GEOTECHNICAL INVESTIGATION

On

PROPOSED RESIDENTIAL AND HOTEL DEVELOPMENT

at
Enterprise Way
Scotts Valley, California

For
City Ventures

By
TMakdissy Consulting, Inc.

Project No. E410-1
November 18, 2014

T. MAKDISSY CONSULTING, INC.
Geotechnical Consultants

Project No. E410-1
November 18, 2014

Mr. Jason Bernstein
Development Associate
City Ventures
444 Spear Street, Suite 200
San Francisco, CA 94105

Subject: Proposed Residential and Hotel Development
Enterprise Way
Scotts Valley, California
GEOTECHNICAL INVESTIGATION

Dear Mr. Bernstein:

In accordance with your authorization, ***TMakdissy Consulting, Inc.***, has investigated the geotechnical conditions at the subject site located in Scotts Valley, California

The accompanying report presents the results of our field investigation. Our findings indicate that development of the site for the proposed residential development is feasible provided the recommendations of this report are carefully followed and are incorporated into the project plans and specifications.

Should you have any questions relating to the contents of this report or should additional information be required, please contact our office at your convenience.

Very Truly Yours
T Makdissy Consulting, Inc.

Simon Makdessi, P.E., G.E.
Senior Engineer

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GEOTECHNICAL IVESTIGATION

Purpose and Scope

The purpose of the investigation for the proposed residential development located on Enterprise Way, Scotts Valley California was to determine the surface and subsurface soil conditions at the subject site. Based on the results of the investigation, criteria were established for the grading of the site, the design of foundations for the proposed development, and the construction of other related facilities on the property.

Our investigation included the following:

a. Field reconnaissance by the Soil Engineer;
b. Determine the general seismicity of the site;
b. Drilling and sampling of three borings;
c. Laboratory testing of soil samples;
d. Analysis of the data and formulation of conclusions and recommendations; and
e. Preparation of this written report.

Details of our field and laboratory investigation are presented in Appendices A and B respectively.

Proposed Development

It is our understanding that the proposed project consists of developing the site for the construction of a 73 unit townhome development within 16 buildings, 2½ to 3 stories in height, and a 60 room boutique hotel. In addition, the development will consist of associated improvements. The structures are planned to be founded on a post-tensioned slab foundation system.

Site Location and Description

The site is located in the central northern end of Scotts Valley, east of Hwy 17, as shown on the attached “Vicinity Map”, Figure 1. Topographically the area is within hilly terrain, however, the site is essentially level, with a slight slope to the south. The site is bounded by Hwy 17 to the north west, Carbonera Creek to the north east and east, and commercial development to the south. We understand that the proposed structures will be set back approximately 100 feet from the top of Carbonera Creek. Carbonera creek varies in depth from 10 to 15 feet and is heavily vegetated. Some minor water flow was observed at the time of our investigation.

The site is currently vacant open space and contains a number of small mounds of soil. Along the north, west and north east sides of the site, minor 4 to 5 foot high berms have been created. A stockpile of various construction debris is present in the north east corner of the site. Vegetation cover consists of a dense coverage of medium high dry grass.

Subsurface Conditions

A total of four borings were drilled to depths ranging from 9.0 to 33.0 feet. The subsurface conditions encountered in the four borings varied and generally consisted of variable sequences and layers of silty clay and sand to the maximum depth explored. Boring B-1 was drilled on the berm feature and encountered layers of sand and clay to approximately 8 feet where native clay was encountered. It appears that below the berm and the near surface soil in borings B-1 and B-4, (along the west side of the site) consists of hard, silty clay, while in borings B-2 and B-3 (east side of site), the near surface soil is a dense silty sand. Below these surface layers variable sequences of silty clay, silty sand and sand were encountered. The consistency of the clays ranged from firm to very stiff and the consistency of the sands ranged from loose/medium dense to very dense. In boring B-2, claystone bedrock was encountered at a depth of 32 feet. In boring B-4, hard material and drilling refusal was encountered at 9 feet, with little to no recovery noted in the sampler. The boring was moved 10 feet in two directions and drilling refusal at the same depth was met in the two additional borings. The nature of the material at 9 feet is unknown and unclear, and may be a bedrock feature.

Groundwater was encountered in boring B-2 at a depth of 18 feet, and in boring B-3 at a depth of 20 feet. Perched water was encountered in boring B-3 at a depth of 10 feet. It is noted that the borings may not have been left open long enough to establish stabilized ground water elevations. Fluctuations in the groundwater table can be expected with changes in seasonal rainfall, urbanization, and construction activities at or in the vicinity of the site.

A more thorough description and stratification of the soil conditions are presented on the respective, “Logs of Test Borings” Appendix A. The approximate locations of the borings are shown on Figure 2, “Site Plan”’ Appendix A.

Liquefaction Potential Evaluation

Liquefaction occurs primarily in relatively loose, saturated, cohesionless soils. Under earthquake stresses, these soils become “quick”, lose their strength and become incapable of supporting the weight of the overlying soils or structures. The data used for evaluating liquefaction potential of the subsurface soils consisted of the penetration resistance, the soil gradation, the relative density of the materials, and the groundwater level. Typically, to properly evaluate liquefaction potential, borings would need to extend to a depth of 45 to 50 feet. The borings for this investigation did not extend to theses depths due to very slow drilling progress within the very stiff and hard soil profile.

Loose to medium dense cohesionless soil such as sands and some silts and low plasticity clays are potentially liquefiable, while dense and very dense cohesionless sands and gravels are considered to have a very low potential for liquefaction. The loose/medium dense sandy material below the groundwater table at a depth of 15 to 25 feet in boring B-2 and at a depth of 20 feet in boring B-3, are potentially liquefiable under a design level earthquake. It is estimated that a liquefaction induced settlements of approximately 0.5 to 1.5 inches may occur in these layers. Even if some additional potentially liquefiable layers are present below the maximum depth explored of 36 feet, due to the discontinuous nature of the layers and the thick predominantly-clay and non liquefiable cover overlying any potential liquefiable layers, will likely limit any surface manifestations of liquefaction to very minor differential settlements of 1.0 inches in 50 feet.

2013 CBC Seismic Design Criteria

The potential damaging effects of regional earthquake activity should be considered in the design of structures. As a minimum, seismic design should be in accordance with Chapter 16 of the 2013 California Building Code (CBC). The 2013 CBC utilizes the design procedures outlined in the 2010 ASCE 7-10 Standard. The seismic design parameters have been developed using the online U.S. Geological Survey, US Seismic Design Maps tool, version 3.1.0, last updated 11 July 2013, and a site location based on longitude and latitude. The parameters generated for the subject site with Latitude 37.06549^{o} N and Longitude -122.99811^{o} W, are presented in Table 1.

Table I
2013 CBC Seismic Design Criteria

Seismic Parameter	Coefficient	Value
Mapped MCE Spectral Acceleration at Short-Period 0.2 secs	S_s	1.920
Mapped MCE Spectral Acceleration at a Period of 1.0s	S_1	0.735
Site Class		D
Adjusted MCE, 5% Damped Spectral Response Acceleration at Short Period of 0.2s for Site Class D	S_{MS}	1.920
Adjusted MCE, 5% Damped Spectral Response Acceleration at Period of 1.0s for Site Class D	S_{M1}	1.103
Design 5% Damped Spectral Response Acceleration at Short Period of 0.2s for Occupancy Category I/II/III	S_{DS}	1.280
Design 5% Damped Spectral Response Acceleration at Period of 1.0s for Occupancy Category I/II/III	S_{D1}	0.735

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

General

1. From a geotechnical point of view, the site is suitable for the construction of the proposed residential development provided the recommendations presented in this report are incorporated into the project plans and specifications.

2. The most prominent geotechnical feature of this site is the presence of berms and variable near surface soil ranging from moderately expansive silty clay at the west side to silty sand along the east side. This variation in material should be carefully considered in the grading, such that non-uniform conditions for a building should be avoided. Building pad grading should be performed such that at least 2 feet of uniform material exists beneath the building pads and may require sub-excavation and mixing of material to achieve this. The actual extent of sub-excavation will depend on actual site conditions, location of the transition and required cuts and fills for the building pads. The fill in the berms must be removed exposing native soil. In addition, the presence of hard material encountered at a depth of 9 feet in boring B-4, is somewhat unusual and we recommend that this area be investigated by excavating a test pit in the area during the initial stages of construction for further evaluation.

3. The proposed structures may be satisfactorily supported on structural post tensioned slabs. Specific foundation design recommendations are provided under the heading Foundations.

Grading

4. The grading requirements presented herein are an integral part of the grading specifications presented in Appendix C and should be considered as such.

5. Grading activities during the rainy season on cohesive soils will be hampered by excessive moisture. Grading activities may be performed during the rainy season, however, achieving proper compaction may be difficult due to excessive moisture; and delays may occur. In addition, measures to control potential erosion may need to be provided. Grading performed during the dry months will minimize the occurrence of the above problems.

6. Currently, the site is vegetated with a medium height of dry grass, and stripping of topsoil may be required prior to grading. Vegetation cover conditions may be different at the time of planned grading, and the depth of stripping, if necessary, or type of site preparation will be evaluated by the Soil Engineer prior to the commencement of any grading activities.

7. After any stripping and site preparation, removal of the berm material, and prior to the placement of any fill, the top 8 inches of exposed native ground for fill areas should be scarified and compacted to a minimum degree of relative compaction of 90% at least 3 percent above optimum moisture content as determined by ASTM D1557-12 Laboratory Test Procedure. If any areas of loose fill, or yielding soil are encountered, these must be excavated and removed, exposing non-yielding native soil. As indicated earlier, if a building pad will consist of variable subgrade conditions ranging from sand and clay, then the pad is to be sub-excavated to a depth of 2 feet, the base of the excavation scarified and compacted as recommended above, the excavated material is to be uniformly mixed and then replaced as engineered fill to a minimum relative compaction of 90% at least 3% over optimum moisture content.

8. The site may be brought to the desired finished grades by placing engineered fill in lifts of 8 inches in uncompacted thickness and compacted to a minimum degree of relative compaction of 90% at least 3 percent above optimum moisture content as determined by ASTM D1557-12 Laboratory Test Procedure.

9. All soils encountered during our investigation except those within the top few inches of predominantly organic material, are suitable for use as engineered fill when placed and compacted at the recommended moisture content and provided it does not contain any debris.

Surface Drainage

10. All finish grades should be provided with a positive gradient to an adequate discharge point in order to provide rapid removal of surface water runoff away from all foundations. No ponding of water should be allowed on the pad or adjacent to the foundations. Surface drainage must be designed by the project Civil Engineer and maintained by the property owners at all times. The pad should be graded in a manner that surface flow is to a controlled discharge system.

11. Lot slopes and drainage must be provided by the project Civil Engineer to remove all storm water from the pad and to minimize storm and/or irrigation water from seeping beneath the structures. Should surface water be allowed to seep under the structure, foundation movement resulting in structural cracking and damage will occur. Finished grades around the perimeter of the residence should be compacted and should be sloped at a minimum 2% gradient away from the exterior foundation. Surface drainage requirements constructed by the builder should be maintained during landscaping. In particular, the creation of planter areas confined on all sides by concrete walkways or decks and the residence foundation is not desirable since any surface water due to rain or irrigation becomes trapped in the planter area with no outlet. If such a landscape feature is necessary, surface area drains in the planter area or a subdrain along the foundation perimeter must be installed.

12. Continuous roof gutters are recommended. According to local government requirements, roof downspout and drain flows should be directed to bio-filtration areas next to the building perimeter, where possible. From a geotechnical and maintenance point of view it is undesirable to discharge water into bio-filtration areas near foundations, because of the possibility of water ponding for sustained periods of time. Typically, the bio-filtration areas consist of an 18 inch layer of sandy loam over 18 inches of permeable gravel material. The top of the bio-filtration area is typically approximately 1 foot below pad grade, therefore, the base of the bio-filtration area will be approximately 4 feet below pad grade. The base of the bio-filtration area will typically contain a perforated pipe to drain any water that may collect within 24 hours. In some situations, the bio-filtration areas may be located as close as 2 to 3 feet from the building perimeter. If such a system is employed, we must be consulted to evaluate the impact of these systems when located in close proximity to the foundation and provide supplemental recommendations including deepened footings or waterproofing. In addition, the property owners must always maintain the bio-filtration area to ensure that it is performing as designed and that water does not pond in the area for longer than 48 hours.

Foundations-Post Tensioned Slab on Grade

13. Post-tensioned slabs should be designed using the method presented in the Design of Post-Tensioned Slabs on Ground, 3rd edition 2004, addendum 2 dated May 2008. The material at the graded foundation level may range from silty clay to a sand. For the purpose of foundation design, we will provide criteria for the clay materials. The following soil and climate parameters were used in our design:

Parameter	Calculated or Assumed Value
Thornthwaite Moisture Index (I_m)	-20
Depth to constant soil suction	5 feet
Constant Soil Suction at depth based on I_m)	3.5 pF
Driest Soil Suction	4.5 pF
Wettest Soil Suction	3.0 pF
Plasticity Index	18
Liquid Limit	39
Percent Passing #200 Sieve	44%
Percent Clay	19%

Using the above values, the recommended geotechnical criteria for use in the design of the post-tensioned slabs is as follows;

	Swelling Mode	
	Center Lift	Edge Lift
Edge Moisture Variation Distance (e_m)	9.0 feet	4.9 feet
Differential Soil Movement (y_m)	0.60 inches	0.91 inches

14. As indicated earlier, bio-filtration areas may be designed close to the foundation. Where bio-filtration areas are located closer than 5 feet of the building, the section of loose loam and gravel, will provide reduced lateral support, and we recommend a deepened footing be constructed along the perimeter the building adjacent to the bio-filtration area and extending 3 feet beyond in plan length. The depth of the deepened footing will depend on how close the bio-filtration area to the building perimeter. As a guide, the footing is to be deepened such that when an imaginary line inclined at 45

degrees from the outside edge base of the footings , it extends below the base of the bio-filtration area excavation.

General Construction Requirements for Post-Tensioned Slab

15. Prior to construction of the slab, the slab subgrade should be observed by the Soil Engineer to verify that all under-slab utility trenches greater than 18 inches in width have been properly backfilled and compacted, and that no loose or soft soils are present on the slab subgrade.

16. Where clayey materials form the foundation subgrade, the slab subgrade should be soaked to saturation (minimum 5% above optimum) to a depth of 12 to 18 inches prior to placement of the capillary break or vapor retarder/barrier. This should be verified and approved by the Soil Engineer. The penetration of a thin metal probe to a depth of 10-12 inches generally indicates sufficient saturation.

17. The four (4) inch (minimum thickness) layer of gravel typically placed to provide a capillary break beneath concrete slab-on-grade floors may be omitted beneath the monolithically poured post-tensioned slab foundations provided that the slabs are at least 10 inches thick. If it is desired to use a 4 inch layer or thinner of gravel section, the gravel should consist of broken stone, crushed or uncrushed gravel, quarry waste, or a combination thereof. The aggregate shall be free from deleterious substances. It shall be of such quality that the absorption of water in a saturated dry condition does not exceed 3% of the oven dry weight of the sample. The material shall be ¾” minus material with no more than 3% passing the #200 sieve.

18. A moisture vapor retarder/barrier is recommended beneath all slabs-on-grade that will be covered by moisture-sensitive flooring materials such as vinyl, linoleum, wood, carpet, rubber, rubber-backed carpet, tile, impermeable floor coatings, adhesives, or where moisture-sensitive equipment, products, or environments will exist. We recommend that design and construction of the moisture vapor retarder/barrier conform to Section 1805 of the 2013 California Building Code and pertinent sections of American Concrete Institute (ACI) guidance documents 302.1R-04, 302.2R-06 and 360R-10.

19. The moisture vapor retarder/barrier can be placed above the 4 inches of gravel or directly on the soil subgrade and should consist of a minimum 10 mils thick polyethylene with a maximum perm

rating of 0.1 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the moisture vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed. The installation of the vapor retarder membrane must be in conformance with ASTM E1643.

20. A minimum of two inches of wetted sand should be placed over the vapor retarder membrane to facilitate curing of the concrete and to act as a cushion to protect the membrane. The perimeter of the mat should be thickened to bear on the prepared building pad and to confine the sand. During winter construction, sand may become saturated due to rainy weather prior to pouring. Saturated sand is not desirable because the sand cushion may become over saturated, and boil into the concrete causing undesirable sand pockets within the slab. As an alternate, a sand-fine gravel mixture that is stable under saturated conditions may be used. However, the material must be approved by the Soil Engineer prior to use.

21. Alternatively, the sand layer may be eliminated provided the concrete has a maximum water/cement ratio of 0.45 and a 15 mil Class A vapor retarder membrane, such as Stego® Wrap or equivalent is used. In any case, the vapor retarder/barrier should have a maximum perm rating of 0.3 in accordance with ASTM E 1745. Seams in the moisture vapor retarder/barrier should be overlapped no less than 6 inches or in accordance with the manufacturer's recommendations. Joints and penetrations should be sealed with the manufacturer's recommended adhesives, pressure-sensitive tape, or both. The contractor must avoid damaging or puncturing the vapor retarder/barrier and repair any punctures with additional polyethylene properly lapped and sealed.

22. Any exterior concrete flatwork such as steps, patios, or sidewalks should be designed independently of the slab, and expansion joints should be provided between the flatwork and the structural unit.

Miscellaneous Concrete Flatwork

23. Miscellaneous flatwork, driveways, and walkways may be designed with a minimum thickness of 4.0 inches. Flatwork, driveways, and walkways should be reinforced with a minimum of

6x6- 10/10 welded wire mesh placed at mid height in the slab. Control joints should be constructed to create squares or rectangles with a maximum spacing of 15 feet on large slab areas. Walkways should be separated from foundations with a thick expansion joint filler. Control joints should be constructed into walkways at a maximum of 5 feet spacing.

24. The sub grade soils beneath all miscellaneous concrete flatwork, driveways, and walkways should be compacted to a degree of relative compaction ranging from at least 90% at 3 percent above optimum moisture content for a minimum depth of 12 inches. The geotechnical engineer should monitor the compaction of the sub grade soils and perform testing to verify that proper compaction has been obtained.

<u>Soil Corrosivity</u>

25. In order to evaluate the corrosion potential of the near surface soil toward concrete and buried metal pipe, a sample of soil within the upper 5 feet was collected and tested for resistivity, soluble chloride, soluble sulfate, and pH. The results of the testing is summarized as follows;

Resistivity	2,398 Ohm-cm
Chloride	16 mg/kg
Sulfate	43 mg/kg
pH	5.9

26. Many factors contribute to the corrosion potential. The most important factor with respect to corrosion potential toward buried metal pipes and fittings is soil resistivity, and the most important factor with respect to corrosion potential toward concrete is the sulfate content.

27. Based on the above results, the near surface soil is severely corrosive to buried metal pipe and fittings. We recommend that a corrosion engineer be consulted to provide specific corrosion protection measures. Further, the sulfate exposure to concrete is negligible, and no special cements are required.

Retaining Walls

28. Retaining walls should be designed to resist lateral pressures exerted from a media having an equivalent fluid weight as follows:

Active Condition	=	45 p.c.f. for horizontal backslope
At-rest Condition	=	65 p.c.f.
Passive Condition	=	250 p.c.f.
Coefficient of Friction	=	0.30

29. For a non-horizontal backslope, the active condition equivalent fluid weight can be increased by 1.5 p.c.f. for each 2 degree rise in slope from the horizontal.

30. Active conditions occur when the top of the wall is free to move outward. At-rest conditions apply when the top of wall is restrained from any movement.

31. It should be noted that the effects of any surcharge, traffic or compaction loads behind the walls must be accounted for in the design of the walls.

32. The above criteria are based on fully drained conditions. If drained conditions are not possible, then the hydrostatic pressure must be included in the design of the wall. An additional linear distribution of hydrostatic pressure of 63 p.c.f. should be adopted, in this case.

33. In order to achieve fully-drained conditions, a drainage filter blanket should be placed behind the wall. The blanket should be a minimum of 12 inches thick and should extend the full height of the wall to within 12 inches of the surface. If the excavated area behind the wall exceeds 12 inches, the entire excavated space behind the 12-inch blanket should consist of compacted engineered fill or blanket material. The drainage blanket material may consist of either granular crushed rock and drain pipe fully encapsulated in geotextile filter fabric or Class II permeable material that meets CalTrans Specification, Section 68, with drainage pipe but without fabric. A 4-inch perforated drain pipe should be installed in the bottom of the drainage blanket and should be underlain by at least 4 inches of filter type material. A 12-inch cap of clayey soil material should be placed over the drainage blanket. A typical detail for retaining wall back drains is presented in Appendix C. All back drains should be outlet to suitable drainage devices. Retaining wall less than 3 feet in height should be provided with backdrains or weep holes.

34. As an alternate to the 12-inch drainage blanket, a pre-fabricated strip drain (such as Miradrain) may be used between the wall and retained soil. In this case, the wall must be designed to resist an additional lateral hydrostatic pressure of 30 p.c.f.

35. Piping with adequate gradient shall be provided to discharge water that collects behind the walls to an adequately controlled discharge system away from the structure foundation.

36. The retaining walls may be founded on a friction pier foundation or on spread footing foundations for walls that are not a part of a building structure. Spread footing and pier design criteria are given below.

<u>Retaining Wall/Soundwall Spread Footings</u>

37. Spread footings should have a minimum depth of twenty four (24) inches below lowest adjacent pad grade (i.e., trenching depth) for soil subgrade. At this depth, the recommended design bearing pressure for continuous footings should not exceed 2,500 p.s.f. due to dead plus sustained live loads and 3,300 p.s.f. due to all loads which include wind and seismic.

38. To accommodate lateral loads, the passive resistance of the foundation soil can be utilized. The passive soil pressures can be assumed to act against the front face of the footing below a depth of one foot below the ground surface. It is recommended that a passive pressure equivalent to that of a fluid weighing 250 p.c.f. be used. The weight of the soil above the footing can be used in the frictional calculations. For design purposes, an allowable friction coefficient of 0.30 can be assumed at the base of the spread footing.

<u>Retaining Wall/Soundwall Friction Piers</u>

39. The piers should be designed on the basis of skin friction acting between the soil and the pier. For the soils at the site, an allowable skin friction value of 500 p.s.f. can be used for combined dead and live loads, below a depth of 3 feet. This value can be increased by one-third for total loads which include wind or seismic forces. Given the moderately expansive nature of the soil, we recommend that any grade beams footings or bottom of soundwall panels that are buried into the ground, should be designed for an uplift pressure of 500 p.s.f. acting against the bottom of the grade beam/soundwall panel and an uplift adhesion of 300 p.s.f. acting along the upper 3 feet of the pier. Resistance to uplift

is to be provided by the pier foundations, and an allowable skin friction value of 500 p.s.f can be used below 3 feet. The size, depth and spacing of the piers is to be determined by the structural engineer.

40. To resist lateral loads, the passive resistance of the soil can be used. The soil passive pressures can be assumed to act against the lateral projected area twice the pier diameter. It is recommended that a passive pressure equivalent to that of a fluid weighing 250 p.c.f be used below 3 feet of final pad grade.

<u>Pavement Areas</u>

41. R-value tests were not performed as part of this investigation, as the soil expected at subgrade level is not known and depends on the planned grading. Assuming the subgrade material will consist of the highly expansive clay material, we will assume an R-value of 5 for preliminary design.

42. Based on a R-Value of 5, the following flexible pavement sections are recommended.

Traffic Index	**AC (inches)**	**Class II[1] AB (inches)**
4.5	3.0	10.0
5.0	3.0	12.0
5.5	3.0	14.0
6.0	4.0	13.5
7.0	4.0	17.0

Notes: [1]Minimum R-Value = 78
R-Value = Resistance Value
All Layers in compacted thickness to Cal-Trans Standard Specifications

43. After underground facilities have been placed in the areas to receive pavement and removal of excess material has been completed, the upper 6 inches of the sub-grade soil shall be scarified, moisture conditioned, and compacted to a minimum relative compaction of 95% in accordance with the grading recommendations specified in this report.

44. All aggregate base material placed subsequently should be compacted to a minimum relative compaction of 95% based on the ASTM Test Procedure of D1557-12 (latest edition). The construction of the pavement areas should conform to the requirements set forth by the latest Standard Specifications of the Department of Transportations of the State of California and/or City of Scotts Valley, Department of Public Works.

45. If planter areas are provided within or immediately adjacent to the pavement areas, provisions should be made to control irrigation water from entering the pavement subgrade. Water entering the pavement section at subgrade level, which does not have a means for discharge, could cause softening of this zone and accelerate pavement degradation.

Utility Trenches

46. Applicable safety standards require that trenches in excess of 5 feet must be properly shored or that the walls of the trench slope back to provide safety for installation of lines. This is particularly relevant if trenching is to extend into the sand. If trench wall sloping is performed, the inclination should vary with the soil type. The underground contractor should request an opinion from the Soil Engineer as to the type of soil and the resulting inclination.

47. With respect to state-of-the-art construction or local requirements, utility lines are generally bedded with granular materials. These materials can convey surface or subsurface water beneath the structures. It is, therefore, recommended that all utility trenches which possess the potential to transport water be sealed with a compacted impervious cohesive soil material or lean concrete where the trench enters/exits the building perimeter.

48. Utility trenches extending underneath all traffic areas must be backfilled with native or approved import material and compacted to a relative compaction of 90% to within 6 inches of the subgrade. The upper 6 inches should be compacted to 95% relative compaction in accordance with Laboratory Test Procedure ASTM D1557 (latest edition). Backfilling and compaction of these trenches must meet the requirements set forth by the City of Scotts Valley, Department of Public Works. Utility trenches within landscape areas may be compacted to a relative compaction of 85%.

Project Review and Construction Monitoring

49. All grading and foundation plans for the development must be reviewed by the Soil Engineer prior to contract bidding or submitted to governmental agencies so that plans are reconciled with soil conditions and sufficient time is allowed for suitable mitigative measures to be incorporated into the final grading specifications.

50. ***TMakdissy Consulting, Inc.*** should be notified at least two working days prior to site clearing, grading, and/or foundation operations on the property. This will give the Soil Engineer ample time to discuss the problems that may be encountered in the field and coordinate the work with the contractor.

51. Field observation and testing during the demolition and/or foundation operations must be provided by representatives of ***TMakdissy Consulting, Inc.*** to enable them to form an opinion regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the specification requirements. Any work related to the grading and/or foundation operations performed without the full knowledge and under the direct observation of the Soil Engineer will render the recommendations of this report invalid. This does not imply full-time observation. The degree of observation and frequency of testing services would depend on the construction methods and schedule, and the item of work.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. It should be noted that it is the responsibility of the owner or his representative to notify ***TMakdissy Consulting, Inc.,*** in writing, a minimum of two working days before any clearing, grading, or foundation excavations can commence at the site.

2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed in the borings and from a reconnaissance of the site. Should any variations or undesirable conditions be encountered during the development of the site, ***TMakdissy Consulting,*** will provide supplemental recommendations as dictated by the field conditions.

3. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the Architect and Engineer for the project and incorporated into the plans and the necessary steps are taken to see that the Contractor and Subcontractors carry out such recommendations in the field.

4. At the present date, the findings of this report are valid for the property investigated. With the passage of time, significant changes in the conditions of a property can occur due to natural processes or works of man on this or adjacent properties. In addition, legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may render this report invalid, wholly or partially. Therefore, this report should not be considered valid after a period of two (2) years without our review, nor should it be used, or is it applicable, for any properties other than those investigated.

5. Not withstanding all the foregoing, applicable codes must be adhered to at all times.

APPENDIX A

Field Investigation

Vicinity Map

Site Plan

Logs of Test Boring

FIELD INVESTIGATION

The field investigation was performed on October 21, 2014, and included a reconnaissance of the site and the drilling of four exploratory borings at the approximate locations shown on Figure 2, "Site Plan".

The six borings were drilled to a maximum depth of 33 feet below the existing ground surface. The drilling was performed with a Mobile B-24 Drill rig utilizing a 4 inch solid flight continuous auger and cat and rope hammer system. Visual classifications were made from cuttings and the samples in the field. As the drilling proceeded, relatively undisturbed core samples were obtained by means of 2.5 inch O.D. split-tube sampler. The sampler was driven into the in-situ soils under the impact of a 140-pound hammer having a free fall of 30 inches. The number of blows required to advance the sampler 12 inches into the soil are reported on the boring logs.

The samples were sealed and returned to the laboratory for testing. Classifications made in the field were verified in the laboratory after further examination and testing.

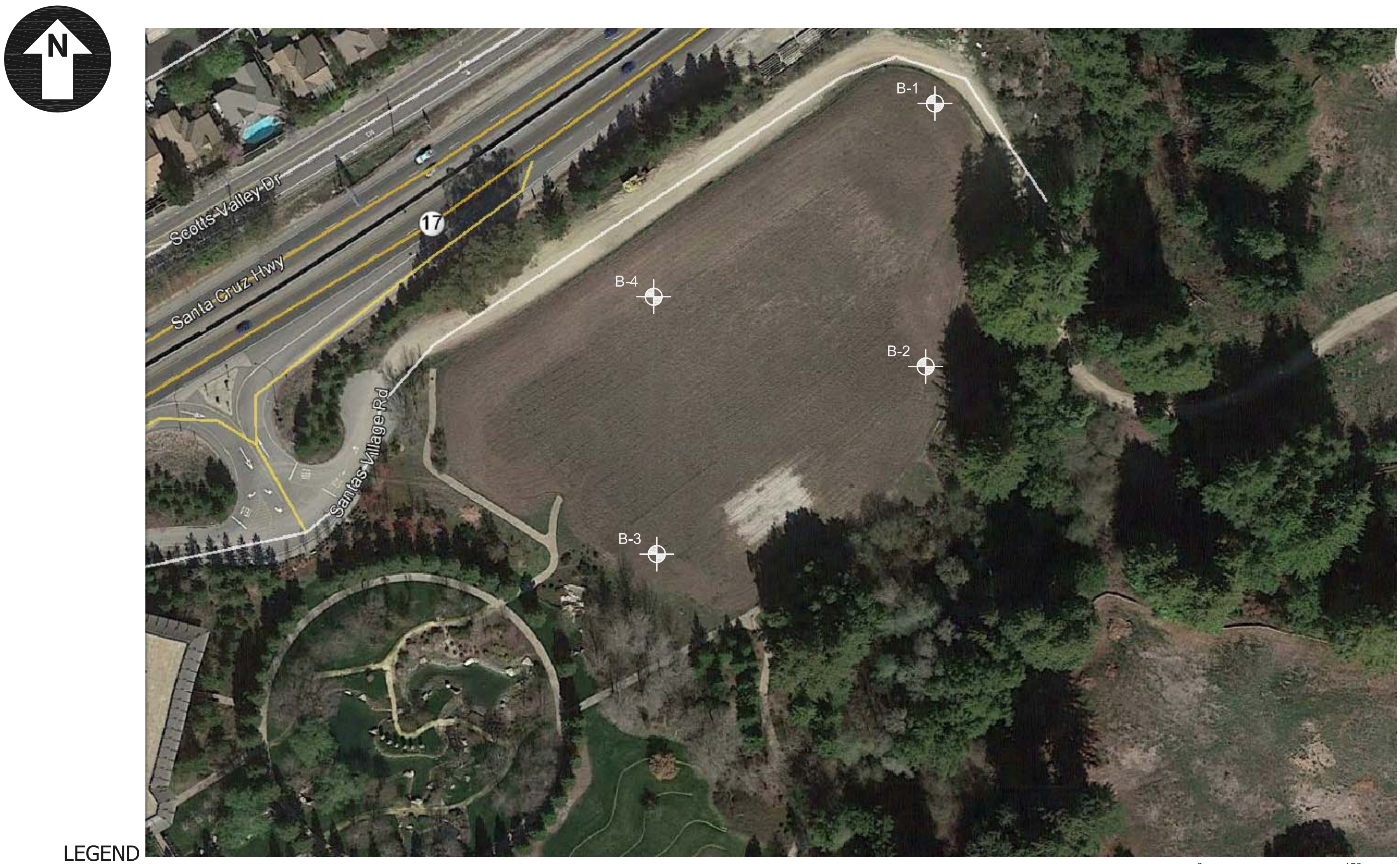
The stratification of the soils, descriptions, location of undisturbed soil samples and blow counts are shown on the respective "Logs of Test Borings" contained within this appendix.

T. MAKDISSY CONSULTING, INC
GEOTECHNICAL CONSULTANTS

ENTERPRISE WAY
SCOTTS VALLEY, CALIFORNIA

Figure No.: 1

Title:	Project No.:	Scale:	Date:	Drawn By:
VICINITY MAP	E410-1	NTS	11/2014	GC



LEGEND

B-1 Approximate Boring Location

Source: Google Earth, 2014

0 75 150 300
Approximate Scale (feet)

T. MAKDISSY CONSULTING, INC
GEOTECHNICAL CONSULTANTS

ENTERPRISE WAY
SCOTTS VALLEY, CALIFORNIA

Figure No.: 2

Title:	Project No.:	Scale:	Date:	Drawn By:
SITE PLAN	E410-1	AS SHOWN	11/2014	GC

APPENDIX B

Laboratory Investigation

Summary of Laboratory Test Results

LABORATORY INVESTIGATION

The laboratory testing program was directed towards providing sufficient information for the determination of the engineering characteristics of the site soils so that the recommendations outlined in this report could be formulated.

Moisture content and dry unit weight tests were performed on relatively undisturbed soil samples in order to determine the consistency of the soil and moisture variation throughout the explored soil profile and to estimate the compressibility of the underlying soils.

Sieve analysis and hydrometer testing were performed to determine the percentage of fines.

Atterberg Limits tests were performed to determine the expansion potential of the foundation soils.

The strength parameters of the foundation soils were obtained by evaluating the penetration resistance (blow counts) during sample recovery.

The corrosion potential of the near surface soil was evaluated by performing resistivity, pH, sulfate and chloride tests.

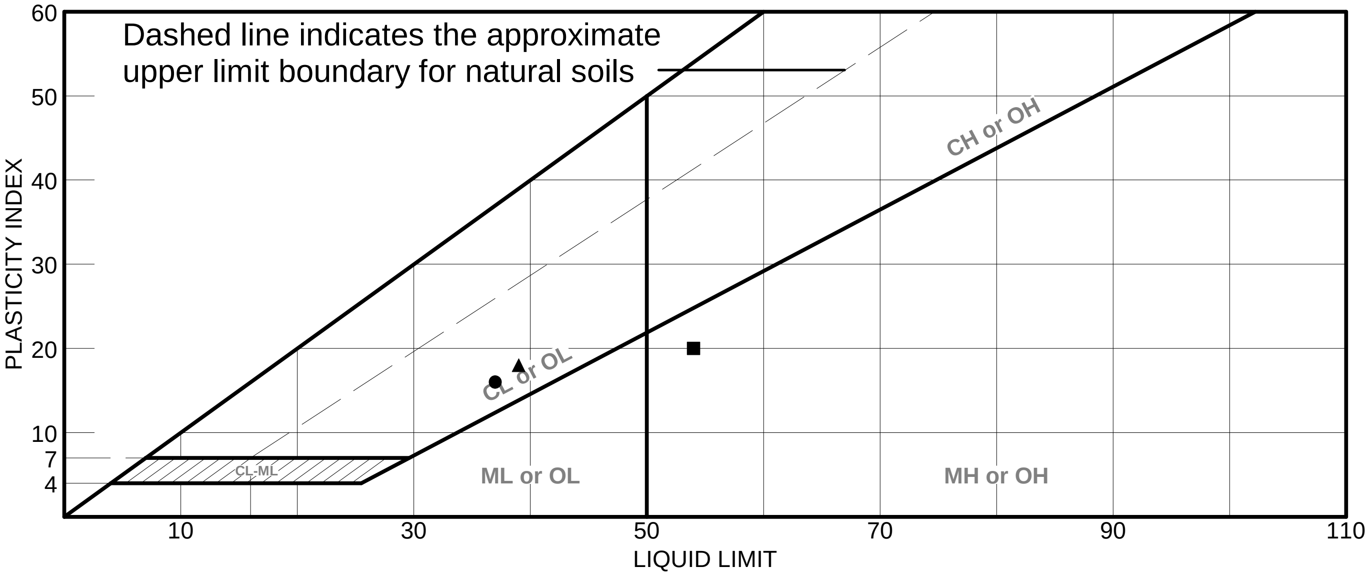
A summary of all laboratory test results is presented on Table B-I of this appendix and on the respective "Logs of Test Borings", Appendix A.

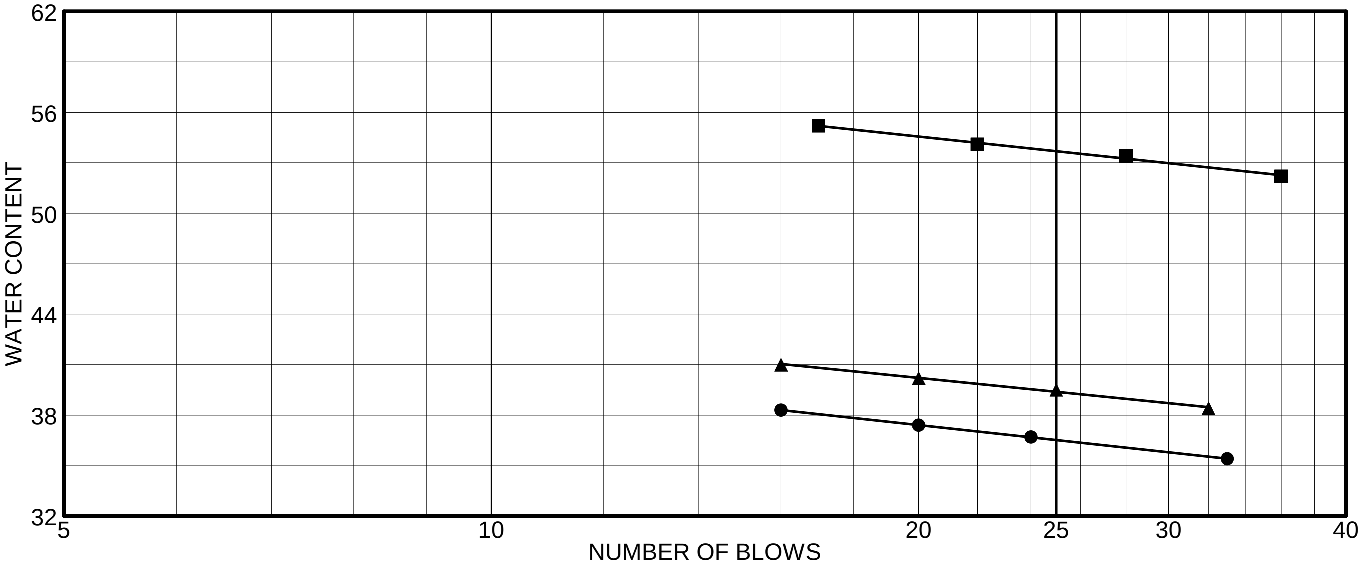
SUMMARY OF LABORATORY TESTS

TABLE B-1

Sample Number	Depth (ft)	Dry Density (p.c.f.)	Moisture Content (% Dry Wt.)	Atterberg Limits		Sieve Analysis (% Passing No. 200 Sieve)
				Liquid Limit (%)	Plasticity Index (%)	
1-1	3	121.5	11.7	37	16	43.2
1-2	6	108.8	14.3			
1-3	11	112.7	15.5			
1-4	15		18.1			
1-5	20					24.9
1-6	25		26.0			
2-5	21					10.7
2-6	25	64.8	56.9	54	20	
3-1	3	98.5	10.9			48.2
3-3	11	104.8	20.2			
3-5	20					32.0
4-1	3	109.0	15.7	39	18	44.2

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Black Lean Clayey SAND	37	21	16	81.8	43.2	SC
■	Very Dark Gray Elastic SILT w/ Sand	54	34	20			
▲	Very Dark Brown Lean Clayey SAND	39	21	18	78.2	44.2	SC

Project No. 740-163 **Client:** Tom Makdissy Consulting, Inc.

Project: Enterprise Way, Scotts Valley - E410-1

● **Source:** 1-1 **Elev./Depth:** 3'

■ **Source:** 2-6 **Elev./Depth:** 25'

▲ **Source:** 4-1 **Elev./Depth:** 3'

Remarks:

●

■

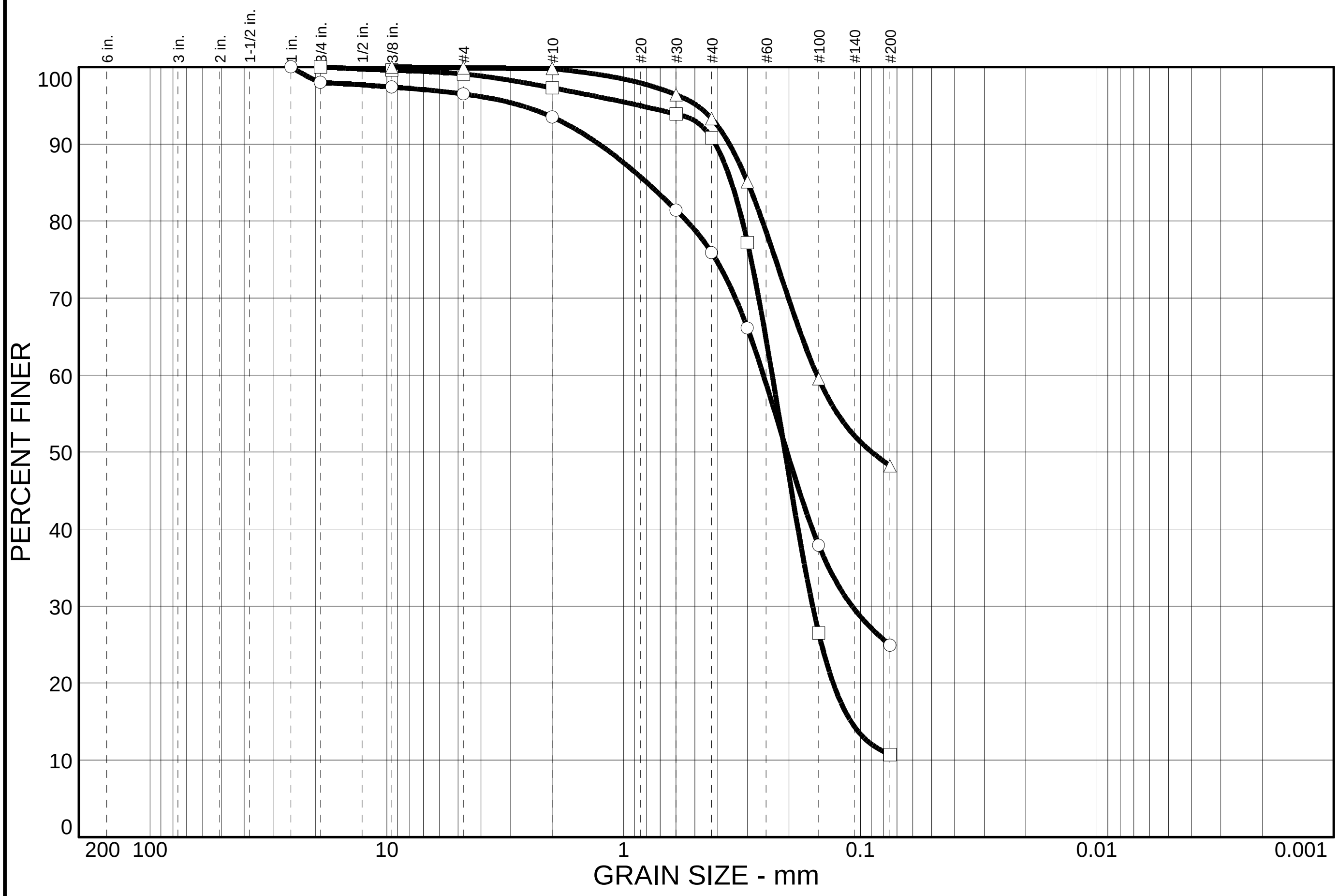
▲

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		3.5	71.6	24.9					
□		0.9	88.4	10.7					
△		0.1	51.7	48.2					

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	98.0	100.0	
3/8"	97.4	99.6	100.0
	GRAIN SIZE		
D_{60}	0.257	0.236	0.153
D_{30}	0.109	0.159	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	96.5	99.1	99.9
#10	93.5	97.3	99.8
#30	81.4	93.9	96.4
#40	75.9	90.8	93.3
#50	66.1	77.2	85.1
#100	37.9	26.5	59.5
#200	24.9	10.7	48.2

SOIL DESCRIPTION

○ Grayish Brown Clayey SAND

□ Gray Poorly Graded SAND w/ Silt

△ Very Dark Brown Clayey SAND

REMARKS:

○

□

△

○ Source: 1-5 Elev./Depth: 20'

□ Source: 2-5 Elev./Depth: 21'

△ Source: 3-1 Elev./Depth: 3'

COOPER TESTING LABORATORY

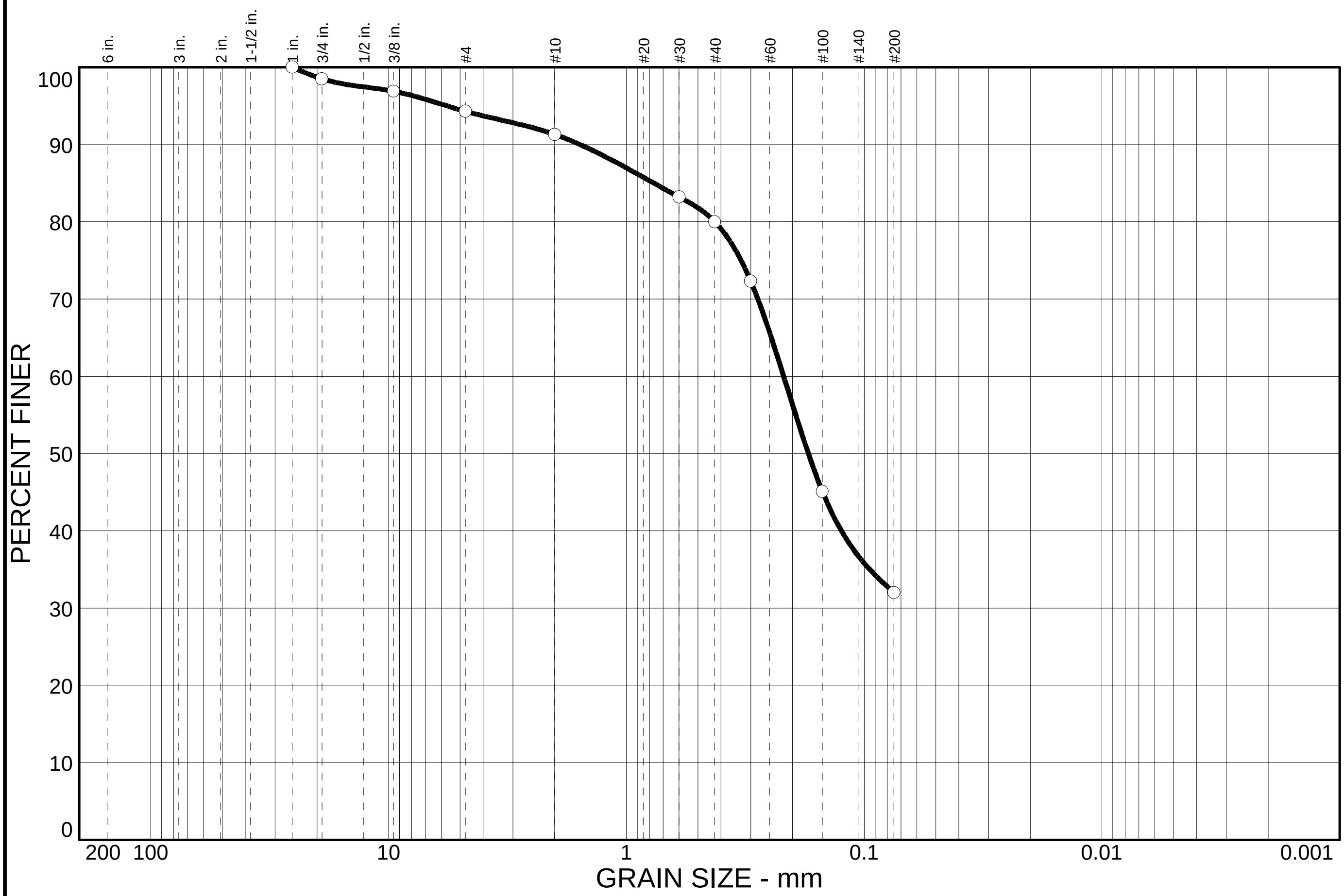
Client: Tom Makdissy Consulting, Inc.

Project: Enterprise Way, Scotts Valley - E410-1

Project No.: 740-163

Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		5.7	62.3	32.0					

SIEVE inches size	PERCENT FINER ○		
1"	100.0		
3/4"	98.5		
3/8"	96.9		
	GRAIN SIZE		
D_{60}	0.218		
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	94.3		
#10	91.3		
#30	83.2		
#40	80.0		
#50	72.3		
#100	45.1		
#200	32.0		

SOIL DESCRIPTION

○ Gray Clayey SAND

REMARKS:

○

○ Source: 3-5

Elev./Depth: 20'

COOPER TESTING LABORATORY

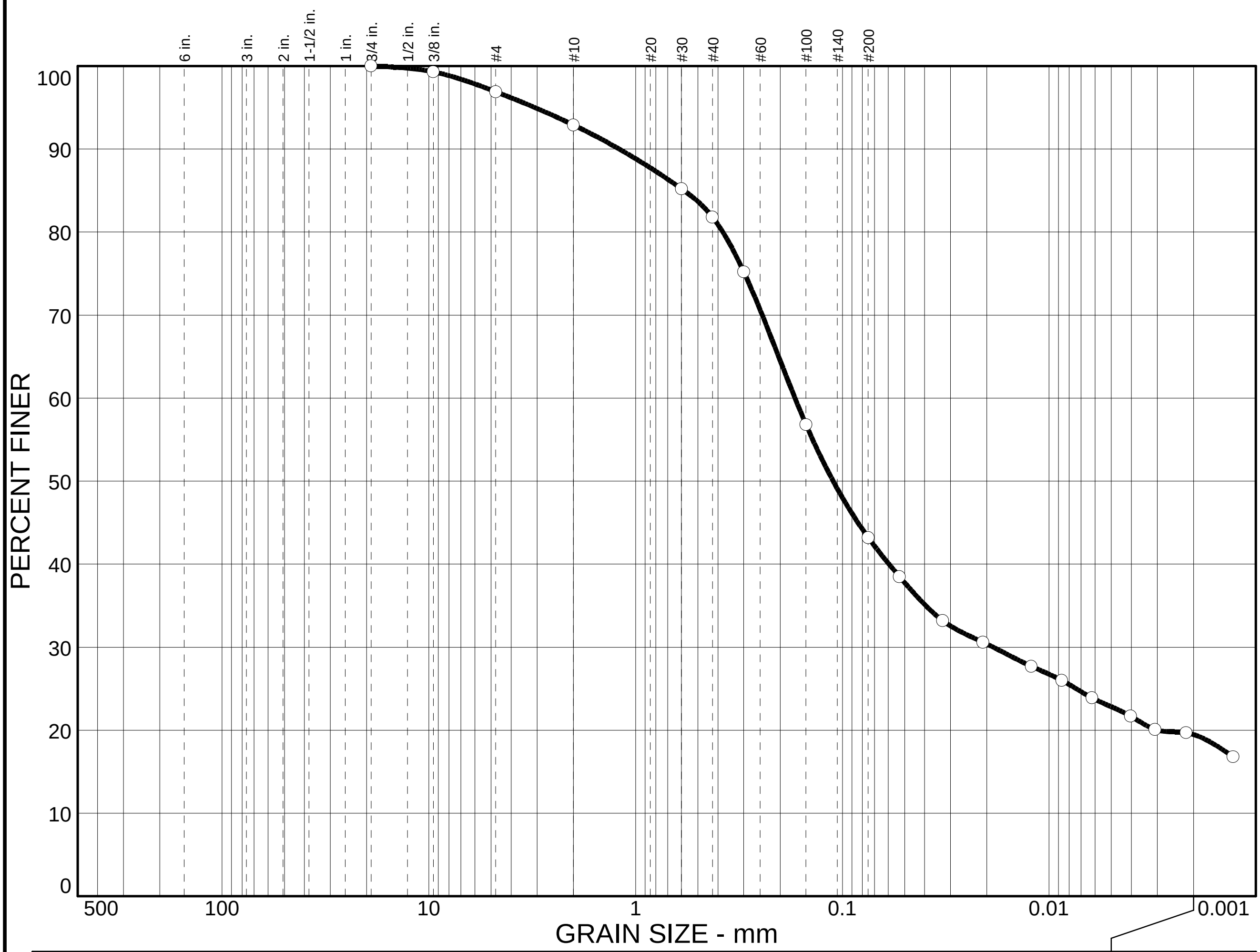
Client: Tom Makdissy Consulting, Inc.

Project: Enterprise Way, Scotts Valley - E410-1

Project No.: 740-163

Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	3.1	53.7	23.7	19.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	99.3		
#4	96.9		
#10	92.9		
#30	85.2		
#40	81.8		
#50	75.2		
#100	56.8		
#200	43.2		
#270	38.5		
0.0327 mm.	33.2		
0.0209 mm.	30.6		
0.0122 mm.	27.7		
0.0087 mm.	26.0		
0.0062 mm.	23.9		
0.0040 mm.	21.7		
0.0031 mm.	20.1		
0.0022 mm.	19.7		
0.0013 mm.	16.8		

* (no specification provided)

Soil Description

Black Lean Clayey SAND

Atterberg Limits

PL= 21 LL= 37 PI= 16

Coefficients

D_{85}= 0.585 D_{60}= 0.170 D_{50}= 0.111
D_{30}= 0.0186 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

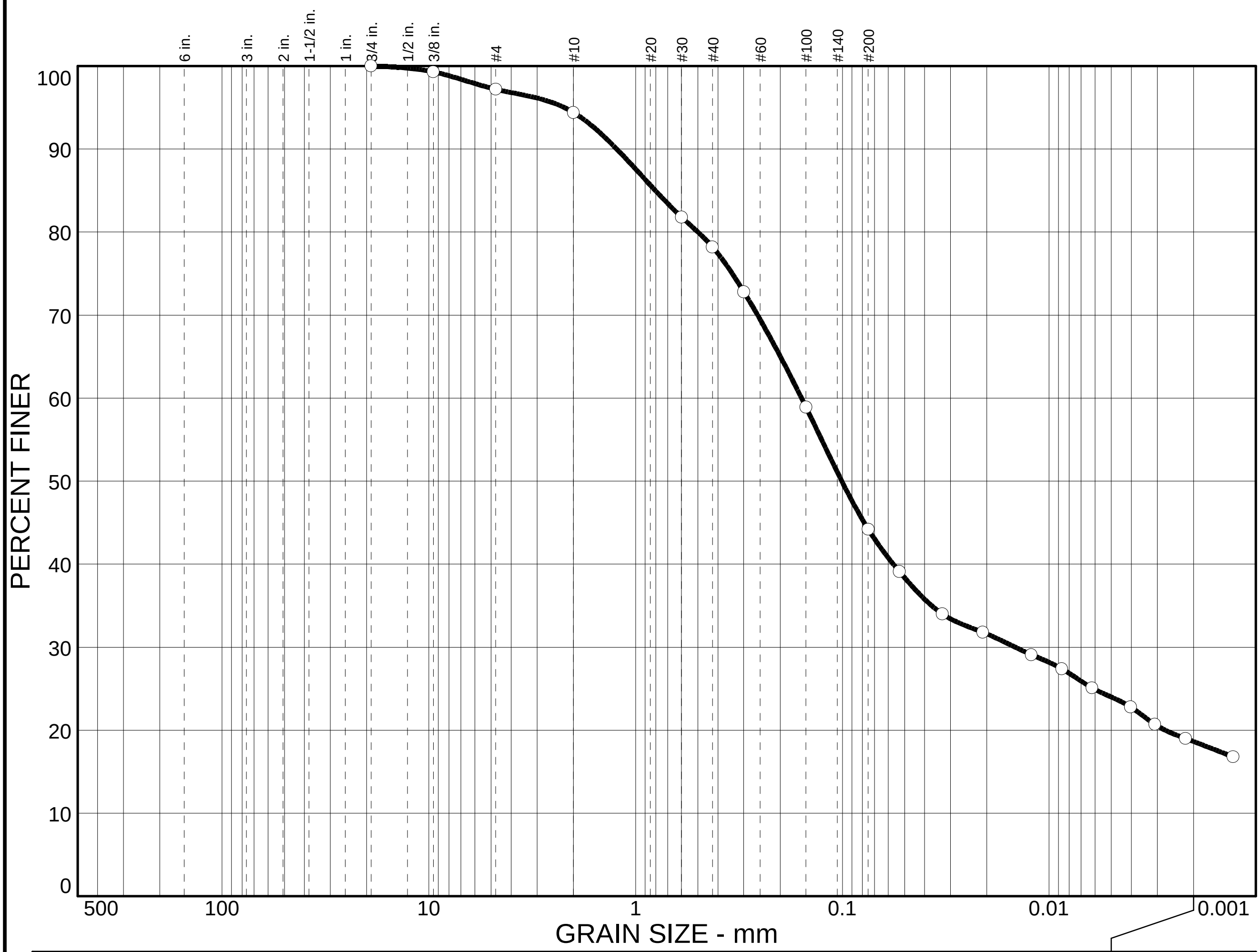
Sample No.: **Source of Sample:** 1-1 **Date:** 11/11/14
Location: **Elev./Depth:** 3'

COOPER TESTING LABORATORY

Client: Tom Makdissy Consulting, Inc.
Project: Enterprise Way, Scotts Valley - E410-1

Project No: 740-163 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	2.8	53.0	25.6	18.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4 in.	100.0		
3/8 in.	99.3		
#4	97.2		
#10	94.4		
#30	81.8		
#40	78.2		
#50	72.8		
#100	58.9		
#200	44.2		
#270	39.1		
0.0328 mm.	34.0		
0.0209 mm.	31.8		
0.0122 mm.	29.1		
0.0087 mm.	27.4		
0.0062 mm.	25.1		
0.0040 mm.	22.8		
0.0031 mm.	20.7		
0.0022 mm.	19.0		
0.0013 mm.	16.8		

* (no specification provided)

Soil Description

Very Dark Brown Lean Clayey SAND

Atterberg Limits

PL= 21 LL= 39 PI= 18

Coefficients

D_{85}= 0.803 D_{60}= 0.158 D_{50}= 0.101
D_{30}= 0.0146 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SC AASHTO=

Remarks

Sample No.: **Source of Sample:** 4-1 **Date:** 11/11/14
Location: **Elev./Depth:** 3'

COOPER TESTING LABORATORY

Client: Tom Makdissy Consulting, Inc.
Project: Enterprise Way, Scotts Valley - E410-1

Project No: 740-163 **Figure**

Corrosivity Tests Summary

CTL # 740-163 | Date: 11/7/2014 | Tested By: PJ | Checked: PJ
Client: T. Makdissy Consulting | Project: Enterprise Way, Scotts Valley | Proj. No: E410-1
Remarks:

Sample Location or ID			Resistivity @ 15.5 °C (Ohm-cm)			Chloride	Sulfate		pH	ORP		Sulfide	Moisture	Soil Visual Description
			As Rec.	Min	Sat.	mg/kg	mg/kg	%		(Redox)		Qualitative	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		E_H (mv)	At Test	by Lead	%	
Boring	Sample, No.	Depth, ft.	ASTM G57	Cal 643	ASTM G57	ASTM D4327	ASTM D4327	ASTM D4327	ASTM G51	ASTM G200	Temp °C	Acetate Paper	ASTM D2216	
2-1	-	3	-	-	2,398	16	43	0.0043	5.9	-	-	-	10.7	Dark Gray Silty SAND

Appendix C

The Grading Specification

Guide Specifications for Rock Under Floor Slabs

THE GRADING SPECIFICATIONS
on
Proposed Residential Development
Enterprise Way
Scotts Valley, California

1. General Description

1.1 These specifications have been prepared for the grading and site development of the subject residential development. ***TMakdissy Consulting Inc.***, hereinafter described as the Soil Engineer, should be consulted prior to any site work connected with site development to ensure compliance with these specifications.

1.2 The Soil Engineer should be notified at least two working days prior to any site clearing or grading operations on the property in order to observe the stripping of organically contaminated material and to coordinate the work with the grading contractor in the field.

1.3 This item shall consist of all clearing or grubbing, preparation of land to be filled, filling of the land, spreading, compaction and control of fill, and all subsidiary work necessary to complete the grading of the filled areas to conform with the lines, grades, and slopes as shown on the accepted plans. The Soil Engineer is not responsible for determining line, grade elevations, or slope gradients. The property owner, or his representative, shall designate the person or organizations who will be responsible for these items of work.

1.4 The contents of these specifications shall be integrated with the soil report of which they are a part, therefore, they shall not be used as a self-contained document.

2. Tests

The standard test used to define maximum densities of all compaction work shall be the ASTM D1557-12 (or latest edition) Laboratory Test Procedure. All densities shall be expressed as a relative compaction in terms of the maximum dry density obtained in the laboratory by the foregoing standard procedure.

3. Clearing, Grubbing, and Preparing Areas To Be Filled

3.1 If encountered, all vegetable matter, trees, root systems, shrubs, debris, and organic topsoil shall be removed from all structural areas and areas to receive fill.

3.2 If encountered, any soil deemed soft or unsuitable by the Soil Engineer shall be removed. Any existing debris or excessively wet soils shall be excavated and removed as required by the Soil Engineer during grading.

3.3 All underground structures shall be removed from the site such as old foundations, abandoned pipe lines, septic tanks, and leach fields.

3.4 The final stripped excavation shall be approved by the Soil Engineer during construction and before further grading is started.

3.5 After the site has been cleared, stripped, excavated to the surface designated to receive fill, and scarified, it shall be disked or bladed until it is uniform and free from large clods. The native subgrade soils shall be moisture conditioned and compacted to the requirements as specified in the grading section of this report. Fill can then be placed to provide the desired finished grades. The contractor shall obtain the Soil Engineer's approval of subgrade compaction before any fill is placed.

4. Materials

4.1 All fill material shall be approved by the Soil Engineer. The material shall be a soil or soil-rock mixture which is free from organic matter or other deleterious substances. The fill material shall not contain rocks or lumps over 6 inches in greatest dimension and not more than 15% larger than 2-1/2 inches. Materials from the site below the stripping depth are suitable for use in fills provided the above requirements are met.

4.2 Materials existing on the site are suitable for use as compacted engineered fill after the removal of all debris and organic material. All fill soils shall be approved by the Soil Engineer in the field.

4.3 Should import material be required, it should be approved by the soil Engineer before it is brought to the site.

5. Placing, Spreading, and Compacting Fill Material

5.1 The fill materials shall be placed in uniform lifts of not more than 8 inches in uncompacted thickness. Each layer shall be spread evenly and shall be thoroughly blade mixed during the spreading to obtain uniformity of material in each layer. Before compaction begins, the fill shall be brought to a water content that will permit proper compaction by either (a) aerating the material if it is too wet, or (b) spraying the material with water if it is too dry.

5.2 After each layer has been placed, mixed, and spread evenly, either import material or native material shall be compacted to a relative compaction designated for engineered fill.

5.3 Compaction shall be by footed rollers or other types of acceptable compacting rollers. Rollers shall be of such design that they will be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is within the specified moisture content range. Rolling of each layer shall be continuous over its entire area and the roller shall make sufficient trips to ensure that the required density has been obtained. No ponding or jetting shall be permitted.

5.4 Field density tests shall be made in each compacted layer by the Soil Engineer in accordance with Laboratory Test Procedure ASTM D1556-64 or D2922-71. When footed rollers are used for compaction, the density tests shall be taken in the compacted material below the surface disturbed by the roller. When these tests indicate that the compaction requirements on any layer of fill, or portion thereof, has not been met, the particular layer, or portion thereof, shall be reworked until the compaction requirements have been met.

5.5 No soil shall be placed or compacted during periods of rain nor on ground which contains free water. Soil which has been soaked and wetted by rain or any other cause shall not be compacted until completely drained and until the moisture content is within the limits hereinbefore described or approved by the Soil Engineer. Approval by the Soil Engineer shall be obtained prior to continuing the grading operations.

6. Pavement

6.1 The proposed subgrade under pavement sections, native soil, and/or fill shall be compacted to a minimum relative compaction of 95% at 3% above optimum moisture content for a depth of 12 inches.

6.2 All aggregate base material placed subsequently should also be compacted to a minimum relative compaction of 95% based on the ASTM Test Procedure D1557-12. The construction of the pavement in the parking and traffic areas should conform to the requirements set forth by the latest Standard Specifications of the Department of Transportation of the State of California and/or City of Scotts Valley, Department of Public Works.

6.3 It is recommended that soils at the proposed subgrade level be tested for a pavement design after the preliminary grading is completed and the soils at the site design subgrade levels are known.

7. Utility Trench Backfill

7.1 The utility trenches extending under concrete slabs-on-grade shall be backfilled with native on-site soils or approved import materials and compacted to the requirements pertaining to the adjacent soil. No ponding or jetting will be permitted.

7.2 Utility trenches extending under all pavement areas shall be backfilled with native or approved import material and properly compacted to meet the requirements set forth by the City of Scotts Valley, Department of Public Works.

7.3 Where any opening is made under or through the perimeter foundations for such items as utility lines and trenches, the openings must be resealed so that they are watertight to prevent the possible entrance of outside irrigation or rain water into the underneath portion of the structures.

8. <u>Subsurface Line Removal</u>

8.1 The methods of removal will be designated by the Soil Engineer in the field depending on the depth and location of the line. One of the following methods will be used.

8.2 Remove the pipe and fill and compact the soil in the trench according to the applicable portions of sections pertaining to compaction and utility backfill.

8.3 The pipe shall be crushed in the trench. The trench shall then be filled and compacted according to the applicable portions of Section 5.

8.4 Cap the ends of the line with concrete to prevent entrance of water. The length of the cap shall not be less than 5 feet. The concrete mix shall have a minimum shrinkage.

9. <u>Unusual Conditions</u>

9.1 In the event that any unusual conditions not covered by the special provisions are encountered during the grading operations, the Soil Engineer shall be immediately notified for additional recommendations.

10. <u>General Requirements</u>

<u>Dust Control</u>

10.1 The contractor shall conduct all grading operations in such a manner as to preclude windblown dirt and dust and related damage to neighboring properties. The means of dust control shall be left to the discretion of the contractor and he shall assume liability for claims related to windblown material.

GUIDE SPECIFICATIONS FOR ROCK UNDER FLOOR SLABS

Definition

Graded gravel or crushed rock for use under slabs-on-grade shall consist of a minimum thickness of mineral aggregate placed in accordance with these specifications and in conformance with the dimensions shown on the plans. The minimum thickness is specified in the accompanying report.

Material

The mineral aggregate shall consist of broken stone, crushed or uncrushed gravel, quarry waste, or a combination thereof. The aggregate shall be free from deleterious substances. It shall be of such quality that the absorption of water in a saturated dry condition does not exceed 3% of the oven dry weight of the sample.

Gradation

The mineral aggregate shall be of such size that the percentage composition by dry weight, as determined by laboratory sieves (U.S. Sieves) will conform to the following gradation:

Sieve Size	Percentage Passing
¾’’	90-100
No. 4	25-60
No. 8	18-45
No. 200	0-3

Placing

Subgrade, upon which gravel or crushed rock is to be placed, shall be prepared as outlined in the accompanying soil report.