GeoMat Testing Laboratories, Inc.

Soil Engineering, Environmental Engineering, Materials Testing, Geology

November 24, 2014

Project No. 14159-01

TO: Crescent Engineering and Construction
9319 Alta Cresta Avenue
Riverside, California 92508

ATTENTION: Fathi Manasrah

SUBJECT: Preliminary Soil Investigation Report, Six Proposed Single Family Residences, APN: 122-180-027, City of Corona, California.

Introduction

In accordance with your authorization, GeoMat Testing Laboratories, Inc. has conducted a preliminary subsurface soil investigation for the subject site. This report should be considered only preliminary in nature; its purpose is to determine the general foundation system for the structure described herein. The following presents a summary of our findings, conclusions, recommendations, and limitations of our work for the proposed construction.

Scope of Work

- Review soils, seismic, groundwater data, and maps in our files.
- Exploration of the site at accessible location by means of a drill rig.
- Sampling of select soils.
- Conduct laboratory testing of select soil samples for classification, shear strength, Atterberg Limits, expansion, and sulfate.
- Prepare CBC seismic design parameters.
- Preparation of a soil investigation report (3 copies) to include: Site preparation recommendations, allowable soil bearing value, Foundation recommendations, Slab-on-grade recommendations, Earth pressures, Site Class, CBC seismic design parameters, and cement type.

Existing Site Condition

The subject site is located on the south side of Corona Avenue and west of Interstate 15 in the City of Corona, California. Refer to Plate 1 for Site Location. Corona Avenue is a paved road with curb and gutter.

The site is approximately 600 X 150 feet. Portion of the property along the highway is a descending slope from the highway to the property. Slope height varies, but average height is 20 feet. The remainder of the site is flat with a total north-south relief of 15 feet. Vegetation at the site is sparse.

Proposed Development

We understand that six wood framed single family homes are proposed for the lot. We anticipate that the proposed structure is to be supported by a combination of isolated square and continuous wall type foundations, and concrete slab-on-grade. We have not been provided with specific foundation loads. We anticipate however, that continuous wall loads will not exceed 2500 pounds per linear foot and isolated column loads of up to 25 kips.

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Proposed Grading

Tentative Tract Map 34018 was provided for the property. The plan shows the six single family lots lined up along the west side of the property. A short Cul-de-Sac designated as Lot ”A” is shown on the east side of the property. Based on the plan, it is our judgment that Lots 1, 2, 4, and 6 will be provided with compacted fill, and Lots 3 and 5 will be graded in sliver cut to fill transition grading.

A retaining wall will be provided for the most east and west sides. A five feet high slope designed at 2H:1V is proposed on the west side of Lot 1.

Field Work

Two exploratory borings were drilled on November 15, 2014 utilizing a CME-45 mobile drill rig equipped with 6 inch diameter hollow stem auger. The borehole location was selected at an accessible, no utility conflict area (see Borehole Location Map, Plate 1).

Relatively undisturbed samples were obtained with the California Ring Sampler (ASTM D 1587). This sampler has three inches external diameter, 2.5 inches inside diameter, and is lined with one inch high brass rings, with an inside diameter of 2.41-inches. The sample barrel is driven into the ground at the bottom of the boring with 140-pound hammer with a free fall of approximately 30-inches. Sampler driving resistance, expressed as blows per six inches of penetration, is presented on the boring logs at the respective sampling depths. Ring samples were retained in close-fitting, moisture tight canisters for transport to our laboratory for testing.

Additional representative samples have been recovered with the SPT (Standard Penetration Test, ASTM D 1586) sampler. This sampler consists of steel driving shoe and tube that split longitudinally in half, and a coupling at the top. The coupling connects the sampler to the drill rod. The standard split tube has an inside diameter of 1 3/8-inch (1 ½ -inch inside diameter without liners) and an outside diameter of 2-inches. Unless noted otherwise, liners are usually not used. The standard driving weight and free fall for this test is similar to California Ring Sampler. Blow counts required to drive the samplers 18-inches are recorded on the boring logs. The sum of the number of blows for the last 12 inches on an 18-inch penetration represents the SPT count. This data is shown on the boring logs when obtained in the field.

A bulk sample was also collected from the auger cuttings during drilling. The sample was collected in a plastic bag, tied, and tagged for the location and depth.

The geotechnical boring log is presented in Appendix B and may include a description and classification of each stratum, sample locations, blow counts, groundwater conditions encountered during drilling, results from selected types of laboratory tests, and drilling information.

Subsurface Findings

Based on our exploratory borings, the exposed surficial material in the upper ten feet is classified as silty sand (USCS “SM”). This material was slightly moist to moist, with fine to coarse grained sand and some gravel. This material is underlain by fine grained silty clay (USCS “CL-ML”).

Laboratory Testing

Laboratory tests were performed on selected soil samples. The tests consisted primarily of moisture, density, sieve analysis, Atterberg Limits, expansion index, direct shear, and sulfate content.

The soil classifications are in conformance with the Unified Soil Classifications System (USCS), as outlined in the Classification and Symbols Chart (Appendix B). A summary of our laboratory testing and ASTM designation is presented in Appendix C.

Groundwater

Groundwater study is not within the scope of this work. Local groundwater elevation is expected to be deeper than 30 feet below ground surface. This information was researched and summarized in the table below; using the Western Municipal Water District's Cooperative Well Measuring Program:

Well #	Well Name	Water Surface Elevation	Date Measured
3S7W24Q	River Road car Wash	545	6/20/2001
The lowest elevation at the subject site is 601			

There was no information from the State Department of Water Resources.

Please note that the potential for rain or irrigation water locally seeping through from adjacent elevated areas and showing up near grades cannot be precluded. Our experience indicates that surface or near-surface groundwater conditions can develop in areas where groundwater conditions did not exist prior to site development, especially in areas where a substantial increase in surface water infiltration results from landscape irrigation.Fluctuations in perched and static water elevations are likely to occur in the future due to variations in precipitation, temperature, consumptive uses, and other factors including urbanization and development which were not present at the time this observations were made. Mitigation for nuisance shallow seeps will be needed if encountered. These mitigations may include subdrains, horizontal drains, toe drains, french drains, heel drains or other devices.

Geologic Findings

The lot is underlain by moderately dense alluvial material. Based on the USGS Geologic Map of Corona North Quadrangles, Figure 2, the site is mapped as very old alluvium channel deposits. These deposits are comprised of well indurated silt, sand, and gravel.

Seismicity Considerations

Ground Rupture:

The site is not within a currently established Earthquake Fault Zone for surface fault rupture hazards. Therefore, the potential for surface rupture is very low.

Ground Shaking:

As it is in all of Southern California, seismic ground shaking at this site is of moderately strong potential.

Stability:

The proposed compacted fill slope on Lot 1 is designed at 2H:1V vertical with a maximum height of 5 feet. At the designed inclination and height the slope is considered grossly stable.

Tsunamis, Inundation, and Seiches:

The site is not located within a coastal area; therefore, tsunamis (seismic sea waves) and seiches are not a potential hazard.

Site Class

It is our opinion that structures should be designed in accordance with the current seismic building code as determined by the structural engineer. The subject site is located in an estimated Site Class "D"

Ground Motion and Seismic Design Parameters:

The peak ground acceleration (PGA) and 2013 CBC seismic design parameters are presented in Appendix D.

Expansive Soil Characteristics

Expansion Index (EI) test was performed on a soil sample obtained from our exploration. Based on the laboratory test results, the soils in the upper few feet have a very low expansion potential (EI<20), as defined in Table 18-I-B of the 2001 CBC. Additional tests should be conducted after completion of grading.

Liquefaction

Liquefaction occurs when loose saturated cohesionless soils are subject to ground shaking during an earthquake of large magnitudewhen the water table is less than 30 feet below ground surface. Because the site is underlain by dense very old alluvial deposits, liquefaction potential at the site is very low.

Conclusions

- Based on laboratory testing; the expansion potential of onsite soils is expected to bevery low (EI<20). This would require verification subsequent to completion of new footing excavations.

- The site is located in a region of generally high seismicity, as is all of southern California. During its design life, the site is expected to experience strong ground motions from earthquakes on regional and/or local causative faults. Therefore typical structural design mitigations should be considered by the structural engineer.

- The potential for seismically induced dynamic settlement of the onsite soils is low because the site is underlain by dense very old alluvial deposits.

- The use of shallow foundation is feasible for the proposed construction.

Recommendations

Building Pad Preparation

All grading should be performed in accordance with our General Earthwork and Grading Specifications presented in Appendix E except as modified within the text of this report. The site should be cleared of undocumented fill, roots, and deleterious material which should be hauled offsite.

After site clearance, the lot area should be overexcavated to remove all loose soil and expose competent material. At least three feet of removal should be anticipated below existing grades. Deeper removals should not be precluded to clean and remove loose soil, fill, roots, etc. Deleterious material should be completely removed if encountered in bottom of the grading areas.

After overexcavation, the exposed surfaces should be further scarified to a depth of at least 12-inches, moisture conditioned and recompacted to at least 90 percent of the maximum dry density, as determined by ASTM D1557 Test Method; prior to placement of fill.

Fill Construction

Any fill to be placed on ground steeper than 5H:1V should be benched into competent material. Benching should be accomplished to expose a minimum three feet vertical wall of competent native material. Any loose topsoil and shallow highly weathered bedrock should be completely removed by benching.

To prevent excessive erosion of fill slope faces, all fill slopes should be over built and trimmed to expose a uniform finish slope face during grading. Slopes should be provided with drainage devices capable of directing surface and subsurface water away from slope faces. Erosion resistant landscaping should be planted on all slopes as soon as practical following grading to prevent erosion. As a minimum, the Slope Maintenance Guidelines in Appendix F should be considered.

Compacted Fills/Imported Soils

Any soil to be placed as fill, whether presently onsite or import, should be approved by the soil engineer or his representative prior to their placement. All onsite soils to be used as fill should be cleansed of any roots, oversize materials generated from rock excavations, or other deleterious materials. Cobbles, larger than 12-inches in diameter should not be placed in the vicinity of foundations and utility lines. All fills should be placed in 6- to -8 inch loose lifts, thoroughly watered, or aerated to near optimum moisture content, mixed and compacted to at least 90 percent relative compaction. This is relative to the maximum dry density determined by ASTM D1557-02 Test Method.

Any imported soils should be sandy (preferably USCS "SM" or "SW", and very low to low in expansion potential) and approved by the soil engineer. The soil engineer or his representative should observe the placement of fill and shall take sufficient tests to verify the moisture content and the uniformity and degree of compaction obtained.

Tentative Foundation Recommendations

The use of shallow spread footings in compacted fill or firm native ground is feasible. A maximum allowable bearing value of 2000psf is recommended for the following the residential footing system.

- Footing system soil should be designed and constructed in a manner that will minimize damage to structure from movement of the soil that occur in the moisture variation depth zone.

- Depth of continuous and pad footings below natural and finish grade should be at least 18 and 24 inches, respectively.

- Footing reinforcement should be determined by the structural engineer, however, minimum reinforcement should be at least two No. 4 reinforcing bars, top and bottom.

- Expansion potential of foundation soils should be verified subsequent to footing excavation and before placement of footing material.

- The above recommended bearing value may be increased by one third for temporary (wind or seismic) loads.

Resistance to lateral footing will be provided by passive earth pressure and base friction. For footings bearing against firm native material, passive earth pressure may be considered to be developed at a rate of 239 per foot of depth to a maximum of 1900 psf. Base friction may be computed at 0.42 times the normal load. If passive earth pressure and friction are combined to provide required resistance to lateral forces, the value of the passive pressure should be reduced to two-thirds the value.

Foundation design comes under the purview of the structural engineer. The above recommendations should not preclude more restrictive structural requirements. The structural engineer should determine the actual footing sizes and reinforcement to resist vertical, horizontal, and uplift forces under static and seismic conditions.

Reinforcement and size recommendations presented in this report are considered the minimum necessary for the soil conditions present at foundation level and are not intended to supersede the design of the project structural engineer or criteria of the governing agencies for the project.

Lateral Earth Pressures/Walls Below Grade

The following lateral earth pressures and soil parameters in conjunction with a 2000 psf soil bearing value for retaining walls may be used for design of retaining walls with free draining compacted backfills. If passive earth pressure and friction are combined to provide required resistance to lateral forces, the value of the passive pressure should be reduced to two-thirds the following recommendations.

Lateral Pressure Condition	Soil Condition	Equivalent Fluid Pressure (pcf)
At Rest Case	Level	52
Active Case	Level	34
Passive Case	Level	239 to a maximum of 1900
Horizontal Coefficient of Friction	0.42	
Unit Soil Weight	110 pcf	
For sloping backfill add 1 pcf for every 2 degrees for active case and add 1.5 pcf for every 2 degrees for at rest case		

We recommend drainage for retaining walls to be provided in accordance with Plate 2. Maximum precautions should be taken when placing drainage materials and during backfilling. All wall backfills should be properly compacted to at least 90 percent relative compaction.

Slabs-on-Grade

Slabs-on-grade placed on compacted ground. Slabs-on-gradeshould be at least 4 inches thick, and should be reinforced with at least No 3 bars at 16inches on-center both ways, properly centered in mid thickness of slabs.

Residential slabs-on-grade should be provided with a 10-mil Visqueen moisture barrier underlain by four of clean sand.

Slab-on-grade thickness and reinforcement should be evaluated by the structural engineer and designed in compliance with applicable codes. Excess soils generated from foundation excavations should not be placed on any building pads without proper moisture and compaction. All slab subgrades should be saturated to a depth of at least 12 inches prior to placement of slab building materials. Moisture content should be tested in the field by the soil engineer. Slabs subgrade should be kept moist and the surface should not be allowed to desiccate.

The addition of fiber mesh in the concrete and careful control of water/cement ratios may lessen the potential for slab cracking. In hot or windy weather, the contractor must take appropriate curing precautions after the placement of concrete.

The use of mechanically compacted low slump concrete (not exceeding 4 inches at the time of placement) is recommended. We recommend that a slipsheet (or equivalent) be utilized if grouted tiles or other crack sensitive flooring (such as marble tiles) is planned directly on concrete slabs.

Settlement

The foundation will be embedded into compacted fill. Native soils below the fill possess relatively high strengths and will not be subject to significant stress increases from the foundations of the new structure. Therefore settlements are expected to be within tolerable limits. Total long-term settlement between similarly loaded adjacent foundation systems should not exceed one inch. The structures should be designed to tolerate a differential settlement on the order of 1/2 to 3/4-inch.

Drainage

Positive drainage should be provided and maintained for the life of the project around the perimeter of all structures and all foundations toward streets or approved drainage devices to minimize water infiltrating into the underlying natural and engineered fill soils, and prevent erosion. In addition, finish subgrade adjacent to exterior footings should be sloped down (at least 2%) and away to facilitate surface drainage. Roof drainage should be collected and directed away from foundations via nonerosive devices. Water, either natural or by irrigation, should not be permitted to pond or saturate the foundation soils.

Planter areas and large trees adjacent to the foundations are not recommended. All planters and terraces should be provided with drainage devices. Internal drainage should be directed to approve drainage collection devices, per the civil engineer recommendations. Location of drainage devices should be in accordance with the design civil engineers drainage and erosion control recommendations.

The owner should be made aware of the potential problems, which may develop when drainage is altered through construction of retaining walls, patios and other devices. Ponded water, leaking irrigation systems, over watering or other conditions which could lead to ground saturation should be avoided. Surface and subsurface runoff from adjacent properties should be controlled. Area drainage collection should be directed away from structures through approved drainage devices. Drainage devices should be maintained.

Cement Type/Corrosion Potential

A soil sample was tested for sulfate content. The test results suggest that soluble sulfate in the selected sample was negligible (0.021 percent), as of the date of this report.

We recommend Type II cement for all concrete work in contact with soil. Ferrous metal pipes should be protected from potential corrosion by bituminous coating, etc. We recommend that all utility pipes be nonmetallic and/or corrosion resistant. If considered critical, these recommendations should be further verified by the testing of soil samples for sulfate and corrosivity during construction.

Soil Type

The surficial soil is classified as silty sand andin our opinion may be classified as Cal-OSHA soil Type “B”.

Trench Backfill

Trenches greater than five feet in depth should be shored or sloped at 1H:1V or flatter in compliance with California OSHA requirements. All utility trenches and retaining wall backfills should be mechanically compacted to the minimum requirements of at least 90 percent relative compaction.

Onsite soils derived from trench excavations can be used as trench backfill. Backfills should be placed in thin lifts and compacted by mechanical means. Material with sand equivalent of at least 30 should be utilized for the pipe zone. No jetting, ponding, or flooding should be permitted within the building area or where trenches are in zone of influence of footing loads. Excavated material from footing trenches should not be placed in slab-on-grade areas unless properly compacted and tested.

We Should Be Retained For The Following Stages Of Construction

Plan Review

The recommendations provided in this report are based on preliminary information and subsurface conditions as interpreted from limited exploratory borehole. We MUST review final grading and foundationplans to revise our conclusions and recommendations, as necessary. Our preliminary conclusions and recommendations should also be reviewed and verified subsequent to footing excavation, and revised accordingly if exposed geotechnical conditions vary from our preliminary findings and interpretations.

Additional Observation and/or Testing

During overexcavation and fill placement.
During retaining wall backfill and compaction.
Following footing excavation and prior to placement of footing materials.
Following slab subgrade saturation for moisture testing and prior to placement of slab materials.
When any unusual conditions are encountered.

Geotechnical Risk

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science.

The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience.

Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations presented in the preceding sections constitute GeoMat Testing Laboratories professional estimate of those measures that are necessary for the proposed structure to perform accordingto the proposed design based on the information generated and referenced during this evaluation, and GeoMat Testing Laboratories experience in working with these conditions.

Limitation Of Investigation

This report was prepared for the proposed location of the building pad. The use by others, or for the purposes other than intended, is at the user's sole risk.

Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar locations within the limitations of scope, schedule, and budget. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

The field and laboratory test data are believed representative of the project site; however, soil conditions can vary significantly. As in most projects, conditions revealed during grading may be at variance with preliminary findings. If this condition occurs, the possible variations must be evaluated by the Project Geotechnical Engineer and adjusted as required or alternate design recommended.

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 subcontractor carry out such recommendations in the field.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein to be unsafe.

The findings, conclusions, and recommendations presented herein are based on our understanding of the project and on subsurface conditions observed during our site work, and are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In additions, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.

The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In additions, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.

If you should have any questions regarding this report, please do not hesitate to call our office. We appreciate this opportunity to be of service.

Submitted for GeoMat Testing Laboratories, Inc.

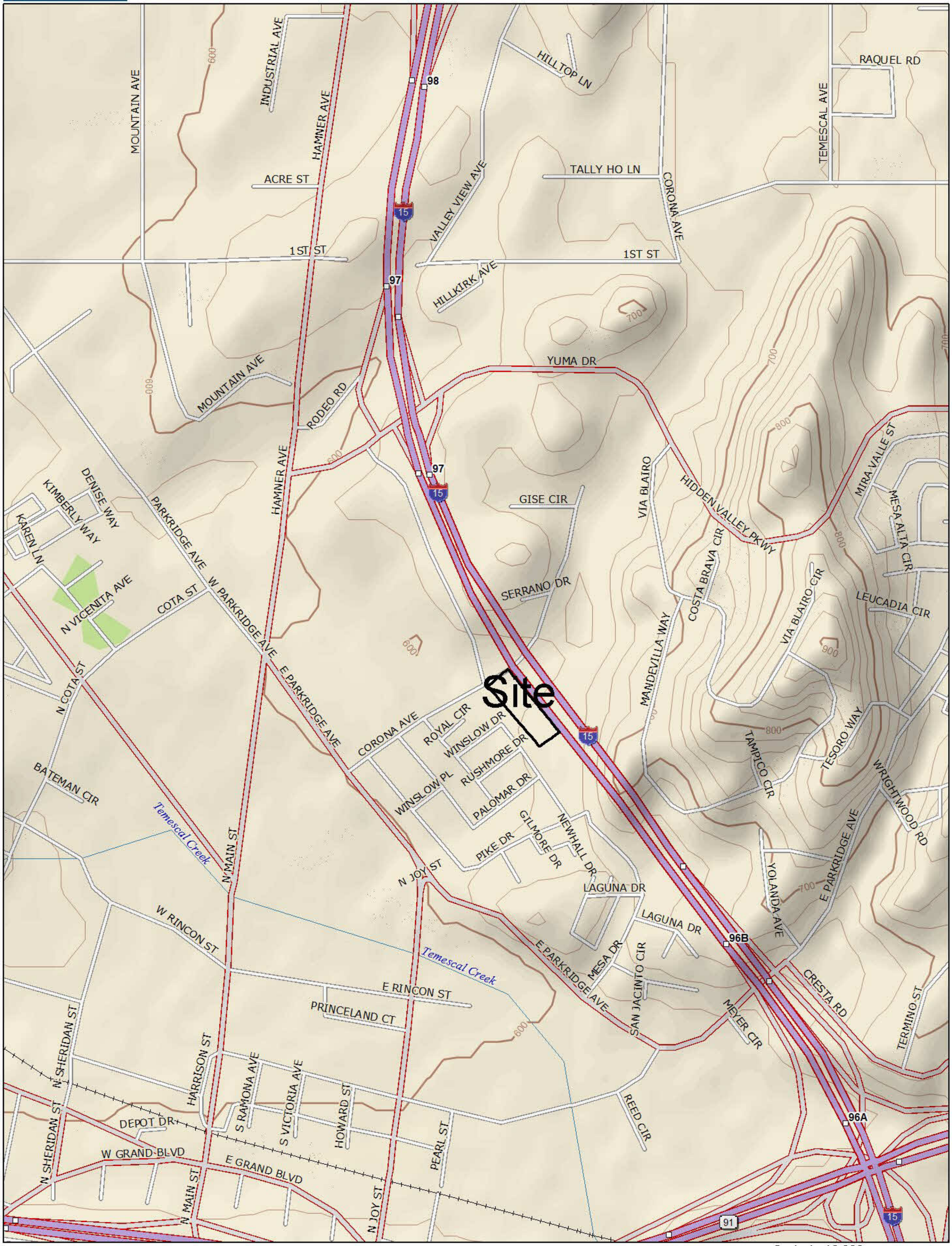
HaythamNabilsi, GE 2375
Principal Engineer

Art Martinez
Staff Engineer

Distribution: [3] Addressee

Attachments:

Figure 1	Site Location Map
Figure 2	Geologic Map
Plate 1	Exploratory Borehole Location Map
Plate 2	Retaining Wall Drainage Detail
Appendix A	References
Appendix B	Exploratory Borehole Logs
Appendix C	Laboratory Test Results
Appendix D	CBC Seismic Design Parameters
Appendix E	General Earthwork Grading and Specifications
Appendix F	Minimum Slope Maintenance Guidelines



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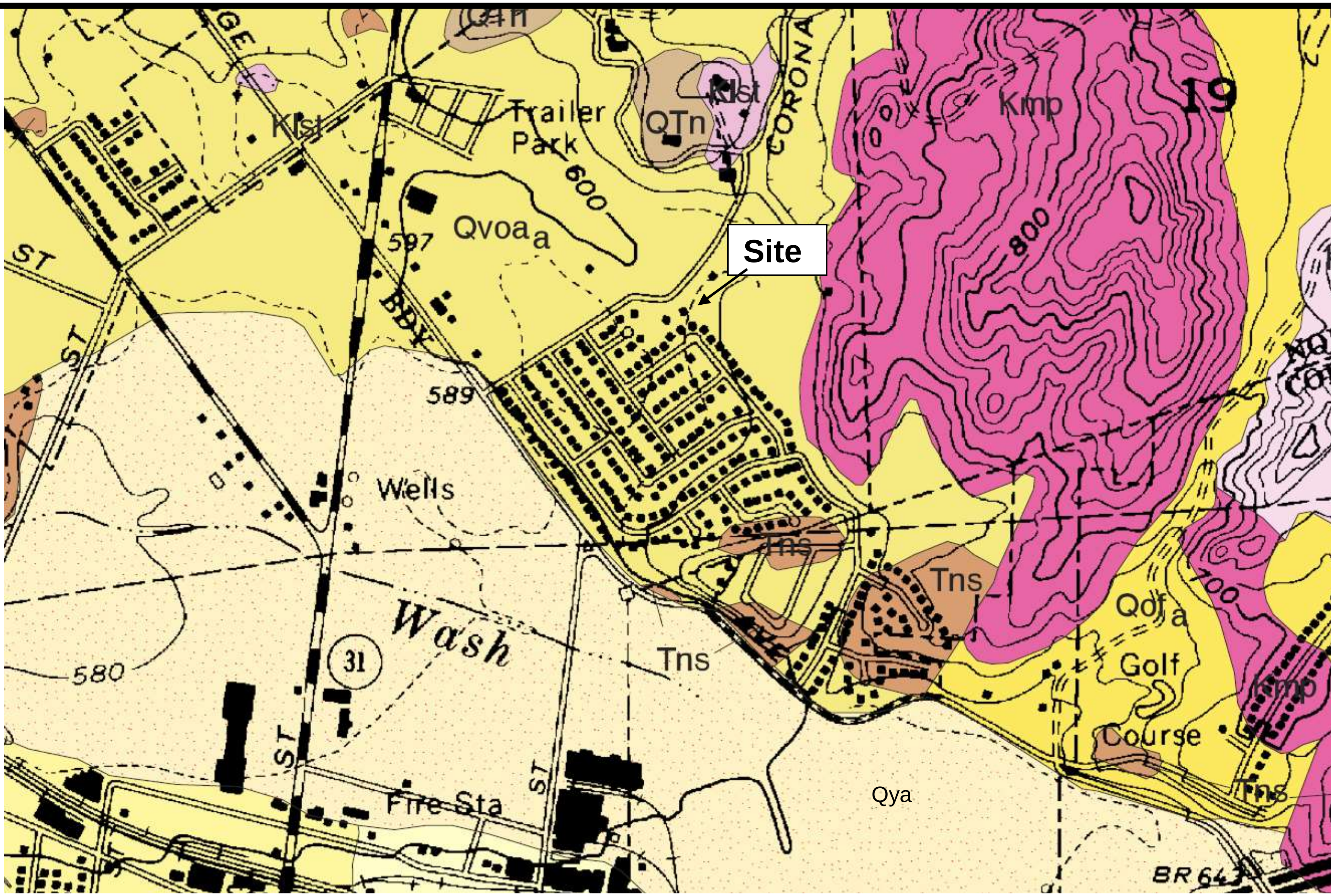
TN

MN (12.1°E)

Scale 1 : 12,800

1" = 1,066.7 ft

Data Zoom 14-0



Geologic Map of Corona North Quadrangle, OFR 02-22

Qya: Young Alluvial Channel Deposits (Holocene to Late Pleistocene)
Qof: Old Alluvial Fan Deposits (Late to Middle Pleistocene)
Qvoa: Very Old Alluvial Channel Deposits (Early Holocene)
QTn: Late Cenozoic sedimentary Rocks (Early Pleistocene to Late Pliocene)
Tns: Sandstone (Pliocene)
Kmp: Micropegmatite Granite of Gavilan Ring Complex (Crateceous)

Geologic Map

APN 122-180-027, Corona, California

Project No: 14159-01
Figure: 2

GeoMat

TENTATIVE TRACT MAP 34018

APN 122-180-027

CORONA , CA

GeoMat Testing Laboratories, Inc.
Exploratory Borehole Location Map
Project No. 14159-01
Plate 1
November 19, 2014
● Approximate Location of Borehole

LEGAL DESCRIPTION

Real Property in the City of Corona, County of Riverside, State of California, described as follows:

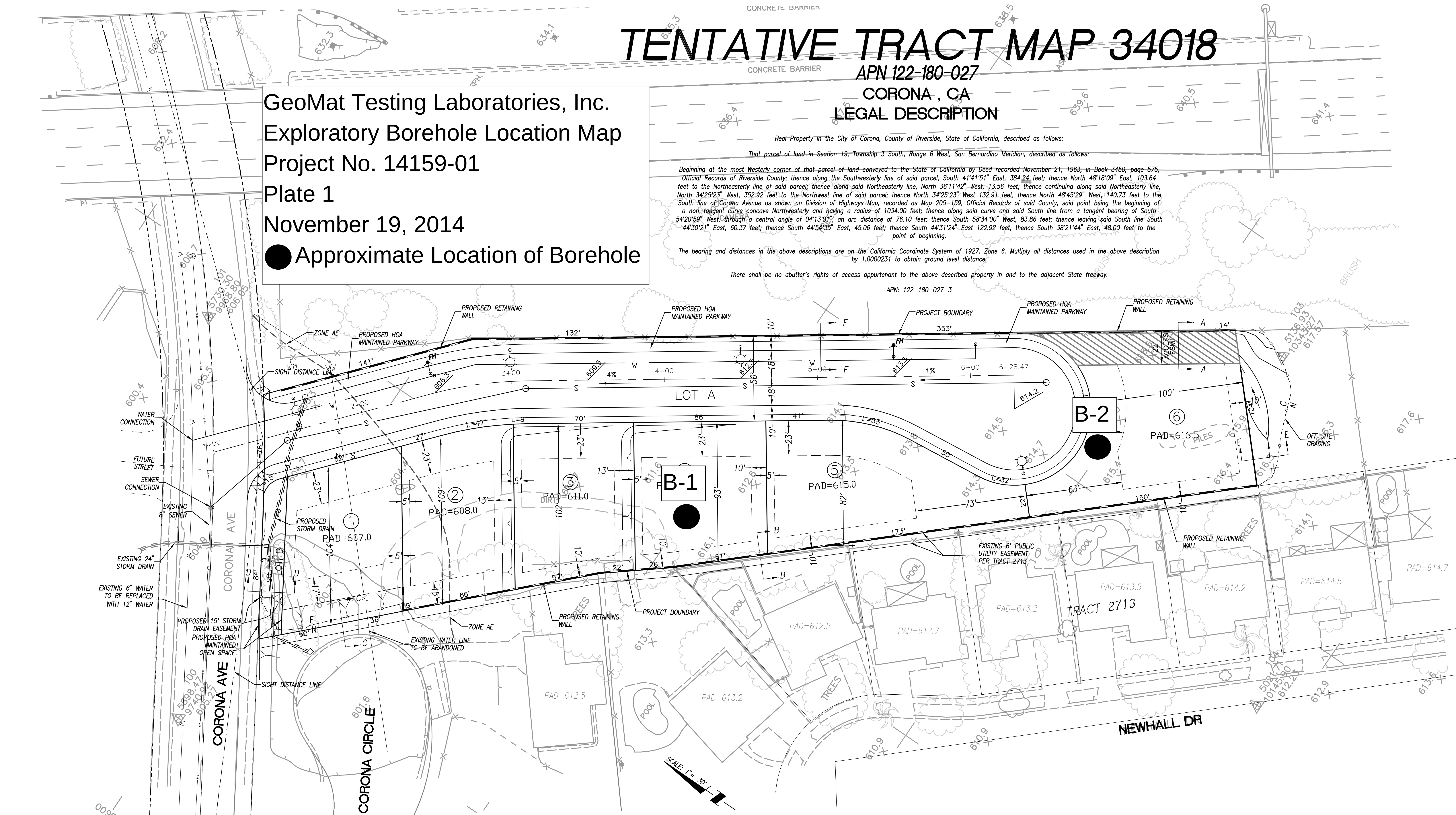
That parcel of land in Section 19, Township 3 South, Range 6 West, San Bernardino Meridian, described as follows:

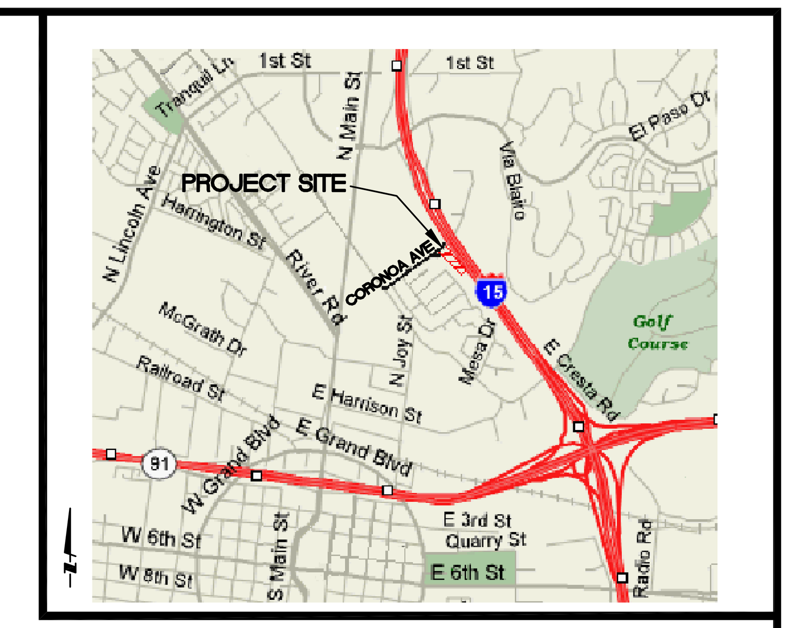
Beginning at the most Westerly corner of that parcel of land conveyed to the State of California by Deed recorded November 21, 1963, in Book 3450, page 575, Official Records of Riverside County; thence along the Southwesterly line of said parcel, South 41°41'51" East, 384.24 feet; thence North 48°18'09" East, 103.64 feet to the Northeasterly line of said parcel; thence along said Northeasterly line, North 36°11'42" West, 13.56 feet; thence continuing along said Northeasterly line, North 34°25'23" West, 352.92 feet to the Northwest line of said parcel; thence North 34°25'23" West 132.91 feet, thence North 48°45'29" West, 140.73 feet to the South line of Corona Avenue as shown on Division of Highways Map, recorded as Map 205–159, Official Records of said County, said point being the beginning of a non-tangent curve concave Northwesterly and having a radius of 1034.00 feet; thence along said curve and said South line from a tangent bearing of South 54°20'59" West, through a central angle of 04°13'01", an arc distance of 76.10 feet; thence South 58°34'00" West, 83.86 feet; thence leaving said South line South 44°30'21" East, 60.37 feet; thence South 44°54'35" East, 45.06 feet; thence South 44°31'24" East 122.92 feet; thence South 38°21'44" East, 48.00 feet to the point of beginning.

The bearing and distances in the above descriptions are on the California Coordinate System of 1927. Zone 6. Multiply all distances used in the above description by 1.0000231 to obtain ground level distance.

There shall be no abutter's rights of access appurtenant to the above described property in and to the adjacent State freeway.

APN: 122-180-027-3





VICINITY MAP

GENERAL LAND PLAN INFO.

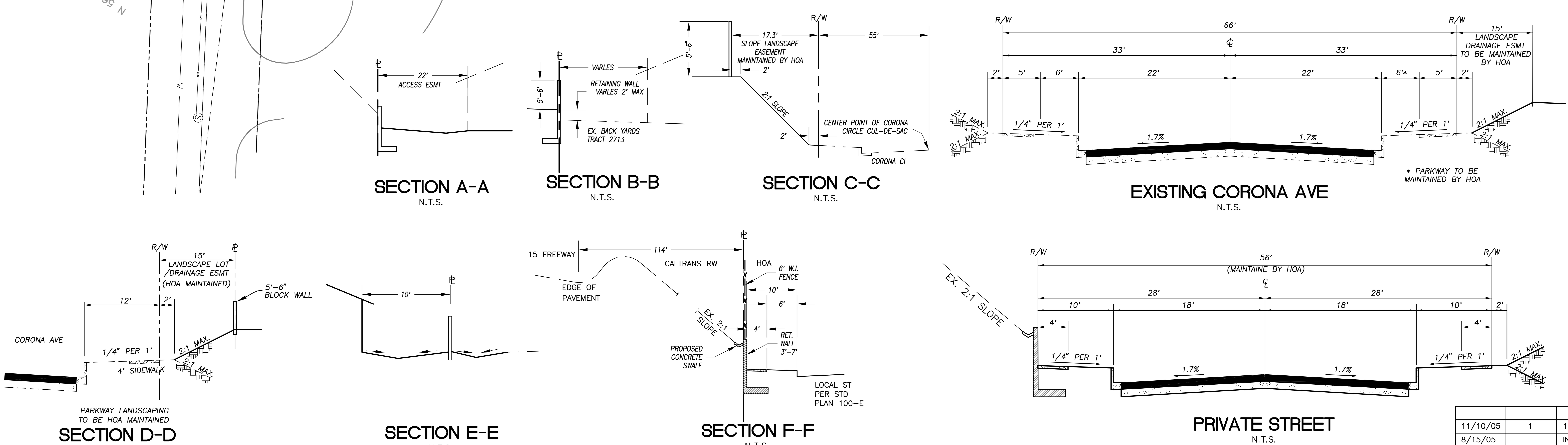
Gross Area: 90,995 sq. ft. (2.09 ac)
Adjusted Gross Area (less street = 39,442 sq. ft) = 51,553 sq. ft. (1.18 ac)
Existing Land use – Vacant
Existing Zoning: A–14.4
General Plan LDR
Proposed land use – single family residential
Proposed Zoning: R–1–7.2
Target density factor – Low– 3–6 du/ac
Max. number if numbered lots/dwelling units permitted = 7.6 du/ac
Proposed number of Lots/dwelling units per land use category = 2.87 lots–du/ac
Proposed number of dwelling units per acre = 2.87 units/ac

FIRE DEPARTMENT NOTES

1. ANY REVISED SITE PLAN SHALL BE SUBMITTED TO THE FIRE DEPARTMENT FOR SCREEN CHECK APPROVAL PRIOR TO BUILDING PLAN SUBMITTAL.
2. ALL PROJECTS SHALL COMPLY WITH THE CITY OF CORONA FIRE DEPARTMENT SITE CONSTRUCTION STANDARD. A COPY OF WHICH IS AVAILABLE AT THE FIRE DEPARTMENT COUNTER. PROJECTS SHALL HAVE APPROVED ALL WEATHER ACCESS FROM TWO (2) DIRECTIONS AND FIRE HYDRANTS PROVIDING THE REQUIRED FIRE FLOW TESTED AND ACCEPTED PRIOR TO COMBUSTIBLE CONSTRUCTION.
3. CUL–DE–SAC(S) SHALL NOT EXCEED FIVE HUNDRED (500) FEET IN LENGTH.
4. STREET AND DRIVE GRADES SHALL NOT EXCEED 10% UNLESS APPROVED BY THE FIRE CHIEF AND CITY ENGINEER.
5. A MINIMUM FIRE FLOW OF 1500 GPM SHALL BE PROVIDED.
6. FIRE HYDRANTS SHALL BE PROVIDED ON ALL STREETS AND DRIVES ADJOINING AND WITHIN THE PROJECT AREA. CONSULT WITH THE FIRE DEPARTMENT FOR PROPOSED HYDRANT LOCATIONS. PROVIDE BLUE DOTS HYDRANT MARKERS PER CITY STANDARD.
7. FIRE HYDRANTS ARE TO BE SPACED A MAXIMUM 300 FEET APART.
8. GROVES AND WEED ABATEMENT SHALL BE MAINTAINED SO AS NOT TO POSE A FIRE HAZARD UNTIL TIME OF DEVELOPMENT.
9. A SPECIFIC ADDRESS, ASSIGNED BY THE CITY OF CORONA, SHALL BE PROVIDED FOR EACH BUILDING AS SPECIFIED BY THE FIRE DEPARTMENT ADDRESS STANDARD WHICH CAN BE OBTAINED AT THE FIRE DEPARTMENT COUNTER AT CITY HALL. ADDRESS MUST BE ILLUMINATED DURING ALL HOURS OF DARKNESS.

GENERAL NOTE:

1. EXISTING LAND USE: VACANT
2. ADJACENT LAND USE : N – RESIDENTIAL – LDR
   S – RESIDENTIAL – LDR
   E – RESIDENTIAL – LDR
   W – VACANT – LDR
3. ELECTRICAL SERVICE WILL BE PROVIDED BY THE SOUTHERN CALIFORNIA EDISON COMPANY. ALL NEW ELECTRICAL SERVICE LINES WILL BE PLACED UNDERGROUND.
4. GAS SERVICE WILL BE PROVIDED BY THE SOUTHERN CALIFORNIA GAS COMPANY.
5. TELEPHONE SERVICE WILL BE PROVIDED BY SBC
6. CABLE T.V. SERVICE WILL BE PROVIDED BY Charter Communications.
7. DOMESTIC WATER, RECLAIMED WATER AND SEWER SERVICE WILL BE PROVIDED BY THE CITY OF CORONA WATER DISTRICT
8. THE DEVELOPER WILL COMPLY WITH ENERGY CONSERVATION MEASURES SET FORTH IN TITLE 24 OF THE CALIFORNIA ADMINISTRATIVE CODE.
9. PROPOSED SEWER FACILITIES: STANDARD LATERAL CONNECTIONS TO SEWER SYSTEM SHALL BE IN ACCORDANCE WITH THE CITY OF CORONA STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF WATER, SEWER AND RECLAIMED WATER FACILITIES.
10. PROPOSED WATER FACILITIES: STANDARD DOMESTIC CONNECTIONS TO WATER SYSTEM SHALL BE IN ACCORDANCE WITH THE CITY OF CORONA STANDARD SPECIFICATIONS FOR THE CONSTRUCTION OF WATER, SEWER AND RECLAIMED WATER FACILITIES.
11. THE DEVELOPER RESERVES THE RIGHT TO FILE MULTIPLE FINAL MAPS FOR THIS TENTATIVE TRACT MAP.
12. A PORTION OF THIS PROJECT IS LOCATED IN FLOOD ZONE AE PER FEDERAL EMERGENCY MANAGEMENT AGENCY (FIRM MAP NO. 0602500005F) EFFECTIVE DATE : JUNE 1996.
13. DRAINAGE OF THIS PROJECT WILL BE CONVEYED BY MEANS OF A SURFACE DRAINAGE, TOE DRAIN AND BROW DITCHES.
14. EXISTING IRRIGATION LINES WILL BE CRUSHED IN PLACE, REMOVED, RELOCATED OR PROTECTED IN PLACE
15. ALL SIDEWALKS SHOWN OUTSIDE PUBLIC STREET RIGHT OF WAY SHALL BE RESERVED AS AN ALL PROPOSED STREETS ARE TO BE PUBLIC STREETS AND MAINTAINED BY THE CITY OF CORONA. EASEMENT FOR INGRESS AND EGRESS FOR PEDESTRIAN PURPOSES.
    a. ALL SIDEWALKS, CURB RETURNS AND PEDESTRIAN CROSSINGS MUST MEET THE TITLE 24 AND AMERICAN DISABILITIES ACT REQUIREMENTS.
16. ALL PROPOSED UTILITIES WILL BE UNDERGROUND.
17. A CLOMR AND A LOMR WILL BE REQUIRED FOR THIS PROJECT
18. EXISTING CORONA AVE. PER CALTRANS CONTRACT 08–171204
19. CORONA AVE. PARKWAY LANDSCAPING TO BE MAINTAINED BY THE HOMEOWNERS ASSOC.



LOT NO.	LOT AREA (SQ.FT.)	LOT WIDTH (FT.)	LOT DEPTH (FT.)	USEABLE PAD AREA (SQ.FT.)	% OF LOT COVERAGE
1	8,105	76	104	3,119	38.9%
2	8,016	73	109	3,919	48.9%
3	8,002	78	102	4,181	52.3%
4	8,066	86	93	4,280	53.1%
5	10,293	124	82	4'026	39.1%
6	12,994	112	100	5,519	42.5%
LOT A	34,037	PRIVATE STREET MAINTAINED BY HOA			
LOT B	1,523	LANDSCAPE LOT MAINTAINED BY HOA			

DATE:	REVISION	DESCRIPTION
11/10/05	1	1st SCREENCHECK COMMENTS
8/15/05		INITAL SUBMITTAL

OWNER
MICHAEL & RUTH SERRATO
1555 LATCHFORD AVE.
HACIENDA HTS. CA 91745

OWNER
THOMAS R SERRATO & C.JOUA SERRATO
24217 E. PEAK CT.
DIAMOND BAR, CA 91765

OWNER
RAMON & EMMA QUEZADA
14541 CABINDA DR.
HACIENDA HTS. CA 91745

OWNER REPRESENTATIVE:
AJM CONSULTING INC.
ALEJANDRO MARTINEZ
18 MOUNTAIN VIEW, IRVINE CA 92612
TEL: 714 812-1987

PREPARED BY:
WILSON MIKAMI CORPORATION
3 PETERS CANYON
SUITE 110
IRVINE, CA 92606
T: 949-679-0090
F: 949-679-0091

TENTATIVE TRACT 34018
APN 122-180-027
CORONA , CA
DATE: 11/10/05
SHEET 1 OF 1
PROJECT No. 10020.00

DPR04-094

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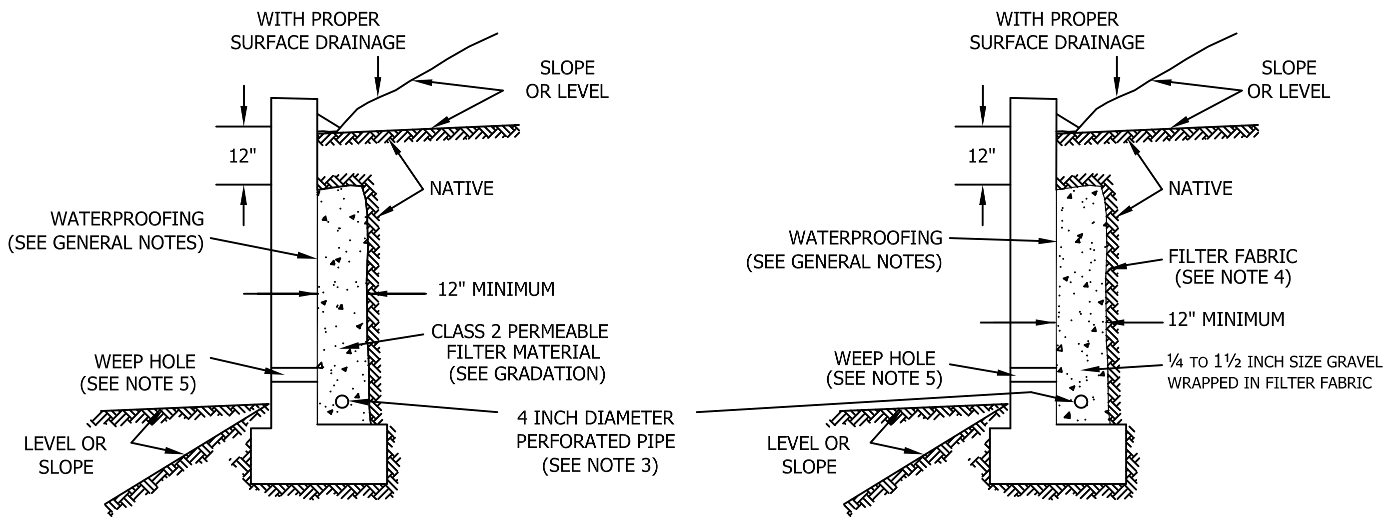
SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

OPTION 1: PIPE SURROUNDED WITH CLASS 2 PERMEABLE MATERIAL

OPTION 2: GRAVEL WRAPPED IN FILTER FABRIC



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

Plate 2

Appendix A

REFERENCES

USGS Geologic Map of San Bernardino and Santa Ana 30’ x 60’ Quadrangles, California.

Geologic Map of the Corona North Quadrangle, 7.5 Minute Series.

City of Corona Planning Department, General Plan.

RiversideCounty, Department of Public Works.

CDMG, Earthquake Fault Zones, Corona North Quadrangle, May 1, 2003.

State of California Department of Water Resources.

Western Municipal Water District, Cooperative Well Measuring Program, Spring 2011.

USGS, Groundwater Information System.

Department of the Navy, Design Manual 7.01, Soil Mechanics, September 1986.

Department of the Navy, Design Manual 7.02, Foundation and Earth Structures, September 1986.

California Geological Survey, Interactive Ground Motion Map, Peak Ground Acceleration (10 percent of being exceeded in 50 years).

Department of the Army, US Army Corps of Engineers, Engineering and Design, Bearing Capacity of Soils, EM 1110-1-1905.

Principals of Foundation Design, Braja Das.

Foundation Analysis and Design, Ed. 5 by Joseph E. Bowles.

Robert Day, Geotechnical Engineer’s Portable Handbook.

Robert Day, Geotechnical Foundation Handbook.

Appendix B

General Notes

DRILLING NOTES

WATER LEVEL MEASUREMENTS

Water levels indicated on the boring logs are levels measured in the borings at the times indicated. In permeable materials, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of groundwater levels is not possible with only short-term observations.

WATER LEVEL OBSERVATION DESIGNATION

W.D.	While Drilling
A.B.	After Boring
B.C.R.	Before Casing Removal
A.C.R.	After Casing Removal
24 hr.	Water level taken approximately 24 hrs. after boring completion

DRILLING AND SAMPLING SYMBOLS

AS	Auger Sample
CS	Continuous Sampler
DB	Diamond Bit -NX unless otherwise noted
HA	Hand Auger
HS	Hollow Stem Auger
PA	Power Auger
RB	Rock Bit
SS*	Split-Barrel
ST	Shelby Tube - 2" (51mm) unless otherwise noted
WB	Wash Bore
CR	Calfornia Ring Sampler 3" O.D., Lined with 2.5"X1" Rings

*The Standard Penetration Test is conducted in conjunction with the split-barrel sampling procedure. The "N" value corresponds to the number of blows required to drive the last 1 foot (0.3m) of an 18 in. (0.46m) long, 2 in. (51mm) O.D. split-barrel sampler with a 140 lb. (63.5 kg) hammer falling a distance of 30 in. (0.76m). The Standard Penetration Test is carried out according to ASTM D-1586. (See "N" Value below.)

SOIL PROPERTIES & DESCRIPTIONS

TEXTURE

PARTICLE	SIZE	
Clay	< 0.002 mm	(< 0.002 mm)
Silt	< #200 Sieve	(0.075 mm)
Sand	#4 to #200 Sieve	(4.75 to 0.075 mm)
Gravel	3 in. to #4 Sieve	(75 mm to 4.75 mm)
Cobbles	12 in. to 3 in.	(300 mm to 75 mm)
Boulders	> 12 in.	(300 mm)

COMPOSITION

SAND & GRAVEL

Description	% by Dry Weight
trace	< 15
with	15 - 29
modifer	> 30

FINES

Description	% by Dry Weight
trace	< 5
with	5 - 12
modifier	> 12

Soil descriptions are based on the Unified Soil Classification System (USCS) as outlined in ASTM Designations D-2487 and D-2488. The USCS group symbol shown on the boring logs correspond to the group names listed below. The description includes soil constituents, consistency, relative density, color and other appropriate descriptive terms. Geologic description of bedrock, when encountered, also is shown in the description column.

GROUP SYMBOL	GROUP NAME	GROUP SYMBOL	GROUP NAME
GW	Well Graded Gravel	CL	Lean Clay
GP	Poorly Graded Gravel	ML	Silt
GM	Silty Gravel	OL	Organic Clay or Silt
GC	Clayey Gravel	CH	Fat Clay
SW	Well Graded Sand	MH	Elastic Silt
SP	Poorly Graded Sand	OH	Organic Clay or Silt
SM	Silty Sand	PT	Peat
SC	Clayey Sand	CL-CH	Lean to Fat Clay

COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (Qu) (psf)	(kPa)
Very Soft	< 500	(< 24)
Soft	500 - 1000	(24 - 48)
Medium	1001 - 2000	(48 - 96)
Stiff	2001 - 4000	(96 - 192)
Very Stiff	4001 - 8000	(192 - 383)
Hard	> 8001	(> 383)

PLASTICITY

Description	Liquid Limit (%)
Lean	< 45%
Lean to Fat	45 to 49%
Fat	≥ 50%

Cohessive Soils

Consistenacy	"N" value
Very Soft	<2
Soft	2-4
Medium	4-8
Stiff (Firm)	8-15
Very Stiff (Very Firm)	15-30
Hard	>30

COHESIONLESS SOILS

RELATIVE DENSITY	"N" VALUE*
Very Loose	0 - 3
Loose	4 - 9
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	≥ 50

BEDROCK PROPERTIES & DESCRIPTIONS

ROCK QUALITY DESIGNATION (RQD)**

DESCRIPTION OF ROCK QUALITY	RQD (%)
Very Poor	0 - 25
Poor	25 - 50
Fair	50 - 75
Good	75 - 90
Excellent	90 - 100

**RQD is defined as the total length of sound core pieces, 4 inches (102mm) or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams and bedding planes.

DEGREE OF WEATHERING

Slightly Weathered	Slight decomposition of parent material in joints and seams.
Weathered	Well-developed and decomposed joints and seams.
Highly Weathered	Rock highly decomposed, may be extremely broken.

SOLUTION AND VOID CONDITIONS

Solid	Contains no voids.
Vuggy	Containing small pits or cavities < 1/2" (13mm).
Porous	Containing numerous voids which may be interconnected.
Cavernous	Containing cavities, sometimes quite large.

When classification of rock materials has been estimated from disturbed samples, core samples and petrographic analysis may reveal other rock types.

HARDNESS & DEGREE OF CEMENTATION

LIMESTONE

Hard	Difficult to scratch with knife.
Moderately Hard	Can scratch with knife but not with fingernail.
Soft	Can be scratched with fingernail.

SHALE

Hard	Can scratch with knife but not with fingernail.
Moderately Hard	Can be scratched with fingernail.
Soft	Can be molded easily with fingers.

SANDSTONE

Well Cemented	Capable of scratching a knife blade.
Cemented	Can be scratched with knife.
Poorly Cemented	Can be broken apart easily with fingers.

BEDDING CHARACTERISTICS

TERM	THICKNESS (inches)	THICKNESS (mm)
Very Thick Bedded	> 36	> 915
Thick Bedded	12 - 36	305 - 915
Medium Bedded	4 - 12	102 - 305
Thin Bedded	1 - 4	25 - 102
Very Thin Bedded	0.4 - 1	10 - 25
Laminated	0.1 - 0.4	2.5 - 10
Thinly Laminated	< 0.1	< 2.5

Bedding Planes	Planes dividing the individual layers, beds or strata of rocks.
Joint	Fracture in rock, generally more or less vertical or transverse to the bedding.
Seam	Applies to bedding plane with an unspecified degree of weathering.

BORHOLE LOG BH-1

		Sheet	1 OF 1
		Date	11/15/2014
Project No.	14159-01	Drilling Co.	GeoMat
Project	Fathi - Corona	Sampler	Cal Mod. And SPT
Client	Crescent Engineering and Construction Services	Method	Hollow Stem
Location	APN 122-180-027, Corona	Hammer Type	140 lb
Coodinate		Surface Elev.	
Notes		Total Depth	15'

Type/Symbol	Casing	Split Spoon	Ring Sampler	Cutting
I.D.		S	R	C
O.D.				
Length				
Hammer Wt.				
Hammer Fall				

Date	Time	Water Depth (ft)	Casing Size (in)	Casing Depth (ft)	Hole Depth (ft)	Symbol
11/15/2014		no seepage				

Depth Below Surface (ft)	Elevation (ft)	Graphic	Soil Sample Type	Number	Symbol	Depth	Blows 0-152.4 mm	152.4-304.8 mm	304.8-457.2 mm	N-Value	N60	(N1)60	VISUAL MATERIAL CLASSIFICATION AND REMARKS	Moisture (%)	Dry Density (pcf)	Test
0			C										**SILTY SAND (SM)**			
1													tan-orange silty sand with gravel, dry			
2																
3			R				21	30	40	46			dense	13	120	
4																
5																
6																
7			S				7	9	11	18			medium dense	10		
8													% Passing No. 200 Sieve = 37			
9																
10			S				9	11	11	22			**SILTY CLAY WITH SAND (CL-ML)**	11		
11													Brown, trace of fine sand, medium dense			
12													% Passing No. 200 Sieve = 48			
13																
14																
15			S				10	13	22	35			**SILTY SAND (SM)**			
16													medium brown, silty fine sand			
17													dense			
18																
19																
20																
21																
22																
23																
24																
25																

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

BORHOLE LOG BH-2

Sheet	1 OF 1		
Date	11/15/2014		
Project No.	14159-01	Drilling Co.	GeoMat
Project	Fathi - Corona	Sampler	Cal Mod. And SPT
Client	Crescent Engineering and Construction Services	Method	Hollow Stem
Location	APN 122-180-027, Corona	Hammer Type	140 lb
Coodinate		Surface Elev.	
Notes		Total Depth	15'

Type/Symbol	Casing	Split Spoon	Ring Sampler	Cutting
I.D.		S	R	C
O.D.				
Length				
Hammer Wt.				
Hammer Fall				

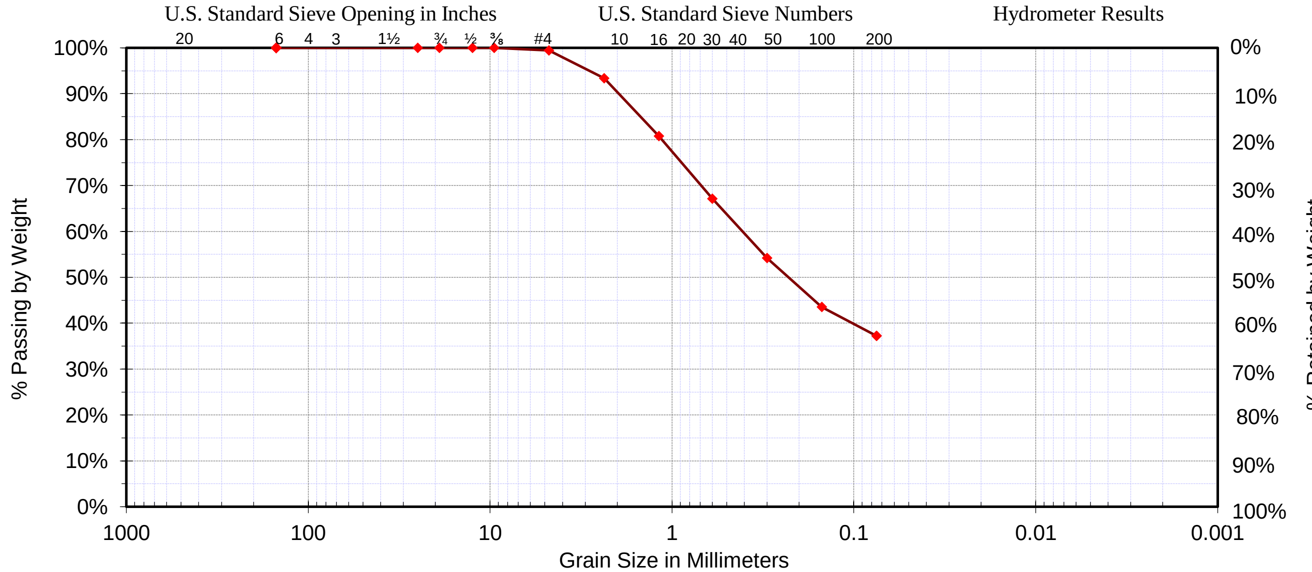
Date	Time	Water Depth (ft)	Casing Size (in)	Casing Depth (ft)	Hole Depth (ft)	Symbol
11/15/2014		no seepage				

Depth Below Surface (ft)	Elevation (ft)	Graphic	Soil Sample Type	Number	Symbol	Depth	Blows 0-152.4 mm	152.4-304.8 mm	304.8-457.2 mm	N-Value	N60	(N1)60	VISUAL MATERIAL CLASSIFICATION AND REMARKS	Moisture (%)	Dry Density (pcf)	Test
0													**SILTY SAND (SM)**			
1													orange-brown silty sand with gravel, dry			
2																
3																
4																
5			R				22	35	41	49			dense	8	128	
6																
7																
8																
9																
10			S				7	11	19	30			**SILTY CLAY WITH SAND (CL-ML)**	14		
11													Gray brown, hard			
12																
13																
14													% Passing No. 200 Sieve = 75, LL=26 PL=20 PI=6			
15			S				8	10	13	23			very firm			
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																

The stratification lines represent the approximate boundary lines between soil and rock types. In-situ, the transition may be gradual.

Appendix C

LABORATORY TEST RESULTS



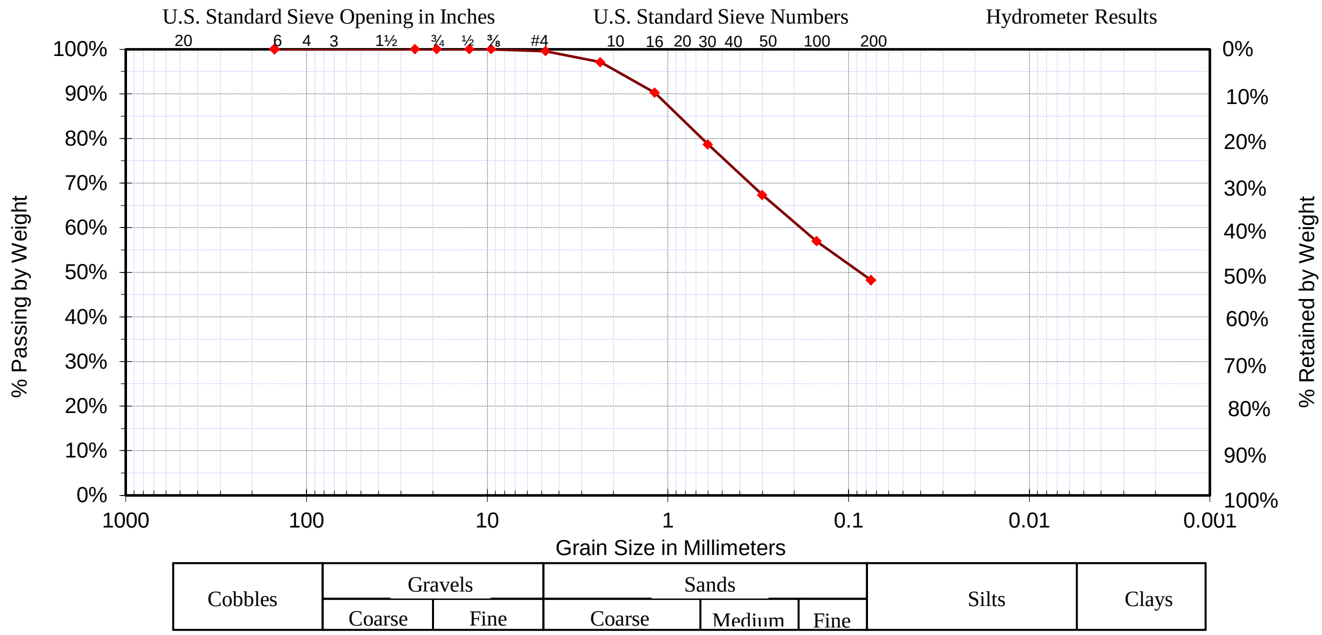
Cobbles	Gravels		Sands			Silts	Clays
	Coarse	Fine	Coarse	Medium	Fine		

Date : 11/17/14	D_{10} = 0.02	**Classification**	% Gravel
Sample #:	D_{30} = 0.06	SM, Silty Sand	0.57%
Sample ID: B1 @ 7'	D_{60} = 0.43		% Sand
Source: Standard Split Spoon	C_C = 0.42	**Specifications**	62.20%
Project: Fathi - Corona	C_U = 21.58	custom specs 1	% Silt & Clay
Location: Investigation	Liquid Limit= n/a		37.24%
Boring #: B1	Plastic Limit= n/a	Fineness Modulus	Sample Moisture
Depth: 7'	Plasticity Index= n/a	1.62	**9.6%**

Coarse Section Sieve Size US	Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50		100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		99.6%		
#4	4.75	99.4%	99.4%		

Fines Section Sieve Size US	Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
#4	4.750	99.4%	99.4%		
#8	2.360	93.4%	93.4%		
#10	2.000		89.5%		
#16	1.180	80.8%	80.8%		
#20	0.850		73.0%		
#30	0.600	67.1%	67.1%		
#40	0.425		59.6%		
#50	0.300	54.2%	54.2%		
#60	0.250		50.6%		
#80	0.180		45.7%		
#100	0.150	43.5%	43.5%		
#140	0.106		39.8%		
#170	0.090		38.5%		
#200	0.075	37.2%	37.2%		
#270	0.053				

LABORATORY TEST RESULTS



Date : 11/17/14	D_{10} = 0.02	**Classification**	% Gravel
Sample #:	D_{30} = 0.05	SM, Silty Sand	0.44%
Sample ID: B1 @ 10'	D_{60} = 0.19		% Sand
Source: Standard Split Spoon	C_C = 0.72	**Specifications**	51.32%
Project: Fathi - Corona	C_U = 12.49	custom specs 1	% Silt & Clay
Location: Investigation	Liquid Limit= n/a		48.24%
Boring #: B1	Plastic Limit= n/a	Fineness Modulus	Sample Moisture
Depth: 10'	Plasticity Index= n/a	1.10	**11.3%**

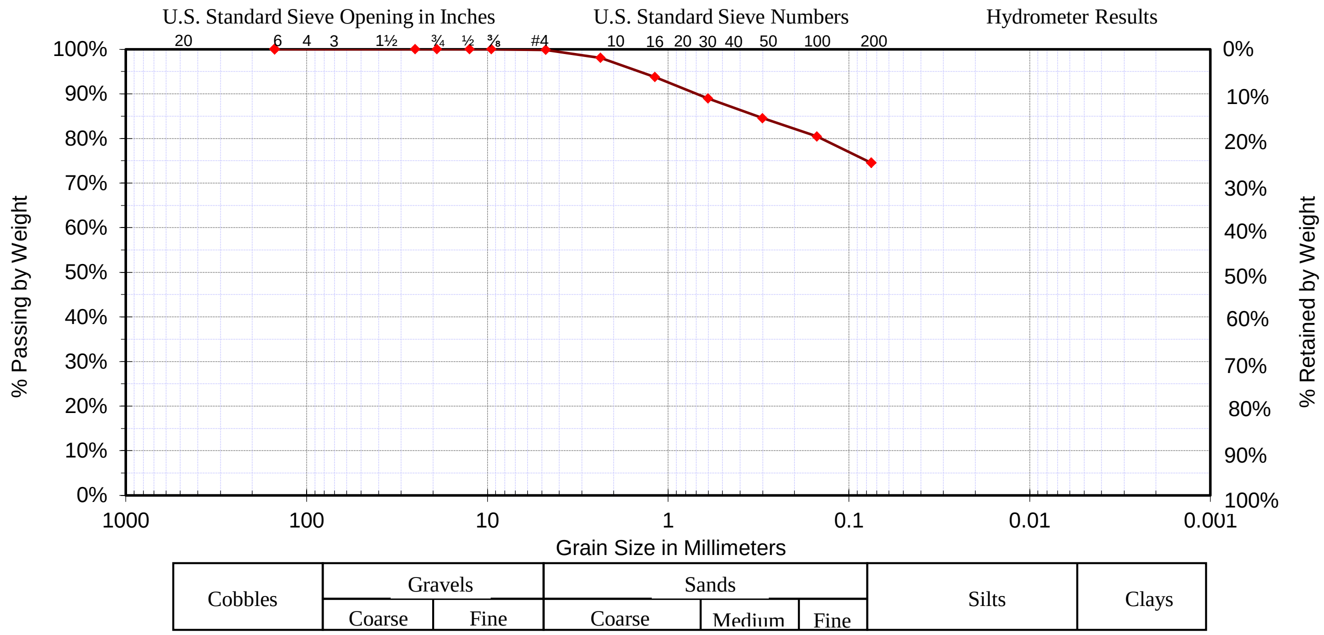
Coarse Section

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50		100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		99.7%		
#4	4.75	99.6%	99.6%		

Fines Section

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
#4	4.750	99.6%	99.6%		
#8	2.360	97.1%	97.1%		
#10	2.000		95.0%		
#16	1.180	90.2%	90.2%		
#20	0.850		83.6%		
#30	0.600	78.6%	78.6%		
#40	0.425		72.0%		
#50	0.300	67.3%	67.3%		
#60	0.250		63.9%		
#80	0.180		59.0%		
#100	0.150	56.9%	56.9%		
#140	0.106		51.8%		
#170	0.090		50.0%		
#200	0.075	48.2%	48.2%		
#270	0.053				

LABORATORY TEST RESULTS

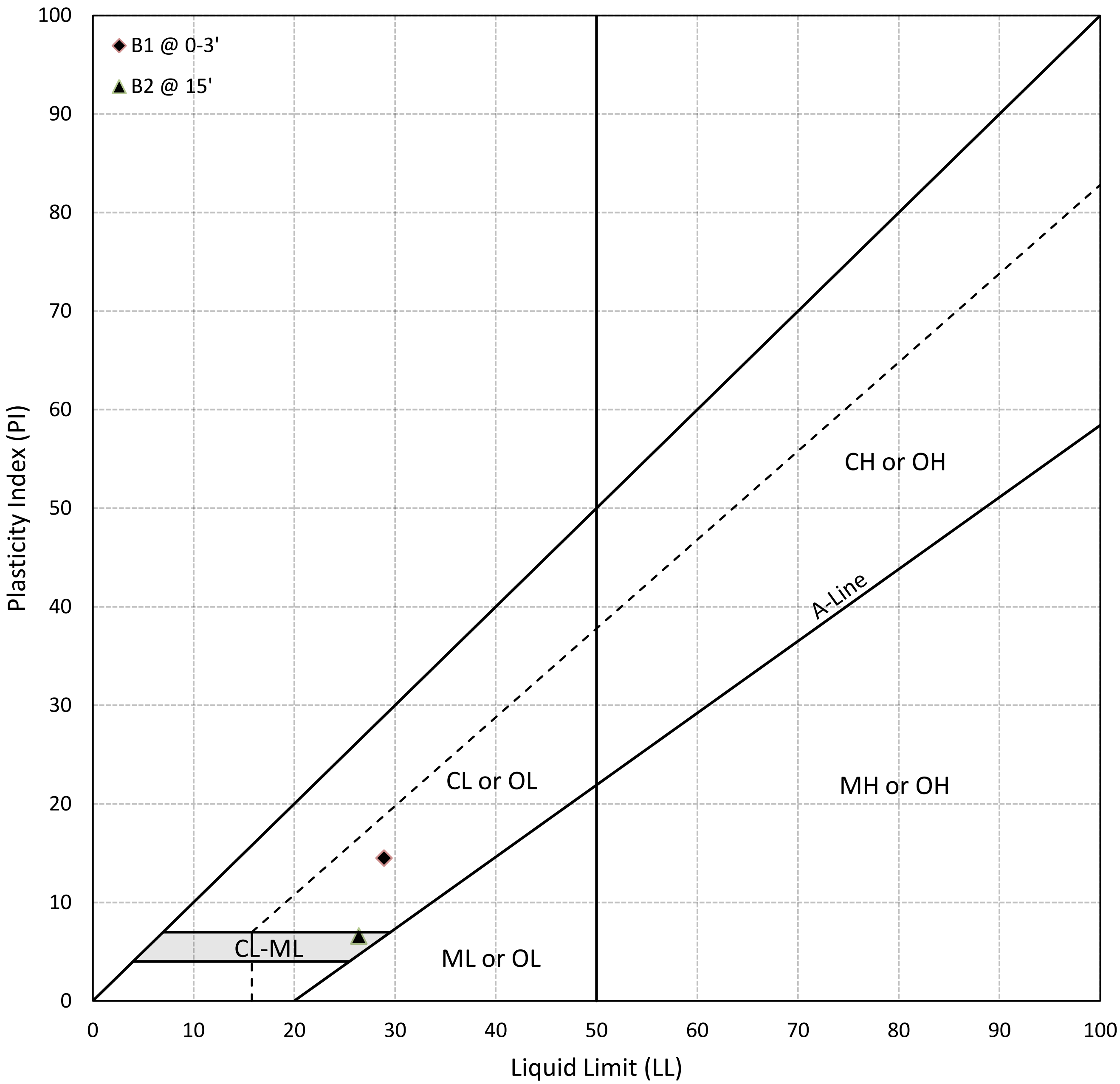


Date :	11/17/14	D_{10} = 0.01	**Classification**		% Gravel
Sample #:		D_{30} = 0.03	CL-ML, Silty Clay with Sand		0.15%
Sample ID:	B2 @ 10'	D_{60} = 0.06			% Sand
Source:	Standard Split Spoon	C_C = 1.50	**Specifications**		25.32%
Project:	Fathi - Corona	C_U = 6.00	custom specs 1		% Silt & Clay
Location:	Investigation	Liquid Limit= 0.26			74.53%
Boring #:	B2	Plastic Limit= 0.20	Fineness Modulus	Sample Moisture	
Depth:	10'	Plasticity Index= 0.07	0.54	**14.2%**	

Coarse Section Sieve Size US	Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
6.00"	150.00		100.0%		
4.00"	100.00		100.0%		
3.00"	75.00		100.0%		
2.50"	63.00		100.0%		
2.00"	50.00		100.0%		
1.75"	45.00		100.0%		
1.50"	37.50		100.0%		
1.25"	31.50		100.0%		
1.00"	25.00	100.0%	100.0%		
7/8"	22.40		100.0%		
3/4"	19.00	100.0%	100.0%		
5/8"	16.00		100.0%		
1/2"	12.50	100.0%	100.0%		
3/8"	9.50	100.0%	100.0%		
1/4"	6.30		99.9%		
#4	4.75	99.8%	99.8%		

Fines Section Sieve Size US	Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
#4	4.750	99.8%	99.8%		
#8	2.360	98.0%	98.0%		
#10	2.000		96.7%		
#16	1.180	93.8%	93.8%		
#20	0.850		91.0%		
#30	0.600	89.0%	89.0%		
#40	0.425		86.4%		
#50	0.300	84.5%	84.5%		
#60	0.250		83.2%		
#80	0.180		81.3%		
#100	0.150	80.5%	80.5%		
#140	0.106		77.0%		
#170	0.090		75.7%		
#200	0.075	74.5%	74.5%		
#270	0.053				

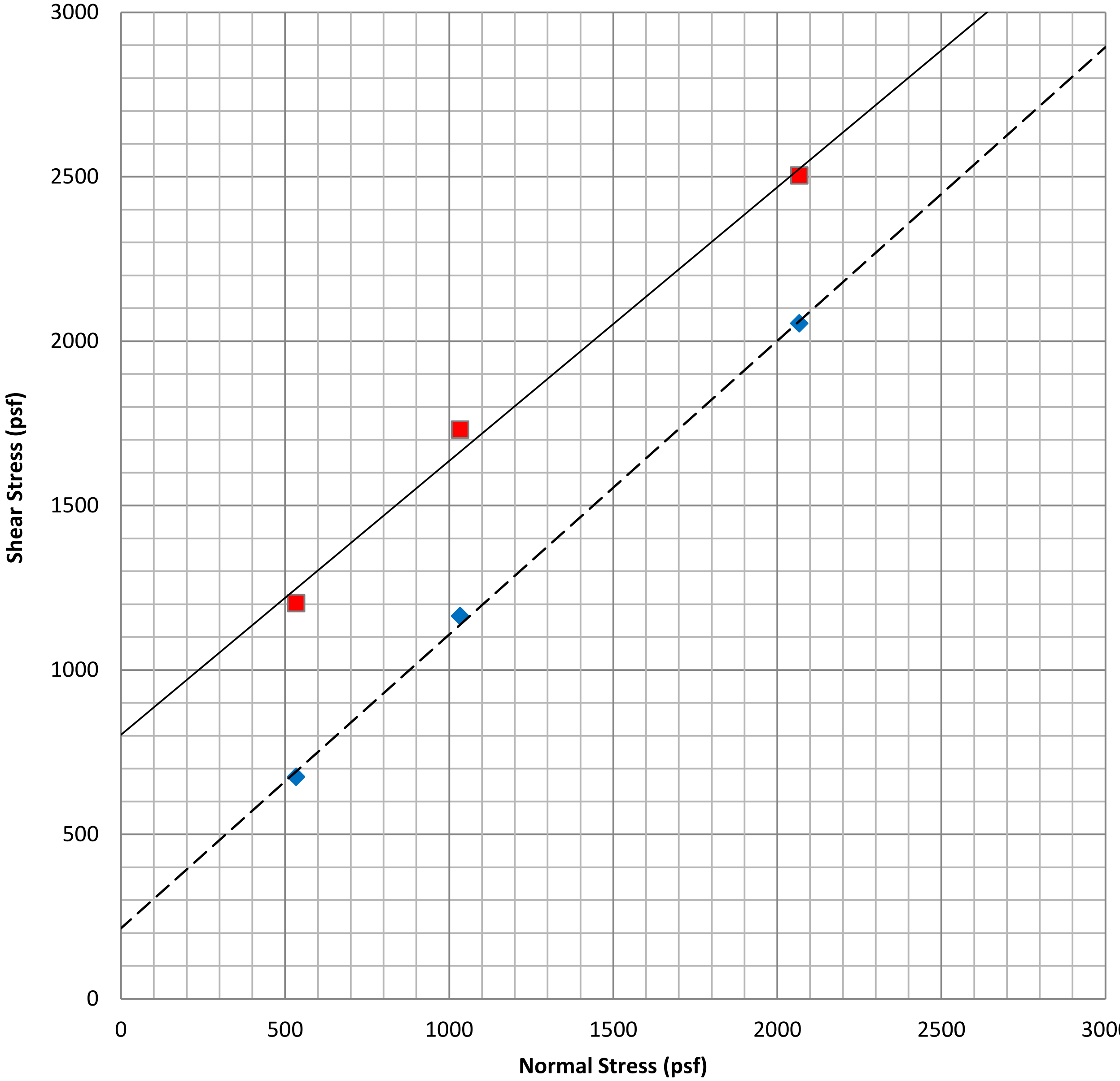
PLASTICITY CHART



ATTERBERG LIMITS TEST RESULTS

LEGEND	CLASSIFICATION	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)
B1 @ 0-3'	Orang-Brown Clayey Sand	28.9	14.4	14.5
B2 @ 15'	Gray-Brown Silty Clay with Sand	26.4	19.8	6.6

DIRECT SHEAR TEST RESULTS



Sample	Symbol	Description	Soil Type [USCS]	Shear Strength	Friction Angle, ϕ [degrees]	Cohesion, c [psf]
B1 @ 5'	—■—	Granitics	SM	Peak	40.0	800
B1 @ 5'	– –◆– –	Granitics	SM	Ultimate	35.0	200

Sample Moisture [%]	Saturated Moisture [%]	Dry Unit Weight [pcf]
12.6	17.7	120.1

SOLUBLE SULFATEAND CHLORIDE TEST RESULTS

Project Name	APN 122-180-027	**Test Date**	11/24/2014
Project No.	14159-01	**Date Sampled**	11/15/2014
Project Location	Corona Avenue, Corona, Ca.	**Sampled By**	TK
Location in Structure	B1@ 0-3'	**Sample Type**	Bulk
Sampled Classification	SM	**Tested By**	AM

TESTING INFORMATION

Sample weight before drying	Not Recorded
Sample weight after drying	Not Recorded
Sample Weight Passing No. 10 Sieve	100 grams
Moisture	N/A

Mixing Ratio	Dilution Factor	Sulfate Reading (ppm)	Sulfate Content (ppm)	Sulfate Content (%)
3	1	70	210	0.021
		Average		

Chloride Reading (ppm)	Chloride Content (ppm)	Chloride Content (%)
Average		

pH	
Average	

ACI 318-05 Table 4.3.1 Requirements for Concrete Exposed to Sulfate-Containing Solutions

Sulfate Exposure	Water-Soluble Sulfate (SO_4) In Soil, % by Mass	Sulfate (SO_4) In Water ppm	Cement Type	Maximum w/cm by Mass	Minimum Design Compressive Strength fc, MPa (psi)
Negligible	< 0.10	< 150	No Special Type	--	--
Moderate (see water)	0.10 to 0.20	150 to 1500	II IP(MS), IS(MS), P(MS), I(PM)(MS), I(SM)(MS)	0.50	28 (4000)
Severe	0.20 to 2.00	1500 to 10,000	V	0.45	31 (4500)
Very Severe	> 2.00	>10,000	V + pozz	0.45	31 (4500)

Caltrans classifies a site as corrosive to structural concrete as an area where soil and/or water contains >500pp chloride, >2000ppm sulfate, or has a pH <5.5. A minimum resistivity of less than 1000 ohm-cm indicates the potential for corrosive environment requiring testing for the above criteria.

The 2007 CBC Section 1904A references ACI 318 for material selection and mix design for reinforced concrete dependant on the onsite corrosion potential, soluble chloride content, and soluble sulfate content in soil

Comments: Sec 4.3 of ACI 318 (2005) Soil environment is detrimental to concrete if it has soluble sulfate >1000ppm and/or pH<5.5. Soil environment is corrosive to reinforcement and steel pipes if Chloride ion >500ppm or pH <4.0.

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

Signature ____________ Date ____________

Print Name ____________ Title ____________

LABORATORY TEST RESULTS

Sample	Compacted Moisture	Compacted Dry Density	Final Moisture	Volumetric Swell	Expansion Index	Expansion Classification
Bulk	9.3%	113.5	17.3%	1.3	13	Very Low
EXPANSION INDEX TEST RESULTS						

Appendix D

Design Maps Detailed Report

ASCE 7-10 Standard (33.89183°N, 117.55657°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 1.730 g
From Figure 22-2 [2]	S_1 = 0.688 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_S$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index *PI* > 20, • Moisture content *w* ≥ 40%, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.730 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.688 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_aS_S = 1.000 \times 1.730 = 1.730$ g

Equation (11.4–2): $S_{M1} = F_vS_1 = 1.500 \times 0.688 = 1.032$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

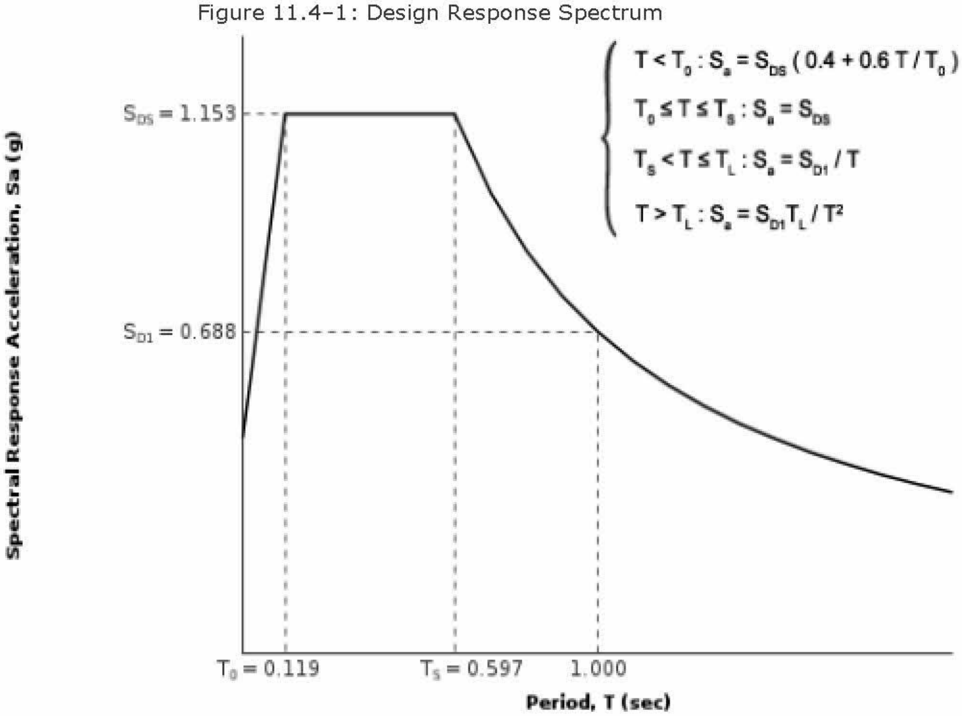
Equation (11.4–3): $S_{DS} = ⅔ S_{MS} = ⅔ \times 1.730 = 1.153$ g

Equation (11.4–4): $S_{D1} = ⅔ S_{M1} = ⅔ \times 1.032 = 0.688$ g

Section 11.4.5 — Design Response Spectrum

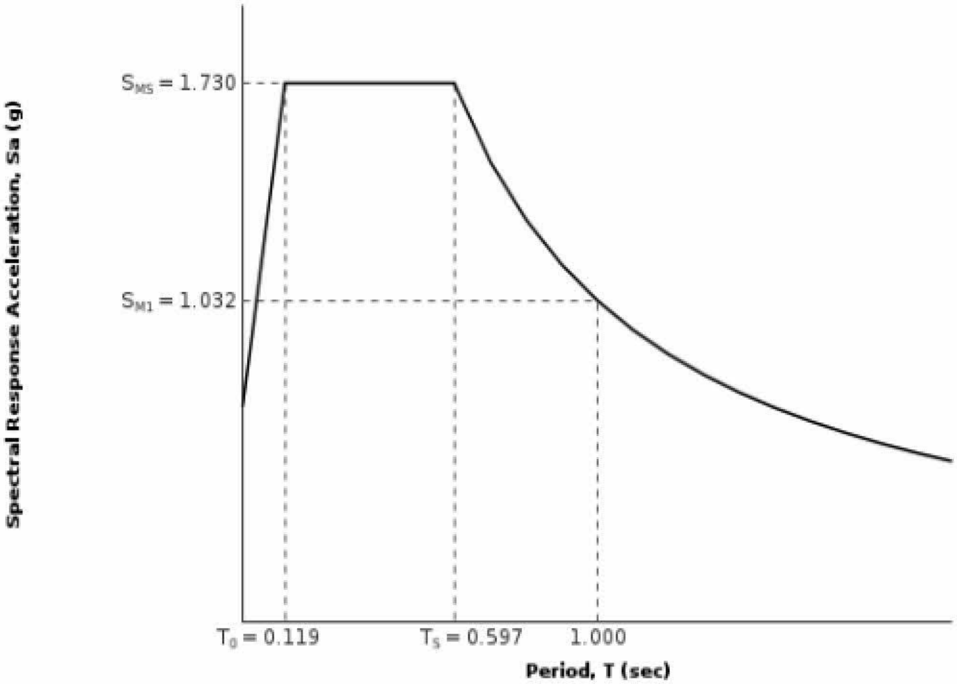
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.652

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.652 = 0.652$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.652 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 1.007

From Figure 22-18 [6] C_{R1} = 1.008

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.153 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.688 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

Appendix E

TABLE OF CONTENT

GENERAL

The guidelines contained herein and the standard details attached hereto represent this firm's standard recommendation for grading and other associated operations on construction projects. These guidelines should be considered a portion of the project specifications.
All plates attached hereto shall be considered as part of these guidelines.
The Contractor should not vary from these guidelines without prior recommendation by the Geotechnical Consultant and the approval of the Client or his authorized representative. Recommendation by the Geotechnical Consultant and/or Client should not be considered to preclude requirements for the approval by the controlling agency prior to the execution of any changes.
These Standard Grading Guidelines and Standard Details may be modified and/or superseded by recommendations contained in the text of the preliminary Geotechnical Report and/or subsequent reports.
If disputes arise out of the interpretation of these grading guidelines or standard details, the Geotechnical Consultant shall provide the governing interpretation.

DEFINITION OF TERMS

ALLUVIUM
Unconsolidated soil deposits resulting from flow of water, including sediments deposited in river beds, canyons, flood plains, lakes, fans and estuaries.
AS-GRADED (AS-BUILT): The surface and subsurface conditions at completion of grading.
BACKCUT: A temporary construction slope at the rear of earth retaining structures such as buttresses, shear keys, stabilization fills or retaining walls.
BACKDRAIN: Generally a pipe and gravel or similar drainage system placed behind earth retaining structures such buttresses, stabilization fills, and retaining walls.
BEDROCK: Relatively undisturbed formational rock, more or less solid, either at the surface or beneath superficial deposits of soil.
BENCH: A relatively level step and near vertical rise excavated into sloping ground on which fill is to be placed.
BORROW (Import): Any fill material hauled to the project site from off-site areas.
BUTTRESS FILL::A fill mass, the configuration of which is designed by engineering calculations to retain slope conditions containing adverse geologic features. A buttress is generally specified by minimum key width and depth and by maximum backcut angle. A buttress normally contains a back-drainage system.
CIVIL ENGINEER: The Registered Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topographic conditions.
CLIENT: The Developer or his authorized representative who is chiefly in charge of the project. He shall have the responsibility of reviewing the findings and recommendations made by the Geotechnical Consultant and shall authorize the Contractor and/or other consultants to perform work and/or provide services.
COLLUVIUM: Generally loose deposits usually found near the base of slopes and brought there chiefly by gravity through slow continuous downhill creep (also see Slope Wash).
COMPACTION : Densification of man-placed fill by mechanical means.
CONTRACTOR – A person or company under contract or otherwise retained by the Client to perform demolition, grading and other site improvements.
DEBRIS: All products of clearing, grubbing, demolition, and contaminated soil materials unsuitable for reuse as compacted fill, and/or any other material so designated by the Geotechnical Consultant.
ENGINEERING GEOLOGIST: A Geologist holding a valid certificate of registration in the specialty of Engineering Geology.
ENGINEERED FILL: A fill of which the Geotechnical Consultant or his representative, during grading, has made sufficient tests to enable him to conclude that the fill has been placed in substantial compliance with the recommendations of the Geotechnical Consultant and the governing agency requirements.
EROSION: The wearing away of ground surface as a result of the movement of wind, water, and/or ice.
EXCAVATION: The mechanical removal of earth materials.
EXISTING GRADE: The ground surface configuration prior to grading.
FILL: Any deposits of soil, rock, soil-rock blends or other similar materials placed by man.
FINISH GRADE: The ground surface configuration at which time the surface elevations conform to the approved plan.

GEOFABRIC: Any engineering textile utilized in geotechnical applications including subgrade stabilization and filtering.
GEOLOGIST: A representative of the Geotechnical Consultant educated and trained in the field of geology.
GEOTECHNICAL CONSULTANT: The Geotechnical Engineering and Engineering Geology consulting firm retained to provide technical services for the project. For the purpose of these specifications, observations by the Geotechnical Consultant include observations by the Soil Engineer, Geotechnical Engineer, Engineering Geologist and those performed by persons employed by and responsible to the Geotechnical Consultants.
GEOTECHNICAL ENGINEER: A licensed Geotechnical Engineer or Civil Engineer who applies scientific methods, engineering principles and professional experience to the acquisition, interpretation and use of knowledge of materials of the earth's crust for the evaluation of engineering problems. Geotechnical Engineering encompasses many of the engineering aspects of soil mechanics, rock mechanics, geology, geophysics, hydrology and related sciences.
GRADING: Any operation consisting of excavation, filling or combinations thereof and associated operations.
LANDSIDE DEBRIS: Material, generally porous and of low density, produced from instability of natural or man-made slopes.
MAXIMUM DENSITY: Standard laboratory test for maximum dry unit weight. Unless otherwise specified, the maximum dry unity weight shall be determined in accordance with ASTM Method of Test D 1557-91.
OPTIMUM MOISTURE – Soil moisture content at the test maximum density.
RELATIVE COMPACTION: The degree of compaction (expressed as a percentage) of dry unit weight of a material as compared to the maximum dry unit weight of the material.
ROUGH GRADE: The ground surface configuration at which time the surface elevations approximately conform to the approved plan.
SITE: The particular parcel of land where grading is being performed.
SHEAR KEY: Similar to buttress, however, it is generally constructed by excavating a slot within a natural slope, in order to stabilize the upper portion of the slope without grading encroaching into the lower portion of the slope.
SLOPE: An inclined ground surface, the steepness of which is generally specified as a ration of horizontal:vertical (e.g., 2:1)
SLOPE WASH: Soil and/or rock material that has been transported down a slope by action of gravity assisted by runoff water not confined by channels (also see Colluvium).
SOIL: Naturally occurring deposits of sand, silt, clay, etc., or combinations thereof.
SOIL ENGINEER: Licensed Geotechnical Engineer or Civil Engineer experienced in soil mechanics (also see Geotechnical Engineer).
STABILIZATION FILL: A fill mass, the configuration of which is typically related to slope height and specified by the standards of practice for enhancing the stability of locally adverse conditions. A stabilization fill is normally specified by minimum key width and depth and by maximum backcut angle. A stabilization fill may or may not have a backdrainage system specified.
SUBDRAIN: Generally a pipe and gravel or similar drainage system placed beneath a fill in the alignment of canyons or formed drainage channels.
SLOUGH: Loose, non-compacted fill material generated during grading operations.
TAILINGS: Non-engineered fill which accumulates on or adjacent to equipment haul-roads.
TERRACE: Relatively level step constructed in the face of a graded slope surface for drainage control and maintenance purposes.
TOPSOIL: The presumable fertile upper zone of soil, which is usually darker in color and loose.
WINDROW: A string of large rocks buried within engineered fill in accordance with guidelines set forth by the Geotechnical Consultant.

OBLIGATIONS OF PARTIES

The Geotechnical Consultant should provide observation and testing services and should make evaluations in order to advise the Client on Geotechnical matters. The Geotechnical Consultant should report his findings and recommendations to the Client or his authorized representative.
The client should be chiefly responsible for all aspects of the project. He or his authorized representative has the responsibility of reviewing the findings and recommendations of the Geotechnical Consultant. He shall authorize or cause to have authorized the Contractor and/or other consultants to perform work and/or provide services.

During grading the Client or his authorized representative should remain on-site or should remain reasonably accessible to all concerned parties in order to make decisions necessary to maintain the flow of the project.
The Contractor should be responsible for the safety of the project and satisfactory completion of all grading and other associated operations on construction projects, including but not limited to, earthwork in accordance with the project plans, specifications and controlling agency requirements. During grading, the Contractor or his authorized representative should remain on-site. Overnight and on days off, the Contractor should remain accessible.

SITE PREPARATION

The Client, prior to any site preparation or grading, should arrange and attend a meeting among the Grading Contractor, the Design Engineer, the Geotechnical Consultant, representatives of the appropriate governing authorities as well as any other concerned parties. All parties should be given at least 48 hours notice.
Clearing and grubbing should consist of the removal of vegetation such as brush, grass, woods, stumps, trees, roots of trees and otherwise deleterious natural materials from the areas to be graded. Clearing and grubbing should extend to the outside of all proposed excavation and fill areas.
Demolition should include removal of buildings, structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, mining shafts, tunnels, etc.) and man-made surface and subsurface improvements from the areas to be graded. Demolition of utilities should include proper capping and/or re-routing pipelines at the project perimeter and cutoff and capping of wells in accordance with the requirements of the governing authorities and the recommendations of the Geotechnical Consultant at the time of the demolition.
Trees, plants or man-made improvements not planned to be removed or demolished should be protected by the Contractor from damage or injury.
Debris generated during clearing, grubbing and/or demolition operations should be wasted from areas to be graded and disposed off-site. Clearing, grubbing and demolition operations should be performed under the observation of the Geotechnical Consultant.
The Client or Contractor should obtain the required approvals for the controlling authorities for the project prior, during and/or after demolition, site preparation and removals, etc. The appropriate approvals should be obtained prior to proceeding with grading operations.

SITE PROTECTION

Protection of the site during the period of grading should be the responsibility of the Contractor. Unless other provisions are made in writing and agreed upon among the concerned parties, completion of a portion of the project should not be considered to preclude that portion or adjacent areas from the requirements for site protection until such time as the entire project is complete as identified by the Geotechnical Consultant, the Client and the regulating agencies.
The Contractor should be responsible for the stability of all temporary excavations. Recommendations by the Geotechnical Consultant pertaining to temporary excavations (e.g., backcuts) are made in consideration of stability of the completed project and therefore, should not be considered to preclude the responsibilities of the Contractor. Recommendations by the Geotechnical Consultant should not be considered to preclude more restrictive requirements by the regulating agencies.
Precautions should be taken during the performance of site clearing, excavations and grading to protect the work site from flooding, ponding, or inundation by poor or improper surface drainage. Temporary provisions should be made during the rainy season to adequately direct surface drainage away from and off the work site. Where low areas can not be avoided, pumps should be kept on hand to continually remove water during periods of rainfall.
During periods of rainfall, plastic sheeting should be kept reasonably accessible to prevent unprotected slopes from becoming saturated. Where necessary during periods of rainfall, the Contractor should install check-dams de-silting basins, rip-rap, sandbags or other devices or methods necessary to control erosion and provide safe conditions.
During periods of rainfall, the Geotechnical Consultant should be kept informed by the Contractor as to the nature of remedial or preventative work being performed (e.g., pumping, placement of sandbags or plastic sheeting, other labor, dozing, etc.).

Following periods of rainfall, the Contractor should contact the Geotechnical Consultant and arrange a walk-over of the site in order to visually assess rain related damage. The Geotechnical Consultant may also recommend excavations and testing in order to aid in his assessments. At the request of the Geotechnical Consultant, the Contractor shall make excavations in order to evaluate the extent of rain related damage.
Rain-related damage should be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress and other adverse conditions identified by the Geotechnical Consultant. Soil adversely affected should be classified as Unsuitable Materials and should be subject to overexcavation and replaced with compacted fill or other remedial grading as recommended by the Geotechnical Consultant.
Relatively level areas, where saturated soils and/or erosion gullies exist to depths greater then 1 foot, should be overexcavated to unaffected, competent material. Where less than 1 foot in depth, unsuitable materials may be processed in-place to achieve near optimum moisture conditions, then thoroughly recompacted in accordance with the applicable specifications. If the desired results are not achieved, the affected materials should be overexcavated then replaced in accordance with the applicable specifications.
In slope areas, where saturated soil and/or erosion gullies exist to depths of greater than 1 foot, should be over-excavated to unaffected, competent material. Where affected materials exist to depths of 1 foot or less below proposed finished grade, remedial grading by moisture conditioning in-place, followed by thorough recompaction in accordance with the applicable grading guidelines herein may be attempted. If the desired results are not achieved, all affected materials should be overexcavated and replaced as compacted fill in accordance with the slope repair recommendations herein. As field conditions dictate, other slope repair procedures may be recommended by the Geotechnical Consultant.

EXCAVATIONS

UNSUITABLE MATERIALS:

Materials which are unsuitable should be excavated under observation and recommendations of the Geotechnical Consultant. Unsuitable materials include, but may not be limited to dry, loose, soft, wet, organic compressible natural soils and fractured, weathered, soft, bedrock and nonengineered or otherwise deleterious fill materials.
Materials identified by the Geotechnical Consultant as unsatisfactory due to its moisture conditions should be overexcavated, watered or dried, as needed, and thoroughly blended to uniform near optimum moisture condition (per Moisture guidelines presented herein) prior to placement as compacted fill.

CUT SLOPES:

Unless otherwise recommended by the Geotechnical Consultant and approved by the regulating agencies, permanent cut slopes should not be steeper than 2:1 (horizontal:vertical).
If excavations for cut slopes expose loose, cohesionless, significantly fractured or otherwise suitable material, overexcavation and replacement of the unsuitable materials with a compacted stabilization fill should be accomplished as recommended by the Geotechnical Consultant. Unless otherwise specified by the Geotechnical Consultant, stabilization fill construction should conform to the requirements of the Standard Details.
The Geotechnical Consultant should review cut slopes during excavation. The Geotechnical Consultant should be notified by the contractor prior to beginning slope excavations.
If during the course of grading, adverse or potentially adverse geotechnical conditions are encountered which were not anticipated in the preliminary report, the Geotechnical Consultant should explore, analyze and make recommendations to treat these problems.
When cuts slopes are made in the direction of the prevailing drainage, a non-erodible diversion swale (brow ditch) should be provided at the top-of-cut.

PAD AREAS:

All lot pad areas, including side yard terraces, above stabilization fills or buttresses should be over-excavated to provide for a minimum of 3-feet (refer to Standard Details) of compacted fill over the entire pad area. Pad areas with both fill and cut materials exposed and pad areas containing both very shallow (less than 3-feet) and deeper fill should be over- thickness (refer to Standard Details).
Cut areas exposing significantly varying material types should also be overexcavated to provide for at least a 3-foot thick compacted fill blanket. Geotechnical conditions may require greater depth of overexcavation. The actual depth should be delineated by the Geotechnical Consultant during grading.

For pad areas created above cut or natural slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm and/or an appropriate pad gradient. A gradient in soil areas away from the top-of-slope of 2 percent or greater is recommended.

COMPACTED FILL

All fill materials should be compacted as specified below or by other methods specifically recommended by the Geotechnical Consultant. Unless otherwise specified, the minimum degree of compaction (relative compaction) should be 90 percent of the laboratory maximum density.

PLACEMENT

Prior to placement of compacted fill, the Contractor should request a review by the Geotechnical Consultant of the exposed ground surface. Unless otherwise recommended, the exposed ground surface should then be scarified (6-inches minimum), watered or dried as needed, thoroughly blended to achieve near optimum moisture conditions, then thoroughly compacted to a minimum of 90 percent of the maximum density. The review by the Geotechnical Consultants should not be considered to preclude requirements of inspection and approval by the governing agency.

Compacted fill should be placed in thin horizontal lifts not exceeding 8-inches in loose thickness prior to compaction. Each lift should be watered or dried as needed, thoroughly blended to achieve near optimum moisture conditions then thoroughly compacted by mechanical methods to a minimum of 90 percent of laboratory maximum dry density. Each lift should be treated in a like manner until the desired finished grades are achieved.

The Contractor should have suitable and sufficient mechanical compaction equipment and watering apparatus on the job site to handle the amount of fill being placed in consideration of moisture retention properties of the materials. If necessary, excavation equipment should be “shut down” temporarily in order to permit proper compaction of fills. Earth moving equipment should only be considered a supplement and not substituted for conventional compaction equipment.

When placing fill in horizontal lifts adjacent to areas sloping steeper than 5:1 (horizontal:vertical), horizontal keys and vertical benches should be excavated into the adjacent slope area. Keying and benching should be sufficient to provide at least 6-foot wide benches and minimum of 4-feet of vertical bench height within the firm natural ground, firm bedrock or engineered compacted fill. No compacted fill should be placed in an area subsequent to keying and benching until the area has been reviewed by the Geotechnical Consultant. Material generated by the benching operation should be moved sufficiently away from the bench area to allow for the recommended review of the horizontal bench prior to placement of fill. Typical keying and benching details have been included within the accompanying Standard Details.

Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a false slope, benching should be conducted in the same manner as above described. At least a 3-foot vertical bench should be established within the firm core of adjacent approved compacted fill prior to placement of additional fill. Benching should proceed in at least 3-foot vertical increments until the desired finished grades are achieved.

Fill should be tested for compliance with the recommended relative compaction and moisture conditions. Field density testing should conform to ASTM Method of Testing D 1556-64, D 2922-78 and/or D2937-71. Tests should be provided for about every 2 vertical feet or 1,000 cubic yards of fill placed. Actual test intervals may vary as field conditions dictate. Fill found not to be in conformance with the grading recommendations should be removed or otherwise handled as recommended by the Geotechnical Consultant.

The Contractor should assist the Geotechnical Consultant and/or his representative by digging test pits for removal determinations and/or for testing compacted fill.

As recommended by the Geotechnical Consultant, the Contractor should “shutdown” or remove any grading equipment from an area being tested.

The Geotechnical Consultant should maintain a plan with estimated locations of field tests. Unless the client provides for actual surveying of test locations, by the Geotechnical Consultant should only be considered rough estimates and should not be utilized for the purpose of preparing cross sections showing test locations or in any case for the purpose of after-the-fact evaluating of the sequence of fill placement.

MOISTURE

For field testing purposes, “near optimum” moisture will vary with material type and other factors including compaction procedures. “Near optimum” may be specifically recommended in Preliminary Investigation Reports and/or may be evaluated during grading.

Prior to placement of additional compacted fill following an overnight or other grading delay, the exposed surface of previously compacted fill should be processed by scarification, watered or dried as needed, thoroughly blended to near-optimum moisture conditions, then recompacted to a minimum of 90 percent of laboratory maximum dry density. Where wet or other dry or other unsuitable materials exist to depths of greater than one foot, the unsuitable materials should be overexcavated.

Following a period of flooding, rainfall or overwatering by other means, no additional fill should be placed until damage assessments have been made and remedial grading performed as described herein.

FILL MATERIAL

Excavated on-site materials which are acceptable to the Geotechnical Consultant may be utilized as compacted fill, provided trash, vegetation and other deleterious materials are removed prior to placement.

Where import materials are required for use on-site, the Geotechnical Consultant should be notified at least 72 hours in advance of importing, in order to sample and test materials from proposed borrow sites. No import materials should be delivered for use on-site without prior sampling and testing by Geotechnical Consultant.

Where oversized rock or similar irreducible material is generated during grading, it is recommended, where practical, to waste such material off-site or on-site in areas designated as “nonstructural rock disposal areas”. Rock placed in disposal areas should be placed with sufficient fines to fill voids. The rock should be compacted in lifts to an unyielding condition. The disposal area should be covered with at least 3-feet of compacted fill, which is free of oversized material. The upper 3-feet should be placed in accordance with the guidelines for compacted fill herein.

Rocks 3 inches in maximum dimension and smaller may be utilized within the compacted fill, provided they are placed in such a manner that nesting of the rock in avoided. Fill should be placed and thoroughly compacted over and around all rock. The amount of rock should not exceed 40 percent by dry weight passing the $^3/_4$-inch sieve size. The 3-inch and 40 percent recommendations herein may vary as field conditions dictate.

During the course of grading operations, rocks or similar irreducible materials greater than 3-inch maximum dimension (oversized material) may be generated. These rocks should not be placed within the compacted fill unless placed as recommended by the Geotechnical Consultant.

Where rocks or similar irreducible materials of greater that 3-inches but less than 4-feet of maximum dimension are generated during grading, or otherwise desired to be placed within an engineered fill, special handling in accordance with the accompanying Standard Details is recommended. Rocks greater than 4 feet should be broken down or disposed off-site. Rocks up to 4-feet maximum dimension should be placed below the upper 10-feet of any fill and should not be closer than 20-feet to any slope face. These recommendations could vary as locations of improvements dictate. Where practical, oversized material should not be placed below areas where structures of deep utilities are proposes.

Oversized material should be placed in windrows on a clean, overexcavated or unyielding compacted fill or firm natural ground surface. Select native or imported granular soil (S.E. 30 or higher) should be placed and thoroughly flooded over and around all windrowed rock, such that voids are filled. Windrows of oversized material should be staggered so that successive strata of oversized material are not in the same vertical plane.

It may be possible to dispose of individual larger rock as field conditions dictate and as recommended by the Geotechnical Consultant at time of placement.

Material that is considered unsuitable by the Geotechnical Consultant should not be utilized in the compacted fill.

During grading operations, placing and mixing the materials from the cut and/or borrow areas may result in soil mixtures which possess unique physical properties. Testing may be required of samples obtained directly from the fill areas in order to verify conformance with the specifications. Processing of these additional samples may take two or more working days. The Contractor may elect to move the operation to other areas within the project, or may continue placing compacted fill pending laboratory and field test results. Should he elect the second alternative, fill placed is done so at the Contractor’s risk.

Any fill placed in areas not previously reviewed and evaluated by the Geotechnical Consultant, and/or in other areas, without prior notification to the Geotechnical Consultant may require removal and recompaction at the Contractor's expense. Determination of overexcavations should be made upon review of field conditions by the Geotechnical Consultant.

FILL SLOPES

Unless otherwise recommended by the Geotechnical Consultant and approved by the regulating agencies, permanent fill slopes should not be steeper than 2:1 (horizontal to vertical).

Except as specifically recommended otherwise or as otherwise provided for in these grading guidelines (Reference Fill Materials), compacted fill slopes should be overbuilt and cut back to grade, exposing the firm, compacted fill inner core. The actual amount of overbuilding may vary as field conditions dictate. If the desired results are not achieved, the existing slopes should be overexcavated and reconstructed under the guidelines of the Geotechnical Consultant. The degree of overbuilding shall be increased until the desired compacted slope surface condition is achieved. Care should be taken by the Contractor to provide thorough mechanical compaction to the outer edge of the overbuilt slope surface.

Although no construction procedure produces a slope free from risk of future movement, overfilling and cutting back of slope to a compacted inner core is, given no other constraints, the most desirable procedure. Other constraints, however, must often be considered. These constraints may include property line situations, access, the critical nature of the development, and cost. Where such constraints are identified, slope face compaction may be attempted by conventional construction procedures including backrolling techniques upon specific recommendations by the Geotechnical Consultant.

As a second best alternative for slopes of 2:1 (horizontal to vertical) or flatter, slope construction may be attempted as outlined herein. Fill placement should proceed in thin lifts, (i.e., 6 to 8 inch loose thickness). Each lift should be moisture conditioned and thoroughly compacted. The desired moisture condition should be maintained and/or reestablished, where necessary, during the period between successive lifts. Selected lifts should be tested to ascertain that desired compaction is being achieved. Care should be taken to extend compactive effort to the outer edge of the slope. Each lift should extend horizontally to the desired finished slope surface or more as needed to ultimately establish desired grades. Grade during construction should not be allowed to roll off at the edge of the slope. It may be helpful to elevate slightly the outer edge of the slope. Slough resulting from the placement of individual lifts should not be allowed to drift down over previous lifts. At intervals not exceeding 4-feet in vertical slope height or the capability of available equipment, whichever is less, fill slopes should be thoroughly backrolled utilizing a conventional sheepsfoot-type roller. Care should be taken to maintain the desired moisture conditions and/or reestablishing same as needed prior to backrolling. Upon achieving final grade, the slopes should again be moisture conditioned and thoroughly backrolled. The use of a side-boom roller will probably be necessary and vibratory methods are strongly recommended. Without delay, so as to avoid (if possible) further moisture conditioning, the slopes should then be grid-rolled to achieve a relatively smooth surface and uniformly compact condition.

In order to monitor slope construction procedures, moisture and density tests will be taken at regular intervals. Failure to achieve the desired results will likely result in a recommendation by the Geotechnical Consultant to overexcavate the slope surfaces followed by reconstruction of the slopes utilizing overfilling and cutting back procedures and/or further attempt at the conventional backrolling approach. Other recommendations may also be provided which would be commensurate with field conditions.

Where placement of fill above a natural slope or above a cut slope is proposed, the fill slope configuration as presented in the accompanying standard Details should be adopted.

For pad areas above fill slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm and pad gradients of at least 2-percent in soil area.

OFF-SITE FILL

Off-site fill should be treated in the same manner as recommended in these specifications for site preparation, excavation, drains, compaction, etc.

Off-site canyon fill should be placed in preparation for future additional fill, as shown in the accompanying Standard Details.

Off-site fill subdrains temporarily terminated (up canyon) should be surveyed for future relocation and connection.

DRAINAGE

Canyon sub-drain systems specified by the Geotechnical Consultant should be installed in accordance with the Standard Details.
Typical sub-drains for compacted fill buttresses, slope stabilization or sidehill masses, should be installed in accordance with the specifications of the accompanying Standard Details.
Roof, pad and slope drainage should be directed away from slopes and areas of structures to suitable disposal areas via non-erodible devices (i.e., gutters, downspouts, concrete swales).
For drainage over soil areas immediately away from structures (i.e., within 4-feet), a minimum of 4 percent gradient should be maintained. Pad drainage of at least 2 percent should be maintained over soil areas. Pad drainage may be reduced to at least 1 percent for projects where no slopes exist, either natural or man-made, or greater than 10-feet in height and where no slopes are planned, either natural or man-made, steeper than 2:1 (horizontal to vertical slope ratio).
Drainage patterns established at the time of fine grading should be maintained throughout the life of the project. Property owners should be made aware that altering drainage patterns can be detrimental to slope stability and foundation performance.

STAKING

In all fill areas, the fill should be compacted prior to the placement of the stakes. This particularly is important on fill slopes. Slope stakes should not be placed until the slope is thoroughly compacted (backrolled). If stakes must be placed prior to the completion of compaction procedures, it must be recognized that they will be removed and/or demolished at such time as compaction procedures resume.
In order to allow for remedial grading operations, which could include overexcavations or slope stabilization, appropriate staking offsets should be provided. For finished slope and stabilization backcut areas, we recommend at least 10-feet setback from proposed toes and tops-of-cut.

SLOPE MAINTENANCE LANDSCAPE PLANTS

In order to enhance superficial slope stability, slope planting should be accomplished at the completion of grading. Slope planting should consist of deep-rooting vegetation requiring little watering. Plants native to the Southern California area and plants relative to native plants are generally desirable. Plants native to other semiarid and arid areas may also be appropriate. A Landscape Architect would be the best party to consult regarding actual types of plants and planting configuration.

IRRIGATION

Irrigation pipes should be anchored to slope faces, not placed in trenches excavated into slope faces.
Slope irrigation should be minimized. If automatic timing devices are utilized on irrigation systems, provisions should be made for interrupting normal irrigation during periods of rainfall.
Though not a requirement, consideration should be give to the installation of near-surface moisture monitoring control devices. Such devices can aid in the maintenance of relatively uniform and reasonably constant moisture conditions.
Property owners should be made aware that overwatering of slopes is detrimental to slope stability.

MAINTENANCE

Periodic inspections of landscaped slope areas should be planned and appropriate measures should be taken to control weeds and enhance growth of the landscape plants. Some areas may require occasional replanting and/or reseeding.
Terrace drains and downdrains should be periodically inspected and maintained free of debris. Damage to drainage improvements should be repaired immediately.
Property owners should be made aware that burrowing animals can be detrimental to slope stability. A preventative program should be established to control burrowing animals.
As a precautionary measure, plastic sheeting should be readily available, or kept on hand, to protect all slope areas from saturation by periods of heavy or prolonged rainfall. This measure is strongly recommended, beginning with the period of time prior to landscape planting.

REPAIRS

If slope failures occur, the Geotechnical Consultant should be contacted for a field review of site conditions and development of recommendations for evaluation and repair.

If slope failure occurs as a result of exposure to periods of heavy rainfall, the failure areas and currently unaffected areas should be covered with plastic sheeting to protect against additional saturation.

In the accompanying Standard Details, appropriate repair procedures are illustrated for superficial slope failures (i.e., occurring typically within the outer 1 foot to 3 feet of a slope face).

TRENCH BACKFILL

Utility trench backfill should, unless otherwise recommended, be compacted by mechanical means. Unless otherwise recommended, the degree of compaction should be a minimum of 95 percent of the laboratory maximum density.

Approved granular material (sand equivalent greater than 30) should be used to bed and backfill utilities to a depth of at least 1 foot over the pipe. This backfill should be uniformly watered, compacted and/or wheel-rolled from the surface to a firm condition for pipe support.

The remainder of the backfill shall be typical on-site soil or imported soil which should be placed in lifts not exceeding 8 inches in thickness, watered or aerated to at least 3 percent above the optimum moisture content, and mechanically compacted to at least 95 percent of maximum dry density (based on ASTM D1557).

Backfill of exterior and interior trenches extending below a 1:1 projection from the outer edge of foundations should be mechanically compacted to a minimum of 95 percent of the laboratory maximum density.

Within slab areas, but outside the influence of foundations, trenches up to 1 foot wide and 2 feet deep may be backfilled with sand and consolidated by uniformly watering or by mechanical means. If on-site materials are utilized, they should be wheel-rolled, tamped or otherwise compacted to a firm condition. For minor interior trenches, density testing may be deleted or spot testing may be elected if deemed necessary, based on review of back-fill operations during construction.

If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, the Contractor may elect the utilization of light weight compaction equipment and/or shading of the conduit with clean, granular material, which should be thoroughly jetted in-place above the conduit, prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate, upon review by the Geotechnical Consultant at the time of construction.

In cases where clean granular materials are proposed for use in lieu of native materials or where flooding or jetting is proposed, the procedures should be considered subject to review by the Geotechnical Consultant.

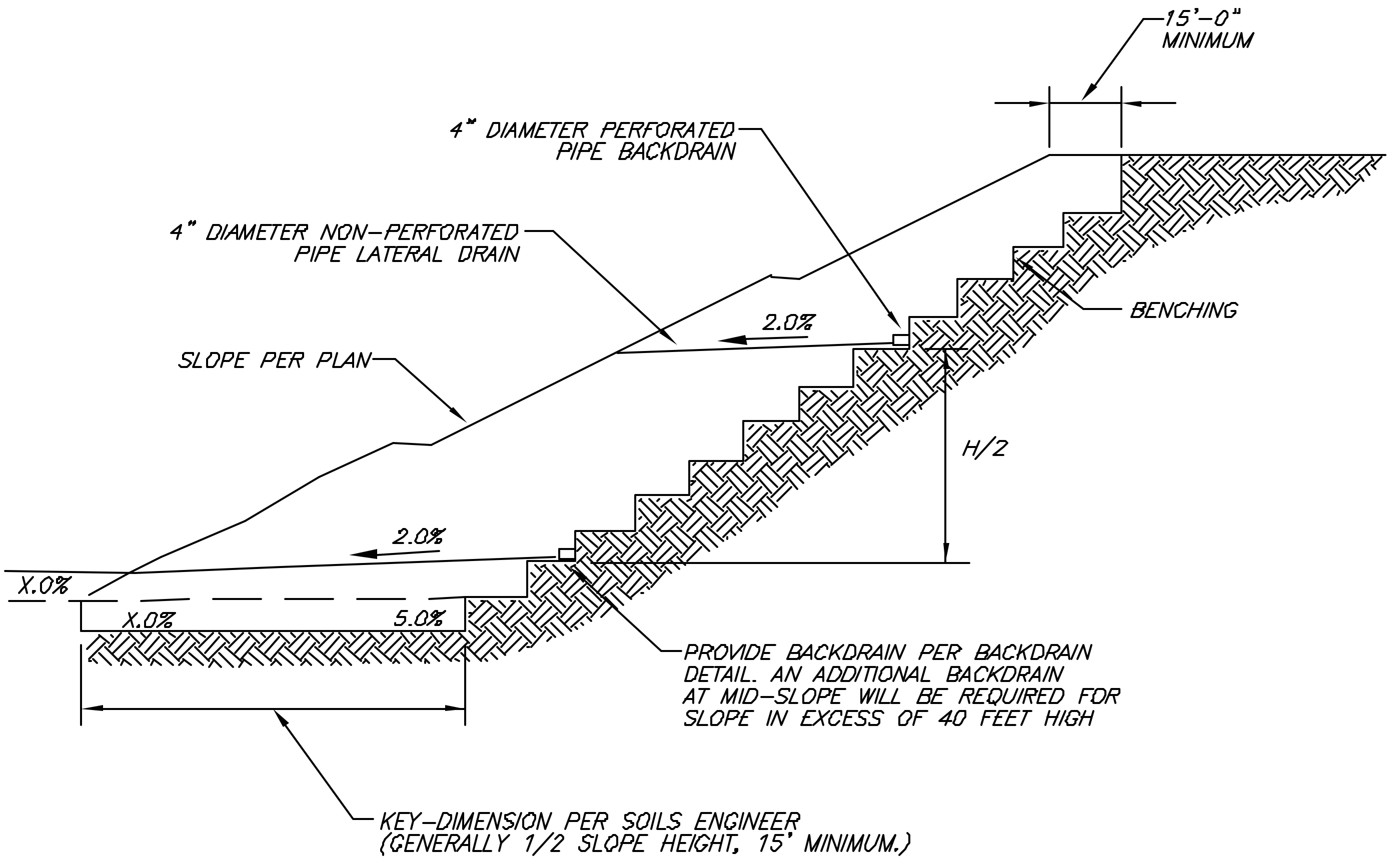
Clean Granular backfill and/or bedding are not recommended in slope areas unless provisions are made for a drainage system to mitigate the potential build-up of seepage forces.

STATUS OF GRADING

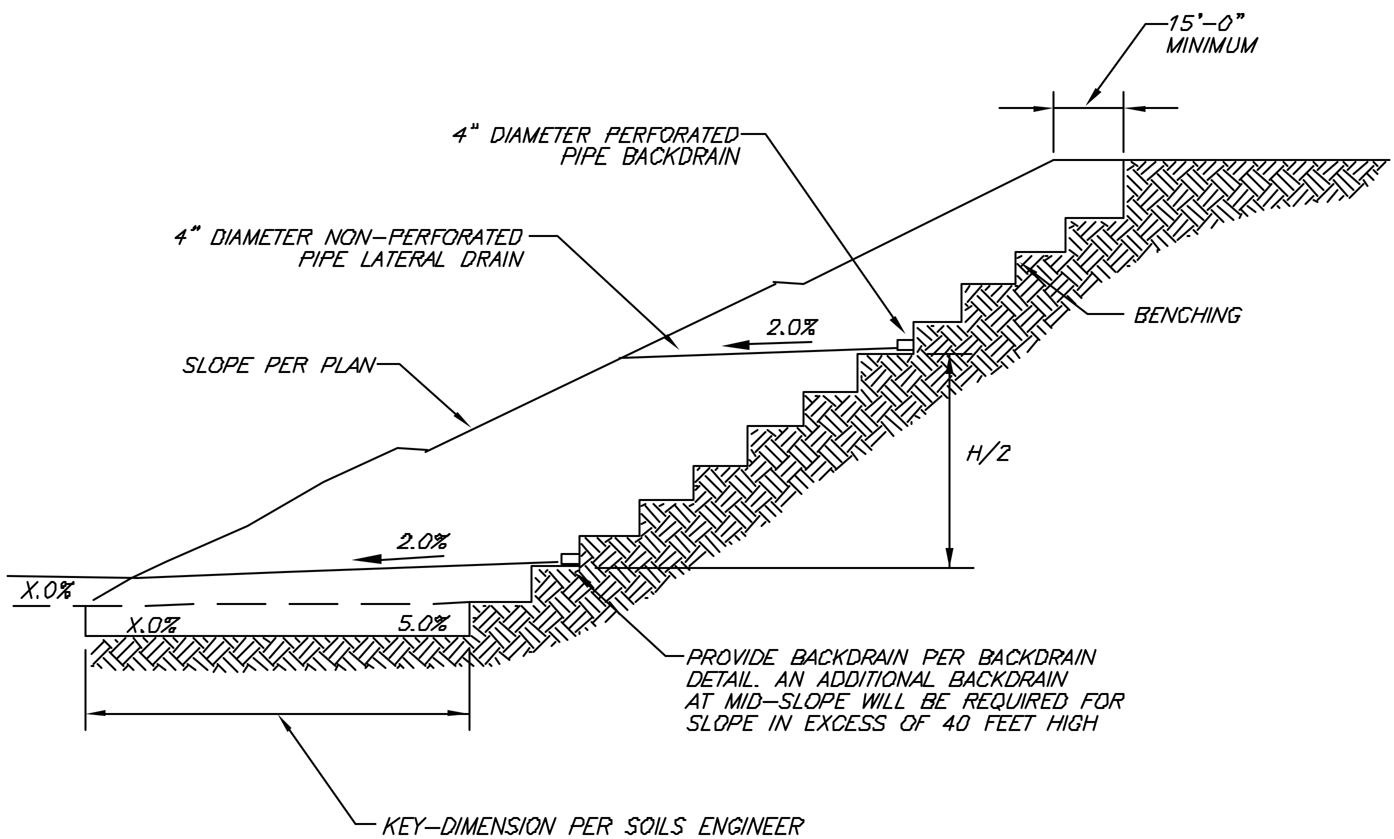
Prior to proceeding with any grading operation, the Geotechnical Consultant should be notified at least two working days in advance in order to schedule the necessary observation and testing services.

Prior to any significant expansion of cut back in the grading operation, the Geotechnical Consultant should be provided with adequate notice (i.e., two days) in order to make appropriate adjustments in observation and testing services.

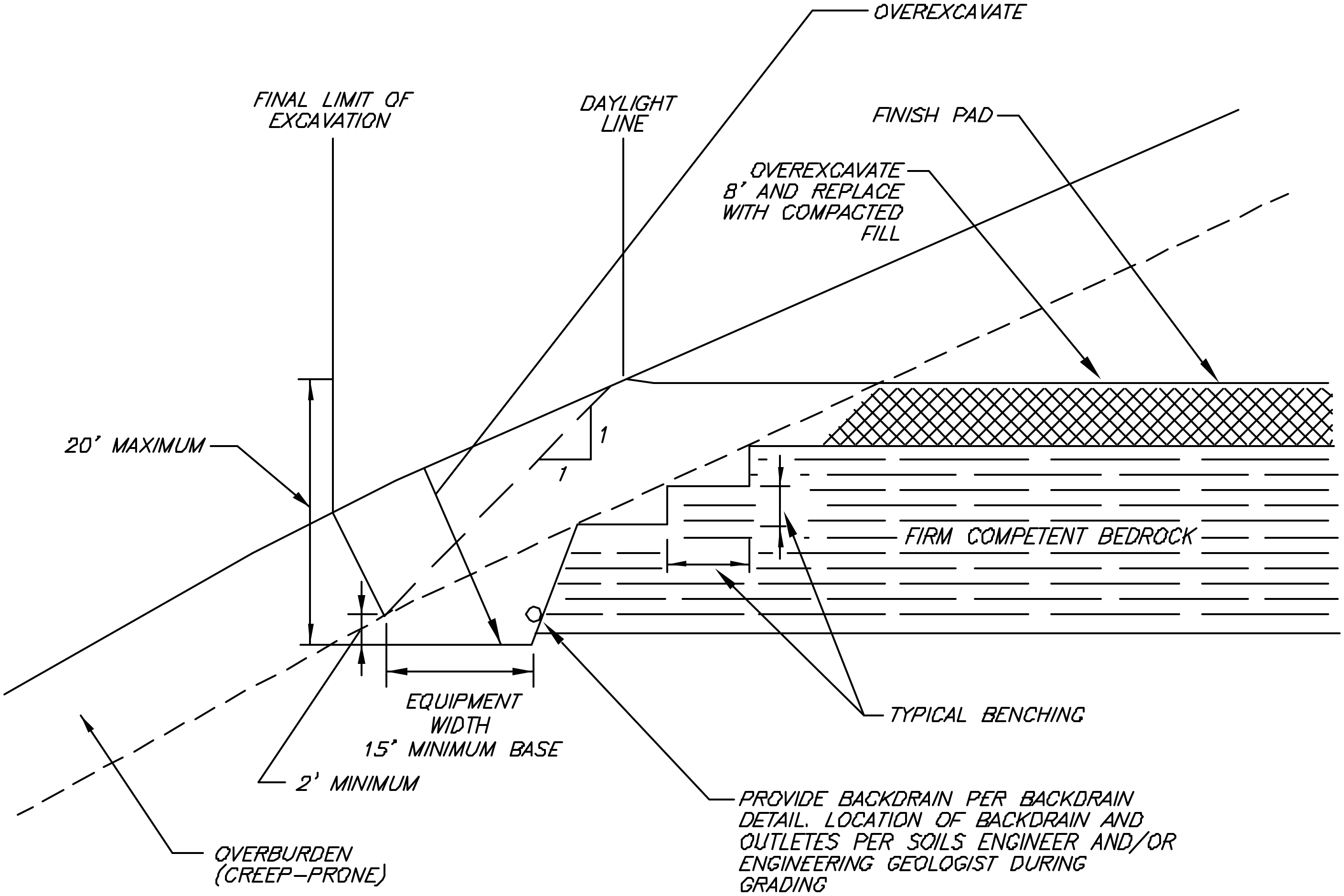
Following completion of grading operations and/or between phases of a grading operation, the Geotechnical Consultant should be provided with at least two working days notice in advance of commencement of additional grading operations.



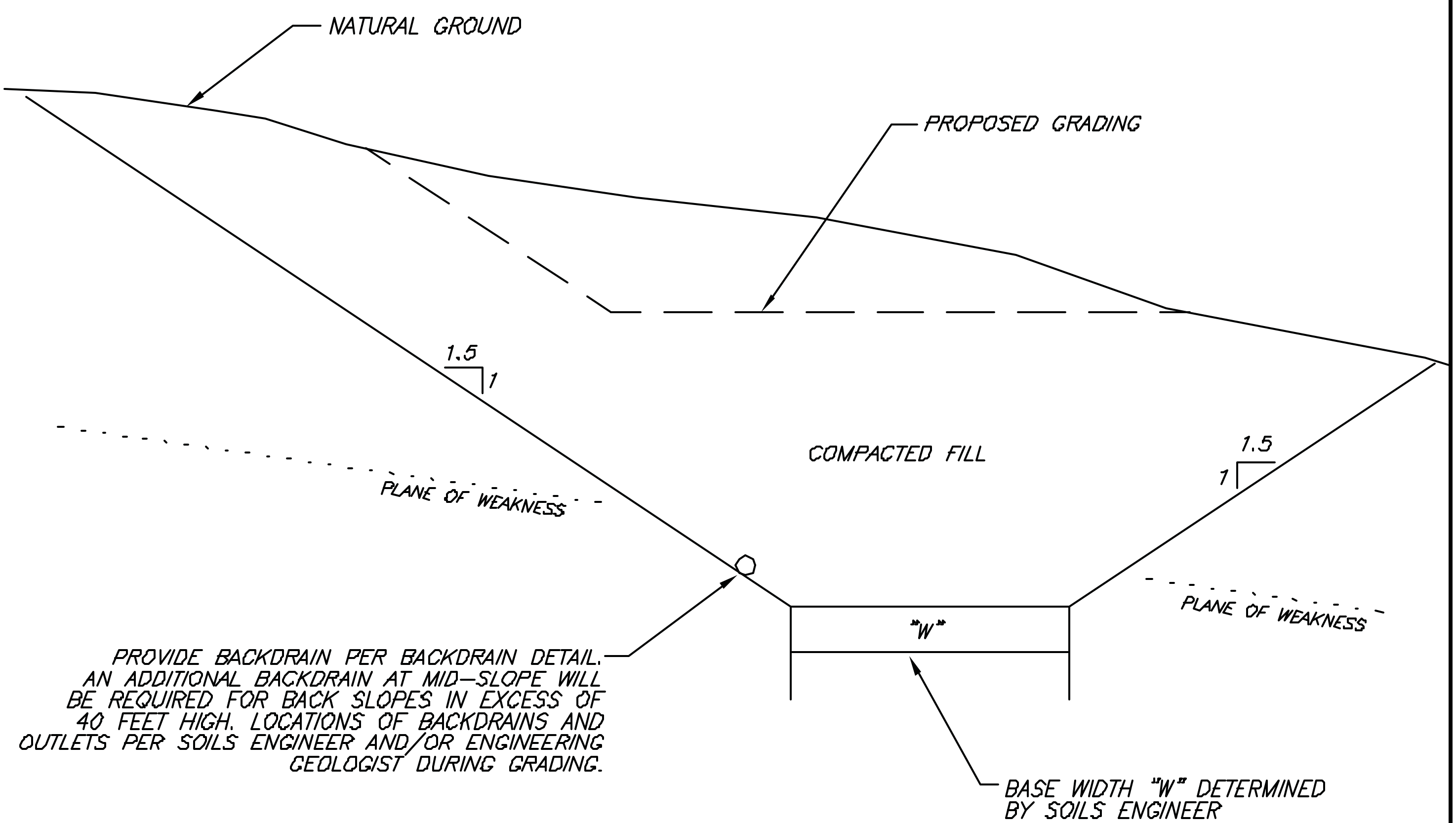
TYPICAL STABILIZATION FILL DETAIL



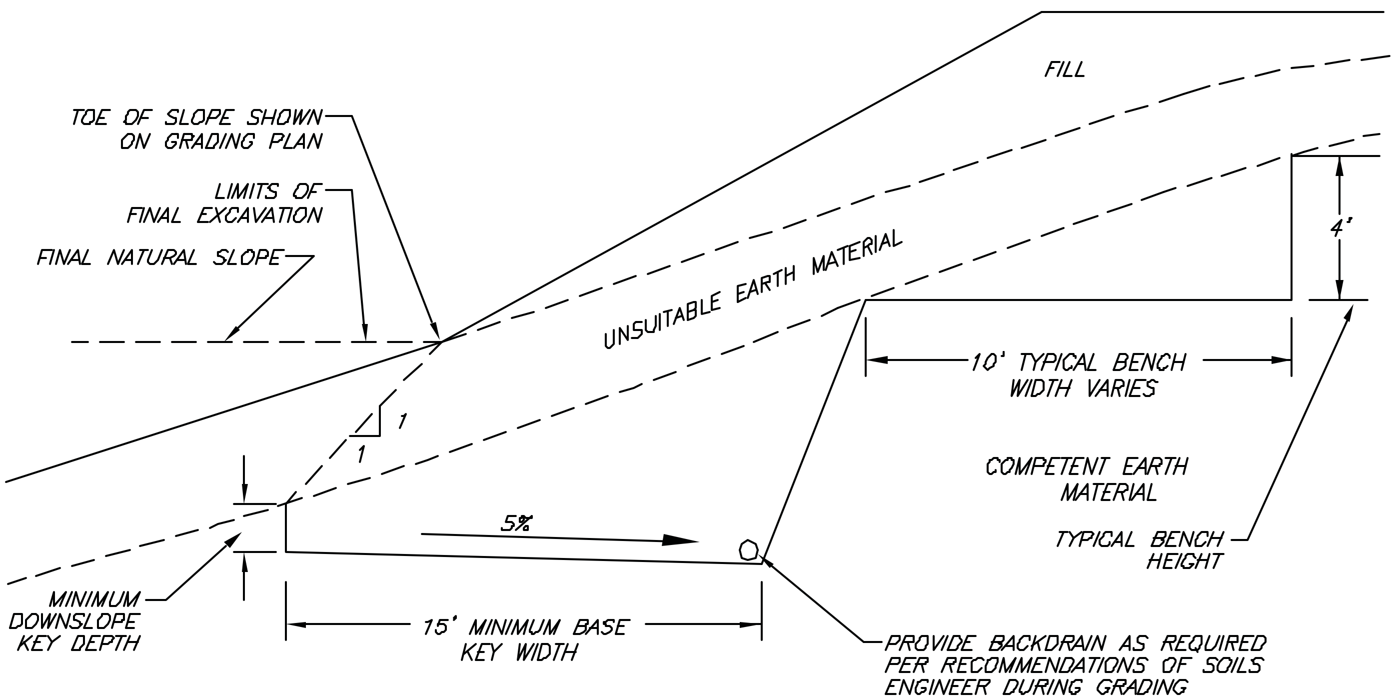
TYPICAL BUTTRESS FILL DETAIL



DAYLIGHT SHEAR KEY DETAIL

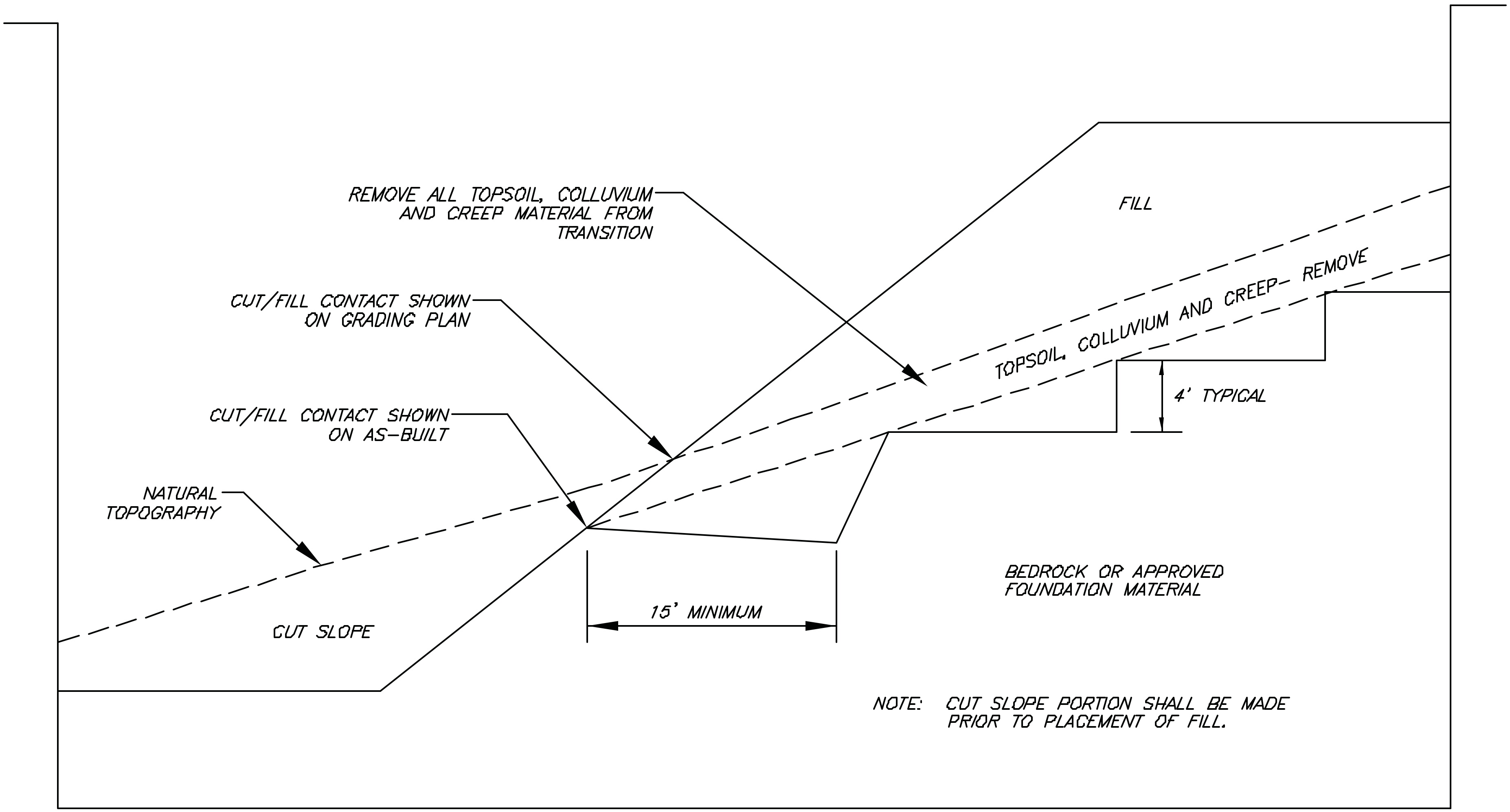


TYPICAL SHEAR KEY DETAIL

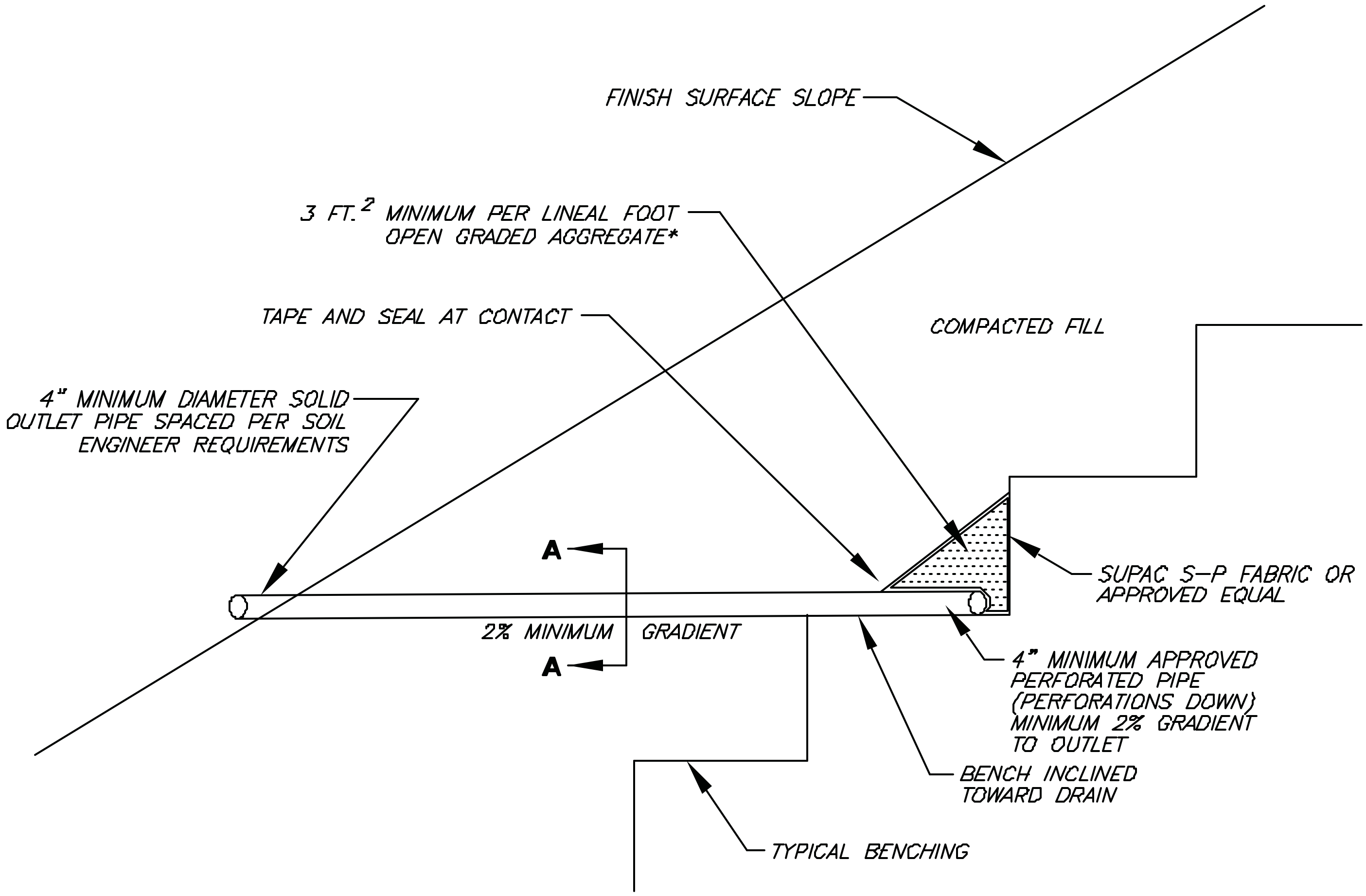


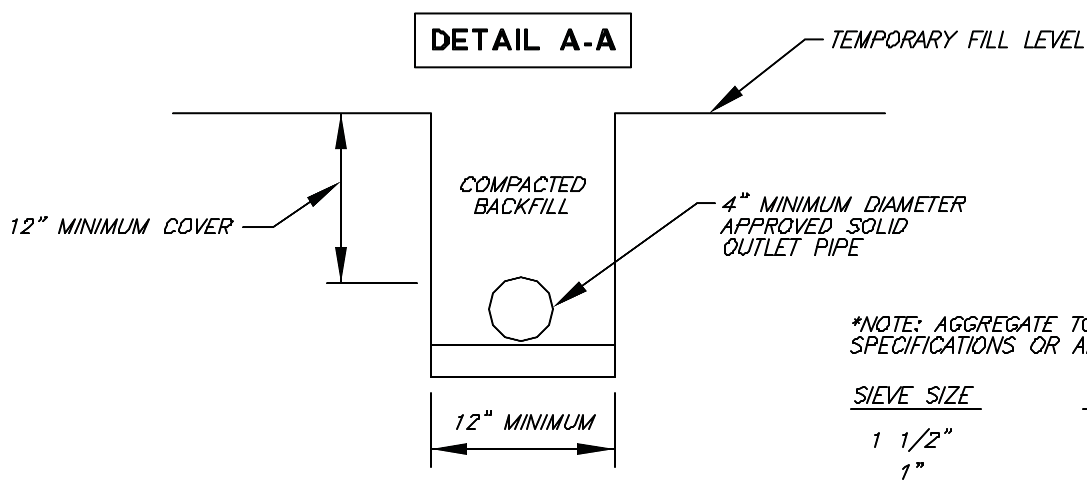
WHERE NATURAL SLOPE IS 5:1 OR LESS, BENCHING IS NOT NECESSARY, HOWEVER, FILL IS NOT TO BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIAL.

FILL SLOPE ABOVE NATURAL GROUND DETAIL



FILL SLOPE ABOVE CUT SLOPE DETAIL

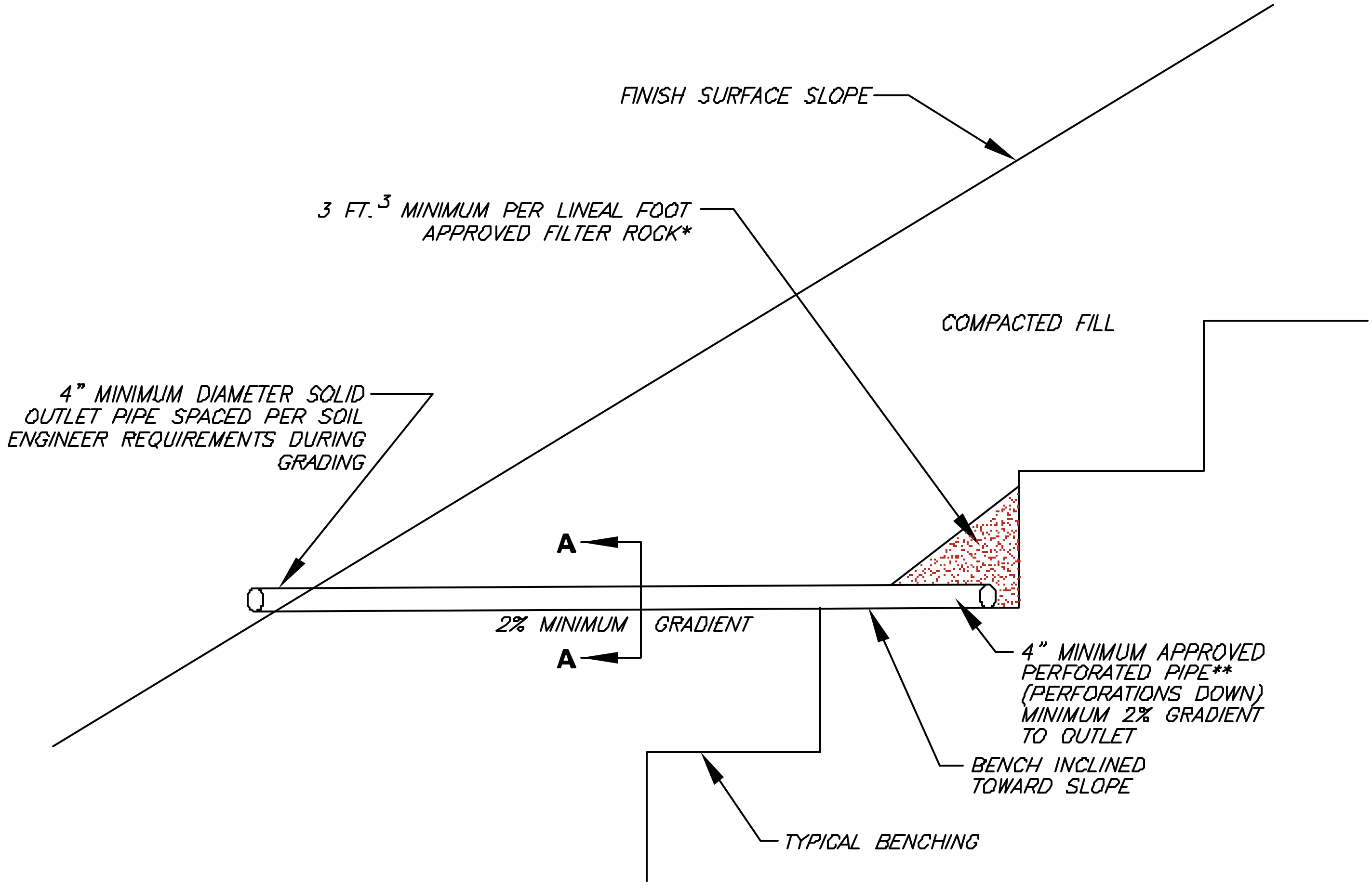




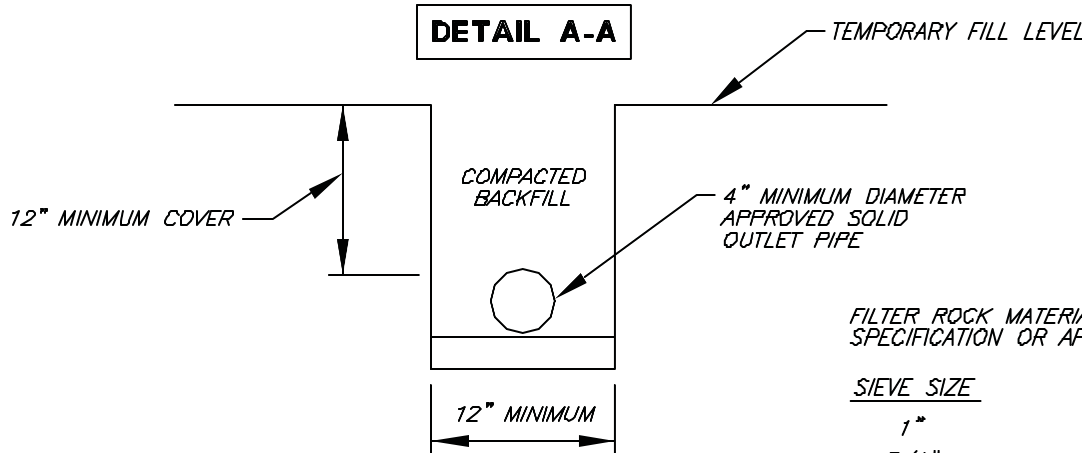
*NOTE: AGGREGATE TO MEET FOLLOWING SPECIFICATIONS OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1 1/2"	100
1"	5-40
3/4"	0-17
3/8"	0-7
NO. 200	0-3

BACKDRAIN DETAIL (GEOFABRIC)



DETAIL A-A



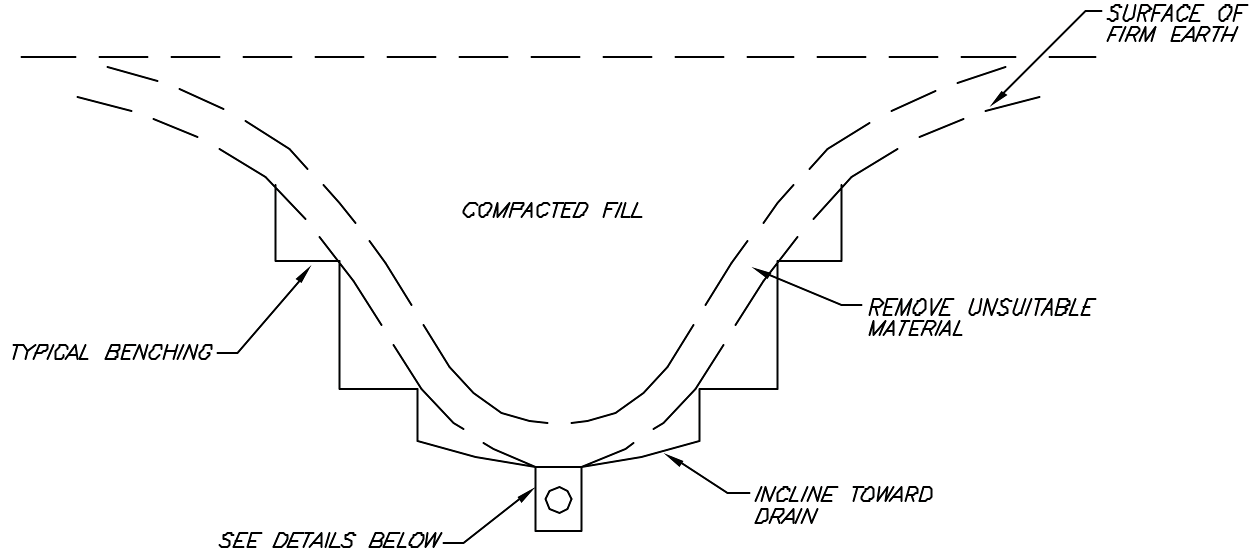
FILTER ROCK MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE
1"	100
3/4"	90–100
3/8"	40–100
NO. 4	25–40
NO. 30	5–15
NO. 50	0–7
NO. 200	0–3

**APPROVED PIPE TYPE:

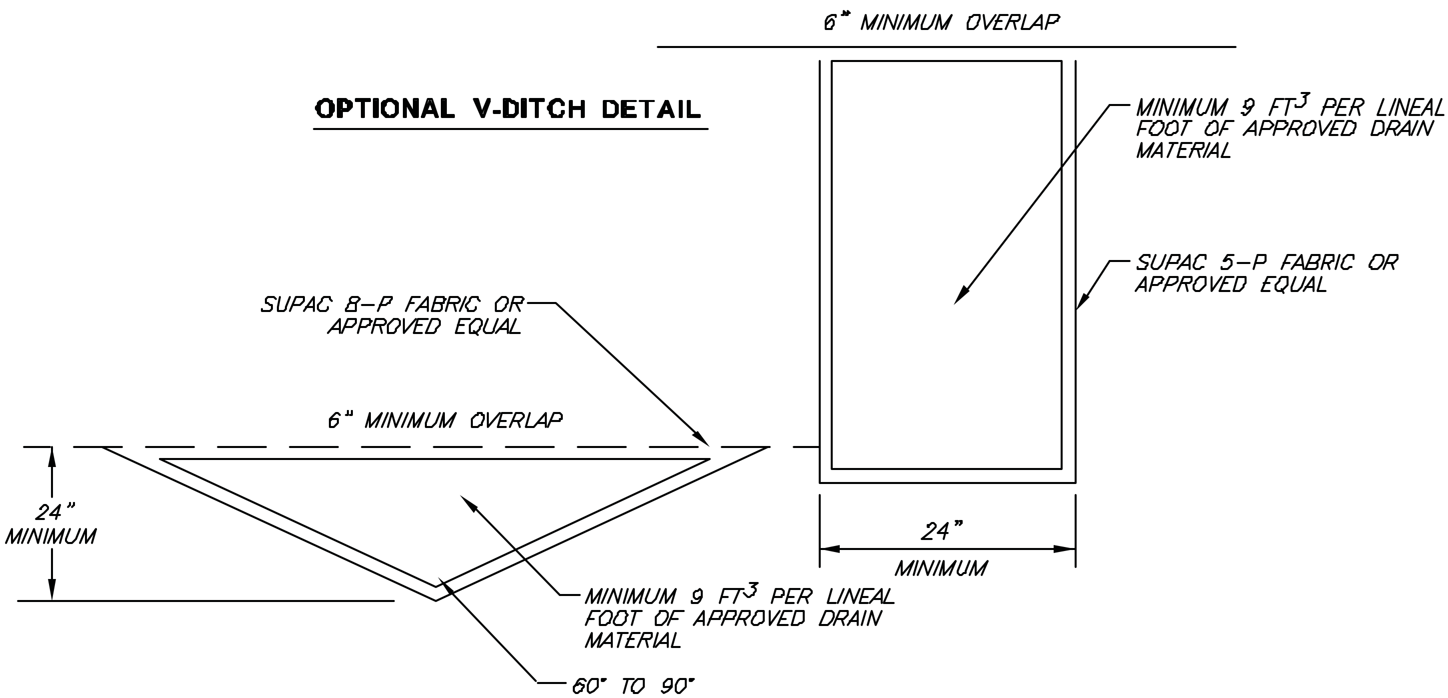
SCHEDULE 40 POLYVINYL CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 PSI.

TYPICAL BACKDRAIN DETAIL



TRENCH DETAIL

OPTIONAL V-DITCH DETAIL



DRAIN MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

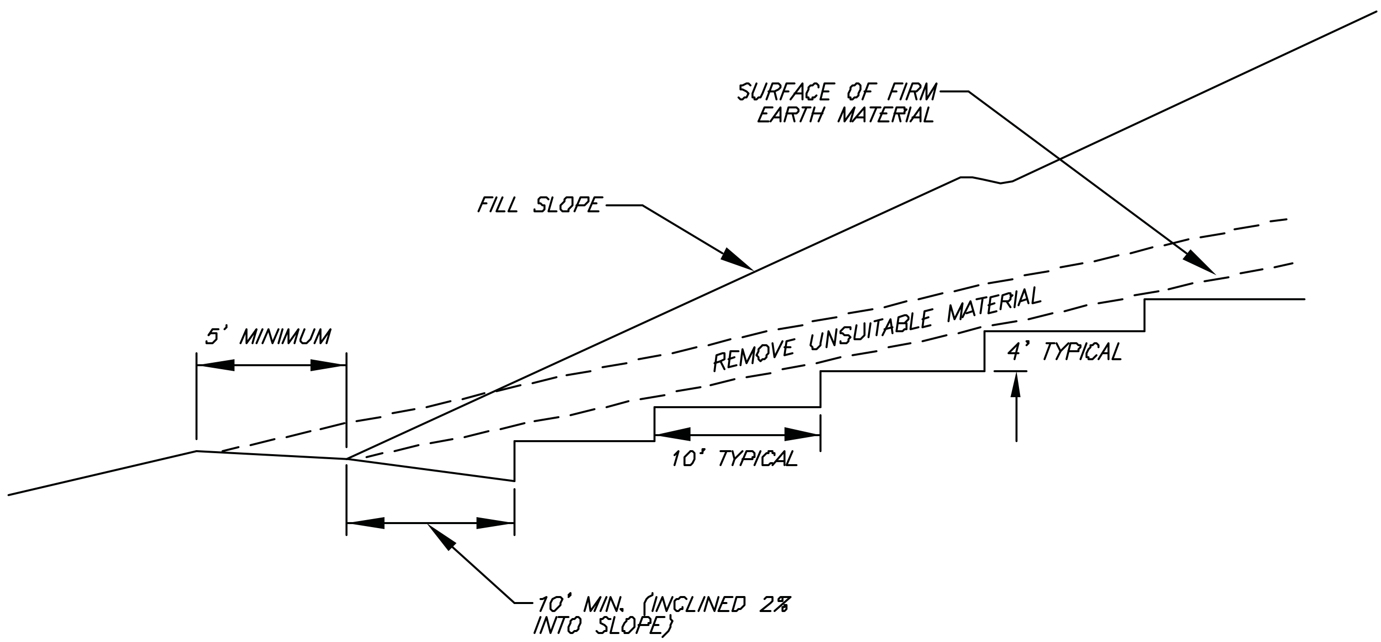
SIEVE SIZE	PERCENTAGE PASSING
1-1/2"	88-100
1"	5-40
3/4"	0-17
3/8"	0-7
NO.:200	0-3

ADD MINIMUM 4" DIAMETER APPROVED PERFORATED PIPE WHEN GRADIENT IS LESS THAN 2%

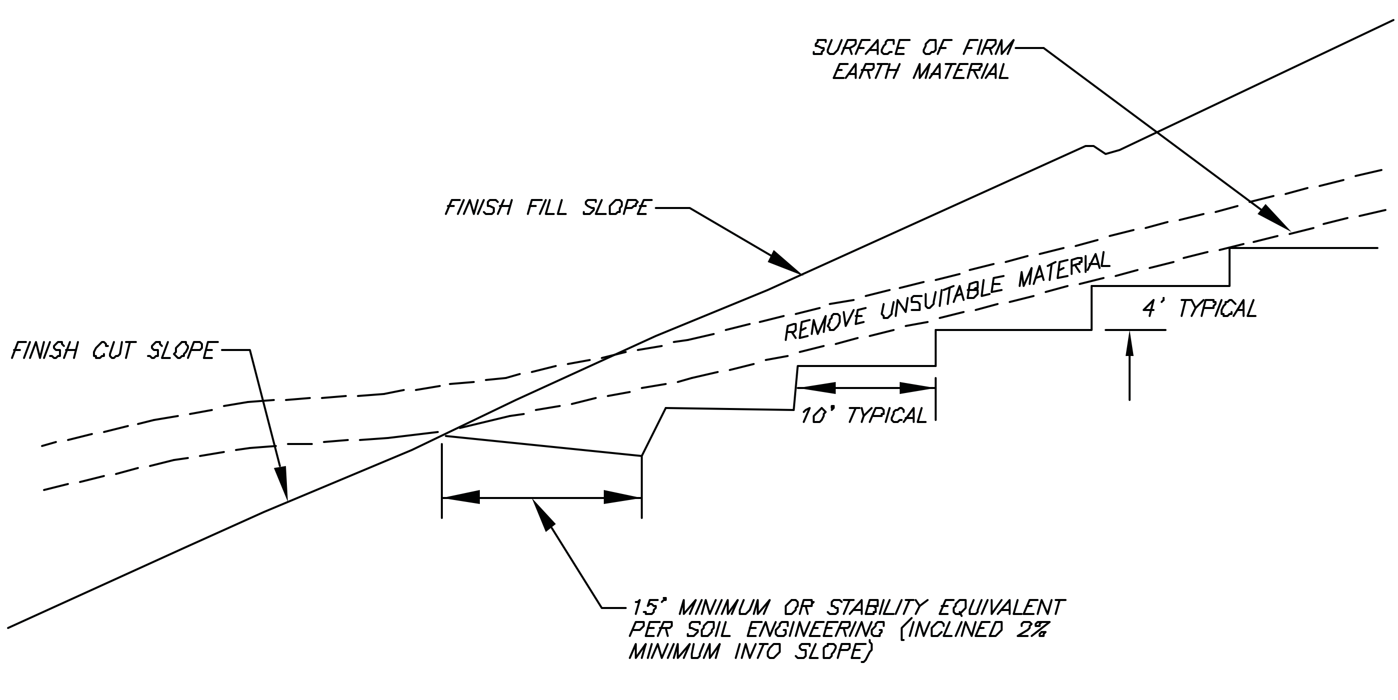
APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.

GEOFABRIC SUBDRAIN DETAIL

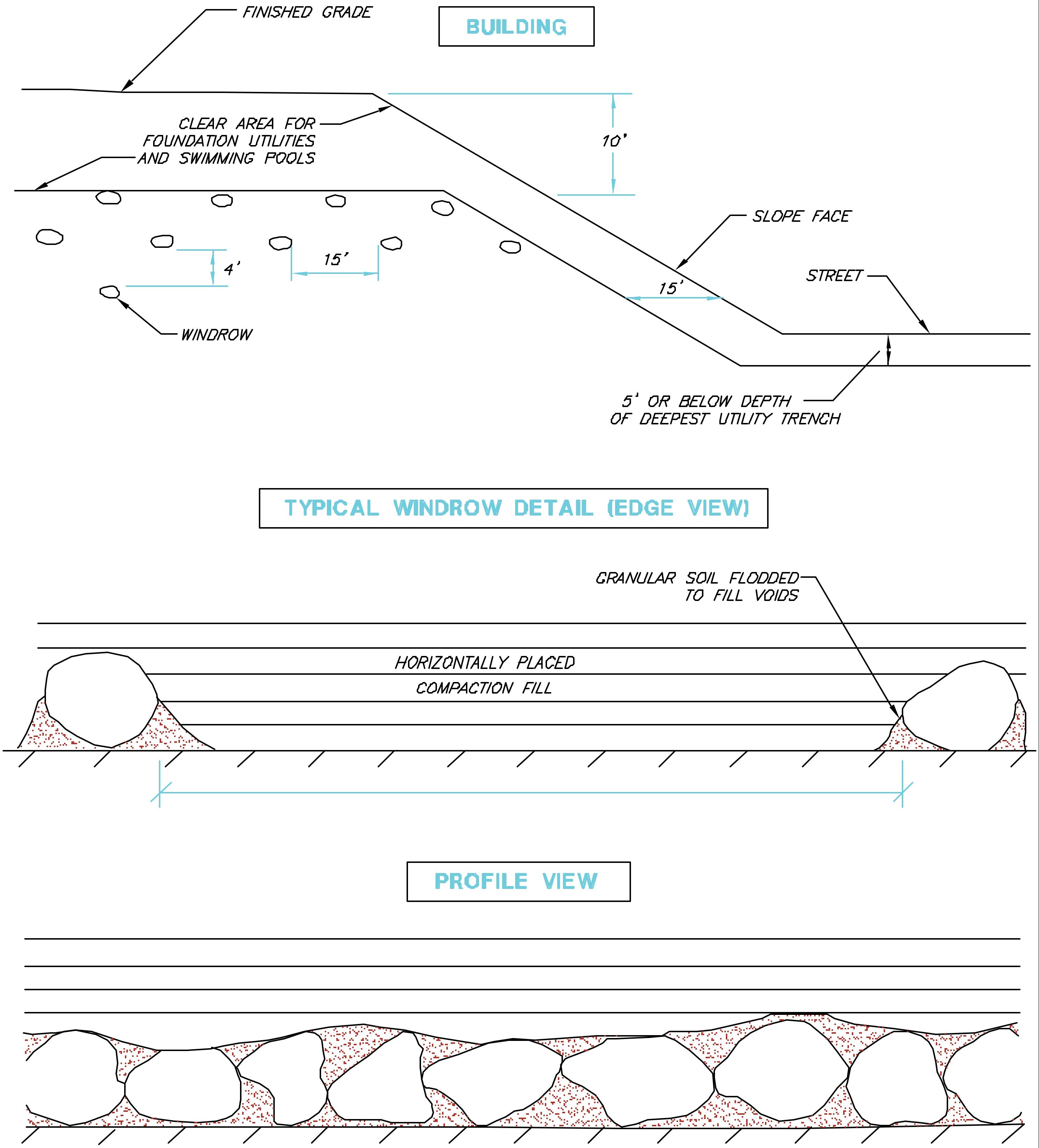
BENCHING FILL OVER NATURAL



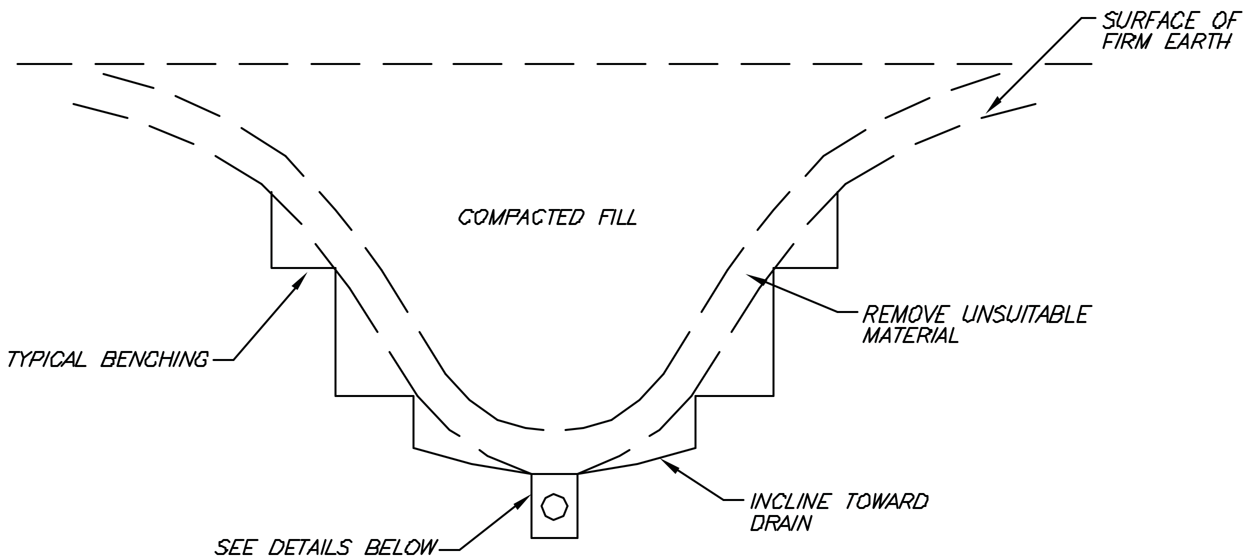
BENCHING FILL OVER CUT



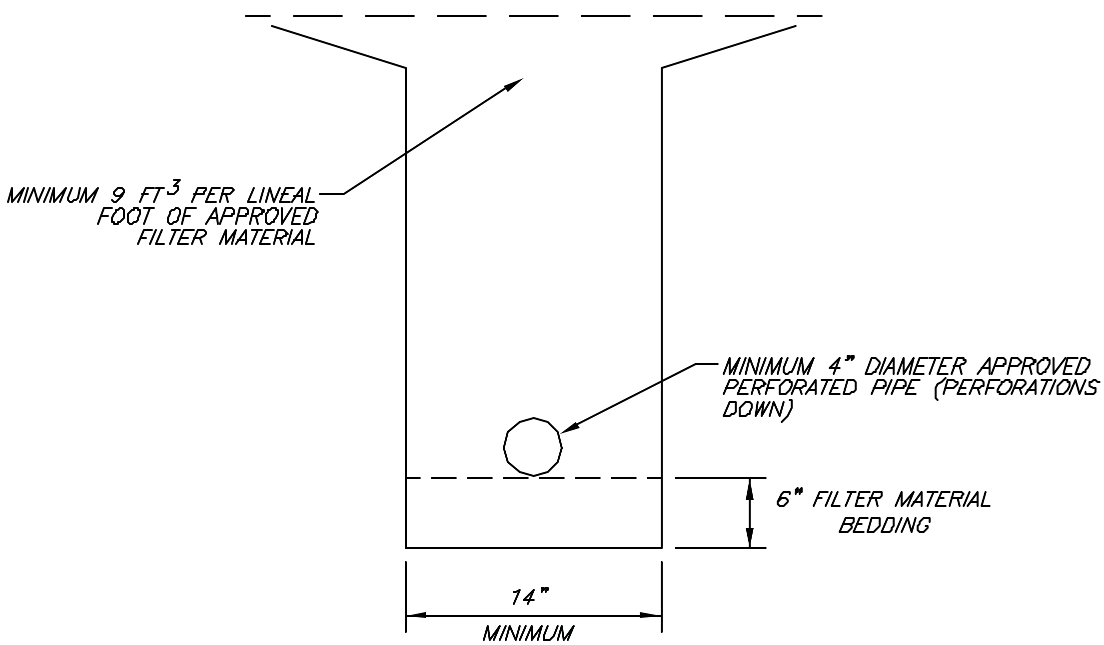
BENCHING FOR COMPACTED FILL DETAIL



ROCK DISPOSAL DETAIL



TRENCH DETAIL



FILTER MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

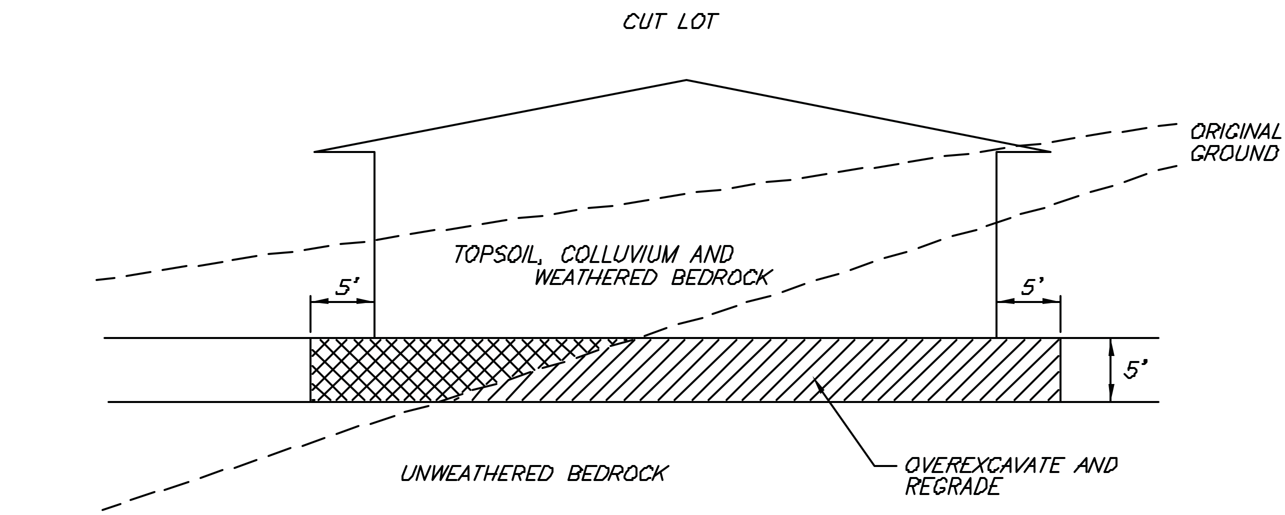
SIEVE SIZE	PERCENTAGE
1"	100
3/4"	90–100
3/8"	40–100
NO. 4	25–40
NO. 30	5–15
NO. 50	0–7
NO. 200	0–3

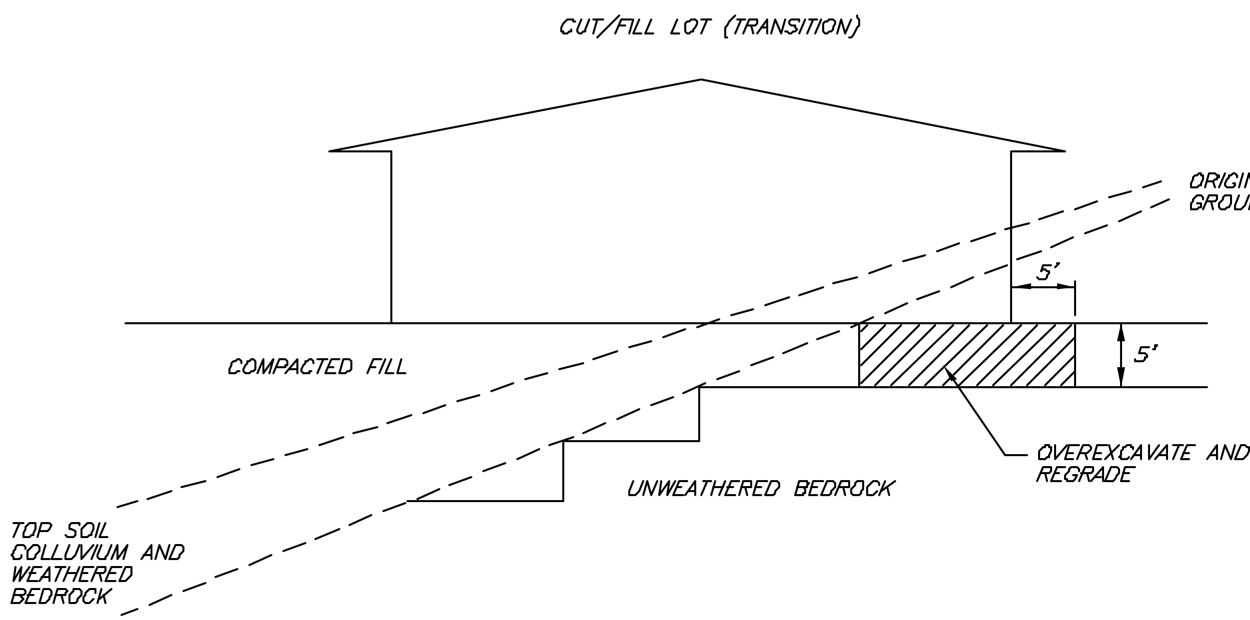
APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.

PIPE DIAMETER TO MEET THE FOLLOWING CRITERIA. SUBJECT TO FIELD REVIEW BASED ON ACTUAL GEOTECHNICAL CONDITIONS ENCOUNTERED DURING GRADING.

LENGTH OF RUN	PIPE DIAMETER
UPPER 500'	4"
NEXT 1000'	6"
> 1500'	8"

TYPICAL CANYON SUBDRAIN DETAIL





TRANSITION LOT DETAIL

Appendix F

SLOPE MAINTENANCE GUIDELINES

Hillside lots in general, and hillside slopes in particular, need maintenance to continue to function and retain their value. Many homeowners are unaware of this and allow deterioration of their property. In addition to his own property, the homeowner may be subject to liability for damage occurring to neighboring properties as a result of his negligence. It is therefore important to familiarize homeowners with some guidelines for maintenance of their properties and make them aware of the importance of maintenance.

Nature slowly wears away land, but human activities such as construction increase the rate of erosion 200, even 2,000 times that amount. When we remove vegetation or other objects that hold soil in place, we expose it to the action of wind and water, and increase its chance of eroding.

The following guidelines are provided for the protection of the homeowner's investment, and should be employed throughout the year.

(a) Care should be taken that slopes, terraces, berms (ridges at crown of slopes), and proper lot drainage are not disturbed. Surface drainage should be conducted from the rear yard to the street by a graded swale through the sideyard, or alternative approved devices.

(b) In general, roof and yard runoff should be conducted to either the street or storm drain by nonerosive devices such as sidewalks, drainage pipes, ground gutters, and driveways. Drainage systems should not be altered without expert consultation.

(c) All drains should be kept cleaned and unclogged, including gutters and downspouts. Terrace drains or gunite ditches should be kept free of debris to allow proper drainage. During heavy rain periods, performance of the drainage system should be inspected. Problems, such as gullying and ponding, if observed, should be corrected as soon as possible.

(d) Any leakage from pools, waterlines, etc. or bypassing of drains should be repaired as soon as possible.

(e) Animal burrows should be filled since they may cause diversion of surface runoff, promote accelerated erosion, and even trigger shallow soil failures.

(f) Slopes should not be altered without expert consultation. Whenever a homeowner plans a significant topographic modification of the lot or slope, a qualified geotechnical consultant should be contacted.

(g) If plans for modification of cut, fill, or natural slopes within a property are considered, an engineering geologist should be consulted. Any oversteepening may result in a need for expensive retaining devices. Undercutting of the bottom of a slope might possibly lead to slope instability or failure and should not be undertaken without expert consultation.

(h) If unusual racking, settling, or earth slippage occurs on the property, the homeowner should consult a qualified soil engineer or an engineering geologist immediately.

(i) The most common causes of slope erosion and shallow slope failures are as follows:

- ❖ Gross negligent of the care and maintenance of the slopes and drainage devices.
- ❖ Inadequate and/or improper planting. (Barren areas should be replanted as soon as possible.)
- ❖ Excessive or insufficient irrigation or diversion of runoff over the slope.
- ❖ Foot traffic on slopes destroying vegetation and exposing soil to erosion potential.

(j) Homeowners should not let conditions on their property create a problem for their neighbors. Cooperation with neighbors could prevent problems; also increase the aesthetic attractiveness of the property.

WINTER ALERT

It is especially important to "winterize" your property by mid-September. Don't wait until spring to put in landscaping. You need winter protection. Final landscaping can be done later. Inexpensive measures installed by mid-September will give you protection quickly that will last all during the wet season.

- ❖ Check before storms to see that drains, gutters, downspouts, and ditches are not clogged by leaves and rubble.
- ❖ Check after major storms to be sure drains are clear and vegetation is holding on slopes. Repair as necessary.
- ❖ Spot seed any bare areas. Broadcast seeds or use a mechanical seeder. A typical slope or bare areas can be done in less than an hour.
- ❖ Give seeds a boost with fertilizer.
- ❖ Mulch if you can, with grass clippings and leaves, bark chips or straw.
- ❖ Use netting to hold soil and seeds on steep slopes.

- ❖ Check with your landscape architect or local nursery for advice.
- ❖ Prepare berms and ditches to drain surface runoff water away from problem areas such as steep, bare slopes.
- ❖ Prepare base areas on slopes for seeding by raking the surface to loosen and roughen soil so it will hold seeds.

CONSTRUCTION

- ❖ Plan construction activities during spring and summer, so that erosion control measures can be in place when the rain comes.
- ❖ Examine your site carefully before building. Be aware of the slope, drainage patterns and soil types. Proper site design will help you avoid expensive stabilization work.
- ❖ Preserve existing vegetation as much as possible. Vegetation will naturally curb erosion, improve the appearance and value of your property, and reduce the cost of landscaping later.
- ❖ Use fencing to protect plants from fill material and traffic. If you have to pave near trees, do so with permeable asphalt or porous paving blocks.
- ❖ Minimize the length and steepness of slopes by benching, terracing, or constructing diversion structures. Landscape benched areas to stabilize the slope and improve its appearance.
- ❖ As soon as possible after grading a site, plant vegetation on all areas that are not to be paved or otherwise covered.

TEMPORARY MEASURES TO STABILIZE THE SOIL

Grass provides the cheapest and most effective short-term erosion control. It grows quickly and covers the ground completely. To find the best seed mixtures and plants for your area, check with your local landscape architect, local nursery, or the U.S. Department of Agriculture Soil Conservation Service. Mulches hold soil moisture and provide ground protection from rain drainage. They also provide a favorable environment for starting and growing plants. Easy-to-obtain mulches are grass clippings, leaves, sawdust, bark chips, and straw.

Straw mulch is nearly 100 percent effective when held in place by spraying with an organic glue or wood fiber (tackifiers), by punching it into the soil with a shovel or roller, or by tacking a netting over it.

Commercial applications of wood fibers combined with various seeds and fertilizers (hydraulic mulching) are effective in stabilizing sloped areas. Hydraulic mulching with a tackifier should be done in two separate applications; the first composed of seed fertilizer and half the mulch, the second composed of the remaining mulch and tackifier. Commercial hydraulic mulch applicators – who also provide other erosion control services – are listed under “landscaping” in the phone book.

Mats of excelsior, jute netting, and plastic sheets can be effective temporary covers, but they must be in contact with the soil and fastened securely to work effectively.

Roof drainage can be collected in barrels or storage containers or touted into lawns, planter boxes, and gardens. Be sure to cover stored water so you don’t collect mosquitoes. Excessive runoff should be directed away from your house. Too much water can damage tress and make foundations unstable.

STRUCTURAL RUNOFF CONTROLS

Even with proper timing and planting, you may need to protect disturbed areas from rainfall until the plants have time to establish themselves. Or you may need permanent ways to transport water across your property so that it doesn’t cause erosion.

To keep water from carrying soil from your site and dumping it into nearby lots, streets, streams and channels, you need ways to reduce its volume and speed. Some examples of what you might use are:

- ❖ Riprap (rock lining) – to protect channel banks from erosive water flow.
- ❖ Sediment trap – to stop runoff carrying sediment and trap the sediment.
- ❖ Storm drain outlet protection – to reduce the speed of water flowing from a pipe onto open ground or into a natural channel.
- ❖ Diversion dike or perimeter dike – to divert excess water to places where it can be disposed of properly.
- ❖ Straw bale dike – to stop and detain sediment from small-unprotected areas (a short-term measure).
- ❖ Perimeter swale – to divert runoff from a disturbed area or to contain runoff within a disturbed area.
- ❖ Grade stabilization structure – to carry concentrated runoff down a slope.