to the building and within a 10-foot zone around the perimeter of the building including sidewalks where reduction of settlement potential is considered more important. During the subgrade moisture conditioning and recompaction process, any clay soils encountered should be replaced with suitable structural fill. The prepared subgrade should extend down and outward from the edges of the foundations at a minimum 1:1 horizontal to vertical projection.

   In pavement areas, the subgrade should be scarified to a depth of 12 inches, moisture conditioned as necessary, and compacted in a manner specified below for the subsequent layers of fill.

   Loose or unstable soils shall be removed, where present, in order to provide a stable platform prior to placement of fill.

4. *Pipe Bedding*: The use and requirements for bedding material should be in accordance with the pipe manufacturer's recommendations, local building authority, or utility district requirements. In confined areas of the pipeline where compaction is difficult, placement of a cementitious flowfill around the pipe should be considered, at the discretion of the designer.

5. *Utility Trench Backfill*: Materials excavated from the utility trenches may be used for trench backfill above the pipe zone fill provided they do not contain unsuitable material or particles larger than 2 inches.

6. *Material Suitability*: All fill material should be free of vegetation, brush, sod, trash and debris, and other deleterious substances, and should not contain rocks or lumps having a diameter of more than 2 inches.

7. *Lift Thickness*: The maximum allowable loose lift thickness should be limited to 8 inches.

Compaction Requirements: A representative of the geotechnical engineer should observe fill placement operations on a part- to full-time basis, depending on the speed at which grading and fill operations are occurring. We recommend the following minimum compaction criteria be used on the project.

| rea | Percentage of Modified Proctor Maximum Dry Density (ASTM D 1557) |
|---|---|
| Foundation Subgrade | 95 |
| Floor Slab Subgrade | 90 |
| Foundation Backfill | 90 |
| Pavement Subgrade | 90 |
| Aggregate Base Course | 90 |
| Exterior Flatwork/Utility Trenches | 90 |
| Landscape Areas, and Other Misc. Overlot Fill Areas | 90 |
| Compaction should be achieved at a moisture content within +/- 2% of the optimum. | |

Grading During Inclement Weather: If grading occurs during the time of year with freezing temperatures, fill should not contain frost or be placed on frozen ground. A loose lift or blanket of soil should be placed on prepared subgrade at the end of day to protect against frost, and the

presence of frost should be checked at the beginning of each day. Any frost should be removed prior to placement of new fill. During periods of precipitation, excessive wetting of building pad and pavement subgrades should be avoided. Measures should be implemented to keep surface runoff from ponding in subgrade areas, to include usage of diversion berms, creation of temporary low areas where water can be directed and removed by pumping, or other methods as appropriate.

## DESIGN AND CONSTRUCTION SUPPORT SERVICES

Kumar & Associates, Inc. should be retained to review the project plans and specifications for conformance with the recommendations provided in our report. We are also available to assist the design team in preparing specifications for geotechnical aspects of the project, and performing additional studies if necessary to accommodate possible changes in the proposed construction.

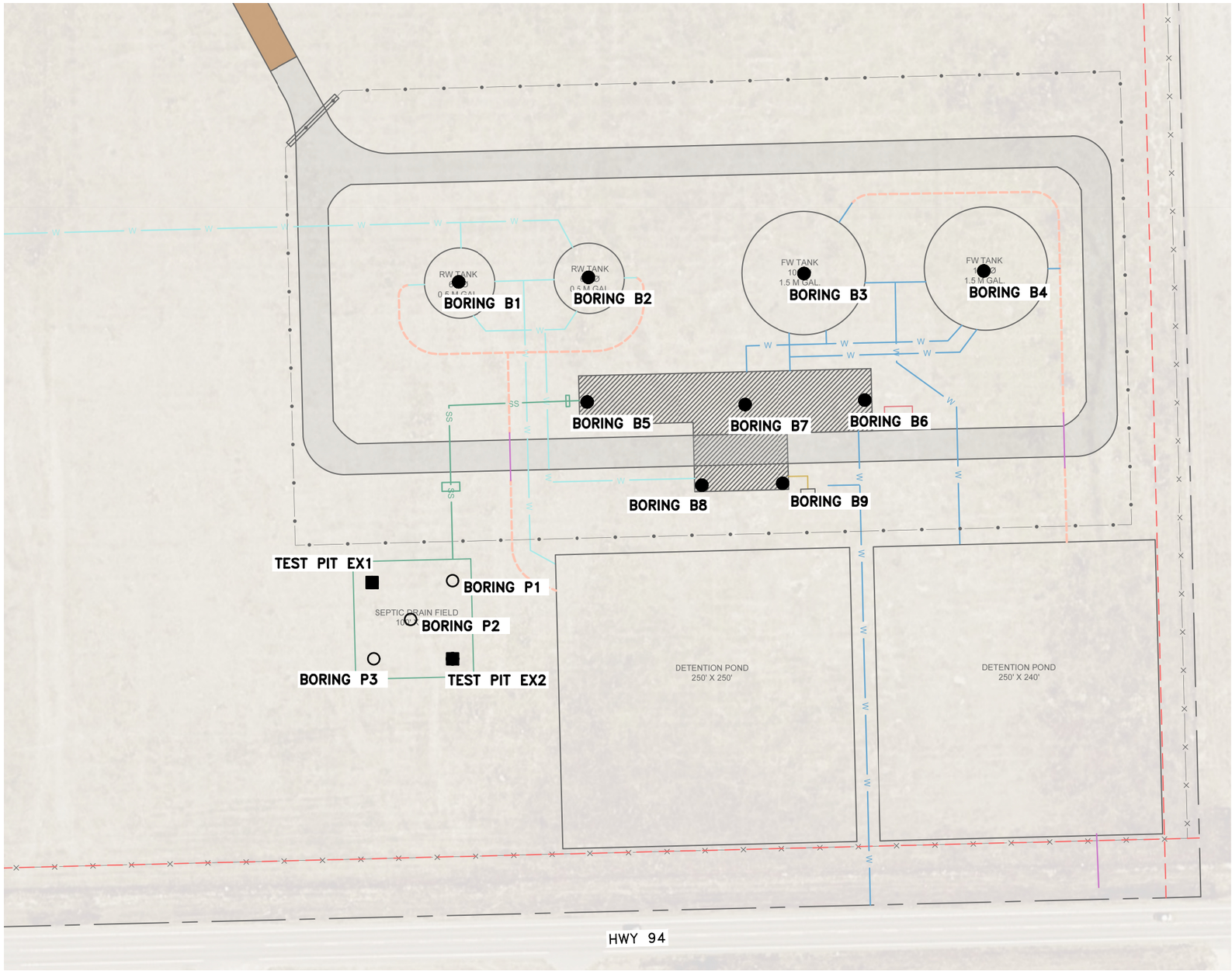
We recommend that Kumar & Associates, Inc. be retained to provide construction observation and testing services to document that the intent of this report and the requirements of the plans and specifications are being followed during construction. This will allow us to identify possible variations in subsurface conditions from those encountered during this study and to allow us to re-evaluate our recommendations, if needed.

## LIMITATIONS

This report has been completed for exclusive use by the client for geotechnical related design and construction criteria for the project. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory borings and test pits at the locations indicated on Fig. 1 or as described in the report, and the proposed type of construction. This report may not reflect subsurface variations that occur, and the nature and extent of variations across the site may not become evident until site grading and excavations are performed. If during construction, fill, soil, rock or water conditions appear to be different from those described herein, Kumar & Associates, Inc. should be advised at once so that a re-evaluation of the recommendations presented in this report can be made. Kumar & Associates, Inc. is not responsible for liability associated with interpretation of subsurface data by others.

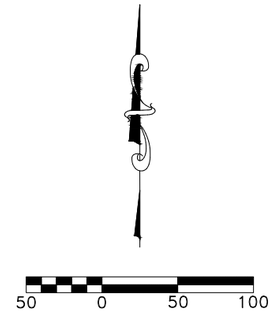
The scope of services for this project does not include identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such contamination, other studies should be undertaken.

DPC:sw




LEGEND:

- ● EXPLORATORY BORING LOCATION.
- ○ PERCOLATION TEST HOLE LOCATION.
- ■ TEST PIT LOCATION.



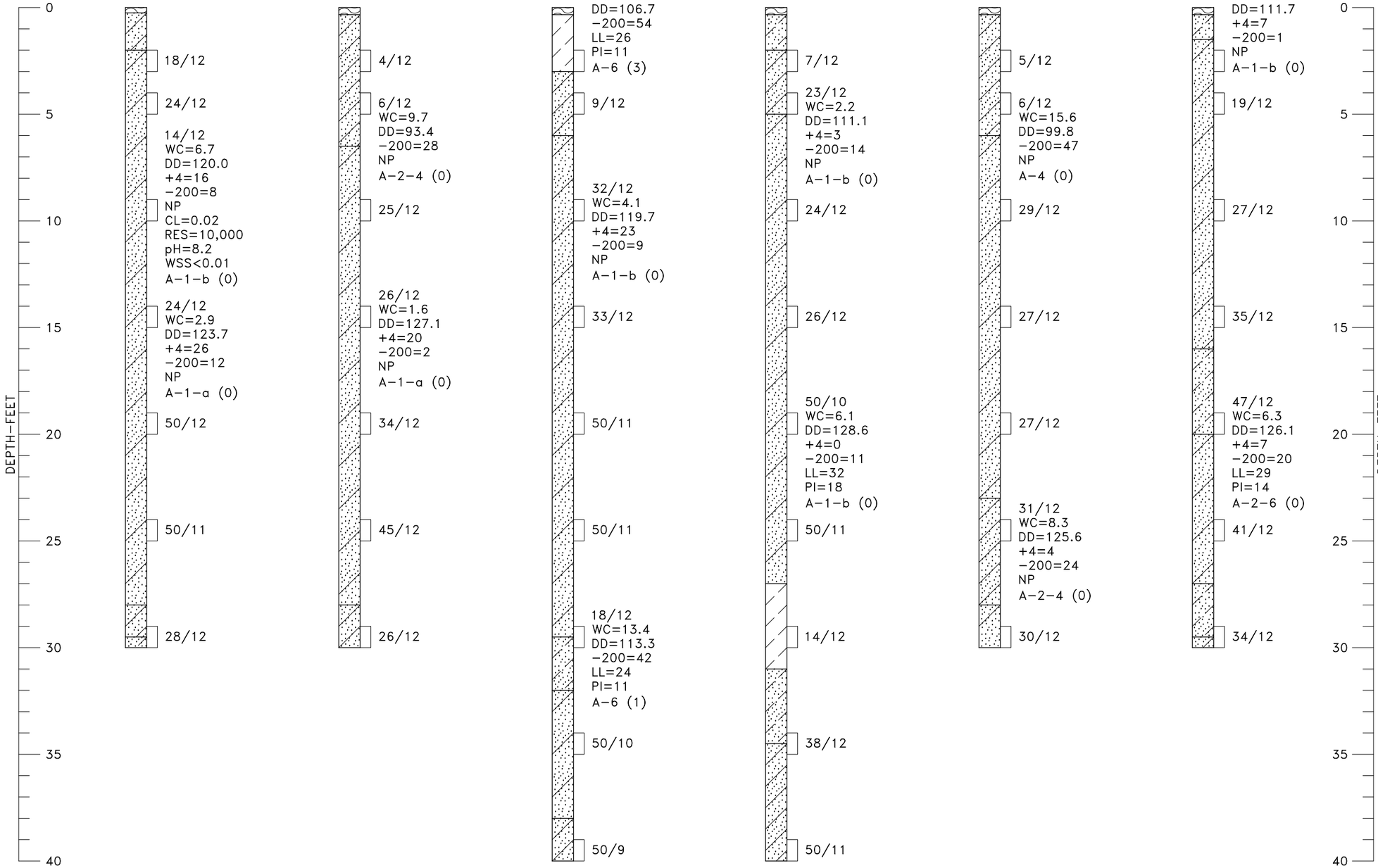

APPROXIMATE SCALE–FEET




VICINITY MAP
NOT TO SCALE

| | | | | |
|---|---|---|---|---|
| 25–2–263 | Kumar & Associates | | LOCATION OF EXPLORATORY BORINGS AND TEST PITS | Fig. 1 |

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| 25−2−263 | Kumar & Associates | | LOGS OF EXPLORATORY BORINGS | Fig. 2 |
|---|---|---|---|---|

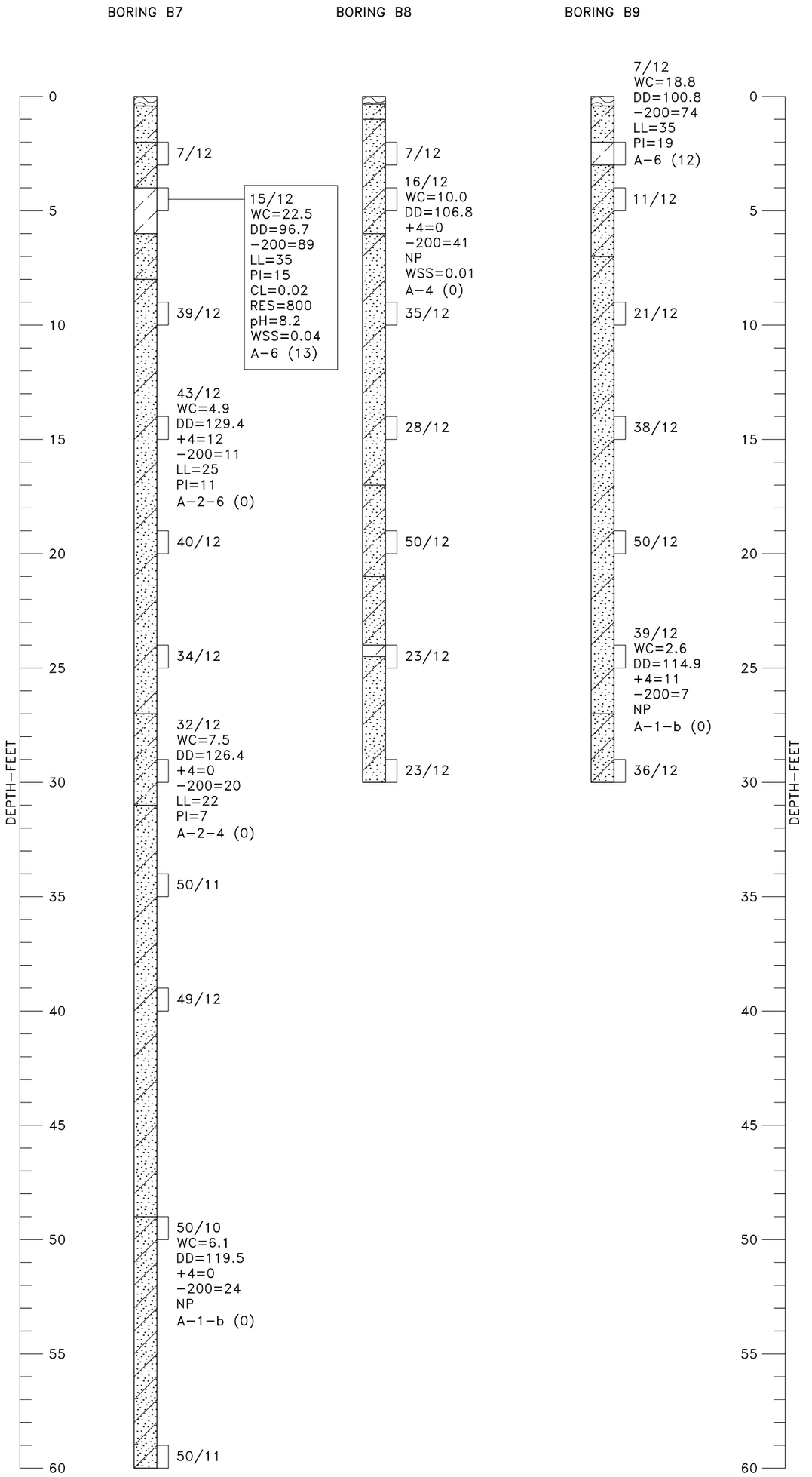
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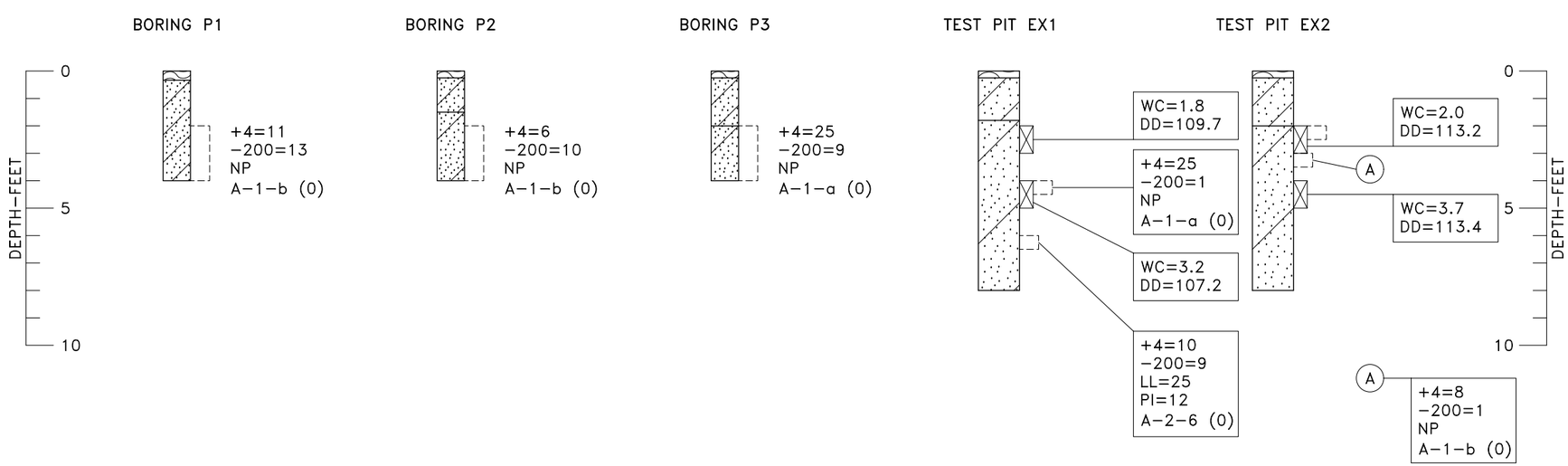
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LOGS OF EXPLORATORY BORINGS

Fig. 3






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| | | | | |
|---|---|---|---|---|
| 25−2−263 | Kumar & Associates | | LOGS OF EXPLORATORY BORINGS AND TEST PITS | Fig. 4 |

## LEGEND


TOPSOIL.


SILTY SAND (SM), WITH OCCASIONAL GRAVEL, LOOSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, TAN, BROWN TO GRAY–BROWN.


POORLY TO WELL GRADED SAND WITH VARIED AMOUNTS OF SILT AND GRAVEL, (SP, SW, SP–SM, SW–SM), MEDIUM DENSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, TAN, BROWN, TAN–GRAY, AND TAN–ORANGE.


CLAYEY SAND (SC), AND SILTY CLAYEY SAND (SC–SM), WITH OCCASIONAL LENSES OF SANDY LEAN CLAY (CL), WITH OCCASIONAL GRAVEL, MEDIUM DENSE TO DENSE, SLIGHTLY MOIST TO MOIST, BROWN TO TAN.


LEAN CLAY (CL), WITH VARIED AMOUNTS OF SAND, MEDIUM STIFF TO VERY STIFF, SLIGHTLY MOIST TO MOIST, BROWN, GRAY, AND GRAY–BROWN.


DRIVE SAMPLE, 2–INCH I.D. CALIFORNIA LINER SAMPLE.


HAND DRIVE SAMPLE, 2–INCH I.D.


DISTURBED BULK SAMPLE.

18/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 18 BLOWS OF A 140–POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

## NOTES

1. THE EXPLORATORY BORINGS WERE DRILLED BETWEEN APRIL 20 AND 21, 2026 WITH A CONTINUOUS–FLIGHT POWER AUGER (4–INCH DIAMTER FOR B1–B9 AND 8–INCH DIAMETER FOR P1–P3). TEST PITS EX1 AND EX2 WERE EXCAVATED MINI–EXCAVATOR ON APRIL 27, 2026.

2. THE LOCATIONS OF THE EXPLORATORY BORINGS AND TEST PITS WERE MEASURED APPROXIMATELY BY HANDHELD GPS DEVICE AND SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

3. THE ELEVATIONS OF THE EXPLORATORY BORINGS AND TEST PITS WERE NOT MEASURED AND THE LOGS OF THE EXPLORATORY BORINGS AND TEST PITS ARE PLOTTED TO DEPTH.

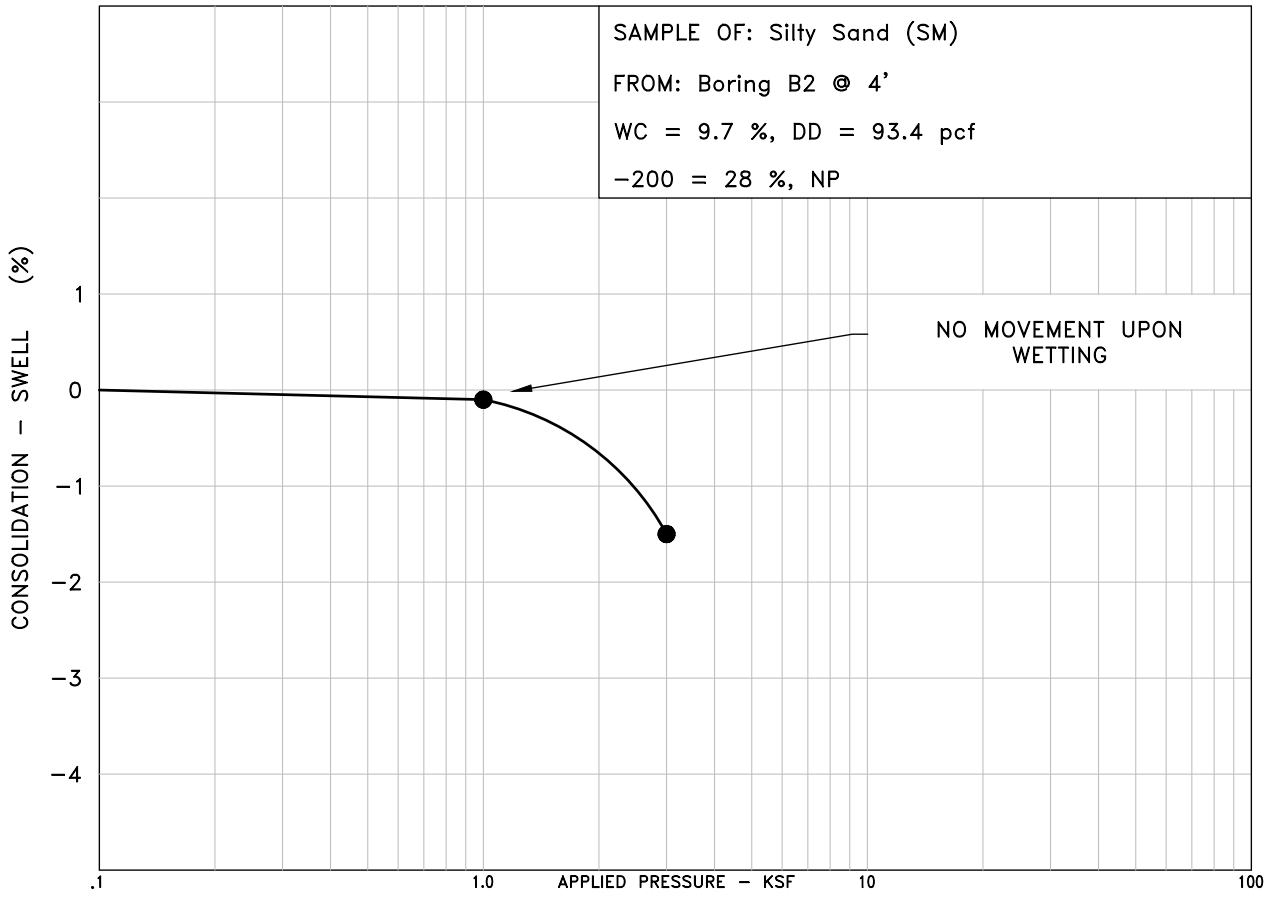
4. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS AND TEST PITS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.

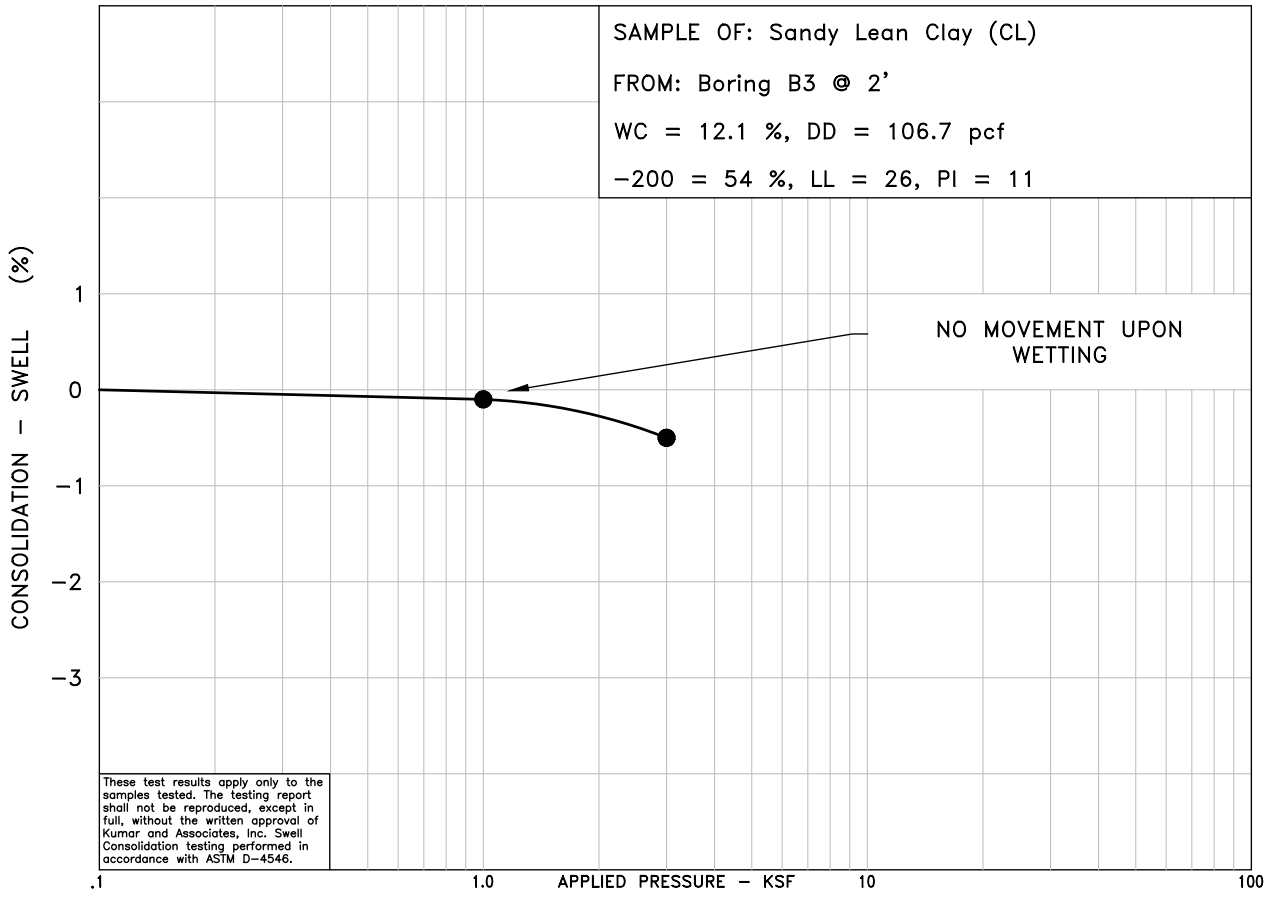
5. GROUNDWATER WAS NOT ENCOUNTERED IN THE BORINGS AT THE TIME OF DRILLING OR WHEN CHECKED 7 TO 8 DAYS LATER. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

6. LABORATORY TEST RESULTS:
   WC = WATER CONTENT (%) (ASTM D2216);
   DD = DRY DENSITY (pcf) (ASTM D2216);
   +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D6913);
   −200= PERCENTAGE PASSING NO. 200 SIEVE (ASTM D1140);
   LL = LIQUID LIMIT (ASTM D4318);
   PI = PLASTICITY INDEX (ASTM D4318);
   NP = NON–PLASTIC (ASTM D4318);
   WSS = WATER SOLUBLE SULFATES (%) (CP–L 2103);
   pH = HYDROGEN ION CONCENTRATION (ASTM E 70);
   RES = MINIMUM LABORATORY RESISTIVITY (ohm–cm.) (ASTM G 57);
   A-2-6 (0) = AASHTO CLASSIFICATION (GROUP INDEX) (AASHTO M 145);
   CL = CHLORIDE CONTENT (%) (AASHTO T291).



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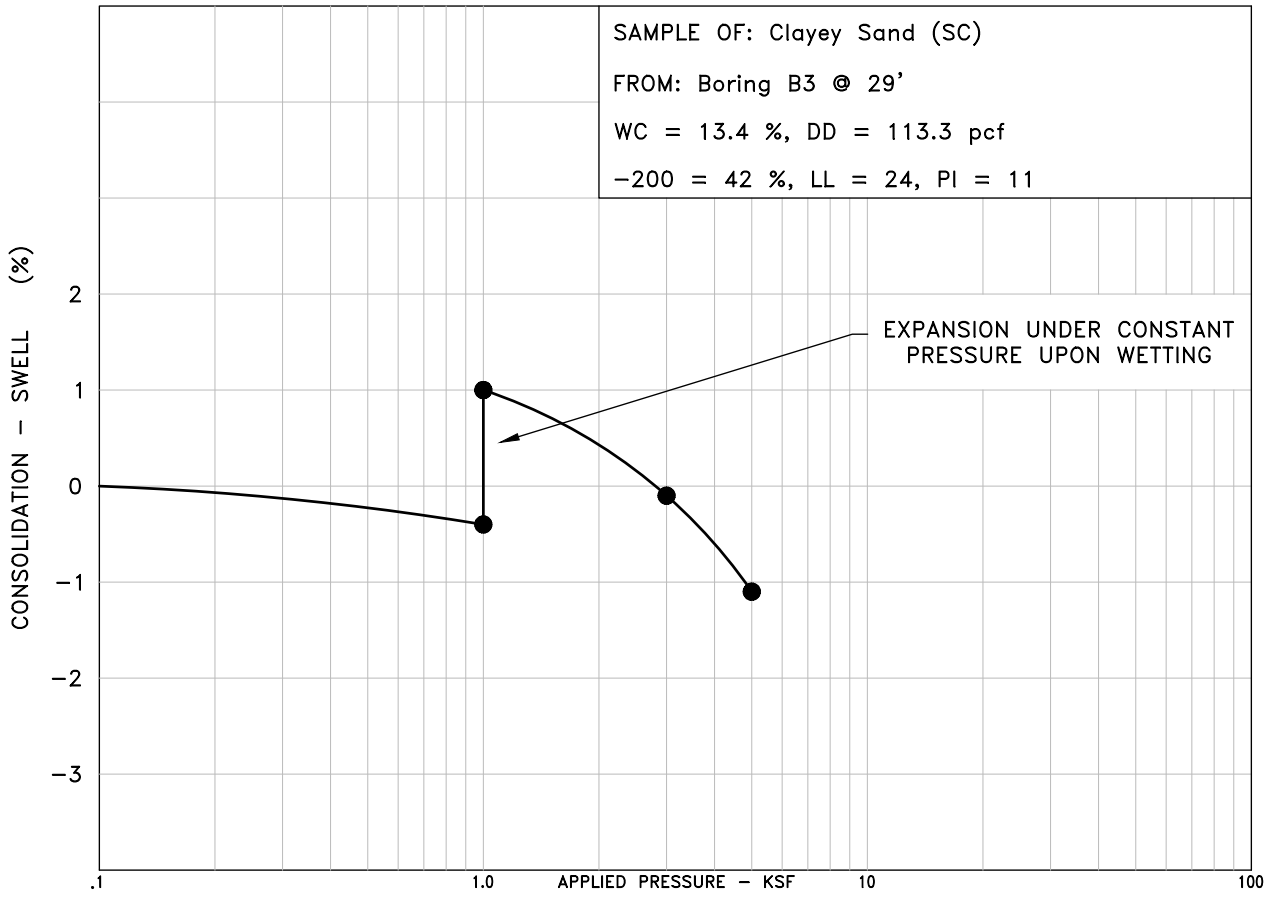


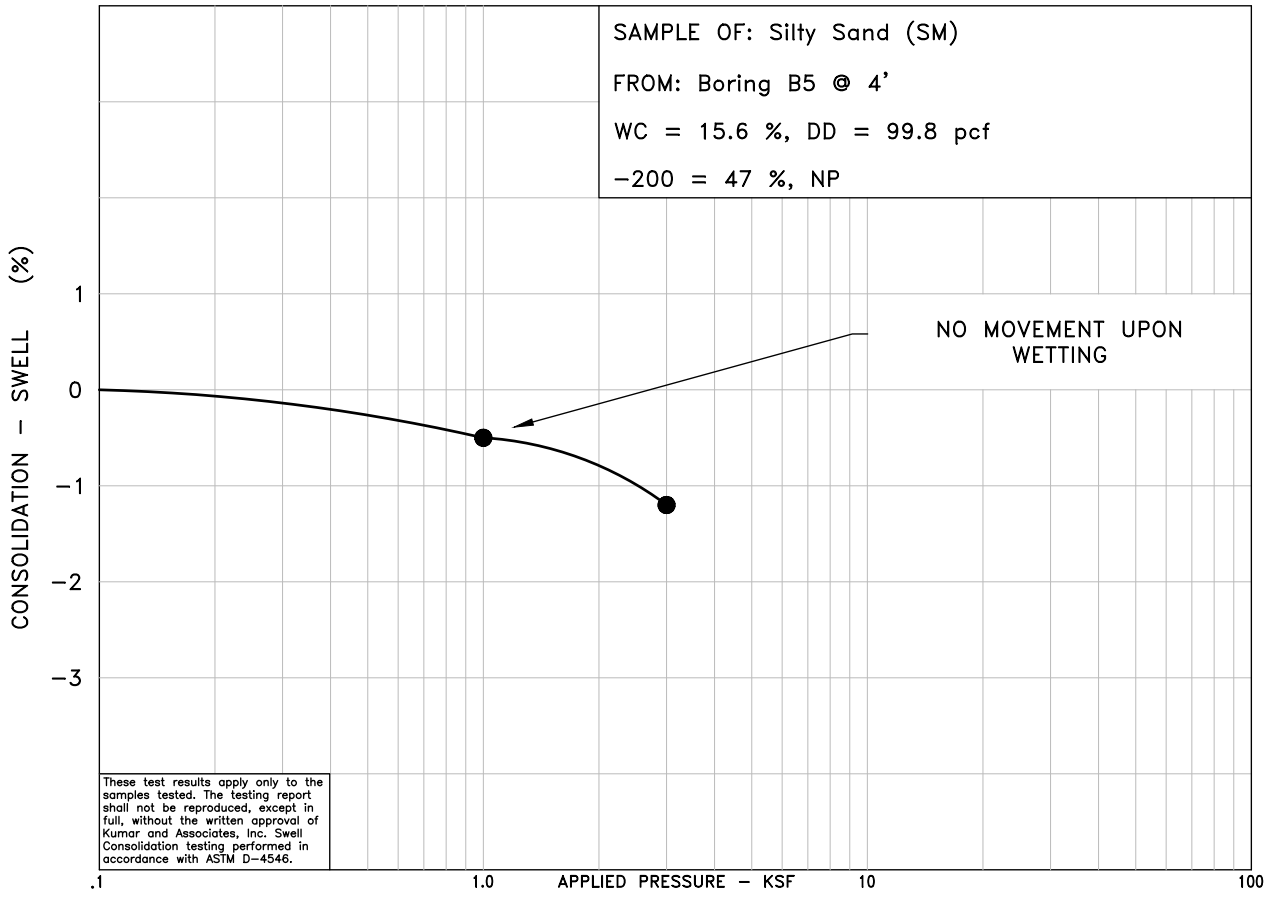




These test results apply only to the samples tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar and Associates, Inc. Swell Consolidation testing performed in accordance with ASTM D-4546.

| 25-2-263 | Kumar & Associates | SWELL-CONSOLIDATION TEST RESULTS | Fig. 6 |
|---|---|---|---|

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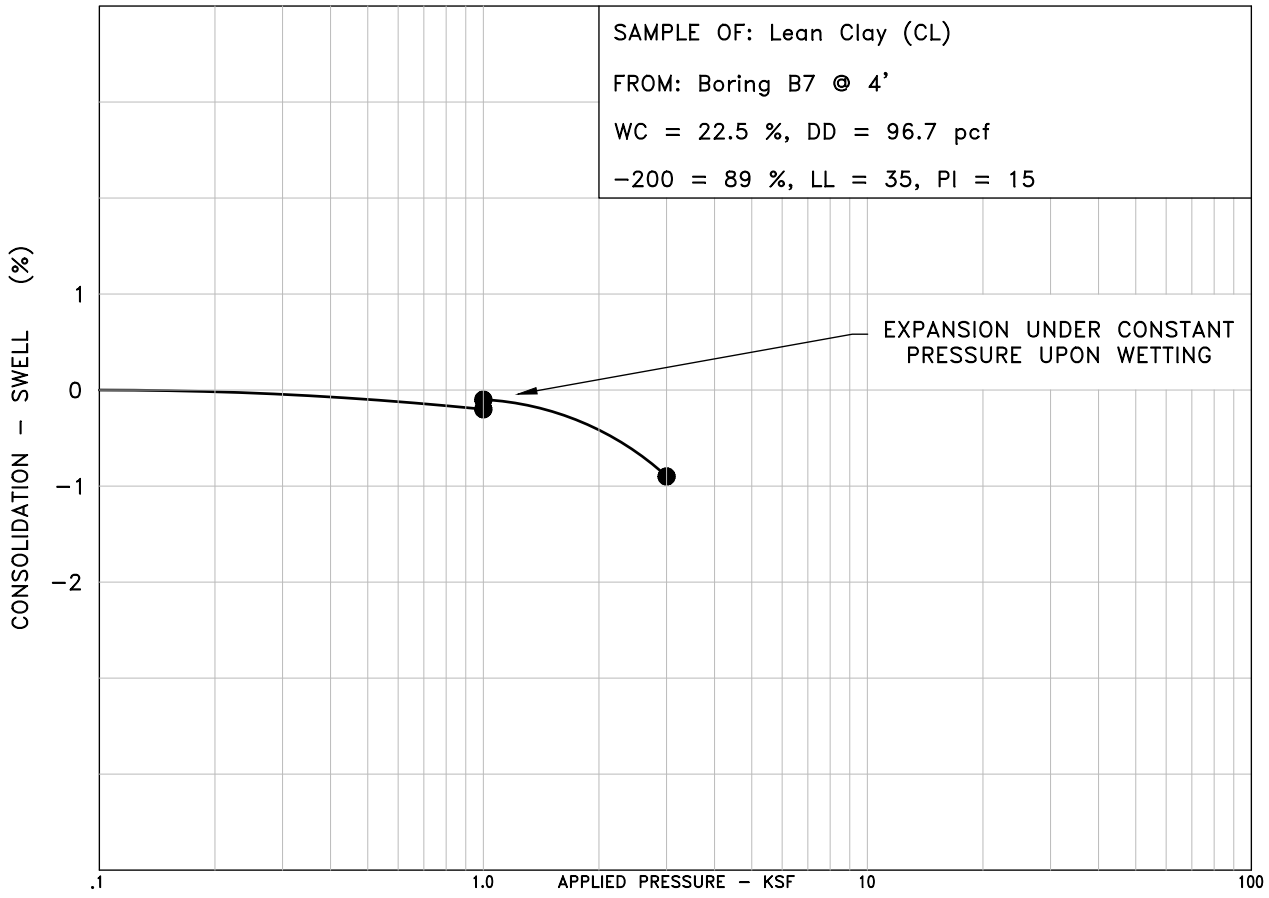


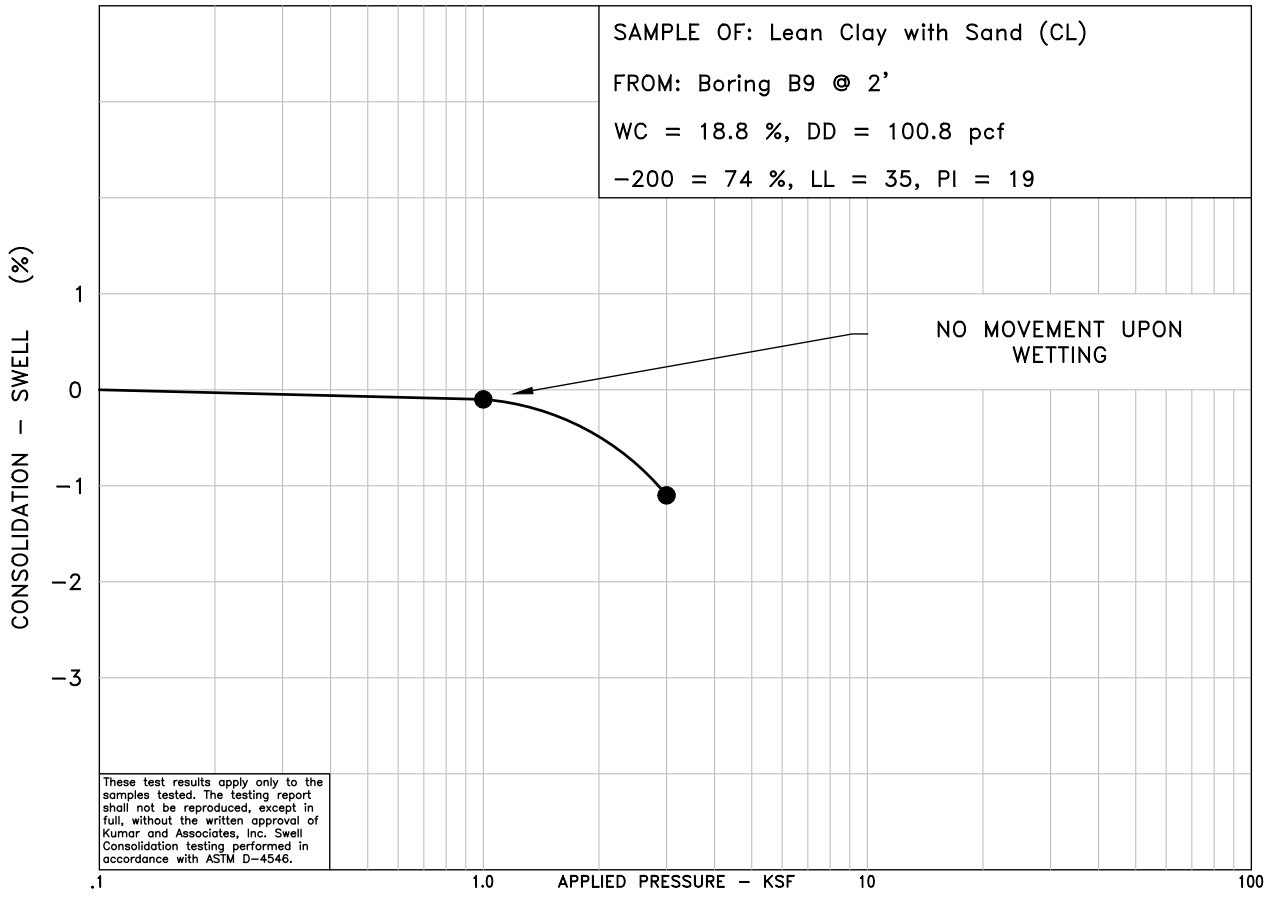




These test results apply only to the samples tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar and Associates, Inc. Swell Consolidation testing performed in accordance with ASTM D−4546.

| 25−2−263 | Kumar & Associates | SWELL−CONSOLIDATION TEST RESULTS | Fig. 7 |
|---|---|---|---|

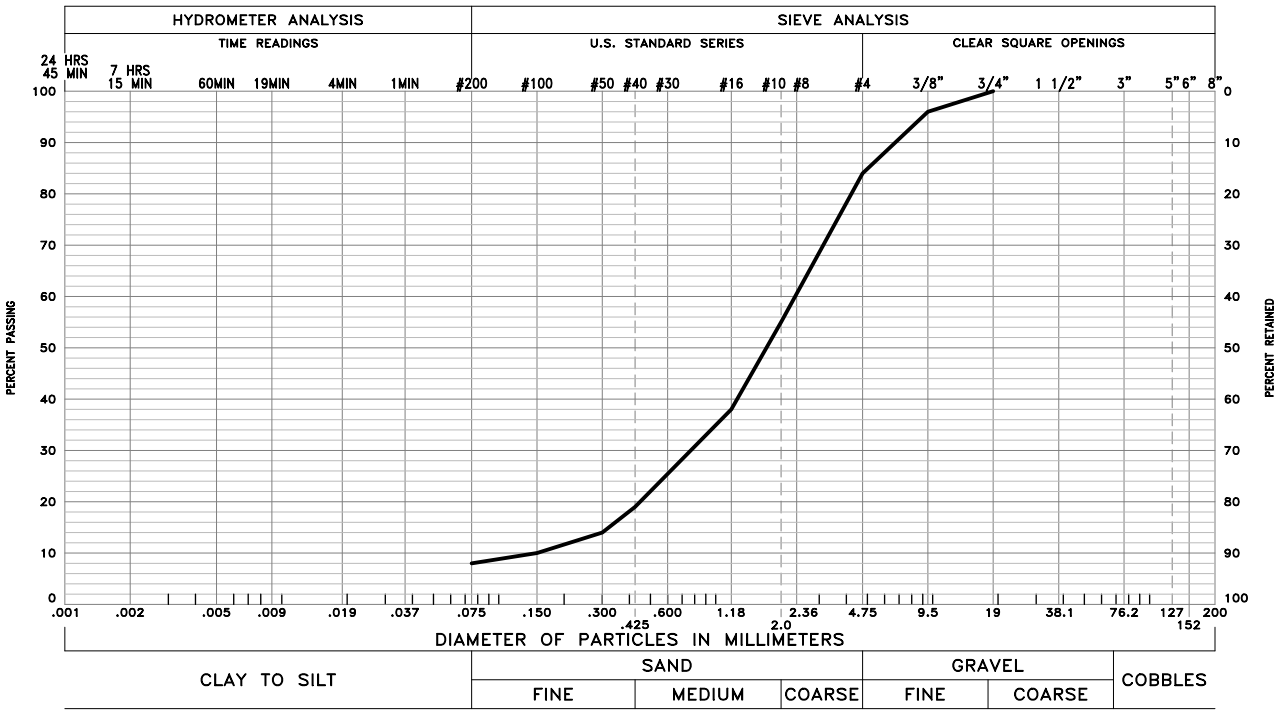
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| 25−2−263 | Kumar & Associates | SWELL−CONSOLIDATION TEST RESULTS | Fig. 8 |
|---|---|---|---|

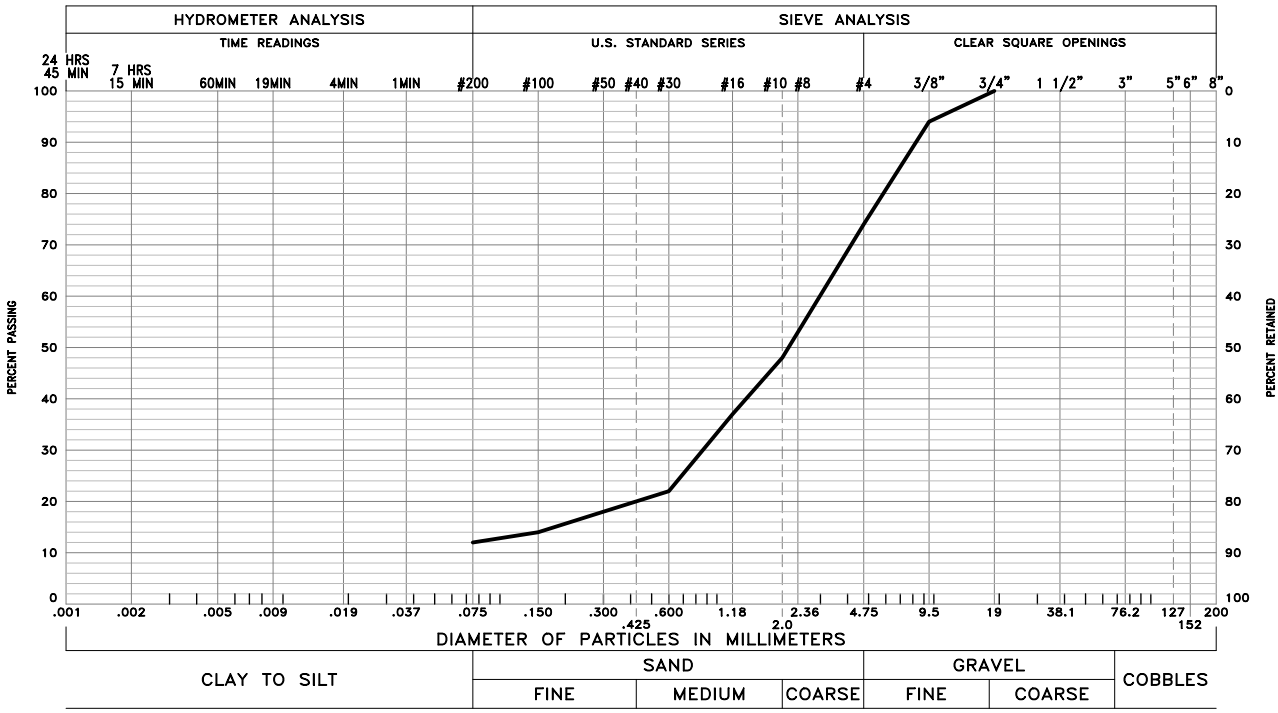
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GRAVEL 16 % SAND 76 % SILT AND CLAY 8 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt & Gravel (SW-SM) FROM: Boring B1 @ 9'




GRAVEL 26 % SAND 62 % SILT AND CLAY 12 %

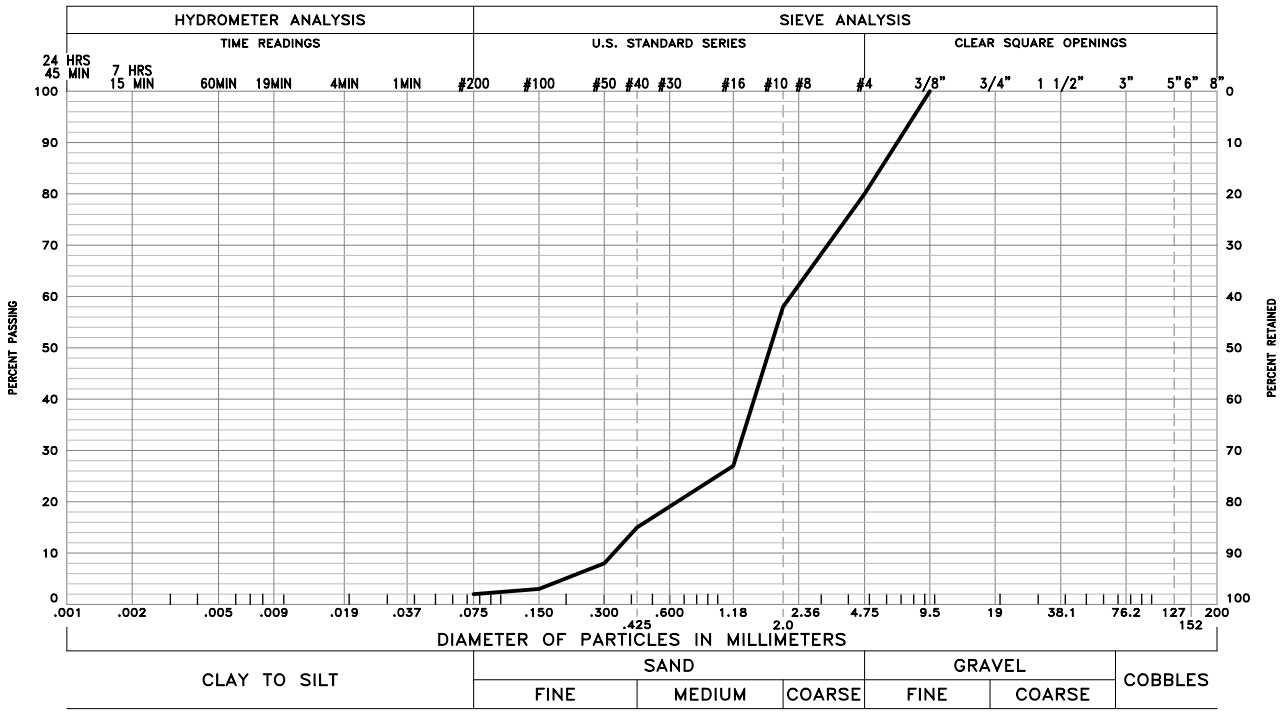
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt & Gravel (SW-SM) FROM: Boring B1 @ 14'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 9 |
|---|---|---|---|

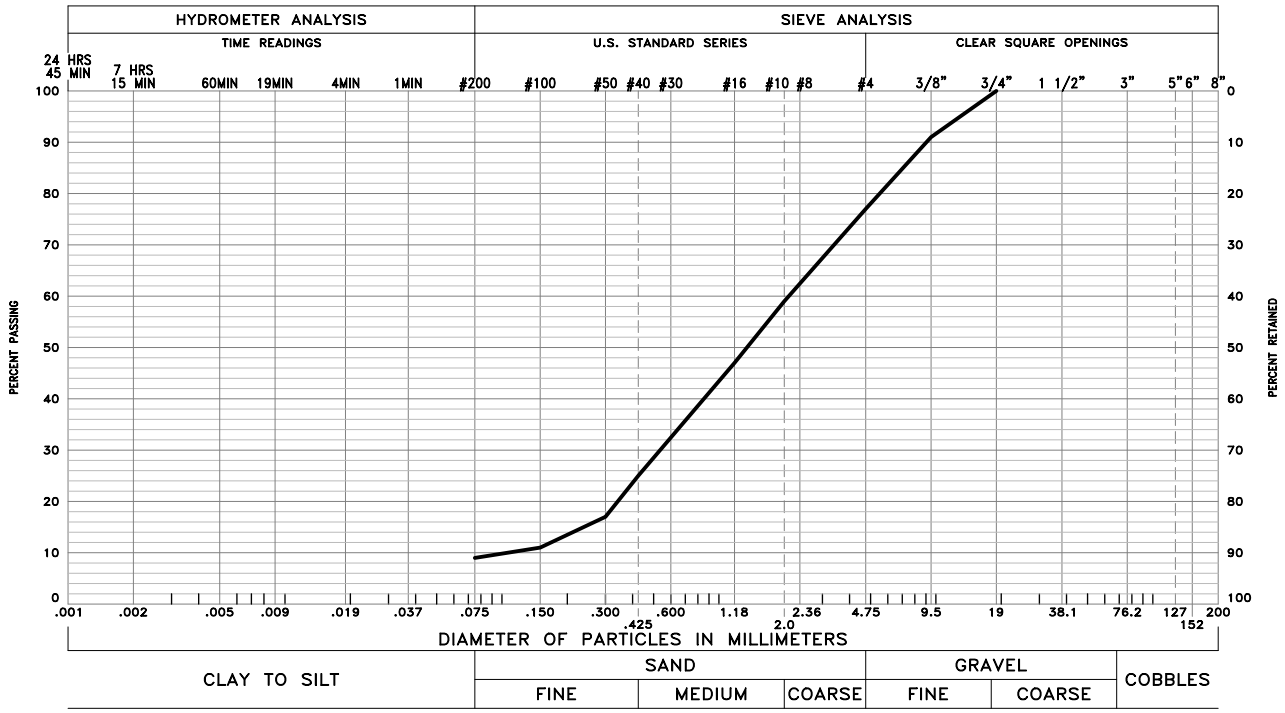
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GRAVEL 20 % SAND 78 % SILT AND CLAY 2 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Gravel (SW) FROM: Boring B2 @ 14'




GRAVEL 23 % SAND 68 % SILT AND CLAY 9 %

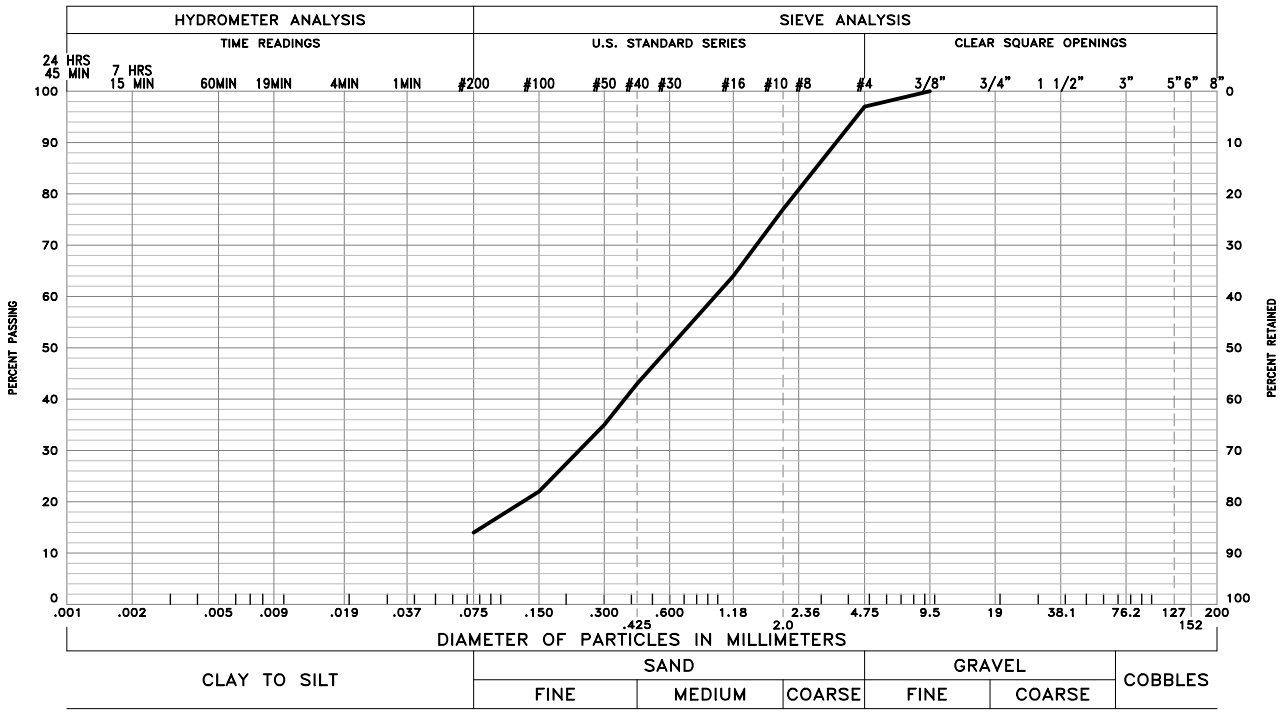
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt & Gravel (SW-SM) FROM: Boring B3 @ 9'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



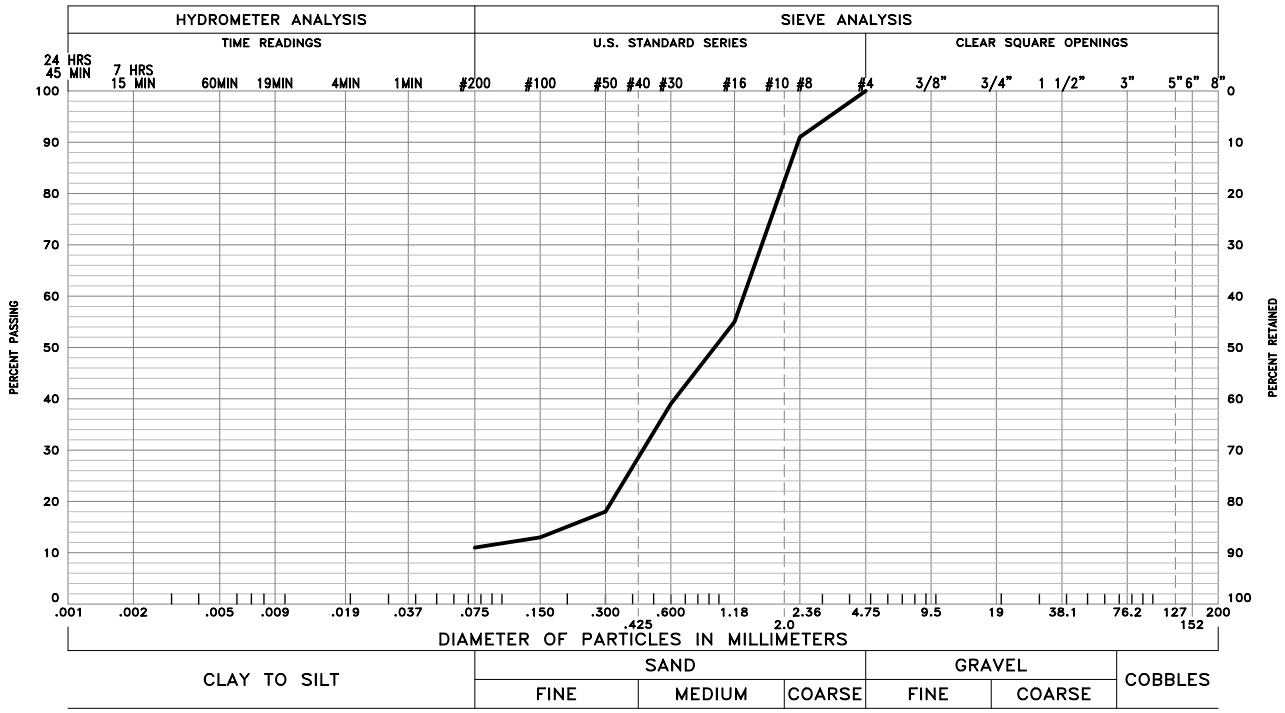
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GRAVEL 3 % SAND 83 % SILT AND CLAY 14 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring B4 @ 4'




GRAVEL 0 % SAND 89 % SILT AND CLAY 11 %

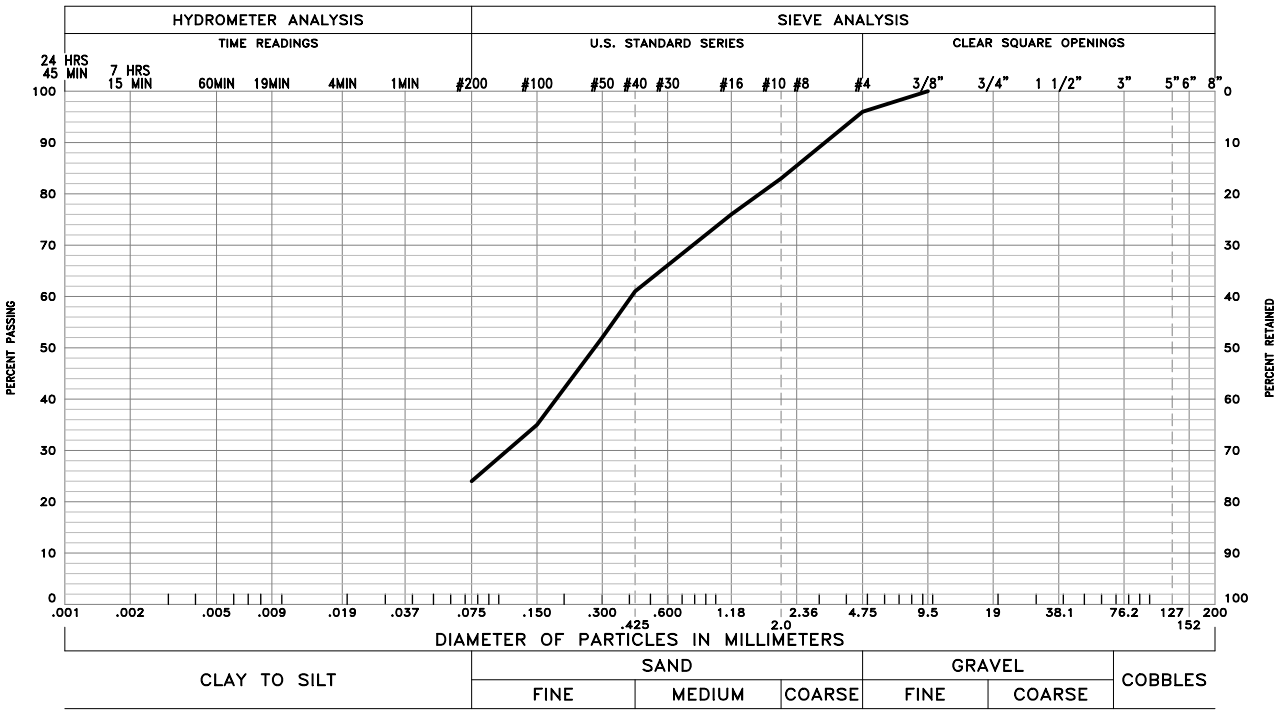
LIQUID LIMIT 32 PLASTICITY INDEX 18

SAMPLE OF: Well Graded Sand with Silt (SW-SM) FROM: Boring B4 @ 19'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



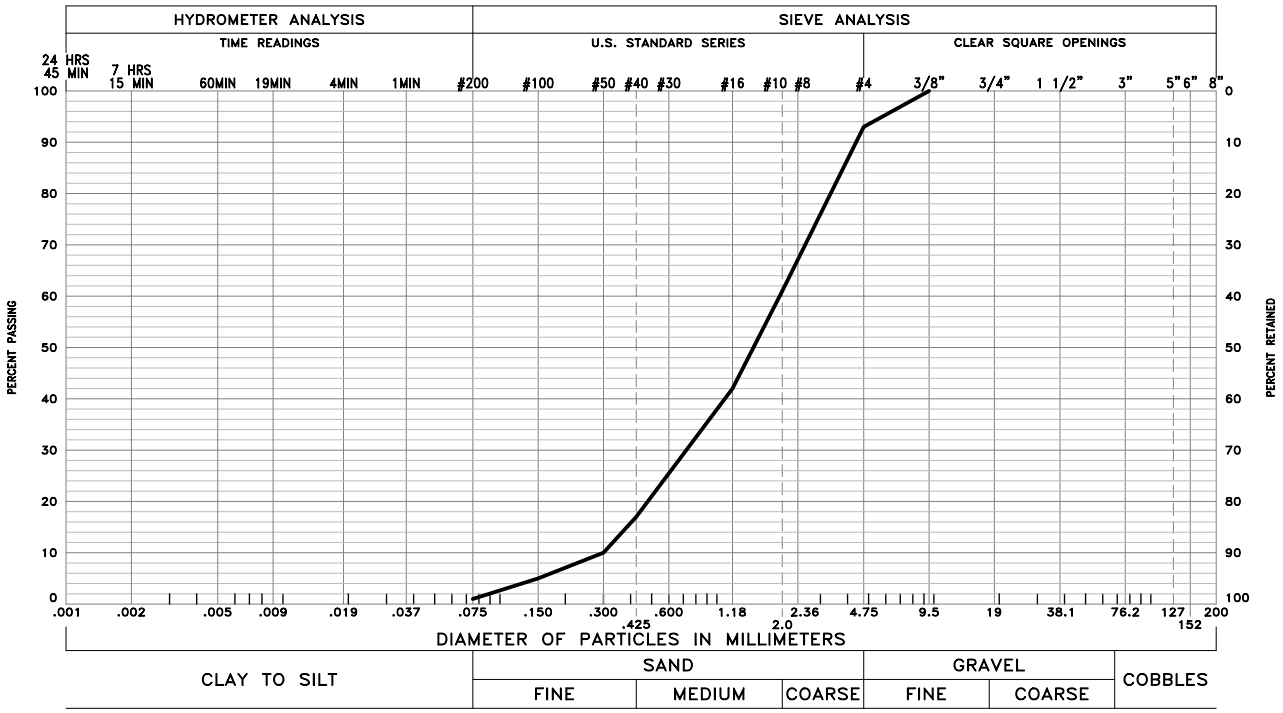
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GRAVEL 4 % SAND 72 % SILT AND CLAY 24 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring B5 @ 24'




GRAVEL 7 % SAND 92 % SILT AND CLAY 1 %

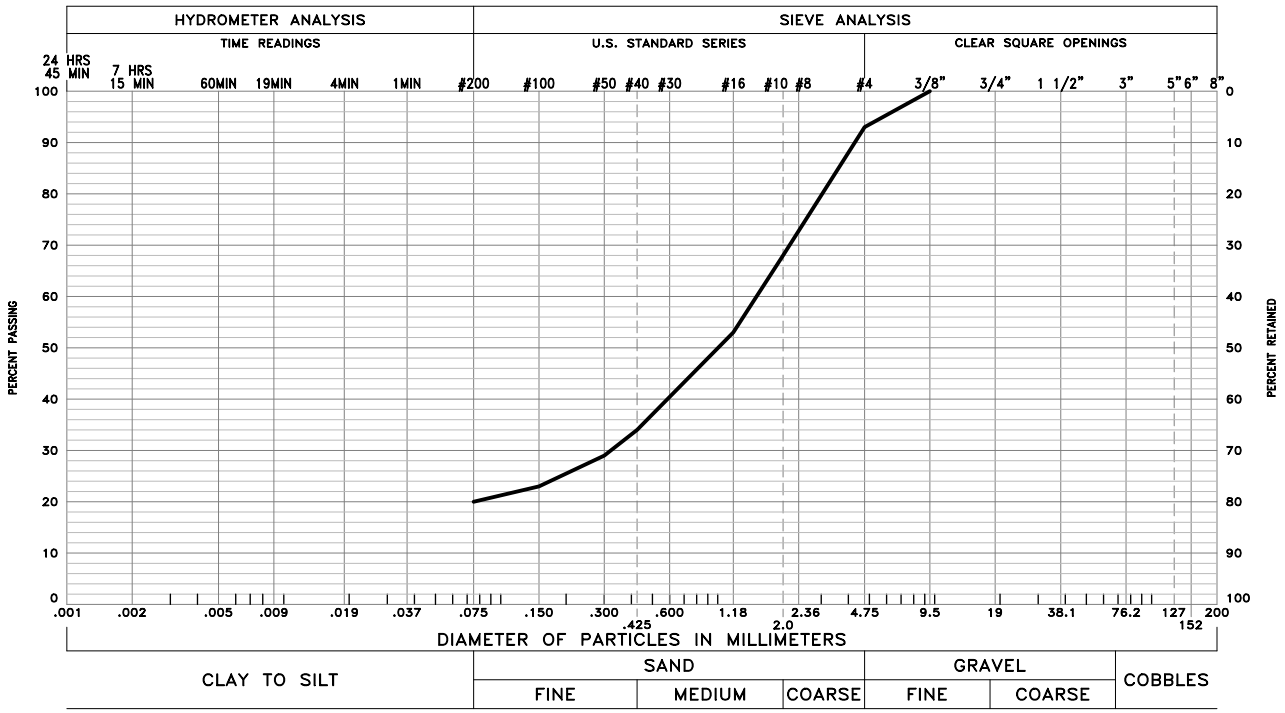
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Poorly Graded Sand (SP) FROM: Boring B6 @ 2'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



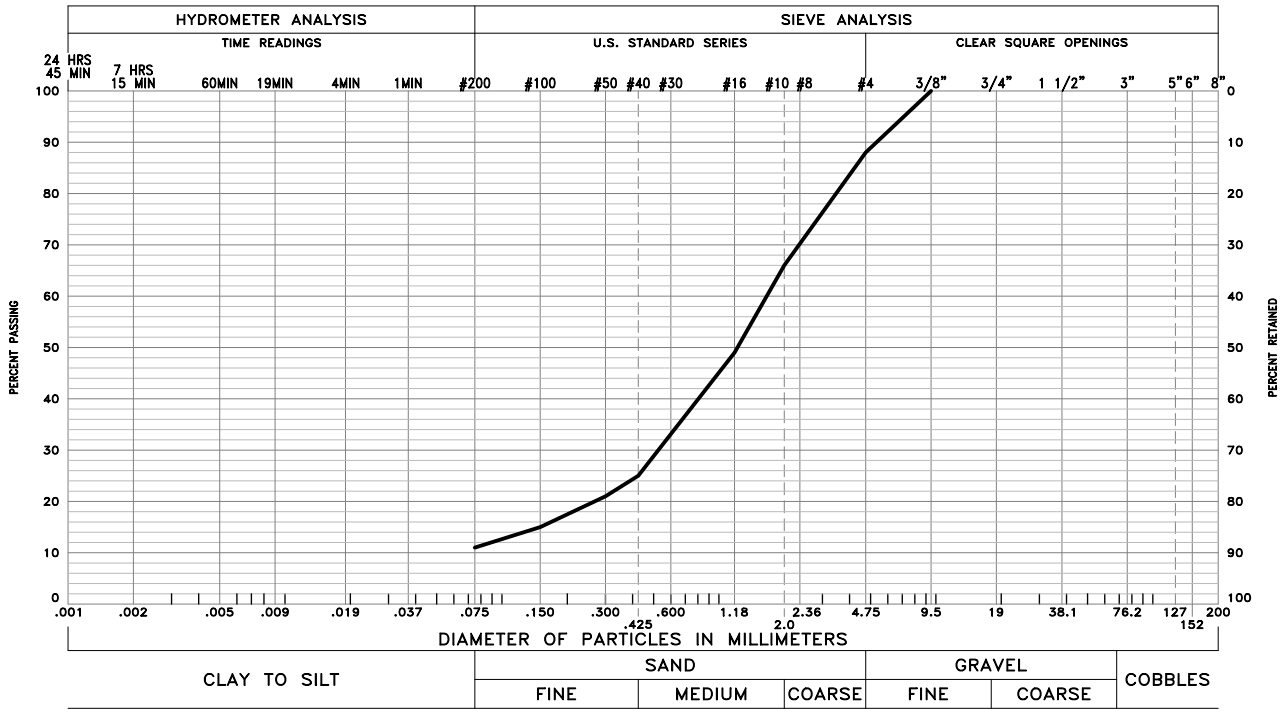
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GRAVEL 7 % SAND 73 % SILT AND CLAY 20 %

LIQUID LIMIT 29 PLASTICITY INDEX 14

SAMPLE OF: Clayey Sand (SC) FROM: Boring B6 @ 19'




GRAVEL 12 % SAND 67 % SILT AND CLAY 11 %

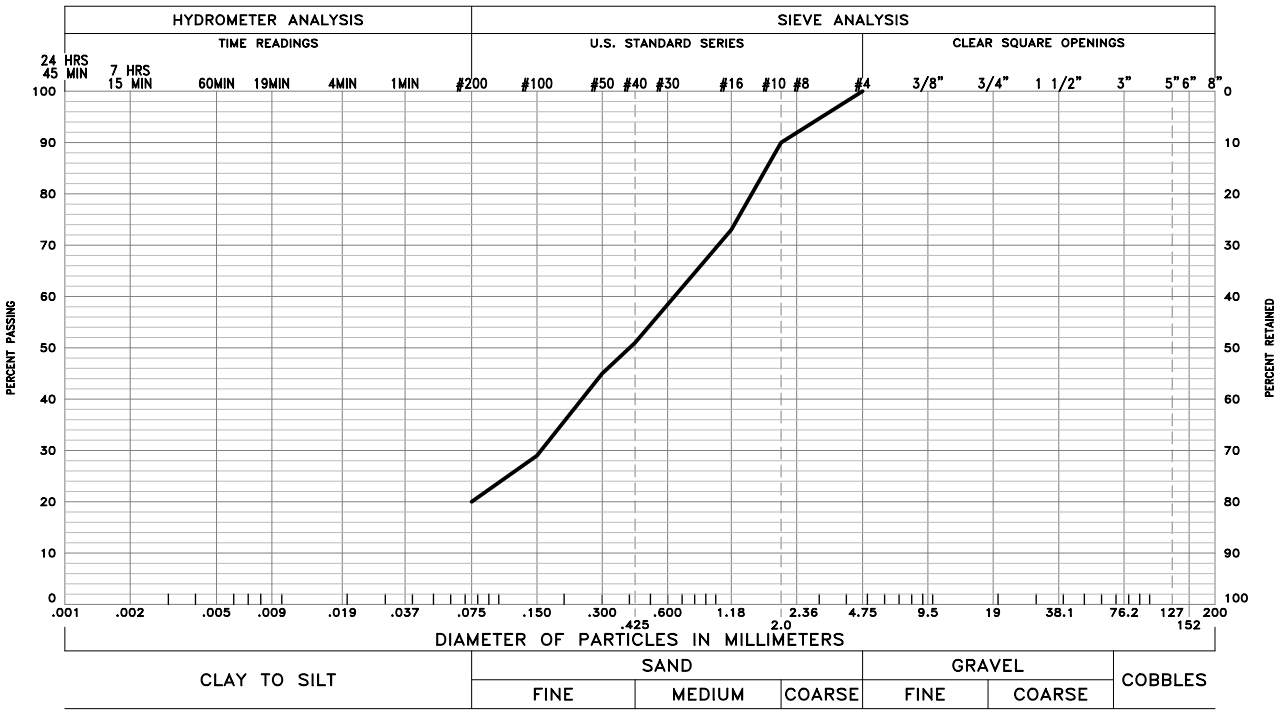
LIQUID LIMIT 25 PLASTICITY INDEX 11

SAMPLE OF: Well Graded Sand with Silt (SW-SM) FROM: Boring B7 @ 14'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 13 |
|---|---|---|---|

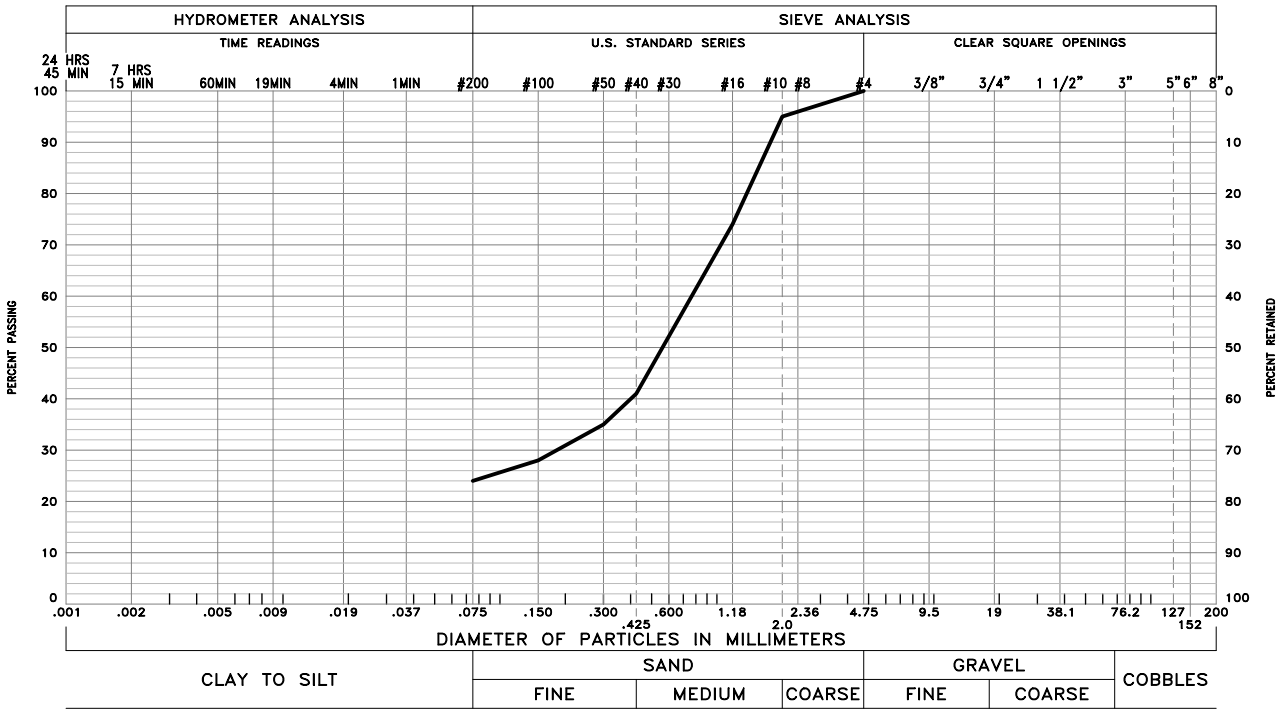
May 15, 2026 - 10:19am
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GRAVEL 0 % SAND 80 % SILT AND CLAY 20 %

LIQUID LIMIT 22 PLASTICITY INDEX 7

SAMPLE OF: Silty Clayey sand (SC-SM) FROM: Boring B7 @ 29'




GRAVEL 0 % SAND 76 % SILT AND CLAY 24 %

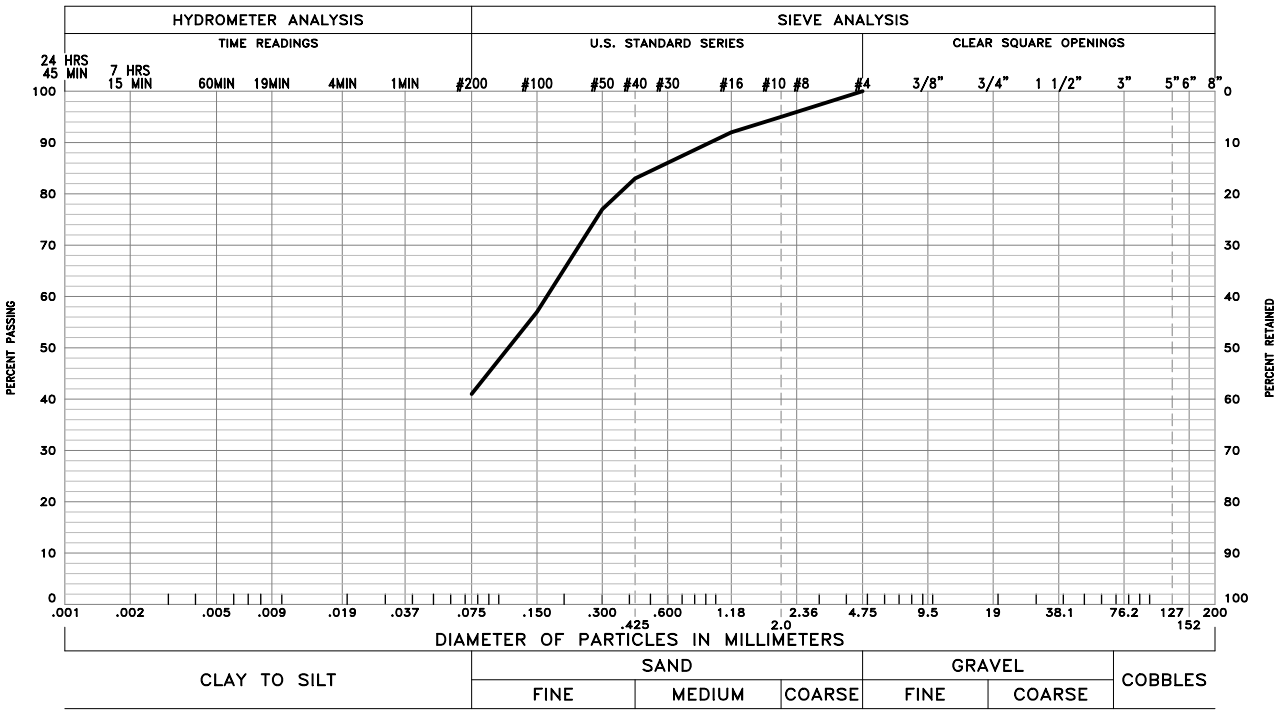
LIQUID LIMIT - PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring B7 @ 49'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 14 |
|---|---|---|---|

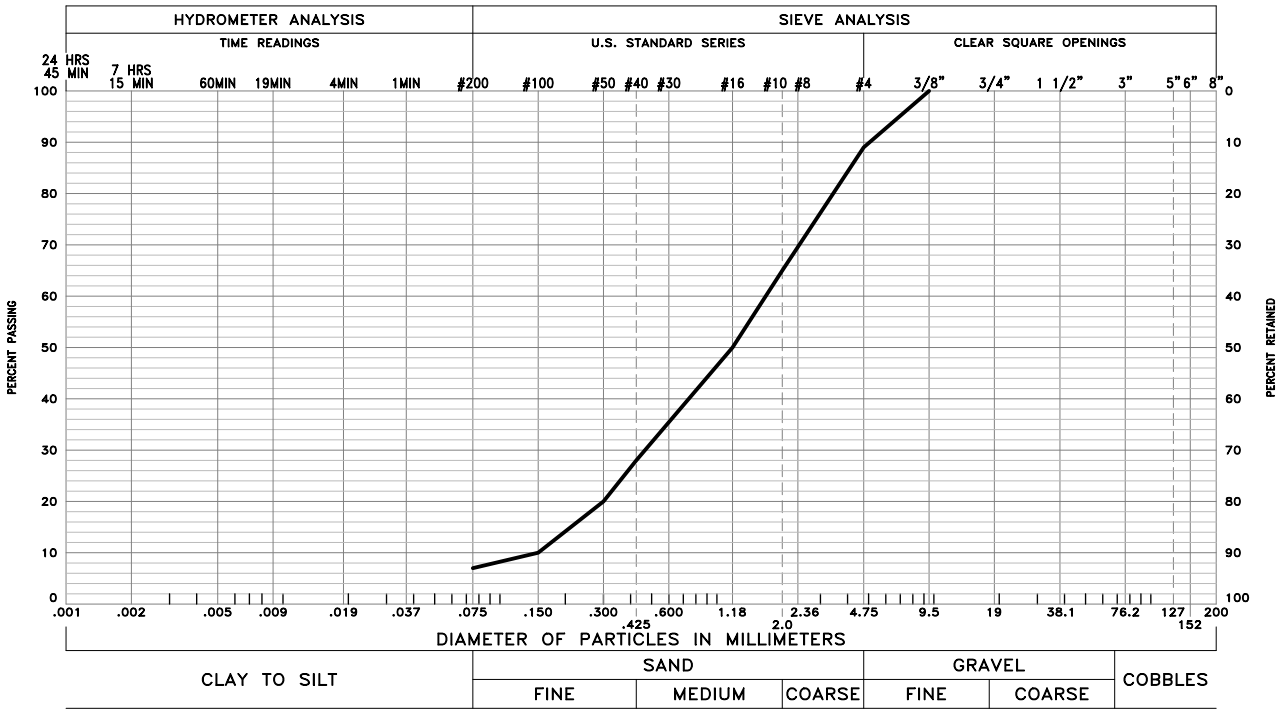
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GRAVEL 0 % SAND 59 % SILT AND CLAY 41 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring B8 @ 4'




GRAVEL 11 % SAND 82 % SILT AND CLAY 7 %

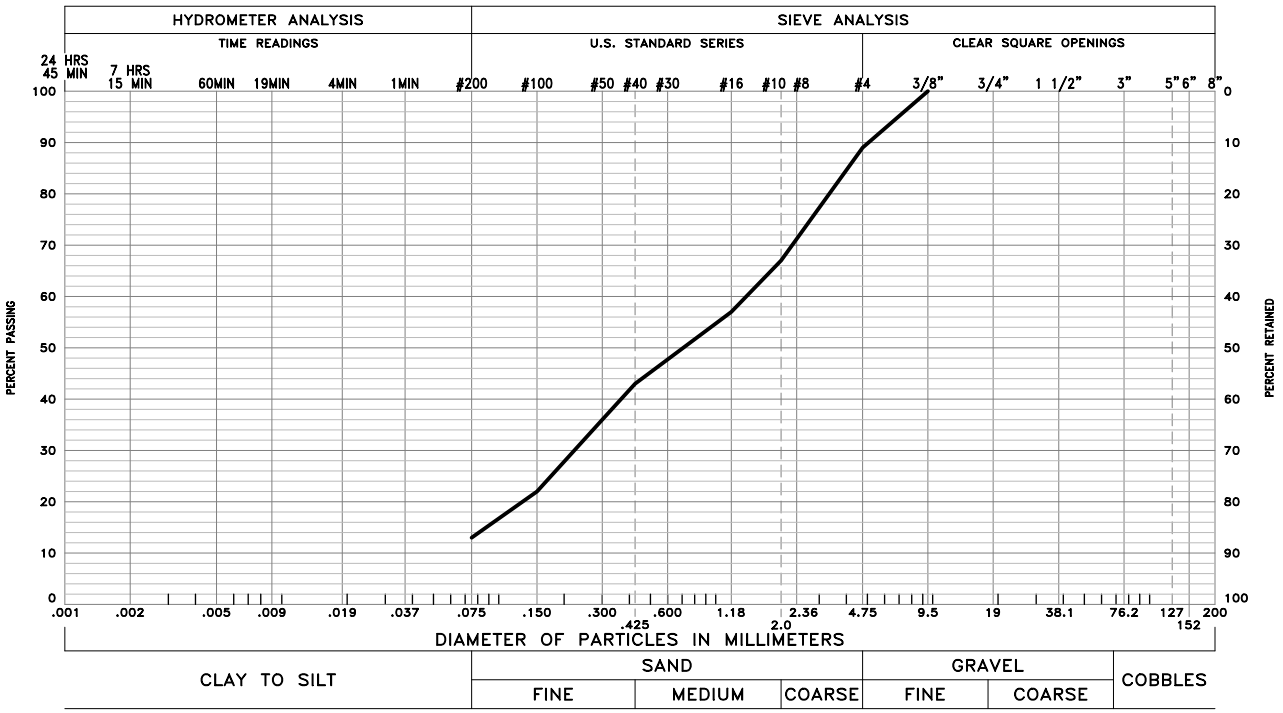
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Poorly Graded Sand with Silt (SP-SM) FROM: Boring B9 @ 24'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 15 |
|---|---|---|---|

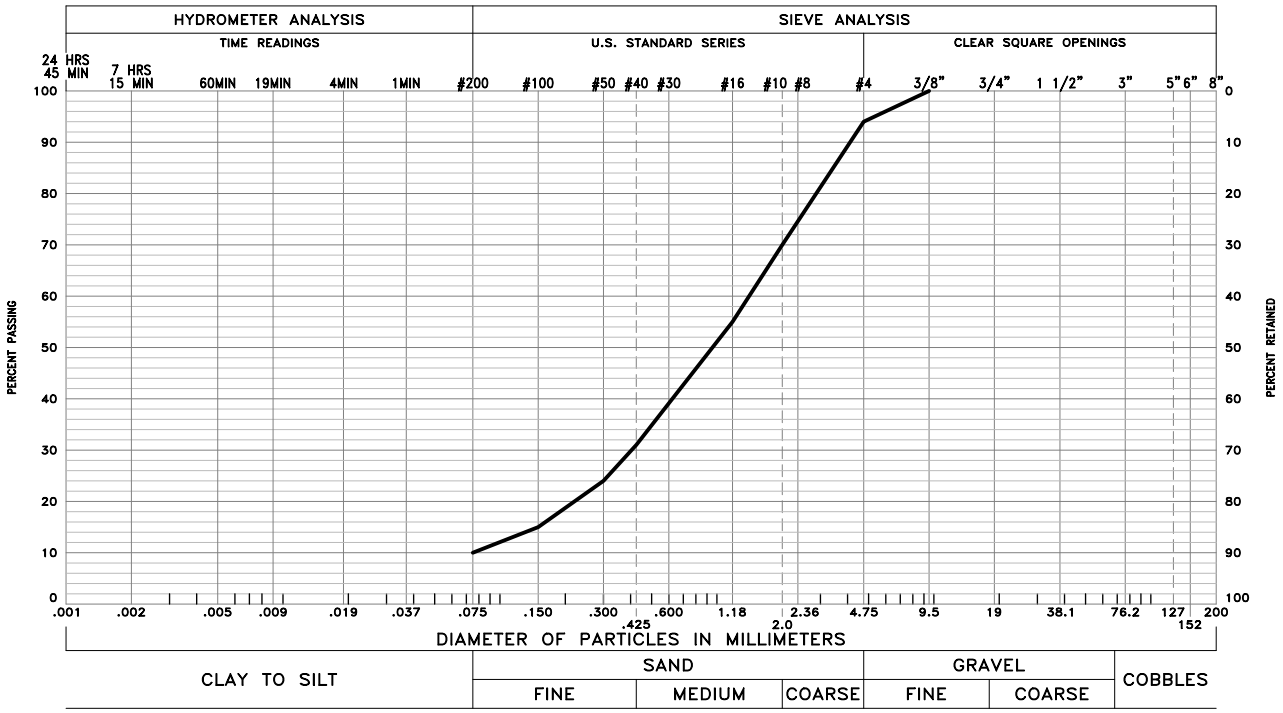
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GRAVEL 11 % SAND 76 % SILT AND CLAY 13 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Silty Sand (SM) FROM: Boring P1 @ 2'–4'




GRAVEL 6 % SAND 84 % SILT AND CLAY 10 %

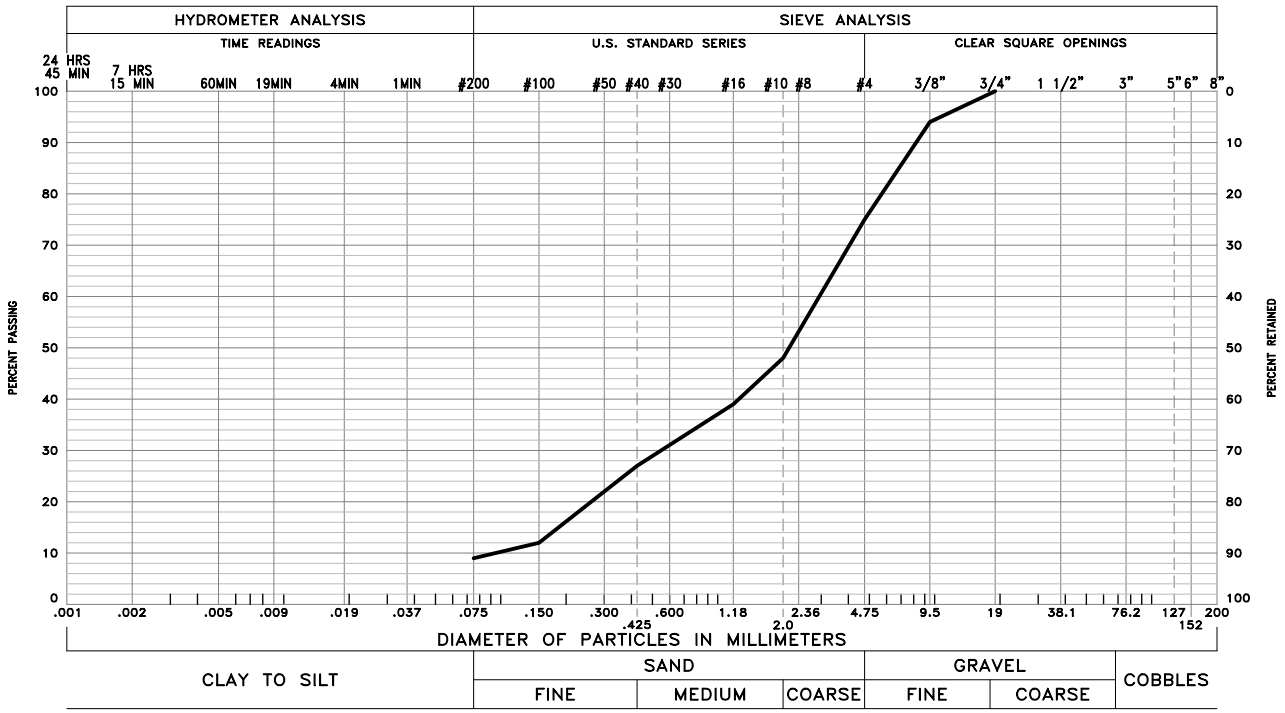
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt (SW–SM) FROM: Boring P2 @ 2'–4'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



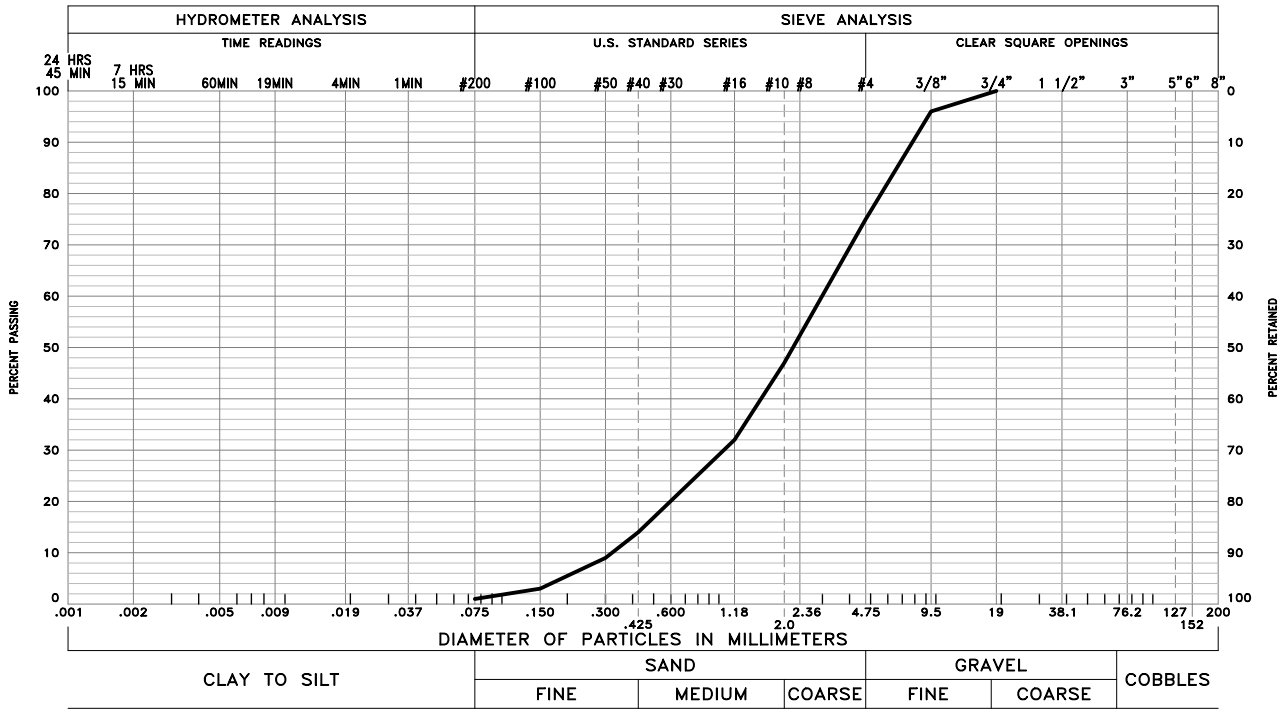
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GRAVEL 25 % SAND 66 % SILT AND CLAY 9 %

LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Silt & Gravel (SW-SM) FROM: Boring P3 @ 2'-4'




GRAVEL 25 % SAND 74 % SILT AND CLAY 1 %

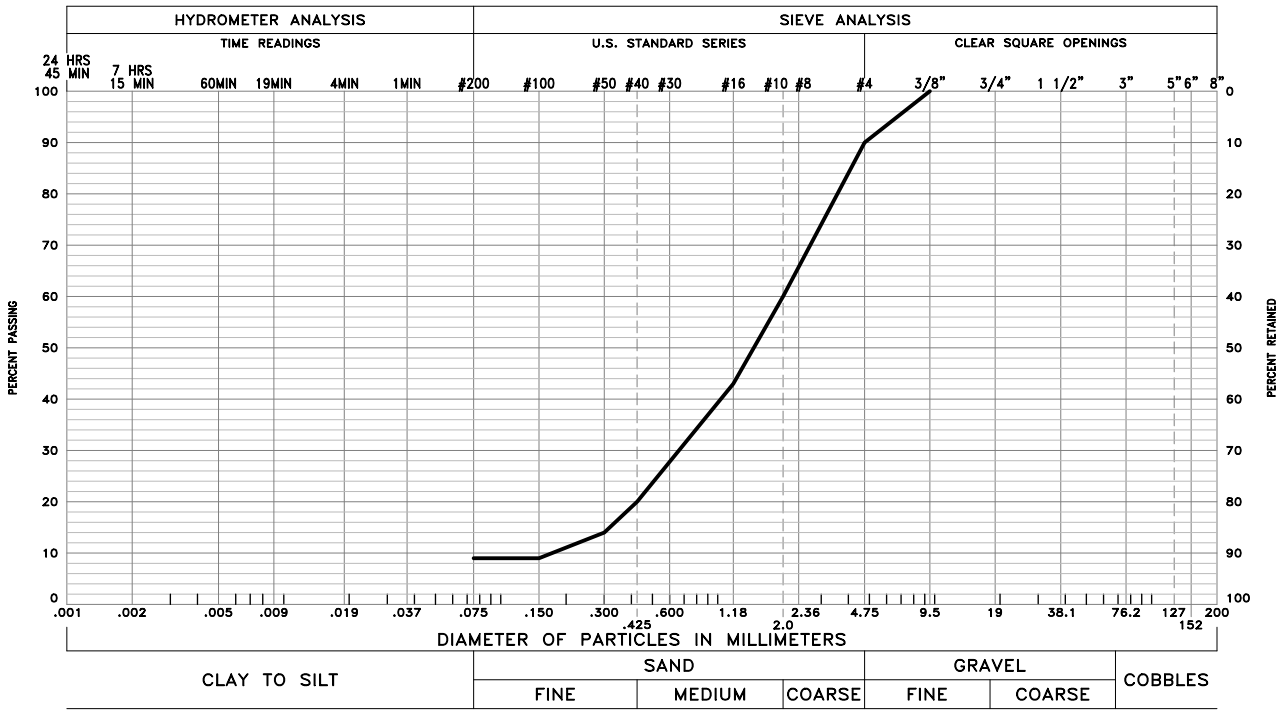
LIQUID LIMIT – PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand with Gravel (SW) FROM: Boring EX1 @ 4'-4.5'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 17 |
|---|---|---|---|

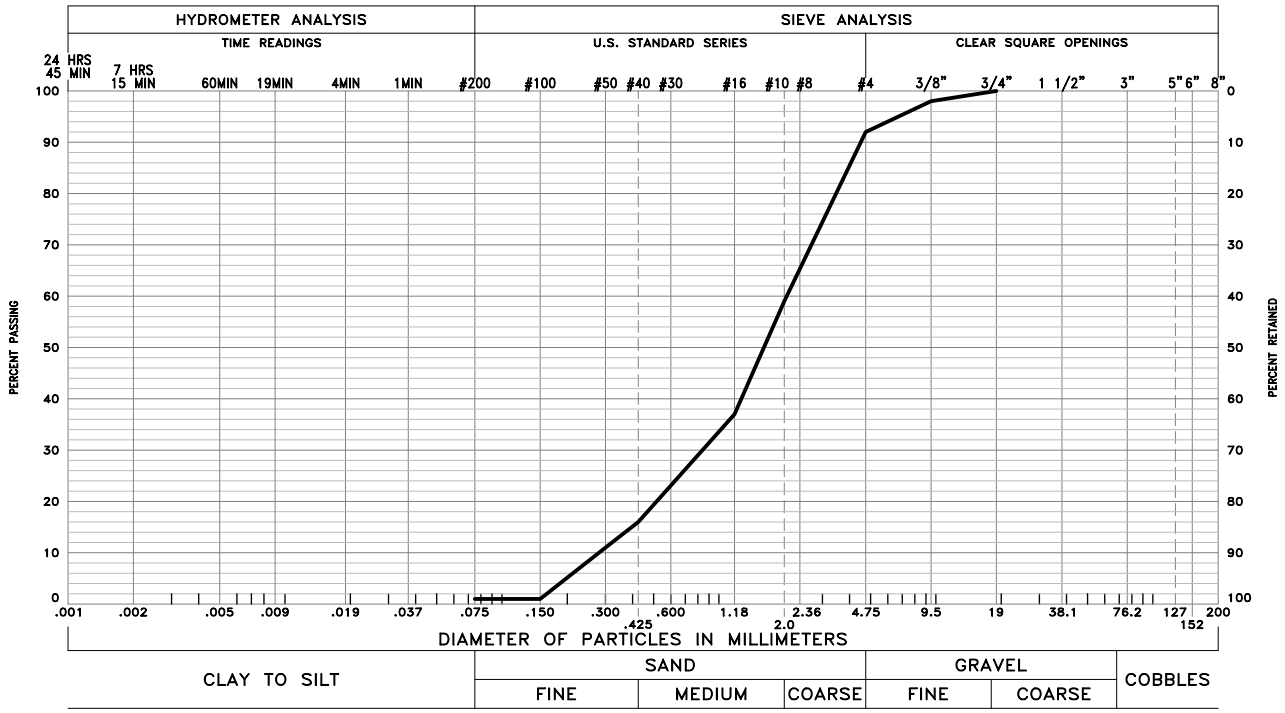
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GRAVEL 10 % SAND 81 % SILT AND CLAY 9 %

LIQUID LIMIT 25 PLASTICITY INDEX 12

SAMPLE OF: Well Graded Sand with Silt (SW-SM) FROM: Boring EX1 @ 6'-6.5'




GRAVEL 8 % SAND 91 % SILT AND CLAY 1 %

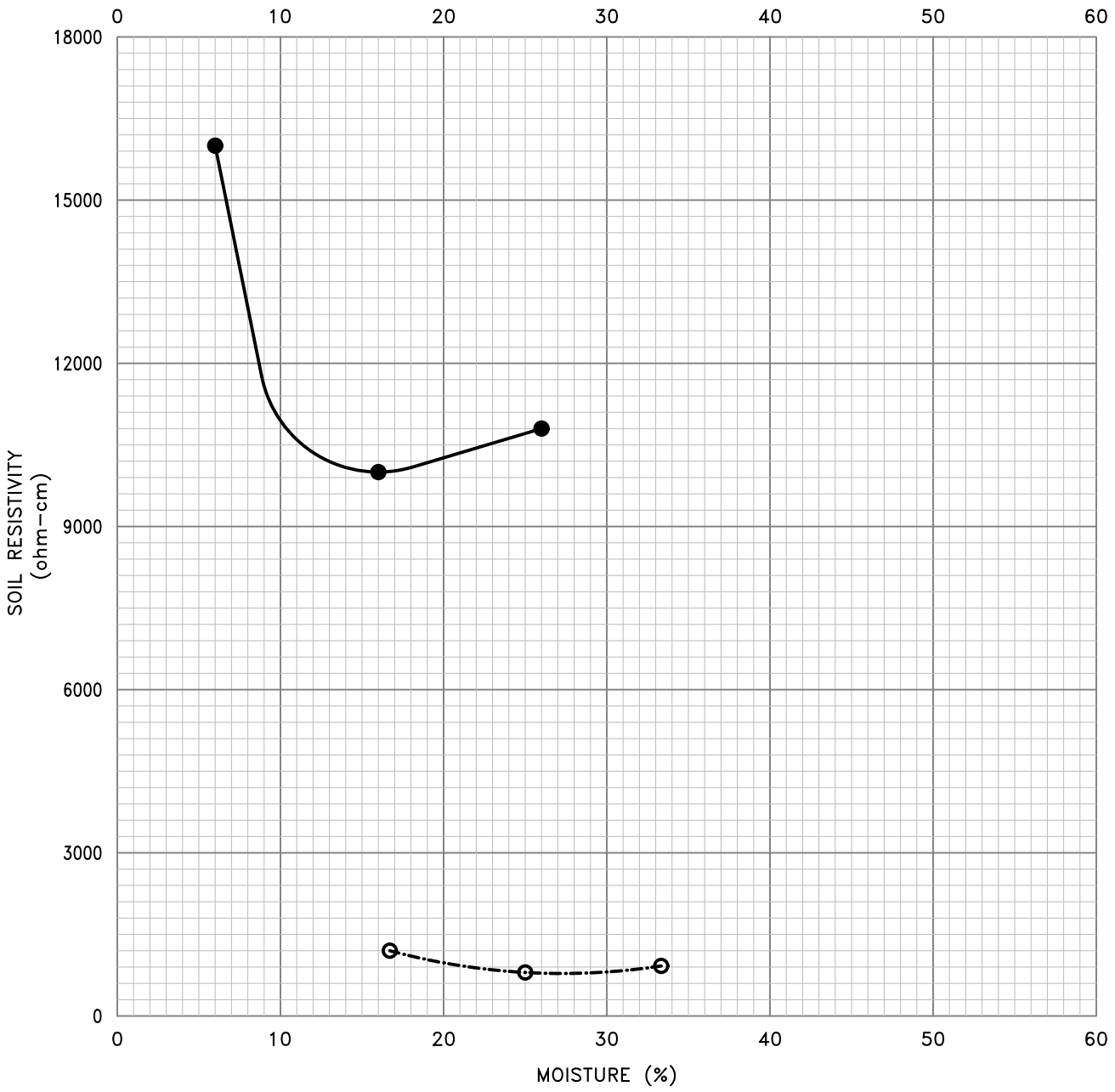
LIQUID LIMIT - PLASTICITY INDEX NP

SAMPLE OF: Well Graded Sand (SW) FROM: Boring EX2 @ 3'-3.5'

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

| 25-2-263 | Kumar & Associates | GRADATION TEST RESULTS | Fig. 18 |
|---|---|---|---|

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| CURVE SYMBOL | SAMPLE IDENTIFICATION | SOIL OR BEDROCK TYPE | MINIMUM RESISTIVITY (ohm-cm) | RESISTIVITY AT IN SITU MOISTURE CONTENT (ohm-cm) |
|---|---|---|---|---|
| ● | Boring 1 @ 9' | Well Graded Sand with Silt & Gravel (SW-SM) | 10,000 | 14,960 |
| ○ | Boring 7 @ 4' | Lean Clay (CL) | 800 | 865 |

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| 25-2-263 | Kumar & Associates | LABORATORY RESISTIVITY RESULTS | Fig. 19 |
|---|---|---|---|

# Kumar and Associates, Inc.

## TABLE I

## SUMMARY OF LABORATORY TEST RESULTS



Project No.: 25-2-263
Project Name: Cherokee Metropolitan District - PFAS Water Treatment Facility
Date Sampled: 4/20/2026 - 4/27/2026
Date Received: 4/22/2026 - 4/28/2026

| SAMPLE LOCATION | | DATE TESTED | NATURAL MOISTURE CONTENT (%) | NATURAL DRY DENSITY (pcf) | GRADATION | | PERCENT PASSING NO. 200 SIEVE | ATTERBERG LIMITS | | WATER SOLUBLE CHLORIDES (%) | MINIMUM ELECTRICAL RESISTIVITY (ohm-cm) | pH | WATER SOLUBLE SULFATES (%) | AASHTO CLASSIFICATION (Group Index) | SOIL OR BEDROCK TYPE (Unified Soil Classification) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BORING | DEPTH (ft) | | | | GRAVEL (%) | SAND (%) | | LIQUID LIMIT | PLASTICITY INDEX | | | | | | |
| B1 | 9 | 5/8/26 | 6.7 | 120.0 | 16 | 76 | 8 | | NP | 0.02 | 10,000 | 8.2 | < 0.01 | A-1-b (0) | Well Graded Sand w/Silt & Gravel (SW-SM) |
| | 14 | 5/8/26 | 2.9 | 123.7 | 26 | 62 | 12 | | NP | | | | | A-1-a (0) | Well Graded Sand w/Silt & Gravel (SW-SM) |
| | | | | | | | | | | | | | | | |
| B2 | 4 | 5/8/26 | 9.7 | 93.4 | | | 28 | | NP | | | | | A-2-4 (0) | Silty Sand (SM) |
| | 14 | 5/8/26 | 1.6 | 127.1 | 20 | 78 | 2 | | NP | | | | | A-1-a (0) | Well Graded Sand w/Gravel (SW) |
| | | | | | | | | | | | | | | | |
| B3 | 2 | 5/8/26 | 12.1 | 106.7 | | | 54 | 26 | 11 | | | | | A-6 (3) | Sandy Lean Clay (CL) |
| | 9 | 5/8/26 | 4.1 | 119.7 | 23 | 68 | 9 | | NP | | | | | A-1-b (0) | Well Graded Sand w/Silt & Gravel (SW-SM) |
| | 29 | 5/8/26 | 13.4 | 113.3 | | | 42 | 24 | 11 | | | | | A-6 (1) | Clayey Sand (SC) |
| | | | | | | | | | | | | | | | |
| B4 | 4 | 5/8/26 | 2.2 | 111.1 | 3 | 83 | 14 | | NP | | | | | A-1-b (0) | Silty Sand (SM) |
| | 19 | 5/8/26 | 6.1 | 128.6 | 0 | 89 | 11 | 32 | 18 | | | | | A-1-b (0) | Well Graded Sand w/Silt (SW-SM) |
| | | | | | | | | | | | | | | | |
| B5 | 4 | 5/8/26 | 15.6 | 99.8 | | | 47 | | NP | | | | | A-4 (0) | Silty Sand (SM) |
| | 24 | 5/8/26 | 8.3 | 125.6 | 4 | 72 | 24 | | NP | | | | | A-2-4 (0) | Silty Sand (SM) |
| | | | | | | | | | | | | | | | |
| B6 | 2 | 5/8/26 | 1.9 | 111.7 | 7 | 92 | 1 | | NP | | | | | A-1-b (0) | Poorly Graded Sand (SP) |
| | 19 | 5/8/26 | 6.3 | 126.1 | 7 | 73 | 20 | 29 | 14 | | | | | A-2-6 (0) | Clayey Sand (SC) |
| | | | | | | | | | | | | | | | |
| B7 | 4 | 5/8/26 | 22.5 | 96.7 | | | 89 | 35 | 15 | 0.02 | 800 | 8.2 | 0.04 | A-6 (13) | Lean Clay (CL) |
| | 14 | 5/8/26 | 4.9 | 129.4 | 12 | 67 | 11 | 25 | 11 | | | | | A-2-6 (0) | Well Graded Sand w/Silt (SW-SM) |
| | 29 | 5/8/26 | 7.5 | 126.4 | 0 | 80 | 20 | 22 | 7 | | | | | A-2-4 (0) | Silty Clayey Sand (SC-SM) |
| | 49 | 5/8/26 | 6.1 | 119.5 | 0 | 76 | 24 | | NP | | | | | A-1-b (0) | Silty Sand (SM) |

# Kumar and Associates, Inc.

## TABLE I

## SUMMARY OF LABORATORY TEST RESULTS



Project No.: 25-2-263
Project Name: Cherokee Metropolitan District - PFAS Water Treatment Facility
Date Sampled: 4/20/2026 - 4/27/2026
Date Received: 4/22/2026 - 4/28/2026

| SAMPLE LOCATION | | DATE TESTED | NATURAL MOISTURE CONTENT (%) | NATURAL DRY DENSITY (pcf) | GRADATION | | PERCENT PASSING NO. 200 SIEVE | ATTERBERG LIMITS | | WATER SOLUBLE CHLORIDES (%) | MINIMUM ELECTRICAL RESISTIVITY (ohm-cm) | pH | WATER SOLUBLE SULFATES (%) | AASHTO CLASSIFICATION (Group Index) | SOIL OR BEDROCK TYPE (Unified Soil Classification) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BORING | DEPTH (ft) | | | | GRAVEL (%) | SAND (%) | | LIQUID LIMIT | PLASTICITY INDEX | | | | | | |
| B8 | 4 | 5/8/26 | 10.0 | 106.8 | 0 | 59 | 41 | | NP | | | | 0.01 | A-4 (0) | Silty Sand (SM) |
| | | | | | | | | | | | | | | | |
| B9 | 2 | 5/8/26 | 18.8 | 100.8 | | | 74 | 35 | 19 | | | | | A-6 (12) | Lean Clay w/Sand (CL) |
| | 24 | 5/8/26 | 2.6 | 114.9 | 11 | 82 | 7 | | NP | | | | | A-1-b (0) | Poorly Graded Sand w/Silt (SP-SM) |
| | | | | | | | | | | | | | | | |
| P1 | 2 - 4 | 5/8/26 | | | 11 | 76 | 13 | | NP | | | | | A-1-b (0) | Silty Sand (SM) |
| | | | | | | | | | | | | | | | |
| P2 | 2 - 4 | 5/8/26 | | | 6 | 84 | 10 | | NP | | | | | A-1-b (0) | Well Graded Sand w/Silt (SW-SM) |
| | | | | | | | | | | | | | | | |
| P3 | 2 - 4 | 5/8/26 | | | 25 | 66 | 9 | | NP | | | | | A-1-a (0) | Well Graded Sand w/Silt & Gravel (SW-SM) |
| | | | | | | | | | | | | | | | |
| EX1 | 2 | 5/8/26 | 1.8 | 109.7 | | | | | | | | | | | Well Graded Sand w/Silt (SW-SM) |
| | 4 | 5/8/26 | 3.2 | 107.2 | | | | | | | | | | | Well Graded Sand w/Silt (SW-SM) |
| | 4 - 4.5 | 5/8/26 | | | 25 | 74 | 1 | | NP | | | | | A-1-a (0) | Well Graded Sand w/Gravel (SW) |
| | 6 - 6.5 | 5/8/26 | | | 10 | 81 | 9 | 25 | 12 | | | | | A-2-6 (0) | Well Graded Sand w/Silt (SW-SM) |
| | | | | | | | | | | | | | | | |
| EX2 | 2 | 5/8/26 | 2.0 | 113.2 | | | | | | | | | | | Well Graded Sand w/Silt (SW-SM) |
| | 4 | 5/8/26 | 3.7 | 113.4 | | | | | | | | | | | Well Graded Sand w/Silt (SW-SM) |
| | 3 - 3.5 | 5/8/26 | | | 8 | 91 | 1 | | NP | | | | | A-1-b (0) | Well Graded Sand (SW) |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |