DUCO ENGINEERING

GEOTECHNICAL EVALUATION REPORT

PROPOSED SEVEN-LOT SUBDIVISION
TENTATIVE TRACT 83304
CHEROKEE COURT
SAN DIMAS, CA 91773

JULY 19, 2021
JOB NO.: 21-061

14175 Telephone Ave. Ste. K | Chino, Ca. 91710 | 909.594.7414 | office@ducoengineering.com

DUCO ENGINEERING

July 19, 2021

Stan Stringfellow
Development 1 Group, Inc.
2011 E. Financial Way, Suite 203
Glendora, CA 91741

REPORT OF GEOTECHNICAL EVALUATION
Proposed Seven-lLot Subdivision
Tentative Tract 83304
Cherokee Court
San Dimas, CA 91773
Job No.: 21-061

Mr. Stringfellow:

Thank you for the opportunity for Duco Engineering, Inc., to provide geotechnical services for the proposed seven-lot subdivision. It is our pleasure to serve as the geotechnical consultants for the design and construction of your project. The following presents a report of the geotechnical evaluation conducted for the subject site on July 2, 2021, in addition to an account of laboratory testing performed, and construction recommendations pertinent to the project. With the validating inclusion of this report and the recommendations herein, the proposed construction is considered geotechnically feasible. Upon completion, foundation and grading plans should be provided to this office for review and, if necessary, further comment. Please notify our office if any significant changes are made to the proposed development or plan, as such changes may warrant further geotechnical comment or revision of the provided recommendations.

Our office welcomes any further questions or comments you may have. It is our desire to serve our clients with the utmost efficiency and professionalism.

Respectfully submitted,

DUCO ENGINEERING INC.

PROFESSIONAL ENGINEER
JAMES D. COLLETT
C 90814
CIVIL
STATE OF CALIFORNIA

James D. Collett, RCE 90814

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1.0 INTRODUCTION

1.1 Scope of Report

The purpose of this evaluation is to assess soil conditions at the subject site located at Tentative Tract 83304 Cherokee Court, in the City of San Dimas, California. This evaluation provides grading and construction recommendations to aid in the design and preparation of the proposed seven-lot subdivision. Reference material for the preparation of this report included a site plan you provided. The recommendations contained in this report are considered pertinent to the currently proposed, reviewed construction only. This firm should be notified immediately of any significant changes in the proposed scope of work, as revision and/or amendment to this report may become necessary.

1.2 Scope of Construction

The proposed site improvements consist of the demolition of the existing site improvements, including the existing house and accessory structures on the south end of the property, and the development of seven (7) new single-family residential lots. Development of these lots will include remedial grading to create firm, competent building pads to support the proposed homes; surface grading to achieve proper elevations and contours, the installation of stormwater retention/infiltration devices along the easterly street front to meet current Low Impact Development standards, and street/sidewalk improvements to serve the proposed homes. The proposed overlying construction is assumed to consist of wood-frame one- and two-story structures, with shallow pad and continuous footings and floor slabs on-grade. Access to each lot will be via drive approaches off Cherokee Court, which is immediately adjacent to the east, though the southmost Lot 1 may be accessed via Baseline Road to the south.

2.0 SITE EVALUATION

2.1 Field Exploration

On July 2, 2021, this firm performed a field reconnaissance at the subject site. Subsurface exploration involved observation and sampling of seven (7) test borings with a hollow-stem auger drill rig. The maximum depth of sampling/exploration extended up to approximately 25 feet below adjacent ground surface. The locations of the test holes and a sketch of the proposed site are attached as Figure No. 1; test hole logs can be found in Appendix A. In-place samples were obtained where feasible using a 2.5-inch O.D. ring sampler, while multiple bulk samples were taken for review and worst-case expansion and corrosivity testing. Three (3) additional locations along the eastern boundary of the property were drilled to a depth of five (5) feet below adjacent grade, which were used to perform stormwater infiltration testing in accordance with Los Angeles County Public Works Department standards, using the borehole percolation method.

2.2 Laboratory Testing

On-site soils as encountered were tested for various material properties/characteristics, including, but not limited to, shear strength, settlement/consolidation behavior, expansive index, and corrosive properties. Laboratory testing for this project was limited to the testing of on-site materials; the

import of any materials for structural fill or backfill may warrant further testing at the time of grading/construction. A brief description of each type of test performed is presented in Appendix B, with results for each test included therein. All remaining soil samples are stored for future reference and analysis, if desired. Unless notified to the contrary, all samples are subject to discarding after 45 days of the date of this report.

2.4 Stormwater Infiltration Testing

Stormwater infiltration testing was conducted at the subject site in general conformance with Los Angeles County infiltration testing guidelines as found in Department of Public Works publication GS 200.1 (LACDPW, 2017). After being drilled to the appropriate depth and diameter (5 feet deep, 8 inches in diameter) with the hollow stem auger, approximately two (2) inches of ¾-inch gravel was placed in the bottom of each boring, after which a perforated pipe was set and the perimeter of the boring backfilled with gravel. After presoaking each boring for one (1) hour, eight (8) test readings were taken at each boring over ten (10) minute intervals; at the completion of these readings a stabilized rate as defined by County standards had occurred. The lowest obtained field infiltration rate was 9.10 in/hr, the average of the final three readings in Test Location 3.

3.0 SITE CONDITIONS

3.1 Site and Surficial Conditions

The lot consists of a trapezoidal, ±1.54-acre property on the northwest corner of Baseline Road and Cherokee Court, some 100 feet deep to the west but extending over 650 feet to the north. Access is provided via a gated driveway emanating from Baseline Road, which is shared with the existing house and detached garage built near the street corner, which is to be demolished in preparation for the new development. The remainder of the lot is relatively vacant, save for wild grass and weeds, perimeter bushes and scattered trees, and the remnants of an irrigation system, which runs along the center of the property north to south. Drainage is varied but overall trends away from its longitudinal midpoint, flowing to the north/northeast and south/southwest. The northmost extent of the site is crossed by a 40-foot-wide utility easement running east-southeast to west-northwest.

3.2 Subsurface Conditions

Soils encountered in subsurface explorations consisted of fills and disturbed native soils to a maximum depth of approximately four (4) feet, constituted of loose to moderately firm silty sand with gravel, scattered organics, and debris. These soils were immediately underlain by competent native soils, consisting of a stratum of cobble overlying interbedded silty coarse sand and gravel for the remainder of the explored depth. No uncertified fill, disturbed, or otherwise unsuitable soils are to be used in the support of any proposed structure and shall be completely removed and recompacted in the preparation to achieve the proposed slab subgrade. Localized conditions may vary from those observed in our field evaluation, depending on past site work. Details of test holes can be found in the log of borings in Appendix A.

3.3 Geologic Setting

The site is located on the Quaternary alluvial plains emanating south from the San Gabriel Mountain Range, just east of the Glendora South Hills. Nearby Quaternary faults include the Sierra Madre Fault (0.37 mi N) and the Indian Hill Fault (0.85 mi S), San Jose Fault (3.96 mi S-SE), while the San Andreas Fault is mapped some 19 miles northeast of the subject site at its nearest point.

3.4 Seismic Hazards

The subject site is mapped by the California Geological Survey as outside of any area of susceptibility to geologic hazards from seismic activity or otherwise, including slope instability, liquefaction, lateral spreading, or fault rupture. It is mapped as outside of any Alquist-Priolo fault zone. These findings are in concurrence with the exploratory evaluation by this firm. The dense, rocky nature of the subgrade in conjunction with the gentle gradients of the property and great depth to groundwater preclude susceptibility to soil strength degradation caused by seismic excitement.

3.5 Groundwater

Groundwater was not encountered in any test pit and is not expected at any level which may affect the proposed development. The California Geological Survey has mapped historic high groundwater as deeper than 50 feet, which is supported by various nearby well data published by the Los Angeles County Department of Public Works.

4.0 SITE CONCLUSIONS

4.1 Site Feasibility

Conditions at the site are considered suitable for the proposed development. Provided the proposed development is constructed in conformance with the recommendations herein, the proposed development will be safe and adequate for its intended use. The proposed construction will not adversely affect the geotechnical stability of properties outside of the building site.

4.2 Soil Expansivity

Expansion testing was performed on the encountered onsite soils. These soils are considered to have a very low expansion potential. Results of these tests can be found in Appendix B. Expansive soil design recommendations herein are based upon the worst-case scenario. During grading procedures, it is possible that the soils that will directly affect the surrounding foundations will vary. An expansion test and revision of these recommendations may be necessary.

4.3 Soil Corrosivity

A representative sample of the onsite soil was previously obtained for corrosivity testing in the referenced report. Results of those tests are presented in Appendix B. Based on the results of the tests, the onsite soils are considered to be moderately corrosive with respect to resistivity only. On-site soils are not considered corrosive to concrete.

4.4 Seismic Design Considerations

The following parameters based on ASCE 7-16 may be used for the proposed structural design in accordance with Section 1613 of the 2016 CBC, provided that the seismic response coefficient is evaluated per Exception 2 of ASCE 7-16 Section 11.4.8:

Table 1: ASCE 7-16 seismic design parameters from seismicmaps.org for (34.1219W, -117.8019E)

Site Class	S_S	S_1	S_{DS}	S_{D1}	S_{MS}	S_{M1}	PGA_M
D	1.701 g	0.642 g	1.134 g	0.728 g	1.701 g	1.091 g	0.798 g

Given the dense, gravelly composition of the native material underlying the proposed compacted fill that will be used to support the proposed construction, distance to mapped active faults, and lack of any significant adjacent slopes that may influence or be influenced by the proposed development, the subject site is not susceptible within reasonably assumed conditions and ground motions to liquefaction, lateral spreading, or slope instability.

4.5 Grading and Site Preparation

Given fills encountered and the proposed site configuration, grading operations, in addition to lot leveling and vector planning, will consist of removal and recompaction of unsuitable soils as necessary to create firm, unyielding building pads and ensure the proposed structures bear into competent material.

4.6 Storm Water Infiltration

Mapped and observed site conditions, including the relatively flat terrain, great depth to groundwater, and coarse nature of subgrade soils are considered favorable for the implementation of stormwater infiltration at the subject site, as are the field infiltration rates obtained through testing. It is our opinion that, provided the proposed stormwater infiltration system is properly designed and constructed in conformance with the proper setbacks and performance criteria—including the recommendations herein as well as any requirements of the City of San Dimas—infiltration devices will perform adequately and effectively as a Low Impact Design (LID) measure.

5.0 GEOTECHNICAL RECOMMENDATIONS

5.1 Soil Corrosivity

Given that on-site soils are considered moderately corrosive with respect to resistivity only, concrete need not incorporate additional measures in accordance with Chapter 4 of ACI 318. It is recommended, however, that all metal pipes should be wrapped in a tape coating system, sleeved, coated with a high-quality dielectric coating, or embedded in 3-sac slurry mix using type V cement. Bond underground steel pipes with rubber-gasketed or other nonconductive type joints for electrical continuity. Copper pipes should be placed in a poly-sleeve or other appropriate material and protected from soil contact. Consideration should be given to running overhead. It should be noted that the municipality may have minimum requirements for mitigation of soil corrosivity; those requirements shall govern if more conservative than the aforementioned recommendations.

5.2 Grading and Site Preparation

In order to provide competent bearing support for the proposed residential and accessory structures, remedial grading shall be performed in the area of the building pad to remove uncertified fill and any other unsuitable soils and replace them with a compacted fill mat. This overexcavation will be sufficiently deep to remove all unsuitable soils down to competent native material, which is anticipated at depths up to four (4) feet below existing grade given the conditions encountered in test borings. The fill cap shall further be appropriately thick so as to provide a minimum of 24 inches of compacted fill below the bottom of any proposed footing, which may necessitate deeper removals depending on finish grade elevations. Removals shall extend laterally five (5) feet or 1:1 the removal depth—whichever is greater—outside the foundation footprint (including any porches), though we suggest that consideration be given to remediating the entire site, to minimize the need for invasive grading operations in the future in the event of further development (room additions, accessory dwelling structures, etc.). All fill placement and compaction shall be in accordance with the requirements of Appendix C herein.

5.2.1 Demolition and Debris Disposal

Any demolition debris, debris encountered in the clearing and grubbing, and all vegetation is to be cleared from the grading area and hauled offsite. Any existing or abandoned utilities located within the proposed development area should be removed or relocated.

5.2.2 Shrinkage

An average shrinkage factor of 10-15% should be anticipated when excavating and recompacting onsite surface soils.

5.2.3 Underground Obstructions

While it is incumbent upon the client and/or designated representative (contractor, etc.) to ensure all on-site utilities are located prior to grading, unknown and/or abandoned utilities may nevertheless be encountered. Should any of these be encountered within the proposed building area, they should

be removed and/or relocated outside the building area at the direction of a person qualified to do so.

Septic tanks, seepage pits, or other similar structures, should they be encountered, should be verified for abandonment of use. Septic tanks shall be entirely removed, seepage pits shall then have the top of said structure demolished to the adjacent overexcavation depth, and the remaining void shall be filled with 3-sack slurry.

5.3 Foundations

Continuous and square footings to support the proposed structure shall be a minimum of 12 and 18 inches deep for one- and two-story support, respectively, and shall bear onto approved compacted fill soils. Continuous footings shall be a minimum of 12 and 15 inches wide for one and two stories, respectively, while pad footings shall be a minimum of 18 inches wide in each plan dimension. All foundations shall have an allowable bearing pressure of 2000 psf, with an allowable increase of 10% for each additional foot of depth (but not width) up to a maximum of 3200 psf. Ultimate passive resistance shall be taken as 250 psf/ft, maximum 3250 psf, with a coefficient of friction of 0.35 where concrete is poured in direct contact with compacted fill or approved natural ground. Settlement is not anticipated to exceed 0.6 inches total, with 0.3 inches of differential over 25 feet. Footing reinforcement shall comply with all code standards but should, at minimum, include one (1) #4 bar each in the top and bottom of each footing. Garage door openings (or similar) shall be spanned by a grade beam. While not a requirement from a geotechnical perspective for this project, tying isolated pad footings to the main foundation system with grade beams is recommended, as doing so will contribute to extending the serviceable life of the structure.

5.4 Floor Slabs

Any concrete floor slab shall be a minimum of 4 inches thick, overlying a minimum of two (2) inches of washed concrete sand with a 10-mil visqueen barrier underneath the sand where impedance of moisture permeation is necessary. These slabs should be supported uniformly by compacted fill. Minimum slab reinforcement shall be #3 bars, 18 inches center-to-center, or equivalent; slab design shall comply with all pertinent code requirements, including reinforcement minimums. Floor slabs should be saw cut at 10-foot spacing to help prevent cracking and other largely cosmetic distress. Patio decks should also follow these recommendations, though the visqueen may be omitted.

5.5 Retaining Walls

Cantilever retaining walls shorter than six (6) feet in retained height may be designed for backfill with on-site granular soils, with an active earth pressure of 33 pcf and 48 pcf E.F.P. for level and 2H:1V inclined backfill respectively, where the walls may deflect a minimum of 0.0025*H measured at the wall top. Restrained walls shall be designed for an at-rest earth pressure of 60 pcf E.F.P. Separation gaps shall be placed at wall vertices to prevent the development of an at-rest condition where the wall is otherwise cantilevered. This firm shall be provided the opportunity to provide further review and design comment on any retaining walls proposed taller than six (6) feet, as these walls must be designed to accommodate design-specific seismic earth pressures. Retaining wall footings may assume the foundation design parameters outlined in Section 5.3, with the exception that they may alternatively bear a minimum of 12 inches into approved native soils. This option will

likely require deepened foundations. A separation gap shall be placed anywhere a retaining wall footing bridges bearing materials between compacted fill and approved native soils.

5.6 Temporary Excavations

All excavations must comply with current OSHA standards, state, local and federal safety regulations. Excavations may be vertically cut to three (3) feet, then be sloped at a slope of 1H:1V. Surcharge loading, including stockpiled soil, should be placed 1:1 the excavation height back from the top of the excavation. Duco Engineering is not the OSHA responsible party and defers to that individual or entity for further guidance.

5.7 Drainage and Landscaping

All site drainage should be collected and transferred to an approved storm water drainage system. No drainage should pond against any foundation or other structure. Any planned area drains should be recessed below grade to allow the free flow of water into the drain inlet. Flatwork and concrete walks should be at an elevation such that they will not obstruct the flow of surface water. Proper drainage should be maintained at all times.

Landscaping improvements must not cause surface water to collect adjacent to any foundation, causing saturated soils adjacent to the foundation. Planters adjacent to the building should be avoided or at least properly designed to reduce the amount of water penetration adjacent to footing subgrades, thereby reducing moisture related foundation damage. Any planned area drains should be recessed below grade to allow the free flow of water into the drain inlet. The resident is responsible for proper maintenance, landscaping, and irrigation.

Irrigation methods should promote uniformity of moisture. Overwatering and underwatering must be avoided. Heavy irrigation and inadequate runoff gradients can create moisture problems. Maintaining adequate surface drainage and controlled irrigation will significantly reduce the potential for nuisance-type moisture issues.

5.8 Hardscape

Hardscape improvements are not generally considered structural; however, we do recommend that overexcavation and recompaction be performed beneath proposed walkways, patios, garden walls, and other landscape features, in order to minimize the potential for cracking and other phenomena. Areas to receive hardscape should have the upper one (1) foot of approved soil or subgrade soil, whichever is deeper, recompacted to a minimum of 90%. Moisture content of subgrade soils should be maintained above optimum moisture. Concrete flatwork should be a minimum full four (4) inches thick, and consideration should be given to reinforcing #3 rebar spaced 18 inches center to center and should comply with all pertinent governing code sections and design manuals. Control joints shall be provided, a minimum of one (1) inch deep, 8 feet on center. All flatwork should be poured independent of any proposed structure and be separated by an expansion joint (felt). Additionally, it is recommended that all flatwork be constructed so that a minimum of ½ inch exists between the concrete flatwork and structures, such as residential buildings, retaining walls and sound privacy walls. Flatwork and concrete walks should be at an elevation such that they will not obstruct the flow of surface water.

5.9 Storm Water Infiltration

Storm water infiltration devices shall be located and constructed in conformance with local and county guidelines—namely, infiltration basin inverts shall maintain a setback of 15 feet from any structure and shall not intersect a 1:1 upward diagonal projection from any footing bottom. Premised upon Los Angeles County Guidelines, the field infiltration rate we obtained shall be a reduced safety factor of 4.0, based on the following criteria:

Table 2: Reduction factors for field-obtained infiltration rates

Rate Reduction Category	*Reduction Factor*
RF_T, reduction for test method	2.0
RF_V, reduction for site variability, certainty	1.0
RF_S, reduction for test method	2.0
$FS = RF_T \times RF_V \times RF_S = 4.0$	

This criteria was selected based on the requirements of the County standards, the frequency and uniformity of our test borings, and the assumption that moderate pre-treatment and system maintenance will occur over the intended life of the infiltration devices. Given this criteria, we recommend a **factored, design infiltration rate of 2.25 in/hr** for any proposed stormwater infiltration devices with invert depths on the order of three (3) to five (5) feet. However, given the coarser composition and higher gravel content of the underlying soils deeper than those tested, we anticipate this design value to be conservative should the basin invert depth exceed five (5) feet below existing. Additional testing or comment may be necessary at the discretion of the governing municipality and/or project civil engineer or should the proposed implementation of storm water retention/infiltration measures differ significantly from what we reasonably assume.

6.0 SUMMARY & CLOSURE

6.1 Future Work

Foundation and grading plans, upon completion, shall be provided to this firm for review, further comment or analysis as necessary, and approval from a geotechnical standpoint. Inspection of the completed foundation excavations should be performed by a member of this firm, prior to the placement of any forms or reinforcement, to ensure conformance with the proposed design and design criteria. These additional services are not considered a part of this report, or within the scope of services currently contracted.

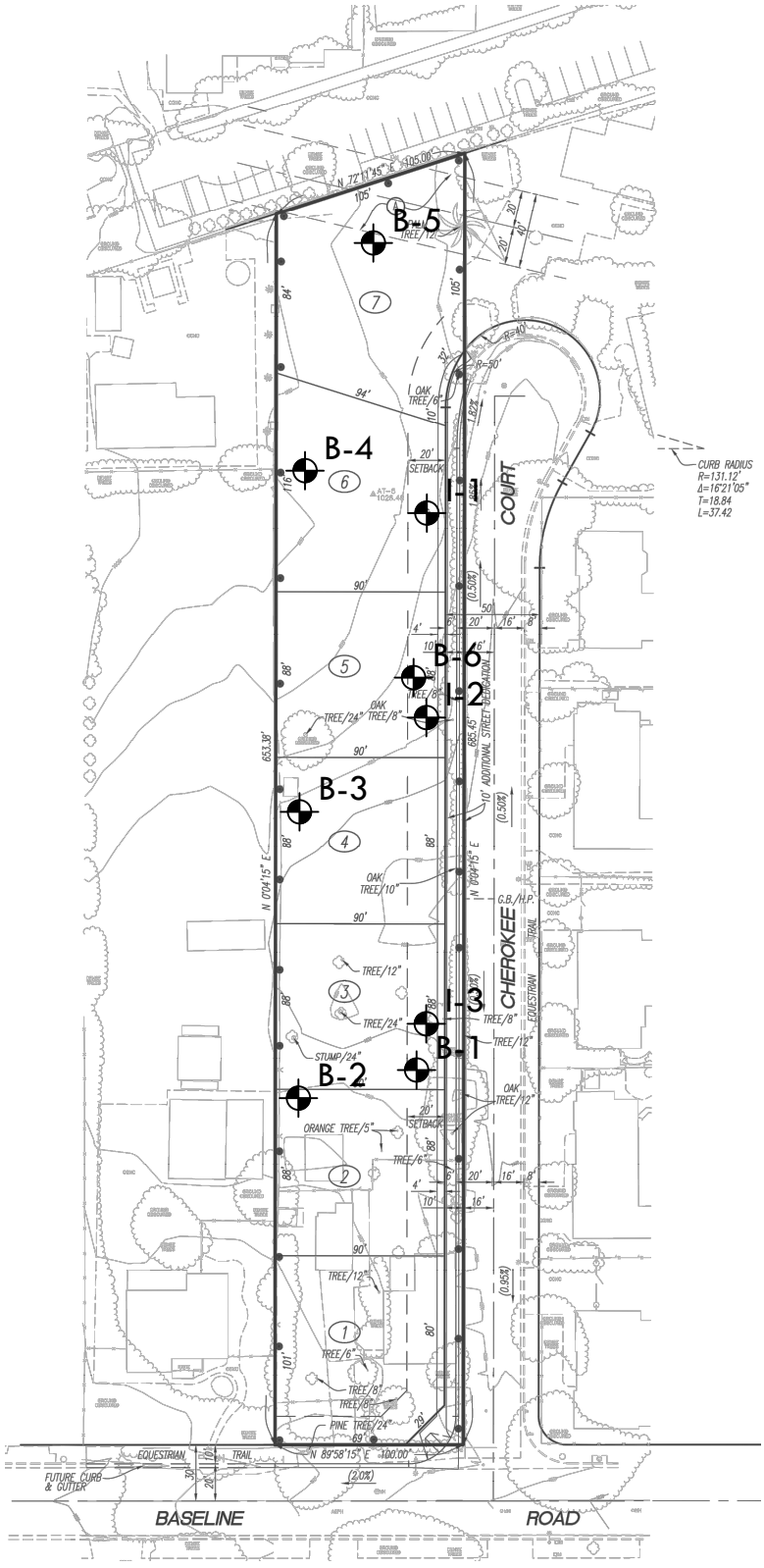
6.3 Closure

The findings in this report are based and prepared in accordance with pertinent state and local building and design codes, as well as generally accepted geotechnical engineering practices. No other warranty, guarantee, or assurance is expressed or implied. This firm is not responsible for work performed outside of its responsible charge as defined in the California Professional Engineers Act and governing board rules, or work for which this firm's recommendations were not adhered to or for which this firm was not provided the opportunity of oversight, comment, and/or inspection.

Should you have any questions with regard to this report of the recommendations contained herein, please contact this office.

A. APPENDIX: MAP, LOGS

Boring locations are approximate and based on field measurements/sightings to existing features.



B-1 Boring Location

I-1 Infiltration Test Location

Site Plan from Andreasen Engineering Inc., 2021.

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PROJECT:

PROPOSED 7-LOT SUBDIVISION
Cherokee Ct.
San Dimas, CA 91773

SHEET TITLE:

BORING LOCATION MAP

Job No: 21-061

1"=100'

FIG. 1

SOIL EXPLORATION LOG

PROJECT: Proposed 7-Lot Subdivision **JOB NO.:** 21-061 **TEST HOLE NO.:** 1
CLIENT: Development 1 Group, Inc. **DATE:** 7/2/2021
LOCATION: E PL, See Plan **ELEVATION:** 1029.7
LOGGED BY: JC **EXCAVATING EQUIPMENT:** 8" Hollow Stem Auger
DEPTH TO WATER: None **CAVING:** None

SUMMARY OF SUBSURFACE CONDITIONS:
This log is part of the report prepared by Duco Engineering, Inc. for this project and should be read together with the report. This summary applies only to the location of the test hole at the time of the excavation. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.

DEPTH (feet)	SAMPLE	BLOW COUNTS	SOIL TYPE	GRAPHIC LOG	USCS	DESCRIPTION	SAMPLE DATA: FIELD MOIST. % OF DRY WT.	SAMPLE DATA: DRY DEN. Lb./Cu. Ft.	SAMPLE DATA: % COMP
0			A		SM	0-2.5', FILL/DISTURBED NATIVE, silty sand and gravel, scattered cobbles and debris, loose, grey-brown, dry to dry-damp			
			B		SM/ GM	2.5-15.5', SILTY COARSE SAND WITH INTERBEDDED GRAVEL, firm, tan-grey, subangular gravel, dry-damp, cobble stratum at contact	1.9		
5		11,10,15				Cobble	2.2	113.6	86.1
10		47,50				Cobble and gravel	3.5	116.5	88.3
15		8,15,28	C		SP/GP	15.5'+, COARSE SAND AND GRAVEL, grey, very firm, damp	4.0		
20									
25						EOB			
30									

DUCO ENGINEERING, INC. FIGURE NO.: 2

SOIL EXPLORATION LOG

PROJECT: Proposed 7-Lot Subdivision **JOB NO.:** 21-061 **TEST HOLE NO.:** 2
CLIENT: Development 1 Group, Inc. **DATE:** 7/2/2021
LOCATION: W PL, See Plan **ELEVATION:** 128.8
LOGGED BY: JC **EXCAVATING EQUIPMENT:** 8" Hollow Stem Auger
DEPTH TO WATER: None **CAVING:** None

SUMMARY OF SUBSURFACE CONDITIONS:
This log is part of the report prepared by Duco Engineering, Inc. for this project and should be read together with the report. This summary applies only to the location of the test hole at the time of the excavation. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.

DEPTH (feet)	SAMPLE	BLOW COUNTS	SOIL TYPE	GRAPHIC LOG	USCS	DESCRIPTION	SAMPLE DATA: FIELD MOIST. % OF DRY WT.	SAMPLE DATA: DRY DEN. Lb./Cu. Ft.	SAMPLE DATA: % COMP
0			A		SM	0-2', FILL/DISTURBED NATIVE, silty sand and gravel, scattered cobbles and debris, loose, grey-brown, dry to dry-damp, burrowing animal holes			
			B		SM/ GM	2-13', SILTY COARSE SAND WITH INTERBEDDED GRAVEL, firm, tan-grey, subangular gravel, dry-damp, cobble stratum at contact			
						Cobble	2.6		
5		8,10,19					1.4		
						Cobble and gravel interbeds			
10		11,19,30					2.6	115.3	87.4
			C		SP/GP	13'+, COARSE SAND AND GRAVEL, grey, very firm, damp			
15						EOB			
20									
25									
30									

DUCO ENGINEERING, INC. FIGURE NO.: 3

SOIL EXPLORATION LOG

PROJECT: Proposed 7-Lot Subdivision **JOB NO.:** 21-061 **TEST HOLE NO.:** 3
CLIENT: Development 1 Group, Inc. **DATE:** 7/2/2021
LOCATION: W PL, See Plan **ELEVATION:** 1029.5
LOGGED BY: JC **EXCAVATING EQUIPMENT:** 8" Hollow Stem Auger
DEPTH TO WATER: None **CAVING:** None

SUMMARY OF SUBSURFACE CONDITIONS:
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DEPTH (feet)	SAMPLE	BLOW COUNTS	SOIL TYPE	GRAPHIC LOG	USCS	DESCRIPTION	SAMPLE DATA: FIELD MOIST. % OF DRY WT.	SAMPLE DATA: DRY DEN. Lb./Cu. Ft.	SAMPLE DATA: % COMP
0			A		SM	0-3', FILL/DISTURBED NATIVE, silty sand and gravel, scattered cobbles and debris, loose, grey-brown, dry to dry-damp, burrowing animal holes			
			B		SM/ GM	2'+, SILTY COARSE SAND WITH INTERBEDDED GRAVEL, very firm, tan-brown, subangular gravel, dry-damp, cobble stratum at contact			
5		10,18,11					2.4	112.9	85.6
		8,10,19					2.0		
						Cobble and gravel interbeds			
10		11,19,30				Disturbed Recovery Cobble	4.4	--	--
15						EOB			
20									
25									
30									

DUCO ENGINEERING, INC. FIGURE NO.: 4

SOIL EXPLORATION LOG

PROJECT: Proposed 7-Lot Subdivision **JOB NO.:** 21-061 **TEST HOLE NO.:** 4
CLIENT: Development 1 Group, Inc. **DATE:** 7/2/2021
LOCATION: W PL, See Plan **ELEVATION:** 1026.2
LOGGED BY: JC **EXCAVATING EQUIPMENT:** 8" Hollow Stem Auger
DEPTH TO WATER: None **CAVING:** None

SUMMARY OF SUBSURFACE CONDITIONS:
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DEPTH (feet)	SAMPLE	BLOW COUNTS	SOIL TYPE	GRAPHIC LOG	USCS	DESCRIPTION	SAMPLE DATA: FIELD MOIST. % OF DRY WT.	SAMPLE DATA: DRY DEN. Lb./Cu. Ft.	SAMPLE DATA: % COMP
0			A		SM	0-4', FILL/DISTURBED NATIVE, silty sand and gravel, scattered cobbles and debris, loose, grey-brown, dry to dry-damp, burrowing animal holes	3.0		
5		8,23,18	B		SM/ GM	4+', SILTY COARSE SAND WITH INTERBEDDED GRAVEL, very firm, tan-brown, subangular gravel, dry-damp, cobble stratum at contact Cobble and gravel interbeds	3.5		
10		16,10,22					1.1		
						EOB			
15									
20									
25									
30									

DUCO ENGINEERING, INC. FIGURE NO.: 5

SOIL EXPLORATION LOG

PROJECT: Proposed 7-Lot Subdivision **JOB NO.:** 21-061 **TEST HOLE NO.:** 5
CLIENT: Development 1 Group, Inc. **DATE:** 7/2/2021
LOCATION: N near easement, See Plan **ELEVATION:** 1027.5
LOGGED BY: JC **EXCAVATING EQUIPMENT:** 8" Hollow Stem Auger
DEPTH TO WATER: None **CAVING:** None

SUMMARY OF SUBSURFACE CONDITIONS:
This log is part of the report prepared by Duco Engineering, Inc. for this project and should be read together with the report. This summary applies only to the location of the test hole at the time of the excavation. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.

DEPTH (feet)	SAMPLE	BLOW COUNTS	SOIL TYPE	GRAPHIC LOG	USCS	DESCRIPTION	SAMPLE DATA: FIELD MOIST. % OF DRY WT.	SAMPLE DATA: DRY DEN. Lb./Cu. Ft.	SAMPLE DATA: % COMP
0			A		SM	0-2.75', FILL/DISTURBED NATIVE, silty sand and gravel, scattered cobbles and debris, loose, grey-brown, dry to dry-damp, burrowing animal holes			
			B		SM/ GM	2.75+', SILTY COARSE SAND WITH INTERBEDDED GRAVEL, very firm, tan-brown, subangular gravel, dry-damp, cobble stratum at contact			
5		11,28,30					1.2	115.7	87.7
						Cobble and gravel interbeds			
10		7,14,29					2.9	113.4	86.0
		12,10,14					3.4		
15						EOB			
20									
25									
30									

DUCO ENGINEERING, INC. FIGURE NO.: 6

SOIL EXPLORATION LOG

PROJECT: Proposed 7-Lot Subdivision **JOB NO.:** 21-061 **TEST HOLE NO.:** 6
CLIENT: Development 1 Group, Inc. **DATE:** 7/2/2021
LOCATION: E PL, See Plan **ELEVATION:** 1028.5
LOGGED BY: JC **EXCAVATING EQUIPMENT:** 8" Hollow Stem Auger
DEPTH TO WATER: None **CAVING:** None

SUMMARY OF SUBSURFACE CONDITIONS:
This log is part of the report prepared by Duco Engineering, Inc. for this project and should be read together with the report. This summary applies only to the location of the test hole at the time of the excavation. Subsurface conditions may differ at other locations and may change at this location with the passage of time. The data presented is a simplification of the actual conditions encountered.

DEPTH (feet)	SAMPLE	BLOW COUNTS	SOIL TYPE	GRAPHIC LOG	USCS	DESCRIPTION	SAMPLE DATA: FIELD MOIST. % OF DRY WT.	SAMPLE DATA: DRY DEN. Lb./Cu. Ft.	SAMPLE DATA: % COMP
0			A		SM	0-3.25', FILL/DISTURBED NATIVE, silty sand and gravel, scattered cobbles and debris, loose, grey-brown, dry to dry-damp, burrowing animal holes			
5		7,12,10	B		SM/ GM	3.25'+, SILTY COARSE SAND WITH INTERBEDDED GRAVEL, very firm, tan-brown, subangular gravel, dry-damp, cobble stratum at contact	1.8	110.9	84.1
						Cobble and gravel interbeds			
10		6,16,20					1.5	118.2	89.6
15						EOB			
20									
25									
30									

DUCO ENGINEERING, INC. FIGURE NO.: 7

B. APPENDIX: LABORATORY TESTING

B1.0 Laboratory Test Procedures

Laboratory tests were performed in general accordance with test methods of the American Society for Testing and Materials (ASTM) or other suggested methods. Test procedures are explained below:

B1.1 Shear Strength

Shear strength characteristics of subsurface soils were evaluated by direct shear testing, in conformance with ASTM D3080. In this method, three (3) or more soil samples (either in-place or remolded to replicate observed or anticipated field conditions) are submerged and consolidated under unique normal loads. After consolidating, each sample is sheared at a constant rate (strain controlled) in a shear box, with shear resistance and displacement measured, recorded, and analyzed. The samples were tested in a 2.5-inch O.D. circular shear box, using a controlled displacement rate of 0.0250-inch per minute in general accordance with ASTM D3080.

B1.2 Settlement

Settlement characteristics of representative samples were evaluated by means of laboratory consolidation tests. Samples were tested in a consolidometer using a dead weight lever system for load application in general accordance with ASTM D2435.

B1.3 Expansive Index (EI)

Expansion tests were performed on representative surface soils in general accordance with the standard procedure of Expansion Index test ASTM 4829. In this testing procedure, the remolded sampled is compacted at 50 percent saturation and, after remolding, the sample is confined under a pressure of 144 psf. and allowed to soak for twenty-four hours. The resulting volume change due to an increase in moisture content is recorded together along with the initial moisture content and dry density. The corresponding Expansion Index is presented in Appendix B.

B1.4 Corrosivity

Corrosivity tests were previously performed on composite samples to evaluate the pH and electrical resistance of the soils. These tests were reportedly conducted in general accordance with California Test method No. 643. Soluble Chlorides were evaluated in general accordance with California test method No. 422. The concentration of soluble sulfate was also evaluated in general accordance with California test method No. 417. Duco Engineering, Inc. does not practice corrosion engineering. We recommend a competent corrosion engineer be retained to further evaluate and test the site soils, as required, to provide specific corrosion mitigation methods appropriate for the project.

B2.0 Laboratory Test Results

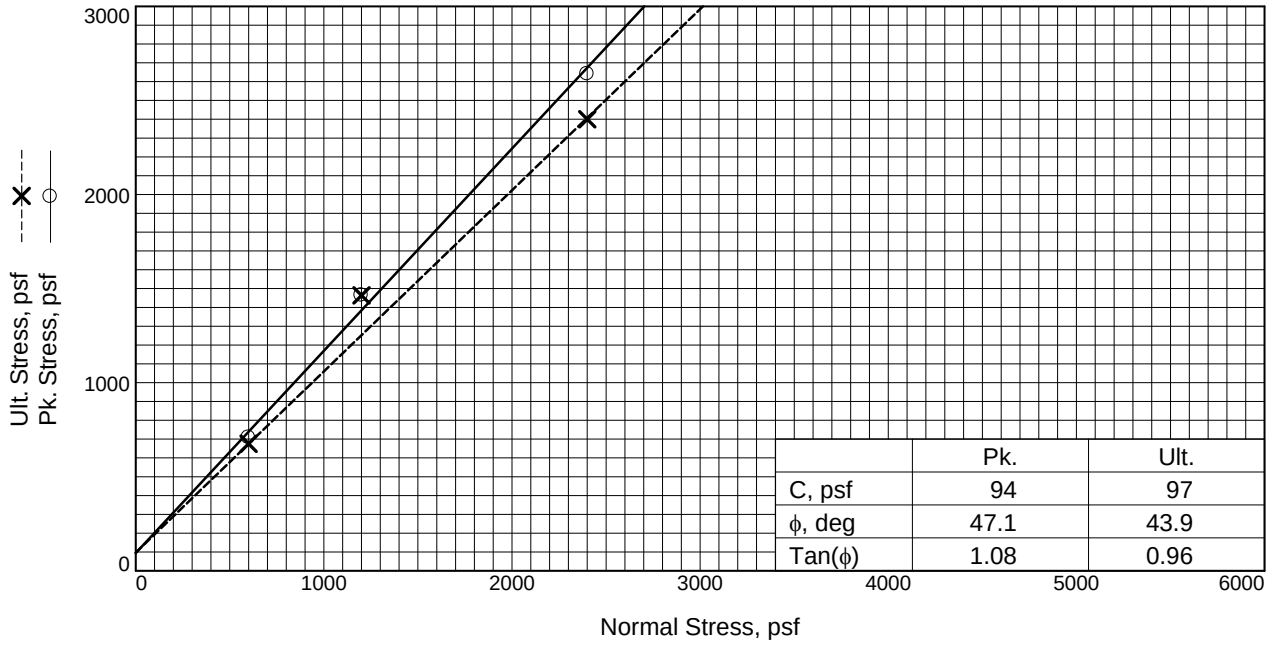
The results of the laboratory tests are presented on the following tables, and subsequent figures. The moisture content results are indicated on the exploratory boring logs, previously presented in Appendix A.

Table B2.1 Maximum Unit Weight and Expansive Index

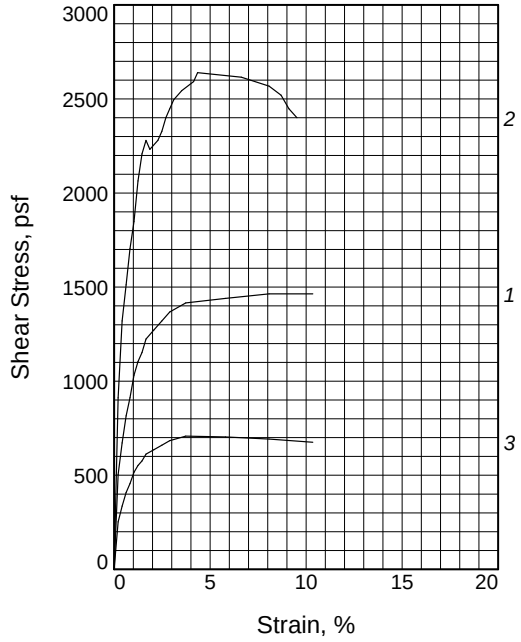
Soil Type	*Opt. Moist.*	*Max. Unit Wt.*	*EI*
F—Fill/Disturbed Native, grey-brown silty sand and gravel (B-4 @1')	12.2 %	127.9 PCF	15
A—Tan-buff Silty Sand (TB3 @ 4.5 ft.)	8.9%	131.9 PCF	0

Table B2.2 Corrosive Properties

Soil Type	*Soluble Sulfate (CA 417)*	*Soluble Chloride (CA 422)*	*Min. Resistivity (CA 643)*	*pH*
F	300 ppm	181 ppm	*5570*	6.2



	Pk.	Ult.
C, psf	94	97
ϕ, deg	47.1	43.9
Tan(ϕ)	1.08	0.96



Sample No.		1	2	3
Initial	Water Content, %	4.3	4.4	4.5
	Dry Density, pcf	113.3	113.0	113.7
	Saturation, %	24.9	25.2	26.0
	Void Ratio	0.4595	0.4638	0.4553
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	17.3	17.5	17.2
	Dry Density, pcf	113.3	113.0	113.7
	Saturation, %	99.8	100.0	100.0
	Void Ratio	0.4595	0.4638	0.4553
	Diameter, in.	2.42	2.42	2.42
	Height, in.	1.00	1.00	1.00
Normal Stress, psf		1200	2400	600
Pk. Stress, psf		1464	2640	708
Strain, %		8.1	4.3	3.7
Ult. Stress, psf		1464	2400	675
Strain, %		8.1	9.5	10.3
Strain rate, in./min.		0.200	0.200	0.200

Sample Type: Drive Sample
Description: SILTY COARSE SAND WITH INTERBEDDED GRAVEL, very firm, tan-brown,

Assumed Specific Gravity= 2.65
Remarks:

Client: Development 1 Group, Inc.

Project: Proposed 7-Lot Subdivision
Cherokee Ct.
Source of Sample: 3 **Depth:** 3.5

Proj. No.: 21-061 **Date Sampled:** 7/2/2021

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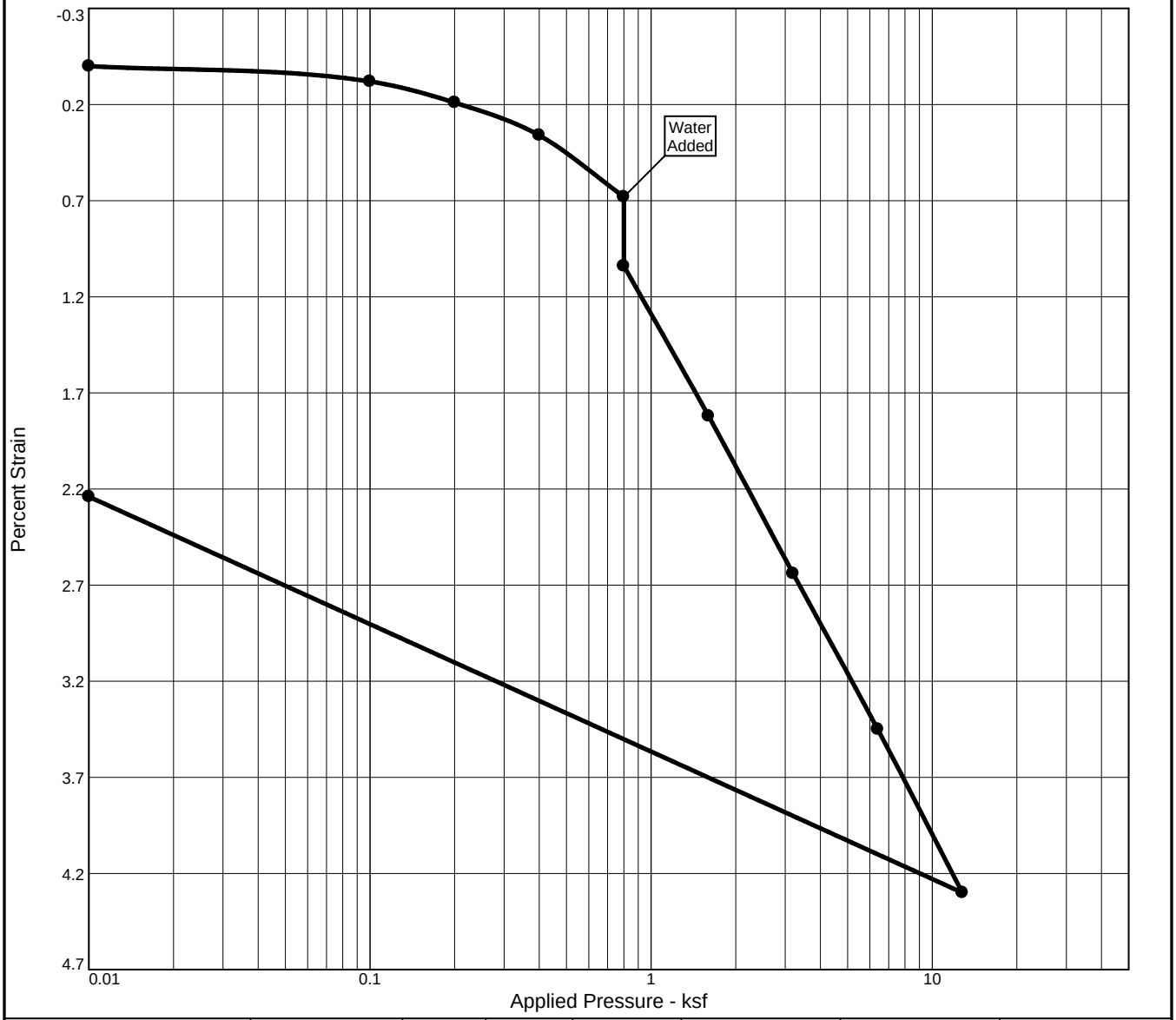
Figure 8

Tested By: JC **Checked By:** DD

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
25.3 %	4.3 %	114.0	NV	NP	2.65	SM/GM		0.451

MATERIAL DESCRIPTION

SILTY COARSE SAND WITH INTERBEDDED GRAVEL, firm, tan-grey, subangular gravel

Project No. 21-061 **Client:** Development 1 Group, Inc.

Project: Proposed 7-Lot Subdivision
Cherokee Ct.

Source of Sample: 1 **Depth:** 5

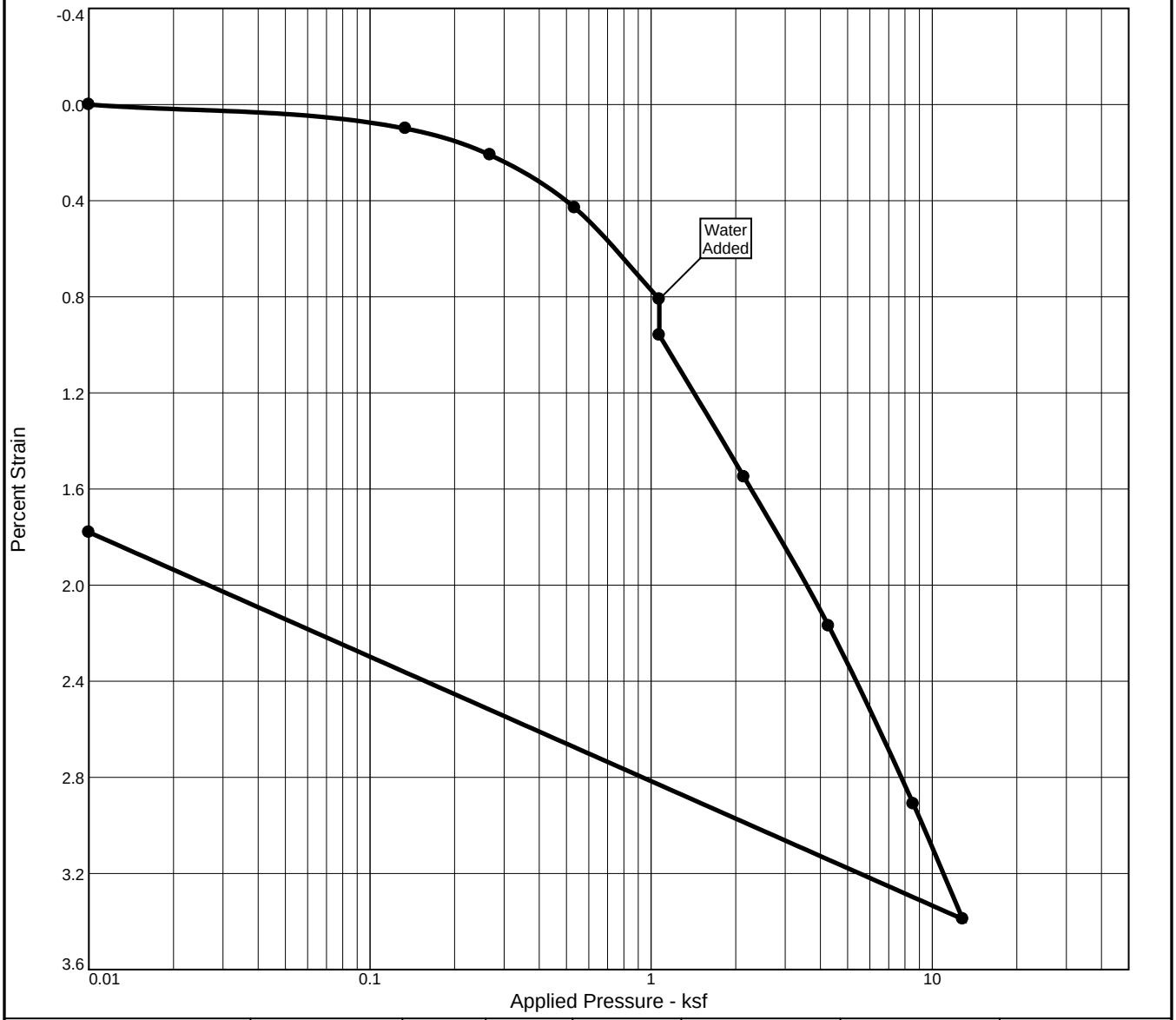
DUCO ENGINEERING, INC.

Remarks:

Figure 9

Tested By: JC **Checked By:** DD

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	USCS	AASHTO	Initial Void Ratio
Saturation	Moisture							
21.3 %	3.6 %	113.8	NV	NP	2.65	SM/GM		0.453

MATERIAL DESCRIPTION

SILTY COARSE SAND WITH INTERBEDDED GRAVEL, very firm, tan-brown, subangular gravel

Project No. 21-061 **Client:** Development 1 Group, Inc.

Project: Proposed 7-Lot Subdivision
Cherokee Ct.

Source of Sample: 5 **Depth:** 9

DUCO ENGINEERING, INC.

Remarks:

Figure 10

Tested By: JC **Checked By:** DD

BORING INFILTRATION
TEST LOG

Project:	Proposed 7-Unit Subdivision	Job No.:	21-061
Address:	Cherokee Ct., San Dimas	Date:	7/2/2021

Test No:	1	Depth to Water Table:	50 ft+	Soak Start:	7:14
Tech:	JC	Depth top BMP Invert:	5 ft	Soak End:	8:14
Depth:	5	Tested Depths:	1-5 ft	1 ft drop time	11.5 min
Diameter:	8	Measurement Method:	Sounder	10/30 min?	10
Soil Type:	SM/GM	Notes:			
Pipe Dia:	2.5				

Start Time	Dur. (min)	d1 (in).	d2 (in).	Vol (in^3)	Area (in^2)	Rate (in/hr)
8:26	10	7.5	59.5	1198.7	716.3	10.04
8:37	10	8.5	58.25	1146.8	719.4	9.56
8:49	10	8	59.5	1187.2	710.0	10.03
9:01	10	7.75	57.5	1146.8	738.3	9.32
9:12	10	8.25	57.75	1141.0	728.8	9.39
9:24	10	8.5	57.25	1123.8	732.0	9.21
9:36	10	7	58.25	1181.4	738.3	9.60
9:40	10	6.25	56.75	1164.1	766.5	9.11

Test No:	2	Depth to Water Table:	50 ft+	Soak Start:	7:17
Tech:	JC	Depth top BMP Invert:	5 ft	Soak End:	8:17
Depth:	5	Tested Depths:	1-5 ft	1 ft drop time	12.5 min
Diameter:	8	Measurement Method:	Sounder	10/30 min?	10
Soil Type:	SM/GM	Notes:			
Pipe Dia:	2.5				

Start Time	Dur. (min)	d1 (in).	d2 (in).	Vol (in^3)	Area (in^2)	Rate (in/hr)
8:31	10	10	55.25	1043.1	738.3	8.48
8:43	10	11.25	56.75	1048.8	703.7	8.94
8:54	10	10.5	57.125	1074.8	708.4	9.10
9:06	10	11.125	58.75	1097.8	680.2	9.68
9:18	10	10.75	59	1112.2	681.7	9.79
9:29	10	10.875	57.125	1066.1	703.7	9.09
9:41	10	10.25	57.75	1094.9	703.7	9.34
9:53	10	10.5	57.875	1092.1	699.0	9.37

Test No:	3	Depth to Water Table:	50 ft+	Soak Start:	7:22
Tech:	JC	Depth top BMP Invert:	5 ft	Soak End:	8:22
Depth:	5	Tested Depths:	1-5 ft	1 ft drop time	11 min
Diameter:	8	Measurement Method:	Sounder	10/30 min?	10
Soil Type:	SM/GM	Notes:			
Pipe Dia:	2.5				

Start Time	Dur. (min)	d1 (in).	d2 (in).	Vol (in^3)	Area (in^2)	Rate (in/hr)
8:36	10	9.5	42.5	760.7	904.8	5.04
8:47	10	9	59.75	1169.9	694.3	10.11
8:59	10	9.75	54.75	1037.3	747.7	8.32
9:12	10	8.75	55.875	1086.3	746.1	8.74
9:25	10	8.875	56.5	1097.8	736.7	8.94
9:37	10	9.875	56.75	1080.5	721.0	8.99
9:49	10	9	57	1106.5	728.8	9.11
10:00	10	8.75	57.25	1118.0	728.8	9.20

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Fig No. 11

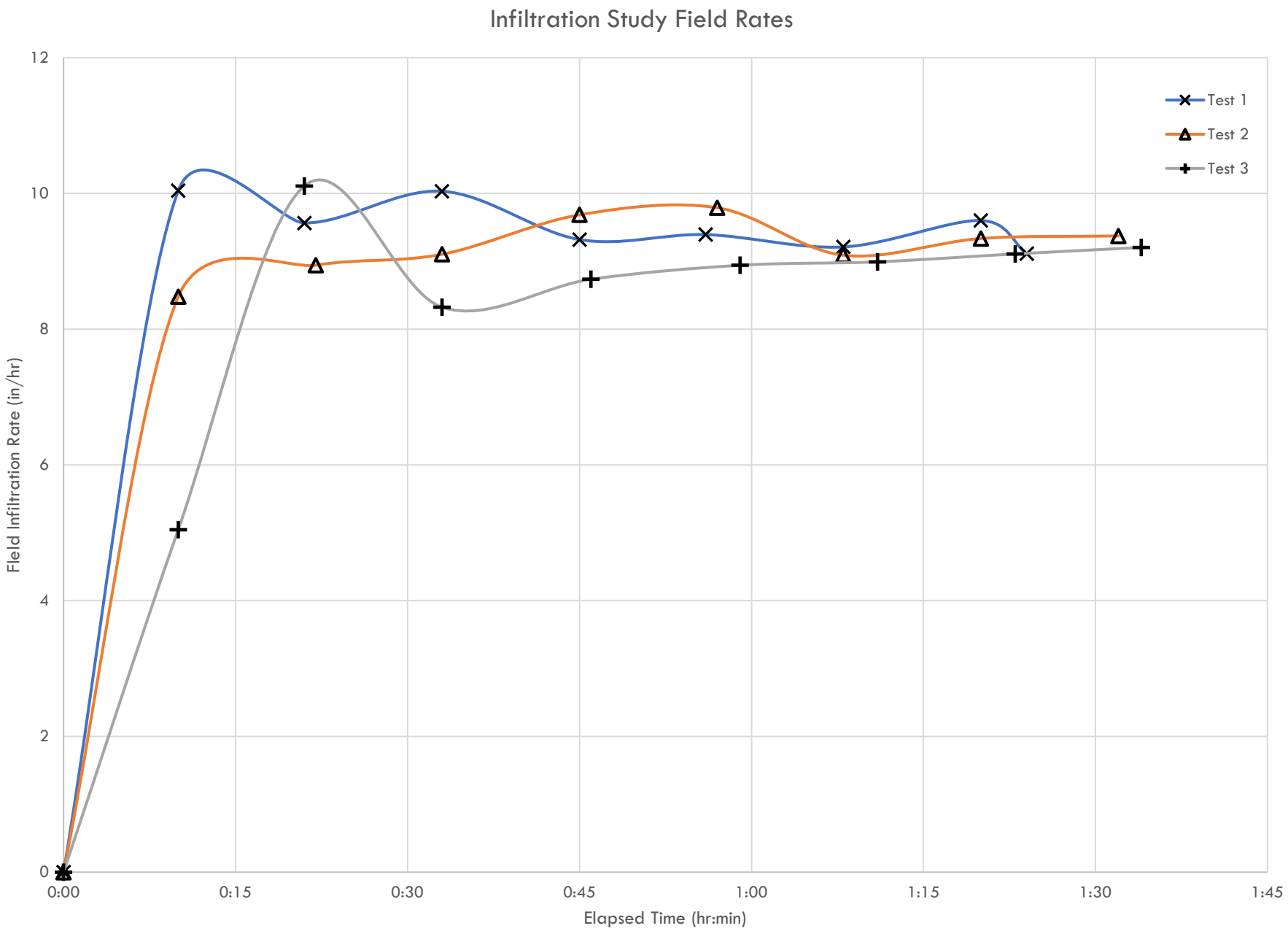

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Fig No.: 12

C. APPENDIX: GENERAL GRADING RECOMMENDATIONS

All grading, including cuts, fills, overexcavations, etc., shall be conducted under the oversight of this firm, and shall be in accordance with the recommendations and provisions of the current California Building Code and any additionally governing design or construction codes, including local regulations.

C.1 Structural Fills

Structural fills shall not be founded on any loose, disturbed, uncertified, and/or unapproved material. Structural fills are generally defined as any fill materials placed in the support of any building or earth structure, including buildings, swimming pools, retaining walls, fill slopes, etc. Structural fills may only be founded on approved native material (i.e. alluvium or bedrock) or certified compacted fill. Typically, no topsoil or colluvium shall remain below any structural fills.

C.2 Overexcavation

Unless otherwise specified, overexcavation of surface soils as required shall extend into approved native material and/or certified compacted fill, penetrating all loose, disturbed and/or unsuitable soils per the direction of the geotechnical engineer or subsequent representative. Overexcavation shall extend laterally outside the building footprint (a) 5 feet, or (b) a distance equal to the depth of adjacent excavation, whichever is greater. Areas where this requirement cannot be met (i.e. adjacent property lines, structures, etc.) shall be reviewed for by this firm on a case-by-case basis. Minimum depth of overexcavation shall be specified by this firm but should, at minimum, extend two (2) feet below the proposed footing bottom elevation(s), if the removal of unsuitable surface materials will not already extend to that depth.

C.3 Fill Placement

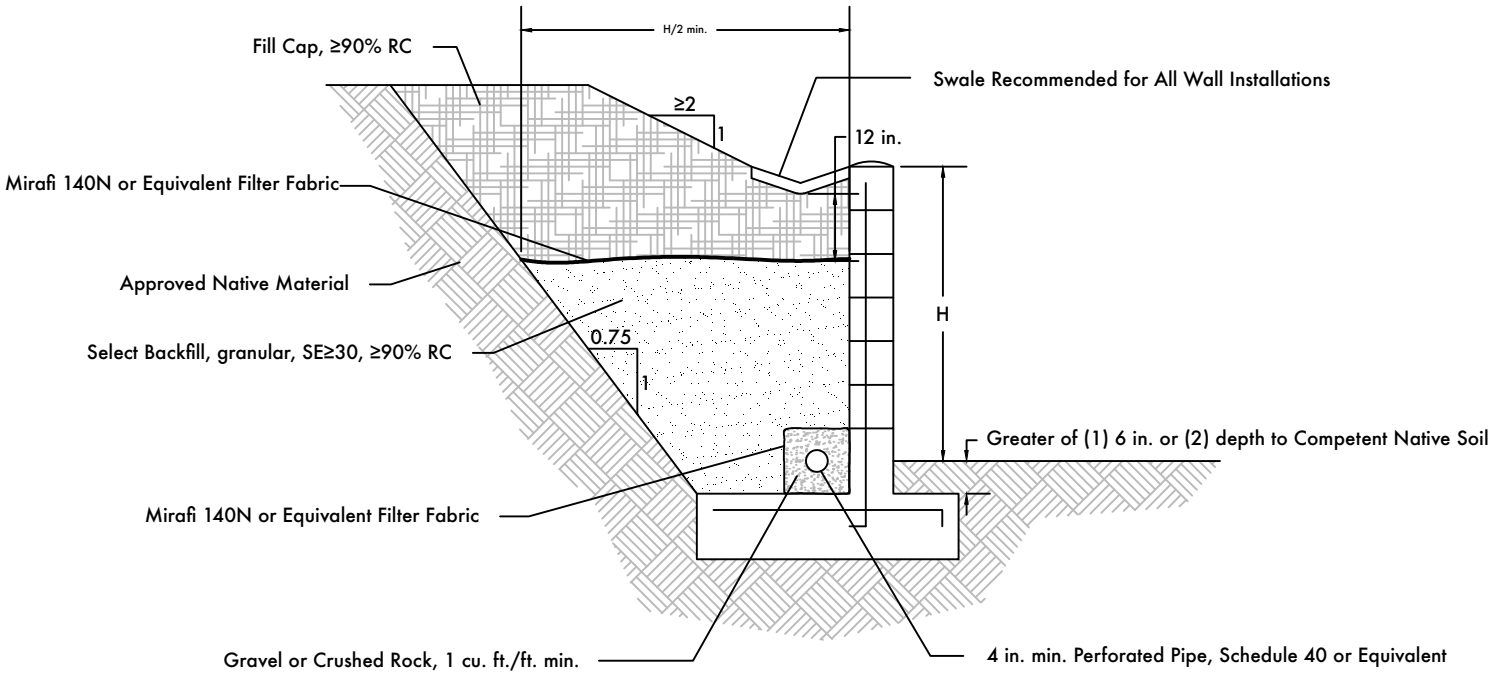
All fill materials placed under the direction of this firm shall be placed as a compacted fill, with a relative compaction of at least 90% with respect to the maximum dry unit weight evaluated in accordance with ASTM D1557, unless otherwise specified at the direction of the municipal authority or this firm (i.e., road base compacted to 95%, deep fills compacted to 93%, etc.). Fill materials shall be moistened or dried back to 115-120% of the optimum moisture content, placed in six (6) to eight (8) inch-thick loose lifts, and compacted with the appropriate equipment. This firm shall test compaction for every two (2) feet of fill thickness, or 1000 cubic yards placed, whichever occurs first.

C.4 Fill Slopes, Retaining Wall Backfills

Any fill slopes or retaining walls placed shall conform to the design recommendations of this firm, as specified in the geotechnical report and/or respective details, attached herein as pertinent. A subdrain shall be installed at the heel of any geotechnical installation—slope, retaining wall, or otherwise. The contractor and/or client are responsible for verifying that the municipal authority does not have additional, stricter requirements than those specified herein for such construction.

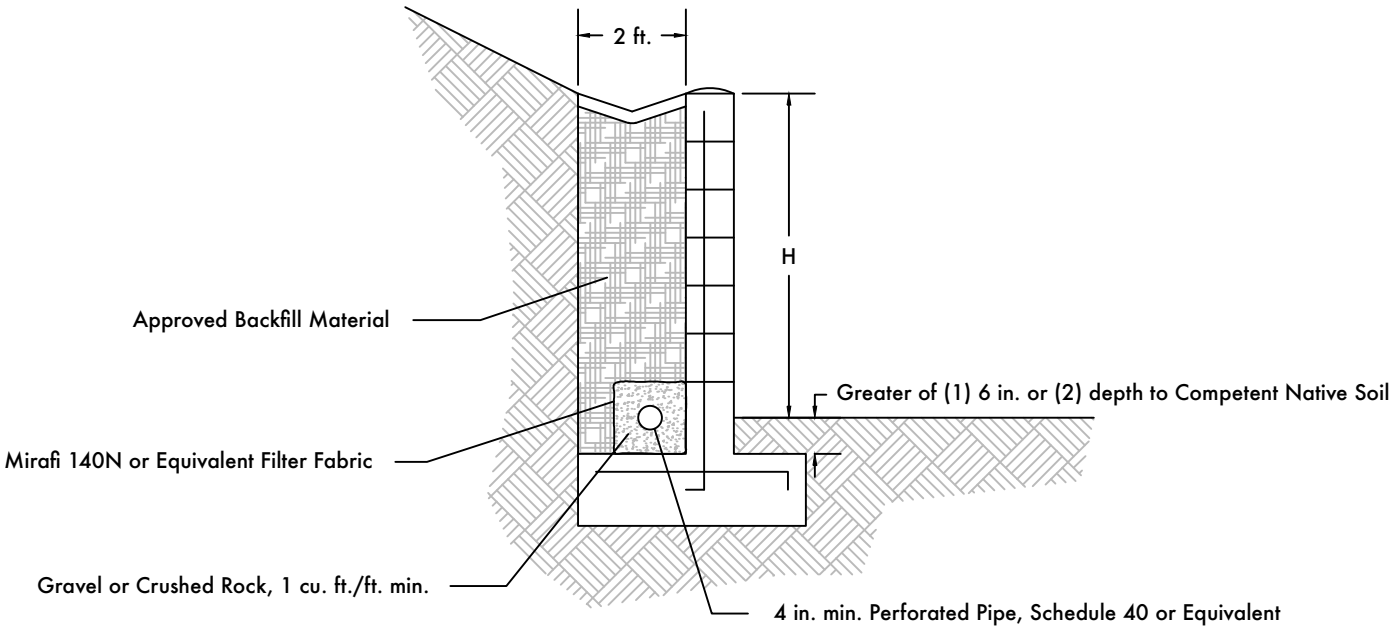
C.5 Grading/Earthwork Inspection

As a condition of grading approval, this firm shall be afforded the opportunity to observe, inspect, and approve all back-cuts, excavation bottoms, subdrains, foundation excavations, and grading operations. Should in-field conditions differ from those observed during the geotechnical evaluation, revisions to the recommendations made by the geotechnical engineer and/or geologist may become necessary. While governing codes specify minimum required inspections for compacted fill placement, this firm reserves the right to perform such inspections and oversight as frequently as necessary to accept geotechnical responsibility for the work performed in good faith.



Select Material Wall Backfill

Native/Limited Access Wall Backfill



DUCO ENGINEERING
14175 Telephone Ave. Ste. K
Chino, CA 91710
909.594.7414
office@ducoengineering.com

SHEET TITLE:

RETAINING WALL BACKFILL DETAILS

Rev. Date: 08/2017

DRW/CHK: JC/DD

FIG. 13