# GEOTECHNICAL ENGINEERING INVESTIGATION
# HMP ADVENTURE PLAY AREA PROJECT
# BAKERSFIELD, KERN COUNTY, CALIFORNIA

BSK PROJECT G00-000-166

PREPARED FOR:

KERN COUNTY CONSTRUCTION SERVICES
1115 TRUXTUN AVENUE, 3RD FLOOR
BAKERSFIELD, CALIFORNIA 93301

DECEMBER 12, 2022

# GEOTECHNICAL ENGINEERING INVESTIGATION
# HMP ADVENTURE PLAY AREA PROJECT
# BAKERSFIELD, KERN COUNTY, CALIFORNIA

Prepared for:

Michael Woodruff
Engineering Technician III
Kern County Construction Services
1115 Truxtun Avenue, 3rd Floor
Bakersfield, California 93301

Bakersfield Project: G00000-166

December 12, 2022

Prepared by:


Logan Prosser, PG
Project Geologist

Adam Terronez, PE, GE
Bakersfield Branch Manager


**BSK Associates**
700 22nd Street
Bakersfield, California 93301
(661) 327-0671
(661) 324-4218 FAX

Distribution: Client (Email: [woodruffm@kerncounty.com])

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# 1. INTRODUCTION

This report presents the results of a Geotechnical Engineering Investigation Report conducted by BSK Associates (BSK) for the Hart Memorial Park (HMP) Adventure Play Area Project in Bakersfield, California (site). The site is located at the existing Hart Memorial Park at the intersection of Lake Road and Levee Drive in northeast Bakersfield, as shown on the Site Vicinity Map, Figure A-1. The geotechnical engineering investigation was conducted in accordance with BSK Proposal GB22-23381, dated February 14, 2022.

## 1.1. Planned Construction

BSK understands that in addition to the new playground structures, other site improvements are to be constructed; these improvements include new restrooms, parking lots, and paved pathways. BSK understands that the structural load of the play equipment is anticipated to be light.

This report provides a description of the geotechnical conditions at the site and provides specific recommendations for earthwork and foundation design with respect to the planned structures. In the event that changes occur in the design of the project, this report's conclusions and recommendations will not be considered valid unless the changes are reviewed with BSK and the conclusions and recommendations are modified or verified in writing. Examples of such changes would include location, size of structures, foundation loads, etc.

## 1.2. Purpose and Scope of Services

The objective of this geotechnical investigation was to characterize the subsurface conditions in the areas of the proposed structures and provide geotechnical engineering recommendations for the preparation of plans and specifications and bearing and lateral earth pressure conditions. The scope of the investigation included a field exploration, laboratory testing, engineering analyses, and preparation of this report.

# 2. FIELD INVESTIGATION AND LABORATORY TESTING

## 2.1. Field Exploration

The field exploration for this investigation was conducted under the oversight of a BSK Geologist. Seven (7) borings were drilled at the site on November 14, 2022 using a CME 95 Drill Rig provided by Baja Exploration to varying depths from 5- to 51.5-feet beneath existing ground surface (bgs). The approximate boring locations are presented on the Boring Location Map, Figure A-2.

The soil materials encountered in the borings were visually classified in the field, and the logs were recorded during the drilling and sampling operations. Visual classification of the materials encountered in the borings were made in general accordance with the Union Soil Classification System (ASTM D 2488). Boring logs are presented in Appendix A and these documents should be consulted for more details concerning subsurface conditions. Stratification lines were approximated by the field staff based on observations made at the time of drilling, while the actual boundaries between soil types may be gradual and soil conditions may vary at other locations.

### 2.2 Laboratory Testing

Laboratory tests were performed on selected soil samples to evaluate moisture content, dry density, shear strength, collapse potential, moisture-density relationship, R-Value, and corrosion characteristics. A description of the laboratory test methods and results are presented in Appendix B.

## 3. SITE GEOLOGY/SEISMICITY CONDITIONS

The following sections address the site descriptions and surface conditions, regional geology and seismic hazards, subsurface conditions, and groundwater conditions at the site. This information is based on BSK's field exploration and published maps and reports.

### 3.1. Site Description and Surface Conditions

The site is located at southeast of the corner of Lake Road and Levee Drive at the existing Hart Memorial Park. The Site surface is currently grass, with a small existing playground adjacent to the drilling sites. The WGS84 GPS coordinates for the approximate center of the site are 35.448226, -118.909721.

### 3.2 Regional Geology and Seismic Hazards Assessment

Our Scope of services included a review of published maps and reports to assess the regional geology and potential for seismic hazards.

#### *3.2.1 Regional Geology*

The site is located in the in the Great Valley California Geomorphic Province. The Great Valley is an alluvial plain about 50-miles wide and 400 miles long in the central part of California. Its northern part is the Sacramento Valley, drained by the Sacramento River and its southern part is the San Joaquin Valley drained by the San Joaquin River. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic (about 160 million years ago). Great oil fields have been found in southernmost San Joaquin Valley and along anticlinal uplifts on its southwestern margin.

#### *3.2.2 Seismic Hazards Assessment*

The types of geologic and seismic hazards assessed include surface ground fault rupture, liquefaction, seismically induced settlement, slope failure, flood hazards and inundation hazards.

The purpose of the Alquist-Priolo Geologic Hazards Zones Act, as summarized in CDMG Special Publication 42 (SP 42), is to "prohibit the location of most structures for human occupancy across the traces of active faults and to mitigate thereby the hazard of fault-rupture." As indicated by SP 42, "the State Geologist is required to delineate "Earthquake Fault Zones" (EFZs) along known active faults in California. Cities and counties affected by the zones must regulate certain development 'projects' within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting.

The Site is not located in an Earthquake Fault Zone. The closest Earthquake Fault Zone is associated with ground breaks from the 1952 Kern County Earthquake, located approximately 1.75-miles north of the Site. Other nearby Earthquake Fault Zones are associated with the Kern Front Fault Zone and the

White Wolf Fault Zone, located approximately 6.47-miles northeast and 18.3-miles southeast of the Site, respectively.

Zones of Required Investigation referred to as "Seismic Hazard Zones" in CCR Section 3722, are areas shown on Seismic Hazard Zone Maps where Site investigations are required to determine the need for mitigation of potential liquefaction and/or earthquake-induced landslide ground displacements. There are no mapped areas that have Seismic Hazard Zones in the project area.

### 3.3 Subsurface Conditions

The subsurface material generally consisted of varied layers of silty sand and sands, with occasional gravel and smaller cobbles to the maximum explored depths of 51.5-feet bgs. Boring logs in Appendix A provide a more detailed description of the materials encountered, including the applicable Unified Soil Classification System symbols.

Based on the results of the consolidation tests, the sandy on-site soils in the upper 5-feet are considered to have a low potential for hydrocompaction.

### 3.4 Groundwater Conditions

Groundwater was encountered at the time of drilling on November 14, 2022. At Boring B-1, which is closest to the adjacent Hart Park Lake, the depth to groundwater was approximately 9-feet bgs. Groundwater was observed at depths of 12-feet and 13.5-feet bgs in Borings B-2 and B-3, respectively.

Please note that the groundwater level may fluctuate both seasonally and from year to year due to variations in rainfall, temperature, distance from Hart Park Lake, pumping from wells and possibly as the result of other factors such as irrigation, that were not evident at the time of our investigation.

## 4. CONCLUSIONS AND RECOMMENDATIONS

Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the soil conditions would not preclude the construction of the proposed improvements.

The proposed improvements may be supported on shallow or mat foundations if the recommendations presented herein are incorporated into the design and construction of the project. The contractor should be advised that caving soils will likely be a factor during site excavations due to the loose sandy soils present onsite.

### 4.1 Seismic Design Criteria

Based on Section 1613.3.2 of the 2019 California Building Code (CBC), the Site shall be classified as Site Class A, B, C, D, E or F based on the Site soil properties and in accordance with Chapter 20 of ASCE 7-16. Based on the “N” values from our soil borings, as per Table 20.3-1 of ASCE 7-10, the Site is Class D ($15 \leq N \leq 50$).

The 2019 CBC utilizes ground motion based on the Risk-Targeted Maximum Considered Earthquake (MCER) that is defined in the 2019 CBC as the most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk. Ground motion parameters in the 2019 CBC are based on ASCE 7-16, Chapter 11.

The Structural Engineers Associates of California (SEAOC) has prepared maps presenting the Risk-Targeted MCE spectral acceleration (5 percent damping) for periods of 0.2 seconds ($S_S$) and 1.0 seconds ($S_1$). The values of $S_S$ and $S_1$ can be obtained from the Occupational Safety Health Planning and Development (OSHPD) Seismic Design Maps Tool at: https://seismicmaps.org/.

The OSHPD Seismic Design Maps Tool and Chapter 16 of the 2019 CBC based on ASCE 7-10 produced the spectral acceleration parameters risk targeted maximum considered earthquake values in Table 1 based on Site Class D conditions.

As per Section 1803.5.12 of the 2019 CBC, peak ground acceleration (PGA) utilized for dynamic lateral earth pressures and liquefaction, shall be based on a site-specific study (ASCE 7-16, Section 21.5) or ASCE 7-16, Section 11.8.3. The OSHPD Seismic Design Maps Tool and based on ASCE 7-16, Section 11.8.3 produced the Geometric Mean PGA value in Table 1 based on Site Class D conditions.

**Table 1: Seismic Design Parameters**

| Seismic Design Parameter | 2019 CBC Value | | Reference |
|---|---|---|---|
| MCE Mapped Spectral Acceleration (g) | $S_S$ = 0.887 | $S_1$ = 0.317 | USGS Mapped Value |
| Amplification Factors (Site Class D) | $F_a$ = 1.145 | $F_v$ = null[1](1.983)[2] | ASCE Table 11.4 |
| Site Adjusted MCE Spectral Acceleration (g) | $S_{MS}$ = 1.016 | $S_{M1}$ = null[1](0.629)[2] | ASCE Equations 11.4.1-2 |
| Design Spectral Acceleration (g) | $S_{DS}$ = 0.677 | $S_{D1}$ = null[1] (0.419)[2] | ASCE Equations 11.4.1-4 |
| Geometric Mean PGA (g) | $PGA_M$ = 0.466 | | Section 11.8.3, ASCE 7-16 |
| Site Short Period – $T_s$ (seconds) | $T_s$ = 0.619 | | $T_s = S_{D1}/ S_{DS}$ |
| Site Long Period – $T_L$ (seconds) | $T_L$ = 12 | | USGS Mapped Value |

Notes: [1] Requires site-specific ground motion procedure or exception as per ASCE 7-16 Section 11.48

[2] Values from ASCE 7-16 supplement, shall only be used to calculate $T_s$

## 4.2 Soil Corrosivity

A surface soil sample obtained from the site was tested to provide a preliminary screening of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts. The test results are presented in Appendix B.

The corrosivity evaluation was performed by BSK on a soil sample obtained at the time of drilling. The soil was evaluated for minimum resistivity (ASTM G57), pH (ASTM D4972), and soluble sulfate and chlorides (ASTM D4327). At Boring B-3, the minimum resistivity was 3,900 ohm-com, pH was 6.20, sulfate and chloride were both below detectable limits.

The water-soluble sulfate content severity class is considered not severe to concrete (Exposure Category S0 per Table 19.3.1.1 of ACI 318-14). A representative sample of the site soil in the vicinity has a minimum resistivity of 3,900 ohm-cm which is considered severely corrosive to buried metal conduit. Therefore, buried metal conduits, ferrous metal pipes, and exposed steel should have a protective coating in accordance with the manufacturer's specification.

### 4.3 Site Preparation Recommendations

The following procedures must be implemented during site preparation for the proposed site improvements. References to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D-1557 (latest test revision) laboratory test procedures.

1. The areas of proposed improvements must be cleared of any encountered subsurface vegetation and debris. Materials resulting from the clearing and stripping operations must be removed and properly disposed of off-site. In addition, all undocumented fills should be removed where encountered and where fills or structural improvements will be placed. BSK recommends 2-feet of engineered fill below shallow foundations. Over excavation should extend laterally 3-feet beyond the edge of foundations for shallow footings. Yielding areas should be observed by the geotechnical consultant and removed and recompacted if necessary.
2. Where existing utilities, inlets, or underground tanks are present, they should be removed to a point at least 3-feet horizontally outside the proposed foundation and pavement areas. Resultant cavities must be backfilled with engineered fill compacted in accordance with the recommendations presented in this report.
3. Following the stripping operations, the areas where shallow foundations are proposed must be overexcavated to a minimum depth of 2-feet below existing site grades or 2-foot below the bottom of the footing elevation, whichever is deeper. After overexcavation, the bottom of the exposed soil should be scarified 12-inches, moisturized to optimum moisture content, and compacted to 90% of ASTM D-1557. We recommend that non-expansive soil (EI < 20) be used below the bottom of shallow foundations.
4. Following the required stripping and overexcavation, in the areas of proposed shallow foundations, the exposed ground surface at the bottom of the overexcavation must be inspected by the Geotechnical Engineer to evaluate if loose or soft zones are present that will require additional overexcavation.
5. Imported soil or native excavated soils, free of organic materials or deleterious substances, may be placed as compacted engineered fill. The material must be free of oversized fragments greater than 3-inches in greatest dimension. Engineered fill underneath and extending 3-feet beyond the structure foundations and must be placed in uniform layers not exceeding 8-inches in loose thickness, moisture conditioned to within 2- to 4-percent above optimum moisture content and compacted to at least 90-percent relative compaction. Engineered fill placed on fill

slopes must be placed in uniform layers not exceeding 8-inches in loose thickness, moisture conditioned to within 2-percent of optimum moisture content, and compacted to at least 90 percent of relative compaction.

6. BSK must be called to the site to verify the import material properties through laboratory testing.
7. If possible, earthwork operations should be scheduled during a dry, warm period of the year. Should these operations be performed during or shortly following periods of inclement weather, unstable soil conditions may result in the soils exhibiting a "pumping" condition. This condition is caused by excess moisture in combination with moving construction equipment, resulting in saturation and zero air voids in the soils. If this condition occurs, the adverse soils will need to be over-excavated to the depth at which stable soils are encountered and replaced with suitable soils compacted as engineered fill. Alternatively, the Contractor may proceed with grading operations after utilizing a method to stabilize the soil subgrade, which should be subject to review and approval by BSK prior to implementation.
8. Import fill materials must be free from organic materials or deleterious substances. The project specifications must require the contractor to contact BSK to review the proposed import fill materials for conformance with these recommendations at least one week prior to importing to the site, whether from on-site or off-site borrow areas. Imported fill soils must be non-hazardous and derived from a single, consistent soil type source conforming to the following criteria:

| | |
|---|---|
| Plasticity Index: | < 12 |
| Expansion Index: | < 20 (Very Low Expansion Potential) |
| Maximum Particle Size: | 3 inches |
| Percent Passing #4 Sieve: | 65 - 100 |
| Percent Passing #200 Sieve: | 20 - 45 |
| Low Corrosion Potential: | Soluble Sulfates < 1,500 ppm |
| | Soluble Chlorides < 150 ppm |
| | Minimum Resistivity > 3,000 ohm-cm |

## 4.4 Foundations

Provided the recommendations contained in this report are implemented during design and construction, it is our opinion that the structures can be supported on concrete slabs-on-grade, shallow foundational spread footings, or mat foundations. A structural engineer should evaluate reinforcement, embedment depth and foundation dimensions based on the requirements for the structural loadings, shrinkage and temperature stresses.

### *4.4.1 Shallow Foundations*

Continuous and isolated spread footings must have a minimum width of 12-inches and 24-inches, respectively. Continuous footing foundations may be designed using a net allowable bearing pressure of 3,000 pounds per square foot (psf). Isolated spread footing foundations may be designed using a net allowable bearing pressure of 2,700 psf. The net allowable bearing pressure applies to the dead load plus live load (DL + LL) condition; it may be increased by 1/3 for wind or seismic loads. Total foundation

settlements are expected to be less than 0.5-inches and differential settlements between similarly loaded (DL + LL) and sized footings are anticipated to be less than 0.25-inches. Differential settlement of continuous footings, expressed in terms of angular distortion, is estimated to be approximately 1/600. For slabs-on-grade, a soil modulus of 200 pci may be used for design.

### *4.4.2 Mat Foundations*

We understand that the structure may be supported on a concrete mat foundation. The mat foundation may be designed to impose a maximum allowable pressure of 2,000 psf due to dead plus live loads. This value may be increased by 1/3 for transient loads such as seismic or wind. The concrete mat foundation should be embedded at least 8-inches below the lowest adjacent grade.

Settlements: Based on the results of our laboratory tests and analyses, total static settlements of the mat foundation under the allowable bearing pressure are expected to be approximately 0.5-inch, and maximum differential settlements are expected to be about 0.25-inch.

## 4.5 Lateral Earth Pressures and Frictional Resistance

Provided the site is prepared as recommended above, the following earth pressure parameters for footings may be used for design purposes. The parameters shown in the following table are for drained conditions of select engineered fill or undisturbed native soil.

**Table 2: Recommended Static Lateral Earth Pressures for Footings**

| Lateral Pressure Condition | Equivalent Fluid Density (pcf) Drained Condition |
|---|---|
| Active Pressure | 40 |
| At Rest Pressure | 50 |
| Passive Pressure | 350 |

The lateral earth pressures listed herein are obtained by the conventional equation for active, at rest, and passive conditions assuming level backfill and a bulk unit weight of 85 pcf for the site soils. A coefficient of friction of 0.30 may be used between soil sub-grade and the bottom of footings.

The coefficient of friction and passive earth pressure values given above represent ultimate soil strength values. BSK recommends that a safety factor consistent with the design conditions be included in their usage in accordance with Sections 1806.3.1 through 1806.3.3 of the 2019 CBC. For stability against lateral sliding that is resisted solely by the passive earth pressure against footings or friction along the bottom of footings, a minimum safety factor of 1.5 is recommended. For stability against lateral sliding that is resisted by combined passive pressure and frictional resistance, a minimum safety factor of 2.0 is recommended. For lateral stability against seismic loading conditions, a minimum safety factor of 1.2 is recommended.

## 4.6 Percolation Testing

The percolation testing was conducted under the oversight of a BSK Project Geologist on November 15, 2022. Four (4) test borings with a diameter of 8-inches were drilled to a maximum depth of 5-feet below

ground surface (bgs) using the CME-95 drilling truck provided by Baja Exploration. Four-inches of gravel was placed at the bottom of each boring and a perforated PVC pipe was inserted into the hole. Additional gravel was placed in the annular space surrounding the PVC pipe to prevent the caving-in of the boring sidewalls. Because of the sandy soil present at each boring, they were pre-soaked with water for approximately 2-hours. A series of falling-head tests were performed at each testing location, where the observed percolation rates were recorded. The slowest percolation rate was used to determine the California Plumbing Code CPC soil type for that testing location. For a detailed view of the percolation test results at the site, please refer to Figures A-4 through A-7.

Based upon the percolation data collected during this investigation, and to the presence of shallow groundwater, BSK recommends a minimum factor of safety of 2 and consideration of the shallow groundwater conditions be incorporated into the proposed leach field design. The slowest observed percolation rate was 14.4 minutes/inch at test location PT-4. However, test location PT-2's slowest observed average was 0.8 minutes/inch. See Table 3 below for California Plumbing Code (CPC) Soil Types.

**Table 3: Summary of Percolation Test Results**

| Test Location | Plumbing Code Soil Type | Soil Description | Slowest Observed Percolation Rate (minute/inch) |
|---|---|---|---|
| PT-1 | 4 | Silty Sand | 12.1 |
| PT-2 | 1 | Silty Sand | 0.8 |
| PT-3 | 2 | Silty Sand | 1.8 |
| PT-4 | 4 | Silty Sand | 14.4 |

## 4.7 Excavation Stability

Soils encountered within the depth explored are generally classified as Type C soils in accordance with OSHA (Occupational Safety and Health Administration). The slopes surrounding or along temporary excavations may be vertical for excavations that are less than five feet deep and exhibit no indication of potential caving, but should be no steeper than 1.5H:1V for excavations that are deeper than 5-feet, up to a maximum depth of 15-feet. Certified trench shields or boxes may also be used to protect workers during construction in excavations that have vertical sidewalls and are greater than 5-feet deep. Temporary excavations for the project construction should be left open for as short a time as possible and should be protected from water runoff. In addition, equipment and/or soil stockpiles must be maintained at least 10-feet away from the top of the excavations. Because of variability in soils, BSK must be afforded the opportunity to observe and document sloping and shoring conditions at the time of construction. Slope height, slope inclination, and excavation depths (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

### 4.8 Trench Backfill and Compaction

Processed on-site soils, which are free of organic material, are suitable for use as general trench backfill above the pipe envelope. Native soil with particles less than 3-inches in the greatest dimension may be incorporated into the backfill and compacted as specified above, provided they are properly mixed into a matrix of friable soils. The backfill must be placed in thin layers not exceeding 12-inches in loose thickness, be well-blended and consistent texture, moisture conditioned to at least optimum moisture content, and compacted to at least 90-percent of the maximum dry density as determined by the ASTM D-1557. The uppermost 12-inches of trench backfill below pavement sections must be compacted to at least 95-percent of the maximum dry density as determined by ASTM D-1557. Moisture content within 2-percent of optimum must be maintained while compacting this upper 12-inch trench backfill zone.

We recommend that trench backfill be tested for compliance with the recommended Relative Compaction and moisture conditions. Field density testing should conform to ASTM Test Methods D-1556 or D-6938. We recommend that field density tests be performed in the utility trench bedding, envelope and backfill for every vertical lift, at an approximate longitudinal spacing of not greater than 150-feet. Backfill that does not conform to the criteria specified in this section should be removed or reworked, as applicable over the trench length represented by the failing test so as to conform to BSK recommendations.

### 4.9 Drainage Considerations

The control surface drainage in the project areas is an important design consideration. BSK recommends that final grading around shallow foundations must provide for positive and enduring drainage away from the structures, and ponding of water must not be allowed around, or near the shallow foundations. Ground surface profiles next to the shallow foundations must have at least a 2-percent gradient away from the structures.

## 5. PLANS AND SPECIFICATIONS REVIEW

BSK recommends that it be retained to review the draft plans and specifications for the project, with regard to foundations and earthwork, prior to their being finalized and issued for construction bidding.

## 6. CONSTRUCTION TESTING AND OBSERVATIONS

Geotechnical testing and observation during construction is a vital extension of this geotechnical investigation. BSK recommends that it be retained for those services. Field review during site preparation and grading allows for evaluation of the exposed soil conditions and confirmation or revision of the assumptions and extrapolations made in formulating the design parameters and recommendations. BSK's observations must be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. BSK must also be called to the site to observe foundation excavations, prior to placement of reinforcing steel or concrete, in order to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report. BSK must also be called to the site to observe placement of foundation and slab concrete.

If a firm other than BSK is retained for these services during construction, then that firm must notify the owner, project designers, governmental building officials, and BSK that the firm has assumed the responsibility for all phases (i.e., both design and construction) of the project within the purview of the geotechnical engineer. Notification must indicate that the firm has reviewed this report and any subsequent addenda, and that it either agrees with BSK's conclusions and recommendations, or that it will provide independent recommendations.

## 7. LIMITATIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the borings performed at the locations shown on the Boring Location Map, Figure A-2. The report does not reflect variations which may occur between or beyond the borings. The nature and extent of such variations may not become evident until construction is initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of the variations.

The validity of the recommendations contained in this report is also dependent upon an adequate testing and observation program during the construction phase. BSK assumes no responsibility for construction compliance with the design concepts or recommendations unless it has been retained to perform the testing and observation services during construction as described above.

The findings of this report are valid as of the present. However, changes in the conditions of the site can occur with the passage of time, whether caused by natural processes or the work of man, on this property or adjacent property. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, governmental policy or the broadening of knowledge.

BSK has prepared this report for the exclusive use of the Client and members of the project design team. The report has been prepared in accordance with generally accepted geotechnical engineering practices which existed in Kern County at the time the report was written. No other warranties either expressed or implied are made as to the professional advice provided under the terms of BSK's agreement with Client and included in this report.

## 8. REFERENCES

Department of Water Resources Sustainable Groundwater Management Act (SMGA) Data Viewer. https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels , November 2022.

Lee, Norman. California Geomorphic Provinces (2012): California Department of Conservation. California Geological Survey, November 2022. <http://www.conservation.ca.gov/cgs/information/publications/cgs_notes/note_36/Documents/note_36.pdf>.

United States Geological Survey/OSHPD, U.S. Seismic Design Maps, https://seismicmaps.org/. November 2022.

# APPENDIX A

# FIELD EXPLORATION

**APPENDIX A**
**FIELD EXPLORATION**

The field exploration for this investigation was conducted under the oversight of a BSK Geologist. Seven (7) borings were drilled at the site on November 14, 2022 using a CME 95 Drill Rig provided by Baja Exploration to a maximum depth of 51.5-feet beneath existing ground surface (bgs).

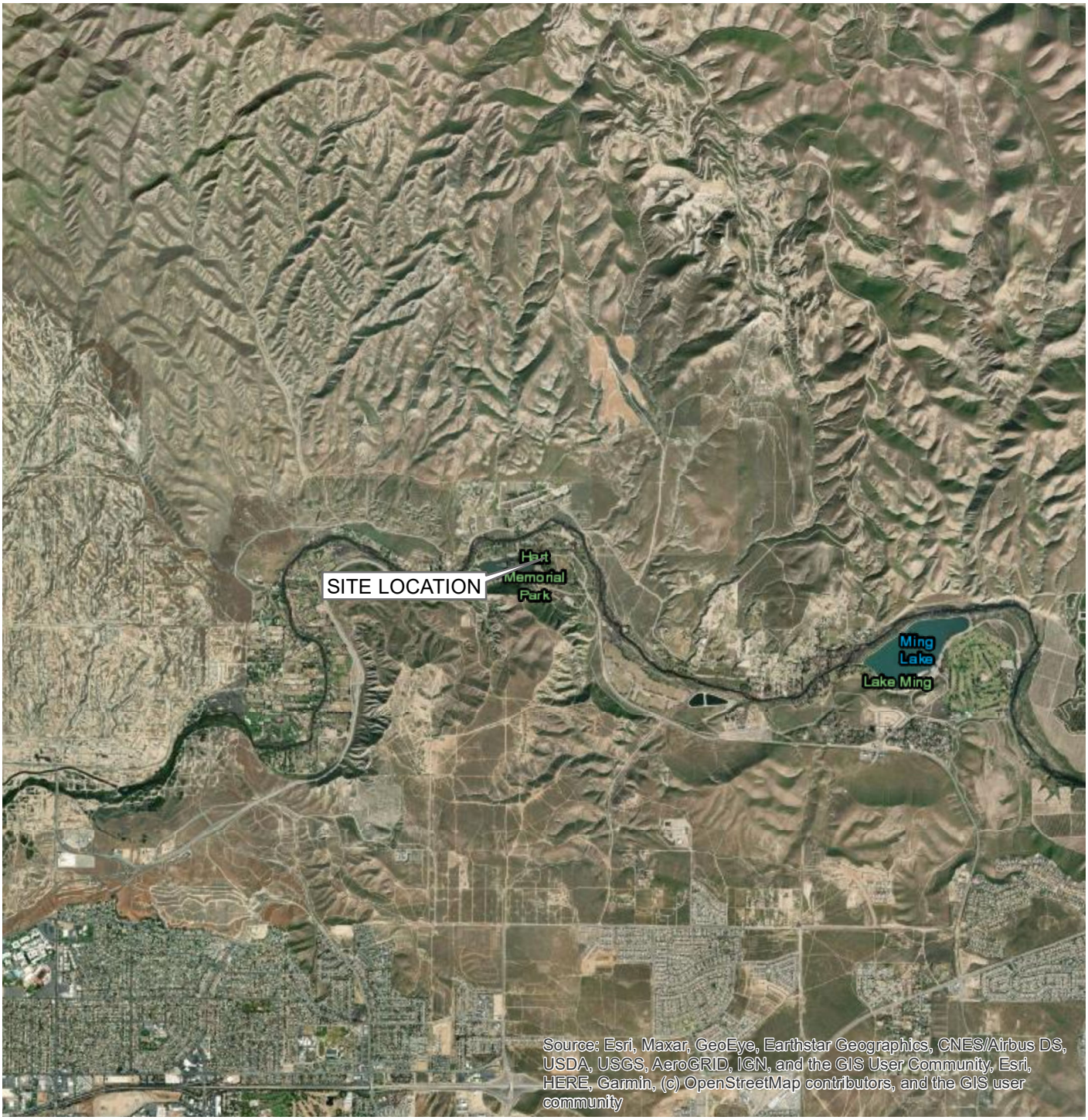
The soil materials encountered in the test borings were visually classified in the field, and the logs were recorded during the drilling and sampling operations. Visual classification of the materials encountered in the test borings was made in general accordance with the Union Soil Classification System (ASTM D-2488). A soil classification chart is presented herein. Boring logs are presented herein and should be consulted for more details concerning subsurface conditions. Stratification lines were approximated by the field staff based on observations made at the time of drilling, while the actual boundaries between soil types may be gradual and soil conditions may vary at other locations.

Subsurface samples were obtained at the successive depths shown on the boring logs by driving samplers which consisted of a 2.5-inch inside diameter (I.D.) California Sampler and a 1.4-inch I.D. Standard Penetration Test (SPT) Sampler. The samplers were driven 18-inches using a 140-pound hammer dropped from a height of 30-inches by means of either an automatic hammer or a down-hole safety hammer. The number of blows required to drive the last 12-inches was recorded as the blow count (blows/foot) on the boring logs. The relatively undisturbed soil core samples were capped at both ends to preserve the samples at their natural moisture content. Soil samples were also obtained using the SPT Sampler lined with metal tubes or unlined in which case the samples were placed and sealed in polyethylene bags. At the completion of the field exploration, the test borings were backfilled with the excavated soil cuttings.

It should be noted that the use of terms such as “loose”, “medium dense”, “dense” or “very dense” to describe the consistency of a soil is based on sampler blow count and is not necessarily reflective of the in-place density or unit weight of the soils being sampled. The relationship between sampler blow count and consistency is provided in the following Tables A-1 and A-2 for coarse-grained (sandy and gravelly) soils and fine grained (silty and clayey) soils, respectively.

| Table A-1: Consistency of Coarse-Grained Soil by Sampler Blow Count | | |
|---|---|---|
| **Consistency Descriptor** | **SPT Blow Count (#Blows / Foot)** | **2.5" I.D. California Sampler Blow Count (#Blows / Foot)** |
| Very Loose | <4 | <6 |
| Loose | 4 – 10 | 6 – 15 |
| Medium Dense | 10 – 30 | 15 – 45 |
| Dense | 30 – 50 | 45 – 80 |
| Very Dense | >50 | >80 |

| Table A-2: Apparent Relative Density of Fine-Grained Soil by Sampler Blow Count | | |
|---|---|---|
| **Consistency Descriptor** | **SPT Blow Count (#Blows / Foot)** | **2.5" I.D. California Sampler Blow Count (#Blows / Foot)** |
| Very Soft | <2 | <3 |
| Soft | 2 – 4 | 3 – 6 |
| Firm | 4 – 8 | 6 – 12 |
| Very Firm | 8 – 15 | 12 – 24 |
| Hard | 15 – 30 | 24 – 45 |
| Very Hard | >30 | >45 |




0 0.5 1 2 Miles

1 inch = 1 miles

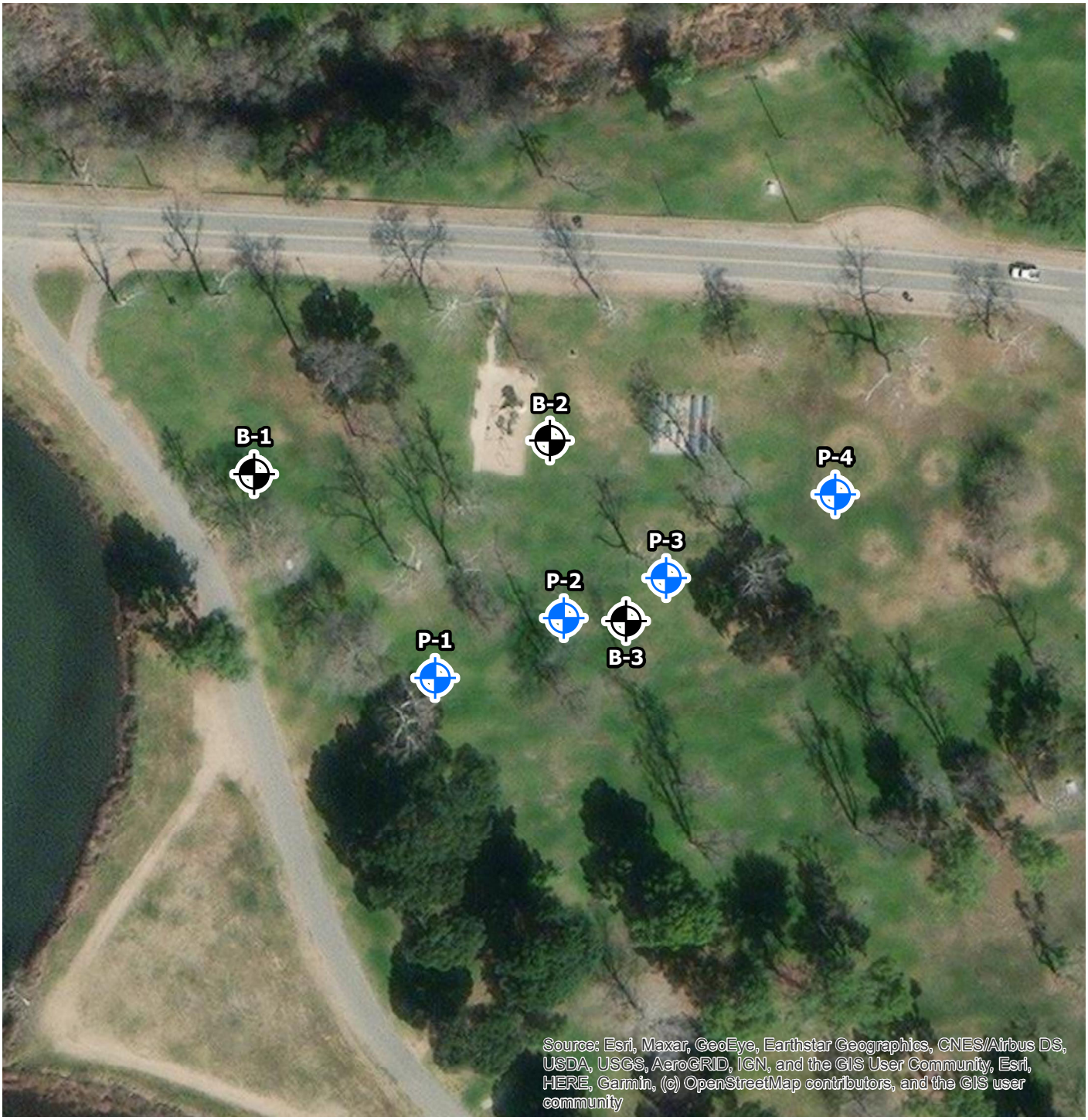
Map Date: 12/5/2022

Document Path: D:\LP\off grid\HMP\Figure 1 Vicinity Map.mxd

BSK ASSOCIATES

Geotechnical Engineering Investigation
Kern County Construction Services
HMP Adventure Play Area Project
Bakersfield, Kern County, California

Figure A-1
Vicinity Map
BSK Project G00000-166




0 50 100 200
Feet

1 inch = 100 feet

Aprroximate Boring Location

Approximate Percolation Test Location

Map Date: 12/5/2022

BSK ASSOCIATES

Geotechnical Engineering Investigation
Kern County Construction Services
HMP Adventure Play Area Project
Bakersfield, Kern County, California

Figure A-2
Vicinity Map
BSK Project G00000-166

Document Path: C:\Users\lprosser\BSK Associates\BSK Documents - BFLD Projects Active\GEO\G00000166-HMP Adventure Play Area\Graphics\Figure 2 Bor Loc Map.mxd

| MAJOR DIVISIONS | | | | TYPICAL NAMES |
|---|---|---|---|---|
| COARSE GRAINED SOILS More than Half >#200 | GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE | CLEAN GRAVELS WITH LITTLE OR NO FINES | GW | WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES |
| | | | GP | POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES |
| | | GRAVELS WITH OVER 15% FINES | GM | SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES |
| | | | GC | CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES |
| | SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE | CLEAN SANDS WITH LITTLE OR NO FINES | SW | WELL GRADED SANDS, GRAVELLY SANDS |
| | | | SP | POORLY GRADED SANDS, GRAVELLY SANDS |
| | | SANDS WITH OVER 15% FINES | SM | SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES |
| | | | SC | CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES |
| FINE GRAINED SOILS More than Half <#200 sieve | SILTS AND CLAYS LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | OL | ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 | | MH | INORGANIC SILTS , MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS |
| | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| | | | OH | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS |
| HIGHLY ORGANIC SOILS | | | Pt | PEAT AND OTHER HIGHLY ORGANIC SOILS |

Note: Dual symbols are used to indicate borderline soil classifications.

| | | | |
|---|---|---|---|
| | Pushed Shelby Tube | RV | R-Value |
| | Standard Penetration Test | SA | Sieve Analysis |
| | Modified California | SW | Swell Test |
| | Auger Cuttings | TC | Cyclic Triaxial |
| | Grab Sample | TX | Unconsolidated Undrained Triaxial |
| | Sample Attempt with No Recovery | TV | Torvane Shear |
| CA | Chemical Analysis | UC | Unconfined Compression |
| CN | Consolidation | (1.2) | (Shear Strength, ksf) |
| CP | Compaction | WA | Wash Analysis |
| DS | Direct Shear | (20) | (with % Passing No. 200 Sieve) |
| PM | Permeability | | Water Level at Time of Drilling |
| PP | Pocket Penetrometer | | Water Level after Drilling (with date measured) |

**SOIL CLASSIFICATION CHART AND KEY TO TEST DATA**
**Unified Soil Classification System**

BSK ASSOCIATES

PLATE: Figure A-3

BSK Associates
700 22nd Street
Bakersfield, CA 93301
Telephone: (661) 327-0671

# LOG OF BORING NO. B-01

Project Name: **HMP Adventure Play Area Project**
Project Number: **G00000-166**
Project Location: **Hart Memorial Park, Bakersfield, CA**
Logged by: **L. Prosser**
Checked by: **A. Terronez**

Surface El.:
Location:

| Depth, feet | Material Description | Samples | Sample Number | Penetration Blows / Foot | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **Surface:** Grass | | | | | | | | | | |
| | **SP/SM: SAND/SILTY SAND:** Very Light Brown; very fine to fine grained; slightly moist; poorly graded; micaceous. | | | 8 | | | 76 | 7 | | | |
| 5 | **SM: SILTY SAND:** Mottled Dark Brown and Dark Red (Oxidation); very fine to fine grained; moist; poorly graded; micaceous. | | | 6 | | | 77 | 26 | | | |
| | ▽ | | | | | | | | | | |
| 10 | **SP: SAND:** Light Gray; fine to medium grained; wet; poorly graded; subangular; micaceous. | | | 9 | | | | | | | |
| 15 | ... Dark Gray. | | | 12 | | | 105 | 28 | | | |
| 20 | ... Fine to coarse grained. | | | 41, 50/ 4" | | | | | | | |
| | End of boring. | | | | | | | | | | |
| 25 | | | | | | | | | | | |

**Completion Depth:** 21.5
**Date Started:** 11/14/22
**Date Completed:** 11/14/22
**California Sampler:** 2.4" inner diameter
**SPT Sampler:** 1.4" inner diameter

**Drilling Equipment:** CME 95
**Drilling Method:** Hollow Stem Auger
**Drive Weight:** 140 pounds
**Hole Diameter:** 8 inches
**Drop:** 30 inches
**Remarks:** Borings backfilled with cuttings. Capped with black-dyed concrete

GEO_TARGET HMP_BLOGS.GPJ GEOTECHNICAL 08.GDT 12/5/22

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700 22nd Street
Bakersfield, CA 93301
Telephone: (661) 327-0671

# LOG OF BORING NO. B-02

Project Name: **HMP Adventure Play Area Project**
Project Number: **G00000-166**
Project Location: **Hart Memorial Park, Bakersfield, CA**
Logged by: **L. Prosser**
Checked by: **A. Terronez**

Surface El.:
Location:

| Depth, feet | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / Foot | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **Surface:** Grass | | | | | | | | | | |
| | **SP/SM: SAND/SILTY SAND:** Very Light Brown; very fine to fine grained; slightly moist; poorly graded; micaceous; thin roots. | ■ | | 7 | | | 80 | 3 | | | |
| 5 | **SM: SILTY SAND:** Mottled Dark Brown and Dark Red (Oxidation); very fine to fine grained; moist; poorly graded; micaceous. | ■ | | 8 | | | 88 | 20 | | | |
| 10 | **SP: SAND:** Dark Gray; fine to medium grained; very moist/wet; poorly graded; subangular; micaceous. ▽ | ■ | | 5 | | | 89 | 35 | | | |
| 15 | ... Fine grained; wet. | ■ | | 15 | | | | | | | |
| 20 | ... Fine to coarse grained; | ■ | | 26 | | | 107 | 17 | | | |
| | End of boring. | | | | | | | | | | |
| 25 | | | | | | | | | | | |

**Completion Depth:** 21.5
**Date Started:** 11/14/22
**Date Completed:** 11/14/22
**California Sampler:** 2.4" inner diameter
**SPT Sampler:** 1.4" inner diameter

**Drilling Equipment:** CME 95
**Drilling Method:** Hollow Stem Auger
**Drive Weight:** 140 pounds
**Hole Diameter:** 8 inches
**Drop:** 30 inches
**Remarks:** Borings backfilled with cuttings. Capped with black-dyed concrete

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700 22nd Street
Bakersfield, CA 93301
Telephone: (661) 327-0671

# LOG OF BORING NO. B-03

Project Name: **HMP Adventure Play Area Project**
Project Number: **G00000-166**
Project Location: **Hart Memorial Park, Bakersfield, CA**
Logged by: **L. Prosser**
Checked by: **A. Terronez**

Surface El.:
Location:

| Depth, feet | Material Description | Samples | Sample Number | Penetration Blows / Foot | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **Surface:** Grass | | | | | | | | | | |
| | **SM: SILTY SAND:** Light Brown; fine grained; moist; poorly graded; micaceous. | | | 8 | | | 78 | 5 | | | |
| 5 | ... Yellowish Brown; thin roots. | | | 6 | | 18 | 81 | 12 | | | |
| 10 | **SP: SAND:** Gray; fine grained; very moist; poorly graded; subangular; micaceous. | | | 9 | | | 94 | 29 | | | |
| 15 | ... Fine to medium grained; wet. | | | 12 | | | 81 | 42 | | | |
| 20 | ... Dark Gray; fine grained; | | | 41, 50/ 4 | | | 89 | 36 | | | |
| 25 | | | | | | | | | | | |

**Completion Depth:** 51.5
**Date Started:** 11/14/22
**Date Completed:** 11/14/22
**California Sampler:** 2.4" inner diameter
**SPT Sampler:** 1.4" inner diameter

**Drilling Equipment:** CME 95
**Drilling Method:** Hollow Stem Auger
**Drive Weight:** 140 pounds
**Hole Diameter:** 8 inches
**Drop:** 30 inches
**Remarks:** Borings backfilled with cuttings. Capped with black-dyed concrete

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700 22nd Street
Bakersfield, CA 93301
Telephone: (661) 327-0671

# LOG OF BORING NO. B-03

Project Name: **HMP Adventure Play Area Project**
Project Number: **G00000-166**
Project Location: **Hart Memorial Park, Bakersfield, CA**
Logged by: **L. Prosser**
Checked by: **A. Terronez**

Surface El.:
Location:

| Depth, feet | Graphic Log | MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / Foot | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ... Gray; fine to coarse sands; fine gravel; subrounded gravel. | | | 54 | | 4 | 124 | 13 | | | |
| 30 | | ... Same as above. | | | 79 | | | 132 | 11 | | | |
| 35 | | ... Very Dark Brown; 2" cobble observed in sampler. | | | 18, 50/ 1" | | | 88 | 33 | | | |
| 40 | | **No Sample:** Sampler bouncing off a down-hole cobble. | | | 50/ 0" | | | | | | | |
| 45 | | **No Sample:** Sampler bouncing off a down-hole cobble. | | | 50/ 0" | | | | | | | |
| 50 | | | | | | | | | | | | |

**Completion Depth:** 51.5
**Date Started:** 11/14/22
**Date Completed:** 11/14/22
**California Sampler:** 2.4" inner diameter
**SPT Sampler:** 1.4" inner diameter

**Drilling Equipment:** CME 95
**Drilling Method:** Hollow Stem Auger
**Drive Weight:** 140 pounds
**Hole Diameter:** 8 inches
**Drop:** 30 inches
**Remarks:** Borings backfilled with cuttings. Capped with black-dyed concrete

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Bakersfield, CA 93301
Telephone: (661) 327-0671

# LOG OF BORING NO. B-03

Project Name: **HMP Adventure Play Area Project**
Project Number: **G00000-166**
Project Location: **Hart Memorial Park, Bakersfield, CA**
Logged by: **L. Prosser**
Checked by: **A. Terronez**

| Depth, feet | Graphic Log | Surface El.: Location: MATERIAL DESCRIPTION | Samples | Sample Number | Penetration Blows / Foot | Pocket Penetrometer, TSF | % Passing No. 200 Sieve | In-Situ Dry Weight (pcf) | In-Situ Moisture Content (%) | Liquid Limit | Plastic Limit | Plasticity Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **ML: Silt:** Dark Gray; moist; micaceous; low plasticity. | X | | 49 | | 79 | | | | | |
| | | End of boring. | | | | | | | | | | |
| 55 | | | | | | | | | | | | |
| 60 | | | | | | | | | | | | |
| 65 | | | | | | | | | | | | |
| 70 | | | | | | | | | | | | |
| 75 | | | | | | | | | | | | |

**Completion Depth:** 51.5
**Date Started:** 11/14/22
**Date Completed:** 11/14/22
**California Sampler:** 2.4" inner diameter
**SPT Sampler:** 1.4" inner diameter

**Drilling Equipment:** CME 95
**Drilling Method:** Hollow Stem Auger
**Drive Weight:** 140 pounds
**Hole Diameter:** 8 inches
**Drop:** 30 inches
**Remarks:** Borings backfilled with cuttings. Capped with black-dyed concrete

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BSK ASSOCIATES

700 22nd Street
Bakersfield, CA 93301
Ph: (661) 327-0671
Fax: (661) 324-4218

# Percolation Test

**Project Name:** HMP Adventure Play Area
**Tested By:** LP
**Project Number:** G00000-166
**Test Date:** 11/15/2022
**Test Hole No:** PT-1
**Depth of Test Hole:** 5-feet
**Time Presaturation:** 2-hours
**Diameter of Test Hole:** 8-inches
**Soil Description:** SM: Brown; very fine to fine grained; poorly graded.

| Initial Time $T_1$ | Depth of Water $d_1$, (Inch) | Final Time $T_2$ | Final Depth $d_2$ (inch) | Time Interval ΔT (min) | Change in Depth Δd (inch) | Percolation Rate ΔT/dΔ (min/inch) |
|---|---|---|---|---|---|---|
| 7:15 | 11.75 | 7:30 | 9 | 15:00 | 2.75 | 5.5 |
| 7:30 | 9 | 7:45 | 7 | 15:00 | 2 | 7.5 |
| 7:45 | 7 | 8:00 | 5.5 | 15:00 | 1.5 | 10.0 |
| 8:00 | 5.5 | 8:15 | 4 | 15:00 | 1.5 | 10.0 |
| 8:15 | 4 | 8:30 | 2.5 | 15:00 | 1.5 | 10.0 |
| 8:30 | 2.5 | 8:45 | 1.75 | 15:00 | 0.75 | 20.0 |
| | | | | | **Average** | **10.5** |
| 8:55 | 12 | 9:10 | 9.5 | 15:00 | 2.5 | 6.0 |
| 9:10 | 9.5 | 9:25 | 8 | 15:00 | 1.5 | 10.0 |
| 9:25 | 8 | 9:40 | 6.5 | 15:00 | 1.5 | 10.0 |
| 9:40 | 6.5 | 9:55 | 5 | 15:00 | 1.5 | 10.0 |
| 9:55 | 5 | 10:10 | 4 | 15:00 | 1 | 15.0 |
| 10:10 | 4 | 10:25 | 3 | 15:00 | 1 | 15.0 |
| 10:25 | 3 | 10:40 | 2 | 15:00 | 1 | 15.0 |
| 10:40 | 2 | 10:55 | 1 | 15:00 | 1 | 15.0 |
| | | | | | **Average** | **12.0** |
| 11:20 | 12 | 11:35 | 9.5 | 15:00 | 2.5 | 6.0 |
| 11:35 | 9.5 | 11:50 | 8.25 | 15:00 | 1.25 | 12.0 |
| 11:50 | 8.25 | 12:05 | 6.5 | 15:00 | 1.75 | 8.6 |
| 12:05 | 6.5 | 12:20 | 5 | 15:00 | 1.5 | 10.0 |
| 12:20 | 5 | 12:35 | 4 | 15:00 | 1 | 15.0 |
| 12:35 | 4 | 12:50 | 3 | 15:00 | 1 | 15.0 |
| 12:50 | 3 | 13:05 | 2 | 15:00 | 1 | 15.0 |
| 13:05 | 2 | 13:20 | 1 | 15:00 | 1 | 15.0 |
| | | | | | **Average** | **12.1** |

**Slowest Average: 12.1 minutes/inch**

Figure A-4

BSK ASSOCIATES

700 22nd Street
Bakersfield, CA 93301
Ph: (661) 327-0671
Fax: (661) 324-4218

# Percolation Test

**Project Name:** HMP Adventure Play Area
**Tested By:** LP
**Project Number:** G00000-166
**Test Date:** 11/15/2022
**Test Hole No:** PT-2
**Depth of Test Hole:** 5-feet
**Time Presaturation:** 2-hours
**Diameter of Test Hole:** 8-inches
**Soil Description:** SM: Brown; very fine to medium grained; poorly graded.

| Initial Time $T_1$ | Depth of Water $d_1$, (Inch) | Final Time $T_2$ | Final Depth $d_2$ (inch) | Time Interval ΔT (min) | Change in Depth Δd (inch) | Percolation Rate ΔT/dΔ (min/inch) |
|---|---|---|---|---|---|---|
| 8:12 | 11 | 8:13 | 8.5 | 01:00 | 2.5 | 0.4 |
| 8:13 | 8.5 | 8:14 | 6.5 | 01:00 | 2 | 0.5 |
| 8:14 | 6.5 | 8:15 | 4.5 | 01:00 | 2 | 0.5 |
| 8:15 | 4.5 | 8:16 | 3 | 01:00 | 1.5 | 0.7 |
| 8:16 | 3 | 8:17 | 2 | 01:00 | 1 | 1.0 |
| 8:17 | 2 | 8:18 | 1 | 01:00 | 1 | 1.0 |
| | | | | | **Average** | **0.7** |
| 8:25 | 12 | 8:26 | 9.5 | 01:00 | 2.5 | 0.4 |
| 8:26 | 9.5 | 8:27 | 8 | 01:00 | 1.5 | 0.7 |
| 8:27 | 8 | 8:28 | 6.5 | 01:00 | 1.5 | 0.7 |
| 8:28 | 6.5 | 8:29 | 5 | 01:00 | 1.5 | 0.7 |
| 8:29 | 5 | 8:30 | 4 | 01:00 | 1 | 1.0 |
| 8:30 | 4 | 8:31 | 3 | 01:00 | 1 | 1.0 |
| 8:31 | 3 | 8:32 | 2 | 01:00 | 1 | 1.0 |
| 8:32 | 2 | 8:33 | 1 | 01:00 | 1 | 1.0 |
| | | | | | **Average** | **0.8** |
| 8:44 | 12 | 8:45 | 9.5 | 01:00 | 2.5 | 0.4 |
| 8:45 | 9.5 | 8:46 | 8.25 | 01:00 | 1.25 | 0.8 |
| 8:46 | 8.25 | 8:47 | 6.5 | 01:00 | 1.75 | 0.6 |
| 8:47 | 6.5 | 8:48 | 5 | 01:00 | 1.5 | 0.7 |
| 8:48 | 5 | 8:49 | 4 | 01:00 | 1 | 1.0 |
| 8:49 | 4 | 8:50 | 3 | 01:00 | 1 | 1.0 |
| 8:50 | 3 | 8:51 | 2 | 01:00 | 1 | 1.0 |
| 8:51 | 2 | 8:52 | 1 | 01:00 | 1 | 1.0 |
| | | | | | **Average** | **0.8** |

**Slowest Average:** **0.8 minutes/inch**

Figure A-5

BSK ASSOCIATES

700 22nd Street
Bakersfield, CA 93301
Ph: (661) 327-0671
Fax: (661) 324-4218

# Percolation Test

**Project Name:** HMP Adventure Play Area
**Tested By:** LP
**Project Number:** G00000-166
**Test Date:** 11/15/2022
**Test Hole No:** PT-3
**Depth of Test Hole:** 5-feet
**Time Presaturation:** 2-hours
**Diameter of Test Hole:** 8-inches
**Soil Description:** SM: Brown; very fine to medium grained; poorly graded.

| Initial Time $T_1$ | Depth of Water $d_1$, (Inch) | Final Time $T_2$ | Final Depth $d_2$ (inch) | Time Interval $\Delta T$ (min) | Change in Depth $\Delta d$ (inch) | Percolation Rate $\Delta T/d\Delta$ (min/inch) |
|---|---|---|---|---|---|---|
| 9:26 | 10 | 9:29 | 7 | 03:00 | 3 | 1.0 |
| 9:29 | 7 | 9:32 | 5.5 | 03:00 | 1.5 | 2.0 |
| 9:32 | 5.5 | 9:35 | 4 | 03:00 | 1.5 | 2.0 |
| 9:35 | 4 | 9:38 | 2.5 | 03:00 | 1.5 | 2.0 |
| 9:38 | 2.5 | 9:41 | 1 | 03:00 | 1.5 | 2.0 |
| | | | | | | |
| | | | | | **Average** | **1.8** |
| 9:46 | 12 | 9:48 | 9.5 | 02:00 | 2.5 | 0.8 |
| 9:48 | 9.5 | 9:50 | 7 | 02:00 | 2.5 | 0.8 |
| 9:50 | 7 | 9:52 | 5.5 | 02:00 | 1.5 | 1.3 |
| 9:52 | 5.5 | 9:54 | 4.5 | 02:00 | 1 | 2.0 |
| 9:54 | 4.5 | 9:56 | 3.5 | 02:00 | 1 | 2.0 |
| 9:56 | 3.5 | 9:58 | 2.5 | 02:00 | 1 | 2.0 |
| 9:58 | 2.5 | 10:00 | 1.5 | 02:00 | 1 | 2.0 |
| | | | | | | |
| | | | | | **Average** | **1.6** |
| 10:10 | 12 | 10:12 | 10 | 02:00 | 2 | 1.0 |
| 10:12 | 10 | 10:14 | 8 | 02:00 | 2 | 1.0 |
| 10:14 | 8 | 10:16 | 6 | 02:00 | 2 | 1.0 |
| 10:16 | 6 | 10:18 | 4 | 02:00 | 2 | 1.0 |
| 10:18 | 4 | 10:20 | 3 | 02:00 | 1 | 2.0 |
| 10:20 | 3 | 10:22 | 2 | 02:00 | 1 | 2.0 |
| 10:22 | 2 | 10:24 | 1 | 02:00 | 1 | 2.0 |
| | | | | | | |
| | | | | | **Average** | **1.4** |

**Slowest Average:** **1.8 minutes/inch**

Figure A-6

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700 22nd Street
Bakersfield, CA 93301
Ph: (661) 327-0671
Fax: (661) 324-4218

# Percolation Test

**Project Name:** HMP Adventure Play Area
**Tested By:** LP
**Project Number:** G00000-166
**Test Date:** 11/15/2022
**Test Hole No:** PT-4
**Depth of Test Hole:** 5-feet
**Time Presaturation:** 2-hours
**Diameter of Test Hole:** 8-inches
**Soil Description:** SM: Brown; very fine to medium grained; poorly graded.

| Initial Time $T_1$ | Depth of Water $d_1$, (Inch) | Final Time $T_2$ | Final Depth $d_2$ (inch) | Time Interval $\Delta T$ (min) | Change in Depth $\Delta d$ (inch) | Percolation Rate $\Delta T/d\Delta$ (min/inch) |
|---|---|---|---|---|---|---|
| 7:25 | 12 | 7:40 | 11 | 15:00 | 1 | 15.0 |
| 7:40 | 11 | 7:55 | 10 | 15:00 | 1 | 15.0 |
| 7:55 | 10 | 8:10 | 9 | 15:00 | 1 | 15.0 |
| 8:10 | 9 | 8:25 | 8 | 15:00 | 1 | 15.0 |
| 8:25 | 8 | 8:40 | 7 | 15:00 | 1 | 15.0 |
| 8:40 | 7 | 8:55 | 5.5 | 15:00 | 1.5 | 10.0 |
| 8:55 | 5.5 | 9:10 | 4.5 | 15:00 | 1 | 15.0 |
| 9:10 | 4.5 | 9:25 | 3.5 | 15:00 | 1 | 15.0 |
| | | | | | **Average** | **14.4** |
| 9:30 | 12 | 9:45 | 11 | 15:00 | 1 | 15.0 |
| 9:45 | 11 | 10:00 | 10 | 15:00 | 1 | 15.0 |
| 10:00 | 10 | 10:15 | 9 | 15:00 | 1 | 15.0 |
| 10:15 | 9 | 10:30 | 8 | 15:00 | 1 | 15.0 |
| 10:30 | 8 | 10:45 | 7 | 15:00 | 1 | 15.0 |
| 10:45 | 7 | 11:00 | 6 | 15:00 | 1 | 15.0 |
| 11:00 | 6 | 11:15 | 4.5 | 15:00 | 1.5 | 10.0 |
| 11:15 | 4.5 | 11:30 | 3 | 15:00 | 1.5 | 10.0 |
| 11:30 | 3 | 11:45 | 2 | 15:00 | 1 | 15.0 |
| 11:45 | 2 | 12:00 | 1 | 15:00 | 1 | 15.0 |
| | | | | | **Average** | **14.3** |
| 10:10 | 12 | 10:12 | 10 | 02:00 | 2 | 7.5 |
| 10:12 | 10 | 10:14 | 9 | 02:00 | 1 | 15.0 |
| 10:14 | 9 | 10:16 | 8 | 02:00 | 1 | 15.0 |
| 10:16 | 8 | 10:18 | 7 | 02:00 | 1 | 15.0 |
| 10:18 | 7 | 10:20 | 6 | 02:00 | 1 | 15.0 |
| 10:20 | 6 | 10:22 | 5 | 02:00 | 1 | 15.0 |
| 10:22 | 5 | 10:24 | 4 | 02:00 | 1 | 15.0 |
| 10:24 | 4 | 10:26 | 3 | 02:00 | 1 | 15.0 |
| 10:26 | 3 | 10:28 | 2 | 02:00 | 1 | 15.0 |
| 10:28 | 2 | 10:30 | 1 | 02:00 | 1 | 15.0 |
| | | | | | **Average** | **13.9** |

**Slowest Average:** **14.4 minutes/inch**

Figure A-7

# APPENDIX B

# LABORATORY TESTING RESULTS

**APPENDIX B**
**LABORATORY TESTING RESULTS**

**Moisture-Density Tests**

The field moisture content, as a percentage of dry weight of the soils, was determined by weighing the samples before and after oven drying in accordance with ASTM D 2216 test procedures. Dry densities, in pounds per cubic foot, were also determined for undisturbed core samples in general accordance with ASTM D 2937 test procedures. Test results are presented on the boring logs in Appendix A.

**Direct Shear Test**

One (1) Direct Shear Test was performed on a relatively undisturbed soil sample obtained at the time of drilling in the area of planned construction. The test was conducted to determine the soil strength characteristics. The standard test method is ASTM D-3080, Direct Shear Test for Soil under Consolidated Drained Conditions. The direct shear test results are presented graphically on Figure B-1.

**Collapse Potential Test**

Two (2) Collapse Potential Test were performed on relatively undisturbed soil samples to evaluate collapse potential characteristics. The tests were performed in general accordance with ASTM D-5333. The samples were initially loaded under as-received moisture content to a selected stress level, loaded up to a maximum load of 1300 psf and were then saturated. The test results are presented on Figures B-2 and B-3.

**Moisture-Density Relationship Test**

One (1) Moisture-Density Relationship Test was run on a representative bulk sample that was obtained from the Site at the time of drilling. The representative bulk sample was tested for optimum moisture content and maximum dry density per both Test Methods ASTM D-1557 and ASTM D-698. The test results are presented on Figure B-4.

**R-Value Test**

One (1) Resistance-Value test was performed on a sample of the soil obtained at the time of drilling in the area of planned construction to evaluate the subgrade material for a pavement design. The soil was evaluated in accordance with ASTM D-2844. The R-Value test results are presented on Figure B-5.

**Soil Corrosivity**

Two (2) Corrosivity Evaluation were performed on bulk soil samples obtained at the time of drilling in the area of planned construction. The soil was evaluated for minimum resistivity (ASTM G57), sulfate ion concentration (ASTM D4327), chloride ion concentration (ASTM D4327), and pH of soil (ASTM D4972). The test results are presented in Table B-1.

| Table B-1: Summary of Corrosion Test Results | | | | |
|---|---|---|---|---|
| **Sample Location** | **pH** | **Sulfate, ppm** | **Chloride, ppm** | **Minimum Resistivity, ohm-cm** |
| B-1 @ 0-5 feet bgs | 6.20 | Not Detected | Not Detected | 3,900 |

| Table B-2: Summary of Minus #200 Wash Test Results | |
|---|---|
| **Test Location** | **Percent Fines** |
| B-3 @ 6-6.5 feet bgs | 18 |
| B-3 @ 26-26.5 feet bgs | 4 |
| B-3 @ 51-51.5 feet bgs | 79 |

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700 22nd St
Bakersfield, CA
Ph: (661) 327-0671
Fax: (661) 324-4218

# Direct Shear Test

**ASTM D 3080**

| | | | |
|---|---|---|---|
| **Project Name:** | Hart Adventure Adventure Play Area Project | **Sample Date:** | 11/15/2022 |
| **Project Number:** | G00-000-166 | **Test Date:** | 11/16/2022 |
| **Lab Tracking ID:** | B22-139 | **Report Date:** | 11/22/2022 |
| **Sample Location:** | B-2 @ 3-3.5 feet bgs | **Sampled By:** | L. Prosser |
| **Sample Description:** | SM: SILTY SAND: yellowish brown, fine to medium grained. | **Tested By:** | I. Pacheco |

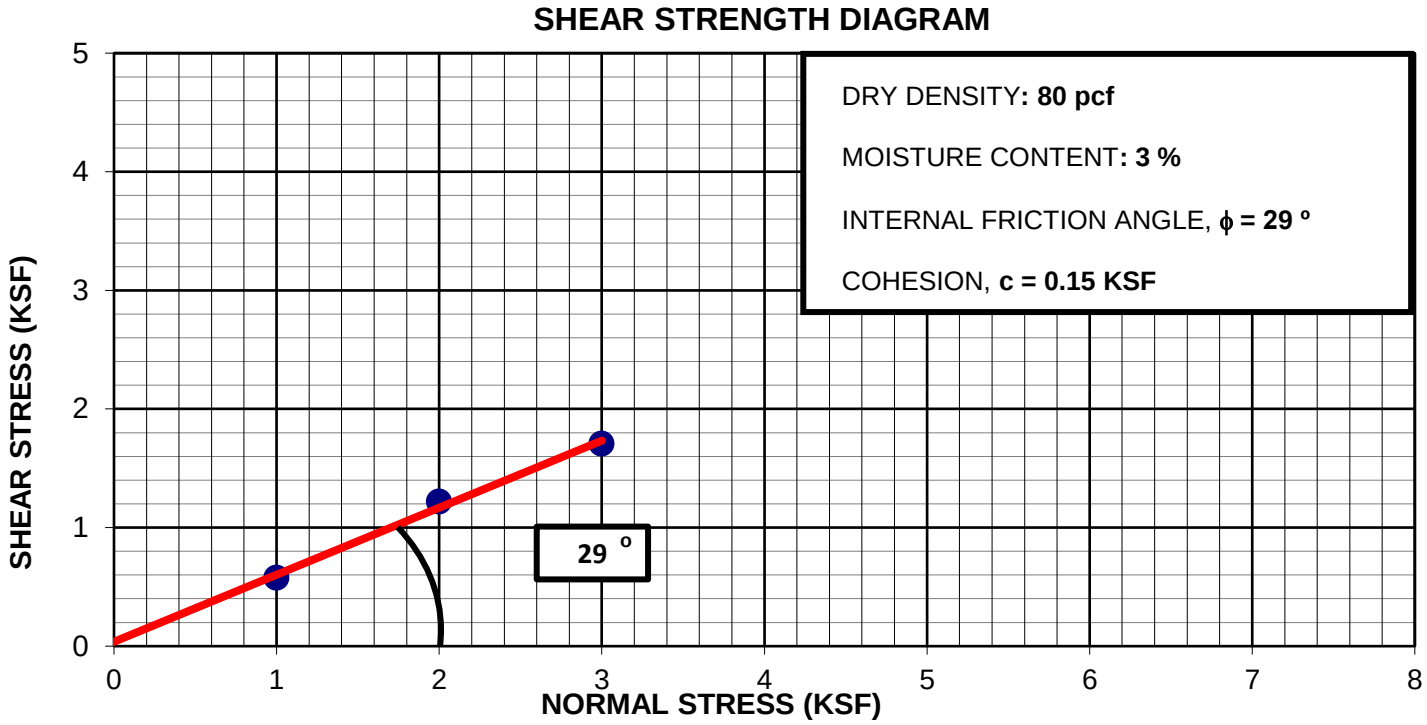


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Figure B-1

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Fax: (661) 324-4218

# Collapse Potential Test

ASTM D 5333, One-Dimensional Analysis

| | | | |
|---|---|---|---|
| **Project Name:** | Hart Park Adventure Play Area Project | **Sample Date:** | 11/15/2022 |
| **Project Number:** | G00-000-166 | **Test Date:** | 11/16/2022 |
| **Sample Location:** | B-1 @ 3.0-3.5 feet bgs | **Sampled By:** | L. Prosser |
| **Sample Description:** | SM: SILTY SAND: light brown, fine to coarse grained, moist. | **Tested By:** | I. Remotigue |
| **Collapse Potential:** | 1.74 percent collapse at 1300 psf | **Dry Density (pcf):** | 76 |
| **Peak Load (psf):** | 1300 | **Initial Moisture Content (%):** | 7 |

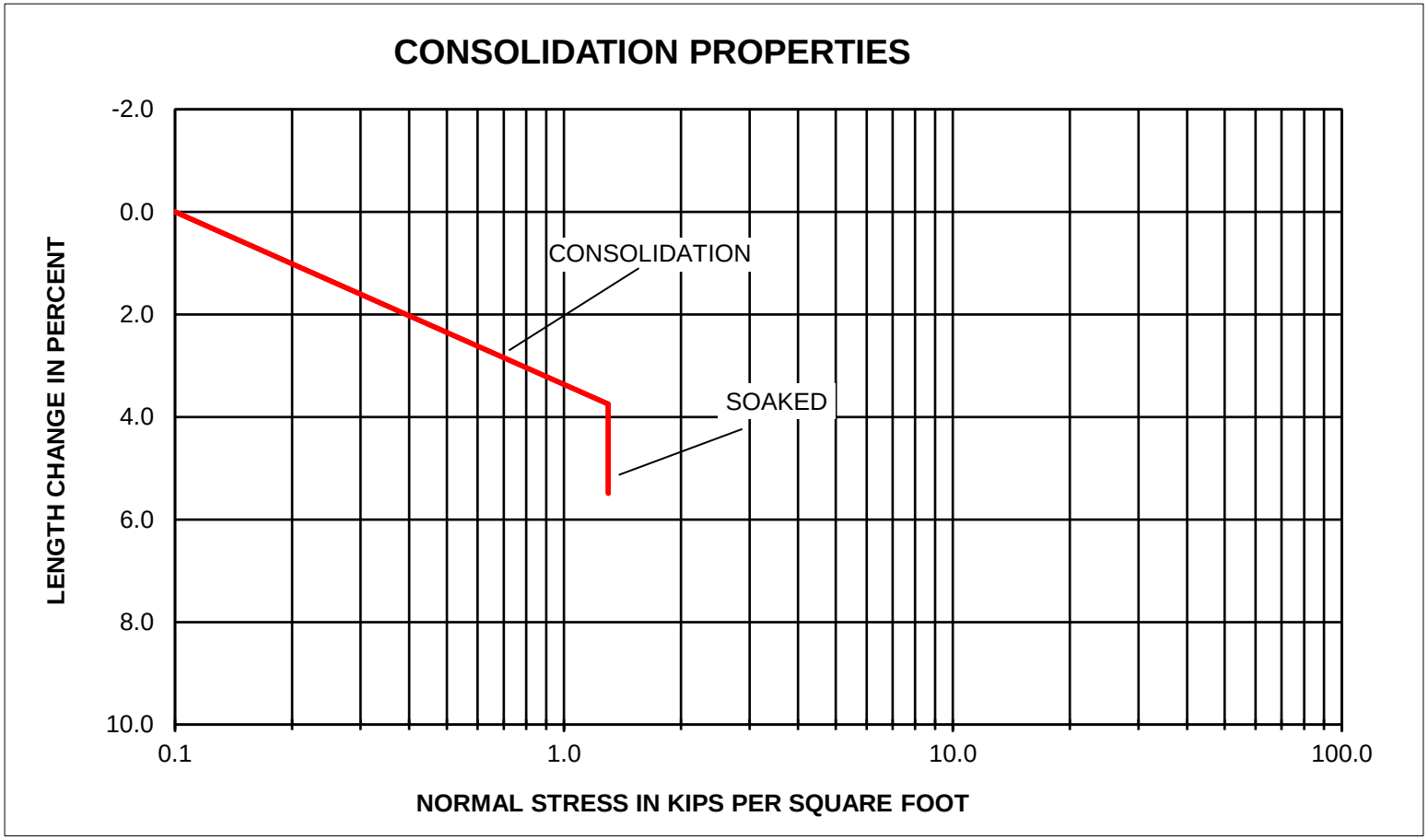


Figure B-2

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700 22nd St
Bakersfield, CA
Ph: (661) 327-0671
Fax: (661) 324-4218

# Collapse Potential Test

ASTM D 5333, One-Dimensional Analysis

| | | | |
|---|---|---|---|
| **Project Name:** | Hart Park Adventure Play Area Project | **Sample Date:** | 11/15/2022 |
| **Project Number:** | G00-000-166 | **Test Date:** | 11/16/2022 |
| **Sample Location:** | B-2 @ 6.0-6.5 feet bgs | **Sampled By:** | L. Prosser |
| **Sample Description:** | SM: SILTY SAND: light brown, fine to coarse grained, moist. | **Tested By:** | I. Pacheco |
| **Collapse Potential:** | 0.46 percent collapse at 1300 psf | **Dry Density (pcf):** | 88 |
| **Peak Load (psf):** | 1300 | **Initial Moisture Content (%):** | 20 |

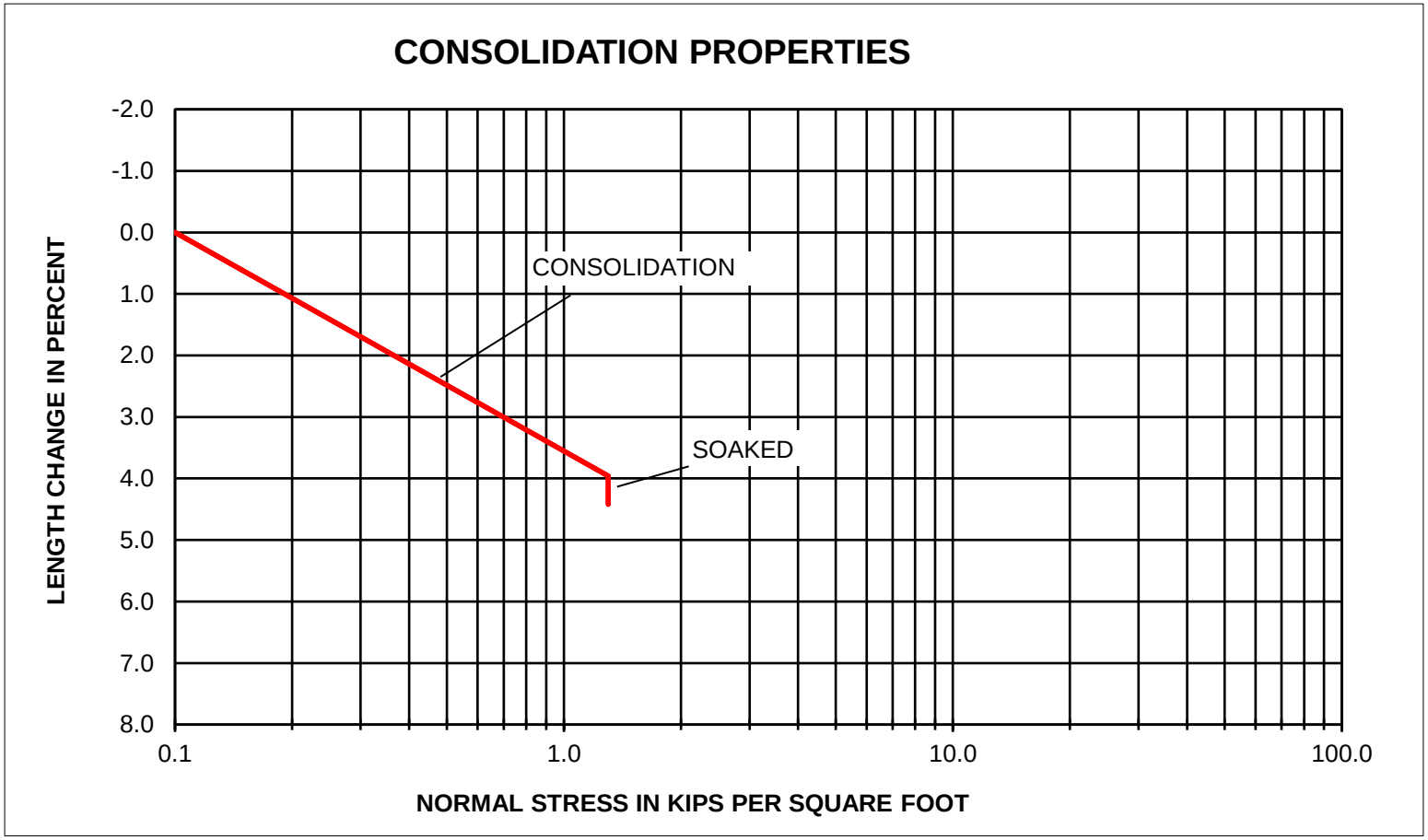


Figure B-3

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Bakersfield, CA 93301
Ph: (661) 327-0671
Fax: (661) 324-4218

# MOISTURE DENSITY RELATIONSHIP
# ASTM D1557

| | | | |
|---|---|---|---|
| **Project Name:** | Hart Park Adventure Play Area Project | **Project Number:** | G00-000-166 |
| **Project Manager:** | A. Terronez | **Lab Number:** | B22-139 |
| **Sample Location:** | B-3 @ 0.0-5.0 feet bgs | **Sample Date:** | 11/15/2022 |
| **Sample Description:** | SM: SILTY SAND: Brown; fine to medium; Moist | | |
| **Tested By:** | J. Buenrostro **Tested Date:** 11/15/2022 | **Sample By:** | L. Prosser |

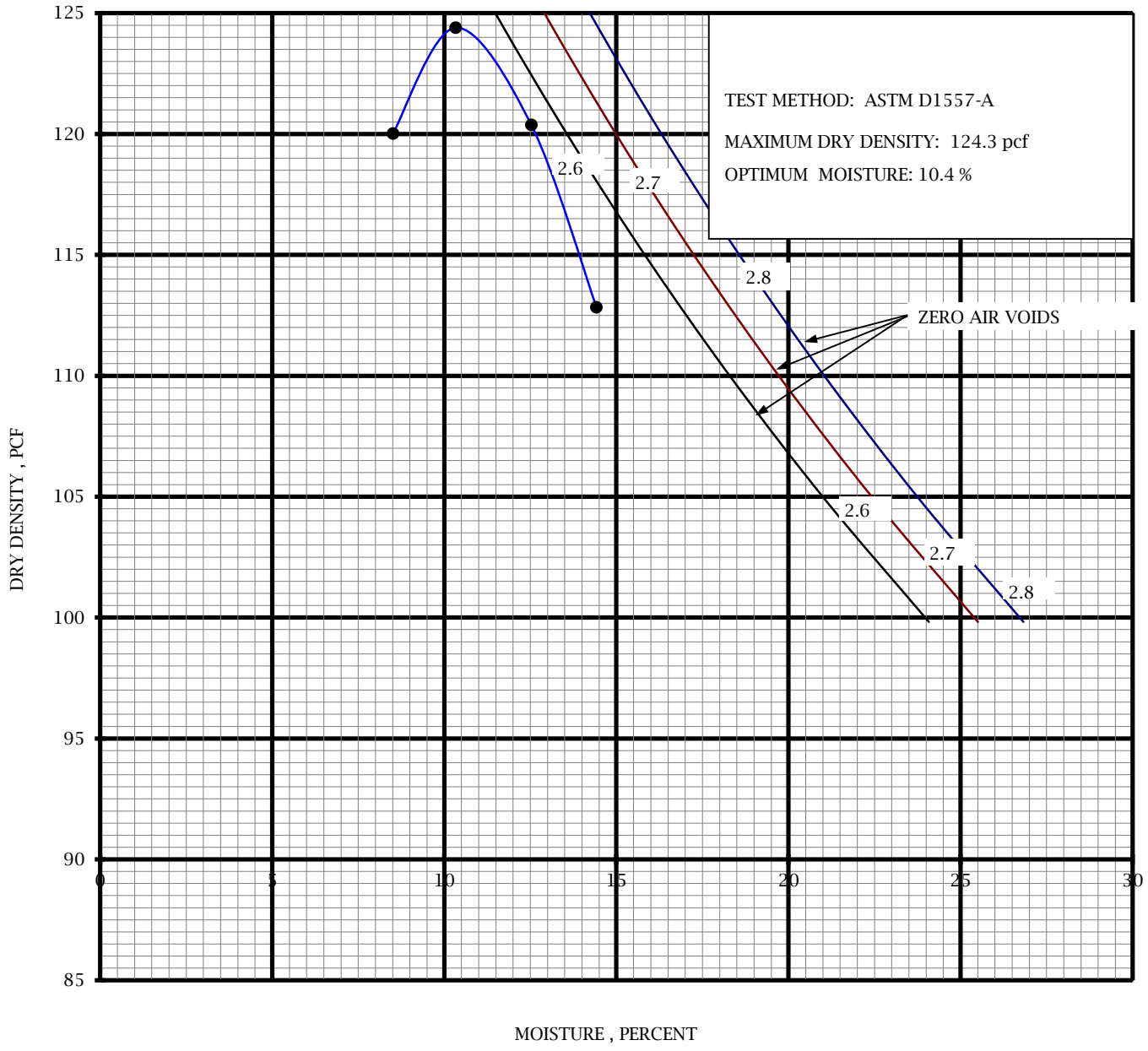


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Figure B-4

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700 22nd St.
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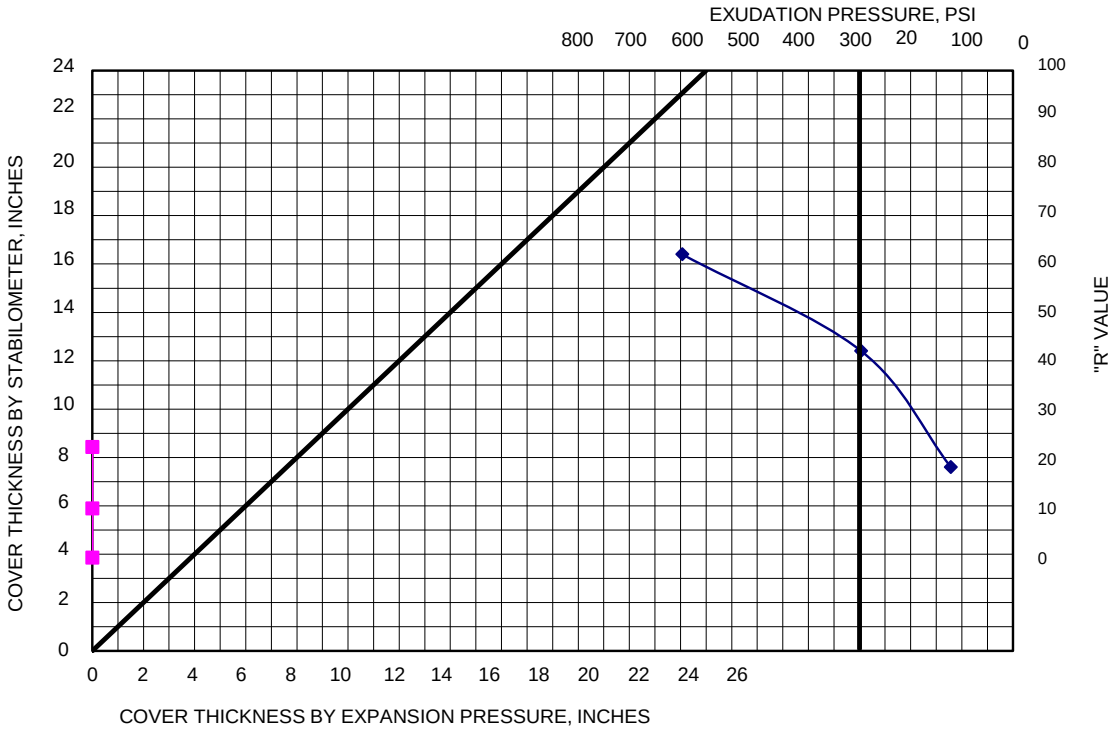
Ph: (661) 327-0670
Fax: (661) 324-4217

# Standard Test Methods for Resistance R-Value and Expansion Pressure of Compacted Soil

**ASTM D-2844**

**Project Name:** Hart Park Adventure Play Area Project
**Project Number:** G00-000-166
**Lab Tracking ID:** B22-139
**Sample Location:** B-3 @0.0-5.0 Feet bgs

**Sample Date:** 11/15/2022
**Test Date:** 11/23/2022
**Report Date:** 11/22/2022
**Tested By:** ILT Remotigue




Sample Description: ML: SANDY SILT: Brown: Fine to Medium.

| SPECIMEN | A | B | C |
|---|---|---|---|
| EXUDATION PRESSURE, LOAD (lb) | 8123.6 | 3726.3 | 1526.3 |
| EXUDATION PRESSURE, PSI | 647 | 297 | 122 |
| EXPANSION, * 0.0001 IN | 0.0026 | 0.0025 | 0.0031 |
| EXPANSION PRESSURE, PSF | 0 | 0 | 0 |
| STABILOMETER PH AT 2000 LBS | 45 | 79 | 125 |
| DISPLACEMENT | 3.86 | 3.47 | 3.28 |
| RESISTANCE VALUE "R" | 62 | 42 | 18 |
| "R" VALUE CORRECTED FOR HEIGHT | 62 | 42 | 18 |
| % MOISTURE AT TEST | 7.2 | 8.2 | 9.2 |
| DRY DENSITY AT TEST, PCF | 120.0 | 110.4 | 109.6 |
| "R" VALUE AT 300 PSI EXUDATION PRESSURE | **42** | | |
| "R" VALUE BY EXPANSION PRESSURE TI = 4.0, GF=1.50 | **N/A** | | |

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Figure B-5