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OFFICE OF DESIGN & CONSTRUCTION SERVICES and PHYSICAL FACILITIES

CONTRACTING SERVICES
Building 439
Santa Barbara, California 93106-1030
Telephone (805) 893-3356
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SENT VIA: FAX ON THIS DATE
 HAND DELIVERY ON THIS DATE
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 UNITED PARCEL SERVICE ON THIS DATE

HOLDERS OF PLANS AND SPECIFICATIONS:

Campus Point Stair Access Way
Project No. FM110220S/987767

Addendum No. 3

September 7, 2011

Enclosed is **ADDENDUM NO. 3** to the Construction Documents on the above-captioned project.

Bid date is September 13, 2011 at 2:30 PM to be held at:

CONTRACTING SERVICES
Facilities Management, Bldg. 439
Door #E, Reception Counter
University of California, Santa Barbara
Santa Barbara, CA 93106-1030

Please allow time for unforeseen traffic delays, securing a parking permit and potential parking problems.
Late arrivals shall be disqualified.

Sincerely,

Greg Moore
Associate Director, Contracting Services

ADDENDUM NUMBER 3

to the

Campus Point Stair Access Way

September 7, 2011

GENERAL

The following changes, additions or deletions shall be made to the following document(s) as indicated; all other conditions shall remain the same.

I. SPECIFICATIONS

Item No.

1. Information Available to Bidders, paragraph 5 Reports, Add the following:
“Geotechnical Engineering Report, Bluff Access Stairway, UCSB Lagoon Restoration Project, University of California Santa Barbara, Santa Barbara, California, Project No. 3064.046,” in its entirety (Attached, 19 pages).

2. Supplementary Conditions, paragraph 12, “Modifications of General Conditions, Article 11 – Insurance and Bonds” Add the following:
 - 11.1.2.4 Builder’s Risk.
Course-of-construction (also known as “Builder’s Risk”) insurance covering all risks of loss. (Any proceeds of loss payable under this coverage shall be used to replace, rebuild or repair the damaged portions of the facilities and structures constructed under this agreement.)
 - .1 Minimum Limits: Completed value of the project with no coinsurance penalty provisions.

 - 11.1.2.5 Property Insurance
Property insurance covering the loss, damage, or destruction of the facilities or structures constructed under this agreement against fire and extended coverage perils. (Any proceeds of loss payable under this coverage shall be used to replace, rebuild and/or repair the damaged portions of the facilities and structures constructed under this agreement.)
 - .1 Minimum Limits: 90 percent of full replacement cost of the facilities or structures.

3. General Conditions, Article 15 – “Miscellaneous Provisions, paragraph 15.1.1 Governing Law” **Add** the following:

This agreement is deemed to be entered into in the County of Alameda.

II. DRAWINGS

Item No.

1. Drawing No. S1.1, General Notes
Replace General Note C.1.A, Drilled Piers, in its entirety with revised note per attached sheet SK-L01 (see Attachment 1).
2. Drawing No. S1.1, General Notes
Replace General Note C.2.A, Shallow Foundations, in its entirety with revised note per attached sheet SK-L01 (see Attachment 1).
3. Drawing No. S2.1, Deck Framing Plan
Revise portion of the Deck Framing Plan per the attached sheet SK-L02 (see Attachment 2)
4. Drawing No. S2.1, Deck Framing Plan
Revise detail reference “4/S3.1” to read “3Y/S3.1”.
5. Drawing S2.1, Deck Framing Plan
Under Key Notes, designations (FB1), (FB2), (FB3), etc. refer to specific beams listed in the Structural Calculations Report provided under specification manual section entitled ‘Information Available to Bidders’ (see paragraph 5 Reports).
6. Drawing No. S3.2, Details & Sections
Delete Detail No. 8, Pad Footing Option for Detail [7/S3.1] in its entirety (see Attachment 3).

END OF ADDENDUM THREE

C. FOUNDATIONS

1. DRILLED PIERS

A.) VERTICAL CAPACITY: ON THE BASIS OF OUR UNDERSTANDING OF THE SUBSURFACE CONDITIONS, USE CAST-IN-PLACE PIERS DESIGNED AS FRICTION PIERS TO SUPPORT THE PROPOSED STAIRWAY. ALLOWABLE SIDE FRICTION VALUES OF 200 PSF PER FOOT OF DEPTH AND 1000 PSF PER FOOT OF DEPTH CAN BE ASSUMED FOR THE MARINE TERRACE DEPOSITS AND CLAYSTONE BEDROCK, RESPECTIVELY. WHERE DRILLED PIERS ARE USED (AND WHERE PRACTICAL), THEY SHOULD BE EMBEDDED A MINIMUM OF 5 FEET INTO THE CLAYSTONE BEDROCK OF THE SISQUOC FORMATION.

C. FOUNDATIONS

2. SHALLOW FOUNDATIONS

A.) ALLOWABLE BEARING CAPACITY AND SETTLEMENT: PLANS FROM UCSB INDICATE THAT A RELATIVELY LARGE LANDING OR PLATFORM IS PROPOSED IN THE AREA NORTH OF THE BLUFF SLOPE. BECAUSE DRILLED SHAFT EXCAVATIONS MAY BE DIFFICULT TO CONSTRUCT IN THIS AREA, IN OUR OPINION, SHALLOW FOUNDATIONS MAY BE A MORE PRACTICAL FOUNDATION ALTERNATIVE TO DRILLED PIERS IN THE AREA NORTH OF THE BLUFF SLOPE. IF SHALLOW FOUNDATIONS ARE USED, THEY SHOULD BE DESIGNED FOR AN ALLOWABLE BEARING CAPACITY OF 1,500 POUNDS PER SQUARE FOOT AND THE FOOTINGS BE UNDERLAIN BY A MINIMUM OF 2 FEET OF COMPACTED FILL MATERIAL PLACED AS DESCRIBED IN THE SOILS REPORT. THE FOOTINGS SHOULD BE AT LEAST 2 FEET WIDE AND BE EMBEDDED AT LEAST 12 INCHES BELOW THE LOWEST ADJACENT GRADE. THE SETTLEMENTS RESULTING FROM STATIC FOUNDATION LOADS SHOULD GENERALLY BE LESS THAN APPROXIMATELY 1-INCH TOTAL AND APPROXIMATELY 1/2-INCH DIFFERENTIAL IN 30 FEET ALONG THE BRIDGE ABUTMENT OR WING WALL FOUNDATION.

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UCSB
LAGOON RESTORATION
Campus Point Stairs
Santa Barbara, California

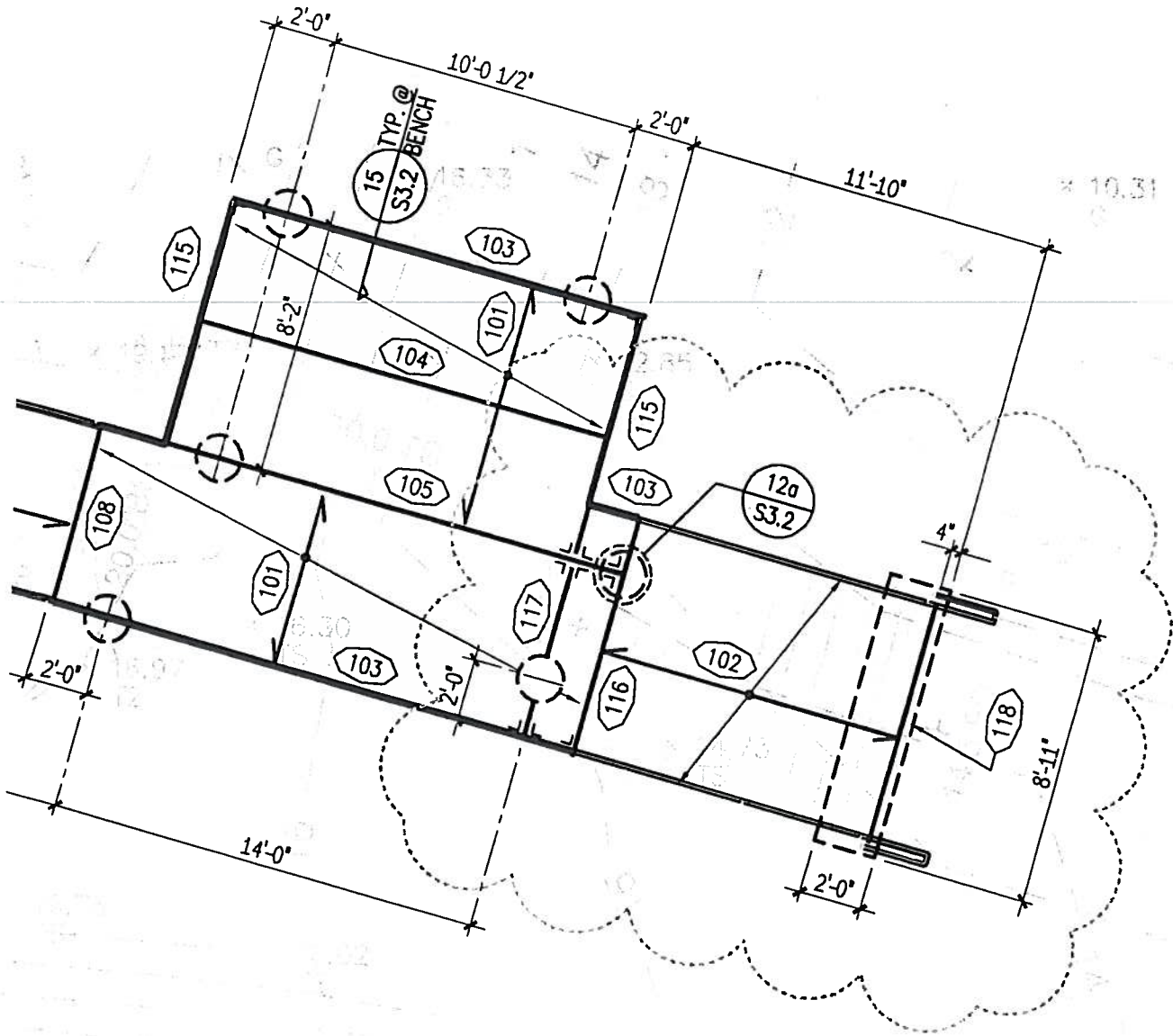
Addendum No. 1
Sheet Reference S1.1

Proj. No.: FM110220S/399-16

Date: 08/03/2011

Scale: N.T.S

SK-L01



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Santa Barbara, California

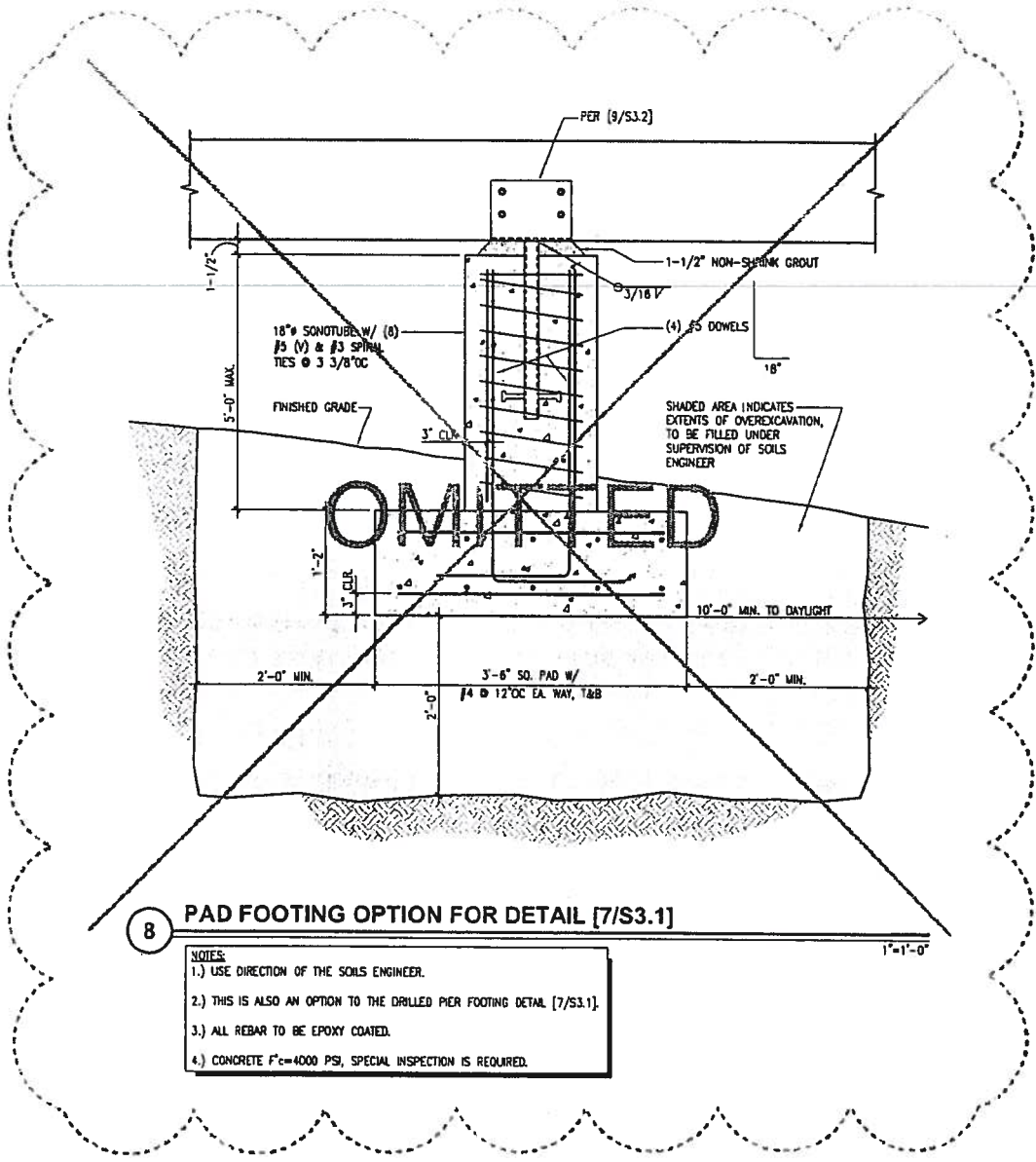
Addendum No. 1
 Sheet Reference S2.1

Proj. No.: FM110220S/399-16

Date: 08/03/2011

Scale: N.T.S.

SK-L02



8 PAD FOOTING OPTION FOR DETAIL [7/S3.1]

- NOTES:**
- 1.) USE DIRECTION OF THE SOILS ENGINEER.
 - 2.) THIS IS ALSO AN OPTION TO THE DRILLED PIER FOOTING DETAIL [7/S3.1].
 - 3.) ALL REBAR TO BE EPOXY COATED.
 - 4.) CONCRETE $F_c=4000$ PSI, SPECIAL INSPECTION IS REQUIRED.

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**UCSB
 LAGOON RESTORATION**
 Campus Point Stairs
 Santa Barbara, California

Addendum No. 1
 Sheet Reference S3.3/DTL 8

Proj. No.: FM110220S/399-16
 Date: 08/03/2011
 Scale: N T S.

SK-L03



March 26, 2007
Project No. 3064.046

University of California at Santa Barbara
Office of Planning and Construction, Building 439
Santa Barbara, California 93106

Attention: Ms. Jennifer Metz

Subject: Geotechnical Engineering Report, Bluff Access Stairway, UCSB Lagoon
Restoration Project, University of California Santa Barbara, Santa Barbara,
California

Dear Ms. Metz:

Fugro is pleased to submit this letter report summarizing our geotechnical evaluation for the proposed bluff access stairway at the main campus of the University of California Santa Barbara (UCSB), Santa Barbara County, California. Geotechnical services for this study were provided in accordance with the scope of services outlined in our proposal dated February 21, 2006, and revised May 17, 2006.

PROJECT DESCRIPTION

The proposed bluff access stairway is located at the southeastern portion of the UCSB lagoon at Campus Point on the main campus of UCSB. The bluff access stairway will provide access between the Campus Point beach and the coastal bluffs and generally consist of constructing a series of wooden stairways and landing areas on the north-facing portion of the bluff between the lagoon and the beach. A series of deeply eroded gullies on the slope of the bluff are currently used as access from the bluffs to the beach. The erosion is occurring from runoff and pedestrian traffic, and we understand the proposed stairs are planned to reduce the erosion impacts on the bluff slope and generally improve this portion of the bluff. The general location of the proposed stairway project is presented on Plate 1 – Site Vicinity Map.

WORK PERFORMED

An outline of our work completed for this report is presented below:

Task 1 – Pre-Design Meeting. Work for this task consisted of attending a pre-design meeting with Jennifer Metz from the UCSB Planning and Development Office, and Lisa Stratton from the Cheadle Center for Biodiversity & Ecological Restoration at UCSB.

Task 2 – Site Reconnaissance. We visited the site area to observe the geologic conditions exposed in the coastal bluffs, the Campus Point beach, and the eroded gullies on the bluff slope where the stairway is proposed. We also located potential subsurface exploration



locations, checked exploration equipment access, and coordinated with Underground Service Alert regarding locations of underground utilities.

Task 3 – Reconnaissance Geologic Mapping. We performed field mapping of the proposed stairway bluff slope to develop an understanding of the geologic stratigraphy in the project area. A reconnaissance geologic map is presented in Plate 2 – Geologic Map and Field Exploration Plan.

Task 4 – Subsurface Exploration. Subsurface exploration for the bluff access stairway project was performed as part of the subsurface exploration program for the UCSB Lagoon Restoration project. One backhoe test pit (TP-3) and boring (DH-1) were excavated and hand sampling was performed at five locations on the bluff slope (S-1 through S-5) at the approximate locations shown on Plate 2 – Geologic Map and Field Exploration Plan. A more detailed description of the test pit and boring excavations and sampling work performed for the project is provided in Appendix A – Field Exploration. Note that TP-1, TP-2, and TP-4 were excavated as part of the wetlands/vernal pool study and the data for those test pits are provided in Fugro (2007)¹

Task 5 – Laboratory Testing. Laboratory testing was performed on selected samples obtained from the test pits and hand sampling locations and were tested for moisture content/dry density, fines content, and shear strength. Brief descriptions of the geotechnical tests performed and the results of the testing program are provided in Appendix B – Laboratory Testing.

Task 6 – Geotechnical Evaluation and Report Preparation. Geotechnical evaluation consisted of assessing field and laboratory test data and performing engineering analyses. This report was prepared using data obtained from our subsurface exploration and geotechnical laboratory testing programs and provides the basis for our geotechnical opinions and recommendations regarding site characteristics and foundation design.

SITE CONDITIONS

Regional and Local Geology

The project is located within the western portion of the Transverse Ranges geomorphic province. The province is locally dominated by the east-west trending Santa Ynez Mountain Range, which extends continuously for about 75 miles from Point Arguello eastward into Ventura County. The Santa Ynez Mountains and adjacent lowlands are comprised of sedimentary rocks and soil materials ranging in age from Cretaceous to recent. Structural geology in the Santa Barbara and Goleta area consists of a south-dipping homocline and adjacent coastal plain cut by a series of subparallel east-west trending faults and folds that are

¹ Fugro (2007), Geotechnical Engineering Report, Proposed Development of Wetlands Habitat, Lagoon Restoration Project, University of California Santa Barbara, Goleta, California, unpublished report prepared for UCSB, Fugro Project No. 3064.046, dated March 22



the result of north-south compressional tectonics. The faults and folds roughly parallel the Santa Ynez Mountains to the north and extend into the Santa Barbara Channel.

The local geology of the Campus Point area generally consists of quaternary-aged marine terrace deposits overlying Miocene-aged Sisquoc formation bedrock. Undifferentiated artificial fill and alluvium and beach sand deposits are present at the north of the base of the bluff slope within the project limits.

Subsurface Conditions

The subsurface conditions at the top of the bluff and the bluff slope area were evaluated in test pit TP-3 and in hand sampling locations S-1 through S-5. The geotechnical conditions at the top of the bluff consist of about 10.5 feet of marine terrace deposits (Qmt₁ and Qmt₂) overlying highly weathered claystone of the Sisquoc formation (Tsq). In the bluff slope area, the conditions consist of a thin veneer of marine terrace deposits (Qmt₁) overlying Sisquoc formation. Sisquoc formation is locally exposed in the bottom of the erosion gullies. No groundwater was encountered during our explorations in the bluff or bluff slope area.

The geotechnical conditions north of the bluff area within the limits of the proposed stairway were evaluated in DH-1 and by reviewing previous geotechnical data in Fugro (1997)². Subsurface conditions encountered in DH-1 consisted of about 9 feet of undifferentiated artificial fill and alluvium overlying extremely weathered Sisquoc formation claystone. Groundwater was encountered in DH-1 at a depth of about 18 feet below the ground surface. The conditions north of DH-1 were evaluated from drill hole data in Fugro (1997). Three drill holes were excavated in the strip of land between the lagoon and the beach. One drill hole was excavated about 60 feet north of the base of the bluff slope (DH-4) and two additional drill holes were excavated in the area of the existing pump station about 180 feet north of the bluff (DH-1 and DH-2). Conditions encountered in those drill holes consisted of undifferentiated artificial fill and alluvium overlying beach sand deposits. Beach sand deposits were encountered to the maximum depth explored for DH-4 of 10 feet and to a depth of about 40 feet in DH-1 and DH-2. Wet soils were noted in DH-1, DH-2, and DH-4 (Fugro 1997) at a depth of about 5 to 6 feet. A copy of the logs for DH-1, DH-2, and DH-4 drilled as part of Fugro (1997) are provided in this report. The location of drill hole DH-4 is shown on Plate 2.

A generalized description of the significant soil material types is provided below.

Undifferentiated Alluvium and Artificial Fill (Qal/Af). Undifferentiated alluvium and artificial fill was encountered in the upper 9 feet of DH-1 at the base of the bluff slope. The soil material consists of loose, brown, and moist silty sand and grades to a soft to medium stiff lean clay with depth. In DH-1, this material was underlain by extremely weathered Sisquoc formation.

² Fugro (1997), Geotechnical Engineering Report, Seawater Renewal Project, University of California Santa Barbara, Santa Barbara, California, unpublished report prepared for UCSB, Fugro Project No. 97-92-7411, dated December 5



The undifferentiated artificial fill and alluvium encountered in the drill holes for Fugro (1997) and excavated north of DH-1 consisted of fine to coarse sand with gravel. A thin layer of clayey sand was logged in DH-4 at a depth of about 3 feet. The undifferentiated artificial fill and alluvium was encountered in the Fugro (1997) explorations to a depth of about 5 feet. Beach sand deposits were encountered in those explorations below the undifferentiated fill and alluvium.

Beach Sand Deposits. As indicated above, beach sand deposits were encountered in the explorations performed in the area between the lagoon and the beach for Fugro (1997). The beach sand deposits generally consist of loose to dense sand with silt with occasional gravel and shell fragments.

Marine Terrace Deposits (Qmt₁ and Qmt₂). The terrace deposits encountered in TP-3 were divided into upper marine terrace deposits (Qmt₁) and lower marine terrace deposits (Qmt₂). The uppermost layer of marine terrace deposits predominantly consists of dark grayish brown to light graying brown, loose, moist to dry silty fine sand to sandy silt. The upper marine terrace deposits were encountered in TP-3 from the ground surface to a depth of about 4 feet. The lower marine terrace deposits (Qmt₂) were encountered in TP-3 below the upper deposits. The lower marine terrace deposits consist of mottled dark yellowish brown to brownish gray, dense, firm silty sand with clay, clayey sand, and very stiff sandy clay. Sisquoc formation bedrock was encountered below the lower terrace deposits in TP-3 at a depth of about 10.5 feet (about elevation 25 feet). Other than at sampling location S-5, Qmt₂ deposits were not observed on the bluff slope or encountered at our hand sampling locations.

Sisquoc Formation (Tsq). The Sisquoc formation is diatomaceous in nature and consists of soft, poorly indurated clayey siltstone. The formation is extremely to highly weathered at the project site but typically becomes moderately to slightly weathered within depths of approximately 10 to 15 feet into the formation. The sediments within the formation can generally be classified as "elastic silt (MH)" based on the Unified Soil Classification System (ASTM D2487).

Groundwater. Groundwater was not observed in the bluff or bluff slope area. Groundwater was measured at the completion of drilling in DH-1 at a depth of about 18 feet and wet soils were noted in DH-1, DH-2, and DH-4 excavated in the area between the lagoon and the beach at a depth of about 5 to 6 feet. We note that transient perched groundwater can develop in the marine terrace deposits or at or near the contact with the Sisquoc formation bedrock. In addition, the depth to groundwater measured in DH-1 may not represent a stabilized water level. For preliminary design, we recommend the groundwater level in this area be assumed at the level of the lagoon or the ocean.

CONCLUSIONS AND RECOMMENDATIONS

Our conclusions and recommendations are based on our exploration and testing programs, together with our understanding of the proposed project. In addition, we anticipate that the column loads for the proposed bluff access stairway will be lightly loaded and designed for pedestrian traffic only and that the stairway will consist of a wooded structure supported on



individual cast-in-place drilled piers or spread footings. We have also assumed that the stability of the existing bluff slope is not an issue relative to the design of the proposed stairway. However, bluff retreat and erosion at the bluff area should be considered a hazard and could impact the performance of the proposed stairway. An assessment of bluff retreat, beach erosion, and the potential for continued erosion of the bluff slope in the gully areas is outside the scope of services for this project.

Because most of the site area consists of relatively steeply sloping topography, we recommend that the proposed stairs and landings be supported on drilled cast in place concrete piers. However, because of the potential for shallow groundwater, the potential for caving in the undifferentiated artificial fill and alluvium and beach sand deposits, and the potentially significant depth to bedrock, supporting the stairs and landings on shallow foundations in the area north of the base of the slope may be a preferable alternative to cast in place concrete piers in this area. Recommendations for drilled concrete piers and shallow foundations are provided below.

Drilled Piers

Vertical Capacity. On the basis of our understanding of the subsurface conditions, we recommend using cast-in-place piers designed as friction piers to support the proposed stairway. Allowable side friction values of 200 psf per foot of depth and 1000 psf per foot of depth can be assumed for the marine terrace deposits and claystone bedrock, respectively. Where drilled piers are used (and where practical), we recommend they be embedded a minimum of 5 feet into the claystone bedrock of the Sisquoc formation.

Lateral Capacity. Lateral resistance for the drilled piers will be provided by passive pressure acting on the side of the shaft. For preliminary design, equivalent fluid pressure of 400 pcf can be assumed for level ground conditions. Where the slope descends away from the piers, the passive pressure should be reduced to 250 pcf. The recommended values of passive pressure are ultimate values and a factor of safety of at least 1.5 should be used in design for overturning conditions.

Drilled Pier Construction Considerations. Cast-in-drilled-hole piles should be installed in general accordance with Section 49 of the Caltrans Standard Specifications and recommendations presented herein. In the bluff area, we anticipate that drilled shafts excavated for the project will encounter marine terrace deposits and Sisquoc formation claystone. If drilled piers are used in the area north of the bluff slope, we anticipate the drilled holes will encounter undifferentiated fill and alluvium and beach sand deposits. Sisquoc formation may be encountered in this area adjacent to the bluff slope.

We anticipate that excavations for drilled shafts in the bluff and bluff slope area should not require the use of casing and/or drilling slurry to advance the drilled shafts to the design depth. However, because shallow groundwater and sandy soils are present in the area north of the bluff slope, casing and/or drill slurry may be required for CIDH piles in this area. Provisions to address potential caving and groundwater in this area should be included in the contract documents. Construction methods should consider the proximity of the work area to the lagoon



and the ocean and to potential environmental issues associated with constructing CIDH piles using casing and/or drilling slurry.

The conditions of the drilled hole should be reviewed for stability before placing reinforcing steel and concrete. Reinforcing steel should be provided with spacers to ensure the required spacing from the sides of the drilled hole. We recommend that rebar spacers consist of the “roller” type rather than concrete cubes or “dobies”. Concrete should be pumped to the base of the piles using a trimie pipe. The concrete should be trimmed to displace groundwater (and loose soils) present at the bottom of the hole. Casing (if used) should be pulled as the concrete level rises in the drilled shaft however a minimum 8 feet of fresh concrete should be inside the casing at all times. The trimie pipe should remain in the fresh concrete through completion of concrete placement. Improper retrieval of the casing or reinsertion of the trimie pipe can cause necking or contamination of the concrete.

Shallow Foundations

Allowable bearing Capacity and Settlement. Plans from UCSB indicate that a relatively large landing or platform is proposed in the area north of the bluff slope. Because drilled shaft excavations may be difficult to construct in this area, in our opinion, shallow foundations may be a more practical foundation alternative to drilled piers in the area north of the bluff slope. If shallow foundations are used, we recommend they be designed for an allowable bearing capacity of 1,500 pounds per square foot and the footings be underlain by a minimum of 2 feet of compacted fill material placed as described in the following sections. The footings should be at least 2 feet wide and be embedded at least 12 inches below the lowest adjacent grade. We estimate that settlements resulting from static foundation loads should generally be less than approximately 1-inch total and approximately 1/2-inch differential in 30 feet along the bridge abutment or wing wall foundation.

Resistance to Lateral Loads. Resistance to lateral loads for shallow foundations can be provided by friction of the base of the footing and passive pressure acting on the buried portion of the footing. Sliding friction acting on the base of the spread footing can provide resistance to lateral loading. Ultimate sliding resistance can be estimated using a coefficient of friction of 0.40 along the base of the footings.

Passive resistance developed from lateral bearing of below-grade walls or footings bearing against compacted fill (assumed to be select fill) can be estimated using a passive pressure corresponding to an equivalent fluid weight of 250 pcf.

The ultimate sliding resistance and passive pressure may be used together without reduction when evaluating overturning or sliding of foundations or below grade walls provided the design incorporates an appropriate factor of safety. Minimum factors of safety of 1.5 and 2.0 are recommended for foundation overturning and sliding, respectively when friction and passive pressure are used together.

Grading For Shallow Foundations. Prior to commencing grading operations, existing fills, soils containing debris, organics, or other unsuitable materials should be cleared from the



construction area. We recommend that the existing soils within a depth of about 2 feet of the foundation level be overexcavated and replaced with compacted fill. The 2-foot overexcavation should extend at least 2 feet beyond the proposed footing limits.

The excavation should be dewatered and free from groundwater seepage and the excavation should be made in a manner that minimizes disturbance of the soils. The excavated subgrade should be cut as neat as possible and observed by Fugro prior to placing fill material. The project specifications should provide for deepening the excavation as needed to provide a stable surface for construction and fill placement.

ADDITIONAL SERVICES

The design and construction phases of the project involve a continuation of the geotechnical evaluation and the observations of site conditions described in this report. In order to provide this continued service, the responsible geotechnical engineer should be in a position to render interpretations, respond to additional information, and observe the contractor's implementation of design. We, therefore, recommend that Fugro be retained during the design and construction stages of this project to provide the additional services identified in this report.

Plan Review

We recommend that Fugro provide a general review of the grading, improvement, and foundation plans. The purpose of this review is to assess general compliance with the earthwork and foundation recommendations of this report, and to confirm that the recommendations given in this report are incorporated in the project design plans and specifications.

Observation and Testing

We recommend that Fugro provide services during the grading and foundation phases of the work. Pile foundation installations should be observed at the time of construction. The purpose of these services is to observe compliance with the initial development concept, specifications, and our geotechnical recommendations. These types of services allow for changes in the recommendations in the event that the subsurface conditions differ from those expected prior to construction.

CLOSURE

Fugro prepared the conclusions and professional opinions presented in this report according to generally accepted geotechnical engineering principles and practices at the time and location this report was prepared. This statement is in lieu of all warranties, expressed or implied.

This report is intended for design-input purposes and has been prepared for the exclusive use of UCSB and their authorized agents. It may not contain sufficient information for other parties or other uses. If any changes are made in the project, as described in this report, the conclusions and recommendations contained in this report should not be considered valid.



Fugro should review any changes in the project, and modify and approve in writing the conclusions and recommendations of this report.

Soil and rock deposits vary in type, strength, and other geotechnical properties between points of observation and exploration. Additionally, groundwater and soil moisture conditions also can vary seasonally or for other reasons. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based upon the findings at the points of exploration, interpolation and extrapolation of information between and beyond the points of observation, and are subject to confirmation based on the conditions revealed by construction. We note that this study does not include any services for the evaluation of the presence or absence of hazardous substances in the soil, groundwater, or surface water. Furthermore, topics such as bluff stability and bluff retreat were outside the scope of this study.

We appreciate the opportunity to continue our involvement with UCSB and work on the Lagoon Restoration Project. Please call our office if you have any questions or comments regarding our geotechnical recommendations for the proposed bluff access stairway.

Sincerely,

FUGRO WEST, INC.


Gregory S. Dentlinger, GE 2249
Associate Engineer


Ryan Wopschall
Staff Geologist



Copies Submitted: 4- Addressee

Attachments:

- Plate 1 – Vicinity Map
- Plate 2 – Geologic Map and Field Exploration Plan
- Appendix A – Subsurface Exploration
- Appendix B – Laboratory Testing

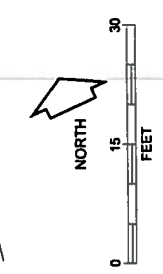


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VICINITY MAP
Bluff Access Stairway - UCSB Lagoon Restoration Project
University of California at Santa Barbara
Goleta, California



GEOLOGIC MAP AND FIELD EXPLORATION PLAN
Bluff Access Stairway - UCSB Lagoon Restoration Project
University of California at Santa Barbara
Goleta, California
PLATE 2



- LEGEND**
- Geologic contact, dashed where approximate
 - ⊕ DH-1 Approximate boring location
 - ⊙ S-5 Approximate hand sample location
 - ⊠ TP-3 Approximate test pit location
 - ⊕ DH-4 Approximate boring location from Fugro (1997)

- Qallaf** Undifferentiated quaternary alluvium and fill
- Qb** Beech Sand
- Qmt1** Marine Terrace Deposits
- Tsq** Sisquoc Formation Bedrock

Topography source: Campus Point Stairway, UCSB Lagoon Restoration, Sheet L1.1 (Van Alst Associates, Inc., 1/15/00).

**APPENDIX A
FIELD EXPLORATION**



APPENDIX A

FIELD EXPLORATION

The field exploration for the Bluff Access Stairway project was done in conjunction with the Lagoon Restoration project and consisted of excavating one backhoe test pit on the coastal bluffs south of the lagoon on February 2, 2007 and excavating one hollow-stem auger boring at the base of the bluff slope on March 13, 2007. Additional hand sampling was performed on the bluff slope area. The field exploration program was conducted in general conformance with our proposal dated May 17, 2006.

Dennis Carroll Contracting provided and operated the backhoe used in our field exploration program and S/G Drilling provided and operated a truck mounted drill rig used for our boring. Test pit TP-3 and drill hole DH-1 were excavated under the observation of an engineer and geologist from Fugro, who prepared logs of the conditions encountered and obtained samples for laboratory observation and testing. The test pit was excavated to a depth of approximately 15 feet below the existing ground surface and the drill hole was excavated to a depth of approximately 25 feet below the existing ground surface. The backhoe test pit and drill hole were backfilled with native material from the excavations.

Modified California samples were obtained in TP-3, DH-1 and along the bluff slope that provides access from the Campus Point beach to the bluffs south of the lagoon. Samples in TP-3 and along the slope were obtained from a hand sampler. Samples obtained in DH-1 were collected using a modified California sampler or standard penetration test (SPT) sampler driven 18-inches into the bottom of the drill hole using a 140-pound automatic trip hammer dropping 30-inches. Recovered samples were placed in transport containers and returned to the laboratory for classification and testing.

Logs of the test pit and drill hole that describe the soils encountered are presented on Plate A-1 Lot of Test Pit and Plate A-2– Log of Drill Hole. A legend of symbols typically used on the test pit logs is given on Plate A-3 – Key to Terms and Symbols Used on Logs. The logs represent the interpretation of field logs and tests, interpolation between samples, and the results of laboratory observation and tests. The stratification lines are approximate boundaries between soil types; the transitions can be gradational.



ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u , ksf
						Campus Point							
						SURFACE EL: 36 ft +/- (rel. MSL datum)							
						MATERIAL DESCRIPTION							
						MARINE TERRACE DEPOSITS (Qmt-1) Silty SAND (SM) to Sandy SILT (ML): loose, dark brownish grey to light greyish brown, moist to dry with depth							
						MARINE TERRACE DEPOSITS (Qmt-2) Silty, Clayey SAND (SC-SM): firm, dark brownish grey to yellowish grey, moist, mottled			5	18			
						SISQUOC FORMATION (Tsq) Clayey SILTSTONE (Rx): soft, poorly indurated, moderate brown to moderate olive brown, damp, highly weathered, shattered, laminated to thinly bedded, friable	92	62	48				0.45 to 0.6
-34	2												
-32	4												
-30	6		4										
-28	8												
-26	10												
-24	12		5										
-22	14												
-20	16												
-18	18												
-16	20												
-14	22												
-12	24												
-10	26												
-8	28												
-6	30												
-4	32												
-2	34												
0	36												
-2	38												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 15.0 ft
 DEPTH TO WATER: Not Encountered
 BACKFILLED WITH: Native Materials
 DRILLING DATE: February 7, 2007

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
 HAMMER TYPE: Automatic Trip
 DRILLED BY: Carroll Backhoe
 LOGGED BY: Ryan Wopschall
 CHECKED BY: G S Denlinger

LOG OF BORING NO. TP-03
 UCSB Lagoon Restoration - Bluff Access Stairway
 Santa Barbara, California



ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: UCSB Campus Point	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u , ksf
						SURFACE EL: 10 ft +/- (rel. MSL datum)							
						MATERIAL DESCRIPTION							
						UNDIFFERENTIATED ALLUVIUM AND ARTIFICIAL FILL (Qal/Af) Sandy SILT (ML): very loose to loose, brown (5YR3/4), moist							
-4	6		2	X	6	Lean CLAY (CL): firm, brown, moist							p 1.8
-10	10		3A 3B		(17)	SISQUOC FORMATION (Tsq) Clayey SILTSTONE (RX): soft, poorly indurated, extremely weathered, very pale orange (10YR8/2) to dark yellowish orange (10YR6/6) mottles, moist							p 2.8
-16	16		4	X	7	firm, highly to extremely weathered, pale olive (10YR6/2), moist							p 2.5
-18	18					▽							
-20	20		5	X	16	stiff to very stiff, moderately weathered, less clay, more coherent rock							p 2.0
-26	26		6	X	28	slightly weathered, increasing structure with depth							p 4.5

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 26.0 ft
 DEPTH TO WATER: 18.0 ft
 BACKFILLED WITH: Cuttings
 DRILLING DATE: March 13, 2007

DRILLING METHOD: 8-inch-dia. Hollow Stem Auger
 HAMMER TYPE: Automatic Trip
 DRILLED BY: S/G Testing
 LOGGED BY: Ryan
 CHECKED BY: G S Denlinger

LOG OF BORING NO. DH-1
 UCSB Lagoon Restoration - Bluff Access Stairway
 Santa Barbara, California



ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLES	BLOW COUNT REC'D/DRIVE"	LOCATION	General Notes
						The drill hole location referencing local landmarks or coordinates	Soil Texture Symbol Sloped line in symbol column indicates transitional boundary Samplers and sampler dimensions (unless otherwise noted in report text) are as follows: Symbol for: 1 SPT Sampler, driven 1-3/8" ID, 2" OD 2 CA Liner Sampler, driven 2-3/8" ID, 3" OD 3 CA Liner Sampler, disturbed 2-3/8" ID, 3" OD 4 Thin-walled Tube, pushed 2-7/8" ID, 3" OD 5 Bulk Bag Sample (from cuttings) 6 CA Liner Sampler, Bagged 7 Hand Auger Sample 8 CME Core Sample 9 Pitcher Sample 10 Lexan Sample 11 Vibracore Sample 12 No Sample Recovered 13 Sonic Soil Core Sample
						SURFACE EL: Using local, MSL, MLLW or other datum	
						MATERIAL DESCRIPTION	Sampler Driving Resistance Number of blows with 140 lb. hammer, falling 30" to drive sampler 1 ft. after seating sampler 6"; for example, Blows/ft Description 25 25 blows drove sampler 12" after initial 6" of seating 86/11" After driving sampler the initial 6" of seating, 36 blows drove sampler through the second 6" interval, and 50 blows drove the sampler 5" into the third interval 50/6" 50 blows drove sampler 6" after initial 6" of seating Ref/3" 50 blows drove sampler 3" during initial 6" seating interval Blow counts for California Liner Sampler shown in () Length of sample symbol approximates recovery length Classification of Soils per ASTM D2487 or D2488 Geologic Formation noted in bold font at the top of interpreted interval Strength Legend Q = Unconfined Compression u = Unconsolidated Undrained Triaxial t = Torvane p = Pocket Penetrometer m = Miniature Vane Water Level Symbols ▽ Initial or perched water level ▼ Final ground water level ⋈ Seepages encountered
-12	2	[Symbol]	1	25		Well graded GRAVEL (GW)	COARSE GRAIN-ZONE
-14	4	[Symbol]	2	(25)		Poorly graded GRAVEL (GP)	
-16	6	[Symbol]	3	(25)		Well graded SAND (SW)	FINE GRAIN-ZONE
-18	8	[Symbol]	4	(25)		Poorly graded SAND (SP)	
-20	10	[Symbol]	5	18"/30"		Silty SAND (SM)	FINE GRAIN-ZONE
-22	12	[Symbol]	6			Clayey SAND (SC)	
-24	14	[Symbol]	7			Silty, Clayey SAND (SC-SM)	FINE GRAIN-ZONE
-26	16	[Symbol]	8	20"/24"		Elastic SILT (MH)	
-28	18	[Symbol]	9			SILT (ML)	FINE GRAIN-ZONE
-30	20	[Symbol]	10	30"/30"		Silty CLAY (CL-ML)	
-32	22	[Symbol]	11	(25)		Fat CLAY (CH)	ROCK
-34	24	[Symbol]	12	30"/30"		Lean CLAY (CL)	
-36	26	[Symbol]	13	20"/24"		CONGLOMERATE	ROCK
-38	28	[Symbol]				SANDSTONE	
-40	30	[Symbol]				SILTSTONE	ROCK
-42	32	[Symbol]				MUDSTONE	
-44	34	[Symbol]				CLAYSTONE	ROCK
-46	36	[Symbol]				BASALT	
-48	38	[Symbol]				ANDESITE BRECCIA	ROCK
		[Symbol]				Paving and/or Base Materials	

KEY TO TERMS & SYMBOLS USED ON LOGS



ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOWCOUNT	LOCATION: South end of pump house dirt road SURFACE EL: 9 ft +/- (rel. MSL datum)	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	Su, ksf
8	0	[Symbol: Fine to coarse sand with gravel]	1	[Symbol: Sampler]	4	ALLUVIUM (Qal) Fine to coarse SAND with gravel (SW): medium dense, moderate olive gray, damp				43			
6	2												
4	4	[Symbol: Clayey fine sand]	NR	[Symbol: Sampler]	(4)	Clayey fine SAND (SC): loose, moderate grayish brown, damp, slight sulfur odor							
2	6	[Symbol: Beach sand deposits]	4	[Symbol: Sampler]	(21)	BEACH SAND DEPOSITS (Qs) Fine SAND (SP) to SAND with silt (SP-SM): loose, dark gray, wet - medium dense at 6-1/2'	128	101	25				
0	8		5	[Symbol: Sampler]	5	- loose at 8'							
-2	10		6	[Symbol: Sampler]	(8)		124	100	24				
-4	12												
-6	14												
-8	16												
-10	18												

COMPLETION DEPTH: 11-1/2 ft
 DEPTH TO WATER: Not Measured
 BACKFILLED WITH: Cuttings
 DRILLING DATE: August 21, 1997

DRILLING METHOD: Hollow Stem Auger
 DRILLED BY: A&R Drilling
 LOGGED BY: GDButler
 CHECKED BY: GSDenlinger

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

LOG OF DRILL HOLE NO. DH-4
 UCSB Seawater System Renewal Project

**APPENDIX B
LABORATORY TESTING**



APPENDIX B

LABORATORY TESTING

This appendix discusses the results of the geotechnical laboratory testing program performed for this geotechnical study. Laboratory tests were performed on selected samples obtained from the field to help classify the soils encountered and to estimate some of their engineering properties. The program was carried out employing, wherever practical, test procedures of the American Society for Testing and Materials (ASTM).

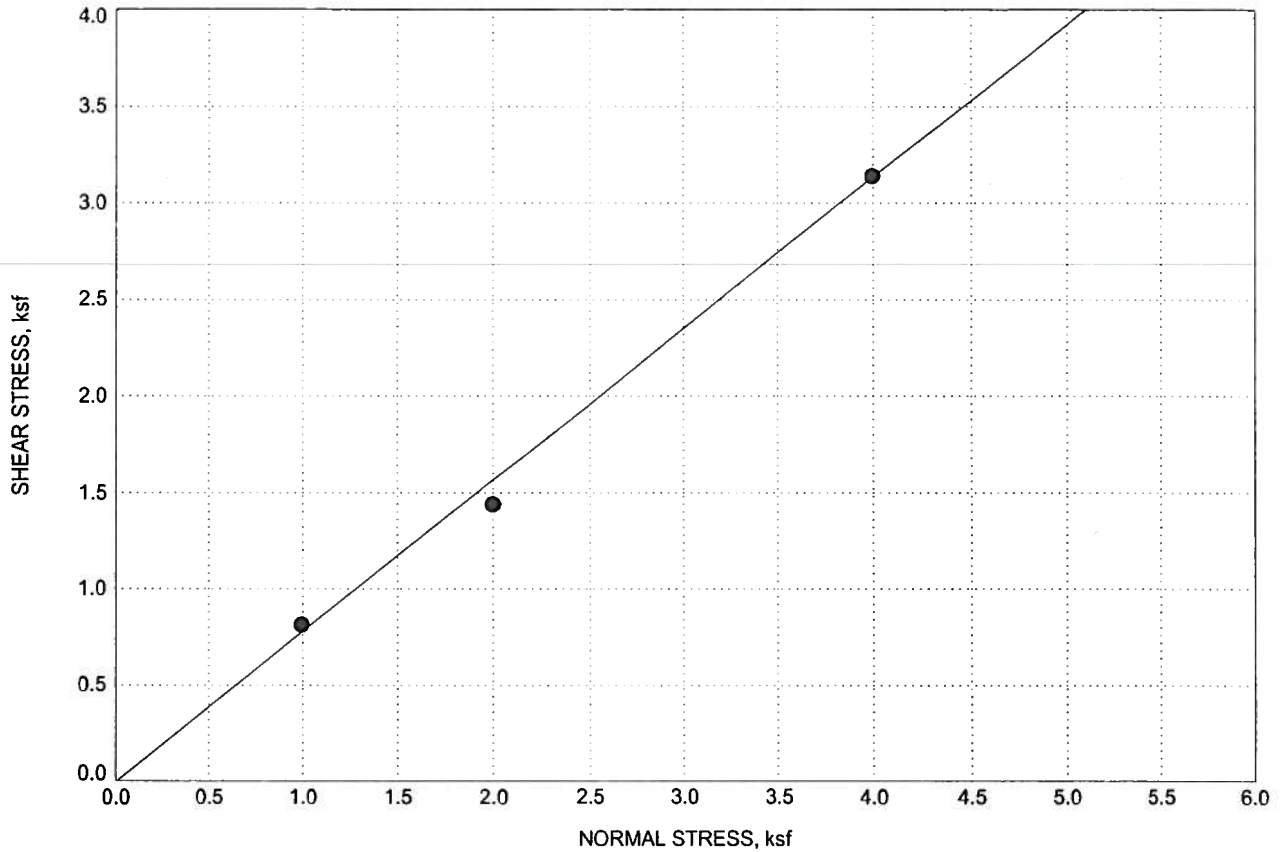
Driven-ring and bulk samples used in the laboratory testing program were obtained from various locations during the course of the field exploration, as discussed in Appendix A. Each sample is identified by sample number and depth. The sample depth refers to the depth to the bottom of the hole prior to sampling. In the case for hand samples S-1 through S-5 along the bluff slope, the depth refers to the elevation above mean sea level where the sample was taken. Hand sample locations and approximate elevation contours are shown on Plate 2 – Geologic Map and Field Exploration Plan. The various laboratory tests performed are described below. A summary of the laboratory tests performed on selected samples is presented on Plate B-1 - Summary of Laboratory Test Results.

- **Laboratory Moisture and Density.** Nine moisture content and dry density tests were performed on selected driven ring and block samples obtained during the field exploration to evaluate the natural moisture content and dry density of the various soil encountered. The results are presented on Plate B-1 and the test pit logs.
- **Percent Finer than #200 Sieve.** Tests for fines content or percent finer than the #200 sieve were made for selected soil samples in general accordance with ASTM D1140. The test results are tabulated on Plate B-1.
- **Direct Shear Tests.** One direct shear test was performed on a selected driven ring sample of the terrace deposits in general accordance with ASTM D3080. The result of the direct shear test is presented on Plate B-2 - Direct Shear Test Results.
- **Unconsolidated Undrained Triaxial Compression Tests.** Triaxial compression tests were performed on selected ring-driven samples obtained from hand sampling locations S-2, S-3, and TP-3. The tests were performed in general accordance with ASTM D2850. Undrained shear strength values estimated from the triaxial compression tests is provided on Plate B-1.



DRILL HOLE	DEPTH, ft	SAMPLE NUMBER	MATERIAL DESCRIPTION	UWWUDW/MCFINES		ATTERBERG LIMITS		COMPACTION TEST		DIRECT SHEAR		COMPRESSIVE STRENGTH TESTS		CORROSION TESTS				R-VALUE	EXPANSION INDEX	SAND EQUIVALENT (SE)	SPECIFIC GRAVITY
				pct	%	LL	PI	MAX DD pct	OPT M/C %	C ksf	PHI deg	Qu ksf	S _u (Cell's) ksf	R	pH	Cl	So ₄ (%)				
S-1	5.0		Clayey SILTSTONE (RX)	89	60	47															
S-2	16.0		Clayey SILTSTONE (RX)	93	73	27							3.9(1.9)								
S-3	21.0		Clayey SILTSTONE (RX)	84	61	38							4.2(2.5)								
S-4	24.0		Clayey SILTSTONE (RX)	102	74	38															
S-5	28.0		Silty SAND (SM)	98	90	9	24			0.0	38										
TP-03	5.0		Clayey SAND (SC)	92	62	48							5.6(1.3)								
TP-03	11.0		Clayey SILTSTONE (RX)																		

SUMMARY OF LABORATORY TEST RESULTS
 UCSB Lagoon Restoration - Bluff Access Stairway
 Santa Barbara, California



COHESION, ksf	0.0
ANGLE OF INTERNAL FRICTION, deg	39
LOCATION	S-5
DEPTH, ft	28
MOISTURE CONTENT, %	9
UNIT DRY WEIGHT, pcf	90
MATERIAL DESCRIPTION	Silty SAND (SM)
SAMPLE CONDITION	Ring Sample

DIRECT SHEAR TEST RESULTS
 UCSB Lagoon Restoration - Bluff Access Stairway
 Santa Barbara, California