GEOTECHNICAL INVESTIGATION

BRADLEY RESIDENCE IMPROVEMENTS

43 SAN RAFAEL AVENUE

SAN ANSELMO, CALIFORNIA

REPORT PREPARED FOR:

JENNIFER BRADLEY

OUR PROJECT NUMBER: WGE140052

October 23, 2014

NEIL O. ANDERSON
AND ASSOCIATES
A Terracon COMPANY

October 23, 2014
Our Project Number: WGE140052

Ms. Jennifer Bradley
43 San Rafael Avenue
San Anselmo, CA 94960

Subject: **Geotechnical Investigation**
Bradley Residence Improvements
43 San Rafael Avenue
San Anselmo, California

Dear Ms. Bradley:

The following report presents the findings and conclusions of our geotechnical investigation conducted at the subject site. The purpose of the report was to provide recommendations for grading, drainage, and the design and construction of the swimming pool, as indicated in our proposal dated August 15, 2014 and accepted September 4, 2014. Recommendations for this project have been provided in the body of the report. Coordination between our office and your grading contractor will help reduce the potential for soil related problems.

<u>Key information regarding this geotechnical report is presented on the following page.</u> This information sheet has been provided to aid you in assessing the limitations of this geotechnical investigation as well as to indicate when additional information from our office may be required.

We appreciate the opportunity of working with you on this project and look forward to providing our services in the future. Please contact us if you have any questions.

Sincerely,
NEIL O. ANDERSON & ASSOCIATES, A TERRACON COMPANY

Anthony K. Tran, Project Manager
Geotechnical Engineer 3003

REGISTERED PROFESSIONAL ENGINEER ANTHONY K. TRAN GE 3003 EXP. 6-30-16 GEOTECHNICAL STATE OF CALIFORNIA
10-23-14

Patrick C. Dell, Principal
Geotechnical Engineer 2186

REGISTERED PROFESSIONAL ENGINEER PATRICK CRAIG DELL No. 2186 GEOTECHNICAL STATE OF CALIFORNIA
10/23/14

KEY INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

➢ ***The Applicability of Geotechnical Reports is Limited***

Geotechnical reports are written to provide test results, observations, and professional opinions regarding a specific site for a specific project. Reports are tailored to the client and are influenced by each client's risk management strategies, economical constraints, and personal preferences. Since each report is a "custom fit" for a particular client, reports should not be transferred to anyone else without first consulting the geotechnical engineer.

Each geotechnical report considers only the construction information and site boundaries that existed at the time of the investigation. Modification of construction plans, such as a change in the shape, size, weight, location, or intended use of a project, nullifies the recommendations contained in the report, unless the geotechnical engineer indicates otherwise. A geotechnical report can not be used for an adjacent site. Time and money can often be saved by consulting with the geotechnical engineer when circumstances change from those which existed when the report was written.

➢ ***Site Conditions Can Change***

The conditions which existed at the time of a geotechnical investigation can change. Investigations can only report conditions at a particular time and place and no guarantee exists to ensure that recommendations will apply after natural or man made changes occur. Examples of some possible changes include: earthquakes, floods, fluctuations in groundwater, construction on or *next* to the site, and the addition or removal of soil. In addition, even the mere passing of time can affect site conditions. Consult with the geotechnical engineer to verify site conditions have not changed since the geotechnical report was completed.

➢ ***Geotechnical Findings Are Comprised Primarily of Professional Opinions***

Even if typical 6 inch borings were spaced 5 feet apart across an entire site (typical borehole spacings are on the order of at least 10's or 100's of feet apart), *less than one percent* of the soil or rock on the site would actually be explored. From this limited exploration, the geotechnical engineer is called on to provide an opinion regarding the subsurface conditions across the site, provide appropriate foundation recommendations, and predict the response of subsurface materials to numerous scenarios using information from samples that may or may not be representative of the entire site. Obviously, most of the geotechnical report is based on the professional opinion of the geotechnical engineer. The actual subsurface conditions may significantly differ from those which were encountered during the geotechnical investigation. Consequently, the most effective method of managing the risks associated with a project is to retain the geotechnical engineer who provided the report throughout construction of the project.

➢ ***Contact Your Geotechnical Engineer When in Doubt***

Time, money, and confusion can all be saved by simple explanations at critical moments. Please contact your geotechnical engineer whenever there is any doubt regarding subsurface conditions or their effect on part or all of any project.

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BRADLEY RESIDENCE IMPROVEMENTS
43 SAN RAFAEL AVENUE
SAN ANSELMO, CALIFORNIA

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GEOTECHNICAL INVESTIGATION

BRADLEY RESIDENCE IMPROVEMENTS

43 SAN RAFAEL AVENUE

SAN ANSELMO, CALIFORNIA

OUR PROJECT NUMBER: WGE140052

1.0 INTRODUCTION

This report presents the findings, conclusions, and recommendations of a geotechnical investigation conducted for the proposed backyard improvements to be constructed at 43 San Rafael Avenue in San Anselmo, California.

We understand that the project will consist of redeveloping the backyard of the subject property. Redevelopment will include (1) new swimming pool, a detached spa, and associated landscaping and hardscape. An existing pool will be demolished to accommodate construction. The existing pool is approximately 15 by 32 feet in size and varied in depth from approximately 3½ to 7 feet. The new pool will be 16 by 75 feet and vary in depth from 4 to 9 feet. The new pool will partially overlap the old pool footprint. The pool and pool construction will include an automatic pool cover and the pool will have an 18 inch tall raised bond beam. Besides the backfilling of the old pool and the excavation of the new pool, we anticipate grading will consist of cuts and fills on the order of 2 feet or less, mainly associated with the construction of new hardscape.

A site plan dated July 2014 showing the proposed location of the pool was provided by Catlin Landscape Architecture to our office for review. It is imperative that our office review the final grading and construction drawings to verify our recommendations have been properly implemented. NOA cannot be held accountable for problems that arise which could have been avoided had these services been performed. The geotechnical study conducted at this site was prepared for the use of the architect and engineer for application to the design of the new swimming pool in accordance with generally accepted geotechnical engineering practices. No warranty is expressed or implied. This report presents the results of this study.

2.0 SUMMARY OF CONCLUSIONS

1. The soils encountered during our field investigation were fairly uniform between test holes. The upper soils consisted of stiff to very stiff sandy clay that extended to depths of between 7½ and 10½ feet below the existing ground surface. The upper soils were underlain by medium stiff clayey sand

and stiff clay to the maximum depth explored of 15½ feet below existing ground surface. For a more detailed description of the soils encountered in the test holes see the Log of Test Boring sheets. At the time of this investigation, groundwater was encountered in our test hole B2 at a depth of 12 feet below existing ground surface. Groundwater levels can and will fluctuate.

2. The pool may utilize typical in-ground construction. However, due to the new pool partially overlapping the old pool footprint, the new swimming pool should be supported on an equal thickness of engineered fill in order to minimize differential movement of the pool shell. We anticipate the new pool will need to be supported on about 2 to 4 feet of engineered fill based on the depth of the old pool excavation and the depth of the new pool. A representative from our office should be present to observe the old pool excavation and verify all demolition debris have been removed from the site, the backfilling of the old pool excavation, the new pool excavation, and the clay soils are in a moist condition prior to placing any fill. Detailed design and construction criteria for the swimming pool are presented in the report.

3. Good surface drainage should be constructed to provide rapid removal of runoff away from the new improvements.

3.0 GENERAL (SURFICIAL) SITE CONDITIONS

At the time of our investigation, the site was developed with an existing two story house with attached garage, detached single story guest house, swimming pool, pool house, and associated hardscapes and landscaping. Landscaping consists of young and mature trees, lawn, bushes and shrubs. It appears that construction of the house and guest house consisted of raised wood floor while the garage and pool house consisted of slab-on-grade-floor. In addition, the construction of the structures consists of wood framing and wood siding with stone veneer. We were unable to determine the house foundation system at the time of our investigation. Based on the lack of visible cracking in the foundation and signs of distress in the stucco, the house and garage appear to be performing well. The existing pool is located near the southeast corner of the property and is approximately 15 by 32 in size and varies in depth from 3½ to 7 feet. The new swimming pool will partially overlap the old pool footprint.

The site is located in a relatively flat area with single family residential homes located adjacent to the south, east, and west of the site and across San Rafael Avenue to the north. The surrounding area consists of residential development.

4.0 GENERAL GEOLOGY AND SEISMICITY

A geologic map of the area indicates the site geology consists of Quaternary Period surficial alluvium deposits.[1] The site is not located within an Alquist-Priolo fault zone.

A liquefaction evaluation was outside the scope of our services and is typically not performed for ancillary structures such as swimming pools. A liquefaction analysis for the subject site was not requested or intended and is beyond the limited scope of this investigation. Based on review of available liquefaction hazard mapping, the site is in an area that has not been evaluated for liquefaction susceptibility. If desired, our office is qualified to perform a liquefaction analysis for the site.

The 2013 California Building Code (CBC), which will be adopted January 1, 2014, references the 2012 International Building Code and the ASCE 7-10 Standard with July 2013 errata. Following is a table of the 2013 California Building Code Soil Parameters[2] which may be used for seismic design of structures at the subject site:

2013 California Building Code Seismic Design Parameters	
Site Class	D
Mapped Spectral Acceleration Value of Rock (Short Period), S_S	1.500g
Mapped Spectral Acceleration Value of Rock (1-Second Period), S_1	0.602g
Site (Amplification) Coefficient, F_a	1.000
Site (Amplification) Coefficient, F_v	1.500
Maximum Considered Earthquake/Site Modified (MCE) Spectral Response Acceleration Value (Short Period), S_{MS}	1.500g
Maximum Considered Earthquake/Site Modified (MCE) Spectral Response Acceleration Value (1-Second Period), S_{M1}	0.903g
Design Spectral Acceleration Value (Short Period), S_{DS}	1.000g
Design Spectral Acceleration Value (1- Second Period), S_{D1}	0.602g
$PGA_M=F_{PGA}$*PGA=1.000*0.528 (ref. ASCE 7-10, Eqn. 11.8-1)	0.528g

A site latitude and longitude of 37.9759° and -122.5655° were utilized in conjunction with the tools provided by United States Geologic Survey web site.

[1] Blake, M.C., Graymer, R.W., Jones, D.L., and Soule, Adam, 2000, Geological map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-2337, scale 1:75,000

[2] USGS Design Detailed Report, http://geohazards.usgs.gov/designmaps/us/application.php

5.0 FIELD EXPLORATION AND LABORATORY TESTING

The field investigation conducted at this site consisted of excavating three exploratory test holes carried to depths of 10½ and 15½ feet below the existing ground surface. The test holes were excavated with a 4 inch diameter hand auger. The locations of the test holes are shown on the Location Map, Plate No. 1. The locations of the test holes were determined by pacing from existing site features; hence, accuracy can be implied only to the degree that this method warrants.

Sampling of the test holes was performed at various depths using a 2.25 inch o.d. hand sampler (HS) with stainless steel tube liners. The hand sampler was driven by a 15-pound hammer with an 18 inch drop. Blow counts required to drive the HS 4 inches were recorded. The HS blow counts were converted to Standard Penetration blow counts for 12 inches based on energy and sampler cross section. This information is presented in the Log of Test Borings, Plates No. 2 through 4.

Soil samples obtained from the test holes were preserved in stainless steel tubes and sealable plastic baggies until the samples could be tested in the laboratory. Samples were taken to the laboratory of Neil O. Anderson & Associates, Inc., Lodi, California and used for performing various laboratory tests. Tests performed consisted of unit weights, moisture contents, Atterberg limits, pocket penterometer readings, and percent passing No. 200 sieve. A summary of the test results are presented on the Log of Test Boring sheets, Plates 2 through 4.

6.0 SOIL CONDITIONS

Visual classification of each soil stratum encountered according to ASTM D2488 (Visual – Manual Procedure) was made in the field by a representative from our office at the time the test holes were drilled. The samples obtained were checked in the laboratory by a geotechnical engineer and classification verified according to ASTM D2487. A classification and graphical representation of each soil encountered is presented on the Log of Test Boring sheets. The test boring legend is presented on Plate No. 5.

The soils encountered during our field investigation were fairly uniform between test holes. The upper soils consisted of stiff to very stiff sandy clay that extended to depths of between 7½ and 10½ feet below the existing ground surface. The upper soils were underlain by medium stiff clayey sand and stiff clay to the maximum depth explored of 15½ feet below existing ground surface. For a more detailed description of the soils encountered in the test holes see the Logs of Test Boring sheets.

Test hole logs show subsurface conditions at the date and location indicated and it is not warranted that they are representative of subsurface conditions at other locations and times.

Groundwater was encountered in boring B2 at a depth of approximately 12 feet below the existing ground surface at the time the test hole was excavated. Groundwater conditions in the future could change due to rainfall, construction activities, irrigation, or other factors. The evaluation of these factors is beyond the scope of this study.

7.0 DESIGN STUDIES AND RECOMMENDATIONS

From a soil engineering standpoint, our office concludes the site is suitable for construction of the proposed improvements; however, all of the conclusions and recommendations presented in this report should be incorporated into the design and construction to help reduce the potential for soil and foundation related problems. The main geotechnical items of consideration are the potential for differential movement where the new pool will overlap the old pool excavation, verify all demolition debris have been removed from the site, and the clay soils are in a moist condition prior to placing any engineered fill.

As a result of the new pool being partially located within the footprint of the old pool, we recommend the pool should be supported by an equal thickness of engineered fill. We anticipate the new pool will need to be supported on about 2 to 4 feet of engineered fill based on the depth of the old pool excavation and the depth of the new pool. <u>A representative from our office should be present to observe the old pool excavation and verify all demolition debris have been removed from the site, the backfilling of the old pool excavation, the new pool excavation, and the clay soils are in a moist condition prior to placing any fill.</u> A sample of the proposed imported engineered fill shall be provided to our office for acceptance a minimum of two weeks prior to hauling material to the site. Detailed design and construction criteria for the swimming pool are presented in Section 7.3 of this report.

7.1 Demolition and Grading

As indicated, the existing swimming pool, hardscapes, and landscaping will be demolished to facilitate construction of the new improvements. All debris generated from the demolition should be completely removed. Construction areas should initially be cleared of all existing organic growth, loose soil, and miscellaneous debris. Any underground utilities that will be abandoned and are smaller than 2 inches in diameter may be left in place. Utilities 2 inches in diameter or larger should be removed, grouted solid, or crushed in place and back-filled. The stumps of any trees should be removed. During stump removal all roots greater than ½ inch in diameter should be grubbed out.

Voids resulting from concrete, asphalt, stump and root or utility removal should be cleaned out of all loose soil and debris, scarified, moisture conditioned, and re-compacted as specified in Appendix A, Engineered Fill Specifications.

Besides the backfilling of the existing pool and excavation of the new pool, we anticipate grading will consist of cuts and fills on the order of 2 feet or less, mainly associated with construction of the new hardscapes. After clearing, any required cuts should be made. Once cuts have been made and prior to placing any engineered fill the subgrade soil and fill should be scarified and compacted. The depth of scarification of subgrade soils and moisture conditioning of the subgrade is highly dependent on the depth of the fill and upon the time of year of construction and the site conditions that existed immediately prior to construction. If construction occurs during the winter or spring, where the subgrade soils are typically already in a moist condition, scarification and compaction may only be 6 inches. If construction occurs during the summer or fall when the subgrade soils have been allowed to dry out deeper, the depth of scarification and moisture conditioning may be as much as 18 to 24 inches. A representative of our office should be present to observe the exposed subgrade and specify the depth of scarification and moisture conditioning required.

After moisture conditioning the native soils, any fill placed should be placed and compacted in accordance with the recommendations specified in Appendix A with the following modification: Any engineered fill placed beneath the pool should be compacted to a minimum 95 percent relative compaction, at a minimum 3 percentage points above optimum moisture content as determined in ASTM D1557. On-site clay soils are not suitable for use as engineered fill beneath the pool. Any import soil used as engineered fill should meet the specifications for engineered fill provided in Appendix A. Import soil utilized as engineered fill should be submitted to our office for testing at least 14 days prior to import. A representative from our office should be present during grading to provide construction observation and compaction testing.

7.2 Excavation

As indicated previously, groundwater was encountered at a depth of 12 feet below the existing ground surface. The groundwater level noted in our boring logs shall not be construed as a maximum or minimum. Groundwater levels can and will fluctuate. The soils encountered in our test holes consisted of stiff to very stiff clayey soils. Conventional excavating equipment should be able to be used for this site. The contractor should plan his work accordingly.

7.3 Swimming Pool

The swimming pool may utilize typical in-ground construction provided it extends and bears on and into a uniform thickness of engineered fill compacted in accordance with the recommendations in Section 7.1 of this report. Over-excavation of the native soils will likely be required to provide a uniform thickness of fill to support the pool. <u>A representative from our office should be present during excavation to verify the pool bears into engineered fill that is in an elevated moisture condition.</u>

The pool walls should be designed to resist an active earth pressure of 60 pounds per cubic foot (pcf) equivalent fluid pressure (EFP) for walls with flat backfill. **Freestanding walls and walls backfilled with fill should be designed for an outward hydrostatic pressure of 65 pcf (EFP).** Any expansive soils encountered in the pool excavation should be maintained in a moist condition during construction.

It is our understanding 18-inch tall raised bond beams are planned for pool construction. Drainage should be installed behind any raised bond beams. Drainage shall consist of either a drainage composite such as Miradrain 6200, Mirafi G100W, or Amerdrain Totaldrain or a 12-inch thick free draining gravel blanket. Free draining gravel shall consist of CalTrans Class II permeable material or 3/4 inch clean gravel wrapped in Mirafi 140N filter fabric or equivalent. The drainage should extend from pool water level to within 12 inches of the top of the raised bond beam. A 4-inch perforated Schedule 40 PVC or ABS drain pipe should be installed at the base of the raised bond beam. The drain pipe should be sloped to a positive gravity outlet at a 2 percent minimum slope.

Groundwater was encountered at a depth of 12 feet below the existing ground surface. The groundwater level noted in our boring logs shall not be construed as a maximum or minimum. Groundwater levels can and will fluctuate. In addition, groundwater could rise to within the elevation of the pool floor. Therefore, the bottom of the pool should be underlain by a 6-inch thick layer of 3/4 inch clean gravel or Caltrans Class II permeable material. A 4-inch diameter perforated Schedule 40 PVC or ABS pipe should be installed at the deepest point of the pool in the gravel to facilitate the collection of water. The pipe should slope to an observation well at a minimum 2 percent slope where water can be removed by pumping. A hydrostatic pressure relief system should be installed in the deep end of the pool.

7.4 Drainage

Special care should be taken to ensure adequate drainage is provided throughout the life of the proposed improvements. A properly designed and constructed pool can be seriously damaged by neglecting to install and regularly verify performance of recommended drainage systems. Care should be taken to ensure that landscaping is not excessively irrigated and to ensure that landscaping drains away from the pool. Surface drainage should be collected and discharged to an existing drainage system. Implementation of adequate drainage for this project can affect the surrounding developments. Consequently, in addition to designing and constructing drainage for this project, the effects of site drainage should be taken into consideration for the existing structures on this lot and surrounding sites. Planned site drainage should consider runoff from adjacent areas and should divert any runoff away from the proposed improvements.

7.5 Exterior Hardscape

Surficial soil within the area of the proposed pool consists of low to moderately plastic sandy clay. The clay soils are susceptible to shifting due to seasonal moisture fluctuations which can lift and crack concrete hardscapes. <u>If shifting and cracking of hardscapes or deck are not desired, all clay soil should be over-excavated, moisture conditioned and compacted as specified in Appendix A, Engineered Fill up to within 24 inches of grade.</u> The surface 24 inches shall consist of Caltrans Class II aggregate base. Concrete pavers should be considered for hardscapes and decks since they are not as susceptible to cracking. <u>If the homeowner is willing to accept more risk of shifting and cracking in concrete patios as a result of deck heave, the surficial silty soils may be presaturated to a depth of 18 inches and overlain by 4 inches of 3/4 inch clean crushed rock, Caltrans Class II permeable material, or Caltrans Class II aggregate base.</u> Concrete patio slabs/decking should be a minimum 5 inches thick and be reinforced with minimum No. 4 bars spaced at 12 inches on center in each way. The subgrade soils and backfill material should be moisture conditioned and compacted as specified in Section 7.1.

7.6 Testing, Inspections and Review

<u>Our office should be afforded the opportunity of reviewing the completed swimming pool and grading/drainage plans to verify that our recommendations have been properly interpreted and incorporated.</u> Unless our office is allowed this opportunity, we disavow any responsibility from problems arising from failure to follow geotechnical recommendations or improper interpretation and implementation of our recommendations.

<u>Our office shall be retained to perform the recommended swimming pool excavation inspections, compaction testing, and grading observations as indicated in Section 7.0 of this report.</u> Unless we have been retained to provide these services, our office cannot be held responsible for problems arising during or after construction that could have been avoided had these services been performed. <u>*The fees for these services are in addition to that associated with this report.*</u>

8.0 LIMITATIONS

The recommendations of this report are based on the information provided regarding the proposed construction as well as the subsoil conditions encountered at the test hole locations. If the proposed construction is modified or re-sited, or if it is found during construction that subsurface conditions differ from those described on the test hole logs, the conclusions and recommendations of the report should be considered invalid unless the changes are reviewed and the conclusions and recommendations modified or approved in writing.

The analysis, conclusions and recommendations contained in this report are based on the site conditions as they existed at the time we drilled our test holes. It was assumed that the test holes are representative of the subsurface conditions throughout the site. If there is a substantial lapse of time between the submission of our report and the start of the work at the site, or if conditions have changed due to natural causes or construction operations at or adjacent to the site, we urge that our report be reviewed to determine the applicability of the conclusions and recommendations considering the changed conditions and time lapse. This report is applicable only for the project and site studied. This report should not be used after 3 years.

Our professional services were performed, our findings obtained, and our recommendations proposed in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. Test findings and statements of professional opinion do not constitute a guarantee or warranty, expressed or implied.

The scope of our services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the soil logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client.

APPENDIX A
Engineered Fill Specifications

SCOPE

Principal items of work included in this section are as follows:

A. Cleaning and Striping

B. Construction of Fill

A. CLEANING AND STRIPPING

Work includes cleaning and stripping of the building pad and surrounding area as indicated on the drawings. From this area remove all debris, irrigation lines, old pavement, trees, brush, roots, and vegetable ruin and grub out all large roots (1/2 inch or greater diameter) to a depth of at least two feet below the footing elevation. The vegetable materials and all materials from the cleaning operation shall be removed from the site.

B. CONSTRUCTION OF FILL

1. Preliminary Operations

After the cleaning and stripping operation and the cuts have been completed and before any fill is placed in any particular area, the existing surface shall be scarified to a depth of 8 inches and compacted to dry densities in excess of 90 percent of the maximum dry density as obtained by the Standard Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort, ASTM D1557 designation. **Any engineered fill placed beneath the pool should be placed and compacted in accordance with Section 7.1 of this report.** The soil should be compacted minimum moisture contents of at least 3 percentage points above the optimum moisture content. It may be necessary to adjust the moisture content of the subgrade soil by watering or aeration, to bring the moisture content of the soil near optimum in order that the specified densities can be obtained.

2. Source of Material

Engineered fill materials (on site or import) shall consist of sandy silts, sands, or sands and gravels unless stated otherwise in the report. Engineered fill material shall not contain rocks greater than 3 inches in greatest dimension and should be non-expansive in nature with a plasticity index less than 12.

At least seven days prior to the placement of any fill, the engineer shall be notified of the source of materials. Samples of the proposed fill shall be obtained to determine the suitability of the materials for use as engineered fill.

3. Placing and Compacting

Fill materials shall be spread in layers and shall have a uniform moisture content that will provide the specified dry density after compaction. If necessary to obtain uniform distribution of moisture, water shall be added to each layer by sprinkling and the soil disked, harrowed, or otherwise manipulated after the water is added. The layers of the fill material shall not exceed 8 inches in thickness and each layer shall be compacted with suitable compaction equipment to provide the specified dry densities.

4. Required Densities

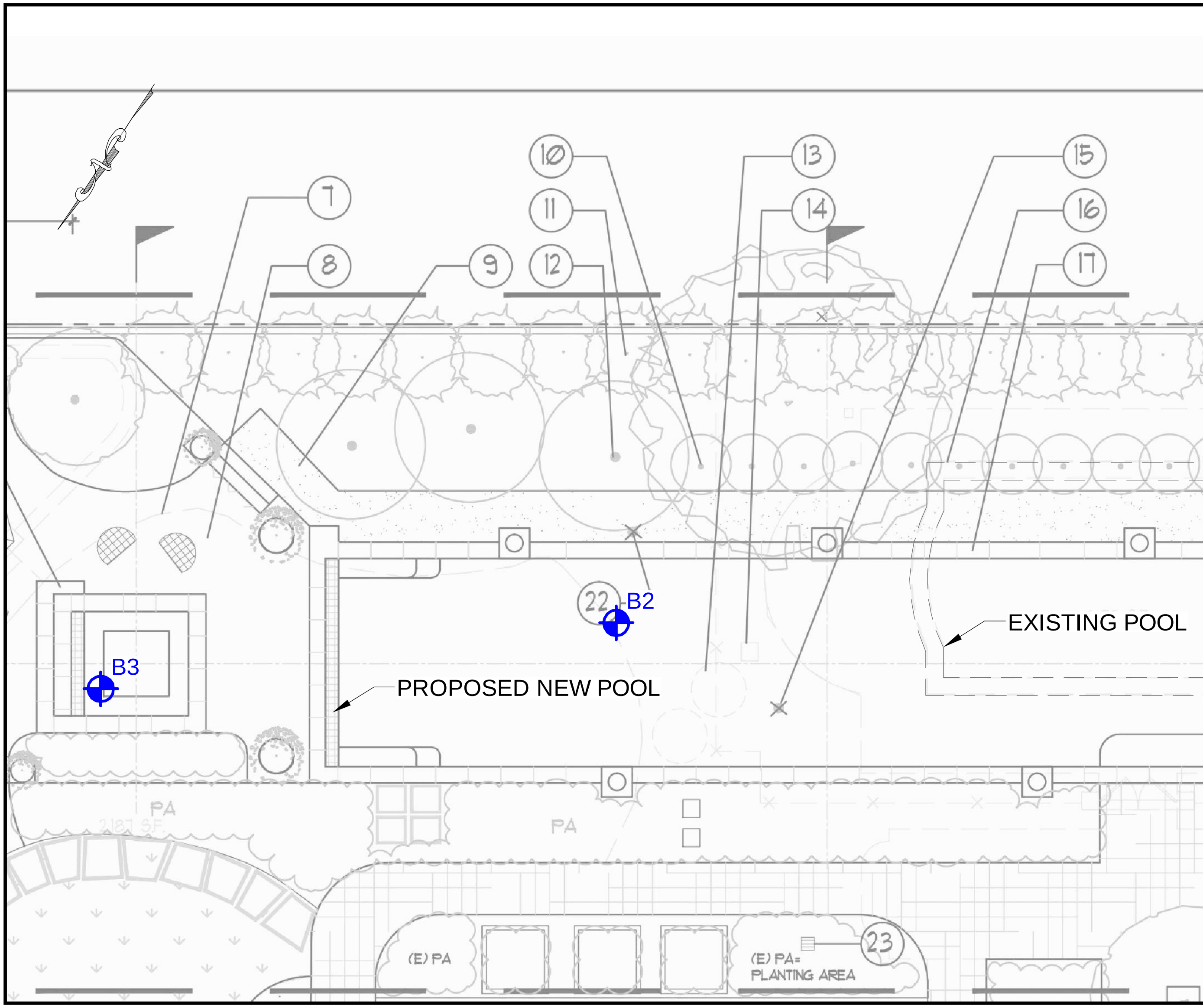
The dry density of the compacted earth shall be at least 90 percent of the maximum dry density obtainable by the ASTM D1557 test method. The optimum moisture content and maximum dry density will be determined by the engineer and this information supplied to the contractor.

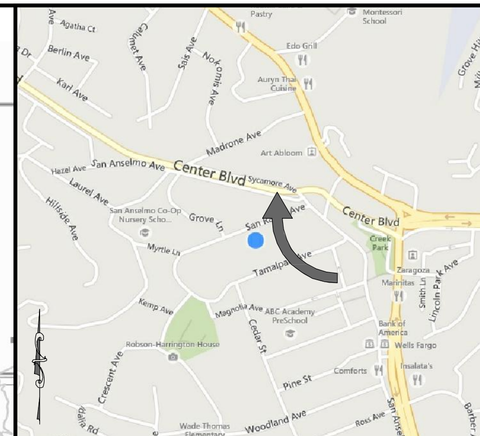
5. Seasonal Limits

No fill shall be placed during weather conditions which will alter the moisture content of the fill materials sufficiently to make adequate compaction impossible. After placing operations have been stopped because of adverse weather conditions, no additional fill material shall be placed until the last layer compacted has been checked and found to be compacted to the specified densities.

6. Control of Compaction

The density of the upper 6 inches of subgrade and of each layer of fill shall be checked by the engineer after each layer has been compacted. Field density tests shall be used to check the compaction of the fill materials. Sufficient tests shall be performed by the engineer on each layer to determine that compaction of the entire area is in general compliance with the compaction specifications. If the dry densities are not satisfactory, the contractor will be required to increase the weight of the roller, the number of passes of the roller, or manipulate the moisture content as required to produce the specified densities.





VICINITY MAP

LEGEND

Approximate location of Boring

NOTE: BORING LOCATIONS ARE APPROXIMATE.
BASE PLAN PROVIDED BY CATLIN LANDSCAPE ARCHITECTURE, SAN ANSELMO, CA.

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BORING LOCATION MAP

BRADLEY RESIDENCE

43 SAN RAFAEL AVE
SAN ANSELMO, CA

DATE:	10/23/2014
JOB NUMBER:	WGE140052
SCALE:	NONE
DRAWN BY:	E. CINTORA
CHECKED BY:	A. TRAN
PLATE:	1

NEIL O. ANDERSON AND ASSOCIATES
A TERRACON COMPANY

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LOG OF BORING
B1
PLATE 2

PROJECT NUMBER: WGE140052
PROJECT NAME: Bradley Residence
LOCATION: San Anselmo, CA
DRILLING METHOD: Hand with AMS Hand Auger and Sampling Kit

DATE DRILLED: 10/2/2014
GROUND SURFACE ELEVATION: 53 Feet
ELEVATION REFERENCE: Google Earth

NOTE: The stratification lines shown represent approximate boundary between soil/rock units which have been located via geotechnical investigation. Boundaries may be gradual.

Depth, ft.	Soil Lithology Description	Ground Water	Sample Location	Sampling Method	Blow Counts	N_{60}	Moisture, %	Dry Density, pcf	Liquid Limit	Plasticity Index	Finer No. 200, %	Unconfined, tsf P.P. or T.V.	Notes
0	CL: Sandy Clay, dark brown, fine, moist, stiff to very stiff												
1			■	HS	93/4"	23	21	78	40	18	68	3.75	PP
4			■	HS	68/4"	15	20	101	35	15	66	3	PP
5.5			■	GS			17						
7	CL: Sandy Clay, olive brown, fine to medium, moist, rust mottling, stiff		■	HS	59/4"	13	19	104				1.5	PP
10	CL: Sandy Clay with 1/8" Gravel, olive brown, fine to coarse, moist, very stiff		■	HS	106/4"	24	18	107					Boring Terminated @ 10.5'

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A TERRACON COMPANY

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LOG OF BORING B2

PLATE 3

PROJECT NUMBER: WGE140052
PROJECT NAME: Bradley Residence
LOCATION: San Anselmo, CA
DRILLING METHOD: Hand with AMS Hand Auger and Sampling Kit

DATE DRILLED: 10/2/2014
GROUND SURFACE ELEVATION: 52 Feet
ELEVATION REFERENCE: Google Earth

Depth, ft.	Soil Lithology	Soil Lithology Description NOTE: The stratification lines shown represent approximate boundary between soil/rock units which have been located via geotechnical investigation. Boundaries may be gradual.	Ground Water	Sample Location	Sampling Method	Blow Counts	N_{60}	Laboratory Data: Moisture, %	Dry Density, pcf	Liquid Limit	Plasticity Index	Finer No. 200, %	Unconfined, tsf P.P. or T.V.	Notes
0		CL: Sandy Clay, brown, fine, dry, with 1/8"-1/4" gravel and rootlets		■	GS			19						
3		CL: Sandy Clay, dark brown, fine, dry, with rootlets, very stiff		■	HS	92/4"	20	17	78				4	PP
6		CL: Sandy Clay, dark brown, fine, moist, with rust mottling, stiff to very stiff		■	HS	68/4"	15	14	89				4	PP
7.5		SC: Clayey Sand, olive brown, fine, moist, with rust and white mottling		■	GS			20						
9		CL: Clay with sand, grey, fine, moist, stiff		■	HS	52/4"	12	20	103	35	17	77	1.5	PP
12		CL: Clay with sand, grey, fine, saturated, stiff	▼	■	HS	46/4"	10	25						
15		SC: Clayey Sand, blue grey with brown, fine, saturated, medium stiff		■	HS	29/4"	6	27						Boring Terminated @ 15.5'

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LOG OF BORING
B3
PLATE 4

PROJECT NUMBER: WGE140052
PROJECT NAME: Bradley Residence
LOCATION: San Anselmo, CA
DRILLING METHOD: Hand with AMS Hand Auger and Sampling Kit

DATE DRILLED: 10/2/2014
GROUND SURFACE ELEVATION: 52 Feet
ELEVATION REFERENCE: Google Earth

Depth, ft.	Soil Lithology	Soil Lithology Description NOTE: The stratification lines shown represent approximate boundary between soil/rock units which have been located via geotechnical investigation. Boundaries may be gradual.	Ground Water	Sample Location	Sampling Method	Blow Counts	N_{60}	Laboratory Data: Moisture, %	Laboratory Data: Dry Density, pcf	Laboratory Data: Liquid Limit	Laboratory Data: Plasticity Index	Laboratory Data: Finer No. 200, %	Laboratory Data: Unconfined, tsf P.P. or T.V.	Notes
0		CL: Sandy Clay, brown, fine, dry, with 1/8"-1/4" gravel, very stiff												
1					HS	71/4"	16	18	75					
5		CL: Sandy Clay, brown, fine, moist, with rootlets, very stiff			HS	80/4"	18	16	78					
6		CL: Sandy Clay, brown, fine, moist, stiff			GS			17						
8		CL: Sandy Clay, brown, fine, moist, with rust mottling, stiff			GS			22						
10		CL: Sandy Clay, brown with grey, fine, moist, with rust mottling, stiff			HS	41/4"	9	23						Boring Terminated @ 10.5'

UNIFIED SOIL CLASSIFICATION SYSTEM AND BORING LOG SYMBOLS

	DESCRIPTION	MAJOR DIVISIONS		
GW	Well-graded gravels, gravel sand mixtures, little or no fines.	Clean gravels (little or no fines)	Gravel and gravelly soils More than 50% of coarse fraction retained on No. 4 sieve	Coarse grained soils more than 50% larger than No. 200 sieve
GP	Poorly-graded gravels, gravel sand mixtures, little or no fines			
GM	Silty gravels, gravel-sand-clay mixtures	Sands with appreciable amount of fines		
GC	Clayey gravels, gravel-sand-clay mixtures			
SW	Well-graded sands, gravelly sands, little or no fines	Clean sand (little or no fines)	Sands and sandy soils More than 50% of coarse fraction passing No. 4 sieve	
SP	Poorly-graded sands, gravelly sands, little or no fines			
SM	Silty sands, sand-silt mixtures	Sands with appreciable amount of fines		
SC	Clayey sands, sand-silt mixtures			
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Liquid limit less than 50	Silts and clays	Fine grained soils more than 50% smaller than No. 200 sieve
CL	Inorganic clays of low to medium plasticity, gravelly clays, lean clays			
OL	Organic silts and organic silty clays of low plasticity			
MH	Inorganic silts, micacious or diatomaceous fine sand or silty soils	Liquid limit greater than 50	Silts and clays	
CH	Inorganic clays of high plasticity, fat clays			
OH	Organic clays of medium to high plasticity, organic silts			
PT	Peat, humas swamp soils with high organic content	Highly organic soils		

DEPTH (FEET)	SAMPLE	SAMPLE TYPE	TEST TYPE	NOTES
	PS	**Push Sample**	Plasticity Grain Size Analysis Uniformity Coefficient Coefficient of Gradation Coefficient of Consolidation Specific Gravity Shrink/Swell Direct Shear Unconfined Compression Triaxial Compression Pocket Penetrometer Torvane Shear Consolidations	pi gr Cu Cc Cv sg s/s ds uc tx p ts c
	SPT	**Drive Sample**, 2.0” o.d., 1.38” i.d., sampler driven with 140 lb. hammer, 30” drop (Standard Penetration Test, SPT).		
	CM	**Drive Sample**, 2.5” o.d., 1.92” i.d., sampler driven with 140 lb. hammer, 30” drop, with 6” tube liners (California Modified, CM).		
	ES	**Ely Sample**, Used to determine unit weight.		
	HS	**Hand Sampler**, 2.0” o.d. sampler driven with 10 lb. hammer, 18” drop, with 4” tube liners.		
	GS	**Grab Sample**, disturbed sample taken from auger tailings and sealed in plastic bag.		

Plate Number 5