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CAPITAL STRATEGIES
PHYSICAL AND ENVIRONMENTAL PLANNING
300 A & E BUILDING
BERKELEY, CALIFORNIA 94720-1382

February 2019

DRAFT SUPPLEMENTAL EIR

TO THE 2020 LONG RANGE DEVELOPMENT PLAN

ENVIRONMENTAL IMPACT REPORT

Project Title:	Upper Hearst Development for the Goldman School of Public Policy and Minor Amendment to the 2020 Long Range Development Plan
Project Location:	The approximately one-acre Project site for the Upper Hearst Development (Assessor's Parcel Number 58-2201-9-1) is located at the Upper Hearst and Ridge parking lots on the northwest corner of La Loma Avenue and Hearst Avenue in the City of Berkeley. The site is bounded to the north by Ridge Road and the Cloyne Court Student Cooperative; to the east by La Loma Avenue; to the south by Hearst Avenue; and to the west by the historic Beta Theta Pi house.
County:	Alameda County, California
Program EIR:	UC Berkeley 2020 Long Range Development Plan EIR, certified by The Regents January 2005, SCH #2003082131; as updated by LRDP Amendment #1 and Addendum #5 to address Climate Change.

1. EXECUTIVE SUMMARY

The California Environmental Quality Act (CEQA) requires lead agencies to disclose and consider the environmental consequences of proposed discretionary projects prior to taking approval action on such projects. As a lead agency, the University of California, Berkeley (UC Berkeley or University) is proposing to construct the mixed-use Upper Hearst Development for the Goldman School of Public Policy (GSPP) (the Upper Hearst Development), and to amend its 2020 Long Range Development Plan (2020 LRDP) to accommodate the proposed housing land use on the Project site (Minor LRDP Amendment). Together, the Upper Hearst Development and amendment to the 2020 LRDP comprise the proposed Project.

This Draft EIR has been prepared to address the environmental effects associated with implementing the proposed Project pursuant to the requirements of CEQA (California Public Resources Code, Section 21000 et seq.), the State CEQA Guidelines (Title 14, California Code of Regulations, Chapter 3, Section 15000 et seq.), and the University of California (UC) procedures for implementing CEQA. As discussed further below, and in accordance with CEQA, this Draft EIR is a Supplemental EIR (SEIR) which is “tiered” from the 2020 Long Range Development Plan Final EIR (State Clearinghouse [SCH] No. 2003082131), certified by The Regents in January 2005, and updated by LRDP Amendment #1 and Addendum #5 to address Climate Change (referred to herein as the 2020 LRDP EIR).

This Executive Summary has been prepared in accordance with CEQA Guidelines Section 15123(b), which states that an EIR should contain a brief summary of the proposed actions and its consequences and should identify (1) each significant effect with proposed mitigation measures and alternatives that would reduce or avoid that effect; (2) areas of controversy known to the lead agency; and (3) issues to be resolved, including the choice among alternatives and how to mitigate significant effects.

1.1 PROJECT SUMMARY

Proposed Project

The Upper Hearst Development would have both residential and academic components. The residential component of the Upper Hearst Development would be constructed in a new building on top of a new Upper Hearst parking structure, as well as on the adjacent at-grade Ridge parking lot at the corner of Ridge Road and La Loma Avenue. The residential component would consist of up to 150 residential units in a mixture of studio and one- and two-bedroom apartments in a building up to six stories tall. At its maximum height, the residential roofline would be up to approximately 72 feet tall on the Ridge Road (north) side, up to 69 feet on the La Loma Avenue (east) side and up to 87 feet tall on the Hearst Avenue (south) side. Motor vehicles would access the parking structure below the residential building via a driveway from Hearst Avenue. To accommodate the new residential building, the entire Ridge surface parking lot would be demolished. As a result of removing existing parking areas, the Upper Hearst Development would reduce the total number of parking spaces on-site from 407 to an estimated 200, including marked parking stalls and attendant parking capacity.

A separate academic building would be constructed to the immediate east of the existing GSPP building, with a minimum setback of 10 feet from the existing building. To accommodate the academic building, the Upper Hearst parking structure would be demolished. The approximately 37,000 gross square feet of office, classroom, and event space in the academic building would serve GSPP’s undergraduate, graduate and Global Executive Education programs. The academic building would be four stories in height over one subterranean level. The fourth level would provide access to a rooftop terrace. The centerpiece of the design would be a two-story atrium bordered on the exterior by a glass façade. This atrium would face west toward the existing GSPP building located at 2607 Hearst Avenue and would have public space and interaction areas. By the end of the 2022-23 academic year, the academic building would house five permanent staff members and 30 students on an average, year-round basis. The academic building's event space would have a seating capacity of 300 and would accommodate up to 450 visitors at maximum capacity; public and private events would occur periodically during both daytime and evening hours.

The Minor LRDP Amendment would accommodate the proposed housing land use on the Project site. Specifically, the Minor LRDP Amendment would expand the Housing Zone to accommodate residential development on the Project site (see Appendix B).

Please see Section 3, *Project Description*, for additional Project information and plans.

Environmental Analysis

This Draft SEIR has been prepared pursuant to CEQA and the CEQA Guidelines to evaluate the environmental effects of the proposed Project, and to identify feasible mitigation measures and alternatives to reduce or avoid the Project's significant impacts.

The Draft SEIR also establishes an updated population baseline to reflect the existing campus headcount (which is greater than the projections in the 2020 LRDP) and new campus headcount projections through the 2022-23 school year, when increased enrollment at GSPP as a result of the Project would plateau. Despite the growth in campus headcount over 2020 LRDP projections, which led to the new baseline, the analysis in this SEIR demonstrates that the UC Berkeley campus is still operating within the capacity and demand identified and analyzed in the 2020 LRDP EIR for resources such as housing, water, electricity and public services, among others. Moreover, to date, UC Berkeley has accommodated the increased campus headcount completely within the physical development identified in the 2020 LRDP and, in fact, has developed fewer square feet of academic and support space and fewer housing units than what was identified in the 2020 LRDP and analyzed in the 2020 LRDP EIR. Nonetheless, in its response to comments to the 2020 LRDP EIR, UC Berkeley made a commitment to the City of Berkeley that, if enrollment increased beyond the projections set forth in the 2020 LRDP, it would undertake additional review under CEQA.

Consistent with this commitment, the SEIR uses an updated population baseline and, in its environmental analysis of each impact category, takes this updated baseline into account and explains how it factors into and/or affects the environmental analysis and significance conclusions reached in the 2020 LRDP EIR and this SEIR. For some impact categories, such as Aesthetics, Cultural Resources, Land Use, and Tribal Cultural Resources, the analysis of whether the increased headcount would cause environmental impacts hinges on physical development to accommodate an increased headcount. For other impact categories, such as Air Quality, Greenhouse Gas Emissions, Noise, Population, Public Services, and Transportation and Traffic, the analysis of whether the increased headcount would cause environmental impacts hinges on population numbers on the campus. The introductory section of each impact category in Section 6, *Environmental Evaluation*, explains the approach taken to account for the increased campus headcount in that section, and how the increase in campus headcount factors into the impact analysis.

Project Alternatives

In accordance with Section 15126.6 of the State CEQA Guidelines, Section 8 of this Draft SEIR describes alternatives to the proposed Project; compares their potential environmental effects to those of the proposed Project; and discusses their ability to meet the Project objectives. The following summarizes each alternative evaluated in this Draft SEIR.

- No Project Alternative. The No Project Alternative assumes that existing conditions would continue. None of the components of the Upper Hearst Development described in Section 3 would be approved, and the existing Upper Hearst parking structure and surface Ridge Lot would be maintained on the Project site as they currently exist. UC Berkeley would not make changes to the existing environment on-site.
- Off-site Lease Agreement Alternative. Under the Off-site Lease Agreement Alternative, GSPP would meet its need for additional academic capacity for GSPP by leasing space in existing buildings on or near the UC Berkeley campus, instead of constructing the proposed Upper Hearst Development. The Project site would remain in its current state, with the existing Upper Hearst parking structure and Ridge surface parking lot. Although UC Berkeley has not identified specific opportunity sites that are available for leasing, it is assumed that physical space of equal size to the proposed 37,000 square-foot academic building would be available to accommodate an expansion of GSPP's academic facilities. This alternative would not involve the construction or leasing of additional residential space for faculty or students.
- Academic Building Only Alternative. Similar to the Project, the Academic Building Only Alternative would involve construction of an academic building on the Project site. While the proposed academic building would be located on the southwestern portion of the site, adjacent to the Beta Theta Pi house, this alternative would place the academic building on the northern portion of the site, where it would replace the Ridge surface parking lot. No residential building would be constructed. By relocating the new academic building and not constructing a residential building, UC Berkeley would retain the existing Upper Heart parking structure. The new academic building also would be reduced to two stories in height, but it would have a similar floor area to the proposed Project (37,000 square feet), by occupying a larger building footprint.
- Reduced Scale Alternative. This Reduced Scale Alternative would reduce the proposed scale of the new academic and residential buildings, thereby reducing the proposed Project's impacts related to compatibility with the surrounding development, including adjacent historic properties. Under this alternative, the new academic building would have a reduced floor area of approximately 25,000 square feet, compared to 37,000 square feet under the proposed Project, while the residential building would have 120 dwelling units (30 fewer than the proposed Project). By reducing the floor area of new buildings, the academic building's height would be reduced from four to three stories, while the residential building would be reduced from up to six to four stories. The new buildings would have increased setbacks from streets relative to the proposed Project. It is assumed that these setbacks would be consistent with the City's R-3 zone standards. As for the proposed development, it is assumed that UC Berkeley would fully demolish the Upper Hearst parking structure to accommodate the new buildings. To accommodate 120 dwelling units in the residential building while reducing its scale, this alternative would involve the removal of more parking spaces than proposed for the Project.

1.2 ISSUES TO BE RESOLVED

Section 15123(b)(3) of the CEQA Guidelines requires that an EIR contain a discussion of issues to be resolved, including the choice among alternatives and whether or how to mitigate significant impacts. With respect to the proposed Project, the key issues to be resolved include decisions by lead agency, as to:

- Whether this environmental document adequately describes the environmental impacts of the proposed Project;
- Whether the mitigation measures and identified campus programs, practices and procedures should be modified and/or adopted;
- Whether the Project's benefits override those environmental impacts that cannot be feasibly avoided or mitigated to a level below significance;
- Whether there are other mitigation measures that should be applied to the Project besides those identified in the EIR; and
- Whether there are any alternatives to the Project that would substantially lessen any of its significant impacts while achieving most of the basic Project objectives.

1.3 AREAS OF CONTROVERSY

Section 15123(b)(2) of the CEQA Guidelines indicates that an EIR summary should identify areas of controversy known to the lead agency, including issues raised by agencies and the public. This Draft SEIR has taken into consideration the comments received from the public and various agencies in response to the Notice of Preparation (NOP) and during the public scoping session held on March 20, 2018. Written comments received during the NOP and scoping period are contained in Appendix A of this SEIR. Environmental issues that have been raised during opportunities for public input regarding the Project are summarized in Section 2, *Introduction*, of this Draft SEIR and are addressed in each relevant issue area analyzed in Section 6, *Environmental Evaluation*, of this Draft SEIR.

Based on input received from the public during the scoping process, areas of controversy include environmental impacts related to population growth, compatibility with historic resources, and utilities.

1.4 SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS

Table 1 presents a summary of the significant environmental impacts resulting from the proposed Project. It should be noted that all relevant continuing best practices (CBPs) and mitigation measures (MMs) from the 2020 LRDP EIR are incorporated into the Project description and would be implemented as a part of the Project and monitored through the Mitigation Monitoring and Reporting Program (MMRP) approved for the Project. Relevant CBPs and MMs from the 2020 LRDP EIR are listed in the introduction to the analysis for each topical issue in Section 6, *Environmental Evaluation*.

Table 1 addresses only those thresholds for which additional project-level analysis is required in this Draft SEIR. Thresholds for which it was determined that no further analysis is required are summarized in the respective topical SEIR sections. Only the CBPs and MMs relevant to the thresholds addressed in this Draft SEIR are included in Table 1-1; the Mitigation Monitoring and Reporting Program (MMRP) that will be prepared for the Project (as discussed below) will include all applicable CBPs and MMs as identified in the SEIR. As shown in Table 1, even with incorporation of the applicable CBPs and MMs, the proposed Project would result in new significant and unavoidable impacts, beyond those identified in the 2020 LRDP EIR, related to visual character and quality and land use compatibility. For the other topical issues, the proposed Project would not introduce new significant and unavoidable impacts or more severe impacts than identified in the 2020 LRDP EIR.

Table 1:
Summary of Significant and Unavoidable Impacts

Resource Topic	Significant and Unavoidable Impact	Applicable Mitigation	Comparison to 2020 LRDP EIR
Aesthetics	Visual character and quality	None	New significant and unavoidable impact
Cultural Resources	Historical resources	▪ 2020 LRDP EIR mitigation: MM CUL-3 ▪ Project-specific mitigation: MM CUL-1	Same impact level
Land Use	Land use compatibility	None	New significant and unavoidable impact
Noise	Construction noise	▪ 2020 LRDP EIR mitigation: MM NOI-4	Same impact level
	Exposure of new residents to ambient noise	▪ 2020 LRDP EIR mitigation: MM NOI-3	Same impact level

2. INTRODUCTION

2.1 INTENDED USES AND PURPOSE OF THE SUPPLEMENTAL EIR

UC Berkeley is proposing to construct and operate the proposed Project on an approximately 44,900-square-foot portion (just over one acre) of a University-owned property at the northwest corner of La Loma Avenue and Hearst Avenue, across Hearst Avenue from the northeastern portion of the UC Berkeley Campus Park. The proposed Project will create vital new academic and study spaces for GSPP programs, maintain as much parking as possible, and incorporate much needed housing. A detailed description is provided in Section 3, *Project Description*, of this Draft SEIR.

This Draft SEIR has been prepared to identify and analyze the environmental impacts associated with implementation of the proposed Project, as well as feasible mitigation measures and alternatives to reduce or avoid the Project's significant effects. This Draft SEIR been prepared in conformance with CEQA and the CEQA Guidelines, and with the University of California (UC) procedures for implementing CEQA. The lead agency is required to consider the information and analysis in the SEIR, along with any other relevant information, in making its decisions on the proposed Project.

The Draft SEIR also updates the 2020 LRDP EIR's population baseline to reflect existing campus headcount as that headcount is greater than the projections used in the 2020 LRDP EIR. The updated baseline and accompanying analysis are intended to facilitate future environmental review of campus development projects that will tier from the 2020 LRDP EIR.

2.2 TYPE OF ENVIRONMENTAL IMPACT REPORT

The 2020 Long Range Development Plan (LRDP) EIR (State Clearinghouse [SCH] No. 2003082131) was prepared to analyze the environmental effects of the 2020 LRDP and was certified by The Regents in January 2005. The 2020 LRDP EIR was updated by LRDP Amendment #1 and Addendum #5 to address Climate Change. The 2020 LRDP EIR is a Program EIR and was prepared in accordance with CEQA Sections 21080.09 and CEQA Guidelines Section 15168.

It has been determined that a supplemental EIR (SEIR) tiered from the 2020 LRDP EIR is the appropriate environmental document for the proposed Project. If an agency determines that one of the conditions described in Public Resources Code Section 21166 and CEQA Guidelines Section 15162 applies to a subsequent discretionary approval, it must prepare either a subsequent EIR or a supplemental EIR. Under CEQA Guidelines Section 15162 a subsequent EIR is required if:

1. Substantial changes are proposed in the project requiring major revisions to the previous EIR because of new significant environmental effects or a substantial increase in the severity of previously identified significant effects;
2. Substantial changes have occurred with respect to the circumstances under which the project is undertaken, which will require major revisions to the previous EIR due to the involvement of new significant environmental effects or a substantial increase in the severity of previously identified significant effects; or
3. New information of substantial importance which was not known and could not have been known with the exercise of reasonable diligence at the time the EIR was certified as complete shows any of the following: (a) the project will have one or more significant effects

> not discussed in the previous EIR; (b) significant effects previously examined will be substantially more severe than shown in the previous EIR; (c) mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or (d) mitigation measures or alternatives which are considerably different from those analyzed in the Final EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative.

CEQA Guidelines Section 15163 sets forth the circumstances under which a project may warrant a supplemental (rather than subsequent) EIR. Specifically, a lead agency shall prepare a supplement to an EIR if any of the conditions described in Section 15162 requiring a further EIR are found, but only minor additions or changes would be necessary to make the original EIR adequate.

With respect to tiering from the 2020 LRDP EIR, CEQA and the CEQA Guidelines encourage the use of tiered environmental documents to eliminate repetitive discussion of the same issues. According to Section 15152 of the CEQA Guidelines "'[t]iering' refers to using the analysis of general matters contained in a broader EIR (such as one prepared for a general plan or policy statement) with later EIRs and negative declarations on narrower projects; incorporating by reference the general discussions from the broader EIR; and concentrating the later EIR or negative declaration solely on issues specific to the later project." Therefore, this SEIR is tiered from the 2020 LRDP EIR. The 2020 LRDP EIR is available for review at: https://capitalstrategies.berkeley.edu/campus-planning/planning-documents.

Section 15152(f) of the CEQA Guidelines instructs that when tiering, a later EIR or Negative Declaration shall be prepared only when the lead agency has determined that the later project may cause significant effects on the environment that were not adequately addressed in the prior EIR or Negative Declaration. Significant environmental effects are considered to have been "adequately addressed" if the lead agency determines that:

(A) they have been mitigated or avoided as a result of the prior environmental impact report and findings adopted in connection with that prior environmental report; or

(B) they have been examined at a sufficient level of detail in the prior environmental impact report to enable those effects to be mitigated or avoided by site specific revisions, the imposition of conditions, or by other means in connection with the approval of the later project.

The 2020 LRDP EIR indicated that projects implementing the 2020 LRDP would be examined to determine whether subsequent project–specific environmental documents are required. (See 2020 LRDP EIR Vol I page 1-2). UC Berkeley's use of the 2020 LRDP and 2020 LRDP EIR in project review was also specifically addressed in the first Thematic Response to comments received on the 2020 LRDP Draft EIR (2020 LRDP EIR Vol 3a, page 11.1- 1), which explained that projects "subsequently proposed must be examined for consistency with the program as described in the 2020 LRDP and with the environmental impact analysis contained in the 2020 LRDP EIR; if new environmental impacts would occur, or if new mitigation measures would be required, an additional environmental document would be prepared."

In conjunction with certification of the 2020 LRDP EIR and approval of the 2020 LRDP, The Regents also adopted a Mitigation Monitoring and Reporting Program (MMRP). The MMRP ensures that campus continuing best practices (CBPs) and mitigation measures (MMs) that are the responsibility of UC Berkeley are enforceable, and implemented in a timely manner. As individual projects, such as the proposed Project, are designed and constructed, they include features necessary to implement relevant CBPs and MMs. In accordance with the Regents' approval of the 2020 LRDP and certification of the 2020 LRDP EIR, all relevant 2020 LRDP EIR CBPs and MMs are incorporated into the proposed Project description and will be implemented as a part of the Project and monitored through the MMRP approved for the 2020 LRDP EIR.

Relevant 2020 LRDP EIR CBPs and MMs are listed in the introduction to the analysis for each topical issue in Section 6, *Environmental Evaluation*. In addition to CBPs and MMs from the 2020 LRDP EIR MMRP relevant to the proposed Project, this SEIR identifies new Project-specific mitigation measures to reduce or avoid Project-specific impacts on historic resources; nonetheless, the SEIR finds a significant unavoidable impact on historic resources.

In summary, this tiered Draft SEIR provides a project-specific environmental analysis to determine if the proposed Project would result in any significant impacts not adequately addressed in the 2020 LRDP EIR and/or if additional mitigation measures beyond those adopted in the MMRP for the 2020 LRDP EIR would be required to reduce impacts to a less than significant level.

2.3 ENVIRONMENTAL IMPACT REPORT PROCESS AND REVIEW

UC Berkeley published and circulated a Notice of Preparation (NOP) of a Draft EIR for the Project on August 15, 2018. UC Berkeley received five formal comment letters during the 30-day NOP review period, from the following agencies, groups and individuals:

- Timothy Burroughs, Director, Department of Planning & Development, City of Berkeley
- Steven Finacom, Chair, City of Berkeley Landmarks Preservation Commission
- David J. Rehnstrom, Manager of Water Distribution Planning, East Bay Municipal Utility District
- Thomas N. Lippe, on behalf of Save Berkeley's Neighborhoods
- Frank Lienert, Associate Governmental Program Analyst, Native American Heritage Commission

Topics of concern raised in the NOP comment letters included impacts related to population growth, compatibility with historic resources, and utilities. Each of these topics is addressed in the SEIR's resource area analysis. The letters are included in Appendix A.

A public hearing on the SEIR will be held on March 12, 2019, at the UC Berkeley Alumni House east of the Haas Pavilion, beginning at 6:30 p.m. Comments on the SEIR must be received in the UC Berkeley Planning Office, 300 A&E Building, UC Berkeley, Berkeley, CA 94720-1382 or via email to planning@berkeley.edu, no later than 5:00 PM on April 8, 2019. For more information contact Raphael Breines, Senior Planner, at (510) 642-6796 or rbreines@berkeley.edu.

Hard copies of the SEIR and the 2020 LRDP EIR are available for review during normal operating hours at Capital Projects' Physical and Environmental Planning offices, 1st floor of the A&E Building on the UC Berkeley campus; and online at https://capitalstrategies.berkeley.edu/capital-projects/design-planning.

The proposed Project is scheduled for consideration of CEQA and design approval at the May 2019 meeting of The Regents of the University of California committee on Finance and Capital Strategies.

Upon certification of the SEIR, The Regents will consider whether to approve the proposed Project. As a part of their consideration for project approval, The Regents must approve Findings of Fact, a Statement of Overriding Considerations, and an MMRP. Where feasible mitigation measures are not available to reduce significant environmental impacts to a less than significant level, impacts are considered significant and unavoidable. Written findings will be prepared for each significant environmental effect identified in the SEIR, as required by CEQA Guidelines Section 15091. If The Regents certify an EIR for a project that has significant and unavoidable impacts, The Regents shall also state, in writing, the specific reasons for approving the project based on the Final EIR and any other information in the public record. This is called a "Statement of Overriding Considerations" and is used to explain the specific reasons that the benefits of a proposed project make its unavoidable environmental effects acceptable. The Statement of Overriding Considerations is adopted when the Final EIR is certified and before action to approve the proposed Project has been taken. Additionally, The Regents must adopt the MMRP to ensure compliance with mitigation measures that have been incorporated into the proposed Project to reduce or avoid significant effects on the environment during construction and/or implementation.

2.4 ORGANIZATION OF THIS DOCUMENT/TABLE OF CONTENTS

This SEIR is organized into the following sections:

Appendices:

3. PROJECT DESCRIPTION

3.1 PROJECT LOCATION

UC Berkeley is located approximately ten miles east of San Francisco, as shown in Figure 1. Interstate 80, Highway 13, Highway 24, and Interstate 580 provide regional vehicular access to the campus. Regional transit access is provided by Bay Area Rapid Transit District (BART) and Alameda-Contra Costa Transit (AC Transit).

As shown in Figure 2, the Project site for the Upper Hearst Development is located on the northwest corner of La Loma Avenue and Hearst Avenue, across Hearst Avenue from the northeastern portion of the UC Berkeley Campus Park. The site is bordered on the north by Ridge Road and older, two to three-story modest-sized single-family and multi-family residential buildings across Ridge Road; on the east by La Loma Avenue and the four-story Foothill Student Housing complex; on the south by Hearst Avenue and the approximately four-story Cory Hall within the Campus Park across Hearst Avenue; and on the west by the approximately three-story GSPP buildings and a four-story student housing building (Cloyne Court Student Cooperative).

3.2 SITE DESCRIPTION

The L-shaped Project site is an approximately 44,900-square-foot portion (just over one acre) of a University-owned property. The site has approximately 125 feet of frontage on Hearst Avenue, 214 feet on La Loma Avenue, and 100 feet on Ridge Road. The southern portion of the site is developed with the 52-foot-tall, four-story Upper Hearst parking structure (also known on campus maps as Parking Structure H), containing 387 parking spaces. This parking structure curves around the corner of the intersection of Hearst Avenue and La Loma Avenue, with chain-link fencing on the roof enclosing the La Loma recreational field, a UC Berkeley Recreational Sports venue. The northern portion of the site is the at-grade, paved Ridge parking lot containing 20 parking stalls with concrete entrance ramps to the west and southeast that lead to the subterranean portions of the Upper Hearst parking structure.

Approximately 49 trees are located within and adjacent to the property lines of the Project site, including street trees. The most prominent trees are two coast redwoods (*Sequoia sempervirens*), both approximately 30 inches in diameter, located in a planter between the northeastern driveway to the Upper Hearst parking structure and La Loma Avenue. Nineteen deciduous sweet gum trees (*Liquidambar styraciflua*) occur in the public right-of-way adjacent to the Project site along Ridge Road, La Loma Avenue, and Hearst Avenue. The front and side yards of the Beta Theta Pi house include ten Victorian box trees (*Pittosporum undulatum*), five Kousa dogwoods (*Cornus kousa*), two Japanese maples (*Acer japonica*), two valley oaks (*Quercus lobata*), a Camperdown elm (*Ulmus glabra 'Camperdownii'*), a hornbeam tree (*Carpinus betulus*), a river birch (*Betulus nigra*), and a sweet gum tree. A valley oak, a coast live oak (*Quercus agrifolia*), and four acacia (*Acacia melanoxylon*) trees occur in the Ridge parking lot. Foundation shrub planting and vine plants also surround the parking structure's façade. Wooden utility poles with downward-facing street lights line La Loma Avenue adjacent to the Project site. Figures 3a through 3c show photographs of existing conditions on and adjacent to the Project site.

The Project site is located within the area of campus designated in the 2020 LRDP as the "City Environs," and within the City Environs' Adjacent Blocks North subarea. The areas within the City Environs are similar in consisting mostly of city blocks served by city streets, and include University-owned properties

FIGURE 1 REGIONAL LOCATION

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FIGURE 2 PROJECT LOCATION

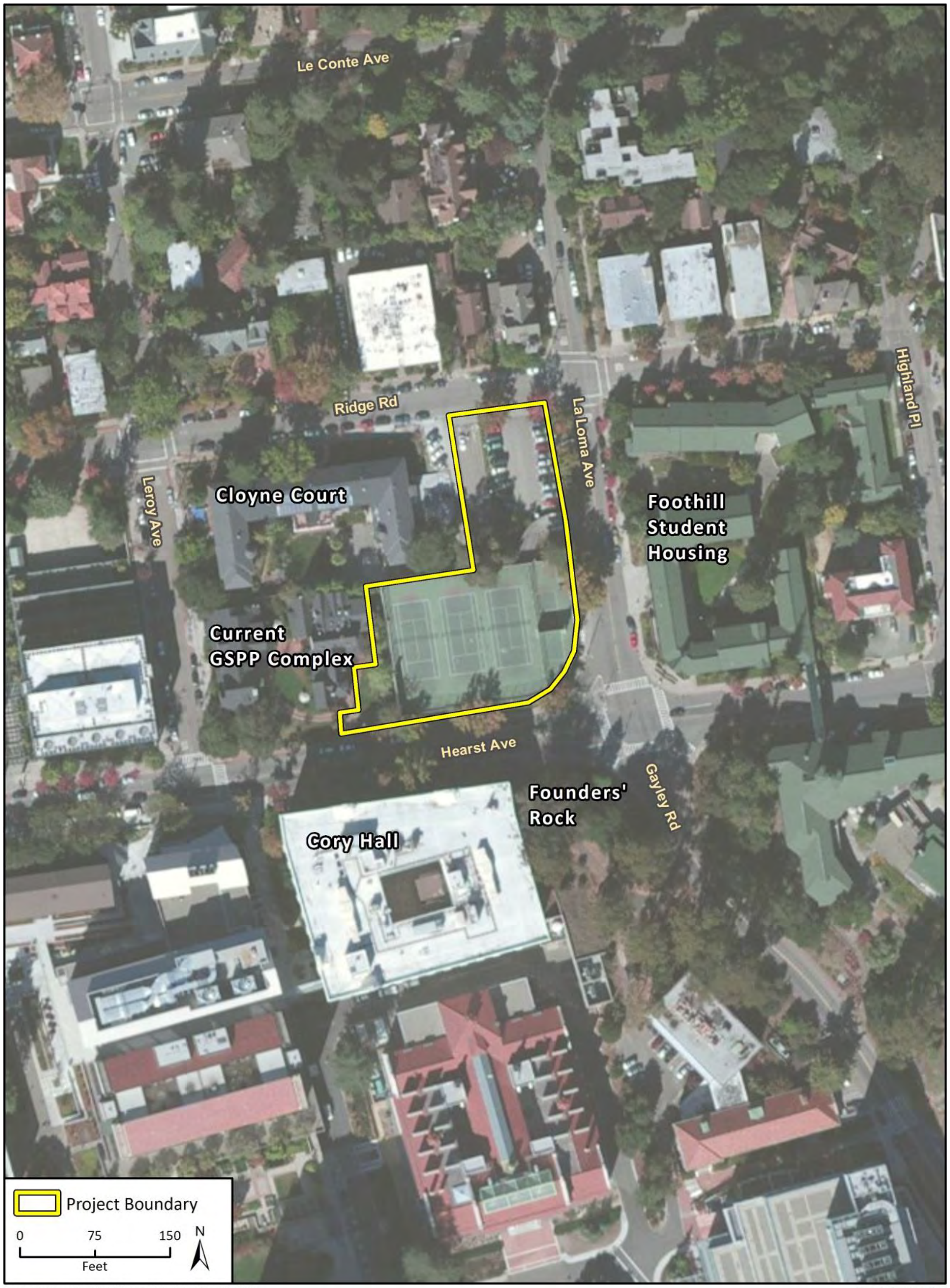

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Fig 2 Project Location

FIGURE 3A PHOTOGRAPHS OF PROJECT SITE

View of Upper Hearst parking structure looking northeast from Hearst Avenue.

Southward view of Ridge Lot from Ridge Road.

FIGURE 3B SURROUNDING AREA PHOTOGRAPHS

Northward view of the historic Beta Theta Pi house on the current GSPP complex.

Northward view of the historic Cloyne Court building from the Upper Hearst structure.

FIGURE 3C SURROUNDING AREA PHOTOGRAPHS

View of residences on Ridge Road across from the Ridge parking lot, looking northeast.

View of Foothill Student Housing complex northeast of La Loma and Hearst avenues.

interspersed with non-university properties. The Adjacent Blocks North subarea is defined as the blocks bound by the Hill Campus, Lawrence Berkeley National Laboratory (LBNL), Ridge Road, Scenic Avenue, Hearst Avenue, Oxford Street, and the Campus Park. Major campus facilities on these blocks include Etcheverry Hall, Soda Hall, GSPP, the Greek Theatre, and the Bowles, Stern, and Foothill residence halls.

The southern boundary of the Project site has frontage along Hearst Avenue, which is a two-way traffic corridor that forms part of the northern perimeter street network around the Campus Park. The Hearst Avenue sidewalk is an intensely used circulation corridor for pedestrians and transit commuters, as a bus stop in front of Cory Hall serves the Perimeter (P) and Central Campus (C) lines of Bear Transit, AC Transit lines 52 and F, and the Blue and Orange Berkeley Lab routes.

3.3 NEED FOR THE PROJECT

The Goldman School of Public Policy is ranked as the number one policy analysis graduate program in the nation by U.S. News & World Report. GSPP faculty represents the top researchers in their respective fields, which include economics, political science, law, social psychology, and engineering. To maintain its pre-eminence, in the last 20 years, GSPP has enhanced its Master's of Public Policy (MPP) program; added additional concurrent degree programs (for a total of six); substantially augmented its Undergraduate Minor in Public Policy (now one of the largest minors on the UC Berkeley campus); established a self-supported Master's of Public Affairs (MPA), which is a one-year program for mid-career professionals; and created Executive Education programs that run throughout the year. To sustain and broaden these programs, GSPP needs additional teaching, research, meeting, lecture, and office space to support faculty, students, visitors, and staff.

GSPP's two existing buildings are fully occupied and intensively used. GSPP's existing facilities have exceeded their capacity and cannot accommodate several key elements of the program including more classroom space to keep pace with enrollment in the MPP program, a large classroom for undergraduate students, and space for a small expansion of its MPA and Executive Education programs. Moreover, GSPP is currently renting 4,500 square feet of space at Memorial Stadium for academic, operations and development uses. The addition of a third academic building is critical for the ongoing success and sustainability of GSPP's programs.

The new academic building would accommodate GSPP operations that currently take place in the existing GSPP buildings and other rented space on campus, while expanding the program's overall capacity to serve an additional five staff members and 30 students on average by the end of the 2023 school year. Further, the UC Berkeley campus is in need of housing for faculty, visiting scholars, graduate students, and post-doctoral students, to help the campus meet its commitment to increasing the housing offered to the UC Berkeley community. The Upper Hearst Development would help meet these needs by providing housing opportunities as well as additional building space for the growth of GSPP's various programs.

Finally, the Upper Hearst Development aims to meet the campus' goal of retaining as much parking as possible by preserving many of the existing parking spaces, while also providing payments in lieu of parking for the spaces that are removed.

3.4 PROJECT OBJECTIVES

The objectives of the Project are to:

- Support UC Berkeley's academic enterprise, enrich the campus community experience and create a sustainable future
- Create a dynamic environment for learning by expanding GSPP with additional teaching, collaborative research and event space, which is imperative to maintaining the school's excellence and ability to recruit outstanding students and retaining expert faculty and scholars
- Fulfill UC Berkeley's Housing Master Plan Task Force Report (January 2017) goal of providing housing on this site to help meet current market demand
- Respond to the shortage of campus housing by providing affordable and accessible housing that improves the quality of life for faculty, staff and students, and supports the academic experience
- Maintain as much parking as possible on site and refurbish the almost 50 year old Upper Hearst Parking Structure in the process
- Transform underutilized University-owned parcels by promoting compact and clustered development of academic and housing facilities where appropriate
- Maintain the historic character and setting of the surrounding landmark buildings to the extent feasible
- Design and build facilities that aesthetically enhance the City and the campus vicinity over existing conditions and that are compatible with the surrounding neighborhood
- Continue to support academic excellence by accommodating recent UC Berkeley student enrollment growth
- Provide the program space, access and housing required to support a vital intellectual and engaged community

3.5 PROJECT DESCRIPTION

The Project would consist of the Upper Hearst Development for GSPP and a Minor LRDP Amendment to accommodate the proposed land uses on the Project site.

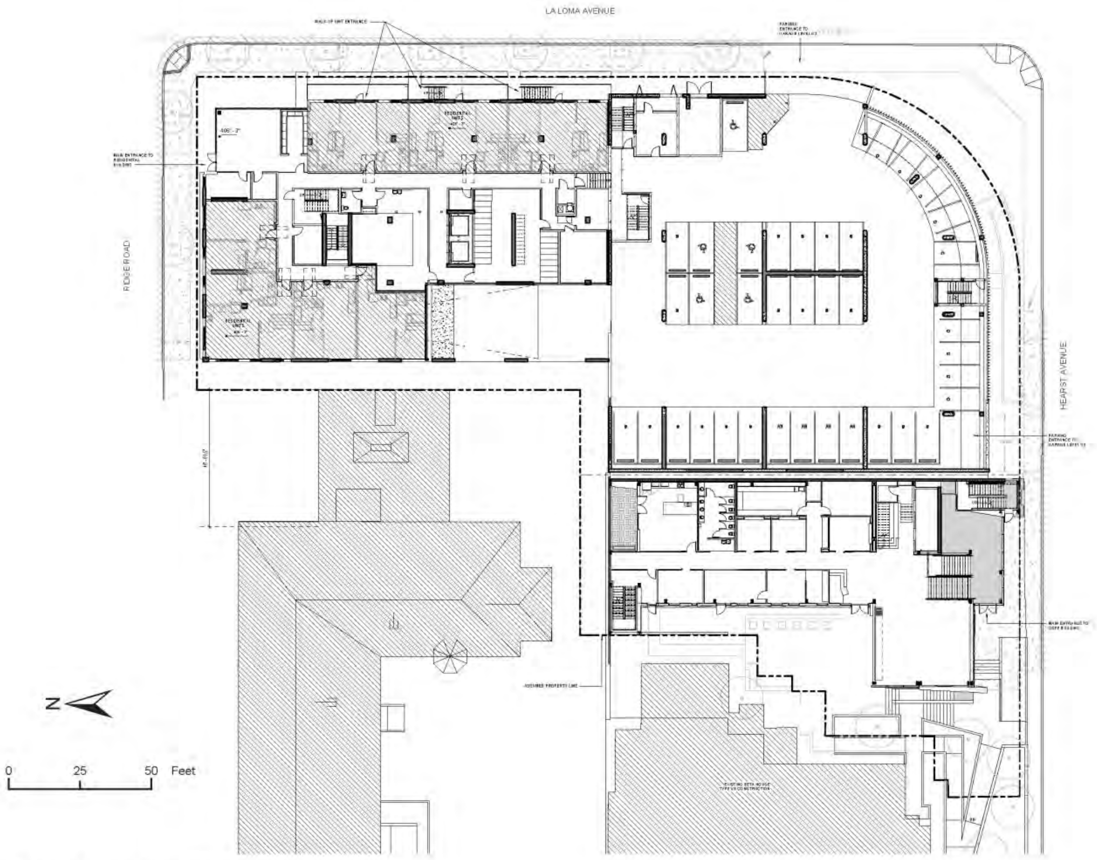
UPPER HEARST DEVELOPMENT

PROGRAM DESCRIPTION

The Upper Hearst Development would have residential and academic components. The construction of these components would alter the provision of parking on the Project site. Figures 4 through 18 show the proposed site plan, floor plans, building elevations, and architectural renderings.

It is anticipated that the Upper Hearst Development would accommodate up to approximately 1,176 occupants, including approximately 300 people seated and up to 450 occupants at maximum capacity in the academic event space; public and private events in this space would occur periodically in the day and evening.

FIGURE 4 PROPOSED SITE PLAN



Source: Solomon Cordwell Buenz, May 2018

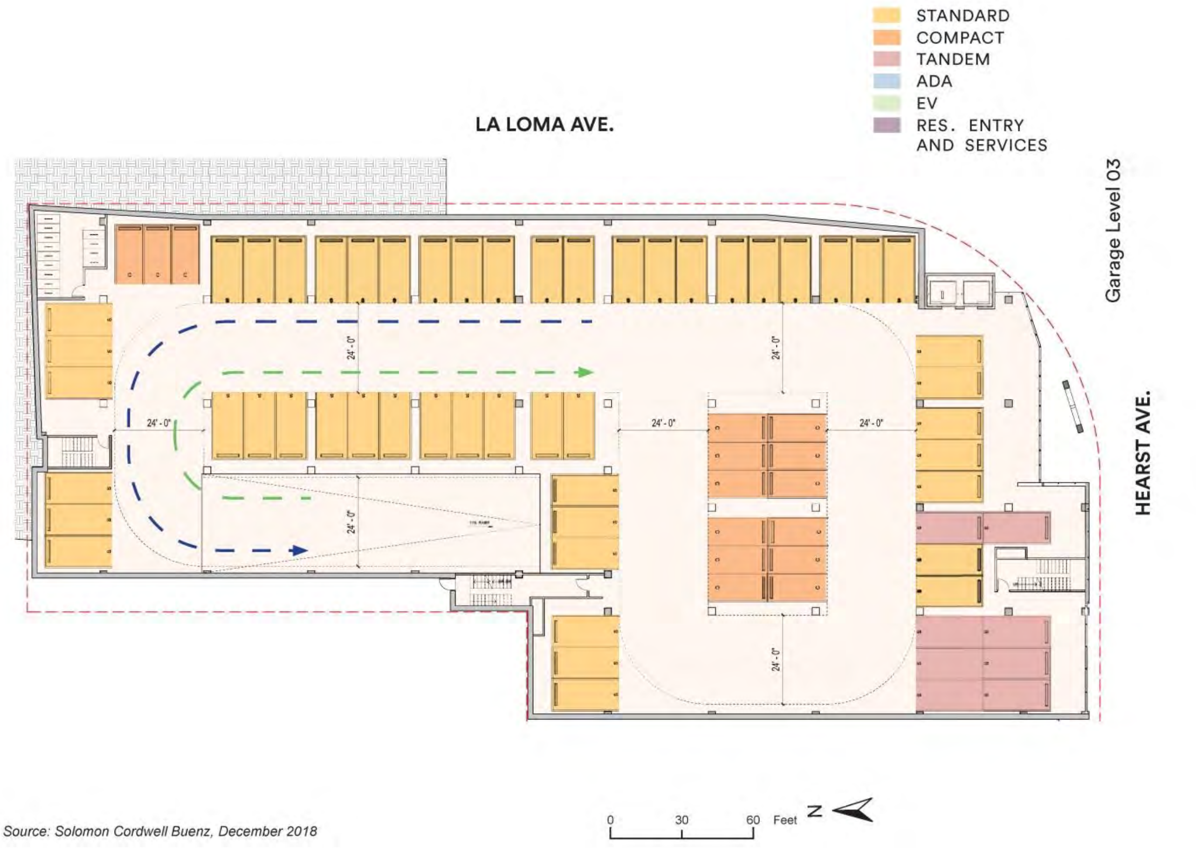
FIGURE 5 GARAGE LEVEL 1 FLOOR PLAN

Source: Solomon Cordwell Buenz, December 2018

FIGURE 6 GARAGE LEVEL 2 FLOOR PLAN

Source: Solomon Cordwell Buenz, December 2018

FIGURE 7 GARAGE LEVEL 3 FLOOR PLAN



Source: Solomon Cordwell Buenz, December 2018

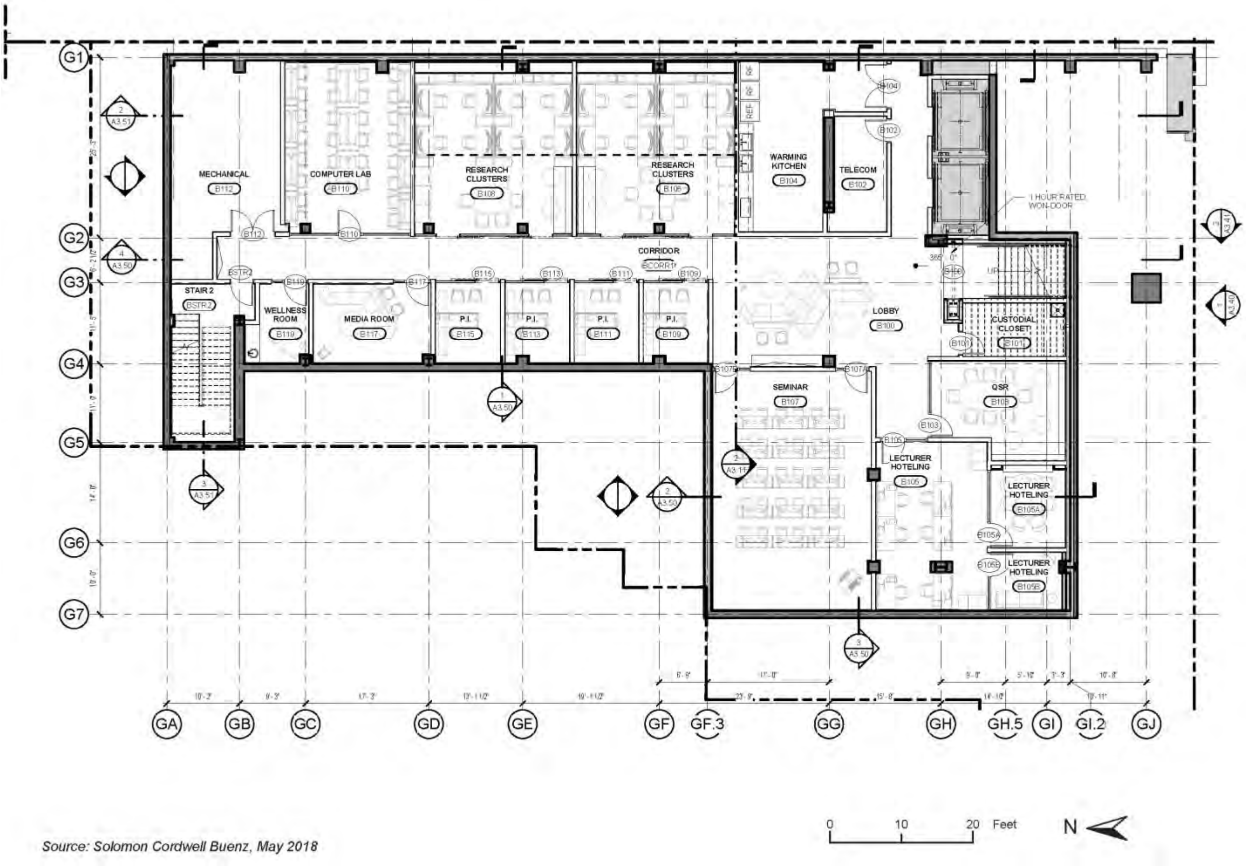
FIGURE 8 RESIDENTIAL BUILDING LEVEL 1 FLOOR PLAN

Source: Solomon Cordwell Buenz, December 2018

FIGURE 9 RESIDENTIAL BUILDING LEVELS 2-5 FLOOR PLAN

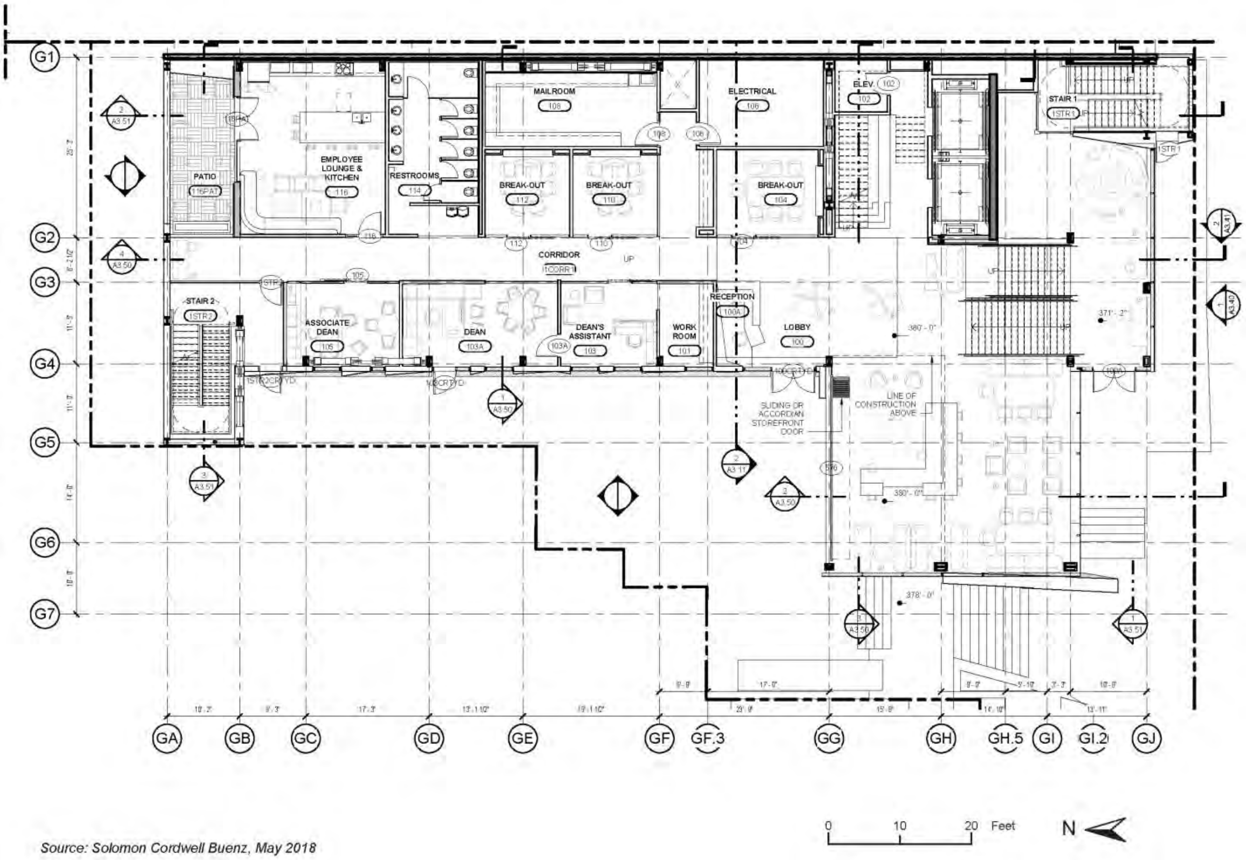
Source: Solomon Cordwell Buenz, December 2018

FIGURE 10 ACADEMIC BUILDING BASEMENT FLOOR PLAN



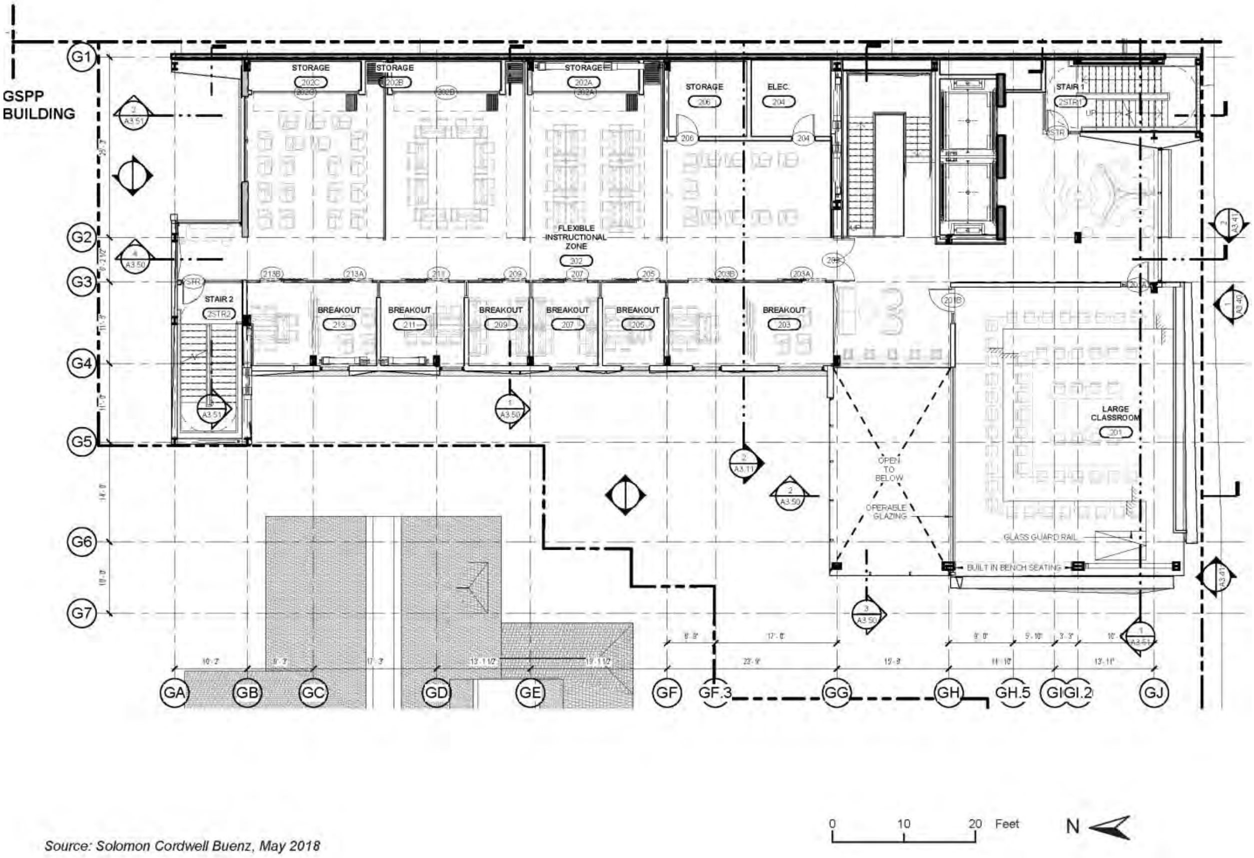
Source: Solomon Cordwell Buenz, May 2018

FIGURE 11 ACADEMIC BUILDING LEVEL 1 PLAN



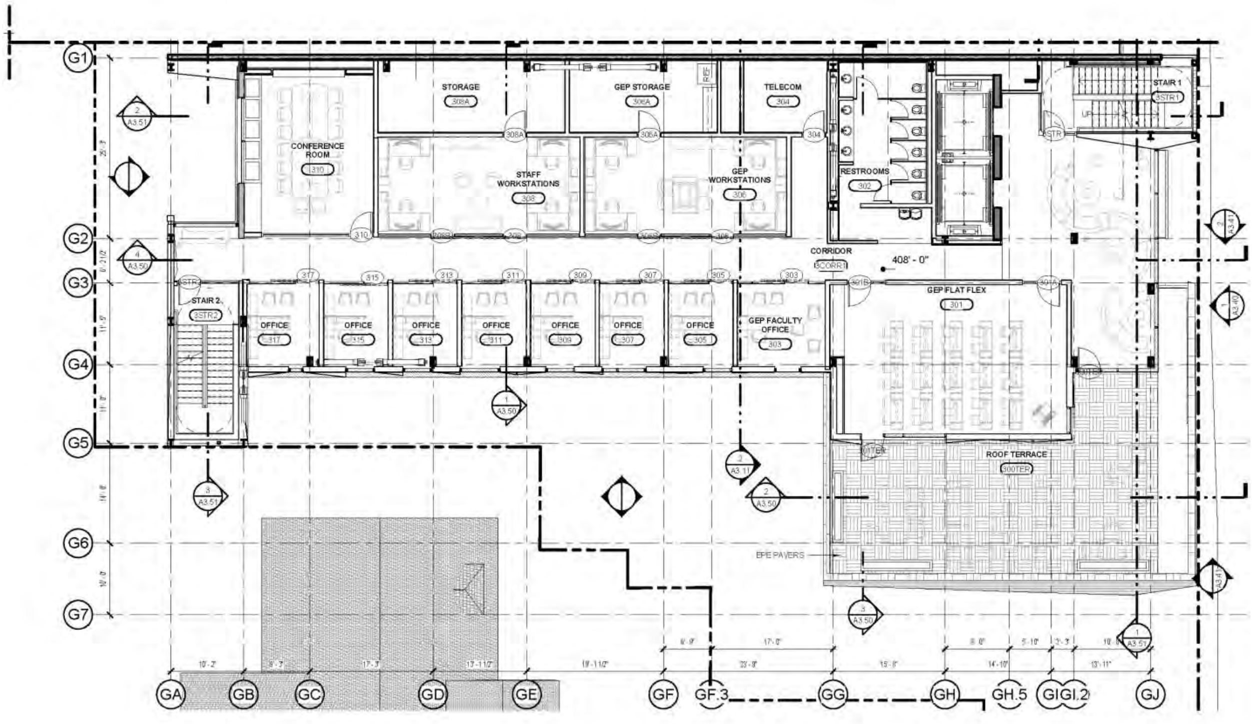
Source: Solomon Cordwell Buenz, May 2018

FIGURE 12 ACADEMIC BUILDING LEVEL 2 PLAN



Source: Solomon Cordwell Buenz, May 2018

FIGURE 13 ACADEMIC BUILDING LEVEL 3 PLAN

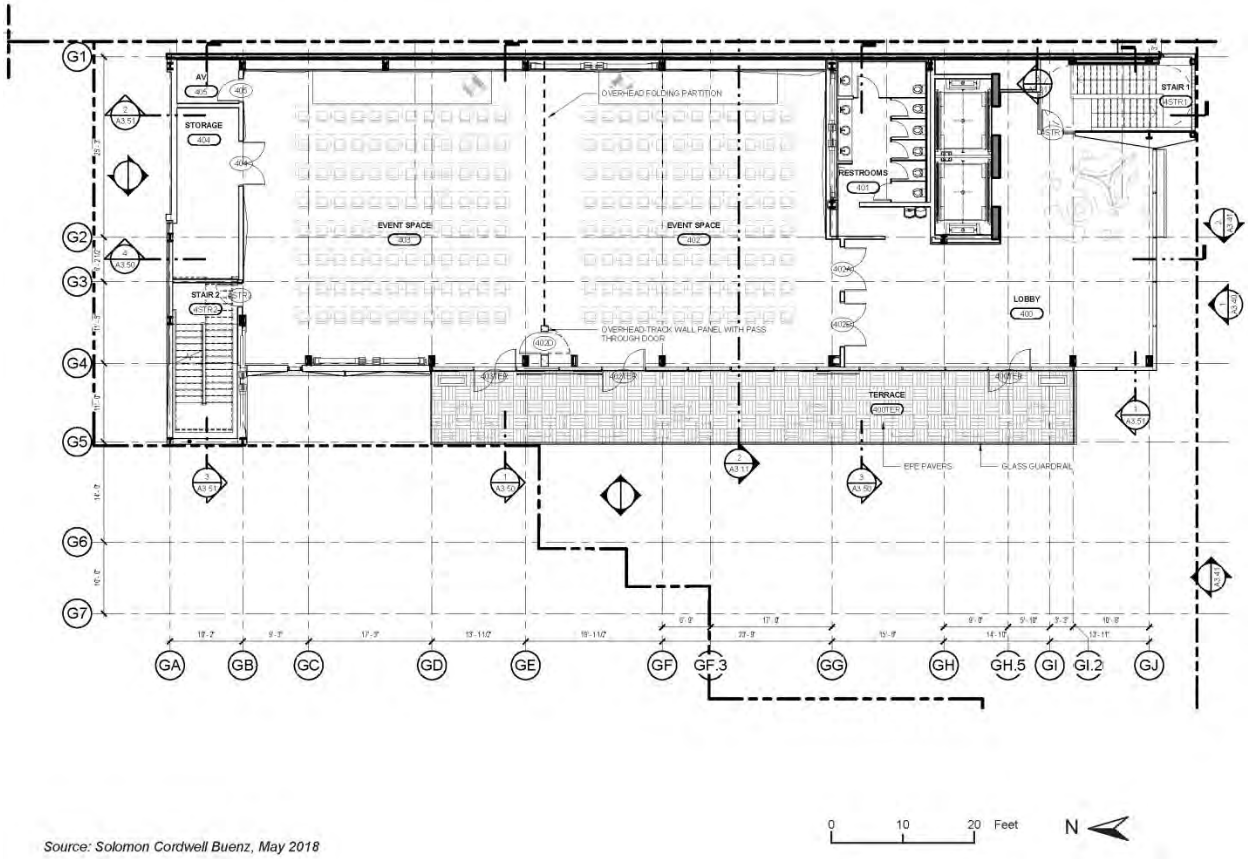


Source: Solomon Cordwell Buenz, May 2018

0 10 20 Feet

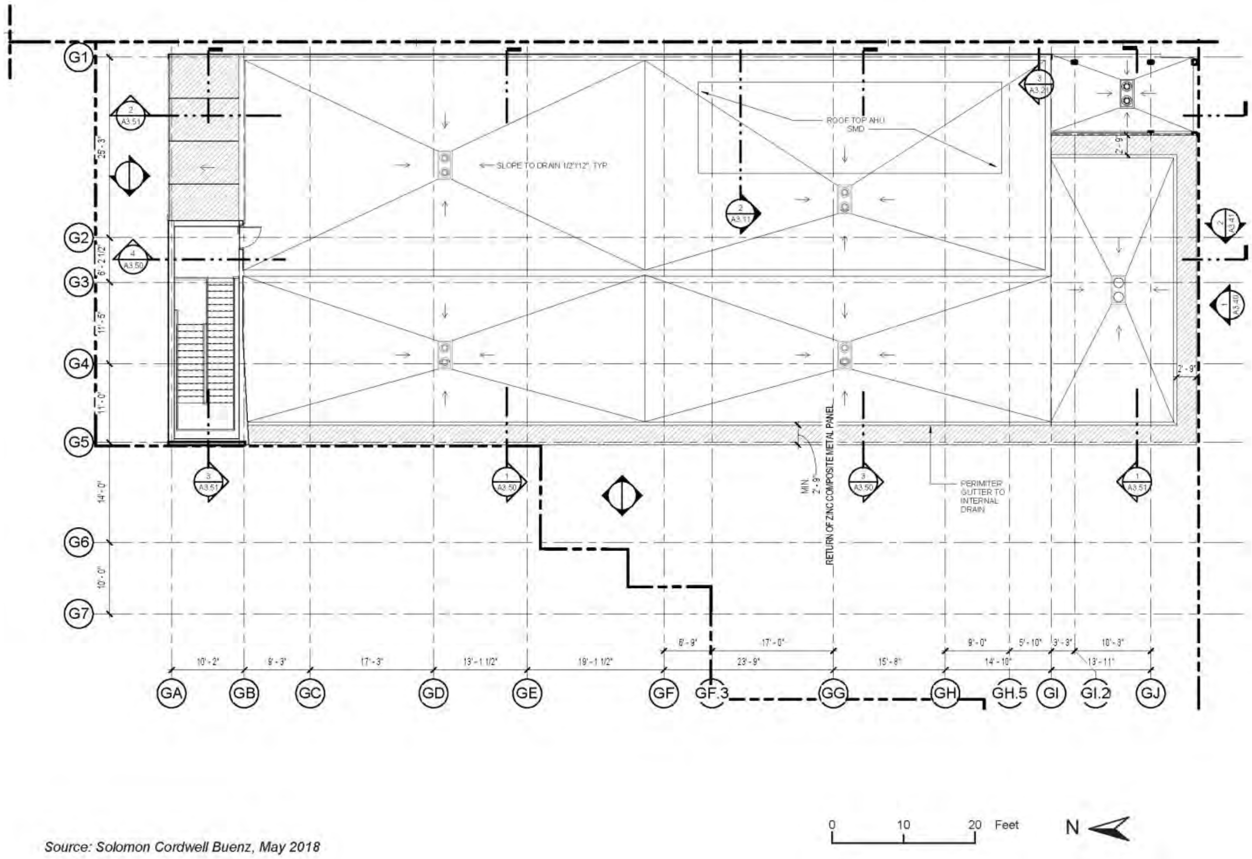
N

FIGURE 14 ACADEMIC BUILDING LEVEL 4 PLAN



Source: Solomon Cordwell Buenz, May 2018

FIGURE 15 ACADEMIC BUILDING ROOF PLAN



Source: Solomon Cordwell Buenz, May 2018

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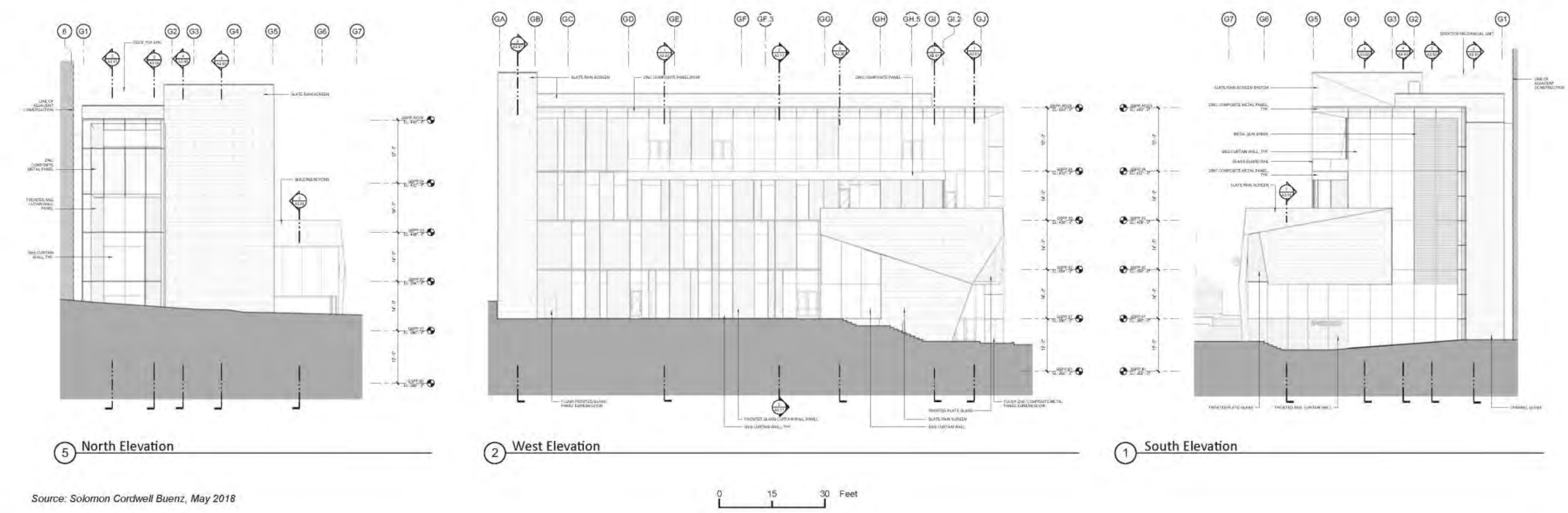
FIGURE 16 RESIDENTIAL BUILDING SECTION

Source: Solomon Cordwell Buenz, December 2018

FIGURE 17 ACADEMIC BUILDING ELEVATIONS



Source: Solomon Cordwell Buenz, May 2018

FIGURE 18 ARCHITECTURAL RENDERINGS

Academic Building

Source: Solomon Cordwell Buenz, May 2018

Residential Building

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Table 2 estimates the number of occupants in each component of the Project.

Table 2:
Estimated Project Occupancy

Use	Size	Occupancy Rate	Occupants
Residences	225 bedrooms	1 person/bedroom	225
Residential amenity space	1,250 sf	1 person/100 sf	13
Academic offices	9,090 sf	1 person/100 sf	91
Academic classrooms	5,950 sf	1 person/ 15 sf	397
Academic event space	3,150 sf	1 person/7 sf	450[1]
Total			***1,176***

[1] Estimated occupancy of academic event space including standing room for 450 people.

Source: Solomon Cordwell Buenz, May 2018

RESIDENTIAL COMPONENT

The residential component of the Upper Hearst Development would be constructed in a new building on top of a new Upper Hearst parking structure as well as on the adjacent at-grade Ridge parking lot now located at the corner of Ridge Road and La Loma Avenue. The residential component would consist of up to 150 residential units in a mixture of studio and one- and two-bedroom apartments in a building up to six stories tall. These units would house faculty, graduate, and post-doctoral students. The residential entrance would be located on the corner of Hearst and La Loma avenues at the P2 garage level. The residential amenity space on level P2 would consist of a lobby, lounge area, mail room, leasing office and fitness center. Additionally, two courtyards are proposed on the first level of residential units (Level R1).

At its maximum height, the residential roofline would be up to approximately 72 feet tall above adjacent grade on the Ridge Road (north) side, up to 69 feet on the La Loma Avenue (east) side and up to 87 feet tall on the Hearst Avenue (south) side (excluding possible rooftop mechanical equipment). It is assumed that the residential building would have no setbacks from adjacent streets, for the purpose of maximizing the provision of housing units while minimizing the building's height to the extent feasible. Two inner courtyards would separate the volumes of the residential building. Vehicles would access the parking structure below the residential building via a driveway from Hearst Avenue. Pedestrian and bicycle access to the housing portion of the site would be provided near the corner of Hearst and La Loma avenues.

ACADEMIC COMPONENT

A separate academic building would be constructed immediately east of the existing GSPP building located at 2607 Hearst Avenue, with a minimum setback of 10 feet from the existing building. To accommodate the new academic building, it is assumed that the entire Upper Hearst parking structure would be demolished. The approximately 37,000 gross square feet of office, classroom, and event space in the academic building would serve GSPP's undergraduate, graduate and Global Executive Education programs. The academic building would be four stories in height over one subterranean level. The fourth level would provide access to a rooftop terrace. The centerpiece of the design is a two-story atrium bordered on the exterior by a glass façade. This atrium would face west toward the existing GSPP buildings and would have public space and interaction areas. Pedestrian and bicycle access to the proposed academic space would be provided from Hearst Avenue through the main entrance. A landscaped courtyard would connect to the main lobby.

The new academic building would accommodate GSPP operations that currently take place in the existing GSPP buildings and other rented space on campus (e.g., Cal Memorial Stadium), while expanding the program's overall capacity. It is anticipated that at full student growth by the end of the 2023 school year the academic building would serve an additional five staff members and 30 students on an average, year-round basis relative to existing conditions. Additional students would be part of GSPP's Masters of Public Affairs and executive education programs. The number of masters students would increase from 35 to 100 students, at most. The Masters of Public Affairs program largely takes place during the summer. The new building would also accommodate additional one-to-two-week executive education programs with 30 to 50 participants. It is anticipated that the event space would accommodate up to 300 people seated and 450 visitors at maximum capacity.

PARKING AND ACCESS

It is assumed for purposes of the environmental analysis that construction of the residential and academic buildings would require complete demolition of the Upper Hearst parking structure. The entire Ridge surface parking lot also would be demolished. The new Upper Hearst parking structure would be expanded northward to Ridge Road with two levels of parking. The Project site currently provides 407 parking spaces, including 337 marked parking stalls and the capacity for 50 attendant parking spaces in the Upper Hearst parking structure, and 20 marked parking spaces in the adjacent Ridge surface parking lot. As a result of removing existing parking areas, it is assumed that the Upper Hearst Development would reduce the total number of parking spaces on-site from 407 to approximately 200, including 175 marked parking spaces and 25 attendant parking spaces. One driveway from Hearst Avenue would provide vehicular access to the parking garage. The parking structure would be screened where it fronts on the corner of Hearst Avenue and La Loma Avenue.

Pedestrian access to the dedicated academic space would be provided from Hearst Avenue through the main entrance of the building. Pedestrian access to the housing portion of the site would be provided at the corner of Hearst and La Loma avenues. Bicyclists could enter the residential building to access bike storage via either the driveway to the parking structure or the residential lobby, both located near the corner of Hearst and La Loma avenues. An estimated fifty-two (52) bicycle parking spaces would be provided in the new or renovated Upper Hearst parking structure.

BUILDING DESIGN

The proposed buildings would have a contemporary design, with concrete, glass, and metal as the predominant exterior materials. At the residential building, exterior materials would include cement plaster, fiber cement panels, painted aluminum, and windows framed by aluminum accent panels. At the academic building, exterior materials would include frosted and clear glass curtain walls, metal sun shades, metal panels, and slate screens. Both buildings would have primarily flat, metal roofs. All roofing materials would have a high solar reflective index to reduce the heat island effect. The third and fourth floors of the academic building would be set back relative to the Beta Theta Pi building.

LANDSCAPING AND STREETSCAPE

Up to 49 trees within and adjacent to the Project site would be removed, including but not limited to a Camperdown elm tree in the front yard of the Beta Theta Pi house and two prominent redwood trees at the eastern end of the Upper Hearst parking structure. The Camperdown elm tree, with its distinctive flat-topped crown, contorted branches, and weeping habit, is a mature and prominent example of an uncommon tree species, as well as a character-defining feature of the Beta Theta Pi house's landscape (Garrett 2019). UC Berkeley's Campus Landscape Architect determined in January 2019 that, for its historical value, this tree qualifies as a "specimen tree" under Campus Specimen Tree Program. However, it was determined that the two redwood trees do not meet UC Berkeley's historical, educational, or aesthetic criteria to be considered "specimen trees." Although these trees are large and partially obstruct views of the on-site parking lots from street level, they are not an integral part of the architectural theme of the Upper Hearst parking structure, nor do they play an important role in framing or screening the structure.

The Project would also involve removal of up to 22 trees in the front and side yards of the Beta Theta Pi house. Six street trees would either remain or be replaced with trees that are compatible with the campus vicinity. Foundation shrub planting and vine plants at the existing building façade would be removed. The Project would not affect the stand of mature oak trees on the GSPP complex to the northeast of the intersection of Hearst and Le Roy avenues.

New interior landscape spaces and roof gardens would have drought-tolerant and primarily native plant species. New exterior lighting would be added to the perimeter of the academic and residential buildings, the pedestrian paths, and to the featured landscape elements to enhance safety and security at night. This exterior lighting would direct light downward and would use a combination of photo sensor and automated time switches. The existing sidewalks, curbs, and gutters adjacent to the Project site on Hearst Avenue, La Loma Avenue, and Ridge Road would also be replaced. New pedestrian ramps also would be installed in front of the Beta Theta Pi house, providing access to a stone-paved courtyard on the western side of the new academic building.

ENERGY EFFICIENCY AND "GREEN" FACILITY MEASURES

The Upper Hearst Development would be required to meet energy efficiency and green facility standards in the UC Sustainable Practices Policy, the UC Berkeley Energy Use Policy, and the UC Berkeley Campus Design Standards. The proposed residential and academic buildings would be designed to achieve a minimum LEED Silver rating and would target a Gold rating for new construction. "Green" facility measures in the proposed buildings would include low-emitting adhesives, sealants, composite wood, agrifiber products, paints, and coatings; Forest Stewardship Council-certified wood; and low-flow plumbing fixtures. According to the LEED checklists prepared for the Project, potable water used in outdoor landscaping would be reduced 50 to 100 percent from baseline building performance, while indoor water use would be reduced by 20 percent. Landscaping would minimize water demand by the use of native, drought-tolerant plants. The buildings' energy use would be reduced by 5 percent compared to baseline building performance in accordance with ASHRAE Standard 90.1-2010.

The proposed land uses and site layout would minimize greenhouse gas emissions from transportation, as the proposed residences for faculty, staff, and students would be located adjacent to the Campus Park and the GSPP complex. Relative to existing conditions, the proximity between residences and academic space would reduce the need for people to commute by motor vehicle to the GSPP buildings, for those residents who are affiliated with GSPP. In addition, the Upper Hearst Development would reduce the number of parking spaces on-site and thereby would induce minimal demand for additional driving. In the new or renovated parking garage, an estimated 10 parking spaces for electric vehicles would be provided. An estimated fifty-two (52) total bicycle parking spaces would be provided in the parking structure.

DRAINAGE AND UTILITIES

The Upper Hearst Development would involve the installation of several bioretention facilities to treat all stormwater runoff from the site before offsite discharge. The majority of the stormwater treatment planters for the residential building would be located at its internal courtyards, which would pick up all runoff from the residential roof. Additional small treatment planters may be installed at the building façade to treat water from the courtyard level. At the academic building, stormwater treatment planters are proposed in the courtyard west of the building to pick up runoff from the roof. An additional small treatment planter may be installed adjacent to the Hearst Avenue sidewalk to pick up surface runoff from the ramp and stairs to the academic building. These stormwater improvements would be designed to maintain or reduce existing peak stormwater flows from the Project site.

Water service and wastewater service would be taken from existing East Bay Municipal Utility District (EBMUD) and City of Berkeley infrastructure under Hearst Avenue and La Loma Avenue. It is anticipated that the new academic building would receive electricity from the campus central energy management system, while the residential building would be unconnected to that system.

CONSTRUCTION

It is anticipated that construction of the Upper Hearst Development would take approximately 23 months overall, beginning in September 2019 and concluding in July 2021. Table 3 shows the expected sequence and duration of construction phases:

Table 3:
Estimated Construction Phasing

Phase	Duration (months)
Earthwork, demolition, grading, concrete	6
Framing, mechanical, electrical, plumbing	7
Exterior and interior finishes	8
Sidewalks	2
Total	***23***

Source: UC Berkeley, April 2018

The delivery of construction equipment, removal of demolished materials, hauling of soil, and use of concrete trucks would be intermittent during the first eight months of construction. Heavy truck activity for material deliveries would occur during the remainder of construction. The academic and residential buildings would be constructed concurrently.

Grading would involve an estimated 13,147 cubic yards of cut and 140 cubic yards of fill, resulting in a net export of 13,007 cubic yards of material for offsite disposal. In addition, demolition of the existing parking areas would require the export of approximately 7,000 cubic yards of material from the Project site. The maximum depth of excavation would be approximately 23 feet below grade level.

LRDP AMENDMENT

The 2020 LRDP assumes that all new University-provided housing would be constructed within the limits of a Housing Zone. Because the proposed residential building would be located outside this Housing Zone, as currently defined in the 2020 LRDP, the Project includes a minor 2020 LRDP amendment to the City Environs Framework text of the 2020 LRDP, which would expand the Housing Zone to accommodate residential development on the Project site. See Appendix B for the complete proposed text amendment to the 2020 LRDP.

3.6 PLANNING CONTEXT

2020 LRDP

The Project is proposed as partial implementation of the 2020 LRDP. Adopted by The Regents in January 2005, the 2020 LRDP describes both the scope and nature of physical development necessary to achieve the academic mission of UC Berkeley for an estimated campus population projected through academic year 2020-2021(UC Berkeley 2005). The 2020 LRDP also prescribes a comprehensive set of principles, policies, and guidelines to inform the location, scale and design of individual capital projects. These include the Location Guidelines, which establish priorities for the location of campus functions, both within the historic Campus Park and outside of it, including the Adjacent Blocks land use zones identified in the 2020 LRDP. The Project site is located within the Adjacent Blocks North subarea. Within the Adjacent Blocks, the Location Guidelines identify Student Services, including "Fitness, recreation, intercollegiate athletics," as priority uses. The 2020 LRDP also identifies UC-owned surface parking lots in the areas surrounding the Campus Park as candidate sites for realizing implementation of the overall 2020 LRDP land use and facilities program. The 2020 LRDP also established a Housing Zone which currently excludes the Project site.

2020 LRDP EIR

The 2020 LRDP EIR provides a comprehensive program-level analysis of the 2020 LRDP, and potential effects on the environment in accordance with Section 15168 of the CEQA Guidelines. The 2020 LRDP EIR prescribes continuing best practices and mitigation measures for all projects implemented under the 2020 LRDP.

UC DESIGN REVIEW PROCESS

The Upper Hearst Development was reviewed by the UC Berkeley Design Review Committee on September 6, 2017; May 17, 2018; June 6, 2018; December 20, 2018; and January 17, 2019. The committee provided comments on the exterior materials of the proposed buildings, screening and design of building components, and potential sound barriers, among other design features.

UC REGENTS REVIEW

The Upper Hearst Development would be funded partially by GSPP's donor funding reserves (approximately $10 million) with the remainder to be financed with a tax-exempt bond under a financing trust structure. Annual revenue capacity from GSPP would fund the operations, management and debt service of the academic building. Rental revenues from the new housing development would support debt service for the residential building and parking structure, as well as the maintenance and operations for the residential building. Because the Upper Hearst Development was not anticipated in UC Berkeley's Capital Financial Plan and the overall cost of the Project would exceed $10 million, review of the Project by The Regents is required.

CITY OF BERKELEY REVIEW

The continuing best practices prescribed in the 2020 LRDP EIR include the following requirements for all projects located in the 'City Environs', which includes the areas within Berkeley lying outside the 'Campus Park' and 'Hill Campus':

> UC Berkeley would make informational presentations on all major projects in the City Environs in Berkeley to the Berkeley Planning Commission and, if relevant, the Berkeley Landmarks Preservation Commission for comment prior to schematic design review by the UC Berkeley Design Review Committee … Whenever a project in the City Environs is under consideration by the UC Berkeley DRC, a staff representative designated by the city in which it is located would be invited to attend and comment on the project. (Continuing Best Practice AES-1-e)

The Project site is located in the City Environs, specifically within the Adjacent Blocks North subarea of the 2020 LRDP, in the City of Berkeley.

Consistent with Continuing Best Practice AES-1-e, UC Berkeley staff presented the Upper Hearst Development at the City of Berkeley Design Review Committee meeting on June 21, 2018, and at the City of Berkeley Landmarks Preservation Commission meeting on July 5, 2018. The City's Design Review Committee found that the proposed buildings' modern design appears to be a "good foil" for an adjacent historic landmark (the Beta Theta Phi house) but should generally fit better into the neighborhood context. To preserve views of the landmark across Hearst Avenue, the City's Design Review Committee recommended setting the buildings further back. The Design Review Committee also recommended the use of alternate exterior building materials that add more warmth and accent colors. The City's Landmarks Preservation Commission expressed concern that the scale, massing, and exterior materials of the proposed buildings would be incompatible with the surrounding neighborhood.

4. RELATIONSHIP TO 2020 LRDP

BACKGROUND

UC Berkeley's 2020 LRDP was approved by The Regents in January 2005, and describes both the scope and nature of physical development necessary to achieve the academic mission of UC Berkeley for an estimated campus population projected through academic year 2020-2021, as well as land use principles and policies to guide the location, scale and design of individual capital projects.

The 2020 LRDP EIR provides a comprehensive program-level analysis of the environmental effects of implementing the 2020 LRDP, in accordance with Section 15168 of the CEQA Guidelines. Under CEQA, subsequent projects should be examined in light of the program-level EIR to determine whether subsequent project-specific environmental documents must be prepared. Subsequent documents may rely on the program-level EIR for information on setting and regulatory framework, for analysis of general growth-related and cumulative impacts, and for alternatives to the 2020 LRDP. 2020 LRDP mitigation measures and continuing best practices that reduce potential impacts of the project would be implemented as part of the project, and would be identified in the project-specific review. Additional mitigation measures may also be identified.

2020 LRDP EIR mitigation measures and continuing best practices to be incorporated into the proposed Project are identified in each topical issue in Section 6, *Environmental Evaluation*, of the SEIR. The 2020 LRDP and the 2020 LRDP EIR are available on line at https://capitalstrategies.berkeley.edu/campus-planning/planning-documents; copies are also available for review during normal operating hours at Capital Strategies' Physical and Environmental Planning offices, 1st floor of the A&E Building on the UC Berkeley campus.

PARAMETERS OF THE 2020 LRDP

This section discusses the parameters of the 2020 LRDP in terms of the location and amount of new development anticipated, and compares the Project to these parameters. The 2020 LRDP establishes a long-term development program for land use zones occupied by University facilities, including the Campus Park, Adjacent Blocks, Southside, Clark Kerr Campus, and Hill Campus. The City Environs encompasses this entire area except for the Campus Park and Hill Campus. The Project site is located in the area designated as the Adjacent Blocks North subarea of the City Environs. In the area governed by the 2020 LRDP, including the Project site, UC Berkeley anticipated over 2.2 million net new gross square feet of development during the 2020 LRDP timeframe. This growth envelope was analyzed in the 2020 LRDP EIR (2020 LRDP EIR Vol 3a, 3.1-14).

In response to future space demand by campus programs, the 2020 LRDP anticipates that capital investment on Adjacent Blocks through 2020 may result in a net increase in program space of up to 1,250,000 gross square feet (gsf), and up to 1,900 net new parking spaces. The 2020 LRDP anticipates that new space on the Adjacent Blocks would be produced by more intensive redevelopment of existing University-owned sites, as well as the California Department of Health Services (DHS) site west of Oxford Street and south of Hearst Avenue, if acquired by UC Berkeley. New space may also be produced on other sites by UC Berkeley directly or through joint ventures. The proposed academic building for the GSPP program would be consistent with the 2020 LRDP's vision of increasing space for campus programs on the Adjacent Blocks. However, the Location Guidelines in the 2020 LRDP prioritize new academic program space on the Campus Park, not on the Adjacent Blocks. Furthermore, the 2020 LRDP does not identify the Upper Hearst parking structure, where the academic building would be built, as a potential development site. Therefore, this analysis assumes that the academic building would be outside the parameters of anticipated development on the Adjacent Blocks. A new 37,000 square-foot academic building on the Project site also would exceed the 2020 LRDP's development parameters for the Adjacent Blocks North subarea. While the 2020 LRDP projects an additional 50,000 gsf of program space in the Adjacent Blocks North subarea, construction of the 23,110-gsf Jacobs Hall leaves approximately 26,890 gsf of anticipated new program space in this area. Nonetheless, construction of the proposed 37,000 square-foot academic building would be within the overall physical development parameters of the 2020 LRDP. While the 2020 LRDP anticipated over 2.2 million net new gross square feet of development to the year 2020, UC Berkeley remains well below that envelope of development with 955,160 gsf constructed or under construction at the end of 2018. This represents only 43.4 percent of the anticipated floor area of new development. Therefore, the new academic and residential buildings would not cause an exceedance of overall development anticipated in the 2020 LRDP.

The housing objectives for the 2020 LRDP require that all new student housing be located either within a mile of the center of the Campus Park, defined as Doe Library, or within one block of a transit line providing trips to Doe Library in under 20 minutes. In the 2020 LRDP, this Housing Zone is defined to exclude those areas with residential designations of under 40 units per acre in a municipal general plan as of July 2003. The Project site is located outside of the Housing Zone because it is in the City of Berkeley's Medium Density Residential land use designation, which allows a maximum residential density of less than 40 units per acre. Therefore, the proposed residential units on the Project site would be outside of the locational parameters of anticipated residential growth under the 2020 LRDP. Nonetheless, the Project proposes up to 225 residential beds, which would be within the overall growth parameters of the 2020 LRDP. Since adoption of the 2020 LRDP, UC Berkeley has added 1,119 of the anticipated 2,600 new beds as of the end of 2018. Because UC Berkeley remains well below this envelope for housing growth, the proposed residential building would not be additional to residential growth anticipated in the 2020 LRDP.

CURRENT AND PROJECTED CAMPUS HEADCOUNT

Projected campus headcount numbers at UC Berkeley were discussed in the 2020 LRDP, Final EIR Section 3.1.5. The 2020 LRDP Final EIR's population numbers were based on actual headcount for students, employees (faculty and staff), and other visitors and vendors. Table 3.1-1 in the Final EIR indicated a student headcount of 31,800 and total regular-term campus headcount of 45,940 for academic year 2001-2002, and projected an academic year 2020 student headcount of 33,450 and total regular-term campus headcount of 51,260. As discussed in Section 3.1.5 of the 2020 LRDP Final EIR, it was anticipated that the student enrollment would level off and stabilize at 33,450 by the year 2010.

As of the publication of the Notice of Preparation for this SEIR in August 2018, UC Berkeley's student enrollment was 40,955 and the total campus headcount was 57,637, both of which exceed the projections described and analyzed in the 2020 LRDP Final EIR (as shown in Table 4 below). The 2017-18 year student enrollment of 40,955 exceeds the 2020 LRDP projection by approximately 7,500 students. Employee numbers are slightly below the 2020 LRDP projections. The increase in student enrollment results primarily from implementation of the California Master Plan for Higher Education which designates UC as the state's primary research institution. Pursuant to the Master Plan, UC selects undergraduates from among the top 12.5 percent of California high school graduates, as well as the top 4 percent of graduates of each California high school. The growth in college-age Californians has resulted in increased enrollment at all UC campuses over the past two decades. [1] For example, on November 19, 2015, the UC Board of Regents approved a Budget Plan to enroll an additional 10,000 undergraduates at UC campuses over the following three years.

Population growth, in and of itself, is not an environmental impact. However, population growth may contribute to an increase in impacts in other topical areas. The population projections provided in the 2020 LRDP were solely for the purpose of conducting the impact analyses in the 2020 LRDP Final EIR. The proposed Upper Hearst Development would house approximately five net new employees and 30 additional students when construction is completed for the academic year 2022-2023. Because the 2020 LRDP Final EIR estimated campus headcount only through 2020 and because the campus headcount projected for 2020 has already been exceeded, the information in the 2020 LRDP Final EIR has become outdated. Therefore, a new baseline is being established for 2018, as well as new future projections to the academic year 2022-2023, the year that the Upper Hearst Development would be completed and occupied by the additional staff and students. This approach is consistent with the commitment that UC Berkeley made to the City of Berkeley in the 2020 LRDP Final EIR to conduct additional environmental review if the campus headcount for 2020 projected in the 2020 LRDP were to be exceeded prior to that time.

Despite the growth in campus headcount over 2020 LRDP projections, which has led to the new campus headcount baseline, the analysis in this SEIR shows that the campus is still operating within the envelope of capacities and demands for resources such as housing, water, electricity, public services, and others that were analyzed in the 2020 LRDP Final EIR. At the end of 2018, approximately 955,160 gsf of new 2020 LRDP developed space had been constructed or was under construction on the campus out of the 2.2 million gsf of development projected in the 2020 LRDP and analyzed in the 2020 LRDP Final EIR for year 2020. This is only 43 percent of the projected development total. Similarly, 1,119 student beds out of the 2,600 beds projected to be built in the 2020 LRDP had been constructed. The lack of new or more severe significant impacts associated with the increase in campus headcount can be attributed to the implementation of various UC policies contributing to a "greener campus" and to shifts in transportation behaviors moving away from single vehicle occupancy trips, among others. Chapter 12, *Population and Housing*, in Section 6, *Environmental Evaluation*, of this SEIR describes the updated baseline and the projected future populations of the campus through the 2022-2023 academic year to coincide with the completion and occupancy of the Upper Hearst Development.

The environmental analysis of each impact category in Section 6 of this SEIR takes into account the updated campus headcount baseline and explains how the increased campus headcount factors into and/or affects the environmental analysis and significance conclusions reached in the 2020 LRDP Final EIR and this SEIR. For some impact categories, such as Aesthetics, Cultural Resources, Land Use, and Tribal Cultural Resources, the analysis of whether the increased headcount causes environmental impacts hinges on physical development. For other impact categories, such as Air Quality, GHG Emissions, Noise, Population, Public Services, and Transportation and Traffic, the analysis of whether the increased headcount causes environmental impacts hinges on population numbers on the campus. The introductory section of each impact category section will explain the approach taken to accounting for the increased campus headcount in that section and how the increase in campus headcount factors into the impact analysis.

[1] California Education Code Sections 66202.5, 66011, and 66741 establish systemwide enrollment commitments for the University of California.

**Table 4:
Comparison of Estimated Campus Headcount
to Existing Conditions and 2020 LRDP Projections**

	Projected Headcount[1] for Year 2020 in the 2020 LRDP	Existing Conditions for 2017-2018 School Year	Estimated Headcount for 2022-2023 School Year	Percent Change from Projected Headcount for Year 2020
Undergraduate students	N/A[3]	29,783	31,380	-
Graduate students	N/A[3]	11,172	13,355	-
Students total[2]	*33,450*	*40,955*	*44,735*	*+33.7%*
Regular faculty	1,980	1,513	1,653	-
Other faculty	-	1,296	1,416	-
Academic staff	4,880	3,426	3,545	-
Non-academic staff	8,950	8,447	8,741	-
Employees total	*15,810*	*14,682*	*15,355*	*-2.9%*
Other visitors & vendors	*2,000*	*2,000*	*2,000*	-
Overall total	***51,260***	***57,637***	***62,090***	***+21.1%***

[1] Annual campus headcount is defined in this table as an average of the fall and spring semesters.

[2] Student counts include regular-term students, not summer-school students.

[3] N/A = not available

Source: UC Berkeley, August 2018

OBJECTIVES OF THE 2020 LRDP

The purpose of the 2020 LRDP is to set forth a framework for land use and capital investment undertaken in support of the campus' academic principles. The 2020 LRDP is driven by the following broad objectives, all of which apply to the Project: (2020 LRDP EIR Vol 3a, 3.1-10).

- **Provide the space, technology and infrastructure we require to excel in education, research, and public service.**
- **Provide the housing, access, and services we require to support a vital intellectual community and promote full engagement in campus life.**
- **Stabilize enrollment at a level commensurate with our academic standards and our land and capital resources.**
- **Build a campus that fosters intellectual synergy and collaborative endeavors both within and across disciplines.**
- **Plan every new project to represent the optimal investment of land and capital in the future of the campus.**
- **Plan every new project as a model of resource conservation and environmental stewardship.**
- **Maintain and enhance the image and experience of the campus, and preserve our historic legacy of landscape and architecture.**
- **Plan every new project to respect and enhance the character, livability, and cultural vitality of our city environs.**

An analysis of the Project's fulfillment of the identified 2020 LRDP Objectives is provided in the Land Use discussion in Section 6, *Environmental Evaluation*.

2020 LRDP CLIMATE CHANGE AMENDMENT

In June 2009, UC Berkeley published a proposed amendment to the 2020 LRDP, Sustainable Campus chapter, to reflect existing campus commitments to address climate change. The 2020 LRDP Climate Change amendment reflects campus policy, including: "Design all aspects of new projects to achieve short term and long term climate change emission targets established in the campus climate action plan." UC Berkeley targets achievement of 1990 greenhouse gas emission levels by 2014, six years ahead of state mandated targets, and climate neutrality as soon as possible but not later than 2050. The amendment links the 2020 LRDP and the campus climate action plan, which is updated annually.

The amendment to the UC Berkeley 2020 LRDP was approved by UC Berkeley based on Addendum #5 to the UC Berkeley 2020 LRDP EIR in July 2009, following review and consideration of comments from community members. Addendum #5 describes existing climate change conditions and evaluates the potential for development under the UC Berkeley 2020 LRDP, with minor amendments to reflect current campus policy, to affect climate change (UC Berkeley 2009). Addendum #5 provides a summary of the current regulatory framework applicable to climate change, discussing the applicable federal, state, regional, and local agencies that regulate, monitor, and control GHG emissions. The Project complies with University policies on sustainable practices, as further described below. See https://capitalstrategies.berkeley.edu/2020LRDP/climate_change for documents and information. The proposed Project would implement the 2020 LRDP, as amended, which includes compliance with emission targets established in the Campus Climate Action Plan and therefore would not conflict with any applicable plan adopted for the purpose of reducing the emissions of greenhouse gases.

5. ENVIRONMENTAL DETERMINATION

UC Berkeley has prepared this Draft Supplemental Environmental Impact Report (SEIR) to evaluate the Project in accordance with CEQA (Public Resources Code Section 21000 et seq.). Based on the SEIR the campus has determined that the Project, which includes a Minor Amendment to the 2020 LRDP to address siting of the proposed residential building, is substantially consistent with the UC Berkeley 2020 LRDP EIR, including later addendum and amendments, but that the Project may cause new impacts not considered in the 2020 LRDP EIR in the areas of Aesthetics and Land Use. No other new information of substantial importance, which was not known at the time the 2020 LRDP EIR was certified, has become available; and thus UC Berkeley has prepared a Supplemental EIR to the 2020 LRDP EIR. The Project Description, above, and the following impact analysis, including all Appendices, for the Project as currently proposed, serves as the SEIR.

On the basis of the initial evaluation that follows, UC Berkeley finds that:

	The proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.
	Although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.
X	The proposed project MAY have a significant effect on the environment and only minor additions or changes would be necessary to make the previous EIR adequately apply to the project in the changed situation. In response, this document constitutes a SUPPLEMENTAL ENVIRONMENTAL IMPACT REPORT.
	The proposed project MAY have a 'potentially significant impact' or 'potentially significant impact unless mitigated' impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable standards and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.
	Although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards; and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, and (c) the project does not involve new information of substantial importance that shows mitigation measures or alternatives which are considerably different from those analyzed in the 2020 LRDP EIR or which were previously considered infeasible, are now feasible; therefore, the 2020 LRDP EIR and the documentation enclosed presents sufficient environmental analysis for the project.

Vini Bhargava
Director, Physical & Environmental Planning, UC Berkeley

6. ENVIRONMENTAL EVALUATION

All answers take account of the whole action involved, including beneficial, direct, indirect, construction-related, operational, and cumulative impacts, based on the checklist questions set forth in Appendix G of the CEQA Guidelines. A list of references used in the preparation of this Draft EIR is included at the end of this document.

In the checklist that follows:

2020 LRDP Analysis Sufficient applies to those issues where the environmental review completed for the 2020 LRDP is determined to be sufficient to address impacts of the Project, and where additional CEQA review would be repetitive. Discussion under each issue area marked '2020 LRDP Analysis Sufficient' includes specific reference to the 2020 LRDP EIR setting, pertinent impact analysis, and continuing best practices and mitigation measures incorporated into the Project to address the potential environmental impact in question.

Further Analysis Required is checked for those potential environmental impacts, which may or may not be significant, for which the environmental review completed for the 2020 LRDP does not in itself provide an adequate basis for a determination of no significant impact, and for which further analysis of the Project is required; when checked, the analysis is presented in the text.

1. AESTHETICS

SETTING

The 2020 LRDP and accompanying EIR provide a framework for considering the visual effects of the Project. The visual setting of the campus and its environs are described in the 2020 LRDP EIR (Section 4.1). According to the 2020 LRDP, the Project site is located within the City Environs. The following text summarizes context information for aesthetics relevant to the Project.

VISUAL CHARACTER

UC Berkeley was established on an expansive landscape of rolling hills, framed by the north and south forks of Strawberry Creek. The Project site is located within the area of campus designated in the 2020 LRDP as the "City Environs," defined to include the Adjacent Blocks, the Southside, Other Berkeley Sites, and the Housing Zone in its entirety: in other words, the entire scope of the 2020 LRDP except for the Campus Park and Hill Campus. The areas within the City Environs are similar in consisting mostly of city blocks served by city streets, and include University-owned properties interspersed with non-university properties.

Similar to the heart of UC Berkeley, the Campus Park, the City Environs have continued to evolve over the years, and in many areas single-family homes have given way to multifamily buildings. Because this development has occurred project by project, many residential districts have an eclectic mix of older one- and two-story single-family homes and newer, larger apartment buildings. The City Environs – the Adjacent Blocks, the Southside, and the Housing Zone – primarily consists of a grid of city blocks developed with a dense but largely low-rise mix of residential, commercial, and institutional buildings. One- to four-story buildings with street level shops and services as well as office or residences on upper floors predominate along arterials, while interior blocks tend to be exclusively residential. According to the 2020 LRDP, the Project site is located within the Adjacent Blocks North subarea, which is bounded by the Hill Campus, LBNL, Ridge Road, Scenic Avenue, Hearst Avenue, Oxford Street, and the Campus Park. Major campus facilities on these blocks include Etcheverry Hall, Soda Hall, GSPP, the Greek Theatre, and the Bowles, Stern, and Foothill residence halls.

The Project site is located in a fully developed and primarily residential Northside neighborhood of Berkeley. As detailed in Chapter 5, *Cultural Resources*, this neighborhood is characterized by historic architecture. Three adjacent historic buildings exemplify the First Bay Tradition of the Arts and Crafts movement in architectural design and include: the Beta Theta Pi house at 2607 Hearst Avenue (west and within Project site), Cloyne Court Student Cooperative at 2600 Ridge Road (north and west of Project site), and a private house (formerly the Phi Kappa Psi fraternity house) at 2627 Ridge Road (immediately north across Ridge Road). The First Bay Tradition was a regional architectural movement identified by simple, rustic design executed primarily in unpainted redwood. Other surrounding single-family homes are mostly two to three-stories and are a mix of older, Tudor and post-Victorian Queen Anne style homes. In addition, surrounding apartments are mostly older, three to five-story buildings.

The predominant feature on the Project site is the L-shaped, four-story Upper Hearst parking structure that was built in 1970. The concrete parking structure curves around the corner of the intersection of La Loma Avenue and Hearst Avenue and includes chain-link fencing on the top of the structure, which encloses a recreational field. The northern portion of the site is the at-grade asphalt Ridge Lot which has 20 parking stalls. Concrete entrance ramps to the west and southeast lead to the subterranean portions of the Upper Hearst parking structure. The topography in the area is generally hilly, sloping generally toward the west. The average slope along Hearst Avenue and Ridge Road is approximately 10 percent. The Project site slopes upward from the southwest to the northeast corner. Refer to Figures 3a through 3c for a visual representation of existing conditions on and adjacent to the Project site.

SCENIC VISTAS, HISTORIC RESOURCES AND LANDSCAPE

Scenic vistas in the vicinity of the Project site include views of the East Bay hills to the northeast and of the San Francisco Bay and the Marin Headlands looking westward along Hearst Avenue. Views of these scenic resources are not currently visible from or through the Project site, except for a narrow portion of the Bay from Hearst Avenue east of La Loma Avenue. The Project site is visible from Hearst Avenue, La Loma Avenue, and Ridge Road. None of these routes have been officially designated by UC Berkeley or City of Berkeley as scenic roadways. Designated historic resources adjacent to the Project site include three buildings in the First Bay Tradition architectural style: University-owned Beta Theta Pi house to the west and the Cloyne Court Student Cooperative building to the west and northwest, and the Phi Kappa Psi house at 2627 Ridge Road to the north.

Approximately 49 trees are located within and adjacent to the Project site with most having a trunk diameter of 14 inches or less. The Camperdown elm tree in the front yard of the Beta Theta Pi house is a mature and prominent example of an unusual tree, and a character-defining feature of the Beta Theta Pi house’s landscape (Garrett 2019). UC Berkeley’s Campus Landscape Architect has determined that this tree qualifies as a specimen tree. Because of its striking appearance, with contorted and weeping branches, and its importance to the greater landscape, the Camperdown elm tree is a scenic resource. Two other trees within the property line are redwoods, each with an approximately 30-inch trunk diameter, adjacent to the existing parking entrance on La Loma Avenue. The redwoods are the tallest trees on the Project site, but the Campus Landscape Architect has determined that they are not specimen trees, so they do not represent scenic resources. Street trees are located across Hearst Avenue in front of Cory Hall; however there are no street trees in front of the existing GSPP buildings along Hearst Avenue. Street trees line the Project site along La Loma Avenue and Ridge Road. Foundation shrub planting and vine plants also surround the building façade.

LIGHTING

Nighttime ambient light levels in the vicinity of the Project site are typical of an urban environment. Wooden utility poles with downward-facing street lights line La Loma Avenue and Ridge Road adjacent to the Project site. The signalized intersection of La Loma Avenue and Hearst Avenue, next to the southeast corner of the site, has additional pole-mounted light fixtures. Buildings adjacent to the Project site, such as Cory Hall, have a low level of exterior lighting. Within the Project site, the Upper Hearst parking structure has interior light fixtures on the ceiling of parking levels, and the Ridge Road entrance to this parking structure has a pole-mounted light fixture. Sensitive receptors in the area include residences in three-to-five-story buildings to the east, north, and west of the Project site. Views from these receptors toward interior lighting at the Upper Hearst parking structure are partially screened by deciduous street trees.

REGULATORY SETTING

2020 LRDP & 2020 LRDP EIR

Review of individual projects under the 2020 LRDP affects the visual quality of the campus and its City Environs by guiding the location, scale, form, and design of new University projects. The 2020 LRDP includes a number of policies and procedures for individual project review to support the Objectives of the 2020 LRDP. Two of the 2020 LRDP Objectives and one of the Policies are particularly relevant to aesthetics:

- **Maintain and enhance the image and experience of the campus, and preserve our historic legacy of landscape and architecture (Objective).**
- **Plan every new project to respect and enhance the character, livability, and cultural vitality of our city environs (Objective).**
- **Use municipal plans and policies to inform the design of future capital projects in the City Environs (Policy).**

As specified in the 2020 LRDP, UC Berkeley endeavors to be responsive to the interface of the campus and the city. For this reason, informational presentations at the schematic design stage of the Project were made to the City of Berkeley's Design Review Committee and Landmarks Preservation Commission.

The Project was reviewed by the UC Berkeley Design Review Committee on September 6, 2017; May 17, 2018; June 6, 2018; December 20, 2018; and January 17, 2019. The committee provided comments on the exterior materials of the proposed buildings, screening and design of building components, and potential sound barriers, among other design features.

SPECIMEN TREES

UC Berkeley has an existing campus program to guide the evaluation and designation of specimen trees. Other plants (shrubs, groundcover or grasses) which meet the criteria may also be considered as specimen flora. The Campus Landscape Architect makes the determination of status, using the following criteria: to be considered a specimen, the tree or plant should be in good health and not pose a hazard to pedestrian and automotive traffic, existing buildings or utilities, and should have one or more of the following qualities:

Aesthetics: The tree is an integral part of an architectural theme, or plays an important role in framing or screening a building or other feature.

Historical: The tree was planted as part of a memorial planting or is a particularly outstanding example of the original botanical garden plantings. The tree is identified by landmark status, named with a plaque, is identified as a contributing feature in an historic structures report and/or identified in the LHP as a character defining feature of the landscape.

Educational: The tree represents a special taxonomic or morphological feature, is unique to the Campus or the San Francisco Bay Area, is a particularly outstanding example of California flora, is part of an experimental planting with a special landscape or agricultural value, or is regularly used by campus instructors as an example of the species.

Strawberry Creek: Removal of the tree would significantly increase erosion potential, affect the natural species diversity of the Creek as a riparian corridor.

Natural Area: The tree is located within the Wickson, Grinnell or Goodspeed Natural Areas (UC Berkeley 1996, cited in UC Berkeley 2004).

Determination of specimen status may extend to a group of trees that has importance as a group, even though the individual trees may not in themselves meet the specimen criteria.

Under this program, the retention of existing specimen trees, shrubs and grass areas is a priority in the final design of proposed projects. Projects are reviewed with the UC Berkeley Design Review Committee to minimize impacts to specimen trees. Site preparation is conducted to minimize removal and/or damage of specimen trees or plant species to the fullest feasible extent. Sensitive construction practices are used to avoid possible damage to trees to be retained, including construction setbacks, installation of temporary construction fencing around individual trees to be preserved, and monitoring by a certified arborist of any required limb removal or disturbance within the dripline of trees to be retained. Grading, vegetation removal and replacement plans, where necessary, are coordinated with the Campus Landscape Architect. Specimen trees impacted are replaced by successful transplanting, or must be replaced by new planting at a ratio of 3 to 1 in closest available sizes. The Campus Landscape Architect determines the size of replacement trees. Trees greater in size than available in the nursery trade may he replaced with the largest feasible tree size. Alternatively, smaller trees in greater number may be considered replacement for a single large specimen tree. Disturbed landscaped areas are restored to the full feasible extent (2020 LRDP EIR Vol 1, p. 4.4-19).

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the proposed Project have been reviewed by the UC Berkeley Design Review Committee, based on project specific design guidelines informed by the provisions of the City of Berkeley General Plan, and the 2020 LRDP.

The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon aesthetics. Where applicable, the Project would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practice AES-1-b: Major new campus projects would continue to be reviewed at each stage of design by the UC Berkeley Design Review Committee. The provisions of the 2020 LRDP, as well as project specific design guidelines prepared for each such project, would guide these reviews.

2020 LRDP Continuing Best Practice AES-1-e: UC Berkeley would make informational presentations of all major projects in the City Environs in Berkeley to the Berkeley Planning Commission and, if relevant, the Berkeley Landmarks Commission for comment prior to schematic design review by the UC Berkeley Design Review Committee. Major projects in the City Environs in Oakland would similarly be presented to the Oakland Planning Commission and, if relevant, to the Oakland Landmarks Preservation Advisory Board.

2020 LRDP Continuing Best Practice AES-1-f: Each individual project built in the City Environs under the 2020 LRDP would be assessed to determine whether it could pose potential significant aesthetic impacts not anticipated in the 2020 LRDP, and if so, the project would be subject to further evaluation under CEQA.

2020 LRDP Continuing Best Practice AES-1-g: To the extent feasible, University housing projects in the 2020 LRDP Housing Zone would not have a greater number of stories nor have setback dimensions less than could be permitted for a project under the relevant city zoning ordinance as of July 2003.

2020 LRDP Mitigation Measure AES-3-a: Lighting for new development projects would be designed to include shields and cut-offs that minimize light spillage onto unintended surfaces and minimize atmospheric light pollution. The only exception to this principle would be in those areas where such features would be incompatible with the visual and/or historic character of the area.

2020 LRDP Mitigation Measure AES-3-b: As part of the design review procedures described in the above Continuing Best Practices, light and glare would be given specific consideration, and measures incorporated into the project design to minimize both. In general, exterior surfaces would not be reflective: architectural screens and shading devices are preferable to reflective glass.

2020 LRDP Continuing Best Practice BIO-1-a: UC Berkeley will continue to implement the Campus Specimen Tree Program to reduce adverse effects to specimen trees and flora. Replacement landscaping will be provided where specimen resources are adversely affected, either through salvage and relocation of existing trees and shrubs or through new plantings of the same genetic strain, as directed by the Campus Landscape Architect.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Aesthetics, the potential environmental impacts resulting from the increase in campus headcount are limited to physical development on the UC Berkeley campus and City Environs. As noted in Section 4, *Relationship to 2020 LRDP*, UC Berkeley has constructed approximately 43 percent of the 2.2 million net new gross square feet of development anticipated in the 2020 LRDP despite the increased campus headcount above 2020 LRDP projections. To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased campus headcount would not be additional to that planned for in the 2020 LRDP. Therefore, such development would not result in additional substantial adverse effects on scenic vistas, substantial damage to scenic resources, new adverse sources of substantial light and glare, or result in a substantial degradation of the existing visual character or quality of the Project Site or its surroundings. Aesthetic impacts would not be more severe than those evaluated in the 2020 LRDP EIR.

AESTHETICS

Would the Project:

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
1. Have a substantial adverse effect on a scenic vista?	●	

The 2020 LRDP identified preservation areas, into which new buildings should not intrude, in order to protect scenic vistas on campus. As shown in Figure 7 of the 2020 LRDP, all preservation areas are located within the Campus Park and not within the Adjacent Blocks North subarea. The nearest preservation area is a view and open space preservation zone located across Hearst Avenue to the south of the Project site, covering Founders' Rock and its immediate vicinity. Therefore, no aspect of the Upper Hearst Development is located within a preservation area identified in the 2020 LRDP. The proposed academic and residential buildings would not obstruct views from the Hearst Avenue corridor of Founders' Rock or other preservation areas located in the Campus Park.

As discussed in the 2020 LRDP EIR, the City Environs are mostly flat and densely urbanized, and since future University projects in the City Environs are expected to be of the same general scale as private projects on similar sites, no significant impacts on scenic vistas were anticipated. Policy UD-31 in the City of Berkeley General Plan identifies "significant views" that merit preservation as ones toward the Bay, the East Bay hills, and landmarks such as the Campanile, the Golden Gate Bridge, and Alcatraz Island. Although the 2020 LRDP EIR anticipates no effect from University projects on scenic vistas, the block of Hearst Avenue southeast of the Project site, between La Loma Avenue and Highland Place, offers narrow westward views of the Bay and ridgelines in the North Bay, partially screened by the branches of street trees and existing development. Because the proposed residential building up to six stories tall on the north side of Hearst Avenue would increase the height of structures on the Project site, relative to the existing four-story Upper Hearst parking structure, the Project would result in a slight additional obstruction of existing scenic Bay views from this road corridor. However, as discussed above, existing development and vegetation partially obstructs Bay views from Hearst Avenue near the Project site, and the Upper Hearst Development would not substantially increase the obstruction of these scenic views. Therefore, consistent with the 2020 LRDP EIR, the Upper Hearst Development would have a less than significant impact on scenic vistas.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
2. Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?		●

The 2020 LRDP EIR found that because no State-designated or eligible scenic highways are located in the vicinity of UC Berkeley, implementation of the 2020 LRDP would have no impact from damaging scenic resources within a scenic highway (2020 LRDP EIR Vol 1, p. 4.1-16). Although the Upper Hearst Development would likely involve removal of a scenic resource, a weeping Camperdown elm tree in the front yard of the historic Beta Theta Pi building, this scenic resource is not visible from a scenic highway. Therefore, consistent with the 2020 LRDP EIR's analysis, the Project would have no impact on scenic resources within a scenic highway.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
3. Create a new source of substantial light or glare which would adversely affect day- or night-time views in the area?		●

The Upper Hearst Development would increase ambient nighttime lighting on the Project site by introducing light emitting diode (LED) fixtures at the exterior of the proposed residential and academic buildings, with higher illumination levels at building entrance and vehicle ramps. The new parking structure would have LED fixtures with occupancy sensors to activate lighting when occupied. Other light fixtures would be installed along pedestrian paths and at featured landscaped elements on the Project site. New exterior light fixtures and illumination through windows from interior lighting would result in an increase in nighttime ambient light levels near the Project site. Exterior lighting also would occasionally be used on the rooftop terrace of the new academic building, during evening events. However, exterior light fixtures would be designed to direct light downward, which would minimize offsite spillover of light. Exterior lighting control will use a combination of photo sensor and automated time switch to increase energy savings. New street trees along the Project site boundary also would partially screen new lighting from the view of adjacent residences. In addition, Mitigation Measures AES-

3-a and AES-3-b in the 2020 LRDP EIR require the use of shields and cut-offs in lighting and the minimal use of reflective exterior surfaces. Implementing these measures would minimize light and glare from the proposed Upper Hearst Development. Therefore the development would not create a new source of substantial light or glare which would adversely affect day or nighttime views in the area. This impact would be less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Substantially degrade the existing visual character or quality of the site and its surroundings?	●	

The proposed Project would alter the existing visual character of the Project site, which is located in an urbanized area of Berkeley. Currently, the site has a utilitarian character with a concrete, multi-story parking structure and an at-grade asphalt parking lot, relieved by scattered mature trees including two tall redwoods adjacent to La Loma Avenue. The Project would involve demolition of the Upper Hearst parking structure, demolition of the Ridge Lot, removal of up to 49 trees, and the construction of two new buildings. Both buildings would have a contemporary design with glass, concrete, and metal as the primary exterior materials. These specific contemporary exterior materials would starkly contrast with the wood-shingled cladding of adjacent buildings, including the historic Cloyne Court Student Cooperative, the Foothill Student Housing complex, and residences north of Ridge Road. In addition, the proposed building materials would contrast with the brick and wood cladding of the historic Beta Theta Pi house to the west of the Project site.

The proposed buildings also would increase the scale and massing of structures on the Project site. The residential building, to be built on top of the parking structure, would have a height of up to six stories, while the academic building would be four stories tall. These new buildings would be higher and of greater mass and scale than all buildings in the immediate vicinity. The new academic building, while incorporating a two-story entrance lobby directly adjacent to the Beta Theta Pi house, would appear more than double the height of the one- to two-story Beta Theta Pi house directly adjacent to its principal elevation. In addition, the residential building would rise up to 87 feet high along Hearst Avenue. This increase in scale and massing would intensify the urban character of the largely residential neighborhood.

As detailed in Chapter 5, *Cultural Resources*, the scale, massing, and palette of exterior materials at the Upper Hearst Development would not be compatible with neighboring areas of Berkeley. The residential building would be substantially higher and of greater mass than all residential buildings in the site vicinity. Reaching up to 87 feet in height along Hearst Avenue, the residential building would exceed the height of adjacent residential buildings, which are up to four stories tall. The proposed building massing and design also would depart from and compromise the setting of adjacent historic resources that were built in the First Bay Tradition of architecture. These historic buildings are characterized by a purposeful integration within their hillside topography and landscape, the use of indigenous materials and wood shingles, sheathing, and half-timbering, and a relatively low scale and mass, among other features. By contrast, the new buildings would have a contemporary design, primarily consisting of fiber-cement and aluminum panels, plaster, and aluminum-framed and punched (deeply recessed) windows, among other materials.

Because of the visual incompatibility between the new buildings and the surrounding neighborhood, the Upper Hearst Development would have a detrimental effect on visual character and quality in the Adjacent Blocks North subarea. Whereas the 2020 LRDP EIR anticipated that adherence to design provisions in the 2020 LRDP would prevent degradation of visual character and quality from new development by UC Berkeley, the proposed Upper Hearst Development would still have a detrimental visual effect on the surrounding neighborhood. Implementation of Mitigation Measure CUL-1, as detailed in Chapter 5, *Cultural Resources*, would reduce this impact to the extent feasible through consultation with an architectural historian. However, this mitigation would not resolve incompatibilities relating to the scale and massing of new buildings. A substantially modified project that reduces the proposed building's scale and mass would be necessary to avoid a significant visual impact. Therefore, the Upper Hearst Development would introduce a new significant and unavoidable impact on visual character and quality, which is more severe than the less than significant impact identified by the 2020 LRDP EIR for this issue.

In December 2018, after release of the Notice of Preparation of this SEIR, the State Office of Planning and Research amended the Appendix G checklist question on visual character and quality. For projects in urban areas, such as the Project site, the revised checklist question asks if a project would conflict with applicable zoning or other regulations governing scenic quality. UC Berkeley's Specimen Tree Program has requirements for designated specimen trees which serve to protect scenic quality. Because construction of the Upper Hearst Development would likely require removal of the specimen Camperdown elm tree, UC Berkeley would implement Continuing Best Practice BIO-1-a by replacing landscaping where specimen resources are adversely affected. The Campus Specimen Tree Program would require replacement of this specimen tree at a 3 to 1 ratio in the closest available sizes to the existing tree. By replacing a removed scenic tree with new trees, UC Berkeley would be consistent with the requirements of the Specimen Tree Program. As discussed in Chapter 10, *Land Use*, UC Berkeley is constitutionally exempt from local land use regulations.

The 2020 LRDP EIR found that new development could degrade visual character and quality, but design provisions of the 2020 LRDP would ensure the contribution of projects under the 2020 LRDP would not be cumulatively considerable (2020 LRDP EIR Vol 1, p. 4.1-22). As discussed above, the Upper Hearst Development would introduce a project-level significant impact on visual character and quality, as a result of incompatibility in scale, massing, and design between the proposed buildings and the surrounding neighborhood. However, other cumulative projects are not located in this Northside Berkeley neighborhood to the north of Hearst Avenue and east of Oxford Street and would not affect its visual setting. It is also assumed that other cumulative projects would be consistent with applicable design standards. Therefore, the Project would not contribute to a significant cumulative impact on visual character or quality as identified in the 2020 LRDP EIR.

SUMMARY OF AESTHETICS ANALYSIS

The 2020 LRDP EIR determined that buildout of the 2020 LRDP, which would incorporate design provisions of the 2020 LRDP and mitigation measures relating to light and glare, would not result in significant aesthetic impacts (2020 LRDP EIR Vol 1, p. 4.1-15 to 4.1-19), nor would the project-level implementation of the 2020 LRDP make a cumulatively considerable contribution to adverse aesthetic impacts (2020 LRDP EIR Vol 1, p. 4.1-22 to 4.1-24). As described above, the Upper Hearst Development would not change the less than significant impact conclusions reached in the 2020 LRDP EIR related to scenic vistas, scenic resources, and light and glare associated with implementation of the 2020 LRDP.

However, because the scale, massing, and palette of exterior materials of the proposed Upper Hearst Development would be incompatible with the surrounding neighborhood and most adjacent structures, and only a substantially modified development with lower scale and mass could resolve these compatibility issues, the Project would result in a more severe, significant and unavoidable impact to the visual character and quality of the site and its surroundings.

2. AIR QUALITY

SETTING

The air quality setting of the campus is described in the 2020 LRDP EIR (Section 4.2). The following text summarizes context information for air quality relevant to the Project.

Construction Emissions. Construction activities are a source of dust emissions that can have temporary impacts on local air quality by possibly exceeding State air quality standards. These emissions are generated from land clearing, ground excavation, cut and fill operations, demolition and the construction of project facilities. Dust emissions vary from day to day depending on the level of activity, the specific operations and the prevailing weather. Air pollutant emissions modeling completed for the 2020 LRDP EIR assumed up to one million gross square feet of space could be under construction at any one time under the 2020 LRDP.

Dust from construction and demolition activities would be addressed by Bay Area Air Quality Management District (BAAQMD) Regulation 1, Section 301, which states that sources cannot emit air contaminants that cause nuisances to ‘any considerable number of persons or the public,’ and by adherence to construction emission mitigation measures incorporated into construction contracts. The Project site is located on an existing at-grade asphalt parking lot and a four-story parking structure.

In December 2015, the California Supreme Court also found that Local agencies need to determine appropriate air quality thresholds of significance based on substantial evidence in the record, based on a December 2015 ruling by the California Supreme Court. Local agencies may rely on the BAAQMD’s CEQA Guidelines (updated May 2017) for assistance in calculating air pollution emissions, obtaining information regarding the health impacts of air pollutants, and identifying potential mitigation measures. However, the thresholds are not mandatory and agencies should apply them after determining that they reflect an appropriate measure of a project’s impacts. For this SEIR, UC Berkeley has determined that the significance thresholds in the BAAQMD’s May 2017 CEQA Guidelines for project operations within the San Francisco Bay Area Air Basin are the most appropriate thresholds for use to determine the air quality impacts of the Project. UC Berkeley has used the previous May 2011 BAAQMD thresholds in past environmental analyses under CEQA and found them based upon substantial evidence to be reasonable thresholds for assessing air quality impacts.

The 2020 LRDP EIR includes mitigation measures and best practices that substantially align with BAAQMD-recommended project-specific control measures for construction; other measures are part of campus best practices in contracting. The eight basic control measures in the most recent BAAQMD CEQA Guidance document (BAAQMD CEQA Guidelines, May 2017, page 8-4) are listed below along with their counterparts in the 2020 LRDP EIR:

1. All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.

Counterpart: 2020 LRDP Continuing Best Practice AIR-4-a (reprinted below)

2. All haul trucks transporting soil, sand, or other loose material off-site shall be covered.

   Counterpart: 2020 LRDP Continuing Best Practice AIR-4-a (reprinted below)

3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.

   Counterpart: 2020 LRDP Mitigation Measure AIR-4-a (reprinted below)

4. All vehicle speeds on unpaved roads shall be limited to 15 mph.

   Counterpart: 2020 LRDP Mitigation Measure AIR-4-a (reprinted below)

5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.

   Counterpart: 2020 LRDP Mitigation Measure AIR-4-a (reprinted below) and 2020 LRDP Continuing Best Practice HYD-2-d which states: UC Berkeley shall continue to develop and implement the recommendations of the Strawberry Creek Management Plan and its updates, and construct improvements as appropriate. These recommendations include, but shall not be limited to, minimization of the amount of land exposed at any one time during construction as feasible; use of temporary vegetation or mulch to stabilize critical areas where construction staging activities must be carried out prior to permanent cover of exposed lands; installation of permanent vegetation and erosion control structures as soon as practical; protection and retention of natural vegetation; and implementation of post-construction structural and non-structural water quality control techniques.

6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.

   Counterpart: 2020 LRDP EIR Continuing Best Practice AIR-4-b (reprinted below).

7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.

   Counterpart: Campus contractors are required to comply with applicable law and regulation.

8. Post a publicly visible sign with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

   Counterpart: All campus construction projects have posted contact information as part of standard practice, with a person responsible for action.

All construction projects implementing the 2020 LRDP remain in substantial compliance with BAAQMD-recommended best practices and controls.

At the time of the preparation of the 2020 LRDP EIR, BAAQMD did not require lead agencies to estimate emissions from construction, nor did the guidelines provide any numerical thresholds to evaluate the significance of emissions, should those be quantified. However, for informational purposes, the 2020 LRDP EIR included estimated criteria pollutant construction emissions from the maximum assumed construction scenario under the 2020 LRDP, using the URBEMIS model. A maximum assumed construction area of 1,000,000 gsf was used as a worst-case condition to characterize emissions from 2020 LRDP-related construction. Modeled emissions of ROG and NOx substantially exceed BAAQMD's project level construction-related thresholds included in the May 2017 CEQA Guidelines. See Table 5 below.

Table 5:
2020 LRDP EIR Emissions Modeling Results

Pollutant	BAAQMD Project Construction Threshold (lbs/day)	Estimated Daily Construction-related Emissions, 2020 LRDP (lbs) (Table 4.2-8, 2020 LRDP EIR)
ROG[1]	54	1,123
NO_X[2]	54	1,565
PM_{10} (exhaust)[3]	82	12
$PM_{2.5}$ (exhaust)[4]	54	Not calculated
PM_{10}/$PM_{2.5}$ fugitive dust[5]	Best management practices	Best management practices applied

[1] ROG = reactive organic gases

[2] NO_x = nitrogen oxides

[3] PM_{10} = particulate matter 10 micrometers or less in diameter

[4] $PM_{2.5}$ = particulate matter 2.5 micrometers or less in diameter

[5] Fugitive dust = very small particles suspended in air

Source: 2020 LRDP EIR Vol 1, p. 4.2-24.

Based on the 2020 LRDP EIR, implementation of the 2020 LRDP would generate emissions exceeding BAAQMD thresholds; however, the 2020 LRDP analysis, conducted for the hypothetical construction of the entirety of the 2020 LRDP program, was conservative. Therefore, this analysis quantifies construction emissions specific to the Upper Hearst Development.

Operational Emissions. The 2020 LRDP EIR concluded that projects implemented as part of the 2020 LRDP, guided by compliance with local regulations, campus policies and programs to reduce emissions and risk of toxic air contaminant (TAC) releases, and incorporating existing best practices and 2020 LRDP EIR mitigation measures would, with the exception of incremental campus growth overall, not result in new significant air quality impacts (2020 LRDP EIR Vol. 1 p. 4.2-20 to 4.2-26). Cumulatively, the 2020 LRDP EIR noted that projects implementing the 2020 LRDP, in combination with other foreseeable projects, may result in a cumulatively considerable increase in nonattainment pollutants that conflicts with the Clean Air Plan (2020 LRDP EIR Vol. 1 p. 4.2-31) and could contribute to a cumulatively considerable increase in TACs, primarily from diesel particulate matter, from stationary and area sources (2020 LRDP EIR Vol 1 p. 4.2-33).

2020 LRDP & 2020 LRDP EIR

Implementation of the 2020 LRDP would influence air quality by guiding the location, scale, form and design of new University projects. The 2020 LRDP includes a number of policies and procedures for individual project review to support the Objectives of the 2020 LRDP. While several of the 2020 LRDP Objectives bear directly or indirectly on air quality, two are particularly relevant:

- **Provide the housing, access, and services we require to support a vital intellectual community and promote full engagement in campus life.**
- **Plan every new project as a model of resource conservation and environmental stewardship.**

With respect to access, the 2020 LRDP anticipates increasing the supply of parking to accommodate unmet demand and future growth, yet reducing growth in demand for parking through incentives for alternate travel modes; and collaborating with local cities and transit providers to improve service to the campus. Policies under the second objective include incorporating sustainable design principles into capital investment decisions; developing a campus standard for sustainable design specific to the UC Berkeley site, climate, and facility inventory; designing new campus buildings to a standard equivalent to LEED 2.1; and designing new campus laboratory buildings to a standard equivalent to LEED 2.1 and LABS 21 environmental performance criteria. UC Berkeley updated these policies to reflect current LEED standards in the Addendum #5 to the 2020 LRDP EIR.

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the Upper Hearst Development would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon air quality. Where applicable, the Project would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practice AIR-4-a: UC Berkeley shall continue to include in all construction contracts the measures specified below to reduce fugitive dust impacts:

- All disturbed areas, including quarry product piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using tarps, water, (non-toxic) chemical stabilizer/suppressant, or vegetative ground cover.
- All on-site unpaved roads and off-site unpaved access roads shall be effectively stabilized of dust emissions using water or (non-toxic) chemical stabilizer/suppressant.
- When quarry product or trash materials are transported off-site, all material shall be covered, or at least two feet of freeboard space from the top of the container shall be maintained.

2020 LRDP Mitigation Measure AIR-4-a: In addition, UC Berkeley shall include in all construction contracts the measures specified below to reduce fugitive dust impacts, including but not limited to the following:

- All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking.
- When demolishing buildings, water shall be applied to all exterior surfaces of the building for dust suppression.
- All operations shall limit or expeditiously remove the accumulation of mud or dirt from paved areas of construction sites and from adjacent public streets as necessary. See also CBP HYD 1-b.
- Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions by utilizing sufficient water or by covering.
- Limit traffic speeds on unpaved roads to 15 mph.
- Water blasting shall be used in lieu of dry sand blasting wherever feasible.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with slopes over one percent.
- To the extent feasible, limit area subject to excavation, grading, and other construction activity at any one time.
- Replant vegetation in disturbed areas as quickly as possible.

2020 LRDP Continuing Best Practice AIR-4-b: UC Berkeley shall continue to implement the following control measure to reduce emissions of diesel particulate matter and ozone precursors from construction equipment exhaust:

- Minimize idling time when construction equipment is not in use.

2020 LRDP Mitigation Measure AIR-4-b: UC Berkeley shall implement the following control measures to reduce emissions of diesel particulate matter and ozone precursors from construction equipment exhaust:

- To the extent that equipment is available and cost effective, UC Berkeley shall require contractors to use alternatives to diesel fuel, retrofit existing engines in construction equipment and employ diesel particulate matter exhaust filtration devices.
- To the extent practicable, manage operation of heavy-duty equipment to reduce emissions, including the use of particulate traps.

2020 LRDP Continuing Best Practice AIR-5: UC Berkeley will continue to implement transportation control measures such as supporting voluntary trip-reduction programs, ridesharing, and implementing facilities.

2020 LRDP Mitigation Measure AIR-5: UC Berkeley will work with the City of Berkeley, ABAG and BAAQMD to ensure that emissions directly and indirectly associated with the campus are adequately accounted for and mitigated in applicable air quality planning efforts.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Air Quality, the potential environmental impacts resulting from the increase in campus headcount are influenced both by physical development on the UC Berkeley campus and City Environs (e.g., construction-related and operational emissions of criteria air pollutants and TACs) and by campus population numbers (e.g., increase in energy users, commuters, and sensitive receptors exposed to TACs).

The increase in UC Berkeley's existing and projected campus headcount would not involve physical development beyond that planned for in the 2020 LRDP. Therefore, new development to accommodate a greater headcount would not be additional to growth anticipated in the 2020 LRDP EIR. As noted above, Mitigation Measure AIR-5 and Continuing Best Practice AIR-5 in the 2020 LRDP EIR would require UC Berkeley to work with the City of Berkeley, ABAG, and BAAQMD to ensure that campus growth is accurately addressed in the Clean Air Plan. Because the increase in UC Berkeley's existing and projected campus headcount would not require additional physical development beyond that anticipated in the 2020 LRDP EIR, it would not result in additional short-term emissions from construction activity or long-term emissions from the operation of structures, and it would not expose sensitive receptors to excessive TAC concentrations beyond the level anticipated in the 2020 LRDP EIR.

The Trip Generation Comparison memorandum prepared by Fehr & Peers (Appendix G) estimates that despite an increase in campus headcount relative to levels previously analyzed in the 2020 LRDP EIR, campus-wide daily and peak-hour trip generation has decreased from the 2001-2002 school year to existing conditions, would still decrease through the 2022-2023 school year, and would be below levels anticipated for 2020 in the 2020 LRDP EIR. Therefore, the additional campus headcount would not result in increased mobile emissions relative to the 2020 LRDP EIR's analysis or in increased traffic congestion that could expose sensitive receptors to substantial carbon monoxide (CO) concentrations. An increased headcount could result in a modest increase in water demand and energy used to transport water. However, as discussed in Chapter 7, *Greenhouse Gas Emissions*, UC Berkeley is required to implement the UC's Carbon Neutrality Initiative, which would aggressively improve energy efficiency in buildings and increase utilization of renewable energy sources. Therefore, increased campus headcount would not result in greater emissions than anticipated in 2020 LRDP EIR and would not conflict with implementation of the Clean Air Plan. Although more people on campus would be exposed to air pollutants, campus occupants would not be exposed to a human cancer risk that exceeds the applicable significance threshold. Furthermore, the increase in UC Berkeley's current and projected campus headcount would not result in additional exposure of people to objectionable odors because, as discussed below, campus facilities do not commonly generate objectionable odors. No increase in the severity of the significant and unavoidable air quality impacts identified in the 2020 LRDP EIR would occur.

AIR QUALITY

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Conflict with or obstruct implementation of the applicable air quality plan?		●

The 2020 LRDP EIR found that operational emissions from implementation of the 2020 LRDP may hinder attainment of the Clean Air Plan, because the 2020 LRDP EIR conservatively assumed that growth under the 2020 LRDP was not included in local area projections (2020 LRDP EIR Vol 1, p. 4.2-26). The 2020 LRDP EIR analysis anticipated up to 2,200,000 million net new gross square feet within the area governed by the 2020 LRDP. As only about 43 percent of the development that was proposed in the 2020 LRDP and analyzed in the 2020 LRDP EIR has occurred, the proposed 37,000 square-foot academic building would fit within this development envelope and would not be additional to the growth anticipated in the 2020 LRDP EIR.

The 2020 LRDP EIR concluded that campus growth may not be consistent with the most recent Clean Air Plan. However, it found that with implementation of the mitigation measures in the 2020 LRDP EIR and coordinated planning efforts with the BAAQMD, the impact from operational emissions would be fully addressed, and future projects implementing the 2020 LRDP would likely be in compliance with air quality plans (2020 LRDP EIR Vol 1, p. 4.2-28 to 4.2-29). As prescribed by Mitigation Measure AIR-5 and Continuing Best Practice AIR-5 in the 2020 LRDP EIR, UC Berkeley would work with the City of Berkeley, ABAG, and BAAQMD to ensure that campus growth is accurately addressed in the Clean Air Plan, and would continue to develop and implement transportation control measures. Therefore, with implementation of these measures, the Upper Hearst Development would not conflict with applicable air quality plans.

Cumulatively, the 2020 LRDP EIR noted that projects implementing the 2020 LRDP, in combination with other foreseeable projects, may result in a cumulatively considerable increase in nonattainment pollutants that conflicts with the Clean Air Plan (2020 LRDP FEIR Vol. 1, p. 4.2-31) and could contribute to a cumulatively considerable increase in toxic air contaminants, primarily from diesel particulate matter, from stationary and area sources (2020 LRDP FEIR Vol 1 p. 4.2-33). Because the proposed Upper Hearst Development would be within the development parameters of the 2020 LRDP, it would not result in additional growth that generates greater air pollution than anticipated in the 2020 LRDP EIR. Therefore, the Project would not considerably contribute to a significant impact related to conflicts with the Clean Air Plan.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Violate any air quality standard or contribute substantially to an existing or projected air quality violation?		●

The 2020 LRDP EIR examined the potential for vehicle and stationary source emissions under the 2020 LRDP to violate state and federal air quality standards or contribute to existing air quality violations, and determined implementation of the 2020 LRDP would not violate the CO standard or expose sensitive receptors to substantial CO concentrations (2020 LRDP EIR Vol 1, p. 4.2-20).

The 2020 LRDP EIR further found that traffic associated with development under the 2020 LRDP would not contribute to a cumulatively considerable increase in or expose receptors to substantial CO concentrations. Using measured CO concentrations associated with peak hour vehicle volumes for the intersection of Mission Boulevard and Jackson Street/Foothill Boulevard in Hayward as a 'worst-case' comparable in the same air basin as the campus, the 2020 LRDP EIR found changes at local intersections resulting from implementation of the 2020 LRDP would not result in significant impacts. As discussed in the Transportation analysis, the Upper Hearst Development would reduce trip generation as compared to the 2020 LRDP EIR, because of the proposed reduction of parking spaces on-site and the constrained supply of nearby on-street parking. Therefore, the Upper Hearst Development would be within the scope of the 2020 LRDP EIR and would have a less than significant impact from contributions to air quality violations.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Expose sensitive receptors to substantial air pollutant concentrations?		●

Independently and in contrast to some types of manufacturing or production uses, University operations are not typically significant emission sources. The 2020 LRDP EIR evaluated whether construction and development activities under the 2020 LRDP would expose sensitive receptors, including nearby schools, to substantial pollutant concentrations. UC Berkeley completed a Health Risk Assessment for the 2020 LRDP EIR, which evaluated risks from TACs to sensitive receptors, including schools, hospitals, day care centers and senior care facilities. The 2020 LRDP EIR evaluated the maximum exposure risk to sensitive receptors from conditions existing at the time, and estimated the maximum exposure risk to sensitive receptors with build out of the 2020 LRDP program (2020 LRDP EIR Vol 1, p. 4.2-15 and 4.2-22).

The Upper Hearst Development would not include laboratory research space or other uses that are considered a stationary pollutant source that may impact nearby receptors. Therefore, it would not contribute excess pollutant concentrations beyond those analyzed in the 2020 LRDP EIR, and this impact would be less than significant.

The 2020 LRDP EIR found that cumulative projects would generate new TAC emissions, resulting in a significant and unavoidable air quality impact (2020 LRDP EIR Vol 1, p. 4.2-33 to 4.2-34). The construction of current cumulative UC Berkeley and LBNL projects that would involve TAC emissions during building operations, such as from emergency generators, would contribute to this impact. By increasing the number of people exposed to air pollution, the Upper Hearst Development may incrementally contribute to this significant cumulative impact identified in the 2020 LRDP EIR.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?	●	

Based on available construction details for the Upper Hearst Development, construction emissions were estimated using the California Emissions Estimator Model (CalEEMod) version 2016.3.2 computer model. Average daily emissions from construction were calculated in CalEEMod, including both on-site and off-site activities. On-site activities would consist of the operation of off-road construction equipment, as well as on-site truck travel (e.g., haul trucks, water trucks, dump trucks, and concrete trucks), whereas off-site sources would be emissions from construction vehicle trips. It was assumed that demolition of the existing parking areas would require the export of approximately 7,000 cubic yards of material from the Project site via truck trips. In addition, it was assumed that the construction would result in a net export of 13,007 cubic yards of soil.

Table 6 shows maximum daily construction emissions results from the Upper Hearst Development activities modeled in CalEEMod and compares them to the BAAQMD thresholds. The modeled emissions do not account for measures required by BAAQMD to reduce dust emissions or for implementation of the required mitigation measures and continuing best practices included in the 2020 LRDP EIR. Therefore, actual emissions during demolition and construction of buildings would be lower than shown in Table 6. Construction emissions would not result in a cumulatively considerable increase of any criteria pollutant, and the development would not contribute additional pollutant concentrations beyond those analyzed in the 2020 LRDP EIR. Consequently, the Upper Hearst Development would have a less than significant impact from emissions of criteria air pollutants.

Table 6:
Maximum Daily On-Site and Off-Site
Construction Air Pollutant Emissions

	Emissions (lbs/day)			
	ROG	**NO_X**	**Exhaust PM_{10}**	**Exhaust $PM_{2.5}$**
2019	2.3	22.7	1.3	1.2
2020	3.0	21.5	0.8	0.8
2021	2.7	19.7	0.7	0.7
Maximum lbs/day[1]	**3.0**	**21.5**	**1.3**	**1.2**
BAAQMD Thresholds	54	54	82	54
Threshold Exceeded?	**No**	**No**	**No**	**No**

[1] *Maximum daily on and off-site emissions based on highest day in any construction year, i.e. 2019, 2020, or 2021.*

Source: CalEEMod; see Appendix C for calculations.

Operation of the proposed buildings would also generate long-term emissions associated with energy and water use, and other on-site activities. However, the Upper Hearst Development would reduce vehicle trip generation compared to existing conditions because of the reduction in parking spaces on-site and the constrained supply on nearby on-street parking. Therefore, mobile emissions generated by activities on the Project site would decrease. The increase in square footage and beds also would be within the development parameters of the 2020 LRDP EIR and therefore would not exceed overall operational emissions from such development. Therefore, operational emissions would not considerably contribute to the significant and unavoidable impact identified in the 2020 LRDP EIR from development under the 2020 LRDP.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
5. Expose people to substantial levels of toxic air contaminants (TACs), such that the exposure could cause an incremental human cancer risk greater than 10 in one million or exceed a hazard index of one for the maximally exposed individual?		●

As described in Air Quality item 3 above, the Upper Hearst Development would not result in a new source of substantial air pollutant emissions. People occupying the new buildings also would not be subject to substantial levels of TACs. As discussed in the 2020 LRDP EIR, campus occupants would not be exposed to a human cancer risk above the significance thresholds of 10 in one million or a hazard index of greater than one for the maximally exposed individual (MEI) (2020 LRDP EIR Vol 1, p. 4.2-21). Therefore, the Upper Hearst Development would not contribute excess pollutant concentrations beyond those analyzed in the 2020 LRDP EIR, and this impact would be less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
6. Cause objectionable odors affecting a substantial number of people?		●

Existing campus facilities are not commonly sources of odors, and no element of the proposed Project is anticipated to result in new odors that may affect a substantial number of people. This impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

SUMMARY OF AIR QUALITY ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, guided by compliance with regulation, campus policies and programs to reduce emissions and risk of TAC releases, would, with one exception, not result in new significant air quality impacts (2020 LRDP EIR Vol 1 p. 4.2-20 to 4.2-26). As the one exception, the 2020 LRDP EIR conservatively estimated that the BAAQMD Clean Air Plan did not include an increment for growth at UC Berkeley, and found that campus growth overall may not comply with the Clean Air Plan, and may result in a cumulatively considerable increase in non-attainment pollutants that conflicts with the Clean Air Plan (2020 LRDP EIR Vol 1 p. 4.2-26, and p. 4.2-31). With implementation of mitigation measures and continuing best practices in the 2020 LRDP EIR, the Upper Hearst Development would not conflict with applicable air quality plans.

Construction period emissions were evaluated and disclosed in the 2020 LRDP EIR, as described above. Emissions conservatively calculated for the entire 2020 LRDP program would exceed project-level emission guidelines. As discussed in Air Quality item 4 above, daily construction emissions associated with the Upper Hearst Development would not exceed the May 2017 BAAQMD project thresholds**.**

As discussed in the analysis above, the Project would not result in significant impacts related to air quality and the environmental impacts resulting from the Project are within the scope of the 2020 LRDP EIR analysis.

3. BIOLOGICAL RESOURCES

SETTING

The following summarizes information for biological resources relevant to the proposed Project, based on the setting described in the 2020 LRDP EIR (Section 4.3), site-specific tree data, and a field visit to the Project site on May 4, 2018.

The Project site is in the City Environs, the area identified in the 2020 LRDP as the lands to the south, north and west of the Campus Park. The City Environs are extensively developed, primarily with residential, commercial, and institutional uses. Sensitive vegetation and wildlife resources are generally absent in the City Environs. Consistent with this setting, the Project site is developed with a parking structure, a surface parking lot, and associated landscaping. Impervious surfaces and structures provide little opportunity for use by wildlife, and species found in the vicinity are typical of those found in urbanized areas.

Trees and shrubs on-site may provide marginal nesting and foraging opportunities for both resident and migratory bird species. As discussed in Section 3.2, approximately 49 trees, including two prominent evergreen coast redwoods (*Sequoia sempervirens*), are located within and adjacent to the Project site. Both redwood trees are approximately 30 inches in diameter and are located between the northeastern driveway to the Upper Hearst parking structure and La Loma Avenue.

Special-status species are plants and animals that are legally protected under the state and/or federal Endangered Species Acts or other regulations, as well as species considered rare enough by the scientific community and trustee agencies to warrant special consideration, particularly with regard to protection of isolated populations, nesting or denning locations, communal roosts, and other essential habitat. Because the Project site is almost entirely paved for parking and is located in a highly urbanized environment, it does not provide suitable habitat for special-status plant or animal species.

2020 LRDP & 2020 LRDP EIR

The provisions of the 2020 LRDP would eliminate or minimize effects on biological resources by guiding the location, scale, form, and design of new University projects. The 2020 LRDP includes a number of policies and procedures for individual project review to support its Objectives. While several of the 2020 LRDP Objectives apply directly or indirectly to biological resources, one is particularly relevant:

- **Plan every new project as a model of resource conservation and environmental stewardship.**

The City Environs framework in the 2020 LRDP states that in response to future space demand by campus programs, capital investment on Adjacent Blocks through 2020 may result in a net increase in program space of up to 1,250,000 gsf, and up to 1,900 net new parking spaces. New space on the Adjacent Blocks would be produced by more intensive redevelopment of existing University owned sites. New space may also be produced on other sites by UC Berkeley directly or through joint ventures. Because the City Environs is heavily developed, there are no specific guidelines or development parameters affecting biological resources within the Adjacent Blocks North subarea.

Specimen Trees. As discussed under Aesthetics, UC Berkeley has a Campus Specimen Tree Program. The Campus Landscape Architect determines if a tree has specimen status, based on its health, whether it poses a hazard, and several other criteria.

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the proposed Project would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon biological resources. Where applicable, the Project would incorporate the following mitigation measures and/or implement best practices. 2020 LRDP Mitigation Measure BIO-1-a focuses on projects implemented in the Campus Park and Hill Campus; however, the mitigation measure is applicable to all areas where trees providing potential nesting habitat would be removed. Thus, for the purpose of this evaluation, Mitigation Measure BIO-1-a also applies to the Project.

2020 LRDP Mitigation Measure BIO-1-a: UC Berkeley will, to the full feasible extent, avoid the disturbance or removal of nests of raptors and other special-status bird species when in active use. A pre-construction nesting survey for loggerhead shrike or raptors, covering a 100 yard perimeter of the project site, would be conducted during the months of March through July prior to commencement of any project that may impact suitable nesting habitat on the Campus Park and Hill Campus. The survey would be conducted by a qualified biologist no more than 30 days prior to initiation of disturbance to potential nesting habitat. In the Hill Campus, surveys would be conducted for new construction projects involving removal of trees and other natural vegetation. In the Campus Park, surveys would be conducted for construction projects involving removal of mature trees within 100 feet of a Natural Area, Strawberry Creek, and the Hill Campus. If any of these species are found within the survey area, grading and construction in the area would not commence, or would continue only after the nests are protected by an adequate setback approved by a qualified biologist. To the full feasible extent, the nest location would be preserved, and alteration would only be allowed if a qualified biologist verifies that birds have either not begun egg-laying and incubation, or that the juveniles from those nests are foraging independently and capable of survival. A pre-construction survey is not required if construction activities commence during the non-nesting season (August through February).

2020 LRDP Continuing Best Practice BIO-1-a: UC Berkeley will continue to implement the Campus Specimen Tree Program to reduce adverse effects to specimen trees and flora. Replacement landscaping will be provided where specimen resources are adversely affected, either through salvage and relocation of existing trees and shrubs or through new plantings of the same genetic strain, as directed by the Campus Landscape Architect.

2020 LRDP Continuing Best Practice BIO-1-c: Because trees and other vegetation require routine maintenance, as trees age and become senescent, UC Berkeley would continue to undertake trimming, thinning, or removal, particularly if trees become a safety hazard.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Biological Resources, the potential environmental impacts resulting from the increase in campus headcount are limited to physical development on the UC Berkeley campus and the City Environs. As noted in Section 4, *Relationship to 2020 LRDP*, UC Berkeley has constructed approximately 43 percent of the 2.2 million net new gross square feet of development anticipated in the 2020 LRDP despite the increased campus headcount above 2020 LRDP projections. To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased campus headcount would not be additional to that planned for in the 2020 LRDP and therefore would not result in more severe impacts on biological resources than analyzed in the 2020 LRDP EIR, including impacts on special-status species, sensitive natural communities, wetlands, and wildlife movement. The increase in UC Berkeley's existing and projected campus headcount also would not result in any conflict with ordinances protecting biological resources.

BIOLOGICAL RESOURCES

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game (CDFG) or US Fish and Wildlife Service (USFWS)?		●

The biological resources evaluation in the 2020 LRDP EIR focuses on potential impacts to the natural areas occurring within both the Hill Campus and Campus Park areas. No specific discussion is provided for the City Environs area. As stated in the 2020 LRDP EIR, the urban lands surrounding Campus Park have limited value to special-status wildlife because of the extent of existing development and intensity of human activity. Impervious surfaces and structures provide little opportunity for use by wildlife, and species found in the vicinity are typically observed in urbanized areas. Because of the extent of past development, the Adjacent Blocks North subarea does not provide suitable habitat for special-status plant or animal species. However, while the possibility is remote, raptors and/or migratory bird species could nest within adjacent trees.

Tree removal or construction in the vicinity of a nest in active use could result in its destruction or abandonment. Conducting a preconstruction nesting survey and suspending construction as warranted, as required by Mitigation Measure BIO-1-a in the 2020 LRDP EIR, would serve to avoid the potential loss of any active raptor nests (2020 LRDP EIR Vol 1, p. 4.3-24). This survey would cover a 100- yard perimeter of the proposed Project site during the months of March through July, no more than 30 days prior to commencement of activity which could impact suitable nesting habitat (Mitigation BIO-1-a), if construction activity commences during the nesting season.

Consistent with the 2020 LRDP EIR's analysis, implementation of Mitigation Measure BIO-1-a would ensure that special-status species and unique vegetation are adequately identified and protected, resulting in a less than significant impact to special-status species and no considerable contribution to a cumulative impact.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFG or USFWS?		●

The Project site is developed with paved parking areas and associated landscaping. No riparian areas or sensitive natural communities as identified in local or regional plans, policies or regulations by the

California Department of Fish and Wildlife (CDFW) or United States Fish and Wildlife Service (USFWS) occur on or near the Project site. Thus, the Upper Hearst Development would have no impact on these resources and would not considerably contribute to a related cumulative impact.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption or other means?		●

The Project site is almost entirely paved with parking areas, except for landscaped margins around the Upper Hearst parking structure and Ridge Lot. No federally protected wetlands as defined by Section 404 of the Clean Water Act were observed during the May 4, 2018, site visit. Furthermore, the U.S Fish and Wildlife Service's National Wetlands Inventory does not identify wetlands on or adjacent to the Project site (U.S. Fish and Wildlife Service 2019). Therefore, the Upper Hearst Development would have no impact on federally protected wetlands and would not considerably contribute to a related cumulative impact.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?		●

The Adjacent Blocks North subarea is located within the urbanized City Environs land use area. The Project site is almost entirely paved for parking areas and does not link habitat areas nor provide the only or a unique means of travel for wildlife within the area. No native resident or migratory fish species or wildlife species use the City Environs area or Project site as a migratory corridor or nursery site. Implementation of Mitigation Measure BIO-1-a in the 2020 LRDP EIR would avoid or minimize potential impacts to migratory bird species and/or nesting raptors using trees or shrubs around the perimeter of the site. Therefore, consistent with the 2020 LRDP EIR's analysis, the Upper Hearst Development would have a less than significant impact on wildlife movement and would not considerably contribute to a related cumulative impact.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
5. Conflict with any local policies or ordinances protecting biological resources?		●

Section 4.3.3 of the 2020 LRDP EIR identifies local ordinances that address sensitive biological resources. The City of Berkeley Coast Live Oak Tree Removal Ordinance (No. 6462-N.S.) and Preservation and Restoration of Natural Watercourses Ordinance (No. 5961) apply to resources within the City Environs surrounding Campus Park. However, local ordinances do not apply to campus projects, because the University of California (UC) is constitutionally exempt from local land use controls whenever using property under its control in furtherance of its educational mission. No natural watercourses occur on or in proximity to the Project site.

UC Berkeley’s Campus Landscape Architect has surveyed the existing trees on and adjacent to the Project site to determine if they meet criteria in the Campus Specimen Tree Program for designation as specimen trees, especially a Camperdown elm tree in the front yard of the Beta Theta Pi house and two coast redwood trees that are approximately 30” in diameter, located between the northeastern driveway to the Upper Hearst parking structure and La Loma Avenue. As discussed in Section 3.5, *Project Description*, the Camperdown elm tree is a mature and prominent example of an uncommon tree species, as well as a character-defining feature of the Beta Theta Pi house’s landscape. UC Berkeley’s Campus Landscape Architect determined in January 2019 that, for its historical value, this tree qualifies as a “specimen tree” under the Campus Specimen Tree Program. However, it was determined that the redwood trees do not meet UC Berkeley’s historical, educational, or aesthetic criteria to be considered “specimen trees.” Although these trees are mature and partially obstruct views of the on-site parking lots from street level, they are not an integral part of the architectural theme of the Upper Hearst parking structure, nor do they play an important role in framing or screening the structure.

Construction of the Upper Hearst Development would likely require removal of the specimen Camperdown elm tree to accommodate a new accessible pathway to the proposed academic building. If this specimen tree is removed, as anticipated, UC Berkeley would implement Continuing Best Practice BIO-1-a by replacing landscaping where specimen resources are adversely affected. The Campus Specimen Tree Program would require replacement of this specimen tree at a 3 to 1 ratio in the closest available sizes to the existing tree. By replacing a removed scenic tree with new trees, UC Berkeley would ensure that the Upper Hearst Development is consistent with the requirements of the Campus Specimen Tree Program. No other local ordinances protecting biological resources are applicable to the proposed Project. Thus, the Upper Hearst Development would not conflict with local policies or ordinances protecting biological resources. Consistent with the 2020 LRDP EIR’s analysis, this impact would be less than significant.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
6. Conflict with any adopted Habitat Conservation Plan, Natural Communities Conservation Plan or other approved local, regional or state habitat conservation plan?		●

The Adjacent Blocks North subarea is not located in any area designated for an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved conservation plan. No impact would occur.

SUMMARY OF BIOLOGICAL RESOURCES ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, incorporating existing best practices and 2020 LRDP EIR mitigation measures, would not result in new significant impacts upon biological resources (2020 LRDP EIR Vol 1, p. 4.3-22 to 4.3-30). The Project site is in the Adjacent Blocks North subarea. This is an urbanized area in Berkeley adjacent to the Campus Park land use area as defined within the 2020 LRDP. No sensitive species are known to occur at the Project site. Measures to reduce possible impacts to nesting species would be implemented as part of the Upper Hearst Development. As discussed in the analysis above, the Upper Hearst Development would not result in significant impacts related to biological resources, and these impacts would be consistent with the 2020 LRDP EIR’s analysis for biological resources.

4. CLIMATE CHANGE

SEE DISCUSSION UNDER GREENHOUSE GAS EMISSIONS, BELOW

5. CULTURAL RESOURCES

SETTING

The cultural resources setting of the UC Berkeley campus is described in the 2020 LRDP EIR (Section 4.4). The following text summarizes information for cultural resources relevant to the Project site. Tribal cultural resources and tribal consultation under California Assembly Bill 52 are discussed separately in Chapter 15, *Tribal Cultural Resources*.

ARCHAEOLOGICAL RESOURCES

Prehistoric archaeological sites have been recorded on the UC Berkeley campus. Based on a records search in the California Historical Resources Information System at the Northwest Information Center, the archaeological sites in closest proximity to the Project site include a human burial recovered in the 1950s during ground clearing activities near Strawberry Creek and a shell midden, both just under 0.5-mile from the Project site. Per the 2020 LRDP EIR, given the long development history of the adjacent blocks, the likelihood of any significant prehistoric archaeological resources remaining intact is slim. There are no known historic archaeological resources on the Project site. However, the Project site was formerly occupied by Newman Hall, and it is possible that structural remains or historic refuse associated with the buildings are present beneath the asphalt pavement.

PALEONTOLOGICAL RESOURCES

No paleontological resources are known to exist within the Adjacent Blocks area; however, based upon local geology, it is possible that excavations within previously undisturbed areas that contain Quaternary alluvium could encounter limited fossils.

HISTORICAL RESOURCES

In accordance with CEQA, qualifying historical resources include buildings, historic districts, structures, objects, or sites that are either eligible for or designated in a national, state, and/or local register.

According to the 2020 LRDP EIR, historical resources located within the geographic scope of the 2020 LRDP fall within two categories: Primary Historical Resources and Secondary Historical Resources. Primary Historical Resources include those listed on the National Register of Historic Places (NRHP) and the California Register of Historical Resources (CRHR). Secondary Historical Resources include resources listed on local registers, as well as resources listed on the state Inventory. Secondary Historical Resources are presumed significant *unless* a preponderance of evidence demonstrates otherwise.

In order to characterize the historic setting and historical resources within or adjacent to the Project site, Rincon Consultants conducted a site visit, a records search of the California Historical Resources Information System at the Northwest Information Center, as well as focused archival and online research. Archives consulted included the City of Berkeley Public Library, including the Central Library History Room. A. In addition, this analysis considered two reports provided to UC Berkeley:

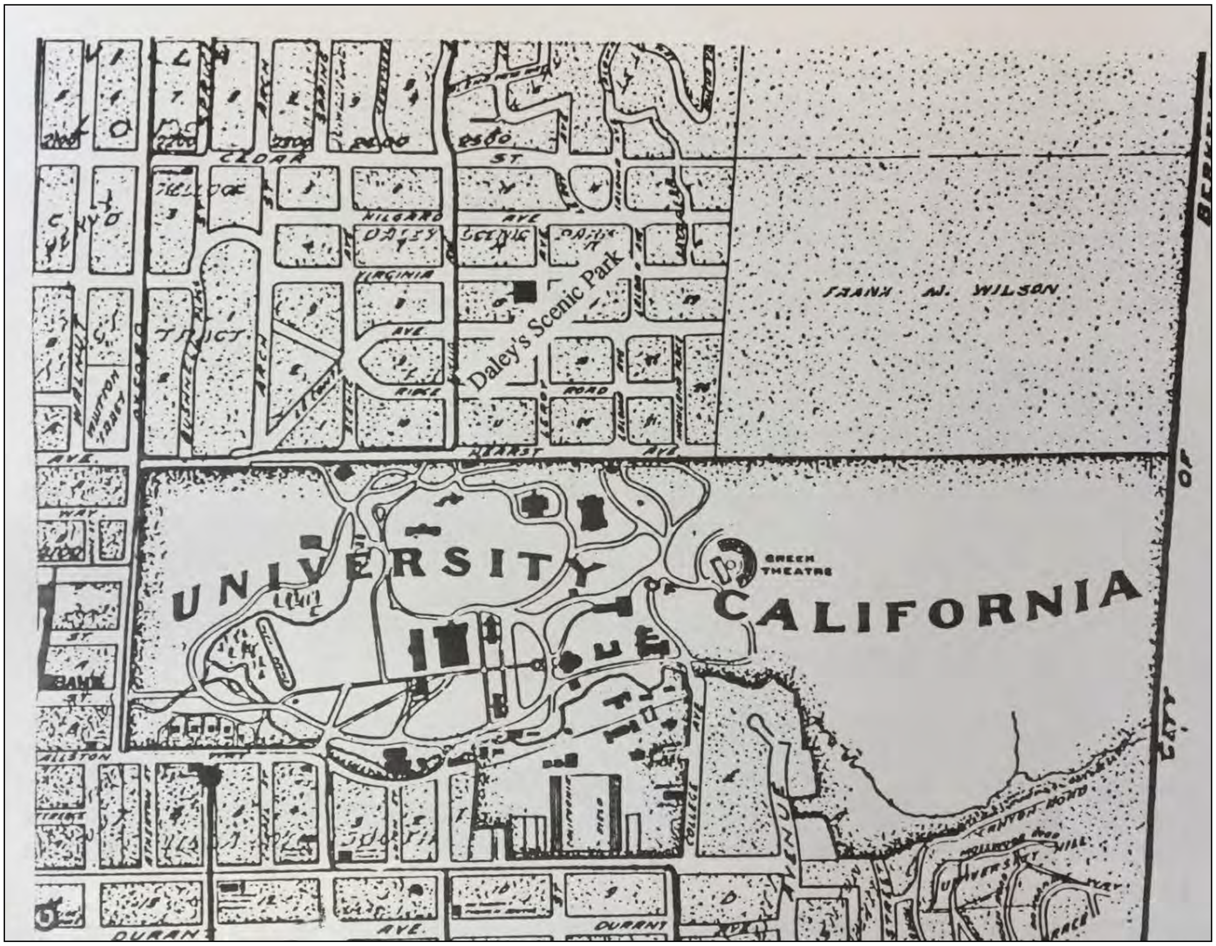
- Preservation Architecture. "Historic Structures Report, Cloyne Court, 2600 Ridge Road, Berkeley, California." July 2007. Prepared for the University Students Cooperative Association, Berkeley, CA.
- Siegel & Strain. "Historic Resources Inventory, University of California, Berkeley: 2607 Hearst, Graduate School of Public Policy (Formerly the Beta Theta Pi Fraternity House). 7 March 1997. Prepared for University of California, Berkeley, Planning, Design and Construction.

The following sections describe the historic setting and identified historical resources within or immediately adjacent to the Project site.

Historic Setting and Context

The Project site is located in the Adjacent Blocks North subarea defined by the 2020 LRDP, a neighborhood also known as Northside. The site also falls within an area of the North Berkeley Hills that became a renowned center for Arts and Crafts architecture. When residential settlement first began in earnest, in the late nineteenth century, the tract now encompassing the Project site was known as Daley's Scenic Park, the "first residential subdivision in the North Berkeley Hills," as shown in Figure 19 (Stern Cerny 1990). It was here that Bernard Maybeck, Charles Keeler, and associates first began exploring and defining Bay Area Arts and Crafts architecture. The Berkeley Fire of 1923 destroyed many of the original homes and buildings in Daley's Scenic Park, including the residences of Bernard Maybeck and John Galen Howard. The Project site, which is adjacent to three surviving Arts and Crafts buildings from this early era, occupies a portion of Daley's Scenic Park that was just outside the 1923 fire line (Stern Cerny 1990; Bruce et al.).

FIGURE 19 DALEY'S SCENIC TRACT, 1914, NORTH BERKELEY HILLS



Source: Stern Cerny, 1990, Northside, p. 7.

The First Bay Tradition and the Arts and Crafts Movement in the North Berkeley Hills

In the late nineteenth and early twentieth century, Daley's Scenic Tract became home to a new architectural idiom, inspired by the Arts and Crafts movement, known as the First Bay Tradition. The North Berkeley Hills provided the inspiration and setting for the First Bay Tradition. Early practitioners in Daley's Scenic Tract included architects such as Bernard Maybeck, Julia Morgan, John Galen Howard, Ernest and Almeric Coxhead, John Hudson Thomas, and James Placheck (many of whom not only practiced but also resided in the neighborhood). In this way, the North Berkeley Hills became an important center for innovative, regionally inflected Arts and Crafts architecture.

The First Bay Tradition expanded on and redefined the Arts and Crafts architecture emerging on the East Coast in the work of architects such as Henry Hobson Richardson and McKim, Mead and White. One of the most significant West Coast innovations, and one that is still evident in the Northside neighborhood, is the focus on site-specific design and creating connections between the indoors and outdoors, buildings, landscaping, and setting:

> What the Bay Tradition added to the Shingle Style was environment, and in particular the generosity of and therefore, connection to outdoor space, open and cheerful western skies,

> hills alternating gold and green, and sculptural woodlands. In fact, it is the connections between setting, landscape and architecture where early Bay Area buildings fully succeeded the Shingle-Style of their Eastern mentors. (Preservation Architecture 2007)

In this way, the woodsy, hillside setting and indoor-outdoor integration became a critical feature for the new First Bay Tradition. As William Wilson Wurster wrote, "The First Bay Tradition went beyond a strictly architectural expression; it also reflected a life style" (Stern Cerny 1990). Commentators at the time recognized this "unique quality" and cohesive, distinctive neighborhood character it created; as a writer for *The San Francisco Chronicle* noted in 1904:

> 'Ramble if you will on the Berkeley slopes north of University of California campus to have your faith in human kind renewed. Wander up Ridge Road until you come to the shingle and clinker brick houses set in the midst of gardens, a lesson in peaceful, harmonious, artistic and natural living, an architectural picture rarely attained' and where '90% of the houses are built in brown shingle.' (Stern Cerny 1990)

In this way, the First Bay Tradition was as much a cultural movement as it was an aesthetic movement. For example, in 1898, a group of women came together in the Northside neighborhood to form the "Hillside Club." With members including the wives of Bernard Maybeck and John Galen Howard, the goal of the Hillside Club was to "'encourage artistic homes built of materials complementing the natural beauty of the Berkeley Hills'":

> Members of the Hillside Club…advocated the 'relationship between nature and simplicity, truth and beauty': design should be 'free of superficial ornament, architecture should be rational, simple, expressive, never ambitious or pretentious, well adapted to their sites, color should not be glaring: essentially, the whole should appear to have grown out of the hillside and to be a part of it.' (Stern Cerny 1990)

These efforts were successful enough that, by the early twentieth century, "'the North side of the Berkeley Campus became the prime example of enlightened environmental planning…where city and country blended harmoniously'" (Stern Cerny 1990). In these years, Northside took on a cohesive feeling and character.

Available literature on the First Bay Tradition and West Coast Arts and Crafts architecture illustrates the important role played by the North Berkeley Hills themselves in the development of the Bay Area version of the Arts and Crafts movement:

> 'The First Bay Tradition' is a term that has been given to a new direction in architectural design begun in San Francisco about 1890. It took root and flowered most distinctively in the North Berkeley Hills just north of the University of California Campus.
>
> While it had its beginnings in the Arts and Crafts Movement in England in the mid-nineteenth century, it was brought to the Bay Area by a group of architects which included Ernest Coxhead, Bernard Maybeck, A.C. Schweinfurth, Willis Polk and later John Galen Howard and Julia Morgan. These architects were classically trained and were inspired by the wide vistas of open rolling hills and winding verdant creek beds. Their designs expressed a philosophy characterized by the use of materials indigenous to the area, in a straight forward and simple manner: structural members were left exposed and became the decorative

> elements, wood was left unpainted, exteriors were often covered with shingles, although board and batten siding as well as half timbering, brick and stucco were also used; subtle historical references are found occasionally. Landscaping featured informal gardens, native stone-work and vine covered arbors, the over-all effect was intended to be compatible with the natural beauty of the Bay Area.
>
> The architectural idiom was so influential that between 1900-1915 the majority of homes built in North Berkeley, branching out from the Daley Scenic Park Tract, were built in this simple rustic style. In other California cities rustic shingles homes were referred to as 'Berkeley Brown Shingles.' (Stern Cerny 1990)

Immediately adjacent to the Project site are three survivors of this early era of Northside development and the First Bay Tradition: the Beta Theta Pi house (west of and within Project site), Cloyne Court (north and west of Project site), and Phi Kappa Psi, 2627 Ridge Road (immediately north across Ridge Road). Each building is a known historical resource pursuant to CEQA. The following section describes these historical resources.

Individual Historical Resources

According to the 2020 LRDP EIR and the California Office of Historic Resources Inventory, the following four historical resources are located within and/or immediately adjacent to the proposed Project site:

1. Beta Theta Pi house (2607 Hearst Avenue), architect Ernest Coxhead, 1893
   Source: 2020 LRDP
   2020 LRDP Status: Secondary Historical Resource, Adjacent Blocks North subarea; eligible for NRHP and CRHR listing; City of Berkeley Landmark

2. Cloyne Court (2600 Ridge Road), architect John Galen Howard, 1904
   Source: 2020 LRDP
   2020 LRDP Status: Primary Historical Resource, Adjacent Blocks North subarea; designated in the NRHP and CRHR; City of Berkeley Landmark

3. Founders' Rock, Hearst Avenue
   Source: 2020 LRDP
   2020 LRDP Status: Primary Historical Resource, Campus Park area; designated in the NRHP and as a State Historic Landmark

4. Phi Kappa Psi, 2627 Ridge Road, 1901
   Source: California Office of Historic Preservation Historic Resources Inventory
   Historic Resource Status: 3S (individually eligible for the NRHP)

Review of previous evaluations and site inspections indicate that Cloyne Court, the Beta Theta Pi house, and Phi Kappa Psi are significant, intact examples of the First Bay Tradition of the Arts and Crafts movement in Berkeley, significant at the national level.

The Beta Theta Pi house is historically significant as an "early, seminal example of the First Bay Area Tradition, a regional architectural movement identified by simple, rustic design executed primarily in unpainted redwood. The building is also significant for its association with important figures in Bay Area architecture: the original architect, Ernest Coxhead; the architects of two later additions, John Bakewell and Arthur Brown, Jr.; Charles Keeler, a key player in the Berkeley Hillside and Bay Area Arts and Crafts movements; and Loring P. Rixford, San Francisco City Architect" (Siegel & Strain 1997). As designed by pioneering Arts and Crafts architects Ernest Coxhead, Bakewell and Brown, and Charles Keeler, the building's design is "pioneering in the simplicity of its geometric massing; its profile an assemblage of parts treated with subtle differences, like a small medieval village. A radical departure from its Victorian contemporaries" (Stern Cerny 1990). Similarly, the Beta Theta Pi house, with its low, varied mass, expansive plan, and orientation to the outdoors, fits within the First Bay Tradition.

Cloyne Court is significant and designated in the NRHP under Criterion C "as an example of the work of John Galen Howard and as an example of the First Bay Tradition style. Howard, Supervising Architect for UC Berkeley and Director of its School of Architecture, worked mainly in the Beaux Arts idiom, but explored the woodsy, Bay Area tradition through some of his work. Cloyne Court Hotel was Howard's first large scale shingled building and is highly reflective of a style that had a huge influence on design in the Bay Area" (Preservation Architecture 2007). In Cloyne Court, the courtyard building plan, the low mass and scale, tailored to fit the sloping hillside, the generous expanses of fenestration facing the landscaping, and the use of natural materials like wood, simply treated, are all reflections of this architectural idiom. As observed by architectural historian Susan Cerny, although Cloyne Court is "a large building,"

> [I]t fits the tenets of the Hillside Club by being entirely clad in unpainted brown shingles, set sufficiently back from the streets to allow for large trees and shrubs and its wide "U" shape provides for a generous south facing garden courtyard giving testimony to the attention paid to gardens and the quiet enjoyment of nature which was an important part of 'building with nature.' (Stern Cerny 1990)

Located just north of the Project site, the Phi Kappa Psi building, constructed in 1901 at 2627 Ridge Road, is part of the First Bay Tradition architecture that defined Daley's Scenic Tract.

The significance of Cloyne Court, the Beta Theta Pi house, and Phi Kappa Psi extends beyond their architectural designs and individual site plans to include the surrounding hillside setting, landscaping, and neighborhood context. These buildings are among only 50 to have survived the 1923 Berkeley Fire, which destroyed nearly 500 buildings in an area "where the First Bay Tradition dominated the built environment before 1923" (Preservation Architecture 2007). Recent infill construction includes UC Berkeley's Foothill Student Housing building, in the northeast corner of the intersection of Hearst and La Loma avenues. The wood-shingle cladding, relatively low height, roof features, U-shape plan, and architectural detailing of the building allow it to blend in with the character and setting of the Arts and Crafts buildings of the neighborhood.

The Upper Hearst parking structure located on the Project site is not identified in the 2020 LRDP as either a Primary or Secondary Historical Resource. UC Berkeley has made the determination that the Upper Hearst parking structure is not a qualifying historical resource. Although the scope of this historic analysis does not include an independent evaluation of the eligibility of properties for historic designation, site observation indicates that additional nearby properties appear to be at least 50 years of age and may represent historical resources.

The following figures present a photographic overview of the Beta Theta Pi house and Cloyne Court, both located within and immediately adjacent to the Project site.

FIGURE 20 BETA THETA PI HOUSE (1893) AND UPPER HEARST PARKING STRUCTURE, SOUTHWEST PERSPECTIVE (TOP) AND SOUTH PERSPECTIVE (BOTTOM)

FIGURE 21 BETA THETA PI & UPPER HEARST PARKING STRUCTURE, SOUTHEASTERN PERSPECTIVE (TOP) AND SOUTHWESTERN PERSPECTIVE (BOTTOM)

FIGURE 22 UPPER HEARST PARKING STRUCTURE AND STUDENT HOUSING, HEARST AND LA LOMA AVENUES, SOUTHERN PERSPECTIVE (TOP) AND SOUTHEASTERN PERSPECTIVE (BOTTOM)

FIGURE 23 UPPER HEARST PARKING STRUCTURE FROM RIDGE ROAD, NORTHERN PERSPECTIVE (TOP) AND HISTORIC CLOYNE COURT (1904), NORTHEASTERN PERSPECTIVE (BOTTOM)

FIGURE 24 ENTRANCE, CLOYNE COURT, NORTHERN PERSPECTIVE (TOP) AND NORTHWESTERN PERSPECTIVE FROM RIDGE ROAD (BOTTOM)

REGULATORY FRAMEWORK

This section presents a focused version of the regulatory framework provided in the 2020 LRDP EIR. This information provides the necessary backdrop and context for the impacts analysis and findings presented below. Refer to the Cultural Resources analysis in the 2020 LRDP EIR (Section 4.4) for a discussion of the National Register of Historic Places (NRHP) and the California Register of Historical Resources (CRHR).

Resources nominated to the CRHR must retain enough of their historic integrity to convey the reasons for their significance.

Secretary of the Interior's Standards for the Treatment of Historic Properties

According to CEQA, a project that complies with the National Park Service *Secretary's Standards for the Treatment of Historic Properties* (*Secretary's Standards)* is generally considered to be a project that will not cause a significant adverse impact to a historical resource (Weeks and Grimmer 2001). The 2020 LRDP EIR also recognizes compliance with the *Secretary's Standards* as a means for avoiding, mitigating or lessening impacts to historical resources. As stated in the 2020 LRDP EIR, if a project could cause a substantial adverse change in features that convey the significance of a primary or secondary resource, an Historic Structures Assessment should be prepared: "Recommendations of the HSA made in accordance with the Secretary of the Interior's Standards would be implemented, in consultation with the UC Berkeley Design Review Committee and the State Historic Preservation Office, such that the integrity of the significant resource is preserved and protected" (2020 LRDP EIR Vol 1, p. 4.4-54 to 4.4-55).

The goal of the *Secretary's Standards* is to outline treatment approaches that allow for the retention of and/or sensitive changes to the distinctive materials and features that lend a historical resource its significance. When changes are carried out according to these standards, the historical resource will retain its historic integrity and thereby continue to convey the reasons for its significance. The *Secretary's Standards* and Guidelines offer general recommendations for preserving, maintaining, repairing, and replacing historical materials and features, as well as designing new additions or making alterations.

These standards also provide guidance on new construction adjacent to historic districts and properties, in order to ensure that there are no indirect adverse impacts to historic properties.
The ten *Secretary's Standards for Rehabilitation* are:

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.
2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.
3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.
4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.
5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a property shall be preserved.

6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.
7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.
8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.
9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.
10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

In order to determine whether a project complies with the *Secretary's Standards*, this analysis considers the "character-defining," or historically significant, features of the historical resources. Character-defining features can include the overall mass and scale of the building, its setting and relationship to the street, building materials, architectural detailing, site design, landscaping and hardscaping, as well as spatial relationships between buildings and open space.

Alterations and replacement of character-defining features over time can impair a historic property's integrity and result in a loss of historic status. Therefore, to ensure that a historic property remains eligible after implementation of projects, character-defining features should be identified and preserved.

"Historic Integrity" Defined

In addition to meeting the criteria described above, in order to qualify for the NRHP and the CRHR, a property must retain "historic integrity" such that it continues to convey the reasons for its historic significance. According to National Register Bulletin No. 15, in order to retain historic integrity and qualify for the NRHP, a property ideally must have all of these seven qualities:

1. Location – the place where the historic property was constructed or where an event occurred;
2. Design – the combination of elements that create the form, plan, space, and style of a property;
3. Setting – the physical environment of a historic property;
4. Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
5. Workmanship – the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory;
6. Feeling – a property's expression of the aesthetic or historic sense of a particular period of time;
7. Association – the direct link between an important historic event or person and a historic property.

For the purposes of this *Secretary's Standards* analysis, the aspects of setting and feeling are most germane. The National Park Service defines the quality of setting in the following way:

> Setting is the physical environment of a historic property. Whereas location refers to the specific place where a property was built or an event occurred, setting refers to the character of the place in which the property played its historical role. It involves how, not just where, the property is situated and its relationship to surrounding features and open space. Setting often reflects the basic physical conditions under which a property was built and the functions it was intended to serve. In addition, the way in which a property is positioned in its environment can reflect the designer's concept of nature and aesthetic preferences.
>
> The physical features that constitute the setting of a historic property can be either natural or manmade, including such elements as: topographic features (a gorge or the crest of a hill); vegetation; simple manmade features (paths or fences); and relationships between buildings and other features or open space. These features and their relationships should be examined not only within the exact boundaries of the property, but also between the property and its surroundings. This is particularly important for districts. (National Park Service 1990)

The National Park Service defines the quality of feeling in the following way: Feeling is a property's expression of the aesthetic or historic sense of a particular period of time. It results from the presence of physical features that, taken together, convey the property's historic character (National Park Service 1990).

2020 LRDP and 2020 LRDP EIR

In recognition of the fact that more than a third of UC Berkeley buildings are over 50 years old; and thus, potentially eligible for the National Register, the 2020 LRDP includes several objectives that seek to protect potential historic resources for future generations. They include:

- **Plan every new project as a model of resource conservation and environmental stewardship.**
- **Maintain and enhance the image and experience of the campus, and preserve our historic legacy of landscape and architecture.**
- **Plan every new project to respect and enhance the character, livability, and cultural vitality of our city environs.**

As noted in the 2020 LRDP, UC Berkeley is home to numerous historical resources "of great distinction," from the Classical Core and its Beaux Arts masterpieces, featuring the work of renowned campus architect John Galen Howard, to Mid-Century Modern and contemporary buildings, all woven together in a unified, cohesive campus with landscaped open areas and circulation corridors.

The 2020 LRDP has policies, objectives, and guidelines to guide development in "City Interface" and "City Environs" areas. The Project site falls within the Adjacent Blocks North subarea of the "City Environs." According to the 2020 LRDP, the vicinity of the Project site, in addition to falling within the City Environs zone, also comprises a "picturesque ensemble" of related buildings. Spanning several city blocks along Hearst and La Loma avenues, this "picturesque ensemble" of related buildings extends along La Loma Avenue from the Foothill Student Center toward the Greek Theatre (moving southeast along La Loma Avenue) and down both the north and south sides of Hearst Avenue, down to the western edge of Cloyne Court (UC Berkeley 2005). This "picturesque ensemble" of buildings includes

Cloyne Court, the Beta Theta Pi house, the Foothill Student Center, which was constructed more recently but echoes the Arts and Crafts design of the aforementioned historic properties, among other properties.

2020 LRDP Continuing Best Practice: City of Berkeley Landmarks Commission Feedback

According to the 2020 LRDP, informational presentations are made by UC Berkeley of all major projects within the Adjacent Blocks area to the City of Berkeley Planning Commission, and, if relevant, the City of Berkeley Landmarks Preservation Commission, for comment prior to schematic design review by the UC Berkeley Design Review Committee.

On 5 July 2018, schematic plans for the Upper Hearst Development were presented to the City of Berkeley Landmarks Preservation Commission. The Landmarks Preservation Commission expressed concerns regarding the mass, scale, and non-contextual architectural design and palette of materials of the Upper Hearst Development, vis-à-vis neighboring historic resources, among other concerns.

2020 LRDP Continuing Best Practice: City of Berkeley Design Review Committee Feedback

According to the 2020 LRDP, "as part of project review, the Design Review Committee should assess potential adverse impacts on cultural resources and recommend measures to minimize such impacts" (UC Berkeley 2005). On 21 June 2018, schematic plans for the proposed Project were presented to the City of Berkeley Design Review Committee. The Design Review Committee also expressed concerns regarding the mass, scale, and non-contextual architectural design and palette of materials of the Upper Hearst Development, vis-à-vis neighboring historic resources, among other concerns.

MITIGATION MEASURES & CONTINUING BEST PRACTICES

The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP on cultural resources. Where applicable, the Upper Hearst Development would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practice CUL-1: In the event that paleontological resource evidence or a unique geological feature is identified during project planning or construction, the work would stop immediately and the find would be protected until its significance can be determined by a qualified paleontologist or geologist. If the resource is determined to be a 'unique resource,' a mitigation plan would be formulated and implemented to appropriately protect the significance of the resource by preservation, documentation, and/or removal, prior to recommencing activities.

2020 LRDP Continuing Best Practice CUL-2-a: If a project could cause a substantial adverse change in features that convey the significance of a primary or secondary resource, an Historic Structures Assessment (HSA) would be prepared. Recommendations of the HSA made in accordance with the Secretary of the Interior's Standards would be implemented, in consultation with the UC Berkeley Design Review Committee and the State Historic Preservation Office, such that the integrity of the significant resource is preserved and protected. Copies of all reports would be filed in the University Archives/Bancroft Library.

2020 LRDP Continuing Best Practice CUL-2-b: UC Berkeley would make informational presentations of all major projects in the City Environs in Berkeley to the Berkeley Planning Commission and, if relevant, the Berkeley Landmarks Commission for comment prior to schematic design review by the UC Berkeley Design Review Committee. Major projects in the City Environs in Oakland would similarly be presented to the Oakland Planning Commission and, if relevant, to the Oakland Landmarks Preservation Advisory Board.

2020 LRDP Mitigation Measure CUL-3: If, in furtherance of the educational mission of the University, a project would require the demolition of a primary or secondary resource, or the alteration of such a resource in a manner not in conformance with the Secretary of the Interior's Standards, the resource would be recorded to archival standards prior to its demolition or alteration.

2020 LRDP Continuing Best Practice CUL-4-a: In the event resources are determined to be present at a project site, the following actions would be implemented as appropriate to the resource and the proposed disturbance:

- UC Berkeley shall retain a qualified archaeologist to conduct a subsurface investigation of the project site, to ascertain the extent of the deposit of any buried archaeological materials relative to the project's area of potential effects. The archaeologist would prepare a site record and file it with the California Historical Resource Information System.
- If the resource extends into the project's area of potential effects, the resource would be evaluated by a qualified archaeologist. UC Berkeley as lead agency would consider this evaluation in determining whether the resource qualifies as a historical resource or a unique archaeological resource under the criteria of CEQA Guidelines section 15064.5. If the resource does not qualify, or if no resource is present within the project area of potential effects, this would be noted in the environmental document and no further mitigation is required unless there is a discovery during construction (see below).
- If a resource within the project area of potential effect is determined to qualify as an historical resource or a unique archaeological resource in accordance with CEQA, UC Berkeley shall consult with a qualified archaeologist to mitigate the effect through data recovery if appropriate to the resource, or to consider means of avoiding or reducing ground disturbance within the site boundaries, including minor modifications of building footprint, landscape modification, the placement of protective fill, the establishment of a preservation easement, or other means that would permit avoidance or substantial preservation in place of the resource. If further data recovery, avoidance or substantial preservation in place is not feasible, UC Berkeley shall implement LRDP Mitigation Measure CUL-5, outlined below.
- A written report of the results of investigations would be prepared by a qualified archaeologist and filed with the University Archives/ Bancroft Library and the Northwest Information Center.

2020 LRDP Mitigation Measure CUL-4-b: If a resource is discovered during construction (whether or not an archaeologist is present), all soil disturbing work within 35 feet of the find shall cease. UC Berkeley shall contact a qualified archaeologist to provide and implement a plan for survey, subsurface investigation as needed to define the deposit, and assessment of the remainder of the site within the project area to determine whether the resource is significant and would be affected by the project, as outlined in Continuing Best Practice CUL-3-a. UC Berkeley would implement the recommendations of the archaeologist.

2020 LRDP Continuing Best Practice CUL-4-b: In the event human or suspected human remains are discovered, UC Berkeley would notify the County Coroner who would determine whether the remains are subject to his or her authority. The Coroner would notify the Native American Heritage Commission if the remains are Native American. UC Berkeley would comply with the provisions of Public Resources

Code Section 5097.98 and CEQA Guidelines Section 15064.5(d) regarding identification and involvement of the Native American Most Likely Descendant and with the provisions of the California Native American Graves Protection and Repatriation Act to ensure that the remains and any associated artifacts recovered are repatriated to the appropriate group, if requested.

2020 LRDP Continuing Best Practice CUL-4-c: Prior to disturbing the soil, contractors shall be notified that they are required to watch for potential archaeological sites and artifacts and to notify UC Berkeley if any are found. In the event of a find, UC Berkeley shall implement 2020 LRDP Mitigation Measure CUL-4-b.

2020 LRDP Mitigation Measure CUL-5: If, in furtherance of the educational mission of the University, a project would require damage to or demolition of a significant archaeological resource, a qualified archaeologist shall, in consultation with UC Berkeley:

- Prepare a research design and archaeological data recovery plan that would attempt to capture those categories of data for which the site is significant, and implement the data recovery plan prior to or during development of the site.
- Perform appropriate technical analyses, prepare a full written report and file it with the appropriate information center, and provide for the permanent curation of recovered materials.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Cultural Resources, the potential environmental impacts resulting from the increase in campus headcount are limited to physical development on the UC Berkeley campus and City Environs. As noted in Section 4, *Relationship to 2020 LRDP*, UC Berkeley has constructed approximately 43 percent of the 2.2 million net new gross square feet of development anticipated in the 2020 LRDP despite the increased campus headcount above 2020 LRDP projections. To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased campus headcount would not be additional to that planned for in the 2020 LRDP. Therefore, the increase in UC Berkeley's existing and projected campus headcount would not result in more severe impacts to cultural resources than analyzed in the 2020 LRDP EIR, including impacts on historical resources, paleontological resources, archaeological resources, or human remains.

CULTURAL RESOURCES

Would the Project:

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
1. Cause a substantial adverse change in the significance of a historical resource as defined in CCR Section 15064.5?	●	

Impacts to significant cultural resources that affect the characteristics of the resource that qualify it for the NRHP or adversely alter the significance of a resource listed on or eligible for the CRHR are considered a significant effect on the environment. In terms of historical resources, these impacts could result from "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired" (CEQA Guidelines, Section 15064.5 [b][1], 2000). Material impairment is defined as demolition or alteration "in an adverse manner [of] those characteristics of an historical resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in, the California Register." (CEQA Guidelines Section 15064.5[b][2][A]).

This impact analysis considers the Upper Hearst Development's consistency with the *Secretary's Standards* to determine its impact on historic resources. As stated above, according to the CEQA Guidelines, projects that comply with the *Secretary's Standards* are generally considered to be projects resulting in less than significant impacts to historic resources. Adherence to these standards can help ensure that in-fill projects adjacent to historic buildings or within historic neighborhoods are compatible and complementary and do not destroy the setting and feeling of the historic property.

The Upper Hearst Development would have the most direct effect on the Upper Hearst parking structure, which would be demolished to accommodate new residential and academic buildings. UC Berkeley has made a determination that the Upper Hearst parking structure is not a qualifying historical resource. Therefore, demolition of the parking structure would not have a direct adverse effect on historical resources.

As stated above, the Project site is adjacent to four known historic properties: Beta Theta Pi, constructed in 1893 (eligible for the NRHP); Cloyne Court, constructed in 1904 (listed in the NRHP and as a State Historic Landmark); Founders' Rock, a natural landscape feature with a period of significance of 1860 (listed in the NRHP); and the Phi Kappa Psi house, located at 2627 Ridge Road immediately north from the Project site (listed in the California Historical Resources Inventory).

Project Compliance with the *Secretary's Standards*

For Founders' Rock, the Upper Hearst Development complies with the *Secretary's Standards*. The Project would not involve physical changes to Founders' Rock. The proposed buildings, on the north side of Hearst Avenue at La Loma Avenue, also are far enough away from Founders' Rock, on the south side of Hearst Avenue, that they comply with the *Secretary's Standards* relating to adjacent new construction and would not adversely affect the setting of this historical resource (Standards No. 9 and 10). Therefore, the Upper Hearst Development would not result in significant adverse impacts to Founders' Rock, and no further analysis is needed.

Two elements of the Upper Hearst Development would be inconsistent with several of the *Secretary's Standards*: (1) the proposed demolition/removal and replacement of character-defining site design features of the Beta Theta Pi house, and (2) the scale, mass, and architectural design of the new academic building and new residential building adjacent to Cloyne Court, the Beta Theta Pi house, and Phi Kappa Psi.

1. **Project Element**: Demolition/removal/replacement of the character-defining site plan and site design of the Beta Theta Pi house.

   This Project element includes the demolition and replacement of most of the primary site design of the Beta Theta Pi house. These plans include removal of 32 feet of the stream-rock retaining wall fronting Beta Theta Pi, as well as removal of historic hardscaping, concrete stairs and railings, approximately 72 feet of brick walkway, and landscaping. These features would be replaced with a concrete, switch-back access ramp, steel hand-railings, and other hardscaping features that would reconfigure and reorient the site design of Beta Theta Pi toward that of the new academic building.

Applicable Standards: *Secretary's Standards for Rehabilitation* Nos. 1, 2, 4, 5, 9, and 10

Discussion: Due to the demolition and removal of distinctive features, materials, and spatial relationships that characterize the historic property and its site design, the Upper Hearst Development would be inconsistent with *Secretary's Standards for Rehabilitation* Nos. 1, 2, 4, 5, 9, 10. Taken together, the existing building setback, landscaping/hardscaping, stream-rock retaining walls, brick pavers, and stairs and railings form the historic property's site design along the principal elevation. This site design clearly reflects a residential fraternity house sited in harmony within its hillside setting, with its generous setback, landscaped lawn and mature trees, stream-rock retaining wall, concrete stairs, brick walkway, and other hardscaping features. For the purposes of this analysis, these features are considered to be character-defining features of primary significance for the resource.

The removal of a 32-foot portion of the stream-rock retaining wall, approximately 72 feet of the brick walkway, as well as removal of most of the front lawn, would alter the setting and feeling of the Beta Theta Pi house. The expanse of the stream-rock retaining wall along the north side of Hearst Avenue also creates a cohesive, unified street line for the historic property and neighboring properties on the block. As part of the historic site design, these features contribute to the integrity of setting and feeling of the historic property, which was specifically designed to complement and reflect its hillside setting, topography, and landscape.

As a result of the Upper Hearst Development, the historic property would no longer read as a stand-alone historical resource, with an independent site and parcel. The new development would envelop the historic property within the site plan of the adjacent academic building, which bears little resemblance to the historic property in terms of materials, design, scale/mass, and setting. In this way, the Project does not conform with a number of the *Secretary's Standards* (Nos. 1, 2, 4, 5, 9, and 10) related to retaining distinctive features, materials, and spatial relationships that characterize the property.

Although the setting and feeling of the Beta Theta Pi house have already been altered through construction of the Upper Heart parking structure, the scale of the parking structure is markedly lower than that of the proposed buildings. In addition, the parking structure does not extend into the site plan or stand-alone parcel of the Beta Theta Pi house. The parking structure's utilitarian, neutral design and palette of materials also do not detract from the historical resource to the point that the setting and feeling of the historical resource are significantly altered.

Without retention of the Beta Theta Pi house's historic site design and plan, including the stream-rock retaining wall, brick walkway, and most of the front lawn, the Upper Hearst Development would not be consistent with the *Secretary's Standards*.

2. **Project Element**: Construction of a new academic building and residential building, sheathed in concrete and aluminum panels, with punched aluminum windows, rising at the highest point to 87

feet tall along Hearst Avenue, immediately adjacent to the Beta Theta Pi house, Cloyne Court, and Phi Kappa Psi.

Applicable Standards: *Secretary's Standards for Rehabilitation* Nos. 9 and 10.

Discussion: Due to the scale, mass, and architectural design/materials of the new buildings in relation to the Beta Theta Pi house, Cloyne Court, and Phi Kappa Psi, the Upper Hearst Development would be inconsistent with *Secretary's Standards for Rehabilitation* No. 9. This standard specifies that "New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment."

The proposed height, mass, and architectural design and materials of the Upper Hearst Development depart from the historic setting of the adjacent historical resources. Designed in the First Bay Tradition to reflect their North Berkeley Hills setting, these historic buildings are significant expressions, by master architects, of the indigenous Arts and Crafts movement that emerged in the North Berkeley Hills in the late nineteenth and early twentieth century. The setting, purposeful integration of the buildings within the hillside topography and landscape, the use of indigenous materials and wood shingles, sheathing, and half-timbering, the high degree of craftsmanship, the balanced design composition, and explicitly domestic scale of the historic properties, expressed through their relatively low scale and mass, are all character-defining features. The new academic building would depart and detract from all of these character-defining features.

The new buildings would be significantly higher and of greater mass and scale than all buildings in the immediate vicinity, including Phi Kappa Psi on the north side of Ridge Road. To the immediate east of the Beta Theta Pi house, the new academic building would consist of two volumes: a lower wing, rising approximately 50 feet, which would serve as an entrance patio, and a higher, four-story classroom wing, rising approximately 75 feet. This building, while incorporating a two-story entrance lobby directly adjacent to the Beta Theta Pi house, would appear more than double the height of the historic one- to two-story Beta Theta Pi house directly adjacent to its principal elevation. In addition, the residential building would be up to 87 feet in height along Hearst Avenue. This addition shifts the setting of the historic properties and the character of neighborhood overall.

Given the relatively lower, one- to two-story scale of the historic properties, this Project element does not meet Standard No. 9's guideline that new construction adjacent to historic resources "shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment."

Sheathing materials on the exterior walls of the proposed buildings would have a contemporary design, primarily consisting of fiber-cement and aluminum panels, plaster, and aluminum-framed, punched (deeply recessed) windows, among other materials. The buildings would be capped with a standing-seam metal roof. Although a contemporary design could comply with the *Secretary's Standards*, the current plans are not sufficiently scaled to or designed in the context of the adjacent historical resources or neighborhood overall to achieve this result. The mass, scale, design, and materials of the new buildings would significantly change and impair the integrity of setting of three historical resources, the Beta Theta Pi house, Cloyne Court, and Phi Kappa Psi.

In summary, the Upper Hearst Development would impair the integrity of two historical resources identified in the 2020 LRDP: the Beta Theta Pi house and Cloyne Court. It would also impair the integrity of a third known historical resource, Phi Kappa Psi, located at 2627 Ridge Road immediately north of the Project site. Therefore, the Upper Hearst Development would have a potentially significant impact on historical resources, requiring mitigation.

Mitigation Measure CUL-1 would require consultation with an architectural historian to consider modifications to the design of proposed buildings that would improve compatibility with neighboring historical resources.

MM-CUL-1: Prior to approval of final design plans for the Upper Hearst Development, UC Berkeley shall retain a historic architect meeting the National Park Service Professional Qualifications Standards for historic architecture to review plans for the proposed academic and residential buildings. The historic architect shall provide input and refinements to the design team regarding modifications to the palette of exterior materials to improve compatibility with neighboring historical resources and compliance with the Secretary of the Interior's Standards. This review shall include, but not be limited to, suggestions for incorporating exterior materials, such as wood or brick, in the design.

Although implementation of Mitigation Measure CUL-1 could improve the compatibility of exterior materials used in the proposed buildings with neighboring historic buildings, the Upper Hearst Development still would have adverse effects on historical resources from removal of a rock retaining wall and brick pathways at the Beta Theta Pi house and from incompatibility of scale and massing. Therefore, this impact would be significant and unavoidable. A significant impact on historical resources would be within the scope of the 2020 LRDP EIR's analysis, which found that new development to further UC Berkeley's educational mission could alter historical resources in a manner not consistent with the *Secretary's Standards*, resulting in a significant and unavoidable impact.

The 2020 LRDP EIR determined that cumulative development at UC Berkeley and LBNL, in combination with other cumulative projects, could have a combined adverse effect on the historical resource base, resulting in a significant and unavoidable impact (2020 LRDP EIR Vol 1, p. 4.4-61). As discussed above, the Upper Hearst Development would degrade the integrity of feeling and setting of historical resources adjacent to the Project site. Therefore, the Project would contribute to a significant and unavoidable cumulative impact on historical resources. Implementation of Mitigation Measure CUL-1, however, would reduce this impact to the extent feasible through the inclusion of exterior materials in building design that are more compatible with nearby historical resources.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Directly or indirectly destroy a unique paleontological resource, or site, or unique geologic feature?		●

As noted in the 2020 LRDP EIR, no known paleontological resources or unique geologic features occur on the UC Berkeley campus (2020 LRDP EIR Vol 1, p. 4.4-48). However, ground disturbance during construction of the Upper Hearst Development could potentially unearth and damage a limited number of fossils. Consistent with Continuing Best Practice CUL-1 in the 2020 LRDP EIR, if paleontological resources are encountered, work must stop immediately and any found resource would be protected until a qualified paleontologist or geologist determines its significance. If the resource is found to be unique, UC Berkeley would prepare and implement a mitigation plan to protect it by preservation, documentation and/or removal, prior to resuming construction activity. Implementation of Continuing Best Practice CUL-1 would minimize potential impacts to paleontological resources. Therefore, consistent with the 2020 LRDP EIR's analysis, the Upper Hearst Development would have a less than significant impact on such resources.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Cause a substantial adverse change in the significance of an archaeological resource pursuant to CCR Section 15064.5?		●

In conformance with Mitigation Measure CUL-4-a in the 2020 LRDP EIR, UC Berkeley has created a confidential map of known sensitive archaeological resources on campus. This map indicates that no known archaeological resources occur on the Project site. However, ground disturbance during construction of the Upper Hearst Development could potentially unearth historic archaeological resources associated with a former building beneath the site's existing paved surface. From roughly 1905 through the 1960s, the Project site was occupied by Newman Hall/Holy Spirit Parish, the Roman Catholic student center associated with UC Berkeley. In accordance with Continuing Best Practice CUL-4-a in the 2020 LRDP EIR, if a cultural resource within the Project site is determined to qualify as an historical resource or unique archaeological resource in accordance with CEQA, UC Berkeley must retain a qualified archaeologist to conduct a subsurface investigation of the Project site to ascertain the extent of any archaeological deposit. If resources are present, they must be evaluated for significance under CEQA. If the find is determined to qualify as an historical and/or unique archaeological resource, UC Berkeley must consider avoidance. If avoidance is not feasible, Mitigation Measure CUL-5 in the 2020 LRDP EIR would require that a qualified archaeologist prepare a research design and data recovery plan to mitigate impacts to the resource. If an unanticipated resource is discovered during construction, Mitigation Measure CUL-4-b in the 2020 LRDP EIR would require that all soil disturbing work within 35 feet of the find must cease and a qualified archaeologist be contacted to examine the deposit and assess appropriate action. By avoiding or treating potential archaeological resources in conformance with the protocols established by the 2020 LRDP EIR (Mitigation Measures CUL-4-b and CUL-5 and Continuing Best Practices CUL-4-a, CUL-4-b, CUL-4-c), the Upper Hearst Development would also have a less than significant impact on such resources.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, would result in a significant and unavoidable cumulative impact on the archaeological resource base (2020 LRDP EIR Vol. 1, p.4.4-61). Although the Project could potentially result in disturbance of archaeological resources, it would not involve additional ground-disturbing development than planned for in the 2020 LRDP. Furthermore, implementation of mitigation measures and continuing best practices in the 2020 LRDP would reduce the Project's potential contribution to the loss of archaeological resources, to the extent feasible. Therefore, the Project would contribute to a significant and unavoidable cumulative impact on archaeological resources, but not to a greater extent than identified in the 2020 LRDP EIR.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
4. Disturb any human remains, including those interred outside of formal cemeteries?		●

Because the Project site is fully developed, it is not anticipated that ground disturbance would uncover human remains. However, in the event human or suspected human remains are discovered, UC Berkeley would implement Continuing Best Practice CUL-4-b from the 2020 LRDP EIR to notify the County Coroner, who would in turn notify the Native American Heritage Commission if the remains are Native American. UC Berkeley would comply with the provisions of Public Resources Code Section 5097.98 and CEQA Guidelines Section 15064.5(d) regarding identification and involvement of the Native American Most Likely Descendant and with the provisions of the California Native American Graves Protection and Repatriation Act to ensure that the remains and any associated artifacts recovered are repatriated to the appropriate group, if requested. Therefore, consistent with the 2020 LRDP EIR's analysis, the Upper Hearst Development would have a less than significant impact on human remains.

SUMMARY OF CULTURAL RESOURCES ANALYSIS

The 2020 LRDP EIR found that certain projects to further UC Berkeley's educational mission could alter historical resources in a manner not consistent with the *Secretary's Standards*, resulting in a significant and unavoidable impact (2020 LRDP EIR Vol 1, p. 4.4-55). While the Upper Hearst Development would have an adverse indirect effect on adjacent historical resources including the Beta Theta Pi house, Cloyne Court, and the Phi Kappa Psi house, resulting in a significant and unavoidable impact, this would be within the scope of the 2020 LRDP EIR's analysis. Moreover, implementation of Mitigation Measure CUL-1 would reduce this impact to the extent feasible, by requiring UC Berkeley to retain a historic architect to provide input and refinements to the design team to improve compatibility with neighboring historical resources.

The 2020 LRDP EIR also found that impacts to archaeological resources, human remains, and paleontological resources would be less than significant with implementation of mitigation measures and continuing best practices, except that impacts to archaeological resources could be significant and unavoidable for certain projects that further UC Berkeley's education mission (2020 LRDP EIR Vol 1, p. 4.4-54 to 4.4-57). It is not anticipated that construction of the Upper Hearst Development would result in disturbance of such cultural resources; however, in the event of their discovery on the Project site, implementation of mitigation measures and continuing best practices in the 2020 LRDP EIR would reduce these impacts to less than significant.

6. GEOLOGY, SEISMICITY, AND SOILS

SETTING

The geological setting of the campus is described in the 2020 LRDP EIR (Section 4.5). The following text summarizes context information for geology, seismicity, and soils relevant to the Project.

The San Francisco Bay Area is one of the more seismically active areas in the world, based on its record of historical earthquakes and its position relative to the North American and Pacific Plate boundaries. To evaluate geologic, seismic, and soil-based hazards on the Project site, Langan Engineering and Environmental Services, Inc. (Langan) prepared an initial geotechnical investigation in February 2018 and an addendum focusing on fault hazards in October 2018 (see Appendix D). Based on these reports, the active Hayward fault passes through the eastern part of the campus, approximately 0.1 miles east of the Project site. The northeastern half of the Project site is mapped as within an Earthquake Fault Zone that encompasses two traces of the Hayward fault. For new developments in an Earthquake Fault Zone, the Alquist-Priolo Earthquake Fault Zoning Act requires an investigation of fault hazards. The U.S. Geological Survey (USGS) maps the two traces of the Hayward fault as approximately 530 feet and 725 feet northeast of the Project site, respectively.

In addition, the Louderback Shear Zone, a 200-foot-wide corridor associated with the Louderback fault, is mapped within the Project site (Appendix D). To investigate whether this fault has been active in the Holocene era (approximately the last 12,000 years), Langan conducted multiple tests of subsurface conditions on the Project site, such as exploratory borings into bedrock and seismic refraction surveys, as well as a comprehensive review of previous studies of faulting in the vicinity of the Project site. As a result, Langan concluded that the Louderback fault trace beneath the Project site has not been active in the Holocene era and does not currently pose a hazard of surface rupture.

A study assessing the probability of earthquakes across California was released in 2015 by the USGS Working Group on California Earthquake Probabilities (Field et al. 2015). The results of the study indicate there is a 72 percent probability of at least one magnitude 6.7 or greater earthquake striking the Bay Area in the 30-year period after 2007. As part of the study, individual probabilities for generating a magnitude 6.7 quake or greater were assigned to specific known major faults. The study estimated that the Hayward-Rodgers Creek fault has a 31 percent probability of generating a magnitude of 6.7 or greater in the analyzed 30-year period.

Groundwater levels in the vicinity of the Project site are expected to range from 10 to 40 feet below the ground surface (Appendix D). The surface parking lot is generally underlain by up to nine feet of heterogeneous fill, consisting mainly of stiff to hard clay and sandy clay, and very dense gravel. The fill under this portion of the site generally has a high to moderate expansion potential. The existing concrete garage slab is underlain by approximately six inches of gravel fill over hard clay, sandy clay, and clay with gravel.

2020 LRDP & 2020 LRDP EIR

The 2020 LRDP guides the location, scale, form and design of new University projects with sensitivity to geology, seismicity and soils considerations. Four of the 2020 LRDP Objectives are particularly relevant:

- **Provide the space, technology and infrastructure we require to excel in education, research, and public service.**
- **Provide the housing, access, and services we require to support a vital intellectual community and promote full engagement in campus life.**
- **Plan every new project to represent the optimal investment of land and capital in the future of the campus.**
- **Plan every new project as a model of resource conservation and environmental stewardship.**

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the new development would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon geology, seismicity and soils. Where applicable, the Project would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practice GEO-1-a: UC Berkeley will continue to comply with the California Building Code and the *University Policy on Seismic Safety*.

2020 LRDP Continuing Best Practice GEO-1-b: Site-specific geotechnical studies will be conducted under the supervision of a California Registered Engineering Geologist or licensed geotechnical engineer and UC Berkeley will incorporate recommendations for geotechnical hazard prevention and abatement into project design.

2020 LRDP Continuing Best Practice GEO-1-c: The Seismic Review Committee (SRC) shall continue to review all seismic and structural engineering design for new and renovated existing buildings on campus and ensure that it conforms to the California Building Code and the *University Policy on Seismic Safety*.

2020 LRDP Continuing Best Practice GEO-1-d: UC Berkeley shall continue to use site-specific seismic ground motion specifications developed for analysis and design of campus projects. The information provides much greater detail than conventional codes and is used for performance-based analyses.

2020 LRDP Continuing Best Practice GEO-1-g: As stipulated in the *University Policy on Seismic Safety*, the design parameters for specific site peak acceleration and structural reinforcement will be determined by the geotechnical and structural engineer for each new or rehabilitation project proposed under the 2020 LRDP. The acceptable level of actual damage that could be sustained by specific structures would be calculated based on geotechnical information obtained at the specific building site.

2020 LRDP Continuing Best Practice GEO-1-i: The site-specific geotechnical studies conducted under GEO-1-b will include an assessment of landslide hazard, including seismic vibration and other factors contributing to slope stability.

2020 LRDP Continuing Best Practice GEO-2: Campus construction projects with potential to cause erosion or sediment loss, or discharge of other pollutants, would include the campus Stormwater Pollution Prevention Specification. This specification includes by reference the "Manual of Standards for Erosion and Sediment Control" of the Association of Bay Area Governments and requires that each large and exterior project develop an Erosion Control Plan.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Geology, Seismicity and Soils, although more people than projected in the 2020 LRDP would occupy structures on campus and be exposed to potential geologic, seismic, and soil-related hazards as a result of the existing and projected campus headcount, the potential environmental impacts resulting from the increase in campus headcount are limited to physical development on the UC Berkeley campus and City Environs. The increase in UC Berkeley's existing and projected campus headcount would not require additional development beyond that planned for in the 2020 LRDP that could expose people or structures to adverse effects from geologic, seismic, and soil-related hazards. Although more people on campus could be exposed to hazards in structures that overlay active faults, the 2020 LRDP EIR notes that UC Berkeley is implementing an extensive seismic improvement program to contribute to a cumulative reduction in risks associated with fault rupture and seismic activity, including ground shaking (2020 LRDP EIR Vol 1, p. 4.5-23 to 4.5-24). Future development also would be subject to the *University Policy on Seismic Safety*, which prohibits building on active faults. As noted in the 2020 LRDP EIR, building codes and local construction requirements also have been established to protect against building collapse and major injury during a seismic event (2020 LRDP EIR Vol 1, p. 4.5-23). These factors would minimize the increase in exposure to fault hazards and ground shaking from additional people on campus.

Similarly, potential impacts related to seismic-related ground failure, including liquefaction, landslides, substantial soil erosion, unstable ground, and expansive soil would be reduced by compliance with the California Building Code, the *University Policy on Seismic Safety*, and other regulatory requirements. The increase in UC Berkeley's existing and projected headcount would incrementally increase the exposure of people to geologic, seismic, and soil-related hazards, but seismic retrofits and adherence to continuing best practices and regulatory standards for new development would substantially reduce these hazards. Therefore, increased headcount would not result in significant impacts related to geology, seismicity, and soils, and these impacts would be consistent with the 2020 LRDP EIR's analysis.

GEOLOGY, SEISMICITY AND SOILS

Would the Project:

Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
1. Rupture of a known earthquake fault?	●	

As discussed above, the Project site is located as close as approximately 530 feet from the nearest trace of the active Hayward fault and is within the mapped shear zone of the Louderback fault (Appendix D). A geotechnical investigation performed by Langan concluded that the Louderback fault trace on the Project site is inactive and does not pose a hazard to structures on the surface. Based on this result, new development on the Project site would not be constructed on an active fault as prohibited by the *University Policy on Seismic Safety* and pursuant to the Alquist-Priolo Earthquake Fault Zoning Act. Furthermore, consistent with Continuing Best Practice GEO-1-b, the Upper Hearst Development would incorporate recommendations for geotechnical hazard prevention and abatement into building design. Recommendations in the geotechnical investigation include site preparation methods, guidance on foundation design, excavation, underpinning and below-grade wall design, addition of site retaining walls, construction monitoring, and seismic design parameters for the Upper Hearst Development. In addition, pursuant to Continuing Best Practice GEO-1-a, the new buildings would be designed for compliance with the *University Policy on Seismic Safety*, which includes provisions to ensure structural safety. UC Berkeley's Seismic Review Committee also has reviewed the proposed buildings for compliance with applicable building design standards and regulations. Therefore, as found by the 2020 LRDP EIR for the 2020 LRDP program as a whole, the Upper Hearst Development would not expose people or structures to substantial hazards from fault rupture (2020 LRDP EIR Vol 1, p. 4.5-17). The Upper Hearst Development's impact related to fault rupture would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, would not expose people or structures to substantial adverse impacts due to fault rupture (2020 LRDP EIR Vol. 1, p. 4.5-23). As discussed above, new development on the Project site would not be constructed on an active fault. Therefore, the Project would not considerably contribute to a cumulative impact related to fault rupture, consistent with the 2020 LRDP EIR's analysis.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
2. Strong seismic ground shaking?		●

UC Berkeley is located in a seismically active region. Ground shaking has the potential to damage buildings. UC Berkeley has implemented a process for the design of new buildings that applies the best available engineering procedure to maximize safety and resiliency, which are incorporated into the 2020 LRDP EIR (Best Practices GEO-1-a through GEO-1-g) and would be applied, where applicable, to the proposed Project. Also, as noted in response to Geology item 1, design and construction of the proposed buildings would be consistent with the *University Policy on Seismic Safety*. Given these practices, the 2020 LRDP EIR determined the impacts to people and property due to seismic ground shaking would be less than significant.

Consistent with the *University Policy on Seismic Safety,* design and construction of the Upper Hearst Development would, at a minimum, comply with the current seismic provisions of CCR, Title 24, California Building Standards Code, or local seismic requirements, whichever requirements are more stringent. Therefore, the new development would be within the scope of the 2020 LRDP EIR's analysis and would have a less than significant impact related to seismic ground shaking.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, would not expose people or structures to substantial adverse impacts due to seismic ground shaking (2020 LRDP EIR Vol. 1, p. 4.5-23). As discussed above, design and construction of the proposed buildings would be consistent with the *University Policy on Seismic Safety* to maximize safety and resiliency. Therefore, the Project would not considerably contribute to a cumulative impact related to seismic ground shaking, consistent with the 2020 LRDP EIR's analysis.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Seismic -related ground failure, including liquefaction?		●

The 2020 LRDP EIR states that "the Adjacent Blocks and the Hill Campus are not located in a liquefaction hazard zone, except at the Memorial Stadium site." (2020 LRDP EIR Vol 1, p. 4.5-10). Memorial Stadium is located approximately 0.4 miles southeast of the site. In addition, Figure 4.5-3 of the 2020 LRDP EIR indicates that the Project site is not located within a liquefaction hazard zone. Because the Project would not introduce additional people to liquefaction hazards, it would result in a less than significant impact from seismic-related ground failure, and would not considerably contribute to a cumulative impact, consistent with the 2020 LRDP EIR's analysis.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Landslides?		●

Landslide risk in the 2020 LRDP area is described as restricted primarily to the hill areas (2020 LRDP EIR, Vol. 1, p. 4.5-19). The Project site is located outside of steep hillside areas to the east of Highland Place and north of Le Conte Avenue, and is surrounded by urban development. As shown on Figure 4.5-3 of the 2020 LRDP EIR, the Project site is not located in an area of landslide risk (2020 LRDP EIR Vol. 1, p. 4.5-12). Therefore, consistent with the 2020 LRDP EIR's analysis, the Project would have a less than significant impact related to landslides and would not considerably contribute to a cumulative impact.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
5. Result in substantial soil erosion or the loss of topsoil?		●

As prescribed in the 2020 LRDP EIR, campus construction projects with potential to cause erosion or sediment loss, or discharge of other pollutants, are undertaken in accordance with the campus Stormwater Pollution Prevention Specification. The specification includes by reference the "Manual of Standards for Erosion and Sediment Control" of the Association of Bay Area Governments and requires development of an erosion control plan (2020 LRDP EIR Best Practice GEO-2). With the inclusion of this practice as part of the Upper Hearst Development, no significant erosion impact is anticipated.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, would not result in substantial soil erosion (2020 LRDP EIR Vol. 1, p. 4.5-24). With adherence to continuing best practices to minimize soil erosion, as noted above, the Project would not considerably contribute to a cumulative impact from soil erosion, consistent with the 2020 LRDP EIR's analysis.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
6. Be located on a geologic unit or soil that is unstable, or would become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction or collapse?		●

The geotechnical investigation of the Project site found that the risk of landslides, lateral spreading, and liquefaction is low (Appendix D). This report includes recommendations to prevent subsidence that could affect the stability of building foundations. As prescribed in the 2020 LRDP EIR, UC Berkeley would incorporate the recommendations relating to geotechnical hazard prevention and abatement in site-specific geotechnical studies into Project design, prior to construction (Best Practice GEO-1-b). Therefore, the Upper Hearst Development would be designed and built to prevent instability from potential subsidence. This impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, would not result in substantial risks to life or property from unstable geologic units or soil (2020 LRDP EIR Vol. 1, p. 4.5-24). As discussed above, the Project would not result in additional risks from landslides, lateral spreading, or liquefaction, or subsidence with adherence to recommendations in the geotechnical investigation. Therefore, the Project would not considerably contribute to a cumulative impact, consistent with the 2020 LRDP EIR's analysis.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
7. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code, creating substantial risks to life or property?		●

Soil surveys indicate that soils in the 2020 LRDP area range from low shrink-swell potential, found primarily in the Hill Campus, to low-to-high shrink-swell potential soils, which exist in the remainder of the 2020 LRDP area. Soil expansiveness potential likely varies across the Campus Park and in the other land use zones given the variety of geologic units underlying the area (2020 LRDP EIR Vol 1. 4.5-13).

The Geotechnical Investigation found that soil on the Project site has moderate to high potential for expansiveness and includes recommendations for building foundations to resist the effects of expansive soil (Appendix D). UC Berkeley would incorporate the recommendations relating to geotechnical hazard prevention and abatement into Project design, prior to construction (Best Practice GEO-1-b). Therefore, the Upper Hearst Development would be within the scope of the 2020 LRDP EIR's analysis and this impact would be less than significant.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, would not result in substantial risks to life or property from expansive soils (2020 LRDP EIR Vol. 1, p. 4.5-24). As discussed above, the Project would not result in additional risks from expansive soils with adherence to recommendations in the geotechnical investigation. Therefore, the Project would not considerably contribute to a cumulative impact, consistent with the 2020 LRDP EIR's analysis.

SUMMARY OF GEOLOGY, SEISMICITY AND SOILS ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, incorporating existing best practices and 2020 LRDP EIR mitigation measures, would not result in new significant impacts in the area of geology, seismicity, or soils (2020 LRDP EIR Vol 1 p. 4.5-17 to 4.5-24). Although the Project site is underlain by a fault trace, a geotechnical investigation concluded that this trace is inactive and does not pose a hazard to structures on-site. Adherence to continuing best practices, recommendations in the geotechnical investigation, and regulatory standards would minimize structural hazards from seismic instability, landslides, unstable geologic units or soil, and expansive soils, and would minimize soil erosion from construction. Therefore, the Upper Hearst Development would not result in significant impacts related to geology, seismicity, and soils, and these impacts would be consistent with the 2020 LRDP EIR's analysis.

7. GREENHOUSE GAS EMISSIONS

SETTING

STATE GHG EMISSIONS INVENTORY

The California Air Resources Board (CARB) tracks greenhouse gas (GHG) emissions in the State in terms of carbon dioxide equivalent emissions (CO_2e). This metric describes the potential of various gases to contribute to global warming. Based on the CARB's California Greenhouse Gas Inventory for 2000-2016, California produced 429.4 million metric tons (MMT) of CO_2e in 2016, achieving its 2020 GHG emission reduction target as emissions fell below 431 MMT of CO_2e (CARB 2018a). The major source of greenhouse gas (GHG) emissions in California is associated with transportation, which contributes 41 percent of the state's total GHG emissions. The industrial sector is the second largest source, contributing 23 percent of the state's GHG emissions. Electric power accounts for approximately 16 percent of the total emissions.

UC BERKELEY GHG EMISSIONS INVENTORY

UC Berkeley's 1990 baseline emissions level is 160,389 metric tons (MT) of CO_2e (UC Berkeley 2019a). Every year, UC Berkeley completes an annual GHG emissions inventory to track its progress toward GHG emission reductions and reports these efforts publicly. The inventories are completed following reporting protocols developed by The Climate Registry, World Resources Institute, and CARB. UC Berkeley reports on ten emissions sources and in three different categories:

- Scope 1 - Direct Emissions: natural gas, campus fleet, emissions from refrigerants
- Scope 2 - Indirect Emissions: purchased electricity, purchased steam
- Scope 3 - Other Emissions: business air travel, student commute, faculty/staff commute, solid waste, water consumption

Table 7 shows the results of the annual GHG inventory from academic year 2009-2010 through academic year 2016-2017. In 2016, the total annual GHG emissions from Scopes 1, 2 and 3 sources were 151,650 metric tons CO_2e; UC Berkeley's 2016 emissions were approximately 5 percent lower than they were in 1990.

Table 7:
UC Berkeley Annual GHG Emission Inventories

Academic Year	Scope 1 Emissions (MT of CO_2e)	Scope 2 Emissions (MT of CO_2e)	Scope 3 Emissions (MT of CO_2e)	Total GHG Emissions (MT of CO_2e)	Service Population[1]	Per SP Emissions (MT of CO_2e)
2009 – 2010	13,759	122,660	40,524	176,943	48,414	3.65
2010 – 2011	12,784	122,833	42,152	177,769	47,992	3.70
2011 – 2012	13,738	111,998	33,573	159,309	48,257	3.30
2012 – 2013	12,776	104,598	33,617	150,991	48,667	3.10
2013 – 2014	13,963	103,823	34,999	152,785	49,277	3.10
2014 – 2015	12,141	98,305	36,422	146,868	51,163	2.87
2015 – 2016	12,099	97,819	44,087	154,005	52,117	2.95
2016 – 2017	12,124	97,277	44,081	151,650	54,319	2.79

Note: Data was not available for academic year 2017-2018.

[1] Service population = students + faculty/staff

Source: UC Berkeley 2016, 2019a, and 2019b; UCOP 2019

UC Berkeley has also completed projections of GHG emissions through academic year 2022-2023. As shown in Table 8, total annual GHG emissions during the 2018 to 2023 period are projected to increase by approximately 41,000 MT of CO_2e per year above total annual GHG emissions reported in 2016 (Stoll 2019; UC Berkeley 2019a). This substantial increase in emissions is due in large part to a major change in UC Berkeley's energy operations and electricity sourcing, which occurred in 2017. Prior to 2017, UC Berkeley received heat for the main campus in the form of high-pressure steam from the on-campus cogeneration plant, which was owned and operated by a third party, and purchased electricity from PG&E to power its main campus, which constitutes 97 percent of UC Berkeley's electricity consumption. Between the opening of the plant in the 1980s and mid-2017, the third-party owner and operator had a power purchase agreement with PG&E to sell electricity generated by the cogeneration plant to PG&E. The GHG emissions associated with the plant during those years were the responsibility of the third-party owner operator. In 2017, the third-party operator's power purchase agreement with PG&E ended as did UC Berkeley's energy services contract with the third-party operator. Following the end of both contracts, UC Berkeley assumed ownership of the cogeneration plant and began to use the majority of its main campus electricity from the cogeneration plant.

As a result of the shift in electricity source from PG&E to the cogeneration plant, the GHG emissions from electricity consumed by UC Berkeley nearly doubled because electricity produced by the cogeneration plant is produced exclusively from natural gas combustion whereas electricity produced by PG&E is partially produced by a mix of carbon-free sources including renewables, nuclear, and hydropower (UC Berkeley 2016). This change in ownership did not result in more GHG emissions overall as the plant existed on campus in 1990. The change in ownership shifted the reporting entity for GHG emissions associated with the plan from the third party to UC Berkeley. As such a recalculation of UC Berkeley's baseline 1990 emission levels would be appropriate according to public sector protocols outlined by the World Resources Institute (WRI 2010).

Table 8:
Projected UC Berkeley GHG Emissions

Academic Year	Scope 1 Emissions (MT of CO_2e)	Scope 2 Emissions (MT of CO_2e)	Scope 3 Emissions (MT of CO_2e)	Total GHG Emissions (MT of CO_2e)	Service Population[1]	Per SP Emissions (MT of CO_2e)
2018 – 2019	144,961	4,556	42,894	192,410	58,763	3.27
2019 – 2020	144,975	4,275	43,187	192,437	59,776	3.22
2020 – 2021	144,989	4,274	43,495	192,757	60,559	3.18
2021 – 2022	145,003	4,272	43,805	193,080	61,357	3.15
2022 – 2023	145,017	4,270	44,117	193,404	62,090	3.11

[1]Service population = students + faculty/staff

Source: Stoll 2019

As indicated by Tables 7 and 8, the shift in sourcing of electricity between 2016 and 2018 has substantially increased UC Berkeley's reported direct Scope 1 emissions from the campus (e.g., the cogeneration plant, which is now owned and operated by UC Berkeley instead of a third-party operator), while decreasing Scope 2 emissions (e.g., purchased electricity and steam). Figure 25 shows UC Berkeley's historic and projected annual GHG emissions by scope.

Annual emissions in 2016 were approximately 151,650 MT of CO_2e per year, or 2.8 MT of CO_2e per service population per year (UC Berkeley 2019a).[2] However, as discussed above, the shift in the main campus electricity source from PG&E to the on-campus cogeneration plant in 2017 is projected to increase UC Berkeley's reported total annual emissions by approximately 41,000 MT of CO_2e per year from 2016 to 2018. As a result, total reported annual GHG emissions are anticipated to increase to approximately 192,000 MT of CO_2e per year, or 3.3 MT of CO_2e per service population per year, for academic year 2018-2019. As campus headcount continues to increase, however, per service population GHG emissions from academic years 2018-2019 through 2022-2023 are projected to decline from approximately 3.27 MT of CO_2e per service population per year to 3.11 MT of CO_2e per service population per year.

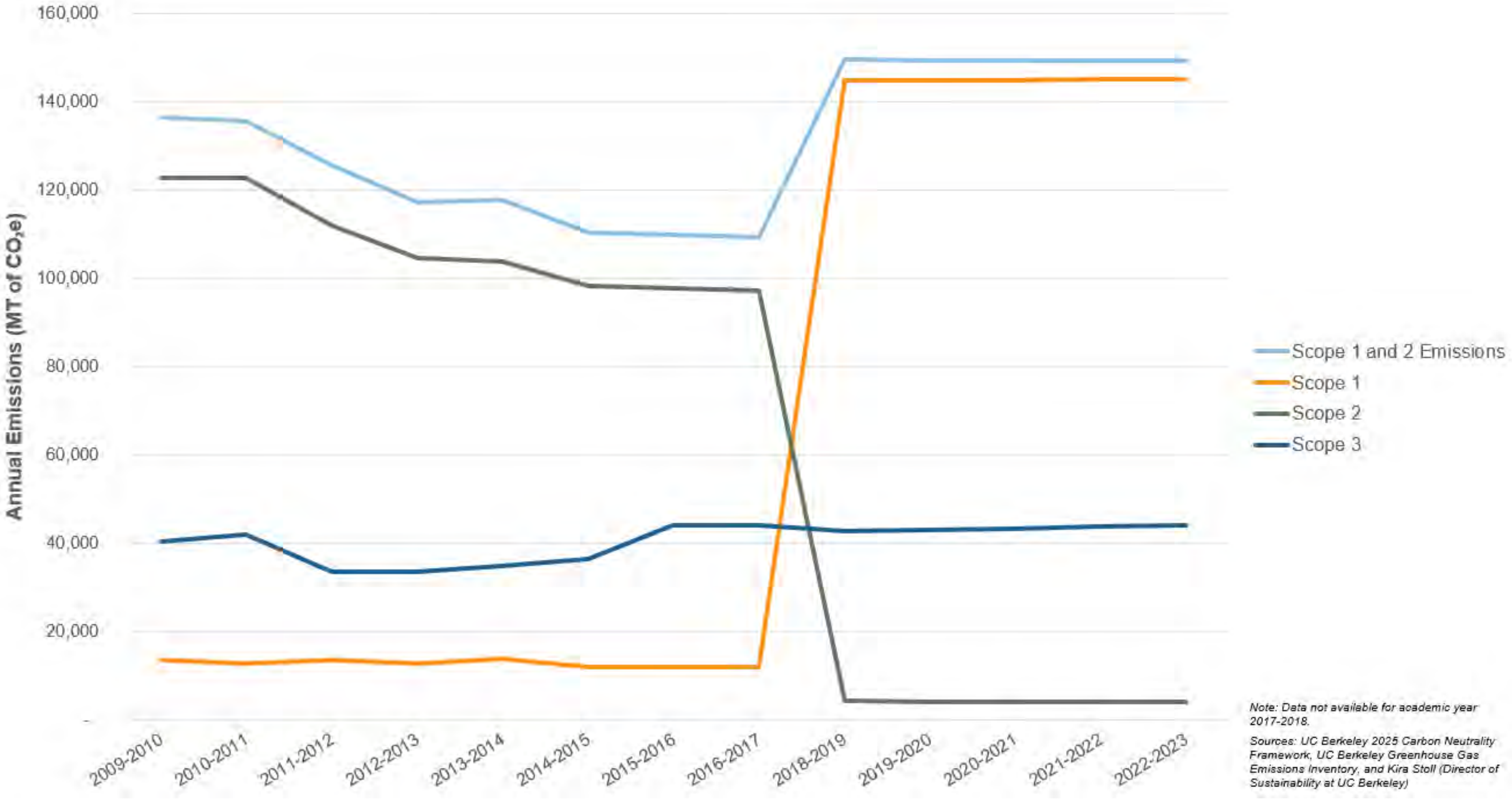
UC BERKELEY SUSTAINABILITY INTIATIVES

Since approval of the 2020 LRDP EIR, UC Berkeley has been at the forefront of leadership of climate change efforts, including establishing policies and goals to achieve carbon neutrality and 100 percent clean energy goals. UC Berkeley has produced three climate action planning documents, with the most recent published in 2016 providing a high-level course of action and strategies to meet the UC system's 2025 carbon neutrality target. UC Berkeley's major climate mitigation accomplishments include:

- Since 2008, UC Berkeley has implemented energy efficiency measures that have reduced carbon emission by 15,000 tons.
- UC Berkeley total GHG emissions in 2016 were approximately 5 percent below the 1990 GHG emission level.
- Energy intensity per square foot has been reduced by 15 percent since 1990, while building space has grown.
- 35 percent of the Berkeley vehicle fleet is either hybrid or powered by alternative fuels.

[2] Service population = 40,173 students + 14,146 faculty/staff (UC Berkeley 2019b and UCOP 2016)

FIGURE 25 UC BERKELEY'S ANNUAL GHG EMISSIONS BY SCOPE



Note: Data not available for academic year 2017-2018.

Sources: UC Berkeley 2025 Carbon Neutrality Framework, UC Berkeley Greenhouse Gas Emissions Inventory, and Kira Stoll (Director of Sustainability at UC Berkeley)

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- Fuel use from the campus fleet and student, faculty, and staff commutes remains more than 25 percent below 1990 levels. Greater than 5,500 people commute by bicycle to campus on a typical school day. The campus transportation survey found that over 12 percent of all campus commuters ride a bike to campus – nearly 21 percent of faculty, 9 percent of staff, 27 percent of graduate students, and 7 percent of undergraduates commute by bicycle.

REGULATORY SETTING

The following regulations address climate change and GHG emissions.

STATE

CARB is responsible for the coordination and oversight of state and local air pollution control programs in California. California has numerous regulations aimed at reducing the state's GHG emissions. These initiatives are summarized below.

California Advanced Clean Cars Program

Assembly Bill (AB) 1493 (2002), California's Advanced Clean Cars program (referred to as "Pavley"), requires CARB to develop and adopt regulations to achieve "the maximum feasible and cost-effective reduction of GHG emissions from motor vehicles." On June 30, 2009, USEPA granted the waiver of Clean Air Act preemption to California for its greenhouse gas emission standards for motor vehicles beginning with the 2009 model year. Pavley I regulates model years from 2009 to 2016 and Pavley II, which is now referred to as "LEV (Low Emission Vehicle) III GHG" regulates model years from 2017 to 2025. The Advanced Clean Cars program coordinates the goals of the LEV, Zero Emissions Vehicles (ZEV), and Clean Fuels Outlet programs, and would provide major reductions in GHG emissions. By 2025, when the rules will be fully implemented, new automobiles will emit 34 percent fewer GHGs and 75 percent fewer smog-forming emissions from their model year 2016 levels (CARB 2011).

Assembly Bill 32

California's major initiative for reducing GHG emissions is outlined in AB 32, the "California Global Warming Solutions Act of 2006," signed into law in 2006. AB 32 codifies the statewide goal of reducing GHG emissions to 1990 levels by 2020, and requires CARB to prepare a Scoping Plan that outlines the main state strategies for reducing GHGs to meet the 2020 deadline. AB 32 requires CARB to adopt regulations to require reporting and verification of statewide GHG emissions. Based on this guidance, CARB approved a 1990 statewide GHG level and 2020 limit of 427 MMT CO2e. The Scoping Plan was approved by CARB on December 11, 2008, and included measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures. Many of the GHG reduction measures included in the Scoping Plan (e.g., Low Carbon Fuel Standard, Advanced Clean Car standards, and cap-and-trade) have been adopted since approval of the Scoping Plan. In May 2014, CARB approved the first update to the AB 32 Scoping Plan. The 2013 Scoping Plan update defines CARB's climate change priorities for the next five years and sets the groundwork to reach post-2020 statewide goals. The update highlights California's progress toward meeting the "near-term" 2020 GHG emission reduction goals defined in the original Scoping Plan. It also evaluates how to align the State's longer-term GHG reduction strategies with other State policy priorities, such as for water, waste, natural resources, clean energy and transportation, and land use (CARB 2014).

Senate Bill 97

Senate Bill (SB) 97, signed in August 2007, acknowledges that climate change is an environmental issue that requires analysis in CEQA documents. In March 2010, the California Resources Agency (Resources Agency) adopted amendments to the CEQA Guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions. The adopted guidelines give lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHG and climate change impacts.

Senate Bill 375

SB 375, signed in August 2008, enhances the state's ability to reach AB 32 goals by directing CARB to develop regional GHG emission reduction targets to be achieved from passenger vehicles for 2020 and 2035. SB 375 directs each of the state's 18 major Metropolitan Planning Organizations (MPO) to prepare a "sustainable communities strategy" (SCS) that contains a growth strategy to meet these emission targets for inclusion in the Regional Transportation Plan (RTP). On September 23, 2010, CARB adopted final regional targets for reducing GHG emissions from 2005 levels by 2020 and 2035. The Association of Bay Area Governments and Metropolitan Transportation Commission were assigned targets of a seven percent reduction in GHGs from transportation sources by 2020 and a 15 percent reduction by 2035. They adopted a RTP/SCS, called Plan Bay Area that would meet the assigned targets when implemented, by achieving a 10 percent per capita GHG emissions reduction in 2020 and a 16 percent reduction in 2035. Plan Bay Area 2040 was adopted on July 26, 2017 and is a limited and focused update of Plan Bay Area report adopted in 2013. Plan Bay Area 2040 builds upon the growth pattern and strategies developed in the original Plan Bay Area but with updated planning assumptions that incorporate key economic, demographic and financial trends (ABAG and MTC 2017a).

Executive Order S-3-05

Executive Order (EO) S-3-05 establishes statewide GHG emissions reduction targets. EO S-3-05 provides that, by 2010, emissions shall be reduced to 2000 levels; by 2020, emissions shall be reduced to 1990 levels; and, by 2050, emissions shall be reduced to 80 percent below 1990 levels. The first and 2010 and 2020 goals were by AB 32 legislation, which gave the CARB the authority to implement plans to achieve these goals. No legislation has been adopted for the 2050 goal.

Senate Bill 32

On September 8, 2016, the governor signed Senate Bill (SB) 32 into law, extending AB 32 by requiring the state to further reduce GHGs to 40 percent below 1990 levels by 2030 (the other provisions of AB 32 remain unchanged). On December 14, 2017, CARB adopted "California's 2017 Climate Change Scoping Plan" (the "2017 Scoping Plan"), which provides a framework for achieving the 2030 target. The 2017 Scoping Plan relies on the continuation and expansion of existing policies and regulations, such as the Cap-and-Trade Program, and implementation of recently adopted policies and policies, such as SB 350 and SB 1383 (see below). The 2017 Scoping Plan also puts an increased emphasis on innovation, adoption of existing technology, and strategic investment to support its strategies. As with the 2013 Scoping Plan Update, the 2017 Scoping Plan does not provide project-level thresholds for land use development. Instead, it recommends that local governments adopt policies and locally-appropriate quantitative thresholds consistent with a statewide per capita goal of six metric tons (MT) CO2e by 2030 and two MT CO2e by 2050 (CARB 2017). As stated in the 2017 Scoping Plan, these goals may be appropriate for plan-level analyses (regional, sub-regional, county, city levels), but not for specific individual projects because they include all emissions sectors in the state (CARB 2017).

Senate Bill 1383

Adopted in September 2016, SB 1383 requires the CARB to approve and begin implementing a comprehensive strategy to reduce emissions of short-lived climate pollutants. The bill requires the strategy to achieve the following reduction targets by 2030:

- Methane – 40 percent below 2013 levels
- Hydrofluorocarbons – 40 percent below 2013 levels
- Anthropogenic black carbon – 50 percent below 2013 levels

The bill also requires the California Department of Resources Recycling and Recovery, in consultation with CARB, to adopt regulations that achieve specified targets for reducing organic waste in landfills.

Senate Bill 100

SB 100 supports the reduction of GHG emissions from the electricity sector by accelerating the state's Renewables Portfolio Standard Program, which was last updated by SB 350 in 2015. SB 100 requires electricity providers to increase procurement from eligible renewable energy resources to 33 percent of total retail sales by 2020, 60 percent by 2030, and 100 percent by 2045.

Executive Order B-55-18

Executive Order (EO) B-55-18 establishes a new statewide policy of achieving net zero carbon emissions by 2045 and to achieve and maintain net negative emissions thereafter. This goal is in addition to the existing statewide GHG reduction targets established by SB 375, SB 32, SB 1383, and SB 100. This EO supersedes the 2050 reduction target established by EO S-3-05. However, no legislation has been adopted for reduction goal of B-55-18.

REGIONAL

The Bay Area Air Quality Management District (BAAQMD) is responsible for enforcing standards and regulating stationary sources in its jurisdiction. BAAQMD regulates GHG emissions through specific rules, regulations, and project and plan level emissions thresholds for GHGs to ensure that the Bay Area contributes to its fair share of emissions reductions. In 2013, BAAQMD adopted a resolution that builds on state and regional climate protection efforts by:

- Setting a goal for the Bay Area region to reduce GHG emissions by 2050 to 80 percent below 1990 levels
- Developing a Regional Climate Protection Strategy to make progress towards the 2050 goal, using BAAQMD's Clean Air Plan to initiate the process
- Developing a 10-point work program to guide the BAAQMD's climate protection activities in the near-term

The BAAQMD is developing the Regional Climate Protection Strategy, but has outlined the 10-point work program, which includes policy approaches, assistance to local governments, and technical programs that will help the region make progress toward the 2050 GHG emissions goal.

The BAAQMD's *CEQA Air Quality Guidelines* recommends a 2020 efficiency threshold of 6.6 MT of CO_2e per service population per year for determining the significance of plan-level impacts related to GHG emissions (BAAQMD 2017). As discussed in Addendum #5 to the 2020 LRDP EIR, the BAAQMD's thresholds for GHG emissions are not clearly applicable to a campus environment and therefore not applied as significance thresholds in the EIR.

UNIVERSITY OF CALIFORNIA

The University of California has adopted the following three GHG reduction goals, which are discussed in further detail below and included in the University of California Office of the President (UCOP) Sustainable Practices Policy under the Climate Protection section (UCOP 2016):

1. Reduce Scope 1, 2, and 3 emissions to 1990 levels by 2020 in compliance with AB 32.
2. Achieve net-zero emissions from Scope 1 and 2 emissions by 2025.
3. Achieve net-zero emissions from specific Scope 3 emissions by 2050.

University of California Carbon Neutrality Initiative

In November 2013, UC President Janet Napolitano introduced the Carbon Neutrality Initiative, which commits UC campuses (buildings and vehicle fleets) to emitting net zero GHG emissions by 2025. In line with this initiative, UC Berkeley and other UC campuses also planned to achieve net zero GHG emissions from commuting and business air travel by 2050. These goals require the UC system, including UC Berkeley, to aggressively improve energy efficiency in buildings, reduce emissions from the campus fleet and other sources, and increase utilization of renewable energy sources (University of California Office of the President [UCOP] 2016; UC Berkeley 2016). The UC defines carbon neutrality as where: … the University will have net zero climate impacts from [GHG] emissions attributed to Scope 1 direct emission sources and Scope 2 indirect emission sources as defined by The Climate Registry, and specific Scope 3 emissions as defined by the American College and University Presidents' Climate Commitment (ACUPCC). This neutrality will be achieved by minimizing GHG emissions from these sources as much as possible and using carbon offsets or other measures to mitigate the remaining GHG emissions (UCOP 2016). The UC has incorporated the Carbon Neutrality Initiative into the UC Sustainable Practices Policy and specifies the reduction targets in the Climate Protection section.

University of California Sustainable Practices Policy

At the direction of The Regents of the University of California, UCOP developed a Sustainable Practices Policy which establishes sustainability goals to be achieved by all campuses and medical centers within the UC system as well as the Lawrence Berkeley National Laboratory. This policy was adopted by the UC system and is regularly updated, with the most recent update occurring in January 2018. It requires UC campuses to achieve carbon neutrality of Scope 1 and 2 emissions by 2025 and carbon neutrality of Scope 3 emissions by 2050. The policy goals encompass nine areas of sustainable practices: green building, clean energy, transportation, climate protection, sustainable operations, waste reduction and recycling, environmentally preferable purchasing, sustainable food service, sustainable water systems. Examples of policies include the following:

Green Building Design.

- All new building projects, other than acute care facilities, shall be designed, constructed, and commissioned to outperform the California Building Code (Title 24 portion of the California

Code of Regulations) energy efficiency standards by at least 20 percent or achieve the whole-building energy performance targets shown in Table 1 of Section V.A.3 of the policy.

- All new buildings will achieve a minimum of U.S. Green Building Council's LEED "Silver" certification and strive to achieve certification of LEED "Gold," whenever possible within the constraints of program needs and standard budget parameters.

Sustainable Transportation.

- Develop a Fleet Sustainability Implementation plan by January 1, 2018 to document the infrastructure and financial needs to implement a low-carbon fleet program and lower campus fleet carbon emissions through 2025.
- To amplify the impact of campus programs, each location is encouraged to partner with local agencies on opportunities to improve sustainable transportation access to and around university facilities in addition to developing its own transportation programs.
- This policy shall be consulted for all new campus development – including acquisitions and leases – to evaluate how the development or acquisition would meet the transportation policies and goals of the campus and University.

Sustainable Building Operations for Campuses.

- The University will incorporate the Sustainable Building Operations policy requirements into existing facilities-related training programs, with the aim of promoting and maintaining the goals of the Policy.

Recycling and Waste Management.

- The University will reduce per capita total municipal solid waste generation at all locations other than medical centers as follows:
    - Reduce waste generation per capita to FY2015/16 levels by 2020,
    - Reduce waste generation by 25 percent per capita from FY2015/16 levels by 2025, and
    - Reduce waste generation by 50 percent per capita from FY2015/16 levels by 2030.
- The University will achieve zero waste by 2020 at all locations other than medical centers. Minimum compliance for zero waste is 90 percent diversion of municipal solid waste from landfills.
- By 2020, the University will prohibit the sale, procurement or distribution of Expanded Polystyrene (EPS) other than that utilized for laboratory supply or medical packaging and products.
- By 2018, no EPS shall be used in foodservice facilities for takeaway containers.

As a member of the UC, the carbon neutrality goals under the Climate Protection section shown above apply to UC Berkeley. By 2025, UC Berkeley must achieve campus-wide zero net emissions from Scope 1 and 2 emissions to comply with the UC's climate change commitments.

UC BERKELEY

UC Berkeley Carbon Neutrality Framework

In 2016, UC Berkeley published the 2025 Carbon Neutrality Framework, which discusses strategies for achieving the University of California's GHG reduction goals of net-zero Scope 1 and 2 emissions by 2025 and net-zero Scope 3 emissions by 2050. The 2025 goal translates to a total emissions reduction of approximately 80 percent below 2016 levels. The 2025 Carbon Neutrality Framework acknowledges the challenge of achieving carbon neutrality given the change in electricity supply source from PG&E, which partially sources electricity from carbon-free sources, to the on-campus cogeneration plant, which relies solely on natural gas combustion. As discussed in the framework, 90 percent of the campus' Scope 1 and 2 emissions are associated with the on-campus cogeneration plant; therefore, reducing GHG emissions from the cogeneration plant and building energy usage is the main focus for achieving carbon neutrality.

UC Berkeley Climate Action Plan

UC Berkeley drafted a Climate Action Plan in 2009 to plan for reducing GHG emissions and eventually achieve climate neutrality. Because the Climate Action Plan has not been formally adopted, it does not serve as a qualified GHG reduction strategy pursuant to CEQA Guidelines Section 15183.5, and this SEIR does not rely on an analysis of the Project's consistency with the Climate Action Plan to determine the Project's impact on climate change.

2020 LRDP & 2020 LRDP EIR

The Project would support 2020 LRDP policies (as amended July 2009) to:

- **Design new buildings to a minimum standard equivalent to LEED silver or systemwide sustainability policy standards, whichever is more stringent.**
- **Design new buildings to outperform the required provisions of Title 24 of the California Energy Code by at least 20 percent or systemwide sustainability policy standards, whichever is more stringent.**
- **Design new projects to minimize energy and water consumption and wastewater production.**
- **Design all aspects of new projects to achieve campus short-term and long-term climate change emission targets established in the campus Climate Action Plan.**

Addendum to the 2020 LRDP EIR

An Addendum to the 2020 LRDP EIR, completed in 2009, describes existing climate change conditions and evaluates the potential for development under the UC Berkeley 2020 LRDP, including construction, to affect climate change. As described in the Addendum, per capita emissions associated with implementation of the 2020 LRDP would be below plan-level significance thresholds available at the time the Addendum was published (2020 LRDP EIR Addendum #5, page 32). Per capita emissions were also estimated to be below the June 2010 plan-level thresholds published by BAAQMD, revised March 2017 (BAAQMD 2017). The Addendum determined that implementation of the 2020 LRDP would not cause significant effects to global climate change with incorporation of all best practices and implementation of UC Berkeley's Climate Action Plan (2020 LRDP EIR Addendum #5, page 55). In addition, the Addendum found that implementation of the 2020 LRDP would not impede or conflict with the emissions reductions targets and strategies prescribed in or developed to implement AB 32, given the provisions of the 2020 LRDP and campus best practices (2020 LRDP EIR Addendum #5, page 45).

The Addendum also calculated emissions from 2020 LRDP-related construction. The 2020 LRDP EIR assumed that up to one million gross square feet of space could be under construction at any time during the course of 2020 LRDP implementation. Although the project's construction emissions are evaluated and considered in this section, construction emissions are not reported in the annual campus inventory, due to the fact that the campus does not directly control construction companies; emissions calculations for construction vehicles would be reported and regulated by construction businesses at their business address.

MITIGATION MEASURES & CONTINUING BEST PRACTICES

The following Continuing Best Practices from the 2020 LRDP EIR are directly aimed at reducing campus-wide GHG emissions.

2020 LRDP Continuing Best Practice CLI-1: UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices.

2020 LRDP Continuing Best Practice CLI-2: UC Berkeley would continue to implement energy conservation measures (such as energy-efficient lighting and microprocessor-controlled HVAC equipment) to reduce the demand for electricity and natural gas. The energy conservation measures may be subject to modification as new technologies are developed or if current technologies become obsolete through replacement.

2020 LRDP Continuing Best Practice CLI-3: UC Berkeley would continue to annually monitor and report upon its progress toward its greenhouse gas emission targets. UC Berkeley would continue to report actions undertaken in the past year, and update its climate action plan annually to specify actions that UC Berkeley is planning to undertake in the current year and future years to achieve emission targets.

In addition to these, as detailed in Addendum #5 to the 2020 LRDP EIR, several continuing best practices and mitigation measures from other resource areas of the 2020 LRDP EIR would also support GHG emission reductions, including Continuing Best Practices AES-1-d, AIR-1, AIR-4-b, AIR-5, BIO-1-a, BIO-1-c, HYD-2-a, HYD-2-c, HYD-3, PUB-2.1-b, PUB-2.1-d, TRA-1-a, TRA-1-b Part 1, TRA-2, TRA-3-a, TRA-3-b, TRA-5, USS-2.1-a, USS-2.1-c, USS-2.1-d, USS-5.1, and USS-5.2 as well as Mitigation Measures AIR-4-b, AIR-5, TRA-11, and TRA-12.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Greenhouse Gas Emissions, the potential environmental impacts resulting from the increase in campus headcount are included in the campus's existing and projected emissions and analyzed below.

GREENHOUSE GAS EMISSIONS

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	●	

Although the 2020 LRDP EIR Addendum #5 determined that implementation of the 2020 LRDP would have a less than significant impact on global climate change, UC Berkeley's GHG emissions trajectory and the regulatory setting for emissions reduction targets have since changed. Considering these changes in circumstances, the following analysis evaluates the impacts of GHG emissions associated with the Project which accounts for an updated population baseline as discussed in Section 2, *Introduction*, of this SEIR.

In 2015 the California Supreme Court submitted an opinion on the Biological Diversity et al. vs. California Department of Fish and Wildlife case, finding that meeting California's statewide reduction goals does not preclude all new development. Rather, the AB 32 Scoping Plan assumes continued growth and depends on increased efficiency and conservation in land use and transportation from all Californians. To the extent that a project incorporates efficiency and conservation measures sufficient to contribute its portion of the overall GHG reductions necessary, one can reasonably argue that the project's impact is not cumulatively considerable, because it is helping to solve the cumulative problem of GHG emissions as envisioned by California law. This finding is consistent with Section 15064.4 of the CEQA Guidelines which details that lead agencies have the discretion to assessing the significance of impacts from GHG emissions on the environment through a qualitative evaluation of the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.

This analysis evaluates the project's consistency with policies adopted to reduce GHG emissions such as AB 32, SB 32, and the UC Carbon Neutrality Initiative to determine whether GHG emissions associated with the Project would result in a significant impact. These regulations and policies are used to qualitatively evaluate the significance because the State and the University of California have determined that achieving these GHG reduction targets is necessary to avoid the adverse effects of climate change. Therefore, if the Project is consistent with these policies, then the Project would not generate significant, cumulatively considerable GHG emissions that would contribute to the cumulative impact of climate change.

Construction and operation of the proposed Upper Hearst Development would generate GHG emissions. The new academic and residential buildings would be within the development parameters of the 2020 LRDP EIR; therefore, their GHG emissions would not be additional to those anticipated in the 2020 LRDP EIR Addendum #5 for the overall 2020 LRDP program, which was calculated to be approximately 237,269 MTCO2 per year in 2020 without the implementation of UC Berkeley's GHG reduction policies and programs. The 2020 LRDP EIR Addendum #5 details the assumptions behind this calculation of GHG emissions under the 2020 LRDP program. Moreover, the proposed Upper Hearst Development would be planned, designed, and managed to comply with the University Policy on Sustainable Practices and would incorporate best practices and specific design elements to reduce GHG emissions, as outlined in Section 3.5.

Consistent with the 2020 LRDP and 2020 LRDP EIR, the new buildings would be designed to achieve a minimum LEED Silver rating and would target a Gold rating for new construction. According to the LEED checklists prepared for the Upper Hearst Development, potable water used in outdoor landscaping would be reduced by 50 to 100 percent from baseline building performance, while indoor water use would be reduced by a minimum of 20 percent from baseline building performance. Landscaping would minimize water demand by the use of native, drought-tolerant plants. Reduced water demand would result in fewer emissions from electricity used to supply water. The Upper Hearst Development also would be subject to the UC Policy on Sustainable Practices green building requirement to outperform California Title 24 energy efficiency standards by a minimum of 20 percent or achieve whole-building energy performance targets shown in Table 1 of Section V.A.3 of the policy, which would incrementally reduce emissions from generating and transporting energy. Exterior lighting would be on photocell control, switching on and off depending on the amount of daylight present. Interior lighting would have occupancy sensors to turn off lights when people are not present and would meet LEED quality criteria.

Exterior windows would enable the use of daylight as an integral part of lighting systems, with shading provided to control illumination levels. In addition, all roofing materials would have a high solar reflective index to reduce the heat island effect.

The proposed facilities and site layout also would minimize GHG emissions from transportation: the proposed residences for campus affiliates would be located adjacent to the GSPP complex and Campus Park. The proximity between residences and academic space would reduce the need for people to commute by motor vehicle to the Project site, relative to existing conditions. In addition, the Upper Hearst Development would reduce the number of parking spaces on-site and, therefore, would not induce demand for additional driving. In the new or renovated parking structure, an estimated 10 parking spaces for electric vehicles and an estimated 52 bicycle parking spaces would be provided.

A modest increase in water consumption and waste generation on campus through the 2022-23 academic year (including the updated campus population baseline and projections) would occur as the result of greater use of sinks, toilets, water fountains, toilets, and trash receptacles. Increased water usage would result in increased GHG emissions from electricity used to transport water, and increased solid waste generation would result in increased GHG emissions from methane offgassing that occurs during decomposition of solid waste at landfills. However, as discussed in Chapter 16, *Utilities and Service Systems*, implementation of water efficiency measures and recycling measures would offset some of the increase in water usage and solid waste generation. In addition, substantial new energy and water demand or solid waste generation that would significantly increase GHG emissions would not occur because no additional physical development beyond that contemplated in 2020 LRDP would be constructed. As discussed in Chapter 14, *Transportation and Traffic*, the Project would not increase motor vehicle trips that would generate GHG emissions, relative to that anticipated in the 2020 LRDP EIR Addendum #5, and in fact, motor vehicle trips are projected to decrease over the period from academic year 2001-2002 to academic year 2022-2023.

CONSISTENCY WITH AB 32

AB 32 requires that California reduce its statewide GHG emissions to 1990 levels by 2020. To contribute to statewide attainment of this target, the UC Sustainable Practices Policy requires that each campus reduce GHG emissions to 1990 levels by 2020. The 2016 GHG inventory total is approximately 5 percent below UC Berkeley's 1990 GHG emissions level. However, as discussed in the Setting, due to the shift in the main campus' electricity source from PG&E to the on-site cogeneration plant in 2017, UC Berkeley's annual GHG emissions from implementation of the 2020 LRDP are projected to exceed 1990 levels from academic year 2018-2019 through academic year 2022-2023. Nonetheless, in accordance with the World Resources Institute's U.S. Public Sector Protocol, the 1990 baseline emissions may need to be recalculated because of the substantial structural change related to the reassignment of control of the on-site cogeneration plant to UC Berkeley. Nonetheless, continued implementation of the 2020 LRDP would not be consistent with the UC's goal of reducing emissions to 1990 levels by 2020 in compliance with AB 32, without further measures to reduce emissions. Because construction and operation of the Upper Hearst Development would be part of implementation of the 2020 LRDP, new GHG emissions from construction and operation of the Project would contribute to the projected campus-wide exceedance of the UC's adopted target of reducing GHG emissions to 1990 levels by 2020 to comply with AB 32.

CONSISTENCY WITH UC POLICY

The UC Carbon Neutrality Initiative and Sustainable Practices Policy require that UC Berkeley reaches "climate neutrality" in Scope 1 and 2 emissions by 2025. This means achieving net zero emissions campus-wide from Scope 1 and 2 sources. As shown in Table 8, UC Berkeley's Scope 1 and 2 emissions in the 2018-2019 academic year are projected to total approximately 149,517 MT of CO_2e (144,961 MT + 4,556 MT). Because construction and operation of the Upper Hearst Development would generate direct emissions from the use of natural gas, electricity, and steam, it would increase existing campus-wide emissions. Therefore, in order for the 2020 LRDP and the Upper Hearst Development to be consistent with UC policy to achieve carbon neutrality in Scope 1 and 2 emissions by 2025, implementation of Mitigation Measure GHG-1 would be required to offset the UC Berkeley's increased GHG emissions.

CONSISTENCY WITH SB 32

It is anticipated that the Upper Hearst Development would be fully operational in 2022-2023. The Association of Environmental Professionals White Paper, Beyond 2020 and Newhall, presents substantial evidence that. GHG significance thresholds should be based on the State-adopted target for the next milestone (i.e., 2020, 2030, or 2050) for which the State has completed adequate GHG reduction planning. Specifically, identified targets should be for a milestone that follows a project's operational year. SB 32 sets a statewide GHG reduction target of 40 percent below 1990 levels by the year 2030. and would therefore be subject to the 2030 GHG reduction target established by SB 32. To contribute to the State's attainment of this target, UC Berkeley would have to reduce total annual GHG emissions 40 percent below 1990 levels by the year 2030, to approximately 96,233 MT of CO_2e.

Beginning in 2018, total GHG emissions from UC Berkeley are projected to increase slightly from 192,410 MT of CO_2e per year in academic year 2018-2019 to 193,404 MT of CO_2e per year in academic year 2022-2023. As a result, UC Berkeley's GHG emissions trajectory is not on track toward attaining the 2030 GHG reduction target established by SB 32 and would be inconsistent with this target. Because GHG emissions from construction and operation of the Upper Hearst Development would contribute to this potential exceedance of applicable GHG reduction targets, the Project would also be inconsistent with SB 32 without mitigation.

As discussed above, implementation of Mitigation Measure GHG-1 would be required to achieve campus-wide net zero Scope 1 and Scope 2 emissions by 2025, consistent with the adopted UC Carbon Neutrality Initiative and Sustainable Practices Policy. This carbon neutrality policy is a more stringent target than SB 32 because it requires net zero Scope 1 and 2 emissions, which comprise approximately 78 percent of UC Berkeley's annual GHG emissions.[3] By achieving carbon neutrality of Scope 1 and 2 emissions, UC Berkeley would reduce total annual GHG emissions to approximately 44,725 MT of CO_2e by 2025, which would be well below the 40 percent GHG emission reductions necessary to achieve the SB 32 target for 2030.[4] As a result, consistency with the UC Carbon Neutrality Initiative and Sustainable Practices Policy would also result in consistency with the GHG reduction target established by SB 32.

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[3] As shown in Table 8, for academic year 2018-2019, UC Berkeley's Scope 1 and 2 emissions are projected to total approximately 149,517 MT of CO_2e per year (144,961 MT + 4,556 MT). Therefore, Scope 1 and 2 emissions comprise approximately 77.7 percent of total annual GHG emissions (149,517 MT / 192,410 MT * 100%)

[4] Scope 3 emissions in academic year 2024-2025 were estimated using a linear trendline of projected Scope 3 emissions from academic year 2018-2019 through academic year 2022-2023.

CONSISTENCY WITH 2017 CLIMATE CHANGE SCOPING PLAN

California's 2017 Climate Change Scoping Plan also includes goals to reduce climate impacts. Table 9 evaluates the Upper Hearst Development's consistency with applicable goals. As shown by Table 9, the Upper Hearst Development would be consistent with applicable goals in California's 2017 Climate Change Scoping Plan to reduce climate impacts.

Table 9:
Consistency with 2017 Climate Change Scoping Plan

Goals	**Implemented by Project?**
Transportation	
Increase the number, safety, connectivity, and attractiveness of biking and walking facilities to increase use.	*Yes. The Upper Hearst Development would facilitate active transportation by adding an estimated 52 bicycle parking spaces on-site.*
Promote transportation fuel system infrastructure for electric, fuel-cell, and other emerging clean technologies that is accessible to the public where possible, and especially in underserved communities, including environmental justice communities.	*Yes. The new or renovated Upper Hearst parking structure would include an estimated 10 parking spaces for electric vehicles.*
Quadruple the proportion of trips taken by foot by 2030 (from a baseline of the 2010–2012 California Household Travel Survey).	*Yes. The proposed residential building would provide housing adjacent to the GSPP complex and the Campus Park, incentivizing pedestrian trips for academic purposes.*
Water	
Make conservation a California way of life by using and reusing water more efficiently through greater water conservation, drought tolerant landscaping, stormwater capture, water recycling, and reuse to help meet future water demands and adapt to climate change.	*Yes. Landscaping would minimize water demand by the use of native, drought-tolerant plants. Irrigation of landscaping would include the use of drip systems. Watering of landscaping would be reduced 50 to 100 percent from baseline building performance. Indoor water use also would be reduced by 20 percent to attain LEED certification. Stormwater runoff would be better controlled due to the conversion of the northern portion of the site from an existing surface parking lot. Stormwater runoff from the buildings and paved areas would be discharged into and filtered through stepped stormwater planters prior to discharge to the City storm drain system*
Energy	
Reduce fossil fuel use.	*Yes. The Upper Hearst Development would reduce the number of parking spaces on-site, incentivizing active transportation and transit use rather than the use of motor vehicles. Vehicle trips would still decrease relative to the 2001-2002 school year. The Project site also is accessible from a number of transit lines that run along Hearst Avenue, which borders the site.*
Reduce energy demand.	*Yes. The Upper Hearst Development would employ energy efficiency strategies in all building disciplines in order to achieve a 20 percent energy use reduction below Title 24 requirements. Exterior lighting would be on photocell control, switching on and off depending on the amount of daylight present. Interior lighting would have occupancy sensors to turn off lights when people are not present and would meet LEED quality criteria. Exterior windows would enable the use of daylight as an integral part of lighting systems, with shading provided to control illumination levels. In addition, all roofing materials would have a high solar reflective index to reduce the heat island effect.*

Table 9:
Consistency with 2017 Climate Change Scoping Plan

Goals	Implemented by Project?
Waste	
Maximize recycling and diversion from landfills.	*Yes. The campus has an existing policy to increase diversion of construction and demolition waste. All trash rooms in the Upper Hearst Development would accommodate recycling and composting containers.*

CONSISTENCY WITH EXECUTIVE ORDER B-55-18 (CARBON NEUTRALITY)

With implementation of Mitigation Measure GHG-1, UC Berkeley would achieve carbon neutrality in Scope 1 and 2 emissions by 2025. Therefore, with mitigation incorporated, UC Berkeley would contribute its fair share toward the statewide 2045 carbon neutrality goal established by EO B-55-18 and would not conflict with this goal.

MM-GHG-1 By May 1, 2021, if necessary, UC Berkeley shall purchase sufficient carbon offsets and/or renewable energy certificates within the State of California to reduce annual campus-wide greenhouse gas emissions to 1990 baseline levels. With such reductions in GHG emissions, UC Berkeley shall meet the GHG reduction target in the UC Sustainable Practices Policy for the year 2020, which would ensure consistency with the statewide target established by AB 32. If necessary, by May 1, 2026, UC Berkeley shall purchase carbon offsets and/or renewable energy certificates to achieve campus-wide carbon neutrality in Scope 1 and 2 emissions by 2025, consistent with the UC Sustainable Practices Policy.

Implementation of Mitigation Measure GHG-1 would ensure that UC Berkeley's net GHG emissions, after purchase of carbon offsets and/or renewable energy certificates, would be consistent with the UC's 2025 carbon neutrality target. As discussed above, by achieving carbon neutrality in Scope 1 and 2 emissions by 2025, UC Berkeley would also meet the State's SB 32 emissions reduction target for 2030 and would contribute its fair share toward the statewide 2045 carbon neutrality goal. Therefore, the impact on global climate change would be less than significant after mitigation.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
2. Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	●	

See previous item.

SUMMARY OF GREENHOUSE GAS EMISSIONS ANALYSIS

The Upper Hearst Development would be within the development parameters of the 2020 LRDP and would not generate additional GHG emissions above those anticipated in the 2020 LRDP EIR Addendum #5. Furthermore, the Upper Hearst Development would be planned, designed, and managed to comply with the UC Sustainable Practices Policy and would incorporate best practices and specific design elements to reduce GHG emissions. Total annual GHG emissions from UC Berkeley are projected to increase in academic year 2018-2019 and continue increasing slightly through academic year 2022-2023 resulting from the change in ownership of the campus cogeneration plant. Therefore, UC Berkeley would implement Mitigation Measure GHG-1. Under this mitigation measure, if UC Berkeley is unable to bring emissions to 1990 levels in 2020 (consistent with AB 32's reduction target) or to achieve carbon neutrality of scope 1 and 2 emissions in 2025 (consistent with the Carbon Neutrality Initiative), it would purchase carbon offsets and/or renewable energy certificates sufficient to reduce GHG impacts to a less than significant level, consistent with the 2020 LRDP EIR Addendum #5's determination of GHG impacts. In addition, the Project would implement the policies described in the 2020 LRDP EIR, as amended. The Project would also be consistent with the strategies and goals of the 2025 Carbon Neutrality Framework and the 2017 Climate Change Scoping Plan and, therefore, would not conflict with any applicable plan adopted for the purpose of reducing the emissions of GHGs.

8. HAZARDOUS MATERIALS

SETTING

This section assesses the Project's effects on human health and the environment due to exposure to hazards and hazardous materials that could be encountered. The potential for impacts from toxic air emissions is considered in Air Quality, above.

To identify potential hazardous materials on the Project site, a Phase I Environmental Site Assessment (ESA) was performed by Langan Engineering and Environmental Services, Inc. in November 2017. This study involved a review of the Project site's land use history, current use of the site, a search of environmental databases for records of hazardous materials on and near the site, interviews with site owners, and inquiries at local agencies (Langan 2017). Based on this research, the Phase I ESA does not identify any potential contamination with hazardous materials on-site. During site reconnaissance no indication of spills or leaks from past on-site activities was observed. Minor oil stained surfaces were observed in both the Upper Hearst parking structure and the Ridge Lot, typical of areas used to park vehicles. Langan determined that oil staining represents a *de minimis* condition, not an environmental concern.

The Upper Hearst Development would be designed, constructed, operated, and maintained consistent with the California Health and Safety Code Division 2.5, Chapter 3, Section 1797.182, California Code of Regulations (CCR) Title 22, Chapter 20 and California Building Code Title 24, Chapter 31B. California Health and Safety Code, Section 25500, et seq., and the related regulations in 19 CCR 2620, et seq., which address the storage of hazardous materials in excess of certain quantities. The law also requires that entities storing hazardous materials be prepared to respond to releases. Those using and storing hazardous materials are required to submit a Hazardous Materials Business Plan (HMBP) to their local Certified Unified Program Agency (CUPA) and report releases to the CUPA or lead agency. The threshold quantities for hazardous materials are 55 gallons for liquids, 500 pounds for solids, and 200 cubic feet for compressed gases measured at standard temperature and pressure. The storage of sodium hypochlorite and muratic acid on-site in the quantities proposed would require preparation of a HMBP.

The UC Berkeley Office of Environment, Health, and Safety (EH&S) has primary responsibility for coordinating the management of hazardous materials on campus in compliance with applicable laws, regulations, and standards and oversees the storage, use, and disposal of hazardous materials campus-wide. The UC Berkeley EH&S Designated Urgent Response Team (DURT), staffed by health and safety professionals, hazardous materials technicians, and licensed hazardous materials drivers, responds to most minor hazardous materials incidents reported on campus. Currently, the DURT is able to respond to an incident within 15 minutes. In the infrequent cases when outside assistance is required, the DURT may request assistance from other nearby agencies, including the Berkeley Fire Department (BFD) and Alameda County Fire Department (ACFD), or from emergency response contractors.

All hazardous materials would be required by existing regulations to be handled and stored in accordance with applicable codes and regulations referenced above. Specific requirements of the California Fire Code Title 24, Part 9 that reduce the risk of fire or the potential for a release of hazardous materials that could affect public health or the environment include:

- Provision of an automatic sprinkler system for indoor hazardous material storage areas.
- Provision of an exhaust system for indoor hazardous material storage areas.
- Separation of incompatible materials by isolating them from each other with a noncombustible partition.
- Spill control in all storage, handling, and dispensing areas.
- Separate secondary containment for each chemical storage system. The secondary containment is required to hold the entire contents of the tank plus the volume of water for the fire suppression system that could be used for fire protection for a period of 20 minutes in the event of a catastrophic spill.

In addition, HMBPs include an inventory and location map of hazardous materials on-site and an emergency response plan for hazardous materials incidents. Specific topics to be covered in the plan include:

- Facility identification
- Emergency contacts
- Chemical inventory information (for every hazardous material)
- Site map
- Emergency notification data
- Procedures to control actual or threatened releases
- Emergency response procedures
- Training procedures
- Certification

HMBPs are filed with the Office of EH&S and updated annually in accordance with applicable regulations. The Office of EH&S ensures review by and distribution to other potentially affected agencies including the BFD.

In accordance with emergency response procedures specified in the HMBP, designated personnel will be trained on appropriate methods to mitigate and control accidental spills.

2020 LRDP & 2020 LRDP EIR

While the 2020 LRDP does not contain specific policies concerning hazardous materials, it does present objectives and policies that indirectly support the safe use of these materials. Three 2020 LRDP Objectives are particularly relevant:

- **Plan every new project as a model of resource conservation and environmental stewardship.**
- **Provide the space, technology and infrastructure we require to excel in education, research, and public service.**
- **Plan every new project to represent the optimal investment of land and capital in the future of the campus.**

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the proposed Upper Hearst Development would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP related to hazardous materials. Where applicable, the Project would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practice HAZ-4: UC Berkeley shall continue to perform site histories and due diligence assessments of all sites where ground-disturbing construction is proposed, to assess the potential for soil and groundwater contamination resulting from past or current site land uses at the site or in the vicinity. The investigation will include review of regulatory records, historical maps and other historical documents, and inspection of current site conditions. UC Berkeley would act to protect the health and safety of workers or others potentially exposed should hazardous site conditions be found.

2020 LRDP Continuing Best Practice HAZ-5: UC Berkeley shall continue to perform hazardous materials surveys prior to capital projects in existing campus buildings. The campus shall continue to comply with federal, state and local regulations governing the abatement and handling of hazardous materials and each project shall address this requirement in all construction.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Hazardous Materials, although more people than projected in the 2020 LRDP could be exposed to hazardous materials as a result of the existing and projected campus headcount, the potential environmental impacts resulting from the increase in campus headcount are largely limited to physical development on the UC Berkeley campus and the City Environs. As noted in Section 4, *Relationship to 2020 LRDP*, UC Berkeley has constructed approximately 43 percent of the 2.2 million net new gross square feet of development anticipated in the 2020 LRDP despite the increased campus headcount above 2020 LRDP projections. To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased campus headcount would not be additional to that planned for in the 2020 LRDP and would not result in additional physical environmental changes such as: the transport, production, or disposal of hazardous materials; upset and accident conditions involving the release of hazardous materials; or emissions of hazardous or acutely hazardous materials within one-quarter mile of an existing or proposed school. No campus physical development would occur on an active hazardous material site.

Therefore, the increase in UC Berkeley's existing and projected headcount would be within the scope of the 2020 LRDP EIR's analysis and would not result in significant impacts related to hazardous materials.

HAZARDOUS MATERIALS

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Create a significant hazard to the public or the environment through the routine transport, use, production, or disposal of hazardous materials?		●

Construction and operation of the proposed academic and residential buildings would not require extensive or ongoing use of materials that would create a significant hazard to the public. The academic building would serve GSPP and would not involve laboratory or other uses that require the use, production, and disposal of large quantities of hazardous materials. All materials used on site, such as the routine use of cleaning supplies to maintain the proposed buildings, would be applied per manufacturing specifications. Thus, the proposed development would not create a significant hazard to the public or environment through the routine transport, use, production, or disposal of hazardous materials. Consistent with the 2020 LRDP EIR's analysis, this impact would be less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?		●

As discussed above, any hazardous materials used for construction or operation of the Upper Hearst Development would be managed by the University's Office of EH&S, consistent with applicable regulations. Thus, the proposed development would not create a significant hazard to the public or environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. Consistent with the 2020 LRDP EIR's analysis, this impact would be less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?		●

The Project site is not located within one-quarter mile of an existing or proposed k-12 school. Therefore, potential impacts to schools or child care facilities would not be greater than what was described in the 2020 LRDP EIR. No impact would occur.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Be located on a hazardous materials site as listed on the 'Cortese List' (compiled pursuant to Government Code Section 65962.5) and as a result create a significant hazard to the public or the environment?		●

Consistent with Continuing Best Practice HAZ-4 in the 2020 LRDP EIR, a Phase I ESA was prepared for the Project site in November 2017 to identify potential hazardous materials on-site. This study included a search of hazardous materials databases for nearby listed sites. No hazardous materials sites were identified within at least a quarter-mile radius of the Project site (Langan 2017). Rincon Consultants updated this finding by reviewing the California State Water Resources Control Board's GeoTracker database and the California Department of Toxic Substances Control's EnviroStor database in May 2018. No hazardous materials sites were listed within 0.5-mile of the Project site. Therefore, construction workers and building occupants would not be exposed to unanticipated contaminants in soil or groundwater. Consistent with the 2020 LRDP EIR's analysis, the Upper Hearst Development would have a less than significant impact related to hazardous materials sites.

SUMMARY OF HAZARDOUS MATERIALS ANALYSIS

Required adherence to applicable existing rules and regulations affecting the storage, use and transport of hazardous chemicals and continuing best practices in the 2020 LRDP EIR would avoid new or significant hazardous materials-related impacts not analyzed in the 2020 LRDP EIR. As discussed in the analysis above, the Upper Hearst Development's impacts would be within the scope of the 2020 LRDP EIR's analysis and would not result in significant impacts related to hazardous materials.

9. HYDROLOGY AND WATER QUALITY

SETTING

The hydrology and water quality setting of the campus is described in the 2020 LRDP EIR (Section 4.7). The following text summarizes context information for hydrology and water quality relevant to the Project.

The Adjacent Blocks North subarea generally drains through culverts into the north fork of Strawberry Creek. In this portion of the watershed, all overland flow is collected by curb-and-gutter systems and delivered through side inlets to the storm drainage culverts beneath local streets. Except for the narrowly landscaped perimeter, almost the entire Project site is currently paved and impervious; thus, the vast majority of site runoff is conveyed directly to existing storm drains.

2020 LRDP & 2020 LRDP EIR

The 2020 LRDP influences hydrology and water quality by guiding the location, scale, form and design of new University projects. The 2020 LRDP includes several policies and procedures for individual project review to support the 2020 LRDP Objectives. Those 2020 LRDP Objectives relevant to hydrology and water quality are shown below:

- **Plan every new project to serve as a model of resource conservation and environmental stewardship.**

- **Maintain and enhance the image and experience of the campus and preserve our historic legacy of landscape and architecture.**

The 2020 LRDP includes several policies and procedures for individual project review to support these Objectives. For each new project to serve as a model of resource conservation and environmental stewardship, the 2020 LRDP envisions developing a campus standard for sustainable design specific to its site, climate, and facility inventory.

CLEAN WATER ACT SECTION 402—NPDES PERMITS

The National Pollutant Discharge Elimination System (NPDES) stormwater permitting program, under Section 402(d) of the federal Clean Water Act (CWA), is administered by the Regional Water Quality Control Boards on behalf of Environmental Protection Agency (EPA) and establishes a framework for regulating nonpoint-source stormwater discharges (33 U.S. Code [U.S.C.] 1251). The objective of the NPDES program is to control and reduce discharges of pollutants to water bodies from surface water, which includes both municipal and industrial wastewater and stormwater runoff. Under the CWA, discharges of pollutants to receiving water are prohibited unless the discharge is in compliance with an NPDES permit. The NPDES permit specifies discharge prohibitions, effluent limitations, and other provisions such as monitoring deemed necessary to protect water quality based on criteria specified in the National Toxics Rule, the California Toxics Rule, and the San Francisco Bay Basin Plan.

The State Water Resources Control Board (SWRCB) has adopted a State-wide NPDES general permit for stormwater discharges associated with construction activities (Construction General Permit) (Order 2009-0009-DWQ), which became effective on July 1, 2010 (Amended by Order No. 2010-0014-DWQ and Order No. 2012-0006-DWQ, effective July 17, 2012). Compliance with the Construction General Permit and preparation and implementation of a stormwater pollution prevention plan (SWPPP) that meets Construction General Permit conditions is required for sites that disturb 1 acre or more and drain to a separate storm sewer system. Construction activities subject to the Construction General Permit include clearing, grading, stockpiling, and excavation. Dischargers must eliminate or reduce non-stormwater discharges to storm sewer systems and other waters. The permit also requires dischargers to consider the use of permanent post-construction management measures that would remain in service to protect water quality throughout the life of the project. All NPDES permits also have inspection, monitoring, and reporting requirements. UC Berkeley is regulated by a NPDES permit as part of the Phase II Small Municipal Separate Storm Sewer System (MS4) Program.

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the Project would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon hydrology and water quality. Where applicable, the Project would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practices HYD-1-a: During the plan check review process and construction phase monitoring, UC Berkeley (EH&S) will verify that the proposed project complies with all applicable requirements and BMPs.

2020 LRDP Continuing Best Practice HYD-1-b: UC Berkeley shall continue implementing an urban runoff management program containing BMPs as published in the Strawberry Creek Management Plan, and as developed through the campus municipal Stormwater Management Plan (SWMP) completed for its pending Phase II MS4 NPDES permit. UC Berkeley will continue to comply with the NPDES stormwater permitting requirements by implementing construction and post construction control measures and BMPs required by project-specific SWPPPs and, upon its approval, by the Phase II SWMP to control pollution. SWPPPs would be prepared as required by the appropriate regulatory agencies including the Regional Water Quality Control Board and where applicable, according to the UC Berkeley Stormwater Pollution Prevention Specification to prevent discharge of pollutants and to minimize sedimentation resulting from construction and the transport of soils by construction vehicles.

2020 LRDP Continuing Best Practice HYD-2-a: In addition to Hydrology Continuing Best Practices 1-a and 1-b above, UC Berkeley will continue to review each development project, to determine whether project runoff would increase pollutant loading. If it is determined that pollutant loading could lead to a violation of the Basin Plan, UC Berkeley would design and implement the necessary improvements to treat stormwater. Such improvements could include grassy swales, detention ponds, continuous centrifugal system units, catch basin oil filters, disconnected downspouts and stormwater planter boxes.

2020 LRDP Continuing Best Practice HYD-2-b: Where feasible, parking would be built in covered parking structures and not exposed to rain to address potential stormwater runoff pollutant loads. See also HYD-2-a.

2020 LRDP Continuing Best Practice HYD-2-c: Landscaped areas of development sites shall be designed to absorb runoff from rooftops and walkways. The Campus Landscape Architect shall ensure open or porous paving systems be included in project designs wherever feasible, to minimize impervious surfaces and absorb runoff.

2020 LRDP Continuing Best Practice HYD-3: In addition to Best Practices 1-a, 1-b, 2-a and 2-c above, UC Berkeley will continue to review each development project, to determine whether rainwater infiltration to groundwater is affected. If it is determined that existing infiltration rates would be adversely affected, UC Berkeley would design and implement the necessary improvements to retain and infiltrate stormwater. Such improvements could include retention basins to collect and retain runoff, grassy swales, infiltration galleries, planter boxes, permeable pavement, or other retention methods. The goal of the improvement should be to ensure that there is no net decrease in the amount of water recharged to groundwater that serves as freshwater replenishment to Strawberry Creek. The improvement should maintain the volume of flows and times of concentration from any given site at pre-development conditions.

2020 LRDP Continuing Best Practice HYD-4-a: In addition to Hydrology Continuing Best Practices 1-a, 1-b, and 2-c, the campus storm drain system would be maintained and cleaned to accommodate existing runoff.

2020 LRDP Continuing Best Practice HYD-4-b: For 2020 LRDP projects in the City Environs (excluding the Campus Park or Hill Campus) improvements would be coordinated with the City Public Works Department.

2020 LRDP Continuing Best Practice HYD-4-e: UC Berkeley shall continue to manage runoff into storm drain systems such that the aggregate effect of projects implementing the 2020 LRDP is no net increase in runoff over existing conditions.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Hydrology and Water Quality, the potential environmental impacts resulting from the increase in campus headcount are mostly limited to physical development on the UC Berkeley campus and City Environs, with the exception of risks associated with flooding and inundation where more people than projected in the 2020 LRDP could be exposed to these risks. As noted in Section 4, *Relationship to 2020 LRDP*, UC Berkeley has constructed approximately 43 percent of the 2.2 million net new gross square feet of development anticipated in the 2020 LRDP despite the increased campus headcount above 2020 LRDP projections. To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased campus headcount would not be additional to that planned for in the 2020 LRDP. Accordingly, the increase in UC Berkeley's existing and projected headcount would not require additional physical development beyond that planned for in the 2020 LRDP that could affect attainment of water quality standards or water discharge requirements, affect ground water supplies, alter drainage patterns, create excessive water runoff, or substantially degrade water quality. In addition, the increase in UC Berkeley's existing and projected headcount would not require additional physical development beyond that planned for in the 2020 LRDP that could place housing within a 100-year flood hazard area or place structures within a 100-year flood hazard area which would impede or redirect flood flows. The increased campus headcount would not result in exposure of people or structures to inundation or to risks of tsunamis, mudflows, or seiches for the reasons set forth in the 2020 LRDP EIR. The increase in UC Berkeley's existing and projected headcount also would be within the scope of the 2020 LRDP EIR's analysis and would not result in significant impacts related to hydrology and water quality.

HYDROLOGY & WATER QUALITY

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Violate any water quality standards or waste discharge requirements?		●

The Upper Hearst Development would be subject to water quality standards that regulate stormwater runoff and associated pollutants. Because construction activity on the Project site would involve ground disturbance on greater than one acre, it would be required to comply with the State-wide NPDES Construction General Permit (Order 2009-0009-DWQ). Earth movement on-site would expose soil to water runoff and entrain sediment in the runoff. Stormwater runoff from the Project site would enter storm drainage culverts and eventually the San Francisco Bay. Sediment in discharge water as well as soil and debris on the haul truck tires, which in turn can be deposited on local streets, could cause increased sediment to be carried off site into the storm drain/sewer, potentially clogging inlets and reducing the functional capacity of the pipes to convey flows. However, the Construction General Permit would require preparation of a SWPPP to reduce/eliminate surface water pollution throughout the construction period. The SWPPP would include, at a minimum, specific and detailed management measures designed to mitigate construction-related pollutants. The SWPPP typically includes the following specific information:

- The pollutants that are likely to be used during construction that could be present in stormwater drainage and non-stormwater discharges, including fuels, lubricants, and other types of materials used for equipment operation;
- Spill prevention and contingency measures, including measures to prevent or clean up spills of hazardous waste and of hazardous materials used for equipment operation, and emergency procedures for responding to spills;
- Personnel training requirements and procedures that must be used to ensure that workers are aware of permit requirements and proper installation methods for management measures specified in the SWPPP; and
- The appropriate personnel responsible for supervisory duties related to implementation, inspection, and maintenance of management measures.

UC Berkeley's Wastewater Quality Program also manages discharges to the sanitary sewers using innovative educational outreach and waste minimization incentives. The program has served as a model to others: its success at preventing pollution was recognized in 2003 when the campus was one of two honorees to be awarded EBMUD’s Pollution Prevention Award for “exemplary performance in complying with discharge requirements.” The campus also instituted the Drain Disposal Policy that sets forth various drain disposal restrictions to ensure compliance with sanitary sewer discharge standards (2020 LRDP EIR Vol. 1, p. 4.7-23).

Excavation also could encounter groundwater, resulting in effluent that requires treatment under the Construction General Permit. A geotechnical report prepared in February 2018 by Langan estimated the groundwater elevation at the Project site to range from approximately 10 to 40 feet below ground surface (bgs) (Appendix D). Excavation would reach a maximum of 23 feet below the surface. If construction were to occur during periods of heavy and sustained precipitation, groundwater could be encountered. Under these circumstances, ponding may also occur. In either case, dewatering may be required.

The Construction General Permit would require that any discharge resulting from dewatering activities be impounded in a sediment retention basin or other holding facility to settle the solids and provide treatment before discharge to receiving water to meet effluent limits for priority pollutants. As stated in the Construction General Permit, all dewatering effluent must:

- Be filtered or treated, using appropriate technology;
- Meet the numeric effluent limitations and numeric action levels for pH and turbidity; and
- Not cause or contribute to a violation of water quality standards.

Although authorized non-stormwater discharges are allowed under the NPDES Construction General Permit from uncontaminated groundwater dewatering (SWRCB 2010), it is unknown at this time whether dewatering effluent would be uncontaminated. If dewatering effluent is contaminated, the San Francisco Bay RWQCB may require an individual NPDES permit for dewatering effluent discharges. Therefore, through compliance with these requirements and regulations, construction-related impacts would not be significant.

Under existing conditions, the Project site is comprised primarily of an impervious asphalt pavement parking lot and a concrete parking structure, with the exception of minor landscaped areas. Although the Upper Hearst Development would not increase the impervious area on the Project site, stormwater would discharge directly to Strawberry Creek and San Francisco Bay and would therefore require preparation of a Stormwater Management Report, according to UC Berkeley's EH&S guidelines. According to the EH&S guidelines, all new development and redevelopment projects are also required to treat stormwater runoff by using Low Impact Development (LID) techniques such as:

- Vegetated areas
- Bioretention areas
- Flow-through planters
- Pervious pavers
- Green roofs
- Media filters

With implementation of LID techniques, all stormwater from the Project site would be treated prior to offsite discharge, and the volume of peak stormwater flow during storm events would not increase beyond existing conditions. Therefore, stormwater discharge quantities would not exceed the growth parameters assessed in the 2020 LRDP EIR, which found the potential impact on water quality standards and waste discharge requirements from implementation of the 2020 LRDP to be less than significant, given existing campus practices. (Best Practices HYD-1-a through HYD-1-d).

With required adherence to existing regulations, 2020 LRDP EIR mitigation measures and UC Berkeley's continuing best practices, no impacts to water quality standards or water discharge requirements greater than or different from what was evaluated in the 2020 LRDP EIR would occur.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
2. Substantially deplete groundwater supplies or quality, or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?		●

As discussed in Hydrology and Water Quality item 1, excavation on the Project site could potentially result in dewatering of groundwater. However, the NPDES Construction General Permit would require that any discharge resulting from dewatering activities be impounded in a sediment retention basin or other holding facility to settle the solids and provide treatment before discharge to receiving water to meet effluent limits for priority pollutants. The extent of potential dewatering on an approximately one-acre site also would not substantially deplete groundwater supplies.

The 2020 LRDP EIR requires that if rainwater infiltration to groundwater is affected, UC Berkeley would design and implement improvements to retain and infiltrate stormwater to ensure there is no net decrease in the amount of water recharged to groundwater that serves to replenish Strawberry Creek: the volume of flows and times of concentration must be maintained at pre-development conditions (Continuing Best Practice HYD-3). Because the Project site is currently almost entirely covered with impervious surface, and the Upper Hearst Development would not increase the area of impervious surface, the proposed Project would not interfere with groundwater recharge. The proposed bioretention facilities in landscaped areas would actually result in an incremental increase in infiltration of stormwater into the soil and recharge of groundwater. Therefore, the Upper Hearst Development would be within the scope of the 2020 LRDP EIR's analysis and would have a less than significant impact on groundwater supplies.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Substantially alter existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in substantial erosion, siltation or flooding on- or off- site?		●

As discussed above, the Project site is almost entirely impervious, and the Upper Hearst Development would not increase the area of impervious surface on-site. The 2020 LRDP EIR requires that new projects be sited and designed so the aggregate effect of projects under the 2020 LRDP is no net increase in runoff over existing conditions (Continuing Best Practice HYD-4-e). Consistent with this best practice, the development would include bioretention facilities that ensure no net increase in runoff. Additionally the site plans include several erosion control measures, referencing those described in the *2003 California Storm Water Best Management Practice Handbook*, to control and stabilize soil during construction, that would further reduce surface runoff that may result in erosion on- or off-site. No stream or drainage courses are located on-site; thus, the Upper Hearst Development would not alter existing drainage patterns or adversely affect post-construction hydrology or water quality and, consistent with the 2020 LRDP EIR's analysis, would have a less than significant impact.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?		●

As discussed in Hydrology and Water Quality item 3, the Upper Hearst Development would include bioretention facilities that ensure no net increase in the volume of stormwater runoff. These facilities would treat stormwater runoff prior to offsite discharge to stormwater drainage systems. Therefore, the impact on existing or planned stormwater drainage system would be less than significant and no greater than evaluated in the 2020 LRDP EIR.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
5. Otherwise substantially degrade water quality?		●

As discussed in Hydrology and Water Quality item 1, construction activity on the Project site would be subject to NPDES Construction General Permit requirements to retain and treat stormwater runoff before offsite discharge. Proposed bioretention facilities also would treat stormwater runoff from the proposed buildings during their operation. UC Berkeley also would implement Continuing Best Practices HYD-1-a through HYD-1-d to meet water quality standards and waste discharge requirements across campus. Therefore, consistent with the 2020 LRDP EIR's analysis, the impact on water quality would be less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
6. Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?		●

The Project site is not within a 100-year flood boundary, as illustrated on Figure 4.7-2 of the 2020 LRDP EIR Vol 1, p. 4.7-13. Thus, no housing would be placed within a 100-year flood hazard area.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
7. Place within a 100-year flood hazard area structures which would impede or redirect flood flows?		●

The Project site is outside the 100-year flood zone, as illustrated on Figure 4.7-2 of the 2020 LRDP EIR Vol 1, p. 4.7-13. Thus, no structures would be placed within a 100-year flood hazard area.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
8. Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?		●

The Campus Park, Hill Campus, and City Environs are outside the inundation hazard area for Berryman and Summit Reservoirs, which are both located north of the site. The Upper Hearst Development would not expose people or structures to inundation as a result of dam or levee failure.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
9. Be subject to inundations by seiches, tsunamis, or mudflows?		●

The City Environs is sufficiently inland and at a sufficiently high elevation that tsunamis and mudflows are not an anticipated risk. No large, open bodies of water that would represent a substantial seiche risk are located on or around the campus. The Project site would not be adversely affected by seiches, tsunamis or mudflows.

SUMMARY OF HYDROLOGY ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, incorporating existing best practices and 2020 LRDP EIR mitigation measures, would not result in new significant hydrology and water quality impacts (2020 LRDP EIR Vol 1, p. 4.7-24 to 4.7-35). As discussed in the analysis above, the Upper Hearst Development would be within the scope of the 2020 LRDP EIR's analysis and would not result in significant impacts related to hydrology and water quality.

10. LAND USE

SETTING

The Project site lies within the subarea designated in the 2020 LRDP as the Adjacent Blocks North. The Adjacent Blocks North subarea is defined in the 2020 LRDP as the blocks bounded by the Hill Campus, LBNL, Ridge Road, Scenic Avenue, Hearst Avenue, Oxford Street, and the Campus Park. Major campus facilities on these blocks include Etcheverry Hall, Soda Hall, GSPP, the Greek Theatre, and the Bowles, Stern, and Foothill residence halls. The land use setting of the Project site is generally described in the 2020 LRDP EIR (Section 4.8) in the discussion of the Adjacent Blocks North subarea. The southern boundary of the Project site has frontage along Hearst Avenue, which is a two-way traffic corridor that forms part of the perimeter street network around the Campus Park.

2020 LRDP & 2020 LRDP EIR

Review of individual projects under the 2020 LRDP would influence land use impacts by guiding the location, scale, form and design of new University projects. The 2020 LRDP includes a number of policies and procedures for individual project review to support the Objectives of the 2020 LRDP. While all the 2020 LRDP Objectives bear directly or indirectly on land use, the following are particularly relevant to the Project:

- **Provide the space, technology and infrastructure we require to excel in education, research, and public service.**
- **Provide the housing, access, and services we require to support a vital intellectual community and promote full engagement in campus life.**
- **Stabilize enrollment at a level commensurate with our academic standards and our land and capital resources.**
- **Build a campus that fosters intellectual synergy and collaboration endeavors both within and across disciplines.**
- **Plan every new project to represent the optimal investment of land and capital in the future of the campus.**
- **Plan every new project as a model of resource conservation and environmental stewardship.**
- **Maintain and enhance the image and experience of the campus, and preserve our historic legacy of landscape and architecture.**
- **Plan every new project to respect and enhance the character, livability, and cultural vitality of our city environs.**

The 2020 LRDP states that while the design of each campus building should reflect its own time and place, it should also reflect the enduring values of elegance and quality, and contribute to a memorable identity for UC Berkeley as a whole. Toward this goal, major capital projects would be reviewed at each stage of design by the UC Berkeley Design Review Committee, as prescribed by Continuing Best Practice AES-1-b.

The 2020 LRDP includes Location Guidelines, which prescribe location priorities for the various campus functions by land use zone. As explained in the 2020 LRDP:

"In order to optimize the use of campus resources, future capital investment and space utilization at UC Berkeley shall be informed by the Location Guidelines shown below. For each new capital project, the policy reviews undertaken at phase 1 and phase 2 of the Campus Project Approval Process, described in section 18 [of the 2020 LRDP], shall include a finding that the project conforms to the Location Guidelines, or state why an exception is warranted."

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the proposed Project would be implemented in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon land use. Where applicable, the Project would incorporate the following continuing best practices:

2020 LRDP Continuing Best Practice LU-2-b: UC Berkeley would make informational presentations of all major projects in the City Environs in Berkeley to the Berkeley Planning Commission and, if relevant, the Berkeley Landmarks Preservation Commission for comment prior to schematic design review by the UC Berkeley Design Review Committee. Major projects in the City Environs in Oakland would similarly be presented to the Oakland Planning Commission and, if relevant, to the Oakland Landmarks Preservation Advisory Board. Whenever a project in the City Environs is under consideration by the UC Berkeley DRC, a staff representative designated by the city in which it is located would be invited to attend and comment on the project.

2020 LRDP Continuing Best Practice LU-2-c: Each individual project built in the Hill Campus or the City Environs under the 2020 LRDP would be assessed to determine whether it could pose potential significant land use impacts not anticipated in the 2020 LRDP, and if so, the project would be subject to further evaluation under CEQA. In general, a project in the Hill Campus or the City Environs would be assumed to have the potential for significant land use impacts if it:

- Includes a use that is not permitted within the city general plan designation for the project site, or
- Has a greater number of stories and/or lesser setback dimensions than could be permitted for a project under the relevant city zoning ordinance as of July 2003.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Land Use, the potential environmental impacts resulting from the increase in campus headcount are limited to physical development on the UC Berkeley Campus and City Environs. As noted in Section 4, *Relationship to 2020 LRDP*, UC Berkeley has constructed approximately 43 percent of the 2.2 million net new gross square feet of development anticipated in the 2020 LRDP despite the increased campus headcount above 2020 LRDP projections. To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased headcount would not be additional to that planned for in the 2020 LRDP.

Accordingly, the increase in UC Berkeley's existing and projected headcount would not involve additional physical development that could impede circulation or access in or near campus. In addition, an increased headcount would not result in new development that conflicts with the 2020 LRDP's locational guidelines and overall parameters for growth in residential, academic, and support facilities. Population growth on campus, and associated development that would not exceed the development parameters of the 2020 LRDP, also would not affect UC Berkeley's attainment of objectives in the 2020 LRDP to improve physical facilities while maintaining the character of campus and surrounding neighborhoods.

The following objective in the 2020 LRDP also would directly apply to enrollment levels:

> ***Objective:*** *Stabilize enrollment at a level commensurate with our academic standards and our land and capital resources.*

UC Berkeley has determined that it can accommodate higher enrollment while maintaining high academic standards and without exceeding its land and capital resources. Increasing headcount projections to accommodate additional students would also be consistent with UC Berkeley's responsibility under the Master Plan for Higher Education to increase its capacity commensurate with growth of the college-age population in California.

Although the increase in campus headcount has been accommodated within the 2020 LRDP development parameters, any development projects implementing the 2020 LRDP within the City Environs that have occurred to date or would be built in the future to accommodate the campus headcount would be subject to Continuing Best Practice LU-2-C, which would address consistency with relevant General Plans and zoning ordinances, ensuring that impacts would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The increase in UC Berkeley's existing and projected headcount would not result in additional physical development in any area designated for an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved conservation plan.

LAND USE

Would the Project:

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
1. Physically divide an established community?		●

The Project site is a University-owned property that fronts on three public streets and is bounded to the west by the existing GSPP buildings and a four-story student housing building (Cloyne Court). No new roads or other linear features that would decrease circulation or access for the surrounding neighborhood are proposed. Pedestrian and vehicular access through the site would be maintained. The Project would not physically divide an established community. No impact would occur.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the project adopted for the purpose of avoiding or mitigating an environmental effect?	●	

This analysis addresses the Project's consistency with the 2020 LRDP, the City's General Plan, and the City's Zoning Ordinance.

As a constitutionally created State entity, UC is not subject to local governments' regulations, such as City or County General Plans or land use ordinances, on property owned or controlled by the UC system and used in furtherance of its educational's mission. Although there is no formal mechanism for joint planning, UC campuses and medical centers (campuses) may consider, for coordination purposes, aspects of local plans and policies when it is appropriate and feasible. Campuses generally seek to maintain an ongoing exchange of ideas and information, and to pursue mutually acceptable solutions for issues that confront both the campuses and their surrounding communities.

2020 LRDP CONSISTENCY

As discussed in Section 4, *Relationship to 2020 LRDP*, the Upper Hearst Development would involve new development that is outside the 2020 LRDP's locational parameters but within its overall development parameters for student beds and square footage for the Berkeley campus as a whole. The 2020 LRDP's Location Guidelines prioritize the placement of academic programs in the Campus Park and student and faculty housing in the Housing Zone. The proposed academic building would be located outside of the Campus Park, while the proposed residential building would be located outside of the Housing Zone. Although the Upper Hearst Development would not adhere to these land use priorities, the Location Guidelines state that exceptions may be allowed where warranted. The proposed academic building would represent a logical expansion of GSPP's academic facilities in the Adjacent Blocks North subarea, being located adjacent to the program's existing complex. This building would also be located immediately across Hearst Avenue from the Campus Park, where the Location Guidelines prioritize academic programs. In addition, the proposed residential building would provide housing for faculty, visiting scholars, graduate students, and post-doctoral students in a location next to the Campus Park, which would minimize travel to campus.

The 2020 LRDP's Housing Zone includes areas within one mile of Doe Library or within one block of a transit line providing trips to Doe Library in under 20 minutes, except for sites with residential designations of under 40 units per acre in a municipal general plan. Because the City of Berkeley has designated the Project site for residential uses at a density of less than 40 units per acre, the Project site is outside of the 2020 LRDP's Housing Zone as currently defined. As a result, the Upper Hearst Development would not be in conformance with the 2020 LRDP's existing Location Guidelines. However, the residential building's site would meet the 2020 LRDP's location criterion of placing student housing within a one-mile radius of the center of campus, or within one block of a transit line providing trips to Doe Library in under 20 minutes. Therefore, the Project includes a minor land use amendment to the 2020 LRDP to allow an exception to the Location Guidelines to accommodate the Upper Hearst Development in its land use plan by adding the site to the Housing Zone. This amendment would make the development consistent with the 2020 LRDP's development assumptions.

The proposed academic and residential buildings would be within the overall development parameters of the 2020 LRDP. While the 2020 LRDP anticipated over 2.2 million net new gross square feet of development to the year 2020, UC Berkeley remains well below that envelope of development as of 2018, with 955,160 gross square feet constructed or under construction since implementation of the 2020 LRDP's building program. Therefore, the 37,000 square-foot academic building would not be beyond the overall growth anticipated in the 2020 LRDP. Similarly, UC Berkeley has substantial remaining capacity with almost 1,500 beds to add housing without exceeding the 2020 LRDP's anticipated increase of 2,600 student beds since 2004. With up to 225 new student beds, the new residential building would not exceed this development parameter.

The Upper Hearst Development also would be consistent with applicable 2020 LRDP Objectives, as discussed below, with the exception of objectives to preserve historic resources and the character of the City Environs.

> ***Objective:*** *Provide the space, technology and infrastructure we require to excel in education, research, and public service.*

The proposed buildings would expand the capacity of the Graduate School of Public Policy, accommodating growth in its graduate and Executive Education programs, and provide needed housing for faculty, visiting scholars, graduate students, and post-doctoral students.

> ***Objective:*** *Provide the housing, access, and services we require to support a vital intellectual community and promote full engagement in campus life.*
> ***Objective:*** *Build a campus that fosters intellectual synergy and collaboration endeavors both within and across disciplines.*

The proposed residential building would add housing units adjacent to the GSPP complex and the Campus Park, fostering collaboration among faculty, visiting scholars, and students, and engagement in academic pursuits.

> ***Objective:*** *Plan every new project as a model of resource conservation and environmental stewardship.*

The Upper Hearst Development would model resource conservation and environmental stewardship by incorporating measures to attain a minimum LEED Silver rating. These measures would improve energy efficiency, water conservation, and indoor air quality, among other environmental benefits.

> ***Objective:*** *Maintain and enhance the image and experience of the campus, and preserve our historic legacy of landscape and architecture.*
> ***Objective:*** *Plan every new project to respect and enhance the character, livability, and cultural vitality of our city environs.*

As discussed in Chapter 1, *Aesthetics*, the Upper Hearst Development would have an adverse effect on the image and architecture of the surrounding neighborhood because the new buildings would have an out-of-context mass/scale, architectural design, and palette of materials. In addition, they would not be consistent with UC Berkeley's Campus Design Standards related to height, setbacks, and perceived mass. As discussed in Chapter 5, *Cultural Resources*, the Upper Hearst Development would adversely affect the setting and integrity of three qualifying historical resources adjacent to the Project site (Cloyne Court, the Beta Theta Pi house, and the Phi Kappa Psi house), which are surviving examples of the First Bay Tradition of the Arts and Crafts movement. Therefore, it would be inconsistent with the objective to respect the character and cultural vitality of the City Environs.

The Project would be consistent with applicable 2020 LRDP policies, as discussed below, with the exception of a policy to protect recreational fields.

> ***Policy:*** *Design future projects to minimize energy and water consumption and wastewater production.*
> ***Policy:*** *Design new buildings to a standard equivalent to LEED 2.1 certification.*
> ***Policy:*** *Design new buildings to outperform the required provisions of Title 24 of the California Energy Code by at least 20 percent.*

As discussed in Section 3.5, *Project Description*, the GSPP buildings would achieve a minimum LEED Silver rating and would target a Gold rating. These LEED ratings would be consistent with the 2020 LRDP's goal of striving for LEED Silver or an equivalent standard in new developments, wherever program needs, site conditions, and budget parameters permit. To obtain a minimum LEED Silver rating, the Upper Hearst Development would reduce the amount of potable water used in outdoor landscaping by 50 to 100 percent from baseline building performance and the amount of indoor water use by 20 percent from baseline building performance. Water demand for landscaping would be minimized through the use of native, drought-tolerant plants. The use of low-flow plumbing fixtures would also reduce wastewater production. The Project also would employ energy efficiency strategies in all building disciplines in order to achieve the 20 percent energy use reduction. The buildings' energy use would be reduced by 5 percent compared to baseline building performance in accordance with ASHRAE Standard 90.1-2010. Therefore, the Upper Hearst Development would be potentially consistent with the above policies.

> ***Policy:*** *Accommodate new and growing academic programs primarily through more intensive use of University owned land on and adjacent to the Campus Park.*
> ***Policy:*** *Increase single graduate student bed spaces to equal 50% of entering graduate students by 2020.*
> ***Policy:*** *Locate all new University housing within a mile or within 20 minutes of campus by transit.*

The Project would add up to 150 apartment units for faculty, staff, and graduate students on a University-owned property in the Adjacent Blocks North subarea, adjacent to the Campus Park. This addition of housing would increase the number of graduate student bed spaces on campus. New housing units would be located adjacent to the proposed academic building and the existing GSPP buildings, facilitating student access to campus. Therefore, the Upper Hearst Development would be potentially consistent with the above policies related to housing growth.

> ***Policy:*** *Replace and consolidate existing University parking displaced by new projects.*

When the construction of new buildings results in the loss of parking spaces, the 2020 LRDP recommends replacing displaced spaces on-site or elsewhere, in order to maintain the supply of parking on campus. The 2020 LRDP states that the scope and budget for each such project should include replacement parking spaces. The proposed Project would involve demolition of the Ridge Lot and the Upper Hearst parking structure, resulting in an aggregate loss of approximately 207 parking spaces. Although the

Upper Hearst Development would not involve direct replacement of these parking spaces, it would contribute in-lieu fees toward improvements to parking and transportation capacity for the campus. Therefore, the Upper Hearst Development would be potentially consistent with this policy to maintain an appropriate supply of parking on campus.

Policy: *Preserve existing recreational fields and restore the fields lost since 1990.*

The Upper Hearst Development would involve demolition of the La Loma recreational field, a UC Berkeley Recreational Sports venue on the roof of the Upper Hearst parking structure. The loss of this field would contribute to a long-term decrease in UC Berkeley's outdoor recreational spaces. UC Berkeley does not have immediate plans to compensate for this loss by building replacement recreational facilities. Therefore, the Upper Hearst Development would be potentially inconsistent with this policy to preserve and restore recreational fields.

CITY OF BERKELEY GENERAL PLAN

Although the University of California is not subject to the City's land use regulations, as discussed above, Continuing Best Practice LU-2-c in the 2020 LRDP EIR requires the assessment of projects in the City Environs for potential land use impacts if the proposed land use is not permitted by the City's General Plan. The proposed academic and residential buildings would be located on a site which the City of Berkeley General Plan has designated for Medium Density Residential use (Berkeley 2009). This land use designation is characterized by a mix of single-family homes and small to medium sized multi-family structures (Berkeley 2001). Building intensities in the Medium Density Residential designation range from 20 to 40 dwelling units per net acre, and the population density generally ranges from 44 to 88 persons per acre. The Upper Hearst Development would introduce a residential building up to six stories tall, with up to 150 apartment units on the approximately one-acre Project site, resulting in a building intensity of approximately 150 units per acre on-site. This intensity of development would exceed the typical range of 20 to 40 units per acre in the Medium Density Residential area. The General Plan also describes the compatible zoning districts for this land use classification as Restricted Multi-family Residential (R-2A), which allows approximately 17 units per acre, and Multiple-family Residential (R-3), which allows approximately 26 units per acre. The proposed residential building would exceed the scale of development envisioned in the City's Medium Density Residential designation. However, the proposed residential use would be allowed under the City's land use designation. The proposed academic use, as a school facility, also would be permitted in the R-3 zone. Therefore, the proposed land uses on the Project site would be consistent with land uses permitted under the municipal general plan.

CITY OF BERKELEY ZONING ORDINANCE

Although the City of Berkeley does not have land use jurisdiction over the Upper Hearst Development, Continuing Best Practice LU-2-c in the 2020 LRDP EIR requires the assessment of projects in the City Environs for potential land use impacts if the proposed number of stories would exceed the maximum permitted by zoning, or if the setback distances would be less than permitted by zoning. As stated in the 2020 LRDP EIR, "significant incompatibilities" could occur if a project conflicted with uses allowed under the local general plan or in terms of physical characteristics, such as height, setbacks, style, and materials.

The Project site is located in the City's Multiple-family Residential zone within the Hillside Overlay Boundary (R-3H). Section 23D.36.070 of the Berkeley Municipal Code sets a maximum height of three stories for main buildings in the R-3 zone. The proposed residential building up to six stories in height and the proposed four-story academic building would both exceed this zoning standard for the number of stories.

Table 10 compares the minimum required and proposed setback distances for the new academic building in the City's R-3 zone. The minimum required setbacks in this zone apply to the first three stories of buildings.

Table 10:
Setback Distances for Academic Building

Story		**Setbacks**			
		Front	**Rear**	**Side**	**Building Separation**
1st	Proposed	8	10	10	10
	Minimum	*15*	*15*	*4*	*8*
2nd	Proposed	8	10	10	10
	Minimum	*15*	*15*	*4*	*12*
3rd	Proposed	8	10	10	10
	Minimum	*15*	*15*	*6*	*16*

Source: Berkeley Municipal Code, Section 23D.36.070D

As shown in Table 10, the proposed academic building would not meet the minimum R-3 zone standards for front, rear, and building separation setbacks. It is assumed that the residential building also would have zero setbacks from adjacent streets, which would not meet the R-3 zone's setback standards. Pursuant to Continuing Best Practice LU-2-c in the 2020 LRDP EIR, a project in the City Environs would be assumed to have the potential for a significant land use impact if it has a greater number of stories and/or lesser setback dimensions than permitted under City zoning. Because the proposed buildings would have a greater number of stories and lesser setback dimensions than could be permitted under City's R-3H zone, the physical characteristics of the Upper Hearst Development would be inconsistent with 2020 LRDP policy to minimize land use incompatibilities. Potential mitigation to minimize these land use incompatibilities would be infeasible because reducing the number of stories and increasing setbacks would impair attainment of Project objectives to meet housing demand. Therefore, the Upper Hearst Development would result in significant and unavoidable land use incompatibilities not foreseen in the 2020 LRDP EIR.

Based on the 2020 LRDP EIR's land use analysis, the 2020 LRDP would have a less than significant cumulative impact related to compatibility with land uses adjacent to new development (2020 LRDP EIR Vol 1, p. 4.8-20 to 4.8-21). In general, development under the 2020 LRDP would be compatible with adjacent general plan designations and thus with existing and future land uses. As discussed above, the proposed Upper Hearst Development would be inconsistent with 2020 LRDP policy to minimize incompatibilities with targeted densities in the City of Berkeley General Plan and with local zoning standards for height and setbacks. Nonetheless, this project-level land use incompatibility would not alter the 2020 LRDP EIR's finding that new development under the 2020 LRDP would generally be compatible with adjacent land uses. Therefore, the Project would not contribute to a significant cumulative impact related to land use.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
3. Conflict with any applicable habitat conservation plan or natural community conservation plan?		●

The Project site is not located within any area designated for an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved conservation plan.

SUMMARY OF LAND USE ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, incorporating existing best practices and 2020 LRDP EIR mitigation measures, would not result in new significant land use impacts (2020 LRDP EIR Vol 1, p. 4.8-15 to 4.8-21). The proposed Upper Hearst Development would be consistent with the 2020 LRDP's development assumptions with approval of a minor 2020 LRDP amendment to accommodate the proposed land uses on the Project site. However, the Upper Hearst Development would conflict with Continuing Best Practice LU-2-c as it relates to the City of Berkeley's local zoning because new buildings would be taller than allowed in the R-3 zone and their massing would encroach on required setbacks. Therefore, the Upper Hearst Development would result in significant and unavoidable land use impacts not foreseen in the 2020 LRDP EIR.

11. NOISE

SETTING

The noise setting of the campus is described in the 2020 LRDP EIR (Section 4.9). The following text summarizes context information for noise relevant to the Project. This is in part based on information contained with the 2020 LRDP EIR.

The noise environment on the UC Berkeley campus and the surrounding city environs results primarily from vehicular traffic on the street network. Intermittent noise from jet aircraft overflights contributes to the noise environment to a lesser extent. Noise levels in the Adjacent Blocks North subarea are highest along Hearst Avenue. Previous measurements in the Adjacent Blocks North subarea indicate average noise levels range from 49 dBA Leq at the top of the Greek Theatre in the evening to 67 dBA Leq at the intersection of Hearst Avenue and Scenic Avenue in the afternoon, including a measurement of 66 dBA Leq near the southeast corner of the Project site at La Loma Avenue and Hearst Avenue (2020 LRDP EIR Vol 1, Table 4.9-3, pages 4.9-10 and 4.9-11).

The Project site is surrounded by noise-sensitive receptors. Residential receptors border the site on the north by Ridge Road and older, modest-sized multi-family residential buildings across Ridge Road. Student housing is located to the east of the site across La Loma Avenue. Additional student housing is located to the west of the site near the GSPP buildings. Occupants of academic buildings near the Project site also may be sensitive to noise. Vehicular traffic is the major source of noise affecting the Project site and surrounding areas.

Existing ambient noise levels were measured in the vicinity of the Project site during a weekday PM peak hour on April 4, 2018, using an ANSI Type II integrating sound level meter. Short-term noise levels were measured near the site's east, west, and south boundaries to determine existing noise levels. As part of the Upper Hearst Environmental Noise Study prepared for the Upper Hearst Development by Charles M. Salter Associates, Inc. (Salter) in May 2018, two multi-day noise measurements were taken in the site vicinity between April 4th and 6th, 2018 (Appendix E). Tables 11 and 12 summarize the short-term and long-term measurement results, and Figure 26 shows the measurement locations.

Table 11:
Short-Term Noise Monitoring Results

Location	Sample Times	Distance to Primary Noise Source	Leq[15] (dBA)	Lmin (dBA)	Lmax (dBA)
Southwest border of Project site	4:12 – 4:27 p.m.	25 feet[1]	65.1	48.9	86.8
Western border of Project site near GSPP buildings	4:31 – 4:46 p.m.	100 feet[2]	64.2	50.9	87.7
Eastern side of Project site across La Loma Avenue near multi-family residences	4:48 – 5:03 p.m.	30 feet[3]	58.7	49.3	71.5

See Appendix E for noise measurement data.

[1] *Distance to centerline of Hearst Avenue*

[2] *Distance to centerline of Ridge Road*

[3] *Distance to centerline of La Loma Avenue*

Table 12:
Long Term Noise Monitoring Results

Location	Sample Dates	Distance to Primary Noise Source	Leq[h] (dBA)	Ldn (dBA)
Southwest border of Project site	April 4-6, 2018	25 feet[1]	72	70
Eastern border of Project site	April 4-6, 2018	30 feet[2]	67	66

See Appendix E for noise measurement data.

[1] *Distance to centerline of Hearst Avenue*

[2] *Distance to centerline of La Loma Avenue*

FIGURE 26 NOISE MEASUREMENT LOCATIONS

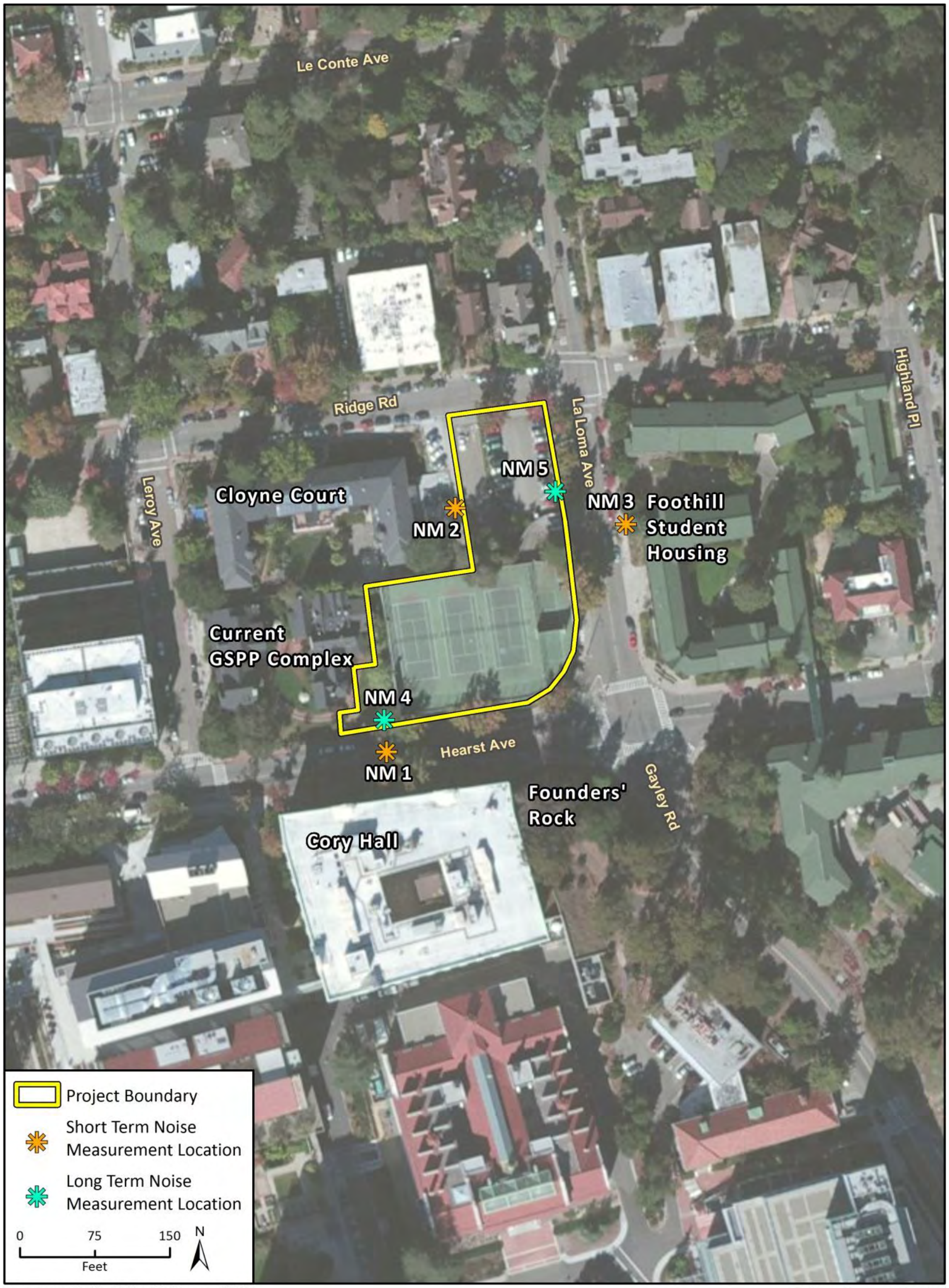

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Fig X Noise Measurement Locations

2020 LRDP & 2020 LRDP EIR

While the 2020 LRDP does not contain any policies that specifically address noise, several Objectives bear directly or indirectly on the noise environment, most importantly:

- **Maintain and enhance the image and experience of the campus, and preserve our historic legacy of landscape and architecture.**
- **Plan every new project to respect and enhance the character, livability, and cultural vitality of our city environs.**

Specific policies relevant to reducing noise impacts on and around the campus include: locating all new University housing within a mile or 20 minutes of campus by transit; reducing demand for parking through incentives for alternate travel modes; collaborating with cities and transit providers to improve service to campus; and minimizing private vehicle traffic in the Campus Park.

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of projects that implement the 2020 LRDP would be performed in conformance with the following applicable mitigation measures and continuing best practices in the 2020 LRDP EIR to reduce their effect on the noise environment:

2020 LRDP Continuing Best Practice NOI-2: Mechanical equipment selection and building design shielding would be used, as appropriate, so that noise levels from future building operations would not exceed the City of Berkeley Noise Ordinance limits for commercial areas or residential zones as measured on any commercial or residential property in the area surrounding a project proposed to implement the 2020 LRDP. Controls that would typically be incorporated to attain this outcome include selection of quiet equipment, sound attenuators on fans, sound attenuator packages for cooling towers and emergency generators, acoustical screen walls, and equipment enclosures.

2020 LRDP Mitigation Measure NOI-3: The University would comply with building standards that reduce noise impacts to residents of University housing to the full feasible extent; additionally, any housing built in areas where noise exposure levels exceed 60 Ldn would incorporate design features to minimize noise exposures to occupants.

2020 LRDP Continuing Best Practice NOI-4-a: The following measures would be included in all construction projects:

- Construction activities will be limited to a schedule that minimizes disruption to uses surrounding the project site as much as possible. Construction outside the Campus Park area will be scheduled within the allowable construction hours designated in the noise ordinance of the local jurisdiction to the full feasible extent, and exceptions will be avoided except where necessary.
- As feasible, construction equipment will be required to be muffled or controlled.
- The intensity of potential noise sources will be reduced where feasible by selection of quieter equipment (e.g. gas or electric equipment instead of diesel powered, low noise air compressors).
- Functions such as concrete mixing and equipment repair will be performed off-site whenever possible.

For projects requiring pile driving:

- With approval of the project structural engineer, pile holes will be pre-drilled to minimize the number of impacts necessary to seat the pile.

- Pile driving will be scheduled to have the least impact on nearby sensitive receptors.
- Pile drivers with the best available noise control technology will be used. For example, pile driving noise control may be achieved by shrouding the pile hammer point of impact, by placing resilient padding directly on top of the pile cap, and/or by reducing exhaust noise with a sound-absorbing muffler.
- Alternatives to impact hammers, such as oscillating or rotating pile installation systems, will be used where possible.

2020 LRDP Continuing Best Practice NOI-4-b: UC Berkeley would continue to precede all new construction projects with community outreach and notification, with the purpose of ensuring that the mutual needs of the particular construction project and of those impacted by construction noise are met, to the extent feasible.

2020 LRDP Mitigation Measure NOI-4: UC Berkeley will develop a comprehensive construction noise control specification to implement additional noise controls, such as noise attenuation barriers, siting of construction laydown and vehicle staging areas, and the measures outlined in Continuing Best Practice NOI-4-a as appropriate to specific projects. The specification will include such information as general provisions, definitions, submittal requirements, construction limitations, requirements for noise and vibration monitoring and control plans, noise control materials and methods. This documentation will be modified as appropriate for a particular construction project and included within the construction specification.

2020 LRDP Mitigation Measure NOI-5: The following measures will be implemented to mitigate construction vibration:

- UC Berkeley will conduct a pre-construction survey prior to the start of pile driving. The survey will address susceptibility ratings of structures, proximity of sensitive receivers and equipment/ operations, and surrounding soil conditions. This survey will document existing conditions as a baseline for determining changes subsequent to pile driving.
- UC Berkeley will establish a vibration checklist for determining whether or not vibration is an issue for a particular project.
- Prior to conducting vibration-causing construction, UC Berkeley will evaluate whether alternative methods are available, such as:
  - Using an alternative to impact pile driving such as vibratory pile drivers or oscillating or rotating pile installation methods.
  - Jetting or partial jetting of piles into place using a water injection at the tip of the pile.
- If vibration monitoring is deemed necessary, the number, type, and location of vibration sensors would be determined by UC Berkeley.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Noise, the potential environmental impacts resulting from the increase in campus headcount are influenced both by physical development on the UC Berkeley campus and City Environs (e.g., exposing people to excess noise levels and temporary increases in ambient noise levels from demolition and construction activities) and by campus population numbers (e.g., permanent increases in ambient noise levels from increased vehicle trips). As noted in Section 4, *Relationship to 2020 LRDP*, UC Berkeley has constructed approximately 43 percent of the 2.2 million net new gross square feet of development anticipated in the 2020 LRDP despite the increased campus headcount above 2020 LRDP projections. To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased campus headcount would not be additional to that planned for in the 2020 LRDP. New residents in UC Berkeley-provided housing would be exposed to ambient traffic noise. The 2020 LRDP EIR found that new residents may be exposed to noise levels exceeding applicable standards after mitigation, because of the academic importance of placing students in housing close to campus, resulting in a significant and unavoidable noise impact (2020 LRDP EIR Vol 1, p. 4.9-17). While additional residents may be exposed to excessive ambient noise, this impact would be within the scope of the 2020 LRDP EIR's analysis, and the increased headcount would not cause an impact more severe than the significant and unavoidable noise impact identified in that EIR for the 2020 LRDP program as a whole.

As discussed in Chapter 14, *Transportation and Traffic*, it is projected that the number of vehicle trips associated with the implementation of the 2020 LRDP, including those associated with the increased headcount, would remain lower than anticipated in the 2020 LRDP EIR for the year 2020. Therefore, increased headcount would not cause a permanent increase in traffic noise beyond that anticipated in the 2020 LRDP EIR, and this impact would be less than significant. The increase in UC Berkeley's existing and projected headcount would not require additional physical development beyond that planned for in the 2020 LRDP that could generate excessive noise levels or ground-borne vibration from construction activity. These noise impacts related to increased headcount would fall within the development parameters of the 2020 LRDP and would be less than significant.

NOISE

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Expose people to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies, without mitigation?	●	

The Upper Hearst Development would cause a significant noise impact if typical daily activities exceed the noise limits established in the Berkeley Noise Ordinance or cause a substantial increase in noise at sensitive receptors. The Berkeley Noise Ordinance establishes exterior noise limits, but in locations where the measured ambient noise level is greater than the limits established in the ordinance, the exterior noise limit is raised to the ambient noise level. The Project site is zoned R-3H, Multiple-family Residential, Hillside Overlay. Therefore, in accordance with Section 13.40.050 of the Berkeley Noise Ordinance allowable exterior noise levels on the Project site are 60 dBA Leq between 7:00 a.m. and 10:00 p.m. and 55 dBA Leq between 10:00 p.m. and 7:00 a.m. As shown in Table 11, the ambient noise level along Hearst Avenue in the vicinity of the Project site is approximately 65 dBA Leq. Because the measured ambient noise level of 65 dBA Leq exceeds the baseline allowable daytime exterior noise level, it becomes the daytime noise standard for purposes of this analysis.

On-Site Operational Noise

The primary noise sources associated with operation of the proposed buildings would include heating, ventilation, and air condition (HVAC) equipment at residential and academic buildings, and noise during events held in open space areas at the academic building. This noise could affect sensitive receptors including residential receptors to the north, and student housing to the east and west, and academic buildings to the west and south. As prescribed in the 2020 LRDP EIR, mechanical equipment selection and shielding would be utilized to ensure noise levels from building operations do not cause City of Berkeley Noise Ordinance limits to be violated at nearby sensitive receptors. Measures to be incorporated to achieve this requirement include selection of quiet equipment, sound attenuators on equipment, and architectural enclosure of roof top equipment (Best Practice NOI-2). Pursuant to the 2020 LRDP EIR, Continuing Best Practice NOI-2 would reduce on-site mechanical noise to a less than significant impact.

The rooftop terrace located on top of the academic building would include public space and interaction areas. Noise generated at the rooftop terrace would consist of conversations during occasional social events or informal social activities. Conversations typically generate noise ranging from approximately 55 dBA Leq at 3 feet when there are normal conversations among a few people to 63 dBA Leq at 3 feet when there are approximately 20 people talking simultaneously (Los Angeles 2014). Assuming that the rooftop terrace would be located as close as 25 feet from residences at Cloyne Court, conversations from the rooftop terrace could reach approximately 45 dBA Leq at adjacent residences. Noise from outdoor events therefore would not approach the applicable ambient noise standard of 65 dBA Leq and would be less than significant.

Interior Noise

Section 1207 of the 2016 California Building Code (Title 24) requires that the indoor noise level in residential units of multi-family dwellings be at or below 45 dBA Ldn due to exterior sources. Section 5.507.4 of the CALGreen Code states that in areas where the exterior noise environment exceeds 65 dB, non-residential buildings should be designed to provide an interior noise environment that does not exceed 50 dBA Leq. This analysis assumes that hours of operation for the academic building could extend from 7:00 a.m. to 10:00 p.m. The 2020 LRDP EIR found that new residences could be exposed to excessive noise levels, especially where occupants face noisy streets, resulting in a significant and unavoidable impact for the 2020 LRDP program (2020 LRDP EIR Vol 1, p. 4.19-7).

As shown in Tables 11 and 12, ambient noise levels in the Project site's vicinity range from 66 dBA to 70 dBA Ldn on a 24-hour basis and 67 dBA to 72 dBA Leq during peak traffic hours. Based on this measured data, the Salter Noise Study calculated the expected interior noise levels at the various facades of the proposed buildings and determined that interior noise levels would exceed standards without the inclusion of specific building materials in the Project design. To reduce interior noise at the academic building to an acceptable level of 50 dBA Leq, the Noise Study recommends installation of windows with Sound Transmission Class (STC) ratings of up to 36. For the residential building to meet the Title 24 standard of 45 dBA Ldn, the Noise Study also specifies minimum recommended STC ratings for windows and doors. Implementation of Mitigation Measure NOI-3 in the 2020 LRDP EIR would ensure compliance with building standards that reduce noise impacts to building occupants, which would involve the inclusion of Project-specific building features recommended by the Noise Study. Therefore, the impact from the exposure of new residents and building occupants to ambient noise would be less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Result in a substantial permanent increase in ambient noise levels in the project vicinity, without appropriate mitigation?		●

As discussed in Noise item 1, the Upper Hearst Development would add new sources of on-site operational noise including HVAC equipment and human conversations during social gatherings in outdoor areas. However, such noise would not exceed applicable standards in the City's Noise Ordinance. Therefore, on-site operational noise would not result in a substantial permanent increase in ambient noise levels in the vicinity of the Project site. As discussed in the 2020 LRDP EIR, a substantial permanent increase in noise would occur if traffic noise levels are projected to increase by greater than 3 dBA Ldn along roadway segments with adjoining noise sensitive land uses. The 2020 LRDP EIR estimated the increase in vehicular traffic noise by comparing traffic resulting from the implementation of the 2020 LRDP to existing traffic volumes along the roadway segments at the 74 intersections analyzed in the 2020 LRDP EIR. The predicted increase in vehicular traffic noise is 0 to 1 dB Ldn throughout the street network. As discussed in the Transportation analysis, the Upper Hearst Development would result in decreased peak-hour motor vehicle trips relative to existing conditions. Consistent with the 2020 LRDP EIR's analysis, the Upper Hearst Development would not result in a perceptible noise increase in nearby roadways. Therefore, the Upper Hearst Development would have a less than significant impact from permanent increases in ambient noise levels.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity, without appropriate mitigation?		●

The 2020 LRDP EIR found that noise resulting from demolition and construction activities would, in some instances, cause a substantial temporary or periodic increase in noise levels, in excess of local standards prescribed in Section 13.40.070 of the City of Berkeley Noise Ordinance at affected residential or commercial property lines (2020 LRDP EIR Vol 1, p. 4.9-17).

It is anticipated that construction of the Upper Hearst Development would take 23 months, beginning in September 2019 and concluding in July 2021. The delivery of construction equipment, removal of demolished materials, hauling of soil, and use of concrete trucks would be intermittent during the first six months of construction. Heavy truck activity for material deliveries would be ongoing for the remainder of construction.

Construction activities at the Project site would occur within 50 feet of adjacent noise-sensitive residences. As discussed in the 2020 LRDP EIR, construction activity could potentially generate noise levels above the allowable levels in the Berkeley Noise Ordinance if such activities occur within about 280 feet of a single-family residence or 160 feet of a multi-family residence. Therefore, noise levels could intermittently and periodically substantially exceed existing ambient noise levels at the receiving properties. Implementation of Continuing Best Practices NOI-4-a, NOI-4-b, and 2020 LRDP Mitigation Measure NOI-4 would control construction-related noise to the extent that is reasonable and feasible. The schedule for construction and demolition activities generating noise in the community would, to the extent possible, reflect the Berkeley Noise Ordinance provisions. Truck traffic would travel to and from the Project site using the City of Berkeley's designated truck routes, to the extent possible, and other major roadways (i.e., Hearst Avenue by the Project site). The siting of staging and laydown areas would consider minimizing noise as stipulated in Continuing Best Practice NOI-4-b. Even after implementation of these continuing best practices and mitigation measures, the noise impact from construction would be significant and unavoidable (2020 LRDP EIR Vol 1, p. 4.9-16 to 4.9-25). However, the Upper Hearst Development would not introduce any new potential impacts beyond those already assessed in the 2020 LRDP EIR.

Demolition and construction activity for cumulative projects, including the proposed Upper Hearst Development, would generate a temporary increase in ambient noise. However, construction noise is a localized issue, and other cumulative project sites are not located close enough to the Project site to result in substantially greater cumulative exposure to construction noise in any given location. As noted above, the Upper Hearst Development would not introduce a more adverse impact from construction noise than anticipated in the 2020 LRDP EIR, after implementation of continuing best practices and mitigation measures from the 2020 LRDP EIR. Increased headcount would not involve additional development beyond that planned for in the 2020 LRDP that could generate construction noise. Therefore, construction noise would not considerably contribute to a cumulative impact.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Expose people to or generate excessive ground-borne vibration or ground-borne noise levels, without mitigation?		●

Construction activities would expose nearby receptors and structures to ground-borne vibration. Construction activities can cause vibration that varies in intensity, depending on several factors. Of all construction activities, the use of pile driving equipment typically generates the highest ground-borne vibration level, followed by vibratory compaction equipment. The expected list of construction equipment for the Upper Hearst Development does not include pile drivers; however, other equipment such as bulldozers used in earth movement, vibratory rollers for paving, drill rigs for shoring work, and trucks loaded with construction materials could be used and may also generate strong vibration levels at adjacent land uses.

Adjacent land uses that are sensitive to vibration include residences at Cloyne Court, Foothill Student Housing, residences north of the Project site, and existing GSPP academic buildings. In addition, historic buildings adjacent to the site, such as the Beta Theta Pi house, could potentially be structurally vulnerable to strong vibration. The proximity of the Beta Theta Pi house to the proposed academic building (a minimum setback of 10 feet) would increase its exposure to vibration from construction activity on the Project site. Of the expected types of construction equipment, vibration rollers cause the highest estimated vibration level of 0.210 inches per second in peak particle velocity (PPV) at a reference distance of 25 feet from the source (FTA 2006). This vibration level would exceed the conservative vibration limit of 0.2 inches/sec PPV identified in the 2020 LRDP EIR for buildings that are found to be structurally sound yet where structural damage is a major concern.

Because vibration levels generated by construction activity could potentially cause structural damage, however unlikely, at adjacent historic buildings, implementation of Mitigation Measure NOI-5 in the 2020 LRDP EIR would be required. Although this measure was written to apply specifically to the use of pile drivers in construction, portions of the measure are also appropriate for the proposed Upper Hearst Development because of its use of vibration-generating equipment and its close proximity to historic structures. Applicable elements of Mitigation Measure NOI-5 would involve conducting a pre-construction survey to address the susceptibility ratings of structures and soil conditions; and monitoring vibration if necessary during construction. Consistent with the 2020 LRDP EIR's analysis, implementation of this measure would reduce the potential impact from vibration on structures to less than significant.

SUMMARY OF NOISE ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, even with incorporation of existing best practices and 2020 LRDP EIR mitigation measures, could result in significant noise impacts resulting from demolition and construction activities (2020 LRDP EIR Vol 1, p. 4.9-16 to 4.9-25). The Upper Hearst Development may incrementally contribute to significant environmental impacts previously identified in the 2020 LRDP EIR, but would not result in those impacts being more severe than as described in the 2020 LRDP EIR. The potential impact of vibration on nearby structures would be less than significant with implementation of applicable measures in Mitigation Measure NOI-5 from the 2020 LRDP EIR. Analysis of noise impacts associated with operation of the Upper Hearst Development indicates that these would not exceed the noise limits established in the Berkeley Noise Ordinance or cause a substantial increase in noise at sensitive receptors and therefore impacts would be less than significant. Interior noise levels in the proposed academic and residential buildings would be acceptable with implementation of Mitigation Measure NOI-3 from the 2020 LRDP EIR.

12. POPULATION AND HOUSING

SETTING

The population setting of the campus is described in the 2020 LRDP EIR (Section 4.10). The 2020 LRDP describes campus population growth in terms of campus headcount. Campus headcount is the number of individuals enrolled or employed at UC Berkeley, plus an estimate of average daily visitors and vendors. Students make up the largest percentage of the campus headcount, followed by nonacademic staff, academic staff, and faculty; the academic staff category includes postdoctoral fellows and visiting scholars. The staff figures are adjusted to exclude student workers to avoid double-counting.

The 2020 LRDP projected that campus headcount during the regular academic year would increase from 45,940 in the 2001-2002 school year to 51,260 by the year 2020, resulting in a net gain of 5,320 people. This net increase in headcount included 1,650 more regular-term students and 2,870 more employees. Under the 2020 LRDP, the regular term campus headcount is projected to increase by up to 12 percent by the year 2020 over what it was in 2001-2002, compared to a projected increase of 6 percent in the City of Berkeley population, and 20 percent in the regional population, during the period 2000-2020. The Project site includes a parking structure and a surface parking lot; no housing is currently present.

2020 LRDP & 2020 LRDP EIR

The 2020 LRDP would influence population and housing by guiding the location, scale, form and design of new University projects. The 2020 LRDP includes a number of policies and procedures for individual project review to support the Objectives of the 2020 LRDP. 2020 LRDP Objectives particularly relevant to population and housing include:

- **Provide the housing, access, and services we require to support a vital intellectual community and promote full engagement in campus life.**
- **Stabilize enrollment at a level commensurate with our academic standards and our land and capital resources.**
- **Plan every new project to respect and enhance the character, livability, and cultural vitality of our city environs.**

MITIGATION MEASURES & CONTINUING BEST PRACTICES

The 2020 LRDP EIR does not include mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP related to population.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Population and Housing, the potential environmental impacts resulting from the increase in campus headcount are influenced both by physical development and by campus population numbers, which are incorporated into the analysis below.

POPULATION AND HOUSING

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	●	

The proposed Upper Hearst Development would have residential and academic components. These components would add residents and employees to the Project site, incrementally contributing to the projected increase in campus headcount and resulting population growth through the 2022-2023 school year. An increased headcount on the UC Berkeley campus also contributes to population growth in the City of Berkeley and the greater Bay Area region. Therefore, this analysis of population impacts considers the combined effect of the proposed Upper Hearst Development and increased campus headcount on population growth. The 2020 LRDP EIR's analysis of population impacts is summarized first, and then the Project's effects on population growth are compared to that analysis.

The 2020 LRDP EIR analyzed the effect of increased campus headcount under the 2020 LRDP on population growth, from a baseline 2001-2002 school year to a time horizon of 2020. It was assumed that, in addition to a direct increase in the student and employee populations at UC Berkeley, new employees would induce household growth in the Bay Area. The 2020 LRDP EIR used an average regional household size of 2.7 people to estimate household growth associated with employees. Based on a projected increase of 2,870 employees, total employment-related population growth would therefore be 7,750 people (2.7 x 2,870 employees). Accounting for 1,650 new students and 7,750 new people related to employment, the 2020 LRDP EIR estimated that the 2020 LRDP would cause a net population increase of 9,400 by the year 2020. The 2020 LRDP EIR found that this growth would represent a less than 1 percent increment of a projected 1.4 million increase in the Bay Area's regional population from 2000 to 2020. It would also not result in an exceedance of the City of Berkeley General Plan EIR's projected population for the year 2020. Furthermore, additional student beds required to accommodate increased enrollment would not result in an exceedance of the City of Berkeley General Plan EIR's projected population for the year 2020. Finally, new housing would be located in areas most suitable for higher density (downtown and along major transit arterials). Therefore, the 2020 LRDP EIR found a less than significant impact related to population growth.

As shown by Table 4 in Section 4, *Relationship to 2020 LRDP*, it is projected that UC Berkeley's headcount would increase by 21.1 percent through the 2022-2023 school year beyond the 2020 LRDP EIR's projections for the year 2020. Student enrollment growth would drive this increase in headcount, while employment would slightly decrease compared with the 2020 LRDP EIR's projections. This change in the number of employees at UC Berkeley would in turn affect the population of employment-related households in the vicinity. Table 13 accounts for employment-related households in estimating the Project's effect on long-term population growth.

Table 13:
Comparison of Projected Population Growth under Increased Campus Headcount and 2020 LRDP

	Projected Population for Year 2020 in the 2020 LRDP	Estimated Population for 2022-2023 School Year	Net Change in Population	Percent Change
Student Enrollment[1]	*33,450*	*44,735*	*+11,285*	*+33.7%*
Employment-Related Population				
Employees	15,810	15,355	-	-
Employee households	26,877	26,104	-	-
Total[2]	*42,687*	*41,459*	*-1,228*	*-2.9%*
Other visitors & vendors	*2,000*	*2,000*	-	-
Overall total	***78,137***	***88,194***	***10,057***	***+12.9%***

[1] Regular-term enrollment

[2] The employee-related population was estimated based on an average household size of 2.7 per employee, as used in the 2020 LRDP EIR.

Source: UC Berkeley, August 2018

As shown in Table 13, it is estimated that the increased headcount relative to the 2020 LRDP EIR's projections would result in a net increase of 10,057 in population, based on greater student enrollment and fewer UC Berkeley employees and associated households. The increased student population over 2020 LRDP projections is a result of the increase in California's college-age population and the mandates of the Master Plan for Higher Education. It is assumed that most of the additional campus population would live in Berkeley or nearby parts of the Bay Area. The expected increase in population would represent approximately 0.7 percent of the projected 1.4 million increase in the Bay Area's population from 2000 to 2020, which would not substantially affect the regional population.

As of January 2018, the City of Berkeley has a population of 121,874 (California Department of Finance 2018), which includes students living in the city and on the UC Berkeley campus. The current citywide population already exceeds the City of Berkeley General Plan EIR's population forecast of 116,359 for the year 2020. The additional campus headcount would increase this existing exceedance of the General Plan EIR's population forecast. However, this analysis is conservative assumption because it assumes that all additional UC Berkeley students under the increased headcount would be new Berkeley residents. In reality, any students already residing in Berkeley would not increase the City's population. In addition, as discussed in Section 4, *Relationship to 2020 LRDP*, it is expected that UC Berkeley would accommodate the additional headcount without leading to physical development that exceeds the 2020 LRDP EIR's projected growth in student beds and building square footage. The 2020 LRDP anticipated the construction of 2,600 new student beds, perhaps entirely within the Housing Zone (2020 LRDP EIR Vol 1, p. 4.10-11). In implementing the 2020 LRDP, UC Berkeley has added 1,119 student beds through the end of 2018, leaving a balance of almost 1,500 student beds remaining under the 2020 LRDP's development parameter of 2,600 student beds. The addition of up to 225 beds on the Project site, some of which could serve graduate and post-doctoral students, would not result in more student beds than anticipated in the 2020 LRDP.

Additional student enrollment could indirectly result in an increase in student rentals of private off-campus housing in Berkeley's residential neighborhoods. This could lead to incrementally greater noise generated from existing sources such as human conversations on sidewalks and residential yards, especially during social gatherings. However, increased headcount would not introduce new sources of noise that may disturb residents, since neighborhoods near UC Berkeley already accommodate a high proportion of off-campus student rentals. Continued implementation of the Berkeley Noise Ordinance would also minimize exposure to high noise levels generated on properties in the city. Other indirect environmental effects of increased population are discussed in Chapter 13, *Public Services*, and Chapter 14, *Transportation and Traffic*, and would not result in additional significant environmental impacts beyond those anticipated in the 2020 LRDP EIR. Therefore, the Project, accounting for the updated campus headcount projections, would not result in significant indirect environmental impacts in off-campus neighborhoods.

Effects on the housing market are not in themselves environmental impacts, but the 2020 LRDP EIR analyzed this issue because it is a matter of public concern (2020 LRDP EIR Vol 1, p. 4.10-13 to 4.10-17). The 2020 LRDP EIR found that new UC Berkeley-provided housing would be more than adequate to accommodate growth in student enrollment, allowing students to vacate private housing units and make them available to other people. However, the projected increase of 11,285 students through the 2022-2023 school year beyond the 2020 LRDP EIR's projection for the year 2020 would place additional demand on the housing market. As noted above, the 2020 LRDP anticipates construction of 2,600 student beds. The additional student population would exceed anticipated growth in UC Berkeley-provided housing, placing greater demand on the private housing market. Nonetheless, it is expected that UC Berkeley would have 1,228 fewer employees than projected in the 2020 LRDP for the year 2020, which would reduce pressure exerted by employee households on the private housing market.

In summary, the proposed increase in campus headcount would generally be accommodated without significant adverse impacts. This is consistent with the 2020 LRDP EIR's finding that the effects of additional population under the 2020 LRDP program would in general be accommodated without significant adverse impacts (2020 LRDP EIR Vol 1, p. 4.10-10). Therefore, the Project would not result in a new significant population impact beyond that already anticipated. The impacts of increased campus headcount with respect to specific environmental topics, such as biological resources and hazardous materials, are analyzed separately under these topical discussions in Section 6, *Environmental Evaluation*, of the SEIR. In addition, the site-specific impacts of the Upper Hearst Development, including new significant impacts related to visual character and quality and to land use incompatibilities beyond those anticipated in the 2020 LRDP EIR, are discussed separately elsewhere in Section 6.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
2. Displace substantial numbers of existing housing or people, necessitating the construction of replacement housing elsewhere?		●

The Upper Hearst Development would not displace any housing and, therefore, would not necessitate the construction of housing elsewhere. This impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The 2020 LRDP EIR found that implementation of the 2020 LRDP would not displace substantial numbers of people or housing (2020 LRDP EIR Vol 1, p. 4.10-10). As discussed above, additional student enrollment through the 2022-2023 school year would exert greater demand on the private housing market. Greater housing demand would increase the incentive to construct additional private housing that caters to UC Berkeley students. If future projects are proposed that would require the displacement of substantial numbers of people or existing housing, necessitating the construction of replacement housing elsewhere, their effects would be evaluated as required by CEQA on a project-specific basis (2020 LRDP EIR Vol 1, p. 4.10-10). The potential displacement of existing tenants in Berkeley also could result in an incremental increase in the population of homeless people living in Berkeley, although the social impacts of displacement are beyond the scope of environmental review under CEQA. The proposed increase in the headcount also may necessitate the construction of new UC Berkeley-provided housing; however, such construction would not require substantial displacements because the 2020 LRDP's land use strategy prioritizes the siting of new housing on UC Berkeley's current property and, where necessary, acquiring other sites where the displacement of existing tenants can be minimized. This impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

SUMMARY OF POPULATION ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, incorporating existing best practices and 2020 LRDP EIR mitigation measures, would not result in new significant impacts related to population and housing (2020 LRDP EIR Vol 1, p. 4.10-10 to 4.10-19). The proposed Upper Hearst Development, along with the increased campus headcount baseline, would add to the population of Berkeley and the greater Bay Area region, beyond levels anticipated in the 2020 LRDP EIR. However, this population increase would not result in additional environmental impacts beyond those anticipated in the 2020 LRDP EIR related to noise, public services, and traffic. The Project, along with the increased headcount baseline, also would not result in significant impacts related to displacement of housing or people. Therefore, population and housing impacts would be within the scope of the 2020 LRDP EIR's analysis, which determined that impacts would be less than significant with implementation of continuing best practices.

13. PUBLIC SERVICES

SETTING

The public services setting of the campus is described in the 2020 LRDP EIR (Section 4.11). The following text summarizes and updates context information for public services relevant to the Project.

Police Protection

Police services in the Adjacent Blocks area are shared by the University of California Police Department (UCPD) and the City of Berkeley Police Department (BPD). The UCPD has a staff of 68 sworn police personnel, 83 full-time civilian personnel, and 45 student employees (UCPD 2018). The current ratio of officers per 1,000 campus population is 1.2 and the department's goal is 1.6 officers per 1,000 campus population (Miller 2018). The main UCPD office is located in Sproul Hall on the Campus Park. The UCPD has no plans for adding new facilities at this time. The BPD has a staff of 181 sworn officers, or roughly 1.49 authorized officers per 1,000 residents (Berkeley 2018). The BPD headquarters are located in the Public Safety Building on Martin Luther King Jr. Way at Center Street. UCPD and BPD partner to ensure appropriate service levels in areas proximate to the campus and coordinate at many levels. The patrol captains from each department confer several times per week about upcoming events, coverage and other relevant issues. UCPD completes a plan review of all proposed University buildings to maximize public safety features in and around proposed buildings. The plan check and design review process would continue to minimize police service impacts of development under the 2020 LRDP.

Fire Protection

The Berkeley Fire Department (BFD) provides fire protection and emergency medical services to the Adjacent Blocks area in the City of Berkeley. Primary response to the campus area from BFD comes from Station Number 2 at 2129 Berkeley Way. Stations 3 and 5 at 2710 Russell Street and 2680 Shattuck Avenue, respectively, offer supplemental support. The BFD provides 24-hour response for emergencies, including fire suppression, medical emergencies, hazardous materials events, and other life threatening situations. The BFD also supports these efforts with fire prevention, disaster preparedness, and public education programs, as well as training for all BFD staff.

UC Berkeley directly employs a campus fire marshal and deputy fire marshals who are responsible for fire prevention activities, including fire and life safety inspections of campus buildings for code compliance, fire and evacuation drills, and development of self-help educational materials for use by residence halls and campus departments (UC Berkeley Office of Environment, Health & Safety 2018).

The UC Berkeley Environment, Health & Safety Department, staffed by health and safety professionals and hazardous materials technicians, responds to hazardous materials incidents reported on campus. Response times vary depending on the nature of the incident and nature and time of the spill and can be up to one hour during off hours. In the infrequent cases when outside assistance is required, the ERT may request assistance from other nearby agencies, including the BFD and Alameda County Fire Department, or from emergency response contractors (UC Berkeley Office of Environment, Health & Safety 2017).

The Office of Emergency Management supports the Berkeley campus community by implementing programs in emergency planning, to build, sustain, and improve the capacity of UC Berkeley to mitigate against, prepare for, respond to, and recover from emergency disasters (UC Berkeley Office of Emergency Management 2018).

Schools

No public schools are located in the Adjacent Blocks area. This area is served by the Berkeley Unified School District (BUSD). The portion of the 2020 LRDP's Housing Zone located in Berkeley is served by the BUSD and the portion of the 2020 LRDP Housing Zone located in Oakland is served by the Oakland Unified School District (OUSD). The current enrollment and capacity of BUSD and OUSD schools are shown in Table 14.

Table 14:
Student Capacity and Enrollment Comparison

Area	Capacity[1]	Enrollment (2017-2018)[2]	Available Capacity
Berkeley Unified School District	11,904	10,340	1,564
Oakland Unified School District	53,474	50,231	3,240

[1] Source: 2020 LRDP EIR Tables 4.11-1A and 4.11-1B. Assumes no change in capacity since 2020 LRDP EIR.

[2] Source: https://dq.cde.ca.gov/dataquest/

Parks and Recreation

UC Berkeley manages over 28.7 acres of recreational space, which translates to 0.50 acres per 1,000 campus headcount population using the current headcount population of 57,637. Campus recreational facilities serve both UC Berkeley and the wider community. UC Berkeley recreational facilities in the Adjacent Blocks include the Maxwell Family field (Gayley Road at Centennial Drive) and the Memorial Stadium Fitness Center (Piedmont Avenue north of Bancroft Way) (UC Berkeley Rec Sports 2018). The area is also served by additional recreational facilities in the Campus Park, trails in the Hill Campus, and City of Berkeley, City of Oakland, and East Bay Regional Park District parks, trails and recreational facilities.

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the Project would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon public services. Where applicable, the Project would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practice PUB-1.1: UCPD would continue its partnership with the City of Berkeley police department to review service levels in the City Environs.

2020 LRDP Continuing Best Practice PUB-2.1-a: UC Berkeley would continue to comply with Title 19 of the California Code of Regulations, which mandates firebreaks of up to 100 feet around buildings or structures in, upon or adjoining any mountainous, forested, brush- or grass-covered lands.

2020 LRDP Continuing Best Practice PUB-2.1-b: UC Berkeley would continue on-going implementation of the Hill Area Fuel Management Program.

2020 LRDP Continuing Best Practice PUB-2.1-c: UC Berkeley would continue to plan and implement programs to reduce risk of wildland fires, including plan review and construction inspection programs that ensure that campus projects incorporate fire prevention measures.

2020 LRDP Continuing Best Practice PUB-2.3: UC Berkeley would continue its partnership with LBNL, ACFD, and the City of Berkeley to ensure adequate fire and emergency service levels to the campus and UC facilities. This partnership shall include consultation on the adequacy of emergency access routes to all new University buildings.

2020 LRDP Mitigation Measure PUB-2.4-a: In order to ensure adequate access for emergency vehicles when construction projects would result in temporary lane or roadway closures, campus project management staff would consult with the UCPD, campus EH&S, the BFD and ACFD to evaluate alternative travel routes and temporary lane or roadway closures prior to the start of construction activity. UC Berkeley will ensure the selected alternative travel routes are not impeded by UC Berkeley activities.

2020 LRDP Mitigation Measure PUB-2.4-b: To the extent feasible, the University would maintain at least one unobstructed lane in both directions on campus roadways at all times, including during construction. At any time only a single lane is available due to construction-related road closures, the University would provide a temporary traffic signal, signal carriers (i.e. flagpersons), or other appropriate traffic controls to allow travel in both directions. If construction activities require the complete closure of a roadway, UC Berkeley would provide signage indicating alternative routes. In the case of Centennial Drive, any complete road closure would be limited to brief interruptions of traffic required by construction operations.

2020 LRDP Continuing Best Practice PUB-2.4: To the extent feasible, for all projects in the City Environs, the University would include the undergrounding of surface utilities along project street frontages, in support of City of Berkeley General Plan Policy S-22.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Public Services, the potential environmental impacts resulting from the increase in campus headcount are accounted for in the analysis below.

PUBLIC SERVICES

POLICE PROTECTION

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Result in the need for new or physically altered police facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, service times, or other performance objectives for police protection?		●

Police protection services for the Berkeley campus and Adjacent Blocks area are provided by the UCPD and the BPD. The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP could increase the demand for police services, but are not anticipated to result in construction of new or altered facilities. The Upper Hearst Development would not increase demand for police protection beyond that anticipated in the 2020 LRDP EIR because, as discussed in Section 4, *Relationship to 2020 LRDP*, it would fall within the overall development parameters of the 2020 LRDP for student beds and building floor area. Therefore, the Project would not introduce any new potential impacts related to police facilities beyond those already assessed in the 2020 LRDP EIR.

To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased campus headcount would not be additional to that planned for in the 2020 LRDP. Accordingly, the increase in UC Berkeley's existing and projected headcount would not require additional physical development beyond that planned for in the 2020 LRDP that could increase the number of structures that require police service. However, it would increase the service population for police protection, as discussed below.

UCPD. As noted above, the UCPD's goal for service ratios is 1.6 officers per 1,000 campus population. Based on the projected campus headcount of 62,090 for the 2022-2023 school year, and assuming the current status of 68 sworn officers, the ratio would be 1.1 officers per 1,000 campus population. Although the department is not currently meeting its stated goal and would continue not to meet the goal, the UCPD is able to serve UC Berkeley's existing and projected headcount with its existing physical facilities. UCPD also has no plans for facility expansion. Therefore, no physical environmental impacts from the increase in the campus headcount would occur.

BPD. The City of Berkeley General Plan EIR found that demand for police services could increase as the result of higher density residential and commercial development, to be mitigated through an annual review of staff and resource needs. Since UCPD would be responsible for police services on campus and would continue to partner with the city in providing services with the increased campus population, no new BPD facilities are anticipated as a result of implementation of the 2020 LRDP. Police service impacts on the BPD would be further mitigated by Continuing Best Practice PUB-1.1. No additional impacts would occur beyond those analyzed in the 2020 LRDP EIR.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, may result in construction of new public service facilities, but these facilities are not anticipated to have significant cumulative environmental impacts (2020 LRDP EIR Vol 1, p. 4.11-32). The proposed Upper Hearst Development would not result in additional development than planned for in the 2020 LRDP and therefore would not contribute to the need for new police facilities to a greater extent than anticipated in the 2020 LRDP EIR. The Project would not considerably contribute to a significant cumulative impact related to police facilities.

FIRE AND EMERGENCY PROTECTION

Would the Project:

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
1. Result in the need for new or physically altered fire or emergency medical services facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, service times or other performance objectives for fire and emergency protection?		●

Fire and emergency medical services to the Project site are primarily provided by BFD. The proposed Project would change the use of the site to add housing and an academic facility to a parking facility, which could incrementally increase the demand for fire and emergency services to the site. However, the Upper Hearst Development would not increase overall campus demand for fire protection beyond that anticipated in the 2020 LRDP EIR. Further, the proposed buildings would be constructed to meet all applicable City Fire Code requirements for use of fire-resistant materials, sprinklers, and other fire prevention measures to reduce the need for fire and emergency response services. Therefore, the Upper Hearst Development would not result in the need for new or physically altered fire or emergency medical services facilities, and the impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The increase in UC Berkeley's existing and projected headcount would not require additional physical development beyond that planned for in the 2020 LRDP. Therefore, it would not increase the number of structures that require fire protection. However, it would increase the service population for fire protection. Measures prescribed in the 2020 LRDP EIR that would be applicable to fire services include continuing the campus partnership with LBNL, the Alameda County Fire Department station at LBNL, and the City of Berkeley to ensure adequate fire and emergency service levels (Continuing Best Practice PUB-2.3). With implementation of this continuing best practice, an increased headcount would not result in the need for new or physically altered fire or emergency medical services facilities, and the impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, may result in construction of new public service facilities, but these facilities are not anticipated to have significant cumulative environmental impacts (2020 LRDP EIR Vol 1, p. 4.11-32). The proposed Upper Hearst Development would not result in additional development than planned for in the 2020 LRDP and therefore would not contribute to the need for new fire protection facilities to a greater extent than anticipated in the 2020 LRDP EIR. The Project would not considerably contribute to a significant cumulative impact related to such facilities.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Expose people or structures to a significant risk of loss, injury or death involving wildland fires?		●

The Campus Park and its environs, including the Adjacent Blocks area, are presently urbanized and are not subject to a substantial risk of wildland fires. Therefore, the impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The increase in UC Berkeley's campus headcount would not require additional physical development beyond that planned for in the 2020 LRDP that could be subject to wildland fires. Under the 2020 LRDP, housing construction also would not be allowed in more fire-prone part of UC Berkeley, the Hill Campus. The 2020 LRDP EIR determined that continuation of the fire prevention activities under Continuing Best Practices PUB-2.1-a, 2.1-b, and 2.1-c would result in a less than significant impact with regard to wildland fires. With continued implementation of these continuing best practices, the impact related to increased headcount would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?		●

As required by the California Building Code, the proposed buildings would be designed to include adequate egress capacity and easily accessible evacuation areas. The buildings would not be sited in a location that would interfere with evacuation routes and would be required to comply with the campus Disaster Response Plan, which includes developing a Building Emergency Plan for each campus building. In addition, the Upper Hearst Development would not alter the alignment or capacity of any streets or access routes in the vicinity of the Project site or otherwise change existing circulation patterns in the area. Therefore, the impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The increase in UC Berkeley's existing and projected headcount would not involve physical changes to the environment that could interfere with emergency response. With continued implementation of control programs to avoid and reduce the potential for emergencies, the increase in the campus headcount would not result in an exceedance of emergency response capabilities. Therefore, the impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Result in inadequate emergency access?		●

The Upper Hearst Development would be constructed to meet the requirements of the California Building Code. Implementation of Continuing Best Practice PUB-2.3 would require consultation on the adequacy of emergency access routes to all new University buildings and would ensure adequate emergency access to the proposed buildings. The Project site also would be accessible directly from

Hearst Avenue via a standard driveway and street frontage. Therefore, the impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The increase in UC Berkeley's existing and projected headcount would not involve physical changes to the environment that could result in inadequate emergency access. As discussed in Chapter 14, *Transportation and Traffic*, it would also not increase the number of vehicle trips beyond the 2020 LRDP EIR's counts for the 2001-2002 school year. Therefore, the increase in the headcount would not result in additional traffic congestion that could impede the movement of emergency vehicles. The increase in headcount would be within the scope of the 2020 LRDP EIR's analysis and would have a less than significant impact.

SCHOOLS

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Result in the need for new or physically altered school facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, service times or other performance objectives for schools?		●

The 2020 LRDP EIR concluded any increased demand for schools associated with expanded enrollment and employment at UC Berkeley under the 2020 LRDP would not create a need for new or altered facilities (2020 LRDP EIR Vol 1, p. 4.11-20). Any incremental increase in demand for school facilities as a result of additional employment by the GSPP program would be consistent with this analysis. Therefore, the impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The 2020 LRDP EIR found that implementation of the 2020 LRDP could increase the demand for schools but was not anticipated to create a need for new or altered facilities. As shown in Table 13, the increase in UC Berkeley's existing and projected headcount would not require additional employment by UC Berkeley beyond that anticipated in the 2020 LRDP EIR. Therefore, it would not result in a greater number of families with school-age children and additional demand for school facilities. It is assumed that the vast majority of students do not have school age children. The impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The 2020 LRDP EIR found that implementation of the 2020 LRDP, in combination with other cumulative projects, may result in construction of new public service facilities, but these facilities are not anticipated to have significant cumulative environmental impacts (2020 LRDP EIR Vol 1, p. 4.11-32). Any incremental increase in demand for school facilities as a result of additional employment by the GSPP program would be within the scope of the 2020 LRDP EIR's analysis and would not substantially contribute to the need for new school facilities. The Project would not considerably contribute to a significant cumulative impact related to school facilities.

PARKS AND RECREATION

Would the Project:

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
1. Result in the need for new or physically altered parks and recreational facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, service times or other performance objectives?	●	

Demolition of the Upper Hearst parking structure would result in the loss of the La Loma athletic field on its rooftop. Currently, several tenants use this space on an infrequent basis under memoranda of understanding with UC Berkeley Recreational Sports including uses such as unmanned aerial vehicle development and rooftop gardening. After demolition of the field, UC Berkeley Recreational Sports would relocate existing recreational use to other campus facilities. Consistent with 2020 LRDP Mitigation Measure PUB-4.4, UC Berkeley has analyzed whether the loss of recreational use at La Loma field would result in increased use at other campus facilities to the extent it would result in the physical deterioration of those facilities. Because of the low level of existing recreational demand at La Loma field, UC Berkeley has determined that other facilities can accommodate this demand without causing overuse and physical deterioration of such facilities. New recreational space to compensate for the field's loss would not be needed.

The 2020 LRDP EIR concluded that any expanded demand for recreation under the 2020 LRDP would not increase the demand for recreation facilities to a point resulting in substantial physical deterioration of parks and recreation facilities, nor create the need for new or expanded facilities to maintain acceptable service ratios (2020 LRDP EIR Vol 1, p. 4.11-26). The addition of new residents on the Project site and expansion of GSPP's academic program would increase demand for recreational fields on campus. Because the supply of outdoor recreational space has decreased at UC Berkeley, greater demand would place further strain on remaining facilities to accommodate the projected campus headcount to 2022-23. However, it is assumed that continued implementation of the 2020 LRDP would involve the restoration of recreational fields that UC Berkeley has lost since 1990. With the construction of new fields, additional demand from an increased headcount would not cause substantial physical deterioration of park and recreational facilities. Therefore, the impact related to deterioration of park and recreational facilities would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The increase in the campus headcount would reduce the current service ratio of UC Berkeley facilities from 0.5 acres per 1,000 campus headcount cited above to 0.46 acres per 1,000, a decrease of approximately 8 percent. This incremental change in demand for recreational facilities would not result in the need for construction of additional facilities beyond those anticipated in the 2020 LRDP EIR. Furthermore, any new recreational facilities would be subject to Continuing Best Practice PUB-4.3 to incorporate all relevant 2020 LRDP mitigation measures and continuing best practices into their design and construction. Therefore, the impact related to construction of new park and recreational facilities would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The 2020 LRDP EIR anticipated that implementation of the 2020 LRDP, in combination with other cumulative projects, would not increase the use of recreation facilities to an extent that could result in their substantial physical deterioration (2020 LRDP EIR Vol. 1, p. 4.11-32). As discussed above, the Project would not result in increased use at recreational facilities to the extent it would result in the physical deterioration of those facilities, and the planned construction of new recreational facilities under the 2020 LRDP would accommodate greater demand. Therefore, the Project would not considerably contribute to a significant cumulative impact related to recreational facilities, consistent with the 2020 LRDP EIR's analysis.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	●	

See previous item.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
3. Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?		●

See item 1.

SUMMARY OF PUBLIC SERVICES ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, incorporating existing best practices and 2020 LRDP EIR mitigation measures, would not result in new significant impacts upon public services (2020 LRDP EIR Vol 1, p. 4.11-11 to 4.11-15; 4.11-10; 4.11-26 to 4.11-28; 4.11-32 to 4.11-33). The Project does not alter assumptions of the 2020 LRDP with regard to emergency access and emergency services demand, or schools. Despite the proposed demolition of a recreational field, the Project would not result in overuse or physical deterioration of other recreational facilities or in the need to construction new facilities.

The increase in UC Berkeley's existing and projected headcount would not increase demand for public services to the extent that construction of additional facilities beyond those anticipated in the 2020 LRDP EIR would be required. Therefore, increased headcount would be within the scope of the 2020 LRDP EIR's analysis and would not result in new significant impacts related to public services.

14. TRANSPORTATION AND TRAFFIC

SETTING

The transportation setting of the campus is described in the 2020 LRDP EIR (Section 4.12), including bicycle, pedestrian and transit modes as well as automobiles. The following text supplements the 2020 LRDP EIR information and updates context information relevant to the Project, accounting for the increase in UC Berkeley's existing and projected headcount. The section is based on the *Upper Hearst Development – Transportation Assessment* prepared by Fehr & Peers in September 2018, Appendix F to this SEIR, and the *UC Berkeley Long Range Development Plan Trip Generation Comparison* prepared by Fehr & Peers in September 2018, Appendix G to this SEIR.

Existing Intersection Operations

Fehr & Peers collected weekday AM and PM peak period (7:00 to 9:00 AM and 4:00 to 6:00 PM) traffic counts, including counts of heavy vehicles, pedestrians and bicycles, at the Gayley Road/La Loma Avenue/Hearst Avenue intersection in April 2018, while UC Berkeley was in normal session. Based on the observed volumes, intersection control, and roadway configurations collected through field observations, Fehr & Peers calculated the AM and PM peak hour intersection level of service (LOS)[5] at the Gayley intersection using the HCM 2010 methodology. This analysis uses the LOS metric for traffic conditions rather than vehicle miles traveled to enable a direct comparison with the 2020 LRDP EIR's analysis of traffic impacts. Table 15 summarizes the existing weekday AM and PM peak hour intersection LOS analysis results. As shown in the table, the intersection operates at LOS B during both AM and PM peak hours.

Table 15:
Existing Weekday Intersection LOS Summary

		AM Peak Hour		PM Peak Hour	
Intersection	**Control[1]**	**Delay (seconds)[2]**	**LOS**	**Delay (seconds)[2]**	**LOS**
Gayley Road/La Loma Avenue/ Hearst Avenue	Signalized	16	B	17	B

[1] Average intersection delay and LOS based on the 2010 HCM method, unless noted. Average delay is reported for signalized intersections.

[2] Estimated based on 2010 HCM delay thresholds

Source: Fehr & Peers 2018

Existing Pedestrian and Bicycle Circulation

Within the Project study area, all roadways provide sidewalks on at least one side of the street and all intersections have marked crosswalks. The Hearst Avenue/Le Roy Avenue and Hearst Avenue/La Loma Avenue intersections are signalized with high-visibility ladder crosswalks on all approaches. The La Loma Avenue/Ridge Road and Le Roy Avenue/Ridge Road intersections are all-way stop-controlled intersections with standard (transverse lines) crosswalks. Both directions of Hearst Avenue are a bicycle route where bicyclists share the travel lane with motor vehicles. There are no designated bicycle facilities on La Loma Avenue, Gayley Road, Ridge Road, and Le Roy Avenue. The City of Berkeley's 2017 Bicycle Master Plan proposes Class III Bicycle Routes along La Loma Avenue and Gayley Road within the Project vicinity. Class III bicycle routes are signed bicycle routes where cyclists share a travel lane with vehicles and may include shared street markings. Sidewalks are provided along all roadway frontages within the vicinity of the Project site.

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[5] The operations of roadway facilities are typically described with the term level of service (LOS), a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, which reflects free-flow conditions where there is very little interaction between vehicles, to LOS F, where the vehicle demand exceeds the capacity and high levels of vehicle delay result. LOS E represents at-capacity operations. When traffic volumes exceed the intersection capacity, stop-and-go conditions result and a vehicle may wait through multiple signal cycles before passing through the intersection; these operations are designated as LOS F.

Existing Transit and Shuttle Services

Transit service providers in the Project vicinity include AC Transit, which provides local and Transbay bus service; Bear Transit, which is UC Berkeley's shuttle system; and LBNL. The nearest bus stop to the Project site is on eastbound Hearst Avenue just east of Le Roy Avenue, which is shared with UC Berkeley Bear Transit. AC Transit Line 52 operates in a clockwise loop around Campus Park and provides connections to University Village in Albany, North Berkeley BART, and Downtown Berkeley. Line F operates in a clockwise loop around the Campus Park and provides connections to Downtown Berkeley, Ashby BART, Emeryville, and Downtown San Francisco. Table 16 summarizes the characteristics of the AC Transit Lines operating in the Project area. The Bear Transit Perimeter Line and the Night Safety Shuttle operate in a clockwise loop around Campus Park, and the Central Campus Line operates in a clockwise loop around the northern parts of the Campus Park and provides connections to Downtown Berkeley. Table 17 summarizes the characteristics of the UC Berkeley BEAR Transit lines in the Project area. The Blue and Orange Berkeley Lab routes providing connections to LBNL also run on Hearst Avenue next to the Project site.

Table 16:
AC Transit Service Characteristics

Line	Route	Nearest Stop	Weekday		Weekend	
			Hours	Headway[1]	Hours	Headway[1]
AC Transit Local Lines						
52	University Village to UC Campus	Eastbound Hearst Ave just east of Le Roy Ave	6:00 AM – 12:00 AM	15 (20)	8:00 AM-8:30 PM	20 (20)
AC Transit Transbay lines						
F	UC Campus to Transbay Terminal	Eastbound Hearst Ave just east of Le Roy Ave	5:00 AM – 1:30 AM	30 (30)	5:00 AM – 12:30 AM	30 (30)

[1] Headway is the frequency, or interval of time, between buses travelling in any given direction along a designated route: Peak Period Headway (Off-Peak Period Headway).

Source: Fehr & Peers 2018

Table 17:
Bear Transit Service Characteristics

Line	Route	Nearest Stop	Weekday		Weekend	
			Hours	Headway[1]	Hours	Headway[1]
Perimeter	Clockwise Loop around campus	Eastbound Hearst just east of Le Roy Avenue	7:00 AM – 7:30 PM	30 (30)	N/A	N/A
Central Campus	Downtown Berkeley to UC Campus	Eastbound Hearst just east of Le Roy Avenue	6:45 AM – 10:45 AM, 4:15 PM – 7:15 PM	20 (20)	N/A	N/A
Night Safety	UC Campus to BART, Clark Kerr Campus, and residences	Eastbound Hearst just east of Le Roy Avenue	7:30 PM – 3:00 AM	15-30	N/A	N/A

[1] Headway is the frequency, or interval of time, between buses travelling in any given direction along a designated route: Peak Period Headway (Off-Peak Period Headway).

Source: Fehr & Peers 2018

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the Project would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon transportation and traffic. Where applicable, the Project would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practice TRA-1-b: UC Berkeley will continue to do strategic bicycle access planning. Issues addressed include bicycle access, circulation and amenities with the goal of increasing bicycle commuting and safety. Planning considers issues such as bicycle access to the campus from adjacent streets and public transit; bicycle, vehicle, and pedestrian interaction; bicycle parking; bicycle safety; incentive programs; education and enforcement; campus bicycle routes; and amenities such as showers.

2020 LRDP Continuing Best Practice TRA-2: The following housing and transportation policies will be continued:

- Except for disabled students, students living in UC Berkeley housing would only be eligible for a daytime student fee lot permit or residence hall parking based upon demonstrated need, which could include medical, employment, academic or other criteria.
- An educational and informational program for students on commute alternatives would be expanded to include all new housing sites.

2020 LRDP Mitigation Measure TRA-2: The planned parking supply for University housing projects under the 2020 LRDP would comply with the relevant municipal zoning ordinance as of July 2003. Where the planned parking supply included in a University housing project would make it ineligible for approval under the subject ordinance, UC Berkeley would conduct further review of parking demand and supply in accordance with CEQA.

2020 LRDP Continuing Best Practice TRA-3-a: Early in construction period planning UC Berkeley shall meet with the contractor for each construction project to describe and establish best practices for reducing construction-period impacts on circulation and parking in the vicinity of the project site.

2020 LRDP Continuing Best Practice TRA-3-b: For each construction project, UC Berkeley will require the prime contractor to prepare a Construction Traffic Management Plan which will include the following elements:

- Proposed truck routes to be used, consistent with the City truck route map.
- Construction hours, including limits on the number of truck trips during the a.m. and p.m. peak traffic periods (7:00 – 9:00 a.m. and 4:00 – 6:00 p.m.), if conditions demonstrate the need.
- Proposed employee parking plan (number of spaces and planned locations).
- Proposed construction equipment and materials staging areas, demonstrating minimal conflicts with circulation patterns.
- Expected traffic detours needed, planned duration of each, and traffic control plans for each.

2020 LRDP Continuing Best Practice TRA-3-c: UC Berkeley will manage project schedules to minimize the overlap of excavation or other heavy truck activity periods that have the potential to combine impacts on traffic loads and street system capacity, to the extent feasible.

2020 LRDP Continuing Best Practice TRA-5: The University shall continue to work to coordinate local transit services as new academic buildings, parking facilities, and campus housing are completed, in order to accommodate changing demand locations or added demand.

2020 LRDP Continuing Best Practice PUB-2.3: UC Berkeley would continue its partnership with LBNL, ACFD, and the City of Berkeley to ensure adequate fire and emergency service levels to the campus and UC facilities. This partnership shall include consultation on the adequacy of emergency access routes to all new University buildings.

Upper Hearst Development Trip Generation

Trip generation refers to the process of estimating the amount of vehicular traffic a project would add to the surrounding roadway system. Vehicle trips were estimated for the peak one-hour period during the morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) commute periods when traffic volumes on the adjacent streets are highest. The trip generation for each component of the Upper Hearst Development is described below:

- **CAMPUS HOUSING.** The Institute of Transportation Engineers (ITE) Trip Generation Manual (10th Edition) was used to estimate the trips generated by the residential component of the project. The ITE trip generation rates are based on national data, collected in both suburban and urban locations, including dense urban locations with higher rates of non-automobile travel. Trips generated by the housing units were estimated using the ITE rates for off-campus student apartments adjacent to campus (ITE code 225), which estimates the number of trips generated based on the number of bedrooms. Although faculty may occupy more proposed housing units, the ITE rates for off-campus student apartments were used because they assume greater trip generation and provide for a more conservative traffic analysis. This analysis is also conservative in that the ITE data used to estimate trip generation is based on data collected at mostly urban sites that are more auto-dependent and provide more parking supply than the Project site’s setting. Estimated trip generation does not account for the constrained parking supply at or near the site. The housing component of the Project is estimated to generate about 27 AM and 56 PM peak hour vehicle trips. Considering that the Project may not provide dedicated parking for residents and that on-street parking is generally at or near-capacity, as discussed above, it is likely that the Project would generate fewer vehicle trips than estimated.
- **ACADEMIC BUILDING**. Vehicle trip generation for the academic building component of the Project was estimated based on the methodology developed for the 2020 LRDP EIR and updated based on the results of the 2016-2017 commute survey of various population groups. The academic building component of the Project is estimated to generate about eight AM and seven PM peak hour trips. This estimate is conservative in that it does not account for the constrained parking supply at or near the site, assumes that all those who wish to drive to the site would be able to drive and park in the site vicinity, and assumes that the new academic building would result in up to 30 net new graduate students and 30 net new faculty and staff.
- **PARKING STRUCTURE**. Fehr & Peers collected peak period vehicle counts at the four existing parking driveways on Tuesday, May 1, 2018. These counts were used to develop an average trip generation rate per parking space for the AM and PM peak hours. Based on these rates, the loss of approximately 207 existing marked and attendant parking spaces is estimated to reduce trip

generation from existing conditions by 50 AM and 68 PM peak hour trips. Daily trips for the parking structure were estimated based on the observed trip generation rate per parking space in the 2020 LRDP EIR of about 2.6 daily trips per space.

Table 18 presents the trip generation estimates for the Upper Hearst Development. It is estimated to increase daily trip generation by about 150 trips, and reduce peak hour trip generation by about 15 trips during the AM peak hour and five trips during the PM peak hour. The reason that daily trips increase while peak hour trips decrease is due to the difference in the trip generation rate per space during the peak and off-peak hours. The trip generation rate per space is lower in the off-peak hours because most parking structure users enter and exit during the peak hours. Thus, the removal of parking would result in a relatively smaller decrease in daily trips than the decrease during peak hours.

Table 18:
Upper Hearst Development Trip Generation Estimates

Land Use	Size[1]	Daily Trips	Weekday AM Peak Hour			Weekday PM Peak Hour		
			In	Out	Total	In	Out	Total
Campus Housing								
Campus Housing	225 Bedrooms	710	11	16	27	28	28	56
Academic Building								
Graduate Student[2]	30 Students	10	1	0	1	0	1	1
Faculty and Staff[3]	30 Persons	30	6	1	7	1	5	6
Subtotal		*40*	*7*	*1*	*8*	*1*	*6*	*7*
Parking Structure[4]								
Parking Structure	-207 Spaces	-600	-48	-2	-50	-15	-52	-68
Net New Trips		***150***	***-30***	***15***	***-15***	***14***	***-18***	***-5***

[1] ITE Trip Generation (10th Edition) land use category 225 (off-campus student apartment) adjacent to campus setting:
Daily Rate: 3.15 trips per bedroom
AM Peak Hour Rate: 0.12 trips per bedroom (41% in, 59% out)
PM Peak Hour Rate: 0.25 trips per bedroom (50% in, 50% out)
[2] Based on the UC Berkeley 2020 LRDP methodology and the travel modes from 2016-2017 survey data:
Daily Rate: 0.23 trips per student
AM Peak Hour Rate: 0.05 trips per student (91% in, 9% out)
PM Peak Hour Rate: 0.05 trips per student (12% in, 88% out)
[3] Based on the UC Berkeley 2020 LRDP methodology and the travel modes from 2016-2017 survey data:
Daily Rate: 0.85 trips per faculty/staff
AM Peak Hour Rate: 0.20 trips per faculty/staff (91% in, 9% out)
PM Peak Hour Rate: 0.19 trips per faculty/staff (12% in, 88% out)
[4] Based on peak period driveway counts at the existing Upper Hearst parking facilities:
Daily Rate: 2.6 trips per parking space
AM Peak Hour Rate: 0.24 trips per parking space (96% in, 4% out)
PM Peak Hour Rate: 0.33 trips per parking space (23% in, 77% out)
Source: Fehr & Peers 2018

Since it is estimated that the Upper Hearst Development would reduce automobile trip generation during the AM and PM peak hours, it would not substantially deteriorate intersection operations near the Project site during peak conditions. The increase in daily trips would not warrant an intersection analysis because the increase in vehicle trips would be added to the study intersection during off-peak hours, when overall intersection volumes are lower than during the peak hours. Additionally, the daily trips would be distributed across all off-peak hours, resulting in minimal additional trips per hour.

Campus Park Trip Generation

Using the most recent data available, Fehr & Peers estimated the current (2017-2018) automobile trip generation for people driving to and from the Campus Park, the 180-acre core area of campus, and estimated the automobile trip generation for the year 2022-2023 based on projected population increases. Table 19 summarizes the total trip generation for the 2001-2002 school year and 2020 as estimated by the 2020 LRDP EIR, and the actual 2017-2018 and estimated 2022-2023 trip generation based on more recent available data.

Table 19:
Campus Park Trip Generation Estimates

Scenario	Daily Trips	Weekday AM Peak Hour			Weekday PM Peak Hour		
		In	Out	Total	In	Out	Total
2001-2002 (Based on 2001 Data)	20,550	4,309	430	4,739	565	4,033	4,598
Estimated 2020 LRDP	24,040	5,228	522	5,750	679	4,849	5,528
Actual 2017-2018	19,140	4,014	400	4,415	526	3,757	4,283
Estimated 2022-2023	20,420	4,238	427	4,710	562	4,008	4,570
2020 LRDP EIR (2001-2002 to 2020)[1]	3,490	918	92	1,010	114	816	930
Actual (2001-2002 to 2017-2018)[2]	-1,410	-295	-29	-324	-39	-276	-315
Estimated (2001-2002 to 2022-2023)[3]	-130	-26	-3	-29	-3	-25	-28

1. E = B – A
2. F = C - A
3. G = D – A
Source: Fehr & Peers 2018

Based on Fehr & Peers' analysis, both the current and projected 2022-2023 trip generation would be less than trip generation for the 2001-2002 school year and the estimated year 2020 as presented in the 2020 LRDP EIR. Additional details and assumptions are presented in Appendix G.

The estimated decrease in trip generation is also consistent with observed traffic volumes. The 2020 LRDP EIR evaluated the impacts of the 2020 LRDP at 75 intersections by collecting AM and PM peak period counts in 2002 and forecasting traffic volumes for year 2020 conditions with the completion of the 2020 LRDP. Fehr & Peers compared the traffic volumes and level of service (LOS) at 32 representative intersections where recent traffic data (2015-2018) is available, such as intersections on Hearst Avenue, University Avenue, Oxford Street/Fulton Street, and Shattuck Avenue. The total intersection volumes in 2015-2018 are on average about 11 percent lower during the AM peak hour and 16 percent lower during the PM peak hour than in 2002. Intersection delay in terms of LOS has improved at some studied intersections. Similarly, the total intersection volumes in 2015-2018 at the 32 intersections are on average about 34 percent lower during both peak hours than the year 2020 forecasts, as estimated in the 2020 LRDP EIR. The year 2020 intersection volume forecasts estimated in the 2020 LRDP EIR account for the completion of the 2020 LRDP and other likely developments in the City of Berkeley and beyond.

Similarly, BART ridership has also increased during the same period. Weekday exits at the Downtown Berkeley BART Station increased from about 10,800 in 2001 to 13,250 in 2017.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Transportation and Traffic, the potential environmental impacts resulting from the increase in campus headcount are accounted for in the analysis below.

TRANSPORTATION AND TRAFFIC

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	●	

The 2020 LRDP EIR determined that implementation of the 2020 LRDP would increase vehicle trips and traffic congestion at signalized intersections, leading to a significant and unavoidable impact on traffic flow because no mitigation measures would be feasible (2020 LRDP EIR Vol 1, p. 4.12-53). However, the trip generation analysis provided above estimates that the Upper Hearst Development would reduce existing AM peak-hour traffic by 15 vehicle trips and PM peak-hour traffic by five vehicle trips. Therefore, it would not considerably contribute to the 2020 LRDP program's significant and unavoidable impact on traffic flow. The Upper Hearst Development would have a less than significant impact on the performance of the circulation system.

As discussed above, the projected 2022-2023 trip generation for the Campus Park would be less than that of the 2001-2002 school year and less than the year 2020 projection as presented in the 2020 LRDP EIR. Therefore, the increase in UC Berkeley's existing and projected headcount would not increase the severity of the 2020 LRDP program's significant and unavoidable impact on traffic flow, and would not contribute to the 2020 LRDP's significant and unavoidable cumulative impacts on the traffic network.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?		●

The 2020 LRDP EIR found the 2020 LRDP program as a whole, if fully implemented, would cause seven Alameda County CMP and MTS designated roadways to exceed the level of service established by the Congestion Management Agency, as a result of increased parking supply and related vehicle trips. No mitigation measures are feasible, and the impact was determined to be significant and unavoidable (2020 LRDP EIR Vol 1, p. 4.12-54). The Upper Hearst Development would incrementally increase existing daily vehicle trips while decreasing AM and PM peak-hour trips. The incremental increase in vehicles spread throughout the day would not introduce any new potential impacts not already assessed in the 2020 LRDP EIR. This impact would be within the scope of the 2020 LRDP EIR's analysis and would not be greater than identified for the 2020 LRDP EIR as a whole.

As discussed above, overall Campus Park projected 2022-2023 vehicle trip generation would be less than during the 2001-2002 school year and less than the year 2020 projection, as presented in the 2020 LRDP EIR. Therefore, the increase in UC Berkeley's existing and projected headcount would not result in an overall increase in traffic congestion. This impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficien
3. Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?		●

The Upper Hearst Development would have no effect on air traffic patterns and would not be located in an area subject to substantial safety risks from aircraft overflights.

The increase in UC Berkeley's existing and projected headcount would not require additional physical development beyond that planned for in the 2020 LRDP that could be subject to safety risks from aircraft. No impact would occur.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
4. Substantially increase hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)? Create unsafe conditions for pedestrians or bicyclists?	●	

The Upper Hearst Development would involve reconfiguring access to the rebuilt parking structure on the Project site. Whereas the existing parking structure has three driveways, from Hearst and La Loma avenues and Ridge Road, the new parking structure would have a single driveway from Hearst Avenue. Based on preliminary site plans for the parking structure, the new Hearst Avenue driveway may not provide adequate sight distance between vehicles exiting the driveway and pedestrians on the adjacent sidewalk (Appendix F). Adequate sight distance is defined as a clear line-of-sight between a motorist 10 feet back from the sidewalk and a pedestrian 10 feet away on each side of the driveway. The potential lack of adequate sight distance would introduce a traffic hazard due to a design feature. Implementation of Mitigation Measure T-1 would be required to ensure adequate sight distance.

MM-T-1 The driveway to the rebuilt Upper Hearst parking structure on Hearst Avenue shall be designed to provide adequate sight distance between vehicles existing the parking garage and pedestrians on the adjacent crosswalk. Adequate sight distance is defined as a clear line-of-sight between a motorist 10 feet back from the sidewalk and a pedestrian 10 feet away on each side of the driveway. If the driveway cannot be sited to provide adequate sight distance, UC Berkeley shall install mirrors on both sides of the driveway to aid drivers' and pedestrians' visibility. In addition, UC Berkeley shall install flashing lights to alert pedestrians when a vehicle is exiting the driveway.

With implementation of Mitigation Measure T-1, adequate sight distance would be provided at the driveway to the Upper Hearst parking structure. The Upper Hearst Development would not involve other significant changes in the road or path system, nor would it introduce any new types of vehicles that could create new design hazards. Therefore, the Upper Hearst Development's impact related to design hazards would be within the scope of the 2020 LRDP EIR's analysis and less than significant. The increase in UC Berkeley's existing and projected headcount would not require additional physical changes beyond those anticipated in the 2020 LRDP in the road or path system or introduce new roadway hazards. This impact would be less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
5. Result in inadequate emergency access?		●

See Public Services item 4, under the Fire and Emergency Protection topic.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
6. Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?		●

The 2020 LRDP describes alternative transportation modes and includes policies to promote and expand their use. The Upper Hearst Development would not involve physical changes to bicycle, pedestrian, or transit facilities in public rights-of-way and would not increase traffic such that the performance of such facilities would be affected. Furthermore, an estimated 52 bicycle parking spaces would be provided in the new or renovated Upper Hearst parking structure. The number of new bike parking spaces would meet or exceed the number calculated by determining 10 percent of the average peak building use, as described in the Campus Bicycle Plan. Therefore, the Upper Hearst Development would be within the scope of the 2020 LRDP EIR's analysis and would have a less than significant impact.

Physical changes beyond those anticipated in the 2020 LRDP that would affect transit, bicycle, or pedestrian facilities. Although transit demand would increase, new transit facilities would not be needed, and the increased use of transit would be consistent with planning objectives for reduced greenhouse gas emissions. Therefore, the headcount increase would not generate demand for transit or bike/pedestrian facilities such that the performance or safety of such facilities would be affected or such that new facilities would be needed. This impact would be less than significant.

SUMMARY OF TRANSPORTATION AND TRAFFIC ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, incorporating existing best practices and 2020 LRDP EIR mitigation measures, would as a whole result in significant impacts upon traffic and transportation, specifically upon two intersections in West Berkeley, primarily due to proposed increases in campus parking supply (2020 LRDP EIR Vol 1, p. 4.12-48 to 4.12-54).

As discussed in the analysis above, current (and projected through 2022-2023) trip generation associated with UC Berkeley is less than projected in the 2020 LRDP EIR for the year 2020, and the Project would not result in new significant impacts related to traffic. No additional mitigation measures have been identified that would further lessen the previously identified impact.

15. TRIBAL CULTURAL RESOURCES

SETTING

Public Resources Code Section 21074 (a)(1)(A) and (B) defines tribal cultural resources as "sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe" and meets either of the following criteria:

1. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or
2. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying these criteria, the lead agency shall consider the significance of the resource to a California Native American tribe.

The 2020 LRDP EIR did not address the issue of "tribal cultural resources" because its publication in 2004 preceded the passage of California Assembly Bill 52 of 2014 (AB 52), which expanded CEQA by defining this issue area as a new resource category. AB 52 establishes that "a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment" (Public Resources Code Section 21084.2). It further states that the lead agency shall establish measures to avoid impacts that would alter the significant characteristics of a tribal cultural resource, when feasible (PRC Section 21084.3).

AB 52 also establishes a formal consultation process for California tribes regarding tribal cultural resources. The consultation process must be completed before a CEQA document can be certified. Under AB 52, lead agencies are required to "begin consultation with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project." Native American tribes to be included in the process are those that have requested notice of projects proposed within the jurisdiction of the lead agency.

UC Berkeley prepared and mailed formal notification letters for the proposed Project to tribes that previously requested to be notified by UC Berkeley of future CEQA projects in accordance with the provisions of AB 52 on July 5, 2018. As of October 2018, no responses have been received and no tribal cultural resources have been identified on-site.

<u>APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE</u>

For Tribal Cultural Resources, the potential environmental impacts resulting from the increase in campus headcount are limited to physical development on the UC Berkeley campus and City Environs. As discussed in Chapter 5, *Cultural Resources*, the increase in UC Berkeley's existing and projected headcount would not require additional physical development beyond that planned for in the 2020 LRDP that could disturb or destroy tribal cultural resources. No impact related to increased campus headcount would occur.

TRIBAL CULTURAL RESOURCES

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Cause a substantial adverse change in the significance of a tribal cultural resource, defined in a Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is: **a. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k)?, or** **b. A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 2024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency shall consider the significant of the resource to a California Native American tribe?**	●	

As discussed above, no tribes contacted as part of the AB 52 consultation process for the Upper Hearst Development have identified the potential for tribal cultural resources to occur on the Project site. Moreover, as discussed in Chapter 5, *Cultural Resources*, based on the prior disturbance of the site, no cultural resources or human remains are expected to be present on the site. In the event that resources are discovered during construction, implementation of continuing best practices and mitigation measures in the 2020 LRDP EIR, including Continuing Best Practice CL-4-a and Mitigation Measure CUL-4b, would ensure a less than significant impact to tribal cultural resources.

16. UTILITIES AND SERVICE SYSTEMS

SETTING

The utilities and service systems of the campus are described in the 2020 LRDP EIR (Section 4.13). The following text summarizes context information for utilities and service systems relevant to the Project.

Water. Water supply and distribution to much of Alameda and Contra Costa Counties is provided by the East Bay Municipal Utilities District. EBMUD conducted a water supply assessment of the 2020 LRDP in January 2004. EBMUD indicated that, based on extensive forecasting in its water supply management program as well as recent land use-based demand forecasting, the projected water demand of 277 million gallons per day (mgd) in its entire service area can be reduced to 229 mgd with successful water recycling and conservation programs in place. The 2020 LRDP would not change the EBMUD 2020 LRDP demand projection (EBMUD 2004). In fact, overall water demand by UC Berkeley has decreased approximately 21 percent from 2004 to 2016 (Stoll 2018), despite new campus development during implementation of the

2020 LRDP and an increase in campus headcount above that anticipated in the 2020 LRDP. UC Berkeley's average water consumption was 1.9 mgd in 2017 (Wang 2018). The Project site would be served from EBMUD's Santa Barbara Regulated Pressure Zone (Maggiore 2018).

Wastewater. EBMUD provides wastewater collection for the entire 2020 LRDP area located in Alameda County and provides wastewater treatment for all of the 2020 LRDP area. Sanitary sewage flows toward the San Francisco Bay through a network of pipes and mains that connect into the EBMUD regional interceptor line, which conveys the sewage south to the EBMUD Special District No. 1 (SD-1) Wastewater Treatment Plant, which then discharges the treated effluent into the Bay from a submerged outfall pipe under the Bay Bridge (2020 LRDP EIR Vol 1, p. 4.13-7).

Wastewater discharge is regulated under the NPDES permit program for direct discharges into receiving waters and by the National Pretreatment Program for indirect discharges to a sewage treatment plant (40 CFR, Chap.1, Subchapter N). Wastewater from the Project site would be treated by EBMUD which has an NPDES Direct Discharge permit to discharge treated wastewater into the San Francisco Bay. Under this permit, EBMUD imposes effluent guidelines and discharge limitations pursuant to the National Pretreatment Program on the campus via the local EBMUD ordinance and by the EBMUD discharge permit issued to the campus (UC Berkeley 2004).

UC Berkeley owns and maintains its own sanitary sewer infrastructure serving the Campus Park. UC Berkeley facilities adjacent to the Campus Park either feed into the University-owned system or connect directly to the City of Berkeley's system (2020 LRDP EIR Vol 1, p. 4.13-8). In this instance, the Project site would connect directly to the city's system via 6-inch lateral connections to sewer lines beneath La Loma Avenue and Hearst Avenue.

Stormwater. The City of Berkeley is responsible for stormwater conveyance within the Adjacent Blocks area of the 2020 LRDP. Currently, stormwater from the Adjacent Blocks flows to Strawberry Creek. The Adjacent Blocks West drains through culverts into lower Strawberry Creek in locations west of the Campus Park. In this portion of the watershed, all overland flow is collected by curb-and-gutter systems and delivered through side inlets to the storm drainage culverts beneath local streets.

A capital improvement program managed by the City of Berkeley maps the entire storm drain system, and schedules needed improvements, such as pipe replacements and enlargements. Ongoing maintenance programs include catch basin cleaning, street/sidewalk sweeping, site inspection, testing and monitoring, runoff control from new development, and public information and participation such as catch basin stenciling. Maintenance and improvements of the system are paid for by the General Fund and through hook-up fees paid by new development.

Solid Waste. During implementation of the 2020 LRDP, the amount of solid waste generated by UC Berkeley and sent to landfills for disposal has substantially decreased. In 2004 UC Berkeley generated 6,049 tons of solid waste (Stoll 2018). In 2016, however, the campus generated 4,062 tons of solid waste, representing a nearly 33 percent decrease from the 2004 total.

Steam. UC Berkeley owns and operates a steam heating distribution system for all buildings and facilities at UC Berkeley. Steam is generated from a cogeneration plant, fueled by natural gas, located behind the Evans Memorial Stadium. Steam is distributed from the central heating plant via a piping system to individual buildings. The cogeneration plant is owned and maintained privately. Peak demand for steam is currently 249,000 pounds per hour and the plant's capacity is 353,000 pounds per hour; in 2002, UC Berkeley used 749 million pounds of steam (2020 LRDP EIR Vol 1, p. 4.13-16). Whenever UC Berkeley develops a preliminary project design for a new development, the Physical Plant/Campus Services Engineering and Utilities Department reviews the project to determine whether existing capacity of the steam system at the point of connection is adequate. If the capacity of the steam system is determined inadequate, UC Berkeley upgrades the system to provide adequate service to the project site before or as part of the project. In the event there is not enough capacity in the steam system, the campus would use natural gas or electricity for building heating and cooling.

On April 22, 2011, UC Berkeley published Addendum #8 to the UC Berkeley 2020 LRDP EIR, for the proposed design and construction of Electrical Switching Station #6. The project was approved on May 17, 2011. The addendum also analyzes a proposed brief amendment to the UC Berkeley 2020 LRDP, Campus Space and Infrastructure chapter, to reflect the need for improvements to the distribution system as may be required to accommodate 2020 LRDP development. CEQA findings in connection with the Addendum are available on the web at http://regents.universityofcalifornia.edu/regmeet/may11/gb2attach5.pdf and incorporated herein by reference.

MITIGATION MEASURES & CONTINUING BEST PRACTICES

Design and construction of the Upper Hearst Development would be performed in conformance with the 2020 LRDP. The 2020 LRDP EIR includes mitigation measures and continuing best practices developed to reduce the effect of the implementation of the 2020 LRDP upon utilities and service systems. Where applicable, the Upper Hearst Development would incorporate the following mitigation measures and/or continuing best practices:

2020 LRDP Continuing Best Practice USS-1.1: For campus development that increases water demand, UC Berkeley would continue to evaluate the size of existing distribution lines as well as pressure of the specific feed affected by development on a project-by-project basis, and necessary improvements would be incorporated into the scope of work for each project to maintain current service and performance levels. The design of the water distribution system, including fire flow, for new buildings would be coordinated among UC Berkeley staff, EBMUD, and the Berkeley Fire Department.

2020 LRDP Continuing Best Practice USS-2.1-a: UC Berkeley will promote and expand the central energy management system (EMS), to tie building water meters into the system for flow monitoring.

2020 LRDP Continuing Best Practice USS-2.1-b: UC Berkeley will analyze water and sewer systems on a project-by-project basis to determine specific capacity considerations in the planning of any project proposed 2020 under the LRDP.

2020 LRDP Continuing Best Practice USS-2.1-c: UC Berkeley will continue and expand programs retrofitting plumbing in high-occupancy buildings and seek funding for these programs from EBMUD or other outside agencies as appropriate.

2020 LRDP Continuing Best Practice USS-2.1-d: UC Berkeley will continue to incorporate specific water conservation measures into project design to reduce water consumption and wastewater generation. This could include the use of special air-flow aerators, water-saving shower heads, flush cycle reducers, low-volume toilets, weather based or evapotranspiration irrigation controllers, drip irrigation systems, the use of drought resistant plantings in landscaped areas, and collaboration with EBMUD to explore suitable uses of recycled water.

2020 LRDP Continuing Best Practice USS-3.1: UC Berkeley shall continue to manage runoff into storm drain systems such that the aggregate effect of projects implementing the 2020 LRDP is no net increase in runoff over existing conditions.

2020 LRDP Continuing Best Practice USS-3.2: In addition to Best Practice USS-3.1, projects proposed with potential to alter drainage patterns in the Hill Campus would be accompanied by a hydrologic modification analysis, and would incorporate a plan to prevent increases of flow from the project site, preventing downstream flooding and substantial siltation and erosion.

2020 LRDP Continuing Best Practice USS-5.1: UC Berkeley would continue to implement a solid waste reduction and recycling program designed to reduce the total quantity of campus solid waste that is disposed of in landfills during implementation of the 2020 LRDP.

2020 LRDP Continuing Best Practice USS-5.2: In accordance with the Regents-adopted green building policy and the policies of the 2020 LRDP, the University would develop a method to quantify solid waste diversion. Contractors working for the University would be required under their contracts to report their solid waste diversion according to the University’s waste management reporting requirements.

2020 LRDP Mitigation Measure USS-5.2: Contractors on future UC Berkeley projects implemented under the 2020 LRDP will be required to recycle or salvage at least 50% of construction, demolition, or land clearing waste. Calculations may be done by weight or volume but must be consistent throughout.

APPROACH TO CAMPUS HEADCOUNT BASELINE UPDATE

For Utilities and Service Systems, the potential environmental impacts resulting from the increase in campus headcount are influenced both by physical development on the UC Berkeley campus and City Environs (e.g., capacity of water entitlements, water facilities, and stormwater drainage facilities) and by campus population numbers (e.g., solid waste generation). As noted in Section 4, *Relationship to 2020 LRDP*, UC Berkeley has constructed approximately 43 percent of the 2.2 million net new gross square feet of development anticipated in the 2020 LRDP despite the increased campus headcount above 2020 LRDP projections. To accommodate an increased campus headcount through the 2022-2023 school year, it is assumed that UC Berkeley would continue to add new academic and support space. However, because substantial development capacity remains under the 2020 LRDP, future physical development associated with an increased campus headcount would not be additional to that planned for in the 2020 LRDP.

While the increase in UC Berkeley’s existing and projected headcount beyond that anticipated in the 2020 LRDP would result in a modest increase in water demand from greater use of sinks, toilets, and water fountains in University facilities, the types and sizes of various land uses are the primary drivers of water demand from campus, and EBMUD considers these factors rather than population size in projecting water demand. UC Berkeley has decreased water demand by approximately 21 percent during implementation of the 2020 LRDP from 2004 to 2016, even while accommodating growth in headcount and new development, as a result of initiatives to improve water efficiency. As a result, UC Berkeley’s water use decreased to 1.9 mgd in 2017 (Wang 2018). Furthermore, the increase in headcount would not lead to additional physical development beyond that planned for in the 2020 LRDP that would generate new demand for water based on EBMUD's water demand factors. Through continued implementation of water efficiency measures, the greater headcount would not increase UC Berkeley's overall water demand from EBMUD beyond that of the overall 2020 LRDP program. The increase in UC Berkeley's existing and projected headcount beyond that anticipated in the 2020 LRDP would generate a modest increase in wastewater flow from campus as a result of greater use of restroom fixtures in UC Berkeley facilities; however, by decreasing overall water use, UC Berkeley has also decreased wastewater flow from campus.

The increase in UC Berkeley's existing and projected headcount would not require additional physical development beyond that planned for in the 2020 LRDP that could affect stormwater drainage facilities or generate excess energy demand for building operations, use energy wastefully or inefficiently, or require new steam or chilled water facilities.

While the increase in UC Berkeley's existing and projected headcount would generate a modest increase in solid waste because of additional people using trash receptacles, it is not expected that solid waste generation would increase overall, due to continued implementation of recycling measures. During implementation of the 2020 LRDP, UC Berkeley has reduced the amount of waste sent to landfills even with the increased campus headcount.

The increase in UC Berkeley's headcount would not result in net increases in water use, wastewater flow, or solid waste generation, with continued implementation of water efficiency and recycling measures. In addition, it would not require additional physical development beyond that planned for in the 2020 LRDP that would affect stormwater drainage facilities or demand greater use of energy, steam, or chilled water. Therefore, increased headcount would have less than significant impacts related to utilities and service systems and would fall within the analysis of Utilities and Services Systems in the 2020 LRDP EIR.

UTILITIES AND SERVICE SYSTEMS

WATER

Would the Project:

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
1. Exceed the capacity of existing and planned water entitlements and resources?	●	

The 2020 LRDP EIR found that implementation of the 2020 LRDP would increase water demand in the EBMUD service area by 424,600 gallons per day (gpd), representing an increase of 0.15 percent beyond EBMUD's predicted demand for 2020 (2020 LRDP EIR Vol 1, p. 4.13-5). Because the Upper Hearst Development would be within the overall development parameters of the 2020 LRDP program, it would not result in additional water demand in the EBMUD service area. The Upper Hearst Development would also meet EBMUD's requirements for water metering and conservation prior to receiving water from the agency. Water service to the proposed residential building would be metered in compliance with Senate Bill 7 (SB-7). In addition, Section 31 of EBMUD's Water Service Regulations would require installation of all applicable water-efficiency measures described in the regulation at the project sponsor's expense before furnishing new or expanded water service. Consistent with Continuing Best Practice USS-2.1-d, specific water conservation measures have been included in the design of the Upper Hearst Development to reduce water consumption and wastewater generation. EBMUD has also requested that the proposed Project comply with the California Model Water Efficient Landscape Ordinance (Division 2, Title 23, California Code of Regulations, Chapter 2.7, Sections 490 through 495); the recommendation has been forwarded to the design team, in order to further reduce the already less than significant impact to water supplies. The Upper Hearst Development would be consistent with the 2020 LRDP EIR's analysis and would have a less than significant impact related to the capacity of water entitlements and resources.

The 2020 LRDP EIR found that implementation of the 2020 LRDP in combination with other cumulative projects would increase demand for water, but not to the extent that would result in the need for new or altered facilities (2020 LRDP EIR Vol. 1, p. 4.13-27). As discussed above, the Upper Hearst Development would be within the overall development parameters of the 2020 LRDP program and therefore would not result in additional water demand in the EBMUD service area. As a result, the Project would not contribute to a cumulative impact related to water resources, consistent with the 2020 LRDP EIR's analysis.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
2. Require or result in the construction of new or expansion of existing water facilities, the construction of which could cause significant adverse effects?		●

Please see response to Water item 1, above. The Project would not require or result in the construction of new or expanded water facilities.

WASTEWATER

Would the Project:

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
1. Result in a determination by the wastewater treatment provider which serves or may serve the Project that it does not have adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	●	

The Upper Hearst Development would be served by the EBMUD Special District No. 1 (SD-1) Wastewater Treatment Plant, which has a current dry weather flow treatment capacity of 168 mgd. The 2020 LRDP EIR projected the increase in wastewater flow to this plant from buildout of the 2020 LRDP, based on demand factors for the gross square footage of new development and the number of new student beds (2020 LRDP EIR Vol 1, p. 4.13-11). Although operation of the Upper Hearst Development would generate wastewater, the proposed 37,000 square-foot academic building and up to 225 student beds would fit within the 2020 LRDP EIR's assumed development parameters for the entire 2020 LRDP program. Therefore, new wastewater flow would not be beyond levels anticipated in the 2020 LRDP EIR and would not require construction of additional wastewater collection facilities.

EBMUD anticipates that the Wastewater Treatment Plant has adequate capacity during dry weather to accommodate wastewater flows from the Upper Hearst Development, provided that wastewater generated by the development complies with the agency’s Wastewater Control Ordinance; however, wastewater flows during storm events may be an issue due to ongoing problems caused by stormwater infiltration (Appendix A). The East Bay regional wastewater collection system experiences exceptionally high peak flows during storms from excessive inflow and infiltration through cracks and misconnections in public and private sewer lines (see Appendix A). EBMUD has historically operated three Wet Weather Facilities to provide treatment for high wet weather flows that exceed the treatment capacity of the Wastewater Treatment Plant. On January 14, 2009, as a result of Environmental Protection Agency’s (EPA) and the State Water Resources Control Board’s (SWRCB) reinterpretation of applicable law, the Regional Water Quality Control Board (RWQCB) issued an order prohibiting further discharges from EBMUD’s Wet Weather Facilities. In addition, on July 22, 2009, a Stipulated Order for Preliminary Relief issued by EPA, SWRCB, and RWQCB became effective. This order requires EBMUD to perform work that will identify problem infiltration/inflow areas, begin to reduce infiltration/inflow through private sewer lateral improvements, and lay the groundwork for future efforts to eliminate discharges from the Wet Weather Facilities.

Stormwater infiltration into existing or new lateral sewer lines that would connect from the Project site to the sewer mains in La Loma Avenue and Hearst Avenue could potentially contribute to high wet weather flows that exceed allowable levels at the Wastewater Treatment Plant. To address potential impacts to wastewater treatment capacity during wet weather the following mitigation measure would be required:

MM-UTIL-1 Existing wastewater collection systems serving the Upper Hearst Development shall be rehabilitated or replaced to ensure that such systems are free from defects or disconnected from the sanitary sewer system. Any new or replacement wastewater collection system infrastructure required to serve the Upper Hearst Development, including sewer lateral lines, shall be constructed to prevent infiltration/inflow to the maximum extent feasible.

Almost the entire Project site is currently paved and impervious; thus, the vast majority of site runoff is conveyed directly to existing storm drains. The Upper Hearst Development would include bioretention planting areas designed to maintain existing peak stormwater flows from the Project site. In addition, the 2020 LRDP EIR notes that localized clusters of new development could exceed the capacity of individual sub-basins, and includes measures to minimize possible collection capacity impacts, including project-by-project analysis of sewer system capacity considerations (Continuing Best Practices USS-2.1-b and USS-2.1-d through USS-2.1-e). As further support of this effort, in May of 2005 the UC Berkeley Chancellor and the mayor of the City of Berkeley signed an agreement earmarking $200,000 annually in UC Berkeley funds to the City of Berkeley to support sewer and storm drain infrastructure projects.

Should it be determined that increases to sewer system collection capacity are required, any replacement/rehabilitation of existing sewer collection lines and construction of new sewer lateral lines would occur within an existing road (Hearst Avenue and La Loma Avenue) in a fully urbanized area. As such, though construction-related effects, such as disruption to traffic flows and construction noise, could occur, these would be temporary and would be addressed through standard measures, such as traffic control and adherence to timing restrictions in the City of Berkeley Noise Ordinance. Therefore, the

Upper Hearst Development's impact related to wastewater facilities would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

The 2020 LRDP EIR found that implementation of the 2020 LRDP in combination with other cumulative projects would increase the demand for wastewater and stormwater conveyance, and may result in the construction of new or altered facilities, but these are not anticipated to have significant cumulative environmental impacts (2020 LRDP EIR Vol. 1, p. 4-13-28). As discussed above, new wastewater flow from the Upper Hearst Development would not be beyond levels anticipated in the 2020 LRDP EIR and would not require construction of additional wastewater collection facilities. With implementation of Mitigation Measure UTIL-1, the Upper Hearst Development also would be constructed to prevent infiltration/inflow to the maximum extent feasible and would not substantially increase cumulative infiltration/inflow to EBMUD's wastewater collection facilities. Therefore, the Project would not considerably contribute to a significant cumulative impact related to wastewater facilities, consistent with the 2020 LRDP EIR's analysis.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
2. Require or result in the construction of new or expansion of existing wastewater treatment facilities, the construction of which could cause significant adverse effects?	●	

See Utilities and Service Systems - Wastewater item 1.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
3. Exceed wastewater treatment requirements of the Regional Water Quality Control Board?		●

EBMUD regulates UC Berkeley's wastewater discharge to its treatment plant through a source control program designed to ensure compliance with its NPDES permit conditions. UC Berkeley is required to comply with conditions of EBMUD's Ordinance 311 and the Main Campus Wastewater Discharge Permit issued by EBMUD's Source Control Division and applicable to all campus laboratory, construction and municipal operations.

UC Berkeley's program has served as a model to others. The program's success at preventing pollution was recognized in 2003 when the campus was one of two honorees to be awarded EBMUD's Pollution Prevention Award for 'exemplary performance in complying with discharge requirements.'

The Upper Hearst Development would not be considered a new land use not previously analyzed in the 2020 LRDP EIR and would not require additional development above that anticipated for the overall 2020 LRDP program; thus, there is no expectation that operation of the Upper Hearst Development would significantly alter campus wastewater discharge or violate water quality standards. Discharge quantities from operation of the Upper Hearst Development would vary but are not expected to exceed the growth parameters assessed in the 2020 LRDP EIR, which found the potential impact on water quality standards and waste discharge requirements resulting from implementation of the 2020 LRDP to be less than significant, given existing campus practices. (Best Practices HYD-1-a through HYD-1-d) Also, see Hydrology and Water Quality item 1.

STORMWATER

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Require or result in the construction of new or expansion of existing stormwater drainage facilities, the construction of which could cause significant adverse effects?		●

As described in Chapter 9, *Hydrology and Water Quality*, the Project site is almost entirely impervious, and the Upper Hearst Development would not increase the area of impervious surface on-site. The 2020 LRDP EIR requires that new projects be sited and designed so the aggregate effect of projects under the 2020 LRDP is no net increase in runoff over existing conditions (Continuing Best Practice HYD-4-e). Consistent with this best practice, the development would include bioretention facilities that ensure no net increase in runoff. Therefore, the Upper Hearst Development would not result in the construction of new or expanded stormwater drainage facilities, and this impact would be less than significant. See also Hydrology and Water Quality items 3 and 4.

SOLID WASTE

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Violate any applicable federal, state, and local statutes and regulations related to solid waste?		●

Although the Upper Hearst Development would generate solid waste for disposal at landfills, implementation of Continuing Best Practice USS-5.1 would require that UC Berkeley continues to implement a solid waste reduction and recycling program designed to reduce the total quantity of campus solid waste that is disposed of in landfills during implementation of the 2020 LRDP. Efforts to minimize UC Berkeley's solid waste generation have reduced the amount sent to landfills by approximately 33 percent from 2004 to 2016. Additionally, Mitigation Measure USS-5.2 in the 2020 LRDP EIR would require recycling or salvage of at least 50 percent of construction and demolition waste generated during construction of the proposed project. These measures would ensure that this impact would be within the scope of the 2020 LRDP EIR's analysis and less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Exceed the permitted capacity of a landfill that serves the project's solid waste disposal needs?		●

UC Berkeley is exempt from Alameda County requirements to dispose of solid waste in the County, and therefore selects landfill sites based on lowest cost. In accordance with The Regents-adopted Policy on Sustainable Practices and the policies of the 2020 LRDP, contractors working for UC Berkeley would be required to report their solid waste diversion according to UC Berkeley's waste management reporting requirements. As discussed in Solid Waste item 1 above, the Upper Hearst Development would not generate additional solid waste beyond that anticipated in the 2020 LRDP EIR. Therefore, the impact related to exceeding the capacity of landfills would be within the scope of the 2020 LRDP EIR's analysis and less than significant (2020 LRDP EIR Vol 1, p. 4.13-21 and 4.13-22).

ENERGY

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Require or result in the construction of new or expansion of existing energy production and/or transmission facilities, the construction of which could cause significant adverse effects?		●

The 2020 LRDP EIR found that buildout of the 2020 LRDP would increase the use of electricity and natural gas, but would not result in the need for new or altered energy facilities (2020 LRDP EIR Vol 1, p. 4.13-25). Therefore, the 2020 LRDP EIR determined the energy use would have less than significant impacts.

While the Upper Hearst Development would generate demand for electricity, natural gas, and steam, it would not exceed the overall development parameters in the 2020 LRDP EIR. Therefore, its impacts related to operational energy demand would be within the scope of the 2020 LRDP EIR's analysis and less than significant. Construction of the Upper Hearst Development also may require upgrades to gas and electricity lines in order to provide adequate levels of service to the Project site. However, these upgrades would occur in already urbanized portions of the East Bay so no environmental impacts from construction would occur. Potential construction-related effects related to upgrades to service lines, such as disruption to traffic flows and construction noise, would be temporary and would be addressed through standard measures, such as traffic control and adherence to timing restrictions in the City of Berkeley Noise Ordinance. Therefore, the impact related to construction would be less than significant.

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
2. Would the Project encourage the wasteful or inefficient use of energy?		●

The Upper Hearst Development would contribute to UC Berkeley continuing to exceed Title 24 energy conservation requirements for new buildings by 20 percent, and would incorporate energy efficient design elements, in accordance with existing policies and 2020 LRDP goals. (2020 LRDP EIR Vol 1, p. 4.13-26). Therefore, this impact would be less than significant.

STEAM AND CHILLED WATER

Would the Project:

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
1. Require or result in the construction of new or expansion of existing steam and/or chilled water facilities, the construction of which could cause significant adverse effects?		●

The 2020 LRDP EIR found that implementation of the 2020 LRDP could increase UC Berkeley's steam demand by up to 22,200 pounds per hour, which would be well within the campus's plant capacity of 353,000 pounds per hour (2020 LRDP EIR Vol 1, p. 4.13-18). While the Upper Hearst Development would generate demand for steam, such demand would not exceed the overall demand of the 2020 LRDP program. Therefore, steam demand from the Upper Hearst Development would be within the scope of the 2020 LRDP EIR's analysis and the Upper Hearst Development would have a less than significant impact.

SUMMARY OF UTILITIES AND SERVICE SYSTEMS ANALYSIS

The 2020 LRDP EIR concluded that projects implementing the 2020 LRDP, incorporating existing best practices and 2020 LRDP EIR mitigation measures, would not result in new significant utilities and service systems impacts (2020 LRDP EIR Vol 1, p. 4.13-5, 4.13-10 to 4.13-12, 4.13-15 to 4.13-16, 4.13-18, 4.13-21 to 4.13-22, 4.13-25 to 4.13-28). Because the proposed Upper Hearst Development would not require additional physical development beyond that anticipated in the 2020 LRDP EIR, the Project's impacts related to water use, stormwater facilities, solid waste, and energy and steam uses would be within the scope of the 2020 LRDP EIR's analysis and less than significant. Compliance with the 2009 RWQCB order prohibiting further discharges from EBMUD's Wet Weather Facilities would require implementation of mitigation to address potential impacts to wastewater treatment capacity during wet weather periods, resulting in a less than significant impact related to wastewater facilities.

17. MANDATORY FINDINGS OF SIGNIFICANCE

	Further Analysis Required	2020 LRDP EIR Analysis Sufficient
Does the Project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	●	

The Project does not pose new concerns about the quality of the environment not analyzed in the 2020 LRDP EIR. Potential impacts of new construction and other 2020 LRDP activities upon fish, wildlife, plant or animal communities, special status species, or important examples of the major periods of California history or prehistory are examined at Section 4.3 of the 2020 LRDP EIR, Vol 1, Biological Resources, and Section 4.4 of the 2020 LRDP EIR, Vol 1, Cultural Resources. No significant and unavoidable impacts on biological resources are anticipated to result from implementation of the 2020 LRDP.

As discussed in Chapter 5, *Cultural Resources*, the proposed Upper Hearst Development would degrade the integrity of setting and feeling of historical resources adjacent to the Project site, which represent important examples of architectural history in California. Despite implementation of feasible mitigation to improve the proposed buildings' compatibility of design with nearby historic buildings, the impact on historic resources would be significant and unavoidable. However, this impact would be within the scope of Impact CUL-3 in the 2020 LRDP EIR, which found projects developed to further UC Berkeley's educational mission could cause substantial adverse changes in the significance of historical resources, resulting in a significant and unavoidable impact. Furthermore, the Project would not eliminate important examples of major periods of California history.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
Does the Project have impacts that are individually limited but cumulatively considerable? ('Cumulatively considerable' means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other projects, and the effects of probable future projects)?	●	

Cumulative impacts related to implementing the 2020 LRDP are analyzed in the 2020 LRDP EIR beginning at the following pages: Aesthetics, p. 4.1-21; Air Quality, p. 4.2-29; Biological Resources, p. 4.3-33; Cultural Resources, p. 4.4-60; Geology, Seismicity and Soils, p. 4.5-22; Hazardous Materials, p. 4.6-32; Hydrology and Water Quality, p. 4.7-31; Land Use, p. 4.8-19; Noise, p. 4.9-23; Population and Housing, p. 4.10-17; Public Services, p. 4.11-29; Transportation and Traffic, p. 4.12-59; Utilities and Service Systems, p. 4.13-27. The 2020 LRDP EIR found significant cumulative impacts on the traffic network due to vehicle trips generated by implementation of the 2020 LRDP (see 2020 LRDP EIR Vol 1, p. 4.12-59 of the); significant cumulative noise impacts from construction noise exceedances of local standards (see 2020 LRDP EIR Vol 1, p. 4.9-24); potential significant cumulative impacts upon the resource base of historical or archaeological resources (see 2020 LRDP EIR Vol 1, p. 4.4-61); and a potential continuing cumulative exceedance of toxic air contaminant emissions (see 2020 LRDP EIR Vol 1, p. 4.2-34).

Appendix I to this SEIR provides a list of major cumulative projects that are under consideration, approved, or under construction on the UC Berkeley campus and in off-campus areas near the Project site. Cumulative projects near the Project site include, but are not limited to, the following:

- Demolition of the 247,000 square-foot Tolman Hall near Hearst Avenue by Arch Street
- The potential construction of a new UC Berkeley residence hall or apartment building with 1,000 to 3,000 student beds on the Oxford Tract
- Construction of the 77,000 square-foot Integrative Genomics Building at LBNL
- Construction of a 142-unit residential building with transitional housing and support services at 2012 Berkeley Way
- Construction of 34 affordable units at 1601 Oxford Street associated with the All Souls Episcopal Parish

Cumulative projects would add housing units, academic and support space, and commercial space, generating new vehicle trips. However, it is estimated that the Project would reduce vehicle trips to and from the Project site, by reducing parking availability in the Upper Hearst parking structure.

Furthermore, as discussed in this SEIR's analysis of traffic impacts, trip generation associated with the UC Berkeley campus is currently less than baseline conditions for the 2001-2002 school year as analyzed in the 2020 LRDP EIR and is projected to remain below baseline conditions through the 2022-2023 school year. Therefore, the Project would not contribute to the 2020 LRDP's significant and unavoidable cumulative impacts on the traffic network.

Demolition and construction activity for cumulative projects, including the proposed Upper Hearst Development, would generate a temporary increase in ambient noise. However, construction noise is a localized issue, and other cumulative project sites are not located close enough to the Project site to result in substantially greater cumulative exposure to construction noise in any given location. As noted in the Noise analysis, the Upper Hearst Development would not introduce a more adverse impact from construction noise than anticipated in the 2020 LRDP EIR, after implementation of continuing best practices and mitigation measures from the 2020 LRDP EIR. Increased headcount would not involve additional development beyond that planned for in the 2020 LRDP that could generate construction noise. Therefore, construction noise from the Project would not be cumulatively considerable.

The 2020 LRDP EIR determined that cumulative development at UC Berkeley and LBNL, in combination with other cumulative projects, could have a combined adverse effect on the historical resource base, resulting in a significant and unavoidable impact (2020 LRDP EIR Vol 1, p. 4.4-61). As discussed in Chapter 5, *Cultural Resources*, the Upper Hearst Development would degrade the integrity of feeling and setting of historical resources adjacent to the Project site. Therefore, the Project would contribute to a significant and unavoidable cumulative impact on historical resources. Implementation of Mitigation Measure CUL-1, however, would reduce this impact to the extent feasible through the inclusion of exterior materials in building design that are more compatible with nearby historical resources.

The 2020 LRDP EIR found that cumulative projects would generate new TAC emissions, resulting in a significant and unavoidable air quality impact (2020 LRDP EIR Vol 1, p. 4.2-33 to 4.2-34). The construction of current cumulative UC Berkeley and LBNL projects that would involve TAC emissions during building operations, such as from emergency generators, would contribute to this impact. By increasing the number of people exposed to air pollution, the Upper Hearst Development may incrementally contribute to this significant cumulative impact identified in the 2020 LRDP EIR.

The Upper Hearst Development would introduce two new significant and unavoidable impacts at the project level that were not anticipated in the 2020 LRDP EIR: degradation of visual character and quality, and land use incompatibility. The 2020 LRDP EIR found that new development could degrade visual character and quality, but design provisions of the 2020 LRDP would ensure the contribution of projects under the 2020 LRDP would not be cumulatively considerable (2020 LRDP EIR Vol 1, p. 4.1-22). As discussed in Chapter 1, *Aesthetics*, the Upper Hearst Development would introduce a project-level significant impact on visual character and quality, as a result of incompatibility in scale, massing, and design between the proposed buildings and the surrounding neighborhood. However, other cumulative projects are not located in this Northside Berkeley neighborhood to the north of Hearst Avenue and east of Oxford Street and would not affect its visual setting. It is also assumed that other cumulative projects would be consistent with applicable design standards. Therefore, the Project would not contribute to a significant cumulative impact on visual character or quality as identified in the 2020 LRDP EIR.

Based on the 2020 LRDP EIR's land use analysis, the 2020 LRDP would have a less than significant cumulative impact related to compatibility with land uses adjacent to new development (2020 LRDP EIR Vol 1, p. 4.8-20 to 4.8-21). In general, development under the 2020 LRDP would be compatible with adjacent general plan designations and thus with existing and future land uses. As discussed in Chapter 10, *Land Use*, the proposed Upper Hearst Development would be inconsistent with 2020 LRDP policy to minimize incompatibilities with local zoning standards for height and setbacks. In addition, proposed buildings' scale, massing, and exterior materials would be incompatible with those of historic buildings in the surrounding residential neighborhood. Nonetheless, this project-level land use incompatibility would not alter the 2020 LRDP EIR's finding that new development under the 2020 LRDP would generally be compatible with adjacent land uses. Therefore, the Project would not contribute to a significant cumulative impact related to land use.

	Further Analysis Required	**2020 LRDP EIR Analysis Sufficient**
Does the Project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	●	

Potential adverse effects on human beings, directly or indirectly, are addressed in the 2020 LRDP EIR sections on Air Quality; Geology, Seismicity and Soils; Hydrology; Noise; Public Services – Fire and Emergency Protection; Transportation and Traffic. Implementation of the 2020 LRDP, including implementation of best practices and mitigation measures, is anticipated to reduce adverse effects on human beings. As the Project would be within the scope of the 2020 LRDP EIR's analysis of these issue areas, it would not cause substantial adverse effects on human beings after implementation of best practices and mitigation measures. See the 2020 LRDP EIR Vol 1, as revised by Vol 3a, within each topic area.

7. OTHER CEQA REQUIRED DISCUSSIONS

This section discusses growth inducing impacts, irreversible environmental impacts, and energy impacts that could be caused by the Project.

GROWTH-INDUCING EFFECTS

Section 15126.2(d) of the CEQA Guidelines requires a discussion of a proposed project's potential to induce growth by, for example, fostering economic or population growth, or removing an obstacle to growth. Growth does not necessarily create significant physical changes to the environment. However, depending upon the type, magnitude, and location of growth, it can result in significant adverse environmental effects. A project's growth-inducing potential is therefore considered significant if growth induced by the project could result in significant physical effects in one or more environmental issue areas.

The proposed Upper Hearst Development would foster population growth by introducing a residential building with up to 150 housing units and an academic building to serve GSPP's expanding graduate program. The academic building would expand the program's overall capacity to serve an additional five staff members and 30 students, on average, by the end of the 2023 school year. This growth on the Project site would incrementally contribute to a projected increase in campus headcount through the 2022-2023 school year. As discussed under Chapter 12, *Population and Housing*, in Section 6, *Environmental Evaluation*, it is estimated that by spring 2023 campus headcount would increase by 21.1 percent beyond the 2020 LRDP's projections for the year 2020. The primary driver of increased headcount would be an increase in student enrollment.

Although projected campus headcount would exceed the 2020 LRDP's projections, it is anticipated that this population growth would not induce physical development beyond that planned for in the 2020 LRDP. As discussed in Section 4, *Relationship to 2020 LRDP*, the 2020 LRDP anticipated over 2.2 million net new gross square feet of development to the year 2020; however, only 43.4 percent of that anticipated floor area has been constructed or is under construction. Similarly, UC Berkeley has ample remaining capacity under the 2020 LRDP's development parameters for student beds, having added 1,119 of the anticipated 2,600 new beds as of the end of 2018. Therefore, it is anticipated that physical development to accommodate an increasing population of students, faculty, and staff would not exceed the development parameters assumed in the 2020 LRDP, and would not result in additional environmental impacts beyond those evaluated in the 2020 LRDP EIR. Section 6, *Environmental Evaluation*, also analyzes the environmental impacts of population growth in itself and finds that they would not be more severe than identified in the 2020 LRDP EIR for the 2020 LRDP program as a whole.

REMOVAL OF OBSTACLES TO GROWTH

The Project site is located in an urbanized area that is fully served by existing infrastructure. As discussed under Chapter 9, *Hydrology and Water Quality*, and Chapter 16, *Utilities and Service Systems*, in Section 6, *Environmental Evaluation*, the Upper Hearst Development would not require a major expansion of public facilities such as wastewater treatment plants and stormwater infrastructure beyond that analyzed by the 2020 LRDP EIR. In the future, with or without the Project, minor improvements to water, sewer, and circulation systems and drainage connection infrastructure could be needed. No new or widened/expanded roads would be required. Therefore, implementation of the Project would not remove additional obstacles to growth.

ENERGY USE AND CONSERVATION

Public Resources Code Section 21100(b)(2) and Appendix F of the CEQA Guidelines require an EIR to discuss the potential for impacts related to energy consumption and/or conservation. A project may have the potential to cause such impacts if it would result in inefficient, wasteful, or unnecessary consumption of energy, including electricity, natural gas, or transportation fuel supplies and/or resources. This section evaluates the anticipated energy demand (including fuel consumption) by the Upper Hearst Development. Energy demand includes natural gas, electricity, and fuel consumption during construction and operation.

California is one of the lowest per capita energy users in the United States, ranked 48th in the nation, due to its energy efficiency programs and mild climate (U.S. Energy Information Administration [EIA] 2018a). California generated 206,336 gigawatt-hours (GWh) of electricity in 2017 (California Energy Commission [CEC] 2018) and used 2,110,829 million cubic feet (MCF) of natural gas in 2017, of which 431,005 MCF were consumed by residential users (EIA 2018b). Additionally, in 2015, the most recent year of data provided by the EIA, California's transportation sector consumed 1,714.4 trillion Btu of motor gasoline in (EIA 2018c). The single largest end-use sector for energy consumption in California is transportation (40 percent), followed by industry (24 percent), commercial (19 percent), and residential (18 percent) (EIA 2018a).

The 2020 LRDP EIR determined that implementation of the 2020 LRDP would increase the use of electricity and natural gas but would not result in the need for new or altered energy facilities. Table 20 estimates electricity and natural gas demand under buildout of the 2020 LRDP development program, in comparison to annual statewide energy use.

Table 20:
2020 LRDP Projected Energy Use Relative to Statewide Energy Use

Form of Energy	Units	Annual LRDP-Related Energy Use	Annual Statewide Energy Use	Project Percent of Statewide Energy Use
Electricity	Megawatt hours	57,202[1]	288,613,480[2]	<0.01%
Natural Gas	Million British thermal units	163,200[1]	1,256,804,492[3]	<0.01%

[1] *Tables 4.13-3 and 4.13-4 in the 2020 LRDP EIR Vol 1*

[2] *CEC 2017a*

[3] *CEC 2017b*

As shown in Table 20, additional energy consumption under buildout of the 2020 LRDP would represent less than 0.01 percent of statewide annual demand for electricity and natural gas.

The Upper Hearst Development would involve energy use during its construction and operational phases. Because it would be within the development parameters of the 2020 LRDP for new academic space and student beds, the Upper Hearst Development would not result in additional energy use than anticipated in the 2020 LRDP EIR. Furthermore, as discussed under Chapter 7, *Greenhouse Gas Emissions*, in Section 6, *Environmental Evaluation*, UC Berkeley is required to implement the UC's Carbon Neutrality Initiative, which would aggressively improve energy efficiency in buildings and increase utilization of renewable energy sources.

The 2020 LRDP EIR did not evaluate the energy impacts of gasoline use in transportation. However, as discussed in Chapter 14, *Transportation and Traffic*, the proposed Project would result in only approximately 150 net new daily trips. The SEIR's traffic analysis projects that, even with the adjusted campus headcount baseline, vehicle trips associated with people on campus would decrease in the 2022-2023 school year relative to trips in the 2001-2002 school year as presented in the 2020 LRDP EIR (Appendix G). As a result, it is expected that gasoline use would not increase beyond conditions analyzed in the 2020 LRDP EIR.

CEQA GUIDELINES APPENDIX F REQUIREMENTS AND ENERGY CONSERVATION STANDARDS

Appendix F of the CEQA Guidelines requires inclusion in an EIR of relevant information that addresses "potential energy impacts of proposed projects, with particular emphasis on avoiding or reducing inefficient, wasteful and unnecessary consumption of energy" (Public Resources Code Section 21100[b][3]). The following discussion addresses direct energy impacts of the Project as framed in Appendix F of the CEQA Guidelines by evaluating whether the Project would result in the wasteful or inefficient consumption of energy or the potential need for new energy-related infrastructure, the construction or operation of which would have significant impacts.

1. Would the Project result in the wasteful and inefficient use of non-renewable resources during construction and operation of the project?

As discussed above, UC Berkeley is required to implement UC's Carbon Neutrality Initiative, which would aggressively improve energy efficiency in buildings and increase utilization of renewable energy sources. The Upper Hearst Development also would be built to achieve a minimum LEED Silver rating and would target a Gold rating for new construction. Therefore, as determined in Chapter 16, *Utilities and Service Systems*, in Section 6, *Environmental Evaluation*, the Upper Hearst Development would not result in the wasteful and inefficient use of non-renewable resources.

2. Would the Project result in the need for new systems or substantial alterations to electrical, natural gas, or communication systems infrastructure, the construction or operation of which would have significant impacts?

As discussed in Chapter 16, *Utilities and Service Systems*, in Section 6, *Environmental Evaluation*, the Upper Hearst Development would not require the construction of additional physical infrastructure than anticipated in the 2020 LRDP EIR.

CUMULATIVE IMPACTS

The Project, in combination with approved, pending, and proposed development in the area as listed in Appendix I, would contribute incrementally to energy resource demand and conservation. Future development would have the cumulative effect of increasing local and regional energy demands, resulting in potential considerable impacts to energy conservation. However, discretionary actions requiring agency approval are required to comply with local, regional, state, and federal policies designed to reduce wasteful energy consumption, and improve overall energy conservation and sustainability. For instance, all local projects involving the development of new buildings must be designed to conform to CALGreen and 2013 California Energy Code, and all UC Berkeley projects must be designed to conform to requirements in the UC Sustainable Practice Policy, such as outperforming Title 24 energy efficiency standards by at least 20 percent. Further, these projects are/would be operated and maintained by UC Berkeley and private utility companies, such as PG&E, which plan for anticipated growth. Electric and natural gas services are provided based on demand from consumers and expanded as needed to meet demand, consistent with applicable local, state, and federal regulations. Therefore, it is not anticipated that the Project contribution to cumulative impacts generated with projects provided in Appendix I would result in a significantly considerable wasteful use of energy resources, such that the Project, and other cumulative projects, would have a cumulative effect on energy conservation. Cumulative impacts would therefore be less than significant.

8. ALTERNATIVES

CEQA Guidelines Section 15126.6(a) states that "[a]n EIR shall describe a range of reasonable alternatives to the project, or to the location of the project, which would feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project, and evaluate the comparative merits of the alternatives." CEQA Guidelines Section 15126.6(e) further requires that an alternative be included that describes what would reasonably be expected to occur on the Project site in the foreseeable future if the proposed development were not approved, based on current plans and consistent with available infrastructure and community services. This is considered to be the "No Project Alternative."

Consistent with CEQA, the alternatives selected for analysis here would reduce or eliminate one or more of the Project's identified environmental impacts while meeting most of its basic objectives. The following four alternatives are evaluated in this SEIR:

- Alternative 1: No Project
- Alternative 2: Off-Site Lease Agreement
- Alternative 3: Academic Building Only
- Alternative 4: Reduced Scale

Table 21 compares the primary features of the proposed Project to those of each alternative.

Table 21:
Comparison of Features of Proposed Project and Alternatives

		Alternative			
Feature	**Proposed Project**	**No Project**	**Off-site Lease Agreement**	**Academic Building Only**	**Reduced Scale**
Parking supply on-site	200 spaces	407 spaces	407 spaces	407 spaces	≤200 spaces
Demolition	1) Upper Hearst parking structure 2) Ridge Lot	None	None	1) Ridge Lot	1) Upper Hearst parking structure 2) Ridge Lot
New structures					
Academic building	37,000 sf	None	None	37,000 sf	25,000 sf
Residential building	Up t o 150 units	None	None	None	Up to 150 units
Parking garage	New Upper Hearst parking structure	None	None	None	New Upper Hearst parking structure
Maximum building height	Up to six stories	N/A	N/A	Two stories	Four stories

Source: UC Berkeley, January 2019

NO PROJECT ALTERNATIVE

The No Project Alternative assumes that existing conditions would continue. None of the Project Site development components described in Section 3.5, *Project Description*, would be approved, and the existing Upper Hearst parking structure and surface Ridge Lot would be maintained on the Project site as they currently exist. UC Berkeley would not make changes to the existing environment.

The No Project Alternative would not result in contributions to the impacts studied in the 2020 LRDP EIR as identified in this SEIR, nor would it result in any of the proposed Project's impacts that would be more severe than identified in the 2020 LRDP EIR, with regard to aesthetics and land use incompatibility. However, the No Project Alternative would not achieve any of the objectives of the proposed Project.

OFF-SITE LEASE AGREEMENT ALTERNATIVE

Under the Off-site Lease Agreement Alternative, GSPP would meet its need for additional academic capacity for GSPP by leasing space in existing buildings on or near the UC Berkeley campus, instead of constructing the proposed Upper Hearst Development. The Project site would remain in its current state, with the existing Upper Hearst parking structure and Ridge surface parking lot. Although UC Berkeley has not identified specific opportunity sites that are available for leasing, it is assumed that physical space of equal size to the proposed 37,000 square-foot academic building would be available to accommodate an expansion of GSPP's academic facilities. This alternative would not involve the construction or leasing of additional residential space for faculty or students.

This alternative would meet Project objectives to improve academic facilities, maintain as much parking as possible on the Project site, maintain the historic character and setting around the Project site, and accommodate increased student enrollment. It would not meet objectives to provide housing, transform underutilized University-owned parcels, and design and build new facilities that are compatible with their surroundings. Although the alternative would meet the objective of maximizing retention of parking on-site, it would not meet the associated objective of refurbishing the Upper Hearst parking structure. In addition, leased space may be distant from the existing GSPP buildings, which would not meet the objective to promote compact and clustered development.

Aesthetics. By avoiding new development on the Project site, the Off-site Lease Agreement Alternative would not involve the removal of character-defining features of the historic Beta Theta Pi house, or the construction of new buildings that could be visually incompatible with the surrounding neighborhood. No off-site construction that could adversely affect aesthetics in other locations would occur. Therefore, whereas the proposed Project would introduce a significant and unavoidable impact to visual character and quality, this alternative would a have less than significant impact, which would be consistent with the 2020 LRDP EIR's analysis of aesthetics.

Cultural Resources. As discussed above, this alternative would avoid the loss of character-defining features at the historic Beta Theta Pi house and the introduction of new buildings that could be incompatible with the Project site's setting. By preserving the Project site in its existing conditions, the alternative would not degrade the setting of adjacent historical resources. No off-site construction that could impair other historical resources would occur. Therefore, while the proposed Project would have a significant and unavoidable impact on historical resources in the interest of furthering UC Berkeley's educational mission, this alternative would add a similar amount of academic space while having a less than significant impact on historical resources. This less than significant impact would be within the scope of the 2020 LRDP EIR's analysis of cultural resources.

Land Use. An off-site lease agreement for expanded academic facilities would not involve new development that could conflict with the 2020 LRDP policy related to the City of Berkeley's zoning standards for building height and setbacks or be incompatible with surrounding land uses. It is assumed that leased academic space would be located on one site, or multiple sites, in the City of Berkeley where such use is allowed under existing zoning. Therefore, this alternative would have a less than significant impact related to land use incompatibility, and would avoid the proposed Project's new significant and unavoidable impact resulting from the incompatibility of new development with 2020 LRDP policy related to consistency with City zoning and surrounding land uses. This impact would be within the scope of the 2020 LRDP EIR's analysis of land use impacts.

Noise. The leasing of academic space in existing facilities would not involve construction activity that would temporarily increase noise levels near sensitive residences. Whereas the proposed Upper Hearst Development would have a significant and unavoidable impact from construction noise, consistent with the 2020 LRDP EIR's analysis, this alternative would have a less than significant impact.

Utilities. The Off-site Lease Agreement Alternative would involve leasing of academic space in existing facilities. It is assumed that GSPP would replace previous tenants in these facilities and therefore would not generate additional demand on utilities and services beyond baseline conditions. Because no new development affecting stormwater facilities would occur, Mitigation Measure UTIL-1 to prevent infiltration and inflow to stormwater pipes would not apply to this alternative. Similar to the proposed Project, utility impacts would be less than significant and within the scope of the 2020 LRDP EIR's analysis.

Summary. The Off-site Lease Agreement Alternative would avoid the proposed Project's new significant and unavoidable impacts on aesthetics and land use consistency. It would also avoid the proposed Project's significant and unavoidable impacts related to historical resources and construction noise that are within the scope of the 2020 LRDP EIR's analysis. Therefore, this alternative would reduce the Project's significant impacts to a less-than-significant level.

ACADEMIC BUILDING ONLY ALTERNATIVE

Similar to the proposed Project, the Academic Building Only Alternative would involve construction of an academic building on the Project site. While the proposed academic building would be located on the southwestern portion of the site, adjacent to the Beta Theta Pi house, this alternative would place the academic building on the northern portion of the site, where it would replace the Ridge surface parking lot, which is roughly 15,000 square feet. No residential building would be constructed. By relocating the new academic building and not constructing a residential building, UC Berkeley would retain the existing Upper Heart parking structure. The new academic building also would be reduced to two stories in height, but it would have a similar floor area to the proposed Project (37,000 square feet), by occupying a larger building footprint.

This alternative would meet most of the Project objectives. By adding an equivalent amount of academic space to that proposed in the Upper Hearst Development, on a site next to the existing GSPP buildings, the alternative would meet objectives to enhance academics and transform underutilized University-owned parcels by promoting compact and clustered development. Retaining the Upper Hearst parking structure would meet the objective to keep as much parking as possible on-site to a greater extent than would the proposed Project. By minimizing the scale of development on-site and its proximity to the historic Beta Theta Pi house, this alternative also would better meet objectives to maintain the aesthetic and historic character of the surrounding neighborhood. However, it would not meet objectives to provide needed housing.

Aesthetics. This alternative would reduce visual changes to the Project site compared to the proposed Project. While the proposed Upper Hearst Development would involve construction of up to a six-story residential building and a four-story academic building, this alternative would add only a two-story academic building. The existing Upper Hearst parking structure also would be retained instead of demolished. The scale of new development would be compatible with neighboring residential buildings and the Beta Theta Pi house, which are at least two stories in height. This alternative also would preserve character-defining features in the front yard of the historic Beta Theta Pi house, including a stream-rock retaining wall and brick pathways. The palette of exterior materials on the academic building could be incompatible with the wood-shingled and brick cladding of adjacent buildings designed in the First Bay Tradition of architecture. Implementation of Mitigation Measure CUL-1 would require consultation with an architectural historian to consider a more compatible palette of exterior materials, but would not necessarily result in a building design that integrates such materials. Therefore, this alternative would substantially reduce the severity of the Project's significant and unavoidable impact on visual character and quality, and could potentially reduce the impact to a less-than-significant level if the building design is compatible with adjacent historical resources.

Cultural Resources. The Academic Building Only Alternative would avoid a direct impact on historical resources by relocating the new academic building away from the historic Beta Theta Pi house. In this location, an accessible pathway to the academic building could be constructed without demolishing character-defining features of the historical resource, including a stream-rock retaining wall and brick pathways. The two-story academic building also would be compatible with the scale of adjacent historical resources, such as the two-story Beta Theta Pi house and the four-story Cloyne Court Student Cooperative. As discussed above, the academic building's exterior materials could be incompatible with adjacent historical resources, but implementation of Mitigation Measure CUL-1 has the potential to resolve this issue. Therefore, this alternative may be compliant with applicable *Secretary's Standards* to protect the integrity of historical resources. The Academic Building Only Alternative would substantially reduce the severity of the Project's significant and unavoidable impact on historical resources, and could potentially reduce this impact to a less-than-significant level if the building design is compatible with adjacent historical resources. Similar to the proposed Project, this alternative would not introduce new potential impacts on historical resources beyond those already assessed in the 2020 LRDP EIR.

Land Use. The new two-story academic building would not exceed the City of Berkeley R-3 zoning district's height limit of three stories. It is assumed that UC Berkeley would have adequate space on the Project site to design this building with setbacks that conform to the R-3 zone's standards. As discussed above, the new building also would be compatible with the scale of surrounding development. Although the building's design could be visually incompatible with that of surrounding buildings, this in itself would not represent a substantial land use incompatibility. Therefore, this alternative would reduce the Project's significant and unavoidable impact related to consistency with 2020 LRDP policy regarding land use incompatibility to a less-than-significant level, consistent with the 2020 LRDP EIR's analysis.

Noise. By substantially reducing the scale of demolition and new construction, this alternative would reduce the duration of noise-generating construction activities. However, adjacent noise-sensitive receptors would still be exposed to high levels of construction noise. Implementation of Continuing Best Practices NOI-4-a, NOI-4-b, and 2020 LRDP Mitigation Measure NOI-4 would control construction-related noise to the extent that is reasonable and feasible. Similar to the proposed Upper Hearst Development, even after implementation of these continuing best practices and mitigation measures, the noise impact from construction would be significant and unavoidable (2020 LRDP EIR Vol 1, p. 4.9-16 to 4.9-25). However, similar to the proposed Project, this alternative would not introduce new potential noise impacts beyond those already assessed in the 2020 LRDP EIR.

Utilities. Because this alternative would not include construction of a residential building and would reduce the scale of the new academic building, it would result in less demand on utility infrastructure than would the Upper Hearst Development. Similar to the proposed Upper Hearst Development, the new academic and residential buildings would not exceed the overall development parameters of the 2020 LRDP program. Therefore, this alternative would not result in additional demand on water, energy, or steam infrastructure than anticipated in the 2020 LRDP EIR. Similar to the proposed development, Mitigation Measure UTIL-1 would be required to prevent infiltration and inflow to stormwater pipes to the maximum extent feasible. With implementation of this measure, the new building would not contribute to excessive infiltration and inflow to EBMUD's sanitary sewer system, and would have a less than significant impact related to wastewater infrastructure. In addition, similar to the proposed Upper Hearst Development, this alternative would not result in a net increase in stormwater flow from the Project site, with adherence to continuing best practices in 2020 LRDP EIR. As for the Project, overall utility impacts would be less than significant with mitigation incorporated, and within the scope of the 2020 LRDP EIR's analysis.

Summary. The Academic Building Only Alternative would substantially reduce the proposed Project's significant and unavoidable impacts on visual character and quality and on historical resources, and could potentially reduce these impacts to a less-than-significant level with implementation of Mitigation Measure CUL-1. Similar to the Project, the impact on historical resources would not be beyond that anticipated in the 2020 LRDP EIR. This alternative also would reduce to a less-than-significant level the Project's significant and unavoidable impact related to land use incompatibility. In addition, impacts related to utility infrastructure would remain less than significant with mitigation to minimize infiltration and inflow to the sanitary sewer system.

REDUCED SCALE ALTERNATIVE

The Reduced Scale Alternative would reduce the proposed scale of the new academic and residential buildings, thereby reducing the proposed Project's impacts related to compatibility with the surrounding development, including adjacent historic properties. Under this alternative, the new academic building would have a reduced floor area of approximately 25,000 square feet, compared to 37,000 square feet under the proposed Project, while the residential building would have 120 dwelling units (30 fewer than the proposed Project). By reducing the floor area of new buildings, the academic building's height would be reduced from four to three stories, while the residential building would be reduced from six to four stories. The new buildings would have increased setbacks from streets relative to the proposed Project. It is assumed that these setbacks would be consistent with the City's R-3 zone standards. As for the proposed development, it is assumed that the Upper Hearst parking structure would be demolished to accommodate the new buildings. To accommodate 120 dwelling units in the residential building while reducing its scale, this alternative would involve the removal of more parking spaces in the Upper Hearst parking structure than proposed for the Project.

This alternative would meet most of the Project objectives, but to a lesser extent than would the proposed Project. By reducing the scale of the new academic building, the alternative would not fully meet objectives related to fulfilling the academic needs of the GSPP program. Similarly, if the residential building included fewer residential units than proposed, it would not fully meet objectives to provide housing on-site to serve current demand and to address the shortage of campus housing. By reducing the scale of development, the alternative would meet the objective of accommodating increased GSPP enrollment to a lesser extent than would the proposed Project. The potential removal of additional parking spaces also would not meet the objective of maintaining as much parking as possible on-site. However, the Reduced Scale Alternative would better meet objectives to maintain the character and setting of surrounding historic buildings and to build facilities that are compatible with the surrounding neighborhood.

Aesthetics. Whereas the proposed Upper Hearst Development would involve construction of a residential building up to six stories above grade level, the Reduced Scale Alternative would include a residential building up to four stories above grade level. A four-story residential building would be more compatible with the scale of two adjacent four-story buildings: the Foothill Student Housing complex, located across La Loma Avenue to the east, and the Cloyne Court Student Cooperative, located west and north of the Project site. Greater setbacks also would reduce the buildings' massing from the perspective of adjacent streets. This reduction in scale and massing would improve the visual compatibility of the alternative with the surrounding neighborhood. Similar to the proposed Upper Hearst Development, the primary palette of exterior materials used in the new buildings would consist of glass, concrete, and metal. This design would contrast with the historic wood-shingled and brick cladding of adjacent buildings designed in the First Bay Tradition of architecture. Furthermore, similar to the proposed development, this alternative would entail removal of a stream-rock retaining wall and brick pathways in the front yard of the historic Beta Theta Pi house adjacent to the Project site, in order to accommodate ADA-accessible ramps to the new academic building. The removal of these character-defining features at a historic building would degrade the visual environment. Therefore, despite this alternative's improved compatibility of scale with the surrounding neighborhood, it would also have a significant and unavoidable impact on visual character and quality, which is beyond that anticipated in the 2020 LRDP EIR.

Cultural Resources. As discussed above, this alternative would improve the compatibility of scale and massing between the new residential building and the surrounding neighborhood, including the historic Cloyne Court Student Cooperative. However, the new buildings' palette of exterior materials, with glass, concrete, and metal predominating, would still be incompatible with the wooden and brick exteriors of adjacent historic buildings styled in the First Bay Tradition of architecture. Implementation of Mitigation Measure CUL-1 would require consultation with a historic architect and consideration of the architect's recommendations for a more compatible palette of exterior materials, but would not necessarily result in a building design that integrates such materials. Moreover, similar to the proposed development, this alternative would involve the removal of character-defining front yard features at the Beta Theta Pi house, degrading its integrity of setting and feeling. The proposed ADA-accessible ramps replacing these features, to serve the new academic building, also would envelop the Beta Theta Pi house, compromising its appearance as a stand-alone historical building. Retention of the Beta Theta Pi house's historic site design and plan, including the stream-rock retaining wall, brick walkway, and most of the front lawn, would be necessary to maintain consistency with the *Secretary's Standards*. Therefore, although lower scale of new buildings would improve their compatibility with the scale of adjacent historical resources, the Reduced Scale Alternative would still be non-compliant with applicable *Secretary's Standards* to protect the integrity of feeling and setting for historical resources. Similar to the proposed Upper Hearst Development, this alternative would have a significant and unavoidable impact on historical resources, but one that is within the scope of the 2020 LRDP EIR's analysis for new development that furthers UC Berkeley's educational mission.

Land Use. While the proposed Upper Hearst Development would not meet the City's R-3 zoning standards for building setbacks, the increased setbacks under the Reduced Scale Alternative would be consistent with City standards. However, similar to the proposed Upper Hearst Development, the new buildings under the Reduced Scale Alternative would not meet the City's R-3 zoning standards with respect to building height and density. Although the new academic building could potentially meet the R-3 zone's maximum height of three stories, the new four-story residential building would exceed this height standard. In addition, as detailed above, the new buildings' palette of exterior materials would be visually incompatible with the character of the surrounding neighborhood. Therefore, although this alternative would reduce the proposed development's incompatibility with surrounding land uses in terms of the scale of buildings, it would still have a new significant and unavoidable impact related to consistency with 2020 LRDP policy regarding land use incompatibility. This impact would exceed the impact anticipated in the 2020 LRDP EIR.

Noise. This alternative would incrementally reduce the scale and duration of construction with respect to the proposed Upper Hearst Development. However, construction activity would still occur in close proximity to adjacent noise-sensitive residences. Implementation of Continuing Best Practices NOI-4-a, NOI-4-b, and 2020 LRDP Mitigation Measure NOI-4 would control construction-related noise to the extent that is reasonable and feasible. Similar to the proposed Upper Hearst Development, even after implementation of these continuing best practices and mitigation measures, the noise impact from construction would be significant and unavoidable (2020 LRDP EIR Vol 1, p. 4.9-16 to 4.9-25). However, the Reduced Scale Alternative would not introduce any new potential noise impacts beyond those already assessed in the 2020 LRDP EIR.

Utilities. Because the Reduced Scale Alternative would introduce new academic and residential buildings with less overall floor area than in the proposed Upper Hearst Development, it would generate incrementally less demand on utilities. Similar to the proposed development, the new buildings would not exceed the overall development parameters of the 2020 LRDP program. Therefore, this alternative would not result in additional demand on water, energy, or steam infrastructure than anticipated in the 2020 LRDP EIR. Also similar to the proposed development, Mitigation Measure UTIL-1 would be required to prevent infiltration and inflow to stormwater pipes to the maximum extent feasible. With implementation of this measure, the new buildings would not contribute to excessive infiltration and inflow to EBMUD's sanitary sewer system, and would have a less than significant impact related to wastewater infrastructure. In addition, similar to the proposed Upper Hearst Development, this alternative would not result in a net increase in stormwater flow from the Project site, with adherence to continuing best practices in the 2020 LRDP EIR. As for the Project, overall utility impacts would be less than significant with mitigation incorporated, and within the scope of the 2020 LRDP EIR's analysis.

Summary. Overall, the Reduced Scale Alternative would have similar impacts to the proposed Project, although it would incrementally reduce the severity of a new significant and unavoidable impact to historical resources. The reduced scale and massing of new buildings would improve their compatibility with surrounding historical resources, but not to the extent that this alternative would avoid a significant and unavoidable impact. However, the impact to historical resources would be no more severe than anticipated in the 2020 LRDP EIR. Similar to the Project, this alternative would have a significant and unavoidable impact from exposing sensitive receptors to construction noise, but one which is no more severe than anticipated in the 2020 LRDP EIR. Also similar to the proposed Project, the Reduced Scale Alternative would introduce significant and unavoidable impacts that were not anticipated in the 2020 LRDP EIR with regard to visual character and quality and to inconsistencies with the LRDP objective regarding land use incompatibility. Relative to the proposed Project, the alternative would incrementally reduce the severity of these new significant impacts. In addition, impacts related to utility infrastructure would remain less than significant with mitigation to minimize infiltration and inflow to the sanitary sewer system.

SUMMARY OF IMPACTS FOR ALTERNATIVES

Table 22 compares the physical impacts for each of the alternatives to the physical impacts of the proposed project.

Table 22:
Comparison of Features of Proposed Project and Alternatives

Issue	**Impact Classification[1]**				
	Proposed Project	**No Project Alternative**	**Off-site Lease Agreement Alternative**	**Academic Building Only Alternative**	**Reduced Scale Alternative**
Aesthetics	Significant and unavoidable[2]	+ Less than significant	+ Less than significant	+ Potentially less than significant with mitigation	+/= Significant and unavoidable
Cultural Resources	Significant and unavoidable	+ Less than significant	+ Less than significant	+ Potentially less than significant with mitigation	+/= Significant and unavoidable
Land Use	Significant and unavoidable[2]	+ Less than significant	+ Less than significant	+ Less than significant	+/= Significant and unavoidable
Noise	Significant and unavoidable	+ Less than significant	+ Less than significant	+/= Significant and unavoidable	= Significant and unavoidable
Utilities	Less than significant with mitigation	+ Less than significant	+ Less than significant	= Less than significant with mitigation	+/= Less than significant with mitigation

+ Superior to the proposed Project (reduced level of impact)
- Inferior to the proposed Project (increased level of impact)
= Similar level of impact to the proposed Project

[1] *Where multiple impact conclusions are reached, the "worst" impact conclusion is listed in the table.*

[2] *The Project would result in new significant and unavoidable impacts that were not anticipated in the 2020 LRDP EIR with regard to the resource topics of visual character and quality and of land use incompatibility. Other significant and unavoidable impacts related to cultural resources and noise would be within the scope of the 2020 LRDP EIR's analysis for implementation of the 2020 LRDP.*

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APPENDIX A

PUBLIC COMMENTS IN RESPONSE TO THE NOTICE OF PREPARATION

Department of Planning & Development

SENT VIA U.S. MAIL and EMAIL

Raphael Breines
Senior Planner
Physical & Environmental Planning
University of California, Berkeley
300 A&E Building
Berkeley, CA 94720
email – rbreines@berkeley.edu

Subject: Response to Notice of Preparation of a Draft Supplemental Environmental Impact Report for the Upper Hearst Development for the Goldman School of Public Policy (GSPP) and Minor Amendment to the 2020 Long Range Development Plan (LRDP)

Dear Raphael Breines,

We appreciate the opportunity to submit comments on the Notice of Preparation (NOP) for the GSPP project and the amendment to the 2020 Long Range Development Plan and we look forward to continued collaboration on next steps.

The NOP addresses two issues: 1) changes to the 2020 LRDP land use plan to accommodate the proposed GSPP project[1] and 2) an increase in current and foreseeable campus population levels above those analyzed in the 2020 LRDP Environmental Impact Report.

In 2005, UC Berkeley released the 2020 Long Range Development Plan and accompanying EIR to establish a framework for the University's land use and capital investments through the year 2020. Also in 2005, UC Berkeley and the City of Berkeley entered into an agreement, valid through spring 2021, regarding planning and development in Berkeley, which includes an annual payment from the University to the City of Berkeley to mitigate the University's impacts on City services, infrastructure, and other aspects of community quality of life.

As you know, the University's student enrollment far exceeds the figures identified in the LRDP and EIR. The City appreciates that the University is taking tangible steps to address the growth in the student population through its strategy to significantly increase the number of beds for students over the next 10 years and beyond. In addition to housing, the growing campus population also has impacts on a range of City services, including traffic and parking

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[1] The GSPP project was reviewed as a courtesy by the City's Landmarks Preservation Commission (LPC) on September 6, 2018; comments from that meeting will be forwarded to you under separate cover.

management, public safety, public health, solid waste management and stormwater. At the same time, we are appreciative of the many ways that the University brings benefits to the city.

The amendment to the LRDP is a good opportunity for the City and University to work together to ensure that the impacts of the growing campus population are accounted for and mitigated. Under CEQA, these impacts must be addressed and, if necessary, mitigated in the Supplemental EIR. The City is in the process of collecting and analyzing data that can illustrate the benefits and impacts of the growth of the campus community, and we look forward to sharing that information as part of this supplemental EIR process.

As the University has expressed, the City and the University have a shared interest in continuing to make Berkeley a desirable place to work, live, play, and study. The City's public safety, parks, transit, commercial areas, and rich arts and cultural scene are a major attraction to students, faculty, and staff. The City and the University have always worked closely together to ensure that City services and University programs remain in balance. We look forward to working with you on the planning and environmental review process for this project as well.

Thank you for the opportunity to engage on these important issues with you and for your continued collaboration.

Sincerely,

Timothy Burroughs
Director, Department of Planning & Development

cc: Vini Bhargava, Director, Physical and Environmental Planning

September 14, 2018

Mr. Raphael Breines
Senior Planner
Physical and Environmental Planning
University of California, Berkeley

via email: rbreines@berkeley.edu

Dear Mr. Breines:

This letter responds to the University of California's Notice of Preparation for the Upper Hearst Development for the Goldman School of Public Policy Project, dated August 15, 2018.

As you know, the proposed project was presented to both the Landmarks Preservation Commission and the City of Berkeley Design Review Committee earlier this year.

At its September regular meeting the Berkeley Landmarks Preservation Commission discussed the Upper Hearst project. The Commission (seven members present) unanimously resolved that a letter should be sent to the University expressing a number of concerns about the Upper Hearst Project.

We note in introduction that the Landmarks Preservation Commission does not object to the creation of new academic facilities facing Hearst Avenue, or multi-unit campus-related housing on this block. Both are appropriate uses.

However, the project as proposed is too physically massive and inappropriately designed for this site.

The decision to perch a huge new residential building atop a three story existing parking structure is especially problematic. A housing structure alone or combined housing / academic building might work for this neighborhood context, with suitable modifications to massing and exterior character. The housing-atop-parking parti does not work well.

Unless significantly modified, the project will do serious, perhaps irreparable, harm to one of Berkeley's most architecturally and culturally important neighborhoods, an area with national architectural and historic significance containing a dense concentration of well documented and recognized historic structures.

The Draft Supplemental EIR should propose and evaluate modifications to the project or alternative projects that would mitigate the negative impacts on the neighborhood and on individual adjacent and nearby historic resources. This must not be a sham review in which inherently infeasible alternatives are proposed then automatically rejected, but a serious discussion of practical alternatives. At least one alternative should examine a project with the complete removal of the parking structure, and one should consider a reduction in the program size of the GSPP addition or the shifting of more of the GSPP addition building away from the adjacent historic structures.

The Northside neighborhood surrounding the Upper Hearst “site” is at the historical center of one of Berkeley’s most distinctive and important architectural districts.

City Landmarks, National Register sites, SHRI properties and other recognized and documented historic resources abound in the immediate vicinity and on the project block. The project location is adjacent or within a few hundred feet of buildings designed by Ernest Coxhead, Bakewell and Brown, John Galen Howard, and Bernard Maybeck.

The first home Maybeck designed in Berkeley was done for Charles Keeler who became the most prominent exponent of “building with nature”; it is just up Ridge Road. Other regionally important homes very close to the project site include Weltevreden (the former Volney Moody House, and the current Tellefson Hall) and Allanoke (designed by Ernest Coxhead). Clyne Court, Howard’s superbly successful essay in shingle style multi-family apartment sits adjacent to the project and could be a model for sensitively designed housing on this block.

Founders’ Rock, the location where the Berkeley campus was both “consecrated for learning” in 1860 and where the name, Berkeley, was inspired in 1866, lies directly cross the street. “Annie’s Oak”, a re-planted oak tree at a site famous in Berkeley history where the original ancient tree was saved from cutting by Mrs. Annie Maybeck, is a block away.

The saving of the original tree on this site was a leading example of the influential advocacy of Berkeley’s Hillside Club which called for buildings to integrate and harmonize with the natural environment. The proposed Upper Hearst project is an vivid example of the opposite.

The surviving buildings and 19th / early 20th century context of the neighborhood are given added importance by the fact that the 1923 Berkeley Fire, which destroyed some 600 homes in North Berkeley, obliterated much of Berkeley’s original “brown shingle” and Arts & Crafts heritage. On the Northside, only a few scattered structures and a small triangle of developed blocks did not burn, giving the remaining pre-1923 buildings additional significance as rare survivors. The Upper Hearst site is in the midst of that triangle of survivors and on the same block with two of the most important of them.

Our concerns focus on these issues:

- the University and its consultants appear to have undertaken no study of, and seem to be largely unaware of, the special historical and architectural significance of this site and its neighborhood, including the history described above. The project architect stated at the Design Review Committee that he had been given no materials on the neighborhood history or context by the University and had not sought out any historical research materials on his own before preparing a design. The University appears to have conducted a design competition for the project without any reference to the historic character of the immediate environs and the broader neighborhood;
- This complacently a-historical attitude displayed by the design team and University representatives at LPC and Design Review Committee meetings is discouraging and worrisome;
- the proposed structures in the project are too massive for their sites, rising several stories (including parking levels) above street level. The structures will overwhelm both the adjacent landmark buildings and the overall neighborhood;
- the linear massing of the new buildings crowds the street and gives no relief from the appearance of a solid, unrelieved, wall of construction inconsistent with a fine-grained neighborhood containing along its edge a mix of residential and institutional structures;
- the program for the project—in terms of both the size of the residential building, and the square footage projected for the Goldman School addition—is quite possibly too large for this site, especially with the retention of the large and bulky corner parking structure;
- the relentlessly modernist exterior of the proposed buildings, including the colors, materials, and detailing, present an “anywhere” and bland modern architectural character that entirely ignores the neighborhood context. The buildings as designed display no sensitively to their surroundings and no sense of a “contemporary / compatible” design approach that would harmonize with the neighborhood.

We urge the University to consult at least the following written historic resources in the CEQA process to provide an accurate and informed historical foundation for planning and design on this site. No accurate and meaningful environmental review of cultural resources can be credibly undertaken without thorough study of, and reference to, these documents to set and understand the cultural and architectural context of this neighborhood.

The materials that should be consulted include, but are not limited to:

- Berkeley Landmarks (Susan Cerny)
- The Architectural Guide: University of California, Berkeley (Harvey Helfand)
- Northside (Susan Cerny)
- 41 Berkeley Walking Tours (Susan Cerny, editor)
- Berkeley Rocks (Jonathan Chester and David Weinstein)
- The Simple Home (Charles Keeler)
- The University's own previous Historic Structures Reports and similar evaluations, and related Cultural Resources sections of CEQA studies researched and written by architectural historians for Cloyne Court, the Graduate School of Public Policy Complex (including the Beta Theta Pi Fraternity), the Foothill dormitory complex, the Naval Architecture Building (now Blum Hall), and Stern Hall.
- Online articles posted on the BerkeleyHeritage.com website dealing with buildings in the immediate neighborhood and vicinity, and/or notable architects who worked there. This would include, but not be limited to, articles and essays regarding Cloyne Court, Charles Keeler and Bernard Maybeck, the Beta Theta Pi fraternity, Bakewell and Brown, Ernest Coxhead, and the Bennington Apartments.

City of Berkeley Planning staff can also supply copies of the landmark applications and designations and SHRI listings for the several officially designated City Landmarks and other historic resources in the vicinity.

In conclusion, we would like to note that in the 1950s and 1960s the University thoughtlessly destroyed much of what remained of the Northside neighborhood, buying and demolishing homes (including a number of large student group quarters), and inserting awkwardly sited and poorly designed structures such as Etcheverry Hall, and two massive parking structures north of Hearst Avenue.

On the Upper Hearst site the University demolished the original Newman Hall (Roman Catholic Student Center) which was one of Berkeley's most handsome and admired institutional buildings outside the campus, and left the land as an unimproved surface parking lot for decades.

In the 1980s and 1990s the University did undertake what could be considered some "repair" to the neighborhood fabric by building a relatively modestly scaled and architecturally compatible addition to the Public Policy School, and constructing the Foothill Housing complex which, although quite large, did break its massing into several buildings and stepped elevations and employed a number of exterior materials reflecting the neighborhood character including wooden shingles, unpeeled redwood logs, and green, shingled, roofs.

(We note that to give the appearance of a shingled structure, the shingles used for roof and walls need not be wooden. Saying that wood cannot be used as an exterior element on the proposed Upper Hearst buildings is not an insurmountable barrier to creating an exterior that appears to have a wooden, Arts & Crafts, character.)

The University has now inexplicably retrenched from those days and seems intent on constructing another out of character and context design assault on this enduring, but still fragile, district of Berkeley history. We ask the campus reverse this approach and plan instead a appropriately scaled, massed, and designed project for this block.

The Commission anticipates discussing and commenting on the Draft Supplemental EIR when it is released. Because of public noticing requirements for meeting agendas, we ask that the release of the Draft Supplemental be scheduled so the Commission may routinely place it on a regular meeting agenda (first Thursday of the month) for review in a timely manner, and also retain at least two weeks following the Commission meeting to prepare and submit comments if the Commission so desires.

Sincerely,

Steven Finacom
Chair
Berkeley Landmarks Preservation Commission

cc:

Fatema Crane, City of Berkeley Planning and Development

EAST BAY
MUNICIPAL UTILITY DISTRICT

September 7, 2018

Raphael Breines, Senior Planner
Physical & Environmental Planning
University of California, Berkeley
300 A&E Building
Berkeley, CA 94720-1382

Re: Notice of Preparation of a Draft Supplemental Environmental Impact Report – Upper Hearst Development for the Goldman School of Public Policy and Minor Amendment to the 2020 Long Range Development Plan, Berkeley

Dear Mr. Breines:

East Bay Municipal Utility District (EBMUD) appreciates the opportunity to comment on the Notice of Preparation of a Draft Supplemental Environmental Impact Report for the Upper Hearst Development for the Goldman School of Public Policy and Minor Amendment to the 2020 Long Range Development Plan (Project) for the University of California, Berkeley (U.C. Berkeley) located in the City of Berkeley. EBMUD has the following comments.

WATER SERVICE

On January 29, 2004, EBMUD provided a written response to U.C. Berkeley for a Water Supply Assessment (WSA) for the U.C. Berkeley 2020 Long Range Development Plan which is attached for your reference. If the proposed Project exceeds the water use and land uses in the approved 2020 Long Range Development Plan WSA, a revised WSA pursuant to Section 15155 of the California Environmental Quality Act Guidelines and Section 10910-10915 of the California Water Code may be required. Please submit a written request to EBMUD to review the Project changes to determine if a revised WSA is required. Preparation of the revised WSA will require U.C. Berkeley to submit data and estimates of future water demands for the Project area to EBMUD. Please be aware that the revised WSA can take up to 90 days to complete from the day the request was received.

EBMUD's Santa Barbara Regulator and Summit Pressure Zones, with service elevation ranges of 400 to 500 feet and 500 to 700 feet, respectively, will serve the proposed Project. Effective January 1, 2018, water service for new multi-unit structures shall be individually metered or sub-metered in compliance with State Senate Bill 7 (SB-7). SB-7 encourages conservation of water in multi-family residential and mixed-use multi-family and commercial buildings through metering infrastructure for each dwelling unit, including appropriate water billing safeguards for both tenants and landlords. EBMUD water services shall be conditioned for all development projects that are subject to SB-7 requirements and will be released only after the Project sponsor has satisfied all requirements and provided evidence of conformance with SB-7. In addition, structures on a single parcel require separate water services. When the development plans are finalized, U.C. Berkeley should contact EBMUD's New Business Office and request a water service estimate to determine costs and conditions for providing water service to the proposed Project. Engineering and installation of water services require substantial lead time, which should be provided for in U.C. Berkeley's development schedule.

WASTEWATER SERVICE

EBMUD's Main Wastewater Treatment Plant (MWWTP) and interceptor system are anticipated to have adequate dry weather capacity to accommodate the proposed wastewater flows from this Project and to treat such flows provided that the wastewater generated by the Project meets the requirements of the EBMUD Wastewater Control Ordinance. However, wet weather flows are a concern. The East Bay regional wastewater collection system experiences exceptionally high peak flows during storms due to excessive infiltration and inflow (I/I) that enters the system through cracks and misconnections in both public and private sewer lines. EBMUD has historically operated three Wet Weather Facilities (WWFs) to provide primary treatment and disinfection for peak wet weather flows that exceed the treatment capacity of the MWWTP. Due to reinterpretation of applicable law, EBMUD's National Pollutant Discharge Elimination System (NPDES) permit now prohibits discharges from EBMUD's WWFs. Additionally, the seven wastewater collection system agencies that discharge to the EBMUD wastewater interceptor system ("Satellite Agencies") hold NPDES permits that prohibit them from causing or contributing to WWF discharges. These NPDES permits have removed the regulatory coverage the East Bay wastewater agencies once relied upon to manage peak wet weather flows.

A federal consent decree, negotiated among EBMUD, the Satellite Agencies, the Environmental Protection Agency (EPA), the State Water Resources Control Board (SWRCB), and the Regional Water Quality Control Board (RWQCB), requires EBMUD and the Satellite Agencies to eliminate WWF discharges by 2036. To meet this requirement, actions will need to be taken over time to reduce I/I in the system. The consent decree requires EBMUD to continue implementation of its Regional Private Sewer Lateral Ordinance (www.eastbaypsl.com), construct various improvements to its interceptor system, and identify key areas of inflow and rapid infiltration over a 22-year period. Over the same time period, the consent decree requires the Satellite Agencies to perform I/I reduction work including sewer main rehabilitation and elimination of inflow sources. EBMUD and the Satellite Agencies must jointly demonstrate at specified intervals that this work has resulted in a sufficient, pre-determined level of reduction in WWF discharges. If sufficient I/I reductions are not achieved, additional investment into the region's wastewater infrastructure would be required, which may result in significant financial implications for East Bay residents.

To ensure that the proposed Project contributes to these legally required I/I reductions, U.C. Berkeley should comply with EBMUD's Regional Private Sewer Lateral Ordinance. Additionally, it would be prudent for U.C. Berkeley to require the following mitigation measures for the proposed Project: (1) replace or rehabilitate any existing sanitary sewer collection systems, including sewer lateral lines to ensure that such systems and lines are free from defects or, alternatively, disconnected from the sanitary sewer system, and (2) ensure any new wastewater collection systems, including sewer lateral lines, for the Project are constructed to prevent I/I to the maximum extent feasible while meeting all requirements contained in the Regional Private Sewer Lateral Ordinance and applicable municipal codes or Satellite Agency ordinances.

WATER CONSERVATION

The proposed Project presents an opportunity to incorporate water conservation measures. EBMUD requests that U.C. Berkeley comply with Assembly Bill 325, "Model Water Efficient Landscape Ordinance," (Division 2, Title 23, California Code of Regulations, Chapter 2.7, Sections 490 through 495) for the proposed Project. U.C. Berkeley should be aware that Section 31 of EBMUD's Water Service Regulations requires that water service shall not be furnished for new or expanded service unless all the applicable water-efficiency measures described in the regulation are installed at the Project sponsor's expense.

If you have any questions concerning this response, please contact Timothy R. McGowan, Senior Civil Engineer, Major Facilities Planning Section at (510) 287-1981.

Sincerely,

FOR

David J. Rehnstrom
Manager of Water Distribution Planning

DJR:KKN:dks
sb18_157.doc

Attachment: Letter to U.C. Berkeley from EBMUD dated January 29, 2004

EAST BAY
MUNICIPAL UTILITY DISTRICT

January 29, 2004

Jennifer Lawrence, Senior Planner
Environmental and Long Range Planning Office
University of California, Berkeley
300 A & E Building, #1382
Berkeley, CA 94607-4249

Dear Ms. Lawrence:

Re: Water Supply Assessment – University of California, Berkeley 2020 Long Range Development Plan

This letter responds to your request of October 22, 2003 for water agency consultation concerning the University of California, Berkeley (U.C. Berkeley) 2020 Long Range Development Plan (Enclosure 1). The East Bay Municipal Utility District (EBMUD) appreciates the opportunity to provide this response.

Pursuant to Sections 10910-10915 (SB-610) of the California Water Code, the project meets the threshold requirement for an assessment of water supply availability based on the amount of water this project would require, which would be greater than the amount of water required by a 500 dwelling unit project. Because this project is not a residential subdivision, Government Code Section 66473.7 (SB-221) does not apply.

Please note that this assessment addresses the issue of water supply only and is not a guarantee of service, and future water service is subject to rates and regulations in effect at the time.

Project Demand

The water demands for the U.C. Berkeley 2020 Long Range Development Plan project area are accounted for in EBMUD's water demand projections as published in EBMUD's 2000 Urban Water Management Plan (UWMP/Enclosure 2). EBMUD's water demand projections account for anticipated future water demands within EBMUD's service boundaries and for variations in demand-attributed changes in development patterns. The current water demand for the existing land uses in the U.C. Berkeley 2020 Long Range Development Plan project area is about 100,000 gallons per day (gpd). The projected demand, based on the projected water consumption by EBMUD for the project area, is estimated to be about 400,000 gpd, which is consistent with EBMUD's demand projections which indicate densification of these types of land uses.

Project Area

The U.C. Berkeley 2020 Long Range Development Plan project area is located in Berkeley and Oakland. The project area consists of approximately 1,400 acres that include the intensively developed Campus Park, the Hill Campus, and areas adjacent to the Campus Park. The Lawrence Berkeley National Laboratory is under Federal jurisdiction and therefore outside the scope of the U.C. Berkeley 2020 Long Range Development Plan.

The project under consideration includes the U.C. Berkeley 2020 Long Range Development Plan (program level analysis) and the Chang-Lin Tien Center for East Asian Studies (project level analysis). The 2020 Long Range Development Plan includes development of residential, classroom and laboratory space. Residential development will consist of 2,500 student housing bed units and 200 faculty/staff units. Approximately 1,540,000 square feet of general campus space and 660,000 square feet of laboratory space will also be constructed under the 2020 Long Range Development Plan. The Tien Center consists of two buildings totaling 103,500 square feet.

EBMUD Water Demand Projections

The water consumption of EBMUD customers has remained relatively level in recent years in spite of population and account growth. Between 1987 and the present, consumption has ranged from a high of approximately 220 million gallons per day (mgd) in 1987 to a low of 170 mgd in 1989. Based on extensive forecasting in EBMUD's Water Supply Management Program (WSMP) and recent land use based demand forecasting, the WSMP forecast 2020 water demand of 277 mgd can be reduced to 229 mgd with successful water recycling and conservation programs that are in place. The U.C. Berkeley 2020 Long Range Development Plan will not change the EBMUD 2020 demand projection.

EBMUD Water Supply and Water Rights

EBMUD has water rights and facilities to divert up to a maximum of 325 mgd from the Mokelumne River, subject to the availability of Mokelumne River runoff and the prior water rights of other users. EBMUD's position in the hierarchy of Mokelumne River water users is determined by a variety of agreements between Mokelumne River water right holders, the appropriative water rights permits and licenses that have been issued by the State, pre-1914 rights, and riparian rights. Conditions that restrict EBMUD's ability to use its 325 mgd entitlement include:

- Upstream water use by prior right holders.
- Downstream water use by riparian and senior appropriators and other downstream obligations, including protection of public trust resources.

- Drought, or less than normal rainfall for more than a year.
- Emergency outage.

During periods of drought, runoff from the Mokelumne River is insufficient to supply the 325 mgd entitlement. EBMUD studies indicate that, with its current water supply and the water demands expected in 2020, deficiencies in supply of up to 67 percent could occur during droughts.

EBMUD UWMP

The UWMP, adopted by the Board of Directors in Resolution No. 33242-01, includes planning level analyses at the County- and EBMUD-wide levels for existing and projected water demand. A summary of EBMUD's demand and supply projections in five-year increments is provided in a table (Enclosure 3) from the UWMP. The data reflects the latest actual and forecast values.

EBMUD's evaluation of water supply availability accounts for the diversions of both upstream and downstream water right holders and fishery releases. Fishery releases are based on the requirements of a 1998 Joint Settlement Agreement (JSA) between EBMUD and State and Federal wildlife agencies. The JSA requires EBMUD to make minimum flow releases from its reservoirs to the lower Mokelumne River to benefit the fishery. As this water is released downriver, it is, therefore, not available for use by EBMUD's customers.

The available supply shown in the table (Enclosure 3) in years 1, 2 and 3 of a multiple-year drought was determined by EBMUD's hydrologic model with the following assumptions:

- EBMUD Drought Planning Sequence is used for 1976, 1977, and 1978.
- Total system storage is depleted by the end of the third year of the drought.
- The diversions by Amador and Calaveras Counties upstream of Pardee Reservoir increase over time.
- Releases are made to meet the requirements of senior downstream water right holders and fishery releases are made according to the JSA.

As discussed under the Drought Management Program section in Chapter 3 of the UWMP, EBMUD's system storage generally allows it to continue serving its customers during dry-year events. EBMUD imposes rationing based on the projected storage at the end of September. By imposing rationing in the first dry year of potential drought, EBMUD attempts to minimize rationing in subsequent years if a drought persists while continuing to meet its current and subsequent-year fishery flow release requirements and obligations to downstream agencies. Table 3-1 in the UWMP summarizes the guidelines for consumer water reduction goals, based on system storage.

In the table (Enclosure 3), "Single Dry" year (or Year 1 of "Multiple Dry Years") is determined to be a year that EBMUD would implement Drought Management Program elements at the "moderate" stage with the goal of achieving between 0 to 15 percent reduction in customer demand. Year 2 of Multiple Dry Years is determined to be a year that EBMUD would implement Drought Management Program elements at the "severe" stage with the goal of achieving between 15 to 25 percent reduction in customer demand. In Year 3 of the multiple-year drought, deficiencies from about 48 percent in year 2005 to about 67 percent in year 2020 are forecast to occur. Therefore, a supplemental supply is needed, which is defined by EBMUD as the additional amount of water necessary to limit customer deficiency to 25 percent in a multiple-year drought while continuing to meet the requirements of senior downstream water right holders and the provisions of the 1998 JSA.

Supplemental Water Supply and Demand Management

The goals of meeting projected water needs and increased water reliability rely on three components: supplemental supply, water conservation, and recycled water.

Chapter 2 of the UWMP describes EBMUD's supplemental water supply project alternatives to meet its long-term water demand. To address the need for a supplemental water supply during droughts, EBMUD signed a contract in 1970 with the Federal government for a supplemental supply from the Central Valley Project (CVP). In 2001, EBMUD certified the environmental documentation amending its CVP contract 14-06-200-5183A, reducing EBMUD's contract from 150,000 acre-feet (AF)/year to an annual entitlement not to exceed 133,000 AF. In 2002, EBMUD signed a Memorandum of Agreement with the City of Sacramento, the County of Sacramento, and the U.S. Bureau of Reclamation to study a joint regional water project on the Sacramento River near Freeport. The Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) of the Freeport Regional Water Project identifies several regulatory permits and approvals required for the implementation of the project alternatives. These are listed in Table 2-6 of the Freeport Regional Water Project Draft EIR/EIS, July 2003.

Chapter 2 of the UWMP also describes other supplemental water projects, including the development of groundwater storage within EBMUD's service area. EBMUD is studying the environmental impacts of these proposed projects. Specific capital outlay and financing information for these projects are included in EBMUD's FY02-03 Budget and Five-Year Plan. The Freeport project would also allow for a future groundwater conjunctive use component and, along with the proposed local groundwater projects, emergency interties, and planned water recycling and conservation efforts, would ensure a reliable water supply to meet projected demands for current and future EBMUD customers within the current service area. Without a supplemental water supply source, continued conservation efforts and further use of recycled water, deficiencies in supply are projected as noted above.

The U.C. Berkeley 2020 Long Range Development Plan presents an opportunity to incorporate many water conservation measures. U.C. Berkeley should include in its conditions of approval for the implementation of the 2020 Long Range Development Plan that the project complies with Division 2, Title 231 California Code of Regulations, Chapter 2.7, Sections 490 through 495 (AB325), and with EBMUD water service regulations in force at the time the application is made. EBMUD staff would appreciate the opportunity to meet with U.C. Berkeley's staff to discuss water conservation programs and best management practices applicable to the project area. A key objective of this discussion will be to explore timely opportunities to expand conservation via early consideration of EBMUD's conservation programs and best management practices applicable to the project.

EBMUD's Policy 73 requires "...that customers...use non-potable water for non-domestic purposes when it is of adequate quality and quantity, available at reasonable cost, not detrimental to public health and not injurious to plant life, fish and wildlife" to offset demand on EBMUD's limited potable water supply. U.C. Berkeley has been identified as a potential customer for EBMUD's Satellite Recycled Water Treatment Facility Project. A study is currently underway to evaluate the feasibility of constructing a small satellite recycled water treatment facility to serve a large customer within the EBMUD wastewater service area, and the U.C. Berkeley campus is one of the large customers under consideration. EBMUD staff will continue to work with U.C. Berkeley as the study proceeds and will coordinate with U.C. Berkeley regarding the installation of dual plumbing systems where feasible.

The project sponsor should contact David J. Rehnstrom, Senior Civil Engineer, at (510) 287-1365 for further information.

Sincerely,

WILLIAM R. KIRKPATRICK
Manager of Water Distribution Planning Division

WRK:GAA:rc
sb04_001b.doc

Enclosures: 1. Letter of Request for Water Supply Assessment dated October 23, 2003
2. EBMUD's 2000 Urban Water Management Plan Area
3. EBMUD's Projected Demand and Available Supply Table

cc: Board of Directors w/o Enclosure 2

Enclosure 1

UNIVERSITY OF CALIFORNIA, BERKELEY

BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

CAPITAL PROJECTS
PHYSICAL AND ENVIRONMENTAL PLANNING
300 A & E BUILDING, # 1382

BERKELEY, CALIFORNIA 94720-1382

October 22, 2003

WATER DISTRIBUTION
OCT 23 2003
PLANNING DIVISION

William R. Kirkpatrick
Manager of Water Distribution Planning
East Bay Municipal Utility District
375 Eleventh Street
Oakland, CA 94607-4249

SUBJECT: Request for a Water Supply Assessment for the 2020 Long Range Development Plan pursuant to Section 10910 of the state Water Code and Section 15083.5, California Environmental Quality Act Guidelines

Dear Mr. Kirkpatrick:

This letter is to formally request that East Bay Municipal Utilities District undertake a water supply assessment (WSA) for UC Berkeley's proposed 2020 Long Range Development Plan (LRDP) pursuant to Section 10910 of the state Water Code and Section 15083.5 of the California Environmental Quality Act Guidelines using information on projected water demand provided in the attachment.

A Notice of Preparation (NOP) for this project was circulated for 30 days beginning August 29, 2003 (ref. *Initial Study Checklist and Notice of Preparation for UC Berkeley 2020 Long Range Development Plan and Chang-Lin Tien Center for East Asian Studies*, dated August 29, 2003). The University received a comment letter from EBMUD dated September 29, 2003 in response to the NOP which states that there was not enough information to assess future water demand. It is our hope that the supplemental information provided with this letter will make it possible to prepare a WSA on behalf of the 2020 LRDP.

As described in the NOP, the new development proposed in the 2020 LRDP – to be analyzed in the EIR – is a maximum of:

- 2,200,000 gross square feet (gsf) of campus academic and support space (including 660,000 gsf identified specifically as laboratory space)
- 2,500 student housing beds
- 200 units of staff/faculty housing

A maximum annual water demand projection was calculated for the 2020 LRDP by applying historical campus water usage to the proposed additional square footage and housing. The campus estimates an additional water demand of 404,000 gpd associated with the plan. Please refer to the attached worksheet for calculations and details.

Please call Billi Romain at (510) 643-4404 if there is any additional information you need to complete the Water Supply Assessment for the 2020 LRDP.

Sincerely,

Jennifer Lawrence, Principal Planner
Environmental and Long Range Planning

Enclosure 3

PROJECTED DEMAND AND AVAILABLE SUPPLY
EAST BAY MUNICIPAL UTILITY DISTRICT

(million gallons per day - mgd)

	2000	2005	2010	2015	2020
Customer Demand[1]	230	242	257	267	277
Adjusted for Conservation[2]	(8)	(14)	(20)	(27)	(34)
Adjusted for Recycled Water[3]	(6)	(9)	(11)	(12)	(14)
Planning Level of Demand	216	219	226	228	229
Available Supply & Need for Supplemental Supply					
Normal Year	>216	>219	>226	>228	>229
Supplemental Supply Need	*0*	*0*	*0*	*0*	*0*
Single Dry Year (Multiple Dry Years - Year 1) Moderate Stage (approximately 7% deficiency)[4]	200	203	210	212	213
Supplemental Supply Need	*0*	*0*	*0*	*0*	*0*
Multiple Dry Years - Year 2 Severe Stage (approximately 25% deficiency)[4]	162	164	169	171	172
Supplemental Supply Need	*0*	*0*	*0*	*0*	*0*
Multiple Dry Years - Year 3					
Available Supply	125	114	95	84	77
Deficiency	42%	48%	58%	63%	67%
Supplemental Supply Need[5] (to limit deficiency to 25%)	*87*	*102*	*128*	*142*	*154*

1. *Demand taken from the 2000 Demand Study.*
2. *Conservation water savings goals from the WCMP 1999 Annual Report, 2 mgd in 1999 and 34 mgd for year 2020, linearly interpolated into five-year increments.*
3. *Chapter 5 of UWMP.*
   Note: Conservation and Reclamation savings reported are those attributed to programs which are a part of the 1993 WSMP. Reference Chapter 6 of UWMP.
4. *Drought conditions per Table 3-1, UWMP.*
5. *The supplemental supply need is calculated from modeling studies and is the amount of water needed to limit customer deficiency to 25 percent and to implement all provisions of the 1998 Joint Settlement Agreement.*

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September 14, 2018

Raphael Breines
Senior Planner
Physical & Environmental Planning
University of California, Berkeley
300 A&E Building, Berkeley, CA 94720-1382
Email: rbreines@berkeley.edu

Re: Scoping Comments: Upper Hearst Project CEQA Review

Dear Mr. Breines:

I write on behalf of Save Berkeley's Neighborhoods to submit scoping comments on the August 15, 2018, Notice of Preparation of a Draft Supplemental Environmental Impact Report for the Upper Hearst Development for the Goldman School of Public Policy and Minor Amendment to the 2020 Long Range Development Plan.

As you may know, Save Berkeley's Neighborhoods is the plaintiff in a pending lawsuit, entitled *Save Berkeley's Neighborhoods v. The Regents of the University of California*, Alameda County Superior Court Case No. RG18902751. A copy of the Petition for Writ of Mandate and Complaint for Declaratory Relief is attached for your reference.

Plaintiffs allege in this lawsuit that the Regents have failed to comply with their legal duty to evaluate the environmental impacts of increases in student enrollment that have occurred since the Regents certification of the EIR for the 2020 Long Range Development Plan (2020 LRDP) and that exceed enrollment increases disclosed in that EIR. The Petition for Writ of Mandate and Complaint for Declaratory Relief allege:

- In 2005, UCB adopted a Long Range Development Plan (2020 LRDP) to achieve a number of objectives through the year 2020, including stabilizing enrollment. In or about 2005, UCB certified a Final Environmental Impact Report for the 2020 LRDP (2005 EIR) pursuant to CEQA. The 2020 LRDP and 2005 EIR projected that by 2020 student enrollment at UCB would increase by 1,650 students above the 2001-02 two-semester average. The 2020 LRDP and 2005 EIR also projected that by 2020 UCB would add 2,500 beds for students.

- On October 30, 2017, UCB responded to the City of Berkeley's request for information regarding enrollment increases. This response shows the actual increase in student enrollment above the 2001-02 two-semester average for the most recent two-semester period (i.e., Spring 2017 and Fall 2017) is 8,302 students. This increase represents a five-fold increase compared to the 1,650 enrollment increase projected in the 2020 LRDP and 2005 EIR. The response also shows UCB has built fewer than 1,000 beds.

- The increase in student enrollment over and above the 1,650 additional students projected by the 2020 LRDP and included in the 2005 EIR's environmental impact analysis (hereinafter the "excess increase in student enrollment") has caused and continues to cause significant adverse environmental impacts that were not analyzed in the 2005 EIR. Plaintiff is informed and believes and on that basis alleges that these impacts include, without limitation, increased use of off-campus housing for and by UCB students, leading to increases in off-campus noise and trash; displacement of tenants resulting in more homeless individuals living on public streets and in local parks; increases in the number of UCB students who are homeless; increases in traffic and transportation related congestion and safety risks; and increased burdens on the City of Berkeley's public safety services, including police, fire, ambulance, and Emergency Medical Technician services.

- Respondents have had and continue to have a legal obligation to analyze the environmental effects of the excess increase in student enrollment pursuant to CEQA, including, without limitation, by preparing and certifying an Environmental Impact Report to assess the significance of impacts caused by the extraordinary increase in enrollment and to identify and adopt mitigation measures to reduce these significant impacts.

UCB's announced intention to combine in a single EIR the environmental review of the Upper Hearst capital improvement project and excess increases in enrollment presents number of legal and practical difficulties that can and should be avoided by separating them into two different EIRs.

UC's enrollment increases are a "CEQA project" in their own right as shown by Education Code section 67504 and Public Resources Code section 21080.9. Education Code section 67504 provides that "The Legislature further finds and declares that the expansion of campus enrollment and facilities may negatively affect the surrounding environment. Consistent with the requirements of the California Environmental Quality Act (CEQA), it is the intent of the Legislature that the University of California sufficiently mitigate significant off-campus impacts related to campus growth and development." Public Resources Code section 21080.9 requires that the University of California, Berkeley (UCB) "consider the environmental impact of academic and enrollment plans" pursuant to CEQA and "that any such plans shall become effective for a campus ... only after the environmental effects of those plans have been analyzed" as required by CEQA.

Even without these statutes, UC's enrollment increases are a CEQA project because they are "an activity directly undertaken by any public agency" "which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment" as provided in CEQA Guideline section 15378.

There is no intrinsic relationship between the two projects that suggest greater efficiencies or other benefits from the combination. To the contrary, there are key "structural" problems caused by combining environmental review of these two distinct CEQA projects in the same EIR: causation, baseline, and timeline.

Causation. The Upper Hearst project is not the cause of increases in enrollment to date and will not be the cause of a portion of future increases. Absent this causal link, it is not clear how a CEQA/EIR process for Upper Hearst project will impose on UC a CEQA-based legal obligation to adopt mitigation to reduce impacts caused by general excess enrollment increases.

Baseline. Any EIR for excess increases in enrollment since adoption of the 2020 LRDP must use 2004 enrollment as its baseline.

Timeline. The CEQA process for the Upper Hearst EIR has no particular deadline, while preparation and certification of an EIR for excess enrollment increases is long overdue and now critically time-sensitive. Therefore, the EIR for excess enrollment increases should not be yoked to the EIR for a major capital project that may face unknown and potentially protracted delays.

Whether combined or stand-alone, the EIR for excess enrollment increases must evaluate impacts of this project on increased use of off-campus housing for and by UCB students, leading to increases in off-campus noise and trash; displacement of tenants resulting in more homeless individuals living on public streets and in local parks; increases in the number of UCB students who are homeless; increases in traffic and transportation related congestion and safety risks; and increased burdens on the City of Berkeley's public safety services, including police, fire, ambulance, and Emergency Medical Technician services.

The EIR should pay particular attention to whether increases in student enrollment at UC Berkeley since 2005 may have had or may in the future have a significant effect on the local environment as a result of increases in off-campus student housing and increasing the ratio between housing demand and housing supply in the City of Berkeley since 2005. This analysis should be based on data regarding residential rental demand by market segment, particularly student housing demand characteristics; data regarding residential rental supply trends and planned and proposed projects in the relevant market area.

Thank you for your attention to this matter.

Very Truly Yours,

Tom Lippe

Thomas N. Lippe

T:\TL\UC Enroll\Corr\UH EIR\EIR001a d0901418.wpd

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Attorney for Plaintiff: Save Berkeley's Neighborhoods

ENDORSED
FILED
ALAMEDA COUNTY
APR 27 2018
CLERK OF THE SUPERIOR COURT
By CURTIYAH GANTER
Deputy

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF ALAMEDA

SAVE BERKELEY'S NEIGHBORHOODS, a California nonprofit public benefit corporation;

Plaintiff,

vs.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA; JANET NAPOLITANO, in her capacity as President of the University of California; CAROL T. CHRIST, in her capacity as Chancellor of the University of California, Berkeley; and DOES 1 through 20,

Respondents and Defendants.

Case No. RG18902751

PETITION FOR WRIT OF MANDATE AND COMPLAINT FOR DECLARATORY RELIEF

[CALIFORNIA ENVIRONMENTAL QUALITY ACT]

Plaintiff Save Berkeley's Neighborhoods alleges:

1. Education Code section 67504 provides that "The Legislature further finds and declares that the expansion of campus enrollment and facilities may negatively affect the surrounding environment. Consistent with the requirements of the California Environmental Quality Act (CEQA), it is the intent of the Legislature that the University of California sufficiently mitigate significant off-campus impacts related to campus growth and development."

2. Public Resources Code section 21080.9 requires that the University of California, Berkeley (UCB) "consider the environmental impact of academic and enrollment plans" pursuant to CEQA and "that any such plans shall become effective for a campus ... only after the environmental effects of those plans have been analyzed" as required by CEQA.

3. In 2005, UCB adopted a Long Range Development Plan (2020 LRDP) to achieve a number of objectives through the year 2020, including stabilizing enrollment. In or about 2005, UCB certified a Final Environmental Impact Report for the 2020 LRDP (2005 EIR) pursuant to CEQA. The 2020 LRDP and 2005 EIR projected that by 2020 student enrollment at UCB would increase by 1,650 students above the 2001-02 two-semester average. The 2020 LRDP and 2005 EIR also projected that by 2020 UCB would add 2,500 beds for students.

4. On October 30, 2017, UCB responded to the City of Berkeley's request for information regarding enrollment increases. This response shows the actual increase in student enrollment above the 2001-02 two-semester average for the most recent two-semester period (i.e., Spring 2017 and Fall 2017) is 8,302 students. This increase represents a five-fold increase compared to the 1,650 enrollment increase projected in the 2020 LRDP and 2005 EIR. The response also shows UCB has built fewer than 1,000 beds.

5. The increase in student enrollment over and above the 1,650 additional students projected by the

2020 LRDP and included in the 2005 EIR's environmental impact analysis (hereinafter the "excess increase in student enrollment") has caused and continues to cause significant adverse environmental impacts that were not analyzed in the 2005 EIR. Plaintiff is informed and believes and on that basis alleges that these impacts include, without limitation, increased use of off-campus housing for and by UCB students, leading to increases in off-campus noise and trash; displacement of tenants resulting in more homeless individuals living on public streets and in local parks; increases in the number of UCB students who are homeless; increases in traffic and transportation related congestion and safety risks; and increased burdens on the City of Berkeley's public safety services, including police, fire, ambulance, and Emergency Medical Technician services.

6. Respondents have had and continue to have a legal obligation to analyze the environmental effects of the excess increase in student enrollment pursuant to CEQA, including, without limitation, by preparing and certifying an Environmental Impact Report to assess the significance of impacts caused by the extraordinary increase in enrollment and to identify and adopt mitigation measures to reduce these significant impacts.

Parties

7. Plaintiff SAVE BERKELEY'S NEIGHBORHOODS (Plaintiff) is a California nonprofit public benefit corporation formed to provide education and advocacy to improve quality of life, protect the environment and implement best planning practices. Plaintiff's founders, members, and directors live in the area affected by the excess increase in student enrollment, have suffered and will continue to suffer injury from adverse environmental impacts caused by the excess increase in student enrollment if the legal violations alleged in this Petition and Complaint are not remedied. Plaintiff was formed and brings this action to represent and advocate the beneficial interests of its founders, members, and directors in obtaining relief from these legal violations and to improve quality of life, protect the

environment and implement best planning practices in connection UCB's increases in student enrollment.

8. Respondent and Defendant THE REGENTS OF THE UNIVERSITY OF CALIFORNIA (hereinafter "Regents") is a public trust corporation and state agency established pursuant to the California Constitution vested with administering the University of California including the management and disposition of property of the University and the lead agency for the 2020 LRDP under CEQA, and is thus responsible for analyzing, disclosing, and mitigating the environmental impacts of the 2020 LRDP and the excess increase in student enrollment.

9. Respondent and Defendant JANET NAPOLITANO is the President of the University of California and is named herein solely in this capacity. Regents Policy 8103 delegates to the President of the University the Regents' authority for budget or design for capital projects consistent with approved Long Range Development Plans and minor Long Range Development Plan amendments.

10. Respondent and Defendant CAROL T. CHRIST is the Chancellor of the University of California, Berkeley, and named herein solely in this capacity.

11. Respondents and Defendants Regents, Janet Napolitano, and Carol T. Christ are hereinafter collectively referred to as "Respondents."

12. Plaintiff does not know the true names and capacities of Respondents and Defendants fictitiously named herein as DOES 1 through 20, inclusive. Plaintiff is informed and believes, and thereon alleges, that such fictitiously named Respondents and Defendants are responsible in some manner for the acts or omissions complained of or pending herein. Plaintiff will amend this Petition to allege the fictitiously named Respondents' and Defendants' true names and capacities when ascertained.

Notice Requirements

13. In accordance with Public Resources Code section 21167.5, Plaintiff served Respondents with

written notice of commencement of this action on April 12, 2018. The Notice of Commencement of Action and Proof of Service are attached hereto as Exhibit 1.

14. In accordance with Public Resources Code section 21167.7 and Code of Civil Procedure section 388, Plaintiff has provided a copy of this pleading to the Attorney General's office. (See Exhibit 2.)

Jurisdiction and Venue

15. Plaintiff brings this action as a Petition for Writ of Mandate pursuant to Code of Civil Procedure sections 1085, 1088.5, and 1094.5, and Public Resources Code sections 21168 and 21168.5; and as a Complaint for Declaratory relief pursuant to Code of Civil Procedure section 1060. The Court has jurisdiction over these claims.

16. Venue is proper in Alameda County under Code of Civil Procedure section 394, subdivision (a), because UCB and Respondents are situated therein.

Standing

17. Plaintiff and, to the extent applicable, its members are beneficially interested in Respondents' full compliance with CEQA. Respondents owed a mandatory duty to comply with CEQA with respect to the 2020 LRDP and the excess increase in student enrollment. Plaintiff has the right to enforce the mandatory duties that CEQA imposes on Respondents.

Exhaustion of Administrative Remedies

18. UCB provides no administrative remedy for the legal claims or grounds of noncompliance with CEQA alleged in this Petition and Complaint and Plaintiff had no opportunity to raise the grounds of noncompliance alleged in this Petition and Complaint in any UCB administrative proceeding.

Private Attorney General Doctrine

19. Plaintiff brings this action as a private attorney general pursuant to Code of Civil Procedure section 1021.5, and any other applicable legal theory, to enforce important rights affecting the public

interest.

20. Issuance of the relief requested in this Petition and Complaint will confer a significant benefit on a large class of persons by ensuring that Respondents analyze and disclose the environmental impact of the excess increase in student enrollment.

21. Issuance of the relief requested in this Petition will result in the enforcement of important rights affecting the public interest. By compelling Respondents to complete adequate environmental review of the excess increase in student enrollment under CEQA, Plaintiff will vindicate the public's important CEQA rights to public disclosure regarding and public participation in government decisions that affect the environment.

22. The necessity and financial burden of enforcement are such as to make an award of attorney's fees appropriate in this proceeding because the transgressor is the agency whose duty it is to enforce the laws at issue in this proceeding.

First Cause of Action
(Violation of CEQA: Pub. Resources Code, § 21000 et seq.)

23. Plaintiff hereby realleges and incorporates the preceding paragraphs of this Petition and Complaint as though set forth herein in full.

24. Respondents prejudicially abused their discretion in violation of CEQA pursuant to Public Resources Code sections 21168 and 21168.5 and Code of Civil Procedure sections 1085 and 1094.5 by failing to analyze the excess increase in student enrollment pursuant to CEQA, including, without limitation, by failing to prepare and certify an Environmental Impact Report to assess the significance of impacts caused by the excess increase in student enrollment and to identify and adopt mitigation measures to reduce these significant impacts.

25. Plaintiff has no other plain, speedy, and adequate remedy in the ordinary course of law and will

suffer irreparable injury unless this Court issues the relief requested in this Petition.

Second Cause of Action
(Declaratory Relief: Code Civ. Proc., § 1060)

26. Plaintiff hereby realleges and incorporates the preceding paragraphs of this Petition and Complaint as though set forth herein in full.

27. Plaintiff seeks a judicial determination and declaration that Respondents violated CEQA by failing to analyze the excess increase in student enrollment pursuant to CEQA.

28. An actual controversy has arisen and now exists between Plaintiff and Respondents. Plaintiff contends that Respondents violated CEQA by failing to analyze the excess increase in student enrollment pursuant to CEQA. Plaintiff is informed and believes, and based thereon alleges, that Respondents dispute these contentions.

Prayer for Relief

WHEREFORE, Plaintiff prays for the following relief:

1. For a writ of mandate compelling Respondents to conduct environmental review of the excess increase in student enrollment pursuant to CEQA including, without limitation, by preparing and certifying an Environmental Impact Report to assess the significance of impacts caused by the excess increase in student enrollment and to identify and adopt mitigation measures to reduce these significant impacts.

2. For a declaration that Respondents have failed to comply with CEQA because it has failed to conduct environmental review of the excess increase in student enrollment, including, without limitation, by failing to prepare and certify an Environmental Impact Report to assess the significance of impacts caused by the excess increase in student enrollment and to identify and adopt mitigation measures to reduce these significant impacts.

3. For an order retaining the Court's jurisdiction over this matter until Respondents comply with the peremptory writ;

4. For an order compelling Respondents to pay Plaintiff's costs of suit;

5. For an order compelling Respondents to pay Plaintiff's reasonable attorneys fees related to these proceedings pursuant to Code of Civil Procedure section 1021.5; and

6. For such other relief as the Court may deem proper.

DATED: April 27, 2018 LAW OFFICES OF THOMAS N. LIPPE, APC

Tom Lippe

Thomas N. Lippe
Attorney for Plaintiff Save Berkeley's Neighborhoods

VERIFICATION

Save Berkeley's Neighborhoods v. The Regents of the University of California, Alameda County Superior Court, Case No. (to be determined)

I, Phillip Bokovoy, declare that:

1. I am a founder and member of the Board of Directors of Plaintiff Save Berkeley's Neighborhoods and its President. I am authorized by Save Berkeley's Neighborhoods to execute this verification.

2. I have read the foregoing Verified Petition for Writ of Mandate and know the contents thereof; the factual allegations therein are true of my own knowledge, except as to those matters which are therein stated upon information or belief, and as to those matters I believe them to be true.

I declare under penalty of perjury, under the laws of the State of California, that the foregoing is true and correct. Executed on April 27, 2018 at San Francisco, California.

Phillip Bokovoy, President, Save Berkeley's Neighborhoods

T:\TL\UC Enroll\Trial\Pleadings\P001f Petition and Complaint 042718.wpd

EXHIBIT 1

Law Offices of
THOMAS N. LIPPE, APC

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April 12, 2018

By email: chancellor@berkeley.edu
Chancellor Carol T. Christ
University of California, Berkeley
c/o Jenny Hanson
Executive Assistant to the Chancellor
Office of the Chancellor
200 California Hall, #1500
Berkeley, CA 94720-1500

By email: regentsoffice@ucop.edu
Regents of the University of California
c/o Anne Shaw
Office of the Secretary and Chief of Staff to the Regents
1111 Franklin St.,12th floor
Oakland, CA 94607

Re: Notice of Intent to Sue Regarding Inadequate CEQA Review of UC Berkeley's 2020 Long Range Development Plan.

Dear Chancellor Christ and Regents of the University of California:

This office represents Save Berkeley's Neighborhoods with respect to the University of California at Berkeley's legal obligations to conduct environmental review of the 2020 Long Range Development Plan (2020 LRDP) in compliance with the California Environmental Quality Act (CEQA).

One of the 2020 LRDP's objectives is to stabilize enrollment. (2020 LRDP, Environmental Impact Report (2004 EIR), p. 3.1-10.) The 2004 EIR evaluated an increase in enrollment of 1,650 students above the 2001-02 two-semester average. (2004 EIR , p. 3.1-14.) The University's October 30, 2017, response to the City of Berkeley's request for information regarding enrollment increases shows an actual increase of 8.302 enrolled students above the 2001-02 two-semester average for the most recent two-semester period (i.e., Spring 2017 and Fall 2017). (Exhibit 1.) This represents a five-fold increase compared to the 2004 EIR's projection of a 1,650 student increase in enrollment.

This change in the project renders the 2004 EIR informationally defective because the EIR does not assess the impact of the actual increase in enrollment, which is orders of magnitude higher than the 1,650-student increase projected in the 2004 EIR. As a result, the University must prepare a supplemental or subsequent EIR to assess the significance of impacts caused by this extraordinary increase in enrollment and to identify and adopt mitigation measures to reduce these significant impacts.

This letter provides notice pursuant to Public Resources Code section 21167.5 that on or before April 20, 2018, Save Berkeley's Neighborhoods intends to file a lawsuit challenging the University's adoption of the 2020 LRDP on grounds the adoption does not comply with CEQA.

Save Berkeley's Neighborhoods is willing to discuss settling this dispute without the need for litigation. At a minimum, any such settlement must include: (1) an enforceable agreement by the University to prepare and certify a new EIR to assess the impacts of the 2020 LRDP as its project description has changed to reflect the increases in enrollment shown in the University's October 30, 2017, response to the City's request for information; (2) the new EIR must use the same environmental baseline used in the 2004 EIR; and (3) tolling the statute of limitations so that Save Berkeley's Neighborhoods is not forced to file its lawsuit to protect against the statute of limitations.

Thank you for your attention to this matter.

Very Truly Yours,

Tom Lippe

Thomas N. Lippe

cc:
David M. Robinson, Interim Chief Campus Counsel
By email: dmrobinson@berkeley.edu

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UNIVERSITY OF CALIFORNIA, BERKELEY

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BERKELEY • DAVIS • IRVINE • LOS ANGELES • MERCED • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

BERKELEY, CALIFORNIA 94720-1382

CAPITAL STRATEGIES
PHYSICAL AND ENVIRONMENTAL PLANNING
A&E Bldg. (MC 1382)

30 October 2017

Mayor Jesse Arreguin
City of Berkeley
2180 Milvia Street
Fifth Floor
Berkeley, California 94704

[Transmitted via email]

Mayor Arreguin:

My office has compiled the attached data in response to your request for information sent to former Chancellor Dirks' office on May 25, 2017. We have organized responses using the item numbers indicated in your letter. The data provided in the attachment is the current available information as of October 2017 and based on our understanding of your request.

Please contact Ruben Lizardo (rlizardo@berkeley.edu) if you have questions or would like clarification on the information that has been provided.

Sincerely,

Emily Marthinsen

Emily Marthinsen
Assistant Vice Chancellor/Campus Architect
Physical & Environmental Planning | Capital Strategies

CC: R Lizardo, R Parikh, S Viducich, A Machamer, S Wilmot

EXHIBIT 1

ATTACHMENT 1. UC RESPONSE TO DATA REQUEST

1. **Registered Student Headcount - Source: CalAnswers Student Census, UC Berkeley Office of Planning and Analysis, Accessed 10.04.2017**

Academic Term	Total Undergraduates	Total Graduate Students	Off-campus Undergraduates	Off-campus Graduate Programs
Fall (F) 05	23,482	10,076	381	668
Spring (S) 06	22,643	9,571	384	674
F06	23,863	10,070	357	713
S07	23,351	9,592	384	732
F07	24,636	10,317	359	752
S08	24,032	9,809	395	766
F08	25,151	10,258	325	743
S09	24,448	9,735	405	758
F09	25,530	10,393	331	757
S10	25,061	9,854	421	773
F10	25,540	10,298	369	777
S11	24,969	9,789	498	762
F11	25,885	10,257	342	782
S12	25,277	9,764	529	788
F12	25,774	10,125	334	789
S13	25,181	9,610	463	800
F13	25,951	10,253	327	881
S14	25,473	9,834	426	954
F14	27,126	10,455	296	1111
S15	25,903	10,065	424	1118
F15	27,496	10,708	335	1243
S16	26,094	10,279	466	1252
F16	29,310	10,863	650	1424
S17	27,784	10,510	425	1480
F17	30,574	11,336	560	1536

Note: Columns indicated total number of students include all registered students, including those enrolled in off-campus programs such as online graduate degree programs, the Education Abroad Program, Global Edge (European Study Abroad), and Freshman in San Francisco. The students enrolled in these off-campus programs are tallied in the "off-campus" columns.

Thomas N. Lippe, SBN 104640
LAW OFFICES OF THOMAS N. LIPPE, APC
201 Mission Street, 12th Floor
San Francisco, California 94105
Tel: (415) 777-5604
Fax: (415) 777-5606
E-mail: Lippelaw@sonic.net

Attorney for Plaintiff: Save Berkeley's Neighborhoods

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF ALAMEDA

SAVE BERKELEY'S NEIGHBORHOODS, a California nonprofit public benefit corporation;

Plaintiff,

vs.

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA; JANET NAPOLITANO, in her capacity as President of the University of California; CAROL T. CHRIST, in her capacity as Chancellor of the University of California, Berkeley; and DOES 1 through 20,

Respondents and Defendants.

Case No.

PROOF OF SERVICE

[CALIFORNIA ENVIRONMENTAL QUALITY ACT]

PROOF OF SERVICE

I am a citizen of the United States, employed in the City and County of San Francisco, California. My business address is 201 Mission Street, 12th Floor, San Francisco, CA 94105. I am over the age of 18 years and not a party to the above entitled action. On April 12, 2018, I served the following document on the parties below, as designated:

- **Re: Notice of Intent to Sue Regarding Inadequate CEQA Review of UC Berkeley's 2020 Long Range Development Plan**

MANNER OF SERVICE
(check all that apply)

[ ]	By Mail:	In the ordinary course of business, I caused each such envelope to be placed in the custody of the United States Postal Service, with postage thereon fully prepaid in a sealed envelope.
[ ]	By Personal Service:	I personally delivered each such envelope to the office of the address on the date last written below.
[ ]	By Overnight FedEx:	I caused such envelope to be placed in a box or other facility regularly maintained by the express service carrier or delivered to an authorized courier or driver authorized by the express service carrier to receive documents, in an envelope or package designated by the express service carrier with delivery fees paid or provided for.
[x]	By E-mail:	I caused such document to be served via electronic mail equipment transmission (E-mail) on the parties as designated on the attached service list by transmitting a true copy to the following E-mail addresses listed under each addressee below.
[ ]	By Personal Delivery by Courier:	I caused each such envelope to be delivered to an authorized courier or driver, in an envelope or package addressed to the addressee below.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed on April 12, 2018, in the City and County of San Francisco, California

Kelly Marie

Kelly Marie Perry

SERVICE LIST

By email: chancellor@berkeley.edu
Chancellor Carol T. Christ
University of California, Berkeley
c/o Jenny Hanson
Executive Assistant to the Chancellor
Office of the Chancellor
200 California Hall, #1500
Berkeley, CA 94720-1500

By email: regentsoffice@ucop.edu
Regents of the University of California
c/o Anne Shaw
Office of the Secretary and Chief of Staff to the Regents
1111 Franklin St.,12th floor
Oakland, CA 94607

By email: dmrobinson@berkeley.edu
David M. Robinson, Interim Chief Campus Counsel

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EXHIBIT 2

Thomas N. Lippe, SBN 104640
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San Francisco, California 94105
Tel: (415) 777-5604
Fax: (415) 777-5606
E-mail: Lippelaw@sonic.net

Attorney for Plaintiff: Save Berkeley's Neighborhoods

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA

IN AND FOR THE COUNTY OF ALAMEDA

SAVE BERKELEY'S NEIGHBORHOODS, a California nonprofit public benefit corporation; Plaintiff, vs. THE REGENTS OF THE UNIVERSITY OF CALIFORNIA; JANET NAPOLITANO, in her capacity as President of the University of California; CAROL T. CHRIST, in her capacity as Chancellor of the University of California, Berkeley; and DOES 1 through 20, Respondents and Defendants.	Case No. **PROOF OF SERVICE** **[CALIFORNIA ENVIRONMENTAL QUALITY ACT]**

PROOF OF SERVICE

I am a citizen of the United States, employed in the City and County of San Francisco, California. My business address is 201 Mission Street, 12th Floor, San Francisco, CA 94105. I am over the age of 18 years and not a party to the above entitled action. On April 27, 2018, I served the following document on the parties below, as designated:

- **PETITION FOR WRIT OF MANDATE AND COMPLAINT FOR DECLARATORY RELIEF**

MANNER OF SERVICE
(check all that apply)

[x]	By Mail:	In the ordinary course of business, I caused each such envelope to be placed in the custody of the United States Postal Service, with postage thereon fully prepaid in a sealed envelope.
[ ]	By Personal Service:	I personally delivered each such envelope to the office of the address on the date last written below.
[ ]	By Overnight FedEx:	I caused such envelope to be placed in a box or other facility regularly maintained by the express service carrier or delivered to an authorized courier or driver authorized by the express service carrier to receive documents, in an envelope or package designated by the express service carrier with delivery fees paid or provided for.
[ ]	By E-mail:	I caused such document to be served via electronic mail equipment transmission (E-mail) on the parties as designated on the attached service list by transmitting a true copy to the following E-mail addresses listed under each addressee below.
[ ]	By Personal Delivery by Courier:	I caused each such envelope to be delivered to an authorized courier or driver, in an envelope or package addressed to the addressee below.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct. Executed on April 27, 2018, in the City and County of San Francisco, California

Kelly Marie

Kelly Marie Perry

SERVICE LIST

Hon. Xavier Becerra
Attorney General
State of California
Office of the Attorney General
1300 I Street
Sacramento, CA 95814

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STATE OF CALIFORNIA Edmund G. Brown Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
Cultural and Environmental Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
Phone (916) 373-3710
Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov
Twitter: @CA_NAHC

August 31, 2018

Raphael Breines, Senior Planner
University of California, Berkeley

VIA Email to: rbreines@berkeley.edu

RE: SCH# 2003082131 Upper Hearst Development for the Goldman School of Public Policy and Minor Amendment to the 2020 Long Range Development Plan, Alameda County

Dear Mr. Breines:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). **AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements**. If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:
   - **a.** A brief description of the project.
   - **b.** The lead agency contact information.
   - **c.** Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
   - **d.** A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).
   - **a.** For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:
   - **a.** Alternatives to the project.
   - **b.** Recommended mitigation measures.
   - **c.** Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:
   - **a.** Type of environmental review necessary.
   - **b.** Significance of the tribal cultural resources.
   - **c.** Significance of the project's impacts on tribal cultural resources.
   - **d.** If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:
   - **a.** Whether the proposed project has a significant impact on an identified tribal cultural resource.
   - **b.** Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:
   - **a.** The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or
   - **b.** A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:
    - **a.** Avoidance and preservation of the resources in place, including, but not limited to:
      - **i.** Planning and construction to avoid the resources and protect the cultural and natural context.
      - **ii.** Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.
    - **b.** Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:
      - **i.** Protecting the cultural character and integrity of the resource.
      - **ii.** Protecting the traditional use of the resource.
      - **iii.** Protecting the confidentiality of the resource.
    - **c.** Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.
    - **d.** Protecting the resource. (Pub. Resource Code §21084.3 (b)).
    - **e.** Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).
    - **f.** Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:
    - **a.** The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.
    - **b.** The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.
    - **c.** The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code §65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
    - **a.** The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
    - **b.** Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (http://ohp.parks.ca.gov/?page_id=1068) for an archaeological records search. The records search will determine:
    - **a.** If part or all of the APE has been previously surveyed for cultural resources.
    - **b.** If any known cultural resources have already been recorded on or adjacent to the APE.
    - **c.** If the probability is low, moderate, or high that cultural resources are located in the APE.
    - **d.** If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
    - **a.** The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
    - **b.** The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:
    - **a.** A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.
    - **b.** A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.
    - **a.** Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.
    - **b.** Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.
    - **c.** Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my email address: Frank.Lienert@nahc.ca.gov.

Sincerely,

For Frank Lienert
Associate Governmental Program Analyst

cc: State Clearinghouse

APPENDIX B

DRAFT MINOR LRDP TEXT AMENDMENT

UC Berkeley 2020 Long Range Development Plan

3.1.14 CITY ENVIRONS FRAMEWORK

PLAN EVERY NEW PROJECT TO RESPECT AND ENHANCE THE CHARACTER, LIVABILITY, AND CULTURAL VITALITY OF OUR CITY ENVIRONS.

….

PROJECT DESIGN

UC Berkeley serves the entire state of California, and thus has a mission that can not always be met entirely within the parameters of municipal policy. In the City Environs, however, the objectives of UC Berkeley must be informed by the plans and policies of neighboring cities, to respect and enhance their character and livability through new university investment.

POLICY: USE MUNICIPAL PLANS AND POLICIES TO INFORM THE DESIGN OF FUTURE CAPITAL PROJECTS IN THE CITY ENVIRONS.
USE THE SOUTHSIDE PLAN AS A GUIDE TO THE DESIGN OF FUTURE CAPITAL PROJECTS IN THE SOUTHSIDE.
PREPARE PROJECT SPECIFIC DESIGN GUIDELINES FOR EACH MAJOR NEW PROJECT.

ADJACENT BLOCKS

City of Berkeley land use regulations for the Adjacent Blocks in place as of July 2003, particularly the height and density provisions of the zoning ordinance, reflect a strong preference toward residential and mixed-use projects. However, in order to meet the demands for program space created by enrollment growth and by ongoing growth in research, sites on the Adjacent Blocks must provide adequate capacity to accommodate these demands, in order to maintain UC Berkeley as the compact, interactive campus described in **Campus Land Use.**

While maximizing the capacity of limited campus lands may be the rule, a rare exception may be made to continue to support excellence, as in the Cal Aquatics Center example. The Cal Aquatics Center would provide needed training facilities for UC Berkeley's outstanding athletes in a low density single use facility in the Adjacent Blocks [*paragraph reflects changes adopted in 2013*].

Major capital projects would be reviewed at each stage of design by the UC Berkeley Design Review Committee, based on project specific design guidelines informed by the provisions of the Berkeley General Plan and other relevant city plans and policies. The university would make informational presentations of all major projects on the Adjacent Blocks to the City of Berkeley Planning Commission and, if relevant, the City of Berkeley Landmarks Commission for comment prior to schematic design review by the UC Berkeley Design Review Committee.

Projects on the Adjacent Blocks within the area of the Southside Plan would as a general rule use the Southside Plan as a guide to project design, as described below.

SOUTHSIDE

The university owns roughly 45% of the land in the Southside, and students comprise over 80% of Southside residents. For both reasons, the Southside has always been the area of Berkeley where a positive, shared city-campus vision is most urgently required, and the lack of such a vision most acutely felt.

In 1997 the City of Berkeley and UC Berkeley signed a Memorandum of Understanding, which states 'the city and the university will jointly participate in the preparation of a Southside Plan ... the campus will acknowledge the Plan as the guide for campus developments in the Southside area'. The city and university have since collaborated on a draft Southside Plan, which as of March 2004 was being finalized for formal city adoption.

View original document at https://capitalstrategies.berkeley.edu/2020LRDP
See page numbered 49 in original

Given the mixed-use character of the Southside and the constant influx of new student residents, it is important to remember the Southside is, first and foremost, a place where people live. While the Southside Plan recognizes there are many areas within the Southside suitable for new non-residential projects, it also recognizes such projects must be planned to enhance the quality of life for all Southside residents.

Assuming no further substantive changes are made by the city prior to adoption, the university should as a general rule use the Southside Plan as its guide for the location and design of future projects in the Southside, as envisioned in the Memorandum of Understanding.

As of 2013, the Southside Plan has been adopted by the City of Berkeley and is the university's guide for the location and design of projects in the Southside. A rare exception may be made, however, to continue to support excellence, as in the Cal Aquatics Center example. The Cal Aquatics Center would provide needed training facilities for UC Berkeley's outstanding athletes in a low density single use facility in an area of the Adjacent Blocks subject to the Southside Plan [*paragraph reflects changes adopted in 2013*].

Major capital projects would be reviewed at each stage of design by the UC Berkeley Design Review Committee, informed by the provisions of the Southside Plan. The university would make informational presentations of all major projects within the Southside Plan area to the City of Berkeley Planning Commission and, if relevant, the City of Berkeley Landmarks Commission for comment prior to schematic design review by the UC Berkeley Design Review Committee.

…

2020 LRDP HOUSING ZONE

The housing objectives for the 2020 LRDP require that all new lower division undergraduate housing be located within a mile of the center of the Campus Park, defined as Doe Library, and all other student housing either within this radius or within one block of a transit line providing trips to Doe Library in under 20 minutes. In the 2020 LRDP, this Housing Zone is defined to exclude those areas with residential designations of under 40 units per acre in a municipal general plan as of July 2003.

The definition of the Housing Zone not only serves the objectives of improving student access to the intellectual and cultural life of the campus and minimizing vehicle trips, it also aligns with our goal to concentrate new housing development along transit routes. While future university housing projects must have adequate density to support reasonable rents, they should also be designed to respect and enhance the character and livability of the cities in which they are located. Therefore, to the extent feasible university housing projects in the Housing Zone should not have a greater number of stories nor have setback dimensions less than could be permitted for a project under the relevant city zoning ordinance as of July 2003. A rare exception may be made, however, to continue to support excellence, as in the Upper Hearst Development for the Goldman School of Public Policy, which would expand the Housing Zone to include high density housing at a site designated in the municipal general plan for medium density development. The Upper Hearst Project would provide needed student, staff and faculty housing at a University-owned site on Hearst Avenue, contiguous with other University-owned sites, while also providing the funding needed to develop new program space for the Goldman School of Public Policy, consistently rated one of the top public policy schools in the nation.

Major capital projects would be reviewed at each stage of design by the UC Berkeley Design Review Committee, based on project specific design guidelines informed by the provisions of the relevant city general plan and other relevant city plans and policies. The university would make informational presentations of all major projects in the Housing Zone to the relevant city planning commission and landmarks commission for comment prior to schematic design review by the UC Berkeley Design Review Committee.

View original document at https://capitalstrategies.berkeley.edu/2020LRDP
See page numbered 49 in original

APPENDIX C

AIR QUALITY MODELING RESULTS

Upper Hearst Development

Alameda County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	91.00	Employee	0.25	64,226.19	0
University/College (4Yr)	860.00	Student	0.25	158,065.82	0
Apartments Mid Rise	150.00	Dwelling Unit	0.50	150,000.00	429

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	63
Climate Zone	5			**Operational Year**	2023
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Per site plans one acre project site. Students = 397 academic classrooms + 450 academic event space + 13 residential amenity space

Construction Phase - Client provided phases and schedule

Trips and VMT -

Demolition - per applicant supplied information. 7,000 cy = 3,300 sf

Grading - Per applicant supplied information 13,000 cy export

Vehicle Trips - Zero trips, project would not increase trips compared to existing conditions.

Woodstoves - No fireplaces per site plans

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblFireplaces	FireplaceDayYear	11.14	0.00
tblFireplaces	FireplaceHourDay	3.50	0.00
tblFireplaces	FireplaceWoodMass	228.80	0.00
tblFireplaces	NumberGas	22.50	0.00
tblFireplaces	NumberNoFireplace	6.00	0.00
tblFireplaces	NumberWood	25.50	0.00
tblGrading	AcresOfGrading	0.75	1.00
tblGrading	MaterialExported	0.00	13,000.00
tblLandUse	LotAcreage	1.47	0.25
tblLandUse	LotAcreage	3.63	0.25
tblLandUse	LotAcreage	3.95	0.50
tblTripsAndVMT	HaulingTripNumber	15.00	0.00
tblTripsAndVMT	HaulingTripNumber	1,625.00	0.00
tblVehicleTrips	ST_TR	6.39	0.00
tblVehicleTrips	ST_TR	3.12	0.00
tblVehicleTrips	ST_TR	1.30	0.00
tblVehicleTrips	SU_TR	5.86	0.00
tblVehicleTrips	WD_TR	6.65	0.00
tblVehicleTrips	WD_TR	8.96	0.00
tblVehicleTrips	WD_TR	1.71	0.00
tblWoodstoves	NumberCatalytic	3.00	0.00
tblWoodstoves	NumberNoncatalytic	3.00	0.00
tblWoodstoves	WoodstoveDayYear	14.12	0.00
tblWoodstoves	WoodstoveWoodMass	582.40	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.1386	1.3793	0.8562	1.4700e-003	0.1656	0.0750	0.2406	0.0570	0.0699	0.1269	0.0000	131.1696	131.1696	0.0336	0.0000	132.0083
2020	0.3340	2.6065	2.1764	5.6400e-003	0.3990	0.1047	0.5037	0.1390	0.1001	0.2390	0.0000	498.8580	498.8580	0.0577	0.0000	500.3005
2021	0.1084	0.8436	0.8397	2.1000e-003	0.0713	0.0327	0.1040	0.0193	0.0313	0.0505	0.0000	185.6246	185.6246	0.0221	0.0000	186.1770
Maximum	**0.3340**	**2.6065**	**2.1764**	**5.6400e-003**	**0.3990**	**0.1047**	**0.5037**	**0.1390**	**0.1001**	**0.2390**	**0.0000**	**498.8580**	**498.8580**	**0.0577**	**0.0000**	**500.3005**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.1386	1.3793	0.8562	1.4700e-003	0.1656	0.0750	0.2406	0.0570	0.0699	0.1269	0.0000	131.1694	131.1694	0.0336	0.0000	132.0082
2020	0.3340	2.6065	2.1764	5.6400e-003	0.3990	0.1047	0.5037	0.1390	0.1001	0.2390	0.0000	498.8578	498.8578	0.0577	0.0000	500.3003
2021	0.1084	0.8436	0.8397	2.1000e-003	0.0713	0.0327	0.1040	0.0193	0.0313	0.0505	0.0000	185.6245	185.6245	0.0221	0.0000	186.1769
Maximum	**0.3340**	**2.6065**	**2.1764**	**5.6400e-003**	**0.3990**	**0.1047**	**0.5037**	**0.1390**	**0.1001**	**0.2390**	**0.0000**	**498.8578**	**498.8578**	**0.0577**	**0.0000**	**500.3003**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**7-1-2019**	**9-30-2019**	0.8232	0.8232
2	**10-1-2019**	**12-31-2019**	0.6887	0.6887
3	**1-1-2020**	**3-31-2020**	0.5298	0.5298
4	**4-1-2020**	**6-30-2020**	0.7878	0.7878
5	**7-1-2020**	**9-30-2020**	0.7792	0.7792
6	**10-1-2020**	**12-31-2020**	0.8034	0.8034
7	**1-1-2021**	**3-31-2021**	0.7191	0.7191
8	**4-1-2021**	**6-30-2021**	0.2454	0.2454
		Highest	0.8232	0.8232

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.7099	0.0129	1.1228	6.0000e-005		6.2000e-003	6.2000e-003		6.2000e-003	6.2000e-003	0.0000	1.8363	1.8363	1.7900e-003	0.0000	1.8812
Energy	0.0481	0.4330	0.3387	2.6200e-003		0.0332	0.0332		0.0332	0.0332	0.0000	1,320.7092	1,320.7092	0.0473	0.0166	1,326.8468
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	60.6436	0.0000	60.6436	3.5839	0.0000	150.2418
Water						0.0000	0.0000		0.0000	0.0000	3.9221	29.8576	33.7797	0.4042	9.7900e-003	46.8022
Total	**1.7579**	**0.4459**	**1.4615**	**2.6800e-003**	**0.0000**	**0.0394**	**0.0394**	**0.0000**	**0.0394**	**0.0394**	**64.5656**	**1,352.4032**	**1,416.9688**	**4.0372**	**0.0264**	**1,525.7720**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	1.7099	0.0129	1.1228	6.0000e-005		6.2000e-003	6.2000e-003		6.2000e-003	6.2000e-003	0.0000	1.8363	1.8363	1.7900e-003	0.0000	1.8812
Energy	0.0481	0.4330	0.3387	2.6200e-003		0.0332	0.0332		0.0332	0.0332	0.0000	1,320.7092	1,320.7092	0.0473	0.0166	1,326.8468
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Waste						0.0000	0.0000		0.0000	0.0000	60.6436	0.0000	60.6436	3.5839	0.0000	150.2418
Water						0.0000	0.0000		0.0000	0.0000	3.9221	29.8576	33.7797	0.4042	9.7900e-003	46.8022
Total	**1.7579**	**0.4459**	**1.4615**	**2.6800e-003**	**0.0000**	**0.0394**	**0.0394**	**0.0000**	**0.0394**	**0.0394**	**64.5656**	**1,352.4032**	**1,416.9688**	**4.0372**	**0.0264**	**1,525.7720**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demo, Concrete	Demolition	7/1/2019	11/11/2019	5	10	
2	Earthwork, grading	Grading	11/12/2019	3/27/2020	5	2	
3	Framing, mechanical, electrical plumbing	Building Construction	3/30/2020	8/28/2020	5	100	
4	Exterior and interior finishes	Building Construction	8/31/2020	4/12/2021	5	100	
5	Sidewalks	Paving	4/13/2021	5/31/2021	5	5	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demo, Concrete	Concrete/Industrial Saws	1	8.00	81	0.73
Demo, Concrete	Rubber Tired Dozers	1	8.00	247	0.40
Demo, Concrete	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Earthwork, grading	Graders	1	6.00	187	0.41
Earthwork, grading	Rubber Tired Dozers	1	6.00	247	0.40
Earthwork, grading	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Framing, mechanical, electrical plumbing	Cranes	1	6.00	231	0.29
Framing, mechanical, electrical plumbing	Forklifts	1	6.00	89	0.20
Framing, mechanical, electrical plumbing	Generator Sets	1	8.00	84	0.74
Framing, mechanical, electrical plumbing	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Framing, mechanical, electrical plumbing	Welders	3	8.00	46	0.45
Exterior and interior finishes	Cranes	1	6.00	231	0.29
Exterior and interior finishes	Forklifts	1	6.00	89	0.20
Exterior and interior finishes	Generator Sets	1	8.00	84	0.74
Exterior and interior finishes	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Exterior and interior finishes	Welders	3	8.00	46	0.45
Sidewalks	Cement and Mortar Mixers	1	6.00	9	0.56
Sidewalks	Pavers	1	6.00	130	0.42
Sidewalks	Paving Equipment	1	8.00	132	0.36
Sidewalks	Rollers	1	7.00	80	0.38
Sidewalks	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demo, Concrete	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Earthwork, grading	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Framing, mechanical, electrical plumbing	7	201.00	52.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Exterior and interior finishes	7	201.00	52.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Sidewalks	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demo, Concrete - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0156	0.0000	0.0156	2.3600e-003	0.0000	2.3600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1102	1.0884	0.7149	1.1600e-003		0.0617	0.0617		0.0577	0.0577	0.0000	102.7972	102.7972	0.0262	0.0000	103.4516
Total	**0.1102**	**1.0884**	**0.7149**	**1.1600e-003**	**0.0156**	**0.0617**	**0.0773**	**2.3600e-003**	**0.0577**	**0.0600**	**0.0000**	**102.7972**	**102.7972**	**0.0262**	**0.0000**	**103.4516**

3.2 Demo, Concrete - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3600e-003	1.8000e-003	0.0182	5.0000e-005	4.9300e-003	4.0000e-005	4.9700e-003	1.3100e-003	3.0000e-005	1.3400e-003	0.0000	4.5258	4.5258	1.3000e-004	0.0000	4.5291
Total	**2.3600e-003**	**1.8000e-003**	**0.0182**	**5.0000e-005**	**4.9300e-003**	**4.0000e-005**	**4.9700e-003**	**1.3100e-003**	**3.0000e-005**	**1.3400e-003**	**0.0000**	**4.5258**	**4.5258**	**1.3000e-004**	**0.0000**	**4.5291**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0156	0.0000	0.0156	2.3600e-003	0.0000	2.3600e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1102	1.0884	0.7149	1.1600e-003		0.0617	0.0617		0.0577	0.0577	0.0000	102.7971	102.7971	0.0262	0.0000	103.4515
Total	**0.1102**	**1.0884**	**0.7149**	**1.1600e-003**	**0.0156**	**0.0617**	**0.0773**	**2.3600e-003**	**0.0577**	**0.0600**	**0.0000**	**102.7971**	**102.7971**	**0.0262**	**0.0000**	**103.4515**

3.2 Demo, Concrete - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.3600e-003	1.8000e-003	0.0182	5.0000e-005	4.9300e-003	4.0000e-005	4.9700e-003	1.3100e-003	3.0000e-005	1.3400e-003	0.0000	4.5258	4.5258	1.3000e-004	0.0000	4.5291
Total	**2.3600e-003**	**1.8000e-003**	**0.0182**	**5.0000e-005**	**4.9300e-003**	**4.0000e-005**	**4.9700e-003**	**1.3100e-003**	**3.0000e-005**	**1.3400e-003**	**0.0000**	**4.5258**	**4.5258**	**1.3000e-004**	**0.0000**	**4.5291**

3.3 Earthwork, grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1439	0.0000	0.1439	0.0530	0.0000	0.0530	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0256	0.2886	0.1189	2.5000e-004		0.0133	0.0133		0.0122	0.0122	0.0000	22.8021	22.8021	7.2100e-003	0.0000	22.9825
Total	**0.0256**	**0.2886**	**0.1189**	**2.5000e-004**	**0.1439**	**0.0133**	**0.1572**	**0.0530**	**0.0122**	**0.0652**	**0.0000**	**22.8021**	**22.8021**	**7.2100e-003**	**0.0000**	**22.9825**

3.3 Earthwork, grading - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.5000e-004	4.2000e-004	4.2000e-003	1.0000e-005	1.1400e-003	1.0000e-005	1.1500e-003	3.0000e-004	1.0000e-005	3.1000e-004	0.0000	1.0444	1.0444	3.0000e-005	0.0000	1.0452
Total	**5.5000e-004**	**4.2000e-004**	**4.2000e-003**	**1.0000e-005**	**1.1400e-003**	**1.0000e-005**	**1.1500e-003**	**3.0000e-004**	**1.0000e-005**	**3.1000e-004**	**0.0000**	**1.0444**	**1.0444**	**3.0000e-005**	**0.0000**	**1.0452**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1439	0.0000	0.1439	0.0530	0.0000	0.0530	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0256	0.2886	0.1189	2.5000e-004		0.0133	0.0133		0.0122	0.0122	0.0000	22.8021	22.8021	7.2100e-003	0.0000	22.9825
Total	**0.0256**	**0.2886**	**0.1189**	**2.5000e-004**	**0.1439**	**0.0133**	**0.1572**	**0.0530**	**0.0122**	**0.0652**	**0.0000**	**22.8021**	**22.8021**	**7.2100e-003**	**0.0000**	**22.9825**

3.3 Earthwork, grading - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.5000e-004	4.2000e-004	4.2000e-003	1.0000e-005	1.1400e-003	1.0000e-005	1.1500e-003	3.0000e-004	1.0000e-005	3.1000e-004	0.0000	1.0444	1.0444	3.0000e-005	0.0000	1.0452
Total	**5.5000e-004**	**4.2000e-004**	**4.2000e-003**	**1.0000e-005**	**1.1400e-003**	**1.0000e-005**	**1.1500e-003**	**3.0000e-004**	**1.0000e-005**	**3.1000e-004**	**0.0000**	**1.0444**	**1.0444**	**3.0000e-005**	**0.0000**	**1.0452**

3.3 Earthwork, grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2049	0.0000	0.2049	0.0866	0.0000	0.0866	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0425	0.4752	0.2033	4.4000e-004		0.0216	0.0216		0.0198	0.0198	0.0000	39.0272	39.0272	0.0126	0.0000	39.3428
Total	**0.0425**	**0.4752**	**0.2033**	**4.4000e-004**	**0.2049**	**0.0216**	**0.2265**	**0.0866**	**0.0198**	**0.1064**	**0.0000**	**39.0272**	**39.0272**	**0.0126**	**0.0000**	**39.3428**

3.3 Earthwork, grading - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.7000e-004	6.4000e-004	6.5900e-003	2.0000e-005	1.9900e-003	1.0000e-005	2.0100e-003	5.3000e-004	1.0000e-005	5.4000e-004	0.0000	1.7712	1.7712	5.0000e-005	0.0000	1.7723
Total	**8.7000e-004**	**6.4000e-004**	**6.5900e-003**	**2.0000e-005**	**1.9900e-003**	**1.0000e-005**	**2.0100e-003**	**5.3000e-004**	**1.0000e-005**	**5.4000e-004**	**0.0000**	**1.7712**	**1.7712**	**5.0000e-005**	**0.0000**	**1.7723**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.2049	0.0000	0.2049	0.0866	0.0000	0.0866	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0425	0.4752	0.2033	4.4000e-004		0.0216	0.0216		0.0198	0.0198	0.0000	39.0272	39.0272	0.0126	0.0000	39.3427
Total	**0.0425**	**0.4752**	**0.2033**	**4.4000e-004**	**0.2049**	**0.0216**	**0.2265**	**0.0866**	**0.0198**	**0.1064**	**0.0000**	**39.0272**	**39.0272**	**0.0126**	**0.0000**	**39.3427**

3.3 Earthwork, grading - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	8.7000e-004	6.4000e-004	6.5900e-003	2.0000e-005	1.9900e-003	1.0000e-005	2.0100e-003	5.3000e-004	1.0000e-005	5.4000e-004	0.0000	1.7712	1.7712	5.0000e-005	0.0000	1.7723
Total	**8.7000e-004**	**6.4000e-004**	**6.5900e-003**	**2.0000e-005**	**1.9900e-003**	**1.0000e-005**	**2.0100e-003**	**5.3000e-004**	**1.0000e-005**	**5.4000e-004**	**0.0000**	**1.7712**	**1.7712**	**5.0000e-005**	**0.0000**	**1.7723**

3.4 Framing, mechanical, electrical plumbing - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1117	0.8134	0.7253	1.2100e-003		0.0438	0.0438		0.0423	0.0423	0.0000	99.8482	99.8482	0.0185	0.0000	100.3116
Total	**0.1117**	**0.8134**	**0.7253**	**1.2100e-003**		**0.0438**	**0.0438**		**0.0423**	**0.0423**	**0.0000**	**99.8482**	**99.8482**	**0.0185**	**0.0000**	**100.3116**

3.4 Framing, mechanical, electrical plumbing - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0107	0.3362	0.0724	7.9000e-004	0.0188	1.5600e-003	0.0203	5.4300e-003	1.4900e-003	6.9300e-003	0.0000	75.6500	75.6500	4.3500e-003	0.0000	75.7587
Worker	0.0382	0.0282	0.2892	8.6000e-004	0.0874	6.1000e-004	0.0880	0.0233	5.6000e-004	0.0238	0.0000	77.7007	77.7007	2.0100e-003	0.0000	77.7508
Total	**0.0490**	**0.3644**	**0.3617**	**1.6500e-003**	**0.1062**	**2.1700e-003**	**0.1084**	**0.0287**	**2.0500e-003**	**0.0307**	**0.0000**	**153.3506**	**153.3506**	**6.3600e-003**	**0.0000**	**153.5095**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1117	0.8134	0.7253	1.2100e-003		0.0438	0.0438		0.0423	0.0423	0.0000	99.8481	99.8481	0.0185	0.0000	100.3114
Total	**0.1117**	**0.8134**	**0.7253**	**1.2100e-003**		**0.0438**	**0.0438**		**0.0423**	**0.0423**	**0.0000**	**99.8481**	**99.8481**	**0.0185**	**0.0000**	**100.3114**

3.4 Framing, mechanical, electrical plumbing - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0107	0.3362	0.0724	7.9000e-004	0.0188	1.5600e-003	0.0203	5.4300e-003	1.4900e-003	6.9300e-003	0.0000	75.6500	75.6500	4.3500e-003	0.0000	75.7587
Worker	0.0382	0.0282	0.2892	8.6000e-004	0.0874	6.1000e-004	0.0880	0.0233	5.6000e-004	0.0238	0.0000	77.7007	77.7007	2.0100e-003	0.0000	77.7508
Total	**0.0490**	**0.3644**	**0.3617**	**1.6500e-003**	**0.1062**	**2.1700e-003**	**0.1084**	**0.0287**	**2.0500e-003**	**0.0307**	**0.0000**	**153.3506**	**153.3506**	**6.3600e-003**	**0.0000**	**153.5095**

3.5 Exterior and interior finishes - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0904	0.6581	0.5869	9.8000e-004		0.0354	0.0354		0.0342	0.0342	0.0000	80.7863	80.7863	0.0150	0.0000	81.1612
Total	**0.0904**	**0.6581**	**0.5869**	**9.8000e-004**		**0.0354**	**0.0354**		**0.0342**	**0.0342**	**0.0000**	**80.7863**	**80.7863**	**0.0150**	**0.0000**	**81.1612**

3.5 Exterior and interior finishes - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	8.6900e-003	0.2720	0.0586	6.4000e-004	0.0152	1.2600e-003	0.0165	4.4000e-003	1.2100e-003	5.6000e-003	0.0000	61.2077	61.2077	3.5200e-003	0.0000	61.2957
Worker	0.0309	0.0228	0.2340	7.0000e-004	0.0707	4.9000e-004	0.0712	0.0188	4.5000e-004	0.0193	0.0000	62.8669	62.8669	1.6200e-003	0.0000	62.9075
Total	**0.0396**	**0.2948**	**0.2926**	**1.3400e-003**	**0.0859**	**1.7500e-003**	**0.0877**	**0.0232**	**1.6600e-003**	**0.0249**	**0.0000**	**124.0746**	**124.0746**	**5.1400e-003**	**0.0000**	**124.2032**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0904	0.6581	0.5869	9.8000e-004		0.0354	0.0354		0.0342	0.0342	0.0000	80.7862	80.7862	0.0150	0.0000	81.1611
Total	**0.0904**	**0.6581**	**0.5869**	**9.8000e-004**		**0.0354**	**0.0354**		**0.0342**	**0.0342**	**0.0000**	**80.7862**	**80.7862**	**0.0150**	**0.0000**	**81.1611**

3.5 Exterior and interior finishes - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	8.6900e-003	0.2720	0.0586	6.4000e-004	0.0152	1.2600e-003	0.0165	4.4000e-003	1.2100e-003	5.6000e-003	0.0000	61.2077	61.2077	3.5200e-003	0.0000	61.2957
Worker	0.0309	0.0228	0.2340	7.0000e-004	0.0707	4.9000e-004	0.0712	0.0188	4.5000e-004	0.0193	0.0000	62.8669	62.8669	1.6200e-003	0.0000	62.9075
Total	**0.0396**	**0.2948**	**0.2926**	**1.3400e-003**	**0.0859**	**1.7500e-003**	**0.0877**	**0.0232**	**1.6600e-003**	**0.0249**	**0.0000**	**124.0746**	**124.0746**	**5.1400e-003**	**0.0000**	**124.2032**

3.5 Exterior and interior finishes - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0653	0.4909	0.4644	7.9000e-004		0.0246	0.0246		0.0238	0.0238	0.0000	65.3571	65.3571	0.0117	0.0000	65.6488
Total	**0.0653**	**0.4909**	**0.4644**	**7.9000e-004**		**0.0246**	**0.0246**		**0.0238**	**0.0238**	**0.0000**	**65.3571**	**65.3571**	**0.0117**	**0.0000**	**65.6488**

3.5 Exterior and interior finishes - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	5.7900e-003	0.2002	0.0424	5.1000e-004	0.0123	4.2000e-004	0.0127	3.5600e-003	4.0000e-004	3.9600e-003	0.0000	49.0409	49.0409	2.6900e-003	0.0000	49.1082
Worker	0.0231	0.0165	0.1725	5.4000e-004	0.0572	3.8000e-004	0.0576	0.0152	3.5000e-004	0.0156	0.0000	49.0943	49.0943	1.1700e-003	0.0000	49.1236
Total	**0.0289**	**0.2167**	**0.2149**	**1.0500e-003**	**0.0695**	**8.0000e-004**	**0.0703**	**0.0188**	**7.5000e-004**	**0.0195**	**0.0000**	**98.1352**	**98.1352**	**3.8600e-003**	**0.0000**	**98.2319**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0653	0.4909	0.4644	7.9000e-004		0.0246	0.0246		0.0238	0.0238	0.0000	65.3571	65.3571	0.0117	0.0000	65.6488
Total	**0.0653**	**0.4909**	**0.4644**	**7.9000e-004**		**0.0246**	**0.0246**		**0.0238**	**0.0238**	**0.0000**	**65.3571**	**65.3571**	**0.0117**	**0.0000**	**65.6488**

3.5 Exterior and interior finishes - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	5.7900e-003	0.2002	0.0424	5.1000e-004	0.0123	4.2000e-004	0.0127	3.5600e-003	4.0000e-004	3.9600e-003	0.0000	49.0409	49.0409	2.6900e-003	0.0000	49.1082
Worker	0.0231	0.0165	0.1725	5.4000e-004	0.0572	3.8000e-004	0.0576	0.0152	3.5000e-004	0.0156	0.0000	49.0943	49.0943	1.1700e-003	0.0000	49.1236
Total	**0.0289**	**0.2167**	**0.2149**	**1.0500e-003**	**0.0695**	**8.0000e-004**	**0.0703**	**0.0188**	**7.5000e-004**	**0.0195**	**0.0000**	**98.1352**	**98.1352**	**3.8600e-003**	**0.0000**	**98.2319**

3.6 Sidewalks - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0135	0.1355	0.1550	2.4000e-004		7.2700e-003	7.2700e-003		6.7000e-003	6.7000e-003	0.0000	20.5887	20.5887	6.5300e-003	0.0000	20.7519
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0135**	**0.1355**	**0.1550**	**2.4000e-004**		**7.2700e-003**	**7.2700e-003**		**6.7000e-003**	**6.7000e-003**	**0.0000**	**20.5887**	**20.5887**	**6.5300e-003**	**0.0000**	**20.7519**

3.6 Sidewalks - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.3000e-004	5.2000e-004	5.4200e-003	2.0000e-005	1.8000e-003	1.0000e-005	1.8100e-003	4.8000e-004	1.0000e-005	4.9000e-004	0.0000	1.5435	1.5435	4.0000e-005	0.0000	1.5445
Total	**7.3000e-004**	**5.2000e-004**	**5.4200e-003**	**2.0000e-005**	**1.8000e-003**	**1.0000e-005**	**1.8100e-003**	**4.8000e-004**	**1.0000e-005**	**4.9000e-004**	**0.0000**	**1.5435**	**1.5435**	**4.0000e-005**	**0.0000**	**1.5445**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0135	0.1355	0.1550	2.4000e-004		7.2700e-003	7.2700e-003		6.7000e-003	6.7000e-003	0.0000	20.5887	20.5887	6.5300e-003	0.0000	20.7519
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0135**	**0.1355**	**0.1550**	**2.4000e-004**		**7.2700e-003**	**7.2700e-003**		**6.7000e-003**	**6.7000e-003**	**0.0000**	**20.5887**	**20.5887**	**6.5300e-003**	**0.0000**	**20.7519**

3.6 Sidewalks - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.3000e-004	5.2000e-004	5.4200e-003	2.0000e-005	1.8000e-003	1.0000e-005	1.8100e-003	4.8000e-004	1.0000e-005	4.9000e-004	0.0000	1.5435	1.5435	4.0000e-005	0.0000	1.5445
Total	**7.3000e-004**	**5.2000e-004**	**5.4200e-003**	**2.0000e-005**	**1.8000e-003**	**1.0000e-005**	**1.8100e-003**	**4.8000e-004**	**1.0000e-005**	**4.9000e-004**	**0.0000**	**1.5435**	**1.5435**	**4.0000e-005**	**0.0000**	**1.5445**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Mid Rise	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Mid Rise	10.80	4.80	5.70	31.00	15.00	54.00	86	11	3
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Mid Rise	0.561348	0.038614	0.190285	0.107199	0.015389	0.005180	0.024554	0.046236	0.002209	0.002456	0.005491	0.000334	0.000704
University/College (4Yr)	0.561348	0.038614	0.190285	0.107199	0.015389	0.005180	0.024554	0.046236	0.002209	0.002456	0.005491	0.000334	0.000704

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	845.1336	845.1336	0.0382	7.9100e-003	848.4450
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	845.1336	845.1336	0.0382	7.9100e-003	848.4450
NaturalGas Mitigated	0.0481	0.4330	0.3387	2.6200e-003		0.0332	0.0332		0.0332	0.0332	0.0000	475.5757	475.5757	9.1200e-003	8.7200e-003	478.4018
NaturalGas Unmitigated	0.0481	0.4330	0.3387	2.6200e-003		0.0332	0.0332		0.0332	0.0332	0.0000	475.5757	475.5757	9.1200e-003	8.7200e-003	478.4018

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Apartments Mid Rise	1.30956e +006	7.0600e-003	0.0603	0.0257	3.9000e-004		4.8800e-003	4.8800e-003		4.8800e-003	4.8800e-003	0.0000	69.8834	69.8834	1.3400e-003	1.2800e-003	70.2986
University/College (4Yr)	2.19654e +006	0.0118	0.1077	0.0905	6.5000e-004		8.1800e-003	8.1800e-003		8.1800e-003	8.1800e-003	0.0000	117.2155	117.2155	2.2500e-003	2.1500e-003	117.9121
University/College (4Yr)	5.40585e +006	0.0292	0.2650	0.2226	1.5900e-003		0.0201	0.0201		0.0201	0.0201	0.0000	288.4768	288.4768	5.5300e-003	5.2900e-003	290.1911
Total		**0.0481**	**0.4330**	**0.3387**	**2.6300e-003**		**0.0332**	**0.0332**		**0.0332**	**0.0332**	**0.0000**	**475.5757**	**475.5757**	**9.1200e-003**	**8.7200e-003**	**478.4018**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Apartments Mid Rise	1.30956e +006	7.0600e-003	0.0603	0.0257	3.9000e-004		4.8800e-003	4.8800e-003		4.8800e-003	4.8800e-003	0.0000	69.8834	69.8834	1.3400e-003	1.2800e-003	70.2986
University/College (4Yr)	2.19654e +006	0.0118	0.1077	0.0905	6.5000e-004		8.1800e-003	8.1800e-003		8.1800e-003	8.1800e-003	0.0000	117.2155	117.2155	2.2500e-003	2.1500e-003	117.9121
University/College (4Yr)	5.40585e +006	0.0292	0.2650	0.2226	1.5900e-003		0.0201	0.0201		0.0201	0.0201	0.0000	288.4768	288.4768	5.5300e-003	5.2900e-003	290.1911
Total		**0.0481**	**0.4330**	**0.3387**	**2.6300e-003**		**0.0332**	**0.0332**		**0.0332**	**0.0332**	**0.0000**	**475.5757**	**475.5757**	**9.1200e-003**	**8.7200e-003**	**478.4018**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Mid Rise	633299	184.2338	8.3300e-003	1.7200e-003	184.9557
University/College (4Yr)	1.61543e+006	469.9479	0.0213	4.4000e-003	471.7893
University/College (4Yr)	656392	190.9519	8.6300e-003	1.7900e-003	191.7001
Total		**845.1336**	**0.0382**	**7.9100e-003**	**848.4450**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Apartments Mid Rise	633299	184.2338	8.3300e-003	1.7200e-003	184.9557
University/College (4Yr)	1.61543e+006	469.9479	0.0213	4.4000e-003	471.7893
University/College (4Yr)	656392	190.9519	8.6300e-003	1.7900e-003	191.7001
Total		**845.1336**	**0.0382**	**7.9100e-003**	**848.4450**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.7099	0.0129	1.1228	6.0000e-005		6.2000e-003	6.2000e-003		6.2000e-003	6.2000e-003	0.0000	1.8363	1.8363	1.7900e-003	0.0000	1.8812
Unmitigated	1.7099	0.0129	1.1228	6.0000e-005		6.2000e-003	6.2000e-003		6.2000e-003	6.2000e-003	0.0000	1.8363	1.8363	1.7900e-003	0.0000	1.8812

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.2215					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.4540					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0344	0.0129	1.1228	6.0000e-005		6.2000e-003	6.2000e-003		6.2000e-003	6.2000e-003	0.0000	1.8363	1.8363	1.7900e-003	0.0000	1.8812
Total	**1.7099**	**0.0129**	**1.1228**	**6.0000e-005**		**6.2000e-003**	**6.2000e-003**		**6.2000e-003**	**6.2000e-003**	**0.0000**	**1.8363**	**1.8363**	**1.7900e-003**	**0.0000**	**1.8812**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.2215					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	1.4540					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0344	0.0129	1.1228	6.0000e-005		6.2000e-003	6.2000e-003		6.2000e-003	6.2000e-003	0.0000	1.8363	1.8363	1.7900e-003	0.0000	1.8812
Total	**1.7099**	**0.0129**	**1.1228**	**6.0000e-005**		**6.2000e-003**	**6.2000e-003**		**6.2000e-003**	**6.2000e-003**	**0.0000**	**1.8363**	**1.8363**	**1.7900e-003**	**0.0000**	**1.8812**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	33.7797	0.4042	9.7900e-003	46.8022
Unmitigated	33.7797	0.4042	9.7900e-003	46.8022

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Mid Rise	9.7731 / 6.1613	24.7580	0.3194	7.7200e-003	35.0451
University/College (4Yr)	0.748186 / 1.17024	2.6066	0.0245	6.0000e-004	3.3970
University/College (4Yr)	1.84135 / 2.88005	6.4151	0.0603	1.4700e-003	8.3602
Total		**33.7797**	**0.4042**	**9.7900e-003**	**46.8022**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Apartments Mid Rise	9.7731 / 6.1613	24.7580	0.3194	7.7200e-003	35.0451
University/College (4Yr)	0.748186 / 1.17024	2.6066	0.0245	6.0000e-004	3.3970
University/College (4Yr)	1.84135 / 2.88005	6.4151	0.0603	1.4700e-003	8.3602
Total		**33.7797**	**0.4042**	**9.7900e-003**	**46.8022**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	60.6436	3.5839	0.0000	150.2418
Unmitigated	60.6436	3.5839	0.0000	150.2418

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Mid Rise	69	14.0064	0.8278	0.0000	34.7002
University/College (4Yr)	156.95	31.8594	1.8828	0.0000	78.9304
University/College (4Yr)	72.8	14.7777	0.8733	0.0000	36.6112
Total		**60.6436**	**3.5839**	**0.0000**	**150.2418**

8.2 Waste by Land Use

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Apartments Mid Rise	69	14.0064	0.8278	0.0000	34.7002
University/College (4Yr)	156.95	31.8594	1.8828	0.0000	78.9304
University/College (4Yr)	72.8	14.7777	0.8733	0.0000	36.6112
Total		**60.6436**	**3.5839**	**0.0000**	**150.2418**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Upper Hearst Development

Alameda County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	91.00	Employee	0.25	64,226.19	0
University/College (4Yr)	860.00	Student	0.25	158,065.82	0
Apartments Mid Rise	150.00	Dwelling Unit	0.50	150,000.00	429

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	63
Climate Zone	5			**Operational Year**	2023
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Per site plans one acre project site. Students = 397 academic classrooms + 450 academic event space + 13 residential amenity space

Construction Phase - Client provided phases and schedule

Trips and VMT -

Demolition - per applicant supplied information. 7,000 cy = 3,300 sf

Grading - Per applicant supplied information 13,000 cy export

Vehicle Trips - Zero trips, project would not increase trips compared to existing conditions.

Woodstoves - No fireplaces per site plans

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblFireplaces	FireplaceDayYear	11.14	0.00
tblFireplaces	FireplaceHourDay	3.50	0.00
tblFireplaces	FireplaceWoodMass	228.80	0.00
tblFireplaces	NumberGas	22.50	0.00
tblFireplaces	NumberNoFireplace	6.00	0.00
tblFireplaces	NumberWood	25.50	0.00
tblGrading	AcresOfGrading	0.75	1.00
tblGrading	MaterialExported	0.00	13,000.00
tblLandUse	LotAcreage	1.47	0.25
tblLandUse	LotAcreage	3.63	0.25
tblLandUse	LotAcreage	3.95	0.50
tblTripsAndVMT	HaulingTripNumber	15.00	0.00
tblTripsAndVMT	HaulingTripNumber	1,625.00	0.00
tblVehicleTrips	ST_TR	6.39	0.00
tblVehicleTrips	ST_TR	3.12	0.00
tblVehicleTrips	ST_TR	1.30	0.00
tblVehicleTrips	SU_TR	5.86	0.00
tblVehicleTrips	WD_TR	6.65	0.00
tblVehicleTrips	WD_TR	8.96	0.00
tblVehicleTrips	WD_TR	1.71	0.00
tblWoodstoves	NumberCatalytic	3.00	0.00
tblWoodstoves	NumberNoncatalytic	3.00	0.00
tblWoodstoves	WoodstoveDayYear	14.12	0.00
tblWoodstoves	WoodstoveWoodMass	582.40	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	2.3470	22.7082	15.3064	0.0252	5.8476	1.2870	6.5845	2.6687	1.2024	3.3466	0.0000	2,472.7783	2,472.7783	0.6043	0.0000	2,487.8851
2020	2.9571	21.2838	20.1491	0.0534	5.8476	0.8351	6.5324	2.6687	0.8059	3.2987	0.0000	5,214.1254	5,214.1254	0.4980	0.0000	5,226.5745
2021	2.6488	19.5476	19.2298	0.0527	2.0035	0.7065	2.7100	0.5394	0.6816	1.2210	0.0000	5,141.2210	5,141.2210	0.4747	0.0000	5,153.0876
Maximum	**2.9571**	**22.7082**	**20.1491**	**0.0534**	**5.8476**	**1.2870**	**6.5845**	**2.6687**	**1.2024**	**3.3466**	**0.0000**	**5,214.1254**	**5,214.1254**	**0.6043**	**0.0000**	**5,226.5745**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	2.3470	22.7082	15.3064	0.0252	5.8476	1.2870	6.5845	2.6687	1.2024	3.3466	0.0000	2,472.7783	2,472.7783	0.6043	0.0000	2,487.8851
2020	2.9571	21.2838	20.1491	0.0534	5.8476	0.8351	6.5324	2.6687	0.8059	3.2987	0.0000	5,214.1254	5,214.1254	0.4980	0.0000	5,226.5745
2021	2.6488	19.5476	19.2298	0.0527	2.0035	0.7065	2.7100	0.5394	0.6816	1.2210	0.0000	5,141.2210	5,141.2210	0.4747	0.0000	5,153.0876
Maximum	**2.9571**	**22.7082**	**20.1491**	**0.0534**	**5.8476**	**1.2870**	**6.5845**	**2.6687**	**1.2024**	**3.3466**	**0.0000**	**5,214.1254**	**5,214.1254**	**0.6043**	**0.0000**	**5,226.5745**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	9.5627	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689	0.0000	22.4910	22.4910	0.0220	0.0000	23.0403
Energy	0.2633	2.3727	1.8560	0.0144		0.1819	0.1819		0.1819	0.1819		2,872.5064	2,872.5064	0.0551	0.0527	2,889.5763
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**9.8260**	**2.5162**	**14.3310**	**0.0150**	**0.0000**	**0.2508**	**0.2508**	**0.0000**	**0.2508**	**0.2508**	**0.0000**	**2,894.9974**	**2,894.9974**	**0.0770**	**0.0527**	**2,912.6166**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	9.5627	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689	0.0000	22.4910	22.4910	0.0220	0.0000	23.0403
Energy	0.2633	2.3727	1.8560	0.0144		0.1819	0.1819		0.1819	0.1819		2,872.5064	2,872.5064	0.0551	0.0527	2,889.5763
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**9.8260**	**2.5162**	**14.3310**	**0.0150**	**0.0000**	**0.2508**	**0.2508**	**0.0000**	**0.2508**	**0.2508**	**0.0000**	**2,894.9974**	**2,894.9974**	**0.0770**	**0.0527**	**2,912.6166**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demo, Concrete	Demolition	7/1/2019	11/11/2019	5	10	
2	Earthwork, grading	Grading	11/12/2019	3/27/2020	5	2	
3	Framing, mechanical, electrical plumbing	Building Construction	3/30/2020	8/28/2020	5	100	
4	Exterior and interior finishes	Building Construction	8/31/2020	4/12/2021	5	100	
5	Sidewalks	Paving	4/13/2021	5/31/2021	5	5	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demo, Concrete	Concrete/Industrial Saws	1	8.00	81	0.73
Demo, Concrete	Rubber Tired Dozers	1	8.00	247	0.40
Demo, Concrete	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Earthwork, grading	Graders	1	6.00	187	0.41
Earthwork, grading	Rubber Tired Dozers	1	6.00	247	0.40
Earthwork, grading	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Framing, mechanical, electrical plumbing	Cranes	1	6.00	231	0.29
Framing, mechanical, electrical plumbing	Forklifts	1	6.00	89	0.20
Framing, mechanical, electrical plumbing	Generator Sets	1	8.00	84	0.74
Framing, mechanical, electrical plumbing	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Framing, mechanical, electrical plumbing	Welders	3	8.00	46	0.45
Exterior and interior finishes	Cranes	1	6.00	231	0.29
Exterior and interior finishes	Forklifts	1	6.00	89	0.20
Exterior and interior finishes	Generator Sets	1	8.00	84	0.74
Exterior and interior finishes	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Exterior and interior finishes	Welders	3	8.00	46	0.45
Sidewalks	Cement and Mortar Mixers	1	6.00	9	0.56
Sidewalks	Pavers	1	6.00	130	0.42
Sidewalks	Paving Equipment	1	8.00	132	0.36
Sidewalks	Rollers	1	7.00	80	0.38
Sidewalks	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demo, Concrete	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Earthwork, grading	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Framing, mechanical, electrical plumbing	7	201.00	52.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Exterior and interior finishes	7	201.00	52.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Sidewalks	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demo, Concrete - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.3248	0.0000	0.3248	0.0492	0.0000	0.0492			0.0000			0.0000
Off-Road	2.2950	22.6751	14.8943	0.0241		1.2863	1.2863		1.2017	1.2017		2,360.7198	2,360.7198	0.6011		2,375.7475
Total	**2.2950**	**22.6751**	**14.8943**	**0.0241**	**0.3248**	**1.2863**	**1.6111**	**0.0492**	**1.2017**	**1.2509**		**2,360.7198**	**2,360.7198**	**0.6011**		**2,375.7475**

3.2 Demo, Concrete - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0520	0.0331	0.4121	1.1300e-003	0.1068	7.3000e-004	0.1075	0.0283	6.8000e-004	0.0290		112.0586	112.0586	3.1600e-003		112.1376
Total	**0.0520**	**0.0331**	**0.4121**	**1.1300e-003**	**0.1068**	**7.3000e-004**	**0.1075**	**0.0283**	**6.8000e-004**	**0.0290**		**112.0586**	**112.0586**	**3.1600e-003**		**112.1376**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.3248	0.0000	0.3248	0.0492	0.0000	0.0492			0.0000			0.0000
Off-Road	2.2950	22.6751	14.8943	0.0241		1.2863	1.2863		1.2017	1.2017	0.0000	2,360.7197	2,360.7197	0.6011		2,375.7475
Total	**2.2950**	**22.6751**	**14.8943**	**0.0241**	**0.3248**	**1.2863**	**1.6111**	**0.0492**	**1.2017**	**1.2509**	**0.0000**	**2,360.7197**	**2,360.7197**	**0.6011**		**2,375.7475**

3.2 Demo, Concrete - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0520	0.0331	0.4121	1.1300e-003	0.1068	7.3000e-004	0.1075	0.0283	6.8000e-004	0.0290		112.0586	112.0586	3.1600e-003		112.1376
Total	**0.0520**	**0.0331**	**0.4121**	**1.1300e-003**	**0.1068**	**7.3000e-004**	**0.1075**	**0.0283**	**6.8000e-004**	**0.0290**		**112.0586**	**112.0586**	**3.1600e-003**		**112.1376**

3.3 Earthwork, grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7819	0.0000	5.7819	2.6512	0.0000	2.6512			0.0000			0.0000
Off-Road	1.4197	16.0357	6.6065	0.0141		0.7365	0.7365		0.6775	0.6775		1,396.3909	1,396.3909	0.4418		1,407.4359
Total	**1.4197**	**16.0357**	**6.6065**	**0.0141**	**5.7819**	**0.7365**	**6.5184**	**2.6512**	**0.6775**	**3.3288**		**1,396.3909**	**1,396.3909**	**0.4418**		**1,407.4359**

3.3 Earthwork, grading - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0320	0.0204	0.2536	6.9000e-004	0.0657	4.5000e-004	0.0662	0.0174	4.2000e-004	0.0179		68.9591	68.9591	1.9500e-003		69.0078
Total	**0.0320**	**0.0204**	**0.2536**	**6.9000e-004**	**0.0657**	**4.5000e-004**	**0.0662**	**0.0174**	**4.2000e-004**	**0.0179**		**68.9591**	**68.9591**	**1.9500e-003**		**69.0078**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7819	0.0000	5.7819	2.6512	0.0000	2.6512			0.0000			0.0000
Off-Road	1.4197	16.0357	6.6065	0.0141		0.7365	0.7365		0.6775	0.6775	0.0000	1,396.3909	1,396.3909	0.4418		1,407.4359
Total	**1.4197**	**16.0357**	**6.6065**	**0.0141**	**5.7819**	**0.7365**	**6.5184**	**2.6512**	**0.6775**	**3.3288**	**0.0000**	**1,396.3909**	**1,396.3909**	**0.4418**		**1,407.4359**

3.3 Earthwork, grading - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0320	0.0204	0.2536	6.9000e-004	0.0657	4.5000e-004	0.0662	0.0174	4.2000e-004	0.0179		68.9591	68.9591	1.9500e-003		69.0078
Total	**0.0320**	**0.0204**	**0.2536**	**6.9000e-004**	**0.0657**	**4.5000e-004**	**0.0662**	**0.0174**	**4.2000e-004**	**0.0179**		**68.9591**	**68.9591**	**1.9500e-003**		**69.0078**

3.3 Earthwork, grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7819	0.0000	5.7819	2.6512	0.0000	2.6512			0.0000			0.0000
Off-Road	1.3498	15.0854	6.4543	0.0141		0.6844	0.6844		0.6296	0.6296		1,365.7183	1,365.7183	0.4417		1,376.7609
Total	**1.3498**	**15.0854**	**6.4543**	**0.0141**	**5.7819**	**0.6844**	**6.4663**	**2.6512**	**0.6296**	**3.2809**		**1,365.7183**	**1,365.7183**	**0.4417**		**1,376.7609**

3.3 Earthwork, grading - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0293	0.0180	0.2282	6.7000e-004	0.0657	4.4000e-004	0.0662	0.0174	4.0000e-004	0.0178		66.8289	66.8289	1.7100e-003		66.8718
Total	**0.0293**	**0.0180**	**0.2282**	**6.7000e-004**	**0.0657**	**4.4000e-004**	**0.0662**	**0.0174**	**4.0000e-004**	**0.0178**		**66.8289**	**66.8289**	**1.7100e-003**		**66.8718**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7819	0.0000	5.7819	2.6512	0.0000	2.6512			0.0000			0.0000
Off-Road	1.3498	15.0854	6.4543	0.0141		0.6844	0.6844		0.6296	0.6296	0.0000	1,365.7183	1,365.7183	0.4417		1,376.7609
Total	**1.3498**	**15.0854**	**6.4543**	**0.0141**	**5.7819**	**0.6844**	**6.4663**	**2.6512**	**0.6296**	**3.2809**	**0.0000**	**1,365.7183**	**1,365.7183**	**0.4417**		**1,376.7609**

3.3 Earthwork, grading - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0293	0.0180	0.2282	6.7000e-004	0.0657	4.4000e-004	0.0662	0.0174	4.0000e-004	0.0178		66.8289	66.8289	1.7100e-003		66.8718
Total	**0.0293**	**0.0180**	**0.2282**	**6.7000e-004**	**0.0657**	**4.4000e-004**	**0.0662**	**0.0174**	**4.0000e-004**	**0.0178**		**66.8289**	**66.8289**	**1.7100e-003**		**66.8718**

3.4 Framing, mechanical, electrical plumbing - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0305	14.7882	13.1881	0.0220		0.7960	0.7960		0.7688	0.7688		2,001.1595	2,001.1595	0.3715		2,010.4467
Total	**2.0305**	**14.7882**	**13.1881**	**0.0220**		**0.7960**	**0.7960**		**0.7688**	**0.7688**		**2,001.1595**	**2,001.1595**	**0.3715**		**2,010.4467**

3.4 Framing, mechanical, electrical plumbing - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1913	6.0430	1.2272	0.0145	0.3523	0.0282	0.3805	0.1015	0.0270	0.1284		1,533.888 9	1,533.888 9	0.0835		1,535.975 0
Worker	0.7354	0.4525	5.7338	0.0169	1.6512	0.0110	1.6622	0.4380	0.0102	0.4481		1,679.077 0	1,679.077 0	0.0430		1,680.152 8
Total	**0.9266**	**6.4955**	**6.9610**	**0.0314**	**2.0035**	**0.0392**	**2.0427**	**0.5394**	**0.0371**	**0.5765**		**3,212.965 9**	**3,212.965 9**	**0.1265**		**3,216.127 8**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0305	14.7882	13.1881	0.0220		0.7960	0.7960		0.7688	0.7688	0.0000	2,001.159 5	2,001.159 5	0.3715		2,010.446 7
Total	**2.0305**	**14.7882**	**13.1881**	**0.0220**		**0.7960**	**0.7960**		**0.7688**	**0.7688**	**0.0000**	**2,001.159 5**	**2,001.159 5**	**0.3715**		**2,010.446 7**

3.4 Framing, mechanical, electrical plumbing - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1913	6.0430	1.2272	0.0145	0.3523	0.0282	0.3805	0.1015	0.0270	0.1284		1,533.8889	1,533.8889	0.0835		1,535.9750
Worker	0.7354	0.4525	5.7338	0.0169	1.6512	0.0110	1.6622	0.4380	0.0102	0.4481		1,679.0770	1,679.0770	0.0430		1,680.1528
Total	**0.9266**	**6.4955**	**6.9610**	**0.0314**	**2.0035**	**0.0392**	**2.0427**	**0.5394**	**0.0371**	**0.5765**		**3,212.9659**	**3,212.9659**	**0.1265**		**3,216.1278**

3.5 Exterior and interior finishes - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0305	14.7882	13.1881	0.0220		0.7960	0.7960		0.7688	0.7688		2,001.1595	2,001.1595	0.3715		2,010.4467
Total	**2.0305**	**14.7882**	**13.1881**	**0.0220**		**0.7960**	**0.7960**		**0.7688**	**0.7688**		**2,001.1595**	**2,001.1595**	**0.3715**		**2,010.4467**

3.5 Exterior and interior finishes - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1913	6.0430	1.2272	0.0145	0.3523	0.0282	0.3805	0.1015	0.0270	0.1284		1,533.8889	1,533.8889	0.0835		1,535.9750
Worker	0.7354	0.4525	5.7338	0.0169	1.6512	0.0110	1.6622	0.4380	0.0102	0.4481		1,679.0770	1,679.0770	0.0430		1,680.1528
Total	**0.9266**	**6.4955**	**6.9610**	**0.0314**	**2.0035**	**0.0392**	**2.0427**	**0.5394**	**0.0371**	**0.5765**		**3,212.9659**	**3,212.9659**	**0.1265**		**3,216.1278**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0305	14.7882	13.1881	0.0220		0.7960	0.7960		0.7688	0.7688	0.0000	2,001.1595	2,001.1595	0.3715		2,010.4467
Total	**2.0305**	**14.7882**	**13.1881**	**0.0220**		**0.7960**	**0.7960**		**0.7688**	**0.7688**	**0.0000**	**2,001.1595**	**2,001.1595**	**0.3715**		**2,010.4467**

3.5 Exterior and interior finishes - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1913	6.0430	1.2272	0.0145	0.3523	0.0282	0.3805	0.1015	0.0270	0.1284		1,533.888 9	1,533.888 9	0.0835		1,535.975 0
Worker	0.7354	0.4525	5.7338	0.0169	1.6512	0.0110	1.6622	0.4380	0.0102	0.4481		1,679.077 0	1,679.077 0	0.0430		1,680.152 8
Total	**0.9266**	**6.4955**	**6.9610**	**0.0314**	**2.0035**	**0.0392**	**2.0427**	**0.5394**	**0.0371**	**0.5765**		**3,212.965 9**	**3,212.965 9**	**0.1265**		**3,216.127 8**

3.5 Exterior and interior finishes - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8125	13.6361	12.8994	0.0221		0.6843	0.6843		0.6608	0.6608		2,001.220 0	2,001.220 0	0.3573		2,010.151 7
Total	**1.8125**	**13.6361**	**12.8994**	**0.0221**		**0.6843**	**0.6843**		**0.6608**	**0.6608**		**2,001.220 0**	**2,001.220 0**	**0.3573**		**2,010.151 7**

3.5 Exterior and interior finishes - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1573	5.5078	1.0945	0.0144	0.3523	0.0115	0.3638	0.1015	0.0110	0.1124		1,519.1822	1,519.1822	0.0789		1,521.1547
Worker	0.6790	0.4037	5.2360	0.0163	1.6512	0.0107	1.6619	0.4380	9.8400e-003	0.4478		1,620.8188	1,620.8188	0.0385		1,621.7812
Total	**0.8363**	**5.9115**	**6.3305**	**0.0307**	**2.0035**	**0.0221**	**2.0256**	**0.5394**	**0.0208**	**0.5602**		**3,140.0010**	**3,140.0010**	**0.1174**		**3,142.9359**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8125	13.6361	12.8994	0.0221		0.6843	0.6843		0.6608	0.6608	0.0000	2,001.2200	2,001.2200	0.3573		2,010.1517
Total	**1.8125**	**13.6361**	**12.8994**	**0.0221**		**0.6843**	**0.6843**		**0.6608**	**0.6608**	**0.0000**	**2,001.2200**	**2,001.2200**	**0.3573**		**2,010.1517**

3.5 Exterior and interior finishes - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1573	5.5078	1.0945	0.0144	0.3523	0.0115	0.3638	0.1015	0.0110	0.1124		1,519.182 2	1,519.182 2	0.0789		1,521.154 7
Worker	0.6790	0.4037	5.2360	0.0163	1.6512	0.0107	1.6619	0.4380	9.8400e-003	0.4478		1,620.818 8	1,620.818 8	0.0385		1,621.781 2
Total	**0.8363**	**5.9115**	**6.3305**	**0.0307**	**2.0035**	**0.0221**	**2.0256**	**0.5394**	**0.0208**	**0.5602**		**3,140.001 0**	**3,140.001 0**	**0.1174**		**3,142.935 9**

3.6 Sidewalks - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.7739	7.7422	8.8569	0.0135		0.4153	0.4153		0.3830	0.3830		1,296.866 4	1,296.866 4	0.4111		1,307.144 2
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.7739**	**7.7422**	**8.8569**	**0.0135**		**0.4153**	**0.4153**		**0.3830**	**0.3830**		**1,296.866 4**	**1,296.866 4**	**0.4111**		**1,307.144 2**

3.6 Sidewalks - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0439	0.0261	0.3386	1.0500e-003	0.1068	6.9000e-004	0.1075	0.0283	6.4000e-004	0.0290		104.8291	104.8291	2.4900e-003		104.8913
Total	**0.0439**	**0.0261**	**0.3386**	**1.0500e-003**	**0.1068**	**6.9000e-004**	**0.1075**	**0.0283**	**6.4000e-004**	**0.0290**		**104.8291**	**104.8291**	**2.4900e-003**		**104.8913**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.7739	7.7422	8.8569	0.0135		0.4153	0.4153		0.3830	0.3830	0.0000	1,296.8664	1,296.8664	0.4111		1,307.1442
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.7739**	**7.7422**	**8.8569**	**0.0135**		**0.4153**	**0.4153**		**0.3830**	**0.3830**	**0.0000**	**1,296.8664**	**1,296.8664**	**0.4111**		**1,307.1442**

3.6 Sidewalks - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0439	0.0261	0.3386	1.0500e-003	0.1068	6.9000e-004	0.1075	0.0283	6.4000e-004	0.0290		104.8291	104.8291	2.4900e-003		104.8913
Total	**0.0439**	**0.0261**	**0.3386**	**1.0500e-003**	**0.1068**	**6.9000e-004**	**0.1075**	**0.0283**	**6.4000e-004**	**0.0290**		**104.8291**	**104.8291**	**2.4900e-003**		**104.8913**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Mid Rise	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Mid Rise	10.80	4.80	5.70	31.00	15.00	54.00	86	11	3
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Mid Rise	0.561348	0.038614	0.190285	0.107199	0.015389	0.005180	0.024554	0.046236	0.002209	0.002456	0.005491	0.000334	0.000704
University/College (4Yr)	0.561348	0.038614	0.190285	0.107199	0.015389	0.005180	0.024554	0.046236	0.002209	0.002456	0.005491	0.000334	0.000704

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.2633	2.3727	1.8560	0.0144		0.1819	0.1819		0.1819	0.1819		2,872.5064	2,872.5064	0.0551	0.0527	2,889.5763
NaturalGas Unmitigated	0.2633	2.3727	1.8560	0.0144		0.1819	0.1819		0.1819	0.1819		2,872.5064	2,872.5064	0.0551	0.0527	2,889.5763

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Mid Rise	3587.85	0.0387	0.3306	0.1407	2.1100e-003		0.0267	0.0267		0.0267	0.0267		422.0998	422.0998	8.0900e-003	7.7400e-003	424.6081
University/College (4Yr)	14810.6	0.1597	1.4520	1.2197	8.7100e-003		0.1104	0.1104		0.1104	0.1104		1,742.4177	1,742.4177	0.0334	0.0319	1,752.7721
University/College (4Yr)	6017.91	0.0649	0.5900	0.4956	3.5400e-003		0.0448	0.0448		0.0448	0.0448		707.9889	707.9889	0.0136	0.0130	712.1962
Total		**0.2633**	**2.3726**	**1.8560**	**0.0144**		**0.1819**	**0.1819**		**0.1819**	**0.1819**		**2,872.5064**	**2,872.5064**	**0.0551**	**0.0527**	**2,889.5763**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Mid Rise	3.58785	0.0387	0.3306	0.1407	2.1100e-003		0.0267	0.0267		0.0267	0.0267		422.0998	422.0998	8.0900e-003	7.7400e-003	424.6081
University/College (4Yr)	14.8106	0.1597	1.4520	1.2197	8.7100e-003		0.1104	0.1104		0.1104	0.1104		1,742.4177	1,742.4177	0.0334	0.0319	1,752.7721
University/College (4Yr)	6.01791	0.0649	0.5900	0.4956	3.5400e-003		0.0448	0.0448		0.0448	0.0448		707.9889	707.9889	0.0136	0.0130	712.1962
Total		**0.2633**	**2.3726**	**1.8560**	**0.0144**		**0.1819**	**0.1819**		**0.1819**	**0.1819**		**2,872.5064**	**2,872.5064**	**0.0551**	**0.0527**	**2,889.5763**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	9.5627	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689	0.0000	22.4910	22.4910	0.0220	0.0000	23.0403
Unmitigated	9.5627	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689	0.0000	22.4910	22.4910	0.0220	0.0000	23.0403

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	1.2137					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	7.9671					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.3819	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689		22.4910	22.4910	0.0220		23.0403
Total	**9.5627**	**0.1436**	**12.4750**	**6.6000e-004**		**0.0689**	**0.0689**		**0.0689**	**0.0689**	**0.0000**	**22.4910**	**22.4910**	**0.0220**	**0.0000**	**23.0403**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	1.2137					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	7.9671					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.3819	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689		22.4910	22.4910	0.0220		23.0403
Total	**9.5627**	**0.1436**	**12.4750**	**6.6000e-004**		**0.0689**	**0.0689**		**0.0689**	**0.0689**	**0.0000**	**22.4910**	**22.4910**	**0.0220**	**0.0000**	**23.0403**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Upper Hearst Development

Alameda County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
University/College (4Yr)	91.00	Employee	0.25	64,226.19	0
University/College (4Yr)	860.00	Student	0.25	158,065.82	0
Apartments Mid Rise	150.00	Dwelling Unit	0.50	150,000.00	429

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	63
Climate Zone	5			**Operational Year**	2023
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Per site plans one acre project site. Students = 397 academic classrooms + 450 academic event space + 13 residential amenity space

Construction Phase - Client provided phases and schedule

Trips and VMT -

Demolition - per applicant supplied information. 7,000 cy = 3,300 sf

Grading - Per applicant supplied information 13,000 cy export

Vehicle Trips - Zero trips, project would not increase trips compared to existing conditions.

Woodstoves - No fireplaces per site plans

Construction Off-road Equipment Mitigation -

Table Name	Column Name	Default Value	New Value
tblFireplaces	FireplaceDayYear	11.14	0.00
tblFireplaces	FireplaceHourDay	3.50	0.00
tblFireplaces	FireplaceWoodMass	228.80	0.00
tblFireplaces	NumberGas	22.50	0.00
tblFireplaces	NumberNoFireplace	6.00	0.00
tblFireplaces	NumberWood	25.50	0.00
tblGrading	AcresOfGrading	0.75	1.00
tblGrading	MaterialExported	0.00	13,000.00
tblLandUse	LotAcreage	1.47	0.25
tblLandUse	LotAcreage	3.63	0.25
tblLandUse	LotAcreage	3.95	0.50
tblTripsAndVMT	HaulingTripNumber	15.00	0.00
tblTripsAndVMT	HaulingTripNumber	1,625.00	0.00
tblVehicleTrips	ST_TR	6.39	0.00
tblVehicleTrips	ST_TR	3.12	0.00
tblVehicleTrips	ST_TR	1.30	0.00
tblVehicleTrips	SU_TR	5.86	0.00
tblVehicleTrips	WD_TR	6.65	0.00
tblVehicleTrips	WD_TR	8.96	0.00
tblVehicleTrips	WD_TR	1.71	0.00
tblWoodstoves	NumberCatalytic	3.00	0.00
tblWoodstoves	NumberNoncatalytic	3.00	0.00
tblWoodstoves	WoodstoveDayYear	14.12	0.00
tblWoodstoves	WoodstoveWoodMass	582.40	0.00

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	2.3493	22.7162	15.2853	0.0251	5.8476	1.2870	6.5845	2.6687	1.2024	3.3466	0.0000	2,463.8424	2,463.8424	0.6041	0.0000	2,478.9446
2020	2.9986	21.4531	20.0230	0.0517	5.8476	0.8356	6.5324	2.6687	0.8064	3.2987	0.0000	5,038.0014	5,038.0014	0.5038	0.0000	5,050.5962
2021	2.6873	19.6862	19.0998	0.0510	2.0035	0.7068	2.7103	0.5394	0.6819	1.2214	0.0000	4,970.1097	4,970.1097	0.4803	0.0000	4,982.1172
Maximum	**2.9986**	**22.7162**	**20.0230**	**0.0517**	**5.8476**	**1.2870**	**6.5845**	**2.6687**	**1.2024**	**3.3466**	**0.0000**	**5,038.0014**	**5,038.0014**	**0.6041**	**0.0000**	**5,050.5962**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	2.3493	22.7162	15.2853	0.0251	5.8476	1.2870	6.5845	2.6687	1.2024	3.3466	0.0000	2,463.8424	2,463.8424	0.6041	0.0000	2,478.9446
2020	2.9986	21.4531	20.0230	0.0517	5.8476	0.8356	6.5324	2.6687	0.8064	3.2987	0.0000	5,038.0014	5,038.0014	0.5038	0.0000	5,050.5962
2021	2.6873	19.6862	19.0998	0.0510	2.0035	0.7068	2.7103	0.5394	0.6819	1.2214	0.0000	4,970.1097	4,970.1097	0.4803	0.0000	4,982.1172
Maximum	**2.9986**	**22.7162**	**20.0230**	**0.0517**	**5.8476**	**1.2870**	**6.5845**	**2.6687**	**1.2024**	**3.3466**	**0.0000**	**5,038.0014**	**5,038.0014**	**0.6041**	**0.0000**	**5,050.5962**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	9.5627	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689	0.0000	22.4910	22.4910	0.0220	0.0000	23.0403
Energy	0.2633	2.3727	1.8560	0.0144		0.1819	0.1819		0.1819	0.1819		2,872.5064	2,872.5064	0.0551	0.0527	2,889.5763
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**9.8260**	**2.5162**	**14.3310**	**0.0150**	**0.0000**	**0.2508**	**0.2508**	**0.0000**	**0.2508**	**0.2508**	**0.0000**	**2,894.9974**	**2,894.9974**	**0.0770**	**0.0527**	**2,912.6166**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	9.5627	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689	0.0000	22.4910	22.4910	0.0220	0.0000	23.0403
Energy	0.2633	2.3727	1.8560	0.0144		0.1819	0.1819		0.1819	0.1819		2,872.5064	2,872.5064	0.0551	0.0527	2,889.5763
Mobile	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Total	**9.8260**	**2.5162**	**14.3310**	**0.0150**	**0.0000**	**0.2508**	**0.2508**	**0.0000**	**0.2508**	**0.2508**	**0.0000**	**2,894.9974**	**2,894.9974**	**0.0770**	**0.0527**	**2,912.6166**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demo, Concrete	Demolition	7/1/2019	11/11/2019	5	10	
2	Earthwork, grading	Grading	11/12/2019	3/27/2020	5	2	
3	Framing, mechanical, electrical plumbing	Building Construction	3/30/2020	8/28/2020	5	100	
4	Exterior and interior finishes	Building Construction	8/31/2020	4/12/2021	5	100	
5	Sidewalks	Paving	4/13/2021	5/31/2021	5	5	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demo, Concrete	Concrete/Industrial Saws	1	8.00	81	0.73
Demo, Concrete	Rubber Tired Dozers	1	8.00	247	0.40
Demo, Concrete	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Earthwork, grading	Graders	1	6.00	187	0.41
Earthwork, grading	Rubber Tired Dozers	1	6.00	247	0.40
Earthwork, grading	Tractors/Loaders/Backhoes	1	7.00	97	0.37
Framing, mechanical, electrical plumbing	Cranes	1	6.00	231	0.29
Framing, mechanical, electrical plumbing	Forklifts	1	6.00	89	0.20
Framing, mechanical, electrical plumbing	Generator Sets	1	8.00	84	0.74
Framing, mechanical, electrical plumbing	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Framing, mechanical, electrical plumbing	Welders	3	8.00	46	0.45
Exterior and interior finishes	Cranes	1	6.00	231	0.29
Exterior and interior finishes	Forklifts	1	6.00	89	0.20
Exterior and interior finishes	Generator Sets	1	8.00	84	0.74
Exterior and interior finishes	Tractors/Loaders/Backhoes	1	6.00	97	0.37
Exterior and interior finishes	Welders	3	8.00	46	0.45
Sidewalks	Cement and Mortar Mixers	1	6.00	9	0.56
Sidewalks	Pavers	1	6.00	130	0.42
Sidewalks	Paving Equipment	1	8.00	132	0.36
Sidewalks	Rollers	1	7.00	80	0.38
Sidewalks	Tractors/Loaders/Backhoes	1	8.00	97	0.37

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demo, Concrete	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Earthwork, grading	3	8.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Framing, mechanical, electrical plumbing	7	201.00	52.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Exterior and interior finishes	7	201.00	52.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Sidewalks	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demo, Concrete - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.3248	0.0000	0.3248	0.0492	0.0000	0.0492			0.0000			0.0000
Off-Road	2.2950	22.6751	14.8943	0.0241		1.2863	1.2863		1.2017	1.2017		2,360.7198	2,360.7198	0.6011		2,375.7475
Total	**2.2950**	**22.6751**	**14.8943**	**0.0241**	**0.3248**	**1.2863**	**1.6111**	**0.0492**	**1.2017**	**1.2509**		**2,360.7198**	**2,360.7198**	**0.6011**		**2,375.7475**

3.2 Demo, Concrete - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0543	0.0412	0.3910	1.0400e-003	0.1068	7.3000e-004	0.1075	0.0283	6.8000e-004	0.0290		103.1226	103.1226	2.9800e-003		103.1972
Total	**0.0543**	**0.0412**	**0.3910**	**1.0400e-003**	**0.1068**	**7.3000e-004**	**0.1075**	**0.0283**	**6.8000e-004**	**0.0290**		**103.1226**	**103.1226**	**2.9800e-003**		**103.1972**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					0.3248	0.0000	0.3248	0.0492	0.0000	0.0492			0.0000			0.0000
Off-Road	2.2950	22.6751	14.8943	0.0241		1.2863	1.2863		1.2017	1.2017	0.0000	2,360.7197	2,360.7197	0.6011		2,375.7475
Total	**2.2950**	**22.6751**	**14.8943**	**0.0241**	**0.3248**	**1.2863**	**1.6111**	**0.0492**	**1.2017**	**1.2509**	**0.0000**	**2,360.7197**	**2,360.7197**	**0.6011**		**2,375.7475**

3.2 Demo, Concrete - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0543	0.0412	0.3910	1.0400e-003	0.1068	7.3000e-004	0.1075	0.0283	6.8000e-004	0.0290		103.1226	103.1226	2.9800e-003		103.1972
Total	**0.0543**	**0.0412**	**0.3910**	**1.0400e-003**	**0.1068**	**7.3000e-004**	**0.1075**	**0.0283**	**6.8000e-004**	**0.0290**		**103.1226**	**103.1226**	**2.9800e-003**		**103.1972**

3.3 Earthwork, grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7819	0.0000	5.7819	2.6512	0.0000	2.6512			0.0000			0.0000
Off-Road	1.4197	16.0357	6.6065	0.0141		0.7365	0.7365		0.6775	0.6775		1,396.3909	1,396.3909	0.4418		1,407.4359
Total	**1.4197**	**16.0357**	**6.6065**	**0.0141**	**5.7819**	**0.7365**	**6.5184**	**2.6512**	**0.6775**	**3.3288**		**1,396.3909**	**1,396.3909**	**0.4418**		**1,407.4359**

3.3 Earthwork, grading - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0334	0.0253	0.2406	6.4000e-004	0.0657	4.5000e-004	0.0662	0.0174	4.2000e-004	0.0179		63.4601	63.4601	1.8300e-003		63.5060
Total	**0.0334**	**0.0253**	**0.2406**	**6.4000e-004**	**0.0657**	**4.5000e-004**	**0.0662**	**0.0174**	**4.2000e-004**	**0.0179**		**63.4601**	**63.4601**	**1.8300e-003**		**63.5060**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7819	0.0000	5.7819	2.6512	0.0000	2.6512			0.0000			0.0000
Off-Road	1.4197	16.0357	6.6065	0.0141		0.7365	0.7365		0.6775	0.6775	0.0000	1,396.3909	1,396.3909	0.4418		1,407.4359
Total	**1.4197**	**16.0357**	**6.6065**	**0.0141**	**5.7819**	**0.7365**	**6.5184**	**2.6512**	**0.6775**	**3.3288**	**0.0000**	**1,396.3909**	**1,396.3909**	**0.4418**		**1,407.4359**

3.3 Earthwork, grading - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0334	0.0253	0.2406	6.4000e-004	0.0657	4.5000e-004	0.0662	0.0174	4.2000e-004	0.0179		63.4601	63.4601	1.8300e-003		63.5060
Total	**0.0334**	**0.0253**	**0.2406**	**6.4000e-004**	**0.0657**	**4.5000e-004**	**0.0662**	**0.0174**	**4.2000e-004**	**0.0179**		**63.4601**	**63.4601**	**1.8300e-003**		**63.5060**

3.3 Earthwork, grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7819	0.0000	5.7819	2.6512	0.0000	2.6512			0.0000			0.0000
Off-Road	1.3498	15.0854	6.4543	0.0141		0.6844	0.6844		0.6296	0.6296		1,365.7183	1,365.7183	0.4417		1,376.7609
Total	**1.3498**	**15.0854**	**6.4543**	**0.0141**	**5.7819**	**0.6844**	**6.4663**	**2.6512**	**0.6296**	**3.2809**		**1,365.7183**	**1,365.7183**	**0.4417**		**1,376.7609**

3.3 Earthwork, grading - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0305	0.0224	0.2155	6.2000e-004	0.0657	4.4000e-004	0.0662	0.0174	4.0000e-004	0.0178		61.4967	61.4967	1.6100e-003		61.5368
Total	**0.0305**	**0.0224**	**0.2155**	**6.2000e-004**	**0.0657**	**4.4000e-004**	**0.0662**	**0.0174**	**4.0000e-004**	**0.0178**		**61.4967**	**61.4967**	**1.6100e-003**		**61.5368**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					5.7819	0.0000	5.7819	2.6512	0.0000	2.6512			0.0000			0.0000
Off-Road	1.3498	15.0854	6.4543	0.0141		0.6844	0.6844		0.6296	0.6296	0.0000	1,365.7183	1,365.7183	0.4417		1,376.7609
Total	**1.3498**	**15.0854**	**6.4543**	**0.0141**	**5.7819**	**0.6844**	**6.4663**	**2.6512**	**0.6296**	**3.2809**	**0.0000**	**1,365.7183**	**1,365.7183**	**0.4417**		**1,376.7609**

3.3 Earthwork, grading - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0305	0.0224	0.2155	6.2000e-004	0.0657	4.4000e-004	0.0662	0.0174	4.0000e-004	0.0178		61.4967	61.4967	1.6100e-003		61.5368
Total	**0.0305**	**0.0224**	**0.2155**	**6.2000e-004**	**0.0657**	**4.4000e-004**	**0.0662**	**0.0174**	**4.0000e-004**	**0.0178**		**61.4967**	**61.4967**	**1.6100e-003**		**61.5368**

3.4 Framing, mechanical, electrical plumbing - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0305	14.7882	13.1881	0.0220		0.7960	0.7960		0.7688	0.7688		2,001.1595	2,001.1595	0.3715		2,010.4467
Total	**2.0305**	**14.7882**	**13.1881**	**0.0220**		**0.7960**	**0.7960**		**0.7688**	**0.7688**		**2,001.1595**	**2,001.1595**	**0.3715**		**2,010.4467**

3.4 Framing, mechanical, electrical plumbing - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2011	6.1022	1.4208	0.0141	0.3523	0.0286	0.3809	0.1015	0.0274	0.1288		1,491.7379	1,491.7379	0.0920		1,494.0372
Worker	0.7670	0.5627	5.4141	0.0155	1.6512	0.0110	1.6622	0.4380	0.0102	0.4481		1,545.1041	1,545.1041	0.0403		1,546.1123
Total	**0.9681**	**6.6649**	**6.8349**	**0.0297**	**2.0035**	**0.0396**	**2.0431**	**0.5394**	**0.0375**	**0.5770**		**3,036.8420**	**3,036.8420**	**0.1323**		**3,040.1495**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0305	14.7882	13.1881	0.0220		0.7960	0.7960		0.7688	0.7688	0.0000	2,001.1595	2,001.1595	0.3715		2,010.4467
Total	**2.0305**	**14.7882**	**13.1881**	**0.0220**		**0.7960**	**0.7960**		**0.7688**	**0.7688**	**0.0000**	**2,001.1595**	**2,001.1595**	**0.3715**		**2,010.4467**

3.4 Framing, mechanical, electrical plumbing - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2011	6.1022	1.4208	0.0141	0.3523	0.0286	0.3809	0.1015	0.0274	0.1288		1,491.7379	1,491.7379	0.0920		1,494.0372
Worker	0.7670	0.5627	5.4141	0.0155	1.6512	0.0110	1.6622	0.4380	0.0102	0.4481		1,545.1041	1,545.1041	0.0403		1,546.1123
Total	**0.9681**	**6.6649**	**6.8349**	**0.0297**	**2.0035**	**0.0396**	**2.0431**	**0.5394**	**0.0375**	**0.5770**		**3,036.8420**	**3,036.8420**	**0.1323**		**3,040.1495**

3.5 Exterior and interior finishes - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0305	14.7882	13.1881	0.0220		0.7960	0.7960		0.7688	0.7688		2,001.1595	2,001.1595	0.3715		2,010.4467
Total	**2.0305**	**14.7882**	**13.1881**	**0.0220**		**0.7960**	**0.7960**		**0.7688**	**0.7688**		**2,001.1595**	**2,001.1595**	**0.3715**		**2,010.4467**

3.5 Exterior and interior finishes - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2011	6.1022	1.4208	0.0141	0.3523	0.0286	0.3809	0.1015	0.0274	0.1288		1,491.7379	1,491.7379	0.0920		1,494.0372
Worker	0.7670	0.5627	5.4141	0.0155	1.6512	0.0110	1.6622	0.4380	0.0102	0.4481		1,545.1041	1,545.1041	0.0403		1,546.1123
Total	**0.9681**	**6.6649**	**6.8349**	**0.0297**	**2.0035**	**0.0396**	**2.0431**	**0.5394**	**0.0375**	**0.5770**		**3,036.8420**	**3,036.8420**	**0.1323**		**3,040.1495**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.0305	14.7882	13.1881	0.0220		0.7960	0.7960		0.7688	0.7688	0.0000	2,001.1595	2,001.1595	0.3715		2,010.4467
Total	**2.0305**	**14.7882**	**13.1881**	**0.0220**		**0.7960**	**0.7960**		**0.7688**	**0.7688**	**0.0000**	**2,001.1595**	**2,001.1595**	**0.3715**		**2,010.4467**

3.5 Exterior and interior finishes - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.2011	6.1022	1.4208	0.0141	0.3523	0.0286	0.3809	0.1015	0.0274	0.1288		1,491.7379	1,491.7379	0.0920		1,494.0372
Worker	0.7670	0.5627	5.4141	0.0155	1.6512	0.0110	1.6622	0.4380	0.0102	0.4481		1,545.1041	1,545.1041	0.0403		1,546.1123
Total	**0.9681**	**6.6649**	**6.8349**	**0.0297**	**2.0035**	**0.0396**	**2.0431**	**0.5394**	**0.0375**	**0.5770**		**3,036.8420**	**3,036.8420**	**0.1323**		**3,040.1495**

3.5 Exterior and interior finishes - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8125	13.6361	12.8994	0.0221		0.6843	0.6843		0.6608	0.6608		2,001.2200	2,001.2200	0.3573		2,010.1517
Total	**1.8125**	**13.6361**	**12.8994**	**0.0221**		**0.6843**	**0.6843**		**0.6608**	**0.6608**		**2,001.2200**	**2,001.2200**	**0.3573**		**2,010.1517**

3.5 Exterior and interior finishes - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1664	5.5483	1.2740	0.0140	0.3523	0.0118	0.3642	0.1015	0.0113	0.1127		1,477.3855	1,477.3855	0.0871		1,479.5618
Worker	0.7084	0.5019	4.9264	0.0150	1.6512	0.0107	1.6619	0.4380	9.8400e-003	0.4478		1,491.5041	1,491.5041	0.0360		1,492.4037
Total	**0.8748**	**6.0502**	**6.2004**	**0.0290**	**2.0035**	**0.0225**	**2.0260**	**0.5394**	**0.0211**	**0.5606**		**2,968.8897**	**2,968.8897**	**0.1230**		**2,971.9655**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.8125	13.6361	12.8994	0.0221		0.6843	0.6843		0.6608	0.6608	0.0000	2,001.2200	2,001.2200	0.3573		2,010.1517
Total	**1.8125**	**13.6361**	**12.8994**	**0.0221**		**0.6843**	**0.6843**		**0.6608**	**0.6608**	**0.0000**	**2,001.2200**	**2,001.2200**	**0.3573**		**2,010.1517**

3.5 Exterior and interior finishes - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.1664	5.5483	1.2740	0.0140	0.3523	0.0118	0.3642	0.1015	0.0113	0.1127		1,477.3855	1,477.3855	0.0871		1,479.5618
Worker	0.7084	0.5019	4.9264	0.0150	1.6512	0.0107	1.6619	0.4380	9.8400e-003	0.4478		1,491.5041	1,491.5041	0.0360		1,492.4037
Total	**0.8748**	**6.0502**	**6.2004**	**0.0290**	**2.0035**	**0.0225**	**2.0260**	**0.5394**	**0.0211**	**0.5606**		**2,968.8897**	**2,968.8897**	**0.1230**		**2,971.9655**

3.6 Sidewalks - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.7739	7.7422	8.8569	0.0135		0.4153	0.4153		0.3830	0.3830		1,296.8664	1,296.8664	0.4111		1,307.1442
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.7739**	**7.7422**	**8.8569**	**0.0135**		**0.4153**	**0.4153**		**0.3830**	**0.3830**		**1,296.8664**	**1,296.8664**	**0.4111**		**1,307.1442**

3.6 Sidewalks - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0458	0.0325	0.3186	9.7000e-004	0.1068	6.9000e-004	0.1075	0.0283	6.4000e-004	0.0290		96.4654	96.4654	2.3300e-003		96.5236
Total	**0.0458**	**0.0325**	**0.3186**	**9.7000e-004**	**0.1068**	**6.9000e-004**	**0.1075**	**0.0283**	**6.4000e-004**	**0.0290**		**96.4654**	**96.4654**	**2.3300e-003**		**96.5236**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.7739	7.7422	8.8569	0.0135		0.4153	0.4153		0.3830	0.3830	0.0000	1,296.8664	1,296.8664	0.4111		1,307.1442
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.7739**	**7.7422**	**8.8569**	**0.0135**		**0.4153**	**0.4153**		**0.3830**	**0.3830**	**0.0000**	**1,296.8664**	**1,296.8664**	**0.4111**		**1,307.1442**

3.6 Sidewalks - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0458	0.0325	0.3186	9.7000e-004	0.1068	6.9000e-004	0.1075	0.0283	6.4000e-004	0.0290		96.4654	96.4654	2.3300e-003		96.5236
Total	**0.0458**	**0.0325**	**0.3186**	**9.7000e-004**	**0.1068**	**6.9000e-004**	**0.1075**	**0.0283**	**6.4000e-004**	**0.0290**		**96.4654**	**96.4654**	**2.3300e-003**		**96.5236**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Apartments Mid Rise	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
University/College (4Yr)	0.00	0.00	0.00		
Total	0.00	0.00	0.00		

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Apartments Mid Rise	10.80	4.80	5.70	31.00	15.00	54.00	86	11	3
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0
University/College (4Yr)	9.50	7.30	7.30	6.40	88.60	5.00	91	9	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Apartments Mid Rise	0.561348	0.038614	0.190285	0.107199	0.015389	0.005180	0.024554	0.046236	0.002209	0.002456	0.005491	0.000334	0.000704
University/College (4Yr)	0.561348	0.038614	0.190285	0.107199	0.015389	0.005180	0.024554	0.046236	0.002209	0.002456	0.005491	0.000334	0.000704

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.2633	2.3727	1.8560	0.0144		0.1819	0.1819		0.1819	0.1819		2,872.5064	2,872.5064	0.0551	0.0527	2,889.5763
NaturalGas Unmitigated	0.2633	2.3727	1.8560	0.0144		0.1819	0.1819		0.1819	0.1819		2,872.5064	2,872.5064	0.0551	0.0527	2,889.5763

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Mid Rise	3587.85	0.0387	0.3306	0.1407	2.1100e-003		0.0267	0.0267		0.0267	0.0267		422.0998	422.0998	8.0900e-003	7.7400e-003	424.6081
University/College (4Yr)	14810.6	0.1597	1.4520	1.2197	8.7100e-003		0.1104	0.1104		0.1104	0.1104		1,742.4177	1,742.4177	0.0334	0.0319	1,752.7721
University/College (4Yr)	6017.91	0.0649	0.5900	0.4956	3.5400e-003		0.0448	0.0448		0.0448	0.0448		707.9889	707.9889	0.0136	0.0130	712.1962
Total		**0.2633**	**2.3726**	**1.8560**	**0.0144**		**0.1819**	**0.1819**		**0.1819**	**0.1819**		**2,872.5064**	**2,872.5064**	**0.0551**	**0.0527**	**2,889.5763**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Apartments Mid Rise	3.58785	0.0387	0.3306	0.1407	2.1100e-003		0.0267	0.0267		0.0267	0.0267		422.0998	422.0998	8.0900e-003	7.7400e-003	424.6081
University/College (4Yr)	14.8106	0.1597	1.4520	1.2197	8.7100e-003		0.1104	0.1104		0.1104	0.1104		1,742.4177	1,742.4177	0.0334	0.0319	1,752.7721
University/College (4Yr)	6.01791	0.0649	0.5900	0.4956	3.5400e-003		0.0448	0.0448		0.0448	0.0448		707.9889	707.9889	0.0136	0.0130	712.1962
Total		**0.2633**	**2.3726**	**1.8560**	**0.0144**		**0.1819**	**0.1819**		**0.1819**	**0.1819**		**2,872.5064**	**2,872.5064**	**0.0551**	**0.0527**	**2,889.5763**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	9.5627	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689	0.0000	22.4910	22.4910	0.0220	0.0000	23.0403
Unmitigated	9.5627	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689	0.0000	22.4910	22.4910	0.0220	0.0000	23.0403

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	1.2137					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	7.9671					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.3819	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689		22.4910	22.4910	0.0220		23.0403
Total	**9.5627**	**0.1436**	**12.4750**	**6.6000e-004**		**0.0689**	**0.0689**		**0.0689**	**0.0689**	**0.0000**	**22.4910**	**22.4910**	**0.0220**	**0.0000**	**23.0403**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	1.2137					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	7.9671					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.3819	0.1436	12.4750	6.6000e-004		0.0689	0.0689		0.0689	0.0689		22.4910	22.4910	0.0220		23.0403
Total	**9.5627**	**0.1436**	**12.4750**	**6.6000e-004**		**0.0689**	**0.0689**		**0.0689**	**0.0689**	**0.0000**	**22.4910**	**22.4910**	**0.0220**	**0.0000**	**23.0403**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

APPENDIX D

GEOTECHNICAL INVESTIGATION

LANGAN

Technical Excellence
Practical Experience
Client Responsiveness

12 October 2018

Mr. Charlie MacDonald
ACC OP Development LLC
12700 Hill Country Boulevard, Suite T-200
Austin, Texas 78738

Subject: Addendum to Geotechnical Investigation Report
Fault Rupture Hazard at Goldman School of Public Policy
Hearst Avenue Academic Housing
Summary of Geologic Review
University of California, Berkeley
Langan Project No.: 731706301

Dear Mr. MacDonald:

Langan is pleased to present this addendum to our geotechnical investigation report, dated 13 February 2018. This letter report addresses the fault rupture hazard for the proposed Goldman School of Public Policy (GSPP) Hearst Avenue Academic Housing site. The project site occupies a reverse L-shaped lot at the northwest corner of Hearst Avenue and La Loma Avenue at the University of California, Berkeley (University) campus (Figure 1, Site Location Map). The site is bound by Ridge Road to the north, La Loma Avenue to the east, Hearst Avenue to the south, a four-story student housing building (Cloyne Court Co-op) and existing GSPP facilities to the west. The southern portion of the site is currently occupied by the four-level Upper Hearst parking structure, which is accessed by concrete entrance ramps along La Loma and Hearst Avenues. The northern portion of the site is currently occupied by an asphalt parking lot which is accessed via Ridge Road to the north.

We understand the proposed development includes demolition of the upper portion of the existing Upper Hearst parking structure, and the construction of a new five story residential units, classrooms and assembly space above the existing parking structure. New construction in the vicinity of the existing asphalt parking lot includes two below grade parking levels and six levels of above grade construction with classrooms and faculty offices. The existing and new buildings are proposed to be structurally connected. Excavations will be approximately 25 feet below grade at the intersection of La Loma Avenue and Ridge Road, with lowest finished grade at approximate Elevation 380 feet[1], based on schematic drawings provided by SCB, the project architect. We understand retaining walls and new stairs will be built off of Hearst Avenue to provide access between the existing and the planned GSPP structures.

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[1] Elevations in this report refer to the City of Berkeley Datum, which corresponds to approximately 3.17 feet below Mean Sea Level (MSL), or the National Geodetic Vertical Datum of 1929 (NGVD 29), and 0.95 feet above the UC Berkeley Datum.

SCOPE OF SERVICES

Our scope of services included performing a desk study to address the potential for active faulting through the project site, which included thorough research and review of:

- Available published and unpublished reports, including Alquist-Priolo and other nearby paleoseismic studies;
- fault creep data from nearby alignment arrays;
- local and regional seismicity data from the Northern California Earthquake Data Center (NCEDC) to evaluate previous and recent seismic and microseismic activity in the area;
- high resolution LiDAR data accessed from the publically available Open Topography website;
- published and unpublished geologic and fault maps;
- stereo-paired aerial photographs to observe evidence of fault-related geomorphology historical land use and urbanization;
- geotechnical reports of existing improvements in the area, as available.

We also reviewed samples and subsurface data obtained during our geotechnical investigation (2017). To supplement our desk review, we retained the services of Lettis Consultants International (LCI) to perform a Fault Displacement Hazard Analysis (FDHA) for the project site. the purpose of our desk study was to evaluate if available data and studies present firm conclusions and indications regarding the presence or absence of active faulting through the project site.

This addendum presents recommendations for seismic design for the proposed structures. Unless explicitly discussed in this letter, the conclusions and recommendations presented in our 13 February report remain unchanged. The project site and associated subsurface exploration points completed for our geotechnical investigation are shown on Figure 2.

The building was in schematic design, building loads had not been finalized, and the fault study was ongoing when the geotechnical investigation report was published. Because there are still a number of undetermined details for the structural design, the purpose of this addendum is to provide seismic design recommendations for the project team; we will provide additional addenda with recommendations in the future as needed.

REGIONAL AND SITE GEOLOGY

The project site is located on the western flanks of the Berkeley Hills, within the of the Coast Ranges geomorphic province of California. The province is generally characterized by northwest-southeast trending valleys, ridges, and mountain chains. The structural grain or fabric of the Coast Ranges parallel the northwest-striking San Andreas fault zone and associated system of faults, including the Hayward fault system to the east. The Hayward fault is characterized as a predominately right-lateral, strike slip fault; the fault zone is comprised of highly deformed rocks, ranging between two and 10 kilometers wide. The terrain along the west side of the Hayward fault is largely supported by a series of sedimentary, igneous, and metamorphic rocks collectively known as the Franciscan Complex of late Jurassic to early Cretaceous (164 to 100 million years ago). The Franciscan Complex basement rocks lay in faulted contact with unmetamorphosed rocks of the Coast Range ophiolite and Great Valley sequence (Graymer, Jones and Brabb, 1995). Locally, the project site is mapped as underlain by silica-carbonate rocks (Figure 3, Regional Geologic Map). Depending on the location, all of the rock types are blanketed by thick sequences of various surficial deposits, including alluvium, colluvium, mass-wasting deposits, and more recently, artificial fill.

The northeastern half of the site is mapped within an Earthquake Zone of Required Investigation for the Hayward fault (Figure 4, Zones of Required Investigation), as zoned by the California Geological Survey. Locally, the zone is established around two mapped Alquist-Priolo (A-P) fault traces, which are depicted on Figure 5. According to the 2006 USGS Fault and Fold Database, the closest trace of the Hayward fault is mapped approximately 530 feet to the northeast site, trending N032W. A second, subparallel trace is mapped approximately 725 feet to the northeast of the project site, trending N035W. Multiple other traces have been mapped by consultants that have performed fault studies in the area, including a shear zone (referenced as the Louderback Shear Zone (LSZ)) associated with the Louderback fault mapped directly through the site, with a projection of N036W. The LSZ is characterized as a 200-foot wide zone of sheared rock and colluvium, originally identified in the Lawson Adit by Louderback (1939); the location and alignment of the Adit are shown on Figure 2. The Louderback trace through the site is not considered to be an active fault, and portions of the LSZ fall outside of the A-P boundary. The Louderback is not a zoned A-P fault. However, Mr. James Lienkaemper formerly of the USGS, indicated evidence for Holocene activity on the Louderback (pers. comm., 2017).

SUBSURFACE CONDITIONS

As part of our geotechnical investigation (Langan 2018), three exploratory borings (designated LB-1 through LB-3) were advanced to depths of between 51 and 65 feet below the existing ground surface (bgs). These borings were drilled in the existing asphalt parking lot to the north of the GSPP parking structure. Boring B-3 was continuously cored starting at a depth of 52 feet. Downhole seismic shear wave velocities were measured in LB-3. Exploratory boring logs are presented in Appendix A.

Two geophysical surveys were also completed across the parking lot consisting of two seismic refraction (SR) and Multi-Channel Analysis of Surface Waves (MASW) lines, designated Line #1 and Line #2, respectively. The results of the geophysical surveys are presented in Appendix B.

Three test pits were excavated adjacent to existing footings of buildings adjacent to the proposed development. The test pit logs are also included in Appendix A.

The ground surface of the site slopes down to the southwest, with ground surface elevations at the parking lot between about 405 feet at the northeastern corner and 390 feet at the southwestern corner of the site, and site grades along Hearst Avenue at the western edge of the parking garage of about 370 feet. To the north, east, south, and west of the site are Ridge Road, La Loma Avenue, Hearst Avenue, and Cloyne Court Co-op and the current GSPP building, respectively. Based on information from the test pits, the adjacent Cloyne Court Co-op and the adjacent GSPP academic building are founded on shallow footings bearing on sand, sandy clay, and silty sand fill over native clayey soil.

The northeast portion of the site is generally underlain by up to nine feet of heterogeneous fill, consisting mainly of stiff to hard clay and sandy clay, and very dense gravel and clayey gravel. The fill, in general, has a moderate to high expansion potential and is underlain by approximately 30 to 40 feet of undifferentiated colluvial materials/surficial deposits, composed of interbedded stiff to hard clay, and sandy clay with medium to very dense clayey sands and silty sands. Colluvial materials were encountered under the fill, underlain by fault gouge, brecciated sandstone and shale, and serpentinite. The brecciated bedrock materials were encountered approximately 30 to 50 feet below the parking lot surface. We interpret the gouge and brecciated bedrock materials to be associated with the mapped LSZ.

Because rotary wash drilling method was used, the depth to groundwater was not observed during our investigation.

Based on our preliminary interpretation of the seismic refraction profiles, we noted at least three prominent velocity contrasts, indicating possible discontinuities at depth (Plate 2, Appendix B). SR Line #1 shows contrast in velocity contours, at 6,000 ft/sec (starting approximately STA 20+00 in from the SW end of the profile) and continuing to 9,000 ft/sec. The contrast in contours indicates the higher velocity materials, interpreted as bedrock, as up to the northeast and lower velocity materials down to the southwest. There is no disruption noted below the 9,000 ft/sec contour within the discontinuity alignment. The contours above also indicate minor downdrop, but appear to be more associated with the southwestern dipping site gradients. Another larger contrast in velocity occurs at the 10,000 ft/sec contour at approximately STA 82+00, which is interpreted as bedrock up to the northeast. The discontinuity tapers out at the 8,000 ft/sec contour, and appears to die out within the bedrock. In Line #2, a discontinuity is visible at approximately STA 43+00, with the 5,000 ft/sec contour dipping vertically to the northeast. The disruption in the velocity contours generally correspond with the Louderback fault trace, as mapped by Lennert and Curtis. The overlying 4,000 ft/sec contour appears undisturbed.

Our interpretations of subsurface conditions, including those interpreted from the SR profiles, are depicted in Figures 6 through 8, Geologic Cross Sections A-A' through C-C'. The interpreted conditions in SR Line #1 are projected onto Geologic Cross Section B-B' (Figure 7), and those in SR Line #2 are projected onto Geologic Cross Section A-A' (Figure 6).

PREVIOUS INVESTIGATIONS AND BACKGROUND

As indicated above, the purpose of our desk study was to evaluate if available data and studies present firm conclusions and indications regarding the presence or absence of active faulting through the project site. This study was performed to generally satisfy requirements of the A-P Act. Subsurface data obtained during our geotechnical investigation and the results of a probabilistic fault displacement hazard analysis (PFDHA) and deterministic fault displacement hazard analysis (DFDHA) performed by our subconsultant Lettis Consultants International (LCI) were used to supplement our study. This study supersedes our preliminary interpretations and conclusions regarding faulting through the project site.

Our scope of services for this task included reviewing: historical maps, stereo-paired historical aerial photographs, available geologic data, and geotechnical and geologic investigation reports completed by others in the vicinity. We also contacted Mr. Lienkaemper retired USGS seismologist, and other consultants who had previously done work in the area to discuss their observations and interpretations of anomalous features that were observed either during their exploratory trench logging or previous construction activities.

Based on our review of aerial photos and historical Sanborn maps, the existing asphalt parking lot was formerly the site of Newman Hall and a rectory, both of which were constructed sometime between 1903 and 1911, and demolished between 1959 and 1969. Newman Hall was underlain by a basement, which is visible in the 1969 aerial photos following the building's demolition. The basement appears to have been backfilled between 1969 and 1973, and used as a parking lot to present day. The existing University parking garage at the corner of Hearst and La Loma Streets was previously occupied by College Hall dormitory, which was demolished around 1938. The existing parking structure and Ridge Road access driveway were fully constructed in their current configuration by 1973.

Summaries of consultant reports that were particularly instructive and their findings are presented below. Project sites, fault traces and fault trenches from the reports referenced below are all depicted on Figure 2:

1. *Fault Hazard Study, Berkeley Campus, University of California, prepared by Lennert and Associates, dated 12 June 1980*; This study was prepared to determine the potential for and extent of surface rupture through the UC Berkeley campus. This study is frequently referenced in subsequent consultant reports (referenced as Lennert and Curtis), and is only included for thoroughness. Lennert and Curtis identified the Hayward fault passing approximately 500 feet to the northeast of the GSPP project site. The Louderback fault

was mapped through the UC Berkeley campus at an orientation that differs from the alignment mapped by later consultants. The fault is mapped as extending east of the Greek theater, trending approximately N050W, and extending through the northeast corner of the GSPP project site. The Lennert and Curtis Louderback fault trace was also characterized as a major feature, dipping steeply to the west, with a well-developed gouge zone and large vertical offsets in bedrock. Although the fault was identified as a major feature, Lennert and Curtis concluded that the fault is inactive. The Louderback fault trace was identified through seismic refraction data; no ground truth was established through subsurface excavations.

2. *Geologic and Fault Hazard Investigation, Proposed Student Housing, University of California*, prepared by Harding Lawson Associates, dated 13 October, 1986; Harding Lawson Associates (HLA) performed a preliminary study that included document review, exploratory borings and eight fault trenches totaling 1075 linear feet. Their study was performed as the initial phase of geotechnical investigations for the Foothill Housing project, consisting of two sites: Hillside and La Loma Ridge. The La Loma Ridge site is across the street to the northeast of the GSPP project site. Three fault trenches designated Trenches A, B and C were excavated for the La Loma Ridge site, and five trenches were excavated as part of Hillside site (D,E,F,G and H). The Hillside and La Loma Ridge housing sites and fault trench locations are depicted on Figure 2. HLA identified the Hayward fault in Trench H, which was excavated to the southeast of the La Loma Ridge site. La Loma Ridge trenches and borings encountered relatively uniform colluvial soils. No bedrock was exposed, but no vertical discontinuities suggestive of faulting were observed in the colluvium. HLA concluded that absence of continuous clay-filled vertical fractures of faults in colluvial material indicated that no active faulting is present at the La Loma Ridge site. HLA sited the active trace of the Hayward fault, and provided preliminary setbacks for the Hillside site.

3. *Geologic and Fault Hazard Investigation, Phase II, Foothill Student Housing, University of California, Berkeley, California*, prepared by Harding Lawson and Associates, dated 12 January 1988; HLA performed a Phase II investigation that included additional research, mapping, 14 borings, and 14 fault trenches totaling 1435 linear feet. The trenches excavated as part of their Phase II investigation were designated as Trenches I through V. The trenches were excavated to observe evidence of active faulting from the Hayward fault and any subsidiary faults, primarily the Louderback fault. Trenches were also excavated across the previously mapped Lennert and Curtis trace of the Louderback fault.

   Hayward Fault- Trenches I, J, K, M, N, O, P, Q, S, T, U and V were excavated in the vicinity of the Hillside housing site, where the Hayward fault was previously mapped and encountered in HLA's Phase I Trench H. Trenches I, K, M, N, P and S exposed what were interpreted to be indicators of active Hayward fault traces. HLA also observed non fault-related features in their trenches, including tension cracks and slip planes, attributed to deep-seated landslide movement.

HLA concluded that two subparallel traces extend through the Hillside site, with the traces up to 160 feet apart. However, it was concluded that no active fault traces extend under Stern Hall, and that the adjacent proposed student housing additions do not contain active fault traces. HLA recommended that structures for human occupancy not be built over the identified, active traces or in between them. Setbacks between 20 feet to 50 feet were used to site buildings away from the identified fault traces.

The Hayward fault, as mapped by HLA, is roughly coincident with Lennert and Curtis's 1980 trace, approximately 500 feet to the northeast of the GSPP project site.

<u>Louderback Fault</u>- Trenches L, W, X and Y were excavated to explore for subsidiary faulting to the Hayward fault, and were excavated across the Louderback trace. To the northwest of Stern Hall, the Louderback was exposed in trenches W and Z. In the vicinity of the La Loma Ridge site, the fault was exposed in Trench L. Trenches L and Y were excavated at the southwest corner of the La Loma Ridge site.

HLA mapped the Louderback fault as a shear zone approximately 200 feet wide. Based on review of historical data, fault studies by others, aerial photos, analysis of topographic features, and observations made in their exploratory fault trenches, HLA concluded that the LSZ is not active, and structures can be placed over it. However, HLA indicated that the shear zone contains vertical separations representing planes of weakness that could experience displacement during a large seismic event, and estimated that lateral displacement at the ground surface above the shear zone would be less than two feet during a maximum probable earthquake, either due to subsidiary faulting or secondary ground deformation. HLA recommended that the buildings constructed over the shear zone be engineered to accommodate the anticipated displacements. HLA did not encounter the Louderback trace, as mapped by Lennert and Curtis, in their fault trenches.

A summary of the fault trench logs and trench descriptions by HLA are included in Appendix B. No age-dating was completed as part of their investigation.

4. <u>*Supplemental Fault Hazard Investigation, "Louderback Trace", Foothill Student Housing Project, University of California, Berkeley, California*, prepared by Harding Lawson Associates, dated 22 June 1988</u>. In addition to extensive document review, HLA performed a supplemental investigation of the Louderback fault to further evaluate the potential for active faulting across the shear zone. HLA geologists observed and documented the conditions of various urban facilities that cross the Louderback to

observe evidence for distress and/or offset. They also performed geologic mapping of accessible portions of the Lawson Adit, and compared their observations to those of previous mapping efforts by others within the Adit.

Two new fault trenches were excavated across the fault, and Trench L was re-excavated and widened at Hearst Avenue and Gayley. Excavated trenches across Louderback ranged between 32 and 120 feet in length, totaling 438 linear feet. Trenches were observed by Jim Lienkaemper of the USGS, California Division of Mines and Geology personnel, geologists from Geomatrix, Dames & Moore, and independent geologic consultants Charles Purcell and Dr. Roy Shlemon. Various other consultants and university personnel were also present to observe the exposed trench walls and document the conditions.

The trench logs indicate numerous shear planes in bedrock and old colluvium; colluviual units were differentiated into younger colluvium (Qyl) and older colluvium (Qocl). Age dating techniques for B soil horizon in Trench Z were performed, and it was determined that young colluvium in the trenches is no older than mid-Holocene. Older colluvium was estimated to be approximately 100,000 years old or older. No shears were observed extending into overlying younger colluvium. Sheared materials observed Trenches R and L were correlated with sheared material observed in Lawson Adit. All trenches encountered sheared bedrock and old colluvium, and some unit continuity was found between trenches. Slickensided surfaces were rarely observed on shears in the trenches, and could not be correlated between trenches or across the same trench. None of the shear planes exposed in trenches were observed to extend up into overlying soil deposits.

HLA again trenched across the Louderback trace mapped by Lennert and Curtis, and did not encounter a fault trace. No throughgoing fault structure was encountered in the exploratory fault trenches. HLA also did not observe evidence of ground cracking that would suggest fault creep on the Louderback fault. Through their observations in the Adit, they concurred with previous conclusions that the Louderback fault is inactive, and that the Louderback "trace" is actually a zone of sheared materials at least 200 feet wide, consisting of a complex zone of thin, numerous discontinuous shears that curve off in various directions, but generally striking to the northwest and dipping moderately to the northeast. The direction of slip of the ancient fault features observed within bedrock exposed in the trenches was interpreted to be near vertical and reverse movement. HLA interpreted the shears as representing a complex system of inactive thrust faults, toes of landslides, or some combination thereof. This movement was interpreted to be associated with ancient folding and compressional uplift of the Berkeley Hills. HLA maintained that active faulting is restricted to the Hayward fault, 450 feet east of the LSZ.

5. <u>Surface Fault Rupture Hazard Evaluation, Proposed Haas School Executive Education Building, University of California, Berkeley, Berkeley, California,</u> <u>prepared by William</u>

Lettis & Associates (WLA), dated November 2007. William Lettis & Associates excavated a trench across the Louderback trace (T-1, Figure 2), and determined that the trace is inactive. However the WLA Louderback trace is placed east of the Greek Theatre and mapped as extending through the La Loma Ridge site, but does not cross the project site.

6. *Review of Ground Cracks- Building B Hillside Site, Foothill Housing Project, University of California, Berkeley, California,* prepared by Geomatrix, dated 5 July 1989.
   During construction of Building B of the Hillside site, ground cracks were encountered in a cut slope above the Building B footprint. The cracks were documented as open, closely spaced and parallel generally striking to northeast, with dips between of 45 to 80 degrees to southeast (into the hillside). None were observed to cross-cut overlying soil horizons, and none were traced to the ground surface. Earth materials were also observed to be laterally continuous on either side of the ground cracks, with no offset. The cracks were within the projection of two trenches that were previously excavated during the HLA Phase II investigation; however, the cracks were not encountered in those trenches, indicating fracture discontinuity along trend between the cut slope and the trench locations. Geomatrix concluded that the ground cracks are not indicative of repeated, lateral and /or vertical fault displacement, but instead may be associated with deformation or shearing associated with surface faulting along the active Hayward fault trace upslope and to the east.

   Geologic Evaluation- Fracture Pattern, Building B, Foothill Housing Project, Berkeley, California, prepared by Kleinfelder, dated 9 October 1990. Kleinfelder provided observations and conclusions to supplement those made by Geomatrix and Patrick Williams, Lawrence Livermore Berkeley Laboratory. Their comments were provided in response to a report submitted to the University by Williams, in which he interpreted the ground cracks as secondary faults with possible Holocene displacement. Kleinfelder concluded that, based on the irregular pattern and orientation of the cracks, including lack of vertical continuity to the ground surface or with depth, the cracks were the result of tension cracks due to intense ground shaking. Kleinfelder disputed Williams' interpretation of the cracks to indicate subsidiary faulting, primarily by citing lack of displacement along the fractures. No changes were made to the mapped active Hayward fault alignment.

7. *Observation of Ground Cracks, Building B Hillside Site, Foothill Student Housing Project, University of California,* prepared by Geomatrix, dated 3 August 1990. Geomatrix prepared a follow-up summary letter to their initial July 1989 Letter (reference #5) The letter documented additional cracks observed in field at the base of exposed foundation excavations for the Hillside Building B site, which were examined by Geomatrix, Kleinfelder and HLA geologists. The cracks were documented to be northwest trending features, dipping approximately 34 to 41 degrees to the northeast. The cracks exhibited horizontal slickenside-like features along their planes. However, within the same area,

similar sub-horizontal features were observed with differing orientations, some orthogonal to the primary fracture planes. It was determined that slickensides were a result of shrink/swell within the clay infilling the fractures. Fractures of varying orientations, striking both northeast and northwest, dipping to north and south, were documented; however, none extended into the base of an overlying B horizon or organic soil layers. The weathering profile was not disrupted along the soil/colluvium contact, and no differences or offsets were noted in the stratigraphic profiles across fracture planes.

The documented observations are inconclusive with respect to the cause and origin of the cracks; Geomatrix could not verify whether the fractures were of tectonic or non-tectonic origin. Geomatrix concluded that the features are not definite indicators of tectonic activity, but noted down to the east dip-slip movement. It was determined that no significant, recurrent displacements have occurred across the fractures, and that the fractures may be due to ground failure from strong seismic ground shaking, slope instability, or localized shearing of earth materials within proximity to rupturing along the active trace during a seismic event.

Geomatrix estimated that future displacements along the active Hayward fault would be up to three feet laterally, and 1 foot vertically; smaller displacements on the order of one foot or less is considered likely along secondary features.

8. <u>Personal communication, James (Jim) Lienkaemper (USGS, retired), various dates</u>: Lienkaemper indicated that, during the trench excavations along the Hayward for the Harding Lawson 1988 trenches, he observed what he interpreted to be evidence for Holocene movement on the Louderback trace in a trench between two wings of Stern Hall, Trench Z (Figure 2). The feature was a young fissure-fill that he interpreted to be of Holocene-age. Lienkaemper also interpreted 2007 LiDAR imagery as showing geomorphic support for an uphill-facing fault scarp, parallel to the main Hayward fault trace. He also noted that, in other trenches, there was little to no Holocene soil cover, and minimal Pleistocene-age colluvium. He emphasized that he observed Holocene offset in Trench Z. Lienkaemper did not get a sense of displacement or dip-slip direction, but interpreted the Louderback to likely be a splay structure, and not a compressional or extensional step-over feature.

9. <u>*Hayward Fault Trace, Parking Structure "H", University of California, Berkeley*, prepared by Woodward-Clyde & Associates (WCA), dated 10 November 1970.</u> Observations made during the construction of the existing parking structure indicate that a well-developed fault trace intersects the northeast corner of the parking structure. The geologist of record interpreted the trace as a "probably active trace of the Hayward fault", but determined that the design of the new parking garage) (now existing) was adequate, and the possibility of rupture along this trace in a future earthquake was remote. Instead, rupture would be limited to the main trace to the east. No study was conducted to supplement their conclusions.

DISCUSSION

Through our document review, we determined that an extensive amount of work had been performed around the campus and project vicinity that identifies well-constrained, active traces of the Hayward fault to the east of the project site, and no active faulting within the immediate vicinity of our project site. The LSZ was also extensively investigated in the 1980's by HLA, who determined that there was a potential for secondary, coseismic deformation or offset on the Louderback fault, the extent of which was never fully determined. Two well-defined fault traces were encountered by WCA during construction of the existing parking structure, which were interpreted at the time to be probable active traces of the Hayward fault. This conclusion was based on observations made during excavations for the garage, and no fault study was done. In our opinion, the faults encountered by Woodward Clyde were likely faults associated with the LSZ and not active traces of the Hayward fault.

With respect to the HLA studies, we find some merit in Lienkaemper's observations that there was little to no Holocene-age earth materials exposed in the trenches across the Louderback fault to fully eliminate the potential for rupture or shearing into overlying, Holocene-age materials. Trench L, which was excavated at the southwest corner of the La Loma Ridge site (Figure 2), encountered the Louderback fault trace at the southwest end of the trench. The contact of the fault with overlying earth materials appear to be somewhat infilled by what was interpreted as old colluvium or weathered in place bedrock. The fault was in direct contact in places with artificial fill, and no young alluvium was observed in between.

Just south of Trench W, Trench Y encountered fault gouge at the southwestern end of the trench; the gouge appears to have been truncated by landslide deposits. Trench X encountered a shear zone with a possible fault; fill was logged directly over the sheared material, but the fault was not traced the ground surface. To the south in Trench W, a shear zone was encountered extending up to the ground surface at the western end of the trench, with fill over residual soil to the northeast. HLA mapped the western half of the trench as within the LSZ.

In Trench Z East, a shear zone encountered does not disrupt an A-horizon within young colluvium. The A-horizon was also undisturbed in Trench Z West. Lienkaemper documented what he interpreted as Holocene infill within a fissure in Trench Z. However, this was not documented in the HLA trench, and no offset or evidence for Holocene activity was documented by the other parties present at the time, including CGS geologists. The trench log suggests that this is fissure fill directly above the shear zone, and colluvium thickens across the shear zone above it.

Based on the data reviewed during our desk study, we concluded that excavating a fault trench for the purpose of evaluating Holocene activity would not be feasible due to removal of Holocene-age overburden during previous grading activities associated with construction of Newman Hall, adjacent rectory (both since demolished), as well as the existing parking structure. Site grades have been reduced to construct the existing parking structure and associated driveways, and significant amounts of fill were placed to fill in the former basement of Newman Hall. To date, we have not encountered reports nor other information disputing HLA's conclusion regarding the potential for secondary, coseismic faulting or deformation across the LSZ during a large seismic event on the Hayward fault. Consequently, our study focused on quantifying potential displacements of the Louderback fault and associated shear zone, and possible adverse impacts on the proposed site development.

LCI was engaged to perform PFDHA and DFDHA and quantify potential fault displacement of the LSZ under various probabilistic and deterministic scenarios (Attachment D- LCI, 2018). LCI performed a probabilistic and deterministic hazard analysis to quantify fault displacement hazard at the project site from secondary faulting or secondary deformation (e.g., localized slip or distributed shear on previously unrecognized faults or tectonic shears) resulting from a large earthquake on northern segment of the Hayward fault. The actively creeping, principal strand of the Northern Hayward fault is well constrained and is approximately 160 to 250 m east of the project site. Consequently, principal fault displacement from the Hayward fault rupture is not considered a hazard for the project site.

CONCLUSIONS

With respect to the potential for surface fault rupture from the Hayward fault, we believe that there is sufficient coverage from fault trenches to the south of the project site that collectively shadow the GSPP project from all inferred projections of the active Hayward fault.

Ground cracking observed at the Hillside site indicate ground cracking at depth in area, away from active faulting. To the best of our knowledge, ground cracks were not encountered at the La Loma Ridge site. A stiff grid of spread footings was ultimately recommended by HLA to support the La Loma buildings.

The Langan borings at the project site encountered sheared, laterally discontinuous materials in all borings. Previous exploration performed at the site by WCA encountered similar conditions in their borings. We also observed discontinuities within the seismic refraction profiles; these are only interpreted as discontinuities at this point, as there is not sufficient ground truth to confirm their presence. Based on our preliminary review of reports and geologic data available to us, we conclude that the active traces of the Hayward fault have been sufficiently identified as located away from the project site, and do not pose a surface fault rupture hazard to the proposed improvements. Although the WCA (1970) report indicated that a "probably active" trace of the Hayward extends through the project site, we conclude that the trace they observed was actually a fault within the LSZ.

With respect to the LSZ, we conclude that the shear zone does extend through the project site, as currently mapped, but the majority of data available strongly supports faults within the LSZ as not Holocene active; however, some of them have ruptured in the late Quaternary. With the exception of one reference, the assembled trench data, analysis and conclusions developed by other consultants for projects in the vicinity generally demonstrate the absence of Holocene-age fault related features from the Louderback fault.

Below are the results of the PFDHA and DFDHA performed by LCI (2018):

PFDHA results

Average Return Period (years)	Net Displacement (inches)
1,000	Negligible
2,500	Negligible
5,000	0.5
10,000	2.5

Summarized from Table 5-1 in LCI report (2018)

DFDHA

Percentile	Corresponding Average Return Period (years)	Displacement
16th	12,500	1 inch
50th (median)	25,000	4 inches
84th	100,000	11 inches

Summarized from Table 5-2 in LCI report (2018)

We understand the project is designed for the Risk-Targeted Maximum Considered Earthquake (MCE_R) and Design Earthquake DE as defined in ASCE 7-10, respectively. The MCE_R level of shaking is the lesser of probabilistic seismic hazard analysis (PSHA) for 2 percent probability of exceedance in 50 years or 84th percentile of the deterministic on the governing fault. For the project site, MCE_R is governed by the 84th percentile deterministic spectrum, which corresponds to a magnitude 7.2 on the Hayward fault (URS/Pacific, 2015). This deterministic spectrum is approximately equivalent to a PSHA having a 1,000 year return period. Based on the results of Table 5-1 in the LCI report (Attachment D, pg. 30), fault displacements for a 1,000 year return event are negligible. Therefore, we conclude that, based on the results of the LCI (2018) study, fault rupture for a 1,000 year return event will have negligible impact on the proposed development.

In our opinion, the proposed structure can be constructed and the existing structure can be retrofitted if designed to accommodate the estimated deformations across the shear zone consistent with the governing level of ground shaking.

Seismic Site Class

The closest active fault to the site is the Hayward fault, approximately 0.2 kilometer away. Probabilistic and deterministic seismic hazard analyses and corresponding acceleration time series were previously developed for the UC Berkeley campus by others (URS/Pacific, 2009, 2015) for rock and thin soil site conditions. URS/Pacific (2015) recommends that sites be classified as one of five different profiles defined as: 1) 10 to 35 feet of soil, 2) 36 to 75 feet of soil, 3) 76 to 150 feet of soil, 4) Rock, 5) Rock – Shear Zone. In our 13 February report, we preliminarily recommended classifying the site as Category 3 (76 to 150 feet of soil). Upon further evaluation of the shear wave velocity profiles and consultation with LCI and the design team, we recommend that the site should be classified as Category 5 (Rock – Shear Zone). In addition, seismic design parameters in accordance with the provisions of 2016 CBC/ASCE 7-10, as presented in the geotechnical report, should be used as appropriate.

If you have additional questions, please do not hesitate to contact us.

Sincerely yours,
Langan Engineering and Environmental Services, Inc.

Carolyn E Ronan

Marina Mascorro, PG, CEG
Senior Project Geologist

M.T. MASCORRO
No. 2646

Cary Ronan, PE, GE
Associate

CAROLYN E. RONAN
NO. GE2741
Exp. 06/30/20

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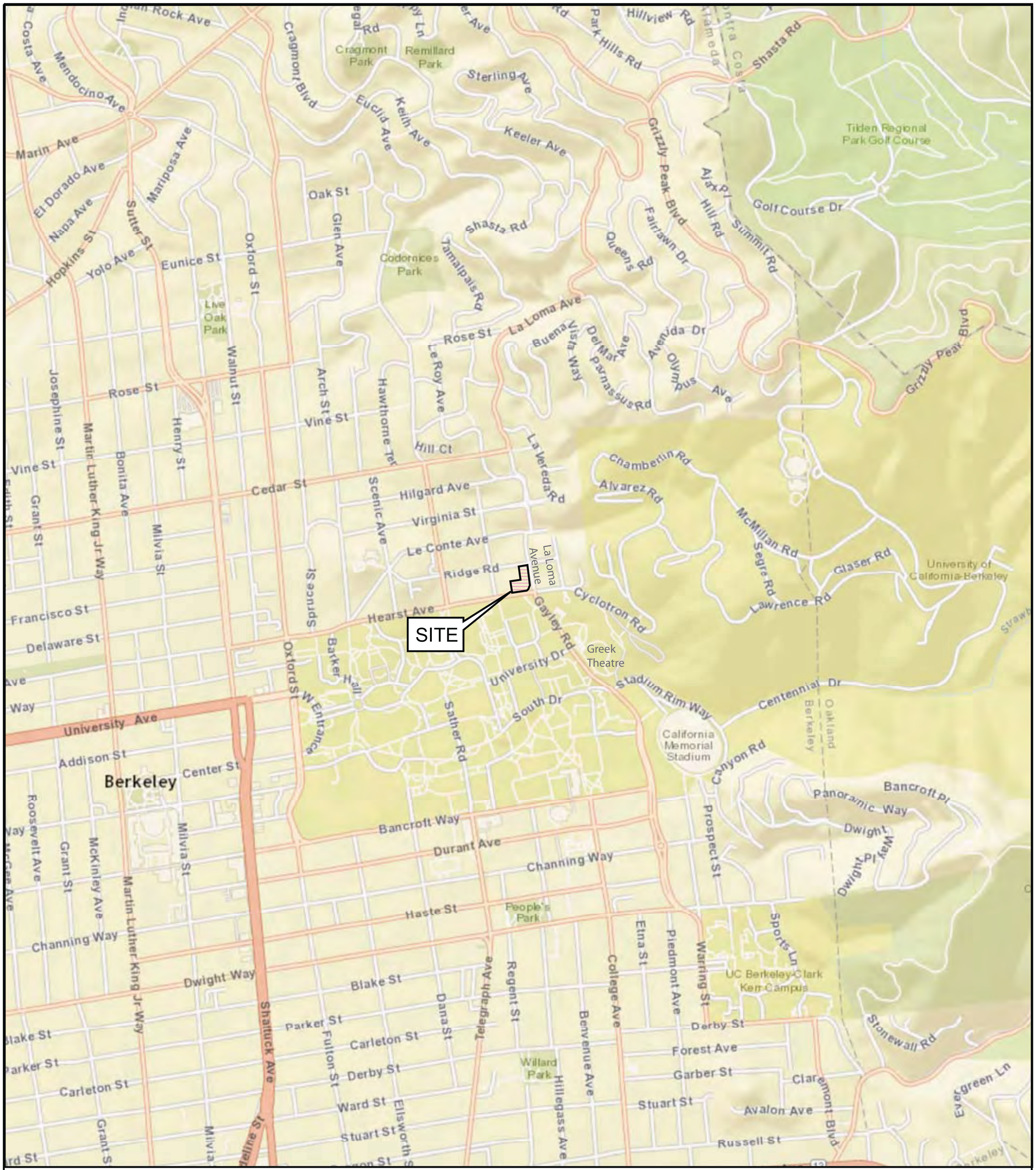
Attachments:

Figure 1: Site Location Map
Figure 2A: Site Plan- Regional
Figure 2B: Site Plan- Detailed
Figure 3: Regional Geologic Map
Figure 4: Map Showing Zones of Required Investigation
Figure 5: Mapped Alquist-Priolo Fault Traces
Figure 6: Geologic Cross Section A-A'
Figure 7: Geologic Cross Section B-B'
Figure 8: Geologic Cross Section C-C'

Appendix A: Langan Boring Logs
Appendix B: Norcal Geophysical Surveys
Appendix C: HLA Fault Trench Logs and Descriptions
Appendix D: LCI, 2018, Fault Displacement Hazard Analysis (Report)
Appendix E: CPTs
Appendix F: Test Pits

FIGURES



NOTES:

World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online.
Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.

0 1,000 2,000
Feet

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Berkeley, California

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SITE LOCATION MAP

Date 10/08/18	Project No. 731706301	Figure 1

Reference: Nearmap aerial imagery, dated 03/09/17.

EXPLANATION

- ▬ ▪ ▬ Langan project site boundary
- - - - AP Zone, West boundary
- ✕ Mapped active Hayward fault, Harding Lawson Associates, 1988
- - - - Updated active Hayward fault, USGS fault and fold database, 2006
- ▬ Mapped Louderback fault, Lennert and Currtis, 1980
- ••• - - ▬ Faults (solid where certain, dashed where approximate, dotted where concealed), Alan Kropp & Associates, 2016
- ▬ Louderback trace, Lettis, 2007
- ▬ Hayward fault active trace, Lettis, 2007
- ▬ Fault trace, Woodward Clyde & Associates, 1970
- ▨ Mapped Louderback Shear Zone, Harding Lawson Associates, 1986 & 1988
- ▬ Fault trenches, Harding Lawson Associates, 1986 and 1988
- - - Approximate location of seismic refraction line, Langan, September 2017'
- ▨ Foothill Housing Project - La Loma Ridge Site
- ▨ Foothill Housing Project - Hillside Site
- ▬ Lawson Adit
- ⊕ Approximate location of boring, September 2017
- ◧ Approximate location of test pit, September 2017
- ● Test borings from 1986, Harding Lawson Associates, 1986
- ● Test borings from 1987, Harding Lawson Associates, 1988
- 300 ▽ Average groundwater elevation (ft, NGVD*)
- ■ Test borings, Mactec, 2003
- ◪ Test borings, Dames & Moore,1989
- ◧ Test borings, Woodward-Clyde-Sherard & Associates, 1968
- ◉ Test borings, Rutherford & Chekene, 1998
- A A' Idealized geologic cross section
- — — — Extent of Figure 2B

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SITE PLAN - REGIONAL

Date 10/08/18	Project No. 731706301	Figure 2A

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Reference: © 2017 Microsoft Corporation, Bing

EXPLANATION

LB-1 ⊕	Approximate location of boring by Langan, September 2017
TP-1 ▮	Approximate location of test pit by Langan, September 2017
CPT-1 ▲	Approximate location of cone penetration test by Langan, December 2017
DPT-1 ◉	Approximate location of dynamic penetration test by Langan, December 2017
WC-1 ●	Approximate location of boring by Woodward Clyde & Associates, 1969
WC-11 ⊕	Approximate location of boring by Woodward Clyde & Associates, 1959
▬ ▪ ▬	Project limits
Line #1	Approximate location of seismic refraction line, September 2017
🟩	Fault trenches, Harding Lawson Associates, 1986 and 1988
🟩	Fault trace, Woodward Clyde and Associates, 1970
A A'	Idealized subsurface profile location, see Figure 2A for full extent

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AND HEARST AVENUE ACADEMIC HOUSING
San Francisco, California

SITE PLAN - DETAILED

Date 06/05/18 | Project No. 731706301 | Figure 2B

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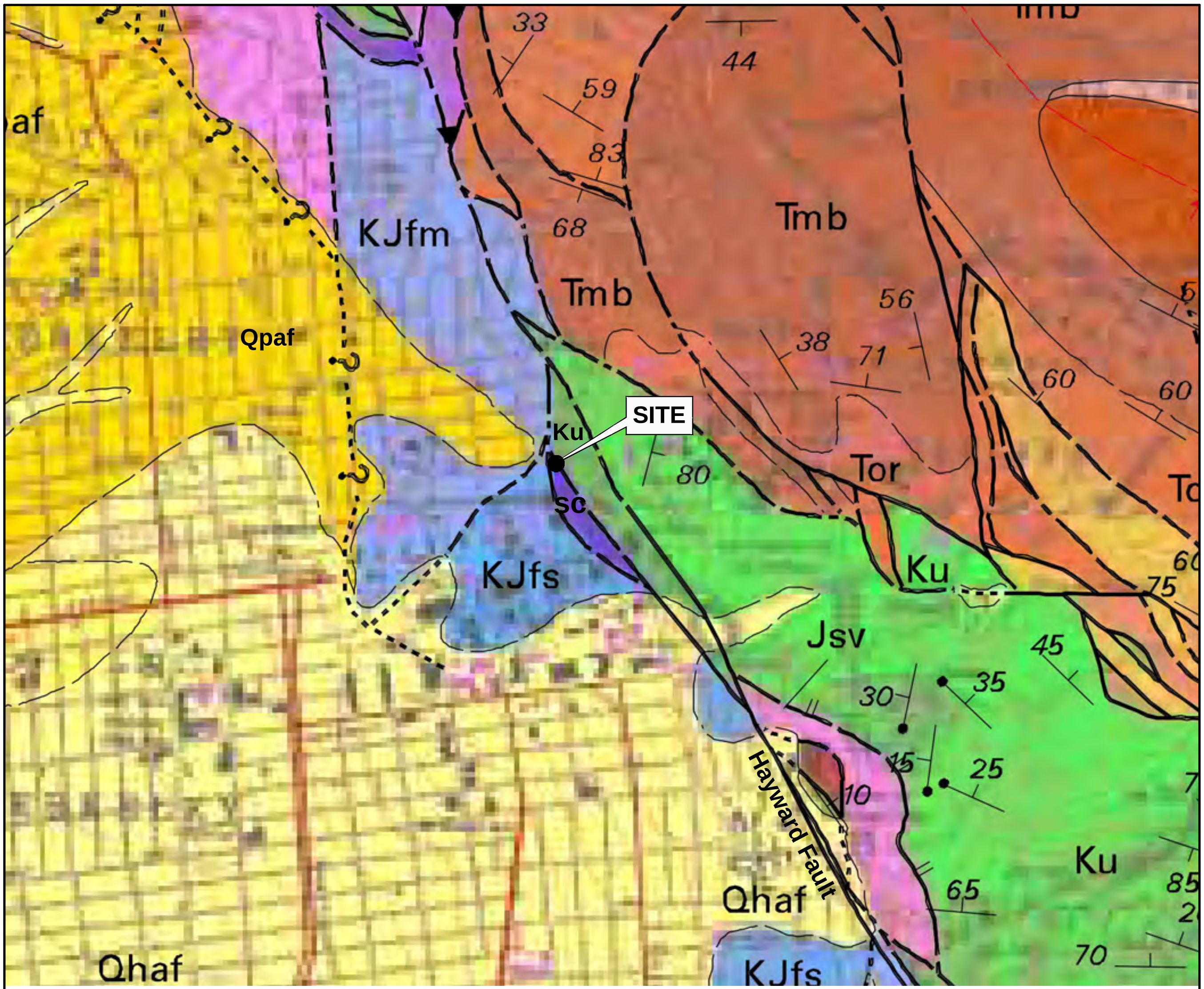

Reference: Geologic Map and Map Database of the Oakland Metropolitan Area, Alameda, Contra Costa, and San Francisco Counties, California, By R.W. Graymer, 2000.

EXPLANATION

Qpaf	Alluvial fan and fluvial deposits (Pleistocene)
Ku	Unnamed sedimentary rocks (Late Cretaceous, Turonian and Cemonanion)
sc	Silica carbonate rock
KJfs	Franciscan complex sandstone, undivided (Late Cretaceous (?) and Late Jurassic)
KJfm	Franciscan complex, melange (Cretaceous Late Jurassic), includes mapped locally: Graywacke and meta-graywacke blocks)

— —. . . .	Geologic contact: dashed where approximate and dotted where concealed
- - -?- - -?- - -	Fault, uncertain
▼ ▼ ▼	Thrust or reverse fault, dashed where inferred, dotted where conceald
35 ┬	Strike and dip of bedding
25 ┬●	Strike and dip of bedding, top indicator observed

0 2000 Feet

Approximate scale

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REGIONAL GEOLOGIC MAP

Date 10/08/18 | Project No. 731706301 | Figure 3

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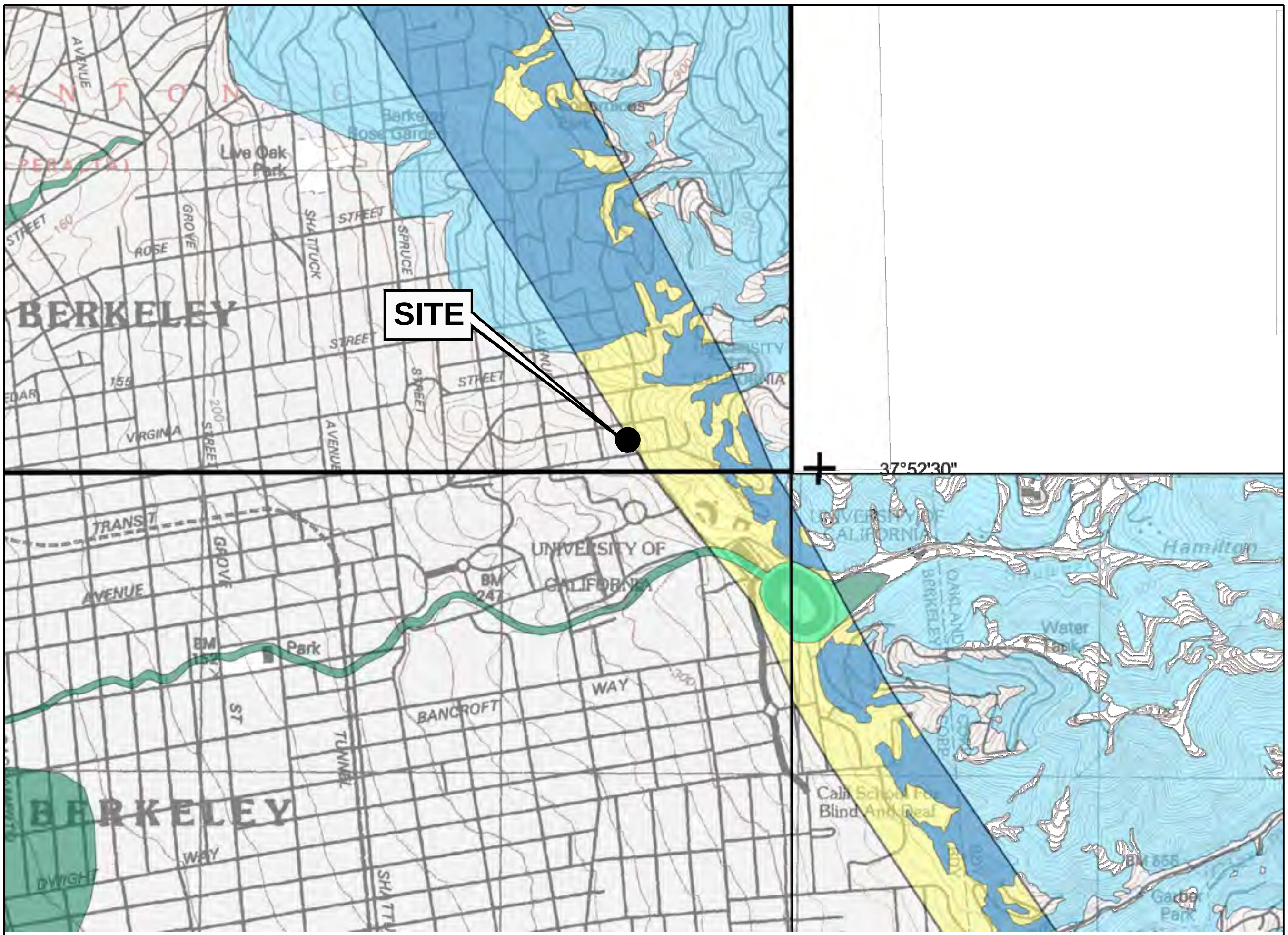


Reference: Earthquake Zones of Required Investigation; Richmond, Oakland West, and Oakland East 7.5-minute Quadrangles; California Geological Survey, undated.

EXPLANATION

ALQUIST-PRIOLO EARTHQUAKE FAULT ZONES

🟨 **Earthquake Fault Zones**
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.

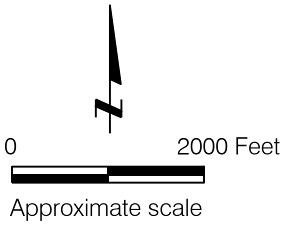
SEISMIC HAZARD ZONES

🟩 **Liquefaction Zones**
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

🟦 **Earthquake-Induced Landslide Zones**
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

OVERLAPPING ALQUIST-PRIOLO AND SEISMIC HAZARD ZONES

▨ **Overlap of Earthquake Fault Zone and Earthquake-Induced Landslide Zone**
Areas that are covered by both Earthquake Fault Zone and Earthquake-Induced Landslide Zone.



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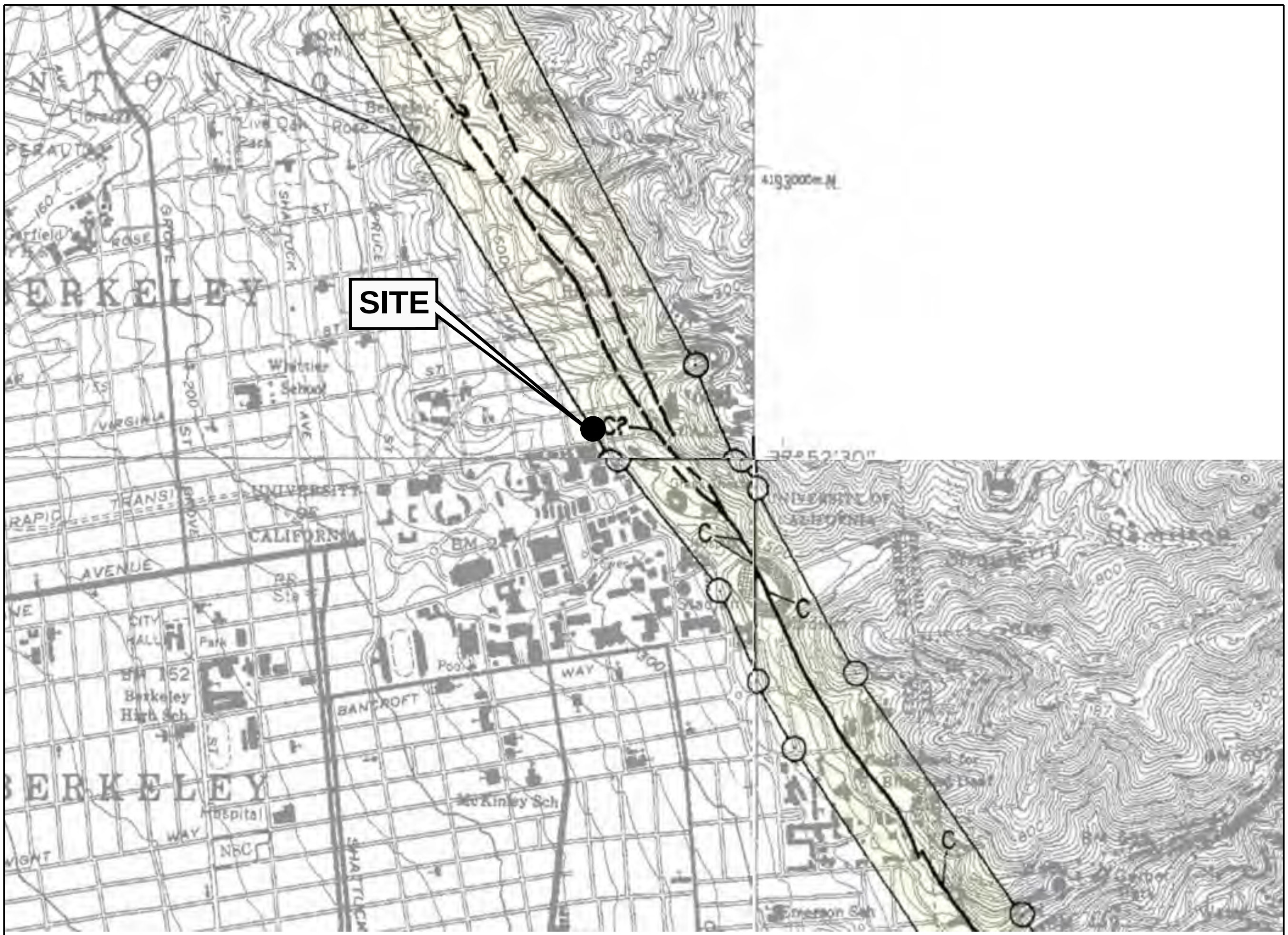
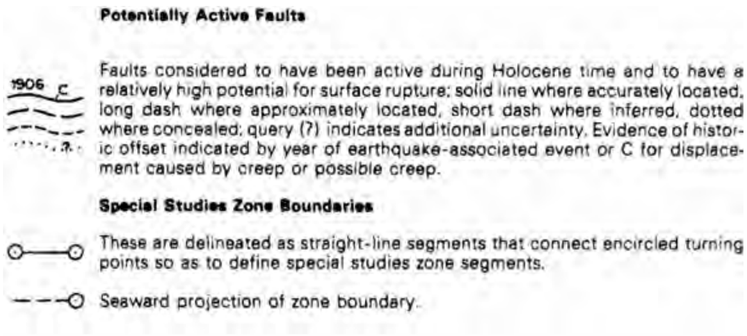
EARTHQUAKE ZONES OF REQUIRED INVESTIGATION

Date 10/08/18 | Project No. 731706301 | Figure 4



Reference: State of California Special Studies Zone, Richmond, Oakland East, and Oakland West, by James Davis, dated January 1, 1982.

EXPLANATION



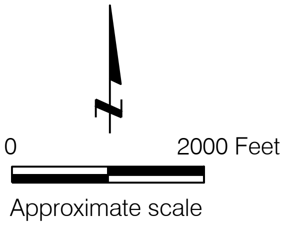
Potentially Active Faults

Faults considered to have been active during Holocene time and to have a relatively high potential for surface rupture; solid line where accurately located, long dash where approximately located, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C for displacement caused by creep or possible creep.

Special Studies Zone Boundaries

These are delineated as straight-line segments that connect encircled turning points so as to define special studies zone segments.

Seaward projection of zone boundary.



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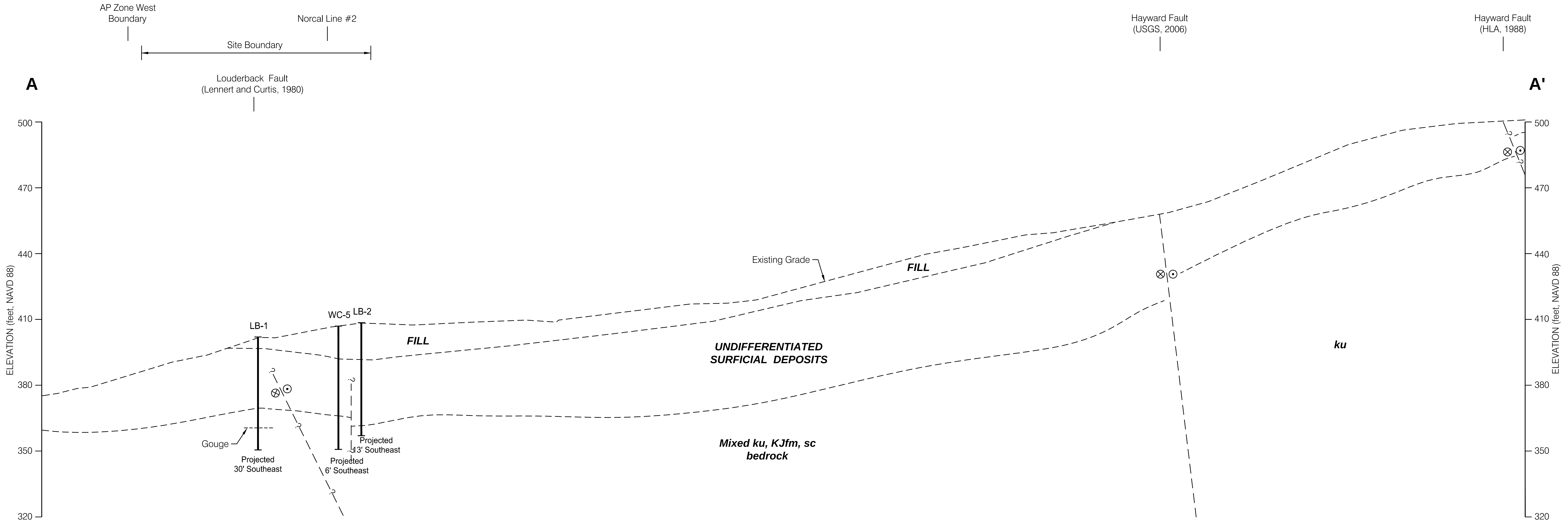
MAPPED ALQUIST-PRIOLO FAULT TRACES

Date 10/08/18 | Project No. 731706301 | Figure 5

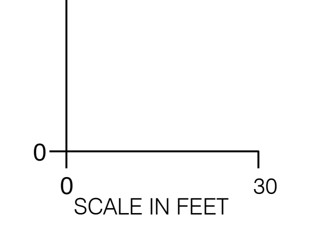


EXPLANATION

– – – – –	Geologic contact, dashed where approximate, queried where inferred
–?– – –	Fault, dashed where inferred, queried where uncertain
⊗|⊙	Away/toward

ku	Undivided Great Valley Complex rocks
KJfm	Franciscan Complex Serpentinite Melange
sc	Silica - carbonate rock
FILL	Artificial/man-made fill

Notes:
1. The above profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.
2. Boring B-1 and B-2 by Langan, 2017
3. North American Vertical Datum of 1988.
4. Topo based on USGS Richmond 7.5-minute Quadrangle, 2012.



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Berkeley, California

IDEALIZED SUBSURFACE PROFILE
A-A'

Date 05/15/18	Project No. 731706301	Figure 6

LANGAN

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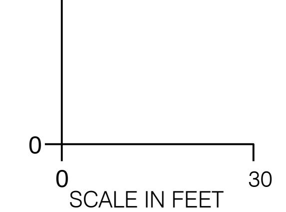
EXPLANATION

– – – –	Geologic contact, dashed where approximate, queried where inferred
–?– – –	Fault, dashed where inferred, queried where uncertain
↳	Shear
⊗⊙	Away/toward

ku	Undivided Great Valley Complex rocks
KJfm	Franciscan Complex Serpentinite Melange
sc	Silica - carbonate rock
FILL	Artificial/man-made fill

Notes:
1. The above profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.
2. Borings 10, 11, 14, and G-26 by Harding Lawson Associates, 1986 and 1988.
3. HLA-B and HLA-C fault trenches by Harding Lawson Associates, 1988.
4. Boring B-3 by Langan, 2017
5. North American Vertical Datum of 1988.
6. Topo based on USGS Richmond 7.5-minute Quadrangle, 2012.



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Berkeley, California

IDEALIZED SUBSURFACE PROFILE B-B'

Date 05/15/18	Project No. 731706301	Figure 7

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EXPLANATION

- - - -	Geologic contact, dashed where approximate, queried where inferred	ku	Undivided Great Valley Complex rocks
—?— — —	Fault, dashed where inferred, queried where uncertain	KJfm	Franciscan Complex Serpentinite Melange
↰	Shear	sc	Silica - carbonate rock
⊗|⊙	Away/toward	*FILL*	Artificial/man-made fill

Notes:
1. The above profile represents a generalized soil cross section interpreted from widely spaced borings. Soil deposits may vary in type, strength, and other important properties between points of exploration.
2. Borings G-27, G-28, and G-29 by Harding Lawson Associates, 1988.
3. HLA-L fault trench by Harding Lawson Associates, 1988.
4. North American Vertical Datum of 1988.
5. Topo based on USGS Richmond 7.5-minute Quadrangle, 2012.

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IDEALIZED SUBSURFACE PROFILE C-C'

Date 05/15/18	Project No. 731706301	Figure 8

LANGAN

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APPENDIX A

Langan Boring Logs

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-1

Boring location: See Site Plan, Figure 2
Logged by: H. Sok
Date started: 9/15/17
Date finished: 9/15/17
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Automatic
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)

Ground Surface Elevation: 402 feet^2

DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value^1	LITHOLOGY	MATERIAL DESCRIPTION		Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0						3.5 inches asphalt concrete (AC)							
0.5						6 inches aggregate base (AB)	**FILL**						
1–2.5	GRAB	⊠			CL	SANDY CLAY with GRAVEL (CL) brown, moist, fine to coarse sand, fine to coarse subangular gravel							
5–6.5	S&H	■	12 20 31	36	CL	SANDY CLAY (CL) yellow-brown, hard, fine- to medium-grained sand, trace angular, fractured, oxidized gravel	**UNDIFFERENTIATED SURFICIAL DEPOSITS**	PP		4,500		12.1	123
7.5–9	SPT	◩	10 18 22	48	SC	CLAYEY SAND with GRAVEL (SC) orange-brown, dense, moist, fine- to coarse-grained, fine oxidized sandstone gravel, chaotic structure Particle Size Analysis, see Appendix F					34.8	13.8	
10–11.5	SPT	◩	13 13 13	31	SC	wet, increased crushed gravel						13.2	
15.5					CL	SANDY CLAY (CL) yellow to yellow-brown, very stiff, wet, fine-grained, trace coarse fractured angular fine to coarse gravel, black decomposing organics							
20–21.5	SPT	◩	6 10 11	25	CL								
30													

LANGAN

Project No.: 731706301
Figure: A-1a

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-1

PAGE 2 OF 2

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
31	SPT	◩	8 16 30	55	CL	CLAY with GRAVEL (CL) gray, hard, with fine subangular to subrounded shale gravel, abraded with polished surfaces				27.5	15.9	
32						SILTSTONE dark gray to black, moderately fractured, low hardness, friable, moderately to deeply weathered						
33												
34												
35												
36												
37												
38												
39						GOUGE yellow-brown to gray, hard, with fine subangular shale and meta-sandstone gravel, lack of internal shearing in clay matrix, polished surfaces on gravel						
40												
41	SPT	◩	14 18 25	52							12.0	
42						LL = 43, PI = 24, see Appendix F						
43												
44												
45												
46	SPT	◩	10 21 29	60		occasional fine carbonate inclusions						
47												
48												
49												
50												
51	SPT	◩	20 26 28	65		gray to green-gray						
52												
53												
54												
55												
56												
57												
58												
59												
60												

Boring terminated at a depth of 51.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscure by drilling method.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively to account for sampler type and hammer energy.

[2] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

LANGAN

Project No.: 731706301

Figure: A-1b

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-2

PAGE 1 OF 2

Boring location: See Site Plan, Figure 2
Date started: 9/15/17
Date finished: 9/15/17
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Automatic
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)
Logged by: H. Sok

LABORATORY TEST DATA

DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: 408.5 feet[2]	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						2 inches asphalt concrete (AC)						
1						7 inches aggregate base (AB)						
2 3 4	S&H	■	6 12 12	17	CL	CLAY with SAND (CL) brown, very stiff, moist, fine sand, trace fine gravel, oxidized LL = 43, PI = 25, see Appendix F	PP		>4,500		14.2	118
5 6	S&H	■	6 9 11	14		grades sandy, brown to dark brown with white calcium carbonate and yellow brown mottling, stiff, oxidized fine sandstone gravel	PP		4,250	62.3	18.3	109
7 8	S&H	■	11 12 12	17		brown with light brown mottling, very stiff, fine to coarse sand, trace silt FILL	PP		4,500			
9					GP	GRAVEL (GP) very dense						
10 11 12	SPT	◩	7 50/ 5.5"	60/ 5.5"	CL	SANDY CLAY (CL) brown to yellow-brown, hard, wet, fine sand, trace gravel, chaotic structure						
13 14					GL	CLAY with GRAVEL (CL) gray to yellow-brown, medium dense to dense, wet, subangular, coarse						
15	SPT	◩	8 12 13	30		Particle Size Analysis, see Appendix F				52.9	15.9	
16 17 18 19					CL	SANDY CLAY (CL) yellow-brown to gray-brown, very stiff, hard, wet, trace fine subangular to subrounded gravel, trace oxidation staining on gravel						
20 21 22	S&H	■	6 12 6	13		yellow-brown with gray-brown mottling, stiff, trace dark brown spots, with deeply weathered fine sandstone gravel, occasional black staining Triaxial Test, see Appendix F	PP TxUU	 2,000	>4,500 3,440		 20.0	 108
23 24 25 26 27	S&H	■	13 18 22	28		very stiff, fine to coarse sand, trace fine subangular gravel, faint oxidation staining Consolidation Test, see Appendix F UNDIFFERENTIATED SURFICIAL DEPOSITS	PP		3,250		17.5	110
28 29 30 31	SPT	◩		20								

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Project No.: 731706301
Figure: A-2a

TEST GEOTECH LOG 731706301.GPJ TR.GDT 12/5/17

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-2

PAGE 2 OF 2

DEPTH (feet)	SAMPLES: Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
	SPT		8 13 15	20	CL	SANDY CLAY (CL) (continued) yellow-brown, fine angular to subangular siltstone gravel, faint oxidation staining, slightly chaotic structure							
32													
33													
34						CLAYEY SAND (SC) yellow-brown, medium dense, wet							
35													
36	SPT		12 18 18	20		increased gravel, coarse, up to 1 inch in diameter, increased structure, transitioning to residual soil					31.1	13.0	
37													
38													
39					SC								
40							**UNDIFFERENTIATED SURFICIAL DEPOSITS**						
41	SPT		12 18 20	46		residual soil, dense							
42													
43													
44													
45													
46	SPT		11 12 14	31		SILTSTONE dark gray, intensely fractrured, low hardness, friable, deeply weathered							
47													
48													
49						GOUGE yellow-brown to gray-brown, hard, siltstone/shale in clay matrix, abraded, polished surfaces							
50													
51	SPT		11 18 28	55									
52													
53													
54													
55													
56	SPT		16 13 21	41									
57						SERPENTINITE MELANGE intensely fractured, low hardness, weak , deeply weathered							
58													
59													
60													
61	SPT		11 18 32	60									
62													

Boring terminated at a depth of 51.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscure by drilling method.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively to account for sampler type and hammer energy.

[2] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

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Project No.: 731706301

Figure: A-2b

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-3

Boring location: See Site Plan, Figure 2
Date started: 9/14/17
Date finished: 9/14/17
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Automatic
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)
Logged by: H. Sok

DEPTH (feet)	SAMPLES Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: 398.5 feet[2]		LABORATORY TEST DATA Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						4 inches asphalt concrete (AC)							
1						CLAY with SAND and GRAVEL (CL) dark brown	FILL						
2						brown to yellow-brown, very stiff, moist, fine sand, coarse gravel							
3	S&H		6 16 14	21	CL			PP		>4,500			
4													
5													
6	S&H		7 7 5	8		yellow-brown with black and brown-red mottling, medium stiff to stiff, scattered organics		PP		3,400		17.2	111
7						wet							
8	SPT		50/ 2"	60/ 2"	GC	CLAYEY GRAVEL (GC) gray-brown, very dense, wet, dark brown-gray subrounded volcanic rock fragments							
9						CLAY with SAND (CL) yellow-brown with gray-brown mottling, stiff, wet, fine to coarse sand, trace fine gravel							
10													
11	S&H		4 7 13	14	CL	LL = 45, PI = 28, see Appendix F fine subangular silica-carbonate gravel, fragments of silty sandstone, gray gouge seams		PP		4,250		24.4	100
12													
13					GC	CLAYEY GRAVEL (GC) fractured rock							
14						CLAYEY SAND with GRAVEL (SC) yellow-brown with dark brown mottling, dense, wet, fine- to coarse-grained, rock fragments highly fractured into fine to coarse gravel, black decomposed organic seams, scattered subrounded fine to coarse gravel, highly oxidized throughout, chaotic structure Particle Size Analysis, see Appendix F	UNDIFFERENTIATED SURFICIAL DEPOSITS						
15													
16	S&H		12 32 29	43	SC			PP		4,500	47.1	25.0	101
17													
18													
19						CLAY with GRAVEL (CL) yellow-brown with gray-brown mottling, very stiff, fine sand, trace coarse sand, abundant red decomposed sandstone clasts with oxidation staining Consolidation Test, see Appendix F							
20													
21	S&H		13 13 22	25				PP		4,250		19.2	109
22													
23													
24					CL								
25													
26	S&H		11 19 37	39		hard, trace coarse gravel, highly oxidized and decomposed sandstone fragments		PP TxUU	 2,300	4,500 5,270		 16.5	 114
27						Triaxial Test, see Appendix F							
28													
29													
30													

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Project No.: 731706301
Figure: A-3a

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-3

PAGE 2 OF 3

DEPTH (feet)	SAMPLES Run Number	Sample Type	SPT N-Value^1	Recovery, %	RQD, %	Drilling Rate (min/ft)	LITHOLOGY	MATERIAL DESCRIPTION		TEST DATA Dip, Degrees	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31			39				CL	SANDY CLAY with GRAVEL (CL) yellow, hard, coarse sand, trace coarse gravel up to 1 inch in length PP (Su >4,500 psf)	UNDIFFERENTIATED SURFICIAL DEPOSITS				
32													
33								CLAY with SAND (CL) gray and dark brown, very stiff, wet, coarse sand, trace fine gravel					
34													
35								PP (Su > 4,500 psf)					
36			25				CL	yellow-brown to red-black serpentinite fragments, fine rounded to subangular gravel, decomposed red sandstone and fresh black meta shale				16.6	115
37			55					Triaxial Test, see Appendix F (Su = 2,960 psf)					
38								red-brown, hard					
39								CLAYEY GRAVEL (GP) yellow-brown to gray with hard, strong black meta sandstone, dense, wet					
40			60/ 3"										
41	1			87.5	0	22	GP						
42	2			87.5	0	5.5							
43							CL	CLAY with SAND (CL) yellow-brown, coarse sand					
44								SHALE MELANGE yellow-brown to gray, moderately fractured, moderately hard, weak, deeply weathered					
45													
46													
47													
48													
49													
50													
51													
52							△	BRECCIA yellow to yellow-brown with orange oxidation staining, low hardness, friable, deeply weathered, variable grain size and composition set in soft and plastic clayey matrix, variable sand content in matrix					
53													
54	3			80	0	2.5							
55													
56													
57								decreased structure and decreased matrix, strong orange oxidation staining, graywacke sandstone inclusion, moderately hard to hard, strong, oxidized pockets					
58	4			24	0	2.4							
59													
60													

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-3

PAGE 3 OF 3

DEPTH (feet)	SAMPLES Run Number	Sample Type	SPT N-Value[1]	Recovery, %	RQD, %	Drilling Rate (min/ft)	LITHOLOGY	MATERIAL DESCRIPTION	TEST DATA Dip, Degrees	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
							△ △	BRECCIA (continued)				
61							△ △	no recovery				
62	5	●		0	0	3.2	△ △					
63							△ △					
64	6		88/ 8"	50	0	20	△ △	gray, moderately hard, moderately strong to strong, little weathered calcite deposits along surfaces				
65							△ △					
66												
67												
68												
69												
70												
71												
72												
73												
74												
75												
76												
77												
78												
79												
80												
81												
82												
83												
84												
85												
86												
87												
88												
89												
90												

Boring terminated at a depth of 65.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscure by drilling method.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively to account for sampler type and hammer energy.

[2] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

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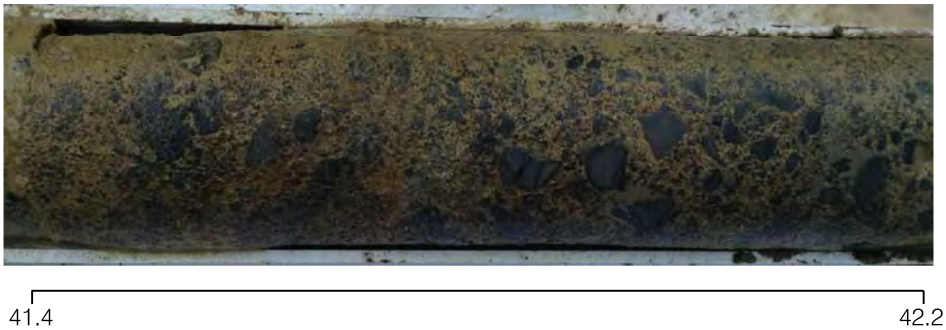
Project No.: 731706301

Figure: A-3c

Run 1: 40.2 to 41 feet (segment from 40.2 to 40.9 feet)

Run 2: 41 to 43 feet (segment from 41 to 41.6 feet)



Run 2: 41 to 43 feet (segment from 41.4 to 42.2 feet)

Run 2: 41 to 43 feet (segment from 42.1 to 42.75 feet)

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AND HEARST AVENUE ACADEMIC HOUSING
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BORING B-3 PHOTOS

Date 03/01/17 | Project No. 731706301 | Figure A-3d

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Run 3: 52 to 56 feet (segment from 52 to 52.5 feet)

Run 3: 52 feet to 56 feet (segment from 52.2 to 53.15 feet)

Run 3: 52 to 56 feet (segment from 53.2 to 54.3 feet)

Run 3: 52 to 56 feet (segment from 54.2 to 55.2 feet)

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BORING B-3 PHOTOS

Date 03/01/17 | Project No. 731706301 | Figure A-3e

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Run 4: 56 to 61 feet (segment from 56 to 56.7 feet)

Run 4: 56 to 61 feet (segment from 56.35 to 57.2 feet)

Run 5: 61 to 63.5 (no recovery)

Run 6: 63.5 to 64 feet

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BORING B-3 PHOTOS

Date 03/01/17	Project No. 731706301	Figure A-3f

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size	**Gravels** (More than half of coarse fraction > no. 4 sieve size)	**GW**	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	**SW**	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	**Silts and Clays** LL = < 50	**ML**	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	**MH**	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		**PT**	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	**Grain Size in Millimeters**
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.075
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.075
Silt and Clay	Below No. 200	Below 0.075

▽ Unstabilized groundwater level

▼ Stabilized groundwater level

SAMPLE DESIGNATIONS/SYMBOLS

▤	Sample taken with Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter. Darkened area indicates soil recovered
◩	Classification sample taken with Standard Penetration Test sampler
◨	Undisturbed sample taken with thin-walled tube
☒	Disturbed sample
⊙	Sampling attempted with no recovery
◫	Core sample
▣	Analytical laboratory sample
▥	Sample taken with Direct Push or Drive sampler

SAMPLER TYPE

C	Core barrel
CA	California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter
D&M	Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube
O	Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube
PT	Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube
S&H	Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter
SPT	Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter
ST	Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

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Berkeley, California

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CLASSIFICATION CHART

Date 09/22/17 | Project No. 731706301 | Figure A-4

I FRACTURING

Intensity	**Size of Pieces in Feet**
Very little fractured	Greater than 4.0
Occasionally fractured	1.0 to 4.0
Moderately fractured	0.5 to 1.0
Closely fractured	0.1 to 0.5
Intensely fractured	0.05 to 0.1
Crushed	Less than 0.05

II HARDNESS

1. **Soft** - reserved for plastic material alone.
2. **Low hardness** - can be gouged deeply or carved easily with a knife blade.
3. **Moderately hard** - can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visible after the powder has been blown away.
4. **Hard** - can be scratched with difficulty; scratch produced a little powder and is often faintly visible.
5. **Very hard** - cannot be scratched with knife blade; leaves a metallic streak.

III STRENGTH

1. **Plastic** or very low strength.
2. **Friable** - crumbles easily by rubbing with fingers.
3. **Weak** - an unfractured specimen of such material will crumble under light hammer blows.
4. **Moderately strong** - specimen will withstand a few heavy hammer blows before breaking.
5. **Strong** - specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.
6. **Very strong** - specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

IV **WEATHERING -** The physical and chemical disintegration and decomposition of rocks and minerals by natural processes such as oxidation, reduction, hydration, solution, carbonation, and freezing and thawing.

D. **Deep** - moderate to complete mineral decomposition; extensive disintegration; deep and thorough discoloration; many fractures, all extensively coated or filled with oxides, carbonates and/or clay or silt.

M. **Moderate** - slight change or partial decomposition of minerals; little disintegration; cementation little to unaffected. Moderate to occasionally intense discoloration. Moderately coated fractures.

L. **Little** - no megascopic decomposition of minerals; little of no effect on normal cementation. Slight and intermittent, or localized discoloration. Few stains on fracture surfaces.

F. **Fresh** - unaffected by weathering agents. No disintegration of discoloration. Fractures usually less numerous than joints.

ADDITIONAL COMMENTS:

V **CONSOLIDATION OF SEDIMENTARY ROCKS:** usually determined from unweathered samples. Largely dependent on cementation.

U = unconsolidated
P = poorly consolidated
M = moderately consolidated
W = well consolidated

VI BEDDING OF SEDIMENTARY ROCKS

Splitting Property	**Thickness**	**Stratification**
Massive	Greater than 4.0 ft.	very thick-bedded
Blocky	2.0 to 4.0 ft.	thick bedded
Slabby	0.2 to 2.0 ft.	thin bedded
Flaggy	0.05 to 0.2 ft.	very thin-bedded
Shaly or platy	0.01 to 0.05 ft.	laminated
Papery	less than 0.01	thinly laminated

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AND HEARST AVENUE ACADEMIC HOUSING
Berkeley, California

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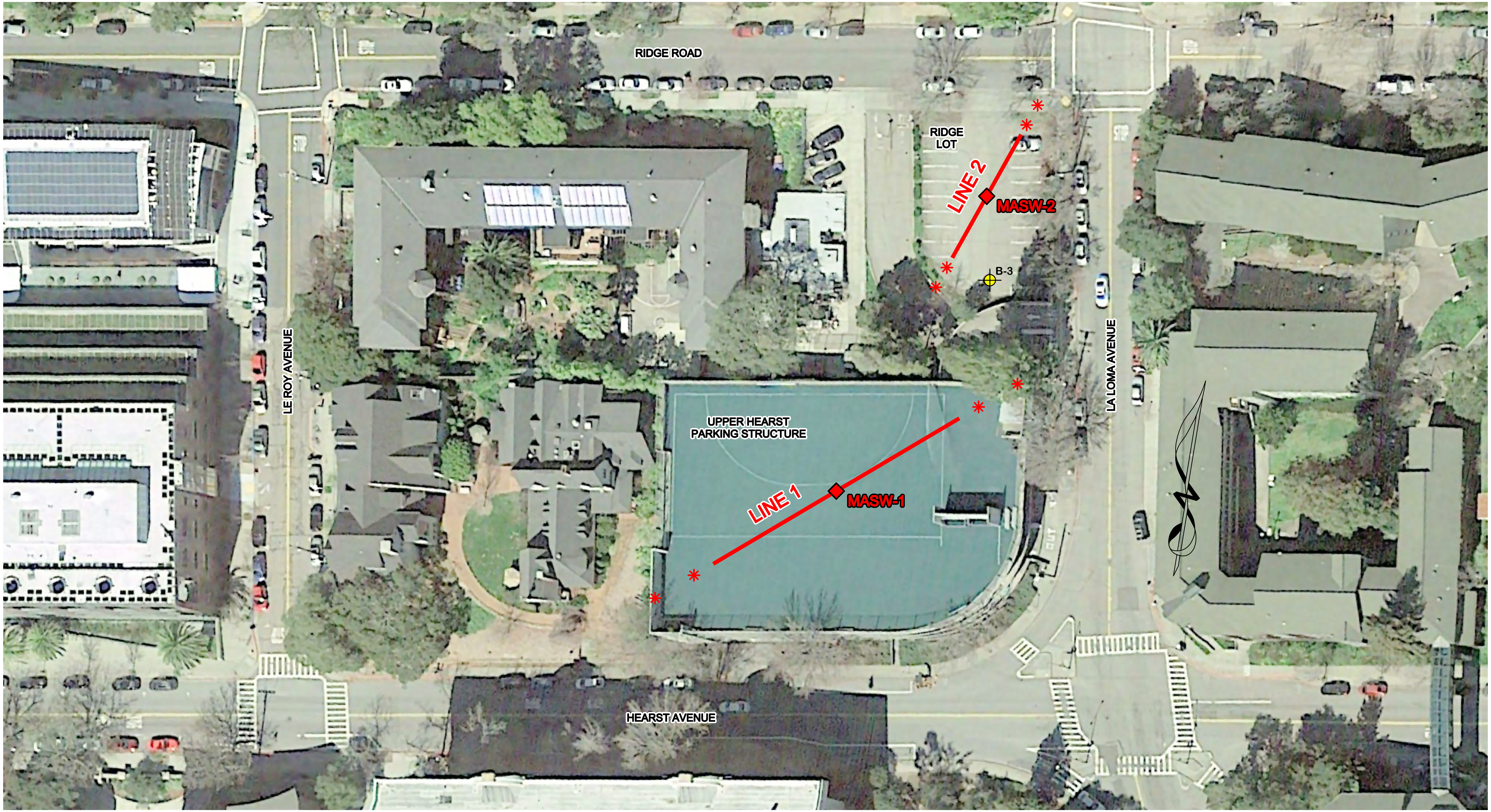
PHYSICAL PROPERTIES CRITERIA FOR ROCK DESCRIPTIONS

Date 09/25/17 | Project No. 731706301 | Figure A-5

APPENDIX B

Norcal Geophysical Surveys



LEGEND

▬	SEISMIC REFRACTION LINE
◆	MASW SOUNDING LOCATION
✳	MASW SHOT POINT
⊕	DOWNHOLE SEISMIC BOREHOLE

SCALE
0 25 50 100
(1 inch = 50 feet)

NORCAL
GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

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REGISTERED GEOPHYSICIST
WILLIAM J. HENRICH
No. 893
STATE OF CALIFORNIA

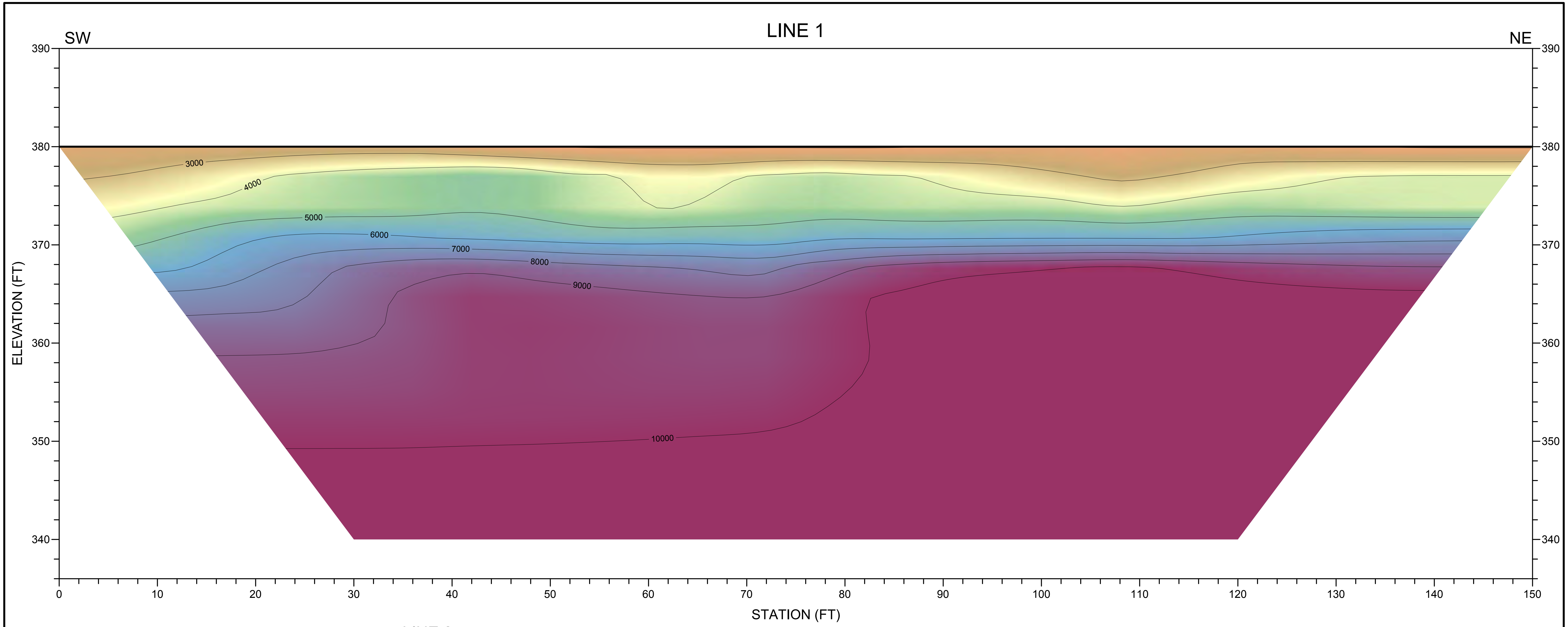
SITE LOCATION MAP
HEARST-LA LOMA PARKING FACILITIES
SURFACE & DOWNHOLE SEISMIC SURVEY

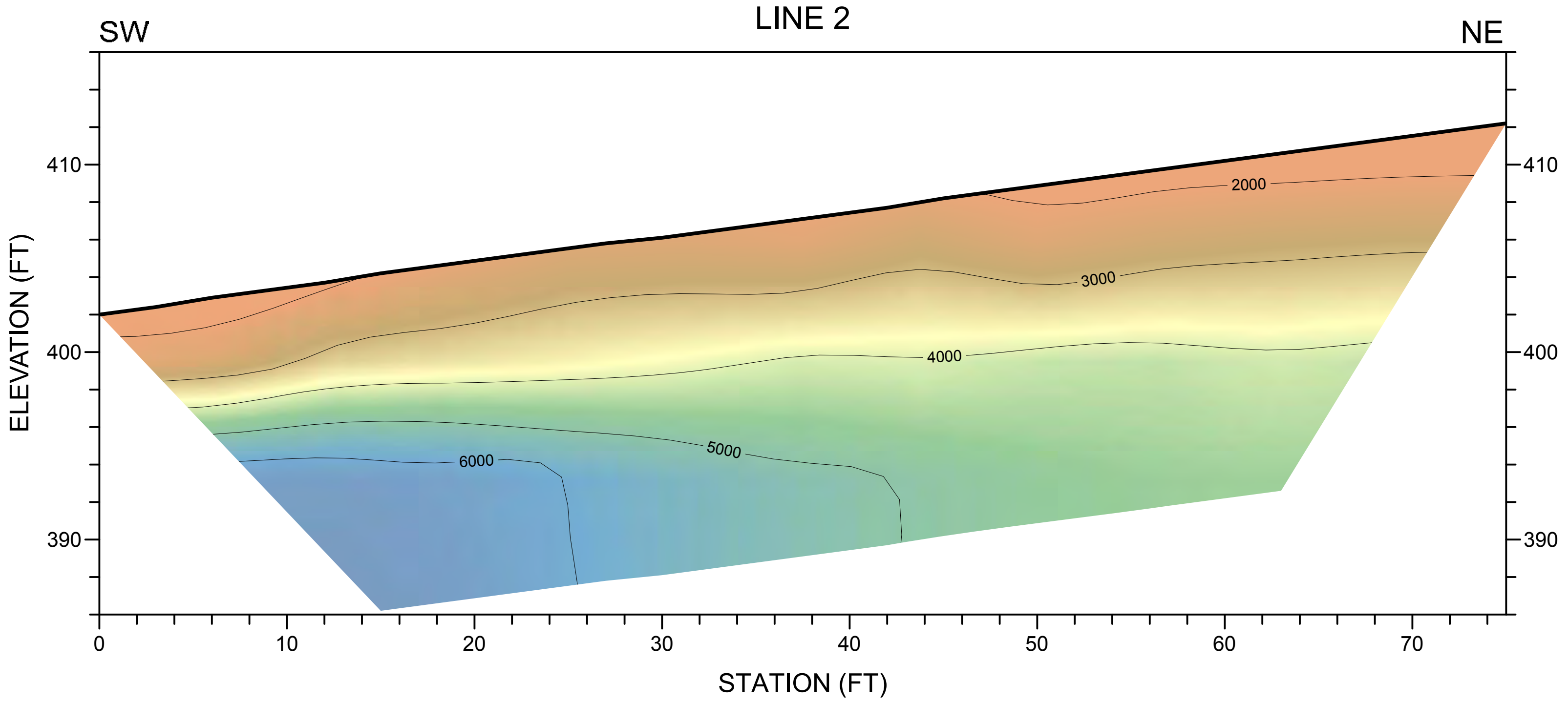
LOCATION: BERKELEY, CALIFORNIA

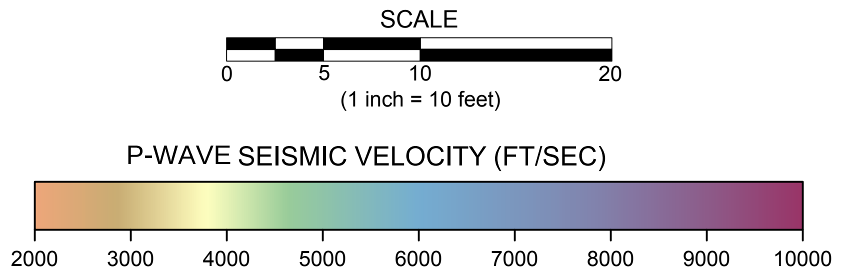
CLIENT: LANGAN

JOB #. NS175052	DATE: OCTOBER 2017	PLATE 1
DRAWN BY: G.RANDALL	APPROVED BY: WJH	

William J Henrich 10/16/2017







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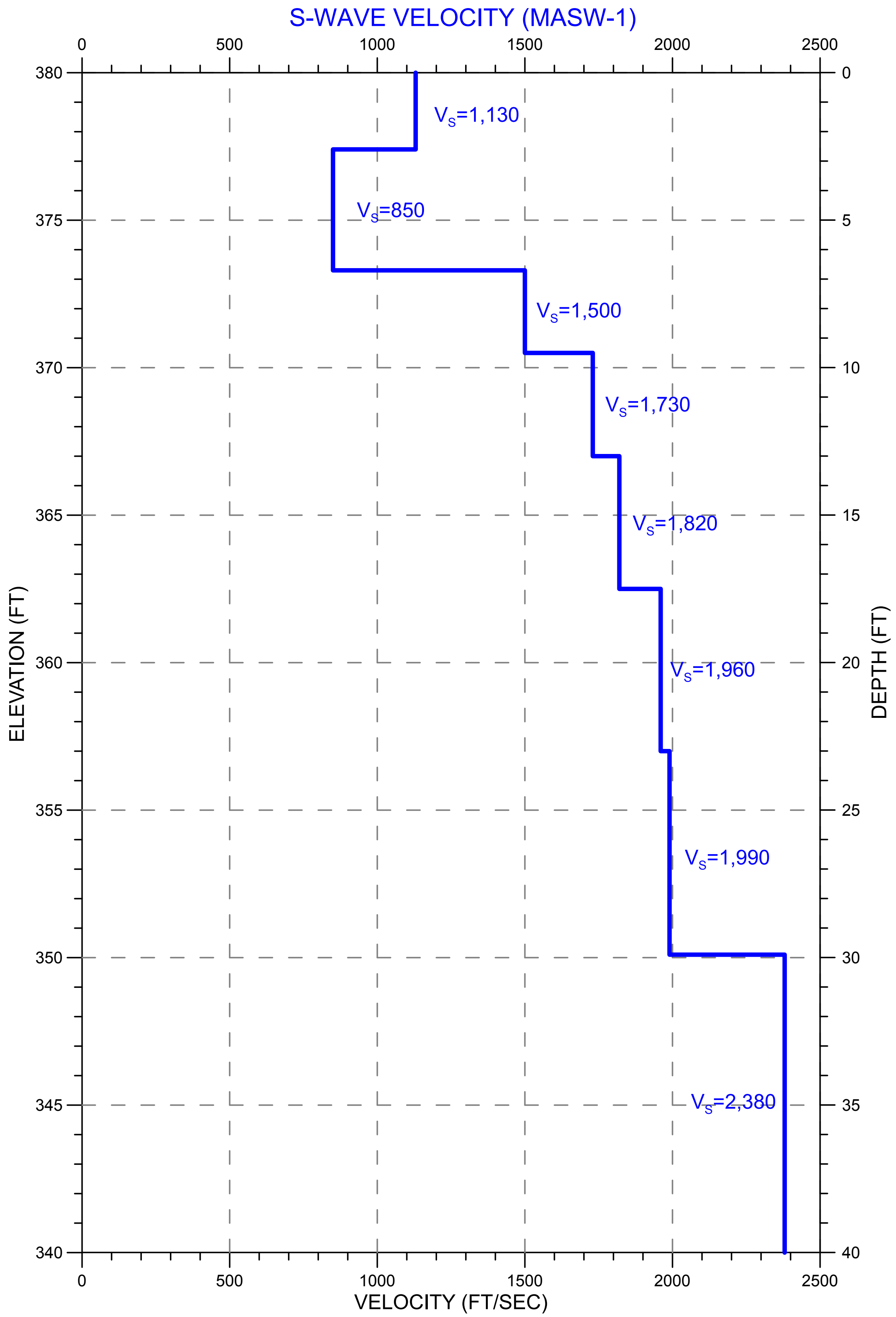
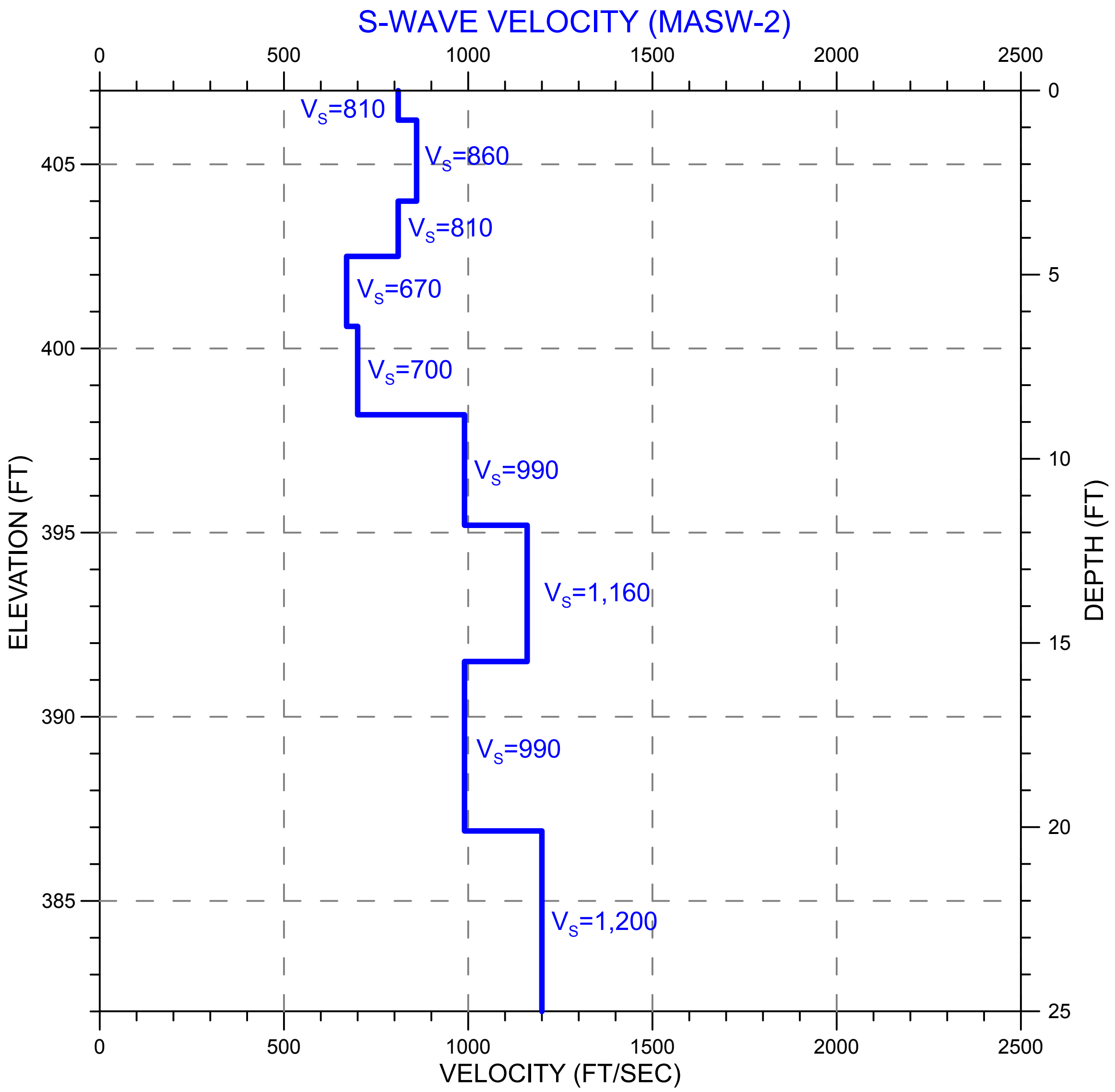
WILLIAM J. HENRICH
No. 893

SEISMIC REFRACTION PROFILES
LINES 1 & 2
HEARST-LA LOMA PARKING FACILITIES

LOCATION: BERKELEY, CALIFORNIA
CLIENT: LANGAN
JOB #: NS175052
DATE: OCTOBER 2017
DRAWN BY: G.RANDALL
APPROVED BY: WJH
10/16/2017

PLATE
2





LEGEND

▬	S-WAVE VELOCITY (MASW)

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WILLIAM J. HENRICH
No. 893

MASW 1D S-WAVE VELOCITY SOUNDINGS
MASW 1 & MASW 2
HEARST-LA LOMA PARKING FACILITIES

LOCATION: BERKELEY, CALIFORNIA

CLIENT: LANGAN

JOB #: NS175052	DATE: OCTOBER 2017	PLATE
DRAWN BY: G.RANDALL	APPROVED BY: WJH	3

William J Henrich 10/16/2017

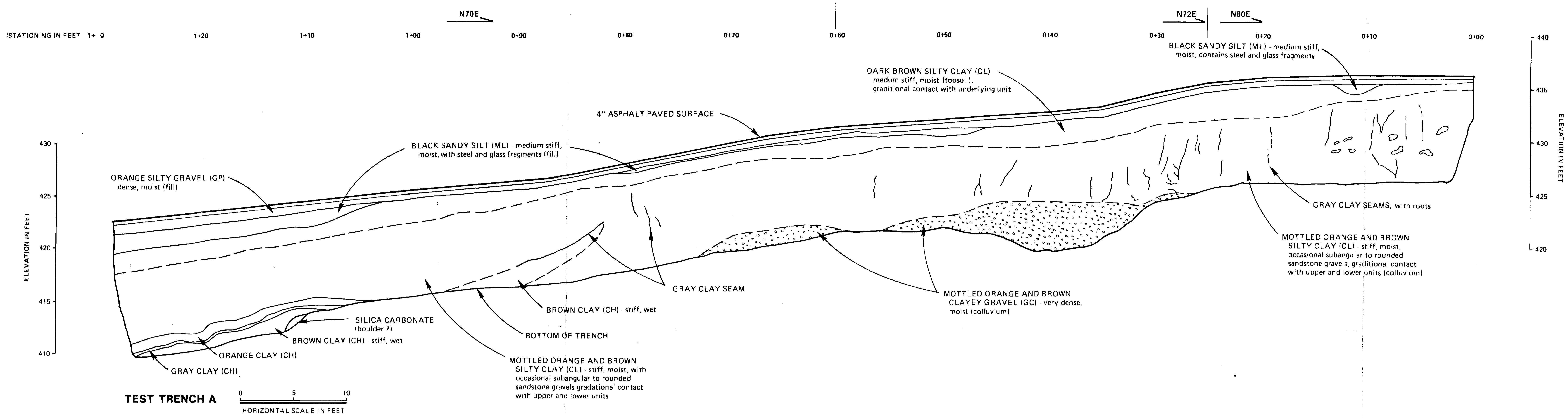
Table 1: Borehole B-3, P- and S-wave Velocity Table

METRIC UNITS DEPTHS & INTERVAL VELOCITIES					IMPERIAL UNITS DEPTHS AND INTERVAL VELOCITIES						
Depth	VsLeft	VsRight	VsAvg	Vp	Depth	VsLeft	VsRight	VsAvg	Vp	VsAvg-3pt	Vp -3pt
Meters	M/sec.	M/sec.	M/sec.	M/sec.	Feet	Ft./sec.	Ft./sec.	Ft./sec.	Ft./sec.	Ft./sec.	Ft./sec.
3.65	296	298	297	1799	11.96	971	976	974	5867		
4.27	305	309	307	1852	14.02	1000	1013	1006	6039	958	5790
4.35	268	277	272	1676	14.26	879	908	893	5465	1013	5793
4.89	342	352	347	1802	16.06	1124	1155	1139	5875	1036	5623
4.91	318	338	328	1695	16.12	1043	1108	1076	5527	1052	5777
5.49	284	289	287	1818	18.00	932	948	940	5929	985	5610
5.50	282	291	286	1648	18.03	925	954	939	5375	986	5797
6.09	327	331	329	1866	19.98	1072	1086	1079	6086	1033	5750
6.13	338	321	329	1775	20.10	1108	1052	1080	5789	1065	5990
6.72	313	318	315	1869	22.06	1025	1045	1035	6095	1058	5825
6.80	325	321	323	1714	22.31	1065	1052	1058	5590	1033	5927
7.01	303	311	307	1869	23.01	994	1019	1007	6095	1084	5848
7.11	355	368	362	1796	23.34	1166	1206	1186	5858	1103	5955
7.25	338	342	340	1813	23.79	1108	1124	1116	5911	1145	5911
7.27	357	333	345	1829	23.84	1172	1094	1133	5965	1127	5990
7.33	350	341	345	1869	24.04	1149	1117	1133	6095	1134	6027
7.55	350	342	346	1846	24.78	1150	1124	1137	6020	1142	6067
7.61	357	347	352	1866	24.96	1172	1139	1155	6086	1107	6018
7.88	321	306	313	1824	25.84	1052	1004	1028	5947	1082	6024
7.93	342	305	324	1852	26.03	1124	1000	1062	6039	1066	5933
7.96	341	334	338	1783	26.13	1120	1097	1109	5814	1141	5892
8.23	382	382	382	1786	27.00	1252	1252	1252	5823	1232	5855
8.54	403	410	407	1818	28.01	1323	1345	1334	5929	1312	5994
8.57	419	403	411	1911	28.12	1375	1323	1349	6231	1348	6104
8.85	413	417	415	1887	29.04	1356	1367	1361	6153	1382	6153
9.13	431	444	437	1863	29.94	1414	1456	1435	6076	1393	6127
9.16	424	418	421	1887	30.04	1390	1373	1381	6153	1413	6071
9.44	446	420	433	1835	30.98	1465	1379	1422	5983	1423	5983
9.76	446	446	446	1783	32.01	1465	1465	1465	5814	1404	5945
9.76	408	401	404	1852	32.02	1337	1316	1327	6039	1430	5945
10.10	463	450	457	1835	33.15	1519	1478	1498	5983	1458	5981
10.38	467	476	472	1815	34.04	1533	1562	1548	5920	1383	6019

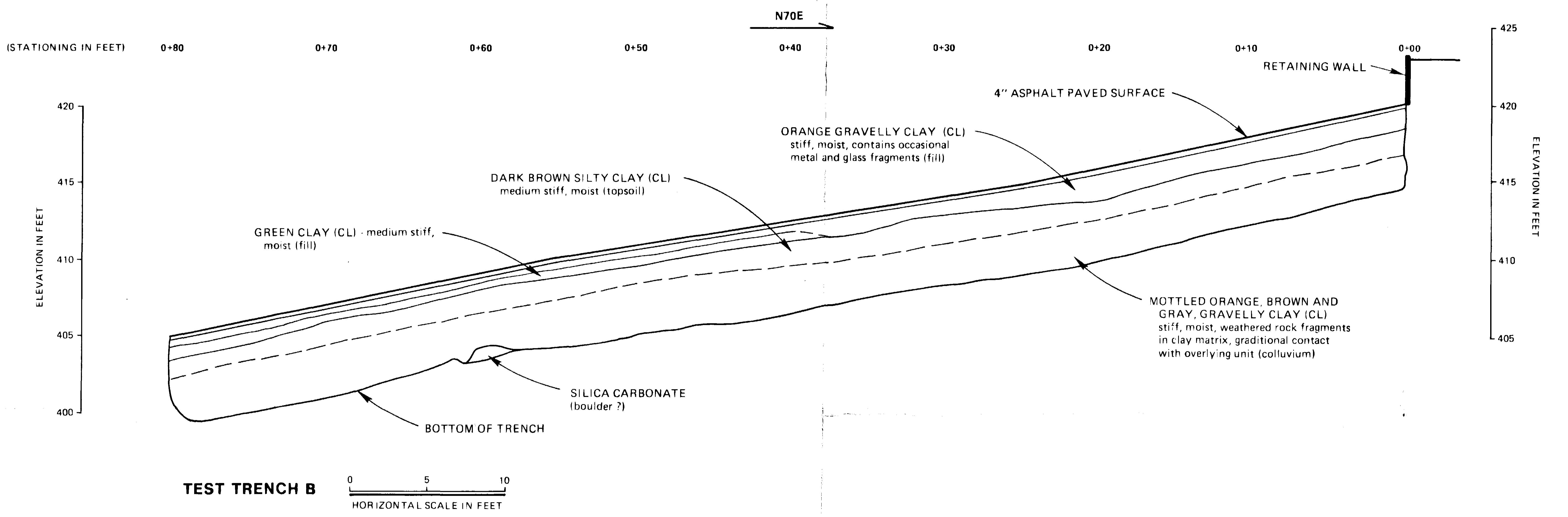
10.39	338	335	336	1887	34.08	1108	1099	1103	6153	1372	6072
10.67	452	441	447	1884	35.02	1485	1445	1465	6143	1310	6022
10.96	413	417	415	1770	35.96	1356	1367	1361	5772	1366	5960
11.00	379	397	388	1829	36.10	1243	1302	1272	5965	1373	5803
11.30	459	446	453	1739	37.07	1505	1465	1485	5671	1284	5930
11.58	326	341	333	1887	38.00	1070	1118	1094	6153	1373	5973
11.64	472	467	469	1869	38.18	1548	1533	1540	6095	1334	6041
11.91	424	410	417	1802	39.09	1390	1345	1367	5875	1324	5979
12.20	328	321	324	1829	40.03	1075	1052	1063	5965	1278	5902
12.22	427	427	427	1799	40.09	1402	1402	1402	5867	1328	5957
12.50	459	467	463	1852	41.02	1505	1533	1519	6039	1559	5930
12.51	521	549	535	1805	41.06	1709	1803	1756	5884	1616	5972
12.79	482	477	479	1838	41.95	1580	1565	1572	5992	1588	5972
12.82	437	439	438	1852	42.07	1433	1439	1436	6039	1514	6084
13.12	476	459	467	1908	43.03	1562	1505	1534	6221	1493	6118
13.12	461	459	460	1869	43.05	1512	1505	1508	6095	1500	6279
13.41	446	442	444	2000	44.01	1465	1452	1458	6522	1505	6424
13.41	467	476	472	2041	44.01	1533	1562	1548	6655	1478	6545
13.70	431	439	435	1980	44.96	1414	1439	1427	6457	1476	6523
13.73	446	441	443	1980	45.06	1465	1445	1455	6457	1497	6523
14.03	495	485	490	2041	46.04	1624	1593	1608	6655	1512	6523
14.05	443	455	449	1980	46.09	1454	1494	1474	6457	1541	6612
14.34	476	463	470	2062	47.05	1562	1519	1541	6724	1580	6612
14.34	532	521	526	2041	47.05	1745	1709	1727	6655	1662	6724
14.63	538	510	524	2083	48.01	1764	1674	1719	6794	1704	6724
14.64	505	510	508	2062	48.03	1657	1674	1665	6724	1729	6818
14.96	546	552	549	2128	49.07	1793	1813	1803	6938	1811	6917
14.97	602	595	599	2174	49.10	1976	1953	1965	7089	1892	6984
15.24	588	575	581	2124	50.01	1930	1886	1908	6926	1862	6984
15.25	515	529	522	2128	50.04	1691	1736	1714	6938	1737	6959
15.45	483	485	484	2151	50.70	1585	1593	1589	7013	1744	6959
15.47	581	595	588	2124	50.75	1907	1953	1930	6926		

APPENDIX C

HLA Fault Trench Logs and Descriptions



TEST TRENCH A



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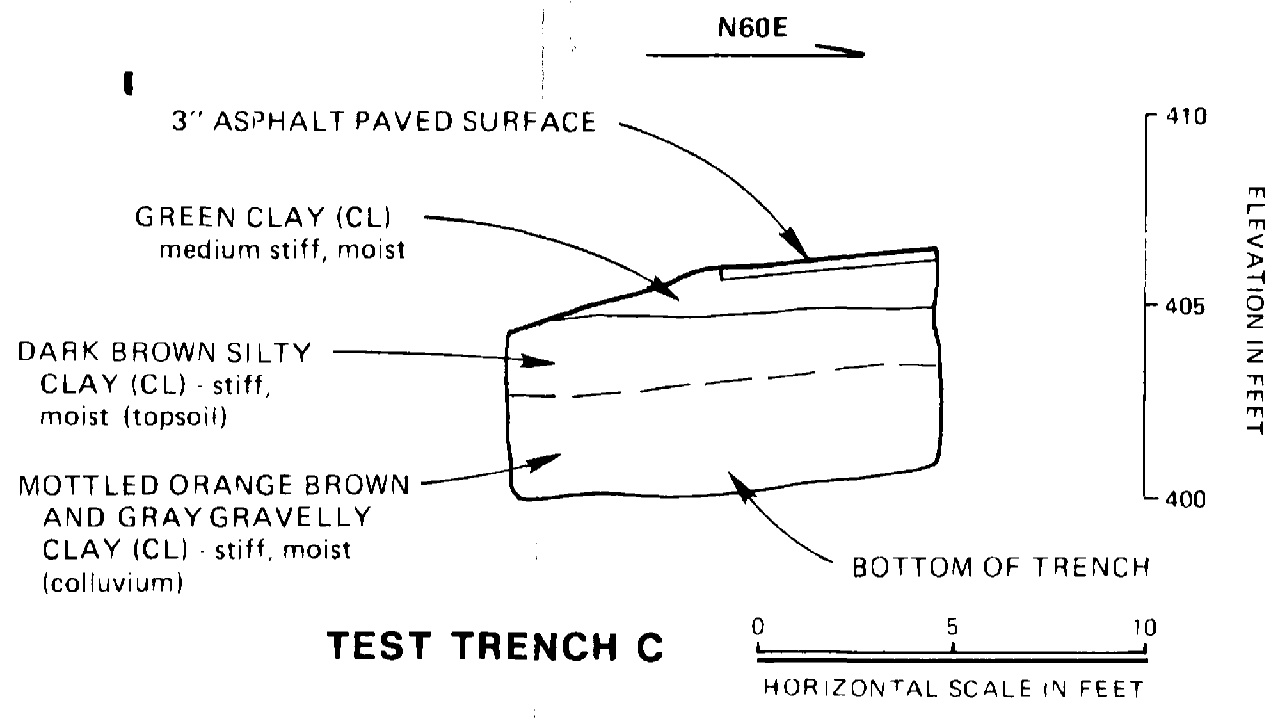
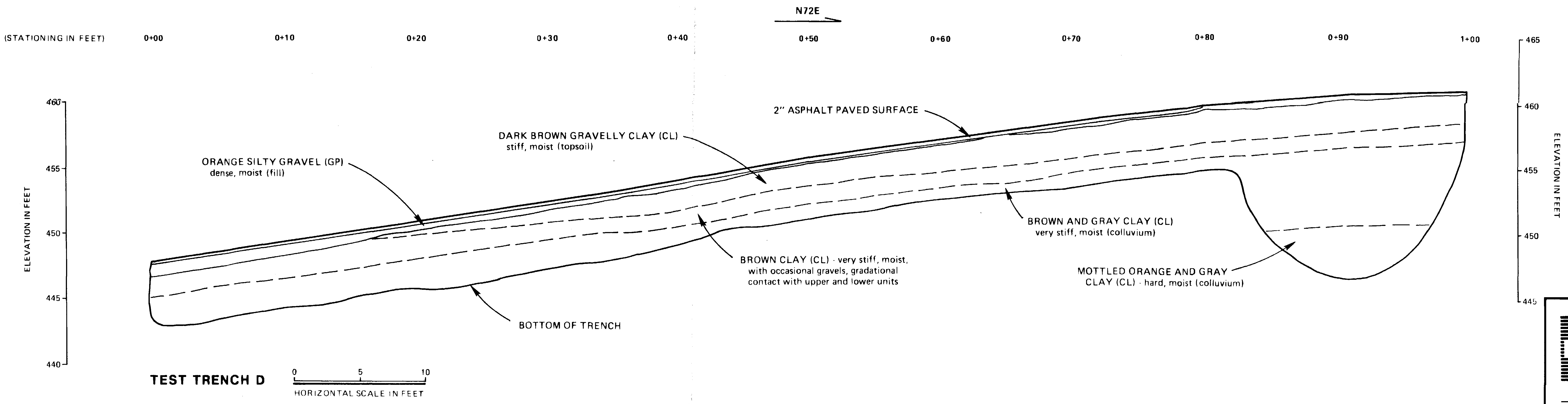


TEST TRENCH C



TEST TRENCH D

Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Log of Test Trenches A, B, C, D
La Loma-Ridge
Student Housing Project
University of California
Berkeley, California

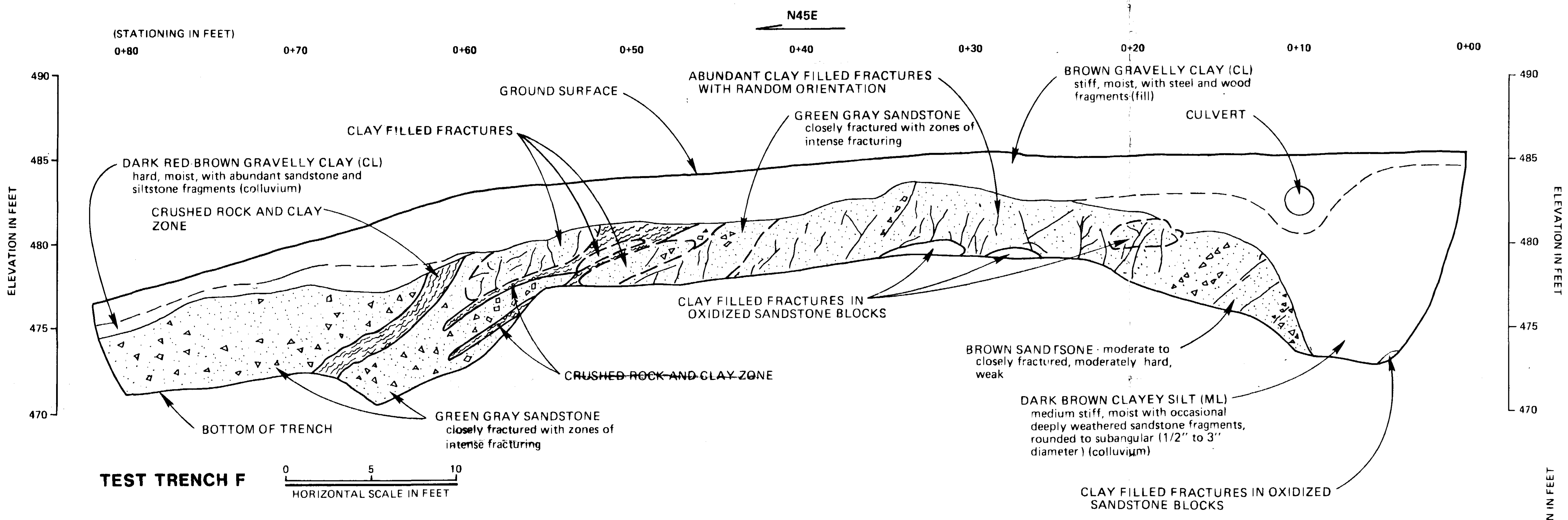
PLATE
22

DRAWN	JOB NUMBER	APPROVED	DATE
PM	2313,057.01	SRK	10/86
REVISED	DATE	REVISED	DATE

669

TEST TRENCH E

TEST TRENCH E CONTINUED



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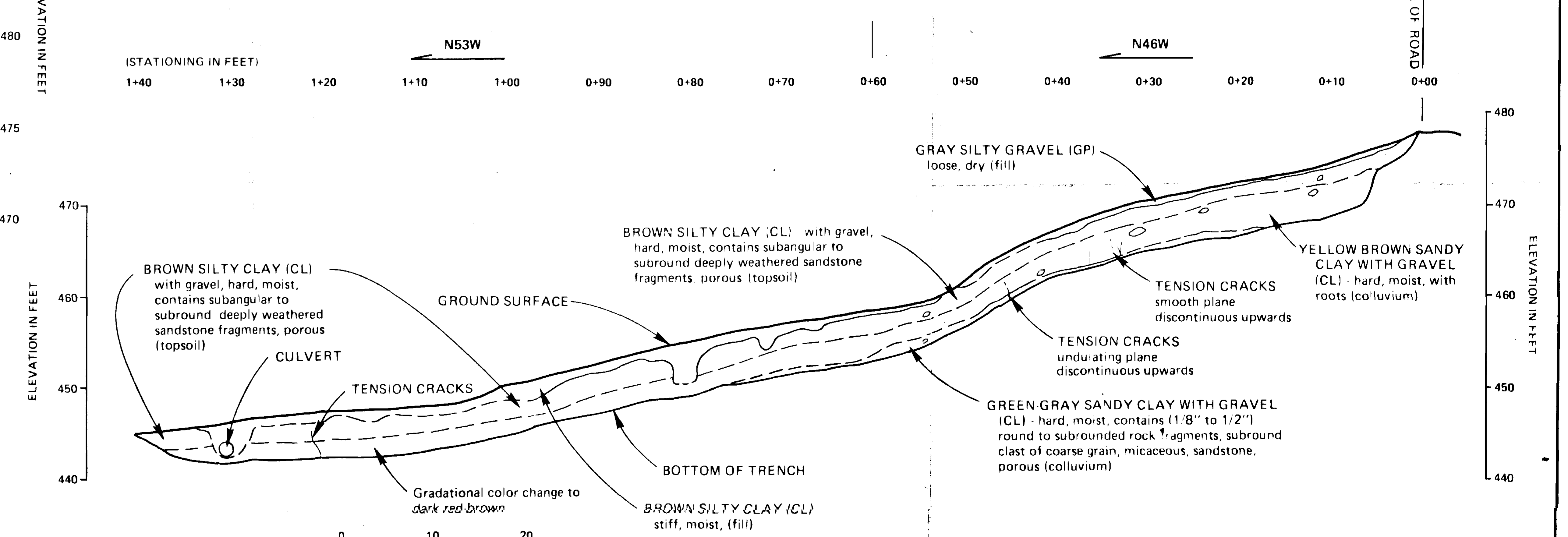
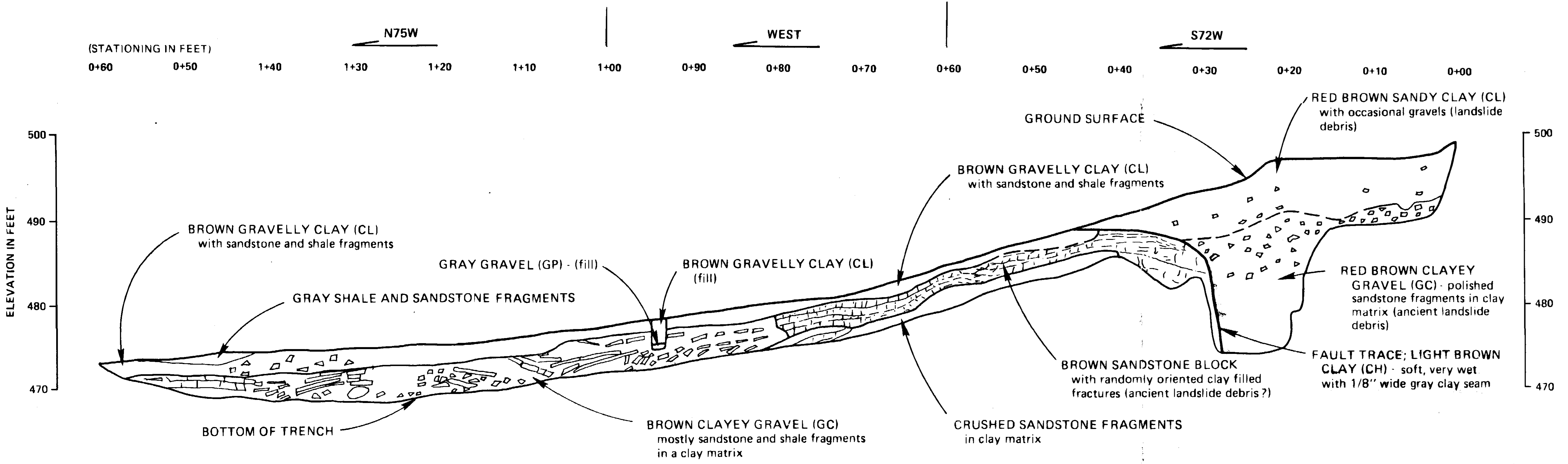


TEST TRENCH G

0 10 20
HORIZONTAL SCALE IN FEET



TEST TRENCH H

HLA

Harding Lawson Associates
Engineers. Geologists
& Geophysicists

Log of Trenches E, F, G, H
Hillside Site
Student Housing Project
University of California
Berkeley, California

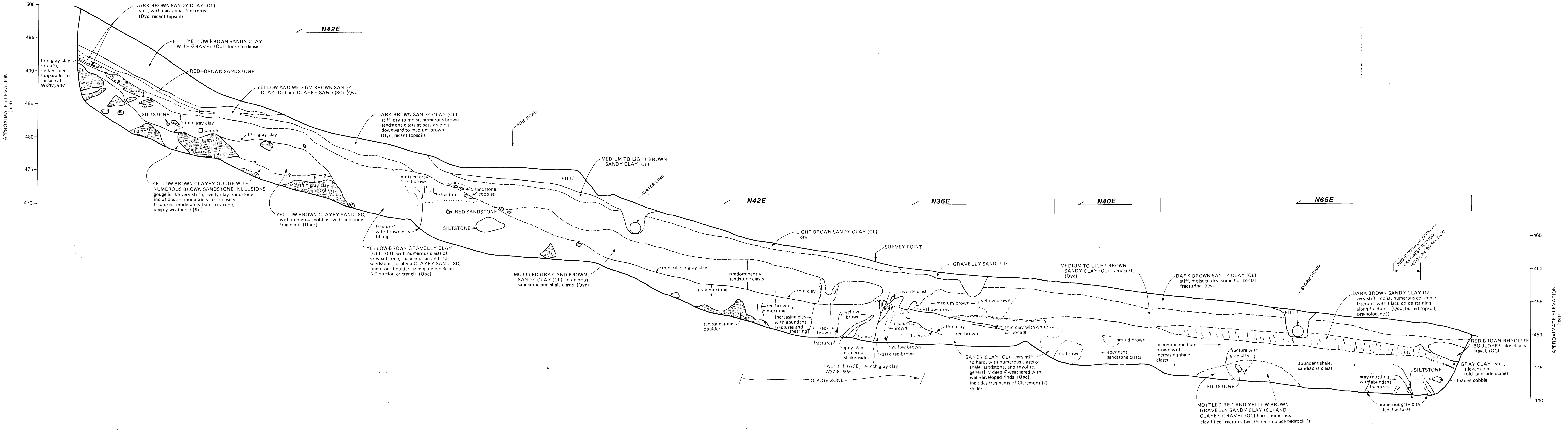
PLATE
21

DRAWN	JOB NUMBER	APPROVED	DATE
PM	2313,057.01	SAK	10/86
REVISED	DATE	REVISED	DATE

6744

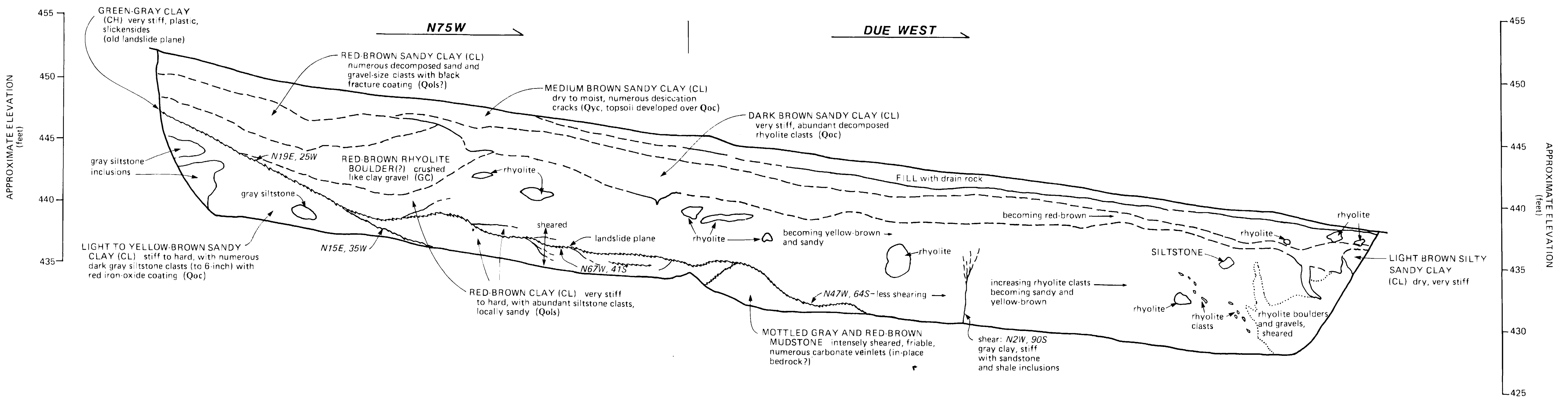
TRENCH I
NE-SW SECTION

1" = 5'



TRENCH I
EAST-WEST SECTION

1" = 5'



EXPLANATION

SOIL UNITS

Fill	Typically sandy and clayey soils of variable consistency
Qyc	Younger Colluvium – Typically medium stiff to stiff sandy and gravelly clays with sandstone and mudstone clasts, including topsoil and slope deposits.
Qols	Older Landslide Deposits – Composed of older colluvial materials underlain by slide planes.
Qoc	Older Colluvium – Generally stiff to hard sandy and gravelly clays with sandstone, mudstone, shale, rhyolite, andesite, basalt, greenstone, and chert clasts exhibiting a high degree of weathering.

BEDROCK UNITS

Ku	Undifferentiated sedimentary rocks including sandstone, mudstone, and shale

SYMBOLS

—— – –?–	Contact, dashed where approximate, queried where uncertain
– –?–	Fault plane, dashed where approximate, queried where uncertain
······	Approximate limit of soil property within a specific unit, such as color, moisture, texture
〰	Thin shear, typically filled with gray clay
☐	Carbon sample location

Harding Lawson Associates
Engineers and Geoscientists

Log of Trench I
Foothill Housing Project
U.C. Berkeley
Berkeley, California

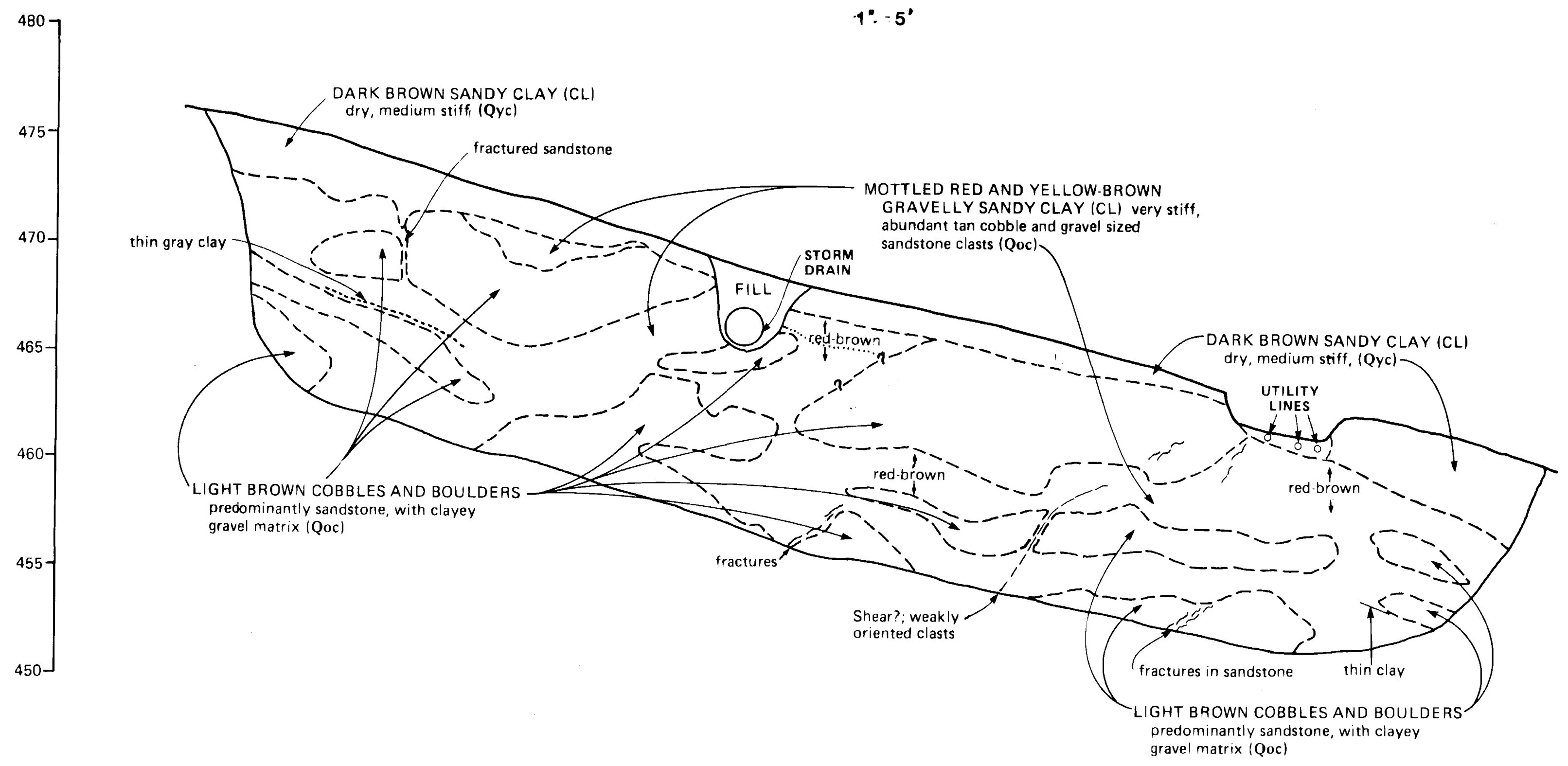
PLATE
6

DRAWN	JOB NUMBER	APPROVED	DATE
RHC	18,360,001.01		12/86
REVISED	DATE	REVISED	DATE

TRENCH J

N52E

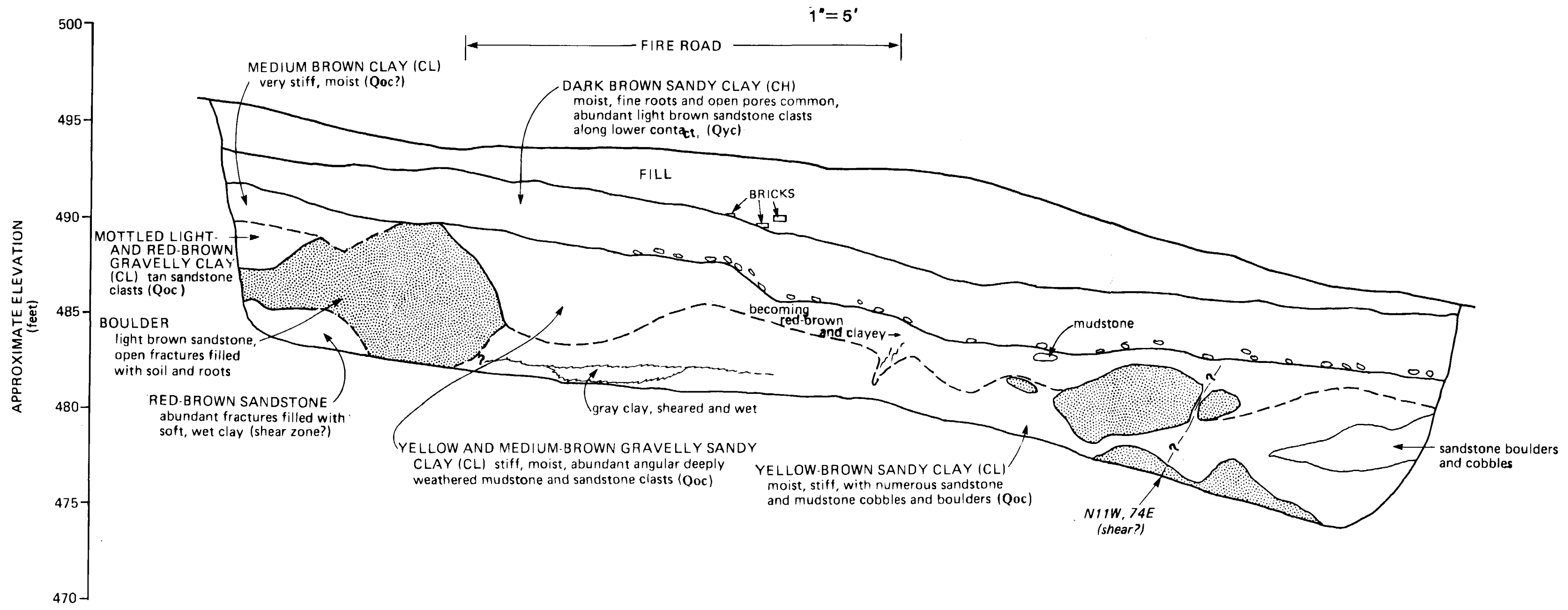
1" - 5'



TRENCH K

N75E

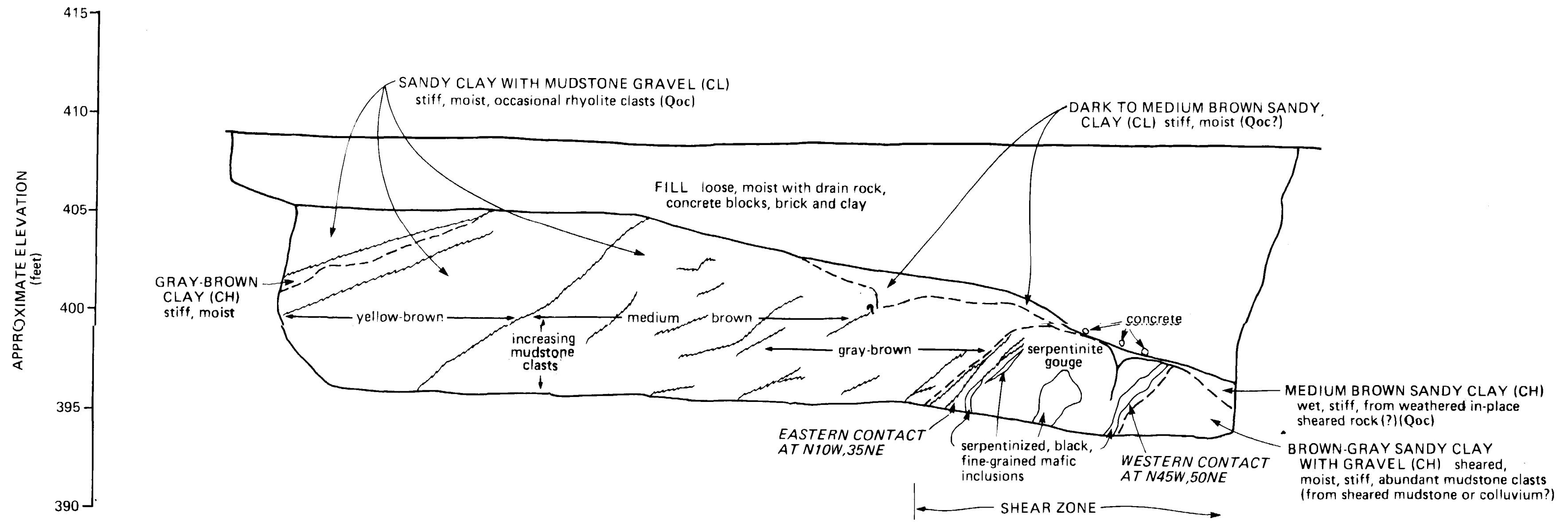
1" = 5'



TRENCH L

N50E

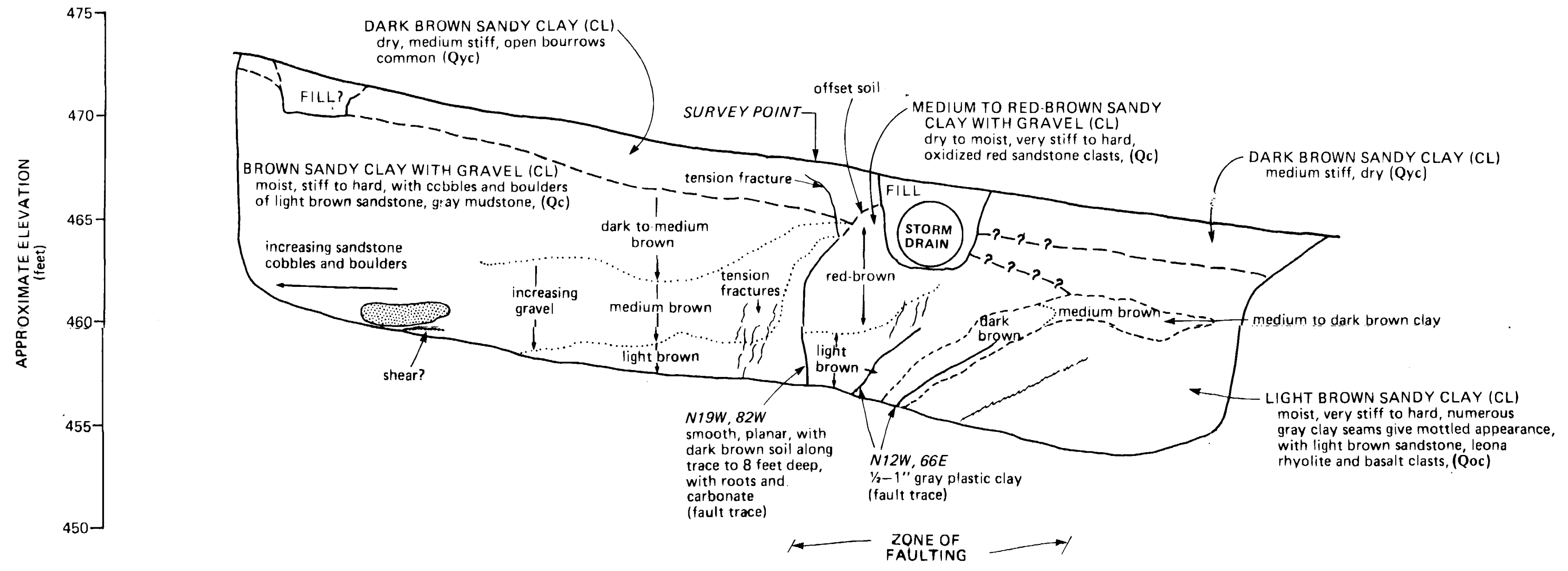
1" = 5'



TRENCH M

N67E

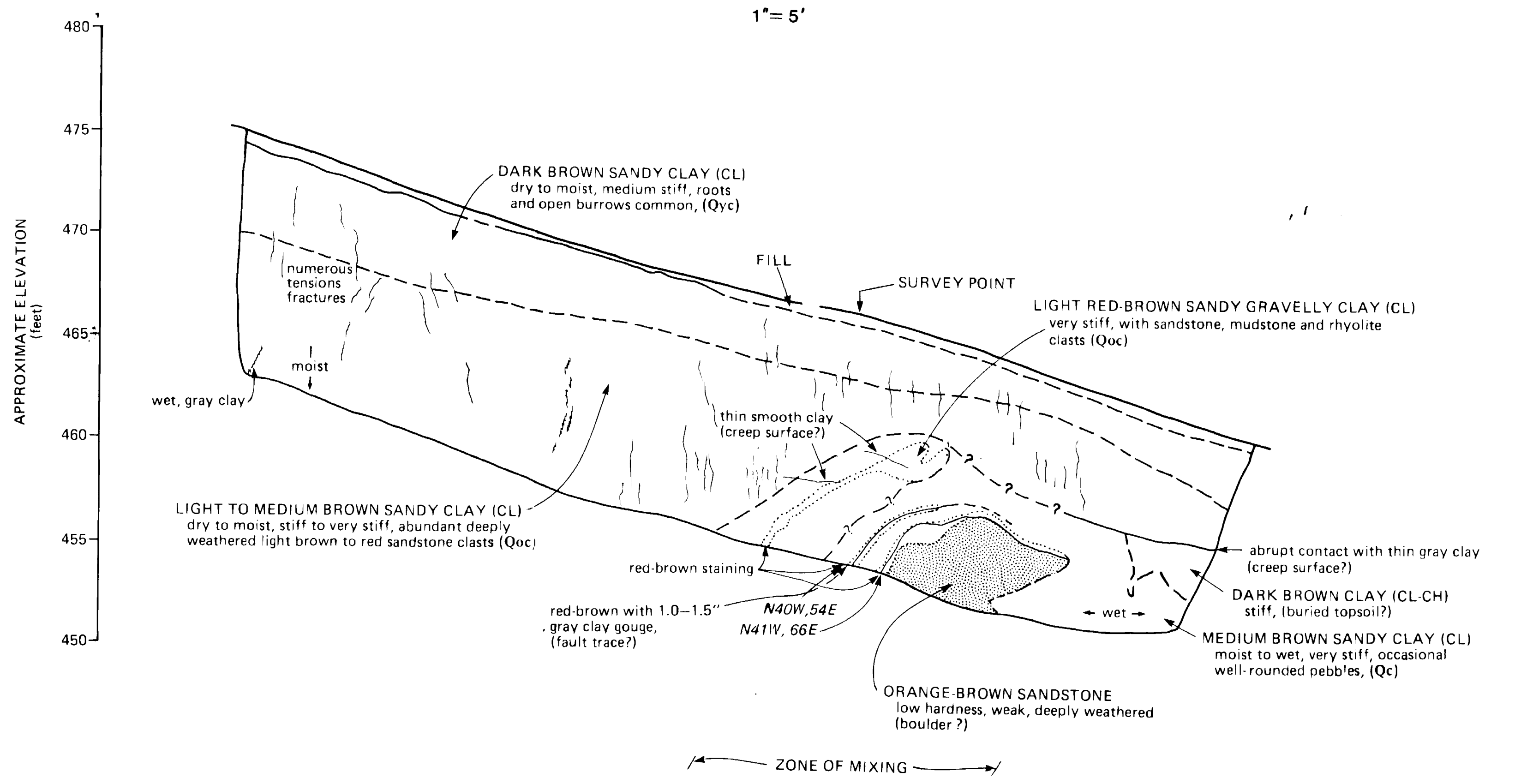
1" = 5'



TRENCH N

N36E

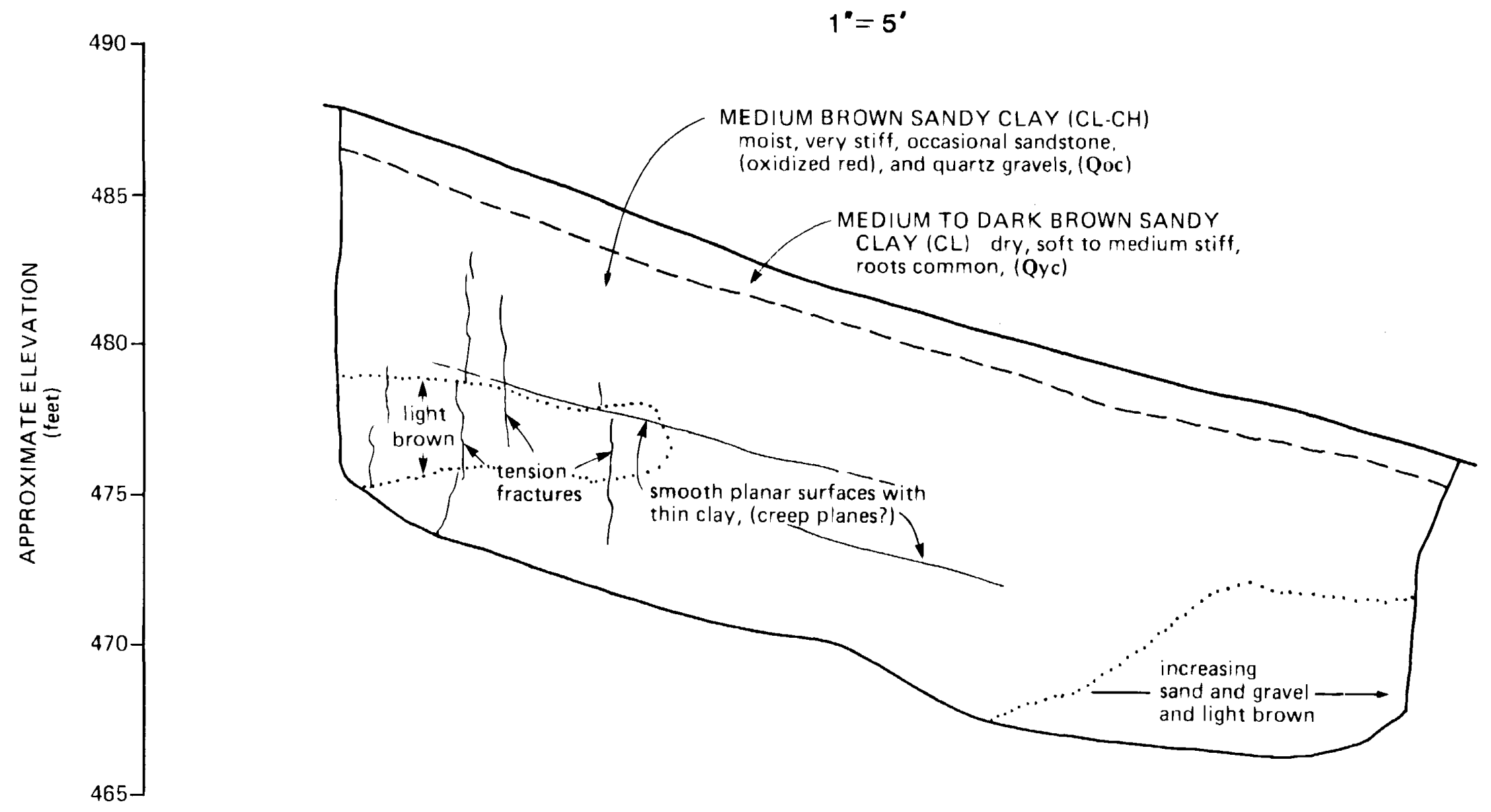
1" = 5'



TRENCH O

N28E

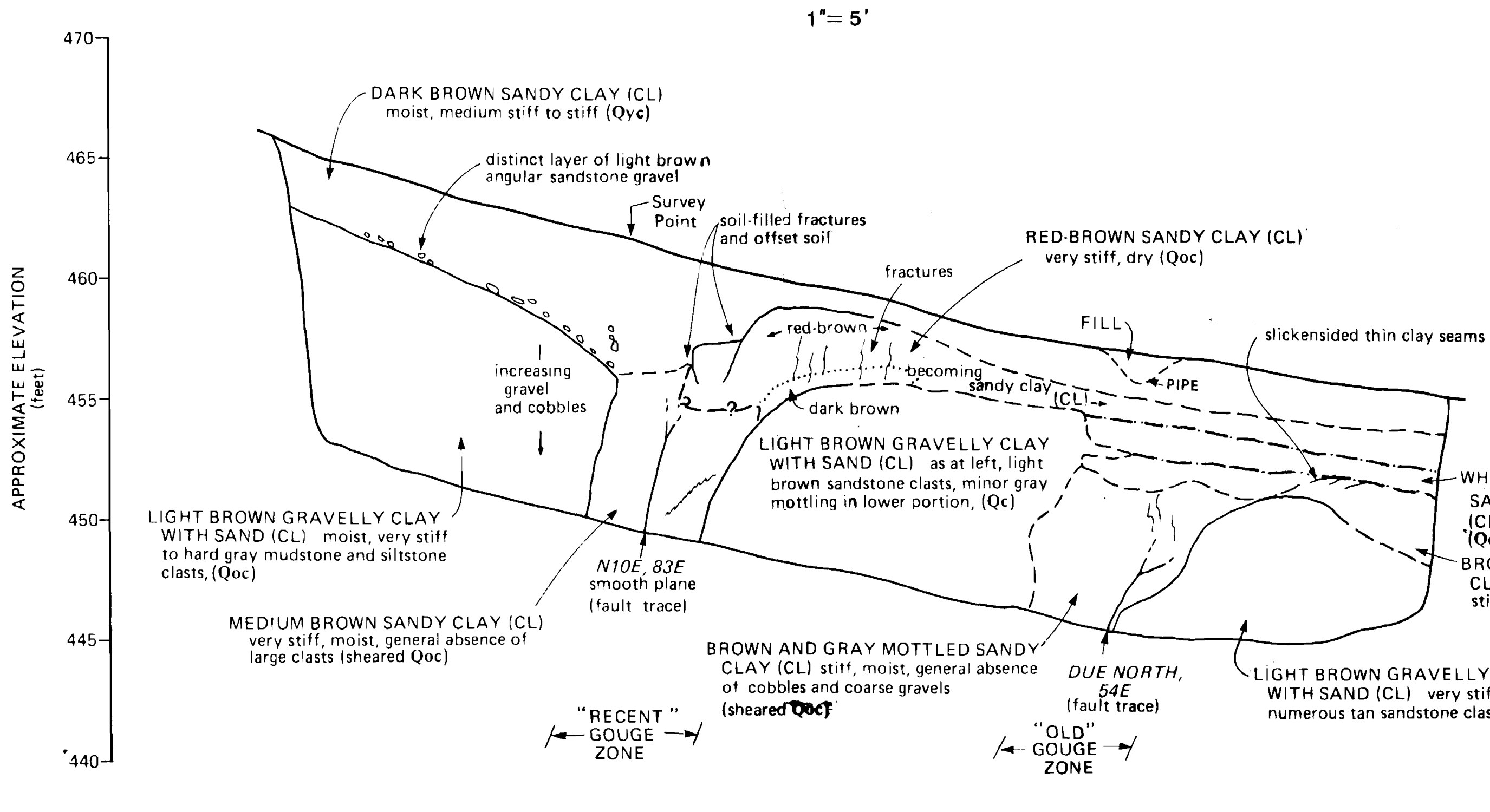
1" = 5'



TRENCH P

N53E

1" = 5'



SOIL UNITS

Fill	Typically sandy and clayey soils of variable consistency
Qyc	Younger Colluvium – Typically medium stiff to stiff sandy and gravelly clays with sandstone and mudstone clasts, including topsoil and slope deposits.
Qols	Older Landslide Deposits -- Composed of older colluvial materials underlain by slide planes.
Qoc	Older Colluvium – Generally stiff to hard sandy and gravelly clays with sandstone, mudstone, shale, rhyolite, andesite, basalt, greenstone, and chert clasts exhibiting a high degree of weathering.

BEDROCK UNITS

Ku	Undifferentiated sedimentary rocks including sandstone, mudstone, and shale

SYMBOLS

—— - - ?—	Contact, dashed where approximate, queried where uncertain
/ - - ?—	Fault plane, dashed where approximate, queried where uncertain
⋯⋯	Approximate limit of soil property within a specific unit, such as color, moisture, texture
〰	Thin shear, typically filled with gray clay
☐	Carbon sample location

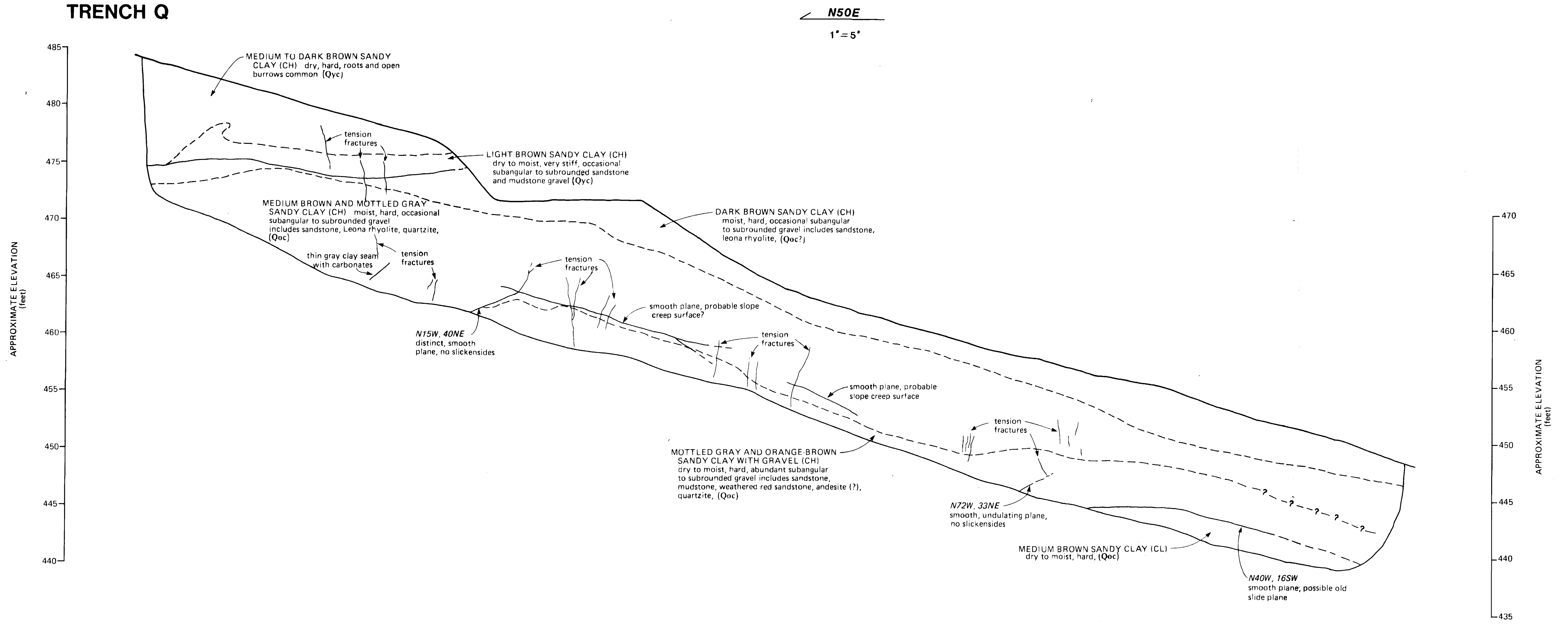
Harding Lawson Associates
Engineers, Geologists
& Geophysicists

Log of Trenches J through P
Foothill Housing Project
U.C. Berkeley
Berkeley, California

PLATE
7

DRAWN	JOB NUMBER	APPROVED	DATE
NB	18,360,001.01		12/86
REVISED	DATE	REVISED	DATE

TRENCH Q



EXPLANATION

SOIL UNITS

Fill	Typically ~~sandy and clayey soils~~ of variable consistency
Qyc	Younger Colluvium – Typically medium stiff to stiff sandy and gravelly clays with sandstone and mudstone clasts, including topsoil and slope deposits.
Qols	Older Landslide Deposits – Composed of older colluvial materials underlain by slide planes.
Qoc	Older Colluvium – Generally stiff to hard sandy and gravelly clays with sandstone, mudstone, shale, rhyolite, andesite, basalt, greenstone, and chert clasts exhibiting a high degree of weathering.

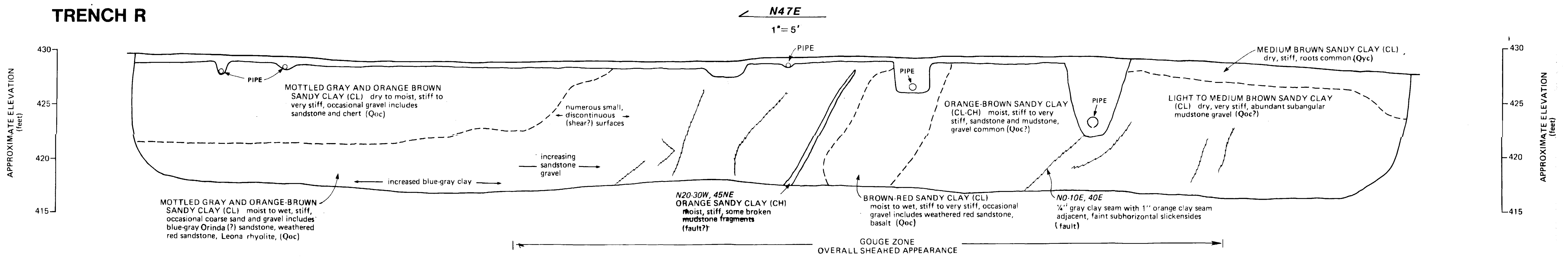
BEDROCK UNITS

Ku	Undifferentiated sedimentary rocks including sandstone, mudstone, and shale

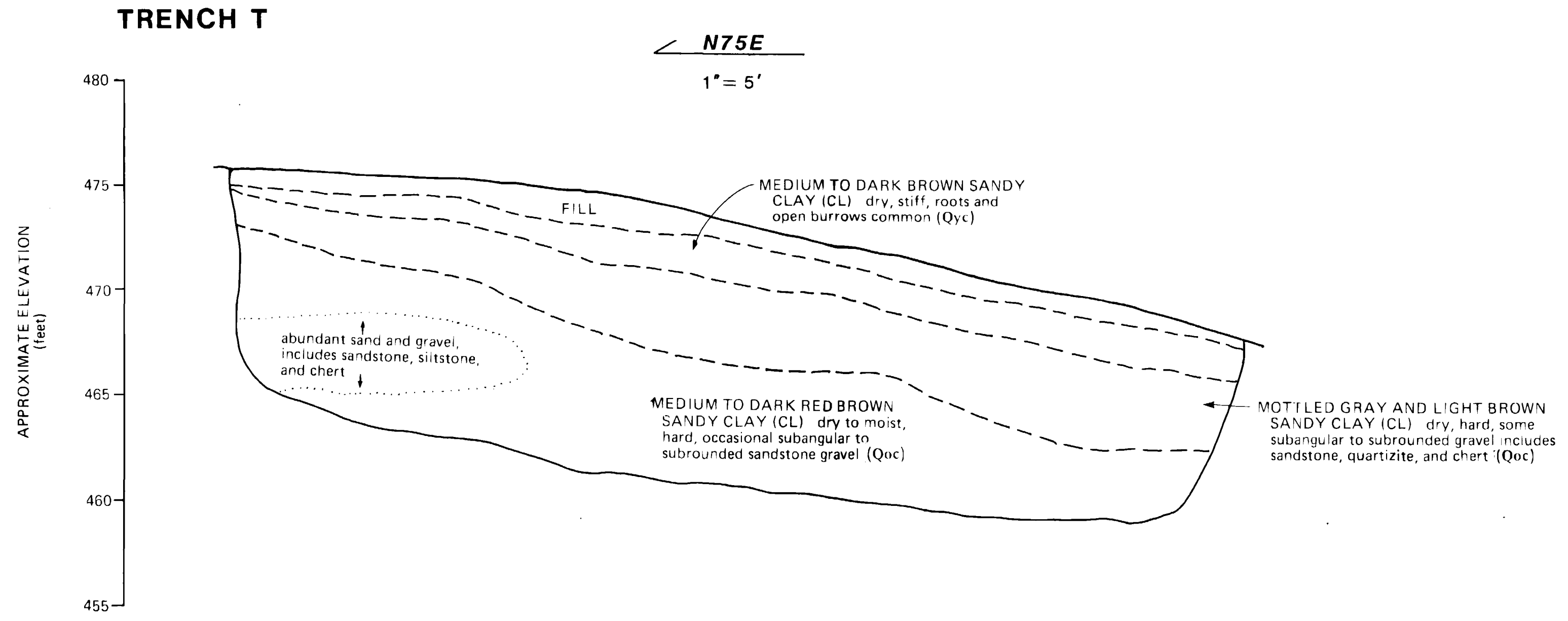
SYMBOLS

—— – –?–	Contact, dashed where approximate, queried where uncertain
/ – ?–	Fault plane, dashed where approximate, queried where uncertain
....	Approximate limit of soil property within a specific unit, such as color, moisture, texture
~~	Thin shear, typically filled with gray clay
☐	Carbon sample location

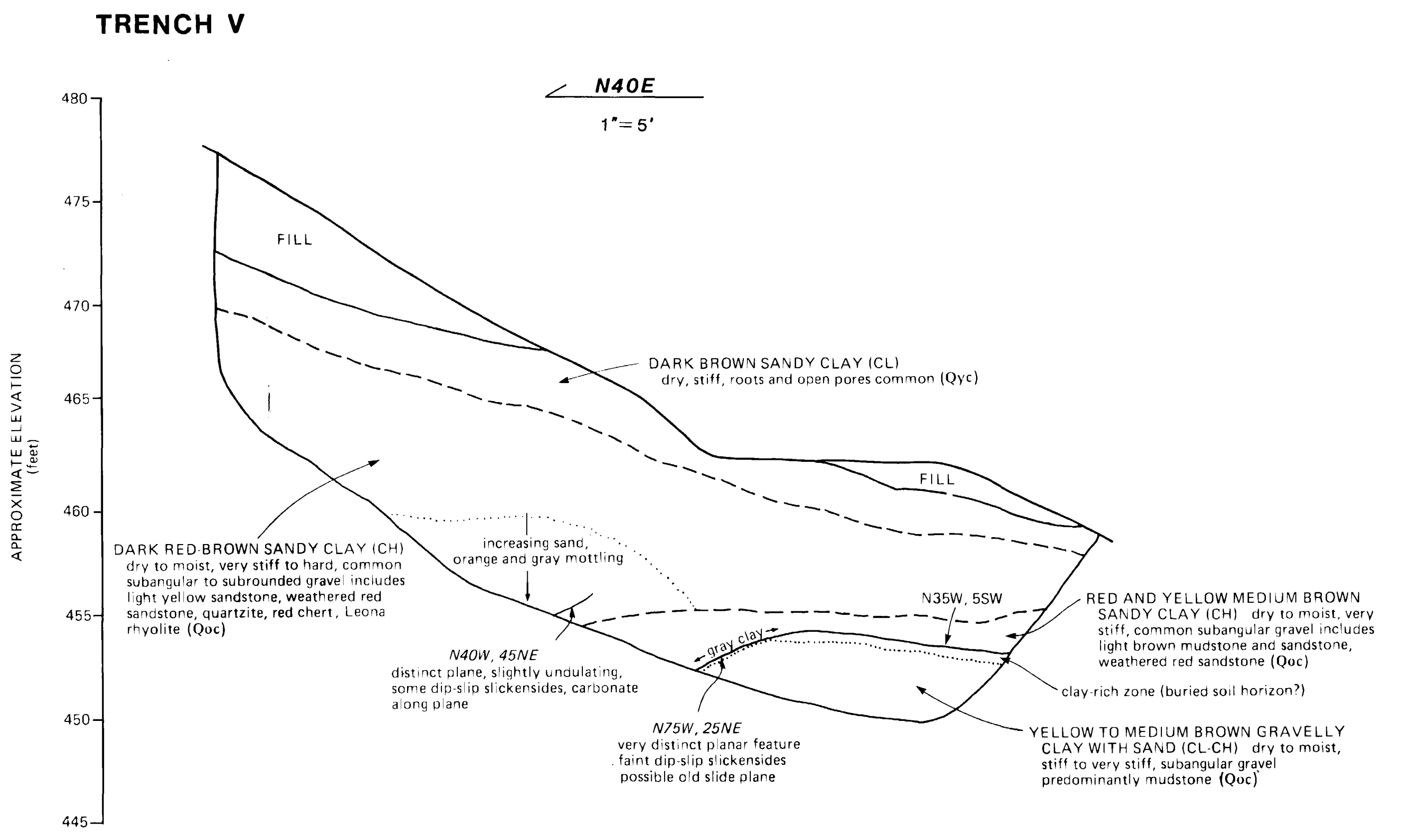
TRENCH R



TRENCH T



TRENCH V



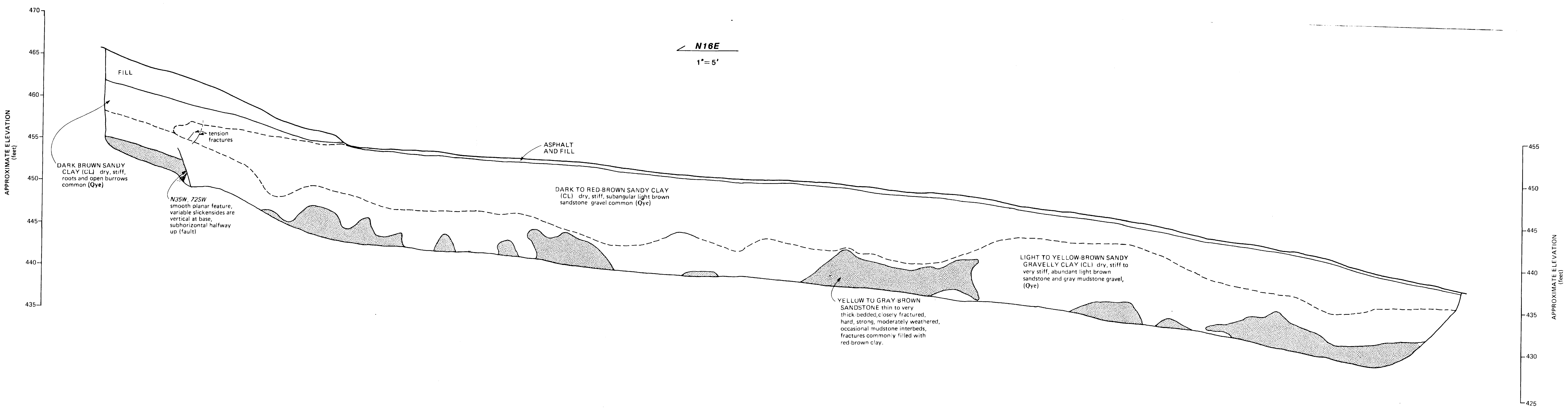
Harding Lawson Associates
Engineers and Geoscientists

Log of Trenches Q, R, T & V
Foothill Housing Project
U.C. Berkeley
Berkeley, California

PLATE **8**

DRAWN	JOB NUMBER	APPROVED	DATE
RHC	18,360,001.01		12/86
REVISED	DATE	REVISED	DATE

TRENCH S



EXPLANATION

SOIL UNITS

Fill	Typically sandy and clayey soils of variable consistency
Qyc	Younger Colluvium – Typically medium stiff to stiff sandy and gravelly clays with sandstone and mudstone clasts, including topsoil and slope deposits.
Qols	Older Landslide Deposits – Composed of older colluvial materials underlain by slide planes.
Qoc	Older Colluvium – Generally stiff to hard sandy and gravelly clays with sandstone, mudstone, shale, rhyolite, andesite, basalt, greenstone, and chert clasts exhibiting a high degree of weathering.

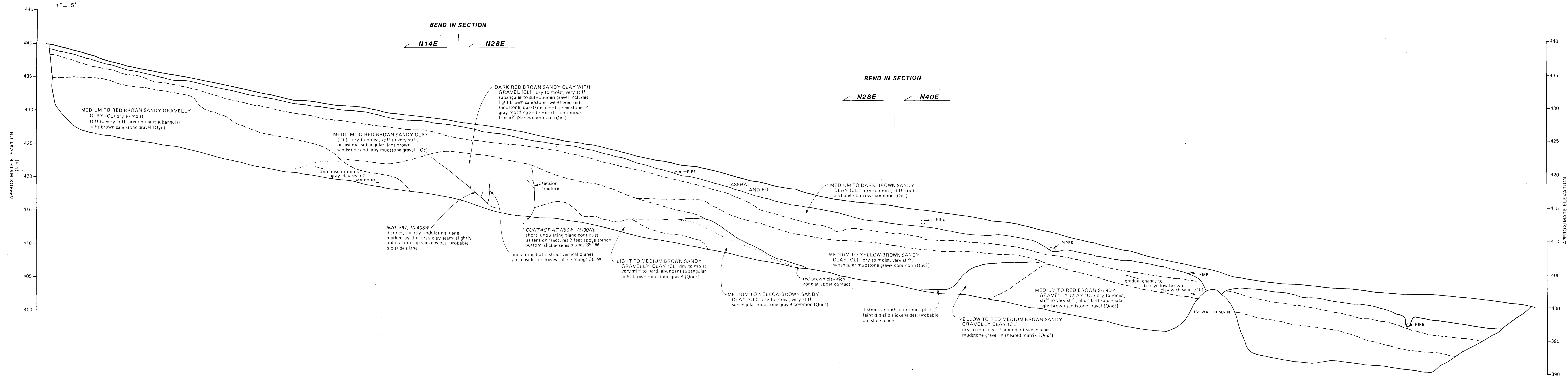
BEDROCK UNITS

Ku	Undifferentiated sedimentary rocks including sandstone, mudstone, and shale

SYMBOLS

——– – –?—	Contact, dashed where approximate, queried where uncertain
- - -?- -	Fault plane, dashed where approximate, queried where uncertain
· · · · · · ·	Approximate limit of soil property within a specific unit, such as color, moisture, texture
〰	Thin shear, typically filled with gray clay
☐	Carbon sample location

TRENCH U

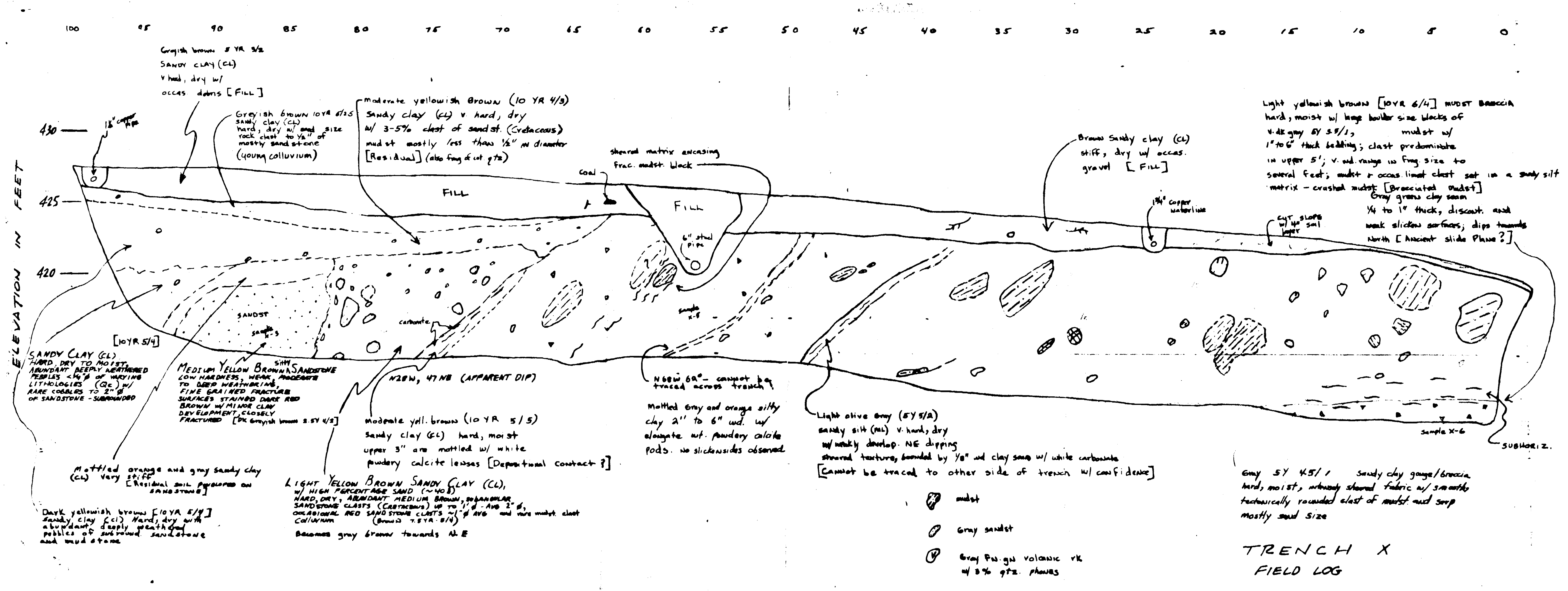


Harding Lawson Associates
Engineers and Geoscientists

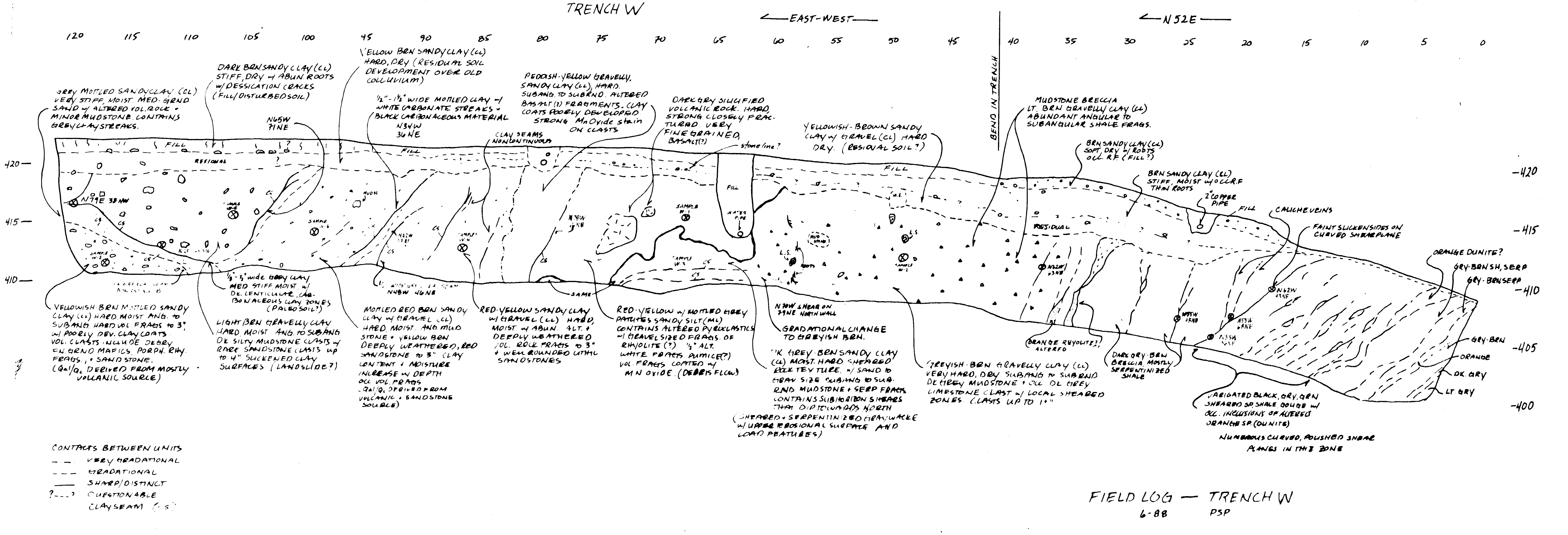
Log of Trenches S & U
Foothill Housing Project
U.C. Berkeley
Berkeley, California

PLATE
9

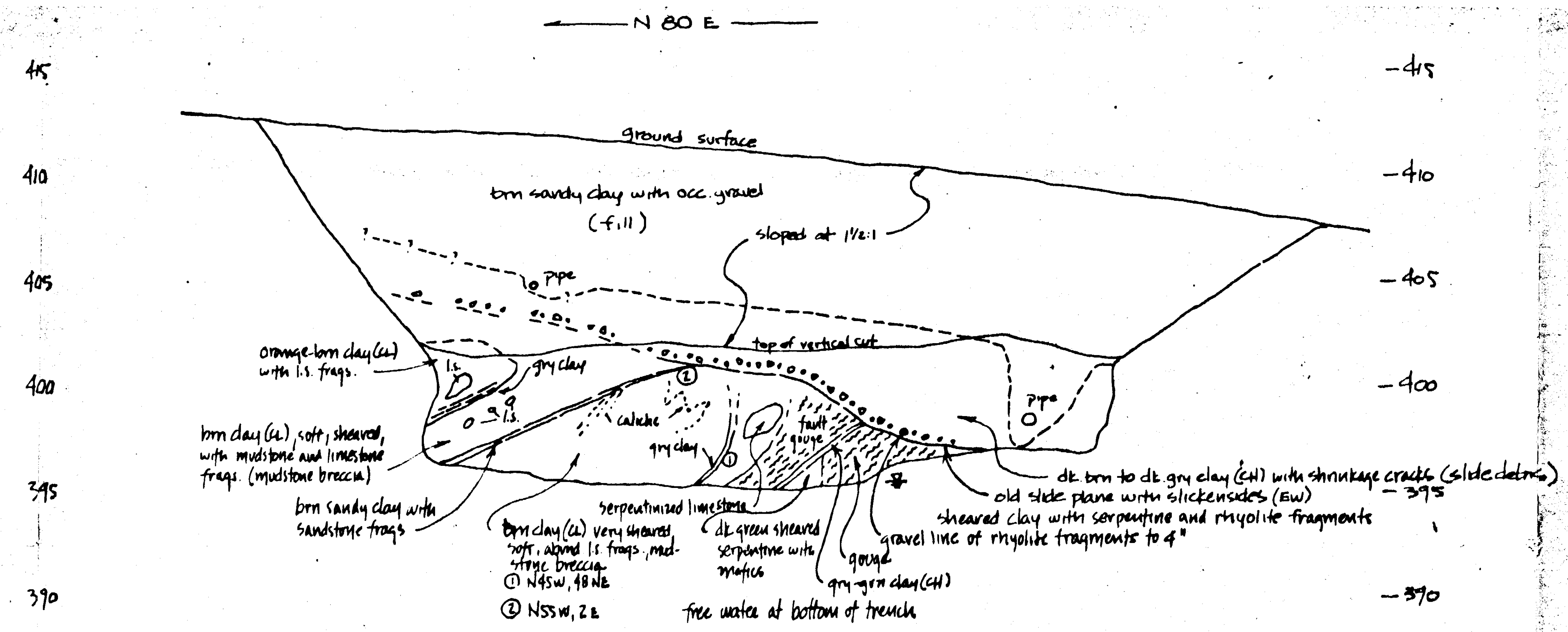
DRAWN	JOB NUMBER	APPROVED	DATE
NB	18,360,001.01		12/86
REVISED	DATE	REVISED	DATE



TRENCH X
FIELD LOG

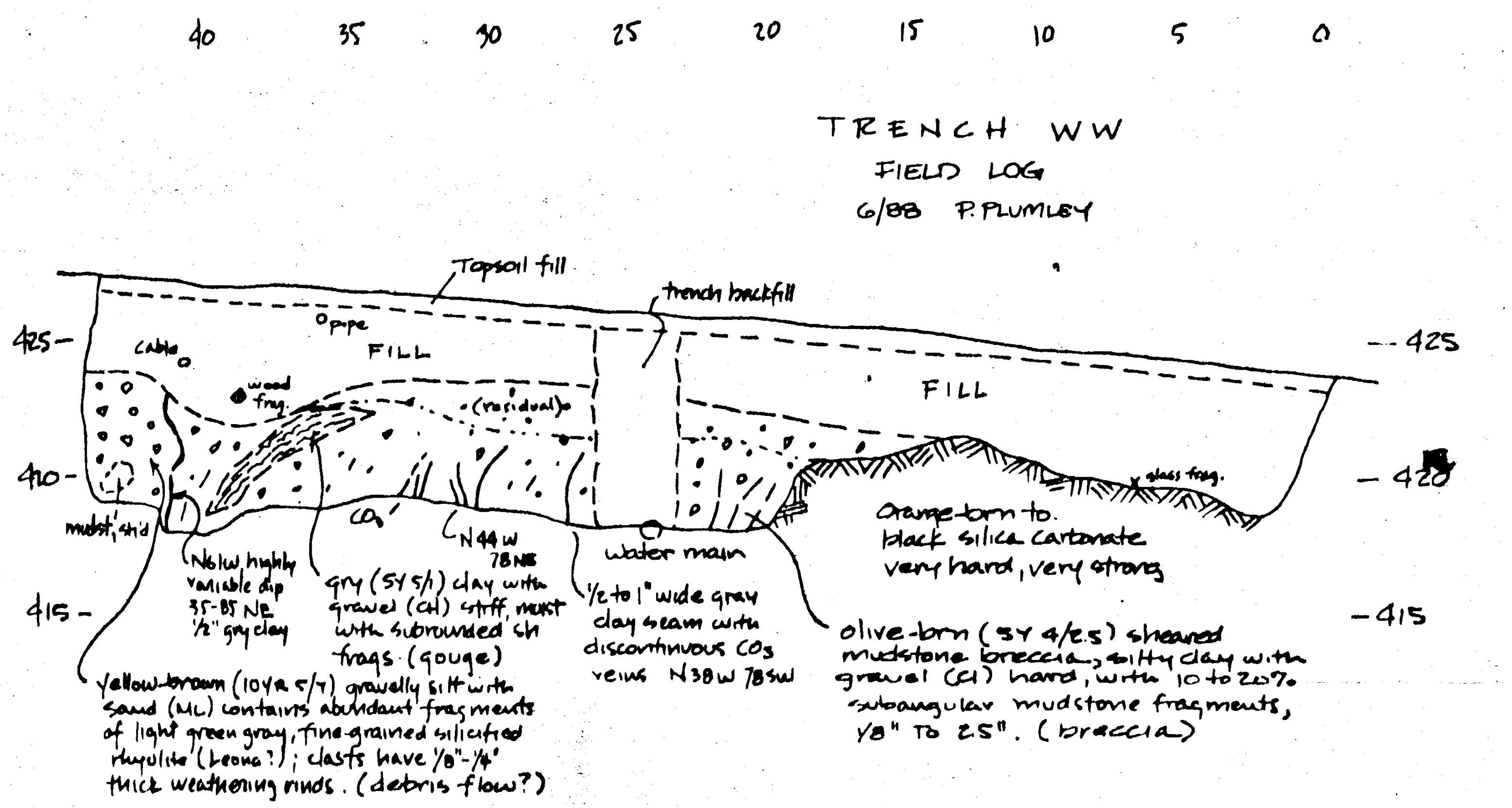


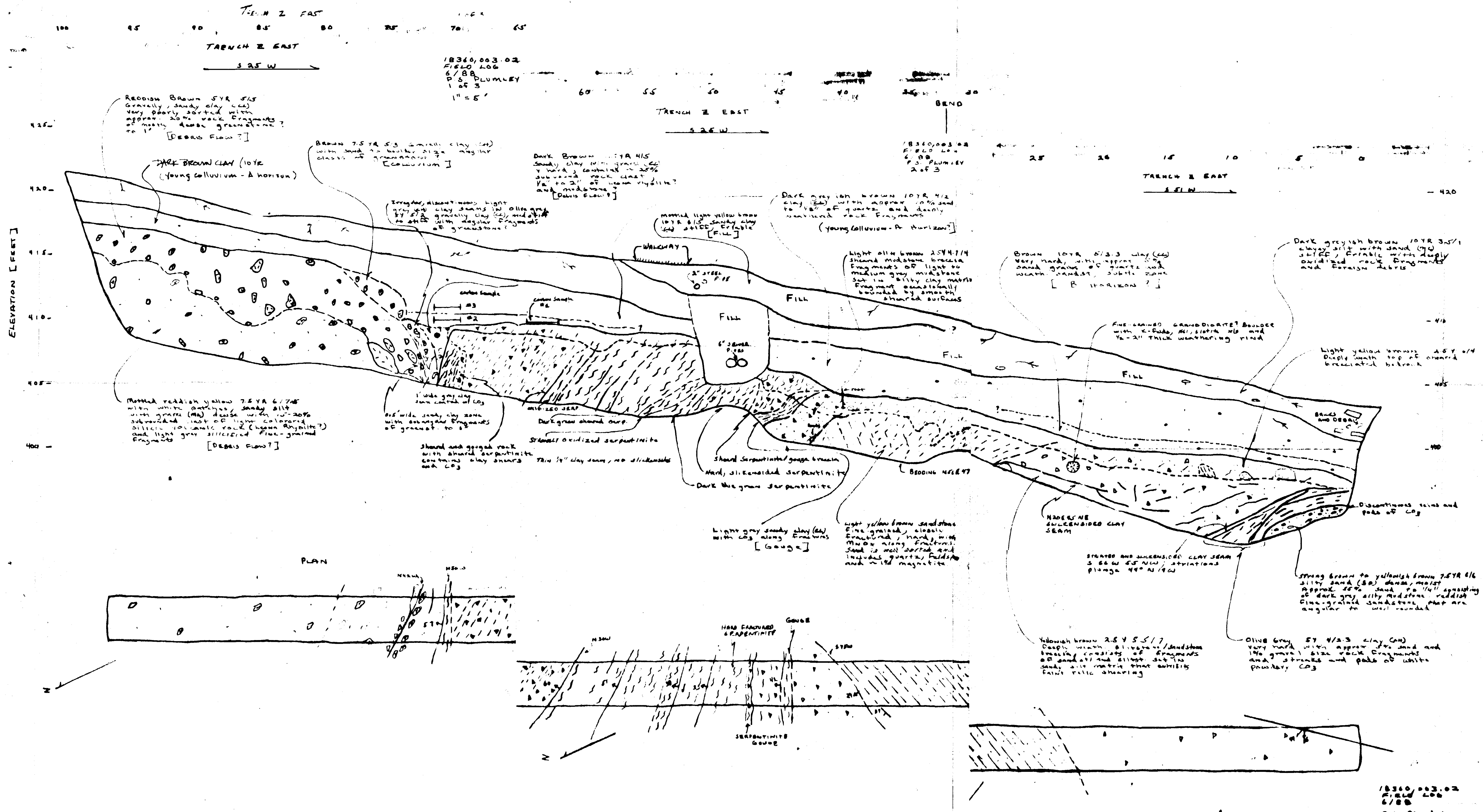
FIELD LOG — TRENCH W
6-88 PSP

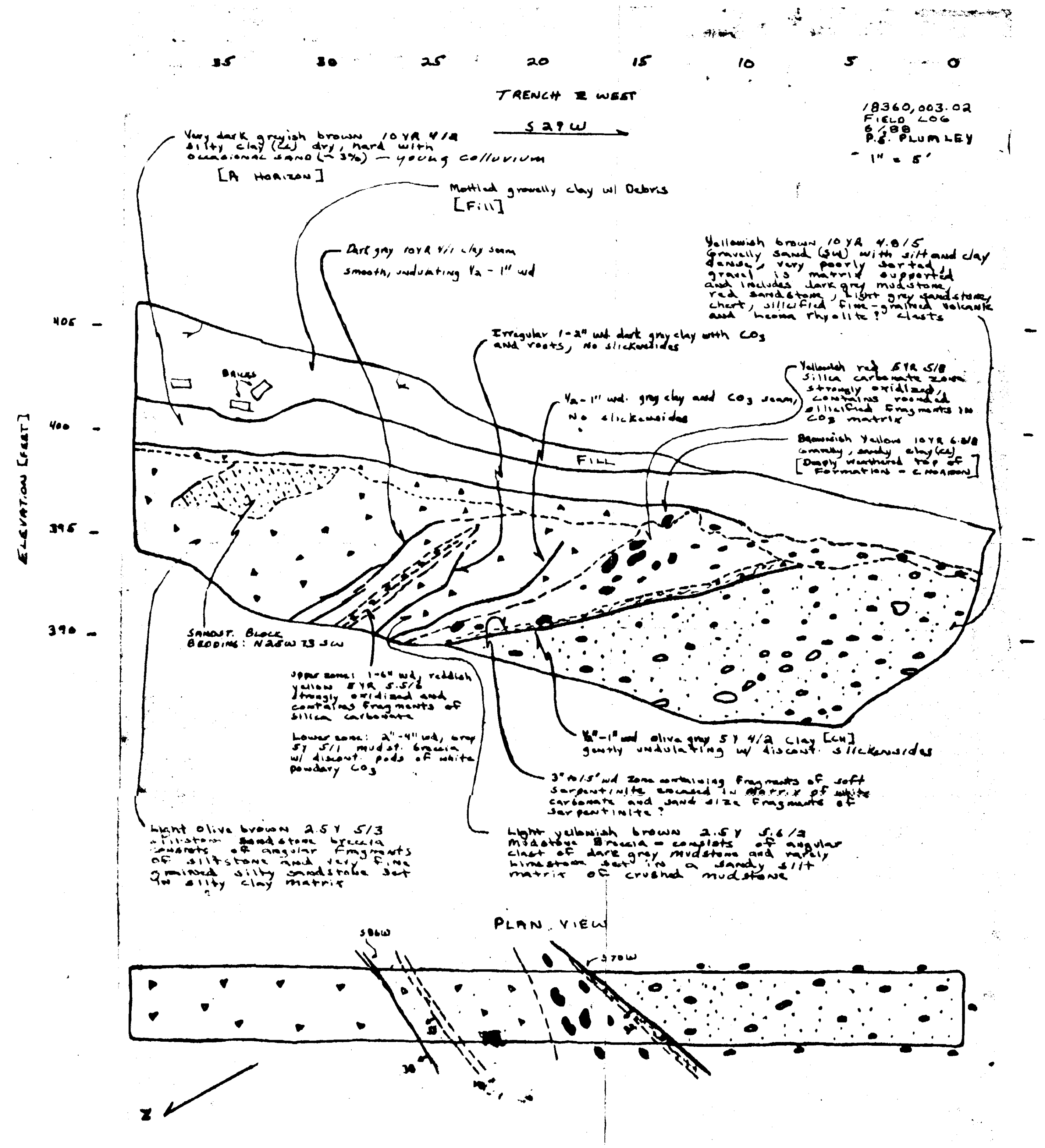


FIELD LOG - TRENCH Y
6-9-88 MNB

TRENCH WW
FIELD LOG
6/88 P. PLUMLEY







Harding Lawson Associates
Engineers and Geoscientists

Log of Trenches X, W, Y,
WW, Z East and Z West
Foothill Housing Project - UCB
Berkeley, California

PLATE
3

DRAWN	JOB NUMBER	APPROVED	DATE
	18,360,001.01	Kolbay	6/88
REVISED	DATE	REVISED	DATE

APPENDIX D

LCI, 2018, Probabilistic Fault Displacement Hazard Analysis – for the Louderback Shear Zone

LCI
EARTH SCIENCE CONSULTANTS

Lettis Consultants International, Inc.
1981 N. Broadway, Suite 330
Walnut Creek, CA 94596
(925) 482-0360; fax (925) 482-0361

LETTER OF TRANSMITTAL

Date: October 8, 2018

Recipient: Ms. Marina Mascorro, PG, CEG
Langan Engineering and Environmental Services
555 Montgomery Street, Suite 1300
San Francisco, CA, 94111
Email: mmascorro@langan.com

SUBJECT: Transmittal of Rev. 0 Report, "Fault Displacement Hazard Analysis for the Proposed Goldman School of Public Policy and Hearst Avenue Academic Housing Site, Berkeley, California"

Contents: Adobe Acrobat PDF file of report.

Dear Ms. Mascorro,

Attached please find our report on fault displacement hazards for the Proposed Goldman School of Public Policy and Hearst Avenue Academic Housing site in Berkeley, California. This final (Rev.0) version addresses comments received from Langan (by Ms. Kate Krug) on October 5th on an earlier draft.

Thanks very much for the opportunity to work with you on this interesting project.

Respectfully,

JOHN N. BALDWIN
exp. 04/19
NO. 2167
JOB

John Baldwin Stephen C. Thompson Nora Lewandowski

John Baldwin, PG, CEG
baldwin@lettisci.com

Stephen Thompson
thompson@lettisci.com

Nora Lewandowski
lewandowski@lettisci.com

Lettis Consultants International, Inc.

Fault Displacement Hazard Analysis for the Proposed Goldman School of Public Policy and Hearst Avenue Academic Housing Site, Berkeley, California

LCI Project No. 1729

Prepared for:
Langan Engineering and Environmental Services, Inc.
555 Montgomery St., Suite 1300
San Francisco, CA 94111

Prepared by:
Lettis Consultants International, Inc.
1981 N Broadway, Suite 330
Walnut Creek, CA 94596

October 8, 2018
Rev. 0

Lettis Consultants International, Inc.

Table of Contents

LISTS OF TABLES AND FIGURES

Tables

Figures

1.0 INTRODUCTION

Lettis Consultants International, Inc. (LCI) performed a probabilistic fault displacement hazard analysis (PFDHA) and deterministic fault displacement hazard analysis (DFDHA) for the proposed Goldman School of Public Policy building and Hearst Avenue Academic Housing building (GSPP-HAAH; site), Berkeley, California. The fault displacement hazard characterization is intended to provide initial estimates on the annual probability and amount of coseismic secondary fault displacement expected on the Louderback shear zone (LSZ) beneath the site in support of seismic design of the proposed buildings.

On the basis of information provided by Langan, we understand that the proposed development includes: (1) demolition of the western and upper portions of the existing Upper Hearst parking structure at the corner of Hearst Avenue and La Loma Avenue, Berkeley, California, (2) construction of a new 4-story building with classrooms and assembly space to the west of the remaining parking structure, (3) an addition of 5 stories of residential space above the remaining parking structure, and (4) and construction of a classroom and faculty office building at the existing surface parking lot to the north of the Hearst parking structure that will consist of two below-grade and six above grade parking levels, respectively.

As shown in Figure 1-1, the northeastern half of the proposed building site is mapped within the State of California Alquist-Priolo Earthquake Fault Zone (A-P Zone) of the Hayward fault (California Geological Survey [CGS], 2001). The closest mapped active Hayward fault trace shown on the A-P map is located approximately 530 ft (160 m) to the northeast of the site (Figure 1-2). The CGS defines an active fault as one that has ruptured in the past approximately 11,000 years. Within the A-P zone are multiple other bedrock fault traces mapped by researchers and consultants, including the approximately 200-ft (61-m)-wide, northwest-trending LSZ that strikes subparallel to the active Hayward fault (Harding Lawson Associates [HLA], 1988a). The LSZ investigated in the early and late 1980's by a number of consultants and researchers, including the CGS (Smith, 1980a, 1980b), is not considered to be active by the State of California and is not depicted on the current State A-P map (Figure 1-1). More recently, however, Lienkaemper (2008) depicts a single fault trace within the broader LSZ as Holocene active. Lienkaemper (2008) shows the fault trace as 600- to 700-ft (183- to 213-m)-long and terminating at or near the intersection of Hearst Avenue and La Loma Avenue directly southeast of the site. Along a simple northwest projection from this termination point, the fault trace would intersect the northeast corner of the proposed GSPP (Figure 1-2). Review of historical consultant reports for the site shows the existence of two fault traces intersecting the northeastern part of the site that lie along projection with the Lienkaemper (2008) fault trace (Woodward-Clyde & Associates [WCA], 1970). Exposures logged during the construction of the present-day parking structure show that the western fault trace juxtaposes late Quaternary alluvium of Blackberry Creek on the west against Jurassic serpentinite on the east (WCA, 1970), which is generally consistent with the geologic units of Graymer et al. (2006) (Figure 1-3). Most of the remainder of the site lies within the projection of the broader (200-ft [61-m]-wide) LSZ as originally identified and described within the Lawson Adit, located approximately 315 ft (96 m) to the south (Louderback, 1939).

Fault exploration studies performed in the 1980's for the Foothill Student Housing Complex—located directly east-southeast of the site—evaluated the LSZ (Figure 1-2). These earlier studies concluded that the LSZ is inactive based on the interpretation of multiple trenches (several of which [trenches L, X, and Y] are near the intersection of Hearst and La Loma Avenues) and limited soil and age-dating analysis. Some of the trenches (e.g., trench Z-East) confirmed the presence of displaced late Quaternary alluvium and colluvium, but the consultants and soil-dating experts interpreted the faulting to be pre-Holocene in age. These observations of displaced Quaternary alluvium are consistent with consultant interpretations of the shear zone(s) in the western portion of the Lawson Adit, where shear planes were documented as terminating below gravels of presumed Quaternary age or older (HLA, 1988a).

Although the LSZ was interpreted to be inactive, the previous consultants performing the 1980's studies recommended that buildings built across the LSZ be designed to withstand secondary fault displacement (HLA, 1988b). Secondary displacement of up to 2 ft (0.6 m) was estimated in these reports, with the displacement being triggered sympathetically by a large earthquake on the Hayward fault. This secondary displacement amount was estimated based on an assumed MCE Hayward fault displacement of 10 ft, and Bonilla (1970) finding that displacement on secondary faults could be up to 20% of the main fault displacement. Information on how the 2 ft (0.6 m) of displacement was considered in the final design of the various student residential facilities was not provided in the documents available for review by Langan (2018).

The reviewed consultant reports and Lienkaemper (2008) indicate it is highly probable that quaternary faulting has occurred beneath the proposed site, and this faulting may be in a favorable orientation and location to accommodate secondary displacement (either as localized fault slip or as distributed shear) during future large Hayward fault earthquakes. Because the fault traces identified by WCA (1970) are on projection with the Lienkaemper (2008) trace that is interpreted as active, it is prudent to consider the possibility of secondary fault rupture across the site, either as a single fault trace or broad zone up to 200 ft (61 m) wide. The lack of Holocene material in the project area and the Lienkaemper (2008) interpretation of an active fault trace to the southeast results in uncertainty in the activity of the LSZ across the project site. Because of this remaining uncertainty on the shear zone's activity, as well as how the LSZ connects with the Hayward fault, and, what coseismic displacement may occur, further evaluation of the potential for secondary fault displacement at the proposed GSPP-HAAH site is warranted. To address these questions, Langan subcontracted LCI to perform a PFDHA and DFDHA for the proposed building site.

1.1 Scope of Work

Based on the available information compiled and reviewed, and our extensive experience conducting fault studies within the Hayward fault zone at U.C. Berkeley, LCI has developed the following scope of work for the GSPP-HAAH:

- Task 1.0 – Review existing data. Includes review and compilation of existing geologic and geotechnical site information, field reconnaissance, and interviews with previous investigators of the LSZ.
- Task 2.0 – Characterization of the LSZ as a potential rupture source based on existing information. Since no trenching is proposed, the technical approach relies on existing campus-wide information to develop the fault characterization data.
- Task 3.0 – Perform probabilistic and deterministic fault displacement hazard analysis
- Task 4.0 – Reporting
- Task 5.0 – Meetings/Presentations of Preliminary Findings

The PFDHA/DFDHA was conducted by Lettis Consultants International, Inc. (LCI) under contract with Langan and under the project management of Mr. John Baldwin (C.E.G.). The report was prepared by LCI geologists Dr. Stephen Thompson and Ms. Nora Lewandowski, and reviewed by Mr. John Baldwin. LCI engineer Dr. Arash Zandieh performed the hazard calculations. Figures were prepared by Ms. Åse Mitchell of LCI. The Rev. 0 version of the report incorporates comments from Langan on an earlier draft that were received October 5th.

1.2 Technical Approach

The first phase of our technical approach included review of existing data, primarily compiled by Langan (2018), and interviews with community experts (Section 2.1) and analysis of the location, geometry, and activity of the LSZ (Section 2.2). The primary data sources used were consultant reports that included subsurface exploration (boreholes, trenching, and logging of a building foundation excavation) of the LSZ and the GSPP-HAAH project site. Also critical to characterizing the LSZ were interviews conducted with previous investigators of the LSZ. These investigators were present in the 1980's when trenching was completed across the LSZ; and the interviews provided context for previous characterizations of the LSZ, specifically regarding its activity. The data review and analysis and information obtained from interviews with experts helped to characterize the LSZ as a potential rupture source in the PFDHA and DFDHA.

The second phase of our technical approach included the PFDHA and DFDHA for the GSPP-HAAH project site (Sections 3.0 through 6.0). The PFDHA methodology selected for the project site follows the "earthquake approach" (Youngs et al., 2003; Petersen et al., 2011) and takes advantage of the abundant geologic and paleoseismic data on the Hayward fault zone in the area of the UCB campus (Langan, 2018), as well as the recently performed PSHA study for the UC Berkeley campus by AECOM (2015). As the proposed site has been extensively modified, direct estimation of the activity of the LSZ beneath the site and, if active, per-event displacements, are not possible. In the PFDHA, displacement hazard results are focused on the criteria used for estimating design ground motions because no building code specifications exist for seismic design of fault displacement hazard. To help assess whether the displacements determined from the PFDHA and whether applying design criteria for ground shaking is reasonable, we also performed a DFDHA. The DFDHA was completed assuming an MCE on the Hayward fault. The PFDHA and DFDHA results and characterization of the LSZ are also used to provide information on the displacement distribution, orientation, and rake at the project site, which may aid in engineering assessments.

2.0 CHARACTERIZATION OF THE LOUDERBACK SHEAR ZONE

Significant work on the LSZ was performed in the 1970's and 1980's by multiple consultants and researchers who collectively interpreted the shear zone as inactive. Very little information has been collected since then to further characterize the LSZ. The shear zone intersects a highly urbanized area consisting of roads, buildings, utilities and landscaped areas. This study, therefore, relies on existing trench and map data collected previously to help estimate the annual probability and amount of coseismic secondary fault displacement beneath the project site. For this study we compiled and reviewed existing geologic information (Section 2.1) and used this information to help constrain the location and activity of the shear zone (Section 2.2). Please see Langan (2018) for a comprehensive review of existing site and local geologic information on the LSZ. The following is a summary of key components that help guide the PFDHA and DFDHA.

2.1 Data Compilation and Review

We reviewed existing publications, consultant reports, and maps that describe or include the LSZ and/or project site to help parameterize the PFDHA and DFHDA. Table 2-1 summarizes key reports used to develop the fault characterization. As previously noted, the northeastern part of the project site lies within the State A-P Zone for the Hayward fault, with the closest mapped trace of the Hayward fault lying approximately 530 ft (162 m) to the northeast of the site (Figure 1-1). The State A-P Zone map does not reference the LSZ, the focus of this study.

The LSZ is located approximately 350 ft (107 m) southwest of the Hayward fault (Figure 1-2). Multiple authors have had different interpretations on the location, activity, and width of faulting of the LSZ, but all have mapped the Louderback as generally northwest-striking and trending subparallel to the Hayward fault. The shear zone was first documented by Louderback (1939) in the Lawson Adit, and was subsequently included in maps by Radbruch-Hall (1974), Lennert and Curtis (1980), and Lienkaemper (2008) as a single trace, and WCA (1970) and HLA (1988a, 1988b) as multiple traces or a zone. Of these interpretations, Lienkaemper (2008) identifies a fault trace within the Louderback shear zone as Holocene active; all others either state the Louderback shear zone is inactive or do not comment on or define its activity. The LSZ is not shown on the present-day A-P map (CGS, 2001).

Table 2-1. Key Reports and Publications Used in the Louderback Shear Zone Characterization.

Author, Year	Type of Report	Key Purpose/Applicability of Work
Woodward-Clyde & Associates, 1969	Consulting Report	Geotechnical investigation at southern part of the project site (Parking Structure H). Includes borehole logs, laboratory testing data, and blow counts for nine exploratory boreholes completed in 1969, and logs for six boreholes completed in 1959. Boreholes were completed in location of Parking Structure H, as well as the northeastern part of the project site.
Woodward-Clyde & Associates, 1970	Consulting Report	Supplement to the Geotechnical Investigation for Parking Structure H. Study includes map and logged excavation face showing two fault traces observed during foundation excavation. Fault displaces Quaternary alluvium and is described as an active trace of the Hayward fault, though no definition of active is provided.
Harding Lawson Associates, 1986	Consulting Report	Geologic and Fault Hazard Investigation, Phase I, for Proposed Student Housing. Study included a total of 15 boreholes at three sites (Hillside, La Loma Ridge, and Bowles Hall Addition), and multiple trenches (trenches A through D at La Loma Ridge and trenches E through H at Hillside). La Loma Ridge is located directly east of the project site (Figure 1-2).
Harding Lawson Associates, 1988a	Consulting Report	Supplemental Fault Hazard Investigation on the Louderback for the Foothill Student Housing Project. Study included five boreholes, six trenches (all of which intersect the LSZ), logging of the western portion of the Lawson Adit, and a pedologic assessment of the soil ages. Study concluded that the LSZ is inactive. Study reviewed by members of the CGS (Jeff Howard, Glenn Borchardt, and Robert Snyder).

Author, Year	Type of Report	Key Purpose/Applicability of Work
Harding Lawson Associates, 1988b	Consulting Report	Geologic and Fault Hazard Investigation, Phase II, Foothill Student Housing. Study included 36 boreholes and 14 trenches (trenches I through V). Trenches L and R intersect the LSZ and exhibit evidence of faulting, however there was insufficient Holocene cover to constrain the age of fault activity.
Lienkaemper, 2008	USGS Map and Digital Database	Digital database of recently active traces of the Hayward fault. Database shows LSZ as a single trace that approximately corresponds to the eastern boundary of the HLA mapping of the shear zone. The database also includes the Lawson Adit, HLA trenches, and interpreted age of offset in the adit and each trench. With the exception of Trench Z-East, all other trenches and the adit are interpreted as having faulted Pliocene or Pleistocene sediments. Trench Z-East (which Lienkaemper combines with Trench Z-West in the database), offset is shown to be Holocene in age based on radiocarbon (14C) dating.
Langan, 2018	Consulting Report	Compilation of previously collected subsurface data, various interpretations of fault traces related to the LSZ, newly collected borehole and geophysical data on the project site. Identify sheared Franciscan melange bedrock beneath the site.

The primary sources of subsurface information used to characterize the LSZ for this project include borehole and trench data provided in HLA (1986, 1988a, 1988b), as well as borehole and foundation excavation documents described in WCA (1969,1970). These data sources provide information on the local subsurface geologic conditions and locations of fault traces or zones of bedrock shearing. Langan (2018) summarized the HLA (1986, 1988a, 1988b) trench findings in detail, and utilized borehole and trench data to construct three preliminary geologic cross sections through the project site. We reviewed the HLA (1986, 1988a, 1988b) trench logs and reports, and where information on fault orientation (strike and dip) and kinematics (slickensides) of the LSZ was available, it was compiled in tabular format. This information can be used to evaluate the displacement distribution, orientation, and rake (vertical to horizontal) of coseismic secondary faulting at the project site (Section 6.0). Langan (2018) also provided a description of development history of the project site based on historical aerial photography, architectural plans, and Sanborn maps. This information was used to provide context for the boring data collected by WCA (1969) and the level of modification of the site topography.

We also contacted several experts from the geosciences community who are familiar with the LSZ and were present when subsurface explorations were completed on the shear zone in the mid-late 1980's. The purpose of these interviews was to gain more context for the 1980's interpretations on the LSZ and activity. Table 2-2 lists the community experts contacted for this study and summary notes from each correspondence.

Table 2-2. Community Experts Contacted as Part of this Study[1].

Contact Name	Position and Agency/Company	Date	Correspondence Detail
Dr. Roy Shlemon	Principal Geologist Roy J. Shlemon & Associates	07/24/2018	Dr. Shlemon visited the 1988 HLA trenches across the LSZ and provided a report to HLA on his qualitative assessment of the age of soils observed in the HLA trenches. This report has not been made available to LCI. During our phone conversation, he stated that he remembered a consensus opinion in 1988 that the LSZ is inactive. Dr. Shlemon did not recall speaking to Mr. James Lienkaemper at the time of the trench review, nor was he aware of Mr. Lienkaemper's alternative interpretation of activity of the LSZ (i.e., active).
Mr. James Lienkaemper	Retired Paleoseismologist USGS	08/01/2018	Mr. Lienkaemper visited the HLA trenches in 1987 and 1988 and interpreted the LSZ as active based on observations of possibly young fissure-fill material in HLA (1988a) Trench Z-East, and an inferred uphill-facing escarpment noted in 2007 LiDAR data. The escarpment coincides with the approximate location of Trench Z-East. In our email correspondence, Mr. Lienkaemper stated that he did not perform a formal review of the HLA trenches and did not recall discussing his interpretations with HLA geologists. It is important to note that the inferred

Contact Name	Position and Agency/Company	Date	Correspondence Detail
			escarpment could be a cultural feature (sidewalk or landscaping). Mr. Lienkaemper did not compare the LiDAR features to pre-development topographic maps.
Glenn Borchardt	Principal Soil Scientist Soil Tectonics	08/02/2018	Dr. Borchardt formally reviewed the 1988 HLA trenches while working for the California Division of Mines and Geology. During our phone conversation, Dr. Borchardt recalled there was no compelling evidence to suggest that the LSZ was an active through-going fault, but stated that it was possible. Dr. Borchardt also stated that even if the fissure-fill in Trench Z-East was Holocene in age as Lienkaemper interpreted, he did not see evidence to support connecting this fissure fill to a larger and longer fault structure. Other CGS employees that reviewed the HLA trenches with Dr. Borchardt include Jeff Howard and Robert Snyder.

Notes:

[1]Mr. Steve Korbay, engineering geologist with HLA during the HLA (1988a, 1988b) trenching of the LSZ, was also contacted for this study. At the time of report writing, Mr. Korbay had not responded to requests by LCI for an interview.

2.2 Analysis of the Location and Activity of Louderback Shear Zone

In this section, subsurface data collected by HLA (1986, 1988a, 1988b) southeast of the project site and data by WCA (1969, 1970) within the project site, are used to characterize the location and activity of the LSZ.

Harding Lawson Associates (1968, 1988a, 1988b)

As summarized in Langan (2018), HLA mapped the LSZ as a complex ≥ 200 ft (61 m) wide zone of faulting that generally strikes northwest and dips northeast (HLA, 1988a, 1988b; Figure 1-2). Interpretations on the broad width of faulting were based primarily on the logging of the western 255 ft (78 m) of the Lawson Adit and eight HLA trenches (HLA, 1988a, 1988b). HLA (1988a, 1988b) delineated the LSZ across the eastern U.C. Berkeley campus based on faulted

Mesozoic bedrock and Quaternary colluvium and thin clay seams (HLA, 1988a, 1988b). The thin clay seams and bedrock shears were discontinuous and generally could not be connected from trench to trench, or from wall to wall within the same trench. HLA (1988a, 1988b) show the shears as terminating below the younger (Holocene) colluvial soils, and the juxtaposition of three main units at the fault zone: Pleistocene colluvium/alluvium, early Cretaceous and/or late Jurassic mudstone breccia, and Jurassic serpentinite. Additionally, in locations that were not covered in shotcrete or timbers in the Lawson Adit, HLA (1988a) logged massive greywacke sandstone, fault gouge, and Quaternary alluvium.

Based on the documentation in HLA (1988a, 1988b) and our interviews with community experts, including former CGS geologists, who reviewed the HLA trenches, the near consensus opinion at the time of trenching was that the LSZ was inactive. James Lienkaemper, who visited the HLA trenches but did not provide a formal review to HLA (1998a, 1988b), apparently was the only individual to interpret the shear zone in Trench Z-East as active (Table 2-2). Mr. Lienkaemper interpreted a fissure-fill in Trench Z-East as Holocene in age, and later used 2007 LiDAR data to interpret an east-facing scarp coincident with the approximate location of the fault in Trench Z-East. The interpretation of fissure-fill and absence of thick deposits of Holocene material across the LSZ were the primary reasons for delineating the shears exposed in trenches of HLA (1988a) as Holocene and uncertain in age. Mr. Lienkaemper stated that he did not recall discussing his interpretations of Trench Z-East with HLA geologists (Table 2-2). Although HLA (1988a) concluded that the LSZ is inactive, trench logs generally show a very thin layer or absence of young Holocene-age colluvium, precluding definitive interpretations on fault activity. Mapping performed by HLA (1988a) shows the LSZ projecting northwest into the central part of the project site. The northwest termination of the shear zone appears to be arbitrary and likely based on the northern limit of the mapping. HLA did not perform any subsurface explorations within the project site (Figure 1-2).

Woodward-Clyde & Associates (1969, 1970)

WCA (1969, 1970) performed several geotechnical investigations prior to construction of Parking Structure H that included 17 borings[1] and logging of the foundation excavation (Figure 2-1). The borehole and excavation logs are evaluated herein for information on the local subsurface conditions to help characterize the location, geometry, and activity of the LSZ across the project site.

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[1] WCA (1970) stated that eight borings were completed in 1959, however the logs for presumably boring 10 and 17 are absent from their report and the locations are not shown on their site plan.

Subsurface Site Conditions

Across a large portion of the project site, WCA (1969) interpret sandy clay fill and estimate up to 7 ft (2 m) of fill in the southwest corner of the site. In some locations, the fill is underlain by several feet of “old topsoil”; this topsoil may be Holocene in age, though WCA (1969) do not provide an age interpretation for the material. Stiff to very stiff silty or sandy clay that contained variable amounts of coarse sand to medium gravel size rock fragments is observed below the topsoil; in some locations, this clay is observed directly below the ground surface or asphalt (Figure 2-2). WCA (1969) interpret the clay as a residual soil or heavily weathered bedrock, though much of the material is likely Quaternary alluvium associated with an inferred paleochannel of Blackberry or Strawberry Creeks. In general, fill and presumed Holocene and Pleistocene material was either highly variable or described inconsistently between WCA (1969) boring logs across the project site, making it difficult to distinguish Holocene material with high confidence or certainty. We considered blow counts and color of units noted in the borehole logs in an attempt to assess the age of deposits across the project site. In general, within the Quaternary units, blow counts and reddening of the units increase with depth, which suggest an increasing age of the material with depth. This information alone is not detailed enough to confidently asses the Pleistocene-Holocene boundary.

The Quaternary colluvium and alluvium ranges from 6 to > 40 feet in thickness, and is underlain by Mesozoic Franciscan complex rocks of shale and greywacke sandstone, the majority of which are weathered, fractured, and jointed. The Langan (2018) boreholes are consistent with the WCA (1969) boreholes, with undifferentiated surficial deposits interpreted to be > 25 feet thick and underlain by Franciscan complex rocks. The depth to bedrock is variable across the site and in most of the WCA (1969) borings below the “planned foundation level” (i.e., elevation of 372 feet, as described in WCA [1969]), however shallow bedrock is observed in borings from the central part of the site near La Loma Avenue. In boring 4, for example, sheared shale is encountered at an elevation of 384 feet[2], 6 ft (1.8 m) below the ground surface (Figures 2-1 and 2-2). This shale in turn is described as underlain by very stiff sandy silty clay (presumably Quaternary alluvium or colluvium) at approximately 30 ft (9.1 m) below ground surface. Shallow bedrock is also observed in the nearby boring 14 (Figure 2-1), though bedrock is not underlain by Quaternary material in this boring.

These units were later observed during the foundation excavation for Parking Structure H, where a fault juxtaposing Quaternary alluvium on the west against Mesozoic sheared and

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[2] Elevation datum is City of Berkeley.

serpentinized shale and sandstone on the east, was observed in the northeast corner of the excavation (Figures 2-1 and 2-3). Similar to available boring logs, WCA (1970) do not distinguish between Holocene and Pleistocene alluvium in the parking lot exposure. The fault observed in the excavation is described further in the next section.

Fault Location and Geometry

During the foundation excavation for Parking Structure H, WCA (1970) document a well-developed curvilinear fault zone in the northeast corner of the parking structure that coincides with the shallow bedrock encountered in borings 4 and 14 (Figure 2-1). The faulting is generally on strike with the LSZ as defined by HLA (1988a, 1988b) and Lienkaemper (2008). WCA (1970) show two fault traces: a western, main trace, and an eastern, secondary trace (Figure 2-2). The main trace exhibits a variable dip along approximately 60 ft (18 m) long exposure, ranging from 50 degrees southwest to vertical. No dip information is provided for the secondary eastern trace. Additionally, the secondary trace is not shown in the WCA (1970) interpretation of the excavation (Figure 2-3). The secondary trace is proximal to the WCA (1969) boring 4, where bedrock was underlain by presumed Quaternary alluvium or colluvium.

The presence of other fault traces in the project area is uncertain. The logging performed by WCA (1970) of the excavation face at the northeast corner of Parking Structure H may suggest that they were present during the excavation of the entire parking structure foundation area and did not observe any other faults in addition to the two shown in Figure 2-1. This is not explicitly stated in their report, however. Unlike borings 4 and 14 where bedrock is shallow, in all other borings located in the Parking Structure H footprint, bedrock was logged either near or below the base of the foundation footing. This suggests that if faulting was encountered elsewhere during the foundation excavation, it would have occurred in offset Quaternary units. If such faults exist, these faults may be more likely missed during mapping and/or may indicate less cumulative displacement compared to the main trace mapped by WCA (1970). Therefore, given the available data, other secondary faulting cannot be precluded elsewhere in the project site.

Recency of Activity

WCA (1970) state that the main trace encountered at the site displaced units “very nearly to the ground surface” and describe the fault as active. No definition of “active faulting” is provided, however, WCA (1970) characterize the observed fault zone part of the active Hayward fault. Identifying active trace(s) of the Hayward fault across the UCB campus at this time was in its infancy as noted by present-day mapping that shows the closest mapped active Hayward fault trace is approximately 530 ft (162 m) east of the site. The WCA (1970) interpretation of the observed fault trace(s) as being part of the Hayward fault preceded Radbruch-Hall (1974) which initially defined the Louderback fault trace east of the site.

In an effort to better evaluate the presence of faulted Holocene material in the WCA (1970) excavation, we evaluated historical topographic maps, construction documents and borehole data. Prior to the foundation excavation activities, WCA (1969) estimated the deepest excavation for the parking structure foundation would be to an elevation of 372 feet, or as much as 25 ft (8.6 m) below the adjacent Hearst and La Loma Avenues. This depth of excavation is generally consistent with the building plans for the parking structure, with the exception of the foundation footing that extends to elevations of 363 to 365.25 feet, depending on location (see Sheets S-6 and S-7, Anshen & Allen Architects, 1970). The logged excavation is approximately 19 ft (5.8 m) high, with the base and top of the excavation at elevations of approximately 370 and 389 feet, respectively (Figures 2-1 and 2-3). East of the interpreted excavation face, La Loma Avenue is at an elevation of approximately 397 feet. These relations suggest as much as 8 ft (2.4 m) of material may have been missing at the time fault exposure was logged. The value of 8 ft (2.4 m) assumes generally flat-lying or gently west-sloping topography across the site. This likely underestimates the variable topography in the site area given the Berkeley Hills and proximity of the site to Blackberry Creek (Figure 1-1). The majority of the shallow surficial deposits likely were removed during the construction of College Hall between 1903 and 1911. Collectively, based on the planned excavation depths for the original parking structure, description of presumed Quaternary deposits in the boring logs, and estimated amount of material removed for the multiple site excavations, it is highly likely that much of the Holocene deposits and “residual soil” have been stripped from the site. The removal of the Holocene deposits prevents further refinement on the age of faulting across the project site. In summary, the fault zone exposure provides an apparent ≥ 19 ft (5.8 m) of vertical separation across the LSZ in the Quaternary (Figure 2-3).

2.3 Summary of Louderback Shear Zone Characterization

We reviewed existing publications, consultant reports, and maps, and interviewed community experts to parameterize the LSZ for the PFDHA and DFDHA. Although mapped by some authors as a single fault trace (e.g., Lienkaemper, 2008), subsurface explorations performed by HLA (1986, 1988a, 1988b) including trenching and logging of the Lawson Adit support characterizing the LSZ as a complex ≥ 200 ft (61 m) wide northwest striking zone of faulting that generally dips northeast. Southeast of the project site, HLA (1988a, 1988b) define the zone based on faulted Mesozoic bedrock (early Cretaceous and/or late Jurassic mudstone breccia and Jurassic serpentinite) and Pleistocene alluvium and colluvium and thin clay seams. The northern extent of their interpreted shear zone is located near the center of the project site (Figure 1-2). This termination is likely based on the northern limit of their mapping and is otherwise arbitrary. At the project site, WCA (1970) defined the LSZ by a similar geologic contact of Quaternary alluvium juxtaposed against Mesozoic sheared and serpentinized shale and sandstone. WCA (1970) mapped two fault traces towards the center of the project site near La Loma Avenue, a western main trace, and an eastern secondary trace (Figure 2-1). However, given uncertainties in the scope of WCA's (1970) analysis, secondary faulting cannot be precluded elsewhere in the project site.

With the exception of Lienkaemper (2008; personal communication), all publications, reports, and community experts interviewed defined the LSZ as inactive, though offsetting late Quaternary deposits. WCA (1970) stated that the fault traces observed during the foundation excavation of Parking Structure H were active, though no definition of active was provided. The existing descriptions from the WCA (1969) borehole logs and WCA (1970) excavation log are inadequate for assessing the Pleistocene-Holocene boundary across the project site and therefore cannot help refine the age of LSZ faulting beyond late Quaternary. Additionally, we interpret that most if not all Holocene material had been removed from the project site at the location of the WCA (1970) excavation face at the time of their interpretation. Because of the uncertainties on the location, width, and activity of faulting within the project site, we performed the PFDHA and DFDHA described in Sections 3.0 through 6.0.

3.0 FAULT DISPLACEMENT HAZARD ANALYSIS METHODOLOGY

The probabilistic fault displacement hazard analysis (PFDHA) methodology implemented in this study follows Youngs et al. (2003) and Petersen et al. (2011), which are based on the more common probabilistic seismic hazard analysis (PSHA) of Cornell (1968). Instead of estimating the annual rate of exceeding a specified earthquake ground motion at a site, PFDHA estimates the annual rate of earthquake-induced displacement D exceeds a specified level, d, at a site x,y of site dimension z (geographic and geometric definitions are shown in Figure 3-1). The time-independent rate of exceedance, $\lambda_{xyz}(D > d)$, is computed as:

$$\lambda_{xyz}(D > d) = \alpha(M_{min}) \int_{M} f_M(m) \int_{S} f_{S|M}(s|m) \times \int_{R_p} f_{R_p}(r_p)\, P_{xy}\left[D > d|m,s,r_p,z\right] dr_p ds dm \qquad (3\text{-}1)$$

where $\alpha(M_{min})$ is the rate of all earthquakes on the fault of interest above a minimum magnitude M_{min}, $f_M(m)$ is the probability density function (PDF) of earthquake magnitudes M (from M_{min}, to a maximum earthquake the fault can produce), and $f_{S|M}(s|m)$ is a PDF of (magnitude-dependent) earthquake rupture locations on the fault source, as measured by the distance S from the end of the fault source to the end of the rupture. These initial terms in (2-1) are exactly comparable to fault source characterization that is required for a PSHA, whereby the location and rate of earthquakes are defined for each seismic source. Additional terms in (2-1) that are specific to PFDHA include a PDF describing the *across* strike rupture location uncertainty, $f_{R_p}(r_p)$, where R_p refers to the perpendicular distance from the site to the principal fault rupture, and a conditional probability of displacement exceedance term (a fault displacement attenuation relation), $P_{xy}\left[D > d|m,s,r_p,z\right]$. This displacement attenuation relation itself may consist of three separate terms, as follows:

$$P_{xy}\left[D > d\middle|m,s,r_p,z\right] = P[sr \neq 0|m]P_{xy}[d \neq 0|s,z,r_p,sr \neq 0] \times P_{xy}\left[D \geq d\middle|m,s,r_p,d \neq 0\right]. \qquad (3\text{-}2)$$

The first term, $P[sr \neq 0|m]$, is the conditional probability that some amount of surface rupture occurs as a result of an earthquake of magnitude m. Whereas in PSHA all earthquakes are presumed to cause some amplitude of vibratory ground motion, in PFDHA not all earthquakes rupture to the surface (or near-surface). Examples of this include the 1994 moment magnitude (M_W) 6.7 Northridge, California earthquake on the Northridge blind thrust (Yeats and Huftile, 1995), and the 2010 M_W 7.0 Haiti earthquake adjacent to the strike-slip Enriquillo fault zone

(Prentice et al., 2010). The second term, $P_{xy}[d \neq 0|s, z, r_p, sr \neq 0]$, is the conditional probability that some amount of surface rupture occurs at the site x,y, given the location of the principal rupture relative to the site (s, z, r_p) and an earthquake that produces some surface rupture. The third and final term in (3-2) is the conditional probability of displacement exceedance at the site of interest, where displacement is expressed as a PDF that is dependent on m, s (represented in Petersen et al. (2011) by the ratio l/L as show in Figure 3-1), and r_p.

The functional forms and/or parameter values of the PDFs and conditional probabilities changes based on the style of faulting (strike-slip, normal, or reverse), and the location and size of the site xyz relative to the principal fault trace. If the site straddles the principal fault (and $r_p \sim 0$), the site is subjected to a principal displacement hazard as well as distributed deformation adjacent to the principal rupture. If the site of interest is away from the principal fault ($r_p > z$), the hazard is from secondary (also called "distributed") fault displacement only. In rare cases, typically associated with reverse faulting environments, the permanent ground deformation hazard is not discrete surface-fault rupture but rather abrupt tilting or warping, such as in the production of fold scarps (Streig et al., 2007; ANSI/ANS 2.30-2015). Figures 3-2 and 3-3 show examples of historic strike-slip surface-fault ruptures from Petersen et al. (2011), and the separate hazards of principal, secondary, and distributed deformation.

For this study, the proposed GSPP-HAAH site is located within a zone of suspected secondary or distributed deformation hazard, at a distance of approximately 160–250 m from the primary strand of the Hayward fault which represents the principal rupture source (Figures 1-1 and 3-4). Thus, the hazard of concern is that of secondary fault displacement (e.g., slip on the fault observed by WCA (1970) in the excavation for the parking structure) or distributed fault displacement (e.g., localized slip or distributed shear on previously unrecognized faults or tectonic shears beneath the proposed GSSP and HAAH structures). Hazard is calculated for three points each representing the center point for an approximately 50 m × 50 m cell (Figure 3-4 and Table 3-1). The proposed GSSP facility is represented by the western point, and the proposed HAAH facility is represented by the two eastern points. The 50 m cell dimension slightly overestimates the precise area of the project facilities, but this difference is not meaningful for the hazard results given the overall uncertainties in the analysis. Table 3-1 lists the longitude and latitude (x and y), cell dimension (z), and distance to the principal fault source from the center points (r_p).

Table 3-1. Locations for Hazard Calculation.

Point Name	Longitude (x), Decimal Degrees WGS84	Latitude (y), Decimal Degrees WGS84	Cell Dimension (z)	Distance from Center Point to Principal Hayward Fault (r_p)
GSSP	-122.25756	37.87573	50 m	220 m
HAAH North	-122.25725	37.87625	50 m	170 m
HAAH South	-122.25725	37.87577	50 m	190 m

The PFDHA hazard formulation in (3-1) and (3-2) was calculated for the three points with parameters in Table 3-1 in LCI's software code TDISE. Alternative parameter values are captured in logic trees that describe the fault source characterization and the fault displacement prediction equations (Section 4). The results are shown graphically in hazard curves of annual probability (or rate or frequency) of exceedance versus net displacement amplitude (Section 5).

In most cases, the hazard curves are applicable for estimating exceedance probabilities of net ground surface amplitudes under "natural" conditions (e.g., natural soil profiles without built structures). In order to make the hazard more useful for consideration of its potential impact on the built environment, and for consideration of how to design or model a structure to withstand displacement, additional information may be needed such as the following:

- displacement orientation (strike and dip of displacements),
- displacement direction (horizontal and vertical components of slip), and
- displacement localization (knife-edge dislocation or distributed shear across a zone).

These parameters are defined in Section 6.

4.0 PFDHA LOGIC TREE

The PFDHA logic trees for the UCB GSPP and HAAH project are presented in Figures 4-1 (for fault source characterization) and 4-2 (for fault displacement prediction model). As stated above, the location of the project is approximately 160 to 250 m from the primary trace of the Hayward fault, and thus the hazard at the site is from secondary, or distributed, fault displacement rather than principal fault displacement.

4.1 Logic Tree Primer

The logic trees consist of nodes and branches that collectively provide the information needed to calculate hazard and capture hazard uncertainty. Nodes are organized in columns in Figures 4-1 and 4-2. Each node represents a model element that is required either to justify the calculation methodology or to parameterize the model. Nodes in Figure 4-1 are named with the initials SC for source characterization, and are numbered sequentially from node SC 1 to SC 11. Nodes in Figure 4-2 are named with the initials DM for displacement model, and are numbered sequentially from node DM 1 to DM 7. The following chapter subsections are organized to follow these nodes.

Branches are organized as one or more rows under each node in Figures 4-1 and 4-2. Branch values represent inputs that are required to implement the model. There are two types of branching structures represented in the logic trees. Branches that are connected by vertical lines (e.g., Figure 4-1, node SC 3) represent relationships whereby multiple values are required to fully describe the model. The one instance in this project where there are such aleatory branching relationships involves the segmentation model for earthquake ruptures on the Hayward fault zone source. Here, the various branch combinations each represent a complete description of how the Hayward fault zone—consisting of separate, non-overlapping Southern Hayward, Northern Hayward, and Rodgers Creek fault segments—rupture as separate segment ruptures or as multi-segment ruptures. Because the study site is located adjacent to the Northern Hayward fault segment, only rupture sources that include the Northern Hayward segment are included in the analysis (Figure 4-3). For example, the “Three Segment” rupture scenario defined under node SC 2 is followed by three aleatory branches that define the three separate rupture segments under node SC 3 (Figure 4-1). Entries of “N/A” (for not applicable) follow the Rodgers Creek and Southern Hayward branches under node SC 4 because the displacement hazard from separate ruptures on those fault segments do not impact the study site. Conversely, a maximum rupture length value of 35 km is provided under node SC 4 for the Northern Hayward branch, and alternative values and weights are provided under nodes SC 5 to SC 11 that are applicable to complete the source description for the Northern Hayward rupture segment branch.

Logic tree branches connected by inclined lines that come together at a dot represent alternative parameters with an “or” relationship. In these cases, branch values represent alternative possible correct values, with the correct value being uncertain but, theoretically, knowable. In these cases, the likelihood that each alternative value represents the correct value is represented by a branch weight, which is listed as a number in square brackets beneath each branch line, with each number less than or equal to one. The branch weights are subject to the requirement that all alternative branch weights sum to unity. These alternatives represent epistemic, or model, uncertainty for parameters that are considered to be ultimately knowable given the collection of enough information.

Each pathway through the logic trees in Figures 4-1 and 4-2 represents a complete and permissible set of model parameter inputs, and a hazard curve can be calculated to represent that pathway. The likelihood that the particular pathway and its resulting hazard curve are correct is indicated by the combined weight of epistemic branch values following that path. The mean hazard curve is calculated as the weighted sum of hazard for every possible pathway through the logic tree.

4.2 Source Characterization Logic Tree

The source characterization logic tree for this study is based on the seismic source characterization developed for the 2015 update to the site-specific seismic hazard analysis for the UCB campus (URS, 2015). The source characterization required for the PFDHA is limited to a single source—the Hayward-Rodgers Creek fault source—and to the subset of ruptures occurring on the Northern Hayward fault segment (Figures 4-1 and 4-3). The URS (2015) characterization of the Hayward fault source is a modification of the fault source characterization developed for the community earthquake rupture forecasts developed by the 2002 Working Group for California Earthquake Probabilities (WGCEP, 2003) and by the 2007 WGCEP, published as the second Uniform California Earthquake Rupture Forecast (UCERF 2; WGCEP, 2008).

The source characterization logic tree provides parameters needed to implement the first parts of equation (3-1) with the following exception. The conditional probability of principal rupture occurring adjacent to the site, represented by $\int_S f_{S|M}(s|m)\,ds$, is solved in the hazard code numerically by placing ruptures on the fault source plane based on magnitude and simple magnitude-area scaling (similar to PSHA codes). For the other terms of the equation—namely the rate of earthquakes and the magnitude PDF on the fault source—the source characterization is defined by fault location and source geometry (nodes SC 1 to SC 5), the earthquake magnitude distribution (nodes SC 6 to SC 8), and the earthquake recurrence rate (nodes SC 9 to SC 11).

4.2.1 Fault source geometry

The fault source geometry model is defined in nodes SC 1 to SC 5 (Figure 4-1). Node SC 1 identifies the Hayward-Rodgers Creek fault source, which is shown in Figure 4-3, and notes that the seismogenic probability (i.e., the degree of belief that the source is capable of generating damaging earthquakes) is 1.0. Node SC 2 describes rupture scenarios for the fault source that are presented as epistemic alternatives for the portions of the fault source that host the largest earthquake ruptures. Node SC 3 identifies the rupture segments or segment combinations that make up the rupture scenarios. As SC 3 provides a definition for the logic tree branches in SC 2, the branches in SC 3 do not have weights. The highest weighted logic tree branches under SC 2 are for the three segment rupture scenario [0.5], which proposes that the Rodgers Creek fault and the Northern and Southern Hayward fault segments rupture separately, and the two segment rupture scenario whereby the Northern and Southern Hayward fault segments rupture together and the Rodgers Creek fault ruptures separately [0.3]. The least weight [0.05] is given to rupture sources that propose the entire Hayward-Rodgers Creek fault source ruptures together or that earthquakes up to M_W 6.9 rupture in “floating” earthquakes up and down the fault source without regard to the proposed fault or fault segment boundaries.

Node SC 4 defines the lengths of the rupture sources. As the model does not include uncertainty in the endpoints of the rupture segments, the maximum rupture length branch values have corresponding weights of [1.0]. As stated in Section 4.1, the PFDHA is only concerned with ruptures that include the Northern Hayward fault segment, as that segment is located adjacent to the project site (Figure 4-3). Any rupture segment or segment combination that does not include the Northern Hayward fault segment is not included in the calculation, and this is indicated by a “N/A” (not applicable) branch entry.

Node SC 5 defines the maximum rupture width for the fault source. For all cases, an identical logic tree structure of 14 km, 12 km, and 10 km values with [0.3], [0.4], and [0.3] weights, respectively is assigned. These values approximately represent the 90th, 50th, and 10th percentile uncertainty values for maximum rupture width, as defined by depth of microseismicity and geodetic modeling. As the Hayward fault dip is steeply dipping to sub-vertical, we do not consider separately fault source dip and maximum depth of the seismogenic crust.

4.2.2 Fault source magnitude distribution

The earthquake magnitude distribution for the Northern Hayward fault source is defined by nodes SC 6, SC 7, and SC 8 (Figure 4-1). The basic approach for assessing the magnitude distribution for the sources is to consider the maximum rupture dimensions of a rupture source, and apply empirical scaling relations between moment magnitude and maximum rupture area (the product of maximum rupture length *L* and maximum rupture width *W*, from nodes SC 4 and SC 5, respectively) or earthquake magnitude and rupture length. Because the Hayward fault creeps, and thus a portion of the fault area slips by stable sliding rather than stick-slip earthquake rupture, the common magnitude-area scaling relations are adjusted to account for a reduction in fault area that is expected to release significant seismic moment (Bakun, 2003). The seismogenic scale factor, *R*, is approximately defined as the ratio of the fault area expected to release full seismic moment to the total fault area. The effective rupture area, *A'*, equal to $L \times W \times R$, is then used in empirical magnitude-rupture area relations (e.g., Wells and Coppersmith, 1994; Hanks and Bakun, 2008). Node SC 6 provides best-estimate values of *R* for the different rupture sources, with the *R* values shown in 4-1 representing an average of estimated values from the recent UCERF 3 study (Field et al., 2013) and from Lienkaemper et al. (2014).

Node SC 7 describes the earthquake magnitude PDF, or the relative frequency distribution of earthquakes sizes from a minimum cutoff magnitude (M_W 5.0 used in this study) to a maximum magnitude (Mmax). Following URS (2015), two PDFs are considered. The higher weighted branch alternative with a weight of [0.7] is the characteristic earthquake magnitude PDF from Youngs and Coppersmith (1985). This model is implemented with a boxcar distribution 0.5 magnitude units wide, centered on a mean “characteristic” magnitude (Mchar) provided under Node SC 8. Approximately 10 percent of the seismic moment rate of the fault source is accommodated through lower earthquake magnitudes (between the minimum magnitude and the lower edge of the boxcar) that follow an exponential magnitude-frequency distribution. The lower weighted branch with [0.3] weight is the maximum magnitude PDF of Wesnousky et al. (1983). The implementation of this model is a truncated normal distribution, centered on Mchar, with a standard deviation of 0.125 magnitude units and truncations at ± 2 standard deviations (yielding a total width of 0.5 magnitude units centered on Mchar).

The Mchar values needed to anchor the magnitude PDFs are provided in node SC 8. These alternative branch values and weights are based on the effective rupture areas of the fault sources (the product of nodes SC 4, 5, and 6) and a weighted combination of three empirical magnitude-scaling relations used by URS (2015) (Hanks and Bakun, 2008 [0.2], Shaw, 2009 [0.4], and Ellsworth, 2003 [0.4]). The center branch Mchar value under node SC 8 (with a weight of [0.6]) represents the weighted average of the effective rupture areas and empirical scaling relations, and the high and low branch Mchar values (with weights of [0.2]) represent the center values ± 0.3 magnitude units that represent the range of branch combinations plus an additional 0.1 magnitude unit that accounts for additional uncertainty in *R*. The aleatory magnitude distribution in the magnitude PDFs account for additional epistemic and aleatory uncertainty in earthquake magnitude given the maximum rupture dimensions for the Northern Hayward fault source.

4.2.3 Fault source recurrence rate

The estimated mean recurrence rate of moderate to large earthquakes on the rupture sources is needed to complete the fault source characterization. Node SC 9 defines the recurrence approach, with alternatives for using fault slip rate (node SC 10) (and moment balancing) or using mean recurrence intervals for surface-rupturing earthquakes estimated from paleoseismic data (node SC 11). Only the rupture source that consists of the single-segment Northern Hayward fault has the branch option for direct mean recurrence interval estimates (Figure 4-1). The reader is directed to URS (2015) for the basis of the recurrence intervals selected in the logic tree. In all other cases, mean recurrence is calculated from the fault slip rate and moment balancing.

Node SC 10 provides estimates of fault slip rate for the Northern Hayward fault. The logic tree branch values of 9, 11, and 7 with weights of [0.6], [0.2], and [0.2] represent the estimated geologic slip rates for the fault at the mean and approximately 95% confidence interval. For the recurrence rate calculation, moment balancing is performed such that the seismic moment rate for the fault source is balanced by the magnitude-frequency distribution of earthquakes generated for the fault source. The *R* factor that was used to adjust the characteristic earthquake magnitudes is also used in the moment balancing to make sure rates of earthquakes on the defined fault source are appropriate.

4.3 Fault Displacement Prediction Model Logic Tree

The fault displacement prediction model provides information to solve the later terms in equation (3-1) and the expanded terms in equation (3-2). A simplification to (3-1) that is used in this analysis is to recognize that the location of the main, creeping Hayward fault that is the locus of principal faulting is well defined adjacent to the project location (Figure 3-4), and treat R_p as a constant.

The remaining terms are those in (3-2) and the logic tree to characterize uncertainties in these terms is presented in Figure 4-2. The first node in the displacement model, node DM 1, shows that the analysis is based on the displacement prediction model of Petersen et al. (2011), which was developed for strike-slip faults and relies on several California earthquakes and other, global earthquakes on relatively similar strike-slip faults as the Hayward fault (with the notable exception that none of the faults are known to creep at levels comparable to the Hayward fault).

The progression of the displacement prediction model logic tree follows the order of terms in (3-2), and includes the following:

- conditional probability of surface rupture, $P[sr \neq 0|m]$, (node DM 2);
- conditional probability of displacement (in this case, secondary or distributed deformation) at the site, $P_{xy}[d \neq 0|s, z, r_p, sr \neq 0]$, (nodes DM 3 and DM 4); and
- the displacement exceedance PDF (in this case, for secondary or distributed deformation), $P_{xy}\left[D \geq d\middle|m, s, r_p, d \neq 0\right]$, (nodes DM 5 and DM 6).

4.3.1 Conditional probability of surface rupture

The first term, $P[sr \neq 0|m]$, is the conditional probability that some amount of surface rupture occurs as a result of an earthquake of magnitude m (Section 3.0). Logic tree node DM 2 shows the implementation of this conditional probability.

The conditional probability of surface rupture is typically based on global empirical observations of earthquakes of varying magnitudes that have or have not produced surface rupture. As the outcome of surface rupture is binary (an earthquake either ruptures the surface or it does not), the probability can be represented through a logistic regression of the form:

$$P[sr \neq 0|m] = \frac{e^{a+bm}}{1+e^{a+bm}} \tag{4-1}$$

The logic tree shows two branch alternatives. The first branch, with a weight of [0.4], is the parameterization of the *a* and *b* constants developed by Wells and Coppersmith (1993) as presented in Youngs et al. (2003) (Table 4-1). This regression was developed from 276 worldwide earthquakes of various slip types, and it predicts that an earthquake of M_W 6.0 has a 45% chance of rupturing the surface, 70% for M_W 6.5, and 87% for M_W 7.0. The second branch, with a weight of [0.6], is shown as “Modified from Takao et al. (2015).” The basis for this branch comes from Takao et al. (2015), who used the same functional form as (4-1) and fit *a* and *b* parameters using 107 inland crustal earthquakes in Japan of mostly reverse and strike-slip styles of faulting. They found a much steeper curve than the global Wells and Coppersmith (1993) data, with an only 7% probability of surface rupture from M_W 6.0, but a 91% probability from M_W 7.0 earthquakes. This result strongly suggests that regionalization is an important consideration for this conditional probability, and that the global average condition may not be an accurate, or best, model to use for any single site in particular.

Table 4-1. Logistic Regression Coefficients for the Conditional Probability of Surface Fault Rupture.

Reference and Data Set	Weight	a	b	P[sr≠0], M_W =6.0	P[sr≠0], M_W =6.5	P[sr≠0], M_W =7.0
Wells and Coppersmith (1993), 276 worldwide earthquakes, all slip types	[0.4]	-12.51	2.053	0.45	0.70	0.87
Takao et al. (2015), 107 crustal earthquakes in Japan, strike-slip and reverse	--	-32.03	4.90	0.07	0.46	0.91
Modified from Takao et al. (2015) for application to the Hayward fault (this study)	[0.6]	-30	5.2	0.77	0.98	1.0

Based on the relatively thin seismogenic crust and creeping nature of the Hayward fault, and given the paleoseismic evidence on the southern and northern Hayward faults for repeated surface-fault ruptures over the past few thousand years (e.g., Lienkaemper and Williams, 2007), and given that surface-fault rupture has occurred historically on Bay Area faults for magnitudes as low as M_W 5.8 (e.g., 1980 M_W 5.8 Greenville fault earthquake; also 1984 M_W 6.2 Morgan Hill earthquake on the Central Calaveras fault, and 2014 M_W 6.0 Napa earthquake on the West Napa fault), we consider the probability of surface rupture (or at least accelerated fault creep at the surface) given magnitude to be much greater for the Hayward fault than the global average or from the Japan dataset. We keep the steep slope from the Takao et al. (2015) relationship, but modify the *a* and *b* values such that the probability of surface rupture is almost a certainty for earthquakes greater than or equal to M_W 6.5, and the probability of a M_W 6.0 on the Hayward generating surface rupture is greater than about 75% (Table 4-1). This modified from Takao et al. (2015) parameterization is not given a weight higher than [0.6] because it is not based on carefully considered data, but rather is defined on the more qualitative basis described above.

4.3.2 Conditional probability of distributed deformation at the site

The second term in equation (3-2), $P_{xy}[d \neq 0|s, z, r_p, sr \neq 0]$, is the conditional probability that some amount of surface displacement occurs at the study site (x,y) of site dimension z given principal rupture adjacent to the site (represented by s) and an earthquake that produces surface rupture ($sr \neq 0$). Logic tree node DM 3 shows that the conditional probabilities developed by Petersen et al. (2011) are used for the median model, and node DM 4 shows that uncertainty in the probabilities is treated epistemically, with branch alternatives for 90th, 50th, and 10th percentile probabilities.

The Petersen et al. (2011) empirical model was developed using data from several well-documented strike-slip earthquakes that documented both principal and distributed displacement (e.g., Figures 3-2 and 3-3). This probability (*P*) is represented through a regression of the form:

$$\ln(P) = a(z)\ln(r_p) + b(z) \qquad (4\text{-}2)$$

where $a(z)$ and $b(z)$ are regression coefficients (dependent on cell size z) and r_p is the perpendicular distance from the site of interest to the primary rupture (Petersen et al., 2011, their Equation 20). Petersen et al. (2011) consider this model to be valid for values of r_p between approximately 200 m and 2.5 km. For distances less than 200 m, Petersen et al. (2011) provide fixed mean probabilities at interval distances based on interpolation. Because the distances considered in this study are in the range of $170 \leq r_p \leq 220$ (Table 3-1), we use the published linear interpolation points of Petersen et al. (2011) for 100 m and 200 m for z = 50 m, and derive an additional interpolation point for r_p = 300 m based on the distributed rupture dataset provided with Petersen et al. (2011) as an electronic supplement. From those data, we also confirmed the published interpolation probabilities for the 100 m and 200 m distances.

Node DM-4 presents the uncertainty in the median model for the probability of distributed deformation at the site of interest. Evaluation of the electronic supplement dataset provided in Petersen et al (2011) shows that the probability of displacement at a site off of the principal rupture varies greatly from earthquake rupture to earthquake rupture. Thus, the average of the earthquakes examined by Petersen et al. (2011) does not necessarily represent the average condition for any individual fault. It is unclear whether the probability of distributed displacement at the GSPP and HAAH sites should be less than, about equal to, or greater than the dataset average. An argument that the probabilities should be less than the dataset average is that the Northern Hayward fault is locally relatively straight and does not show much structural complexity along its creeping trace (e.g., Figure 1-1). This simplicity and the creeping behavior may tend to minimize off-fault displacement during large earthquakes, and concentrate the strain at the ground surface along the creeping trace. An argument that the probabilities of off-fault displacement at the project sites may be higher than the dataset average is that we know a late Quaternary fault underlies a portion of the site (Figures 1-2, 1-3, and 3-4), and the Louderback shear zone probably underlies the entire study site. In contrast, the Petersen et al. (2011) dataset and methodology to estimate off-fault rupture probabilities does not restrict its examination to only those areas with pre-existing faulting, and thus many of the areas around the historic ruptures that go into the conditional probability analysis are likely areas that are unfaulted. Because of the uncertainty in how to center the conditional probability of distributed rupture for the project site, we center the probabilities on the dataset average (the 50th percentile), and adopt a 3-point uncertainty distribution with branches representing the 90th and 10th percentile probabilities from the Petersen et al. (2011) dataset and the calculated sample standard deviations derived from the data (Figure 4-2). The weighting scheme of [0.3], [0.4], [0.3] for the 90th, 50th, and 10th percentile values follows the recommended 3-point approximation for a continuous uncertainty distribution by Keefer and Bodily (1983) for cases where the tails of the distribution are poorly defined. The probability levels, values and weights for the linear interpolation points used in the analysis are provided in Table 4-2.

Table 4-2. Linear Interpolation Points for the Conditional Probability of Distributed Deformation for the 50 m × 50 m Cell Size from Analysis of Data in Petersen et al. (2011).

Probability	Linear Interpolation Probabilities *P*(r_p)			Branch Weight
	P(100 m)	P(200 m)	P(300 m)	
90th Percentile	0.0804	0.0505	0.0425	[0.3]
50th Percentile	0.0482	0.0262	0.0203	[0.4]
10th Percentile	0.0160	0.0018	0.0001	[0.3]

4.3.3 Displacement exceedance PDF for distributed deformation

The displacement exceedance model for distributed deformation, $P_{xy}\left[D \geq d \middle| m, s, r_p, d \neq 0\right]$, is described under nodes DM 5 and DM 6 in the displacement model logic tree (Figure 4-2). Node DM 5 contains two alternative models from Petersen et al. (2011); both models are fit to a set of strike-slip earthquake data between approximately 20 m and 3 km from the principal rupture (Petersen et al., 2011). The first branch, with a weight of [0.3], is for a functional form that solves for distributed displacement *d* as a function of m and r_p. From equation 18 of Petersen et al. (2011), it is:

$$\ln(d) = 1.4016m - 0.1671\ln(r_p) - 6.7991 + 1.1193\varepsilon \qquad (4\text{-}3)$$

where *d* is in centimeters and r_p is in meters. The regression standard deviation of 1.1193 is multiplied by the standard normal distribution function, ε, to represent event to event variability.

The second branch under node DM 5 uses an alternative functional form that solves for normalized *d* over the average displacement of the rupture, D_{ave} , as a function of r_p:

$$\ln\left({}^{d}/_{D_{ave}}\right) = -0.1826\ln(r_p) - 1.5471 + 1.1388\varepsilon \tag{4-4}$$

This second branch is given a higher weight of [0.7] due to the greater flexibility of the model to explore uncertainty of distributed displacement amplitudes (through node DM 6). For both (4-3) and (4-4), the natural log standard deviations are used to capture aleatory variability in distributed displacement.

Node DM 6 explores equations to derive the average principal fault displacement as a function of magnitude, $D_{ave}(m)$, to provide the input required for implementing (4-4). Three branch alternatives are considered that explore epistemic uncertainty in average principal displacement for the Northern Hayward fault (Figure 4-2). The branch alternatives are based on the published equation of Wells and Coppersmith (1994) constrained by global data of strike-slip ruptures. This equation has the form:

$$\log_{10} D_{ave} = bm + a + \tau\varepsilon \tag{4-5}$$

with τ representing the published standard deviation of the regression and ε representing the standard normal distribution. Best fit *a* and *b* values are listed in Table 4-3 as are the values for ε and τ. The upper (90th percentile) and lower (10th percentile) branches each are weighted [0.3] and the central (50th percentile) branch has a weight of [0.4] following Keefer and Bodily (1983).

Table 4-3. Parameters used for Average Principal Fault Displacement Estimations Based on Wells and Coppersmith (1994).

Probability	**Parameters for $\log_{10} D_{ave} = bm + a + \tau\varepsilon$**				**Branch Weight**
	b	***a***	τ	ε	
90th Percentile	0.90	-5.96	0.28	+1.28	[0.3]
50th Percentile	0.90	-6.32	0.28	0	[0.4]
10th Percentile	0.90	-6.68	0.28	-1.28	[0.3]

4.4 Deterministic Hazard Analysis

In addition to the PFDHA, a deterministic hazard analysis was performed in order to understand the median and higher and lower standard deviation displacements that may be expected from a maximum credible earthquake (MCE) comparable to that selected for deterministic ground motions. Following URS (2015), an MCE of M_W 7.0 on the Hayward fault was selected as the scenario earthquake. The scenario deterministic case for fault displacement hazard implicitly assumes that this earthquake causes surface rupture within the site of interest, and thus the conditional probabilities defined under nodes DM 2 to DM 4 are not applied. The displacement hazard and its uncertainty is estimated following the same equations and weights under nodes DM 5 and DM 6 in Figure 4-2, with r_p values based on Table 3-1. The alternative branches and aleatory variabilities in equations (4-3) and (4-4) allow for assessment of the median (50th), 84th, and other percentile deterministic displacements to be calculated.

5.0 HAZARD RESULTS

Probabilistic and deterministic hazard results presented in this section represent net displacement hazard for the project site. The specific characteristics of the net displacement, including orientation, distribution, horizontal and vertical components, and coseismic slip versus afterslip, are discussed in Section 6.0. The probabilistic results are based on the full PFDHA logic trees shown in Figures 4-1 and 4-2, and were calculated using LCI's hazard code TDISE. The deterministic results are based on a specific set of conditions from the logic trees as described in Section 5.4. The hazard results are presented in four types of figures, as follows:

- Hazard curves showing total hazard for each of the three center points (representing hazard within an approximately 50 m cell dimension) shown in Figure 3-4, as well as a summed mean hazard curve showing the hazard from the combined HAAH-North and HAAH-South cells;
- Hazard fractiles for one center point (representing HAAH-North) showing total epistemic uncertainty in the results captured in the logic trees;
- Hazard curves for one center point (representing HAAH-North) showing weighted hazard contribution by rupture scenario, and conditional (unweighted) hazard curves by rupture scenario to examine the contribution to hazard uncertainty due to the fault source model;
- A deterministic exceedance curve, showing both the mean deterministic exceedance and conditional (unweighted) exceedance curves to examine the contribution to uncertainty from the fault displacement prediction equation.

5.1 Mean Hazard

The mean hazard results of the PFDHA for the three hazard center points are presented in terms of mean annual frequency of exceedance (MAFE; in units of per year) as a function of net displacement amplitude in units of centimeters (panel a) and inches (panel b) (Figure 5-1). The mean, or "total" displacement hazard is the sum of all paths through the logic tree, with each path multiplied by its weight. The MAFE is the reciprocal of the average return period. Figure 5-1 also shows the mean total displacement hazard for the sum of the two center points representing the HAAH (HAAH-North + HAAH-South). As stated in Section 3-4, the 50 m cell dimensions are slightly greater than the physical footprints of the proposed structures they are intended to represent, but this difference is not meaningful compared to the overall uncertainties in the calculation. The individual HAAH point hazard curves and the combined north and south HAAH point hazard curves are an additional representation of probabilistic fault displacement hazard uncertainty for the proposed project site.

The mean hazard curves all fall entirely below the 10^{-3} yr^{-1} MAFE hazard level, indicating that mean hazard is negligible at the 1,000 yr average return period (Figure 5-1). The hazard curves for each 50 m cell center point all fall below the 2×10^{-4} yr^{-1} MAFE, or 5,000 yr average return period as well. The sum of the two HAAH center points, which approximates the hazard of fault displacement beneath the entire proposed HAAH facility, flattens at approximately 2.5×10^{-4} yr^{-1} MAFE, or 4,000 yr average return period. For a displacement amplitude of 1 inch (~2.5 cm), the corresponding mean return periods (rounded to the nearest 1,000 yr) range from 6,000 yr (for the sum of the two HAAH points) to 14,000 yr (for the GSPP). This basic result reflects the very low probabilistic hazard of fault displacement compared to other probabilistic seismic hazard levels commonly considered for buildings. Table 5-1 shows the hazard results (at net displacement in inches) at various MAFEs between 10^{-3} and 10^{-4} yr^{-1} (1,000 and 10,000 yr average return periods).

Table 5-1. PFDHA Results for the GSPP and HAAH at Selected Hazard Levels.

Hazard Level		Net Displacement (inches)(1)			
Mean Annual Exceedance Frequency (yr^{-1})	Average Return Period (yr)	GSPP	HAAH-North	HAAH-South	HAAH-Combined
1×10^{-3} yr^{-1}	1,000	--	--	--	--
4×10^{-4} yr^{-1}	2,500	--	--	--	--
2×10^{-4} yr^{-1}	5,000	--	--	--	0.5
1×10^{-4} yr^{-1}	10,000	<0.1	0.6	0.3	2.5

Note

(1) Dashed line indicates case where hazard curve lies entirely below the specified hazard level, and hazard is considered to be "negligible."

5.2 Hazard Fractiles

As the field of PFDHA is relatively new, it is important to consider the uncertainty in the mean hazard curves. Figure 5-2 shows the hazard fractiles for the HAAH-North point, which represents the closest point to the principal Hayward fault source and highest of the 50 m cell points. The figure shows the mean hazard curve (black dashed line) along with hazard fractiles in colored, solid lines at the 5th, 15th, 50th (median), 85th, and 95th percentiles. These fractile curves indicate the range of possibly correct hazard curves given the epistemic (or model) uncertainties in the logic trees. The 95th fractile, as an example, represents the hazard curve that would be exceeded only 5 percent of the time for all possible paths (scaled by weight) through the logic tree. The 50th (or median) fractile represents a hazard curve that would be exceeded for about half of the possible paths through the logic tree. The weighted mean hazard curve falls between the median and 85th fractile hazard curves, as is common.

The hazard fractiles show that, even at the 95th fractile, the mean hazard is lower than the 10^{-3} yr^{-1} hazard level for the HAAH-North point. At the 4 × 10^{-4} yr^{-1} hazard level (2,500 yr average return period), the 95th fractile shows a displacement amplitude of only 0.2 cm (about 0.08 inches) (Figure 5-2). This result suggests that the mean hazard results showing negligible hazard at the 10^{-3} hazard level are robust even given the considerable epistemic uncertainties in the logic tree model.

5.3 Hazard Sensitivity to Hayward Fault Source Characterization

Figure 5-3 provides to ways to examine how different concepts of large earthquakes on the Hayward fault source affect the PFDHA results at the GSSP and HAAH sites. Similar to the hazard fractiles, Figure 5-3 shows hazard for the HAAH-North center point only, as results for this point are representative for the entire project area. Panel (a) shows the total hazard curve (dashed black line) and the weighted contribution to the total hazard from each rupture scenario (logic tree node SC 2; Figure 4-1). Reflecting the highest weight for the “Three Segments” [0.5] and “Two Segments (Version B)” [0.3] branches, the blue and purple solid lines show a much greater contribution to the total hazard than the other three branches. The highest weighted “Three Segments” branch, which models earthquakes on the Northern Hayward fault as coming from repeated smaller magnitude, single-segment ruptures, has the largest contribution at the smaller amplitudes (reflecting both the highest weight and a more frequent occurrence), but has a lower contribution to total hazard at amplitudes above 10 cm. Above 10 cm, the hazard is dominated by the “Two-Segment” scenario that models earthquakes on the Northern Hayward fault as coming from repeated earthquakes on a combined Southern + Northern Hayward fault source (Figure 4-3) that are a larger magnitude (and thus larger corresponding displacement, on average) than the single-segment rupture scenario.

Panel (b) of Figure 5-3 shows conditional hazard curves, or unweighted curves. Conditional hazard curves reflect the hazard curves under the sensitivity condition that the particular logic-tree branch is given full weight of [1.0], and the other branches have zero weight. The plot shows that all rupture scenarios except the “Two Segment (Version A)” scenario give very similar rates of earthquakes involving the Northern Hayward fault (as seen by the narrow grouping of curves a the lowest displacement amplitudes). The “Two Segment (Version A)” earthquake scenario, in which the Northern Hayward fault segment and the Rodgers Creek fault rupture together and the Southern Hayward fault segment ruptures independently (Figures 4-1 and 4-3) results in a lower mean rate of earthquakes that the others. This sensitivity shows that the low hazard results for the GSPP and HAAH sites are robust and independent of the assumption made on how large earthquakes are released on the Northern Hayward fault segment.

5.4 Deterministic Displacement Hazard

The deterministic displacement hazard for the project site is shown as a plot of exceedance probability versus net displacement, with displacement amplitude in inches (Figure 5-4). As described in Section 4.4, the deterministic analysis is based on an MCE M_W 7.0 earthquake on the entire Hayward fault source (Northern + Southern fault segments), similar to the scenario earthquake selected for deterministic ground motion analysis (URS, 2015). In the deterministic analysis, displacement hazard is estimated based on assuming that the scenario earthquake ruptures beneath the site, and the amplitude of displacement is captured by weighted uncertainties in the secondary displacement exceedance model (nodes DM 5 and DM 6 in Figure 4-2). Each displacement exceedance equation includes an aleatory term that describes event-to-event natural variability in amplitude (Section 4.3.3, equations 4-3 and 4-4). Figure 4-5 shows the weighted mean displacement exceedance curve (solid black line) and conditional exceedance curves (dashed lines) for each of the four branch combination alternatives for predicting displacement at the project site given the occurrence of the M_W 7.0 scenario earthquake. As the r_p distance in (4-3) and (4-4) is a very weak predictor of displacement amplitude, the exceedance curves in Figure 5-4 applies to the entire site. The plot shows that, especially at the median exceedance probability, the selection of functional form of the displacement prediction model (i.e., node DM 5 in Figure 4-2) has very little effect on hazard estimation. When considering uncertainties in the average displacement (D_{ave}) of the entire rupture given magnitude, however, as explored in node DM 6, uncertainty in the median displacement is on the order of a factor of two (Figure 5-4).

Deterministic net displacement exceedance values at the median (50th percentile), 16th percentile, and 84th percentile are listed in Table 5-2 and indicated on Figure 5-4 as dashed horizontal lines. These values, or other percentile values, range from 1 to 11 inches with a median value of 4 inches, and may be used by the project in the event the project desires to consider displacement hazard and its possible impact on the project from a scenario—rather than probabilistic—perspective.

Table 5-2. Deterministic Displacement Hazard Results for the GSPP and HAAH Sites at Selected Percentiles.

Hazard Level		Mean Net Displacement Hazard (inches)
Percentile	Corresponding Average Return Period(1) (yr)	
16th	12,500	1
50th (median)	25,000	4
84th	100,000	11

Note

(1) Corresponding average return periods are for a PFDHA calculated for a generic 50 m cell within the project area (e.g., hazard curves for single points in Figure 5-1). Return periods are rounded to the nearest 500 yr for the 16th percentile and to the nearest 1,000 yr for the median and 84th percentile levels.

Although 50th and 84th percentile deterministic values are commonly considered in PSHA, we show the 16th percentile deterministic values as well. We do so to reflect the results of both the PFDHA and the geological analysis in Section 2 that suggest the activity of the Louderback shear zone (and the potential for fault rupture at the GSPP and HAAH sites) is low, and therefore evaluating the performance of the proposed facilities for displacement amplitudes less than the median may be justifiable.

6.0 DISPLACEMENT CHARACTERISTICS

A practical goal of the fault displacement hazard analysis is to provide guidance for engineering assessments of the possible performance impacts of fault displacement hazard. If the project decides to consider non-negligible fault displacement in a performance evaluation or in structural design, we provide summary information to help guide an understanding of how earthquake-related net displacements beneath the project site, with amounts and probabilities of exceedance based on the deterministic and PFHDA results in Section 5, may be distributed beneath the structures, how the slips may be oriented, and what the likely horizontal and vertical slip components would be. In addition, we discuss the uncertainty related to the timing of the displacement, and whether it may occur entirely as coseismic displacement or as a combination of coseismic slip and afterslip. Displacement characteristics based on the geologic assessment are summarized in Table 6-1.

Localization or distribution of displacement and orientation

The net displacement hazards estimated in Section 5 may be either localized on a single slip plane or distributed across a broad shear zone beneath the project facility. This broad uncertainty is due to the incomplete knowledge of geologic conditions directly beneath the site. The late Pleistocene fault beneath the proposed HAAH as documented by WCA (1970) and shown in Figures 2-1, 2-3, and 3-4 is a clear potential source for secondary displacement to localize, but the net displacements may also manifest as distributed shear or localized slip across other portions of the facility.

The likely orientation of the displacement is sub-parallel to the principal Hayward fault trace to sub-parallel to fault strands within the Louderback shear zone documented by HLA (1988) and others (Figure 1-2). Displacements on steeply dipping planes striking approximately N40°W, but possibly between N15°W and N55°W are most probable (Table 6-1).

Slip direction and horizontal and vertical slip components

Secondary fault displacement or distributed shear beneath the GSPP and HAAH structures is likely to be in a direction sub-parallel to the slip on the principal Hayward fault, with the possibility that the secondary displacements may accommodate a greater ratio of vertical displacement due to slip partitioning. Our preferred interpretation, based on the HLA (1988) trenches and geologic relationship of the WCA (1970) exposure, is that the slip will occur as right-lateral strike slip with an east-side up vertical component (Table 6-1). Although east-side up is considered most likely, we cannot preclude west-side up vertical components. The relative components of vertical and horizontal slip are similarly uncertain, but we recommend that two end-members be considered in analysis based on an evaluation of distributed displacements from strike-slip earthquakes in Petersen et al. (2011): First, a strike-slip scenario where horizontal slip is equal to the net displacements from Section 5, and vertical slip is negligible. The second end-member is an oblique slip case (with a rake of about 50°) where vertical slip is a maximum of 0.75 times the net displacement, and the horizontal slip component is 0.66 times the net displacement (Table 6-1). The Petersen et al. (2011) dataset suggest that, although steeper rakes are observed, they are relatively rare compared to rakes less than about 50°.

Table 6-1. Characteristics of Possible Secondary (or Distributed) Displacements beneath the GSPP and HAAH Sites.

Characteristic	**Notes**
Localization	May be localized as secondary fault displacement (e.g., on an existing fault like the one documented by WCA (1970) under Parking Structure H) or as distributed shear beneath the entire structural footprint.
Orientation	Subparallel to Louderback shear zone faults or principal Hayward fault; consider N40°W (preferred); N15°W to N55°W (range) for strike; subvertical to steeply east or west dipping.
Slip direction	Right-lateral strike-slip with an east-side up vertical component is most likely; west-side up vertical component possible but less likely
Vertical and horizontal amounts	Consider end-member “strike-slip” and “oblique” possibilities. Strike-slip case: Horizontal = 1.0*net displacement; Vertical = 0 Oblique case: Max vertical = 0.75*net displacement; Horizontal = 0.66*net.
Timing of displacement	Slip will probably be a combination of coseismic slip and post-seismic afterslip; afterslip likely would be power-law exponential decay in hours/days/weeks following the earthquake as per Aagaard et al. (2012).

Timing of displacement

Due to the creeping behavior of the Northern Hayward fault, surface-fault rupture following a large earthquake is expected to occur by a combination of coseismic slip and post-seismic afterslip (Aagaard et al., 2012). Examination of earthquake afterslip following several historical California earthquakes suggests that displacement follows a power-law decay with slip occurring weeks to months following the earthquake. Although it is uncertain whether distributed or secondary displacement follows a similar coseismic-afterslip pattern as principal faulting, we consider it most likely that the timing of secondary or distributed slip beneath the GSPP and HAAH would be some combination of coseismic slip (during strong ground shaking) and post-seismic afterslip (after shaking and decaying in the hours to weeks following the earthquake) (Table 6-1).

7.0 CONCLUSIONS

This evaluation included a review of information on the Louderback shear zone and a displacement hazard analysis for the proposed GSPP and HAAH facilities in Berkeley, California. The review of geological and geotechnical information suggests that the Louderback shear zone identified previously to the southeast extends beneath the GSPP and HAAH sites, and in at least one location (beneath the proposed HAAH) a late Quaternary fault underlies the site. Based on review of reports and discussions with experts, the preponderance of evidence is that faults within the Louderback shear zone are not Holocene active, but several of them have moved in the late Quaternary and there is still uncertainty regarding the potential for secondary displacement within the shear zone during future, large earthquakes on the adjacent Northern Hayward fault. A probabilistic and deterministic hazard analysis explores the fault displacement hazard to the GSPP and HAAH project sites. The hazard comes from secondary faulting or distributed tectonic deformation resulting from a large earthquake on Northern Hayward fault. The actively creeping, principal strand of the Northern Hayward fault is well located approximately 160 to 250 m east of the project site, and thus principal fault displacement hazard is not considered applicable for the project sites.

The PFDHA shows that the fault displacement hazard low for the project sites compared to hazard levels commonly considered for seismic loads in building design. There is a negligible displacement hazard to the GSPP and HAAH facilities at hazard levels corresponding to average return periods of 1,000 and 2,500 years, and the hazard corresponding to a 10,000 yr average return period is less than an inch for any given 50 m × 50 m cell location beneath the proposed project, and is on the order of 2.5 inches for the entire HAAH facility footprint (Table 5-1). Examination of hazard fractiles and a sensitivity to Hayward fault rupture scenarios suggest that the low hazard result—especially at the 1,000 and 2,500 yr average return periods—is robust.

The deterministic displacement hazard analysis, which explores the amount of displacement that may be expected beneath the GSPP or HAAH facilities given a scenario M_W 7.0 Hayward fault earthquake that does produce rupture beneath the project site, suggests a median displacement may be on the order of 4 inches, and displacements of 1 to 11 inches are possible at the 16th to 84th percentile levels, respectively (Table 5-2). The average return periods from the PFDHA corresponding to these amplitudes are between 12,500 yr (for the 1 inch displacement hazard at the 16th percentile) to 100,000 yr (for the 11 inch displacement at the 84th percentile). These long average return periods are qualitatively consistent with the geological assessments of the Louderback shear zone, which suggest that rupture probably last occurred prior to about 11,000 years ago.

If the project wishes to consider fault displacement hazard in the design or performance evaluation of the proposed structures, displacement characteristics are provided in Section 6. These characteristics include the estimated localization, displacement orientation and direction, relative amounts of horizontal and vertical displacement, and the expected timing of displacement (as a combination of coseismic slip and post-seismic afterslip). These parameters may be developed further if necessary for the project.

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8.0 REFERENCES

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Figures

EXPLANATION

— — Project site

— · · Creek; solid where visible, dotted where underground (modified from Sowers et al., 2010)

— A-P zone boundary (CGS, 2001)

— — Fault; solid where certain, dashed where approximate (CGS, 2001)

Sources:
Aerial imagery from USGS (2009)
0.5 m hillshaded DEM from Earthscope (2007)
10 m hillshaded DEM from USGS NED (2013)

N W E S

0 200 400 ft

0 100 200 m

Map projection and scale: NAD 1983 UTM Zone 10N, 1:4,000

Building Site Location Map of the GSPP-HAAH

UCB LANGAN GSPP-HAAH PROJECT

Lettis Consultants International, Inc.

Figure **1-1**

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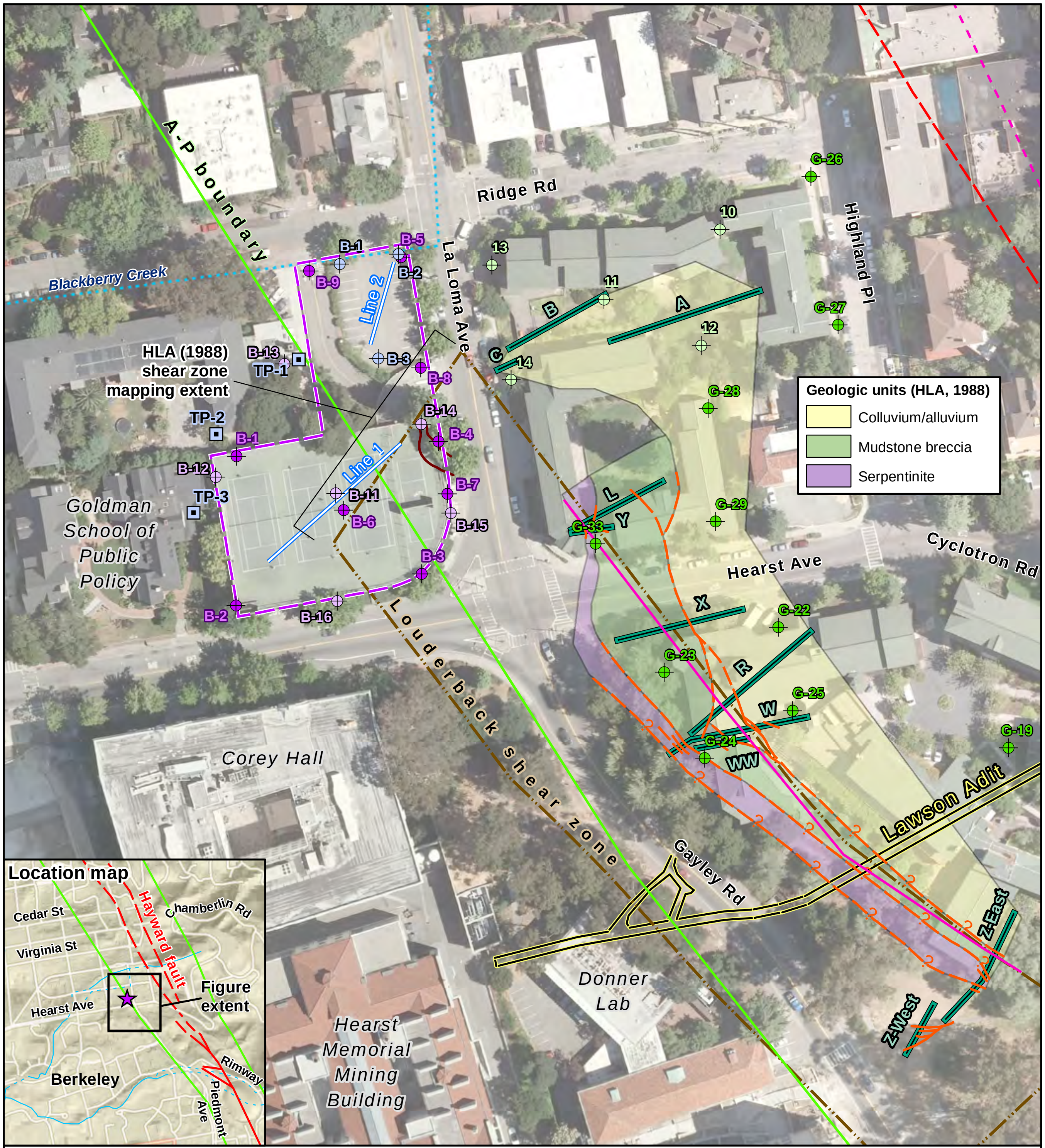


EXPLANATION

Project site

Creek; solid where visible, dotted where underground (modified from Sowers et al., 2010)

Exploration data:

⊡ Test pit (Langan, 2017)	⊕ Boring (HLA, 1988)
⊕ Boring (Langan, 2017)	⊕ Boring (WCA, 1959)
⊕ Boring (HLA, 1986)	⊕ Boring (WCA, 1969)

Trench (HLA, 1988)

Lawson Adit

Seismic line (Langan, 2017)

Fault data:

Fault; solid where certain, dashed where approximate (Lienkaemper, 2006)

Fault; solid where certain, dashed where approximate (CGS, 2001)

Fault; solid where certain, dashed where approximate, queried where uncertain (HLA, 1988)

Fault (WCA, 1970)

A-P zone boundary (CGS, 2001)

Louderback shear zone (HLA, 1988)

Notes:
- HLA - Harding Lawson Associates
- WCA - Woodward-Clyde & Associates
- Geologic unit mapping extent based on HLA (1986, 1988) trench observations.

Sources:
- Aerial imagery from USGS (2009)
- 10 m hillshaded DEM from USGS NED (2013)

N W E S

0 100 200 ft

0 50 100 m

Map projection and scale: NAD 1983 UTM Zone 10N, 1:1,500

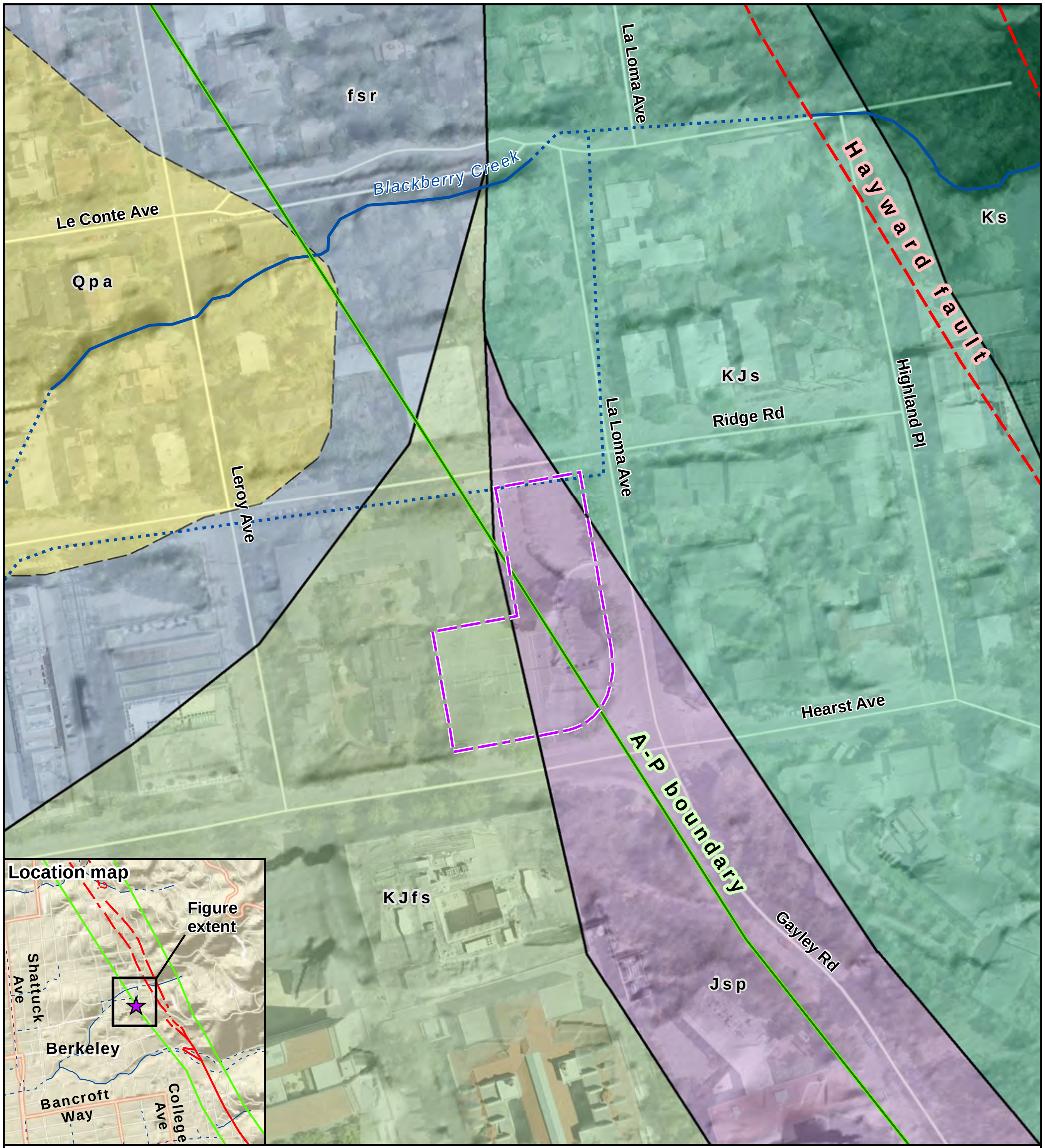
Locations of Subsurface Investigations Across the Louderback Shear Zone

UCB LANGAN GSPP-HAAH PROJECT

Lettis Consultants International, Inc.

Figure 1-2

File path: S:\1729\Figures\Figure_1-2.mxd; Date: 10/08/2018; User: ase, LCI; Rev.1



EXPLANATION

Project site

Creek; solid where visible, dotted where underground (modified from Sowers et al., 2010)

Fault data

A-P zone boundary (CGS, 2001)

Fault; solid where certain, dashed where approximate (CGS, 2001)

Fault (Graymer et al., 2006)

Geologic Units (Graymer et al., 2006)

Geologic contact

- 🟨 **Qpa** - Alluvium (Pleistocene)
- 🟦 **fsr** - Franciscan Complex mélange (Eocene, Paleocene, Cretaceous)
- 🟩 **Ks** - Great Valley complex sedimentary rocks (Cretaceous)
- 🟩 **KJs** - Great Valley complex sedimentary rocks (Cretaceous, Jurassic)
- 🟩 **KJfs** - Franciscan Complex sedimentary rocks (Cretaceous, Jurassic)
- 🟪 **Jsp** - serpentinite (Jurassic)

Sources:
Aerial imagery from USGS (2009)
0.5 m hillshaded DEM from Earthscope (2007)
10 m hillshaded DEM from USGS NED (2013)

N W E S

0 100 200 ft

0 50 100 m

Map projection and scale: NAD 1983 UTM Zone 10N, 1:2,000

Geologic Map of the GSPP-HAAH Building Site Area

UCB LANGAN GSPP-HAAH PROJECT

Lettis Consultants International, Inc.

Figure **1-3**

File path: S:\1729\Figures\Figure_1-3.mxd; Date: 10/08/2018; User: ase, LCI; Rev.1

EXPLANATION

▬ ▬	Project site	▨	Parking structure H
━ ···	Creek; solid where visible, dotted where underground (modified from Sowers et al., 2010)		

Exploration data:

▣	Test pit (Langan, 2017)	⊕	Boring (WCA, 1959)	├─┤	Cross section (WCA, 1970)
⊕	Boring (Langan, 2017)	⊕	Boring (WCA, 1969)	═	Seismic line (Langan, 2017)
⊕	Boring (HLA, 1986)				

Fault data:

▬ ▬	Fault (WCA, 1970)	▬··	Louderback shear zone (HLA, 1988)
━	A-P zone boundary (CGS, 2001)		

Notes:
See Figure 2-3 for cross section details
HLA - Harding Lawson Associates
WCA - Woodward-Clyde & Associates

Sources:
Aerial imagery from USGS (2009)
Panel (b) topo basemaps from WCA (1970)

Map projection: NAD 1983 UTM Zone 10N

Fault Traces Mapped by Woodward-Clyde & Associates (1970) in Parking Structure H Foundation Excavation

UCB LANGAN GSPP-HAAH PROJECT

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Figure 2-1

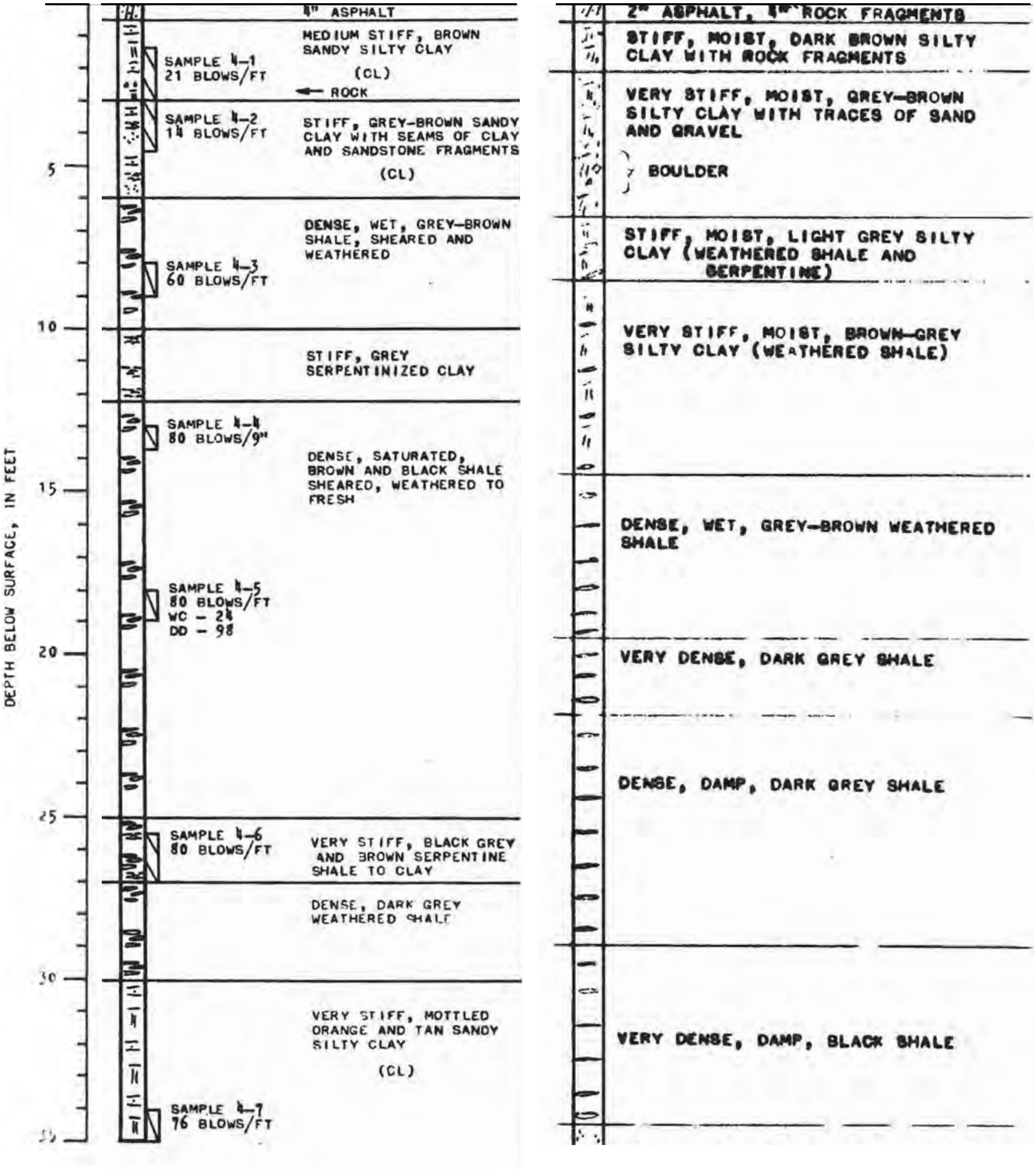
File path: S:\1729\Figures\Figure_2-1.mxd; Date: 10/08/2018; User: ase, LCI; Rev.1

Boring 4

(Elevation: 390'±)

Boring 14

(Elevation: ~ 390')



Notes:
- See Figure 1-2 for location of borings.
- Boring 14 continues an additional 28' until bottom of hole.
- Elevation of Boring 14 was not provided in the log and was estimated from a 1969 topographic survey of the project site.

Logs of Boring 4 and Boring 14 from Woodward-Clyde & Associates (1969)

UCB LANGAN GSPP-HAAH PROJECT

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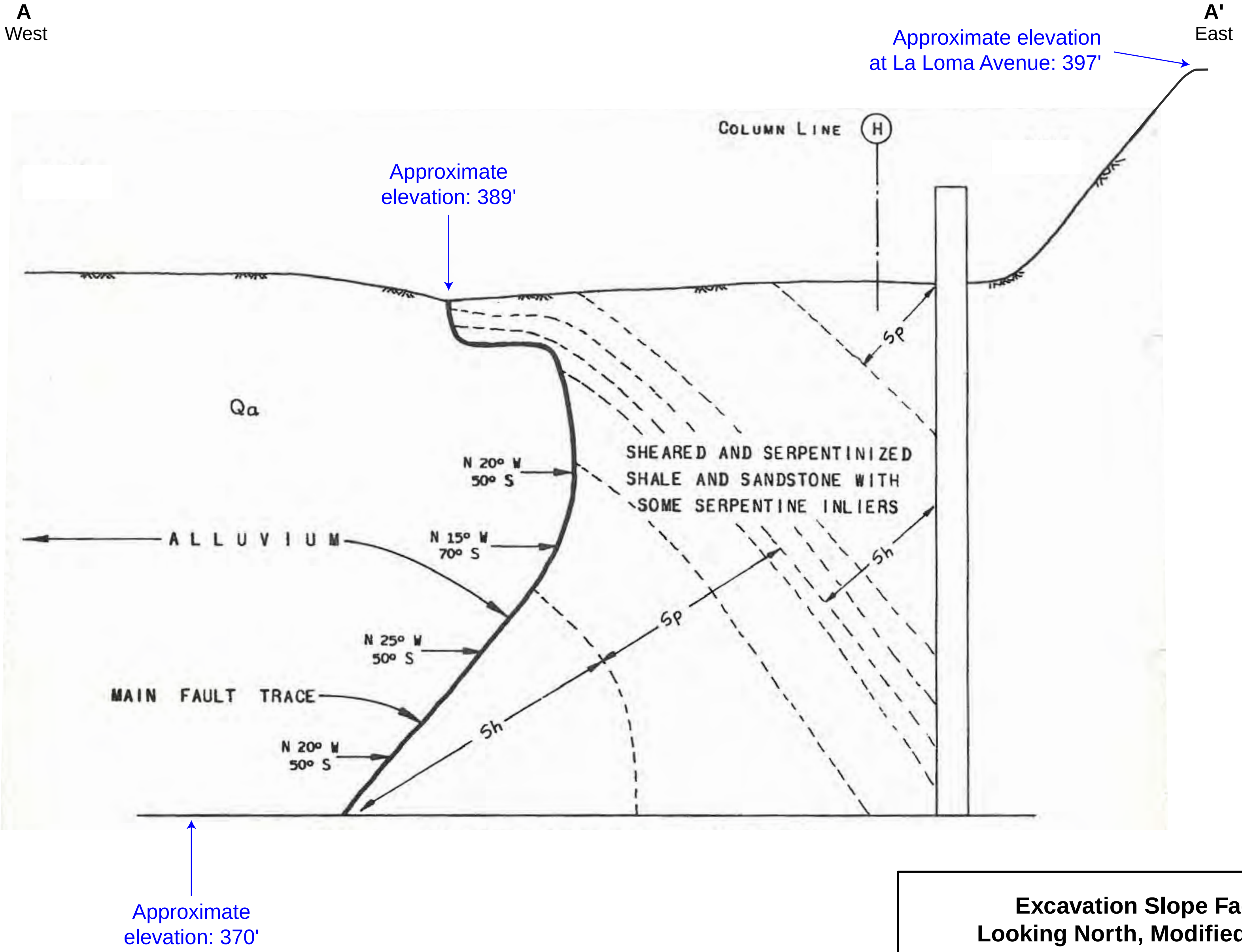
Figure **2-2**

File path: S:\1729\Figures\Figure_2-2.ai; Date: 08/15/2018; User: Åse, LCI; Rev.1



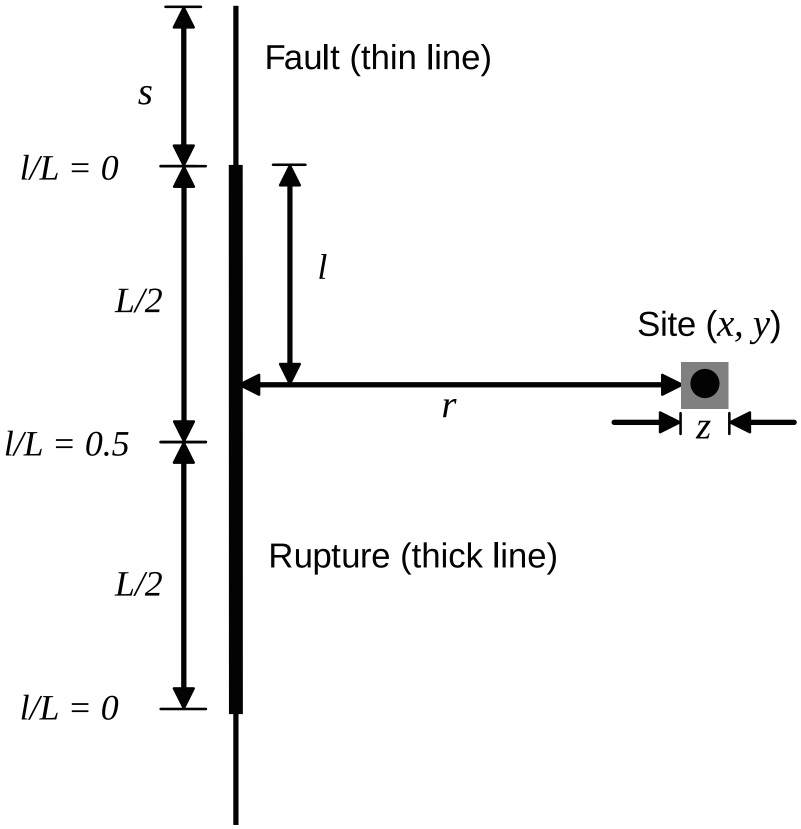
Notes:
- Approximate scale: 1 in. = 3 ft.
- See Figure 2-1 for cross section location
- Reconstruction suggests approximately 8 ft of material has been removed above the existing exposure which suggests near-surface Holocene material is likely absent.

Excavation Slope Face
Looking North, Modified from
Woodward-Clyde & Associates (1970)

UCB LANGAN GSPP-HAAH PROJECT

LCI Lettis Consultants International, Inc. | Figure **2-3**

File path: S:\1729\Figures\Figure_2-3.ai; Date: 08/15/2018; User: Åse, LCI; Rev.1



Variables used in the fault-displacement hazard analysis:

x,y	Site coordinates
z	Dimension of the site area considered for probability of fault rupture
r	Distance from the site to the mapped fault trace
l	Distance from the nearest point on the rupture to the closest end of the rupture
L	Total Rupture Length
s	Distance from the end of the rupture to the end of the fault

Definition of PFDHA Variables, Earthquake Magnitude Approach (After Petersen et al., 2011)

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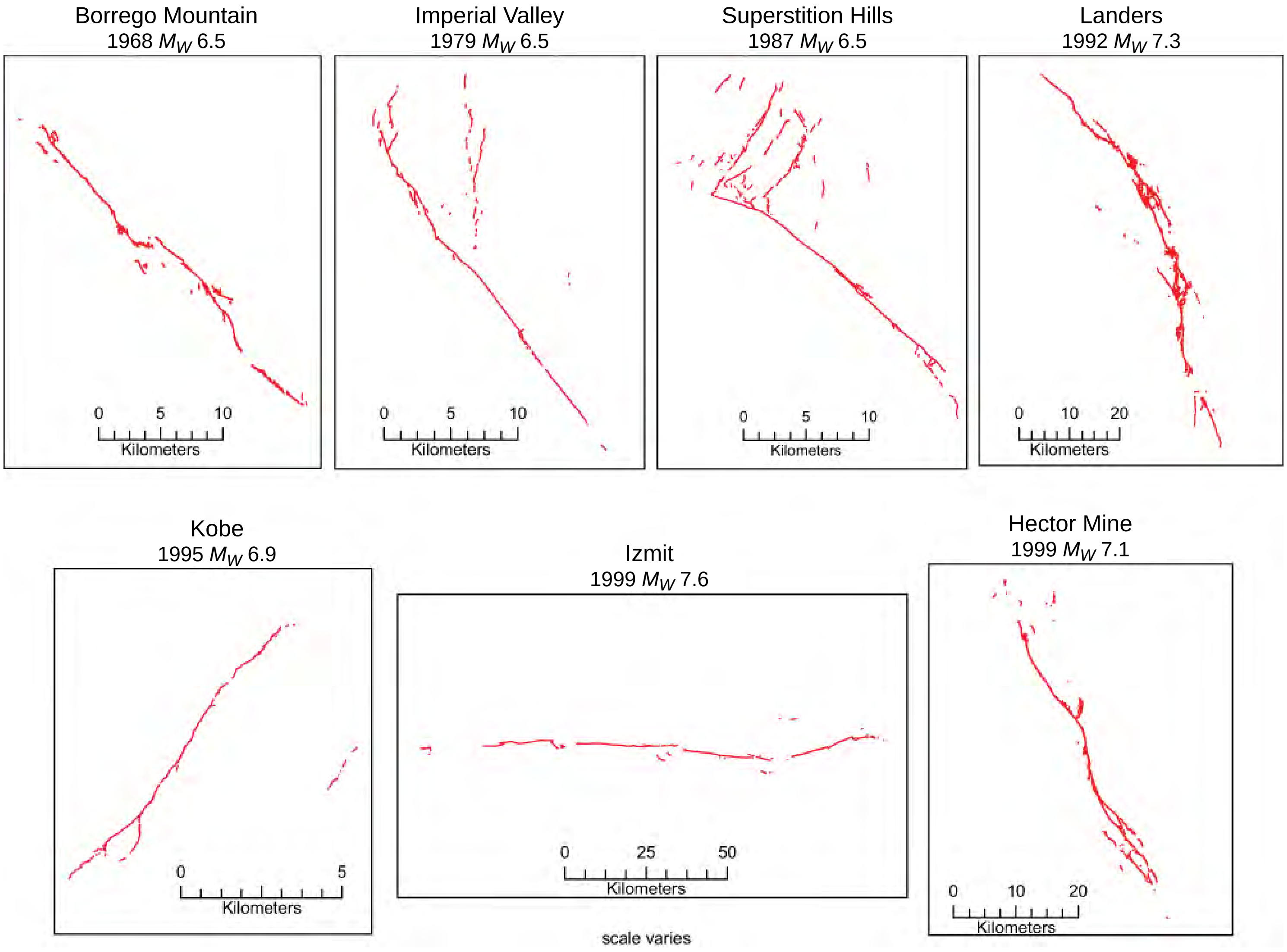
Figure **3-1**

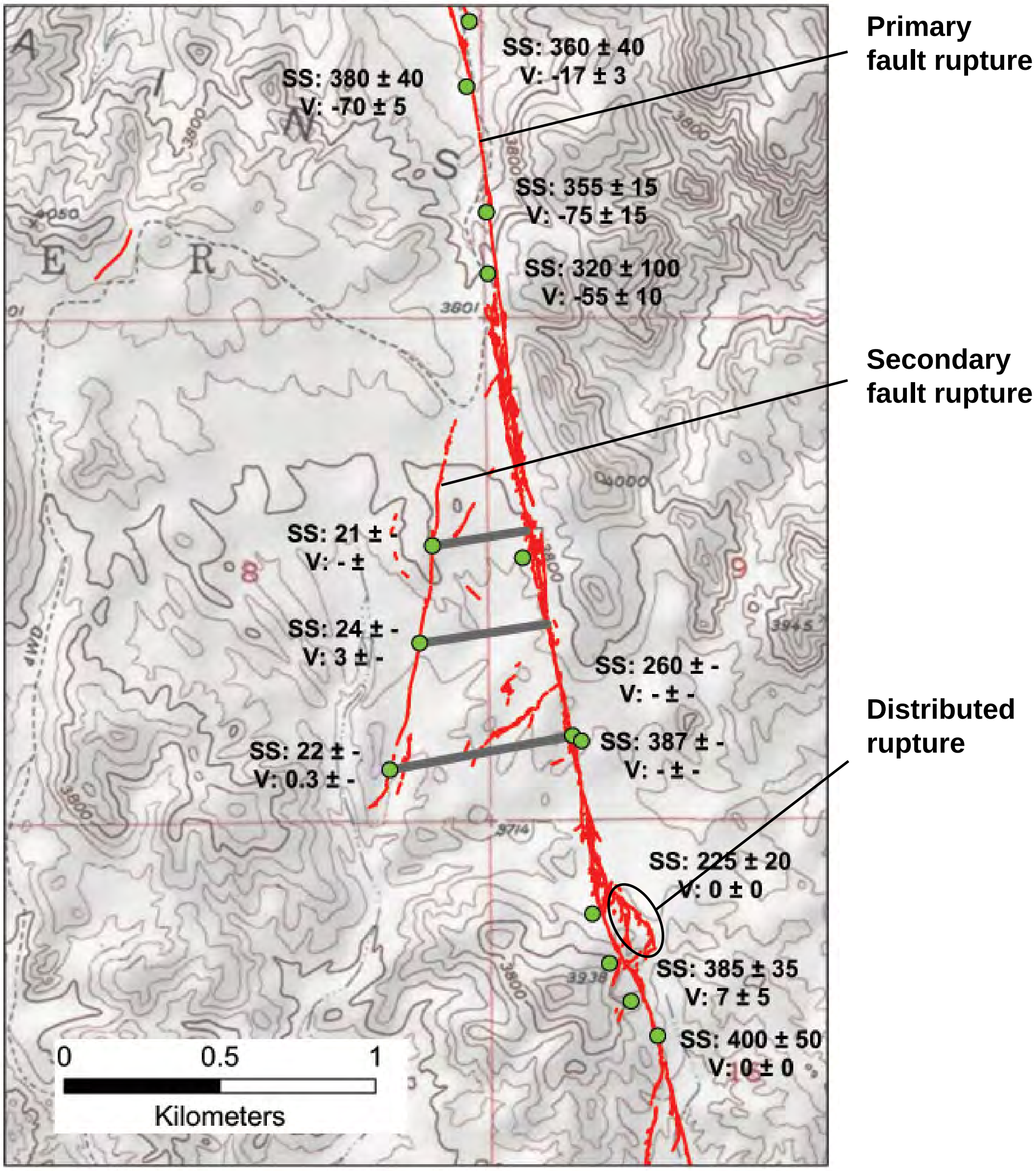
File path: S:\1729\Figures\Figure_3-1.ai; Date: 08/16/2018; User: Åse, LCI; Rev.1



Examples of Historic Strike-Slip Surface Ruptures (After Petersen et al., 2011)

UCB LANGAN GSPP-HAAH PROJECT

Lettis Consultants International, Inc. | Figure **3-2**



EXPLANATION

SS: Lateral component of slip in centimeters

V: Vertical component of slip in centimeters

● Slip measurements

▬ Distance from secondary rupture to primary rupture

Example of Primary, Secondary, and Distributed Fault Rupture, Hector Mine Earthquake (After Petersen et al., 2011)

UCB LANGAN GSPP-HAAH PROJECT

Lettis Consultants International, Inc.

Figure **3-3**

File path: S:\1729\Figures\Figure_3-3.ai; Date: 08/16/2018; User: Åse, LCI; Rev.1

EXPLANATION

- - - Project site

Fault data:

— - — Principal Hayward fault; solid where certain, dashed where approximate (Lienkaemper, 2006)

— Fault (WCA, 1970)

▭ Louderback shear zone (HLA, 1988)

Hazard location center point:

▲ GSPP

▲ HAAH-North

▲ HAAH-South

Hazard cells (50 m x 50 m):

▭ GSPP

▭ HAAH

Notes:
GSPP - Goldman School of Public Policy
HAAH - Hearst Avenue Academic Housing

Sources:
Aerial imagery from USGS (2009)

N W E S

0 100 200 ft

0 50 100 m

Map projection and scale: NAD 1983 UTM Zone 10N, 1:1,500

Hazard Calculation Point and 50 m Cell Locations

UCB LANGAN GSPP-HAAH PROJECT

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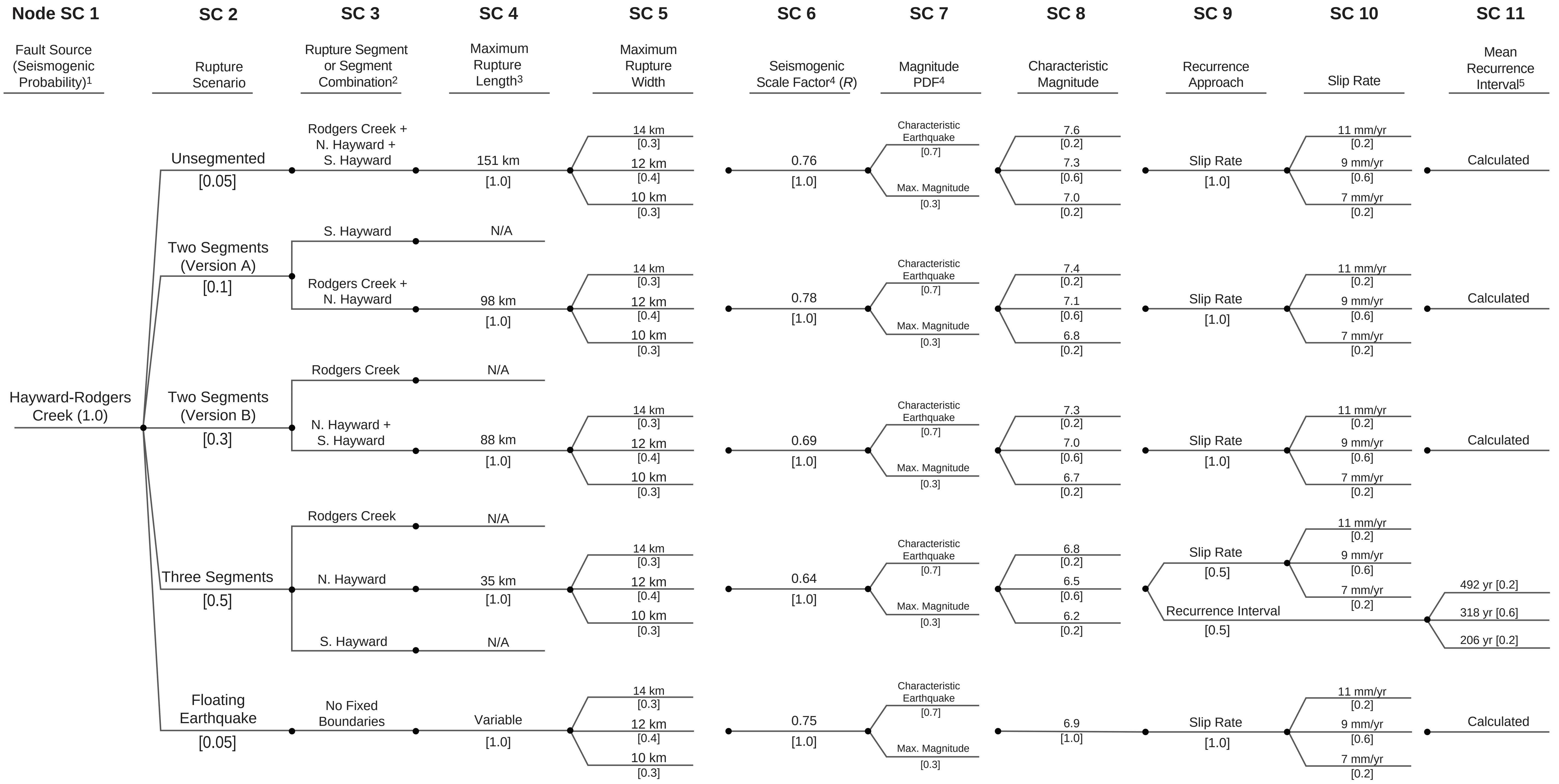
Figure **3-4**

File path: S:\1729\Figures\Figure_3-4.mxd; Date: 10/08/2018; User: ase, LCI; Rev.1



Notes:
1. Fault source characterization based on URS (2015).
2. Figure 4-3 shows locations of fault segments used to construct the rupture sources.
3. For rupture sources that do not involve the Northern Hayward segment, “N/A” (not applicable) is listed to indicate it is not part of the hazard assessment.
4. See text for explanation.
5. Mean recurrence rates (inverse of recurrence intervals) are calculated using moment balancing when fault slip rate is the approach. Slip rates are multiplied by the R value in the moment balancing.

Source Characterization Logic Tree for Northern Hayward Fault

UCB LANGAN GSPP-HAAH PROJECT

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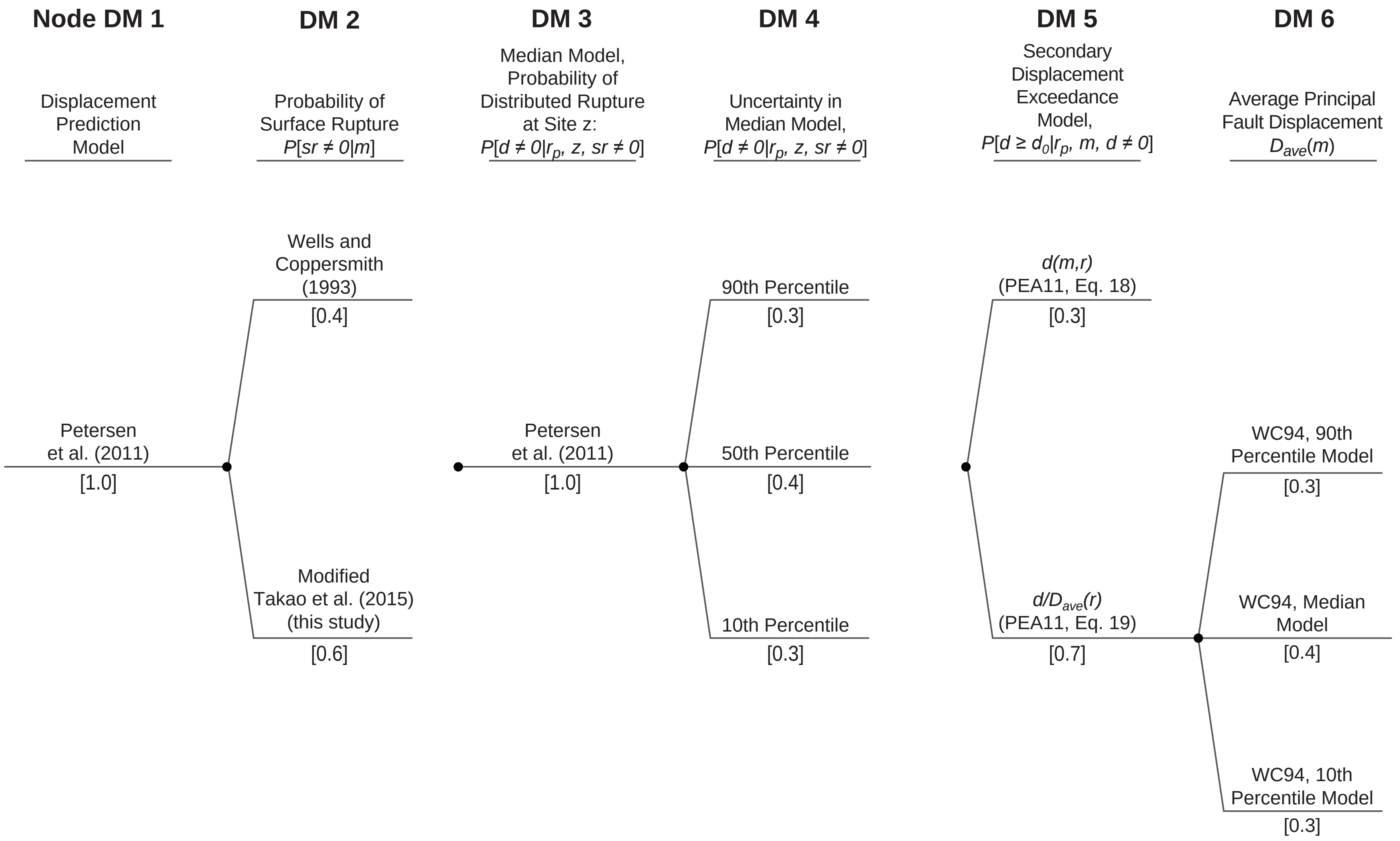
Figure **4-1**

File path: S:\1729\Figures\FIGURE_4-1.ai; Date: 08/15/2018; User:Steve, LCI; Rev.1



Notes:
- PEA11 = Petersen et al. (2011)
- WC94 = Wells and Coppersmith (1994)

Displacement Prediction Model
Logic Tree

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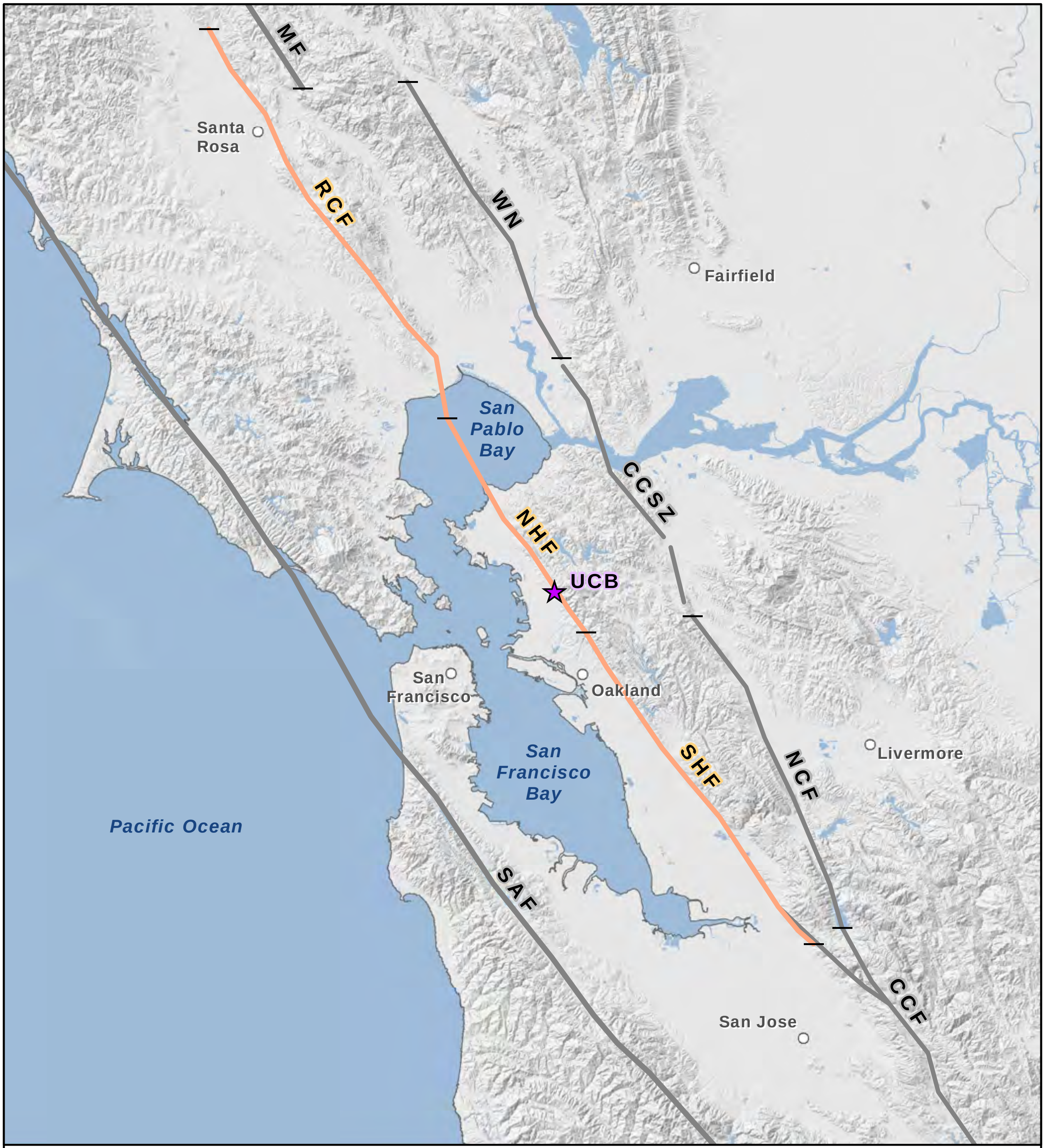
Figure **4-2**

File path: S:\1729\Figures\fIGURE_4-2.ai; Date: 08/16/2018; User:Steve, LCI; Rev.1



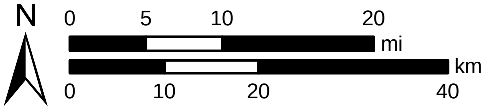
EXPLANATION:

★ Project Site

Fault segment:
NHF - Northern Hayward fault
RCF - Rodgers Creek fault
SHF - Southern Hayward fault

Selected other fault sources:
CCF - Central Calaveras fault
CCSZ - Contra Costa shear zone
MF - Maacama fault
NCF - Northern Calaveras fault
SAF - San Andreas fault
WN - West Napa fault

Sources:
Faults modified from WGCEP (2008)
30 m hillshaded DEM from DFG (2002)



Map projection and scale: NAD 1983 UTM Zone 10N, 1:800,000

Hayward-Rodgers Creek Fault Source

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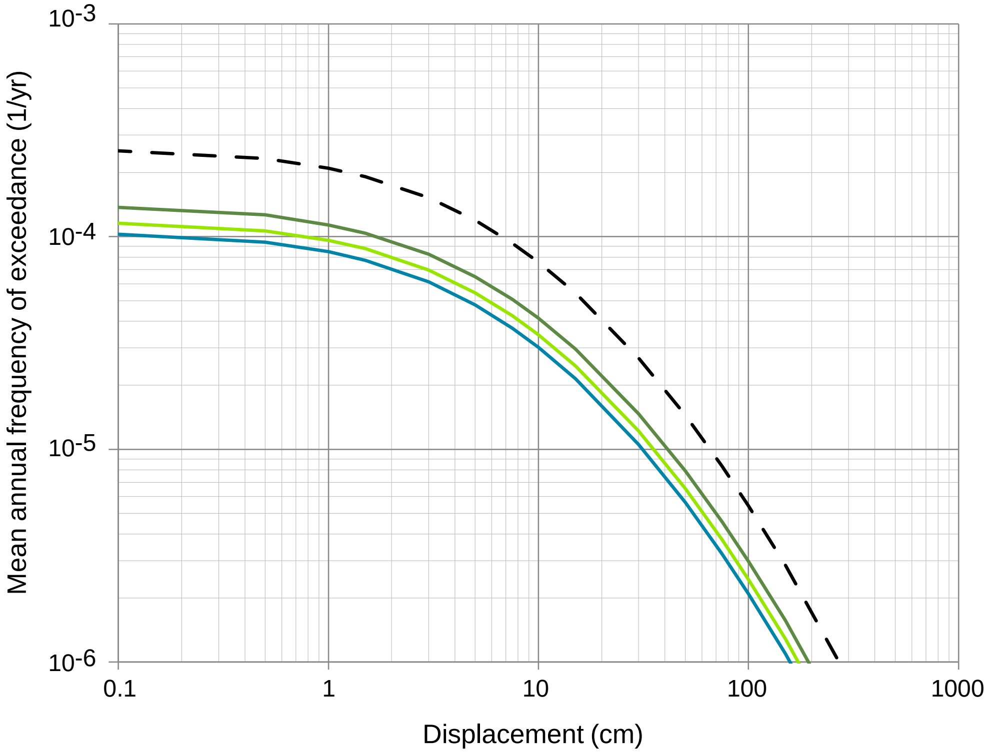
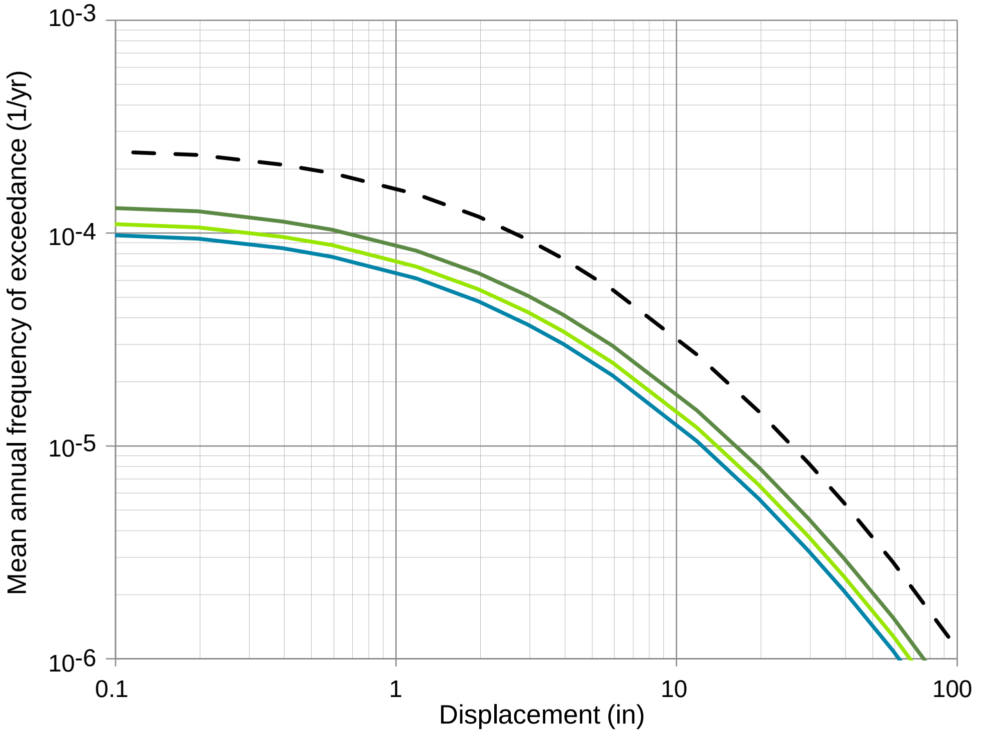
Figure **4-3**

File path: S:\1729\Figures\Figure_4-3.mxd; Date: 10/08/2018; User: ase, LCI; Rev.1

(a) Total Hazard Curves (Centimeters)



(b) Total Hazard Curves (Inches)



EXPLANATION

— GSPP

— HAAH-North

— HAAH-South

- - HAAH-Sum

Notes:
- Figure 3-4 shows location of 50 m cells and center points

Total Displacement Hazard Curves for the GSPP, HAAH-North, and HAAH-South 50 m Cells, and Summed HAAH Cells in (a) Centimeters and (b) Inches

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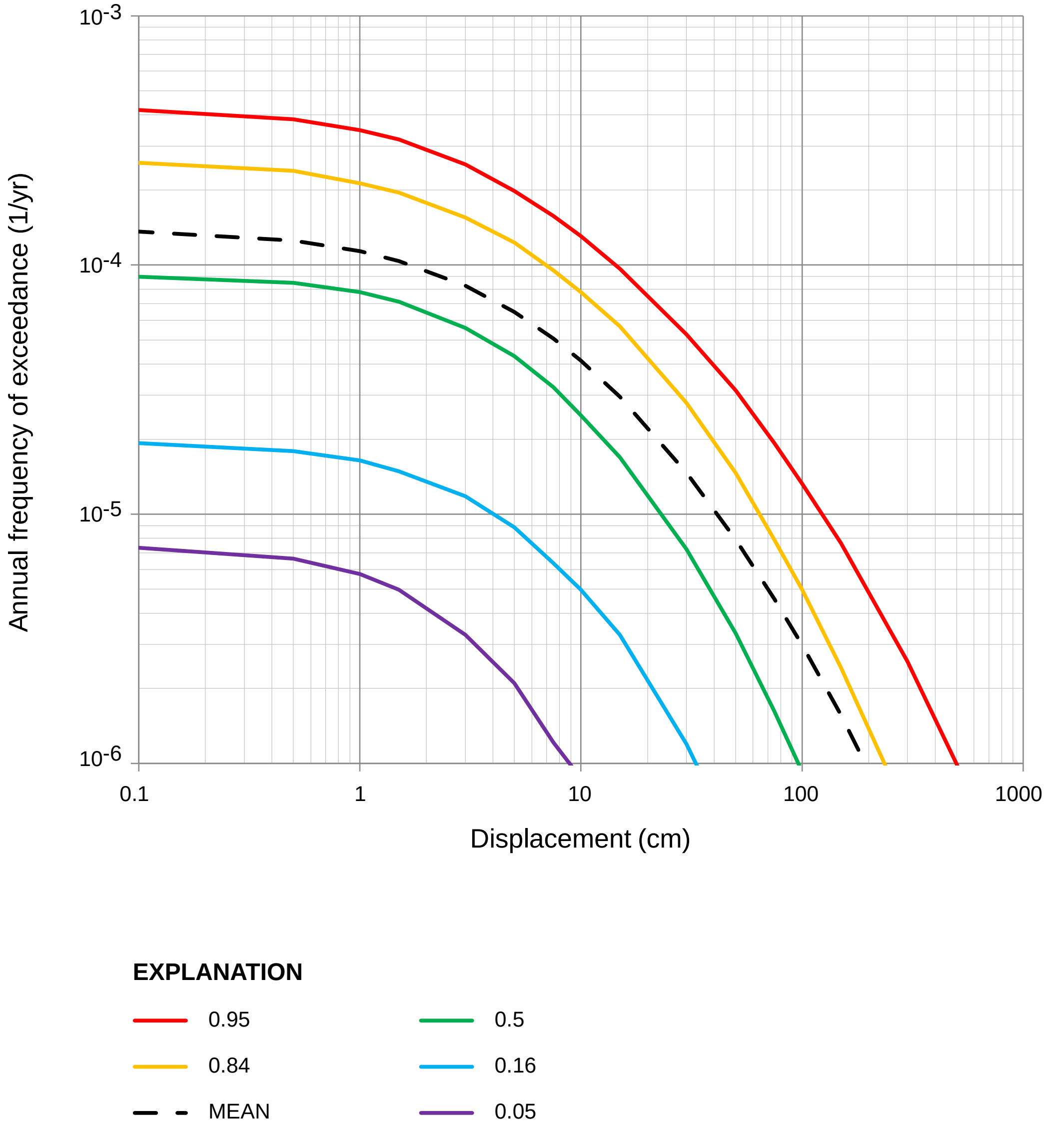
Figure **5-1**

File path: S:\1729\Figures\Figures\Figure_5-1.ai; Date: 08/17/2018; User: S. Thompson, LCI; Rev.1



Notes:
- Figure 3-4 shows location of 50 m cells and center points.

Mean and Fractile Hazard Curves for the HAAH-North 50 m Cell in Centimeters

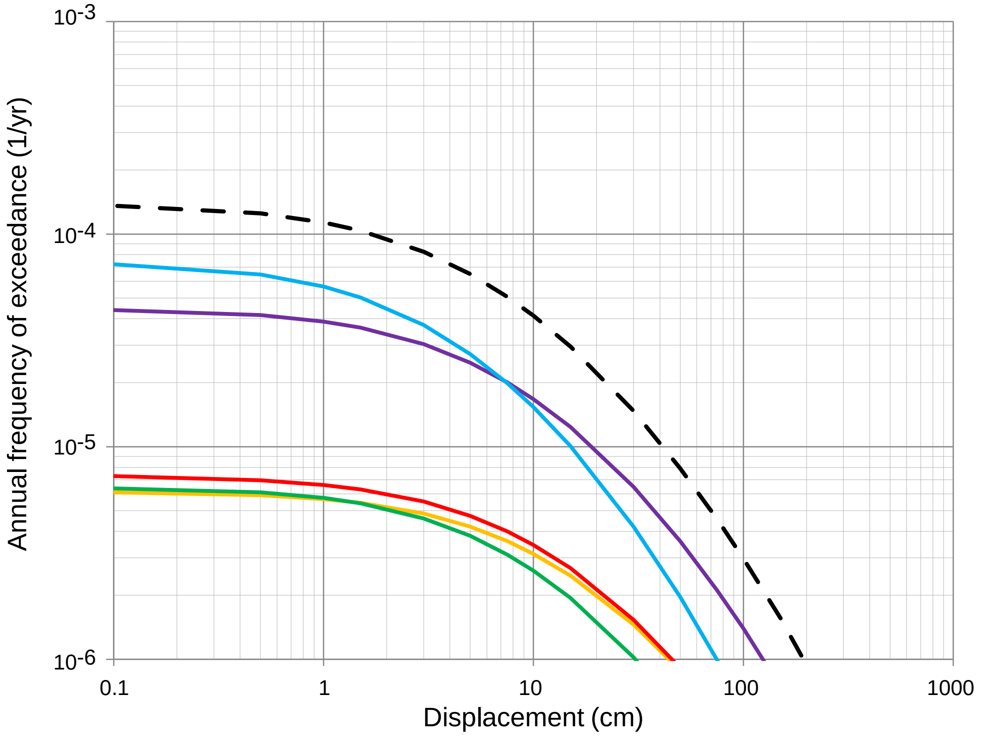
UCB LANGAN GSPP-HAAH PROJECT

Lettis Consultants International

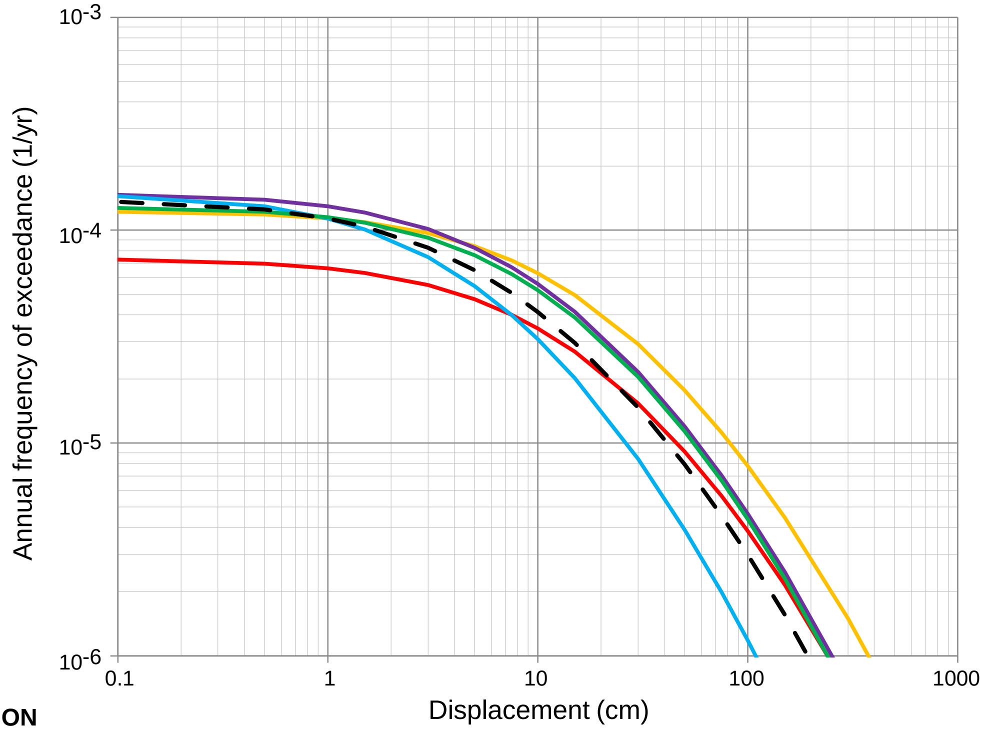
Figure **5-2**

File path: S:\1729\Figures\Figures\Figure_5-2.ai; Date: 08/17/2018; User: S. Thompson, LCI; Rev.1

(a) Weighted Contribution by Rupture Scenario (Centimeters)



(b) Conditional (Unweighted) Hazard Curves by Rupture Scenario (Centimeters)



EXPLANATION

- Unsegmented
- Two Segments (Version A)
- Two Segments (Version B)
- Three Segments
- Floating Earthquakes
- – – Total Hazard

Notes:
- Figure 3-4 shows location of 50 m cells and center points.
- Figure 4-1 shows source characterization logic tree with rupture scenarios.

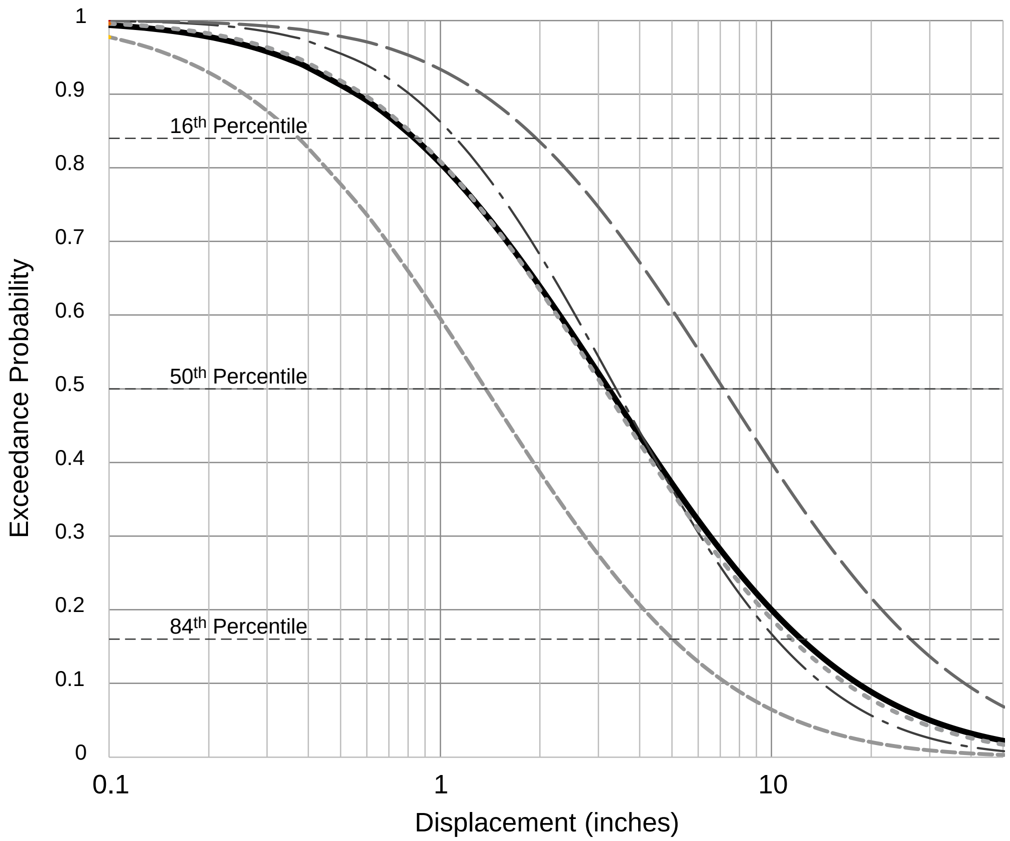
Contribution to Hazard by Rupture Scenario to HAAH-North 50 m Cell Showing (a) Weighted Contribution, and (b) Conditional (Unweighted) Hazard Curves

UCB LANGAN GSPP-HAAH PROJECT

Lettis Consultants International

Figure **5-3**

File path: S:\1729\Figures\Figures\Figure_5-3.ai; Date: 08/17/2018; User: S. Thompson, LCI; Rev.1



EXPLANATION

- Weighted mean
- $f(m,r)$
- $f(d/D_{ave},r)$, 90%D_{ave}
- $f(d/D_{ave},r)$, 50%D_{ave}
- $f(d/D_{ave},r)$, 10%D_{ave}

Notes:
1. Mean deterministic hazard exceedance curve is applicable to the GSPP and HAAH sites. See text for applicability.
2. Conditional (unweighted) exceedance curves show uncertainty in displacement prediction equations. See Figure 4-2, nodes DM 5 and DM 6.

Mean Deterministic Hazard Exceedance Curve and Conditional (Unweighted) Exceedance Curves in Inches

UCB LANGAN GSPP-HAAH PROJECT

Lettis Consultants International

Figure **5-4**

File path: S:\1729\Figures\Figure_5-4.ai; Date: 08/20/2018; User: S. Thompson, LCI; Rev.1

APPENDIX E

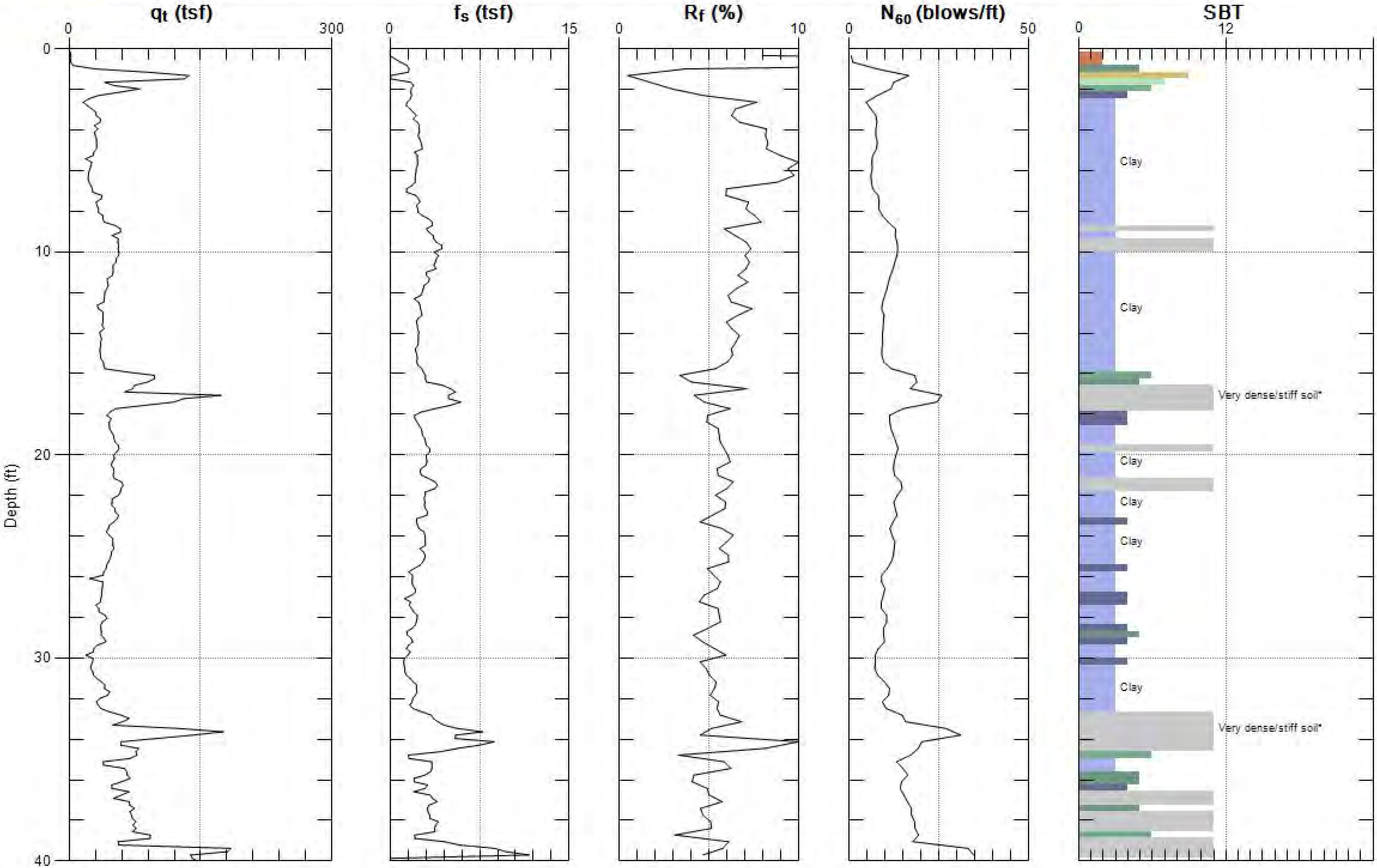
CPTs

GREGG

LANGAN

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-01 **Date: 12/21/17 09:55**



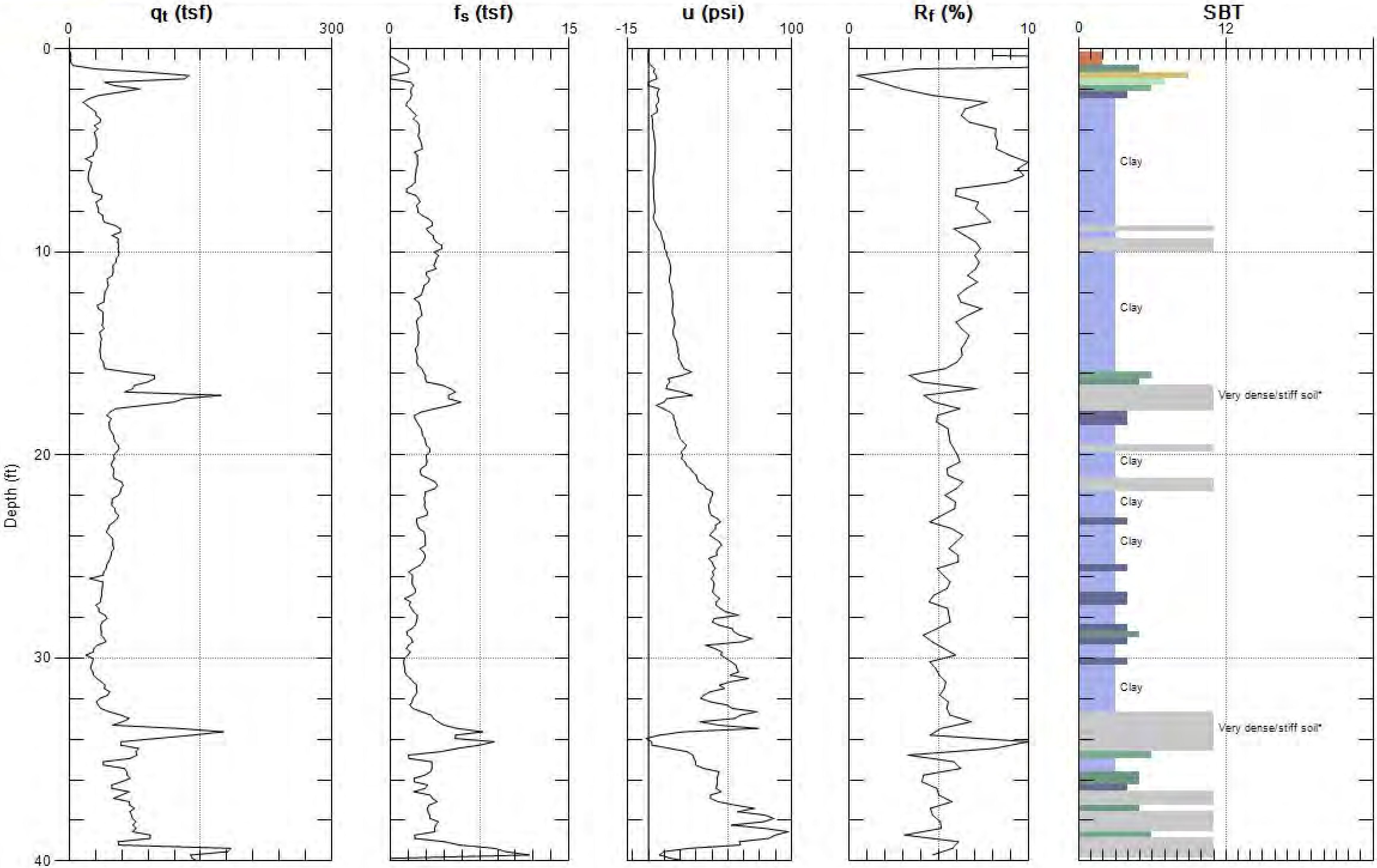
Max. Depth: 40.026 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG

LANGAN

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**
Sounding: CPT-01 **Date: 12/21/17 09:55**



Max. Depth: 40.026 (ft)
Avg. Interval: 0.328 (ft)

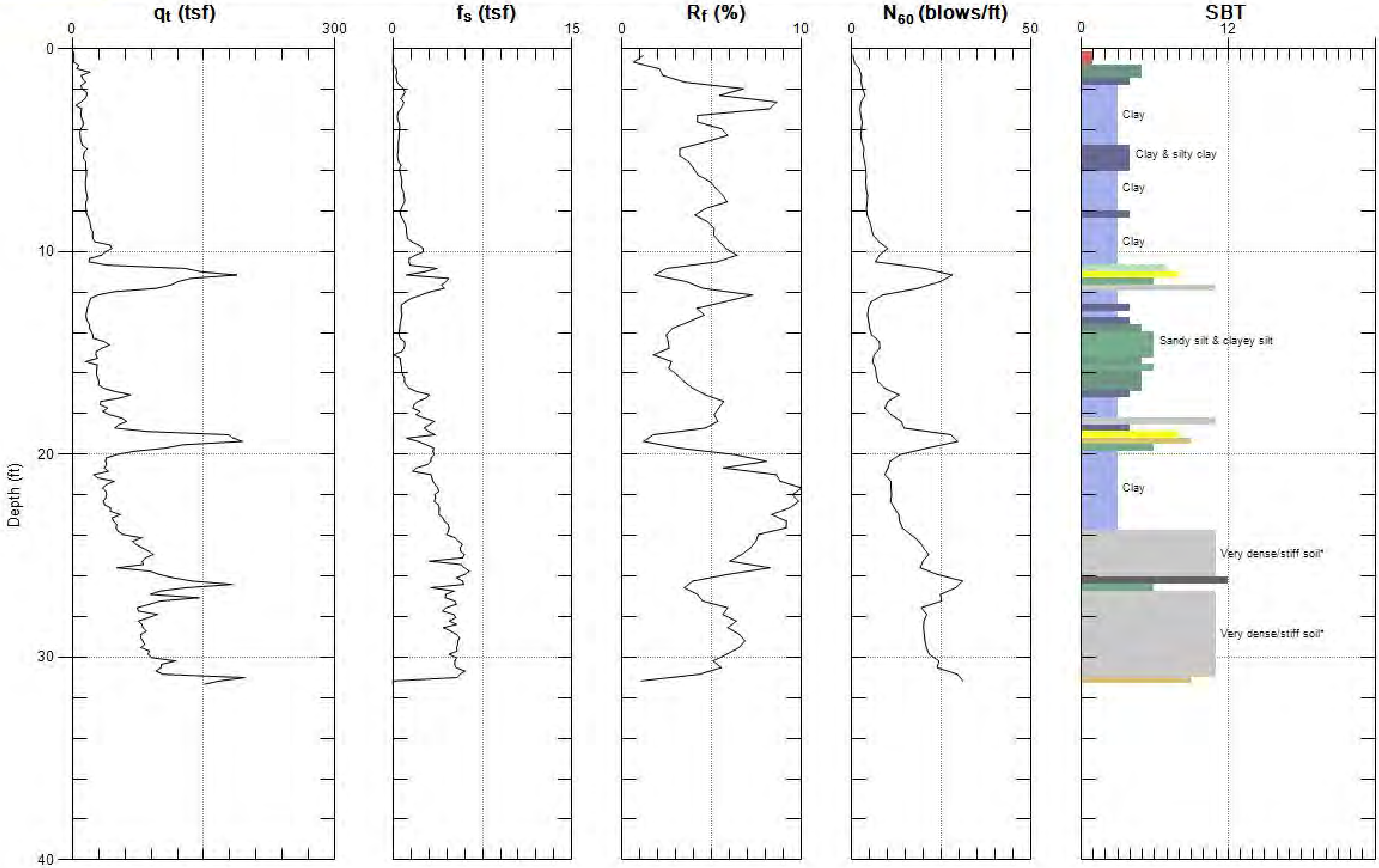
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LANGAN

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-02 **Date: 12/21/17 11:57**



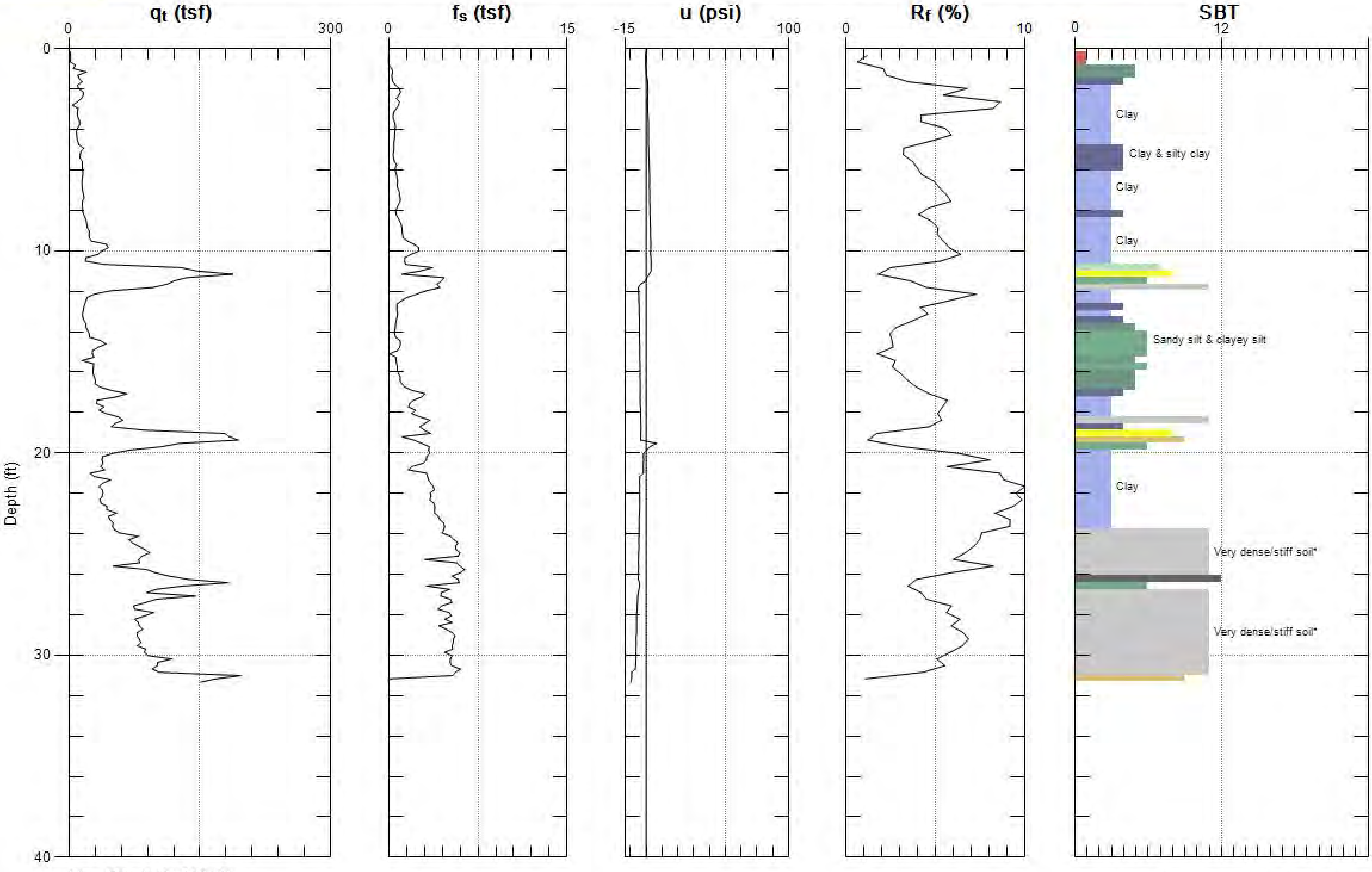
Max. Depth: 31.332 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LANGAN

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-02 **Date: 12/21/17 11:57**



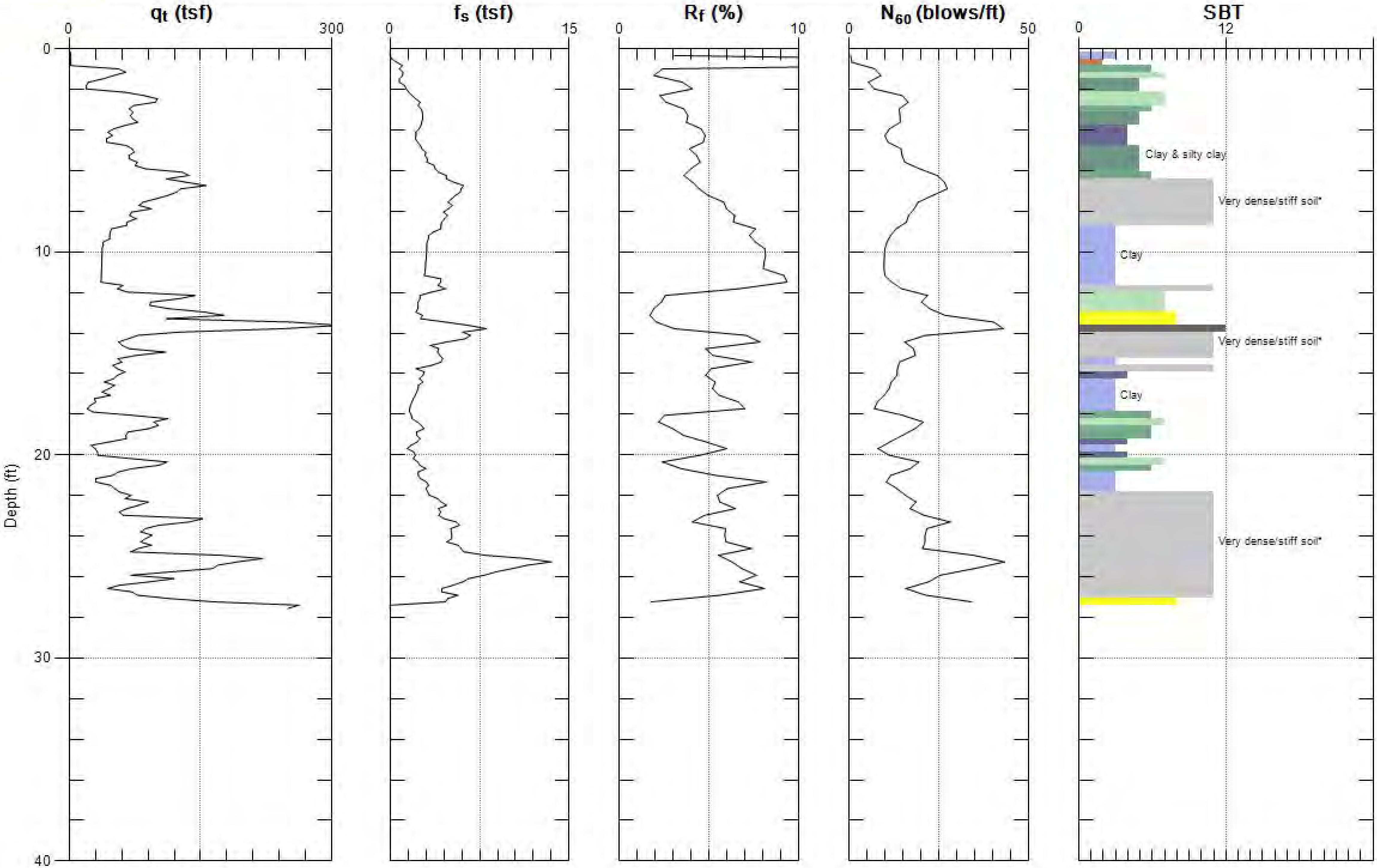
Max. Depth: 31.332 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LANGAN

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-03 **Date: 12/21/17 10:58**



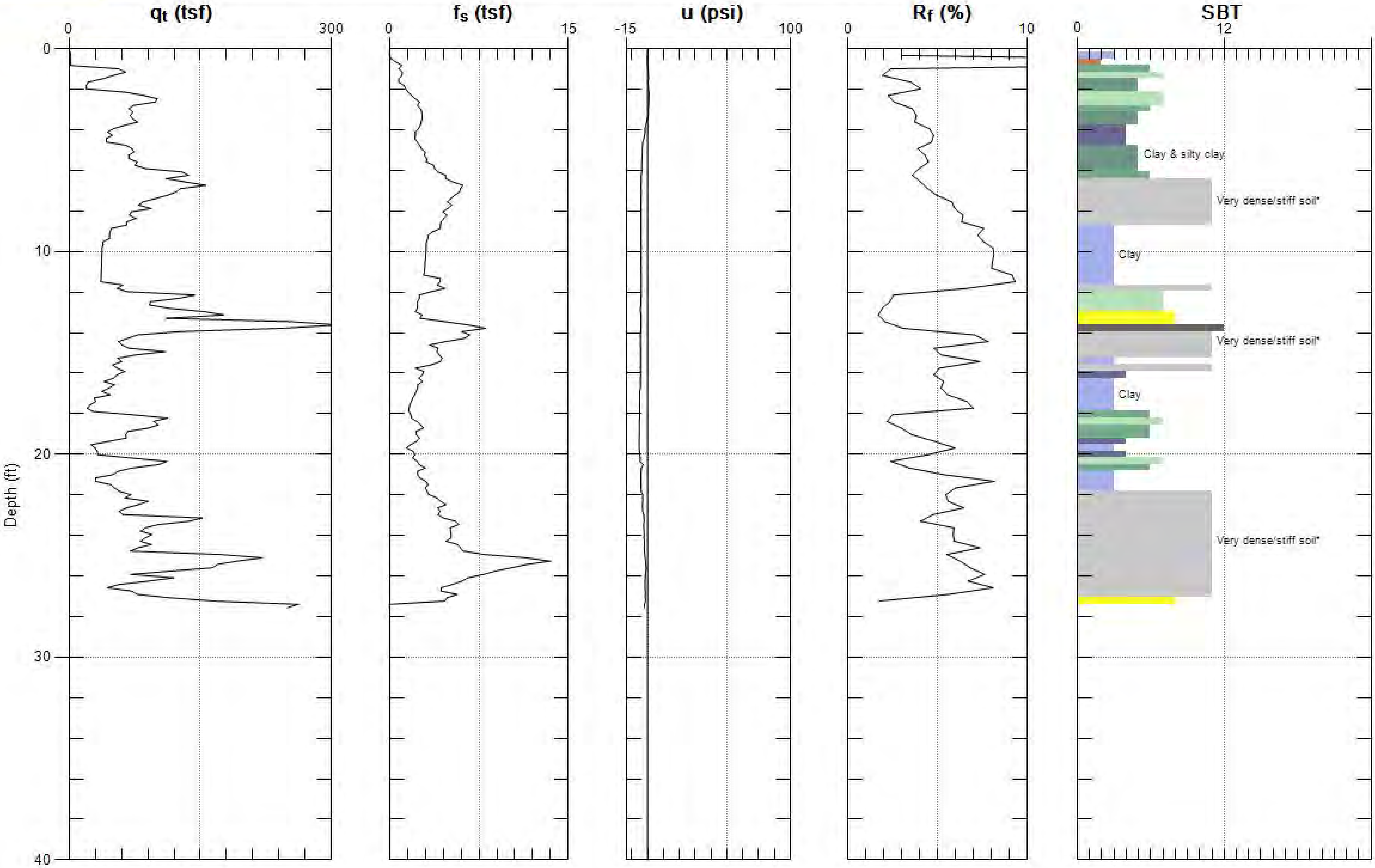
Max. Depth: 27.559 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LANGAN

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-03 **Date: 12/21/17 10:58**



Max. Depth: 27.559 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*.

The cone takes measurements of tip resistance (q_c), sleeve resistance (f_s), and penetration pore water pressure (u_2). Measurements are taken at either 2.5 or 5 cm intervals during penetration to provide a nearly continuous profile. CPT data reduction and basic interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored electronically for further analysis and reference. All CPT soundings are performed in accordance with revised ASTM standards (D 5778-12).

The 5mm thick porous plastic filter element is located directly behind the cone tip in the u_2 location. A new saturated filter element is used on each sounding to measure both penetration pore pressures as well as measurements during a dissipation test (*PPDT*). Prior to each test, the filter element is fully saturated with oil under vacuum pressure to improve accuracy.

When the sounding is completed, the test hole is backfilled according to client specifications. If grouting is used, the procedure generally consists of pushing a hollow tremie pipe with a "knock out" plug to the termination depth of the CPT hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

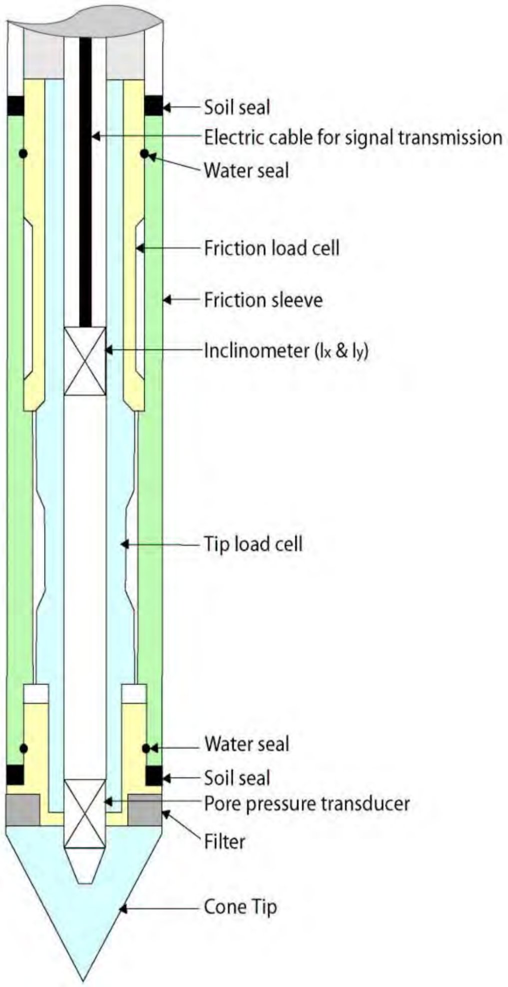


Figure CPT

Gregg 15cm^2 Standard Cone Specifications

Dimensions	
Cone base area	15 cm^2
Sleeve surface area	225 cm^2
Cone net area ratio	0.80
Specifications	
Cone load cell	
Full scale range	180 kN (20 tons)
Overload capacity	150%
Full scale tip stress	120 MPa (1,200 tsf)
Repeatability	120 kPa (1.2 tsf)
Sleeve load cell	
Full scale range	31 kN (3.5 tons)
Overload capacity	150%
Full scale sleeve stress	1,400 kPa (15 tsf)
Repeatability	1.4 kPa (0.015 tsf)
Pore pressure transducer	
Full scale range	7,000 kPa (1,000 psi)
Overload capacity	150%
Repeatability	7 kPa (1 psi)

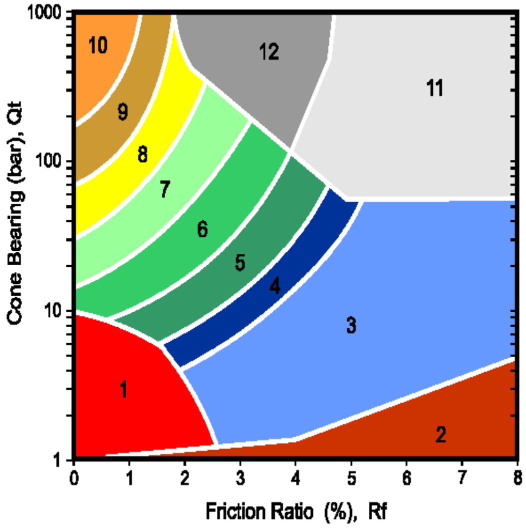
Note: The repeatability during field use will depend somewhat on ground conditions, abrasion, maintenance and zero load stability.

Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected are presented in graphical and electronic form in the report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings deeper than 30m, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson (Guide to Cone Penetration Testing, 2015). The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software. Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.



ZONE		SBT
1		🟥 Sensitive, fine grained
2		🟫 Organic materials
3		🟦 Clay
4		🟦 Silty clay to clay
5		🟩 Clayey silt to silty clay
6		🟩 Sandy silt to clayey silt
7		🟨 Silty sand to sandy silt
8		🟨 Sand to silty sand
9		🟫 Sand
10		🟧 Gravely sand to sand
11		⬜ Very stiff fine grained*
12		⬛ Sand to clayey sand*

*over consolidated or cemented

Figure SBT (After Robertson et al., 1986) – Note: Colors may vary slightly compared to plots

Cone Penetration Test (CPT) Interpretation

Gregg uses a proprietary CPT interpretation and plotting software. The software takes the CPT data and performs basic interpretation in terms of soil behavior type (SBT) and various geotechnical parameters using current published empirical correlations based on the comprehensive review by Lunne, Robertson and Powell (1997). The interpretation is presented in tabular format using MS Excel. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

The following provides a summary of the methods used for the interpretation. Many of the empirical correlations to estimate geotechnical parameters have constants that have a range of values depending on soil type, geologic origin and other factors. The software uses 'default' values that have been selected to provide, in general, conservatively low estimates of the various geotechnical parameters.

Input:

1 Units for display (Imperial or metric) (atm. pressure, p_a = 0.96 tsf or 0.1 MPa)
2 Depth interval to average results (ft or m). Data are collected at either 0.02 or 0.05m and can be averaged every 1, 3 or 5 intervals.
3 Elevation of ground surface (ft or m)
4 Depth to water table, z_w (ft or m) – input required
5 Net area ratio for cone, a (default to 0.80)
6 Relative Density constant, C_{Dr} (default to 350)
7 Young's modulus number for sands, α (default to 5)
8 Small strain shear modulus number
  a. for sands, S_G (default to 180 for SBT_n 5, 6, 7)
  b. for clays, C_G (default to 50 for SBT_n 1, 2, 3 & 4)
9 Undrained shear strength cone factor for clays, N_{kt} (default to 15)
10 Over Consolidation ratio number, k_{ocr} (default to 0.3)
11 Unit weight of water, (default to γ_w = 62.4 lb/ft^3 or 9.81 kN/m^3)

Column

1 Depth, z, (m) – CPT data is collected in meters
2 Depth (ft)
3 Cone resistance, q_c (tsf or MPa)
4 Sleeve resistance, f_s (tsf or MPa)
5 Penetration pore pressure, u (psi or MPa), measured behind the cone (i.e. u_2)
6 Other – any additional data
7 Total cone resistance, q_t (tsf or MPa) $q_t = q_c + u\,(1-a)$

8	Friction Ratio, R_f (%)	$R_f = (f_s/q_t) \times 100\%$
9	Soil Behavior Type (non-normalized), SBT	see note
10	Unit weight, γ (pcf or kN/m^3)	based on SBT, see note
11	Total overburden stress, σ_v (tsf)	$\sigma_{vo} = \sigma\ z$
12	In-situ pore pressure, u_o (tsf)	$u_o = \gamma_w\ (z - z_w)$
13	Effective overburden stress, σ'_{vo} (tsf)	$\sigma'_{vo} = \sigma_{vo} - u_o$
14	Normalized cone resistance, Q_{t1}	$Q_{t1} = (q_t - \sigma_{vo}) / \sigma'_{vo}$
15	Normalized friction ratio, F_r (%)	$F_r = f_s / (q_t - \sigma_{vo}) \times 100\%$
16	Normalized Pore Pressure ratio, B_q	$B_q = u - u_o / (q_t - \sigma_{vo})$
17	Soil Behavior Type (normalized), SBT_n	see note
18	SBT_n Index, I_c	see note
19	Normalized Cone resistance, Q_{tn} (n varies with I_c)	see note
20	Estimated permeability, k_{SBT} (cm/sec or ft/sec)	see note
21	Equivalent SPT N_{60}, blows/ft	see note
22	Equivalent SPT $(N_1)_{60}$ blows/ft	see note
23	Estimated Relative Density, D_r, (%)	see note
24	Estimated Friction Angle, ϕ', (degrees)	see note
25	Estimated Young's modulus, E_s (tsf)	see note
26	Estimated small strain Shear modulus, Go (tsf)	see note
27	Estimated Undrained shear strength, s_u (tsf)	see note
28	Estimated Undrained strength ratio	s_u/σ_v'
29	Estimated Over Consolidation ratio, OCR	see note

Notes:

1 Soil Behavior Type (non-normalized), SBT (Lunne et al., 1997 and table below)

2 Unit weight, γ either constant at 119 pcf or based on Non-normalized SBT (Lunne et al., 1997 and table below)

3 Soil Behavior Type (Normalized), SBT_n Lunne et al. (1997)

4 SBT_n Index, I_c $I_c = ((3.47 - \log Q_{t1})^2 + (\log F_r + 1.22)^2)^{0.5}$

5 Normalized Cone resistance, Q_{tn} (n varies with Ic)

$Q_{tn} = ((q_t - \sigma_{vo})/pa)\ (pa/(\sigma'_{vo})^n$ and recalculate I_c, then iterate:

When $I_c < 1.64$, n = 0.5 (clean sand)
When $I_c > 3.30$, n = 1.0 (clays)
When $1.64 < I_c < 3.30$, $n = (I_c - 1.64)0.3 + 0.5$
Iterate until the change in n, $\Delta n < 0.01$

6 Estimated permeability, k_{SBT} based on Normalized SBT_n (Lunne et al., 1997 and table below)

7 Equivalent SPT N_{60}, blows/ft Lunne et al. (1997)

$$\frac{(q_t/p_a)}{N_{60}} = 8.5\left(1-\frac{I_c}{4.6}\right)$$

8 Equivalent SPT $(N_1)_{60}$ blows/ft $(N_1)_{60} = N_{60}\,C_N,$
where $C_N = (pa/\sigma'_{vo})^{0.5}$

9 Relative Density, D_r, (%) $D_r^2 = Q_{tn} / C_{Dr}$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

10 Friction Angle, ϕ', (degrees) $\tan\phi' = \frac{1}{2.68}\left[\log\left(\frac{q_c}{\sigma'_{vo}}\right)+0.29\right]$

Only SBT_n 5, 6, 7 & 8 *Show'N/A' in zones 1, 2, 3, 4 & 9*

11 Young's modulus, E_s $E_s = \alpha\, q_t$
Only SBT_n 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

12 Small strain shear modulus, Go

a. $G_o = S_G\,(q_t\ \sigma'_{vo}\ pa)^{1/3}$ *For SBT_n 5, 6, 7*

b. $G_o = C_G\,q_t$ *For SBT_n 1, 2, 3& 4*

Show 'N/A' in zones 8 & 9

13 Undrained shear strength, s_u $s_u = (q_t - \sigma_{vo}) / N_{kt}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

14 Over Consolidation ratio, OCR $OCR = k_{ocr}\,Q_{t1}$
Only SBT_n 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

The following updated and simplified SBT descriptions have been used in the software:

SBT Zones		**SBT_n Zones**	
1	sensitive fine grained	1	sensitive fine grained
2	organic soil	2	organic soil
3	clay	3	clay
4	clay & silty clay	4	clay & silty clay
5	clay & silty clay		
6	sandy silt & clayey silt		

7	silty sand & sandy silt	5	silty sand & sandy silt
8	sand & silty sand	6	sand & silty sand
9	sand		
10	sand	7	sand
11	very dense/stiff soil*	8	very dense/stiff soil*
12	very dense/stiff soil*	9	very dense/stiff soil*

*heavily overconsolidated and/or cemented

Track when soils fall with zones of same description and print that description (i.e. if soils fall only within SBT zones 4 & 5, print ‘clays & silty clays’)

Estimated Permeability (see Lunne et al., 1997)

SBT_n	Permeability (ft/sec)	(m/sec)
1	$3x\ 10^{-8}$	$1x\ 10^{-8}$
2	$3x\ 10^{-7}$	$1x\ 10^{-7}$
3	$1x\ 10^{-9}$	$3x\ 10^{-10}$
4	$3x\ 10^{-8}$	$1x\ 10^{-8}$
5	$3x\ 10^{-6}$	$1x\ 10^{-6}$
6	$3x\ 10^{-4}$	$1x\ 10^{-4}$
7	$3x\ 10^{-2}$	$1x\ 10^{-2}$
8	$3x\ 10^{-6}$	$1x\ 10^{-6}$
9	$1x\ 10^{-8}$	$3x\ 10^{-9}$

Estimated Unit Weight (see Lunne et al., 1997)

SBT	Approximate Unit Weight (lb/ft^3)	(kN/m^3)
1	111.4	17.5
2	79.6	12.5
3	111.4	17.5
4	114.6	18.0
5	114.6	18.0
6	114.6	18.0
7	117.8	18.5
8	120.9	19.0
9	124.1	19.5
10	127.3	20.0
11	130.5	20.5
12	120.9	19.0

Pore Pressure Dissipation Tests (PPDT)

Pore Pressure Dissipation Tests (PPDT's) conducted at various intervals can be used to measure equilibrium water pressure (at the time of the CPT). If conditions are hydrostatic, the equilibrium water pressure can be used to determine the approximate depth of the ground water table. A PPDT is conducted when penetration is halted at specific intervals determined by the field representative. The variation of the penetration pore pressure (*u)* with time is measured behind the tip of the cone and recorded.

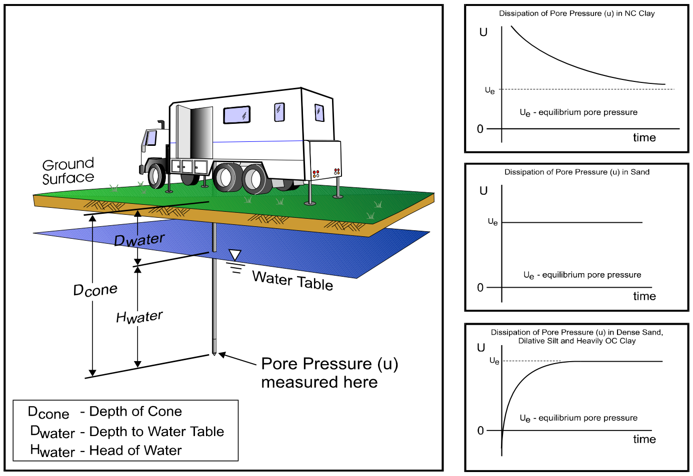
Pore pressure dissipation data can be interpreted to provide estimates of:

- Equilibrium piezometric pressure
- Phreatic Surface
- In situ horizontal coefficient of consolidation (c_h)
- In situ horizontal coefficient of permeability (k_h)

In order to correctly interpret the equilibrium piezometric pressure and/or the phreatic surface, the pore pressure must be monitored until it reaches equilibrium, *Figure PPDT*. This time is commonly referred to as t_{100}, the point at which 100% of the excess pore pressure has dissipated.

A complete reference on pore pressure dissipation tests is presented by Robertson et al. 1992 and Lunne et al. 1997.

A summary of the pore pressure dissipation tests are summarized in Table 1.



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

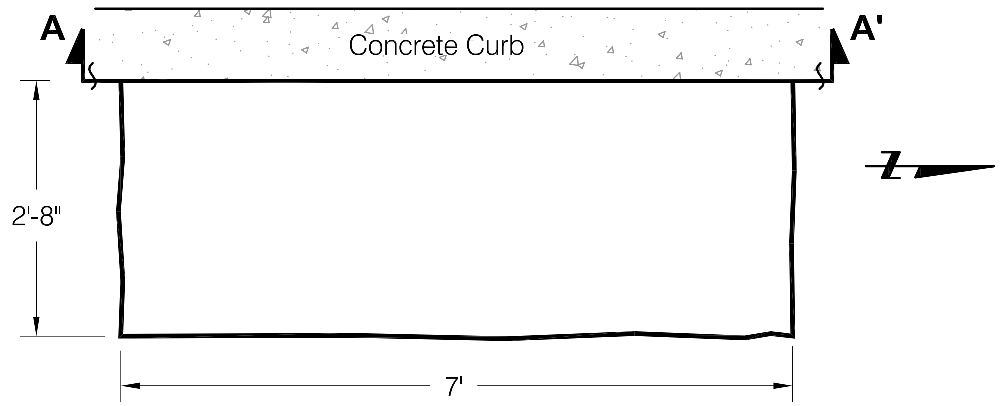
where $H_{water} = U_e$ (depth units)

Useful Conversion Factors:
1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

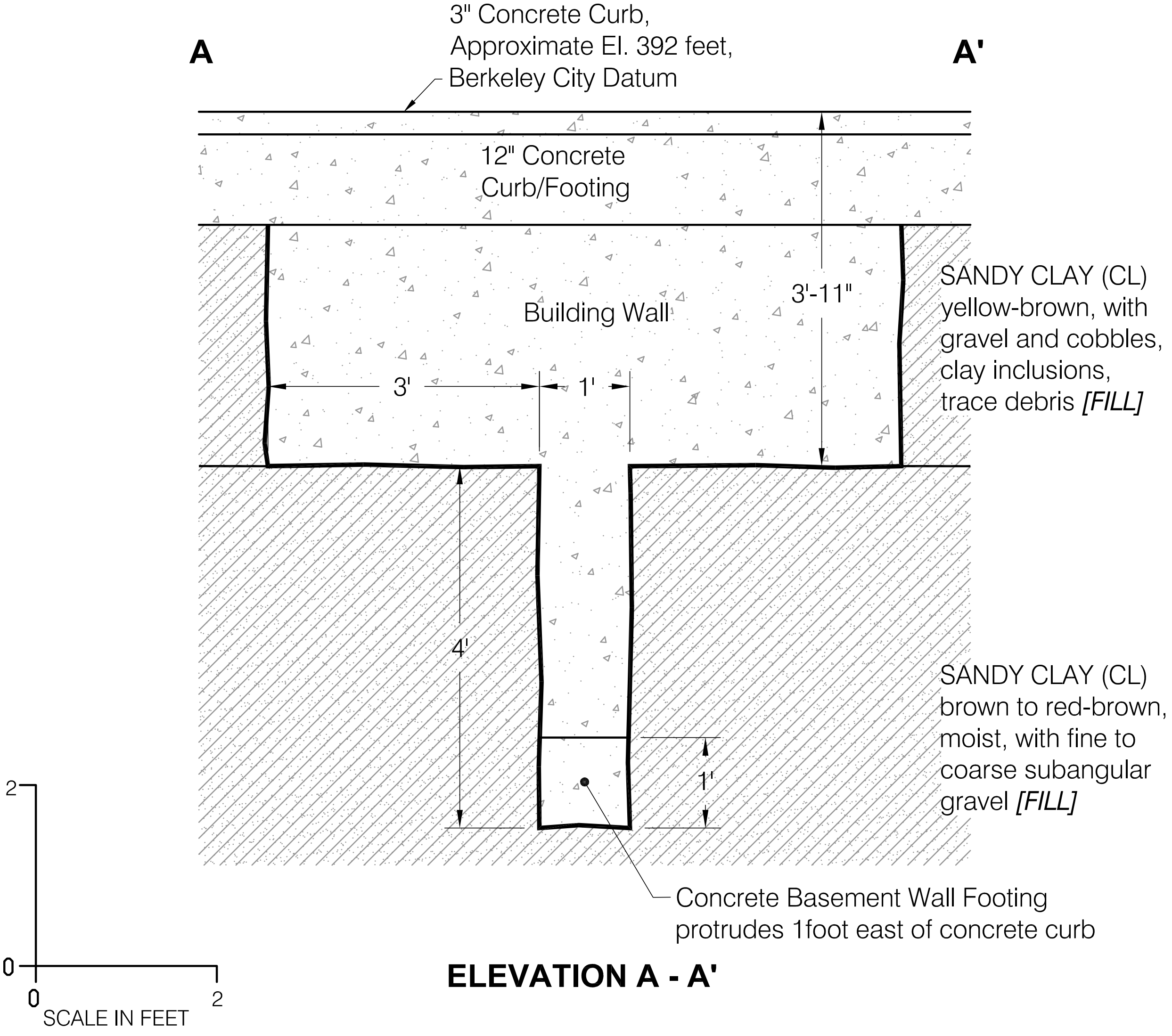
Figure PPDT

APPENDIX F

Test Pits



PLAN VIEW



ELEVATION A - A'

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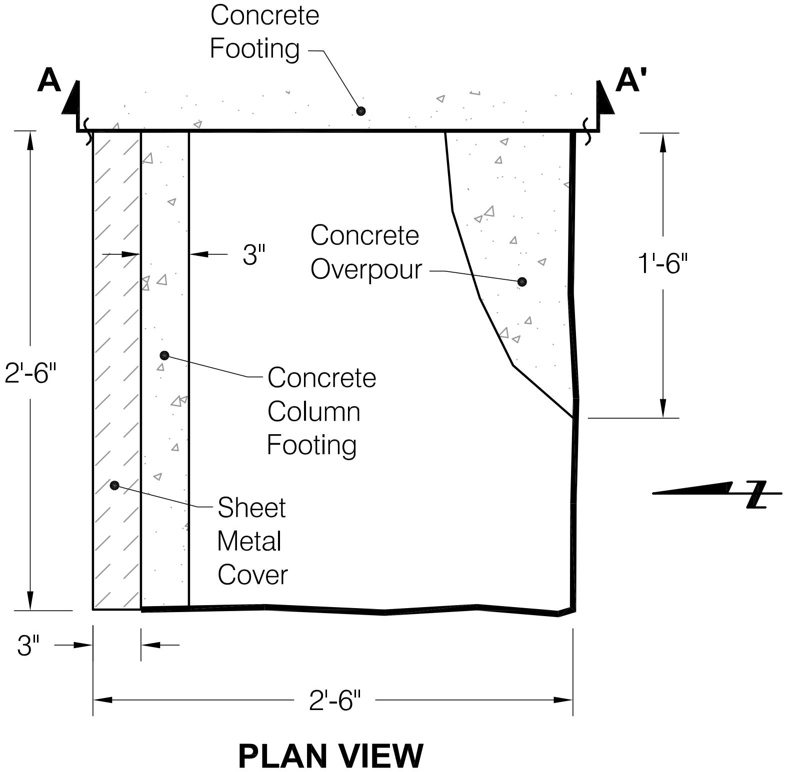
UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY
AND HEARST AVENUE ACADEMIC HOUSING
Berkeley, California

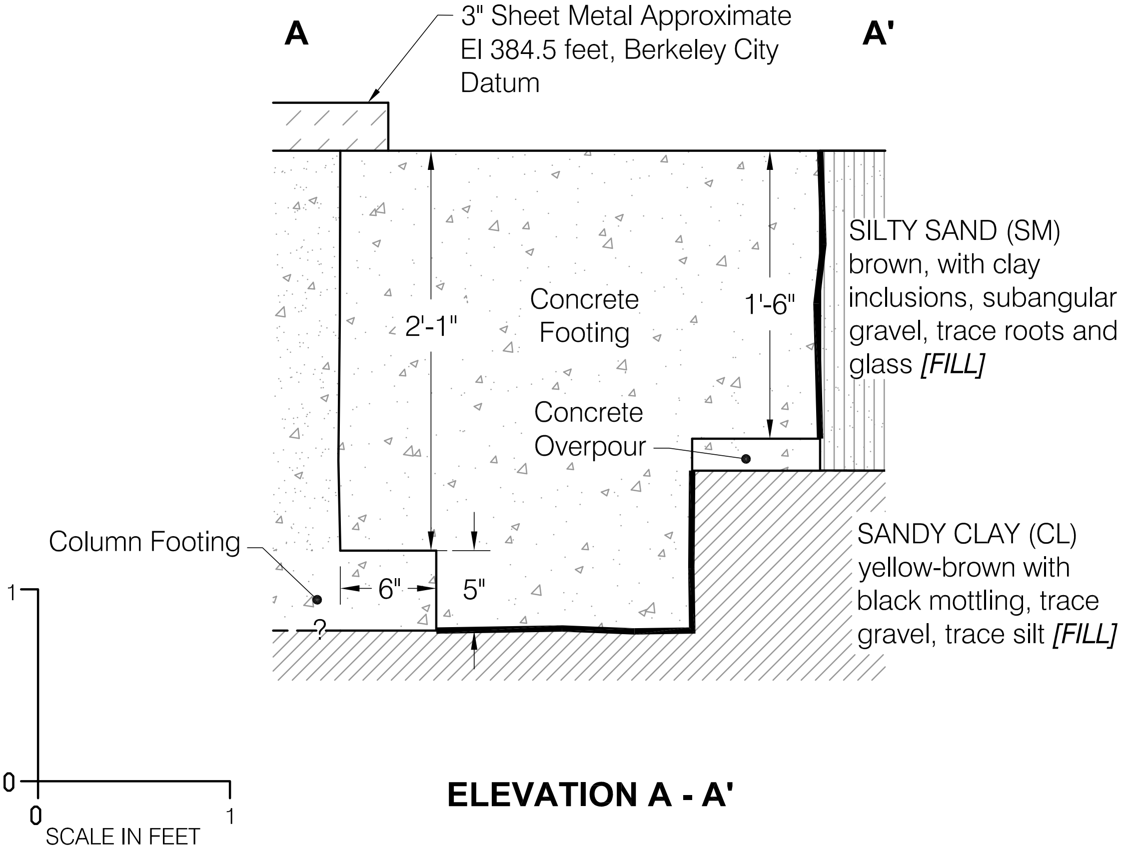
LANGAN

LOG OF TEST PIT
TP-1

Date 09/25/17	Project No. 731706301	Figure C-1



PLAN VIEW



ELEVATION A - A'

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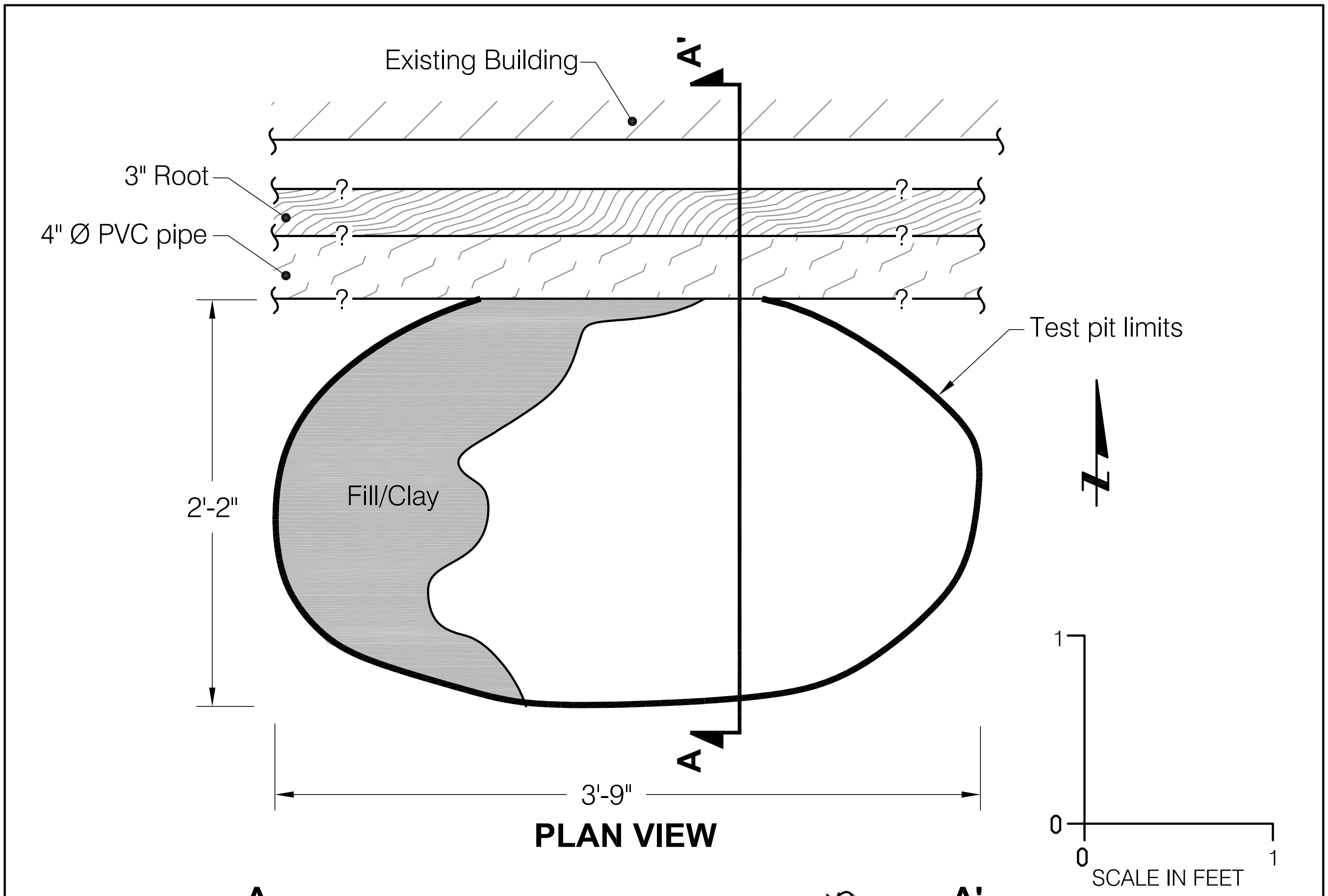
Berkeley, California

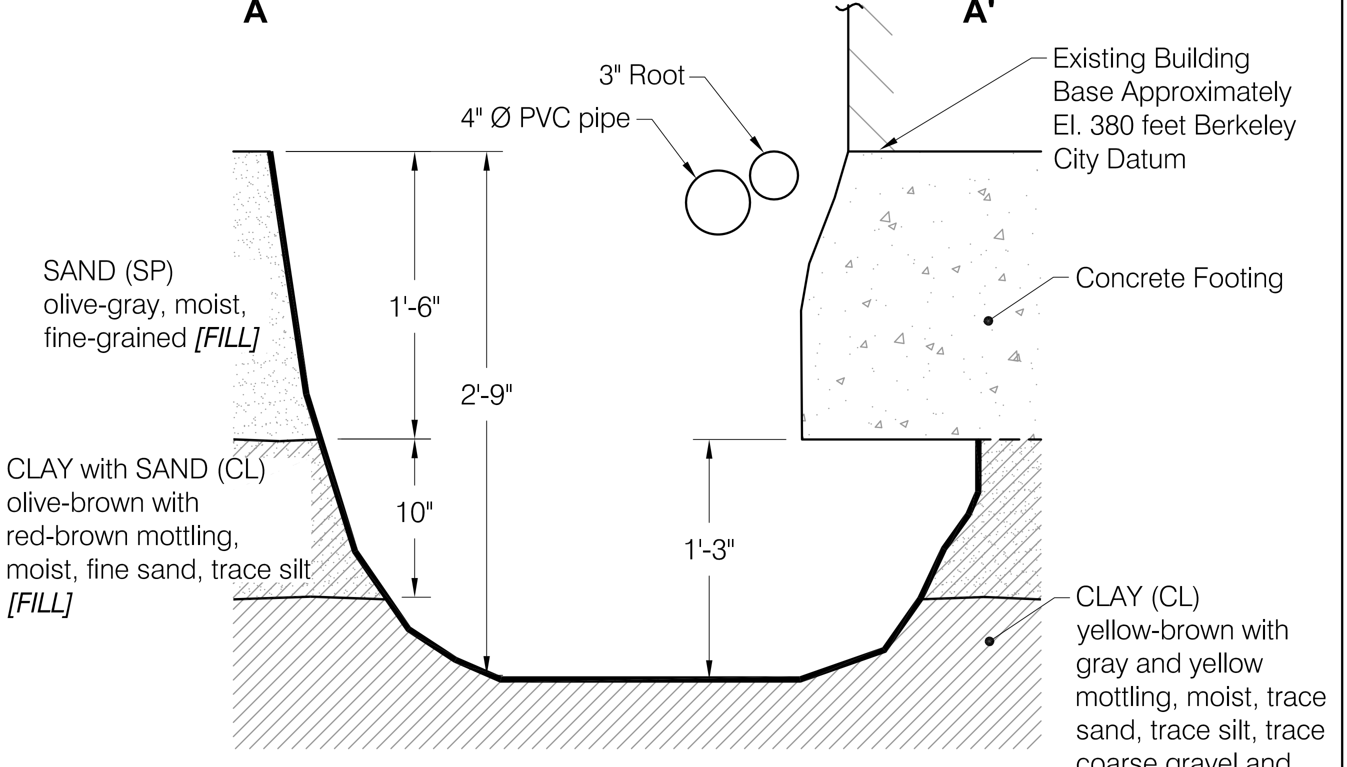
LANGAN

LOG OF TEST PIT TP-2

Date 09/25/17	Project No. 731706301	Figure C-2



PLAN VIEW



ELEVATION A - A'

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Berkeley, California

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LOG OF TEST PIT
TP-3

Date 09/25/17 | Project No. 731706301 | Figure C-3

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GEOTECHNICAL INVESTIGATION, PRELIMINARY ENVIRONMENTAL SITE CHARACTERIZATION, AND FAULT STUDY

UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING

Berkeley, California

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13 February 2018
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GEOTECHNICAL INVESTIGATION, PRELIMINARY ENVIRONMENTAL SITE CHARACTERIZATION, AND FAULT STUDY
UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING
Berkeley, California

1.0 INTRODUCTION

This report presents the results of the geotechnical investigation, preliminary environmental site characterization (ESC), and fault study performed by Langan Engineering and Environmental Services, Inc. (Langan) for the proposed new student housing development at the Goldman School of Public Policy (GSPP) and Hearst Avenue Academic Housing site. The site is at the corner of Hearst Avenue and La Loma Avenue at the University of California, Berkeley (University) campus. The location of the site is shown on Figure 1.

The site is L-shaped and approximately one acre in size. As shown on Figure 2, the southern portion of the site is occupied by the four-level Upper Hearst parking structure, and the northern portion of the site is occupied by an at-grade asphalt-paved parking lot with concrete entrance ramps to the west and southeast that lead to the below-grade portions of the structure. The site is bound by Ridge Road to the north; La Loma Avenue to the east; Hearst Avenue to the south; and a four-story student housing building (Cloyne Court Co-op) and the current GSPP building to the west. The northeastern half of the site is within a state-designated Alquist-Priolo Earthquake Fault Zone.

We understand the proposed development includes demolition of the upper portion of the existing Upper Hearst parking structure, construction of a new 5-story GSPP building with classrooms and assembly space, and addition of 5 stories of residential space above the remaining parking structure. The proposed development will also extend to the surface parking lot to the north of the parking structure. This portion of the development will include two below-grade parking levels (approximately 25 feet below grade at the intersection of La Loma Avenue and Ridge Road, at approximate Elevation 380 feet[1] (based on schematic

---

[1] Elevations in this report refer to the City of Berkeley Datum, which corresponds to approximately 3.17 feet below Mean Sea Level (MSL), or the National Geodetic Vertical Datum of 1929 (NGVD 29), and 0.95 feet above the UC Berkeley Datum.

drawings provided by the architect) and six levels of above-grade construction with classrooms and faculty offices. We understand retaining walls and new stairs will be built off of Hearst Avenue to provide access between the existing and the planned GSPP structures.

2.0 SCOPE OF SERVICES

The geotechnical portion of our scope of services, outlined in our proposal dated 22 September 2017, consisted of exploring the subsurface conditions at the site and performing laboratory tests and engineering analyses to develop conclusions and recommendations regarding:

- soil, rock, and groundwater conditions at the site
- adjacent building foundation conditions at test pit locations
- appropriate foundation type(s)
- design criteria for the recommended appropriate foundation type(s), including values for vertical (compression and uplift) and lateral capacities
- estimated foundation settlements
- site preparation, including grading, demolition and stripping
- fill quality and compaction criteria
- slab-on-grade subgrade preparation
- retaining and below-grade wall design criteria
- excavations, temporary slopes, and shoring design criteria, if needed
- moisture proofing for slabs-on-grade and site drainage
- utility trench backfill
- soil corrosivity
- site seismicity and geologic conditions
- seismic hazards, including ground rupture, liquefaction, lateral spreading, and differential compaction
- seismic design criteria in accordance with 2016 California Building Code (CBC)
- construction considerations.

The geologic portion of our scope of services, also outlined in our proposal dated 22 September 2017, consists of a desk study of local and regional data; the results of which are summarized herein.

The environmental portion of our scope of services, also outlined in our proposal dated 22 September 2017, consists of completing a Phase I environmental site assessment (ESA) and a preliminary ESC. The results of the Phase I ESA and the preliminary ESC are presented in Section 7.6.

The preliminary ESC scope consists of collecting shallow soil samples during the geotechnical field investigation; analyzing the soil samples for various non-metal and metal chemical parameters; and describing the soil sampling procedures, analytical results, and our general opinion regarding the presence of hazardous and/or contaminated materials beneath the site.

3.0 FIELD EXPLORATION

Our field exploration included: 1) drilling three borings, designated B-1 through B-3, including rock coring, 2) performing downhole seismic shear wave velocity readings in the deepest boring (B-3) and a geophysical seismic refraction survey consisting of two seismic lines, designated Line #1 and Line #2, 3) excavating three test pits, designated TP-1 through TP-3 adjacent to neighboring structures to investigate foundation conditions, 4) performing three dynamic penetrometer tests (DPTs), and 5) performing three cone penetrometer tests (CPTs). The approximate locations of the borings, seismic lines, test pits, DPTs, and CPTs are presented on Figure 2. Details of each aspect of our field exploration are outlined in the remainder of this section.

3.1 Borings

The borings were drilled on 14 and 15 September 2017 by Pitcher Drilling Co. of East Palo Alto, California (Pitcher) using a truck-mounted drill rig equipped with rotary wash drilling equipment. The borings were advanced to depths of between 51 and 65 feet below the existing ground surface (bgs). Prior to performing our field investigation we coordinated with the University and Cloyne Court Co-op, notified Underground Service Alert, and retained a private underground utility locating service to check that locations of exploration points were clear of existing utilities. Drilling permits from the City of Berkeley were not required because the property is owned by the University.

During drilling, our field representatives logged the borings and obtained representative samples of the soil encountered for classification and laboratory testing. The boring logs are presented in Appendix A on Figures A-1 through A-3. Photographs of rock core collected are presented on Figures A-3d through A-3f. The soil and rock encountered in the borings were classified in accordance with the soil and rock classification systems presented on Figures A-4 and A-5.

Soil samples were obtained during drilling using the following sampler types:

- Standard penetration test (SPT) split-barrel sampler with a 2.0-inch-outside diameter and a 1.5-inch-inside diameter, without liners
- Sprague and Henwood (S&H) split-barrel sampler with a 3.0-inch-outside diameter and a 2.5-inch-inside diameter lined with brass or stainless steel tubes with an inside diameter of 2.43 inches
- HQ-3 Core barrel rock coring system.

The SPT and S&H samplers were driven with an automatic-safety hammer. The hammer was 140 pounds and dropped 30 inches to cause a hammer blow on the sampler. The samplers were driven up to 18 inches and the hammer blows required to drive the sampler every six inches of penetration were recorded and are presented on the boring logs. A "blow count" is defined as the number of hammer blows per six inches of penetration or 50 blows for six inches or less of penetration. The driving of samplers was discontinued if the observed (recorded) blow count was 50 for six inches or less of penetration. The blow counts required to drive the S&H and SPT samplers were converted to approximate SPT N-values using factors of 0.7 and 1.2, respectively, to account for sampler type and hammer energy and are shown on the boring logs. The blow counts used for this conversion were: 1) the last two blow counts if the sampler was driven more than 12 inches, 2) the last one blow count if the sampler was driven more than six inches but less than 12 inches, and 3) the only blow count if the sampler was driven six inches or less.

The HQ-3 coring system was used to obtain core samples in rock.

Upon completion of the borings, the boreholes were backfilled with cement grout. Soil cuttings from the borings were placed into 55-gallon drums, which were transported off-site for proper testing and disposal by Pitcher.

3.2 In-Situ Seismic Downhole and Refraction Studies

To measure the in-situ shear wave velocity of the subsurface materials, Norcal Geophysical Consultants, Inc. of Cotati, California (Norcal) performed suspension P-S velocity logging to a depth of approximately 50 feet bgs in Boring B-3. The suspension P-S velocity logging system uses a 7-meter probe, containing a source and two receivers spaced one meter apart, suspended by a cable. The armored 4- or 7-conductor cable serves both to support the probe and to convey data to and from a recording/control device on the surface. The probe is lowered into the borehole to a specified depth (a rotary encoder on a winch measures probe depth), where the source generates a pressure wave in the borehole fluid. The pressure wave is converted to seismic waves (P and S) at the borehole wall. Along the wall at each receiver location, the P and S waves are converted back to pressure waves in the fluid and received by the geophones, which send the data to the recorder on the surface. The elapsed time between arrivals of the waves at the receivers is used to determine the average velocity of a one-meter-high column of soil around the borehole.

Norcal also performed two seismic refraction lines at the site to characterize variations in the P- and S-wave velocities of the material in the upper 40 to 70 feet of the subsurface along both lines. The seismic refraction surveys are useful in estimating the depth to the rock surface, the strength of rock, and the rippability (excavatability) characteristics of the rock. Multi-Channel Analysis of Surface Waves (MASW) techniques were used to obtain the seismic readings: 24 geophones spaced 6-ft apart with shot points located 12-ft and 36-ft off each end of the seismic lines were be used. A 16-pound sledge hammer striking a metal plate placed on the ground surface was used to generate the seismic energy. All seismic data was recorded on a 24-channel Geometrics seismic system. Color coded P-wave velocity profiles, and 1-D S-wave velocity graphs of P- and S-wave velocities with depth at the center point of the respective geophone arrays are included in Appendix B.

3.3 Test Pits

Three test pits were excavated by A&B Construction of Berkeley, California on 14 and 15 September 2017 in order to expose the bottom of footings at adjacent buildings. The locations of the test pits are shown on Figure 2, and the test pit logs are included in Appendix C. Test Pit TP-1 was in a concrete-covered area and required saw cutting of the concrete. The sides of the test pits did not require any shoring during excavation and did not encounter groundwater. Our field representative logged the foundation and soil conditions exposed in each test pit before the pits were backfilled with the spoils from excavation in relatively thin lifts and mechanically tamped/compacted. Concrete was patched at TP-1 to match the adjacent slab thickness.

3.4 Dynamic Penetrometer Tests

We performed three dynamic penetrometer tests (DPTs) from the ground floor of the existing garage on 22 December 2017. The locations of the DPTs are shown on Figure 2, and the DPT logs are included in Appendix D. The DPTs were performed to depths between 3-1/2 and 6-1/2 feet below the ground floor slab. A DPT consists of driving a 1.4-inch-diameter, cone-tipped probe into the ground with a hand-held 35-pound safety hammer falling approximately 15 inches. The blows required to drive the rods and cone into the soil were recorded at 10 centimeter (approximately four-inch) intervals and were converted to SPT N-values, for use in our engineering studies. After the completion of each DPT, our field representatives used a hand auger below the ground floor slab to collect grab samples for field and office classification and laboratory testing. Upon completion of each DPT and hand auger, the void was filled with cement grout and the garage floor slab was patched at each location to match the adjacent slab thickness.

3.5 Cone Penetration Tests

In addition to the DPTs, three portable cone penetration tests (CPTs) were performed from the ground floor of the existing garage by Gregg Drilling and Testing, Inc. of Martinez, California on 22 December 2017. The CPTs were performed by hydraulically pushing a 1.7-inch-diameter cone-tipped probe into the ground using a limited access ramset rig. The cone on the end of the probe is equipped to measure tip resistance, and the sleeve behind the cone tip measures frictional resistance. Electrical strain gauges within the cone measure soil parameters continuously for the entire depth advanced. Penetration data is transferred to a computer and processed to provide engineering information, such as the type of soil encountered and its approximate strength characteristics. Upon completion of each CPT, the hole was backfilled with cement grout and the garage floor slab was patched at each location to match the adjacent slab thickness. The CPT results are presented as Appendix E.

4.0 LABORATORY TESTING

The geotechnical soil samples recovered from the field exploration programs were re-examined in the office for soil classification, and representative samples were selected for laboratory testing. The laboratory testing program was designed to correlate and evaluate engineering properties of the soil at the site. Samples were tested to measure moisture content, dry density, fines content, particle size, strength, compressibility, plasticity (Atterberg limits), and corrosivity. Results of all but the corrosivity laboratory tests are included on the boring logs and in Appendix F. The corrosivity results and a brief evaluation are presented in Section 7.5 and Appendix G.

In the field, the environmental soil samples were sealed with Teflon and plastic caps, labeled, and placed on ice in a cooler for delivery to McCampbell Analytical, a State of California certified analytical laboratory based in Pittsburg, California, under chain of custody procedures. A total of six soil samples were submitted for some or all of the following chemical analyses:

- Total petroleum hydrocarbons (TPH) as gasoline (TPHg), diesel (TPHd), and motor oil (TPHmo) by EPA Method 8021/8015;
- Polychlorinated biphenyls (PCBs) by EPA Method 8082;
- Volatile organic compounds (VOCs) by EPA Method 8260;
- Polynuclear aromatics (PNAs) and polyaromatic hydrocarbons (PAHs) by EPA Method 8270C-SIM;
- Semi-volatile organic compounds (SVOCs) by EPA Method 8270;
- California assessment manual (CAM) 17 metals by EPA Method 6020; and
- Asbestos by California Air Resource Board (CARB) Method 435.

The soil analytical results from the site's preliminary ESC are discussed in Section 7.6. Copies of the certified analytical reports are provided in Appendix H.

5.0 SITE AND SUBSURFACE CONDITIONS

The site is occupied by the four-level Upper Hearst parking structure, which is supported on shallow, spread footings[2], and an at-grade asphalt-paved parking lot. The ground surface of the site slopes down to the southwest, with ground surface elevations at the parking lot between about 405 feet at the northeastern corner and 390 feet at the southwestern corner of the site, and site grades along Hearst Avenue at the western edge of the parking garage of about

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[2] Per as-built "Parking Garage H" drawings for the University of California, Berkeley by David J. Russell, dated March 1969.

370 feet. To the north, east, south, and west of the site are Ridge Road, La Loma Avenue, Hearst Avenue, and Cloyne Court Co-op and the current GSPP building, respectively. Based on information obtained in the test pits, the adjacent Cloyne Court Co-op and the adjacent GSPP academic building are founded on shallow footings bearing on sand, sandy clay, and silty sand fill over native clayey soil.

The parking lot on Ridge Road is generally underlain by up to nine feet of heterogeneous fill, consisting mainly of stiff to hard clay and sandy clay, and very dense gravel and clayey gravel. The fill, in general, has a moderate to high expansion potential and is underlain by approximately 30 to 40 feet of undifferentiated colluvial materials/surficial deposits, composed of interbedded stiff to hard clay, and sandy clay with medium to very dense clayey sands and silty sands. Colluvial materials are underlain by fault gouge, brecciated sandstone and shale, and serpentinite, which were encountered at approximately 30 to 50 feet below the parking lot surface. We interpret the gouge and brecciated bedrock materials to be associated with the mapped Louderback shear zone. The existing concrete garage slab along Hearst Avenue is underlain by approximately 6 inches of gravel fill over hard clay, sandy clay, and clay with gravel.

Depth to groundwater in the site vicinity is expected to range from approximately 10 to 40 feet bgs; however, it was not observed during our borings due to the rotary wash drilling fluids obscuring the groundwater level. The inferred groundwater gradient is to the southwest, which corresponds to the site's topography. We anticipate the groundwater varies seasonally. On the basis of the available groundwater information from past investigations in the vicinity of the site and to account for the gradient across the site and seasonal fluctuations, we judge that a design groundwater level of Elevation 370 feet, which corresponds to approximately 20 to 35 feet bgs at the existing parking lot or approximately 1 to 3 feet bgs at the existing garage entrance on Hearst Avenue, is appropriate. A pore pressure dissipation test performed in CPT-2 indicates that the groundwater is approximately 4 feet bgs at the CPT-2 location; this is consistent with the design groundwater level of Elevation 370 feet.

6.0 REGIONAL SEISMICITY AND FAULTING

The major active faults in the area are the Total Hayward, Total Hayward-Rodgers Creek, Mount Diablo, Calaveras, Green Valley, Rodgers Creek, and San Andreas faults. These and other faults of the region are shown on Figure 3. For each of the active faults within about 50 kilometers (km) of the site, the distance from the site and estimated mean characteristic

Moment magnitude[3] [2007 Working Group on California Earthquake Probabilities (WGCEP) (2008) and Cao et al. (2003)] are summarized in Table 1.

TABLE 1
Regional Faults and Seismicity

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude
Total Hayward	0.2	Northeast	7.0
Total Hayward-Rodgers Creek	0.2	Northeast	7.3
Mount Diablo Thrust	19	East	6.7
Green Valley Connected	22	East	6.8
Total Calaveras	23	East	7.0
Rodgers Creek	28	Northwest	7.1
N. San Andreas - Peninsula	29	West	7.2
N. San Andreas (1906 event)	29	West	8.1
N. San Andreas - North Coast	30	West	7.5
West Napa	32	North	6.7
San Gregorio Connected	34	West	7.5
Greenville Connected	37	East	7.0
Great Valley 5, Pittsburg Kirby Hills	39	East	6.7
Monte Vista-Shannon	49	South	6.5
Point Reyes	51	West	6.9

Figure 3 also shows the earthquake epicenters for events with magnitude greater than 5.0 from January 1800 through August 2014. Since 1800, four major earthquakes have been recorded on the San Andreas fault. In 1836 an earthquake with an estimated maximum intensity of VII on the Modified Mercalli (MM) scale (Figure 4) occurred east of Monterey Bay on the San Andreas fault (Toppozada and Borchardt 1998). The estimated Moment magnitude, $M_{w,}$ for this earthquake is about 6.25. In 1838, an earthquake occurred with an estimated intensity of about VIII-IX (MM), corresponding to a M_w of about 7.5. The San Francisco Earthquake of 1906

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[3] Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the San Andreas fault from Shelter Cove to San Juan Bautista approximately 470 kilometers in length. It had a maximum intensity of XI (MM), a M_w of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The Loma Prieta Earthquake occurred on 17 October 1989, in the Santa Cruz Mountains with a M_w of 6.9, approximately 99 km from the site.

In 1868 an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward fault. The estimated M_w for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude (probably a M_w of about 6.5) was reported on the Calaveras fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill earthquake ($M_w = 6.2$).

The most recent earthquake to affect the Bay Area occurred on 24 August 2014 and was located on the West Napa fault with a M_W of 6.0, approximately 39 km from the site.

The 2014 Working Group for California Earthquake Probabilities (WGCEP) at the U.S. Geologic Survey (USGS) predicted a 72 percent chance of a magnitude 6.7 or greater earthquake occurring in the San Francisco Bay Area in 30 years (Fields et al. 2015). More specific estimates of the probabilities for different faults in the Bay Area are presented in Table 2.

TABLE 2

WGCEP (2015) Estimates of 30-Year Probability (2014 to 2043) of a Magnitude 6.7 or Greater Earthquake

Fault	Probability (percent)
Hayward-Rodgers Creek	31
N. San Andreas	21
Calaveras	7
San Gregorio	6
Concord-Green Valley	3
Greenville	3
Mount Diablo Thrust	1

7.0 DISCUSSION AND CONCLUSIONS

From a geotechnical standpoint, we conclude the proposed new 5- to 6-story GSPP classroom and residential development can be constructed as planned provided the geotechnical recommendations presented in this report are incorporated in the project plans and specifications and are implemented during construction. The primary geotechnical concerns for the project are the presence of expansive soil, selecting appropriate foundation and temporary shoring types to support the building and excavation loads, constructing near fault traces and on shear zone material, and constructing near existing adjacent buildings. Our conclusions regarding seismic hazards, the most appropriate foundation and shoring type(s), settlement, and other geotechnical issues are presented in this section.

7.1 Seismic Hazards

During a major earthquake on one of the nearby faults, strong to very strong shaking is expected to occur at the site. Strong shaking during an earthquake can result in ground failure such as that associated with soil liquefaction,[4] lateral spreading,[5] and cyclic densification[6]. We used the results of the borings and our understanding of the site geology to evaluate the potential for these phenomena to occur at the site. The results of our evaluation are presented in the following sections.

The California Geological Survey (CGS)[7] has prepared a map titled *Earthquake Zones of Required Investigation, Richmond Quadrangle* (undated), released 10 April 2017. This map was prepared in accordance with the Seismic Hazards Mapping Act of 1990 and Alquist-Priolo (AP) Earthquake Fault Zoning Act, and shows both seismic hazard and AP zones. The northeastern half of the project site is mapped within an earthquake zone of required investigation.

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[4] Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits.

[5] Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

[6] Cyclic densification is a phenomenon in which non-saturated, cohesionless soil is compacted by earthquake vibrations, causing differential settlement.

[7] Formerly the California Division of Mines and Geology.

7.1.1 Fault Rupture

Historically, ground surface ruptures closely follow the traces of geologically young faults. The northeastern half of the site is located within an Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act (Figure 5). The Louderback shear zone is mapped as extending through the project site. A number of fault investigations have been completed on the UC Berkeley Campus, and within the vicinity of the site, to determine whether the Louderback is Holocene-active. As part of our fault evaluation, we have contacted Jim Lienkaemper of the USGS, discussed the Louderback fault with other consultants who have evaluated fault activity on the various fault traces extending through the UC Berkeley campus and vicinity, and reviewed the following fault studies:

- Harding Lawson Associates, Geologic and Fault Hazard Investigation, Proposed Student Housing, University of California, Berkeley, California, 13 November 1986;
- Harding Lawson Associates, Geologic and Fault Hazard Investigation, Phase II, Foothill Student Housing, University of California, Berkeley, California, 12 January, 1988;
- Harding Lawson Associates Supplemental Fault Hazard Investigation, "Louderback Trace", Foothill Student Housing Project, University of California, Berkeley, California, 22 June 1988;
- Kleinfelder, 1990, Geologic Evaluation – Fracture Pattern, Building B, Foothill Housing Project, Berkeley, California, consultant report;
- GTC "Fault Investigation, West Trace of the Hayward Fault, Bowles Hall Renovation Project, University of California, Berkeley, California." 6 August 1992;
- William Lettis & Associates, Inc., Revised Draft Report, Fault Displacement Hazard Study, Bowles Hall, Berkeley, California, 3 January 2008;
- Alan Kropp & Associates, Initial Geotechnical/Geological Assessment Joint Chemistry and Engineering Building, University of California- Berkeley, 21 June 2016.

We have also reviewed numerous, older AP reports that were on file with the California Geological Survey[8]. According to Harding Lawson & Associates (HLA) (1988) and GTC (1992) reports, studies by George Louderback in 1939 concluded that the Hayward fault is split into

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[8] A complete list of reports reviewed is included in the references.

two traces in the vicinity of the Greek Theater. One trace is west of the colonnade (near Gayley Road) and the other trace is east of the seating Greek Theater seating bowl. Subsequent studies, including those referenced above, have identified the western "active" trace of the Hayward fault to be east of the Greek Theater seating bowl (HLA 1988). Furthermore, Louderback also indicated that the westernmost trace (subsequently named the Louderback trace) had not moved in "a very long time" (GTC 1992). HLA evaluated the La Loma Ridge housing site, across the street from the project site, and determined that no active faults pass through the site. In their study, HLA referenced a 1939 study by Louderback, which included observations made in the Lawson Adit, located approximately 215 feet to the south of the intersection of La Loma and Hearst Ave (southeast corner of the site). Louderback observed that Holocene-age alluvial gravels were not offset in the vicinity of the mapped fault trace. HLA confirmed the lack of offset in its own supplemental study on the Louderback fault (HLA 1988).

We understand that a report prepared by William Lettis & Associates in 2007 for the Haas School Executive Business Building presented a detailed discussion summarizing the various traces of the Hayward fault and the conclusions from previous studies. They also concluded that the Louderback trace in the vicinity of the Greek Theater stage area shows no evidence of recent faulting and is inactive. We have not reviewed this report to date, but are in the process of acquiring it to verify this conclusion.

Kropp (2016) completed a preliminary geotechnical and geological assessment for a proposed new Joint Chemistry and Engineering Building in the existing location of Donner Laboratory Building, approximately 360 feet south of the project site. Kropp concluded that no active faults extend through this location, and that the nearest active trace of the Hayward fault is approximately 150 feet to the northeast. However, we have not confirmed that there is an active fault trace in this location as stated in Kropp's report. Kropp also concludes that the Louderback fault is inactive.

Our review of fault investigations and geologic analysis is ongoing. We have recently acquired information that suggests potential Holocene offset on the Louderback fault in the vicinity of Stern Hall, and are in the process of pursuing additional information from the USGS regarding this interpretation. Based on the distance of the project site from the nearest active trace of Hayward fault and review of fault investigations in the area, our preliminary assessment to date is that most evidence seems to suggest that the Louderback fault is inactive. We are still reviewing reports and discussing fault observations with the USGS and other consultants who have evaluated the Louderback. Our final conclusions and supporting figures will be included in an addendum to this report.

7.1.2 Liquefaction and Associated Hazards

Liquefaction is a phenomenon in which saturated soil temporarily loses strength from the build-up of excess pore water pressure, especially during earthquake-induced cyclic loading. Flow failure, lateral spreading, differential settlement, loss of bearing strength, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction. We evaluated the potential for liquefaction to occur at the site in accordance with Special Publication 117A, *Guidelines for Evaluating and Mitigating Seismic Hazards Zones in California*, dated 11 September 2008.

In general, the site subsurface material consists of relatively dense granular soil and stiff cohesive soil such that we conclude, in general, the site subsurface material has sufficient relative density and/or cohesion to resist liquefaction. Accordingly, we judge the potential for liquefaction to occur at the site is low. Because the potential for liquefaction is low, we conclude that the potential for seismic hazards associated with liquefaction, such as sand boils, are also low.

7.1.3 Lateral Spreading

Lateral spreading is a phenomenon in which a surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. The surficial blocks are transported downslope or in the direction of a free face, such as a channel, by earthquake and gravitational forces. Lateral spreading is generally the most pervasive and damaging type of liquefaction-induced ground failure generated by earthquakes.

Because the potential for liquefaction at the site is low, we conclude, likewise, the potential of lateral spreading at the site is low.

7.1.4 Seismic Densification

Seismic densification, also referred to as cyclic densification, of non-saturated cohesionless soil (sand and silt above the groundwater table) caused by earthquake vibrations may result in settlement. Because of the cohesion and relative density of the soil encountered above the groundwater table, we conclude the potential for cyclic densification and resulting ground settlement is low.

7.2 Expansive Soil

Laboratory test results indicate the fill soil and gouge material have moderate to high expansion potential. Expansive soil is subject to high volume changes during seasonal fluctuations in moisture content. These volume changes can cause cracking of foundations and floor slabs. Therefore, foundations and slabs should be designed and constructed to resist the effects of the expansive soil. These effects can be mitigated by moisture conditioning the expansive soil and providing non-expansive engineered fill below slabs and supporting foundations founded on fill soils.

7.3 Foundations and Settlement

We conclude the proposed new portion of the building can be supported on a mat foundation and the improvements to the existing structure can be supported on the existing spread footings. Previous experience with similar soil types indicates exterior concrete slabs-on-grade should perform satisfactorily if they are supported on a layer of select fill at least 12 inches thick.

We conclude the new building can be supported on a shallow mat foundation on native material and the improvements to the existing structure can be supported on the existing spread footings. Design recommendations for a mat foundation are presented in Section 8.2. We expect that at the new building foundation subgrade (assumed to be about 15 to 30 feet below the existing parking lot ground surface), colluvial materials, composed of interbedded stiff to hard clay and sandy clay with medium to very dense clayey sand and silty sand, will be present. We expect gouge, brecciated bedrock materials and serpentinite below the colluvial materials, at approximately 30 to 50 feet below the parking lot surface, corresponding to approximately 10 to 25 feet below the basement finished floor. It is unlikely that any sandstone and shale or other bedrock unit that could be encountered in excavations is laterally continuous, and should not be relied upon for support. We anticipate settlement under the existing garage structure is substantially complete. We anticipate additional loads from the proposed improvements to the structure could produce settlement on the order of ½ inch. We estimate immediate settlement of the soil below the new building may be on the order of 1 inch. These settlement estimates are based on preliminary loads provided by the structural engineer[9] and foundations designed in

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[9] The building is in schematic design and building loads have not yet been finalized.

accordance with the recommendations provided in Section 8.2. More detailed estimates of settlement based on final building loads will be provided in an addendum to this report, if necessary.

7.4 Construction Considerations

Construction of the new building will require an excavation of up to about 25 feet below existing parking lot grades. We anticipate the soil beneath the site can be excavated with conventional equipment; however, remnants of former buildings, concrete foundations, slabs, walls, etc. should be expected to be encountered. During excavation for the proposed below-grade levels, shoring will be required to laterally restrain the sides of the excavation and limit the movement of adjacent improvements, such as public streets and sidewalks, and adjacent structures.

We judge the most economical shoring system for the project would consist of soldier piles, timber lagging, and tiebacks. Internal braces may be required if there are obstructions precluding use of tiebacks or if extending them beyond property lines is not permitted.

For a soldier beam and lagging system, steel soldier piles are placed in predrilled holes and backfilled with lean and/or full-strength concrete. Wood lagging would be placed between the soldier beams as the excavation proceeds. Drilling of the holes for the soldier piles will likely require casing and/or the use of drilling mud to prevent caving of the sand and gravel layers. The shoring system and adjacent improvements should be monitored for movements throughout the excavation until the street-level slab is cast.

Where the proposed excavation extends deeper than the foundations of adjacent buildings, underpinning should be provided to support the adjacent building loads (or the shoring and basement walls should be designed to accommodate surcharge pressures from adjacent building loads). Underpinning could consist of hand-excavated piers that extend at least two feet below the planned bottom of excavation. Underpinning piers are usually about 30- by 48-inches in plan and are shored using pressure-treated lagging. The piers are reinforced with steel and are filled with concrete; the pier should be pre-loaded by jacking against the foundation, and the top of the pier dry-packed to fit tightly with the base of the underpinned foundation. The piers should act in end bearing in the strata below the bottom of the proposed excavation. Alternatively, slant-drilled piles could be used as underpinning.

7.5 Groundwater and Dewatering

Groundwater levels measured on site and in nearby investigations indicate that the depth to groundwater varies across the site (10 to 40 feet below existing ground surface at the parking lot and less than 5 feet below existing ground floor slab level at the garage). Depending on the time of year excavations are made, and due to perched water, water could be encountered during excavation and be present at the bottom of excavations. As a result, the contractor should be prepared to control groundwater when making excavations.

7.6 Soil Corrosivity

CERCO Analytical of Concord, California evaluated the corrosivity of the site fill by testing two composite samples obtained from depths of 3.5 feet from Boring B-2 and 1 to 4 feet from DPT-1. Corrosion potential was determined based on the nominal resistivity measurement (100 percent saturation), chloride ion concentration, sulfate ion concentration, pH, and redox potential.

The test results indicate the samples tested are "corrosive." Test results and brief evaluations describing the corrosion characteristics and corrosion protection recommendations are included in Appendix G.

7.7 Phase I ESA and Preliminary Environmental Site Characterization Results

The Phase I ESA, completed and report dated 15 November 2017, did not identify any recognized environmental conditions directly or indirectly associated with the site. Results of the preliminary ESC are as follows.

Soil analytical results for parameters other than metals are summarized in Analytical Summary Table 1 and were compared to both the San Francisco Bay Area Regional Water Quality Control Board (RWQCB) Tier 1 environmental screening levels (ESLs) summary table (RWQCB, February 2016 [Rev. 3]) and construction worker direct exposure ESLs for any soil type at any depth for any land use (RWQCB, Table S-1, February 2016 [Rev. 3]). TPHg was detected above the laboratory reporting limit (1.0 milligram per kilogram (mg/kg)) in one of the six samples analyzed at a concentration of 1.4 mg/kg. TPHd was detected above the laboratory reporting limit (1.0 mg/kg) in four of the six samples analyzed at concentrations ranging from 2.5 mg/kg to 210 mg/kg. TPHmo was detected above the laboratory reporting limit in five of the six samples analyzed at concentrations ranging from 8.6 mg/kg to 4,300 mg/kg. None of the TPH concentrations detected in the six samples analyzed exceed the established ESLs.

A trace concentration of 1,2,4-trimethylbenzene, a VOC, was detected in one of the four samples analyzed, at a concentration of 0.0075 mg/kg. There are no established ESLs for 1,2,4-trimethylbenzene.

Trace to low-level concentrations of PNAs and PAHs were detected in one of the two samples analyzed. Benzo(a)pyrene and benzo(b)fluoranthene (both PAHs/PNAs) were detected at concentrations of 0.083 mg/kg and 0.24 mg/kg, respectively which exceed the established Tier 1 ESLs of 0.016 mg/kg and 0.16 mg/kg, respectively. However, the detected concentrations of benzo(a)pyrene and benzo(b)fluoranthene do not exceed the established construction worker direct exposure ESLs of 1.6 mg/kg and 16 mg/kg, respectively.

Trace to low-level concentrations of SVOCs were detected in one of the three samples analyzed. Bis(2-chloroisopropyl)ether, dibenzo(a,h)anthracene, and naphthalene were detected at concentrations of 0.015 mg/kg, 0.064 mg/kg, and 0.028 mg/kg, respectively. The detected concentrations of bis(2-chloroisopropyl)ether and dibenzo(a,h)anthracene exceed the established Tier 1 ESLs of 0.0039 mg/kg and 0.016 mg/kg, respectively. However, the detected concentrations of bis(2-chloroisopropyl)ether and dibenzo(a,h)anthracene do not exceed the established construction worker direct exposure ESLs of 220 mg/kg and 1.6 mg/kg, respectively.

No PCBs or asbestos were detected at or above method reporting limits in the sample analyzed.

Soil analytical results for metal parameters are summarized in Analytical Summary Table 2, and were compared to the total threshold limit concentration (TTLC) and background concentrations of metals in Bay Area soils. All detected metals concentrations were within normal[10] background ranges found in the western United States, specifically the Bay Area.

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[10] "Background concentration ranges of metals in Bay Area soils, Appendix A, Table A-2 from Environmental Resources Management. Feasibility Study, Hookston Station, Pleasant Hill, California. July 2006.

8.0 RECOMMENDATIONS

Recommendations for site preparation, foundation design, excavation and shoring, tiebacks, underpinning, below-grade walls, floor slabs, retaining walls, construction monitoring, seismic design, and preliminary ESC are presented in this section of the report.

8.1 Earthwork

This section presents earthwork recommendations for site preparation and grading.

8.1.1 Site Preparation

Grading operations should commence after demolition and removal of the existing pavements, foundations, slabs, and underground utilities within the development area. Following demolition, all areas to receive improvements should be stripped of vegetation and organic topsoil. The pavement material, including asphalt, may be segregated from organic topsoil and used as compacted fill, provided it meets the fill requirements presented in Section 8.1.3. The stripped organic soil can be stockpiled for later use in landscaped areas, if approved by the architect; organic topsoil should not be used as compacted fill.

Where utilities that are removed extend off site, they should be capped or plugged with grout at the property line. It may be feasible to abandon utilities in-place by filling them with grout, provided they will not interfere with future utilities or affect building foundations. The utility lines should be addressed on a case-by-case basis.

8.1.2 Subgrade Preparation

The soil exposed at the bottom of foundation excavations and floor slab-on-grade areas should be cleared of loose material and should be non-yielding. We recommend at least 12 inches of non-expansive engineered fill be placed beneath proposed exterior concrete flatwork, including patio slabs and sidewalks; the fill should extend at least two feet beyond the slab edges. The upper 12 inches of soil in exterior slab areas should be moisture-conditioned to at least three percent above optimum moisture content and compacted to between 88 and 93 percent relative compaction.

If the subgrade is disturbed during utility or foundation construction, it should be re-rolled and moisture conditioned prior to flatwork or slab construction.

8.1.3 Engineered Fill Placement and Compaction

Excavated on-site soil may be suitable for reuse as engineered fill or backfill provided it meets the following requirements:

- is free of organic material
- contains no rocks or lumps larger than three inches in greatest dimension
- has a low expansion potential (defined by a liquid limit of less than 40 and a plasticity index lower than 12)
- is non-corrosive and non-hazardous
- is confirmed as environmentally acceptable by Langan

In addition, engineered fill should contain at least 20 percent fines (particles passing the No. 200 sieve) to reduce the potential for surface water to infiltrate beneath slabs. Engineered fill should be placed in lifts not exceeding eight inches in loose thickness and compacted to at least 90 percent relative compaction. During construction, we should check that the on-site and any proposed import material are suitable for use as fill. In lieu of soil fill, lean concrete or controlled density fill (CDF) may be used.

Langan should approve all sources of imported fill at least three days before use at the site. The grading contractor should provide analytical test results or other suitable environmental documentation indicating the imported fill is free of hazardous materials at least three days before use at the site. If data are not available, up to two weeks should be allowed to perform, review, and approve analytical testing on the proposed import material. A bulk sample of approved fill should be provided to Langan at least three working days before use at the site so a compaction curve can be prepared.

8.1.4 Utilities and Utility Trenches

Excavations in soil for utility trenches can be made with conventional earth-moving equipment. Backfill for utility trenches and other excavations is also considered fill, and should be compacted according to the recommendations presented in Section 8.1.3. If imported clean sand or gravel is used as backfill, however, it should be compacted to at least 95 percent relative compaction. Jetting of trench backfill should not be permitted. Special care should be taken when backfilling utility trenches in pavement areas. Poor compaction may cause excessive settlements, resulting in damage to the pavement section.

Utility trenches should be excavated at least four inches below the bottom of pipes or conduits and have clearances of at least four inches on both sides. To provide uniform support, pipes or conduits should be bedded on a minimum of four inches of sand or fine gravel. After pipes and conduits are tested, inspected (if required), and approved, they should be covered to a depth of six inches with sand or fine gravel, which should then be mechanically tamped.

Where utility trenches backfilled with sand or gravel enter the building, an impermeable plug consisting of native clay or lean concrete, at least five feet in length, should be installed at the building line. Further, where sand- or gravel-backfilled trenches cross planter areas and pass below asphalt or concrete pavements, a similar plug should be placed at the edge of the pavement. The purpose of these plugs is to reduce the potential for water to become trapped in trenches beneath the building or pavements. This trapped water can cause heaving of soils beneath slabs and softening of subgrade soil beneath pavements.

8.2 Mat Foundation

The new portion of the building should be supported on a mat bearing on firm soil, which we anticipate to be native colluvial material over gouge, brecciated bedrock materials and serpentinite.

A mat foundation bearing on this material may be designed for a preliminary allowable bearing pressure of 4,500 psf for dead loads, 6,800 psf for dead plus live loads, and 9,100 psf for total design forces, i.e. including wind and/or seismic load. Mat foundations should be embedded at least 24 inches below lowest adjacent soil subgrade.

Lateral loads can be resisted by a combination of passive pressures on the vertical faces of the foundations and friction along the bases of the foundations. We recommend passive resistance be calculated using a uniform pressure of 2,000 psf. The upper foot of soil should be ignored unless it is confined by slabs or pavement. Frictional resistance should be computed using a base friction coefficient of 0.25. These values include a factor of safety of 1.5, and may be used in combination without reduction.

Weak soil or non-engineered fill encountered in the bottom of foundation excavations should be excavated and replaced with engineered fill or lean concrete. The bottoms and sides of the foundation excavations should be wetted following excavation and maintained in a moist condition until concrete is placed. We should check foundation excavations prior to placement of reinforcing steel. Foundation excavations should be free of standing water, debris, and disturbed materials prior to placing concrete. Positive surface drainage should be provided around the building to direct surface water away from the foundations. In addition, roof downspouts should be discharged into controlled drainage facilities to keep the water away from the foundations.

Further detailed recommendations and geotechnical design parameters to be used to support structural design of the new building atop the existing parking garage footings are underway in conjunction with continued structural design, as it evolves. These recommendations will be provided in addenda to this report, as appropriate.

8.3 Excavation, Temporary Slopes, and Shoring

Langan is in the process of developing final shoring pressures for the excavation which will be provided in an addendum to this report. Tied-back soldier piles and lagging shoring should be designed to resist these pressures. However, for preliminary design, we recommend using an apparent pressure of 30H, where H is the height of the wall, for tied-back and internally braced shoring. The shoring designer should evaluate the required penetration depth of the soldier piles. The soldier piles should have sufficient axial capacity to support the vertical load acting on the piles, if any. Temporary slopes should not be steeper than 1.5:1 (horizontal to vertical) for slopes up to 15 feet in height. Slopes higher than 15 feet should be analyzed.

8.4 Tiebacks

Tiebacks should derive their load-carrying capacity from the soil behind an imaginary line sloping upward from a point H/5 feet away from the bottom of the excavation at an angle 60 degrees from horizontal, where H is the wall height in feet.

Allowable capacities of the tiebacks will depend on the installation method, hole diameter, grout pressure, and workmanship. For estimating purposes, we recommend using a skin friction value of 500 psf tiebacks with for gravity placed grout or 1,000 psf for pressure-grouted tiebacks within the bond length, with a minimum bond length of 15 feet. The stressing (unbonded) length should be at least 15 feet for steel strands and 10 feet for steel bars. These values include a safety factor of approximately 1.5. A Klemm-type rig (double cased hole) should be used to drill the shafts and the tiebacks should be equipped with post-grout tubes.

Determining the length of tieback required to resist the earth pressures presented above should be the contractor's responsibility. The computed bond length should be confirmed by a testing program under our observation. Testing procedures should follow those described in Section 8.5 for tieback testing.

If any tiebacks fail to meet the testing requirements, additional tiebacks should be added to compensate for the deficiency as required by the shoring designer. Additionally, the tiebacks should be checked 24 hours after initial prestressing to check that stress relaxation has not occurred. The bottom of the excavation should not extend more than two feet below a row of unsecured tiebacks.

8.5 Tieback Testing

We should observe tieback testing. The first two production tiebacks and two percent of the remaining tiebacks should be performance-tested to at least 1.25 times the design load. The remaining tiebacks should be confirmed by proof tests also to at least 1.25 times the design load.

The movement of each tieback should be monitored with a free-standing, tripod-mounted dial gauge during performance and proof testing. The performance test is used to verify the capacity and the load-deformation behavior of the tiebacks. It is also used to separate and identify the causes of tieback movement, and to check that the designed unbonded length has been established. In the performance test, the load is applied to the tieback in several cycles of incremental loading and unloading. During the test, the tieback load and movement are measured. The maximum test load should be held for a minimum of 10 minutes, with readings taken at 0, 1, 3, 6, and 10 minutes. If the difference between the 1- and 10-minute readings is less than 0.04 inch during the loading, the test is discontinued. If the difference is more than 0.04 inch, the holding period is extended by 50 minutes to 60 minutes, and the movements should be recorded at 15, 20, 25, 30, 45, and 60 minutes.

A proof test is a test used to measure the total movement of the tieback during one cycle of incremental loading. The maximum test load should be held for a minimum of 10 minutes, with readings taken at 0, 1, 2, 3, 6, and 10 minutes. If the difference between the 1- and 10-minute readings is less than 0.04 inch, the test is discontinued. If the difference is more than 0.04 inch, the holding period is extended by 50 minutes to 60 minutes, and the movements should be recorded at 15, 20, 25, 30, 45, and 60 minutes.

We should evaluate the tieback test results and determine whether the tiebacks are acceptable. A performance- or proof-tested tieback with a ten-minute hold is acceptable if the tieback carries the maximum test load with less than 0.04 inch movement between one and 10 minutes, and total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

A performance- or proof-tested tieback with a 60-minute hold is acceptable if the tieback carries the maximum test load with less than 0.08 inch movement between six and 60 minutes, and total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

Tiebacks that failed to meet the first criterion will be assigned a reduced capacity. If the total movement of the tiebacks at the maximum test load does not exceed 80 percent of the theoretical elastic elongation of the unbonded length, the contractor should replace the tiebacks.

8.6 Underpinning Design

Underpinning piers might be required to support the loads of adjacent structures during construction of the proposed basement levels. Piers should bottom at least two feet below the bottom of the excavation. We recommend underpinning piers be designed using preliminary allowable bearing pressures of 3,000 psf for dead loads, 4,500 psf for dead plus live loads, and 6,000 psf for total design forces, i.e. including wind and/or seismic load, provided native material is exposed at the base of the piers.

The piers should be designed to resist at-rest soil pressures. Because expansive soil is present at the site, we recommend an equivalent fluid unit weight of 75 pcf be used to determine the lateral earth pressure against the pier. Lateral earth pressures may be resisted by tiebacks and passive resistance against the portion of the pier extending below the excavation. We recommend passive resistance below the bottom of the excavation be calculated using a uniform pressure of 2,000 psf. This value includes a factor of safety of about 1.5 and assumes the groundwater level is a minimum of 3 feet below the bottom of the underpinning pier.

The bottom of the piers should be free of standing water, debris, and disturbed materials prior to placing concrete. We should check the excavations prior to placement of reinforcing steel to confirm the exposed soil is suitable to support the design bearing pressures. If loose or soft soil or undesirable material is encountered, it should be removed and the overexcavation backfilled with lean or structural concrete to the bottom of the pier.

If slant-drilled piles are used as underpinning, to compute the embedment depth of the piles, we recommend using an allowable skin friction of 500 psf below the bottom of the excavation.

8.7 Below-Grade Wall Design

To protect against moisture migration, basement walls should be waterproofed and water stops should be placed at all construction joints. We recommend all below-grade and retaining walls be designed to resist lateral pressures imposed by the adjacent soil and vehicles. Lateral earth pressures on basement walls will depend partially on the restraint at the top of the walls. Accordingly, walls should be designed for the equivalent fluid weights (triangular distribution) presented in Table 3.

Table 3 presents the active, at-rest, and total pressures (active plus seismic pressure increment) for soil with level backfill for drained conditions. We used the procedures outlined in Sitar et al. (2012) to compute the seismic active pressure. The more critical condition of either at-rest pressure or active pressure plus a seismic increment (total pressure) should be checked.

TABLE 3

Below-Grade Wall Design

Retained Material	**Static Conditions**		**Seismic Conditions**	
	Unrestrained Walls Active Condition (pcf)	**Restrained Walls At-Rest Condition (pcf)**	**Total (Active Plus Seismic Increment) (pcf)**	
			DE	**MCE_R**
Soil Above the Groundwater Level, Drained	75	75	75	90

Notes:

1. The more critical condition of either at-rest pressure (static condition) or active pressure plus a seismic pressure increment (seismic condition) should be checked.
2. DE = Design Earthquake
3. MCE_R = Rick Targeted Maximum Considered Earthquake
5. Structural engineer to determine appropriate load combinations for design of below grade walls.

Surcharge loads from traffic and the foundations of adjacent structures should be included in the wall design. If surcharge loads occur above an imaginary 30-degree line (from the horizontal) projected up from the bottom of a retaining wall, a surcharge pressure should be included in the wall design. If this condition exists, we should be consulted to estimate the added pressure on a case-by-case basis. Where truck traffic will pass within 10 feet of retaining walls, temporary traffic loads should be considered in the design of the walls. Traffic loads may be modeled by a uniform pressure of 100 pounds per square foot applied in the upper 10 feet of the walls.

The recommended design pressures assume the walls will be properly backdrained above the design groundwater level to prevent the buildup of hydrostatic pressure. One acceptable method for backdraining walls is to place a prefabricated drainage panel against the backside of the newly cast wall. If temporary shoring is used, the panel may be placed directly on the shoring prior to casting the wall. The panel should extend down to a perforated PVC collector pipe or an equivalent "flat" pipe (such as AdvanEdge) at the base of the wall or shoring. The PVC pipe should be bedded on and covered by at least 4 inches of Class 2 permeable material (per Caltrans Standard Specifications) or drain rock, and the aggregate material should be surrounded by filter fabric (Mirafi 140NC or equivalent). We should check the manufacturer's specifications regarding the proposed prefabricated drainage panel material to confirm it is appropriate for its intended use. The pipe should be connected to a suitable discharge point. If a flat pipe surrounded by a filter fabric is used, it is not necessary to surround it with rock. The closed pipe should be sloped to drain to a suitable outlet. If water is collected in a sump, a pumping system may be required to carry the water to the storm drain system. In lieu of a backdrain system for outside retaining walls, weep holes could be used. We recommend at least one row of weep holes be installed and they be spaced at no more than 5 feet on-center.

If placed, wall backfill should be compacted to at least 95 percent relative compaction using light compaction equipment. If heavy equipment is used, the wall should be appropriately designed to withstand loads exerted by the equipment and/or temporarily braced.

8.8 Floor Slabs

Moisture is likely to condense on the underside of the floor slabs, even though they may be above the design groundwater level. Consequently a moisture barrier should be installed beneath new slabs, including mat foundation slabs, if movement of water vapor through the slabs is not acceptable. A typical moisture barrier consists of a capillary moisture break and a water vapor retarder.

A capillary moisture break consists of at least four inches of clean, free-draining gravel or crushed rock. The vapor retarder should meet the requirements for Class C vapor retarders stated in the current ASTM E1745. The vapor retarder should be placed in accordance with the requirements of the current ASTM E1643. These requirements include overlapping seams by six inches, taping seams, and sealing penetrations in the vapor retarder. The particle size of the gravel/crushed rock should meet the gradation requirements presented in Table 4.

TABLE 4

Gradation Requirements for Capillary Moisture Break

Sieve Size	Percentage Passing Sieve
Gravel or Crushed Rock	
1 inch	90 – 100
3/4 inch	30 – 100
1/2 inch	5 – 25
3/8 inch	0 – 6

Concrete mixes with high water/cement (w/c) ratios result in excess water in the concrete, which increases the cure time and results in excessive vapor transmission through the slab. Therefore, concrete for the floor slab should have a low w/c ratio - less than 0.45. If necessary, workability should be increased by adding plasticizers. In addition, the slab should be properly cured. Before the floor covering is placed, the contractor should check that the concrete surface moisture emission levels (if emission testing is required) meet the manufacturer's requirements.

8.9 Site Retaining Walls

We understand site design may include cantilever retaining walls supported on shallow footings or cantilever soldier-pile-and-lagging walls. Cantilever walls should be designed in accordance with below-grade wall design recommendations presented in Section 8.7. Because of the pervious nature of wood lagging, no additional drainage would be required behind a soldier-pile-and-lagging wall provided impervious facing is not installed against the front of the wall. During placement of backfill behind retaining walls, the walls should be braced, or hand compaction equipment should be used, to prevent surcharges on walls.

Retaining walls may be supported on shallow, spread or continuous footings bearing on firm soil, which we anticipate to be fill or colluvial material over gouge, brecciated bedrock materials and serpentinite. Our recommendation is that footings bearing on this material be designed for an allowable bearing pressure of 3,000 psf for dead plus live loads; this value may be increased by 1/3 for total loads, including wind and seismic.

To reduce the potential for movement of the footings due to shrink and swell of the expansive clay, we recommend that the bottom of the footings should be embedded at least 36 inches below the lowest adjacent soil subgrade and should be at least 18 inches wide. Proposed footings adjacent to utility trenches or other footings should bear below an imaginary 1.5:1 (horizontal to vertical) plane projected upward from the bottom edge of the utility trench or adjacent footings.

Lateral loads can be resisted by a combination of passive pressures on the vertical faces of the foundations and friction along the bases of the foundations. We recommend passive resistance be calculated using a uniform pressure of 1,500 psf. The upper foot of soil should be ignored unless it is confined by slabs or pavement. Frictional resistance should be computed using a base friction coefficient of 0.25. These values include a factor of safety of 1.5, and may be used in combination without reduction.

For a soldier-beam-and-lagging wall, lateral forces may be resisted by passive earth pressures against the embedded vertical faces of the soldier beams. We recommend passive resistance be calculated using a uniform pressure of 1,500 psf. The passive pressure may be applied over three pier diameters or the spacing between soldier beams, whichever is less. In addition, the upper foot of soil below the finished subgrade level should be ignored for passive resistance unless it is confined by a slab.

Weak soil or non-engineered fill encountered in the bottom of foundation excavations should be removed and replaced with engineered fill or lean concrete. The bottoms and sides of the foundation excavations should be wetted following excavation and maintained in a moist condition until concrete is placed. We should check foundation excavations prior to placement of reinforcing steel. Foundation excavations should be free of standing water, debris, and disturbed materials prior to placing concrete.

8.10 Construction Monitoring

The conditions of existing buildings and other improvements within 100 feet of the site should be photographed and surveyed prior to the start of construction and monitored periodically during construction.

To monitor ground movements, groundwater levels, and shoring movements, we recommend installing survey points on the adjacent buildings and streets that are within 100 feet of the site. In addition, survey points should be installed at the tops of the shoring walls at 20-foot-spacing. The survey points should be read regularly and the results should be submitted to us in a timely manner for review. For estimating purposes, assume that the survey points will be read as follows:

- Prior to any shoring work at the site
- After installing soldier piles
- Weekly during excavation work
- After the excavation reaches the planned excavation level
- Every two weeks until the street-level floor slab is constructed

8.11 Seismic Design

The closest active fault to the site is the Hayward Fault, which is about 0.2 kilometer away. Probabilistic and deterministic seismic hazard analyses and acceleration time histories were previously performed for the UC Berkeley campus by others (URS/Pacific, 2009, 2015) for rock and thin soil site conditions. In the 2015 report, they recommend that sites be classified as one of five different profiles defined as: 1) 10 to 35 feet of soil, 2) 36 to 75 feet of soil, 3) 76 to 150 feet of soil, 4) Rock, 5) Rock – Shear Zone. On the basis of the results of our geotechnical investigation and a review of nearby data and the 2015 URS/Pacific Engineering & Analysis report; our conclusion is that the site should be classified as Category 3 (76 to 150 feet of soil). Any changes to the recommended site class based on discussions with the project structural engineer will be provided in addenda to this report, as appropriate.

In addition, seismic design parameters are presented for the subject site below, in accordance with the provisions of 2016 CBC/ASCE 7-10:

- Site Class C
- Risk Targeted Maximum Considered Earthquake (MCE_R) S_S and S_1 of 2.473g and 1.027g, respectively.
- Site Coefficients F_A and F_V of 1.0 and 1.3, respectively
- MCE_R spectral response acceleration parameters at short periods, S_{MS}, and at one-second period, S_{M1}, of 2.473g and 1.336g, respectively.
- Design Earthquake (DE) spectral response acceleration parameters at short period, S_{DS}, and at one-second period, S_{D1}, of 1.649g and 0.890g, respectively.

8.12 Preliminary Environmental Site Characterization

The soil analytical results from this preliminary ESC are presented in Analytical Summary Tables 1 and 2, and copies of the certified analytical reports are provided in Appendix H. As previously summarized in Section 7.6, low level contamination from petroleum hydrocarbons, VOCs, PAHs/PNAs, and SVOCs were detected in the site's shallow subsurface. However, no hazardous material was detected. Based on the analytical results, if the disturbance, removal, and/or off-site disposal of the site's shallow subsurface soil material is required, the material will likely be classified as Class II non-hazardous or unrestrictive waste, depending on the criteria of the accepting facility criteria.

The presence of these compounds poses minimal soil management and health and safety (H&S) issues to be addressed as part of the site development activities. The soil management objectives for the site are to minimize exposure of construction workers at the site, nearby residents and/or pedestrians, and future users of the site, to constituents in soil and groundwater.

Based on the limited area of the site and the characterization of soil that has been completed, it is anticipated that soil excavated during the construction activities will be directly loaded into trucks for off-site disposal; if necessary, other means for disposal of soils include use of bins for containing soil prior to transport and off-site disposal. If needed, additional soil samples will be tested for analysis typically required by regulated landfills.

If soil stockpiling of suspected contaminated soil is to be performed, the excavation contractor shall establish appropriate soil stockpile locations on the site to properly segregate, cover, control dust, profile, and manage the excavated soil. At a minimum, stockpiled soils should be placed on top of one layer of 10-mil polyethylene sheeting (or equivalent), such as Visqueen. When stockpiled soil is not actively being handled, top sheeting should be adequately secured so that all surface areas are covered.

If needed, chemical testing of any stockpiled soil will be performed to profile the soil for disposal. Soil profiling criteria depends on the proposed landfill location or off-site receiving facility. These procedures should be established by the excavation contractor and coordinated with the proposed landfills prior to initiating soil excavation. Langan should be provided documentation from the excavation contractor that the soils from the site to the proposed acceptance facilities have been approved. Typical soil profiling requirements for landfills are one four-point composite sample per 250 - 500 cubic yards to be disposed.

9.0 FUTURE GEOTECHNICAL SERVICES

As the structural design is advanced, we anticipate on-going discussions and coordination with the design team. Further, detailed geotechnical design recommendations will be presented in addenda to this report, as necessary. During final design we should be retained to consult with the design team as geotechnical questions arise. Prior to construction, we should review the project plans and specifications to check their conformance with the intent of our recommendations. During construction, we should observe site preparation, shoring and underpinning, testing of tiebacks, installation and testing of building and retaining wall foundations, slab and pavement subgrade preparation, placement and compaction of fill, and grading. These observations will allow us to compare the actual with the anticipated soil conditions and to check that the contractors’ work conforms to the geotechnical aspects of the plans and recommendations.

10.0 LIMITATIONS

The conclusions and recommendations provided in this report result from our interpretation of the geotechnical conditions existing at the site inferred from a limited number of exploration points as well as architectural and structural information provided by the architect. Actual subsurface conditions could vary. Recommendations provided are dependent upon one another and no recommendation should be followed independent of the others. Any proposed changes in structures, depths of excavation, or their locations should be brought to Langan's attention as soon as possible so that we can determine whether such changes affect our recommendations. Information on subsurface strata and groundwater levels shown on the logs represent conditions encountered only at the locations indicated and at the time of investigation. If different conditions are encountered during construction, they should immediately be brought to Langan's attention for evaluation, as they may affect our recommendations.

This report has been prepared to assist the Owner, architect, and structural engineer in the design process and is only applicable to the design of the specific project identified. The information in this report cannot be utilized or depended on by engineers or contractors who are involved in evaluations or designs of facilities on adjacent properties which are beyond the limits of that which is the specific subject of this report.

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TABLES

Analytical Summary Table 1
Soil Analytical Results - Non-Metals
UC Berkeley - Goldman School of Public Policy
and Hearst Avenue Academic Housing
Berkeley, Ca

Sample ID	Sample depth (feet)	Date Sampled	TPHg	TPHd	TPHmo	PCBs	VOC	All Other VOCs	PAHs/PNAs													All Other PAHs/PNAs	SVOCs			All Other SVOCs	Asbestos
							1,2,4-Trimethyl-benzene		Anthracene	Benzo (a) anthracene	Benzo (a) pyrene	Benzo (b) fluoranthene	Benzo (g,h,i) perylene	Benzo (k) fluoranthene	Chrysene	Fluoranthene	Indeno (1,2,3-cd) pyrene	1-Methyl-naphthalene	2-Methyl-naphthalene	Phenanthrene	Pyrene		Bis (2-chloro-isopropyl) ether	Dibenzo (a,h) anthracene	Naphthalene		
			(mg/kg)																								(%)
B-1-2.0	2	9/15/17	1.4	210	4,300	ND	0.0075	ND	0.055	0.12	**0.083**	**0.24**	0.14	0.061	0.45	0.54	0.059	0.023	0.034	0.55	0.57	ND	**0.015**	**0.064**	0.028	ND	--
B-1-5.5	5.5	9/15/17	< 1.0	< 1.0	< 5.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B-2-3.0	3	9/15/17	< 1.0	3.5	18	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.25
B-2-5.5	5.5	9/15/17	< 1.0	< 1.0	8.6	--	< 0.0050	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.25	< 0.25	< 0.25	ND	--
B-3-3.0	3	9/15/17	< 1.0	3.6	24	ND	< 0.0050	ND	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	ND	< 0.25	< 0.25	< 0.25	ND	--
B-3-5.5	5.5	9/15/17	< 1.0	2.5	12	--	< 0.0050	ND	--	--	--	--	--	--	--	--	--	--	--	--	--	--	< 0.25	< 0.25	< 0.25	ND	--
Tier 1 ESL			100	230	5,100	0.25	--	Various	2.8	0.16	0.016	0.16	2.5	1.6	3.8	60	0.16	--	0.25	11	85	Various	0.0039	0.016	0.033	Various	--
Direct Exposure ESL			2,800	880	32,000	5.6	--	Various	50,000	16	1.6	16	--	150	1,500	6,700	16	--	670	--	5,000	Various	220	1.6	350	Various	--

Notes:
mg/kg - Milligrams per kilogram
% - Percentage
TPHg - Total petroleum hydrocarbons as gasoline
TPHd - Total petroleum hydrocarbons as diesel
TPHmo - Total petroleum hydrocarbons as motor oil
PCBs - Polychlorinated biphenyls
VOCs - Volatile organic compounds
PAHs/PNAs - Polycyclicaromatic hydrocarbons / polynuclear aromatics
SVOCs - Semi-volatile organic compounds
< 1.0 - Analyte was not detected above the laboratory reporting limit (1.0 mg/kg)
Bold indicates exceedance of Tier 1 ESL.
ND - Not detected at or above the laboratory reporting limit(s)
-- Sample not analyzed or criteria not established
ESL - Environmental screening level(s)
Various - ESLs, where established, vary for each of the multiple compounds analyzed
Tier 1 ESL - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels - *Tier 1 Soil.* February 2016 [Rev. 3]
Direct Exposure ESL - San Francisco Bay Regional Water Quality Control Board's Environmental Screening Levels - Direct Exposure Human Health Risk Levels for Any Land Use/Any depth Soil Exposure (Table S-1) for Construction Workers. February 2016 [Rev. 3]

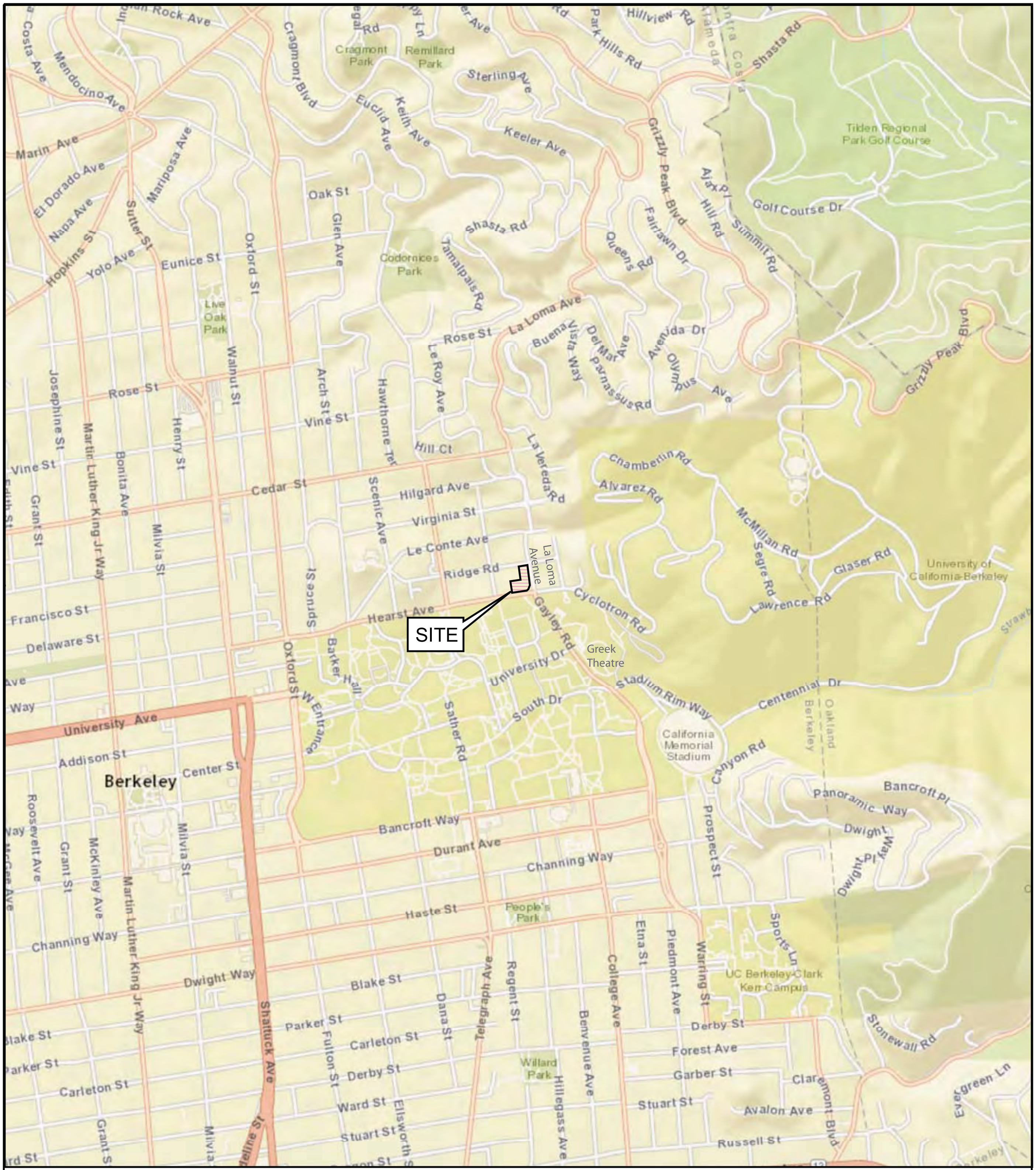
Langan Project: 731706301
December 2017

Analytical Summary Table 2
Soil Analytical Results - Metals
UC Berkeley - Golman School of Public Policy and Hearst Avenue Academic Housing
Berkeley, Ca

Sample ID	Sample Depth (feet)	Date Sampled	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
			(mg/kg)																
B-1-2.0	2	9/15/17	1.3	3.8	120	< 0.50	< 0.25	30	11	120	9.3	0.13	< 0.50	53	< 0.50	< 0.50	< 0.50	34	110
B-1-5.5	5.5	9/15/17	0.92	10	140	0.60	< 0.25	40	12	47	8.6	< 0.050	0.69	47	< 0.50	< 0.50	< 0.50	70	77
B-2-3.0	3	9/15/17	0.95	9.0	150	0.53	< 0.25	52	11	39	41	0.21	0.66	57	< 0.50	< 0.50	< 0.50	54	94
B-2-5.5	5.5	9/15/17	0.78	8.1	160	0.54	< 0.25	35	11	37	16	0.098	0.64	41	< 0.50	< 0.50	< 0.50	59	68
B-3-3.0	3	9/15/17	0.81	7.8	150	< 0.50	< 0.25	49	14	41	26	0.13	0.61	72	< 0.50	< 0.50	< 0.50	62	88
B-3-5.5	5.5	9/15/17	0.86	9.7	140	< 0.50	< 0.25	36	8.6	33	38	0.072	0.75	27	< 0.50	< 0.50	< 0.50	57	53
Background [Metal] in Bay Area Soils*			1.5-7.1	1.2-31	41-411	0.29-1.1	0.27-3.3	10-142	6.5-25.5	5.4-100	4.8-65	0.07-0.6	0.33-11.4	16-144	< 0.25-7	0.2-2.2	< 0.25-42.5	22-90	33-282
Hazardous Waste Criteria																			
TTLC		(mg/kg)	500	500	10,000	75	100	2,500	8,000	2,500	1,000	20	3,500	2,000	100	500	700	2,400	5,000
STLC		(mg/L)	15	5	100	0.75	1	–	80	25	–	0.2	350	–	1	5	7	24	250
TCLP		(mg/L)	–	5	100	–	1	–	–	–	–	0.2	–	–	1	5	–	–	–

Notes:
mg/kg - Milligrams per kilogram
mg/L - Milligrams per liter
< 0.50 - Analyte was not detected at or above the laboratory reporting limit (0.50 mg/kg)
-- Criteria not established
TTLC - California Total Threshold Limit Concentration - State hazardous waste criterion
STLC - California Soluble Threshold Limit Concentration
TCLP - Federal Toxicity Characteristic Leaching Procedure
*Background concentration ranges of metals in Bay Area soils, Appendix A, Table A-2 from Environmental Resources Management. Feasibility Study, Hookston Station, Pleasant Hill, California. July 2006

FIGURES



NOTES:

World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online.
Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.

0 1,000 2,000
Feet

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UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING

Berkeley, California

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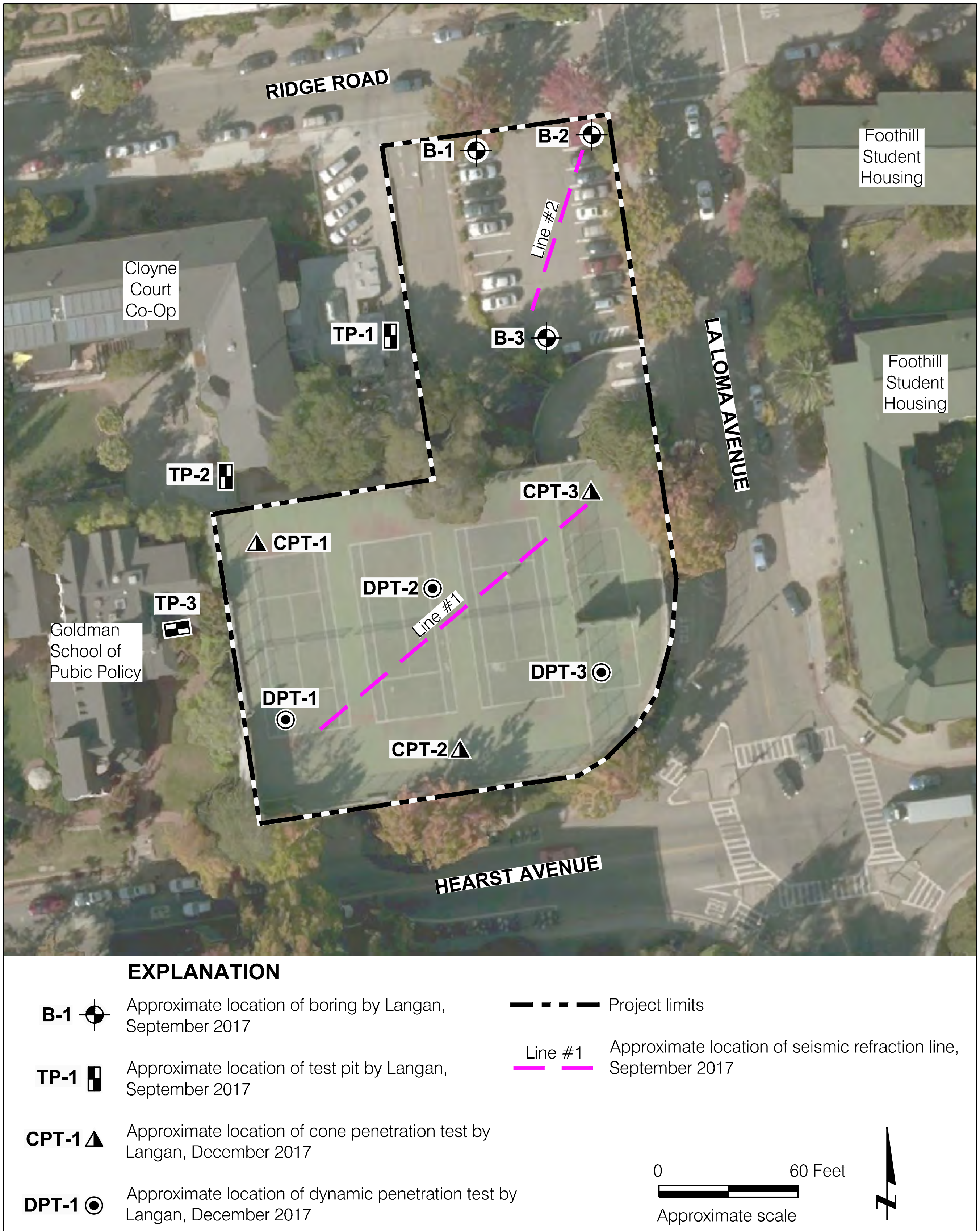
SITE LOCATION MAP

Date 09/14/17	Project No. 731706301	Figure 1



EXPLANATION

B-1 ⊕	Approximate location of boring by Langan, September 2017
TP-1 ◧	Approximate location of test pit by Langan, September 2017
CPT-1 ▲	Approximate location of cone penetration test by Langan, December 2017
DPT-1 ◉	Approximate location of dynamic penetration test by Langan, December 2017
▬ ▪ ▬	Project limits
Line #1	Approximate location of seismic refraction line, September 2017

Reference: © 2017 Microsoft Corporation, Bing

\\langan.com\data\SFO\data3\731706301\Project Data\CAD\01\2D-DesignFiles\Geotechnical\731706301-B-SP0106.dwg 1/18/18

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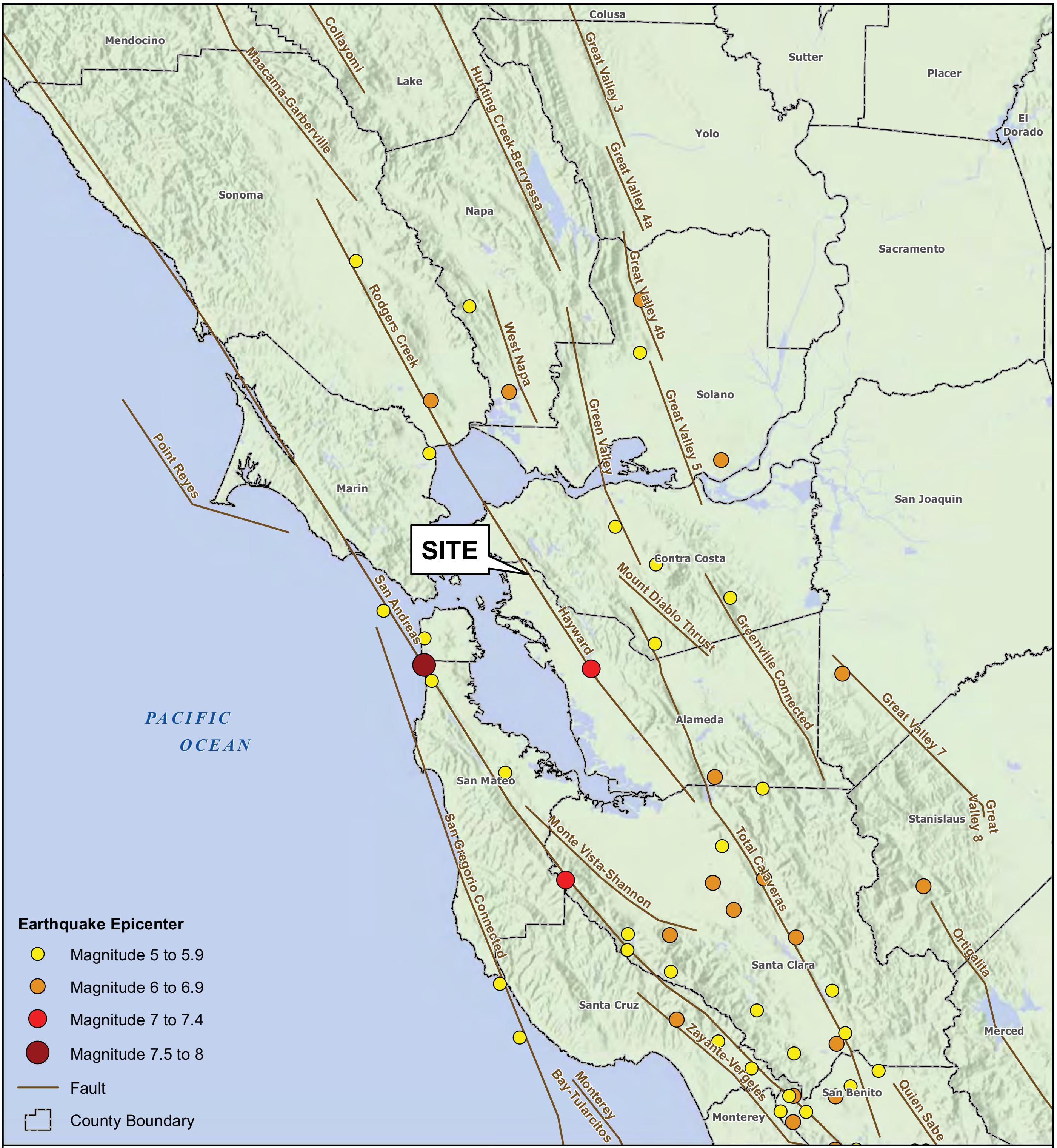
SITE PLAN

Date 01/18/18 | Project No. 731706301 | Figure 2



Notes:

1. Quaternary fault data displayed are based on a generalized version of U.S Geological Survey (USGS) Quaternary Fault and fold database, 2010. For cartographic purposes only.
2. The Earthquake Epicenter (Magnitude) data is provided by the USGS and is current through 08/26/2014.
3. Basemap hillshade and County boundaries provided by USGS and California Department of Transportation.
4. Map displayed in California State Coordinate System, California (Teale) Albers, North American Datum of 1983 (NAD83), Meters.

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MAP OF MAJOR FAULTS AND EARTHQUAKE EPICENTERS IN THE SAN FRANCISCO BAY AREA

Date 10/19/2017	Project No. 731706301	Figure 3

\\langan.com\data\SFO\data3\731706301\Project Data\ArcGIS\MXD\Geotech_Figures\Fault Map.mxd User: Cyoung

I	**Not felt by people, except under especially favorable circumstances. However, dizziness or nausea may be experienced.** Sometimes birds and animals are uneasy or disturbed. Trees, structures, liquids, bodies of water may sway gently, and doors may swing very slowly.
II	**Felt indoors by a few people, especially on upper floors of multi-story buildings, and by sensitive or nervous persons.** As in Grade I, birds and animals are disturbed, and trees, structures, liquids and bodies of water may sway. Hanging objects swing, especially if they are delicately suspended.
III	**Felt indoors by several people, usually as a rapid vibration that may not be recognized as an earthquake at first. Vibration is similar to that of a light, or lightly loaded trucks, or heavy trucks some distance away. Duration may be estimated in some cases.** Movements may be appreciable on upper levels of tall structures. Standing motor cars may rock slightly.
IV	**Felt indoors by many, outdoors by a few. Awakens a few individuals, particularly light sleepers, but frightens no one except those apprehensive from previous experience. Vibration like that due to passing of heavy, or heavily loaded trucks. Sensation like a heavy body striking building, or the falling of heavy objects inside.** Dishes, windows and doors rattle; glassware and crockery clink and clash. Walls and house frames creak, especially if intensity is in the upper range of this grade. Hanging objects often swing. Liquids in open vessels are disturbed slightly. Stationary automobiles rock noticeably.
V	**Felt indoors by practically everyone, outdoors by most people. Direction can often be estimated by those outdoors. Awakens many, or most sleepers. Frightens a few people, with slight excitement; some persons run outdoors.** Buildings tremble throughout. Dishes and glassware break to some extent. Windows crack in some cases, but not generally. Vases and small or unstable objects overturn in many instances, and a few fall. Hanging objects and doors swing generally or considerably. Pictures knock against walls, or swing out of place. Doors and shutters open or close abruptly. Pendulum clocks stop, or run fast or slow. Small objects move, and furnishings may shift to a slight extent. Small amounts of liquids spill from well-filled open containers. Trees and bushes shake slightly.
VI	**Felt by everyone, indoors and outdoors. Awakens all sleepers. Frightens many people; general excitement, and some persons run outdoors.** Persons move unsteadily. Trees and bushes shake slightly to moderately. Liquids are set in strong motion. Small bells in churches and schools ring. Poorly built buildings may be damaged. Plaster falls in small amounts. Other plaster cracks somewhat. Many dishes and glasses, and a few windows break. Knickknacks, books and pictures fall. Furniture overturns in many instances. Heavy furnishings move.
VII	**Frightens everyone. General alarm, and everyone runs outdoors.** People find it difficult to stand. Persons driving cars notice shaking. Trees and bushes shake moderately to strongly. Waves form on ponds, lakes and streams. Water is muddied. Gravel or sand stream banks cave in. Large church bells ring. Suspended objects quiver. Damage is negligible in buildings of good design and construction; slight to moderate in well-built ordinary buildings; considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Plaster and some stucco fall. Many windows and some furniture break. Loosened brickwork and tiles shake down. Weak chimneys break at the roofline. Cornices fall from towers and high buildings. Bricks and stones are dislodged. Heavy furniture overturns. Concrete irrigation ditches are considerably damaged.
VIII	**General fright, and alarm approaches panic.** Persons driving cars are disturbed. Trees shake strongly, and branches and trunks break off (especially palm trees). Sand and mud erupts in small amounts. Flow of springs and wells is temporarily and sometimes permanently changed. Dry wells renew flow. Temperatures of spring and well waters varies. Damage slight in brick structures built especially to withstand earthquakes; considerable in ordinary substantial buildings, with some partial collapse; heavy in some wooden houses, with some tumbling down. Panel walls break away in frame structures. Decayed pilings break off. Walls fall. Solid stone walls crack and break seriously. Wet grounds and steep slopes crack to some extent. Chimneys, columns, monuments and factory stacks and towers twist and fall. Very heavy furniture moves conspicuously or overturns.
IX	**Panic is general.** Ground cracks conspicuously. Damage is considerable in masonry structures built especially to withstand earthquakes; great in other masonry buildings - some collapse in large part. Some wood frame houses built especially to withstand earthquakes are thrown out of plumb, others are shifted wholly off foundations. Reservoirs are seriously damaged and underground pipes sometimes break.
X	**Panic is general.** Ground, especially when loose and wet, cracks up to widths of several inches; fissures up to a yard in width run parallel to canal and stream banks. Landsliding is considerable from river banks and steep coasts. Sand and mud shifts horizontally on beaches and flat land. Water level changes in wells. Water is thrown on banks of canals, lakes, rivers, etc. Dams, dikes, embankments are seriously damaged. Well-built wooden structures and bridges are severely damaged, and some collapse. Dangerous cracks develop in excellent brick walls. Most masonry and frame structures, and their foundations are destroyed. Railroad rails bend slightly. Pipe lines buried in earth tear apart or are crushed endwise. Open cracks and broad wavy folds open in cement pavements and asphalt road surfaces.
XI	**Panic is general.** Disturbances in ground are many and widespread, varying with the ground material. Broad fissures, earth slumps, and land slips develop in soft, wet ground. Water charged with sand and mud is ejected in large amounts. Sea waves of significant magnitude may develop. Damage is severe to wood frame structures, especially near shock centers, great to dams, dikes and embankments, even at long distances. Few if any masonry structures remain standing. Supporting piers or pillars of large, well-built bridges are wrecked. Wooden bridges that "give" are less affected. Railroad rails bend greatly and some thrust endwise. Pipe lines buried in earth are put completely out of service.
XII	**Panic is general.** Damage is total, and practically all works of construction are damaged greatly or destroyed. Disturbances in the ground are great and varied, and numerous shearing cracks develop. Landslides, rock falls, and slumps in river banks are numerous and extensive. Large rock masses are wrenched loose and torn off. Fault slips develop in firm rock, and horizontal and vertical offset displacements are notable. Water channels, both surface and underground, are disturbed and modified greatly. Lakes are dammed, new waterfalls are produced, rivers are deflected, etc. Surface waves are seen on ground surfaces. Lines of sight and level are distorted. Objects are thrown upward into the air.

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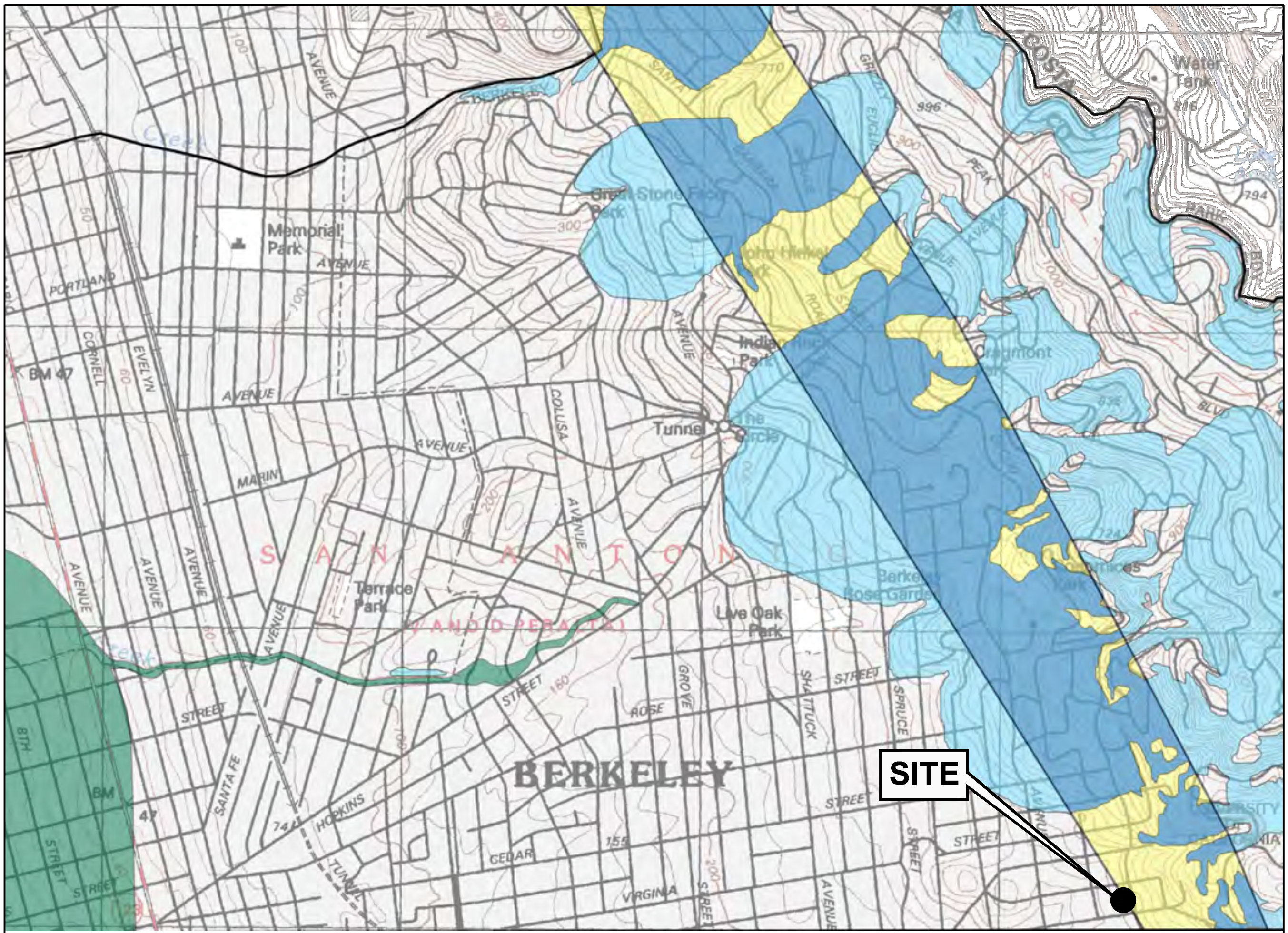
MODIFIED MERCALLI INTENSITY SCALE

Date 10/19/17 | Project No. 731706301 | Figure 4



Reference:Earthquake Fault Zones and Seismic Harzard Zones, Richmond 7.5 minute Quadrangle by John G. Parrish, PHD. dated 01/01/82 and 02/14/03 respectively.

EXPLANATION

ALQUIST-PRIOLO EARTHQUAKE FAULT ZONES

🟨 **Earthquake Fault Zones**
Zone boundaries are delineated by straight-line segments; the boundaries define the zone encompassing active faults that constitute a potential hazard to structures from surface faulting or fault creep such that avoidance as described in Public Resources Code Section 2621.5(a) would be required.

SEISMIC HAZARD ZONES

🟩 **Liquefaction Zones**
Areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

🟦 **Earthquake-Induced Landslide Zones**
Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required.

OVERLAPPING ALQUIST-PRIOLO AND SEISMIC HAZARD ZONES

🟦 **Overlap of Earthquake Fault Zone and Earthquake-Induced Landslide Zone**
Areas that are covered by both Earthquake Fault Zone and Earthquake-Induced Landslide Zone.

0 2000 Feet
Approximate scale

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REGIONAL ALQUIST-PRIOLO EARTHQUAKE FAULT ZONE MAP

Date 12/20/17 | Project No. 731706301 | Figure 5

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APPENDIX A

LOGS OF BORINGS

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-1

PAGE 1 OF 2

Boring location: See Site Plan, Figure 2
Logged by: H. Sok
Date started: 9/15/17
Date finished: 9/15/17
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Automatic
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)

DEPTH (feet)	SAMPLES Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION Ground Surface Elevation: 402 feet[2]	LABORATORY TEST DATA Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						3.5 inches asphalt concrete (AC)						
						6 inches aggregate base (AB)						
1 2 3 4	GRAB	☒			CL	SANDY CLAY with GRAVEL (CL) brown, moist, fine to coarse sand, fine to coarse subangular gravel						
5 6 7	S&H	■	12 20 31	36	CL	SANDY CLAY (CL) yellow-brown, hard, fine- to medium-grained sand, trace angular, fractured, oxidized gravel	PP		4,500		12.1	123
8 9	SPT	◩	10 18 22	48	SC	CLAYEY SAND with GRAVEL (SC) orange-brown, dense, moist, fine- to coarse-grained, fine oxidized sandstone gravel, chaotic structure Particle Size Analysis, see Appendix F				34.8	13.8	
10 11 12 13 14 15	SPT	◩	13 13 13	31		wet, increased crushed gravel					13.2	
16 17 18 19					CL	SANDY CLAY (CL) yellow to yellow-brown, very stiff, wet, fine-grained, trace coarse fractured angular fine to coarse gravel, black decomposing organics						
20 21 22 23 24 25 26 27 28 29 30	SPT	◩	6 10 11	25								

FILL

UNDIFFERENTIATED SURFICIAL DEPOSITS

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Project No.: 731706301
Figure: A-1a

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-1

PAGE 2 OF 2

DEPTH (feet)	SAMPLES: Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
31	SPT	◩	8 16 30	55	CL	CLAY with GRAVEL (CL) gray, hard, with fine subangular to subrounded shale gravel, abraded with polished surfaces				27.5	15.9	
32						SILTSTONE dark gray to black, moderately fractured, low hardness, friable, moderately to deeply weathered						
33												
34												
35												
36												
37												
38												
39												
40						GOUGE yellow-brown to gray, hard, with fine subangular shale and meta-sandstone gravel, lack of internal shearing in clay matrix, polished surfaces on gravel LL = 43, PI = 24, see Appendix F						
41	SPT	◩	14 18 25	52							12.0	
42												
43												
44												
45												
46	SPT	◩	10 21 29	60		occasional fine carbonate inclusions						
47												
48												
49												
50						gray to green-gray						
51	SPT	◩	20 26 28	65								
52												
53												
54												
55												
56												
57												
58												
59												
60												

Boring terminated at a depth of 51.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscure by drilling method.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively to account for sampler type and hammer energy.
[2] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

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Project No.: 731706301

Figure: A-1b

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-2

PAGE 1 OF 2

Boring location: See Site Plan, Figure 2
Date started: 9/15/17
Date finished: 9/15/17
Drilling method: Rotary Wash
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Automatic
Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)
Logged by: H. Sok

Ground Surface Elevation: 408.5 feet[2]

	SAMPLES							LABORATORY TEST DATA					
DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION		Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0						2 inches asphalt concrete (AC)							
						7 inches aggregate base (AB)	FILL						
1–3	S&H	■	6 12 12	17	CL	CLAY with SAND (CL) brown, very stiff, moist, fine sand, trace fine gravel, oxidized LL = 43, PI = 25, see Appendix F		PP		>4,500		14.2	118
5–6	S&H	■	6 9 11	14		grades sandy, brown to dark brown with white calcium carbonate and yellow brown mottling, stiff, oxidized fine sandstone gravel		PP		4,250	62.3	18.3	109
7–8	S&H	■	11 12 12	17		brown with light brown mottling, very stiff, fine to coarse sand, trace silt		PP		4,500			
9					GP	GRAVEL (GP) very dense							
10	SPT	◩	7 50/ 5.5"	60/ 5.5"	CL	SANDY CLAY (CL) brown to yellow-brown, hard, wet, fine sand, trace gravel, chaotic structure							
12.5					GL	CLAY with GRAVEL (CL) gray to yellow-brown, medium dense to dense, wet, subangular, coarse							
15	SPT	◩	8 12 13	30		Particle Size Analysis, see Appendix F					52.9	15.9	
15.5					CL	SANDY CLAY (CL) yellow-brown to gray-brown, very stiff, hard, wet, trace fine subangular to subrounded gravel, trace oxidation staining on gravel	UNDIFFERENTIATED SURFICIAL DEPOSITS						
20–21	S&H	■	6 12 6	13		yellow-brown with gray-brown mottling, stiff, trace dark brown spots, with deeply weathered fine sandstone gravel, occasional black staining Triaxial Test, see Appendix F		PP TxUU	 2,000	>4,500 3,440		20.0	108
25–26	S&H	■	13 18 22	28		very stiff, fine to coarse sand, trace fine subangular gravel, faint oxidation staining Consolidation Test, see Appendix F		PP		3,250		17.5	110
30	SPT	◩		20									
31													

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Project No.: 731706301
Figure: A-2a

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-2

PAGE 2 OF 2

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	LABORATORY TEST DATA: Confining Pressure Lbs/Sq Ft	LABORATORY TEST DATA: Shear Strength Lbs/Sq Ft	LABORATORY TEST DATA: Fines %	LABORATORY TEST DATA: Natural Moisture Content, %	LABORATORY TEST DATA: Dry Density Lbs/Cu Ft
	SPT	☐	8 13 15	20	CL	SANDY CLAY (CL) (continued) yellow-brown, fine angular to subangular siltstone gravel, faint oxidation staining, slightly chaotic structure						
32												
33						CLAYEY SAND (SC) yellow-brown, medium dense, wet						
34												
35						increased gravel, coarse, up to 1 inch in diameter, increased structure, transitioning to residual soil						
36	SPT	◩	12 18 18	20						31.1	13.0	
37												
38					SC							
39												
40						residual soil, dense						
41	SPT	◩	12 18 20	46								
42												
43												
44												
45						SILTSTONE dark gray, intensely fractrured, low hardness, friable, deeply weathered						
46	SPT	◩	11 12 14	31								
47												
48												
49						GOUGE yellow-brown to gray-brown, hard, siltstone/shale in clay matrix, abraded, polished surfaces						
50												
51	SPT	◩	11 18 28	55								
52												
53												
54												
55												
56	SPT	◩	16 13 21	41								
57						SERPENTINITE MELANGE intensely fractured, low hardness, weak , deeply weathered						
58												
59												
60												
61	SPT	◩	11 18 32	60								
62												

UNDIFFERENTIATED SURFICIAL DEPOSITS

Boring terminated at a depth of 51.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscure by drilling method.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively to account for sampler type and hammer energy.

[2] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

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Project No.: 731706301

Figure: A-2b

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-3

Boring location: See Site Plan, Figure 2

Logged by: H. Sok

Date started: 9/14/17

Date finished: 9/14/17

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30 inches

Hammer type: Automatic

Samplers: Sprague & Henwood (S&H), Standard Penetration Test (SPT)

DEPTH (feet)	SAMPLES				LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA					
	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]		Ground Surface Elevation: 398.5 feet[2]		Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						4 inches asphalt concrete (AC)							
1						CLAY with SAND and GRAVEL (CL) dark brown	FILL						
2						brown to yellow-brown, very stiff, moist, fine sand, coarse gravel							
3	S&H		6 16 14	21	CL			PP		>4,500			
4													
5													
6	S&H		7 7 5	8		yellow-brown with black and brown-red mottling, medium stiff to stiff, scattered organics		PP		3,400		17.2	111
7						wet							
8	SPT		50/ 2"	60/ 2"	GC	CLAYEY GRAVEL (GC) gray-brown, very dense, wet, dark brown-gray subrounded volcanic rock fragments							
9													
10						CLAY with SAND (CL) yellow-brown with gray-brown mottling, stiff, wet, fine to coarse sand, trace fine gravel							
11	S&H		4 7 13	14	CL	LL = 45, PI = 28, see Appendix F fine subangular silica-carbonate gravel, fragments of silty sandstone, gray gouge seams		PP		4,250		24.4	100
12													
13					GC	CLAYEY GRAVEL (GC) fractured rock							
14													
15						CLAYEY SAND with GRAVEL (SC) yellow-brown with dark brown mottling, dense, wet, fine- to coarse-grained, rock fragments highly fractured into fine to coarse gravel, black decomposed organic seams, scattered subrounded fine to coarse gravel, highly oxidized throughout, chaotic structure Particle Size Analysis, see Appendix F							
16	S&H		12 32 29	43	SC			PP		4,500	47.1	25.0	101
17													
18													
19						CLAY with GRAVEL (CL) yellow-brown with gray-brown mottling, very stiff, fine sand, trace coarse sand, abundant red decomposed sandstone clasts with oxidation staining Consolidation Test, see Appendix F	UNDIFFERENTIATED SURFICIAL DEPOSITS						
20													
21	S&H		13 13 22	25				PP		4,250		19.2	109
22													
23													
24					CL								
25													
26	S&H		11 19 37	39		hard, trace coarse gravel, highly oxidized and decomposed sandstone fragments		PP TxUU	 2,300	4,500 5,270		 16.5	 114
27						Triaxial Test, see Appendix F							
28													
29													
30													

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PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-3

DEPTH (feet)	SAMPLES: Run Number	SAMPLES: Sample Type	SAMPLES: SPT N-Value^1	SAMPLES: Recovery, %	SAMPLES: RQD, %	Drilling Rate (min/ft)	LITHOLOGY	MATERIAL DESCRIPTION	TEST DATA: Dip, Degrees	TEST DATA: Fines %	TEST DATA: Natural Moisture Content, %	TEST DATA: Dry Density Lbs/Cu Ft
31			39				CL	SANDY CLAY with GRAVEL (CL) yellow, hard, coarse sand, trace coarse gravel up to 1 inch in length PP (Su >4,500 psf)				
32												
33							CL	CLAY with SAND (CL) gray and dark brown, very stiff, wet, coarse sand, trace fine gravel				
34												
35								PP (Su > 4,500 psf)				
36			25					yellow-brown to red-black serpentinite fragments, fine rounded to subangular gravel, decomposed red sandstone and fresh black meta shale			16.6	115
37			55					Triaxial Test, see Appendix F (Su = 2,960 psf)				
38								red-brown, hard				
39							GP	CLAYEY GRAVEL (GP) yellow-brown to gray with hard, strong black meta sandstone, dense, wet				
40			60/ 3"									
41	1			87.5	0	22						
42	2			87.5	0	5.5						
43							CL	CLAY with SAND (CL) yellow-brown, coarse sand				
44								SHALE MELANGE yellow-brown to gray, moderately fractured, moderately hard, weak, deeply weathered				
45												
46												
47												
48												
49												
50												
51												
52							△	BRECCIA yellow to yellow-brown with orange oxidation staining, low hardness, friable, deeply weathered, variable grain size and composition set in soft and plastic clayey matrix, variable sand content in matrix				
53												
54	3			80	0	2.5						
55												
56												
57								decreased structure and decreased matrix, strong orange oxidation staining, graywacke sandstone inclusion, moderately hard to hard, strong, oxidized pockets				
58	4			24	0	2.4						
59												
60												

UNDIFFERENTIATED SURFICIAL DEPOSITS

LANGAN

Project No.: 731706301
Figure: A-3b

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring B-3

DEPTH (feet)	SAMPLES: Run Number	SAMPLES: Sample Type	SAMPLES: SPT N-Value[1]	SAMPLES: Recovery, %	SAMPLES: RQD, %	Drilling Rate (min/ft)	LITHOLOGY	MATERIAL DESCRIPTION	TEST DATA: Dip, Degrees	TEST DATA: Fines %	TEST DATA: Natural Moisture Content, %	TEST DATA: Dry Density Lbs/Cu Ft
							△	BRECCIA (continued)				
61							△ △	no recovery				
62	5	●		0	0	3.2	△ △					
63							△ △					
64	6			50	0	20	△ △	gray, moderately hard, moderately strong to strong, little weathered calcite deposits along surfaces				
65			88/ 8"				△ △					
66												
67												
68												
69												
70												
71												
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Boring terminated at a depth of 65.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscure by drilling method.
PP = pocket penetrometer.

[1] S&H and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively to account for sampler type and hammer energy.

[2] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

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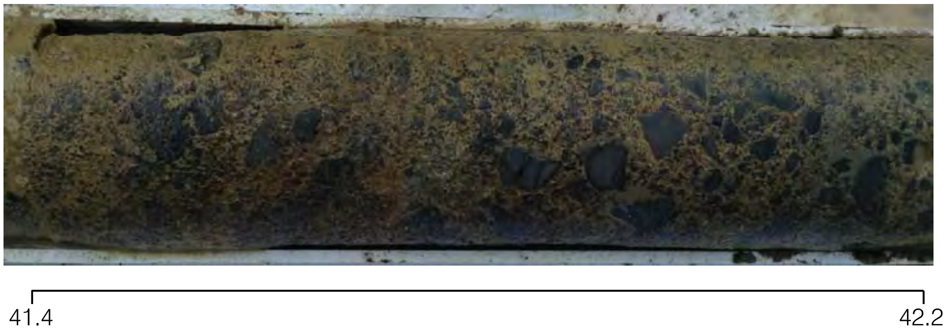
Project No.: 731706301
Figure: A-3c

Run 1: 40.2 to 41 feet (segment from 40.2 to 40.9 feet)

Run 2: 41 to 43 feet (segment from 41 to 41.6 feet)



Run 2: 41 to 43 feet (segment from 41.4 to 42.2 feet)

Run 2: 41 to 43 feet (segment from 42.1 to 42.75 feet)

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BORING B-3 PHOTOS

Date 03/01/17 | Project No. 731706301 | Figure A-3d

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Run 3: 52 to 56 feet (segment from 52 to 52.5 feet)

Run 3: 52 feet to 56 feet (segment from 52.2 to 53.15 feet)

Run 3: 52 to 56 feet (segment from 53.2 to 54.3 feet)

Run 3: 52 to 56 feet (segment from 54.2 to 55.2 feet)

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BORING B-3 PHOTOS

Date 03/01/17 | Project No. 731706301 | Figure A-3e

Run 4: 56 to 61 feet (segment from 56 to 56.7 feet)

Run 4: 56 to 61 feet (segment from 56.35 to 57.2 feet)

Run 5: 61 to 63.5 (no recovery)

Run 6: 63.5 to 64 feet

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BORING B-3 PHOTOS

Date 03/01/17	Project No. 731706301	Figure A-3f

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size	**Gravels** (More than half of coarse fraction > no. 4 sieve size)	**GW**	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	**SW**	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	**Silts and Clays** LL = < 50	**ML**	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	**MH**	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		**PT**	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.075
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.075
Silt and Clay	Below No. 200	Below 0.075

▽ Unstabilized groundwater level

▼ Stabilized groundwater level

SAMPLE DESIGNATIONS/SYMBOLS

⬒	Sample taken with Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter. Darkened area indicates soil recovered
◩	Classification sample taken with Standard Penetration Test sampler
◨	Undisturbed sample taken with thin-walled tube
☒	Disturbed sample
⊡	Sampling attempted with no recovery
◫	Core sample
▣	Analytical laboratory sample
▥	Sample taken with Direct Push or Drive sampler

SAMPLER TYPE

C	Core barrel
CA	California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter
D&M	Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube
O	Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube
PT	Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube
S&H	Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter
SPT	Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter
ST	Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

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CLASSIFICATION CHART

Date 09/22/17 | Project No. 731706301 | Figure A-4

I FRACTURING

Intensity	Size of Pieces in Feet
Very little fractured	Greater than 4.0
Occasionally fractured	1.0 to 4.0
Moderately fractured	0.5 to 1.0
Closely fractured	0.1 to 0.5
Intensely fractured	0.05 to 0.1
Crushed	Less than 0.05

II HARDNESS

1. **Soft** - reserved for plastic material alone.
2. **Low hardness** - can be gouged deeply or carved easily with a knife blade.
3. **Moderately hard** - can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visible after the powder has been blown away.
4. **Hard** - can be scratched with difficulty; scratch produced a little powder and is often faintly visible.
5. **Very hard** - cannot be scratched with knife blade; leaves a metallic streak.

III STRENGTH

1. **Plastic** or very low strength.
2. **Friable** - crumbles easily by rubbing with fingers.
3. **Weak** - an unfractured specimen of such material will crumble under light hammer blows.
4. **Moderately strong** - specimen will withstand a few heavy hammer blows before breaking.
5. **Strong** - specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.
6. **Very strong** - specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

IV WEATHERING - The physical and chemical disintegration and decomposition of rocks and minerals by natural processes such as oxidation, reduction, hydration, solution, carbonation, and freezing and thawing.

D. **Deep** - moderate to complete mineral decomposition; extensive disintegration; deep and thorough discoloration; many fractures, all extensively coated or filled with oxides, carbonates and/or clay or silt.

M. **Moderate** - slight change or partial decomposition of minerals; little disintegration; cementation little to unaffected. Moderate to occasionally intense discoloration. Moderately coated fractures.

L. **Little** - no megascopic decomposition of minerals; little of no effect on normal cementation. Slight and intermittent, or localized discoloration. Few stains on fracture surfaces.

F. **Fresh** - unaffected by weathering agents. No disintegration of discoloration. Fractures usually less numerous than joints.

ADDITIONAL COMMENTS:

V CONSOLIDATION OF SEDIMENTARY ROCKS: usually determined from unweathered samples. Largely dependent on cementation.

U = unconsolidated
P = poorly consolidated
M = moderately consolidated
W = well consolidated

VI BEDDING OF SEDIMENTARY ROCKS

Splitting Property	Thickness	Stratification
Massive	Greater than 4.0 ft.	very thick-bedded
Blocky	2.0 to 4.0 ft.	thick bedded
Slabby	0.2 to 2.0 ft.	thin bedded
Flaggy	0.05 to 0.2 ft.	very thin-bedded
Shaly or platy	0.01 to 0.05 ft.	laminated
Papery	less than 0.01	thinly laminated

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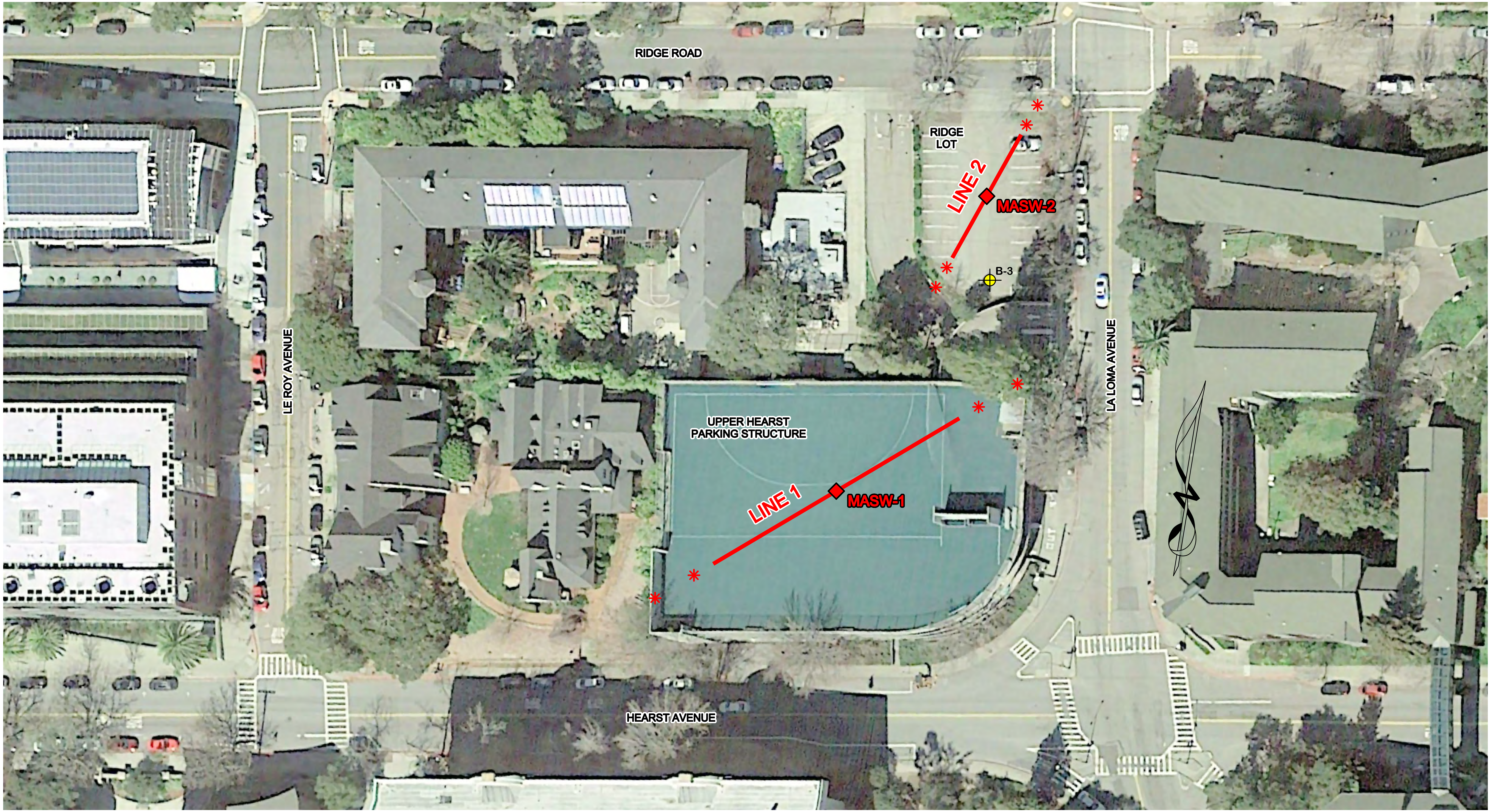
PHYSICAL PROPERTIES CRITERIA FOR ROCK DESCRIPTIONS

Date 09/25/17 | Project No. 731706301 | Figure A-5

APPENDIX B

GEOPHYSICAL TEST RESULTS



LEGEND

▬	SEISMIC REFRACTION LINE
◆	MASW SOUNDING LOCATION
✳	MASW SHOT POINT
⊕	DOWNHOLE SEISMIC BOREHOLE

SCALE
0 25 50 100
(1 inch = 50 feet)

NORCAL
GEOPHYSICAL CONSULTANTS INC.
A Terracon COMPANY

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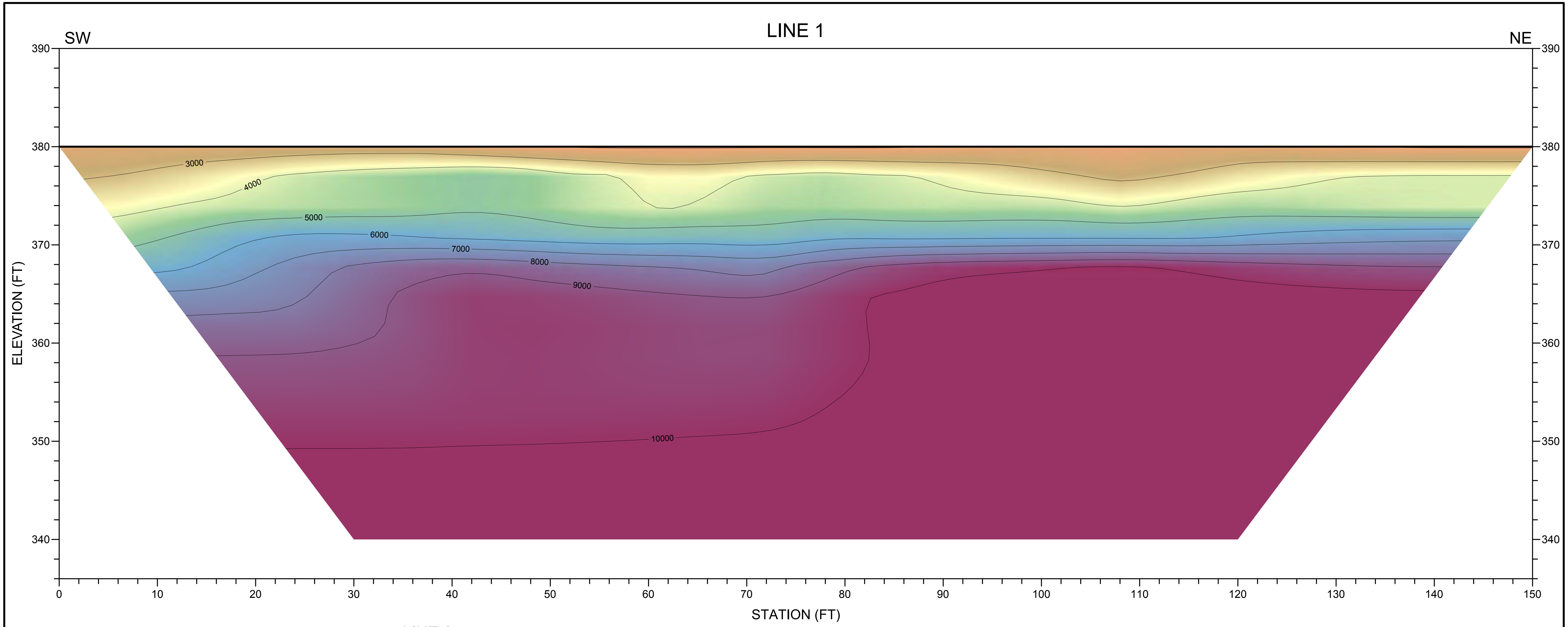
REGISTERED GEOPHYSICIST
WILLIAM J. HENRICH
No. 893
STATE OF CALIFORNIA

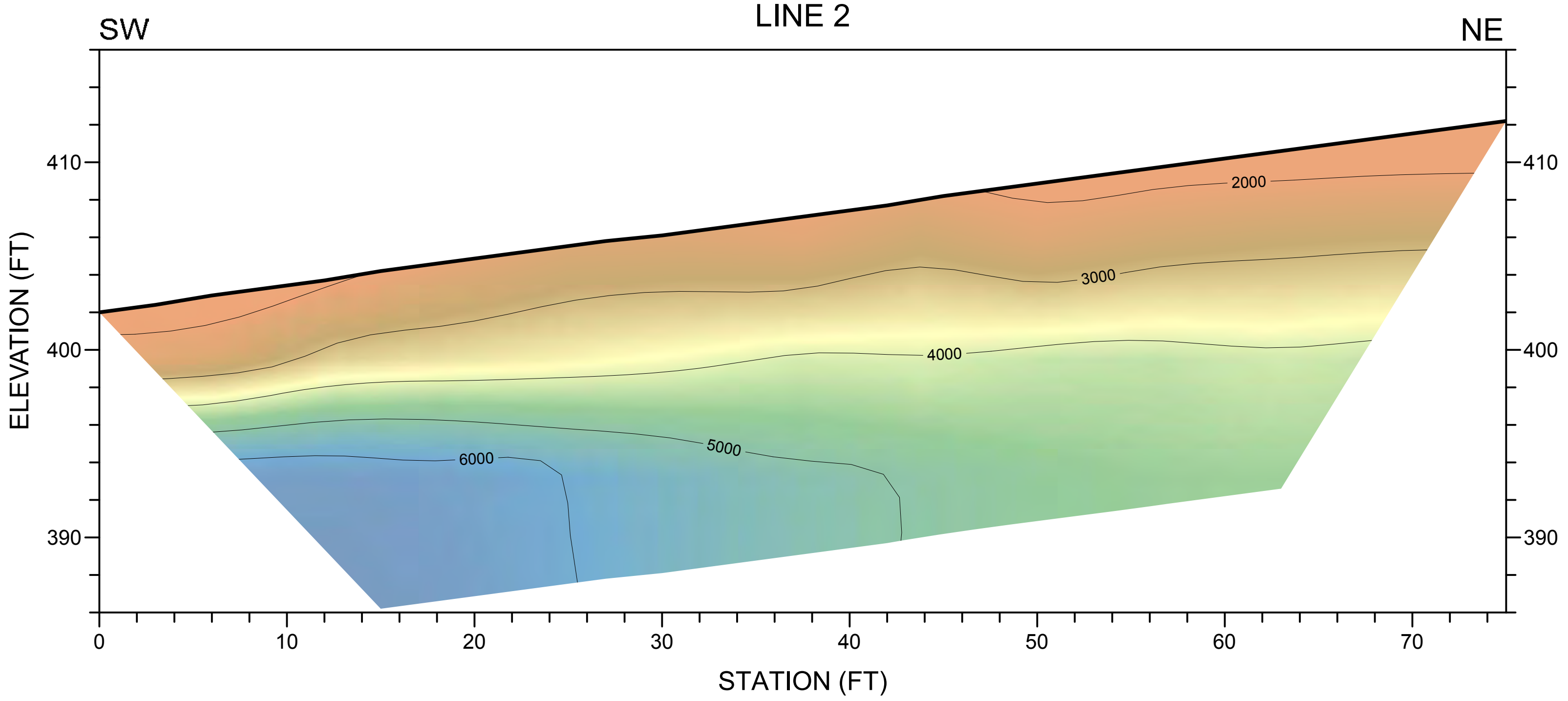
SITE LOCATION MAP
HEARST-LA LOMA PARKING FACILITIES
SURFACE & DOWNHOLE SEISMIC SURVEY

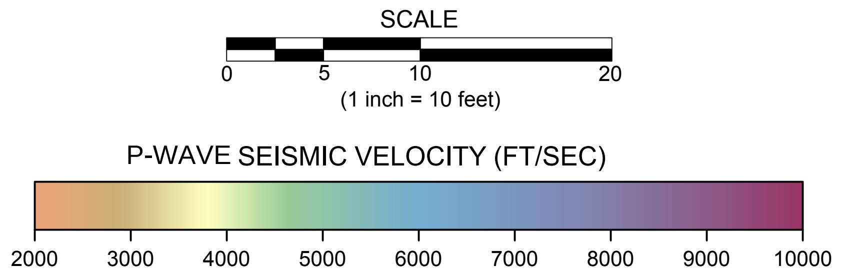
LOCATION: BERKELEY, CALIFORNIA

CLIENT: LANGAN

JOB #. NS175052	DATE: OCTOBER 2017	PLATE 1
DRAWN BY: G.RANDALL	APPROVED BY: WJH	
William J Henrich 10/16/2017		







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WILLIAM J. HENRICH
No. 893

SEISMIC REFRACTION PROFILES
LINES 1 & 2
HEARST-LA LOMA PARKING FACILITIES

LOCATION: BERKELEY, CALIFORNIA

CLIENT: LANGAN

JOB #: NS175052

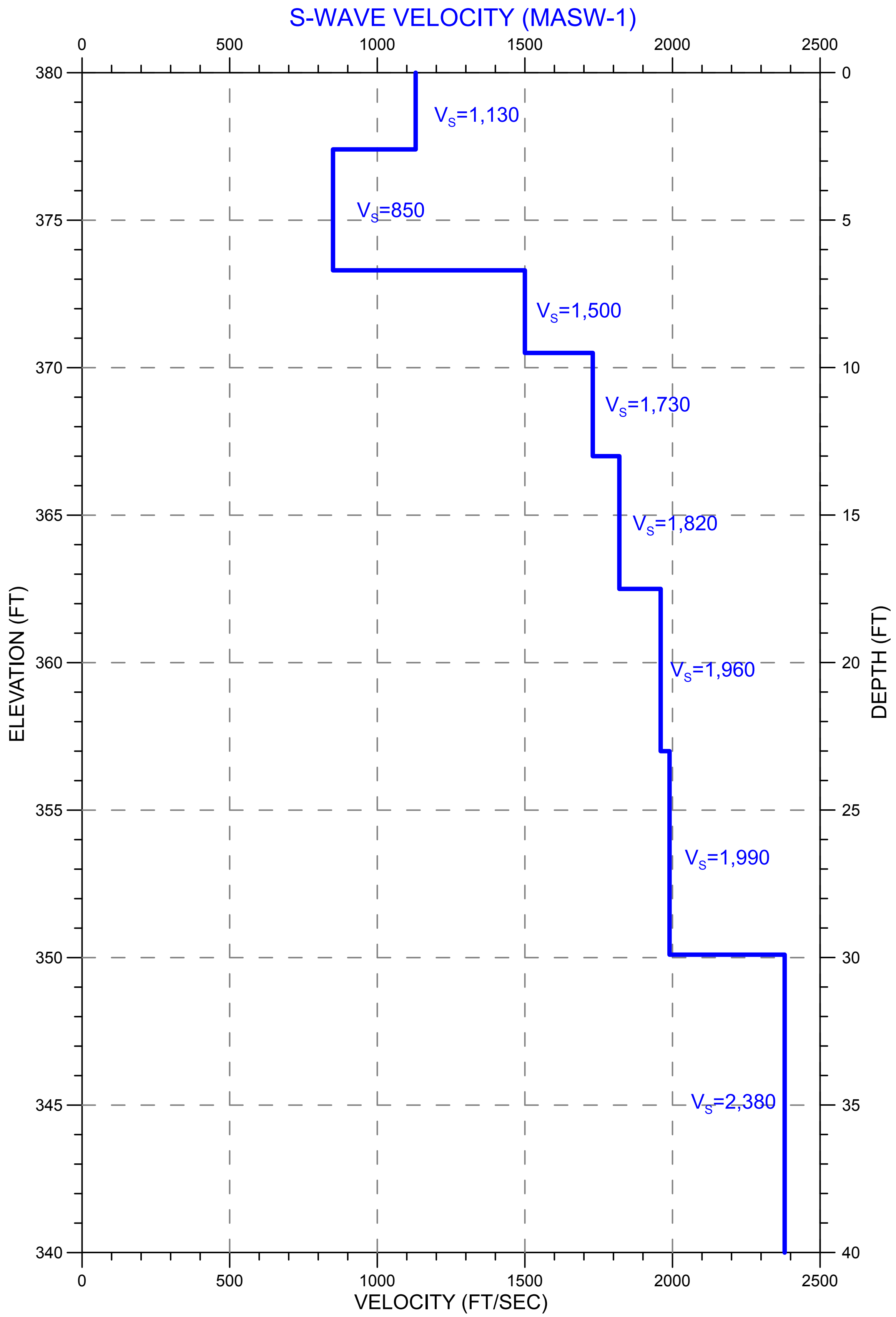
DATE: OCTOBER 2017

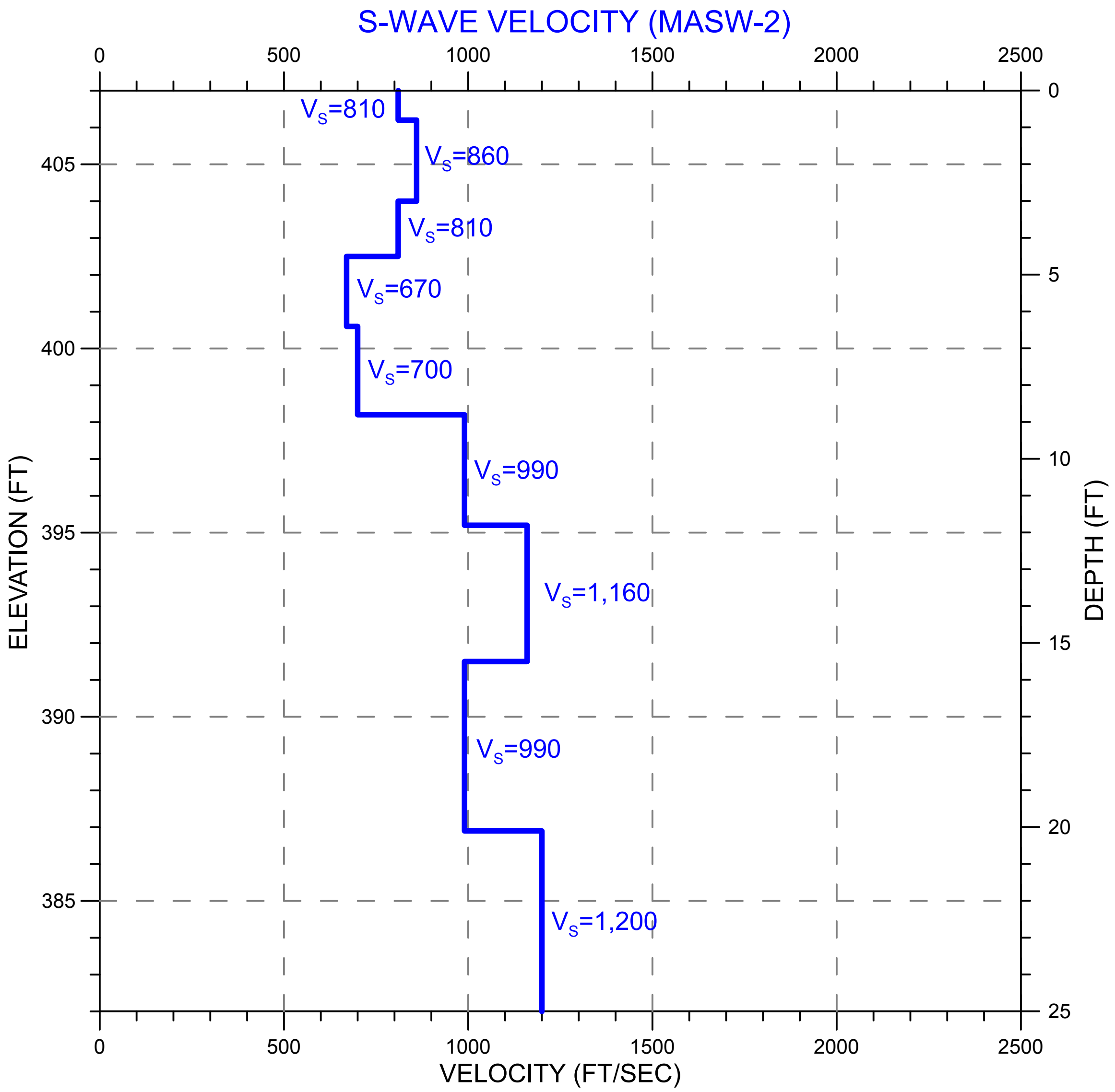
DRAWN BY: G.RANDALL

APPROVED BY: WJH

William J Henrich 10/16/2017

PLATE
2





LEGEND	
▬	S-WAVE VELOCITY (MASW)

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REGISTERED GEOPHYSICIST
WILLIAM J. HENRICH
No. 893
STATE OF CALIFORNIA

MASW 1D S-WAVE VELOCITY SOUNDINGS
MASW 1 & MASW 2
HEARST-LA LOMA PARKING FACILITIES

LOCATION: BERKELEY, CALIFORNIA
CLIENT: LANGAN
JOB #: NS175052
DATE: OCTOBER 2017
DRAWN BY: G.RANDALL
APPROVED BY: WJH
William J. Henrich 10/16/2017
PLATE
3

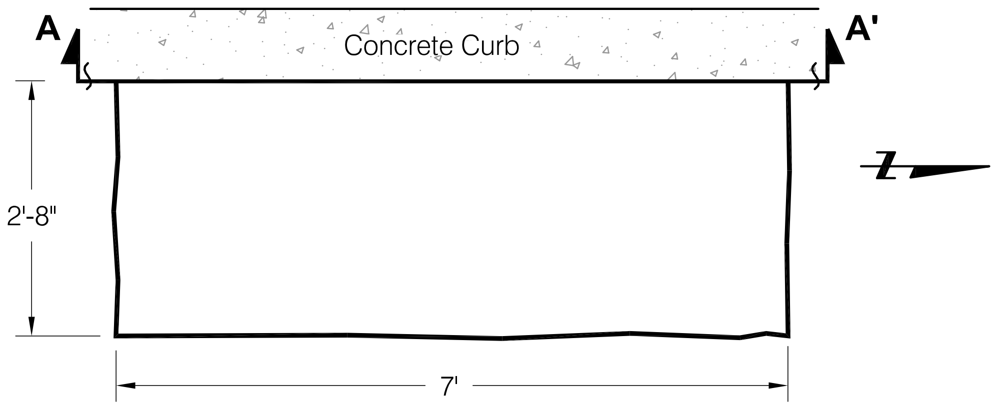
Table 1: Borehole B-3, P- and S-wave Velocity Table

METRIC UNITS DEPTHS & INTERVAL VELOCITIES					IMPERIAL UNITS DEPTHS AND INTERVAL VELOCITIES						
Depth	VsLeft	VsRight	VsAvg	Vp	Depth	VsLeft	VsRight	VsAvg	Vp	VsAvg-3pt	Vp -3pt
Meters	M/sec.	M/sec.	M/sec.	M/sec.	Feet	Ft./sec.	Ft./sec.	Ft./sec.	Ft./sec.	Ft./sec.	Ft./sec.
3.65	296	298	297	1799	11.96	971	976	974	5867		
4.27	305	309	307	1852	14.02	1000	1013	1006	6039	958	5790
4.35	268	277	272	1676	14.26	879	908	893	5465	1013	5793
4.89	342	352	347	1802	16.06	1124	1155	1139	5875	1036	5623
4.91	318	338	328	1695	16.12	1043	1108	1076	5527	1052	5777
5.49	284	289	287	1818	18.00	932	948	940	5929	985	5610
5.50	282	291	286	1648	18.03	925	954	939	5375	986	5797
6.09	327	331	329	1866	19.98	1072	1086	1079	6086	1033	5750
6.13	338	321	329	1775	20.10	1108	1052	1080	5789	1065	5990
6.72	313	318	315	1869	22.06	1025	1045	1035	6095	1058	5825
6.80	325	321	323	1714	22.31	1065	1052	1058	5590	1033	5927
7.01	303	311	307	1869	23.01	994	1019	1007	6095	1084	5848
7.11	355	368	362	1796	23.34	1166	1206	1186	5858	1103	5955
7.25	338	342	340	1813	23.79	1108	1124	1116	5911	1145	5911
7.27	357	333	345	1829	23.84	1172	1094	1133	5965	1127	5990
7.33	350	341	345	1869	24.04	1149	1117	1133	6095	1134	6027
7.55	350	342	346	1846	24.78	1150	1124	1137	6020	1142	6067
7.61	357	347	352	1866	24.96	1172	1139	1155	6086	1107	6018
7.88	321	306	313	1824	25.84	1052	1004	1028	5947	1082	6024
7.93	342	305	324	1852	26.03	1124	1000	1062	6039	1066	5933
7.96	341	334	338	1783	26.13	1120	1097	1109	5814	1141	5892
8.23	382	382	382	1786	27.00	1252	1252	1252	5823	1232	5855
8.54	403	410	407	1818	28.01	1323	1345	1334	5929	1312	5994
8.57	419	403	411	1911	28.12	1375	1323	1349	6231	1348	6104
8.85	413	417	415	1887	29.04	1356	1367	1361	6153	1382	6153
9.13	431	444	437	1863	29.94	1414	1456	1435	6076	1393	6127
9.16	424	418	421	1887	30.04	1390	1373	1381	6153	1413	6071
9.44	446	420	433	1835	30.98	1465	1379	1422	5983	1423	5983
9.76	446	446	446	1783	32.01	1465	1465	1465	5814	1404	5945
9.76	408	401	404	1852	32.02	1337	1316	1327	6039	1430	5945
10.10	463	450	457	1835	33.15	1519	1478	1498	5983	1458	5981
10.38	467	476	472	1815	34.04	1533	1562	1548	5920	1383	6019

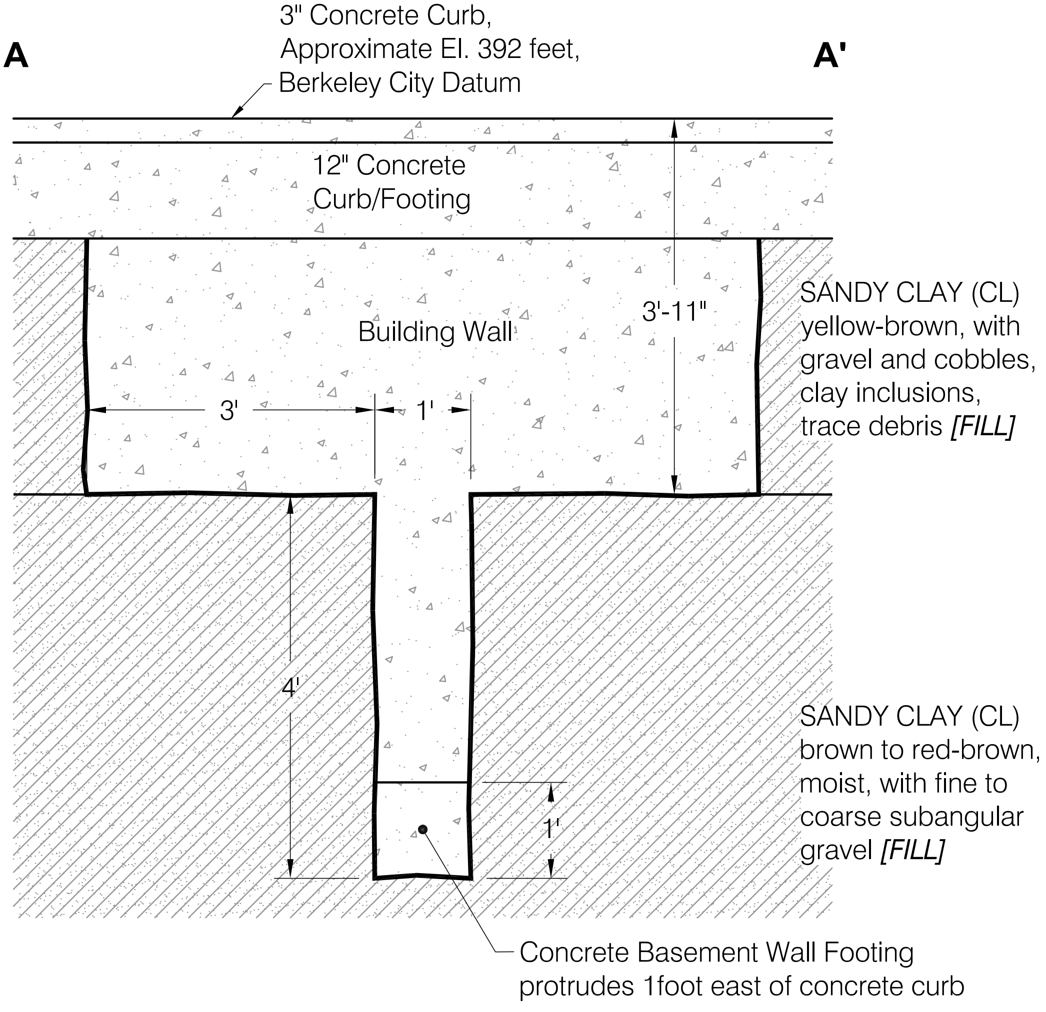
10.39	338	335	336	1887	34.08	1108	1099	1103	6153	1372	6072
10.67	452	441	447	1884	35.02	1485	1445	1465	6143	1310	6022
10.96	413	417	415	1770	35.96	1356	1367	1361	5772	1366	5960
11.00	379	397	388	1829	36.10	1243	1302	1272	5965	1373	5803
11.30	459	446	453	1739	37.07	1505	1465	1485	5671	1284	5930
11.58	326	341	333	1887	38.00	1070	1118	1094	6153	1373	5973
11.64	472	467	469	1869	38.18	1548	1533	1540	6095	1334	6041
11.91	424	410	417	1802	39.09	1390	1345	1367	5875	1324	5979
12.20	328	321	324	1829	40.03	1075	1052	1063	5965	1278	5902
12.22	427	427	427	1799	40.09	1402	1402	1402	5867	1328	5957
12.50	459	467	463	1852	41.02	1505	1533	1519	6039	1559	5930
12.51	521	549	535	1805	41.06	1709	1803	1756	5884	1616	5972
12.79	482	477	479	1838	41.95	1580	1565	1572	5992	1588	5972
12.82	437	439	438	1852	42.07	1433	1439	1436	6039	1514	6084
13.12	476	459	467	1908	43.03	1562	1505	1534	6221	1493	6118
13.12	461	459	460	1869	43.05	1512	1505	1508	6095	1500	6279
13.41	446	442	444	2000	44.01	1465	1452	1458	6522	1505	6424
13.41	467	476	472	2041	44.01	1533	1562	1548	6655	1478	6545
13.70	431	439	435	1980	44.96	1414	1439	1427	6457	1476	6523
13.73	446	441	443	1980	45.06	1465	1445	1455	6457	1497	6523
14.03	495	485	490	2041	46.04	1624	1593	1608	6655	1512	6523
14.05	443	455	449	1980	46.09	1454	1494	1474	6457	1541	6612
14.34	476	463	470	2062	47.05	1562	1519	1541	6724	1580	6612
14.34	532	521	526	2041	47.05	1745	1709	1727	6655	1662	6724
14.63	538	510	524	2083	48.01	1764	1674	1719	6794	1704	6724
14.64	505	510	508	2062	48.03	1657	1674	1665	6724	1729	6818
14.96	546	552	549	2128	49.07	1793	1813	1803	6938	1811	6917
14.97	602	595	599	2174	49.10	1976	1953	1965	7089	1892	6984
15.24	588	575	581	2124	50.01	1930	1886	1908	6926	1862	6984
15.25	515	529	522	2128	50.04	1691	1736	1714	6938	1737	6959
15.45	483	485	484	2151	50.70	1585	1593	1589	7013	1744	6959
15.47	581	595	588	2124	50.75	1907	1953	1930	6926		

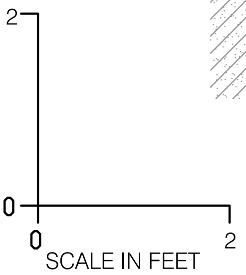
APPENDIX C

LOGS OF TEST PITS



PLAN VIEW





ELEVATION A - A'

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LOG OF TEST PIT
TP-1

Date 09/25/17	Project No. 731706301	Figure C-1

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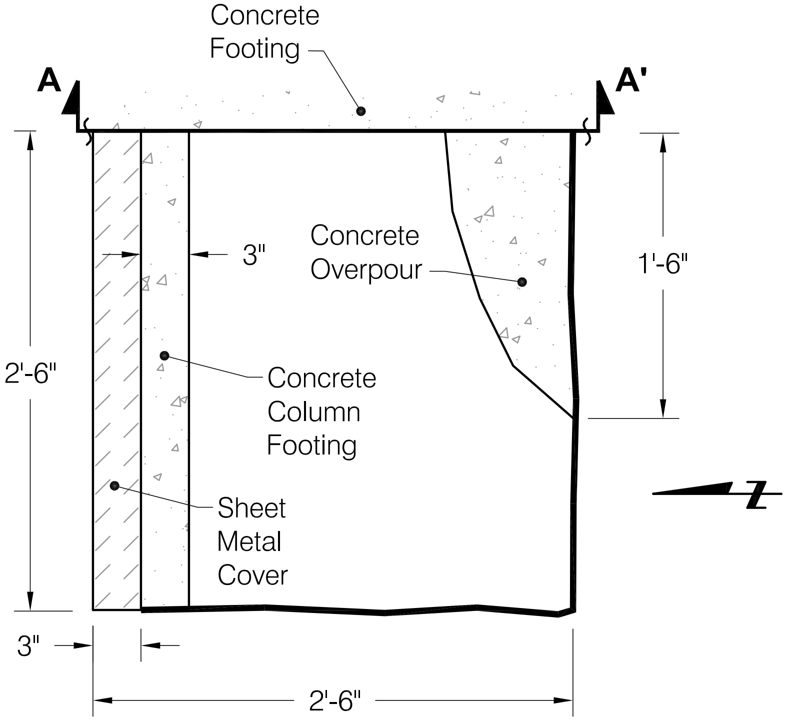
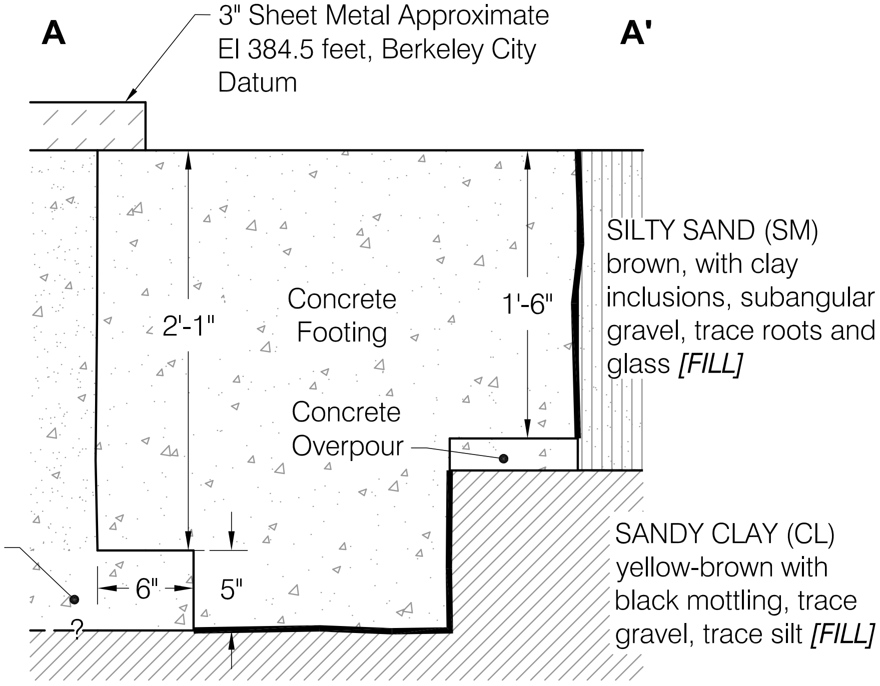
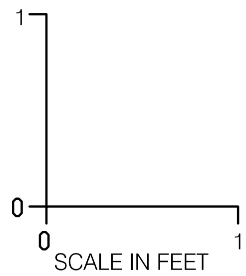


PLAN VIEW





ELEVATION A - A'

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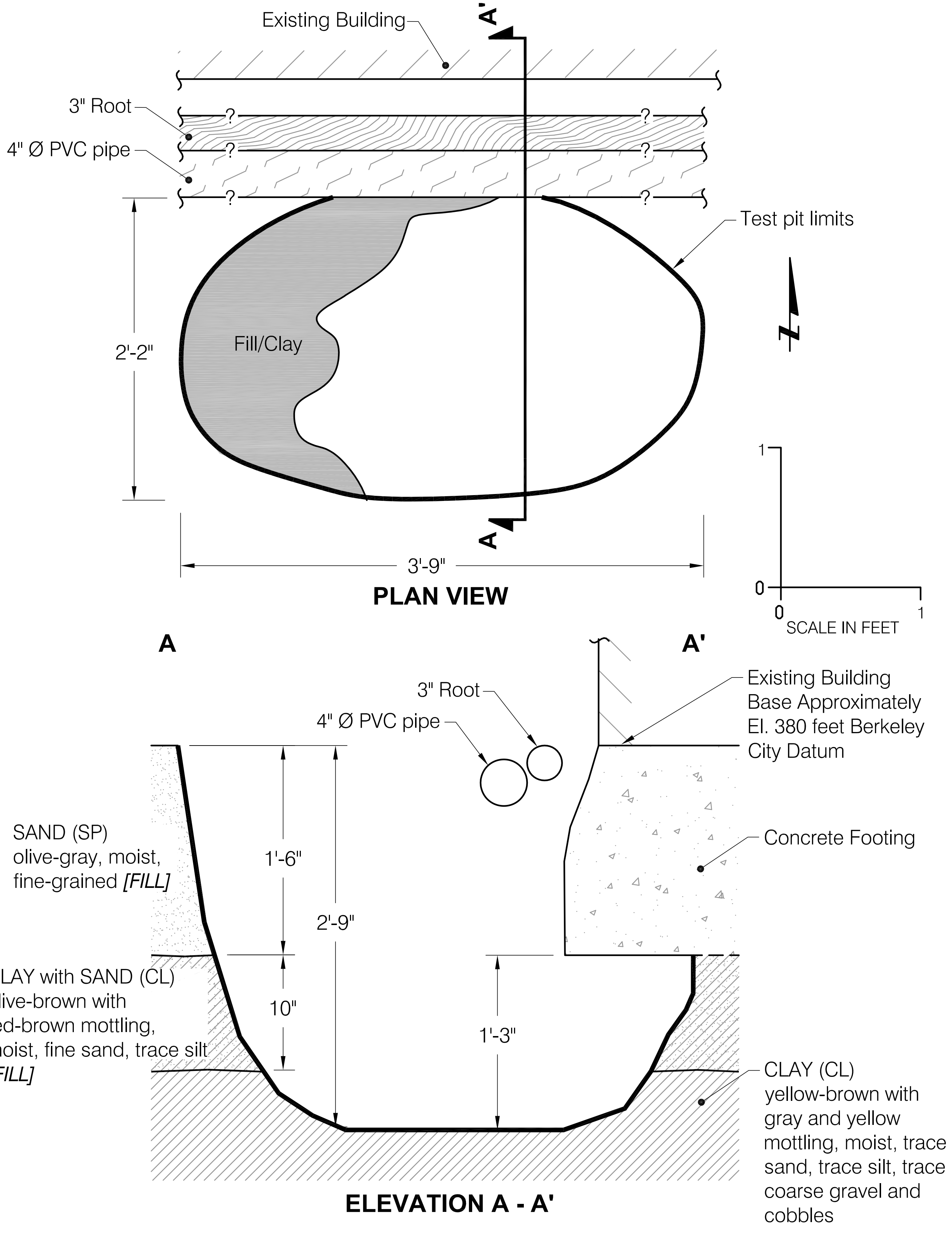
LANGAN

LOG OF TEST PIT
TP-2

Date 09/25/17 | Project No. 731706301 | Figure C-2

\\langan.com\data\SFO\data3\731706301\Project Data\CAD\01\2D-DesignFiles\Geotechnical\731706301-B-XS0101.dwg 12/21/17



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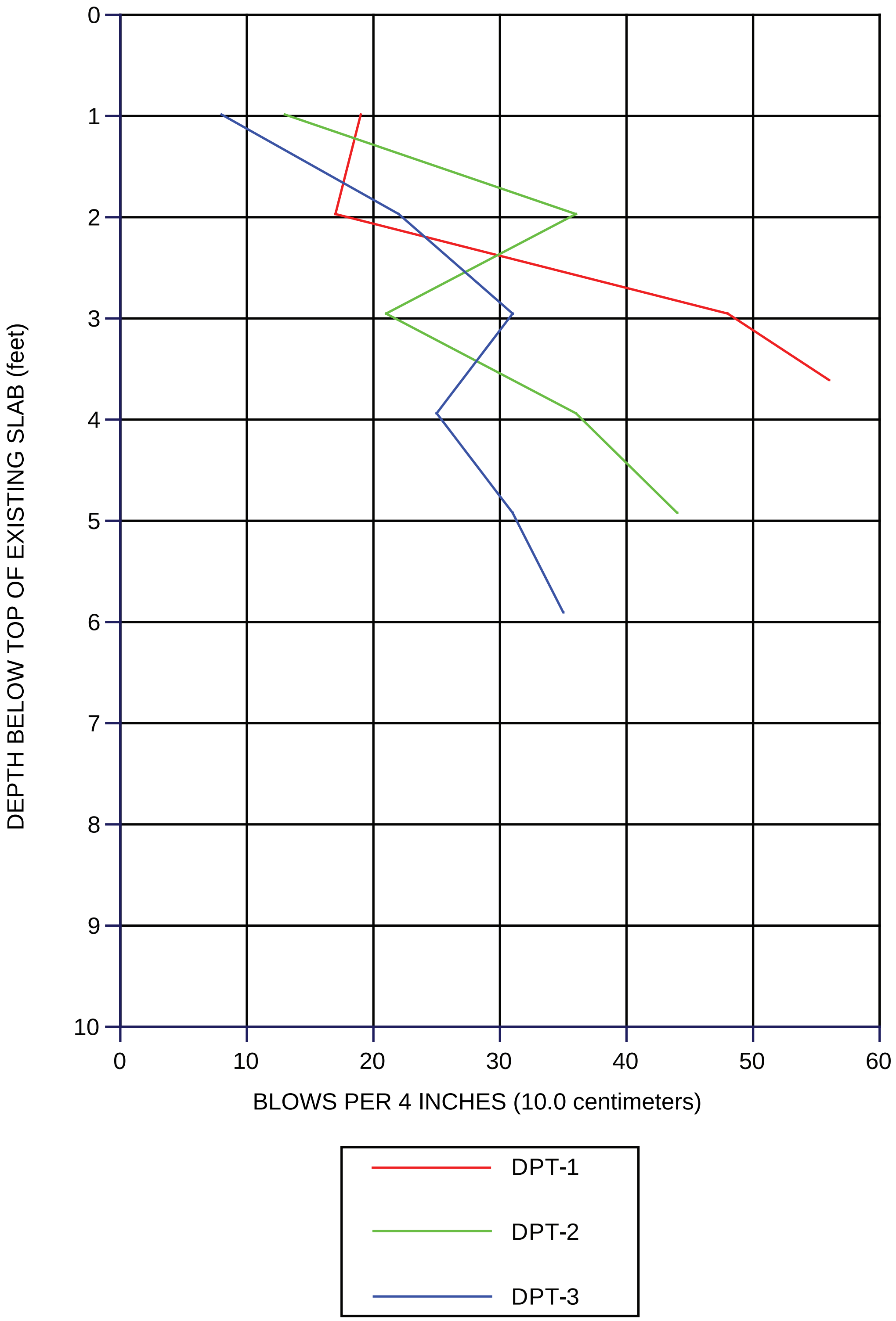
LOG OF TEST PIT
TP-3

Date 09/25/17 | Project No. 731706301 | Figure C-3

\\langan.com\data\SFO\data3\731706301\Project Data\CAD\01\2D-DesignFiles\Geotechnical\731706301-B-XS0101.dwg 12/21/17

APPENDIX D

DYNAMIC PENETROMETER TESTS



Notes:

1. Depth of zero feet on graph corresponds to top of existing ground surface.

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LANGAN

DYNAMIC PENETROMETER TESTS
DPT-1 TO DPT-3

Date 01/19/18 | Project No. 731706301 | Figure D-1

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring DPT-1

PAGE 1 OF 1

Boring location: See Site Plan, Figure 2

Logged by: C. Leege

Date started: 12/22/17

Date finished: 12/22/17

Drilling method: Hand Auger

Hammer weight/drop: NA

Hammer type: NA

Samplers: Hand Auger

	SAMPLES						LABORATORY TEST DATA					
DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						5 inches concrete						
1		☒		19	GP	GRAVEL (GP) gray, medium dense, moist, coarse, subangular to angular						
2	BULK			17	CL	SANDY CLAY (CL) gray to yellow-brown, hard, moist, fine to coarse-grained sand, with some fine to coarse subangular gravel up to 1.5 inches in diameter						
3				48 56								
4												
5												
6												
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Boring terminated at a depth of 4 feet below ground surface.
Boring backfilled with cuttings.
Groundwater not encountered during drilling.
SPT N values (blows per foot) were converted from Dynamic Penetration Test (DPT) blow counts (blows per 10cm) using the Dutch Formula.

[1] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

LANGAN

Project No.: 731706301

Figure: D-2

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring DPT-2

PAGE 1 OF 1

Boring location: See Site Plan, Figure 2

Date started: 12/22/17

Date finished: 12/22/17

Drilling method: Hand Auger

Hammer weight/drop: NA

Hammer type: NA

Samplers: Hand Auger

Logged by: C. Leege

	SAMPLES						LABORATORY TEST DATA					
DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value^1	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						7 inches concrete						
1				13	GP	GRAVEL (GP) gray, medium dense, coarse, angular						
2	BULK	☒		36	CL-CH	CLAY (CL/CH) olive-gray with red-brown and dark brown mottling, moist, very stiff, with some fine gravel LL = 50, PI = 31, see Appendix F					18.5	
3				21								
4	BULK	☒		36	CL	SANDY CLAY (CL) red-brown, hard, moist, some fine to coarse subangular to angular gravel Partical Size Analysis, see Appendix F				59.0	18.3	
5				44								
6												
7												
8												
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Boring terminated at a depth of 5.3 feet below ground surface.
Boring backfilled with cuttings.
Groundwater not encountered during drilling.
SPT N values (blows per foot) were converted from Dynamic Penetration Test (DPT) blow counts (blows per 10cm) using the Dutch Formula.

[1] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

LANGAN

Project No.: 731706301

Figure: D-3

PROJECT: **UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING**
Berkeley, California

Log of Boring DPT-3

PAGE 1 OF 1

Boring location: See Site Plan, Figure 2
Logged by: C. Leege
Date started: 12/22/17
Date finished: 12/22/17
Drilling method: Hand Auger
Hammer weight/drop: NA
Hammer type: NA
Samplers: Hand Auger

DEPTH (feet)	SAMPLES Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
						6 inches concrete						
1	BULK	☒		8	GP	GRAVEL (GP) gray, medium dense to dense, moist, fine to coarse, some medium to coarse sand, trace clay						
2				22								
3	BULK	☒		31	CL	SANDY CLAY (CL) yellow-brown, very stiff, moist, fine sand				64.4	16.5	
4				25	CL-CH	CLAY with SAND (CL/CH) red-brown, hard, moist, trace fine gravel LL = 50, PI = 32, see Appendix F						
5	BULK	☒		31							17.6	
6				35								
7												
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Boring terminated at a depth of 5 feet below ground surface.
Boring backfilled with cuttings.
Groundwater not encountered during drilling.
SPT N values (blows per foot) were converted from Dynamic Penetration Test (DPT) blow counts (blows per 10cm) using the Dutch Formula.

[1] Elevations based on the City of Berkeley Datum and the Parking Structure "H" Topo drawing by David J. Russell, Land Surveyor, dated 03/69, by the Universtiy of California.

LANGAN

Project No.: 731706301
Figure: D-4

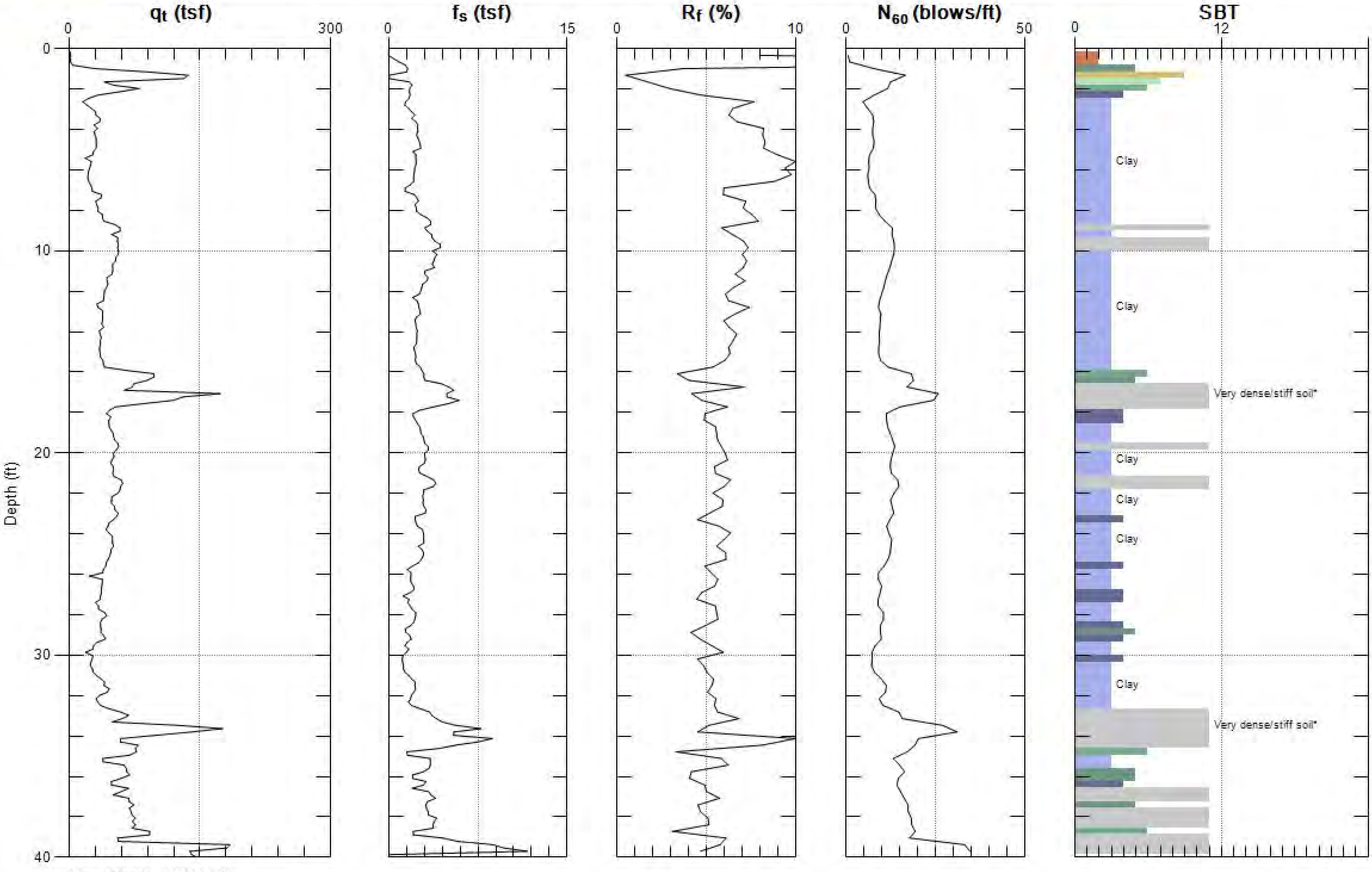
APPENDIX E

CONE PENETRATION TESTS

GREGG **LANGAN**

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-01 **Date: 12/21/17 09:55**



Max. Depth: 40.026 (ft)
Avg. Interval: 0.328 (ft)

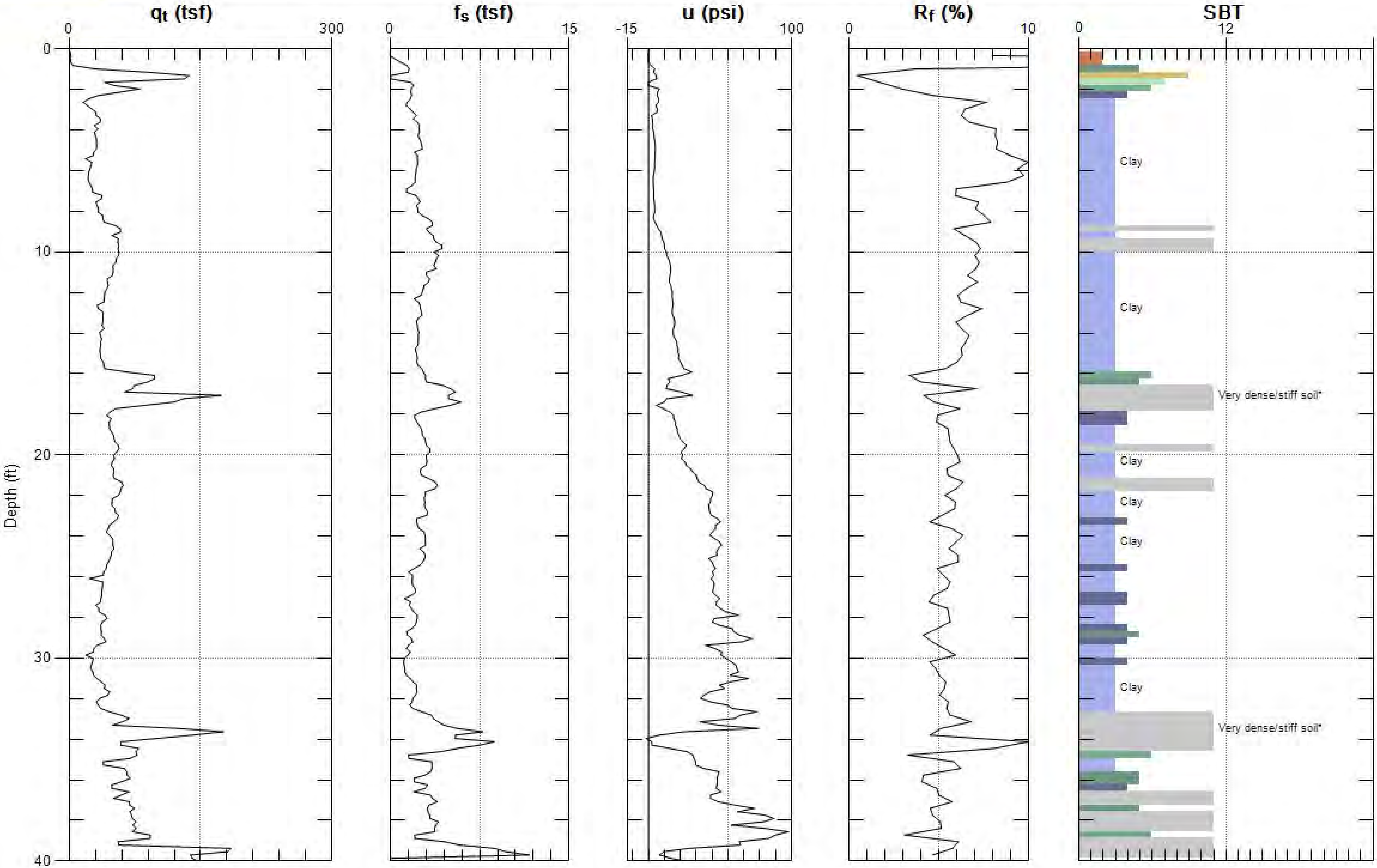
SBT: Soil Behavior Type (Robertson 1990)

GREGG

LANGAN

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-01 **Date: 12/21/17 09:55**



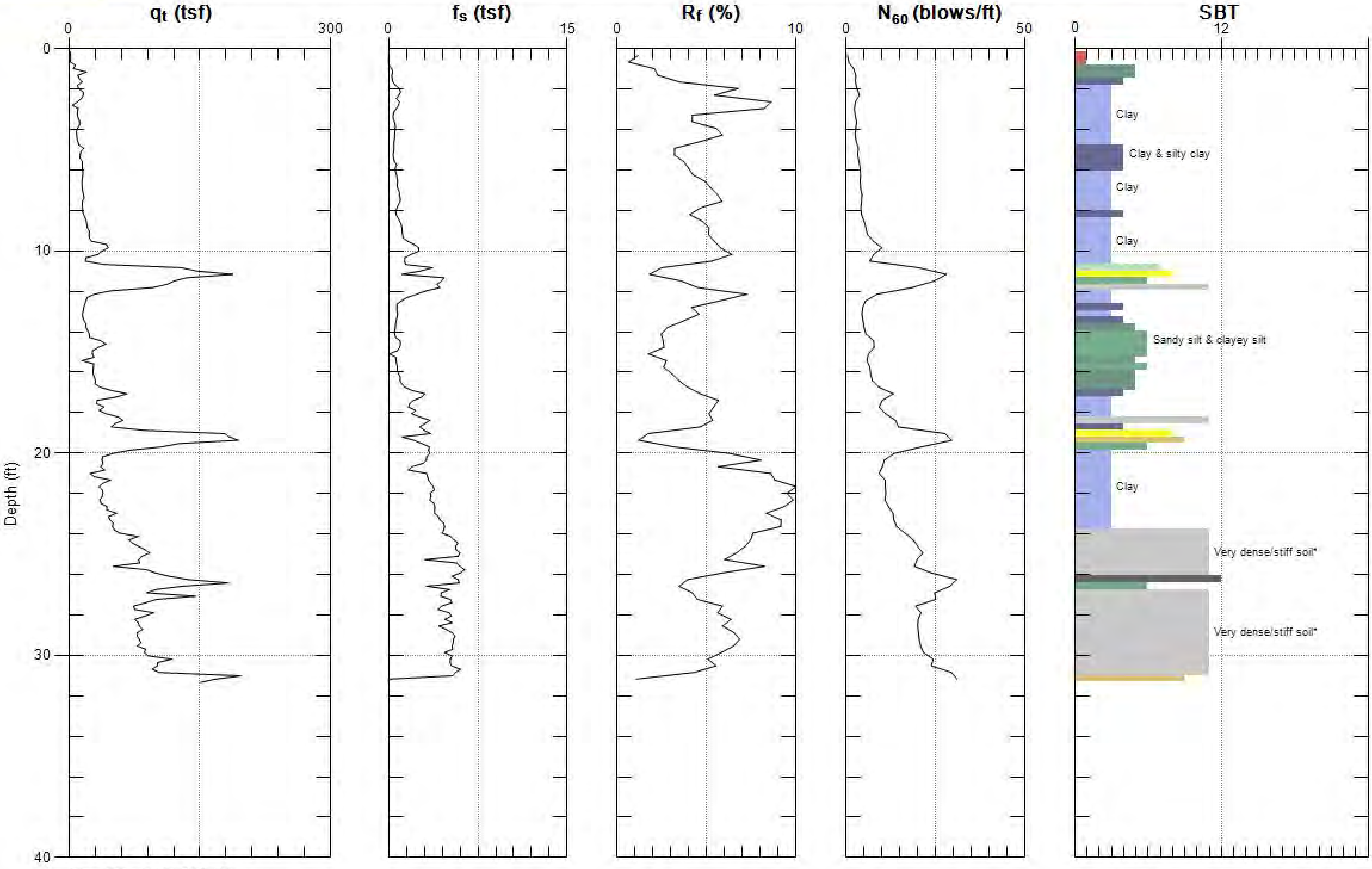
Max. Depth: 40.026 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **LANGAN**

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-02 **Date: 12/21/17 11:57**



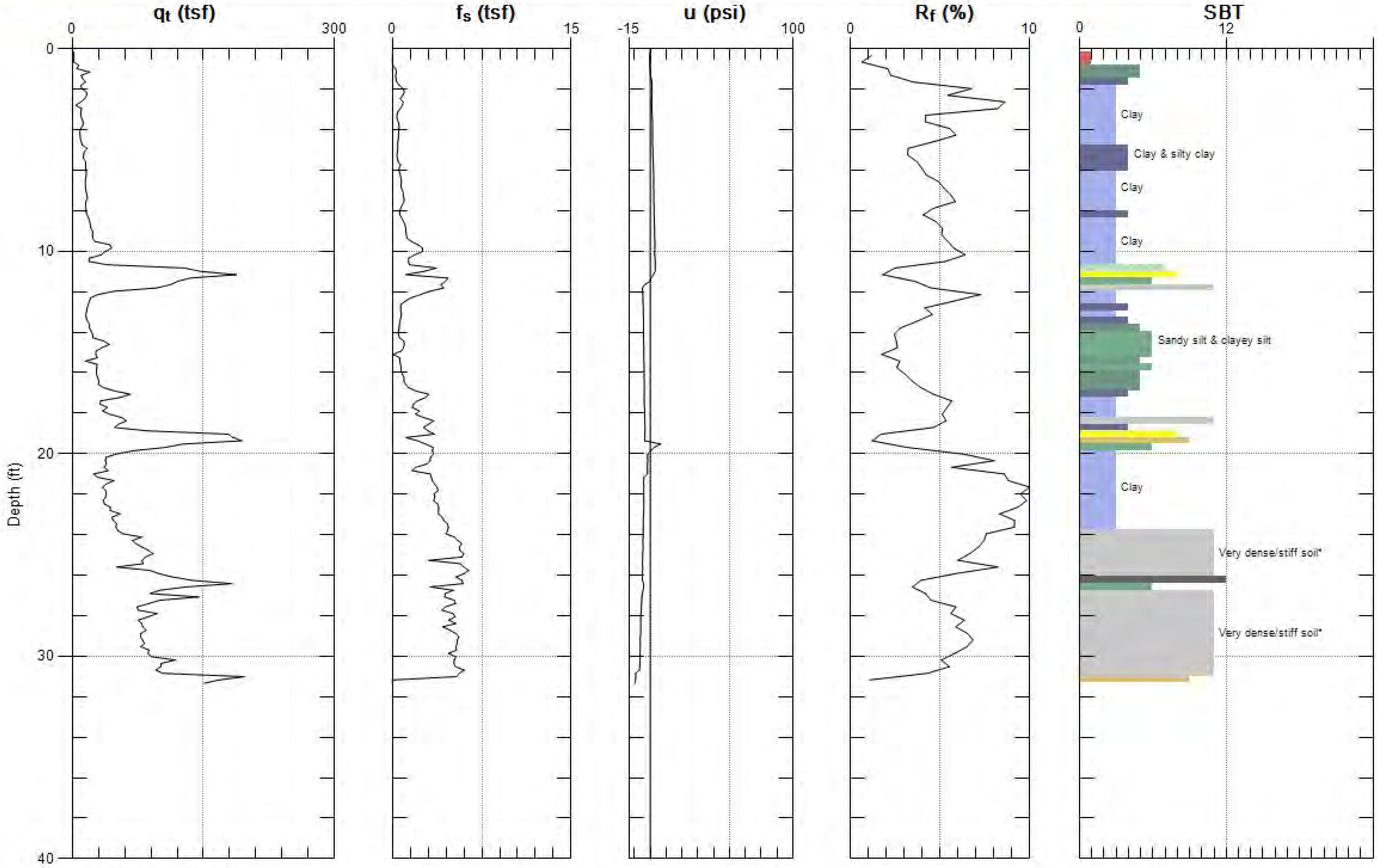
Max. Depth: 31.332 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **LANGAN**

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-02 **Date: 12/21/17 11:57**



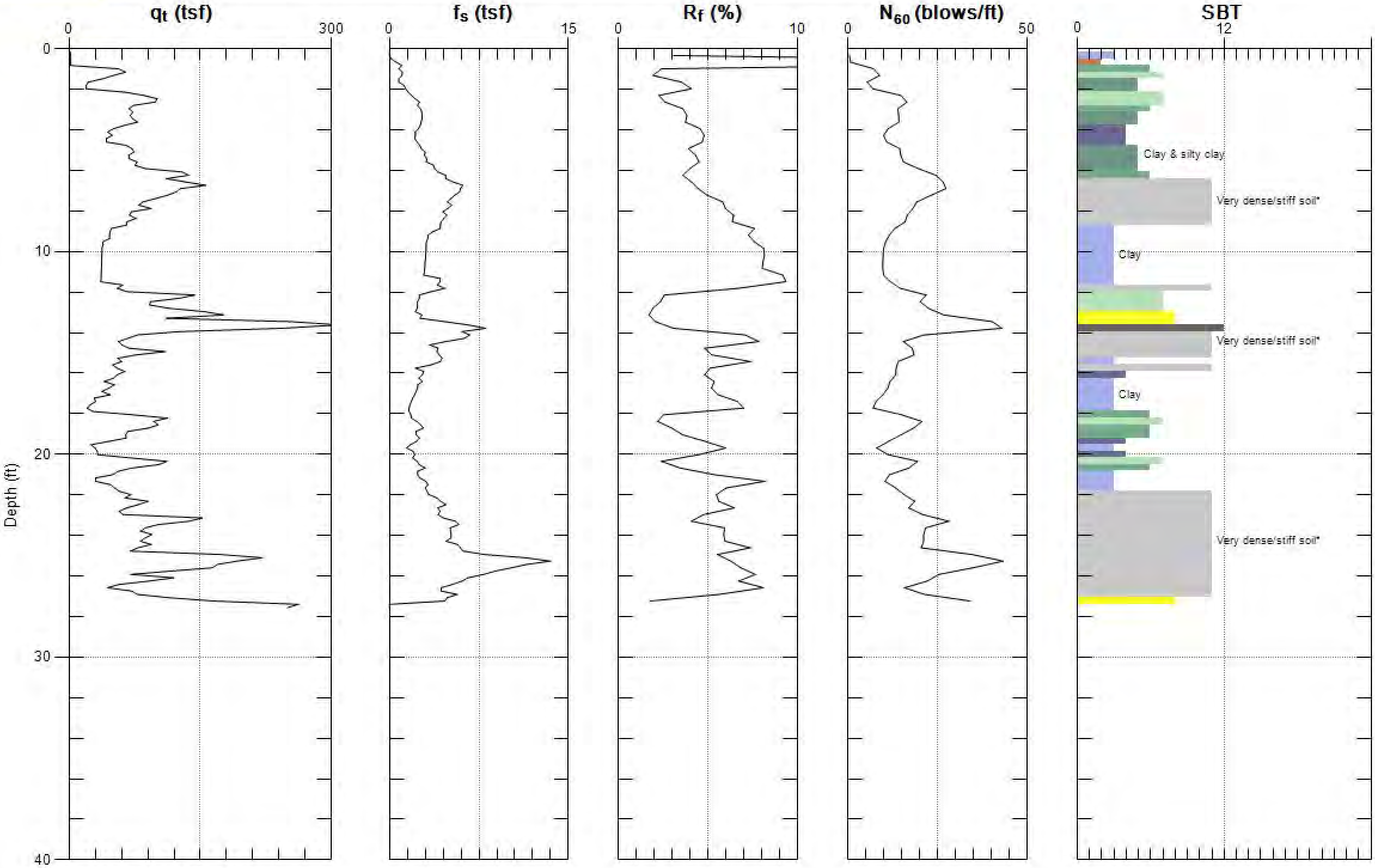
Max. Depth: 31.332 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

GREGG **LANGAN**

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-03 **Date: 12/21/17 10:58**



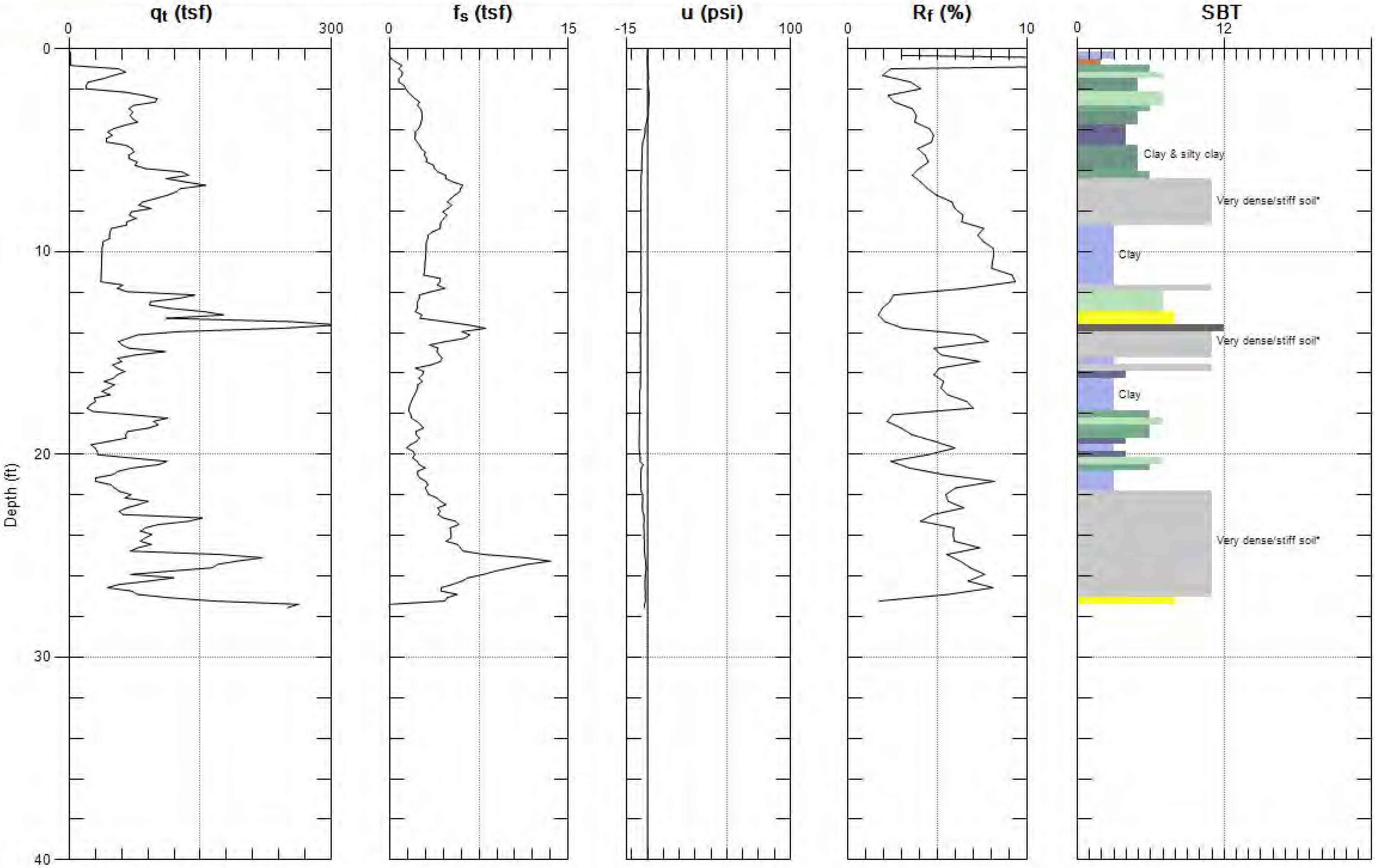
Max. Depth: 27.559 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

LANGAN

Site: UPR. HEARST PARKING **Engineer: S.BOUDREAU**

Sounding: CPT-03 **Date: 12/21/17 10:58**



Max. Depth: 27.559 (ft)
Avg. Interval: 0.328 (ft)

SBT: Soil Behavior Type (Robertson 1990)

Cone Penetration Testing Procedure (CPT)

Gregg Drilling carries out all Cone Penetration Tests (CPT) using an integrated electronic cone system, *Figure CPT*.

The cone takes measurements of tip resistance (q_c), sleeve resistance (f_s), and penetration pore water pressure (u_2). Measurements are taken at either 2.5 or 5 cm intervals during penetration to provide a nearly continuous profile. CPT data reduction and basic interpretation is performed in real time facilitating on-site decision making. The above mentioned parameters are stored electronically for further analysis and reference. All CPT soundings are performed in accordance with revised ASTM standards (D 5778-12).

The 5mm thick porous plastic filter element is located directly behind the cone tip in the u_2 location. A new saturated filter element is used on each sounding to measure both penetration pore pressures as well as measurements during a dissipation test (*PPDT*). Prior to each test, the filter element is fully saturated with oil under vacuum pressure to improve accuracy.

When the sounding is completed, the test hole is backfilled according to client specifications. If grouting is used, the procedure generally consists of pushing a hollow tremie pipe with a "knock out" plug to the termination depth of the CPT hole. Grout is then pumped under pressure as the tremie pipe is pulled from the hole. Disruption or further contamination to the site is therefore minimized.

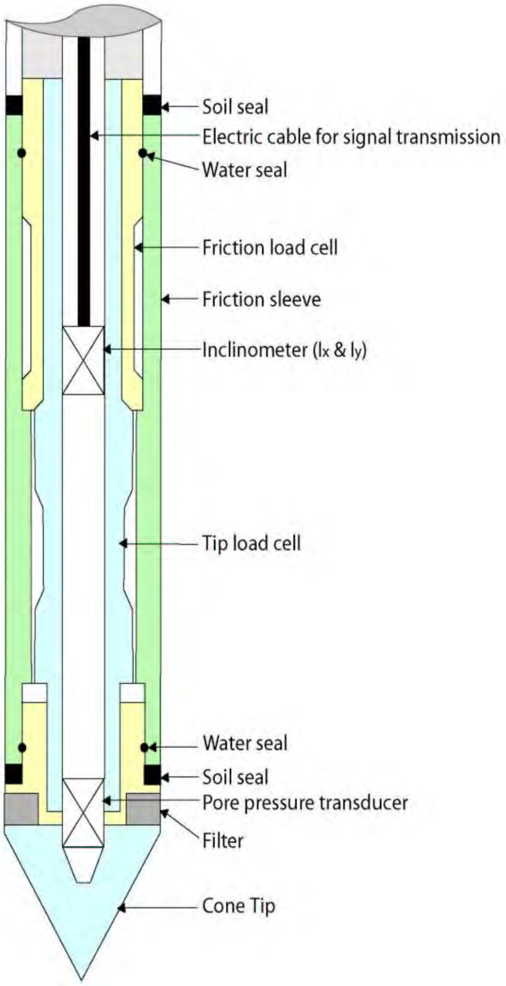


Figure CPT

Gregg $15cm^2$ Standard Cone Specifications

Dimensions	
Cone base area	15 cm^2
Sleeve surface area	225 cm^2
Cone net area ratio	0.80
Specifications	
Cone load cell	
Full scale range	180 kN (20 tons)
Overload capacity	150%
Full scale tip stress	120 MPa (1,200 tsf)
Repeatability	120 kPa (1.2 tsf)
Sleeve load cell	
Full scale range	31 kN (3.5 tons)
Overload capacity	150%
Full scale sleeve stress	1,400 kPa (15 tsf)
Repeatability	1.4 kPa (0.015 tsf)
Pore pressure transducer	
Full scale range	7,000 kPa (1,000 psi)
Overload capacity	150%
Repeatability	7 kPa (1 psi)

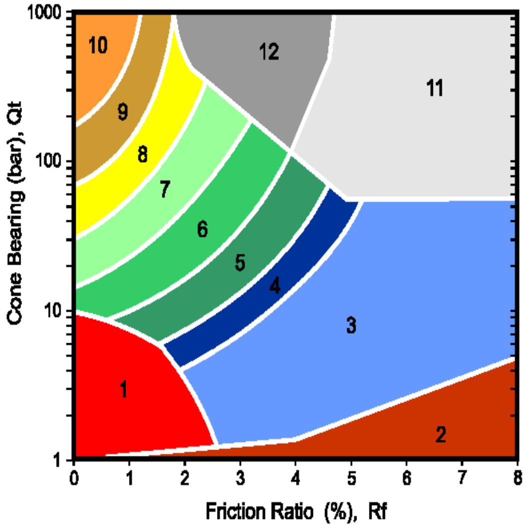
Note: The repeatability during field use will depend somewhat on ground conditions, abrasion, maintenance and zero load stability.

Cone Penetration Test Data & Interpretation

The Cone Penetration Test (CPT) data collected are presented in graphical and electronic form in the report. The plots include interpreted Soil Behavior Type (SBT) based on the charts described by Robertson (1990). Typical plots display SBT based on the non-normalized charts of Robertson et al (1986). For CPT soundings deeper than 30m, we recommend the use of the normalized charts of Robertson (1990) which can be displayed as SBTn, upon request. The report also includes spreadsheet output of computer calculations of basic interpretation in terms of SBT and SBTn and various geotechnical parameters using current published correlations based on the comprehensive review by Lunne, Robertson and Powell (1997), as well as recent updates by Professor Robertson (Guide to Cone Penetration Testing, 2015). The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg Drilling & Testing Inc. does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software. Some interpretation methods require input of the groundwater level to calculate vertical effective stress. An estimate of the in-situ groundwater level has been made based on field observations and/or CPT results, but should be verified by the user.

A summary of locations and depths is available in Table 1. Note that all penetration depths referenced in the data are with respect to the existing ground surface.

Note that it is not always possible to clearly identify a soil type based solely on q_t, f_s, and u_2. In these situations, experience, judgment, and an assessment of the pore pressure dissipation data should be used to infer the correct soil behavior type.



ZONE		SBT
1		🟥 Sensitive, fine grained
2		🟫 Organic materials
3		🟦 Clay
4		🟦 Silty clay to clay
5		🟩 Clayey silt to silty clay
6		🟩 Sandy silt to clayey silt
7		🟩 Silty sand to sandy silt
8		🟨 Sand to silty sand
9		🟫 Sand
10		🟧 Gravely sand to sand
11		⬜ Very stiff fine grained*
12		⬛ Sand to clayey sand*

*over consolidated or cemented

Figure SBT (After Robertson et al., 1986) – Note: Colors may vary slightly compared to plots

Cone Penetration Test (CPT) Interpretation

Gregg uses a proprietary CPT interpretation and plotting software. The software takes the CPT data and performs basic interpretation in terms of soil behavior type (SBT) and various geotechnical parameters using current published empirical correlations based on the comprehensive review by Lunne, Robertson and Powell (1997). The interpretation is presented in tabular format using MS Excel. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed. Gregg does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the software and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used in the software.

The following provides a summary of the methods used for the interpretation. Many of the empirical correlations to estimate geotechnical parameters have constants that have a range of values depending on soil type, geologic origin and other factors. The software uses 'default' values that have been selected to provide, in general, conservatively low estimates of the various geotechnical parameters.

Input:

1. Units for display (Imperial or metric) (atm. pressure, p_a = 0.96 tsf or 0.1 MPa)
2. Depth interval to average results (ft or m). Data are collected at either 0.02 or 0.05m and can be averaged every 1, 3 or 5 intervals.
3. Elevation of ground surface (ft or m)
4. Depth to water table, z_w (ft or m) – input required
5. Net area ratio for cone, a (default to 0.80)
6. Relative Density constant, C_{Dr} (default to 350)
7. Young's modulus number for sands, α (default to 5)
8. Small strain shear modulus number
    a. for sands, S_G (default to 180 for SBT_n 5, 6, 7)
    b. for clays, C_G (default to 50 for SBT_n 1, 2, 3 & 4)
9. Undrained shear strength cone factor for clays, N_{kt} (default to 15)
10. Over Consolidation ratio number, k_{ocr} (default to 0.3)
11. Unit weight of water, (default to γ_w = 62.4 lb/ft^3 or 9.81 kN/m^3)

Column

1. Depth, z, (m) – CPT data is collected in meters
2. Depth (ft)
3. Cone resistance, q_c (tsf or MPa)
4. Sleeve resistance, f_s (tsf or MPa)
5. Penetration pore pressure, u (psi or MPa), measured behind the cone (i.e. u_2)
6. Other – any additional data
7. Total cone resistance, q_t (tsf or MPa) $q_t = q_c + u\,(1-a)$

8	Friction Ratio, R_f (%)	$R_f = (f_s/q_t) \times 100\%$
9	Soil Behavior Type (non-normalized), SBT	see note
10	Unit weight, γ (pcf or kN/m^3)	based on SBT, see note
11	Total overburden stress, σ_v (tsf)	$\sigma_{vo} = \sigma z$
12	In-situ pore pressure, u_o (tsf)	$u_o = \gamma_w (z - z_w)$
13	Effective overburden stress, σ'_{vo} (tsf)	$\sigma'_{vo} = \sigma_{vo} - u_o$
14	Normalized cone resistance, Q_{t1}	$Q_{t1}= (q_t - \sigma_{vo}) / \sigma'_{vo}$
15	Normalized friction ratio, F_r (%)	$F_r = f_s / (q_t - \sigma_{vo}) \times 100\%$
16	Normalized Pore Pressure ratio, B_q	$B_q = u - u_o / (q_t - \sigma_{vo})$
17	Soil Behavior Type (normalized), SBT_n	see note
18	SBT_n Index, I_c	see note
19	Normalized Cone resistance, Q_{tn} (n varies with I_c)	see note
20	Estimated permeability, k_{SBT} (cm/sec or ft/sec)	see note
21	Equivalent SPT N_{60}, blows/ft	see note
22	Equivalent SPT $(N_1)_{60}$ blows/ft	see note
23	Estimated Relative Density, D_r, (%)	see note
24	Estimated Friction Angle, ϕ', (degrees)	see note
25	Estimated Young's modulus, E_s (tsf)	see note
26	Estimated small strain Shear modulus, Go (tsf)	see note
27	Estimated Undrained shear strength, s_u (tsf)	see note
28	Estimated Undrained strength ratio	s_u/σ_v'
29	Estimated Over Consolidation ratio, OCR	see note

Notes:

1 Soil Behavior Type (non-normalized), SBT (Lunne et al., 1997 and table below)

2 Unit weight, γ either constant at 119 pcf or based on Non-normalized SBT (Lunne et al., 1997 and table below)

3 Soil Behavior Type (Normalized), SBT_n Lunne et al. (1997)

4 SBT_n Index, I_c $I_c = ((3.47 - \log Q_{t1})^2 + (\log F_r + 1.22)^2)^{0.5}$

5 Normalized Cone resistance, Q_{tn} (n varies with Ic)

$Q_{tn} = ((q_t - \sigma_{vo})/pa)\ (pa/(\sigma'_{vo})^n$ and recalculate I_c, then iterate:

When $I_c < 1.64$, n = 0.5 (clean sand)
When $I_c > 3.30$, n = 1.0 (clays)
When $1.64 < I_c < 3.30$, $n = (I_c - 1.64)0.3 + 0.5$
Iterate until the change in n, $\Delta n < 0.01$

6 Estimated permeability, k_{SBT} based on Normalized SBT_n (Lunne et al., 1997 and table below)

7 Equivalent SPT N_{60}, blows/ft Lunne et al. (1997)

$$\frac{(q_t/p_a)}{N_{60}} = 8.5\left(1 - \frac{I_c}{4.6}\right)$$

8 Equivalent SPT $(N_1)_{60}$ blows/ft $(N_1)_{60} = N_{60}\,C_{N,}$
where $C_N = (pa/\sigma'_{vo})^{0.5}$

9 Relative Density, D_r, (%) $D_r^2 = Q_{tn} / C_{Dr}$
Only SBT$_n$ 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

10 Friction Angle, ϕ', (degrees) $\tan \phi' = \frac{1}{2.68}\left[\log\left(\frac{q_c}{\sigma'_{vo}}\right) + 0.29\right]$

Only SBT$_n$ 5, 6, 7 & 8 *Show'N/A' in zones 1, 2, 3, 4 & 9*

11 Young's modulus, E_s $E_s = \alpha\, q_t$
Only SBT$_n$ 5, 6, 7 & 8 *Show 'N/A' in zones 1, 2, 3, 4 & 9*

12 Small strain shear modulus, Go
a. $G_o = S_G\,(q_t\ \sigma'_{vo}\ pa)^{1/3}$ *For SBT$_n$ 5, 6, 7*
b. $G_o = C_G\,q_t$ *For SBT$_n$ 1, 2, 3& 4*
Show 'N/A' in zones 8 & 9

13 Undrained shear strength, s_u $s_u = (q_t - \sigma_{vo}) / N_{kt}$
Only SBT$_n$ 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

14 Over Consolidation ratio, OCR $OCR = k_{ocr}\,Q_{t1}$
Only SBT$_n$ 1, 2, 3, 4 & 9 *Show 'N/A' in zones 5, 6, 7 & 8*

The following updated and simplified SBT descriptions have been used in the software:

SBT Zones	
1	sensitive fine grained
2	organic soil
3	clay
4	clay & silty clay
5	clay & silty clay
6	sandy silt & clayey silt

SBT$_n$ Zones	
1	sensitive fine grained
2	organic soil
3	clay
4	clay & silty clay

7	silty sand & sandy silt	5	silty sand & sandy silt
8	sand & silty sand	6	sand & silty sand
9	sand		
10	sand	7	sand
11	very dense/stiff soil*	8	very dense/stiff soil*
12	very dense/stiff soil*	9	very dense/stiff soil*

*heavily overconsolidated and/or cemented

Track when soils fall with zones of same description and print that description (i.e. if soils fall only within SBT zones 4 & 5, print ‘clays & silty clays’)

Estimated Permeability (see Lunne et al., 1997)

SBT_n	Permeability (ft/sec)	(m/sec)
1	$3x\ 10^{-8}$	$1x\ 10^{-8}$
2	$3x\ 10^{-7}$	$1x\ 10^{-7}$
3	$1x\ 10^{-9}$	$3x\ 10^{-10}$
4	$3x\ 10^{-8}$	$1x\ 10^{-8}$
5	$3x\ 10^{-6}$	$1x\ 10^{-6}$
6	$3x\ 10^{-4}$	$1x\ 10^{-4}$
7	$3x\ 10^{-2}$	$1x\ 10^{-2}$
8	$3x\ 10^{-6}$	$1x\ 10^{-6}$
9	$1x\ 10^{-8}$	$3x\ 10^{-9}$

Estimated Unit Weight (see Lunne et al., 1997)

SBT	Approximate Unit Weight (lb/ft^3)	(kN/m^3)
1	111.4	17.5
2	79.6	12.5
3	111.4	17.5
4	114.6	18.0
5	114.6	18.0
6	114.6	18.0
7	117.8	18.5
8	120.9	19.0
9	124.1	19.5
10	127.3	20.0
11	130.5	20.5
12	120.9	19.0

Pore Pressure Dissipation Tests (PPDT)

Pore Pressure Dissipation Tests (PPDT's) conducted at various intervals can be used to measure equilibrium water pressure (at the time of the CPT). If conditions are hydrostatic, the equilibrium water pressure can be used to determine the approximate depth of the ground water table. A PPDT is conducted when penetration is halted at specific intervals determined by the field representative. The variation of the penetration pore pressure (*u*) with time is measured behind the tip of the cone and recorded.

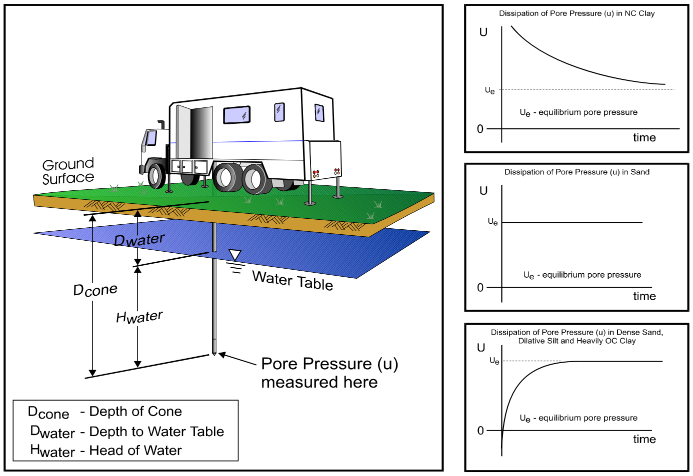
Pore pressure dissipation data can be interpreted to provide estimates of:

- Equilibrium piezometric pressure
- Phreatic Surface
- In situ horizontal coefficient of consolidation (c_h)
- In situ horizontal coefficient of permeability (k_h)

In order to correctly interpret the equilibrium piezometric pressure and/or the phreatic surface, the pore pressure must be monitored until it reaches equilibrium, *Figure PPDT*. This time is commonly referred to as t_{100}, the point at which 100% of the excess pore pressure has dissipated.

A complete reference on pore pressure dissipation tests is presented by Robertson et al. 1992 and Lunne et al. 1997.

A summary of the pore pressure dissipation tests are summarized in Table 1.



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

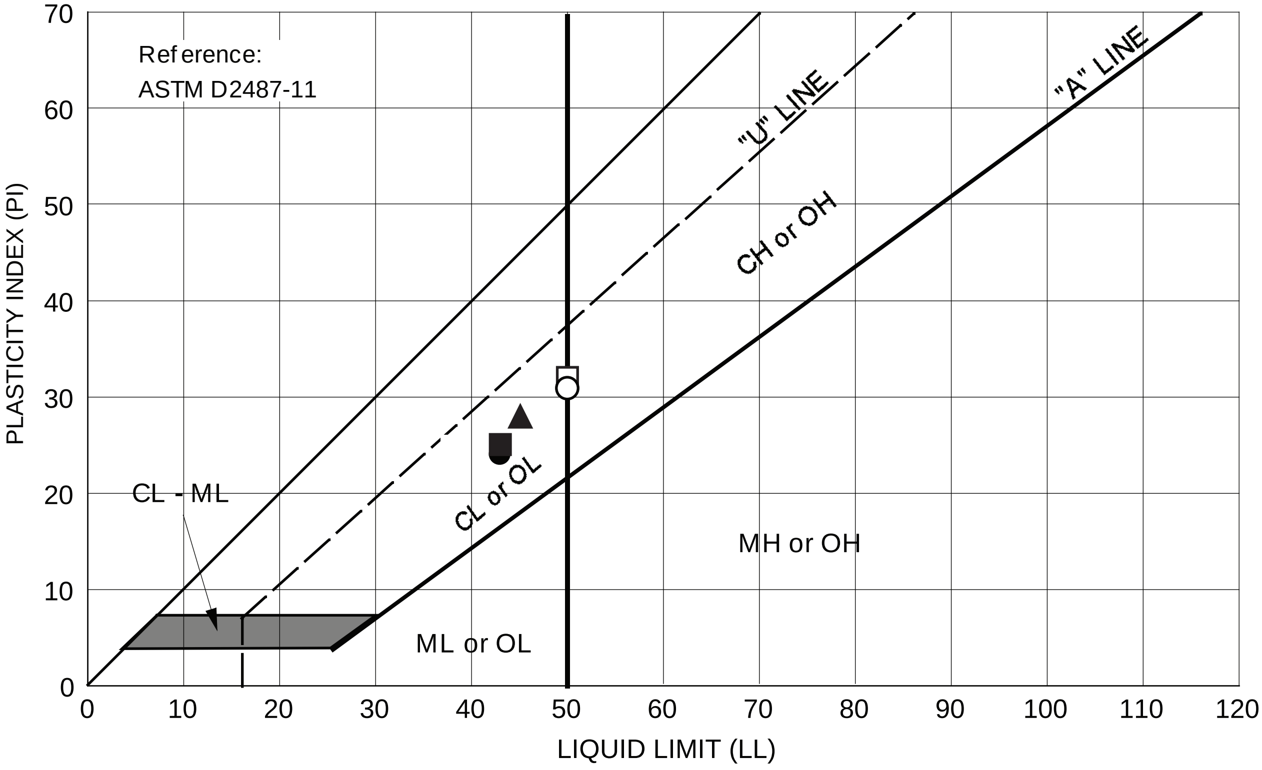
Useful Conversion Factors:

1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

Figure PPDT

APPENDIX F

LABORATORY TEST RESULTS



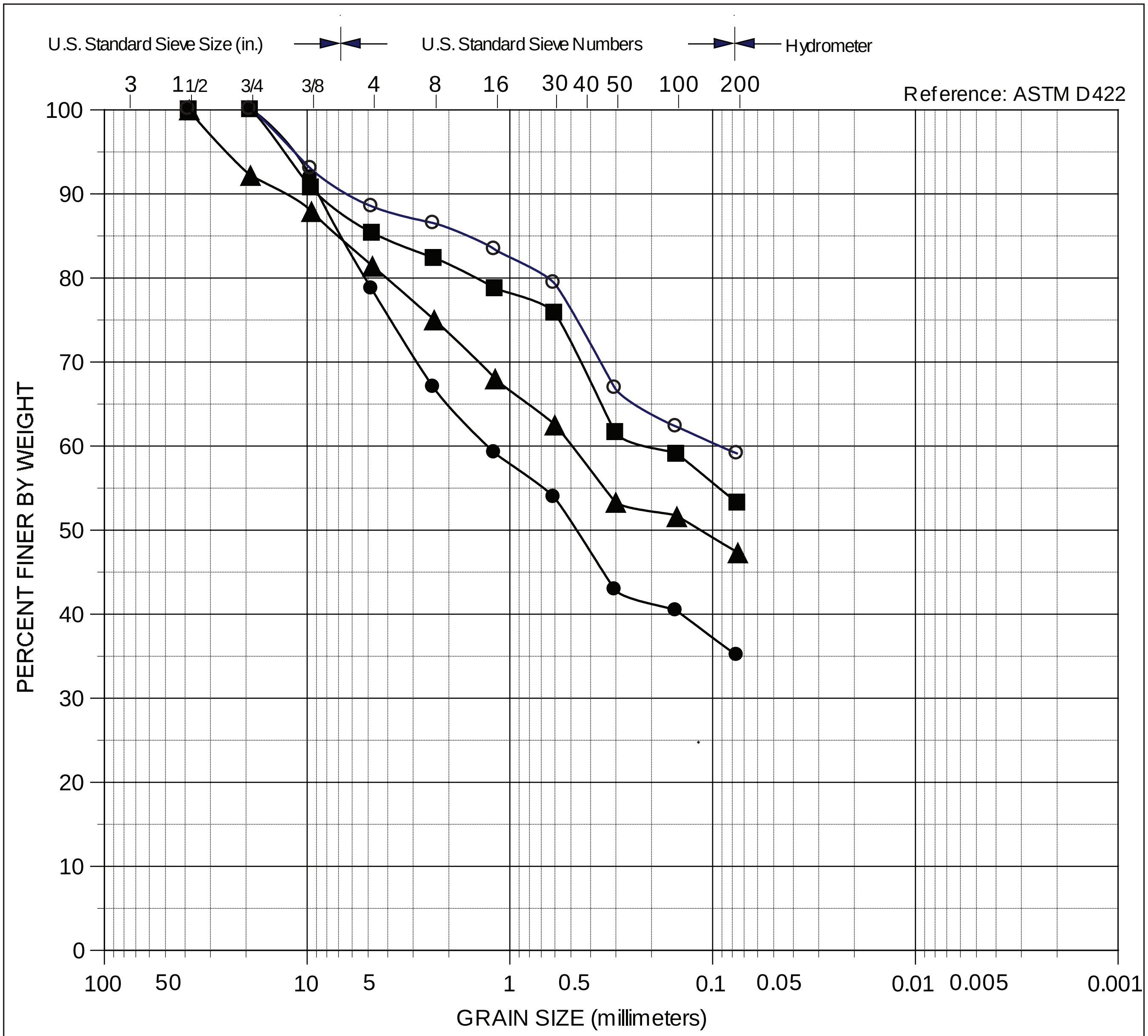
Symbol	Source	Description and Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
●	B-1 at 40 feet	GOUGE, yellow-brown to gray	12.0	43	24	--
■	B-2 at 3.5 feet	CLAY with SAND (CL), brown	14.2	43	25	--
▲	B-3 at 11 feet	CLAY with SAND (CL), yellow-brown with gray-brown mottling	24.4	45	28	--
○	DPT-2 at 1.5 feet	CLAY (CL/CH), olive-gray with red-brown and dark brown mottling	18.5	50	31	--
□	DPT-3 at 4.5 feet	CLAY with SAND (CL/CH), red-brown	17.6	50	32	--

UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING
Berkeley, California

LANGAN

PLASTICITY CHART

Date 10/16/17 | Project No. 731706301 | Figure F-1



	% Gravel		%Sand			% Fines	
Sample	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Symbol	Sample Source	Classification
●	B-1 at 7.5 feet	CLAYEY SAND with GRAVEL (CL), orange-brown
■	B-2 at 15 feet	CLAY with GRAVEL (CL), gray to yellow-brown
▲	B-3 at 15.5 feet	CLAYEY SAND with GRAVEL (SC), yellow-brown with dark brown mottling
○	DPT-2 at 3.5 feet	SANDY CLAY (CL), red-brown

UC BERKELEY GOLDMAN SCHOOL OF PUBLIC POLICY AND HEARST AVENUE ACADEMIC HOUSING
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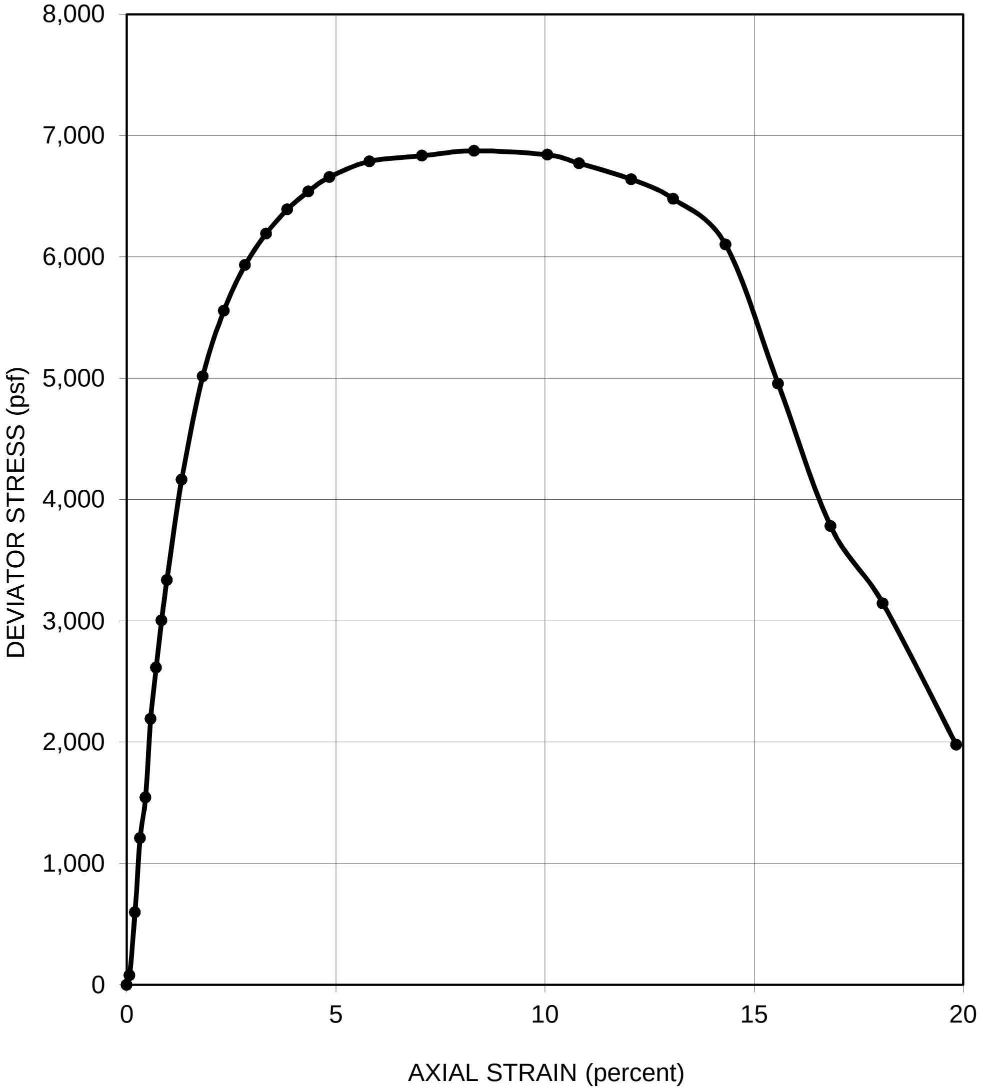
PARTICLE SIZE ANALYSIS

Date 10/16/17 | Project No. 731706301 | Figure F-2



SAMPLER TYPE	Sprague & Henwood			SHEAR STRENGTH	3,440	psf
DIAMETER (in.)	2.41	HEIGHT (in.) 5.52		STRAIN AT FAILURE	8.3	%
MOISTURE CONTENT		20.0	%	CONFINING PRESSURE	2,000	psf
DRY DENSITY		108	pcf	STRAIN RATE	0.75	% / min
DESCRIPTION	SANDY CLAY (CL), yellow-brown with gray-brown mottling			SOURCE	B-2 at 21 feet	

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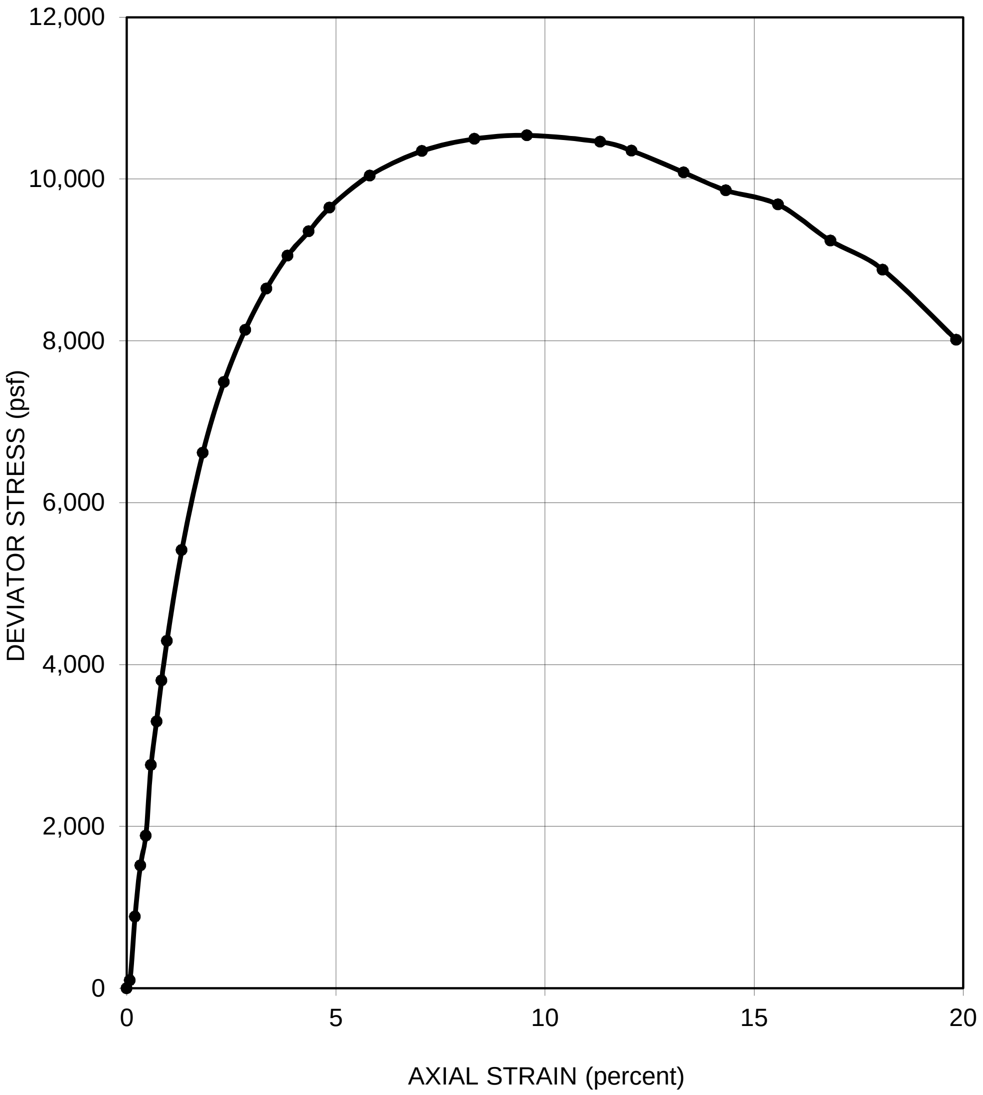
UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Date 10/19/17 | Project No. 731706301 | Figure F-3



SAMPLER TYPE	Sprague & Henwood			SHEAR STRENGTH	5,270	psf
DIAMETER (in.)	2.41	HEIGHT (in.)	5.62	STRAIN AT FAILURE	9.6	%
MOISTURE CONTENT		16.5	%	CONFINING PRESSURE	2,300	psf
DRY DENSITY		114	pcf	STRAIN RATE	0.75	% / min
DESCRIPTION	CLAY with GRAVEL (CL), yellow-brown with gray-brown mottling			SOURCE	B-3 at 26 feet	

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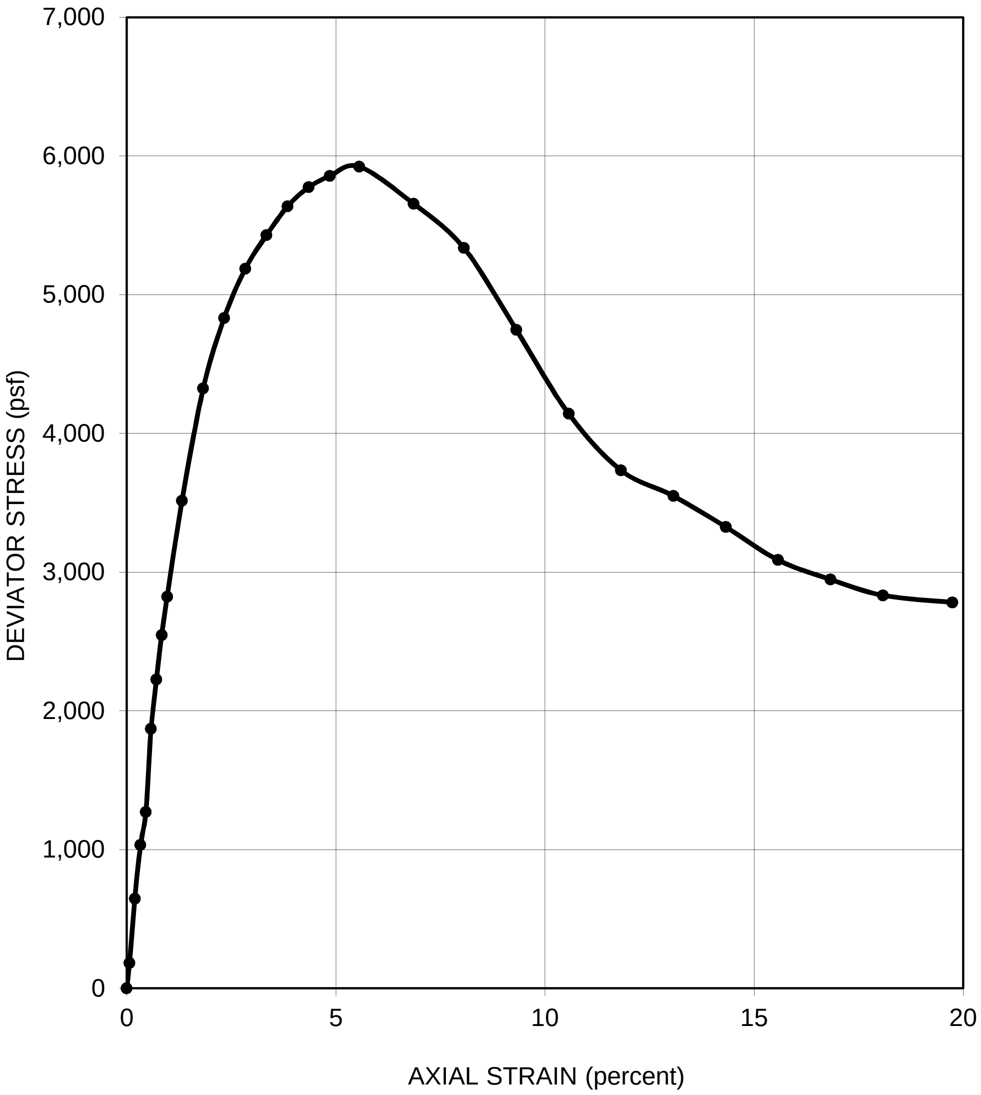
UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Date 10/19/17 | Project No. 731706301 | Figure F-4



SAMPLER TYPE	Sprague & Henwood			SHEAR STRENGTH	2,960	psf
DIAMETER (in.)	2.41	HEIGHT (in.) 5.62		STRAIN AT FAILURE	5.6	%
MOISTURE CONTENT		16.6	%	CONFINING PRESSURE	2,700	psf
DRY DENSITY		115	pcf	STRAIN RATE	0.75	% / min
DESCRIPTION	CLAY with SAND (CL), yellow-brown				SOURCE	B-3 at 36 feet

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AND HEARST AVENUE ACADEMIC HOUSING
Berkeley, California

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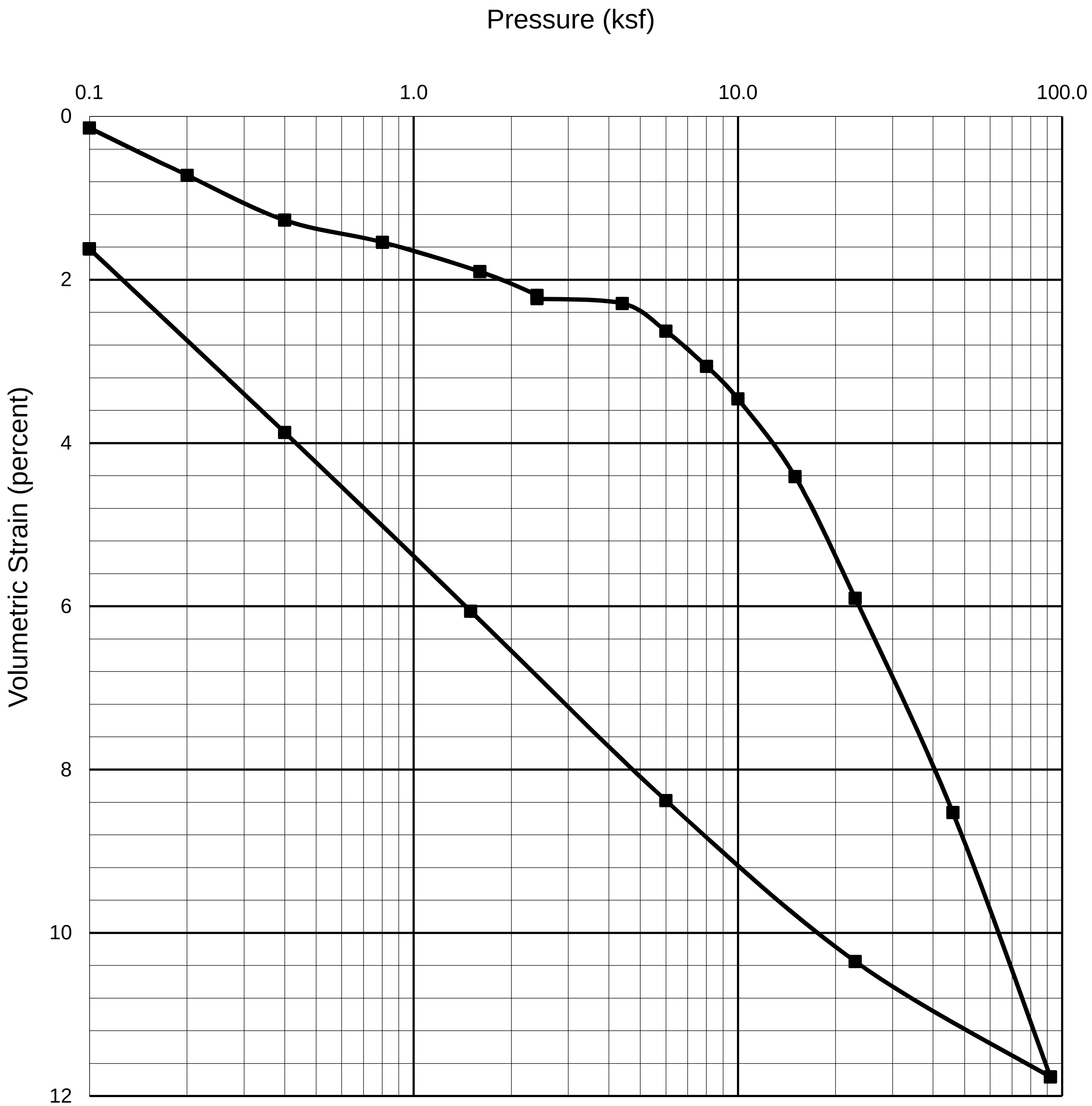
UNCONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST

Date 10/19/17 | Project No. 731706301 | Figure F-5



Sampler Type: Sprague & Henwood				Condition		Before Test		After Test	
Diameter (in)	2.42	Height (in)	1.00	Water Content	w_o	17.5 %	w_f	18.7 %	
Overburden Pressure, p_o	3,300 psf			Void Ratio	e_o	0.53	e_f	0.50	
Preconsol. Pressure, p_c	10,000 psf			Saturation	S_o	90 %	S_f	100 %	
Compression Ratio, $C_{\varepsilon c}$	0.10			Dry Density	γ_d	110 pcf	γ_d	112 pcf	
LL - -		PL - -		PI - -		G_s 2.70 (assumed)			
Classification SANDY CLAY (CL), yellow-brown with gray-brown mottling						Source B-2 at 26 feet			

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AND HEARST AVENUE ACADEMIC HOUSING
Berkeley, California

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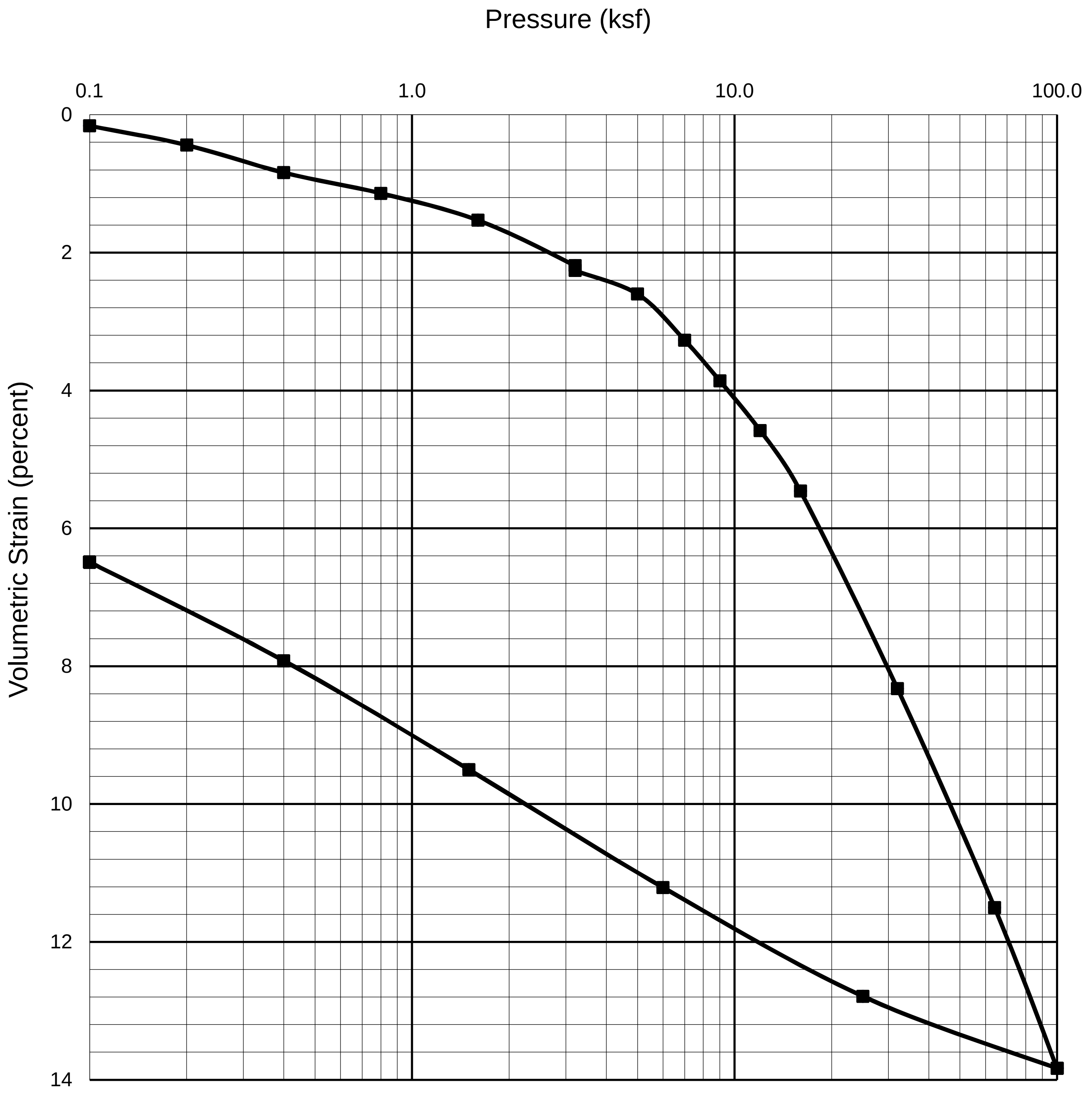
CONSOLIDATION TEST REPORT

Date 10/19/17 | Project No. 731706301 | Figure F-6



Sampler Type:	Sprague & Henwood			Condition		Before Test		After Test
Diameter (in)	2.42	Height (in)	1.00	Water Content	w_o	19.2 %	w_f	16.7 %
Overburden Pressure, p_o	2,700 psf			Void Ratio	e_o	0.55	e_f	0.45
Preconsol. Pressure, p_c	10,000 psf			Saturation	S_o	94 %	S_f	100 %
Compression Ratio, $C_{\varepsilon c}$	0.12			Dry Density	γ_d	109 pcf	γ_d	116 pcf

LL - -	PL - -	PI - -	G_s 2.70 (assumed)

Classification CLAYEY SAND with GRAVEL (SC), yellow-brown with gray-brown mottling

Source B-3 at 21 feet

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AND HEARST AVENUE ACADEMIC HOUSING
Berkeley, California

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CONSOLIDATION TEST REPORT

Date 10/19/17 | Project No. 731706301 | Figure F-7

APPENDIX G

CORROSIVITY ANALYSIS WITH BRIEF EVALUATION

California State Certified Laboratory No. 2153

CERCO
analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

12 October, 2017

Job No. 1709208
Cust. No. 10727

Ms. Sarah Boudreau
Langan Treadwell Rollo
555 Montgomery Street, Suite 1300
San Francisco, CA 94111

Subject: Project No.: 731706301.700.031
Project Name: UC Berkeley Upper Hearst
Corrosivity Analysis – ASTM Methods

Dear Ms. Boudreau:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on September 29, 2017. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurements, the sample is classified as "corrosive" and Sample No.002 is classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration is none detected with a detection limit of 15 mg/kg.

The sulfate ion concentrations is 240 mg/kg and are determined to be sufficient to potentially be detrimental to reinforced concrete structures and cement mortar-coated steel at these locations. Therefore, concrete that comes into contact with this soil should use sulfate resistant cement such as Type II, with a maximum water-to-cement ratio of 0.55.

The pH of the soil is 7.98 which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 350-mV which is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO
analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

Client:	Langan Treadwell Rollo
Client's Project No.:	731706301.700.031
Client's Project Name:	UC Berkeley Upper Hearst
Date Sampled:	Not Indicated
Date Received:	29-Sep-17
Matrix:	Soil
Authorization:	Chain of Custody

Date of Report: 12-Oct-2017

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1709208-001	B-2 2 @ 3.5'	350	7.98	-	660	-	N.D.	240

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	11-Oct-2017	11-Oct-2017	-	11-Oct-2017	-	11-Oct-2017	11-Oct-2017

* Results Reported on "As Received" Basis

N.D. - None Detected

Cheryl McMillen
Laboratory Director

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

California State Certified Laboratory No. 2153

CERCO
analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

2 February, 2018

Job No. 1801231
Cust. No. 10727

Ms. Sarah Boudreau
Langan
555 Montgomery Street, Suite 1300
San Francisco, CA 94111

Subject: Project No.: 731706301.700.031
Project Name: UC Berkeley Upper Hearst
Corrosivity Analysis – ASTM Methods

Dear Ms. Boudreau:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on January 29, 2018. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, the sample is classified as "corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration is none detected with a detection limit of 15 mg/kg.

The sulfate ion concentration is 26 mg/kg and is determined to be insufficient to damage reinforced concrete structures and cement mortar-coated steel at these locations.

The pH of the soil is 7.49, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 440-mV which is indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO
analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

Client:	Langan
Client's Project No.:	731706301.700.031
Client's Project Name:	UC Berkeley Upper Hearst
Date Sampled:	Not Indicated
Date Received:	29-Jan-18
Matrix:	Soil
Authorization:	Chain of Custody

Date of Report: 2-Feb-2018

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1801231-001	DPT-1 1 @ 1'-4'	440	7.49	-	1,100	-	N.D.	26

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	1-Feb-2018	1-Feb-2018	-	1-Feb-2018	-	1-Feb-2018	1-Feb-2018

* Results Reported on "As Received" Basis

N.D. - None Detected

Cheryl McMillen
Laboratory Director

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

APPENDIX H

CERTIFIED ANALYTICAL REPORTS

McCampbell Analytical, Inc.

"When Quality Counts"

Analytical Report

WorkOrder: 1709793

Report Created for: Langan

555 Montgomery St., Suite 1300
San Francisco, CA 94111

Project Contact: Peter Cusack
Project P.O.:
Project Name: 731706301; UC Berkeley GSPP & Housing

Project Received: 09/19/2017

Analytical Report reviewed & approved for release on 09/27/2017 by:

Angela Rydelius,
Laboratory Manager

1534 Willow Pass Rd. Pittsburg, CA 94565 ♦ TEL: (877) 252-9262 ♦ FAX: (925) 252-9269 ♦ www.mccampbell.com
CA ELAP 1644 ♦ NELAP 4033 ORELAP

Glossary of Terms & Qualifier Definitions

Client: Langan
Project: 731706301; UC Berkeley GSPP & Housing
WorkOrder: 1709793

Glossary Abbreviation

%D	Serial Dilution Percent Difference
95% Interval	95% Confident Interval
DF	Dilution Factor
DI WET	(DISTLC) Waste Extraction Test using DI water
DISS	Dissolved (direct analysis of 0.45 µm filtered and acidified water sample)
DLT	Dilution Test (Serial Dilution)
DUP	Duplicate
EDL	Estimated Detection Limit
ERS	External reference sample. Second source calibration verification.
ITEF	International Toxicity Equivalence Factor
LCS	Laboratory Control Sample
MB	Method Blank
MB % Rec	% Recovery of Surrogate in Method Blank, if applicable
MDL	Method Detection Limit
ML	Minimum Level of Quantitation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
ND	Not detected at or above the indicated MDL or RL
NR	Data Not Reported due to matrix interference or insufficient sample amount.
PDS	Post Digestion Spike
PDSD	Post Digestion Spike Duplicate
PF	Prep Factor
RD	Relative Difference
RL	Reporting Limit (The RL is the lowest calibration standard in a multipoint calibration.)
RPD	Relative Percent Deviation
RRT	Relative Retention Time
SPK Val	Spike Value
SPKRef Val	Spike Reference Value
SPLP	Synthetic Precipitation Leachate Procedure
ST	Sorbent Tube
TCLP	Toxicity Characteristic Leachate Procedure
TEQ	Toxicity Equivalents
WET (STLC)	Waste Extraction Test (Soluble Threshold Limit Concentration)

Glossary of Terms & Qualifier Definitions

Client: Langan
Project: 731706301; UC Berkeley GSPP & Housing
WorkOrder: 1709793

Analytical Qualifiers

S	Surrogate spike recovery outside accepted recovery limits
a3	Sample diluted due to high organic content.
a4	Reporting limits raised due to the sample's matrix prohibiting a full volume extraction.
c2	Surrogate recovery outside of the control limits due to matrix interference.
d7	Strongly aged gasoline or diesel range compounds are significant in the TPH(g) chromatogram
e2	Diesel range compounds are significant; no recognizable pattern
e7	Oil range compounds are significant
h4	Sulfuric acid permanganate (EPA 3665) cleanup
k10	CARB 435 Exception 1 - No asbestos detected

Quality Control Qualifiers

F2	LCS/LCSD recovery and/or RPD is out of acceptance criteria.
F3	The surrogate standard recovery and/or RPD is outside of acceptance limits.

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/19/17	**Analytical Method:**	SW8082
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Polychlorinated Biphenyls (PCBs) Aroclors

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC22 09191758.D**	**145782**

Analytes	Result	RL	DF	Date Analyzed
Aroclor1016	ND	1.0	20	09/21/2017 02:52
Aroclor1221	ND	1.0	20	09/21/2017 02:52
Aroclor1232	ND	1.0	20	09/21/2017 02:52
Aroclor1242	ND	1.0	20	09/21/2017 02:52
Aroclor1248	ND	1.0	20	09/21/2017 02:52
Aroclor1254	ND	1.0	20	09/21/2017 02:52
Aroclor1260	ND	1.0	20	09/21/2017 02:52
PCBs, total	ND	1.0	20	09/21/2017 02:52

Surrogates	REC (%)	Limits	
Decachlorobiphenyl	106	70-130	09/21/2017 02:52

Analyst(s): CK   Analytical Comments: h4

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**GC22 09221772.D**	**145782**

Analytes	Result	RL	DF	Date Analyzed
Aroclor1016	ND	0.050	1	09/24/2017 07:43
Aroclor1221	ND	0.050	1	09/24/2017 07:43
Aroclor1232	ND	0.050	1	09/24/2017 07:43
Aroclor1242	ND	0.050	1	09/24/2017 07:43
Aroclor1248	ND	0.050	1	09/24/2017 07:43
Aroclor1254	ND	0.050	1	09/24/2017 07:43
Aroclor1260	ND	0.050	1	09/24/2017 07:43
PCBs, total	ND	0.050	1	09/24/2017 07:43

Surrogates	REC (%)	Limits	
Decachlorobiphenyl	118	70-130	09/24/2017 07:43

Analyst(s): SS   Analytical Comments: h4

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC38 09251713.D**	**146037**

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	0.10	1	09/25/2017 15:07
tert-Amyl methyl ether (TAME)	ND	0.0050	1	09/25/2017 15:07
Benzene	ND	0.0050	1	09/25/2017 15:07
Bromobenzene	ND	0.0050	1	09/25/2017 15:07
Bromochloromethane	ND	0.0050	1	09/25/2017 15:07
Bromodichloromethane	ND	0.0050	1	09/25/2017 15:07
Bromoform	ND	0.0050	1	09/25/2017 15:07
Bromomethane	ND	0.0050	1	09/25/2017 15:07
2-Butanone (MEK)	ND	0.020	1	09/25/2017 15:07
t-Butyl alcohol (TBA)	ND	0.050	1	09/25/2017 15:07
n-Butyl benzene	ND	0.0050	1	09/25/2017 15:07
sec-Butyl benzene	ND	0.0050	1	09/25/2017 15:07
tert-Butyl benzene	ND	0.0050	1	09/25/2017 15:07
Carbon Disulfide	ND	0.0050	1	09/25/2017 15:07
Carbon Tetrachloride	ND	0.0050	1	09/25/2017 15:07
Chlorobenzene	ND	0.0050	1	09/25/2017 15:07
Chloroethane	ND	0.0050	1	09/25/2017 15:07
Chloroform	ND	0.0050	1	09/25/2017 15:07
Chloromethane	ND	0.0050	1	09/25/2017 15:07
2-Chlorotoluene	ND	0.0050	1	09/25/2017 15:07
4-Chlorotoluene	ND	0.0050	1	09/25/2017 15:07
Dibromochloromethane	ND	0.0050	1	09/25/2017 15:07
1,2-Dibromo-3-chloropropane	ND	0.0040	1	09/25/2017 15:07
1,2-Dibromoethane (EDB)	ND	0.0040	1	09/25/2017 15:07
Dibromomethane	ND	0.0050	1	09/25/2017 15:07
1,2-Dichlorobenzene	ND	0.0050	1	09/25/2017 15:07
1,3-Dichlorobenzene	ND	0.0050	1	09/25/2017 15:07
1,4-Dichlorobenzene	ND	0.0050	1	09/25/2017 15:07
Dichlorodifluoromethane	ND	0.0050	1	09/25/2017 15:07
1,1-Dichloroethane	ND	0.0050	1	09/25/2017 15:07
1,2-Dichloroethane (1,2-DCA)	ND	0.0040	1	09/25/2017 15:07
1,1-Dichloroethene	ND	0.0050	1	09/25/2017 15:07
cis-1,2-Dichloroethene	ND	0.0050	1	09/25/2017 15:07
trans-1,2-Dichloroethene	ND	0.0050	1	09/25/2017 15:07
1,2-Dichloropropane	ND	0.0050	1	09/25/2017 15:07
1,3-Dichloropropane	ND	0.0050	1	09/25/2017 15:07
2,2-Dichloropropane	ND	0.0050	1	09/25/2017 15:07

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC38 09251713.D**	**146037**

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.0050	1	09/25/2017 15:07
cis-1,3-Dichloropropene	ND	0.0050	1	09/25/2017 15:07
trans-1,3-Dichloropropene	ND	0.0050	1	09/25/2017 15:07
Diisopropyl ether (DIPE)	ND	0.0050	1	09/25/2017 15:07
Ethylbenzene	ND	0.0050	1	09/25/2017 15:07
Ethyl tert-butyl ether (ETBE)	ND	0.0050	1	09/25/2017 15:07
Freon 113	ND	0.0050	1	09/25/2017 15:07
Hexachlorobutadiene	ND	0.0050	1	09/25/2017 15:07
Hexachloroethane	ND	0.0050	1	09/25/2017 15:07
2-Hexanone	ND	0.0050	1	09/25/2017 15:07
Isopropylbenzene	ND	0.0050	1	09/25/2017 15:07
4-Isopropyl toluene	ND	0.0050	1	09/25/2017 15:07
Methyl-t-butyl ether (MTBE)	ND	0.0050	1	09/25/2017 15:07
Methylene chloride	ND	0.0050	1	09/25/2017 15:07
4-Methyl-2-pentanone (MIBK)	ND	0.0050	1	09/25/2017 15:07
Naphthalene	**0.0073**	0.0050	1	09/25/2017 15:07
n-Propyl benzene	ND	0.0050	1	09/25/2017 15:07
Styrene	ND	0.0050	1	09/25/2017 15:07
1,1,1,2-Tetrachloroethane	ND	0.0050	1	09/25/2017 15:07
1,1,2,2-Tetrachloroethane	ND	0.0050	1	09/25/2017 15:07
Tetrachloroethene	ND	0.0050	1	09/25/2017 15:07
Toluene	ND	0.0050	1	09/25/2017 15:07
1,2,3-Trichlorobenzene	ND	0.0050	1	09/25/2017 15:07
1,2,4-Trichlorobenzene	ND	0.0050	1	09/25/2017 15:07
1,1,1-Trichloroethane	ND	0.0050	1	09/25/2017 15:07
1,1,2-Trichloroethane	ND	0.0050	1	09/25/2017 15:07
Trichloroethene	ND	0.0050	1	09/25/2017 15:07
Trichlorofluoromethane	ND	0.0050	1	09/25/2017 15:07
1,2,3-Trichloropropane	ND	0.0050	1	09/25/2017 15:07
1,2,4-Trimethylbenzene	**0.0075**	0.0050	1	09/25/2017 15:07
1,3,5-Trimethylbenzene	ND	0.0050	1	09/25/2017 15:07
Vinyl Chloride	ND	0.0050	1	09/25/2017 15:07
Xylenes, Total	ND	0.0050	1	09/25/2017 15:07

(Cont.)

Angela Rydelius, Lab Manager

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC38 09251713.D**	**146037**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	121	82-136		09/25/2017 15:07
Toluene-d8	115	92-139		09/25/2017 15:07
4-BFB	110	82-135		09/25/2017 15:07
Benzene-d6	86	55-122		09/25/2017 15:07
Ethylbenzene-d10	95	58-141		09/25/2017 15:07
1,2-DCB-d4	76	51-107		09/25/2017 15:07

Analyst(s): AK

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	**1709793-004A**	**Soil**	**09/15/2017 08:50**	**GC28 09231713.D**	**145735**

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	0.10	1	09/23/2017 15:42
tert-Amyl methyl ether (TAME)	ND	0.0050	1	09/23/2017 15:42
Benzene	ND	0.0050	1	09/23/2017 15:42
Bromobenzene	ND	0.0050	1	09/23/2017 15:42
Bromochloromethane	ND	0.0050	1	09/23/2017 15:42
Bromodichloromethane	ND	0.0050	1	09/23/2017 15:42
Bromoform	ND	0.0050	1	09/23/2017 15:42
Bromomethane	ND	0.0050	1	09/23/2017 15:42
2-Butanone (MEK)	ND	0.020	1	09/23/2017 15:42
t-Butyl alcohol (TBA)	ND	0.050	1	09/23/2017 15:42
n-Butyl benzene	ND	0.0050	1	09/23/2017 15:42
sec-Butyl benzene	ND	0.0050	1	09/23/2017 15:42
tert-Butyl benzene	ND	0.0050	1	09/23/2017 15:42
Carbon Disulfide	ND	0.0050	1	09/23/2017 15:42
Carbon Tetrachloride	ND	0.0050	1	09/23/2017 15:42
Chlorobenzene	ND	0.0050	1	09/23/2017 15:42
Chloroethane	ND	0.0050	1	09/23/2017 15:42
Chloroform	ND	0.0050	1	09/23/2017 15:42
Chloromethane	ND	0.0050	1	09/23/2017 15:42
2-Chlorotoluene	ND	0.0050	1	09/23/2017 15:42
4-Chlorotoluene	ND	0.0050	1	09/23/2017 15:42
Dibromochloromethane	ND	0.0050	1	09/23/2017 15:42
1,2-Dibromo-3-chloropropane	ND	0.0040	1	09/23/2017 15:42
1,2-Dibromoethane (EDB)	ND	0.0040	1	09/23/2017 15:42
Dibromomethane	ND	0.0050	1	09/23/2017 15:42
1,2-Dichlorobenzene	ND	0.0050	1	09/23/2017 15:42
1,3-Dichlorobenzene	ND	0.0050	1	09/23/2017 15:42
1,4-Dichlorobenzene	ND	0.0050	1	09/23/2017 15:42
Dichlorodifluoromethane	ND	0.0050	1	09/23/2017 15:42
1,1-Dichloroethane	ND	0.0050	1	09/23/2017 15:42
1,2-Dichloroethane (1,2-DCA)	ND	0.0040	1	09/23/2017 15:42
1,1-Dichloroethene	ND	0.0050	1	09/23/2017 15:42
cis-1,2-Dichloroethene	ND	0.0050	1	09/23/2017 15:42
trans-1,2-Dichloroethene	ND	0.0050	1	09/23/2017 15:42
1,2-Dichloropropane	ND	0.0050	1	09/23/2017 15:42
1,3-Dichloropropane	ND	0.0050	1	09/23/2017 15:42
2,2-Dichloropropane	ND	0.0050	1	09/23/2017 15:42

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	**1709793-004A**	**Soil**	**09/15/2017 08:50**	**GC28 09231713.D**	**145735**

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.0050	1	09/23/2017 15:42
cis-1,3-Dichloropropene	ND	0.0050	1	09/23/2017 15:42
trans-1,3-Dichloropropene	ND	0.0050	1	09/23/2017 15:42
Diisopropyl ether (DIPE)	ND	0.0050	1	09/23/2017 15:42
Ethylbenzene	ND	0.0050	1	09/23/2017 15:42
Ethyl tert-butyl ether (ETBE)	ND	0.0050	1	09/23/2017 15:42
Freon 113	ND	0.0050	1	09/23/2017 15:42
Hexachlorobutadiene	ND	0.0050	1	09/23/2017 15:42
Hexachloroethane	ND	0.0050	1	09/23/2017 15:42
2-Hexanone	ND	0.0050	1	09/23/2017 15:42
Isopropylbenzene	ND	0.0050	1	09/23/2017 15:42
4-Isopropyl toluene	ND	0.0050	1	09/23/2017 15:42
Methyl-t-butyl ether (MTBE)	ND	0.0050	1	09/23/2017 15:42
Methylene chloride	ND	0.0050	1	09/23/2017 15:42
4-Methyl-2-pentanone (MIBK)	ND	0.0050	1	09/23/2017 15:42
Naphthalene	ND	0.0050	1	09/23/2017 15:42
n-Propyl benzene	ND	0.0050	1	09/23/2017 15:42
Styrene	ND	0.0050	1	09/23/2017 15:42
1,1,1,2-Tetrachloroethane	ND	0.0050	1	09/23/2017 15:42
1,1,2,2-Tetrachloroethane	ND	0.0050	1	09/23/2017 15:42
Tetrachloroethene	ND	0.0050	1	09/23/2017 15:42
Toluene	ND	0.0050	1	09/23/2017 15:42
1,2,3-Trichlorobenzene	ND	0.0050	1	09/23/2017 15:42
1,2,4-Trichlorobenzene	ND	0.0050	1	09/23/2017 15:42
1,1,1-Trichloroethane	ND	0.0050	1	09/23/2017 15:42
1,1,2-Trichloroethane	ND	0.0050	1	09/23/2017 15:42
Trichloroethene	ND	0.0050	1	09/23/2017 15:42
Trichlorofluoromethane	ND	0.0050	1	09/23/2017 15:42
1,2,3-Trichloropropane	ND	0.0050	1	09/23/2017 15:42
1,2,4-Trimethylbenzene	ND	0.0050	1	09/23/2017 15:42
1,3,5-Trimethylbenzene	ND	0.0050	1	09/23/2017 15:42
Vinyl Chloride	ND	0.0050	1	09/23/2017 15:42
Xylenes, Total	ND	0.0050	1	09/23/2017 15:42

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	**1709793-004A**	**Soil**	**09/15/2017 08:50**	**GC28 09231713.D**	**145735**

Analytes	Result		RL	DF	Date Analyzed
Surrogates	REC (%)	Qualifiers	Limits		
Dibromofluoromethane	103		82-136		09/23/2017 15:42
Toluene-d8	111		92-139		09/23/2017 15:42
4-BFB	81	S	82-135		09/23/2017 15:42
Benzene-d6	82		55-122		09/23/2017 15:42
Ethylbenzene-d10	93		58-141		09/23/2017 15:42
1,2-DCB-d4	77		51-107		09/23/2017 15:42

Analyst(s): AK

Analytical Comments: c2

(Cont.)

Angela Rydelius, Lab Manager

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**GC28 09231711.D**	**145735**

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	0.10	1	09/23/2017 14:25
tert-Amyl methyl ether (TAME)	ND	0.0050	1	09/23/2017 14:25
Benzene	ND	0.0050	1	09/23/2017 14:25
Bromobenzene	ND	0.0050	1	09/23/2017 14:25
Bromochloromethane	ND	0.0050	1	09/23/2017 14:25
Bromodichloromethane	ND	0.0050	1	09/23/2017 14:25
Bromoform	ND	0.0050	1	09/23/2017 14:25
Bromomethane	ND	0.0050	1	09/23/2017 14:25
2-Butanone (MEK)	ND	0.020	1	09/23/2017 14:25
t-Butyl alcohol (TBA)	ND	0.050	1	09/23/2017 14:25
n-Butyl benzene	ND	0.0050	1	09/23/2017 14:25
sec-Butyl benzene	ND	0.0050	1	09/23/2017 14:25
tert-Butyl benzene	ND	0.0050	1	09/23/2017 14:25
Carbon Disulfide	ND	0.0050	1	09/23/2017 14:25
Carbon Tetrachloride	ND	0.0050	1	09/23/2017 14:25
Chlorobenzene	ND	0.0050	1	09/23/2017 14:25
Chloroethane	ND	0.0050	1	09/23/2017 14:25
Chloroform	ND	0.0050	1	09/23/2017 14:25
Chloromethane	ND	0.0050	1	09/23/2017 14:25
2-Chlorotoluene	ND	0.0050	1	09/23/2017 14:25
4-Chlorotoluene	ND	0.0050	1	09/23/2017 14:25
Dibromochloromethane	ND	0.0050	1	09/23/2017 14:25
1,2-Dibromo-3-chloropropane	ND	0.0040	1	09/23/2017 14:25
1,2-Dibromoethane (EDB)	ND	0.0040	1	09/23/2017 14:25
Dibromomethane	ND	0.0050	1	09/23/2017 14:25
1,2-Dichlorobenzene	ND	0.0050	1	09/23/2017 14:25
1,3-Dichlorobenzene	ND	0.0050	1	09/23/2017 14:25
1,4-Dichlorobenzene	ND	0.0050	1	09/23/2017 14:25
Dichlorodifluoromethane	ND	0.0050	1	09/23/2017 14:25
1,1-Dichloroethane	ND	0.0050	1	09/23/2017 14:25
1,2-Dichloroethane (1,2-DCA)	ND	0.0040	1	09/23/2017 14:25
1,1-Dichloroethene	ND	0.0050	1	09/23/2017 14:25
cis-1,2-Dichloroethene	ND	0.0050	1	09/23/2017 14:25
trans-1,2-Dichloroethene	ND	0.0050	1	09/23/2017 14:25
1,2-Dichloropropane	ND	0.0050	1	09/23/2017 14:25
1,3-Dichloropropane	ND	0.0050	1	09/23/2017 14:25
2,2-Dichloropropane	ND	0.0050	1	09/23/2017 14:25

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	1709793-006A	Soil	09/15/2017 07:52	GC28 09231711.D	145735

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.0050	1	09/23/2017 14:25
cis-1,3-Dichloropropene	ND	0.0050	1	09/23/2017 14:25
trans-1,3-Dichloropropene	ND	0.0050	1	09/23/2017 14:25
Diisopropyl ether (DIPE)	ND	0.0050	1	09/23/2017 14:25
Ethylbenzene	ND	0.0050	1	09/23/2017 14:25
Ethyl tert-butyl ether (ETBE)	ND	0.0050	1	09/23/2017 14:25
Freon 113	ND	0.0050	1	09/23/2017 14:25
Hexachlorobutadiene	ND	0.0050	1	09/23/2017 14:25
Hexachloroethane	ND	0.0050	1	09/23/2017 14:25
2-Hexanone	ND	0.0050	1	09/23/2017 14:25
Isopropylbenzene	ND	0.0050	1	09/23/2017 14:25
4-Isopropyl toluene	ND	0.0050	1	09/23/2017 14:25
Methyl-t-butyl ether (MTBE)	ND	0.0050	1	09/23/2017 14:25
Methylene chloride	ND	0.0050	1	09/23/2017 14:25
4-Methyl-2-pentanone (MIBK)	ND	0.0050	1	09/23/2017 14:25
Naphthalene	ND	0.0050	1	09/23/2017 14:25
n-Propyl benzene	ND	0.0050	1	09/23/2017 14:25
Styrene	ND	0.0050	1	09/23/2017 14:25
1,1,1,2-Tetrachloroethane	ND	0.0050	1	09/23/2017 14:25
1,1,2,2-Tetrachloroethane	ND	0.0050	1	09/23/2017 14:25
Tetrachloroethene	ND	0.0050	1	09/23/2017 14:25
Toluene	ND	0.0050	1	09/23/2017 14:25
1,2,3-Trichlorobenzene	ND	0.0050	1	09/23/2017 14:25
1,2,4-Trichlorobenzene	ND	0.0050	1	09/23/2017 14:25
1,1,1-Trichloroethane	ND	0.0050	1	09/23/2017 14:25
1,1,2-Trichloroethane	ND	0.0050	1	09/23/2017 14:25
Trichloroethene	ND	0.0050	1	09/23/2017 14:25
Trichlorofluoromethane	ND	0.0050	1	09/23/2017 14:25
1,2,3-Trichloropropane	ND	0.0050	1	09/23/2017 14:25
1,2,4-Trimethylbenzene	ND	0.0050	1	09/23/2017 14:25
1,3,5-Trimethylbenzene	ND	0.0050	1	09/23/2017 14:25
Vinyl Chloride	ND	0.0050	1	09/23/2017 14:25
Xylenes, Total	ND	0.0050	1	09/23/2017 14:25

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**GC28 09231711.D**	**145735**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	102	82-136		09/23/2017 14:25
Toluene-d8	111	92-139		09/23/2017 14:25
4-BFB	82	82-135		09/23/2017 14:25
Benzene-d6	86	55-122		09/23/2017 14:25
Ethylbenzene-d10	96	58-141		09/23/2017 14:25
1,2-DCB-d4	80	51-107		09/23/2017 14:25

Analyst(s): AK

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	1709793-007A	Soil	09/15/2017 08:03	GC28 09231712.D	145735

Analytes	Result	RL	DF	Date Analyzed
Acetone	ND	0.10	1	09/23/2017 15:04
tert-Amyl methyl ether (TAME)	ND	0.0050	1	09/23/2017 15:04
Benzene	ND	0.0050	1	09/23/2017 15:04
Bromobenzene	ND	0.0050	1	09/23/2017 15:04
Bromochloromethane	ND	0.0050	1	09/23/2017 15:04
Bromodichloromethane	ND	0.0050	1	09/23/2017 15:04
Bromoform	ND	0.0050	1	09/23/2017 15:04
Bromomethane	ND	0.0050	1	09/23/2017 15:04
2-Butanone (MEK)	ND	0.020	1	09/23/2017 15:04
t-Butyl alcohol (TBA)	ND	0.050	1	09/23/2017 15:04
n-Butyl benzene	ND	0.0050	1	09/23/2017 15:04
sec-Butyl benzene	ND	0.0050	1	09/23/2017 15:04
tert-Butyl benzene	ND	0.0050	1	09/23/2017 15:04
Carbon Disulfide	ND	0.0050	1	09/23/2017 15:04
Carbon Tetrachloride	ND	0.0050	1	09/23/2017 15:04
Chlorobenzene	ND	0.0050	1	09/23/2017 15:04
Chloroethane	ND	0.0050	1	09/23/2017 15:04
Chloroform	ND	0.0050	1	09/23/2017 15:04
Chloromethane	ND	0.0050	1	09/23/2017 15:04
2-Chlorotoluene	ND	0.0050	1	09/23/2017 15:04
4-Chlorotoluene	ND	0.0050	1	09/23/2017 15:04
Dibromochloromethane	ND	0.0050	1	09/23/2017 15:04
1,2-Dibromo-3-chloropropane	ND	0.0040	1	09/23/2017 15:04
1,2-Dibromoethane (EDB)	ND	0.0040	1	09/23/2017 15:04
Dibromomethane	ND	0.0050	1	09/23/2017 15:04
1,2-Dichlorobenzene	ND	0.0050	1	09/23/2017 15:04
1,3-Dichlorobenzene	ND	0.0050	1	09/23/2017 15:04
1,4-Dichlorobenzene	ND	0.0050	1	09/23/2017 15:04
Dichlorodifluoromethane	ND	0.0050	1	09/23/2017 15:04
1,1-Dichloroethane	ND	0.0050	1	09/23/2017 15:04
1,2-Dichloroethane (1,2-DCA)	ND	0.0040	1	09/23/2017 15:04
1,1-Dichloroethene	ND	0.0050	1	09/23/2017 15:04
cis-1,2-Dichloroethene	ND	0.0050	1	09/23/2017 15:04
trans-1,2-Dichloroethene	ND	0.0050	1	09/23/2017 15:04
1,2-Dichloropropane	ND	0.0050	1	09/23/2017 15:04
1,3-Dichloropropane	ND	0.0050	1	09/23/2017 15:04
2,2-Dichloropropane	ND	0.0050	1	09/23/2017 15:04

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Angela Rydelius, Lab Manager

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	**1709793-007A**	**Soil**	**09/15/2017 08:03**	**GC28 09231712.D**	**145735**

Analytes	Result	RL	DF	Date Analyzed
1,1-Dichloropropene	ND	0.0050	1	09/23/2017 15:04
cis-1,3-Dichloropropene	ND	0.0050	1	09/23/2017 15:04
trans-1,3-Dichloropropene	ND	0.0050	1	09/23/2017 15:04
Diisopropyl ether (DIPE)	ND	0.0050	1	09/23/2017 15:04
Ethylbenzene	ND	0.0050	1	09/23/2017 15:04
Ethyl tert-butyl ether (ETBE)	ND	0.0050	1	09/23/2017 15:04
Freon 113	ND	0.0050	1	09/23/2017 15:04
Hexachlorobutadiene	ND	0.0050	1	09/23/2017 15:04
Hexachloroethane	ND	0.0050	1	09/23/2017 15:04
2-Hexanone	ND	0.0050	1	09/23/2017 15:04
Isopropylbenzene	ND	0.0050	1	09/23/2017 15:04
4-Isopropyl toluene	ND	0.0050	1	09/23/2017 15:04
Methyl-t-butyl ether (MTBE)	ND	0.0050	1	09/23/2017 15:04
Methylene chloride	ND	0.0050	1	09/23/2017 15:04
4-Methyl-2-pentanone (MIBK)	ND	0.0050	1	09/23/2017 15:04
Naphthalene	ND	0.0050	1	09/23/2017 15:04
n-Propyl benzene	ND	0.0050	1	09/23/2017 15:04
Styrene	ND	0.0050	1	09/23/2017 15:04
1,1,1,2-Tetrachloroethane	ND	0.0050	1	09/23/2017 15:04
1,1,2,2-Tetrachloroethane	ND	0.0050	1	09/23/2017 15:04
Tetrachloroethene	ND	0.0050	1	09/23/2017 15:04
Toluene	ND	0.0050	1	09/23/2017 15:04
1,2,3-Trichlorobenzene	ND	0.0050	1	09/23/2017 15:04
1,2,4-Trichlorobenzene	ND	0.0050	1	09/23/2017 15:04
1,1,1-Trichloroethane	ND	0.0050	1	09/23/2017 15:04
1,1,2-Trichloroethane	ND	0.0050	1	09/23/2017 15:04
Trichloroethene	ND	0.0050	1	09/23/2017 15:04
Trichlorofluoromethane	ND	0.0050	1	09/23/2017 15:04
1,2,3-Trichloropropane	ND	0.0050	1	09/23/2017 15:04
1,2,4-Trimethylbenzene	ND	0.0050	1	09/23/2017 15:04
1,3,5-Trimethylbenzene	ND	0.0050	1	09/23/2017 15:04
Vinyl Chloride	ND	0.0050	1	09/23/2017 15:04
Xylenes, Total	ND	0.0050	1	09/23/2017 15:04

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8260B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	**1709793-007A**	**Soil**	**09/15/2017 08:03**	**GC28 09231712.D**	**145735**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
Dibromofluoromethane	102	82-136		09/23/2017 15:04
Toluene-d8	111	92-139		09/23/2017 15:04
4-BFB	83	82-135		09/23/2017 15:04
Benzene-d6	85	55-122		09/23/2017 15:04
Ethylbenzene-d10	95	58-141		09/23/2017 15:04
1,2-DCB-d4	79	51-107		09/23/2017 15:04

Analyst(s): AK

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C-SIM
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Polynuclear Aromatic Hydrocarbons (PAHs / PNAs) using SIM Mode

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC35 09201708.D**	**145799**

Analytes	Result	RL	DF	Date Analyzed
Acenaphthene	ND	0.50	50	09/20/2017 12:37
Acenaphthylene	ND	0.50	50	09/20/2017 12:37
Anthracene	ND	0.50	50	09/20/2017 12:37
Benzo (a) anthracene	ND	0.50	50	09/20/2017 12:37
Benzo (a) pyrene	ND	0.50	50	09/20/2017 12:37
Benzo (b) fluoranthene	ND	0.50	50	09/20/2017 12:37
Benzo (g,h,i) perylene	ND	0.50	50	09/20/2017 12:37
Benzo (k) fluoranthene	ND	0.50	50	09/20/2017 12:37
Chrysene	ND	0.50	50	09/20/2017 12:37
Dibenzo (a,h) anthracene	ND	0.50	50	09/20/2017 12:37
Fluoranthene	**0.94**	0.50	50	09/20/2017 12:37
Fluorene	ND	0.50	50	09/20/2017 12:37
Indeno (1,2,3-cd) pyrene	ND	0.50	50	09/20/2017 12:37
1-Methylnaphthalene	ND	0.50	50	09/20/2017 12:37
2-Methylnaphthalene	ND	0.50	50	09/20/2017 12:37
Naphthalene	ND	0.50	50	09/20/2017 12:37
Phenanthrene	**0.80**	0.50	50	09/20/2017 12:37
Pyrene	**0.73**	0.50	50	09/20/2017 12:37

Surrogates	REC (%)	Limits	Date Analyzed
1-Fluoronaphthalene	117	30-130	09/20/2017 12:37
2-Fluorobiphenyl	114	30-130	09/20/2017 12:37

Analyst(s): REB

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C-SIM
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Polynuclear Aromatic Hydrocarbons (PAHs / PNAs) using SIM Mode

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**GC35 09201709.D**	**145799**

Analytes	Result	RL	DF	Date Analyzed
Acenaphthene	ND	0.010	1	09/20/2017 13:02
Acenaphthylene	ND	0.010	1	09/20/2017 13:02
Anthracene	ND	0.010	1	09/20/2017 13:02
Benzo (a) anthracene	ND	0.010	1	09/20/2017 13:02
Benzo (a) pyrene	ND	0.010	1	09/20/2017 13:02
Benzo (b) fluoranthene	ND	0.010	1	09/20/2017 13:02
Benzo (g,h,i) perylene	ND	0.010	1	09/20/2017 13:02
Benzo (k) fluoranthene	ND	0.010	1	09/20/2017 13:02
Chrysene	ND	0.010	1	09/20/2017 13:02
Dibenzo (a,h) anthracene	ND	0.010	1	09/20/2017 13:02
Fluoranthene	ND	0.010	1	09/20/2017 13:02
Fluorene	ND	0.010	1	09/20/2017 13:02
Indeno (1,2,3-cd) pyrene	ND	0.010	1	09/20/2017 13:02
1-Methylnaphthalene	ND	0.010	1	09/20/2017 13:02
2-Methylnaphthalene	ND	0.010	1	09/20/2017 13:02
Naphthalene	ND	0.010	1	09/20/2017 13:02
Phenanthrene	ND	0.010	1	09/20/2017 13:02
Pyrene	ND	0.010	1	09/20/2017 13:02

Surrogates	REC (%)	Limits	
1-Fluoronaphthalene	114	30-130	09/20/2017 13:02
2-Fluorobiphenyl	113	30-130	09/20/2017 13:02

Analyst(s): REB

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC17 09201721.D**	**145800**

Analytes	Result	RL	DF	Date Analyzed
Acenaphthene	ND	20	10	09/20/2017 18:06
Acenaphthylene	ND	20	10	09/20/2017 18:06
Acetochlor	ND	20	10	09/20/2017 18:06
Anthracene	ND	20	10	09/20/2017 18:06
Benzidine	ND	100	10	09/20/2017 18:06
Benzo (a) anthracene	ND	20	10	09/20/2017 18:06
Benzo (a) pyrene	ND	20	10	09/20/2017 18:06
Benzo (b) fluoranthene	ND	20	10	09/20/2017 18:06
Benzo (g,h,i) perylene	ND	20	10	09/20/2017 18:06
Benzo (k) fluoranthene	ND	20	10	09/20/2017 18:06
Benzyl Alcohol	ND	100	10	09/20/2017 18:06
1,1-Biphenyl	ND	20	10	09/20/2017 18:06
Bis (2-chloroethoxy) Methane	ND	20	10	09/20/2017 18:06
Bis (2-chloroethyl) Ether	ND	20	10	09/20/2017 18:06
Bis (2-chloroisopropyl) Ether	ND	20	10	09/20/2017 18:06
Bis (2-ethylhexyl) Adipate	ND	20	10	09/20/2017 18:06
Bis (2-ethylhexyl) Phthalate	ND	20	10	09/20/2017 18:06
4-Bromophenyl Phenyl Ether	ND	20	10	09/20/2017 18:06
Butylbenzyl Phthalate	ND	20	10	09/20/2017 18:06
4-Chloroaniline	ND	40	10	09/20/2017 18:06
4-Chloro-3-methylphenol	ND	20	10	09/20/2017 18:06
2-Chloronaphthalene	ND	20	10	09/20/2017 18:06
2-Chlorophenol	ND	20	10	09/20/2017 18:06
4-Chlorophenyl Phenyl Ether	ND	20	10	09/20/2017 18:06
Chrysene	ND	20	10	09/20/2017 18:06
Dibenzo (a,h) anthracene	ND	20	10	09/20/2017 18:06
Dibenzofuran	ND	20	10	09/20/2017 18:06
Di-n-butyl Phthalate	ND	20	10	09/20/2017 18:06
1,2-Dichlorobenzene	ND	20	10	09/20/2017 18:06
1,3-Dichlorobenzene	ND	20	10	09/20/2017 18:06
1,4-Dichlorobenzene	ND	20	10	09/20/2017 18:06
3,3-Dichlorobenzidine	ND	40	10	09/20/2017 18:06
2,4-Dichlorophenol	ND	20	10	09/20/2017 18:06
Diethyl Phthalate	ND	20	10	09/20/2017 18:06
2,4-Dimethylphenol	ND	20	10	09/20/2017 18:06
Dimethyl Phthalate	ND	20	10	09/20/2017 18:06
4,6-Dinitro-2-methylphenol	ND	100	10	09/20/2017 18:06

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC17 09201721.D**	**145800**

Analytes	Result	RL	DF	Date Analyzed
2,4-Dinitrophenol	ND	500	10	09/20/2017 18:06
2,4-Dinitrotoluene	ND	20	10	09/20/2017 18:06
2,6-Dinitrotoluene	ND	20	10	09/20/2017 18:06
Di-n-octyl Phthalate	ND	40	10	09/20/2017 18:06
1,2-Diphenylhydrazine	ND	20	10	09/20/2017 18:06
Fluoranthene	ND	20	10	09/20/2017 18:06
Fluorene	ND	20	10	09/20/2017 18:06
Hexachlorobenzene	ND	20	10	09/20/2017 18:06
Hexachlorobutadiene	ND	20	10	09/20/2017 18:06
Hexachlorocyclopentadiene	ND	100	10	09/20/2017 18:06
Hexachloroethane	ND	20	10	09/20/2017 18:06
Indeno (1,2,3-cd) pyrene	ND	20	10	09/20/2017 18:06
Isophorone	ND	20	10	09/20/2017 18:06
2-Methylnaphthalene	ND	20	10	09/20/2017 18:06
2-Methylphenol (o-Cresol)	ND	20	10	09/20/2017 18:06
3 & 4-Methylphenol (m,p-Cresol)	ND	20	10	09/20/2017 18:06
Naphthalene	ND	20	10	09/20/2017 18:06
2-Nitroaniline	ND	100	10	09/20/2017 18:06
3-Nitroaniline	ND	100	10	09/20/2017 18:06
4-Nitroaniline	ND	100	10	09/20/2017 18:06
Nitrobenzene	ND	20	10	09/20/2017 18:06
2-Nitrophenol	ND	100	10	09/20/2017 18:06
4-Nitrophenol	ND	100	10	09/20/2017 18:06
N-Nitrosodiphenylamine	ND	20	10	09/20/2017 18:06
N-Nitrosodi-n-propylamine	ND	20	10	09/20/2017 18:06
Pentachlorophenol	ND	100	10	09/20/2017 18:06
Phenanthrene	ND	20	10	09/20/2017 18:06
Phenol	ND	20	10	09/20/2017 18:06
Pyrene	ND	20	10	09/20/2017 18:06
Pyridine	ND	20	10	09/20/2017 18:06
1,2,4-Trichlorobenzene	ND	20	10	09/20/2017 18:06
2,4,5-Trichlorophenol	ND	20	10	09/20/2017 18:06
2,4,6-Trichlorophenol	ND	20	10	09/20/2017 18:06

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC17 09201721.D**	**145800**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
2-Fluorophenol	84	30-130		09/20/2017 18:06
Phenol-d5	65	30-130		09/20/2017 18:06
Nitrobenzene-d5	67	30-130		09/20/2017 18:06
2-Fluorobiphenyl	67	30-130		09/20/2017 18:06
2,4,6-Tribromophenol	130	16-130		09/20/2017 18:06
4-Terphenyl-d14	68	30-130		09/20/2017 18:06

Analyst(s): REB

Analytical Comments: a3,a4

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	1709793-004A	Soil	09/15/2017 08:50	GC17 09201722.D	145800

Analytes	Result	RL	DF	Date Analyzed
Acenaphthene	ND	0.25	1	09/20/2017 18:33
Acenaphthylene	ND	0.25	1	09/20/2017 18:33
Acetochlor	ND	0.25	1	09/20/2017 18:33
Anthracene	ND	0.25	1	09/20/2017 18:33
Benzidine	ND	1.3	1	09/20/2017 18:33
Benzo (a) anthracene	ND	0.25	1	09/20/2017 18:33
Benzo (a) pyrene	ND	0.25	1	09/20/2017 18:33
Benzo (b) fluoranthene	ND	0.25	1	09/20/2017 18:33
Benzo (g,h,i) perylene	ND	0.25	1	09/20/2017 18:33
Benzo (k) fluoranthene	ND	0.25	1	09/20/2017 18:33
Benzyl Alcohol	ND	1.3	1	09/20/2017 18:33
1,1-Biphenyl	ND	0.25	1	09/20/2017 18:33
Bis (2-chloroethoxy) Methane	ND	0.25	1	09/20/2017 18:33
Bis (2-chloroethyl) Ether	ND	0.25	1	09/20/2017 18:33
Bis (2-chloroisopropyl) Ether	ND	0.25	1	09/20/2017 18:33
Bis (2-ethylhexyl) Adipate	ND	0.25	1	09/20/2017 18:33
Bis (2-ethylhexyl) Phthalate	ND	0.25	1	09/20/2017 18:33
4-Bromophenyl Phenyl Ether	ND	0.25	1	09/20/2017 18:33
Butylbenzyl Phthalate	ND	0.25	1	09/20/2017 18:33
4-Chloroaniline	ND	0.50	1	09/20/2017 18:33
4-Chloro-3-methylphenol	ND	0.25	1	09/20/2017 18:33
2-Chloronaphthalene	ND	0.25	1	09/20/2017 18:33
2-Chlorophenol	ND	0.25	1	09/20/2017 18:33
4-Chlorophenyl Phenyl Ether	ND	0.25	1	09/20/2017 18:33
Chrysene	ND	0.25	1	09/20/2017 18:33
Dibenzo (a,h) anthracene	ND	0.25	1	09/20/2017 18:33
Dibenzofuran	ND	0.25	1	09/20/2017 18:33
Di-n-butyl Phthalate	ND	0.25	1	09/20/2017 18:33
1,2-Dichlorobenzene	ND	0.25	1	09/20/2017 18:33
1,3-Dichlorobenzene	ND	0.25	1	09/20/2017 18:33
1,4-Dichlorobenzene	ND	0.25	1	09/20/2017 18:33
3,3-Dichlorobenzidine	ND	0.50	1	09/20/2017 18:33
2,4-Dichlorophenol	ND	0.25	1	09/20/2017 18:33
Diethyl Phthalate	ND	0.25	1	09/20/2017 18:33
2,4-Dimethylphenol	ND	0.25	1	09/20/2017 18:33
Dimethyl Phthalate	ND	0.25	1	09/20/2017 18:33
4,6-Dinitro-2-methylphenol	ND	1.3	1	09/20/2017 18:33

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	1709793-004A	Soil	09/15/2017 08:50	GC17 09201722.D	145800

Analytes	Result	RL	DF	Date Analyzed
2,4-Dinitrophenol	ND	6.3	1	09/20/2017 18:33
2,4-Dinitrotoluene	ND	0.25	1	09/20/2017 18:33
2,6-Dinitrotoluene	ND	0.25	1	09/20/2017 18:33
Di-n-octyl Phthalate	ND	0.50	1	09/20/2017 18:33
1,2-Diphenylhydrazine	ND	0.25	1	09/20/2017 18:33
Fluoranthene	ND	0.25	1	09/20/2017 18:33
Fluorene	ND	0.25	1	09/20/2017 18:33
Hexachlorobenzene	ND	0.25	1	09/20/2017 18:33
Hexachlorobutadiene	ND	0.25	1	09/20/2017 18:33
Hexachlorocyclopentadiene	ND	1.3	1	09/20/2017 18:33
Hexachloroethane	ND	0.25	1	09/20/2017 18:33
Indeno (1,2,3-cd) pyrene	ND	0.25	1	09/20/2017 18:33
Isophorone	ND	0.25	1	09/20/2017 18:33
2-Methylnaphthalene	ND	0.25	1	09/20/2017 18:33
2-Methylphenol (o-Cresol)	ND	0.25	1	09/20/2017 18:33
3 & 4-Methylphenol (m,p-Cresol)	ND	0.25	1	09/20/2017 18:33
Naphthalene	ND	0.25	1	09/20/2017 18:33
2-Nitroaniline	ND	1.3	1	09/20/2017 18:33
3-Nitroaniline	ND	1.3	1	09/20/2017 18:33
4-Nitroaniline	ND	1.3	1	09/20/2017 18:33
Nitrobenzene	ND	0.25	1	09/20/2017 18:33
2-Nitrophenol	ND	1.3	1	09/20/2017 18:33
4-Nitrophenol	ND	1.3	1	09/20/2017 18:33
N-Nitrosodiphenylamine	ND	0.25	1	09/20/2017 18:33
N-Nitrosodi-n-propylamine	ND	0.25	1	09/20/2017 18:33
Pentachlorophenol	ND	1.3	1	09/20/2017 18:33
Phenanthrene	ND	0.25	1	09/20/2017 18:33
Phenol	ND	0.25	1	09/20/2017 18:33
Pyrene	ND	0.25	1	09/20/2017 18:33
Pyridine	ND	0.25	1	09/20/2017 18:33
1,2,4-Trichlorobenzene	ND	0.25	1	09/20/2017 18:33
2,4,5-Trichlorophenol	ND	0.25	1	09/20/2017 18:33
2,4,6-Trichlorophenol	ND	0.25	1	09/20/2017 18:33

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	**1709793-004A**	**Soil**	**09/15/2017 08:50**	**GC17 09201722.D**	**145800**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
2-Fluorophenol	79	30-130		09/20/2017 18:33
Phenol-d5	72	30-130		09/20/2017 18:33
Nitrobenzene-d5	72	30-130		09/20/2017 18:33
2-Fluorobiphenyl	62	30-130		09/20/2017 18:33
2,4,6-Tribromophenol	47	16-130		09/20/2017 18:33
4-Terphenyl-d14	74	30-130		09/20/2017 18:33

Analyst(s): REB

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	1709793-006A	Soil	09/15/2017 07:52	GC17 09201723.D	145800

Analytes	Result	RL	DF	Date Analyzed
Acenaphthene	ND	0.25	1	09/20/2017 19:00
Acenaphthylene	ND	0.25	1	09/20/2017 19:00
Acetochlor	ND	0.25	1	09/20/2017 19:00
Anthracene	ND	0.25	1	09/20/2017 19:00
Benzidine	ND	1.3	1	09/20/2017 19:00
Benzo (a) anthracene	ND	0.25	1	09/20/2017 19:00
Benzo (a) pyrene	ND	0.25	1	09/20/2017 19:00
Benzo (b) fluoranthene	ND	0.25	1	09/20/2017 19:00
Benzo (g,h,i) perylene	ND	0.25	1	09/20/2017 19:00
Benzo (k) fluoranthene	ND	0.25	1	09/20/2017 19:00
Benzyl Alcohol	ND	1.3	1	09/20/2017 19:00
1,1-Biphenyl	ND	0.25	1	09/20/2017 19:00
Bis (2-chloroethoxy) Methane	ND	0.25	1	09/20/2017 19:00
Bis (2-chloroethyl) Ether	ND	0.25	1	09/20/2017 19:00
Bis (2-chloroisopropyl) Ether	ND	0.25	1	09/20/2017 19:00
Bis (2-ethylhexyl) Adipate	ND	0.25	1	09/20/2017 19:00
Bis (2-ethylhexyl) Phthalate	ND	0.25	1	09/20/2017 19:00
4-Bromophenyl Phenyl Ether	ND	0.25	1	09/20/2017 19:00
Butylbenzyl Phthalate	ND	0.25	1	09/20/2017 19:00
4-Chloroaniline	ND	0.50	1	09/20/2017 19:00
4-Chloro-3-methylphenol	ND	0.25	1	09/20/2017 19:00
2-Chloronaphthalene	ND	0.25	1	09/20/2017 19:00
2-Chlorophenol	ND	0.25	1	09/20/2017 19:00
4-Chlorophenyl Phenyl Ether	ND	0.25	1	09/20/2017 19:00
Chrysene	ND	0.25	1	09/20/2017 19:00
Dibenzo (a,h) anthracene	ND	0.25	1	09/20/2017 19:00
Dibenzofuran	ND	0.25	1	09/20/2017 19:00
Di-n-butyl Phthalate	ND	0.25	1	09/20/2017 19:00
1,2-Dichlorobenzene	ND	0.25	1	09/20/2017 19:00
1,3-Dichlorobenzene	ND	0.25	1	09/20/2017 19:00
1,4-Dichlorobenzene	ND	0.25	1	09/20/2017 19:00
3,3-Dichlorobenzidine	ND	0.50	1	09/20/2017 19:00
2,4-Dichlorophenol	ND	0.25	1	09/20/2017 19:00
Diethyl Phthalate	ND	0.25	1	09/20/2017 19:00
2,4-Dimethylphenol	ND	0.25	1	09/20/2017 19:00
Dimethyl Phthalate	ND	0.25	1	09/20/2017 19:00
4,6-Dinitro-2-methylphenol	ND	1.3	1	09/20/2017 19:00

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**GC17 09201723.D**	**145800**

Analytes	Result	RL	DF	Date Analyzed
2,4-Dinitrophenol	ND	6.3	1	09/20/2017 19:00
2,4-Dinitrotoluene	ND	0.25	1	09/20/2017 19:00
2,6-Dinitrotoluene	ND	0.25	1	09/20/2017 19:00
Di-n-octyl Phthalate	ND	0.50	1	09/20/2017 19:00
1,2-Diphenylhydrazine	ND	0.25	1	09/20/2017 19:00
Fluoranthene	ND	0.25	1	09/20/2017 19:00
Fluorene	ND	0.25	1	09/20/2017 19:00
Hexachlorobenzene	ND	0.25	1	09/20/2017 19:00
Hexachlorobutadiene	ND	0.25	1	09/20/2017 19:00
Hexachlorocyclopentadiene	ND	1.3	1	09/20/2017 19:00
Hexachloroethane	ND	0.25	1	09/20/2017 19:00
Indeno (1,2,3-cd) pyrene	ND	0.25	1	09/20/2017 19:00
Isophorone	ND	0.25	1	09/20/2017 19:00
2-Methylnaphthalene	ND	0.25	1	09/20/2017 19:00
2-Methylphenol (o-Cresol)	ND	0.25	1	09/20/2017 19:00
3 & 4-Methylphenol (m,p-Cresol)	ND	0.25	1	09/20/2017 19:00
Naphthalene	ND	0.25	1	09/20/2017 19:00
2-Nitroaniline	ND	1.3	1	09/20/2017 19:00
3-Nitroaniline	ND	1.3	1	09/20/2017 19:00
4-Nitroaniline	ND	1.3	1	09/20/2017 19:00
Nitrobenzene	ND	0.25	1	09/20/2017 19:00
2-Nitrophenol	ND	1.3	1	09/20/2017 19:00
4-Nitrophenol	ND	1.3	1	09/20/2017 19:00
N-Nitrosodiphenylamine	ND	0.25	1	09/20/2017 19:00
N-Nitrosodi-n-propylamine	ND	0.25	1	09/20/2017 19:00
Pentachlorophenol	ND	1.3	1	09/20/2017 19:00
Phenanthrene	ND	0.25	1	09/20/2017 19:00
Phenol	ND	0.25	1	09/20/2017 19:00
Pyrene	ND	0.25	1	09/20/2017 19:00
Pyridine	ND	0.25	1	09/20/2017 19:00
1,2,4-Trichlorobenzene	ND	0.25	1	09/20/2017 19:00
2,4,5-Trichlorophenol	ND	0.25	1	09/20/2017 19:00
2,4,6-Trichlorophenol	ND	0.25	1	09/20/2017 19:00

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**GC17 09201723.D**	**145800**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
2-Fluorophenol	83	30-130		09/20/2017 19:00
Phenol-d5	76	30-130		09/20/2017 19:00
Nitrobenzene-d5	71	30-130		09/20/2017 19:00
2-Fluorobiphenyl	61	30-130		09/20/2017 19:00
2,4,6-Tribromophenol	46	16-130		09/20/2017 19:00
4-Terphenyl-d14	63	30-130		09/20/2017 19:00

Analyst(s): REB

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	1709793-007A	Soil	09/15/2017 08:03	GC17 09201724.D	145800

Analytes	Result	RL	DF	Date Analyzed
Acenaphthene	ND	0.25	1	09/20/2017 19:27
Acenaphthylene	ND	0.25	1	09/20/2017 19:27
Acetochlor	ND	0.25	1	09/20/2017 19:27
Anthracene	ND	0.25	1	09/20/2017 19:27
Benzidine	ND	1.3	1	09/20/2017 19:27
Benzo (a) anthracene	ND	0.25	1	09/20/2017 19:27
Benzo (a) pyrene	ND	0.25	1	09/20/2017 19:27
Benzo (b) fluoranthene	ND	0.25	1	09/20/2017 19:27
Benzo (g,h,i) perylene	ND	0.25	1	09/20/2017 19:27
Benzo (k) fluoranthene	ND	0.25	1	09/20/2017 19:27
Benzyl Alcohol	ND	1.3	1	09/20/2017 19:27
1,1-Biphenyl	ND	0.25	1	09/20/2017 19:27
Bis (2-chloroethoxy) Methane	ND	0.25	1	09/20/2017 19:27
Bis (2-chloroethyl) Ether	ND	0.25	1	09/20/2017 19:27
Bis (2-chloroisopropyl) Ether	ND	0.25	1	09/20/2017 19:27
Bis (2-ethylhexyl) Adipate	ND	0.25	1	09/20/2017 19:27
Bis (2-ethylhexyl) Phthalate	ND	0.25	1	09/20/2017 19:27
4-Bromophenyl Phenyl Ether	ND	0.25	1	09/20/2017 19:27
Butylbenzyl Phthalate	ND	0.25	1	09/20/2017 19:27
4-Chloroaniline	ND	0.50	1	09/20/2017 19:27
4-Chloro-3-methylphenol	ND	0.25	1	09/20/2017 19:27
2-Chloronaphthalene	ND	0.25	1	09/20/2017 19:27
2-Chlorophenol	ND	0.25	1	09/20/2017 19:27
4-Chlorophenyl Phenyl Ether	ND	0.25	1	09/20/2017 19:27
Chrysene	ND	0.25	1	09/20/2017 19:27
Dibenzo (a,h) anthracene	ND	0.25	1	09/20/2017 19:27
Dibenzofuran	ND	0.25	1	09/20/2017 19:27
Di-n-butyl Phthalate	ND	0.25	1	09/20/2017 19:27
1,2-Dichlorobenzene	ND	0.25	1	09/20/2017 19:27
1,3-Dichlorobenzene	ND	0.25	1	09/20/2017 19:27
1,4-Dichlorobenzene	ND	0.25	1	09/20/2017 19:27
3,3-Dichlorobenzidine	ND	0.50	1	09/20/2017 19:27
2,4-Dichlorophenol	ND	0.25	1	09/20/2017 19:27
Diethyl Phthalate	ND	0.25	1	09/20/2017 19:27
2,4-Dimethylphenol	ND	0.25	1	09/20/2017 19:27
Dimethyl Phthalate	ND	0.25	1	09/20/2017 19:27
4,6-Dinitro-2-methylphenol	ND	1.3	1	09/20/2017 19:27

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Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	1709793-007A	Soil	09/15/2017 08:03	GC17 09201724.D	145800

Analytes	Result	RL	DF	Date Analyzed
2,4-Dinitrophenol	ND	6.3	1	09/20/2017 19:27
2,4-Dinitrotoluene	ND	0.25	1	09/20/2017 19:27
2,6-Dinitrotoluene	ND	0.25	1	09/20/2017 19:27
Di-n-octyl Phthalate	ND	0.50	1	09/20/2017 19:27
1,2-Diphenylhydrazine	ND	0.25	1	09/20/2017 19:27
Fluoranthene	ND	0.25	1	09/20/2017 19:27
Fluorene	ND	0.25	1	09/20/2017 19:27
Hexachlorobenzene	ND	0.25	1	09/20/2017 19:27
Hexachlorobutadiene	ND	0.25	1	09/20/2017 19:27
Hexachlorocyclopentadiene	ND	1.3	1	09/20/2017 19:27
Hexachloroethane	ND	0.25	1	09/20/2017 19:27
Indeno (1,2,3-cd) pyrene	ND	0.25	1	09/20/2017 19:27
Isophorone	ND	0.25	1	09/20/2017 19:27
2-Methylnaphthalene	ND	0.25	1	09/20/2017 19:27
2-Methylphenol (o-Cresol)	ND	0.25	1	09/20/2017 19:27
3 & 4-Methylphenol (m,p-Cresol)	ND	0.25	1	09/20/2017 19:27
Naphthalene	ND	0.25	1	09/20/2017 19:27
2-Nitroaniline	ND	1.3	1	09/20/2017 19:27
3-Nitroaniline	ND	1.3	1	09/20/2017 19:27
4-Nitroaniline	ND	1.3	1	09/20/2017 19:27
Nitrobenzene	ND	0.25	1	09/20/2017 19:27
2-Nitrophenol	ND	1.3	1	09/20/2017 19:27
4-Nitrophenol	ND	1.3	1	09/20/2017 19:27
N-Nitrosodiphenylamine	ND	0.25	1	09/20/2017 19:27
N-Nitrosodi-n-propylamine	ND	0.25	1	09/20/2017 19:27
Pentachlorophenol	ND	1.3	1	09/20/2017 19:27
Phenanthrene	ND	0.25	1	09/20/2017 19:27
Phenol	ND	0.25	1	09/20/2017 19:27
Pyrene	ND	0.25	1	09/20/2017 19:27
Pyridine	ND	0.25	1	09/20/2017 19:27
1,2,4-Trichlorobenzene	ND	0.25	1	09/20/2017 19:27
2,4,5-Trichlorophenol	ND	0.25	1	09/20/2017 19:27
2,4,6-Trichlorophenol	ND	0.25	1	09/20/2017 19:27

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/20/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	**1709793-007A**	**Soil**	**09/15/2017 08:03**	**GC17 09201724.D**	**145800**

Analytes	Result	RL	DF	Date Analyzed
Surrogates	REC (%)	Limits		
2-Fluorophenol	77	30-130		09/20/2017 19:27
Phenol-d5	71	30-130		09/20/2017 19:27
Nitrobenzene-d5	69	30-130		09/20/2017 19:27
2-Fluorobiphenyl	60	30-130		09/20/2017 19:27
2,4,6-Tribromophenol	42	16-130		09/20/2017 19:27
4-Terphenyl-d14	68	30-130		09/20/2017 19:27

Analyst(s): REB

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3050B
Date Prepared:	9/19/17	**Analytical Method:**	SW6020
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**ICP-MS3 131SMPL.D**	**145773**

Analytes	Result	RL	DF	Date Analyzed
Antimony	**1.3**	0.50	1	09/20/2017 23:20
Arsenic	**3.8**	0.50	1	09/20/2017 23:20
Barium	**120**	5.0	1	09/20/2017 23:20
Beryllium	ND	0.50	1	09/20/2017 23:20
Cadmium	ND	0.25	1	09/20/2017 23:20
Chromium	**30**	0.50	1	09/20/2017 23:20
Cobalt	**11**	0.50	1	09/20/2017 23:20
Copper	**120**	0.50	1	09/20/2017 23:20
Lead	**9.3**	0.50	1	09/20/2017 23:20
Mercury	**0.13**	0.050	1	09/20/2017 23:20
Molybdenum	ND	0.50	1	09/20/2017 23:20
Nickel	**53**	0.50	1	09/20/2017 23:20
Selenium	ND	0.50	1	09/20/2017 23:20
Silver	ND	0.50	1	09/20/2017 23:20
Thallium	ND	0.50	1	09/20/2017 23:20
Vanadium	**34**	0.50	1	09/20/2017 23:20
Zinc	**110**	5.0	1	09/20/2017 23:20

Surrogates	REC (%)	Limits		
Terbium	101	70-130		09/20/2017 23:20

Analyst(s): DB

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3050B
Date Prepared:	9/19/17	**Analytical Method:**	SW6020
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-5.5	**1709793-002A**	**Soil**	**09/15/2017 15:30**	**ICP-MS3 132SMPL.D**	**145773**

Analytes	Result	RL	DF	Date Analyzed
Antimony	**0.92**	0.50	1	09/20/2017 23:26
Arsenic	**10**	0.50	1	09/20/2017 23:26
Barium	**140**	5.0	1	09/20/2017 23:26
Beryllium	**0.60**	0.50	1	09/20/2017 23:26
Cadmium	ND	0.25	1	09/20/2017 23:26
Chromium	**40**	0.50	1	09/20/2017 23:26
Cobalt	**12**	0.50	1	09/20/2017 23:26
Copper	**47**	0.50	1	09/20/2017 23:26
Lead	**8.6**	0.50	1	09/20/2017 23:26
Mercury	ND	0.050	1	09/20/2017 23:26
Molybdenum	**0.69**	0.50	1	09/20/2017 23:26
Nickel	**47**	0.50	1	09/20/2017 23:26
Selenium	ND	0.50	1	09/20/2017 23:26
Silver	ND	0.50	1	09/20/2017 23:26
Thallium	ND	0.50	1	09/20/2017 23:26
Vanadium	**70**	0.50	1	09/20/2017 23:26
Zinc	**77**	5.0	1	09/20/2017 23:26

Surrogates	REC (%)	Limits	
Terbium	103	70-130	09/20/2017 23:26

Analyst(s): DB

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3050B
Date Prepared:	9/19/17	**Analytical Method:**	SW6020
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-3.0	**1709793-003A**	**Soil**	**09/15/2017 08:40**	**ICP-MS3 133SMPL.D**	**145773**

Analytes	Result	RL	DF	Date Analyzed
Antimony	**0.95**	0.50	1	09/20/2017 23:32
Arsenic	**9.0**	0.50	1	09/20/2017 23:32
Barium	**150**	5.0	1	09/20/2017 23:32
Beryllium	**0.53**	0.50	1	09/20/2017 23:32
Cadmium	ND	0.25	1	09/20/2017 23:32
Chromium	**52**	0.50	1	09/20/2017 23:32
Cobalt	**11**	0.50	1	09/20/2017 23:32
Copper	**39**	0.50	1	09/20/2017 23:32
Lead	**41**	0.50	1	09/20/2017 23:32
Mercury	**0.21**	0.050	1	09/20/2017 23:32
Molybdenum	**0.66**	0.50	1	09/20/2017 23:32
Nickel	**57**	0.50	1	09/20/2017 23:32
Selenium	ND	0.50	1	09/20/2017 23:32
Silver	ND	0.50	1	09/20/2017 23:32
Thallium	ND	0.50	1	09/20/2017 23:32
Vanadium	**54**	0.50	1	09/20/2017 23:32
Zinc	**94**	5.0	1	09/20/2017 23:32

Surrogates	REC (%)	Limits	
Terbium	107	70-130	09/20/2017 23:32

Analyst(s): DB

(Cont.)

Angela Rydelius, Lab Manager

Analytical Report

Client: Langan
Date Received: 9/19/17 16:30
Date Prepared: 9/19/17
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
Extraction Method: SW3050B
Analytical Method: SW6020
Unit: mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	**1709793-004A**	**Soil**	**09/15/2017 08:50**	**ICP-MS3 134SMPL.D**	**145773**

Analytes	Result	RL	DF	Date Analyzed
Antimony	**0.78**	0.50	1	09/20/2017 23:38
Arsenic	**8.1**	0.50	1	09/20/2017 23:38
Barium	**160**	5.0	1	09/20/2017 23:38
Beryllium	**0.54**	0.50	1	09/20/2017 23:38
Cadmium	ND	0.25	1	09/20/2017 23:38
Chromium	**35**	0.50	1	09/20/2017 23:38
Cobalt	**11**	0.50	1	09/20/2017 23:38
Copper	**37**	0.50	1	09/20/2017 23:38
Lead	**16**	0.50	1	09/20/2017 23:38
Mercury	**0.098**	0.050	1	09/20/2017 23:38
Molybdenum	**0.64**	0.50	1	09/20/2017 23:38
Nickel	**41**	0.50	1	09/20/2017 23:38
Selenium	ND	0.50	1	09/20/2017 23:38
Silver	ND	0.50	1	09/20/2017 23:38
Thallium	ND	0.50	1	09/20/2017 23:38
Vanadium	**59**	0.50	1	09/20/2017 23:38
Zinc	**68**	5.0	1	09/20/2017 23:38

Surrogates	REC (%)	Limits	
Terbium	99	70-130	09/20/2017 23:38

Analyst(s): DB

(Cont.)

Angela Rydelius, Lab Manager

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3050B
Date Prepared:	9/19/17	**Analytical Method:**	SW6020
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**ICP-MS3 138SMPL.D**	**145773**

Analytes	Result	RL	DF	Date Analyzed
Antimony	**0.81**	0.50	1	09/21/2017 00:03
Arsenic	**7.8**	0.50	1	09/21/2017 00:03
Barium	**150**	5.0	1	09/21/2017 00:03
Beryllium	ND	0.50	1	09/21/2017 00:03
Cadmium	ND	0.25	1	09/21/2017 00:03
Chromium	**49**	0.50	1	09/21/2017 00:03
Cobalt	**14**	0.50	1	09/21/2017 00:03
Copper	**41**	0.50	1	09/21/2017 00:03
Lead	**26**	0.50	1	09/21/2017 00:03
Mercury	**0.13**	0.050	1	09/21/2017 00:03
Molybdenum	**0.61**	0.50	1	09/21/2017 00:03
Nickel	**72**	0.50	1	09/21/2017 00:03
Selenium	ND	0.50	1	09/21/2017 00:03
Silver	ND	0.50	1	09/21/2017 00:03
Thallium	ND	0.50	1	09/21/2017 00:03
Vanadium	**62**	0.50	1	09/21/2017 00:03
Zinc	**88**	5.0	1	09/21/2017 00:03

Surrogates	REC (%)	Limits	
Terbium	105	70-130	09/21/2017 00:03

Analyst(s): DB

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3050B
Date Prepared:	9/19/17	**Analytical Method:**	SW6020
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

CAM / CCR 17 Metals

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	**1709793-007A**	**Soil**	**09/15/2017 08:03**	**ICP-MS3 139SMPL.D**	**145773**

Analytes	Result	RL	DF	Date Analyzed
Antimony	**0.86**	0.50	1	09/21/2017 00:09
Arsenic	**9.7**	0.50	1	09/21/2017 00:09
Barium	**140**	5.0	1	09/21/2017 00:09
Beryllium	ND	0.50	1	09/21/2017 00:09
Cadmium	ND	0.25	1	09/21/2017 00:09
Chromium	**36**	0.50	1	09/21/2017 00:09
Cobalt	**8.6**	0.50	1	09/21/2017 00:09
Copper	**33**	0.50	1	09/21/2017 00:09
Lead	**38**	0.50	1	09/21/2017 00:09
Mercury	**0.072**	0.050	1	09/21/2017 00:09
Molybdenum	**0.75**	0.50	1	09/21/2017 00:09
Nickel	**27**	0.50	1	09/21/2017 00:09
Selenium	ND	0.50	1	09/21/2017 00:09
Silver	ND	0.50	1	09/21/2017 00:09
Thallium	ND	0.50	1	09/21/2017 00:09
Vanadium	**57**	0.50	1	09/21/2017 00:09
Zinc	**53**	5.0	1	09/21/2017 00:09

Surrogates	REC (%)	Limits	
Terbium	100	70-130	09/21/2017 00:09

Analyst(s): DB

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	CARB 435 Asbestos
Date Prepared:	9/20/17	**Analytical Method:**	435 CARB
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	%

Asbestos (CARB 435) 400 Point Count

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-3.0	**1709793-003A**	**Soil**	**09/15/2017 08:40**	**WetChem**	**145994**

Analytes	Result	RL	DF	Date Analyzed
Asbestos	ND	0.25	1	09/22/2017 14:00

Analyst(s): DA

Analytical Comments: k10

Angela Rydelius, Lab Manager

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8021B/8015Bm
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC19 09251715.D**	**146028**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	**1.4**	1.0	1	09/25/2017 17:18
MTBE	---	0.050	1	09/25/2017 17:18
Benzene	---	0.0050	1	09/25/2017 17:18
Toluene	---	0.0050	1	09/25/2017 17:18
Ethylbenzene	---	0.0050	1	09/25/2017 17:18
Xylenes	---	0.015	1	09/25/2017 17:18

Surrogates	REC (%)	Limits	
2-Fluorotoluene	89	62-126	09/25/2017 17:18

Analyst(s): IA

Analytical Comments: d7

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-5.5	**1709793-002A**	**Soil**	**09/15/2017 15:30**	**GC19 09221717.D**	**145736**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	1.0	1	09/22/2017 20:26
MTBE	---	0.050	1	09/22/2017 20:26
Benzene	---	0.0050	1	09/22/2017 20:26
Toluene	---	0.0050	1	09/22/2017 20:26
Ethylbenzene	---	0.0050	1	09/22/2017 20:26
Xylenes	---	0.015	1	09/22/2017 20:26

Surrogates	REC (%)	Limits	
2-Fluorotoluene	77	62-126	09/22/2017 20:26

Analyst(s): IA

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8021B/8015Bm
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-3.0	**1709793-003A**	**Soil**	**09/15/2017 08:40**	**GC19 09221718.D**	**145736**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	1.0	1	09/22/2017 20:57
MTBE	---	0.050	1	09/22/2017 20:57
Benzene	---	0.0050	1	09/22/2017 20:57
Toluene	---	0.0050	1	09/22/2017 20:57
Ethylbenzene	---	0.0050	1	09/22/2017 20:57
Xylenes	---	0.015	1	09/22/2017 20:57

Surrogates	REC (%)	Limits	Date Analyzed
2-Fluorotoluene	79	62-126	09/22/2017 20:57

Analyst(s): IA

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	**1709793-004A**	**Soil**	**09/15/2017 08:50**	**GC19 09211736.D**	**145736**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	1.0	1	09/22/2017 05:40
MTBE	---	0.050	1	09/22/2017 05:40
Benzene	---	0.0050	1	09/22/2017 05:40
Toluene	---	0.0050	1	09/22/2017 05:40
Ethylbenzene	---	0.0050	1	09/22/2017 05:40
Xylenes	---	0.015	1	09/22/2017 05:40

Surrogates	REC (%)	Limits	Date Analyzed
2-Fluorotoluene	82	62-126	09/22/2017 05:40

Analyst(s): IA

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW5030B
Date Prepared:	9/19/17-9/25/17	**Analytical Method:**	SW8021B/8015Bm
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Gasoline Range (C6-C12) Volatile Hydrocarbons as Gasoline with BTEX and MTBE

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**GC19 09211738.D**	**145736**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	1.0	1	09/22/2017 06:40
MTBE	---	0.050	1	09/22/2017 06:40
Benzene	---	0.0050	1	09/22/2017 06:40
Toluene	---	0.0050	1	09/22/2017 06:40
Ethylbenzene	---	0.0050	1	09/22/2017 06:40
Xylenes	---	0.015	1	09/22/2017 06:40

Surrogates	REC (%)	Limits	
2-Fluorotoluene	87	62-126	09/22/2017 06:40

Analyst(s): IA

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	**1709793-007A**	**Soil**	**09/15/2017 08:03**	**GC19 09211739.D**	**145736**

Analytes	Result	RL	DF	Date Analyzed
TPH(g) (C6-C12)	ND	1.0	1	09/22/2017 07:10
MTBE	---	0.050	1	09/22/2017 07:10
Benzene	---	0.0050	1	09/22/2017 07:10
Toluene	---	0.0050	1	09/22/2017 07:10
Ethylbenzene	---	0.0050	1	09/22/2017 07:10
Xylenes	---	0.015	1	09/22/2017 07:10

Surrogates	REC (%)	Limits	
2-Fluorotoluene	77	62-126	09/22/2017 07:10

Analyst(s): IA

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/19/17	**Analytical Method:**	SW8015B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC9a 09261710.D**	**145780**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	**210**	50	50	09/26/2017 13:48
TPH-Motor Oil (C18-C36)	**4300**	250	50	09/26/2017 13:48

Surrogates	REC (%)	Qualifiers	Limits	
C9	271	S	78-126	09/26/2017 13:48

Analyst(s): TK   Analytical Comments: e7,e2,c2

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-5.5	**1709793-002A**	**Soil**	**09/15/2017 15:30**	**GC39A 09251750.D**	**145780**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	1.0	1	09/26/2017 00:37
TPH-Motor Oil (C18-C36)	ND	5.0	1	09/26/2017 00:37

Surrogates	REC (%)	Limits	
C9	95	78-126	09/26/2017 00:37

Analyst(s): TK

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-3.0	**1709793-003A**	**Soil**	**09/15/2017 08:40**	**GC39A 09251752.D**	**145780**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	**3.5**	1.0	1	09/26/2017 01:15
TPH-Motor Oil (C18-C36)	**18**	5.0	1	09/26/2017 01:15

Surrogates	REC (%)	Limits	
C9	97	78-126	09/26/2017 01:15

Analyst(s): TK   Analytical Comments: e7,e2

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B
Date Prepared:	9/19/17	**Analytical Method:**	SW8015B
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Total Extractable Petroleum Hydrocarbons w/out SG Clean-Up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-2-5.5	**1709793-004A**	**Soil**	**09/15/2017 08:50**	**GC39A 09251744.D**	**145780**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	ND	1.0	1	09/25/2017 22:40
TPH-Motor Oil (C18-C36)	**8.6**	5.0	1	09/25/2017 22:40

Surrogates	REC (%)	Limits	
C9	95	78-126	09/25/2017 22:40

Analyst(s): TK

Analytical Comments: e7

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-3.0	**1709793-006A**	**Soil**	**09/15/2017 07:52**	**GC39A 09251760.D**	**145780**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	**3.6**	1.0	1	09/26/2017 03:51
TPH-Motor Oil (C18-C36)	**24**	5.0	1	09/26/2017 03:51

Surrogates	REC (%)	Limits	
C9	97	78-126	09/26/2017 03:51

Analyst(s): TK

Analytical Comments: e7,e2

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-3-5.5	**1709793-007A**	**Soil**	**09/15/2017 08:03**	**GC39A 09251756.D**	**145780**

Analytes	Result	RL	DF	Date Analyzed
TPH-Diesel (C10-C23)	**2.5**	1.0	1	09/26/2017 02:33
TPH-Motor Oil (C18-C36)	**12**	5.0	1	09/26/2017 02:33

Surrogates	REC (%)	Limits	
C9	95	78-126	09/26/2017 02:33

Analyst(s): TK

Analytical Comments: e7,e2

Quality Control Report

Client: Langan
Date Prepared: 9/19/17
Date Analyzed: 9/21/17
Instrument: GC22
Matrix: Soil
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
BatchID: 145782
Extraction Method: SW3550B
Analytical Method: SW8082
Unit: mg/kg
Sample ID: MB/LCS-145782
1709793-001AMS/MSD

QC Summary Report for SW8082

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Aroclor1016	ND	0.151	0.050	0.15	-	101	70-130
Aroclor1221	ND	-	0.050	-	-	-	-
Aroclor1232	ND	-	0.050	-	-	-	-
Aroclor1242	ND	-	0.050	-	-	-	-
Aroclor1248	ND	-	0.050	-	-	-	-
Aroclor1254	ND	-	0.050	-	-	-	-
Aroclor1260	ND	0.148	0.050	0.15	-	98	70-130
PCBs, total	ND	-	0.050	-	-	-	-
Surrogate Recovery							
Decachlorobiphenyl	0.04906	0.0523		0.050	98	105	70-130

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Aroclor1016	NR	NR		ND<1	NR	NR	-	NR	-
Aroclor1260	NR	NR		ND<1	NR	NR	-	NR	-
Surrogate Recovery									
Decachlorobiphenyl	NR	NR			NR	NR	-	NR	-

QA/QC Officer

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	145735
Date Analyzed:	9/20/17 - 9/22/17	**Extraction Method:**	SW5030B
Instrument:	GC10, GC18	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145735 1709780-002AMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Acetone	ND	1.18	0.10	1	-	118	48-156
tert-Amyl methyl ether (TAME)	ND	0.0400	0.0050	0.050	-	80	56-115
Benzene	ND	0.0476	0.0050	0.050	-	95	63-131
Bromobenzene	ND	0.0490	0.0050	0.050	-	98	66-127
Bromochloromethane	ND	0.0449	0.0050	0.050	-	90	64-124
Bromodichloromethane	ND	0.0416	0.0050	0.050	-	83	64-120
Bromoform	ND	0.0350	0.0050	0.050	-	70	48-92
Bromomethane	ND	0.0578	0.0050	0.050	-	116	25-163
2-Butanone (MEK)	ND	0.184	0.020	0.20	-	92	51-133
t-Butyl alcohol (TBA)	ND	0.202	0.050	0.20	-	101	52-129
n-Butyl benzene	ND	0.0721	0.0050	0.050	-	144	83-200
sec-Butyl benzene	ND	0.0789	0.0050	0.050	-	158	81-199
tert-Butyl benzene	ND	0.0662	0.0050	0.050	-	132	79-178
Carbon Disulfide	ND	0.0522	0.0050	0.050	-	104	64-136
Carbon Tetrachloride	ND	0.0482	0.0050	0.050	-	96	66-140
Chlorobenzene	ND	0.0453	0.0050	0.050	-	91	73-116
Chloroethane	ND	0.0569	0.0050	0.050	-	114	35-147
Chloroform	ND	0.0454	0.0050	0.050	-	91	65-130
Chloromethane	ND	0.0444	0.0050	0.050	-	89	30-137
2-Chlorotoluene	ND	0.0619	0.0050	0.050	-	124	75-152
4-Chlorotoluene	ND	0.0561	0.0050	0.050	-	112	71-148
Dibromochloromethane	ND	0.0406	0.0050	0.050	-	81	61-106
1,2-Dibromo-3-chloropropane	ND	0.0162	0.0040	0.020	-	81	36-120
1,2-Dibromoethane (EDB)	ND	0.0441	0.0040	0.050	-	88	67-118
Dibromomethane	ND	0.0425	0.0050	0.050	-	85	61-116
1,2-Dichlorobenzene	ND	0.0398	0.0050	0.050	-	80	59-106
1,3-Dichlorobenzene	ND	0.0569	0.0050	0.050	-	114	75-129
1,4-Dichlorobenzene	ND	0.0476	0.0050	0.050	-	95	66-127
Dichlorodifluoromethane	ND	0.0233	0.0050	0.050	-	47	13-74
1,1-Dichloroethane	ND	0.0468	0.0050	0.050	-	94	65-134
1,2-Dichloroethane (1,2-DCA)	ND	0.0449	0.0040	0.050	-	90	57-131
1,1-Dichloroethene	ND	0.0488	0.0050	0.050	-	98	62-127
cis-1,2-Dichloroethene	ND	0.0461	0.0050	0.050	-	92	66-130
trans-1,2-Dichloroethene	ND	0.0484	0.0050	0.050	-	97	60-131
1,2-Dichloropropane	ND	0.0428	0.0050	0.050	-	86	63-127
1,3-Dichloropropane	ND	0.0452	0.0050	0.050	-	90	68-124
2,2-Dichloropropane	ND	0.0503	0.0050	0.050	-	101	63-150

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	145735
Date Analyzed:	9/20/17 - 9/22/17	**Extraction Method:**	SW5030B
Instrument:	GC10, GC18	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145735 1709780-002AMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
1,1-Dichloropropene	ND	0.0486	0.0050	0.050	-	97	67-134
cis-1,3-Dichloropropene	ND	0.0460	0.0050	0.050	-	92	65-138
trans-1,3-Dichloropropene	ND	0.0458	0.0050	0.050	-	92	66-124
Diisopropyl ether (DIPE)	ND	0.0420	0.0050	0.050	-	84	58-129
Ethylbenzene	ND	0.0540	0.0050	0.050	-	108	73-145
Ethyl tert-butyl ether (ETBE)	ND	0.0431	0.0050	0.050	-	86	62-125
Freon 113	ND	0.0445	0.0050	0.050	-	89	55-116
Hexachlorobutadiene	ND	0.0545	0.0050	0.050	-	109	75-178
Hexachloroethane	ND	0.0593	0.0050	0.050	-	119	75-152
2-Hexanone	ND	0.0396	0.0050	0.050	-	79	41-113
Isopropylbenzene	ND	0.0705	0.0050	0.050	-	141	67-172
4-Isopropyl toluene	ND	0.0695	0.0050	0.050	-	139	88-171
Methyl-t-butyl ether (MTBE)	ND	0.0446	0.0050	0.050	-	89	58-122
Methylene chloride	ND	0.0458	0.0050	0.050	-	92	57-140
4-Methyl-2-pentanone (MIBK)	ND	0.0383	0.0050	0.050	-	77	42-117
Naphthalene	ND	0.0230	0.0050	0.050	-	46	29-65
n-Propyl benzene	ND	0.0711	0.0050	0.050	-	142	85-174
Styrene	ND	0.0422	0.0050	0.050	-	84	63-126
1,1,1,2-Tetrachloroethane	ND	0.0438	0.0050	0.050	-	88	68-131
1,1,2,2-Tetrachloroethane	ND	0.0434	0.0050	0.050	-	87	45-121
Tetrachloroethene	ND	0.0512	0.0050	0.050	-	102	65-150
Toluene	ND	0.0489	0.0050	0.050	-	98	72-135
1,2,3-Trichlorobenzene	ND	0.0291	0.0050	0.050	-	58	35-80
1,2,4-Trichlorobenzene	ND	0.0344	0.0050	0.050	-	69	45-103
1,1,1-Trichloroethane	ND	0.0483	0.0050	0.050	-	97	67-137
1,1,2-Trichloroethane	ND	0.0434	0.0050	0.050	-	87	67-117
Trichloroethene	ND	0.0456	0.0050	0.050	-	91	62-135
Trichlorofluoromethane	ND	0.0470	0.0050	0.050	-	94	56-124
1,2,3-Trichloropropane	ND	0.0538	0.0050	0.050	-	108	58-133
1,2,4-Trimethylbenzene	ND	0.0622	0.0050	0.050	-	124	78-161
1,3,5-Trimethylbenzene	ND	0.0662	0.0050	0.050	-	132	85-170
Vinyl Chloride	ND	0.0489	0.0050	0.050	-	98	32-142
Xylenes, Total	ND	0.152	0.0050	0.15	-	101	70-137

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Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	145735
Date Analyzed:	9/20/17 - 9/22/17	**Extraction Method:**	SW5030B
Instrument:	GC10, GC18	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145735 1709780-002AMS/MSD

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Surrogate Recovery							
Dibromofluoromethane	0.1442	0.144		0.12	115	115	87-127
Toluene-d8	0.1622	0.167		0.12	130	134	93-141
4-BFB	0.01284	0.0136		0.012	103	109	84-137
Benzene-d6	0.1149	0.115		0.10	115	115	67-131
Ethylbenzene-d10	0.132	0.134		0.10	132	135	78-153
1,2-DCB-d4	0.0763	0.0840		0.10	76	84	63-109

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	145735
Date Analyzed:	9/20/17 - 9/22/17	**Extraction Method:**	SW5030B
Instrument:	GC10, GC18	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145735 1709780-002AMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Acetone	0.992	0.919	1	ND	99	92	36-141	7.67	20
tert-Amyl methyl ether (TAME)	0.0360	0.0332	0.050	ND	72	66	46-105	8.11	20
Benzene	0.0422	0.0396	0.050	ND	84	79	46-124	6.34	20
Bromobenzene	0.0429	0.0394	0.050	ND	86	79	50-119	8.55	20
Bromochloromethane	0.0398	0.0368	0.050	ND	80	74	42-122	7.73	20
Bromodichloromethane	0.0376	0.0353	0.050	ND	75	71	48-112	6.35	20
Bromoform	0.0330	0.0310	0.050	ND	66	62	36-90	6.07	20
Bromomethane	0.0480	0.0489	0.050	ND	96	98	10-149	1.85	20
2-Butanone (MEK)	0.161	0.143	0.20	ND	80	71	43-114	12.0	20
t-Butyl alcohol (TBA)	0.181	0.166	0.20	ND	91	83	33-123	8.51	20
n-Butyl benzene	0.0596	0.0552	0.050	ND	119	111	40-185	7.59	20
sec-Butyl benzene	0.0646	0.0610	0.050	ND	129	122	40-183	5.77	20
tert-Butyl benzene	0.0547	0.0504	0.050	ND	109	101	44-168	8.17	20
Carbon Disulfide	0.0452	0.0427	0.050	ND	90	85	23-139	5.61	20
Carbon Tetrachloride	0.0427	0.0404	0.050	ND	85	81	43-133	5.60	20
Chlorobenzene	0.0404	0.0376	0.050	ND	81	75	51-115	7.06	20
Chloroethane	0.0484	0.0468	0.050	ND	97	94	16-138	3.42	20
Chloroform	0.0404	0.0380	0.050	ND	81	76	54-117	6.13	20
Chloromethane	0.0370	0.0364	0.050	ND	74	73	14-128	1.52	20
2-Chlorotoluene	0.0524	0.0481	0.050	ND	105	96	54-141	8.57	20
4-Chlorotoluene	0.0471	0.0435	0.050	ND	94	87	52-134	7.97	20
Dibromochloromethane	0.0366	0.0343	0.050	ND	73	69	46-102	6.41	20
1,2-Dibromo-3-chloropropane	0.0145	0.0136	0.020	ND	72	68	16-120	6.32	20
1,2-Dibromoethane (EDB)	0.0389	0.0362	0.050	ND	78	72	48-113	7.24	20
Dibromomethane	0.0383	0.0358	0.050	ND	77	72	44-110	6.67	20
1,2-Dichlorobenzene	0.0354	0.0334	0.050	ND	71	67	43-106	5.84	20
1,3-Dichlorobenzene	0.0491	0.0453	0.050	ND	98	91	49-128	8.13	20
1,4-Dichlorobenzene	0.0422	0.0392	0.050	ND	84	78	48-120	7.36	20
Dichlorodifluoromethane	0.0181	0.0186	0.050	ND	36	37	8-63	2.65	20
1,1-Dichloroethane	0.0415	0.0391	0.050	ND	83	78	50-122	6.01	20
1,2-Dichloroethane (1,2-DCA)	0.0402	0.0376	0.050	ND	80	75	46-116	6.44	20
1,1-Dichloroethene	0.0428	0.0406	0.050	ND	86	81	37-124	5.35	20
cis-1,2-Dichloroethene	0.0410	0.0385	0.050	ND	82	77	47-123	6.23	20
trans-1,2-Dichloroethene	0.0426	0.0399	0.050	ND	85	80	31-131	6.35	20
1,2-Dichloropropane	0.0384	0.0360	0.050	ND	77	72	50-116	6.46	20
1,3-Dichloropropane	0.0403	0.0371	0.050	ND	81	74	52-115	8.29	20
2,2-Dichloropropane	0.0444	0.0418	0.050	ND	89	84	43-137	6.25	20

(Cont.)

Quality Control Report

Client: Langan
Date Prepared: 9/19/17
Date Analyzed: 9/20/17 - 9/22/17
Instrument: GC10, GC18
Matrix: Soil
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
BatchID: 145735
Extraction Method: SW5030B
Analytical Method: SW8260B
Unit: mg/kg
Sample ID: MB/LCS-145735
1709780-002AMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
1,1-Dichloropropene	0.0431	0.0406	0.050	ND	86	81	43-126	5.99	20
cis-1,3-Dichloropropene	0.0408	0.0374	0.050	ND	82	75	35-134	8.63	20
trans-1,3-Dichloropropene	0.0409	0.0377	0.050	ND	82	75	35-124	8.27	20
Diisopropyl ether (DIPE)	0.0374	0.0347	0.050	ND	75	69	49-116	7.58	20
Ethylbenzene	0.0486	0.0448	0.050	ND	97	90	49-137	8.23	20
Ethyl tert-butyl ether (ETBE)	0.0382	0.0352	0.050	ND	76	70	50-113	8.34	20
Freon 113	0.0373	0.0356	0.050	ND	75	71	28-114	4.90	20
Hexachlorobutadiene	0.0467	0.0431	0.050	ND	93	86	22-180	8.08	20
Hexachloroethane	0.0490	0.0462	0.050	ND	98	92	28-158	5.90	20
2-Hexanone	0.0361	0.0328	0.050	ND	72	66	31-102	9.68	20
Isopropylbenzene	0.0582	0.0536	0.050	ND	116	107	50-153	8.34	20
4-Isopropyl toluene	0.0582	0.0545	0.050	ND	117	109	41-171	6.71	20
Methyl-t-butyl ether (MTBE)	0.0394	0.0362	0.050	ND	79	72	48-110	8.47	20
Methylene chloride	0.0411	0.0391	0.050	ND	82	78	42-127	5.01	20
4-Methyl-2-pentanone (MIBK)	0.0344	0.0316	0.050	ND	69	63	24-114	8.49	20
Naphthalene	0.0219	0.0196	0.050	ND	44	39	19-69	11.0	20
n-Propyl benzene	0.0585	0.0538	0.050	ND	117	108	46-168	8.40	20
Styrene	0.0379	0.0356	0.050	ND	76	71	42-122	6.29	20
1,1,1,2-Tetrachloroethane	0.0389	0.0361	0.050	ND	78	72	52-121	7.39	20
1,1,2,2-Tetrachloroethane	0.0387	0.0367	0.050	ND	77	73	27-116	5.36	20
Tetrachloroethene	0.0450	0.0418	0.050	ND	90	84	37-149	7.19	20
Toluene	0.0490	0.0444	0.050	0.01348	71	62	52-124	9.82	20
1,2,3-Trichlorobenzene	0.0274	0.0252	0.050	ND	55	50	20-86	8.60	20
1,2,4-Trichlorobenzene	0.0314	0.0287	0.050	ND	63	57	24-107	9.12	20
1,1,1-Trichloroethane	0.0428	0.0405	0.050	ND	86	81	48-128	5.60	20
1,1,2-Trichloroethane	0.0388	0.0361	0.050	ND	77	72	51-110	7.18	20
Trichloroethene	0.0406	0.0383	0.050	ND	81	77	42-128	5.93	20
Trichlorofluoromethane	0.0402	0.0381	0.050	ND	80	76	31-121	5.46	20
1,2,3-Trichloropropane	0.0467	0.0427	0.050	ND	93	85	50-115	9.13	20
1,2,4-Trimethylbenzene	0.0524	0.0490	0.050	ND	105	98	48-151	6.68	20
1,3,5-Trimethylbenzene	0.0551	0.0509	0.050	ND	110	102	51-159	7.87	20
Vinyl Chloride	0.0408	0.0403	0.050	ND	82	81	11-136	1.41	20
Xylenes, Total	0.140	0.129	0.15	ND	94	86	38-141	8.32	20

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Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	145735
Date Analyzed:	9/20/17 - 9/22/17	**Extraction Method:**	SW5030B
Instrument:	GC10, GC18	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145735 1709780-002AMS/MSD

QC Summary Report for SW8260B

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Surrogate Recovery									
Dibromofluoromethane	0.144	0.144	0.12		115	115	82-136	0	20
Toluene-d8	0.165	0.162	0.12		132	129	92-139	1.73	20
4-BFB	0.0130	0.0130	0.012		104	104	82-135	0	20
Benzene-d6	0.101	0.0958	0.10		101	96	55-122	5.75	20
Ethylbenzene-d10	0.118	0.110	0.10		118	110	58-141	7.15	20
1,2-DCB-d4	0.0756	0.0720	0.10		76	72	51-107	4.75	20

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QA/QC Officer

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/25/17	**BatchID:**	146037
Date Analyzed:	9/26/17	**Extraction Method:**	SW5030B
Instrument:	GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146037

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Acetone	ND	1.04	0.10	1	-	104	48-156
tert-Amyl methyl ether (TAME)	ND	0.0334	0.0050	0.050	-	67	56-115
Benzene	ND	0.0440	0.0050	0.050	-	88	63-131
Bromobenzene	ND	0.0433	0.0050	0.050	-	87	66-127
Bromochloromethane	ND	0.0412	0.0050	0.050	-	82	64-124
Bromodichloromethane	ND	0.0454	0.0050	0.050	-	91	64-120
Bromoform	ND	0.0372	0.0050	0.050	-	74	48-92
Bromomethane	ND	0.0587	0.0050	0.050	-	117	25-163
2-Butanone (MEK)	ND	0.139	0.020	0.20	-	70	51-133
t-Butyl alcohol (TBA)	ND	0.161	0.050	0.20	-	80	52-129
n-Butyl benzene	ND	0.0567	0.0050	0.050	-	113	83-200
sec-Butyl benzene	ND	0.0581	0.0050	0.050	-	116	81-199
tert-Butyl benzene	ND	0.0530	0.0050	0.050	-	106	79-178
Carbon Disulfide	ND	0.0561	0.0050	0.050	-	112	64-136
Carbon Tetrachloride	ND	0.0499	0.0050	0.050	-	100	66-140
Chlorobenzene	ND	0.0434	0.0050	0.050	-	87	73-116
Chloroethane	ND	0.0536	0.0050	0.050	-	107	35-147
Chloroform	ND	0.0438	0.0050	0.050	-	88	65-130
Chloromethane	ND	0.0575	0.0050	0.050	-	115	30-137
2-Chlorotoluene	ND	0.0485	0.0050	0.050	-	97	75-152
4-Chlorotoluene	ND	0.0479	0.0050	0.050	-	96	71-148
Dibromochloromethane	ND	0.0379	0.0050	0.050	-	76	61-106
1,2-Dibromo-3-chloropropane	ND	0.0127	0.0040	0.020	-	64	36-120
1,2-Dibromoethane (EDB)	ND	0.0403	0.0040	0.050	-	81	67-118
Dibromomethane	ND	0.0400	0.0050	0.050	-	80	61-116
1,2-Dichlorobenzene	ND	0.0389	0.0050	0.050	-	78	59-106
1,3-Dichlorobenzene	ND	0.0466	0.0050	0.050	-	93	75-129
1,4-Dichlorobenzene	ND	0.0439	0.0050	0.050	-	88	66-127
Dichlorodifluoromethane	ND	0.0345	0.0050	0.050	-	69	13-74
1,1-Dichloroethane	ND	0.0435	0.0050	0.050	-	87	65-134
1,2-Dichloroethane (1,2-DCA)	ND	0.0391	0.0040	0.050	-	78	57-131
1,1-Dichloroethene	ND	0.0529	0.0050	0.050	-	106	62-127
cis-1,2-Dichloroethene	ND	0.0383	0.0050	0.050	-	77	66-130
trans-1,2-Dichloroethene	ND	0.0514	0.0050	0.050	-	103	60-131
1,2-Dichloropropane	ND	0.0420	0.0050	0.050	-	84	63-127
1,3-Dichloropropane	ND	0.0379	0.0050	0.050	-	76	68-124
2,2-Dichloropropane	ND	0.0507	0.0050	0.050	-	101	63-150

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QA/QC Officer

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/25/17	**BatchID:**	146037
Date Analyzed:	9/26/17	**Extraction Method:**	SW5030B
Instrument:	GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146037

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
1,1-Dichloropropene	ND	0.0476	0.0050	0.050	-	95	67-134
cis-1,3-Dichloropropene	ND	0.0402	0.0050	0.050	-	80	65-138
trans-1,3-Dichloropropene	ND	0.0380	0.0050	0.050	-	76	66-124
Diisopropyl ether (DIPE)	ND	0.0383	0.0050	0.050	-	77	58-129
Ethylbenzene	ND	0.0487	0.0050	0.050	-	97	73-145
Ethyl tert-butyl ether (ETBE)	ND	0.0364	0.0050	0.050	-	73	62-125
Freon 113	ND	0.0482	0.0050	0.050	-	96	55-116
Hexachlorobutadiene	ND	0.0606	0.0050	0.050	-	121	75-178
Hexachloroethane	ND	0.0514	0.0050	0.050	-	103	75-152
2-Hexanone	ND	0.0301	0.0050	0.050	-	60	41-113
Isopropylbenzene	ND	0.0532	0.0050	0.050	-	106	67-172
4-Isopropyl toluene	ND	0.0560	0.0050	0.050	-	112	88-171
Methyl-t-butyl ether (MTBE)	ND	0.0359	0.0050	0.050	-	72	58-122
Methylene chloride	ND	0.0543	0.0050	0.050	-	109	57-140
4-Methyl-2-pentanone (MIBK)	ND	0.0287	0.0050	0.050	-	57	42-117
Naphthalene	ND	0.0206	0.0050	0.050	-	41	29-65
n-Propyl benzene	ND	0.0560	0.0050	0.050	-	112	85-174
Styrene	ND	0.0462	0.0050	0.050	-	93	63-126
1,1,1,2-Tetrachloroethane	ND	0.0480	0.0050	0.050	-	96	68-131
1,1,2,2-Tetrachloroethane	ND	0.0343	0.0050	0.050	-	69	45-121
Tetrachloroethene	ND	0.0518	0.0050	0.050	-	104	65-150
Toluene	ND	0.0471	0.0050	0.050	-	94	72-135
1,2,3-Trichlorobenzene	ND	0.0290	0.0050	0.050	-	58	35-80
1,2,4-Trichlorobenzene	ND	0.0374	0.0050	0.050	-	75	45-103
1,1,1-Trichloroethane	ND	0.0471	0.0050	0.050	-	94	67-137
1,1,2-Trichloroethane	ND	0.0385	0.0050	0.050	-	77	67-117
Trichloroethene	ND	0.0463	0.0050	0.050	-	93	62-135
Trichlorofluoromethane	ND	0.0524	0.0050	0.050	-	105	56-124
1,2,3-Trichloropropane	ND	0.0384	0.0050	0.050	-	77	58-133
1,2,4-Trimethylbenzene	ND	0.0531	0.0050	0.050	-	106	78-161
1,3,5-Trimethylbenzene	ND	0.0538	0.0050	0.050	-	108	85-170
Vinyl Chloride	ND	0.0622	0.0050	0.050	-	124	32-142
Xylenes, Total	ND	0.146	0.0050	0.15	-	97	70-137

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QA/QC Officer

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/25/17	**BatchID:**	146037
Date Analyzed:	9/26/17	**Extraction Method:**	SW5030B
Instrument:	GC28	**Analytical Method:**	SW8260B
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146037

QC Summary Report for SW8260B

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Surrogate Recovery							
Dibromofluoromethane	0.1236	0.126		0.12	99	100	87-127
Toluene-d8	0.1412	0.140		0.12	113	112	93-141
4-BFB	0.009991	0.0113		0.012	80,F3	90	84-137
Benzene-d6	0.08958	0.0915		0.10	90	92	67-131
Ethylbenzene-d10	0.1037	0.103		0.10	104	103	78-153
1,2-DCB-d4	0.08249	0.0836		0.10	82	84	63-109

Quality Control Report

Client: Langan
Date Prepared: 9/20/17
Date Analyzed: 9/20/17
Instrument: GC35
Matrix: Soil
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
BatchID: 145799
Extraction Method: SW3550B
Analytical Method: SW8270C-SIM
Unit: mg/kg
Sample ID: MB/LCS-145799
1709774-001AMS/MSD

QC Summary Report for SW8270C

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Acenaphthene	ND	-	0.010	-	-	-	-
Acenaphthylene	ND	-	0.010	-	-	-	-
Anthracene	ND	-	0.010	-	-	-	-
Benzo (a) anthracene	ND	-	0.010	-	-	-	-
Benzo (a) pyrene	ND	0.184	0.010	0.20	-	92	23-129
Benzo (b) fluoranthene	ND	-	0.010	-	-	-	-
Benzo (g,h,i) perylene	ND	-	0.010	-	-	-	-
Benzo (k) fluoranthene	ND	-	0.010	-	-	-	-
Chrysene	ND	0.164	0.010	0.20	-	82	38-104
Dibenzo (a,h) anthracene	ND	-	0.010	-	-	-	-
Fluoranthene	ND	-	0.010	-	-	-	-
Fluorene	ND	-	0.010	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND	-	0.010	-	-	-	-
1-Methylnaphthalene	ND	0.226	0.010	0.20	-	113, F2	59-106
2-Methylnaphthalene	ND	0.214	0.010	0.20	-	107	54-108
Naphthalene	ND	-	0.010	-	-	-	-
Phenanthrene	ND	0.187	0.010	0.20	-	94	48-107
Pyrene	ND	0.204	0.010	0.20	-	102	40-104
Surrogate Recovery							
1-Fluoronaphthalene	0.4606	0.519		0.50	92	104	63-123
2-Fluorobiphenyl	0.424	0.484		0.50	85	97	55-127

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Benzo (a) pyrene	NR	NR		ND<10	NR	NR	-	NR	-
Chrysene	NR	NR		ND<10	NR	NR	-	NR	-
1-Methylnaphthalene	NR	NR		ND<10	NR	NR	-	NR	-
2-Methylnaphthalene	NR	NR		ND<10	NR	NR	-	NR	-
Phenanthrene	NR	NR		ND<10	NR	NR	-	NR	-
Pyrene	NR	NR		ND<10	NR	NR	-	NR	-
Surrogate Recovery									
1-Fluoronaphthalene	NR	NR			NR	NR	-	NR	-
2-Fluorobiphenyl	NR	NR			NR	NR	-	NR	-

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/20/17	**BatchID:**	145800
Date Analyzed:	9/20/17	**Extraction Method:**	SW3550B
Instrument:	GC17	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145800 1709774-001AMS/MSD

QC Summary Report for SW8270C

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Acenaphthene	ND	2.88	0.25	5	-	58	46-118
Acenaphthylene	ND	3.13	0.25	5	-	63	43-122
Acetochlor	ND	-	0.25	-	-	-	-
Anthracene	ND	3.10	0.25	5	-	62	47-125
Benzidine	ND	1.07	1.3	5	-	21	13-83
Benzo (a) anthracene	ND	3.14	0.25	5	-	63	53-117
Benzo (a) pyrene	ND	4.10	0.25	5	-	82	53-138
Benzo (b) fluoranthene	ND	3.65	0.25	5	-	73	48-125
Benzo (g,h,i) perylene	ND	3.96	0.25	5	-	79	51-146
Benzo (k) fluoranthene	ND	3.42	0.25	5	-	68	53-124
Benzyl Alcohol	ND	3.32	1.3	5	-	66	51-105
1,1-Biphenyl	ND	-	0.25	-	-	-	-
Bis (2-chloroethoxy) Methane	ND	2.85	0.25	5	-	57	48-115
Bis (2-chloroethyl) Ether	ND	3.11	0.25	5	-	62	51-105
Bis (2-chloroisopropyl) Ether	ND	3.08	0.25	5	-	62, F2	85-119
Bis (2-ethylhexyl) Adipate	ND	3.27	0.25	5	-	65	46-117
Bis (2-ethylhexyl) Phthalate	ND	2.92	0.25	5	-	58	50-124
4-Bromophenyl Phenyl Ether	ND	3.01	0.25	5	-	60, F2	70-112
Butylbenzyl Phthalate	ND	3.44	0.25	5	-	69	55-127
4-Chloroaniline	ND	1.72	0.50	5	-	34	18-77
4-Chloro-3-methylphenol	ND	3.33	0.25	5	-	67	49-123
2-Chloronaphthalene	ND	2.74	0.25	5	-	55	44-109
2-Chlorophenol	ND	3.30	0.25	5	-	66	55-116
4-Chlorophenyl Phenyl Ether	ND	3.00	0.25	5	-	60	45-122
Chrysene	ND	3.43	0.25	5	-	69	54-116
Dibenzo (a,h) anthracene	ND	4.02	0.25	5	-	80	52-141
Dibenzofuran	ND	3.09	0.25	5	-	62	46-117
Di-n-butyl Phthalate	ND	2.87	0.25	5	-	57	45-126
1,2-Dichlorobenzene	ND	3.45	0.25	5	-	69	55-105
1,3-Dichlorobenzene	ND	3.28	0.25	5	-	66	51-104
1,4-Dichlorobenzene	ND	3.08	0.25	5	-	62	50-102
3,3-Dichlorobenzidine	ND	2.14	0.50	5	-	43	20-84
2,4-Dichlorophenol	ND	3.61	0.25	5	-	72	54-124
Diethyl Phthalate	ND	2.86	0.25	5	-	57	42-118
2,4-Dimethylphenol	ND	3.41	0.25	5	-	68	53-120
Dimethyl Phthalate	ND	2.79	0.25	5	-	56	45-118
4,6-Dinitro-2-methylphenol	ND	3.69	1.3	5	-	74	32-126

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Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/20/17	**BatchID:**	145800
Date Analyzed:	9/20/17	**Extraction Method:**	SW3550B
Instrument:	GC17	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145800 1709774-001AMS/MSD

QC Summary Report for SW8270C

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
2,4-Dinitrophenol	ND	3.97	6.3	5	-	79	20-130
2,4-Dinitrotoluene	ND	3.17	0.25	5	-	63	47-117
2,6-Dinitrotoluene	ND	3.29	0.25	5	-	66	48-121
Di-n-octyl Phthalate	ND	3.88	0.50	5	-	78	40-150
1,2-Diphenylhydrazine	ND	2.94	0.25	5	-	59, F2	88-117
Fluoranthene	ND	3.03	0.25	5	-	61	45-126
Fluorene	ND	2.90	0.25	5	-	58	43-118
Hexachlorobenzene	ND	2.84	0.25	5	-	57	47-130
Hexachlorobutadiene	ND	3.27	0.25	5	-	65	50-121
Hexachlorocyclopentadiene	ND	2.58	1.3	5	-	52	30-89
Hexachloroethane	ND	3.60	0.25	5	-	72	50-106
Indeno (1,2,3-cd) pyrene	ND	4.02	0.25	5	-	80	51-138
Isophorone	ND	2.45	0.25	5	-	49	38-92
2-Methylnaphthalene	ND	3.17	0.25	5	-	63	51-121
2-Methylphenol (o-Cresol)	ND	3.22	0.25	5	-	65	48-114
3 & 4-Methylphenol (m,p-Cresol)	ND	3.05	0.25	5	-	61	30-130
Naphthalene	ND	3.00	0.25	5	-	60	50-113
2-Nitroaniline	ND	2.91	1.3	5	-	58	45-115
3-Nitroaniline	ND	2.30	1.3	5	-	46	31-93
4-Nitroaniline	ND	2.82	1.3	5	-	56	41-108
Nitrobenzene	ND	3.51	0.25	5	-	70	49-122
2-Nitrophenol	ND	3.80	1.3	5	-	76	54-121
4-Nitrophenol	ND	2.56	1.3	5	-	51	40-102
N-Nitrosodiphenylamine	ND	-	0.25	-	-	-	-
N-Nitrosodi-n-propylamine	ND	2.90	0.25	5	-	58	47-108
Pentachlorophenol	ND	3.12	1.3	5	-	62	39-134
Phenanthrene	ND	3.02	0.25	5	-	60	49-123
Phenol	ND	3.06	0.25	5	-	61	49-107
Pyrene	ND	3.29	0.25	5	-	66	55-124
Pyridine	ND	4.92	0.25	5	-	98	70-130
1,2,4-Trichlorobenzene	ND	3.36	0.25	5	-	67	51-121
2,4,5-Trichlorophenol	ND	3.60	0.25	5	-	72	45-126
2,4,6-Trichlorophenol	ND	3.51	0.25	5	-	70	46-128

(Cont.)

NELAP 4033ORELAP

QA/QC Officer

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/20/17	**BatchID:**	145800
Date Analyzed:	9/20/17	**Extraction Method:**	SW3550B
Instrument:	GC17	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145800 1709774-001AMS/MSD

QC Summary Report for SW8270C

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Surrogate Recovery							
2-Fluorophenol	4.187	3.91		5	84	78	47-125
Phenol-d5	3.86	3.58		5	77	72	45-117
Nitrobenzene-d5	3.961	3.83		5	79	77	39-121
2-Fluorobiphenyl	3.516	3.37		5	70	67	35-120
2,4,6-Tribromophenol	3.007	3.06		5	60	61	32-111
4-Terphenyl-d14	3.69	3.68		5	74	73	32-128

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/20/17	**BatchID:**	145800
Date Analyzed:	9/20/17	**Extraction Method:**	SW3550B
Instrument:	GC17	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145800 1709774-001AMS/MSD

QC Summary Report for SW8270C

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Acenaphthene	NR	NR		ND<200	NR	NR	-	NR	-
Acenaphthylene	NR	NR		ND<200	NR	NR	-	NR	-
Anthracene	NR	NR		ND<200	NR	NR	-	NR	-
Benzidine	NR	NR		ND<1000	NR	NR	-	NR	-
Benzo (a) anthracene	NR	NR		ND<200	NR	NR	-	NR	-
Benzo (a) pyrene	NR	NR		ND<200	NR	NR	-	NR	-
Benzo (b) fluoranthene	NR	NR		ND<200	NR	NR	-	NR	-
Benzo (g,h,i) perylene	NR	NR		ND<200	NR	NR	-	NR	-
Benzo (k) fluoranthene	NR	NR		ND<200	NR	NR	-	NR	-
Benzyl Alcohol	NR	NR		ND<1000	NR	NR	-	NR	-
Bis (2-chloroethoxy) Methane	NR	NR		ND<200	NR	NR	-	NR	-
Bis (2-chloroethyl) Ether	NR	NR		ND<200	NR	NR	-	NR	-
Bis (2-chloroisopropyl) Ether	NR	NR		ND<200	NR	NR	-	NR	-
Bis (2-ethylhexyl) Adipate	NR	NR		ND<200	NR	NR	-	NR	-
Bis (2-ethylhexyl) Phthalate	NR	NR		ND<200	NR	NR	-	NR	-
4-Bromophenyl Phenyl Ether	NR	NR		ND<200	NR	NR	-	NR	-
Butylbenzyl Phthalate	NR	NR		ND<200	NR	NR	-	NR	-
4-Chloroaniline	NR	NR		ND<400	NR	NR	-	NR	-
4-Chloro-3-methylphenol	NR	NR		ND<200	NR	NR	-	NR	-
2-Chloronaphthalene	NR	NR		ND<200	NR	NR	-	NR	-
2-Chlorophenol	NR	NR		ND<200	NR	NR	-	NR	-
4-Chlorophenyl Phenyl Ether	NR	NR		ND<200	NR	NR	-	NR	-
Chrysene	NR	NR		ND<200	NR	NR	-	NR	-
Dibenzo (a,h) anthracene	NR	NR		ND<200	NR	NR	-	NR	-
Dibenzofuran	NR	NR		ND<200	NR	NR	-	NR	-
Di-n-butyl Phthalate	NR	NR		ND<200	NR	NR	-	NR	-
1,2-Dichlorobenzene	NR	NR		ND<200	NR	NR	-	NR	-
1,3-Dichlorobenzene	NR	NR		ND<200	NR	NR	-	NR	-
1,4-Dichlorobenzene	NR	NR		ND<200	NR	NR	-	NR	-
3,3-Dichlorobenzidine	NR	NR		ND<400	NR	NR	-	NR	-
2,4-Dichlorophenol	NR	NR		ND<200	NR	NR	-	NR	-
Diethyl Phthalate	NR	NR		ND<200	NR	NR	-	NR	-
2,4-Dimethylphenol	NR	NR		ND<200	NR	NR	-	NR	-
Dimethyl Phthalate	NR	NR		ND<200	NR	NR	-	NR	-
4,6-Dinitro-2-methylphenol	NR	NR		ND<1000	NR	NR	-	NR	-
2,4-Dinitrophenol	NR	NR		ND<5000	NR	NR	-	NR	-
2,4-Dinitrotoluene	NR	NR		ND<200	NR	NR	-	NR	-

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/20/17	**BatchID:**	145800
Date Analyzed:	9/20/17	**Extraction Method:**	SW3550B
Instrument:	GC17	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145800 1709774-001AMS/MSD

QC Summary Report for SW8270C

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
2,6-Dinitrotoluene	NR	NR		ND<200	NR	NR	-	NR	-
Di-n-octyl Phthalate	NR	NR		ND<400	NR	NR	-	NR	-
1,2-Diphenylhydrazine	NR	NR		ND<200	NR	NR	-	NR	-
Fluoranthene	NR	NR		ND<200	NR	NR	-	NR	-
Fluorene	NR	NR		ND<200	NR	NR	-	NR	-
Hexachlorobenzene	NR	NR		ND<200	NR	NR	-	NR	-
Hexachlorobutadiene	NR	NR		ND<200	NR	NR	-	NR	-
Hexachlorocyclopentadiene	NR	NR		ND<1000	NR	NR	-	NR	-
Hexachloroethane	NR	NR		ND<200	NR	NR	-	NR	-
Indeno (1,2,3-cd) pyrene	NR	NR		ND<200	NR	NR	-	NR	-
Isophorone	NR	NR		ND<200	NR	NR	-	NR	-
2-Methylnaphthalene	NR	NR		ND<200	NR	NR	-	NR	-
2-Methylphenol (o-Cresol)	NR	NR		ND<200	NR	NR	-	NR	-
3 & 4-Methylphenol (m,p-Cresol)	NR	NR		ND<200	NR	NR	-	NR	-
Naphthalene	NR	NR		ND<200	NR	NR	-	NR	-
2-Nitroaniline	NR	NR		ND<1000	NR	NR	-	NR	-
3-Nitroaniline	NR	NR		ND<1000	NR	NR	-	NR	-
4-Nitroaniline	NR	NR		ND<1000	NR	NR	-	NR	-
Nitrobenzene	NR	NR		ND<200	NR	NR	-	NR	-
2-Nitrophenol	NR	NR		ND<1000	NR	NR	-	NR	-
4-Nitrophenol	NR	NR		ND<1000	NR	NR	-	NR	-
N-Nitrosodi-n-propylamine	NR	NR		ND<200	NR	NR	-	NR	-
Pentachlorophenol	NR	NR		ND<1000	NR	NR	-	NR	-
Phenanthrene	NR	NR		ND<200	NR	NR	-	NR	-
Phenol	NR	NR		ND<200	NR	NR	-	NR	-
Pyrene	NR	NR		ND<200	NR	NR	-	NR	-
Pyridine	NR	NR		ND<200	NR	NR	-	NR	-
1,2,4-Trichlorobenzene	NR	NR		ND<200	NR	NR	-	NR	-
2,4,5-Trichlorophenol	NR	NR		ND<200	NR	NR	-	NR	-
2,4,6-Trichlorophenol	NR	NR		ND<200	NR	NR	-	NR	-

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/20/17	**BatchID:**	145800
Date Analyzed:	9/20/17	**Extraction Method:**	SW3550B
Instrument:	GC17	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145800 1709774-001AMS/MSD

QC Summary Report for SW8270C

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Surrogate Recovery									
2-Fluorophenol	NR	NR			NR	NR	-	NR	-
Phenol-d5	NR	NR			NR	NR	-	NR	-
Nitrobenzene-d5	NR	NR			NR	NR	-	NR	-
2-Fluorobiphenyl	NR	NR			NR	NR	-	NR	-
2,4,6-Tribromophenol	NR	NR			NR	NR	-	NR	-
4-Terphenyl-d14	NR	NR			NR	NR	-	NR	-

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	145773
Date Analyzed:	9/20/17	**Extraction Method:**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145773 1709780-001AMS/MSD

QC Summary Report for Metals

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Antimony	ND	54.7	0.50	50	-	109	75-125
Arsenic	ND	54.1	0.50	50	-	108	75-125
Barium	ND	546	5.0	500	-	109	75-125
Beryllium	ND	52.6	0.50	50	-	105	75-125
Cadmium	ND	53.6	0.25	50	-	107	75-125
Chromium	ND	53.0	0.50	50	-	106	75-125
Cobalt	ND	50.6	0.50	50	-	101	75-125
Copper	ND	53.4	0.50	50	-	107	75-125
Lead	ND	52.6	0.50	50	-	105	75-125
Mercury	ND	1.40	0.050	1.25	-	112	75-125
Molybdenum	ND	53.4	0.50	50	-	107	75-125
Nickel	ND	54.4	0.50	50	-	109	75-125
Selenium	ND	54.0	0.50	50	-	108	75-125
Silver	ND	52.0	0.50	50	-	104	75-125
Thallium	ND	50.4	0.50	50	-	101	75-125
Vanadium	ND	52.6	0.50	50	-	105	75-125
Zinc	ND	516	5.0	500	-	103	75-125
Surrogate Recovery							
Terbium	546.9	559		500	109	112	70-130

(Cont.)

QA/QC Officer

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	145773
Date Analyzed:	9/20/17	**Extraction Method:**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145773 1709780-001AMS/MSD

QC Summary Report for Metals

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Antimony	52.3	53.0	50	1.114	102	104	75-125	1.42	20
Arsenic	55.2	57.7	50	5.811	99	104	75-125	4.46	20
Barium	613	628	500	88.94	105	108	75-125	2.32	20
Beryllium	50.3	50.3	50	ND	100	100	75-125	0	20
Cadmium	51.7	52.3	50	ND	103	104	75-125	1.10	20
Chromium	97.5	105	50	46.47	102	117	75-125	7.44	20
Cobalt	53.2	54.5	50	7.060	92	95	75-125	2.41	20
Copper	59.8	60.8	50	9.890	100	102	75-125	1.71	20
Lead	57.1	59.3	50	8.188	98	102	75-125	3.90	20
Mercury	1.40	1.42	1.25	0.05340	108	109	75-125	1.14	20
Molybdenum	51.2	51.9	50	ND	102	103	75-125	1.46	20
Nickel	90.3	97.6	50	42.87	95	110	75-125	7.75	20
Selenium	51.4	52.4	50	ND	102	104	75-125	1.91	20
Silver	50.0	50.0	50	ND	100	100	75-125	0	20
Thallium	49.1	49.6	50	ND	98	99	75-125	0.871	20
Vanadium	87.9	96.4	50	37.11	102	119	75-125	9.25	20
Zinc	525	526	500	28.60	99	99	75-125	0	20
Surrogate Recovery									
Terbium	540	546	500		108	109	70-130	1.01	20

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Antimony	ND<2.5	1.114	-	-
Arsenic	5.56	5.811	4.32	-
Barium	90.4	88.94	1.64	-
Beryllium	ND<2.5	ND	-	-
Cadmium	ND<1.2	ND	-	-
Chromium	48.4	46.47	4.15	20
Cobalt	7.56	7.060	7.08	-
Copper	10.1	9.890	2.12	-
Lead	8.54	8.188	4.30	-
Mercury	ND<0.25	0.05340	-	-
Molybdenum	ND<2.5	ND	-	-
Nickel	45.4	42.87	5.90	20
Selenium	ND<2.5	ND	-	-

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	145773
Date Analyzed:	9/20/17	**Extraction Method:**	SW3050B
Instrument:	ICP-MS3	**Analytical Method:**	SW6020
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-145773 1709780-001AMS/MSD

QC Summary Report for Metals

Analyte	DLT Result	DLTRef Val	%D	%D Limit
Silver	ND<2.5	ND	-	-
Thallium	ND<2.5	ND	-	-
Vanadium	39.1	37.11	5.36	20
Zinc	ND<25	28.60	-	-

%D Control Limit applied to analytes with concentrations greater than 25 times the reporting limits.

Quality Control Report

Client: Langan
Date Prepared: 9/19/17
Date Analyzed: 9/20/17
Instrument: GC7
Matrix: Soil
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
BatchID: 145736
Extraction Method: SW5030B
Analytical Method: SW8021B/8015Bm
Unit: mg/Kg
Sample ID: MB/LCS-145736
1709774-001AMS/MSD

QC Summary Report for SW8021B/8015Bm

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
TPH(g) (C6-C12)	ND	1.0	-	-	-
MTBE	ND	0.050	-	-	-
Benzene	ND	0.0050	-	-	-
Toluene	ND	0.0050	-	-	-
Ethylbenzene	ND	0.0050	-	-	-
Xylenes	ND	0.015	-	-	-
Surrogate Recovery					
2-Fluorotoluene	0.08753		0.10	88	75-134

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
TPH(btex)	0.552	-	0.60	92	-	82-118	-	-
MTBE	0.0788	-	0.10	79	-	61-119	-	-
Benzene	0.0963	-	0.10	96	-	77-128	-	-
Toluene	0.0878	-	0.10	88	-	74-132	-	-
Ethylbenzene	0.109	-	0.10	109	-	84-127	-	-
Xylenes	0.335	-	0.30	112	-	86-129	-	-
Surrogate Recovery								
2-Fluorotoluene	0.0910	-	0.10	91	-	75-134	-	-

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
TPH(btex)	NR	NR		130	NR	NR	-	NR	-
MTBE	NR	NR		ND<2.5	NR	NR	-	NR	-
Benzene	NR	NR		ND<0.25	NR	NR	-	NR	-
Toluene	NR	NR		ND<0.25	NR	NR	-	NR	-
Ethylbenzene	NR	NR		ND<0.25	NR	NR	-	NR	-
Xylenes	NR	NR		ND<0.75	NR	NR	-	NR	-
Surrogate Recovery									
2-Fluorotoluene	NR	NR			NR	NR	-	NR	-

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/25/17	**BatchID:**	146028
Date Analyzed:	9/25/17 - 9/27/17	**Extraction Method:**	SW5030B
Instrument:	GC19	**Analytical Method:**	SW8021B/8015Bm
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146028 1709967-001AMS/MSD

QC Summary Report for SW8021B/8015Bm

Analyte	MB Result	RL	SPK Val	MB SS %REC	MB SS Limits
TPH(g) (C6-C12)	ND	1.0	-	-	-
MTBE	ND	0.050	-	-	-
Benzene	ND	0.0050	-	-	-
Toluene	ND	0.0050	-	-	-
Ethylbenzene	ND	0.0050	-	-	-
Xylenes	ND	0.015	-	-	-
Surrogate Recovery					
2-Fluorotoluene	0.08546		0.10	85	75-134

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
TPH(btex)	0.580	-	0.60	97	-	82-118	-	-
MTBE	0.0947	-	0.10	95	-	61-119	-	-
Benzene	0.106	-	0.10	106	-	77-128	-	-
Toluene	0.108	-	0.10	108	-	74-132	-	-
Ethylbenzene	0.107	-	0.10	107	-	84-127	-	-
Xylenes	0.310	-	0.30	103	-	86-129	-	-
Surrogate Recovery								
2-Fluorotoluene	0.0888	-	0.10	89	-	75-134	-	-

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
TPH(btex)	0.564	0.546	0.60	ND	94	91	58-129	3.18	20
MTBE	0.0897	0.0948	0.10	ND	85	90	47-118	5.48	20
Benzene	0.0970	0.103	0.10	ND	97	103	55-129	5.96	20
Toluene	0.103	0.109	0.10	ND	99	106	56-130	5.81	20
Ethylbenzene	0.0987	0.105	0.10	ND	99	105	63-129	5.98	20
Xylenes	0.296	0.310	0.30	ND	99	103	64-131	4.72	20
Surrogate Recovery									
2-Fluorotoluene	0.0859	0.0885	0.10		86	89	62-126	3.02	20

Quality Control Report

Client: Langan
Date Prepared: 9/19/17
Date Analyzed: 9/20/17
Instrument: GC11A
Matrix: Soil
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
BatchID: 145780
Extraction Method: SW3550B
Analytical Method: SW8015B
Unit: mg/Kg
Sample ID: MB/LCS-145780
1709793-001AMS/MSD

QC Report for SW8015B w/out SG Clean-Up

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
TPH-Diesel (C10-C23)	ND	38.4	1.0	40	-	96	75-128
TPH-Motor Oil (C18-C36)	ND	-	5.0	-	-	-	-
Surrogate Recovery							
C9	22.08	21.3		25	88	85	72-122

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
TPH-Diesel (C10-C23)	NR	NR		210	NR	NR	-	NR	-
Surrogate Recovery									
C9	NR	NR			NR	NR	-	NR	-

NELAP 4033ORELAP

QA/QC Officer

McCampbell Analytical, Inc.

1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

WorkOrder: 1709793 **ClientCode: TWRF**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ▨ EQuIS ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

▨ Detection Summary ▨ Dry-Weight

Report to:

Peter Cusack
Langan
555 Montgomery St., Suite 1300
San Francisco, CA 94111
(415) 955-5244 FAX: (415) 955-9041

Email: pcusack@langan.com
cc/3rd Party: kstaehlin@langan.com;
PO:
ProjectNo: 731706301; UC Berkeley GSPP & Housing

Bill to:

Accounts Payable
Langan
555 Montgomery St., Suite 1300
San Francisco, CA 94111
Langan_InvoiceCapture@concursolutio

Requested TAT: **5 days;**

Date Received: **09/19/2017**

Date Logged: **09/19/2017**

					Requested Tests (See legend below)											
Lab ID	**Client ID**	**Matrix**	**Collection Date**	**Hold**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1709793-001	B-1-2.0	Soil	9/15/2017 15:20	☐	A	A	A	A	A		A	A				
1709793-002	B-1-5.5	Soil	9/15/2017 15:30	☐					A		A	A				
1709793-003	B-2-3.0	Soil	9/15/2017 08:40	☐					A	A	A	A				
1709793-004	B-2-5.5	Soil	9/15/2017 08:50	☐		A		A	A		A	A				
1709793-006	B-3-3.0	Soil	9/15/2017 07:52	☐	A	A	A	A	A		A	A				
1709793-007	B-3-5.5	Soil	9/15/2017 08:03	☐		A		A	A		A	A				

Test Legend:

1	**8082_PCB_S**	**2**	**8260B_S**	**3**	**8270_PNA_S**	**4**	**8270_S**
5	**CAM17MS_TTLC_S**	**6**	**CARB435_400**	**7**	**G-MBTEX_S**	**8**	**TPH(DMO)_S**
9		**10**		**11**		**12**	

Prepared by: Alexandra Iniguez

The following SampIDs: 001A, 002A, 003A, 004A, 006A, 007A contain testgroup Multi Range_S.

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

WORK ORDER SUMMARY

Client Name: LANGAN

Client Contact: Peter Cusack

Contact's Email: pcusack@langan.com

Project: 731706301; UC Berkeley GSPP & Housing

Comments:

Work Order: 1709793

QC Level: LEVEL 2

Date Logged: 9/19/2017

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1709793-001A	B-1-2.0	Soil	Multi-Range TPH(g,d,mo) by EPA 8015Bm	1	Stainless Steel tube 2.5"x6"	☐	9/15/2017 15:20	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
			SW8270C (SVOCs)			☐		5 days		☐	
			SW8270C (PAHs/PNAs)			☐		5 days		☐	
			SW8260B (VOCs)			☐		5 days		☐	
			SW8082 (PCBs Only)			☐		5 days		☐	
1709793-002A	B-1-5.5	Soil	Multi-Range TPH(g,d,mo) by EPA 8015Bm	1	Stainless Steel tube 2.5"x6"	☐	9/15/2017 15:30	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
1709793-003A	B-2-3.0	Soil	Multi-Range TPH(g,d,mo) by EPA 8015Bm	1	Stainless Steel tube 2.5"x6"	☐	9/15/2017 8:40	5 days		☐	
			Asbestos, CARB 435, 400 Point			☐		5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
1709793-004A	B-2-5.5	Soil	Multi-Range TPH(g,d,mo) by EPA 8015Bm	1	Stainless Steel tube 2.5"x6"	☐	9/15/2017 8:50	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
			SW8270C (SVOCs)			☐		5 days		☐	
			SW8260B (VOCs)			☐		5 days		☐	

NOTES:
- **STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).**
- **MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.**

WORK ORDER SUMMARY

Client Name: LANGAN
Client Contact: Peter Cusack
Contact's Email: pcusack@langan.com

Project: 731706301; UC Berkeley GSPP & Housing
Comments:

Work Order: 1709793
QC Level: LEVEL 2
Date Logged: 9/19/2017

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	De-chlorinated	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1709793-005A	B-2-8.0	Soil		1	Stainless Steel tube 2.5"x6"	☐	9/15/2017 8:58			☑	
1709793-006A	B-3-3.0	Soil	Multi-Range TPH(g,d,mo) by EPA 8015Bm	1	Stainless Steel tube 2.5"x6"	☐	9/15/2017 7:52	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
			SW8270C (SVOCs)			☐		5 days		☐	
			SW8270C (PAHs/PNAs)			☐		5 days		☐	
			SW8260B (VOCs)			☐		5 days		☐	
			SW8082 (PCBs Only)			☐		5 days		☐	
1709793-007A	B-3-5.5	Soil	Multi-Range TPH(g,d,mo) by EPA 8015Bm	1	Stainless Steel tube 2.5"x6"	☐	9/15/2017 8:03	5 days		☐	
			SW6020 (CAM 17)			☐		5 days		☐	
			SW8270C (SVOCs)			☐		5 days		☐	
			SW8260B (VOCs)			☐		5 days		☐	
1709793-008A	B-3-10.5	Soil		1	Stainless Steel tube 2.5"x6"	☐	9/15/2017 8:12			☑	

NOTES:
- **STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).**
- **MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.**

1709793

PLEASE C.C. ANNIE S. AT
KSTAEHLIN@LANGAN.COM

10337

LANGAN

CHAIN OF CUSTODY RECORD

Page 1 of 1

☒ 555 Montgomery Street. Suite 1300, San Francisco, CA 94111
☐ 501 14th Street, Third Floor, Oakland CA 94612
☐ 3320 Data Drive, Suite 350, Rancho Cordova, CA 95670-7982
☐ 4030 Moorpark Ave. Suite 210, San Jose, CA 95117-1849

Site Name: UC BERKELEY GSPP & HOUSING
Job Number: 731706301
Project Manager\Contact: PETER CUSACK
Samplers: KSS
Recorder (Signature Required):

Turnaround Time
STANDARD

Field Sample Identification No.	Date	Time	Lab Sample No.	Matrix				No. Containers & Preservative						Analysis Requested														Remarks
				Soil	Water	Air	Other	HCL	H_2SO_4	HNO_3	Ice			TPH g,d,mo	VOCs	SVOCs	PNAs & PAHs	PCBs	CAM 17	ASBESTOS BY CARB 435	LUFT 5 METALS					Silica gel clean-up	Hold	
B-1-2.0	9/15/17	1520		X							X			X	X	X	X	X	X									
B-1-5.5		1520		X							X			X					X									
B-2-3.0		0840		X							X			X					X	X								
B-2-5.5		0850		X							X			X	X	X			X									
B-2-8.0		0858		X							X			X						X	X						⊗	PLEASE PLACE THESE SAMPLES ON HOLD. DO NOT ANALYZE.
B-3-3.0		0752		X							X			X	X	X	X	X	X									
B-3-5.5		0803		X							X			X	X	X			X									
B-3-10.5	9/15/17	0812		X							X			X						X	X						⊗	

Relinquished by: (Signature)	Date:	Time	Received by: (Signature)	Date	Time
			Basit	9/19/17	12:45
Basit	9/18/17	1630		9/18/17	1630
			Received by Lab: (Signature)		

Sent to Laboratory (Name): McCAMPBELL ANALYTICAL
Laboratory Comments/Notes:

Method of Shipment ☒ Lab courier ☐ Fed Ex ☐ Airborne ☐ UPS
☐ Hand Carried ☐ Private Courier (Co. Name)

White Copy - Original   Yellow Copy - Laboratory   Pink Copy - Field   COC Number:

Sample Receipt Checklist

Client Name: **Langan**
Project Name: **731706301; UC Berkeley GSPP & Housing**
WorkOrder №: **1709793** Matrix: Soil
Carrier: Basit Sheikh (MAI Courier)

Date and Time Received **9/19/2017 16:30**
Date Logged: **9/19/2017**
Received by: Alexandra Iniguez
Logged by: Alexandra Iniguez

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Sample IDs noted by Client on COC?	Yes ☑	No ☐	
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐	
Sampler's name noted on COC?	Yes ☑	No ☐	
COC agrees with Quote?	Yes ☐	No ☐	NA ☑

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☑	No ☐	NA ☐
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☑	No ☐	NA ☐
Sample/Temp Blank temperature	Temp: 3.4°C		NA ☐
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	NA ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
pH acceptable upon receipt (Metal: <2; 522: <4; 218.7: >8)?	Yes ☐	No ☐	NA ☑
Samples Received on Ice?	Yes ☑	No ☐	

(Ice Type: WET ICE)

UCMR Samples:

Total Chlorine tested and acceptable upon receipt for EPA 522?	Yes ☐	No ☐	NA ☑
Free Chlorine tested and acceptable upon receipt for EPA 218.7, 300.1, 537, 539?	Yes ☐	No ☐	NA ☑

Comments:

McCampbell Analytical, Inc.

"When Quality Counts"

Analytical Report

WorkOrder: 1709793 A

Report Created for: Langan

555 Montgomery St., Suite 1300
San Francisco, CA 94111

Project Contact: Peter Cusack
Project P.O.:
Project Name: 731706301; UC Berkeley GSPP & Housing

Project Received: 09/19/2017

Analytical Report reviewed & approved for release on 10/10/2017 by:

Angela Rydelius,
Laboratory Manager

The report shall not be reproduced except in full, without the written approval of the laboratory. The analytical results relate only to the items tested. Results reported conform to the most current NELAP standards, where applicable, unless otherwise stated in the case narrative.

1534 Willow Pass Rd. Pittsburg, CA 94565 ♦ TEL: (877) 252-9262 ♦ FAX: (925) 252-9269 ♦ www.mccampbell.com
CA ELAP 1644 ♦ NELAP 4033 ORELAP

Glossary of Terms & Qualifier Definitions

Client: Langan
Project: 731706301; UC Berkeley GSPP & Housing
WorkOrder: 1709793 A

Glossary Abbreviation

%D	Serial Dilution Percent Difference
95% Interval	95% Confident Interval
DF	Dilution Factor
DI WET	(DISTLC) Waste Extraction Test using DI water
DISS	Dissolved (direct analysis of 0.45 µm filtered and acidified water sample)
DLT	Dilution Test (Serial Dilution)
DUP	Duplicate
EDL	Estimated Detection Limit
ERS	External reference sample. Second source calibration verification.
ITEF	International Toxicity Equivalence Factor
LCS	Laboratory Control Sample
MB	Method Blank
MB % Rec	% Recovery of Surrogate in Method Blank, if applicable
MDL	Method Detection Limit
ML	Minimum Level of Quantitation
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
ND	Not detected at or above the indicated MDL or RL
NR	Data Not Reported due to matrix interference or insufficient sample amount.
PDS	Post Digestion Spike
PDSD	Post Digestion Spike Duplicate
PF	Prep Factor
RD	Relative Difference
RL	Reporting Limit (The RL is the lowest calibration standard in a multipoint calibration.)
RPD	Relative Percent Deviation
RRT	Relative Retention Time
SPK Val	Spike Value
SPKRef Val	Spike Reference Value
SPLP	Synthetic Precipitation Leachate Procedure
ST	Sorbent Tube
TCLP	Toxicity Characteristic Leachate Procedure
TEQ	Toxicity Equivalents
WET (STLC)	Waste Extraction Test (Soluble Threshold Limit Concentration)

Glossary of Terms & Qualifier Definitions

Client: Langan
Project: 731706301; UC Berkeley GSPP & Housing
WorkOrder: 1709793 A

Analytical Qualifiers

B	Analyte detected in the associated Method Blank and in the sample
H	Samples were analyzed out of holding time
S	Surrogate spike recovery outside accepted recovery limits

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B/3630C
Date Prepared:	9/19/17	**Analytical Method:**	SW8082
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Polychlorinated Biphenyls (PCBs) Aroclors w/ Column Style Clean-up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC40 10091763.d**	**146429**

Analytes	Result	MDL	RL	DF	Date Analyzed
Aroclor1016	ND	0.0051	0.050	1	10/09/2017 22:29
Aroclor1221	ND	0.011	0.050	1	10/09/2017 22:29
Aroclor1232	ND	0.0063	0.050	1	10/09/2017 22:29
Aroclor1242	ND	0.0067	0.050	1	10/09/2017 22:29
Aroclor1248	ND	0.0040	0.050	1	10/09/2017 22:29
Aroclor1254	ND	0.0068	0.050	1	10/09/2017 22:29
Aroclor1260	ND	0.0061	0.050	1	10/09/2017 22:29
PCBs, total	ND	0.0040	0.050	1	10/09/2017 22:29

Surrogates	REC (%)	Limits	
Decachlorobiphenyl	71	55-152	10/09/2017 22:29

Analyst(s): KX

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B/3640A
Date Prepared:	10/2/17	**Analytical Method:**	SW8270C-SIM
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/kg

Polynuclear Aromatic Hydrocarbons (PNAs) using SIM Mode w/ GPC Clean-up

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC35 10031722.D**	**146407**

Analytes	Result	Qualifiers	RL	DF	Date Analyzed
Acenaphthene	ND	H	0.020	2	10/03/2017 20:38
Acenaphthylene	ND	H	0.020	2	10/03/2017 20:38
Anthracene	**0.055**	H	0.020	2	10/03/2017 20:38
Benzo (a) anthracene	**0.12**	H	0.020	2	10/03/2017 20:38
Benzo (a) pyrene	**0.083**	H	0.020	2	10/03/2017 20:38
Benzo (b) fluoranthene	**0.24**	H	0.020	2	10/03/2017 20:38
Benzo (g,h,i) perylene	**0.14**	H	0.020	2	10/03/2017 20:38
Benzo (k) fluoranthene	**0.061**	H	0.020	2	10/03/2017 20:38
Chrysene	**0.45**	H	0.020	2	10/03/2017 20:38
Dibenzo (a,h) anthracene	ND	H	0.020	2	10/03/2017 20:38
Fluoranthene	**0.54**	H	0.020	2	10/03/2017 20:38
Fluorene	ND	H	0.020	2	10/03/2017 20:38
Indeno (1,2,3-cd) pyrene	**0.059**	H	0.020	2	10/03/2017 20:38
1-Methylnaphthalene	**0.023**	H	0.020	2	10/03/2017 20:38
2-Methylnaphthalene	**0.034**	H	0.020	2	10/03/2017 20:38
Naphthalene	ND	H	0.020	2	10/03/2017 20:38
Phenanthrene	**0.55**	H	0.020	2	10/03/2017 20:38
Pyrene	**0.57**	H	0.020	2	10/03/2017 20:38

Surrogates	REC (%)	Qualifiers	Limits	
1-Fluoronaphthalene	183	SH	30-130	10/03/2017 20:38
2-Fluorobiphenyl	178	SH	30-130	10/03/2017 20:38

Analyst(s): REB

Analytical Report

Client: Langan
Date Received: 9/19/17 16:30
Date Prepared: 10/2/17
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
Extraction Method: SW3550B/3640A
Analytical Method: SW8270C
Unit: mg/Kg

Semi-Volatile Organics (Low Level) with GPC Cleanup

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC21 10021711.D**	**146411**

Analytes	Result	Qualifiers	MDL	RL	DF	Date Analyzed
Acenaphthene	ND	H	1.4	2.5	10	10/02/2017 17:02
Acenaphthylene	ND	H	1.4	2.5	10	10/02/2017 17:02
Acetochlor	ND	H	2.5	2.5	10	10/02/2017 17:02
Anthracene	ND	H	1.4	2.5	10	10/02/2017 17:02
Benzidine	ND	H	2.3	13	10	10/02/2017 17:02
Benzo (a) anthracene	ND	H	0.50	0.50	10	10/02/2017 17:02
Benzo (a) pyrene	**0.080**	BH	0.025	0.025	10	10/02/2017 17:02
Benzo (b) fluoranthene	**0.24**	H	0.12	0.12	10	10/02/2017 17:02
Benzo (g,h,i) perylene	ND	H	1.5	2.5	10	10/02/2017 17:02
Benzo (k) fluoranthene	ND	H	1.6	2.5	10	10/02/2017 17:02
Benzyl Alcohol	ND	H	5.1	13	10	10/02/2017 17:02
1,1-Biphenyl	ND	H	1.5	2.5	10	10/02/2017 17:02
Bis (2-chloroethoxy) Methane	ND	H	1.4	2.5	10	10/02/2017 17:02
Bis (2-chloroethyl) Ether	ND	H	0.012	0.012	10	10/02/2017 17:02
Bis (2-chloroisopropyl) Ether	**0.015**	H	0.012	0.012	10	10/02/2017 17:02
Bis (2-ethylhexyl) Adipate	ND	H	2.5	2.5	10	10/02/2017 17:02
Bis (2-ethylhexyl) Phthalate	ND	H	1.3	2.5	10	10/02/2017 17:02
4-Bromophenyl Phenyl Ether	ND	H	1.6	2.5	10	10/02/2017 17:02
Butylbenzyl Phthalate	ND	H	1.3	2.5	10	10/02/2017 17:02
4-Chloroaniline	ND	H	0.012	0.012	10	10/02/2017 17:02
4-Chloro-3-methylphenol	ND	H	1.2	2.5	10	10/02/2017 17:02
2-Chloronaphthalene	ND	H	1.6	2.5	10	10/02/2017 17:02
2-Chlorophenol	ND	H	0.050	0.050	10	10/02/2017 17:02
4-Chlorophenyl Phenyl Ether	ND	H	1.5	2.5	10	10/02/2017 17:02
Chrysene	ND	H	1.4	2.5	10	10/02/2017 17:02
Dibenzo (a,h) anthracene	**0.064**	H	0.025	0.025	10	10/02/2017 17:02
Dibenzofuran	ND	H	1.3	2.5	10	10/02/2017 17:02
Di-n-butyl Phthalate	ND	H	1.3	2.5	10	10/02/2017 17:02
1,2-Dichlorobenzene	ND	H	1.2	2.5	10	10/02/2017 17:02
1,3-Dichlorobenzene	ND	H	1.4	2.5	10	10/02/2017 17:02
1,4-Dichlorobenzene	ND	H	0.25	0.25	10	10/02/2017 17:02
3,3-Dichlorobenzidine	ND	H	0.050	0.050	10	10/02/2017 17:02
2,4-Dichlorophenol	ND	H	0.025	0.025	10	10/02/2017 17:02
Diethyl Phthalate	ND	H	0.025	0.025	10	10/02/2017 17:02
2,4-Dimethylphenol	ND	H	0.25	0.25	10	10/02/2017 17:02
Dimethyl Phthalate	ND	H	0.025	0.025	10	10/02/2017 17:02
4,6-Dinitro-2-methylphenol	ND	H	1.3	13	10	10/02/2017 17:02

(Cont.)

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B/3640A
Date Prepared:	10/2/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics (Low Level) with GPC Cleanup

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	1709793-001A	Soil	09/15/2017 15:20	GC21 10021711.D	146411

Analytes	Result	Qualifiers	MDL	RL	DF	Date Analyzed
2,4-Dinitrophenol	ND	H	6.2	6.2	10	10/02/2017 17:02
2,4-Dinitrotoluene	ND	H	0.25	0.25	10	10/02/2017 17:02
2,6-Dinitrotoluene	ND	H	1.4	2.5	10	10/02/2017 17:02
Di-n-octyl Phthalate	ND	H	1.4	5.0	10	10/02/2017 17:02
1,2-Diphenylhydrazine	ND	H	1.6	2.5	10	10/02/2017 17:02
Fluoranthene	ND	H	1.3	2.5	10	10/02/2017 17:02
Fluorene	ND	H	1.4	2.5	10	10/02/2017 17:02
Hexachlorobenzene	ND	H	0.25	0.25	10	10/02/2017 17:02
Hexachlorobutadiene	ND	H	0.25	0.25	10	10/02/2017 17:02
Hexachlorocyclopentadiene	ND	H	7.3	13	10	10/02/2017 17:02
Hexachloroethane	ND	H	1.4	2.5	10	10/02/2017 17:02
Indeno (1,2,3-cd) pyrene	ND	H	0.12	0.12	10	10/02/2017 17:02
Isophorone	ND	H	1.2	2.5	10	10/02/2017 17:02
2-Methylnaphthalene	ND	H	0.25	0.25	10	10/02/2017 17:02
2-Methylphenol (o-Cresol)	ND	H	1.4	2.5	10	10/02/2017 17:02
3 & 4-Methylphenol (m,p-Cresol)	ND	H	1.2	2.5	10	10/02/2017 17:02
Naphthalene	**0.028**	H	0.025	0.025	10	10/02/2017 17:02
2-Nitroaniline	ND	H	6.2	13	10	10/02/2017 17:02
3-Nitroaniline	ND	H	5.9	13	10	10/02/2017 17:02
4-Nitroaniline	ND	H	5.5	13	10	10/02/2017 17:02
Nitrobenzene	ND	H	1.4	2.5	10	10/02/2017 17:02
2-Nitrophenol	ND	H	6.4	13	10	10/02/2017 17:02
4-Nitrophenol	ND	H	4.1	13	10	10/02/2017 17:02
N-Nitrosodiphenylamine	ND	H	1.6	2.5	10	10/02/2017 17:02
N-Nitrosodi-n-propylamine	ND	H	0.12	0.12	10	10/02/2017 17:02
Pentachlorophenol	ND	H	3.2	13	10	10/02/2017 17:02
Phenanthrene	ND	H	1.4	2.5	10	10/02/2017 17:02
Phenol	ND	H	0.050	0.050	10	10/02/2017 17:02
Pyrene	ND	H	1.3	2.5	10	10/02/2017 17:02
Pyridine	ND	H	2.5	2.5	10	10/02/2017 17:02
1,2,4-Trichlorobenzene	ND	H	1.4	2.5	10	10/02/2017 17:02
2,4,5-Trichlorophenol	ND	H	0.12	0.12	10	10/02/2017 17:02
2,4,6-Trichlorophenol	ND	H	0.12	0.12	10	10/02/2017 17:02

(Cont.)

Angela Rydelius, Lab Manager

Analytical Report

Client:	Langan	**WorkOrder:**	1709793
Date Received:	9/19/17 16:30	**Extraction Method:**	SW3550B/3640A
Date Prepared:	10/2/17	**Analytical Method:**	SW8270C
Project:	731706301; UC Berkeley GSPP & Housing	**Unit:**	mg/Kg

Semi-Volatile Organics (Low Level) with GPC Cleanup

Client ID	Lab ID	Matrix	Date Collected	Instrument	Batch ID
B-1-2.0	**1709793-001A**	**Soil**	**09/15/2017 15:20**	**GC21 10021711.D**	**146411**

Analytes	Result	Qualifiers	MDL	RL	DF	Date Analyzed

Surrogates	REC (%)	Qualifiers	Limits	Date Analyzed
2-Fluorophenol	69	H	30-130	10/02/2017 17:02
Phenol-d5	71	H	30-130	10/02/2017 17:02
Nitrobenzene-d5	59	H	30-130	10/02/2017 17:02
2-Fluorobiphenyl	65	H	30-130	10/02/2017 17:02
2,4,6-Tribromophenol	58	H	16-130	10/02/2017 17:02
4-Terphenyl-d14	79	H	30-130	10/02/2017 17:02

Analyst(s): REB

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	9/19/17	**BatchID:**	146429
Date Analyzed:	10/4/17	**Extraction Method:**	SW3550B/3630C
Instrument:	GC40	**Analytical Method:**	SW8082
Matrix:	Soil	**Unit:**	mg/kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS/LCSD-146429

QC Summary for SW8082

Analyte	MB Result	MDL	RL	SPK Val	MB SS %REC	MB SS Limits
Aroclor1016	ND	0.0051	0.050	-	-	-
Aroclor1016	ND	0.0051	0.050	-	-	-
Aroclor1221	ND	0.011	0.050	-	-	-
Aroclor1232	ND	0.0063	0.050	-	-	-
Aroclor1242	ND	0.0067	0.050	-	-	-
Aroclor1248	ND	0.0040	0.050	-	-	-
Aroclor1254	ND	0.0068	0.050	-	-	-
Aroclor1260	ND	0.0061	0.050	-	-	-
Aroclor1260	ND	0.0061	0.050	-	-	-
Aroclor1262	ND	0.050	0.050	-	-	-
Aroclor1268	ND	0.050	0.050	-	-	-
PCBs, total	ND	0.0040	0.050	-	-	-
Surrogate Recovery						
Decachlorobiphenyl	0.05012			0.050	100	57-151
Decachlorobiphenyl	0.04651			0.05	93	59-137
Decachlorobiphenyl	0.04418			0.050	88	57-145

Analyte	LCS Result	LCSD Result	SPK Val	LCS %REC	LCSD %REC	LCS/LCSD Limits	RPD	RPD Limit
Aroclor1016	0.148	0.150	0.15	98	100	35-157	1.24	20
Aroclor1016	0.148	0.150	0.15	98	100	35-157	1.24	20
Aroclor1260	0.150	0.157	0.15	100	105	61-147	4.81	20
Aroclor1260	0.150	0.157	0.15	100	105	61-147	4.81	20
Surrogate Recovery								
Decachlorobiphenyl	0.0531	0.0554	0.050	106	111	68-141	4.25	20
Decachlorobiphenyl	0.0531	0.0554	0.050	106	111	68-141	4.25	20
Decachlorobiphenyl	0.0420	0.0475	0.050	84	95	59-137	4.43	20

Quality Control Report

Client: Langan
Date Prepared: 10/2/17
Date Analyzed: 10/3/17
Instrument: GC35
Matrix: Soil
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
BatchID: 146407
Extraction Method: SW3550B/3640A
Analytical Method: SW8270C-SIM
Unit: mg/kg
Sample ID: MB/LCS-146407
1709793-001AMS/MSD

QC Summary Report for SW8270C

Analyte	MB Result	LCS Result	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Acenaphthene	ND	-	0.010	-	-	-	-
Acenaphthylene	ND	-	0.010	-	-	-	-
Anthracene	ND	-	0.010	-	-	-	-
Benzo (a) anthracene	ND	-	0.010	-	-	-	-
Benzo (a) pyrene	ND	0.165	0.010	0.20	-	83	30-130
Benzo (b) fluoranthene	ND	-	0.010	-	-	-	-
Benzo (g,h,i) perylene	ND	-	0.010	-	-	-	-
Benzo (k) fluoranthene	ND	-	0.010	-	-	-	-
Chrysene	ND	0.192	0.010	0.20	-	96	30-130
Dibenzo (a,h) anthracene	ND	-	0.010	-	-	-	-
Fluoranthene	ND	-	0.010	-	-	-	-
Fluorene	ND	-	0.010	-	-	-	-
Indeno (1,2,3-cd) pyrene	ND	-	0.010	-	-	-	-
1-Methylnaphthalene	ND	0.193	0.010	0.20	-	96	30-130
2-Methylnaphthalene	ND	0.179	0.010	0.20	-	89	30-130
Naphthalene	ND	-	0.010	-	-	-	-
Phenanthrene	ND	0.171	0.010	0.20	-	85	30-130
Pyrene	ND	0.168	0.010	0.20	-	84	30-130
Surrogate Recovery							
1-Fluoronaphthalene	0.5757	0.456		0.50	115	91	30-130
2-Fluorobiphenyl	0.5968	0.458		0.50	119	92	30-130

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Benzo (a) pyrene	NR	NR		0.083	NR	NR	-	NR	-
Chrysene	NR	NR		0.45	NR	NR	-	NR	-
1-Methylnaphthalene	NR	NR		0.023	NR	NR	-	NR	-
2-Methylnaphthalene	NR	NR		0.034	NR	NR	-	NR	-
Phenanthrene	NR	NR		0.55	NR	NR	-	NR	-
Pyrene	NR	NR		0.57	NR	NR	-	NR	-
Surrogate Recovery									
1-Fluoronaphthalene	NR	NR			NR	NR	-	NR	-
2-Fluorobiphenyl	NR	NR			NR	NR	-	NR	-

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QA/QC Officer

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	10/2/17	**BatchID:**	146411
Date Analyzed:	10/2/17	**Extraction Method**	SW3550B/3640A
Instrument:	GC21	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146411 1709793-001AMS/MSD

QC Summary Report for SW8270C (Low Level) w/ GPC

Analyte	MB Result	LCS Result	MDL	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Acenaphthene	ND	3.75	0.14	0.25	5	-	75	32-118
Acenaphthylene	ND	4.07	0.14	0.25	5	-	81	32-122
Acetochlor	ND	-	0.25	0.25	-	-	-	-
Anthracene	ND	3.97	0.14	0.25	5	-	79	36-125
Benzidine	ND	1.91	0.23	1.3	5	-	38	4-83
Benzo (a) anthracene	ND	4.37	0.050	0.050	5	-	87	35-117
Benzo (a) pyrene	0.00297	4.51	0.0025	0.0025	5	-	90	42-138
Benzo (b) fluoranthene	ND	4.42	0.012	0.012	5	-	88	37-125
Benzo (g,h,i) perylene	ND	4.73	0.15	0.25	5	-	95	45-146
Benzo (k) fluoranthene	ND	4.08	0.16	0.25	5	-	82	39-124
Benzyl Alcohol	ND	3.91	0.51	1.3	5	-	78	5-105
1,1-Biphenyl	ND	-	0.15	0.25	-	-	-	-
Bis (2-chloroethoxy) Methane	ND	4.16	0.14	0.25	5	-	83	35-115
Bis (2-chloroethyl) Ether	ND	4.04	0.0012	0.0012	5	-	81	35-105
Bis (2-chloroisopropyl) Ether	ND	4.66	0.0012	0.0012	5	-	93	34-119
Bis (2-ethylhexyl) Adipate	ND	5.23	0.25	0.25	5	-	105	27-117
Bis (2-ethylhexyl) Phthalate	ND	4.97	0.13	0.25	5	-	99	34-124
4-Bromophenyl Phenyl Ether	ND	4.18	0.16	0.25	5	-	84	33-112
Butylbenzyl Phthalate	ND	5.02	0.13	0.25	5	-	100	35-127
4-Chloroaniline	ND	2.58	0.0012	0.0012	5	-	52	12-77
4-Chloro-3-methylphenol	ND	4.60	0.12	0.25	5	-	92	35-123
2-Chloronaphthalene	ND	3.59	0.16	0.25	5	-	72	28-109
2-Chlorophenol	0.005781	4.09	0.0050	0.0050	5	-	82	38-116
4-Chlorophenyl Phenyl Ether	ND	4.21	0.15	0.25	5	-	84	33-122
Chrysene	ND	4.18	0.14	0.25	5	-	84	37-116
Dibenzo (a,h) anthracene	ND	4.60	0.0025	0.0025	5	-	92	43-141
Dibenzofuran	ND	4.05	0.13	0.25	5	-	81	33-117
Di-n-butyl Phthalate	ND	4.06	0.13	0.25	5	-	81	38-126
1,2-Dichlorobenzene	ND	4.06	0.12	0.25	5	-	81	34-105
1,3-Dichlorobenzene	ND	4.05	0.14	0.25	5	-	81	33-104
1,4-Dichlorobenzene	ND	3.54	0.025	0.025	5	-	71	31-102
3,3-Dichlorobenzidine	ND	2.33	0.0050	0.0050	5	-	47	14-84
2,4-Dichlorophenol	ND	4.87	0.0025	0.0025	5	-	97	31-124
Diethyl Phthalate	ND	4.05	0.0025	0.0025	5	-	81	35-118
2,4-Dimethylphenol	ND	4.59	0.025	0.025	5	-	92	30-120
Dimethyl Phthalate	ND	3.94	0.0025	0.0025	5	-	79	33-118
4,6-Dinitro-2-methylphenol	ND	3.94	0.13	1.3	5	-	79	12-126

(Cont.)

Quality Control Report

Client: Langan
Date Prepared: 10/2/17
Date Analyzed: 10/2/17
Instrument: GC21
Matrix: Soil
Project: 731706301; UC Berkeley GSPP & Housing

WorkOrder: 1709793
BatchID: 146411
Extraction Method SW3550B/3640A
Analytical Method: SW8270C
Unit: mg/Kg
Sample ID: MB/LCS-146411
1709793-001AMS/MSD

QC Summary Report for SW8270C (Low Level) w/ GPC

Analyte	MB Result	LCS Result	MDL	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
2,4-Dinitrophenol	ND	3.98	0.62	0.62	5	-	80	8-130
2,4-Dinitrotoluene	ND	4.29	0.025	0.025	5	-	86	38-117
2,6-Dinitrotoluene	ND	4.19	0.14	0.25	5	-	84	35-121
Di-n-octyl Phthalate	ND	5.16	0.14	0.50	5	-	103	42-150
1,2-Diphenylhydrazine	ND	4.09	0.16	0.25	5	-	82	0-117
Fluoranthene	ND	4.06	0.13	0.25	5	-	81	38-126
Fluorene	ND	3.93	0.14	0.25	5	-	79	34-118
Hexachlorobenzene	ND	3.73	0.025	0.025	5	-	75	30-130
Hexachlorobutadiene	ND	4.26	0.025	0.025	5	-	85	33-121
Hexachlorocyclopentadiene	ND	3.06	0.73	1.3	5	-	61	8-89
Hexachloroethane	ND	4.09	0.14	0.25	5	-	82	32-106
Indeno (1,2,3-cd) pyrene	ND	4.57	0.012	0.012	5	-	91	43-138
Isophorone	ND	3.56	0.12	0.25	5	-	71	26-92
2-Methylnaphthalene	ND	4.44	0.025	0.025	5	-	89	30-121
2-Methylphenol (o-Cresol)	ND	3.85	0.14	0.25	5	-	77	34-114
3 & 4-Methylphenol (m,p-Cresol)	ND	3.98	0.12	0.25	5	-	80	26-130
Naphthalene	ND	3.99	0.0025	0.0025	5	-	80	33-113
2-Nitroaniline	ND	4.31	0.62	1.3	5	-	86	29-115
3-Nitroaniline	ND	2.77	0.59	1.3	5	-	55	25-93
4-Nitroaniline	ND	3.70	0.55	1.3	5	-	74	31-108
Nitrobenzene	ND	4.27	0.14	0.25	5	-	85	33-122
2-Nitrophenol	ND	4.69	0.64	1.3	5	-	94	32-121
4-Nitrophenol	ND	3.79	0.41	1.3	5	-	76	27-102
N-Nitrosodiphenylamine	ND	-	0.16	0.25	-	-	-	-
N-Nitrosodi-n-propylamine	ND	4.30	0.012	0.012	5	-	86	25-108
Pentachlorophenol	ND	5.85	0.32	1.3	5	-	117	28-134
Phenanthrene	ND	4.54	0.14	0.25	5	-	91	36-123
Phenol	ND	3.99	0.0050	0.0050	5	-	80	33-107
Pyrene	ND	4.47	0.13	0.25	5	-	89	38-124
Pyridine	ND	5.07	0.25	0.25	5	-	101	30-130
1,2,4-Trichlorobenzene	ND	4.44	0.14	0.25	5	-	89	34-121
2,4,5-Trichlorophenol	ND	4.28	0.012	0.012	5	-	86	31-126
2,4,6-Trichlorophenol	ND	4.52	0.012	0.012	5	-	90	32-128

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	10/2/17	**BatchID:**	146411
Date Analyzed:	10/2/17	**Extraction Method**	SW3550B/3640A
Instrument:	GC21	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146411 1709793-001AMS/MSD

QC Summary Report for SW8270C (Low Level) w/ GPC

Analyte	MB Result	LCS Result	MDL	RL	SPK Val	MB SS %REC	LCS %REC	LCS Limits
Surrogate Recovery								
2-Fluorophenol	4.601	4.53			5	92	91	31-108
Phenol-d5	4.609	4.42			5	92	88	32-106
Nitrobenzene-d5	4.104	4.32			5	82	86	27-109
2-Fluorobiphenyl	3.923	4.10			5	78	82	26-100
2,4,6-Tribromophenol	4.197	4.89			5	84	98	25-106
4-Terphenyl-d14	4.415	4.97			5	88	99	27-113

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	10/2/17	**BatchID:**	146411
Date Analyzed:	10/2/17	**Extraction Method**	SW3550B/3640A
Instrument:	GC21	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146411 1709793-001AMS/MSD

QC Summary Report for SW8270C (Low Level) w/ GPC

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Acenaphthene	NR	NR		ND<2.5	NR	NR	-	NR	-
Acenaphthylene	NR	NR		ND<2.5	NR	NR	-	NR	-
Anthracene	NR	NR		ND<2.5	NR	NR	-	NR	-
Benzidine	NR	NR		ND<13	NR	NR	-	NR	-
Benzo (a) anthracene	NR	NR		ND<0.5	NR	NR	-	NR	-
Benzo (a) pyrene	NR	NR		0.08	NR	NR	-	NR	-
Benzo (b) fluoranthene	NR	NR		0.24	NR	NR	-	NR	-
Benzo (g,h,i) perylene	NR	NR		ND<2.5	NR	NR	-	NR	-
Benzo (k) fluoranthene	NR	NR		ND<2.5	NR	NR	-	NR	-
Benzyl Alcohol	NR	NR		ND<13	NR	NR	-	NR	-
Bis (2-chloroethoxy) Methane	NR	NR		ND<2.5	NR	NR	-	NR	-
Bis (2-chloroethyl) Ether	NR	NR		ND<0.012	NR	NR	-	NR	-
Bis (2-chloroisopropyl) Ether	NR	NR		0.015	NR	NR	-	NR	-
Bis (2-ethylhexyl) Adipate	NR	NR		ND<2.5	NR	NR	-	NR	-
Bis (2-ethylhexyl) Phthalate	NR	NR		ND<2.5	NR	NR	-	NR	-
4-Bromophenyl Phenyl Ether	NR	NR		ND<2.5	NR	NR	-	NR	-
Butylbenzyl Phthalate	NR	NR		ND<2.5	NR	NR	-	NR	-
4-Chloroaniline	NR	NR		ND<0.012	NR	NR	-	NR	-
4-Chloro-3-methylphenol	NR	NR		ND<2.5	NR	NR	-	NR	-
2-Chloronaphthalene	NR	NR		ND<2.5	NR	NR	-	NR	-
2-Chlorophenol	NR	NR		ND<0.05	NR	NR	-	NR	-
4-Chlorophenyl Phenyl Ether	NR	NR		ND<2.5	NR	NR	-	NR	-
Chrysene	NR	NR		ND<2.5	NR	NR	-	NR	-
Dibenzo (a,h) anthracene	NR	NR		0.064	NR	NR	-	NR	-
Dibenzofuran	NR	NR		ND<2.5	NR	NR	-	NR	-
Di-n-butyl Phthalate	NR	NR		ND<2.5	NR	NR	-	NR	-
1,2-Dichlorobenzene	NR	NR		ND<2.5	NR	NR	-	NR	-
1,3-Dichlorobenzene	NR	NR		ND<2.5	NR	NR	-	NR	-
1,4-Dichlorobenzene	NR	NR		ND<0.25	NR	NR	-	NR	-
3,3-Dichlorobenzidine	NR	NR		ND<0.05	NR	NR	-	NR	-
2,4-Dichlorophenol	NR	NR		ND<0.025	NR	NR	-	NR	-
Diethyl Phthalate	NR	NR		ND<0.025	NR	NR	-	NR	-
2,4-Dimethylphenol	NR	NR		ND<0.25	NR	NR	-	NR	-
Dimethyl Phthalate	NR	NR		ND<0.025	NR	NR	-	NR	-
4,6-Dinitro-2-methylphenol	NR	NR		ND<13	NR	NR	-	NR	-
2,4-Dinitrophenol	NR	NR		ND<6.2	NR	NR	-	NR	-
2,4-Dinitrotoluene	NR	NR		ND<0.25	NR	NR	-	NR	-

(Cont.)

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	10/2/17	**BatchID:**	146411
Date Analyzed:	10/2/17	**Extraction Method**	SW3550B/3640A
Instrument:	GC21	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146411 1709793-001AMS/MSD

QC Summary Report for SW8270C (Low Level) w/ GPC

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
2,6-Dinitrotoluene	NR	NR		ND<2.5	NR	NR	-	NR	-
Di-n-octyl Phthalate	NR	NR		ND<5	NR	NR	-	NR	-
1,2-Diphenylhydrazine	NR	NR		ND<2.5	NR	NR	-	NR	-
Fluoranthene	NR	NR		ND<2.5	NR	NR	-	NR	-
Fluorene	NR	NR		ND<2.5	NR	NR	-	NR	-
Hexachlorobenzene	NR	NR		ND<0.25	NR	NR	-	NR	-
Hexachlorobutadiene	NR	NR		ND<0.25	NR	NR	-	NR	-
Hexachlorocyclopentadiene	NR	NR		ND<13	NR	NR	-	NR	-
Hexachloroethane	NR	NR		ND<2.5	NR	NR	-	NR	-
Indeno (1,2,3-cd) pyrene	NR	NR		ND<0.12	NR	NR	-	NR	-
Isophorone	NR	NR		ND<2.5	NR	NR	-	NR	-
2-Methylnaphthalene	NR	NR		ND<0.25	NR	NR	-	NR	-
2-Methylphenol (o-Cresol)	NR	NR		ND<2.5	NR	NR	-	NR	-
3 & 4-Methylphenol (m,p-Cresol)	NR	NR		ND<2.5	NR	NR	-	NR	-
Naphthalene	NR	NR		0.028	NR	NR	-	NR	-
2-Nitroaniline	NR	NR		ND<13	NR	NR	-	NR	-
3-Nitroaniline	NR	NR		ND<13	NR	NR	-	NR	-
4-Nitroaniline	NR	NR		ND<13	NR	NR	-	NR	-
Nitrobenzene	NR	NR		ND<2.5	NR	NR	-	NR	-
2-Nitrophenol	NR	NR		ND<13	NR	NR	-	NR	-
4-Nitrophenol	NR	NR		ND<13	NR	NR	-	NR	-
N-Nitrosodi-n-propylamine	NR	NR		ND<0.12	NR	NR	-	NR	-
Pentachlorophenol	NR	NR		ND<13	NR	NR	-	NR	-
Phenanthrene	NR	NR		ND<2.5	NR	NR	-	NR	-
Phenol	NR	NR		ND<0.05	NR	NR	-	NR	-
Pyrene	NR	NR		ND<2.5	NR	NR	-	NR	-
Pyridine	NR	NR		ND<2.5	NR	NR	-	NR	-
1,2,4-Trichlorobenzene	NR	NR		ND<2.5	NR	NR	-	NR	-
2,4,5-Trichlorophenol	NR	NR		ND<0.12	NR	NR	-	NR	-
2,4,6-Trichlorophenol	NR	NR		ND<0.12	NR	NR	-	NR	-

(Cont.)

QA/QC Officer

Quality Control Report

Client:	Langan	**WorkOrder:**	1709793
Date Prepared:	10/2/17	**BatchID:**	146411
Date Analyzed:	10/2/17	**Extraction Method**	SW3550B/3640A
Instrument:	GC21	**Analytical Method:**	SW8270C
Matrix:	Soil	**Unit:**	mg/Kg
Project:	731706301; UC Berkeley GSPP & Housing	**Sample ID:**	MB/LCS-146411 1709793-001AMS/MSD

QC Summary Report for SW8270C (Low Level) w/ GPC

Analyte	MS Result	MSD Result	SPK Val	SPKRef Val	MS %REC	MSD %REC	MS/MSD Limits	RPD	RPD Limit
Surrogate Recovery									
2-Fluorophenol	NR	NR			NR	NR	-	NR	-
Phenol-d5	NR	NR			NR	NR	-	NR	-
Nitrobenzene-d5	NR	NR			NR	NR	-	NR	-
2-Fluorobiphenyl	NR	NR			NR	NR	-	NR	-
2,4,6-Tribromophenol	NR	NR			NR	NR	-	NR	-
4-Terphenyl-d14	NR	NR			NR	NR	-	NR	-

QA/QC Officer

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

Page 1 of 1

WorkOrder: 1709793 **A** **ClientCode: TWRF**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☐ Fax ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

▣ Detection Summary ▣ Dry-Weight

Report to:
Peter Cusack
Langan
555 Montgomery St., Suite 1300
San Francisco, CA 94111
(415) 955-5244 FAX: (415) 955-9041

Email: pcusack@langan.com
cc/3rd Party: kstaehlin@langan.com;
PO:
ProjectNo: 731706301; UC Berkeley GSPP & Housing

Bill to:
Accounts Payable
Langan
555 Montgomery St., Suite 1300
San Francisco, CA 94111
Langan_InvoiceCapture@concursolutio

Requested TAT: **5 days;**

Date Received: **09/19/2017**
Date Logged: **09/19/2017**
Date Add-On: **10/02/2017**

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below)											
					1	2	3	4	5	6	7	8	9	10	11	12
1709793-001	B-1-2.0	Soil	9/15/2017 15:20	☐	A	A	A									

Test Legend:

1	**8082_PCB_ESL_S [J]**	**2**	**8270_ESL_S [J]**	**3**	**8270_PNA_GPC_S**	**4**	
5		**6**		**7**		**8**	
9		**10**		**11**		**12**	

Prepared by: Alexandra Iniguez

Add-On Prepared By: Kena Ponce

Comments: PCB & 8270 ESLs added 10/02/17 STAT

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

WORK ORDER SUMMARY

Client Name: LANGAN
Client Contact: Peter Cusack
Contact's Email pcusack@langan.com

Project: 731706301; UC Berkeley GSPP & Housing

Comments: PCB & 8270 ESLs added 10/02/17 STAT

Work Order: 1709793
QC Level: LEVEL 2
Date Logged: 9/19/2017
Date Add-On: 10/2/2017

Lab ID	Client ID	Matrix	Test Name	Containers /Composites	Bottle & Preservative	Collection Date & Time	TAT	Sediment Content	Hold	SubOut
1709793-001A	B-1-2.0	Soil	SW8270C (PNAs w/ GPC)	1	Stainless Steel tube 2.5"x6"	9/15/2017 15:20	5 days		☐	
			SW8270C (SVOCs) ESLs				5 days		☐	
			SW8082 (PCBs Only)				5 days		☐	

NOTES: **- STLC and TCLP extractions require 2 days to complete; therefore, all TATs begin after the extraction is completed (i.e., One-day TAT yields results in 3 days from sample submission).**

- MAI assumes that all material present in the provided sampling container is considered part of the sample - MAI does not exclude any material from the sample prior to sample preparation unless requested in writing by the client.

1709793

* PLEASE C.C. ANNIE S. AT *
KSTAEHLIN@LANGAN.com

10337

LANGAN

CHAIN OF CUSTODY RECORD

Page 1 of 1

☒ 555 Montgomery Street. Suite 1300, San Francisco, CA 94111
☐ 501 14th Street, Third Floor, Oakland CA 94612
☐ 3320 Data Drive, Suite 350, Rancho Cordova, CA 95670-7982
☐ 4030 Moorpark Ave. Suite 210, San Jose, CA 95117-1849

Site Name: UC BERKELEY GSPP & HOUSING
Job Number: 731706301
Project Manager\Contact: PETER CUSACK
Samplers: KSS
Recorder (Signature Required):

Turnaround Time: STANDARD

Field Sample Identification No.	Date	Time	Lab Sample No.	Soil	Water	Air	Other	HCL	H_2SO_4	HNO_3	Ice			TPH g,d,mo	VOCs	SVOCs	PNAs & PAHs	PCBs	CAM 17	ASBESTOS by CARB 435	LUFT 5 METALS	PCB ESC 10/2/17 STAT	8270 ESC 10/2/17 STAT	8310 PNA ESC 10/2/17 STAT		Silica gel clean-up	Hold	Remarks
B-1-2.0	9/15/17	1520		X							X			X	X	X	X	X	X			X	X	X				
B-1-5.5		1520		X							X			X					X									
B-2-3.0		0840		X							X			X					X	X								
B-2-5.5		0850		X							X			X	X	X			X									
B-2-8.0		0858		X							X			X						X	X						X	PLEASE PLACE THESE SAMPLES ON HOLD. DO NOT ANALYZE.
B-3-3.0		0752		X							X			X	X	X	X	X	X									
B-3-5.5		0803		X							X			X	X	X			X									
B-3-10.5	9/15/17	0812		X							X			X						X	X						X	

Relinquished by: (Signature)	Date:	Time	Received by: (Signature) Basit	Date 9/19/17	Time 12:45
Relinquished by: (Signature) Basit	Date: 9/18/17	Time 1630	Received by: (Signature)	Date 9/18/17	Time 1630
Relinquished by: (Signature)	Date:	Time	Received by Lab: (Signature)	Date	Time

Sent to Laboratory (Name): McCAMPBELL ANALYTICAL
Laboratory Comments/Notes:

Method of Shipment ☒ Lab courier ☐ Fed Ex ☐ Airborne ☐ UPS
☐ Hand Carried ☐ Private Courier (Co. Name)

White Copy - Original   Yellow Copy - Laboratory   Pink Copy - Field   COC Number:

DISTRIBUTION

Electronic Copy:
Charlie MacDonald
ACC OP Development LLC
12700 Hill Country Boulevard, Suite T-200
Austin, TX 78738

Electronic Copy:
Mike Korolyk, SE
Tipping Structural Engineers
1906 Shattuck Avenue
Berkeley, CA 94704

Electronic Copy:
Tim Stevens
Solomon Cordwell Buenz Architecture
255 California Street, 3rd Floor
San Francisco, CA 94111

QUALITY CONTROL REVIEWER:

Richard D. Rodgers

Richard D. Rodgers, PE, GE
Principal/Senior Consultant

APPENDIX E

NOISE TECHNICAL APPENDIX

```
-         Freq Weight : A
-         Time Weight : FAST
-         Level Range : 40-100
-         Max dB : 86.8 - 2018/05/04 16:25:47
-         Level Range : 40-100
-         SEL : 94.6
-         Leq : 65.1
-
          No.s            Date Time     (dB)
         -----------------------------------------------------------------------
             1  2018/05/04 16:12:18     57.7
             2  2018/05/04 16:12:19     57.4
             3  2018/05/04 16:12:20     59.0
             4  2018/05/04 16:12:21     55.2
             5  2018/05/04 16:12:22     56.8
             6  2018/05/04 16:12:23     56.0
             7  2018/05/04 16:12:24     54.6
             8  2018/05/04 16:12:25     55.2
             9  2018/05/04 16:12:26     56.5
            10  2018/05/04 16:12:27     58.4
            11  2018/05/04 16:12:28     59.2
            12  2018/05/04 16:12:29     57.7
            13  2018/05/04 16:12:30     55.0
            14  2018/05/04 16:12:31     53.3
            15  2018/05/04 16:12:32     52.9
            16  2018/05/04 16:12:33     53.4
            17  2018/05/04 16:12:34     53.9
            18  2018/05/04 16:12:35     54.1
            19  2018/05/04 16:12:36     54.7
            20  2018/05/04 16:12:37     56.2
            21  2018/05/04 16:12:38     55.7
            22  2018/05/04 16:12:39     56.8
            23  2018/05/04 16:12:40     58.4
            24  2018/05/04 16:12:41     61.7
            25  2018/05/04 16:12:42     60.7
            26  2018/05/04 16:12:43     59.8
            27  2018/05/04 16:12:44     59.8
            28  2018/05/04 16:12:45     60.8
            29  2018/05/04 16:12:46     60.8
            30  2018/05/04 16:12:47     62.5
            31  2018/05/04 16:12:48     61.9
            32  2018/05/04 16:12:49     64.5
            33  2018/05/04 16:12:50     68.0
            34  2018/05/04 16:12:51     68.5
            35  2018/05/04 16:12:52     68.1
            36  2018/05/04 16:12:53     67.1
            37  2018/05/04 16:12:54     67.2
            38  2018/05/04 16:12:55     72.3
            39  2018/05/04 16:12:56     70.3
            40  2018/05/04 16:12:57     67.4
            41  2018/05/04 16:12:58     67.0
            42  2018/05/04 16:12:59     71.7
            43  2018/05/04 16:13:00     71.9
            44  2018/05/04 16:13:01     70.7
            45  2018/05/04 16:13:02     70.6
            46  2018/05/04 16:13:03     70.2
            47  2018/05/04 16:13:04     67.6
            48  2018/05/04 16:13:05     69.7
            49  2018/05/04 16:13:06     62.8
            50  2018/05/04 16:13:07     61.5
            51  2018/05/04 16:13:08     61.2
            52  2018/05/04 16:13:09     61.0
            53  2018/05/04 16:13:10     61.3
            54  2018/05/04 16:13:11     61.5
            55  2018/05/04 16:13:12     61.7
            56  2018/05/04 16:13:13     61.1
            57  2018/05/04 16:13:14     61.9
            58  2018/05/04 16:13:15     61.9
            59  2018/05/04 16:13:16     61.1
            60  2018/05/04 16:13:17     60.8
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            62  2018/05/04 16:13:19     62.5
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            64  2018/05/04 16:13:21     69.7
            65  2018/05/04 16:13:22     60.0
            66  2018/05/04 16:13:23     64.1
            67  2018/05/04 16:13:24     63.2
            68  2018/05/04 16:13:25     64.5
            69  2018/05/04 16:13:26     63.8
            70  2018/05/04 16:13:27     59.7
            71  2018/05/04 16:13:28     69.9
            72  2018/05/04 16:13:29     72.7
            73  2018/05/04 16:13:30     69.0
            74  2018/05/04 16:13:31     68.6
            75  2018/05/04 16:13:32     63.1
            76  2018/05/04 16:13:33     61.6
            77  2018/05/04 16:13:34     57.3
            78  2018/05/04 16:13:35     57.6
            79  2018/05/04 16:13:36     57.5
            80  2018/05/04 16:13:37     58.5
            81  2018/05/04 16:13:38     59.2
            82  2018/05/04 16:13:39     59.5
            83  2018/05/04 16:13:40     75.0
            84  2018/05/04 16:13:41     61.7
            85  2018/05/04 16:13:42     57.3
```

```
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 87  2018/05/04 16:13:44     58.5
 88  2018/05/04 16:13:45     57.9
 89  2018/05/04 16:13:46     62.2
 90  2018/05/04 16:13:47     58.9
 91  2018/05/04 16:13:48     58.0
 92  2018/05/04 16:13:49     61.8
 93  2018/05/04 16:13:50     64.6
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 95  2018/05/04 16:13:52     65.5
 96  2018/05/04 16:13:53     65.0
 97  2018/05/04 16:13:54     59.4
 98  2018/05/04 16:13:55     57.6
 99  2018/05/04 16:13:56     56.7
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101  2018/05/04 16:13:58     54.8
102  2018/05/04 16:13:59     59.0
103  2018/05/04 16:14:00     58.9
104  2018/05/04 16:14:01     53.8
105  2018/05/04 16:14:02     53.1
106  2018/05/04 16:14:03     53.6
107  2018/05/04 16:14:04     53.7
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113  2018/05/04 16:14:10     55.3
114  2018/05/04 16:14:11     54.8
115  2018/05/04 16:14:12     56.2
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117  2018/05/04 16:14:14     60.0
118  2018/05/04 16:14:15     62.9
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120  2018/05/04 16:14:17     66.4
121  2018/05/04 16:14:18     68.0
122  2018/05/04 16:14:19     65.2
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127  2018/05/04 16:14:24     56.7
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132  2018/05/04 16:14:29     56.5
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134  2018/05/04 16:14:31     54.8
135  2018/05/04 16:14:32     59.6
136  2018/05/04 16:14:33     62.2
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138  2018/05/04 16:14:35     60.9
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140  2018/05/04 16:14:37     62.0
141  2018/05/04 16:14:38     65.3
142  2018/05/04 16:14:39     63.8
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147  2018/05/04 16:14:44     64.1
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161  2018/05/04 16:14:58     57.7
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183  2018/05/04 16:15:20     58.5
184  2018/05/04 16:15:21     61.6
```

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189  2018/05/04 16:15:26     73.8
190  2018/05/04 16:15:27     70.1
191  2018/05/04 16:15:28     65.4
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193  2018/05/04 16:15:30     72.0
194  2018/05/04 16:15:31     69.7
195  2018/05/04 16:15:32     60.2
196  2018/05/04 16:15:33     57.9
197  2018/05/04 16:15:34     56.5
198  2018/05/04 16:15:35     57.5
199  2018/05/04 16:15:36     57.6
200  2018/05/04 16:15:37     57.4
201  2018/05/04 16:15:38     56.7
202  2018/05/04 16:15:39     59.2
203  2018/05/04 16:15:40     59.5
204  2018/05/04 16:15:41     58.0
205  2018/05/04 16:15:42     59.8
206  2018/05/04 16:15:43     61.8
207  2018/05/04 16:15:44     63.2
208  2018/05/04 16:15:45     67.7
209  2018/05/04 16:15:46     70.1
210  2018/05/04 16:15:47     70.6
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213  2018/05/04 16:15:50     75.3
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216  2018/05/04 16:15:53     68.5
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262  2018/05/04 16:16:39     58.0
263  2018/05/04 16:16:40     56.8
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272  2018/05/04 16:16:49     62.9
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275  2018/05/04 16:16:52     56.5
276  2018/05/04 16:16:53     54.8
277  2018/05/04 16:16:54     53.9
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279  2018/05/04 16:16:56     52.8
280  2018/05/04 16:16:57     52.6
281  2018/05/04 16:16:58     51.9
282  2018/05/04 16:16:59     51.7
283  2018/05/04 16:17:00     51.9
```

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285  2018/05/04 16:17:02     52.5
286  2018/05/04 16:17:03     55.7
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288  2018/05/04 16:17:05     55.7
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290  2018/05/04 16:17:07     55.5
291  2018/05/04 16:17:08     56.8
292  2018/05/04 16:17:09     60.7
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308  2018/05/04 16:17:25     65.3
309  2018/05/04 16:17:26     64.3
310  2018/05/04 16:17:27     60.9
311  2018/05/04 16:17:28     57.8
312  2018/05/04 16:17:29     56.4
313  2018/05/04 16:17:30     61.1
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765  2018/05/04 16:25:02     53.4
766  2018/05/04 16:25:03     54.9
767  2018/05/04 16:25:04     56.3
768  2018/05/04 16:25:05     60.7
769  2018/05/04 16:25:06     62.6
770  2018/05/04 16:25:07     58.9
771  2018/05/04 16:25:08     58.0
772  2018/05/04 16:25:09     56.1
773  2018/05/04 16:25:10     57.5
774  2018/05/04 16:25:11     57.7
775  2018/05/04 16:25:12     57.8
776  2018/05/04 16:25:13     56.8
777  2018/05/04 16:25:14     57.1
778  2018/05/04 16:25:15     59.1
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783  2018/05/04 16:25:20     60.8
784  2018/05/04 16:25:21     60.0
785  2018/05/04 16:25:22     62.2
786  2018/05/04 16:25:23     60.8
787  2018/05/04 16:25:24     58.5
788  2018/05/04 16:25:25     57.8
789  2018/05/04 16:25:26     61.1
790  2018/05/04 16:25:27     64.3
791  2018/05/04 16:25:28     60.0
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793  2018/05/04 16:25:30     65.1
794  2018/05/04 16:25:31     62.8
795  2018/05/04 16:25:32     62.0
796  2018/05/04 16:25:33     58.6
797  2018/05/04 16:25:34     55.6
798  2018/05/04 16:25:35     54.4
799  2018/05/04 16:25:36     57.1
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801  2018/05/04 16:25:38     54.3
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803  2018/05/04 16:25:40     74.5
804  2018/05/04 16:25:41     67.2
805  2018/05/04 16:25:42     74.0
806  2018/05/04 16:25:43     77.3
807  2018/05/04 16:25:44     77.1
808  2018/05/04 16:25:45     84.9
809  2018/05/04 16:25:46     84.5
810  2018/05/04 16:25:47     84.5
811  2018/05/04 16:25:48     78.8
812  2018/05/04 16:25:49     66.6
813  2018/05/04 16:25:50     64.0
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815  2018/05/04 16:25:52     68.9
816  2018/05/04 16:25:53     69.5
817  2018/05/04 16:25:54     66.6
818  2018/05/04 16:25:55     59.8
819  2018/05/04 16:25:56     58.9
820  2018/05/04 16:25:57     58.8
821  2018/05/04 16:25:58     55.7
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823  2018/05/04 16:26:00     56.6
824  2018/05/04 16:26:01     55.4
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826  2018/05/04 16:26:03     55.8
827  2018/05/04 16:26:04     53.3
828  2018/05/04 16:26:05     53.3
829  2018/05/04 16:26:06     53.7
830  2018/05/04 16:26:07     54.2
831  2018/05/04 16:26:08     54.1
832  2018/05/04 16:26:09     55.1
833  2018/05/04 16:26:10     56.9
834  2018/05/04 16:26:11     65.3
835  2018/05/04 16:26:12     64.0
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837  2018/05/04 16:26:14     55.2
838  2018/05/04 16:26:15     53.5
839  2018/05/04 16:26:16     52.6
840  2018/05/04 16:26:17     52.2
841  2018/05/04 16:26:18     51.8
842  2018/05/04 16:26:19     53.4
843  2018/05/04 16:26:20     53.0
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845  2018/05/04 16:26:22     54.7
846  2018/05/04 16:26:23     60.2
847  2018/05/04 16:26:24     58.0
848  2018/05/04 16:26:25     59.5
849  2018/05/04 16:26:26     63.9
850  2018/05/04 16:26:27     62.9
851  2018/05/04 16:26:28     59.6
852  2018/05/04 16:26:29     58.8
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857  2018/05/04 16:26:34     58.7
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861  2018/05/04 16:26:38     57.6
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865  2018/05/04 16:26:42     58.8
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867  2018/05/04 16:26:44     56.9
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870  2018/05/04 16:26:47     52.4
871  2018/05/04 16:26:48     51.9
872  2018/05/04 16:26:49     52.3
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874  2018/05/04 16:26:51     53.6
875  2018/05/04 16:26:52     53.0
876  2018/05/04 16:26:53     52.9
877  2018/05/04 16:26:54     51.9
```

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879  2018/05/04 16:26:56     51.4
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881  2018/05/04 16:26:58     53.1
882  2018/05/04 16:26:59     54.9
883  2018/05/04 16:27:00     57.9
884  2018/05/04 16:27:01     63.9
885  2018/05/04 16:27:02     60.3
886  2018/05/04 16:27:03     58.9
887  2018/05/04 16:27:04     57.7
888  2018/05/04 16:27:05     57.8
889  2018/05/04 16:27:06     58.0
890  2018/05/04 16:27:07     56.7
891  2018/05/04 16:27:08     56.5
892  2018/05/04 16:27:09     56.9
893  2018/05/04 16:27:10     56.4
894  2018/05/04 16:27:11     58.1
895  2018/05/04 16:27:12     61.5
896  2018/05/04 16:27:13     61.8
897  2018/05/04 16:27:14     60.1
898  2018/05/04 16:27:15     59.5
899  2018/05/04 16:27:16     59.5
900  2018/05/04 16:27:17     60.4
```

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-         Freq Weight : A
-         Time Weight : FAST
-         Level Range : 40-100
-         Max dB : 87.7 - 2018/05/04 16:35:37
-         Level Range : 40-100
-         SEL : 93.7
-         Leq : 64.2
-
          No.s            Date Time     (dB)
         ----------------------------------------------------------------------
             1  2018/05/04 16:31:03     61.4
             2  2018/05/04 16:31:04     60.5
             3  2018/05/04 16:31:05     61.4
             4  2018/05/04 16:31:06     61.1
             5  2018/05/04 16:31:07     60.8
             6  2018/05/04 16:31:08     60.6
             7  2018/05/04 16:31:09     60.3
             8  2018/05/04 16:31:10     59.6
             9  2018/05/04 16:31:11     59.4
            10  2018/05/04 16:31:12     61.5
            11  2018/05/04 16:31:13     63.0
            12  2018/05/04 16:31:14     63.7
            13  2018/05/04 16:31:15     64.7
            14  2018/05/04 16:31:16     64.2
            15  2018/05/04 16:31:17     63.7
            16  2018/05/04 16:31:18     64.8
            17  2018/05/04 16:31:19     60.5
            18  2018/05/04 16:31:20     58.8
            19  2018/05/04 16:31:21     59.1
            20  2018/05/04 16:31:22     58.9
            21  2018/05/04 16:31:23     56.4
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            24  2018/05/04 16:31:26     58.9
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            30  2018/05/04 16:31:32     61.8
            31  2018/05/04 16:31:33     59.7
            32  2018/05/04 16:31:34     59.5
            33  2018/05/04 16:31:35     59.9
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            35  2018/05/04 16:31:37     62.7
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            39  2018/05/04 16:31:41     61.9
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            47  2018/05/04 16:31:49     60.5
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            49  2018/05/04 16:31:51     61.7
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            54  2018/05/04 16:31:56     61.5
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            78  2018/05/04 16:32:20     57.6
            79  2018/05/04 16:32:21     56.7
            80  2018/05/04 16:32:22     56.0
            81  2018/05/04 16:32:23     56.2
            82  2018/05/04 16:32:24     57.0
            83  2018/05/04 16:32:25     57.0
            84  2018/05/04 16:32:26     56.4
            85  2018/05/04 16:32:27     56.8
```

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 92  2018/05/04 16:32:34     61.2
 93  2018/05/04 16:32:35     63.5
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 95  2018/05/04 16:32:37     59.2
 96  2018/05/04 16:32:38     59.1
 97  2018/05/04 16:32:39     58.6
 98  2018/05/04 16:32:40     60.0
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100  2018/05/04 16:32:42     60.6
101  2018/05/04 16:32:43     60.3
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103  2018/05/04 16:32:45     63.4
104  2018/05/04 16:32:46     61.7
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107  2018/05/04 16:32:49     59.9
108  2018/05/04 16:32:50     67.6
109  2018/05/04 16:32:51     60.1
110  2018/05/04 16:32:52     60.7
111  2018/05/04 16:32:53     65.7
112  2018/05/04 16:32:54     62.7
113  2018/05/04 16:32:55     61.4
114  2018/05/04 16:32:56     60.3
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116  2018/05/04 16:32:58     62.8
117  2018/05/04 16:32:59     60.4
118  2018/05/04 16:33:00     60.4
119  2018/05/04 16:33:01     62.6
120  2018/05/04 16:33:02     64.6
121  2018/05/04 16:33:03     62.3
122  2018/05/04 16:33:04     60.7
123  2018/05/04 16:33:05     62.4
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183  2018/05/04 16:34:05     63.1
184  2018/05/04 16:34:06     55.7
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272  2018/05/04 16:35:34     69.5
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280  2018/05/04 16:35:42     63.1
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```

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   750  2018/05/04 16:43:32     67.9
   751  2018/05/04 16:43:33     68.1
   752  2018/05/04 16:43:34     67.6
   753  2018/05/04 16:43:35     67.1
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   756  2018/05/04 16:43:38     67.4
   757  2018/05/04 16:43:39     67.3
   758  2018/05/04 16:43:40     67.5
   759  2018/05/04 16:43:41     69.9
   760  2018/05/04 16:43:42     74.6
   761  2018/05/04 16:43:43     73.8
   762  2018/05/04 16:43:44     73.9
   763  2018/05/04 16:43:45     72.0
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   766  2018/05/04 16:43:48     67.9
   767  2018/05/04 16:43:49     70.5
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   773  2018/05/04 16:43:55     57.6
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   775  2018/05/04 16:43:57     54.6
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   777  2018/05/04 16:43:59     56.4
   778  2018/05/04 16:44:00     57.5
```

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783  2018/05/04 16:44:05     57.5
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785  2018/05/04 16:44:07     57.7
786  2018/05/04 16:44:08     55.0
787  2018/05/04 16:44:09     56.4
788  2018/05/04 16:44:10     56.6
789  2018/05/04 16:44:11     62.7
790  2018/05/04 16:44:12     56.0
791  2018/05/04 16:44:13     60.6
792  2018/05/04 16:44:14     57.9
793  2018/05/04 16:44:15     59.8
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798  2018/05/04 16:44:20     65.0
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804  2018/05/04 16:44:26     61.0
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807  2018/05/04 16:44:29     61.7
808  2018/05/04 16:44:30     61.1
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810  2018/05/04 16:44:32     61.8
811  2018/05/04 16:44:33     61.3
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813  2018/05/04 16:44:35     59.4
814  2018/05/04 16:44:36     58.7
815  2018/05/04 16:44:37     57.7
816  2018/05/04 16:44:38     58.8
817  2018/05/04 16:44:39     59.7
818  2018/05/04 16:44:40     62.0
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820  2018/05/04 16:44:42     58.1
821  2018/05/04 16:44:43     58.9
822  2018/05/04 16:44:44     57.6
823  2018/05/04 16:44:45     59.0
824  2018/05/04 16:44:46     62.3
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826  2018/05/04 16:44:48     59.9
827  2018/05/04 16:44:49     60.9
828  2018/05/04 16:44:50     64.6
829  2018/05/04 16:44:51     65.0
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831  2018/05/04 16:44:53     65.8
832  2018/05/04 16:44:54     66.5
833  2018/05/04 16:44:55     68.1
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835  2018/05/04 16:44:57     68.5
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845  2018/05/04 16:45:07     66.1
846  2018/05/04 16:45:08     65.5
847  2018/05/04 16:45:09     67.0
848  2018/05/04 16:45:10     65.3
849  2018/05/04 16:45:11     66.8
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859  2018/05/04 16:45:21     59.4
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865  2018/05/04 16:45:27     63.0
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868  2018/05/04 16:45:30     60.5
869  2018/05/04 16:45:31     61.3
870  2018/05/04 16:45:32     61.5
871  2018/05/04 16:45:33     65.0
872  2018/05/04 16:45:34     65.5
873  2018/05/04 16:45:35     66.6
874  2018/05/04 16:45:36     69.4
875  2018/05/04 16:45:37     72.9
876  2018/05/04 16:45:38     74.8
877  2018/05/04 16:45:39     77.5
```

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879  2018/05/04 16:45:41     73.3
880  2018/05/04 16:45:42     69.6
881  2018/05/04 16:45:43     67.1
882  2018/05/04 16:45:44     64.7
883  2018/05/04 16:45:45     63.2
884  2018/05/04 16:45:46     63.0
885  2018/05/04 16:45:47     62.1
886  2018/05/04 16:45:48     61.2
887  2018/05/04 16:45:49     61.6
888  2018/05/04 16:45:50     59.5
889  2018/05/04 16:45:51     56.8
890  2018/05/04 16:45:52     56.1
891  2018/05/04 16:45:53     55.6
892  2018/05/04 16:45:54     55.1
893  2018/05/04 16:45:55     56.1
894  2018/05/04 16:45:56     55.6
895  2018/05/04 16:45:57     54.5
896  2018/05/04 16:45:58     56.6
897  2018/05/04 16:45:59     59.5
898  2018/05/04 16:46:00     58.1
899  2018/05/04 16:46:01     56.4
900  2018/05/04 16:46:02     58.0
```

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-         Freq Weight : A
-         Time Weight : FAST
-         Level Range : 40-100
-         Max dB : 71.5 - 2018/05/04 17:02:15
-         Level Range : 40-100
-         SEL : 88.2
-         Leq : 58.7
-
          No.s            Date Time     (dB)
         -----------------------------------------------------------------------
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             2  2018/05/04 16:48:52     53.7
             3  2018/05/04 16:48:53     54.0
             4  2018/05/04 16:48:54     52.5
             5  2018/05/04 16:48:55     54.1
             6  2018/05/04 16:48:56     57.7
             7  2018/05/04 16:48:57     56.9
             8  2018/05/04 16:48:58     56.9
             9  2018/05/04 16:48:59     58.1
            10  2018/05/04 16:49:00     56.9
            11  2018/05/04 16:49:01     58.4
            12  2018/05/04 16:49:02     61.4
            13  2018/05/04 16:49:03     57.4
            14  2018/05/04 16:49:04     58.1
            15  2018/05/04 16:49:05     58.2
            16  2018/05/04 16:49:06     56.4
            17  2018/05/04 16:49:07     57.3
            18  2018/05/04 16:49:08     57.8
            19  2018/05/04 16:49:09     57.3
            20  2018/05/04 16:49:10     57.4
            21  2018/05/04 16:49:11     58.8
            22  2018/05/04 16:49:12     56.8
            23  2018/05/04 16:49:13     54.6
            24  2018/05/04 16:49:14     54.3
            25  2018/05/04 16:49:15     59.5
            26  2018/05/04 16:49:16     57.8
            27  2018/05/04 16:49:17     63.7
            28  2018/05/04 16:49:18     65.3
            29  2018/05/04 16:49:19     63.3
            30  2018/05/04 16:49:20     60.0
            31  2018/05/04 16:49:21     58.0
            32  2018/05/04 16:49:22     56.3
            33  2018/05/04 16:49:23     53.3
            34  2018/05/04 16:49:24     52.3
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            37  2018/05/04 16:49:27     51.4
            38  2018/05/04 16:49:28     53.0
            39  2018/05/04 16:49:29     53.5
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            44  2018/05/04 16:49:34     60.8
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            48  2018/05/04 16:49:38     56.8
            49  2018/05/04 16:49:39     57.4
            50  2018/05/04 16:49:40     57.7
            51  2018/05/04 16:49:41     57.1
            52  2018/05/04 16:49:42     56.9
            53  2018/05/04 16:49:43     56.8
            54  2018/05/04 16:49:44     59.2
            55  2018/05/04 16:49:45     63.2
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            63  2018/05/04 16:49:53     51.1
            64  2018/05/04 16:49:54     52.1
            65  2018/05/04 16:49:55     61.3
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            74  2018/05/04 16:50:04     54.9
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            79  2018/05/04 16:50:09     56.6
            80  2018/05/04 16:50:10     54.6
            81  2018/05/04 16:50:11     56.5
            82  2018/05/04 16:50:12     56.7
            83  2018/05/04 16:50:13     57.3
            84  2018/05/04 16:50:14     56.5
            85  2018/05/04 16:50:15     54.4
```

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  87  2018/05/04 16:50:17     55.1
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  89  2018/05/04 16:50:19     59.4
  90  2018/05/04 16:50:20     62.1
  91  2018/05/04 16:50:21     61.0
  92  2018/05/04 16:50:22     61.3
  93  2018/05/04 16:50:23     64.8
  94  2018/05/04 16:50:24     58.6
  95  2018/05/04 16:50:25     59.2
  96  2018/05/04 16:50:26     59.6
  97  2018/05/04 16:50:27     58.1
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  99  2018/05/04 16:50:29     56.8
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 103  2018/05/04 16:50:33     53.4
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 106  2018/05/04 16:50:36     62.5
 107  2018/05/04 16:50:37     64.5
 108  2018/05/04 16:50:38     69.0
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 110  2018/05/04 16:50:40     56.3
 111  2018/05/04 16:50:41     56.6
 112  2018/05/04 16:50:42     54.9
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 118  2018/05/04 16:50:48     57.5
 119  2018/05/04 16:50:49     58.1
 120  2018/05/04 16:50:50     56.7
 121  2018/05/04 16:50:51     58.0
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 123  2018/05/04 16:50:53     58.2
 124  2018/05/04 16:50:54     58.9
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283  2018/05/04 16:53:33     60.0
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734  2018/05/04 17:01:04     50.9
735  2018/05/04 17:01:05     60.0
736  2018/05/04 17:01:06     51.1
737  2018/05/04 17:01:07     50.7
738  2018/05/04 17:01:08     51.8
739  2018/05/04 17:01:09     52.8
740  2018/05/04 17:01:10     52.6
741  2018/05/04 17:01:11     55.7
742  2018/05/04 17:01:12     54.6
743  2018/05/04 17:01:13     53.3
744  2018/05/04 17:01:14     58.8
745  2018/05/04 17:01:15     61.0
746  2018/05/04 17:01:16     66.0
747  2018/05/04 17:01:17     67.2
748  2018/05/04 17:01:18     62.5
749  2018/05/04 17:01:19     58.8
750  2018/05/04 17:01:20     58.7
751  2018/05/04 17:01:21     57.4
752  2018/05/04 17:01:22     57.1
753  2018/05/04 17:01:23     56.4
754  2018/05/04 17:01:24     57.4
755  2018/05/04 17:01:25     56.5
756  2018/05/04 17:01:26     57.3
757  2018/05/04 17:01:27     58.6
758  2018/05/04 17:01:28     58.3
759  2018/05/04 17:01:29     57.1
760  2018/05/04 17:01:30     58.4
761  2018/05/04 17:01:31     58.6
762  2018/05/04 17:01:32     57.0
763  2018/05/04 17:01:33     58.2
764  2018/05/04 17:01:34     57.1
765  2018/05/04 17:01:35     55.5
766  2018/05/04 17:01:36     56.0
767  2018/05/04 17:01:37     59.6
768  2018/05/04 17:01:38     56.9
769  2018/05/04 17:01:39     56.1
770  2018/05/04 17:01:40     56.8
771  2018/05/04 17:01:41     56.5
772  2018/05/04 17:01:42     55.0
773  2018/05/04 17:01:43     59.3
774  2018/05/04 17:01:44     57.3
775  2018/05/04 17:01:45     56.1
776  2018/05/04 17:01:46     55.9
777  2018/05/04 17:01:47     56.5
778  2018/05/04 17:01:48     57.5
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779  2018/05/04 17:01:49     55.5
780  2018/05/04 17:01:50     55.1
781  2018/05/04 17:01:51     57.1
782  2018/05/04 17:01:52     56.6
783  2018/05/04 17:01:53     56.0
784  2018/05/04 17:01:54     55.5
785  2018/05/04 17:01:55     54.3
786  2018/05/04 17:01:56     56.2
787  2018/05/04 17:01:57     55.3
788  2018/05/04 17:01:58     56.1
789  2018/05/04 17:01:59     58.6
790  2018/05/04 17:02:00     60.3
791  2018/05/04 17:02:01     60.7
792  2018/05/04 17:02:02     58.8
793  2018/05/04 17:02:03     58.7
794  2018/05/04 17:02:04     58.7
795  2018/05/04 17:02:05     58.8
796  2018/05/04 17:02:06     59.3
797  2018/05/04 17:02:07     57.2
798  2018/05/04 17:02:08     58.3
799  2018/05/04 17:02:09     59.5
800  2018/05/04 17:02:10     58.5
801  2018/05/04 17:02:11     57.9
802  2018/05/04 17:02:12     56.3
803  2018/05/04 17:02:13     57.2
804  2018/05/04 17:02:14     62.3
805  2018/05/04 17:02:15     59.5
806  2018/05/04 17:02:16     58.7
807  2018/05/04 17:02:17     62.7
808  2018/05/04 17:02:18     61.7
809  2018/05/04 17:02:19     59.4
810  2018/05/04 17:02:20     58.0
811  2018/05/04 17:02:21     57.0
812  2018/05/04 17:02:22     58.1
813  2018/05/04 17:02:23     55.7
814  2018/05/04 17:02:24     55.8
815  2018/05/04 17:02:25     57.5
816  2018/05/04 17:02:26     56.3
817  2018/05/04 17:02:27     56.8
818  2018/05/04 17:02:28     57.4
819  2018/05/04 17:02:29     57.7
820  2018/05/04 17:02:30     53.8
821  2018/05/04 17:02:31     53.6
822  2018/05/04 17:02:32     52.1
823  2018/05/04 17:02:33     52.0
824  2018/05/04 17:02:34     52.3
825  2018/05/04 17:02:35     52.7
826  2018/05/04 17:02:36     52.5
827  2018/05/04 17:02:37     53.4
828  2018/05/04 17:02:38     56.1
829  2018/05/04 17:02:39     57.4
830  2018/05/04 17:02:40     57.0
831  2018/05/04 17:02:41     59.8
832  2018/05/04 17:02:42     57.2
833  2018/05/04 17:02:43     56.7
834  2018/05/04 17:02:44     56.3
835  2018/05/04 17:02:45     58.3
836  2018/05/04 17:02:46     58.5
837  2018/05/04 17:02:47     62.0
838  2018/05/04 17:02:48     60.1
839  2018/05/04 17:02:49     58.7
840  2018/05/04 17:02:50     58.0
841  2018/05/04 17:02:51     57.5
842  2018/05/04 17:02:52     58.1
843  2018/05/04 17:02:53     60.7
844  2018/05/04 17:02:54     65.1
845  2018/05/04 17:02:55     61.1
846  2018/05/04 17:02:56     57.4
847  2018/05/04 17:02:57     58.4
848  2018/05/04 17:02:58     57.5
849  2018/05/04 17:02:59     59.1
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851  2018/05/04 17:03:01     57.3
852  2018/05/04 17:03:02     56.3
853  2018/05/04 17:03:03     56.2
854  2018/05/04 17:03:04     54.8
855  2018/05/04 17:03:05     55.0
856  2018/05/04 17:03:06     60.5
857  2018/05/04 17:03:07     56.9
858  2018/05/04 17:03:08     58.8
859  2018/05/04 17:03:09     60.5
860  2018/05/04 17:03:10     59.2
861  2018/05/04 17:03:11     57.6
862  2018/05/04 17:03:12     56.2
863  2018/05/04 17:03:13     55.8
864  2018/05/04 17:03:14     55.6
865  2018/05/04 17:03:15     55.5
866  2018/05/04 17:03:16     54.8
867  2018/05/04 17:03:17     56.5
868  2018/05/04 17:03:18     58.6
869  2018/05/04 17:03:19     58.4
870  2018/05/04 17:03:20     60.2
871  2018/05/04 17:03:21     61.4
872  2018/05/04 17:03:22     60.3
873  2018/05/04 17:03:23     59.4
874  2018/05/04 17:03:24     59.5
875  2018/05/04 17:03:25     62.1
876  2018/05/04 17:03:26     68.4
877  2018/05/04 17:03:27     64.5
```

```
878  2018/05/04 17:03:28     62.9
879  2018/05/04 17:03:29     59.1
880  2018/05/04 17:03:30     61.8
881  2018/05/04 17:03:31     57.8
882  2018/05/04 17:03:32     55.1
883  2018/05/04 17:03:33     57.0
884  2018/05/04 17:03:34     55.4
885  2018/05/04 17:03:35     53.5
886  2018/05/04 17:03:36     54.9
887  2018/05/04 17:03:37     55.8
888  2018/05/04 17:03:38     54.8
889  2018/05/04 17:03:39     55.0
890  2018/05/04 17:03:40     53.9
891  2018/05/04 17:03:41     61.0
892  2018/05/04 17:03:42     51.9
893  2018/05/04 17:03:43     56.9
894  2018/05/04 17:03:44     53.2
895  2018/05/04 17:03:45     52.3
896  2018/05/04 17:03:46     50.9
897  2018/05/04 17:03:47     50.7
898  2018/05/04 17:03:48     50.5
899  2018/05/04 17:03:49     52.8
900  2018/05/04 17:03:50     52.3
```

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9 May 2018

Melissa Godfrey
Solomon Cordwell Buenz
255 California Street, Floor 3
San Francisco, CA 94111
Email: melissa.godfrey@scb.com

Subject: UC Upper Hearst
Environmental Noise Study
Salter Project 18-0018

Dear Melissa:

As requested, we have conducted a preliminary environmental noise study for this project. The purpose of this study is to quantify the existing and future noise levels at the project site, compare the noise levels with applicable standards, and propose mitigation measures as necessary. This report summarizes the results of our study.

Our analysis was based on the floor plans of the 100% SD drawings received 4 May 2018. The project includes a six-story residential building and a four-story faculty building for the Goldman School of Public Policy (GSPP).

PROJECT CRITERIA

State Noise Standards (Title 24)

Section 1207 of the 2016 California Building Code (Title 24) requires that the indoor noise level in residential units of multi-family dwellings not exceed DNL[1] 45 dB due to exterior sources. This is applicable to the residential portion of the project.

CALGreen

The CALGreen code addresses exterior noise intrusion in Section 5.507.4, *Acoustical Control*. This applies to non-residential buildings, which includes the GSPP faculty building.

> *Section 5.507.4 Acoustical Control. There is a requirement for mitigating exterior noise at commercial spaces where sound levels regularly exceed 65 dB. If the exterior noise level regularly exceeds 65 dB, then the building envelope must have wall and roof-ceiling assemblies*

---

[1] DNL (Day-Night Average Sound Level) – A descriptor for a 24-hour A-weighted average noise level. DNL accounts for the increased acoustical sensitivity of people to noise during the nighttime hours. DNL penalizes sound levels by 10 dB during the hours from 10 PM to 7 AM. For practical purposes, the DNL and CNEL are usually interchangeable. DNL is sometimes written as L_{dn}.

> *designed to provide an interior noise environment not exceeding an $L_{eq}(h)$[2] of 50 dB in occupied areas during hours of operation.*

We assumed that the hours of operation for the faculty spaces would be from 7 am to 10 pm and used the loudest $L_{eq}(h)$ during that period as the basis of design.

NOISE ENVIRONMENT

The project is bounded by Hearst Avenue, La Loma Avenue, and Ridge Road. The noise environment is dominated by street traffic along these streets.

To quantify the existing noise environment, we conducted two multi-day measurements at the site between 4 and 6 April 2018. The long-term meters were placed at a height of 12 feet above grade. See Figure 1 for measurement locations and measured noise levels.

Based on our measured data, we calculated the expected noise levels at the various facades and elevations. A traffic volume study has not been provided for the roadways, so we have added 1 dB to the measured noise level to account for future traffic increases[3].

RECOMMENDATIONS

General

Using the abovementioned drawings that show unit plans and elevations, we calculated the window and exterior door STC[4] ratings needed to meet the criteria.

The recommended STC ratings are for full window assemblies (glass and frame) rather than just the glass itself. Tested sound-rated assemblies should be used.

For reference, typical construction-grade dual-pane windows achieve an STC rating of 28. One-inch glazing assemblies (two 1/4-inch thick panes with a 1/2-inch airspace) typically achieve an STC rating of 32. Where STC ratings above 33 are required, at least one pane will need to be laminated.

---

[2] $L_{eq}(h)$ – The equivalent steady-state A-weighted sound level that, in an hour, would contain the same acoustic energy as the time-varying sound level during the same hour.

[3] The California Department of Transportation (DOT) assumes a traffic volume increase of three-percent per year, which corresponds to a 1 dB increase in DNL over a ten-year period.

[4] STC (Sound Transmission Class) – A single-number rating defined in ASTM E90 that quantifies the airborne sound insulating performance of a partition under laboratory conditions. Increasing STC ratings correspond to improved airborne sound insulation.

GSPP Faculty Building

To meet the CALGreen interior noise criterion of $L_{eq}(h)$ 50 dB, the window STC ratings need to be as shown on Figures 2 through 6 with STC ratings up to 36. Since the finishes for the GSPP are in flux, our calculations are based on the assumption that office spaces and learning spaces will have carpeted flooring or acoustical tile ceilings.

Residential Building

To meet the Title 24 interior DNL 45 dB noise goal, it will be necessary for all facades to be sound-rated. The minimum required window and exterior door STC ratings will need to be as shown on Figures 4 through 7. Our calculations are based on the following assumptions:

- 9-foot high ceilings
- All rooms (including bedrooms) will have hard-surfaced flooring

Where windows need to be closed to achieve an indoor DNL of 45 dB, an alternative method of supplying fresh air (e.g., mechanical ventilation) should be provided. This applies to all residences. This issue should be discussed with the project mechanical engineer.

* * *

This concludes our environmental noise study for the UC Upper Hearst project. Should you have any questions, please give us a call.

Sincerely,

CHARLES M. SALTER ASSOCIATES

Sybille Roth
Consultant

Valerie Smith, PE
Principal Consultant

Enclosures as noted

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UC BERKELEY UPPER HEARST
MEASUREMENT LOCATIONS AND MEASURED NOISE LEVELS

FIGURE 1

Salter #	SMR/EBM
18–0018	05.09.18

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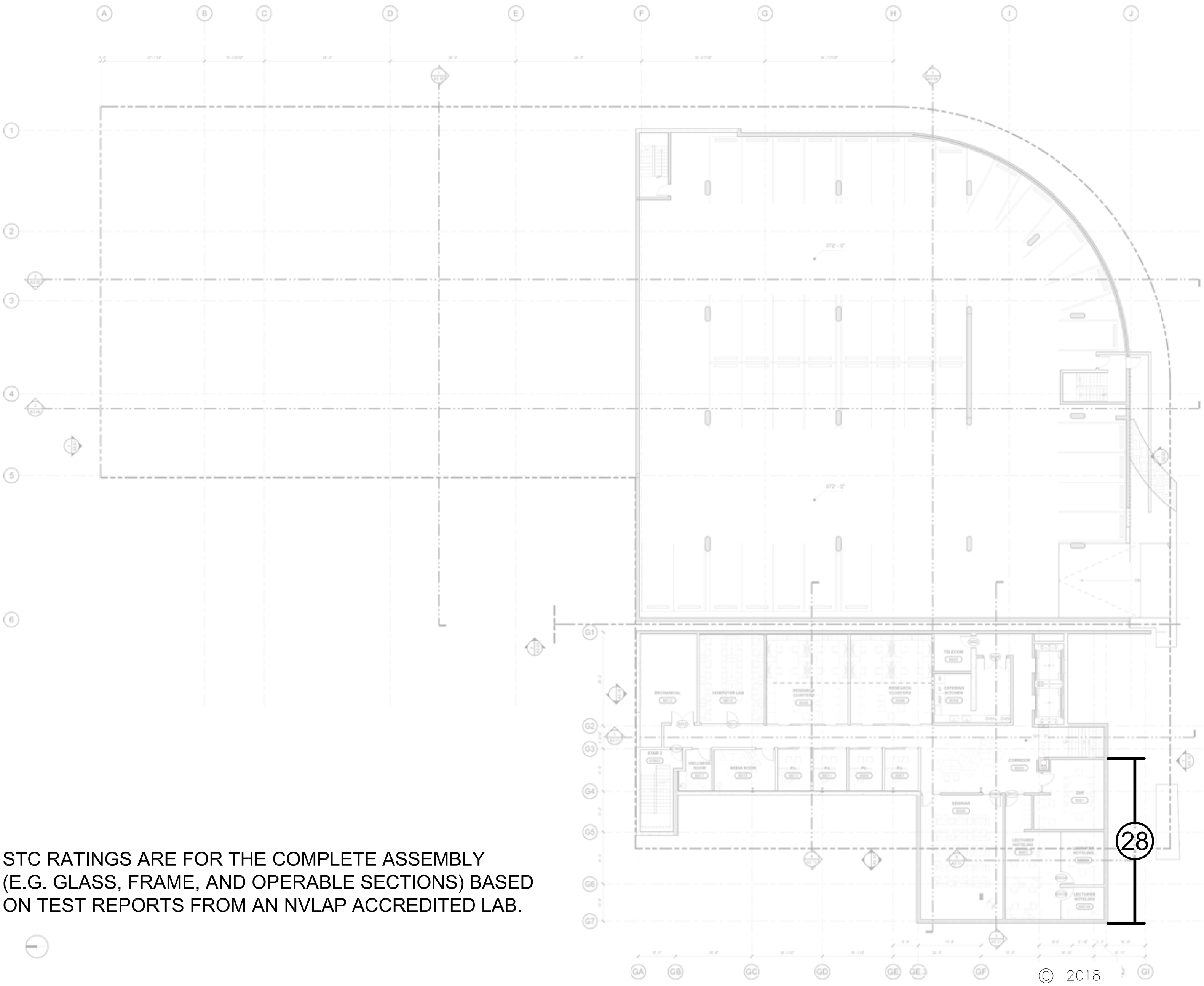

NOTE: STC RATINGS ARE FOR THE COMPLETE ASSEMBLY
(E.G. GLASS, FRAME, AND OPERABLE SECTIONS) BASED
ON TEST REPORTS FROM AN NVLAP ACCREDITED LAB.

GSPP - BASEMENT

UC BERKELEY UPPER HEARST
MINIMUM CODE-REQUIRED STC RATINGS FOR WINDOWS AND EXTERIOR DOORS

FIGURE 2

Salter #
18-0018

SMR/EBM
05.09.18

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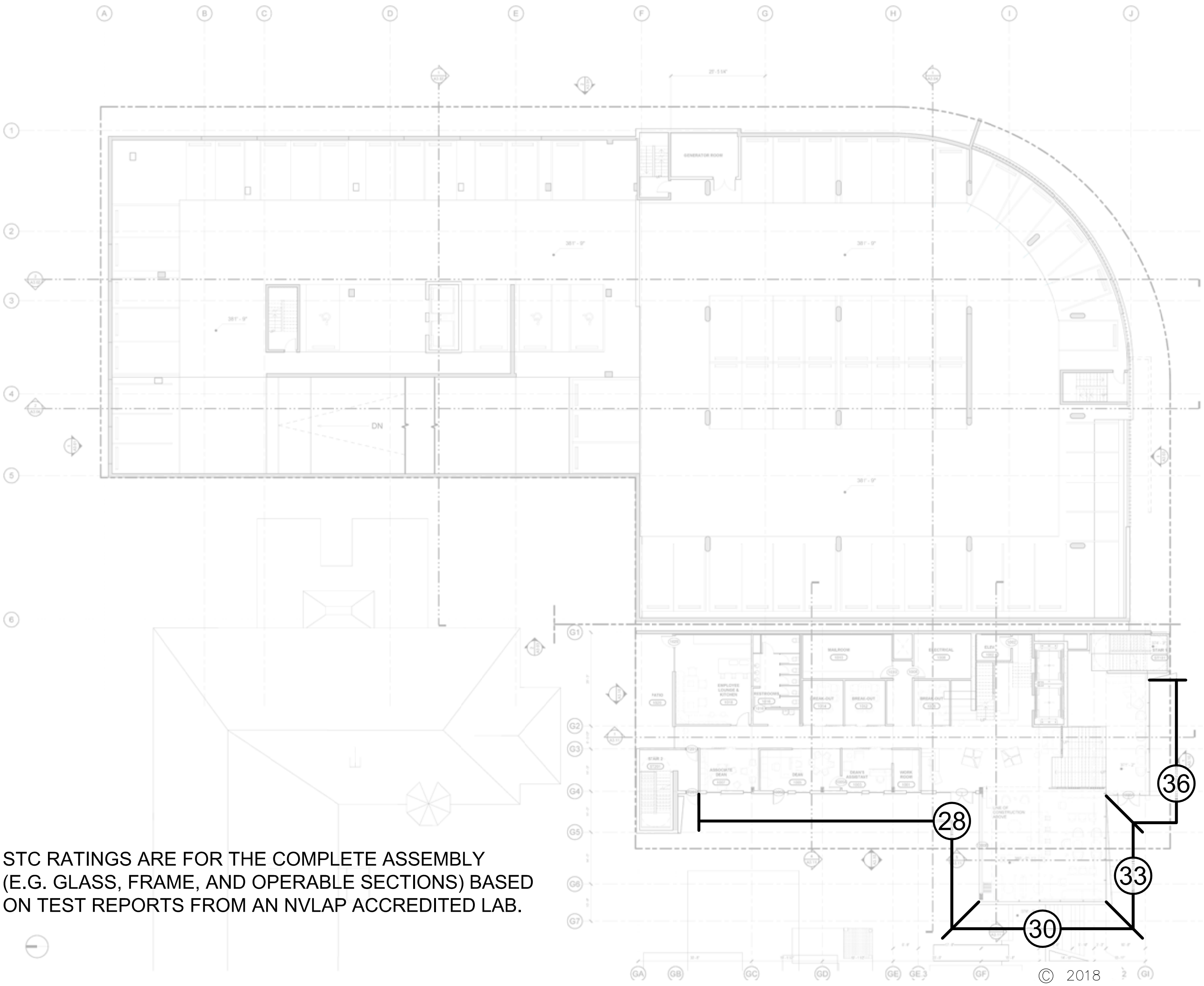


NOTE: STC RATINGS ARE FOR THE COMPLETE ASSEMBLY
(E.G. GLASS, FRAME, AND OPERABLE SECTIONS) BASED
ON TEST REPORTS FROM AN NVLAP ACCREDITED LAB.

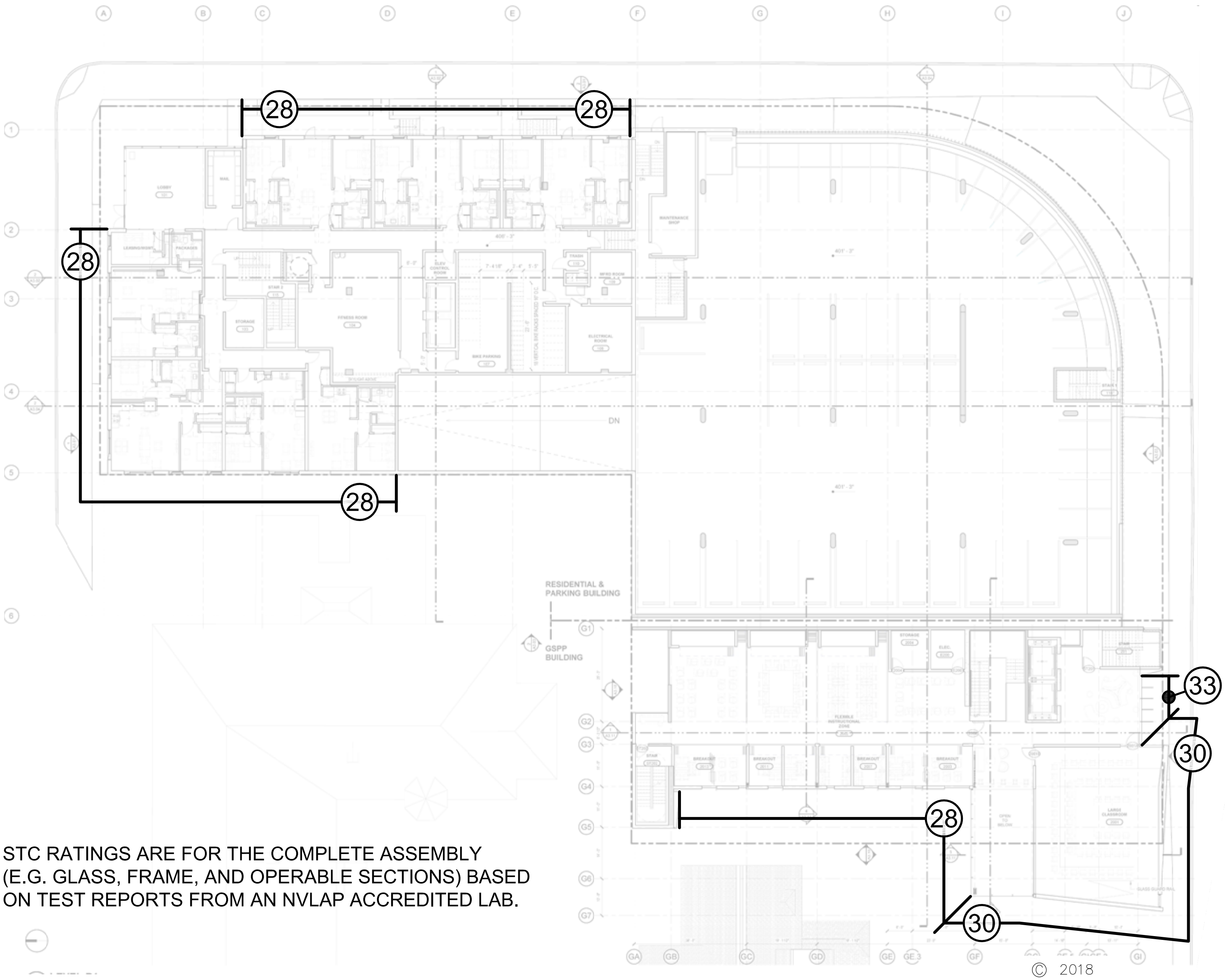
GSPP - LEVEL 1

UC BERKELEY UPPER HEARST
MINIMUM CODE–REQUIRED STC RATINGS FOR WINDOWS AND EXTERIOR DOORS

FIGURE 3

Salter #
18–0018

SMR/EBM
05.09.18



NOTE: STC RATINGS ARE FOR THE COMPLETE ASSEMBLY
(E.G. GLASS, FRAME, AND OPERABLE SECTIONS) BASED
ON TEST REPORTS FROM AN NVLAP ACCREDITED LAB.

GSPP - LEVEL 2 / RESIDENTIAL - LEVEL 1

UC BERKELEY UPPER HEARST
MINIMUM CODE-REQUIRED STC RATINGS FOR WINDOWS AND EXTERIOR DOORS

FIGURE 4

Salter #
18-0018

SMR/EBM
05.09.18

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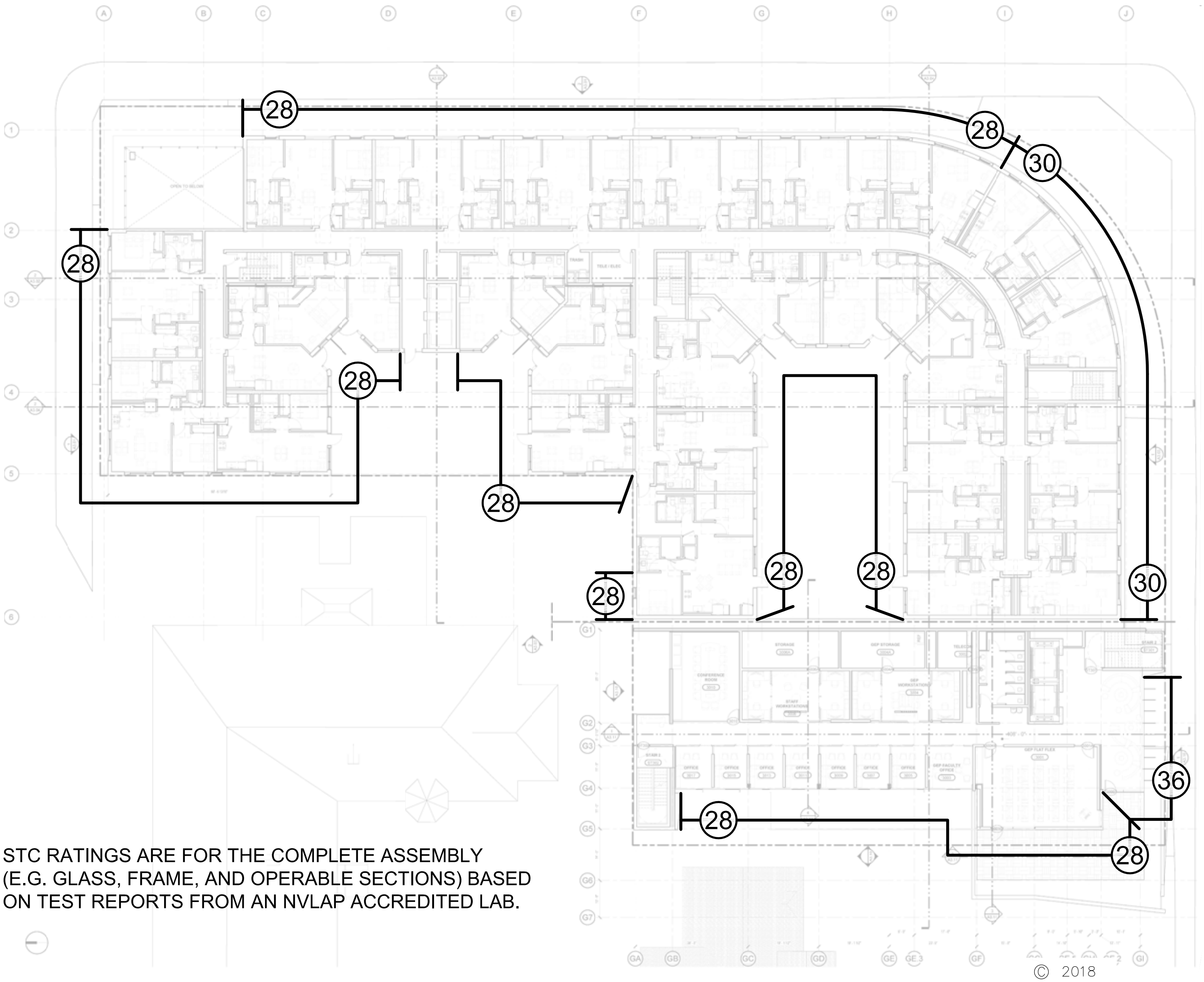

NOTE: STC RATINGS ARE FOR THE COMPLETE ASSEMBLY
(E.G. GLASS, FRAME, AND OPERABLE SECTIONS) BASED
ON TEST REPORTS FROM AN NVLAP ACCREDITED LAB.

GSPP - LEVEL 3 / RESIDENTIAL - LEVEL 2

UC BERKELEY UPPER HEARST
MINIMUM CODE–REQUIRED STC RATINGS
FOR WINDOWS AND EXTERIOR DOORS

FIGURE 5

Salter #
18–0018

SMR/EBM
05.09.18

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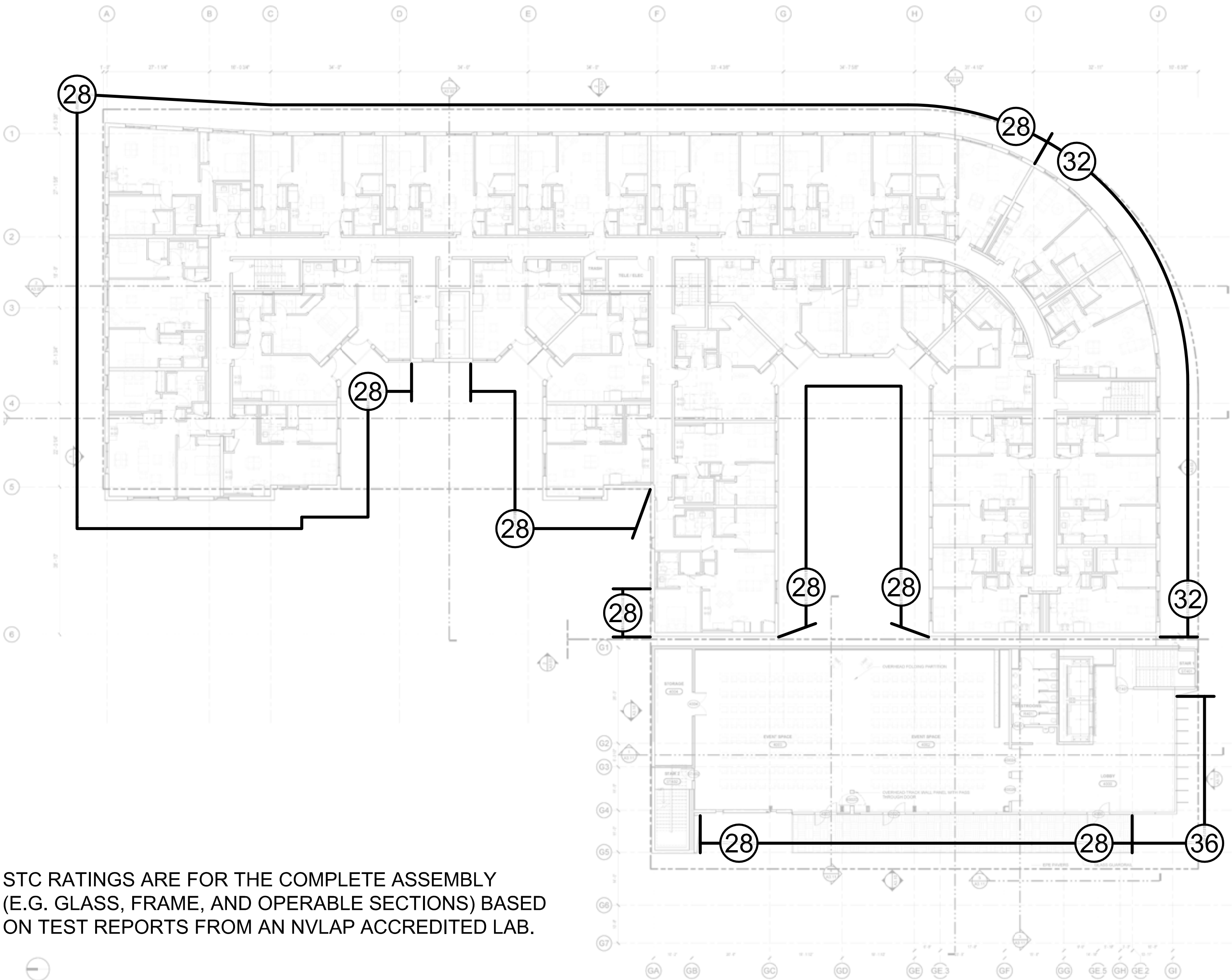

NOTE: STC RATINGS ARE FOR THE COMPLETE ASSEMBLY
(E.G. GLASS, FRAME, AND OPERABLE SECTIONS) BASED
ON TEST REPORTS FROM AN NVLAP ACCREDITED LAB.

GSPP - LEVEL 4 / RESIDENTIAL - LEVELS 3 TO 5

UC BERKELEY UPPER HEARST
MINIMUM CODE–REQUIRED STC RATINGS FOR WINDOWS AND EXTERIOR DOORS

FIGURE 6

Salter #	SMR/EBM
18–0018	05.09.18

APPENDIX F

UPPER HEARST DEVELOPMENT – TRANSPORTATION ASSESSMENT

FEHR & PEERS

DRAFT MEMORANDUM

Date: January 25, 2019

To: Jonathan Berlin, Rincon Consultants

From: Huma Husain and Sam Tabibnia, Fehr & Peers

Subject: Upper Hearst Development – Transportation Assessment

OK18-0253

Fehr & Peers assessed the existing conditions and vehicle trip generation for the proposed Upper Hearst development in Berkeley, California (Proposed Project). Based on our assessment, an intersection impact analysis is not needed for the Proposed Project because the project would generate fewer vehicle trips than existing conditions during both the AM and PM peak hours.

This memorandum summarizes the project description, existing conditions, and trip generation estimates and driveway queuing for both project options.

PROJECT DESCRIPTION

The Proposed Project is located at the northwest corner of the La Loma Avenue/Hearst Avenue intersection. The site is currently occupied by the Upper Hearst surface parking lot and the multi-level Upper Hearst parking structure providing a total of 407 parking spaces, which includes 357 standard parking spaces and 50 attendant spaces. The existing parking spaces can be accessed through driveways on Ridge Road and Hearst and La Loma Avenues.

The Proposed Project would provide a total of 200 parking spaces, including 175 standard parking spaces and 25 attendant spaces, where attendant parking is estimated using the same proportion of standard spaces to attendant spaces in the existing garage. The Project would therefore eliminate 207 existing parking spaces by demolishing the surface parking and removing a portion of the parking structure to construct up to 150 new graduate student and/or faculty/staff housing units (consisting of 225 bedrooms) and up to 37,000 square feet of academic building. It is assumed that the Project may not provide dedicated parking spaces for the project, but the retained parking facility would continue to provide parking for

University of California, Berkeley parking permit holders and visitors. Automobile access to and from the parking structure would be provided through one driveway on Hearst Avenue.

EXISTING CONDITIONS

EXISTING ROADWAY NETWORK

The project site is bordered by the following local roadways described below.

LOCAL ROADWAYS

Hearst Avenue is a two-lane east-west minor arterial extending between the Eastshore Freeway in the west and Highland Place in the east. Directly adjacent to the project area, westbound Hearst Avenue has metered parallel vehicle and motorcycle parking, and eastbound Hearst Avenue has metered motorcycle parking with a right-turn pocket. Hearst Avenue borders the south side of the project site.

La Loma Avenue/Gayley Road is a two-lane north-south local street extending between the UC Berkeley campus in the south and Glendale La Loma Park in the north. Adjacent to the project site, both directions of La Loma have Residential Parking Permit (RPP) and two-hour parallel vehicle parking. La Loma Avenue borders the east side of the project site.

Ridge Road is a two-lane east-west local street extending between the Pacific School of Religion at Le Conte Avenue in the west and Highland Place in the east. Adjacent to the project site, both directions of Ridge Road have RPP and two-hour parallel vehicle parking. Ridge Road borders the north side of the project site.

Le Roy Avenue is a two-lane north-south local street extending between the UC Berkeley campus to the south and residential neighborhoods near the Berkeley Rose Garden to the north. Adjacent to the project site, northbound Le Roy has metered one-hour parallel parking, and southbound Le Roy has metered one-hour parallel parking with a third of the block dedicated to disabled parking.

EXISTING TRANSIT AND SHUTTLE SERVICES

Transit service providers in the project vicinity include AC Transit, which provides local and Transbay bus service, and Bear Transit, which is UC Berkeley’s shuttle system.

AC TRANSIT

Local bus service in Berkeley is provided by AC Transit. The nearest bus stop to the project site is on eastbound Hearst Avenue just east of Le Roy Avenue, which is shared with UC Berkeley Bear Transit. This bus stop is served by Lines 52 and F and provides a bench and shelter. Line 52 operates in a clockwise loop around Campus Park and provides connections to University Village in Albany, North Berkeley BART, and Downtown Berkeley. Line F operates in a clockwise loop around the Campus Park and provides connections to Downtown Berkeley, Ashby BART, Emeryville, and Downtown San Francisco. **Table 1** summarizes the characteristics of the AC Transit Lines operating in the project area.

UC BERKELEY BEAR TRANSIT

Bear Transit is UC Berkeley's shuttle system, serving the Campus Park and vicinity. The nearest bus stop to the project site is on eastbound Hearst Avenue just east of Le Roy Avenue, which is shared with AC Transit. This bus stop is served by the Perimeter Line, Central Campus, and Night Safety Shuttle. The Perimeter Line and the Night Safety Shuttle operate in a clockwise loop around Campus Park, and the Central Campus Line operates in a clockwise loop around the northern parts of the Campus Park and provides connections to Downtown Berkeley. **Table 1** summarizes the characteristics of the UC Berkeley BEAR Transit lines in the project area.

TABLE 1 - TRANSIT ROUTES IN THE PROJECT AREA

Line	Route	Nearest Stop	Weekday		Weekend	
			Hours	Headway[1]	Hours	Headway[1]
AC Transit Local Lines						
52	University Village to UC Campus	Eastbound Hearst Avenue just east of Le Roy Avenue	6:00 AM–12:00 AM	15 (20)	8:00 AM–8:30 PM	20 (20)
AC Transit Transbay Lines						
F	UC Campus to Transbay Terminal	Eastbound Hearst Avenue just east of Le Roy Avenue	5:00 AM-1:30 AM	30 (30)	5:00 AM-12:30AM	30 (30)
Bear Transit Lines						
Perimeter	Clockwise loop around campus	Eastbound Hearst Avenue just east of Le Roy Avenue	7:00 AM – 7:30 PM	30 (30)	N/A	N/A
Central Campus	Downtown Berkeley to UC Campus	Eastbound Hearst Avenue just east of Le Roy Avenue	6:45 AM – 10:45 AM 4:15 PM – 7:15 PM	20 (20)	N/A	N/A
Night Safety	UC Campus to BART, Clark Kerr Campus, and residences	Eastbound Hearst Avenue just east of Le Roy Avenue	7:30 PM – 3:00 AM	15-30	N/A	N/A

1. Headway is the frequency, or interval of time, between buses travelling in any given direction along a designated route: Peak Period Headway (Off-Peak Period Headway).

Source: AC Transit website; summarized by Fehr & Peers, 2019.

EXISTING PEDESTRIAN AND BICYCLE CIRCULATION

Within the project study area, all roadways provide sidewalks on at least one side of the street and all intersections have marked crosswalks. The Hearst Avenue/Le Roy Avenue and Hearst Avenue/La Loma Avenue intersections are signalized with high-visibility ladder crosswalks on all approaches. The La Loma Avenue/Ridge Road and Le Roy Avenue/Ridge Road intersections are all-way stop-controlled intersections with standard (transverse lines) crosswalks.

Based on the City of Berkeley *Bicycle Master Plan* (May 2017), bicycle facilities can be classified into the following types:

- ***Multi-Use Paths (Class I)*** – These facilities provide completely separated, exclusive right-of-way for bicycling, walking, and other non-motorized uses.

- ***Bicycle Lanes (Class II)*** – These facilities are striped, preferential lanes for one-way bicycle travel on roadways. Some Class II bicycle lanes include striped buffers that add a few feet of separation between the bicycle lane and traffic lane or parking aisle. Caltrans requires a minimum of four feet of paved surface for Class II bikeways on roadways without gutters and five feet for roadways with gutters or adjacent to on-street parking.

- ***Bicycle Routes (Class III)*** – These facilities are signed bicycle routes where people riding bicycles share a travel lane with people driving motor vehicles. Because they are mixed-flow facilities, Class III bicycle routes are only appropriate for low-volume streets with slow travel speeds. Bicycle Boulevards are included in this classification.

- ***Separated Bikeways (Class IV)*** – These are separated and protected bikeways where a type of barrier, usually curbs, bollards, or parking isles, separate the bike lane from the vehicular flow of traffic. These are also known as cycle tracks.

Currently, bicyclists are allowed on all streets within the study area. Hearst Avenue is a Class III Bicycle Route on both directions of the street adjacent to the project site. There are no designated bicycle facilities on La Loma Avenue, Gayley Road, Ridge Road, and Le Roy Avenue. The 2017 *Bicycle Master Plan* proposes Class III Bicycle Routes along La Loma Avenue and Gayley Road within the project vicinity.

EXISTING INTERSECTION OPERATIONS

Fehr & Peers collected weekday AM and PM peak period (7:00 to 9:00 AM and 4:00 to 6:00 PM) traffic counts, including counts of heavy vehicles, pedestrians and bicycles, at the Gayley Road/La Loma Avenue/ Hearst Avenue intersection in April 2018, while UC Berkeley was in normal session. **Appendix A** presents the raw collected traffic data.

Based on the observed volumes, intersection control, and roadway configurations collected through field observations, Fehr & Peers calculated the AM and PM peak hour intersection level of service (LOS)[1] at the

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[1] The operations of roadway facilities are typically described with the term level of service (LOS), a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, which reflects free-flow conditions where there is very little interaction between vehicles, to LOS F, where the vehicle demand exceeds the capacity and high levels of vehicle delay result. LOS E represents at-capacity operations. When traffic volumes exceed the intersection capacity, stop-and-go conditions result and a vehicle may wait through multiple signal cycles before passing through the intersection; these operations are designated as LOS F.

Gayley intersection using the HCM 2010 methodology. **Table 2** summarizes the existing weekday AM and PM peak hour intersection LOS analysis results. **Appendix B** provides the detailed calculation work sheets. As shown in the table, the intersection operates at LOS B during both AM and PM peak hours.

TABLE 2 - EXISTING WEEKDAY INTERSECTION LOS SUMMARY

Intersection	Control[1]	AM Peak Hour		PM Peak Hour	
		Delay (Seconds)[2]	LOS	Delay (Seconds)[2]	LOS
1. Gayley Road/La Loma Avenue/Hearst Avenue	Signalized	16	B	17	B

1. Average intersection delay and LOS based on the 2010 HCM method, unless noted. Average delay is reported for signalized intersections.
2. Estimated based on 2010 HCM delay thresholds.

Source: Fehr & Peers, 2019.

PROJECT EVALUATION

PROJECT TRIP GENERATION

Trip generation refers to the process of estimating the amount of vehicular traffic a project would add to the surrounding roadway system. Vehicle trips were estimated for the peak one-hour period during the morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) commute periods when traffic volumes on the adjacent streets are highest. The trip generation for each project component is described below:

CAMPUS HOUSING

The Institute of Transportation Engineers (ITE) *Trip Generation Manual (10th Edition)* was used to estimate the trips generated by the residential component of the project. The ITE trip generation rates are based on national data, collected in both suburban and urban locations, including dense urban locations with higher rates of non-automobile travel. Trips generated by the housing units were estimated using the ITE rates for off-campus student apartments adjacent to campus (ITE code 225), which estimates the number of trips generated based on the number of bedrooms.

The housing component of the project is estimated to generate about 27 AM and 56 PM peak hour trips . This estimate is conservative in that the ITE data used to estimate trip generation is based on data collected at mostly urban sites that are more auto-dependent and provide more parking supply than the project setting. The estimate does not account for the constrained parking supply at or near the site. Considering that the project may not provide dedicated parking for residents and that on-street parking is generally at or near-capacity, it is likely that the project would generate fewer trips than estimated.

ACADEMIC BUILDING

The trip generation for the academic building component of the project was estimated based on the methodology developed for the UC Berkeley 2020 Long Range Development Plan (LRDP) EIR and updated based on the results of the 2016-2017 commute survey of various population groups. UC Berkeley estimates that the new academic building would result in up to 30 net new graduate students and 30 net new faculty and staff.

The academic building component of the project is estimated to generate about eight AM and seven PM peak hour trips. This estimate is conservative in that it does not account for the constrained parking supply at or near the site and assumes that all those who wish to drive to the site would be able to drive and park in the project vicinity.

PARKING STRUCTURE

Fehr & Peers collected peak period vehicle counts at the four existing parking driveways on Tuesday, May 1, 2018. These counts were used to develop an average trip generation rate per parking space for the AM and PM peak hours. Based on these rates, the demolition of the 207 parking spaces under the Proposed Project is estimated to reduce trip generation by 50 AM and 68 PM peak hour trips. Daily trips for the parking structure were estimated based on the observed trip generation rate per parking space in the 2020 LRDP EIR of about 2.6 daily trips per space.

TRIP GENERATION SUMMARY

Table 3 presents the trip generation estimates for the project. The Proposed Project is estimated to increase daily trip generation by about 150 trips, reduce peak hour trip generation by about 15 trips during the AM peak hour, and by five trips during the PM peak hour.

The reason that daily trips increase while peak hour trips decrease is due to the difference in the trip generation rate per space during the peak and off-peak hours. The trip generation rate per space is lower in the off-peak hours because most parking structure users enter and exit during the peak hours. Thus, the removal of parking would result in a relatively smaller decrease in daily trips than the decrease during peak hours.

Since the Proposed Project would reduce automobile trip generation during both the AM and PM peak hours, it would not deteriorate intersection operations in the project area during peak conditions. The increase in daily trips would not warrant an intersection analysis because the increase in trips would be added to the study intersection during off-peak hours, when overall intersection volumes are lower than during the peak hours. Additionally, the daily trips would be distributed across all off-peak hours, resulting in minimal additional trips per hour. Thus, no intersection impact analysis is necessary.

TABLE 3 - PROJECT TRIP GENERATION

Land Use	Size	Daily Trips	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Campus Housing[1]								
Campus Housing	225 Bedrooms	**710**	11	16	**27**	28	28	**56**
Academic Building								
Graduate Student[2]	30 Students	**10**	1	0	**1**	0	1	**1**
Faculty and Staff[3]	30 Persons	**30**	6	1	**7**	1	5	**6**
	Subtotal	***40***	7	*1*	***8***	*1*	6	***7***
Parking Structure[4]								
Parking Structure	-207 Spaces	**-600**	-48	-2	**-50**	-15	-52	**-68**
Net New Trips		**150**	**-30**	**15**	**-15**	**14**	**-18**	**-5**

1. ITE *Trip Generation (10th Edition)* land use category 225 (off-campus student apartment) adjacent to campus setting:
    Daily Rate: 3.15 trips per bedroom
    AM Peak Hour Rate: 0.12 trips per bedroom (41% in, 59% out)
    PM Peak Hour Rate: 0.25 trips per bedroom (50% in, 50% out)
2. Based on the UC Berkeley 2020 LRDP methodology and the travel modes from 2016-2017 survey data:
    Daily Rate: 0.23 trips per student
    AM Peak Hour Rate: 0.05 trips per student (91% in, 9% out)
    PM Peak Hour Rate: 0.05 trips per student (12% in, 88% out)
3. Based on the UC Berkeley 2020 LRDP methodology and the travel modes from 2016-2017 survey data:
    Daily Rate: 0.85 trips per faculty/staff
    AM Peak Hour Rate: 0.20 trips per faculty/staff (91% in, 9% out)
    PM Peak Hour Rate: 0.19 trips per faculty/staff (12% in, 88% out)
4. Based on peak period driveway counts at the existing Upper Hearst parking facilities:
    Daily Rate: 2.6 trips per parking space
    AM Peak Hour Rate: 0.24 trips per parking space (96% in, 4% out)

PM Peak Hour Rate: 0.33 trips per parking space (23% in, 77% out)
Source: Fehr & Peers, 2019.

QUEUEING ANALYSIS AND DRIVEWAY OPERATIONS

A queuing analysis was completed for the Gayley Road/La Loma Avenue/Hearst Avenue intersection and the adjacent garage driveway to assess the impact of the Proposed Project driveway on queuing. Queues were analyzed by modeling traffic operations at the Gayley Road/La Loma Avenue/Hearst Avenue intersection and the project driveway on Hearst Avenue using Synchro 10 software to estimate the 95th percentile queues during the AM and PM peak hours. [2] Driveway volumes were estimated by applying the existing average trip generation rate per space (summarized in the trip generation section above) to the proposed number of spaces under the Proposed Project and all trips were assigned to the single driveway. Queue reports are provided in **Appendix C**.

The Proposed Project would provide one driveway on Hearst Avenue approximately 200 feet west of the Gayley Road/La Loma Avenue/Hearst Avenue intersection. **Table 4** summarizes the 95th percentile queue lengths. Vehicles queues are not expected to result in queue spillbacks and block upstream intersections or driveways during the AM and PM peak hours. Therefore, the project driveway would not cause a significant queuing conflict.

TABLE 4 – PROJECT QUEUING SUMMARY

Movement	Storage Length[1]	95th Percentile Queue Length[2]	
		AM Peak Hour	PM Peak Hour
Gayley Road/La Loma Avenue/Hearst Avenue			
Eastbound	200 feet	110 feet	50 feet
Hearst Avenue Driveway			
Eastbound	240 feet	<20 feet	<20 feet
Westbound	200 feet	<20 feet	<20 feet

Bold indicated that 95th percentile queue would exceed the available storage.

1. Storage length is defined as the length in feet between the study intersection and the nearest adjacent intersection.
2. 95th percentile queue based on the Synchro 10 software.

Source: Fehr & Peers, 2019.

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[2] 95th percentile queue means that 95% of the time, the queue is below the values shown. The remaining 5% of the time, the queue is above that value.

Based on our review of the preliminary site plan for the Proposed Project, the Hearst Avenue driveway may not provide adequate sight distance between vehicles exiting the driveway and pedestrians on the adjacent sidewalk. Adequate sight distance is defined as a clear line-of-sight between a motorist ten feet back from the sidewalk and a pedestrian ten feet away on each side of the driveway.

> **Recommendation 1:** For the Proposed Project, ensure that the garage driveway on Hearst Avenue would provide adequate sight distance between vehicles existing the parking garage and pedestrians on the adjacent crosswalk. If adequate sight distance cannot be provided, install mirrors on both sides of the driveway to aid drivers' and pedestrians' visibility and install flashing lights to alert pedestrians when a vehicle is exiting the driveway.

Please contact us with questions or comments.

Attachments:

Appendix A – Intersection Counts

Appendix B – Intersection LOS Calculations

Appendix C – Intersection Queue Results

Prepared by National Data & Surveying Services

Gayley Rd & Hearst Ave

Peak Hour Turning Movement Count

ID: 18-08207-001
City: Berkeley

Day: Tuesday
Date: 04/24/2018

PEAK HOURS	COUNT PERIODS
08:00 AM - 09:00 AM	07:00 AM - 09:00 AM
NONE	NONE
04:45 PM - 05:45 PM	04:00 PM - 06:00 PM

Gayley Rd

SOUTHBOUND

AM	14	265	23	0	226	AM
NOON	0	0	0	0	0	NOON
PM	23	224	7	0	330	PM
	↲	↓	↳	⤸	⇧	
	0.5	0.5	0	0		

Hearst Ave

EASTBOUND

AM	NOON	PM		
266	0	345	⇦	
0	0	0	⤺	0
21	0	23	↱	0
131	0	33	→	0.5
222	0	255	↴	0.5
AM	NOON	PM		

CONTROL

Signalized

	AM	NOON	PM
TEV	1216	0	1278
PHF	0.97		0.93

WESTBOUND

Hearst Ave

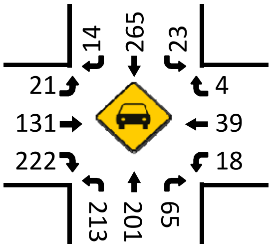
		PM	NOON	AM
0	↰	30	0	4
2	←	118	0	39
0	↲	62	0	18
0	⤹	0	0	0
	⇨	62	0	219
		PM	NOON	AM

	0	0	0.5	0.5		
	⤺	↰	↑	↱		
	⇩					
PM	541	0	204	277	22	PM
NOON	0	0	0	0	0	NOON
AM	505	0	213	201	65	AM

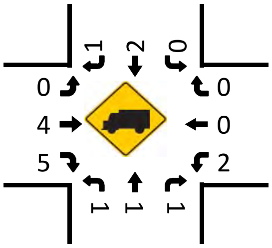
NORTHBOUND

Gayley Rd

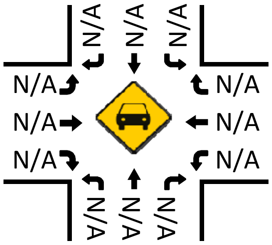
Total Vehicles (AM)



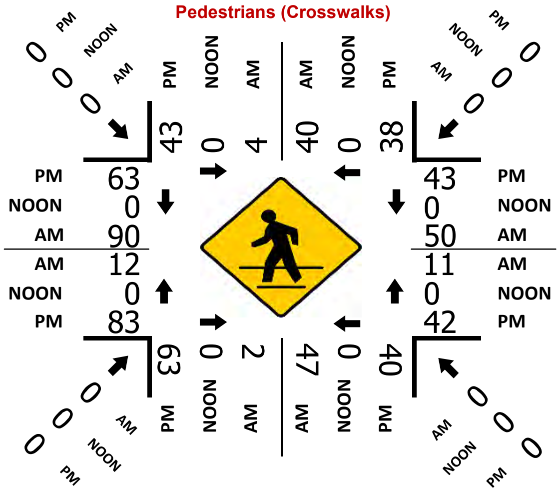
Bikes (AM)



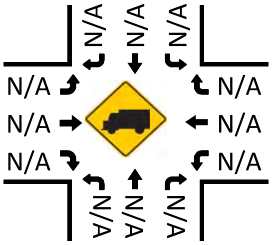
Total Vehicles (Noon)



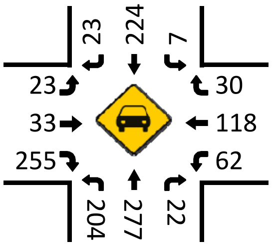
Pedestrians (Crosswalks)



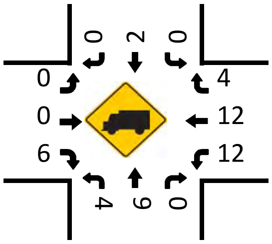
Bikes (NOON)



Total Vehicles (PM)



Bikes (PM)



HCM 2010 Signalized Intersection Summary
1: Gayley Road/La Loma Avenue & Hearst Avenue

08/27/2018

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰	↱			↰	↱		✥	
Traffic Volume (veh/h)	21	131	222	18	39	4	213	201	65	23	265	14
Future Volume (veh/h)	21	131	222	18	39	4	213	201	65	23	265	14
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.93		0.90	0.96		0.92	0.96		1.00	0.98		0.89
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1976	1976	1900	1900	1900
Adj Flow Rate, veh/h	22	135	229	19	40	4	220	207	0	24	273	14
Adj No. of Lanes	0	1	1	1	1	0	0	1	1	0	1	0
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Percent Heavy Veh, %	0	0	0	0	0	0	0	0	0	0	0	0
Cap, veh/h	98	537	464	346	537	54	475	405	955	92	948	47
Arrive On Green	0.32	0.32	0.32	0.32	0.32	0.32	0.57	0.57	0.00	0.57	0.57	0.57
Sat Flow, veh/h	147	1683	1454	994	1685	169	715	712	1680	77	1666	82
Grp Volume(v), veh/h	157	0	229	19	0	44	427	0	0	311	0	0
Grp Sat Flow(s),veh/h/ln	1830	0	1454	994	0	1854	1426	0	1680	1825	0	0
Q Serve(g_s), s	0.0	0.0	10.2	1.2	0.0	1.3	7.3	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	4.9	0.0	10.2	6.1	0.0	1.3	14.2	0.0	0.0	6.9	0.0	0.0
Prop In Lane	0.14		1.00	1.00		0.09	0.52		1.00	0.08		0.05
Lane Grp Cap(c), veh/h	635	0	464	346	0	591	879	0	955	1087	0	0
V/C Ratio(X)	0.25	0.00	0.49	0.05	0.00	0.07	0.49	0.00	0.00	0.29	0.00	0.00
Avail Cap(c_a), veh/h	635	0	464	346	0	591	879	0	955	1087	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	20.2	0.0	22.0	22.5	0.0	19.0	10.4	0.0	0.0	8.9	0.0	0.0
Incr Delay (d2), s/veh	0.9	0.0	3.7	0.3	0.0	0.2	1.9	0.0	0.0	0.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.7	0.0	4.6	0.3	0.0	0.7	6.2	0.0	0.0	3.7	0.0	0.0
LnGrp Delay(d),s/veh	21.2	0.0	25.8	22.8	0.0	19.3	12.3	0.0	0.0	9.6	0.0	0.0
LnGrp LOS	C		C	C		B	B			A		
Approach Vol, veh/h		386			63			427			311	
Approach Delay, s/veh		23.9			20.3			12.3			9.6	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		30.0		50.0		30.0		50.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		25.5		45.5		25.5		45.5
Max Q Clear Time (g_c+I1), s		8.1		16.2		12.2		8.9
Green Ext Time (p_c), s		2.1		6.0		1.8		6.3

Intersection Summary		
HCM 2010 Ctrl Delay		15.8
HCM 2010 LOS		B

HCM 2010 Signalized Intersection Summary
1: Gayley Road/La Loma Avenue & Hearst Avenue

08/27/2018

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱	↰	↱			↰	↱		✥	
Traffic Volume (veh/h)	23	33	255	62	118	30	204	277	22	7	224	23
Future Volume (veh/h)	23	33	255	62	118	30	204	277	22	7	224	23
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.89		0.84	0.91		0.81	0.94		1.00	0.98		0.85
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1900	1900	1900	1900	1900	1900	1976	1976	1900	1900	1900
Adj Flow Rate, veh/h	25	35	274	67	127	32	219	298	0	8	241	25
Adj No. of Lanes	0	1	1	1	1	0	0	1	1	0	1	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	0	0	0	0	0	0	0	0	0	0	0	0
Cap, veh/h	223	288	437	346	449	113	414	498	939	57	919	93
Arrive On Green	0.32	0.32	0.32	0.32	0.32	0.32	0.56	0.56	0.00	0.56	0.56	0.56
Sat Flow, veh/h	482	892	1357	993	1392	351	620	891	1680	15	1643	166
Grp Volume(v), veh/h	60	0	274	67	0	159	517	0	0	274	0	0
Grp Sat Flow(s),veh/h/ln	1375	0	1357	993	0	1742	1511	0	1680	1825	0	0
Q Serve(g_s), s	0.1	0.0	13.0	4.1	0.0	5.2	10.7	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	5.3	0.0	13.0	9.4	0.0	5.2	16.5	0.0	0.0	5.9	0.0	0.0
Prop In Lane	0.42		1.00	1.00		0.20	0.42		1.00	0.03		0.09
Lane Grp Cap(c), veh/h	510	0	437	346	0	562	913	0	939	1069	0	0
V/C Ratio(X)	0.12	0.00	0.63	0.19	0.00	0.28	0.57	0.00	0.00	0.26	0.00	0.00
Avail Cap(c_a), veh/h	510	0	437	346	0	562	913	0	939	1069	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	18.1	0.0	21.9	22.7	0.0	19.2	10.8	0.0	0.0	8.7	0.0	0.0
Incr Delay (d2), s/veh	0.5	0.0	6.6	1.2	0.0	1.3	2.5	0.0	0.0	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	5.7	1.2	0.0	2.7	7.7	0.0	0.0	3.1	0.0	0.0
LnGrp Delay(d),s/veh	18.5	0.0	28.5	24.0	0.0	20.5	13.4	0.0	0.0	9.3	0.0	0.0
LnGrp LOS	B		C	C		C	B			A		
Approach Vol, veh/h		334			226			517			274	
Approach Delay, s/veh		26.7			21.5			13.4			9.3	
Approach LOS		C			C			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		29.0		47.0		29.0		47.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		24.5		42.5		24.5		42.5
Max Q Clear Time (g_c+I1), s		11.4		18.5		15.0		7.9
Green Ext Time (p_c), s		2.5		6.3		2.1		6.9

Intersection Summary	
HCM 2010 Ctrl Delay	17.2
HCM 2010 LOS	B

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰↑	↑↱		↲↳	
Traffic Vol, veh/h	24	373	243	23	1	1
Future Vol, veh/h	24	373	243	23	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	24	373	243	23	1	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	266	0	-	0	676	255
Stage 1	-	-	-	-	255	-
Stage 2	-	-	-	-	421	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1298	-	-	-	419	784
Stage 1	-	-	-	-	788	-
Stage 2	-	-	-	-	662	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1298	-	-	-	409	784
Mov Cap-2 Maneuver	-	-	-	-	409	-
Stage 1	-	-	-	-	770	-
Stage 2	-	-	-	-	662	-

Approach	EB		WB		SB
HCM Control Delay, s	0.5		0		11.7
HCM LOS					B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1298	-	-	-	538
HCM Lane V/C Ratio	0.018	-	-	-	0.004
HCM Control Delay (s)	7.8	0	-	-	11.7
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0

HCM 2010 TWSC
6: Hearst Avenue

Upper Hearst TIA
01/24/2019

Intersection	
Int Delay, s/veh	1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↱		⋎	
Traffic Vol, veh/h	8	286	338	7	25	26
Future Vol, veh/h	8	286	338	7	25	26
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	100	100	100	100	100	100
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	8	286	338	7	25	26

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	345	0	-	0	644	342
Stage 1	-	-	-	-	342	-
Stage 2	-	-	-	-	302	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1214	-	-	-	437	701
Stage 1	-	-	-	-	719	-
Stage 2	-	-	-	-	750	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1214	-	-	-	434	701
Mov Cap-2 Maneuver	-	-	-	-	434	-
Stage 1	-	-	-	-	713	-
Stage 2	-	-	-	-	750	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	12.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1214	-	-	-	539
HCM Lane V/C Ratio	0.007	-	-	-	0.095
HCM Control Delay (s)	8	0	-	-	12.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Queues
1: Gayley Road/La Loma Avenue & Hearst Avenue

Upper Hearst TIA
01/24/2019

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	157	229	19	44	427	67	311
v/c Ratio	0.27	0.37	0.06	0.07	0.58	0.08	0.32
Control Delay	21.9	5.0	19.7	18.2	15.1	4.1	10.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.9	5.0	19.7	18.2	15.1	4.1	10.0
Queue Length 50th (ft)	58	0	7	14	126	5	74
Queue Length 95th (ft)	105	47	21	36	214	21	121
Internal Link Dist (ft)	157			326	271		278
Turn Bay Length (ft)		50	40			40	
Base Capacity (vph)	577	611	334	594	737	866	982
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.27	0.37	0.06	0.07	0.58	0.08	0.32

Intersection Summary

1: Gayley Road/La Loma Avenue & Hearst Avenue

	→	↘	↙	←	↑	↗	↓
Lane Group	EBT	EBR	WBL	WBT	NBT	NBR	SBT
Lane Group Flow (vph)	58	263	64	153	496	23	262
v/c Ratio	0.11	0.41	0.17	0.26	0.60	0.03	0.26
Control Delay	20.1	5.1	21.3	19.4	15.3	3.9	9.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	5.1	21.3	19.4	15.3	3.9	9.2
Queue Length 50th (ft)	20	0	23	50	150	1	58
Queue Length 95th (ft)	47	50	52	95	247	10	98
Internal Link Dist (ft)	157			326	271		278
Turn Bay Length (ft)		50	40			40	
Base Capacity (vph)	515	634	371	586	820	856	1004
Starvation Cap Reductn	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.41	0.17	0.26	0.60	0.03	0.26

Intersection Summary

APPENDIX G

UC BERKELEY LONG RANGE DEVELOPMENT PLAN TRIP GENERATION COMPARISON

FEHR & PEERS

DRAFT MEMORANDUM

Date:	September 13, 2018
To:	Todd Henry, UC Berkeley
From:	Sam Tabibnia and Lee Reis
Subject:	**UC Berkeley Long Range Development Plan – Trip Generation Comparison**

OK18-0265.01

Using the most recent data available, Fehr & Peers estimated the current (2017-2018) automobile trip generation for the UC Berkeley Campus Park and estimated the automobile trip generation for the year 2022-2023 based on projected population increases. Based on our analysis, both the current and projected 2022-2023 trip generation are less than the 2001-2002 and the estimated year 2020 as presented in the *2020 Long Range Development Plan Draft Environmental Impact Report* (LRDP EIR). This memorandum presents our estimates the Campus Park trip generation for 2017-2018 and 2022-2023, reasons for the decrease in trip generation, and comparison to the observed traffic and transit data

Trip Generation Estimates

Table 1 summarizes the total trip generation for 2001-2002 and 2020 as estimated by the 2020 LRDP EIR, and the actual 2017-2018 and estimated 2022-2023 based on more recent available data. **Appendix A** provides the detailed trip generation estimates for each scenario and summarizes the population and mode share data used to estimate the trip generation.

The 2020 LRDP EIR estimated trip generation by applying mode share data from surveys of the various population groups conducted in 2001 to the population numbers. Similarly, the results of the more recent 2017 surveys were applied to the actual 2017-2018 and estimated 2022-2023 population numbers to estimate the more current daily trip generations. The 2017-2018 and 2022-2023 peak hour trip generation estimates assume the same factors used in the 2020 LRDP EIR to estimate the peak hour trip generation.

TABLE 1 – AUTOMBILE TRIP GENERATION SUMMARY

Scenario	Daily Trips	AM Peak Hour			PM Peak Hour		
		In	**Out**	**Total**	**In**	**Out**	**Total**
A. 2001-2002 (Based on 2001 Data) [1]	20,550	4,309	430	4,739	565	4,033	4,598
B. Estimated 2020 LRDP [1]	24,040	5,228	522	5,750	679	4,849	5,528
C. Actual 2017-2018 [1]	19,140	4,014	400	4,415	526	3,757	4,283
D. Estimated 2022-2023 [1]	20,420	4,283	427	4,710	562	4,008	4,570
E. LRDP EIR (2001-2002 to 2020)[2]	3,490	918	92	1,010	114	816	930
F. Actual (2001-2002 to 2017-2018)[3]	-1,410	-295	-29	-324	-39	-276	-315
G. Estimated (2001-2002 to 2022-2023)[4]	-130	-26	-3	-29	-3	-25	-28

Notes: See Appendix A for detailed calculations.
1. Source: 2020 LRDP EIR
2. E = B – A
3. F = C – A
4. G = D – A

The actual 2017-2018 trip generation is about seven percent lower than the trip generation in 2001-2002, while the 2020 LRDP EIR estimated a net increase of 16 percent in daily trips and 20 percent in peak hour trips between 2001-2002 and 2020 when the LRDP would be completed. The net decrease in automobile trip generation is mostly due to the decrease in the number of people across all population groups driving to/from the Campus Park. The 2020 LRDP EIR assumed that similar percentages of the different population groups as in 2001-2002 would continue to drive to/from Campus Park in 2020. However, comparing the 2001 and 2017 surveys shows a decrease in the drive alone mode share for all population groups. Overall, it is estimated that in 2001 about 23 percent of the total population commuted to/from Campus Park by driving alone, which by 2017 decreased to 16 percent. Although the Campus Park population in 2017-2018 was about 6,400 higher (corresponding to about 12 percent) than estimated by the 2020 LRDP EIR in 2020, the overall automobile trip generation decreased due to the overall decrease in the number of people driving across all population groups.

The estimated 2022-2023 trip generation assumes the same travel characteristics as the 2017-2018 population, which is a conservative estimate for automobile trip generation based on recent trends of fewer people driving to and from Campus Park and the limited UC-operated parking which is expected to remain the same as the current supply. The overall population is estimated to increase by about 34 percent between 2001-2002 and 2022-2023, while the total automobile trip generation is estimated to be about one percent less than in 2001-2002. While the campus population is expected to increase for all population groups by 2022-2023, the largest proportion of the increase would be undergraduate and graduate students, who are more likely to walk, ride bicycles, or take public transit compared to faculty and staff.

Reasons for Trip Generation Decrease

The factors that are likely contributing to the decrease in automobile trip generation between 2001-2002 and 2017-2018 include:

- The number of parking spaces operated by the University has decreased. The 2020 LRDP EIR analysis was based on an estimated increase of 2,300 university-operated parking spaces from 7,690 spaces in 2001 to 9,990 spaces in 2020. In reality, the University is currently operating 6,560 parking spaces, a decrease of 1,130 spaces (15 percent) since 2001. During the same period, the number of parking permits has decreased by 100 (two percent). In 2016-2017, there were 1.2 permits for each parking space, compared to 1.0 permits per space in 2001-2002.
- The number of beds available in University-affiliated housing in the vicinity of the Campus Park has increased from 6,004 in 2001-2002 to 7,578 in 2017-2018.[1] As a result, more students live within walking and biking distance of Campus Park.
- The University has expanded its Transportation Demand Management (TDM) program to include the following strategies that further encourage students, faculty, and staff to use non-automobile travel modes:
    - AC Transit Class Pass for all students
    - Easy Pass for non-students
    - Bike share through Ford GoBike, including new stations around the Campus Park, and subsidized memberships for Educational Opportunity Program students
    - BerkeleyMoves! Commuter Club (app and website)
    - Addition of about 1,000 bicycle parking spaces. New buildings must provide bike parking for 15 percent of occupants and include an indoor secure bike parking storage area
    - Bike fix-it stations for bike commuters
    - Electronic bike lockers

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[1] The recently completed Blackwell Hall (752 beds) and Shattuck Studios (21 units) are not included in the total.

  - Zipcar discount rates
  - GIG Car Share
  - BART subsidy
  - Increased parking costs
  - Modified night-safety programs
  - Designated TDM Administrator and increased marketing
- Improvements in pedestrian and bicycle facilities in the surrounding areas, such as the addition of sidewalks on the south side of Hearst Avenue and parking protected bikeways on Fulton Street and Bancroft Way.

Consistency with Observed Traffic and Transit Data

The estimated decrease in trip generation is also consistent with observed traffic volumes. The 2020 LRDP EIR evaluated the impacts of the LRDP at 75 intersections by collecting AM and PM peak period counts in 2002 and forecasting traffic volumes for 2020 conditions with the completion of the 2020 LRDP. **Appendix B** compares the traffic volumes and level of service (LOS) at 32 intersections where recent traffic data (2015-2018) is available. The total intersection volumes in 2015-2018 are on average about 11 percent lower during the AM peak hour and 16 percent lower during the PM peak hour than in 2002. Similarly, the total intersection volumes in 2015-2018 at the 32 intersections are on average about 34 percent lower during both peak hours than the year 2020 forecasts as estimated in the 2020 LRDP EIR. The year 2020 intersection volume forecasts estimated in the 2020 LRDP EIR account for the completion of the LRDP and other likely developments in the City of Berkeley and beyond.

Similarly, BART ridership has also increased during the same period. Weekday exits at the Downtown Berkeley BART Station increased from about 10,800 in 2001 to 13,250 in 2017. [2]

Please contact us with questions or comments.

Attachments:

Appendix A – Population, Mode Share, and Trip Generation Estimates

Appendix B – Intersection Volume and LOS Comparison

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[2] http://www.bart.gov/sites/default/files/docs/FY%20Avg%20Wkdy%20Exits%20by%20Station_6.xlsx

1. Population Comparison

Population Group	Actual 2001-2002	Estimated 2020 (LRDP)	Actual 2017-2018	Estimated 2022-2023	Estimated Change, 2001-2002 to 2020 (LRDP)	Actual Change, 2001-2002 to 2017-2018	Estimated Change, 2017-2018 to 2022-2023	Estimated change (2001-2002 to 2020) compared to actual (2001-2002 to 2017-2018)
	[A]	[B]	[C]	[D]	[E = B - A]	[F = C -A]	[G = D - C]	[H = F- E]
Students	31,800	33,450	40,955	44,735	+1,650	+9,155	+3,781	+7,505
Undergraduate	23,100	23,950	29,783	31,380	+850	+6,683	+1,597	+5,833
Graduate	8,700	9,500	11,172	13,355	+800	+2,472	+2,184	+1,672
Faculty	1,760	1,980	1,513	1,653	+220	-247	+140	-467
Post-docs and Visiting Scholars	1,935	3,075	1,296	1,416	+1,140	-639	+120	-1,779
Academic Staff	1,105	1,805	3,426	3,545	+700	+2,321	+119	+1,621
Non-Academic Staff	8,140	8,950	8,447	8,741	+810	+307	+294	-503
Total	**44,740**	**49,260**	**55,637**	**60,090**	**+4,520**	**+10,897**	**+4,454**	**+6,377**

Note:

1. Population is average of fall and spring enrollment and excludes off-campus students.

Sources: UC Berkeley 2020 LRDP (Columns A and B), UC Berkeley, 2018 (Columns C and D)

2a. Mode Share, Actual 2001-2002

Population Group	Walk	Bicycle	Drive Alone	Carpool/ Vanpool	Public Transit	Did not work/ telecommute/Other[1]	Total
Undergraduate Students	55%	5%	8%	1%	21%	10%	100%
Graduate Students	22%	16%	16%	2%	34%	10%	100%
Faculty	9%	14%	51%	6%	10%	10%	100%
Post-docs and Visiting Scholars	9%	14%	51%	6%	10%	10%	100%
Academic Staff	11%	10%	51%	7%	11%	10%	100%
Non-Academic Staff	8%	6%	47%	10%	19%	10%	100%

Note:

1. The LRDP EIR assumed 10% of the campus population did not travel to campus on a given day.

Source: UC Berkeley 2020 LRDP EIR

2b. Mode Share, Actual 2017-2018

Population Group	Walk	Bicycle	Drive Alone	Carpool/ Vanpool	Public Transi	Did not work/ telecommute/Other[1]	Total
Undergraduate Students	63%	8%	6%	2%	17%	4%	100%
Graduate Students	25%	24%	10%	3%	29%	9%	100%
Faculty	11%	18%	36%	6%	14%	15%	100%
Post-docs and Visiting Scholars[2]	11%	18%	36%	6%	14%	15%	100%
Academic Staff[3]	8%	11%	39%	8%	29%	5%	100%
Non-Academic Staff[3]	8%	11%	39%	8%	29%	5%	100%

Notes:

1. The estimates for 2018 used survey data on the percent of people who did not travel to campus on a given day or used a mode different from those listed. This is considered a conservative estimate compared to 2001-2002, since it does not account for people who do not travel to campus on a given day due to travel, illness, or other reasons.

2. Post-docs and Visiting Scholars were not differentiated in 2016-2017 surveying and were assumed to have the same travel characteristics as Faculty.

3. Academic and Non-Academic staff were grouped in one staff category in 2016-2017 surveying and were assumed to have the same travel characteristics.

Source: 2016-2017 UC Berkeley Transportation Survey

3a. Daily Trip Generation Estimate (2001-2002 Total)

Population Group	**Walk**	**Bicycle**	**Drive Alone**	**Carpool/ Vanpool**	**Public Transit**	**Total**	
Students	29,238	5,094	6,480	810	15,618	57,240	
Undergraduate	25,410	2,310	3,696	462	9,702	41,580	
Graduate	3,828	2,784	2,784	348	5,916	15,660	
Faculty	317	493	1,795	211	352	3,168	
Post-docs and Visiting Scholars	348	542	1,974	232	387	3,483	
Academic Staff	243	221	1,127	155	243	1,989	
Non-Academic Staff	1,302	977	7,652	1,628	3,093	14,652	**Automobile Trips**
Total	**31,448**	**7,327**	**19,028**	**3,036**	**19,693**	**80,532**	**20,546**

3b. Daily Trip Generation Estimate (2020 Total as Estimated in LRDP EIR)

Population Group	**Walk**	**Bicycle**	**Drive Alone**	**Carpool/ Vanpool**	**Public Transit**	**Total**	
Students	30,525	5,435	6,872	859	16,519	60,210	
Undergraduate	26,345	2,395	3,832	479	10,059	43,110	
Graduate	4,180	3,040	3,040	380	6,460	17,100	
Faculty	356	554	2,020	238	396	3,564	
Post-docs and Visiting Scholars	554	861	3,137	369	615	5,536	
Academic Staff	397	361	1,841	253	397	3,249	
Non-Academic Staff	1,432	1,074	8,413	1,790	3,401	16,110	**Automobile Trips**
Total	**33,264**	**8,285**	**22,283**	**3,509**	**21,328**	**88,669**	**24,038**
Difference from 2001-2002	+1,816	+958	+3,255	+473	+1,635	+8,137	+3,492

3c. Daily Trip Generation Estimate (Actual 2017-2018 Total)

Population Group	**Walk**	**Bicycle**	**Drive Alone**	**Carpool/ Vanpool**	**Public Transit**	**Total**	
Students	43,113	10,127	5,808	1,861	16,605	77,514	
Undergraduate	37,527	4,765	3,574	1,191	10,126	57,183	
Graduate	5,586	5,362	2,234	670	6,479	20,331	
Faculty	333	545	1,089	182	424	2,573	
Post-docs and Visiting Scholars	285	467	933	156	363	2,204	
Academic Staff	548	754	2,672	548	1,987	6,509	
Non-Academic Staff	1,352	1,858	6,589	1,352	4,899	16,050	**Automobile Trips**
Total	**45,631**	**13,751**	**17,091**	**4,099**	**24,278**	**104,850**	**19,140**
Difference from 2001-2002	+14,183	+6,424	-1,937	+1,063	+4,585	+24,318	-1,406
Difference from 2020 Estimated Change	+12,367	+5,466	-5,192	+590	+2,950	+16,181	-4,898

3d. Daily Trip Generation Estimate (2022-2023 Forecast Total)

Population Group	**Walk**	**Bicycle**	**Drive Alone**	**Carpool/ Vanpool**	**Public Transit**	**Total**	
Students	46,217	11,431	6,437	2,056	18,415	84,556	
Undergraduate	39,539	5,021	3,766	1,255	10,669	60,250	
Graduate	6,678	6,410	2,671	801	7,746	24,306	
Faculty	364	595	1,190	198	463	2,810	
Post-docs and Visiting Scholars	311	510	1,019	170	396	2,406	
Academic Staff	567	780	2,765	567	2,056	6,735	
Non-Academic Staff	1,399	1,923	6,818	1,399	5,070	16,609	**Automobile Trips**
Total	**48,858**	**15,239**	**18,229**	**4,390**	**26,400**	**113,116**	**20,420**
Difference from 2001-2002	+17,410	+7,912	-799	+1,354	+6,707	+32,584	-126
Difference from 2020 Estimated Change	+15,594	+6,954	-4,054	+881	+5,072	+24,447	-3,618

Appendix B - Intersection Volume and LOS Comparison

			LRDP EIR												2015-2018 Data								Percent Difference in Volume			
			Existing Conditions (2002)						2020 With Project Conditions						Existing Conditions								2002 to 2014-2018		LRDP 2020 Forecast to 2014-2018	
		Intersection Control	AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour			AM Peak Hour			PM Peak Hour								
ID	Intersection Name		Volume	Delay	LOS	Volume	Delay	LOS	Volume	Delay	LOS	Volume	Delay	LOS	Volume	Delay	LOS	Volume	Delay	LOS	Source	Count Date	AM	PM	AM	PM
1	Marin Avenue / San Pablo Avenue	Signalized	3,486	79	E	4,055	50	D	4,580	>80	F	5,389	>80	F	3,289	38	D	3,695	43	D	Existing Conditions Report, San Pablo Avenue Corridor Project (March 2018)	November 2016	-6%	-9%	-28%	-31%
4	Gilman Street / San Pablo Avenue	Signalized	2,575	41	D	3,381	42	D	3,438	46	D	4,404	69	E	2,564	47	D	3,201	50	D	1500 San Pablo Avenue TIS (May 2015)	December 2014	0%	-5%	-25%	-27%
															2,607	47	D	2,956	30	C	Existing Conditions Report, San Pablo Avenue Corridor Project (March 2018)	November 2016	1%	-13%	-24%	-33%
8	Cedar Street / Oxford Street	Signalized	1,784	49	D	1,680	22	C	2,229	58	E	2,327	63	E	1,367	16	B	1,532	19	B	Realm Middle School TIA (July 2018)	May 2018	-23%	-9%	-39%	-34%
12	Hearst Avenue / Oxford Street	Signalized	2,713	10	B	2,899	54	D	3,389	12	B	4,767	49	D	1,789	22	C	2,036	23	C	Realm Middle School TIA (July 2018)	May 2018	-34%	-30%	-47%	-57%
14	Hearst Avenue / Arch Street / Le Conte Avenue	Side-Street Stop-Controlled in 2002, Signalized in 2018	1,285	11 (SB)	B	1,400	14 (SB)	B	1,656	11 (SB)	B	1,865	18 (SB)	C	816	23	C	946	27	C	Realm Middle School TIA (July 2018)	May 2018	-36%	-32%	-51%	-49%
17	Hearst Avenue / Le Roy Avenue	Side-Street Stop-Controlled in 2002, Signalized in 2018	807	12 (SB)	B	1,005	15 (SB)	C	1,084	14(SB)	B	1,378	19 (SB)	C	694			732			UC Berkeley	April 2018	-14%	-27%	-36%	-47%
18	Hearst Ave / Gayley Rd / La Loma Ave	Signalized	1,440	23	C	1,555	25	C	1,951	>60	E	2,052	>69	E	1,216	16	B	1,278	17	B	UC Berkeley	April 2018	-16%	-18%	-38%	-38%
20	University Avenue / Sixth Street	Signalized	3,375	>80	F	4,031	>80	F	4,338	>80	F	5,210	>80	F	3,584	52	D	3,970	74	E	1500 San Pablo Avenue TIS (May 2015)	December 2014	6%	-2%	-17%	-24%
															3,372	44	D	3,798	52	D	1050 Parker Street TIA (June 2017)	February 2016	0%	-6%	-22%	-27%
21	University Avenue / San Pablo Avenue	Signalized	3,604	>80	F	4,457	>80	F	4,793	>80	F	5,788	>80	F	3,454	46	D	3,899	59	E	1500 San Pablo Avenue TIS (May 2015)	December 2014	-4%	-13%	-28%	-33%
															3,350	37	D	3,746	43	D	1050 Parker Street TIA (June 2017)	February 2016	-7%	-16%	-30%	-35%
															3,411	47	D	3,699	43	D	Existing Conditions Report, San Pablo Avenue Corridor Project (March 2018)	November 2016	-5%	-17%	-29%	-36%
22	University Avenue / MLK Way	Signalized	3,337	21	C	3,859	32	C	4,534	40	D	4,975	41	D	3,384	28	C	3,657	29	C	2190 Shattuck Avenue Mixed Use Project Draft EIR (August 2017)	October 2016	1%	-5%	-25%	-26%
24	University Avenue / Shattuck Avenue (West)	Signalized	2,295	20	B	2,892	18	B	3,346	37	D	4,071	22	C	2,059	21	C	2,372	20	B	2190 Shattuck Avenue Mixed Use Project Draft EIR (August 2017)	October 2016	-10%	-18%	-38%	-42%
26	University Avenue / Oxford Street	Signalized	2,453	29	C	2,799	18	B	3,168	39	D	3,565	29	C	1,583			1,896			Realm Middle School TIA (July 2018)	May 2018	-35%	-32%	-50%	-47%
28	Addison Street / Oxford Street	Side-Street Stop-Controlled	1,962	10 (EB)	A	2,142	17 (EB)	C	2,541	35 (EB)	E	2,780	>45 (EB)	E	1,414	60 (EB)	F	1,849	88 (EB)	F	2129 Shattuck Avenue Project Draft EIR (April 2016)	May 2015	-28%	-14%	-44%	-33%
															1,342			1,438			2129 Shattuck Traffic Control Plan	April 2018	-32%	-33%	-47%	-48%
29	Center Street / Shattuck Avenue	Signalized	1,797	15	B	2,555	14	B	2,568	17	B	3,407	17	B	1,776	15	B	1,978	18	B	2190 Shattuck Avenue Mixed Use Project Draft EIR (August 2017)	October 2016	-1%	-23%	-31%	-42%
31	Center Street / Oxford Street	Signalized	2,062	8	A	2,360	8	A	2,666	13	B	3,033	11	B	1,495			1,609			2129 Shattuck Traffic Control Plan	April 2018	-27%	-32%	-44%	-47%
36	Bancroft Way / Shattuck Avenue	Signalized	2,042	9	A	2,693	13	B	2,804	11	B	3,579	22	C	1,973	12	B	2,244	16	B	2190 Shattuck Avenue Mixed Use Project Draft EIR (August 2017)	October 2016	-3%	-17%	-30%	-37%
37	Bancroft Way / Fulton Street	Signalized	2,216	6	A	2,610	7	A	2,723	10	A	3,344	10	B				1,983			AC Transit	April 2014		-24%		-41%
																		1,986			City of Berkeley Counts (April 2017)	April 2017		-24%		-41%
38	Bancroft Way / Ellsworth Street	Side-Street Stop-Controlled	1,025	16 (NB)	C	1,342	13 (NB)	B	1,389	22 (NB)	C	1,791	39 (NB)	E				1,074			City of Berkeley Counts (April 2017)	April 2017		-20%		-40%
39	Bancroft Way / Dana Street	Side-Street Stop-Controlled in 2002, Signalized in 2018	866	0	A	1,155	0	A	1,178	0	A	1,624	0	A				875			City of Berkeley Counts (April 2017)	April 2017		-24%		-46%
41	Bancroft Way / Bowditch Street	All-Way Stop-Controlled	784	12	B	784	12	B	1,020	14	B	1,127	16	C	309	9	A	544	10	A	2580 Bancroft Way Mixed-Use Project Draft EIR (April 2018)	November 2017	-61%	-31%	-70%	-52%
58	Dwight Way / Shattuck Avenue	Signalized	2,928	10	B	3,622	13	B	3,657	17	B	4,311	17	B	2,480	21	C	2,925	21	C	Adeline Corridor Specific Plan Existing Conditions Report (August 2015)	April 2015	-15%	-19%	-32%	-32%
64	Adeline Street / Shattuck Avenue	Signalized	2,796	15	B	3,382	24	C	3,325	20	C	3,987	33	C	2,357	16	B	2,646	16	B	Adeline Corridor Specific Plan Existing Conditions Report (August 2015)	April 2015	-16%	-22%	-29%	-34%
67	Ashby Avenue / Seventh	Signalized	3,202	34	C	3,284	52	D	3,899	54	D	3,938	>80	F	3,264	39	D	3,484	65	E	1050 Parker Street TIA (June 2017)	June 2015	2%	6%	-16%	-12%
68	Ashby Avenue / San Pablo Avenue	Signalized	3,354	29	C	4,034	31	C	4,525	42	D	5,253	41	D	3,129	44	D	3,769	51	D	3100 San Pablo Avenue TIA (April 2017)	June 2015	-7%	-7%	-31%	-28%
															3,497	39	D	3,776	58	E	Existing Conditions Report, San Pablo Avenue Corridor Project (March 2018)	November 2016	4%	-6%	-23%	-28%
69	Ashby Avenue / Adeline Street	Signalized	2,695	40	D	3,089	37	D	3,400	42	D	3,772	39	D	2,681	31	C	3,070	35	C	Adeline Corridor Specific Plan Existing Conditions Report (August 2015)	April 2015	-1%	-1%	-21%	-19%
70	Ashby Avenue / Shattuck Avenue	Signalized	2,695	15	B	2,837	30	C	3,331	17	B	3,426	43	D	2,520	13	B	2,589	14	B	3000 Shattuck Avenue Mixed Use Project (May 2017)	August 2014	-6%	-9%	-24%	-24%
															2,444	28	C	2,567	28	C	Adeline Corridor Specific Plan Existing Conditions Report (August 2015)	April 2015	-9%	-10%	-27%	-25%
72	Ashby Avenue /College Avenue	Signalized	2,332	31	C	2,344	29	C	2,783	36	D	2,871	39	D	2,005	25	C	2,064	24	C	Claremont Hotel - Club Expansion and Residential Project EIR (Not Published)	October 2015	-14%	-12%	-28%	-28%
73	Ashby Avenue / Claremont Avenue	Signalized	2,844	22	C	2,819	22	B	3,505	27	C	3,590	27	C	2,498	23	C	2,623	81	F	Claremont Hotel - Club Expansion and Residential Project EIR (Not Published)	October 2015	-12%	-7%	-29%	-27%
74	Tunnel Road / Highway 13	Signalized	3,335	16	B	3,298	14	B	3,865	17	B	3,879	16	B	2,430	16	B	2,732	13	B	Claremont Hotel - Club Expansion and Residential Project EIR (Not Published)	October 2015	-27%	-17%	-37%	-30%

APPENDIX H

APPLICABLE 2020 LRDP EIR MITIGATION MEASURES AND CONTINUING BEST PRACTICES

APPLICABLE 2020 LRDP EIR MITIGATION MEASURES AND CONTINUING BEST PRACTICES

AESTHETICS

Continuing Best Practice AES-1-b: Major new campus projects would continue to be reviewed at each stage of design by the UC Berkeley Design Review Committee. The provisions of the 2020 LRDP, as well as project specific design guidelines prepared for each such project, would guide these reviews.

Continuing Best Practice AES-1-e: UC Berkeley would make informational presentations of all major projects in the City Environs in Berkeley to the Berkeley Planning Commission and, if relevant, the Berkeley Landmarks Commission for comment prior to schematic design review by the UC Berkeley Design Review Committee. Major projects in the City Environs in Oakland would similarly be presented to the Oakland Planning Commission and, if relevant, to the Oakland Landmarks Preservation Advisory Board.

Continuing Best Practice AES-1-f: Each individual project built in the City Environs under the 2020 LRDP would be assessed to determine whether it could pose potential significant aesthetic impacts not anticipated in the 2020 LRDP, and if so, the project would be subject to further evaluation under CEQA.

Continuing Best Practice AES-1-g: To the extent feasible, University housing projects in the 2020 LRDP Housing Zone would not have a greater number of stories nor have setback dimensions less than could be permitted for a project under the relevant city zoning ordinance as of July 2003.

Mitigation Measure AES-3-a: Lighting for new development projects would be designed to include shields and cut-offs that minimize light spillage onto unintended surfaces and minimize atmospheric light pollution. The only exception to this principle would be in those areas where such features would be incompatible with the visual and/or historic character of the area.

Mitigation Measure AES-3-b: As part of the design review procedures described in the above Continuing Best Practices, light and glare would be given specific consideration, and measures incorporated into the project design to minimize both. In general, exterior surfaces would not be reflective: architectural screens and shading devices are preferable to reflective glass.

AIR QUALITY

Continuing Best Practice AIR-4-a: UC Berkeley shall continue to include in all construction contracts the measures specified below to reduce fugitive dust impacts:

- All disturbed areas, including quarry product piles, which are not being actively utilized for construction purposes, shall be effectively stabilized of dust emissions using tarps, water, (non-toxic) chemical stabilizer/suppressant, or vegetative ground cover.
- All on-site unpaved roads and off-site unpaved access roads shall be effectively stabilized of dust emissions using water or (non-toxic) chemical stabilizer/suppressant.

- When quarry product or trash materials are transported off-site, all material shall be covered, or at least two feet of freeboard space from the top of the container shall be maintained.

Mitigation Measure AIR-4-a: In addition, UC Berkeley shall include in all construction contracts the measures specified below to reduce fugitive dust impacts, including but not limited to the following:

- All land clearing, grubbing, scraping, excavation, land leveling, grading, cut and fill, and demolition activities shall be effectively controlled of fugitive dust emissions utilizing application of water or by presoaking.
- When demolishing buildings, water shall be applied to all exterior surfaces of the building for dust suppression.
- All operations shall limit or expeditiously remove the accumulation of mud or dirt from paved areas of construction sites and from adjacent public streets as necessary. See also CBP HYD 1-b.
- Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, said piles shall be effectively stabilized of fugitive dust emissions by utilizing sufficient water or by covering.
- Limit traffic speeds on unpaved roads to 15 mph.
- Water blasting shall be used in lieu of dry sand blasting wherever feasible.
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways from sites with slopes over one percent.
- To the extent feasible, limit area subject to excavation, grading, and other construction activity at any one time.
- Replant vegetation in disturbed areas as quickly as possible.

Continuing Best Practice AIR-4-b: UC Berkeley shall continue to implement the following control measure to reduce emissions of diesel particulate matter and ozone precursors from construction equipment exhaust:

- Minimize idling time when construction equipment is not in use.

Mitigation Measure AIR-4-b: UC Berkeley shall implement the following control measures to reduce emissions of diesel particulate matter and ozone precursors from construction equipment exhaust:

- To the extent that equipment is available and cost effective, UC Berkeley shall require contractors to use alternatives to diesel fuel, retrofit existing engines in construction equipment and employ diesel particulate matter exhaust filtration devices.
- To the extent practicable, manage operation of heavy-duty equipment to reduce emissions, including the use of particulate traps.

Continuing Best Practice AIR-5: UC Berkeley will continue to implement transportation control measures such as supporting voluntary trip-reduction programs, ridesharing, and implementing facilities.

Mitigation Measure AIR-5: UC Berkeley will work with the City of Berkeley, ABAG and BAAQMD to ensure that emissions directly and indirectly associated with the campus are adequately accounted for and mitigated in applicable air quality planning efforts.

BIOLOGICAL RESOURCES

Mitigation Measure BIO-1-a: UC Berkeley will, to the full feasible extent, avoid the disturbance or removal of nests of raptors and other special-status bird species when in active use. A pre-construction nesting survey for loggerhead shrike or raptors, covering a 100 yard perimeter of the project site, would be conducted during the months of March through July prior to commencement of any project that may impact suitable nesting habitat on the Campus Park and Hill Campus. The survey would be conducted by a qualified biologist no more than 30 days prior to initiation of disturbance to potential nesting habitat. In the Hill Campus, surveys would be conducted for new construction projects involving removal of trees and other natural vegetation. In the Campus Park, surveys would be conducted for construction projects involving removal of mature trees within 100 feet of a Natural Area, Strawberry Creek, and the Hill Campus. If any of these species are found within the survey area, grading and construction in the area would not commence, or would continue only after the nests are protected by an adequate setback approved by a qualified biologist. To the full feasible extent, the nest location would be preserved, and alteration would only be allowed if a qualified biologist verifies that birds have either not begun egg-laying and incubation, or that the juveniles from those nests are foraging independently and capable of survival. A pre-construction survey is not required if construction activities commence during the non-nesting season (August through February).

Mitigation Measure BIO-1-b: UC Berkeley will, to the full feasible extent, avoid the remote potential for direct mortality of special-status bats and destruction of maternal roosts. A pre-construction roosting survey for special-status bat species, covering the project site and any affected buildings, would be conducted during the months of March through August prior to commencement of any project that may impact suitable maternal roosting habitat on the Campus Park and Hill Campus. The survey would be conducted by a qualified biologist no more than 30 days prior to initiation of disturbance to potential roosting habitat. In the Hill Campus, surveys would be conducted for new construction projects prior to grading, vegetation removal, and remodel or demolition of buildings with isolated attics and other suitable roosting habitat. In the Campus Park, surveys would be conducted for construction projects prior to remodel or demolition of buildings with isolated attics. If any maternal roosts are detected during the months of March through August, construction activities would not commence, or would continue only after the roost is protected by an adequate setback approved by a qualified biologist. To the full feasible extent, the maternal roost location would be preserved, and alteration would only be allowed if a qualified biologist verifies that bats have completed rearing young, that the juveniles are foraging independently and capable of survival, and bats have been subsequently passively excluded from the roost location. A pre-construction survey is not required if construction activities commence outside the maternal roosting season (September through February).

Continuing Best Practice BIO-1-a: UC Berkeley will continue to implement the Campus Specimen Tree Program to reduce adverse effects to specimen trees and flora. Replacement landscaping will be provided where specimen resources are adversely affected, either through salvage and relocation of existing trees and shrubs or through new plantings of the same genetic strain, as directed by the Campus Landscape Architect.

CLIMATE CHANGE

Continuing Best Practice CLI-1 : UC Berkeley would continue to implement provisions of the UC Policy on Sustainable Practices including, but not limited to: Green Building Design; Clean Energy Standards; Climate Protection Practices; Sustainable Transportation Practices; Sustainable Operations; Recycling and Waste Management; and Environmentally Preferable Purchasing Practices.

Continuing Best Practice CLI-2 : UC Berkeley would continue to implement energy conservation measures (such as energy-efficient lighting and microprocessor-controlled HVAC equipment) to reduce the demand for electricity and natural gas. The energy conservation measures may be subject to modification as new technologies are developed or if current technologies become obsolete through replacement.

Continuing Best Practice CLI-3: UC Berkeley would continue to annually monitor and report upon its progress toward its greenhouse gas emission targets. UC Berkeley would continue to report actions undertaken in the past year, and update its climate action plan annually to specify actions that UC Berkeley is planning to undertake in the current year and future years to achieve emission targets.

CULTURAL RESOURCES

Continuing Best Practice CUL-1: In the event that paleontological resource evidence or a unique geological feature is identified during project planning or construction, the work would stop immediately and the find would be protected until its significance can be determined by a qualified paleontologist or geologist. If the resource is determined to be a 'unique resource,' a mitigation plan would be formulated and implemented to appropriately protect the significance of the resource by preservation, documentation, and/or removal, prior to recommencing activities.

Continuing Best Practice CUL-2-a: If a project could cause a substantial adverse change in features that convey the significance of a primary or secondary resource, an Historic Structures Assessment (HSA) would be prepared. Recommendations of the HSA made in accordance with the Secretary of the Interior's Standards would be implemented, in consultation with the UC Berkeley Design Review Committee and the State Historic Preservation Office, such that the integrity of the significant resource is preserved and protected. Copies of all reports would be filed in the University Archives/Bancroft Library.

Continuing Best Practice CUL-2-b: UC Berkeley would make informational presentations of all major projects in the City Environs in Berkeley to the Berkeley Planning Commission and, if relevant, the Berkeley Landmarks Commission for comment prior to schematic design review by the UC Berkeley Design Review Committee. Major projects in the City Environs in Oakland would similarly be presented to the Oakland Planning Commission and, if relevant, to the Oakland Landmarks Preservation Advisory Board.

Mitigation Measure CUL-3: If, in furtherance of the educational mission of the University, a project would require the demolition of a primary or secondary resource, or the alteration of such a resource in a manner not in conformance with the Secretary of the Interior's Standards, the resource would be recorded to archival standards prior to its demolition or alteration.

Continuing Best Practice CUL-4-a: In the event resources are determined to be present at a project site, the following actions would be implemented as appropriate to the resource and the proposed disturbance:

- UC Berkeley shall retain a qualified archaeologist to conduct a subsurface investigation of the project site, to ascertain the extent of the deposit of any buried archaeological materials relative to the project's area of potential effects. The archaeologist would prepare a site record and file it with the California Historical Resource Information System.
- If the resource extends into the project's area of potential effects, the resource would be evaluated by a qualified archaeologist. UC Berkeley as lead agency would consider this evaluation in determining whether the resource qualifies as a historical resource or a unique archaeological resource under the criteria of CEQA Guidelines section 15064.5. If the resource does not qualify, or if no resource is present within the project area of potential effects, this would be noted in the environmental document and no further mitigation is required unless there is a discovery during construction (see below).
- If a resource within the project area of potential effect is determined to qualify as an historical resource or a unique archaeological resource in accordance with CEQA, UC Berkeley shall consult with a qualified archaeologist to mitigate the effect through data recovery if appropriate to the resource, or to consider means of avoiding or reducing ground disturbance within the site boundaries, including minor modifications of building footprint, landscape modification, the placement of protective fill, the establishment of a preservation easement, or other means that would permit avoidance or substantial preservation in place of the resource. If further data recovery, avoidance or substantial preservation in place is not feasible, UC Berkeley shall implement LRDP Mitigation Measure CUL-5, outlined below.
- A written report of the results of investigations would be prepared by a qualified archaeologist and filed with the University Archives/ Bancroft Library and the Northwest Information Center.

Mitigation Measure CUL-4-b: If a resource is discovered during construction (whether or not an archaeologist is present), all soil disturbing work within 35 feet of the find shall cease. UC Berkeley shall contact a qualified archaeologist to provide and implement a plan for survey, subsurface investigation as needed to define the deposit, and assessment of the remainder of the site within the project area to determine whether the resource is significant and would be affected by the project, as outlined in Continuing Best Practice CUL-3-a. UC Berkeley would implement the recommendations of the archaeologist.

Continuing Best Practice CUL-4-b: In the event human or suspected human remains are discovered, UC Berkeley would notify the County Coroner who would determine whether the remains are subject to his or her authority. The Coroner would notify the Native American Heritage Commission if the remains are Native American. UC Berkeley would comply with the provisions of Public Resources Code Section 5097.98 and CEQA Guidelines Section 15064.5(d) regarding identification and involvement of the Native American Most Likely Descendant and with the provisions of the California Native American Graves Protection and Repatriation Act to ensure that the remains and any associated artifacts recovered are repatriated to the appropriate group, if requested.

Continuing Best Practice CUL-4-c: Prior to disturbing the soil, contractors shall be notified that they are required to watch for potential archaeological sites and artifacts and to notify UC Berkeley if any are found. In the event of a find, UC Berkeley shall implement LRDP Mitigation Measure CUL-4-b.

Mitigation Measure CUL-5: If, in furtherance of the educational mission of the University, a project would require damage to or demolition of a significant archaeological resource, a qualified archaeologist shall, in consultation with UC Berkeley:

- Prepare a research design and archaeological data recovery plan that would attempt to capture those categories of data for which the site is significant, and implement the data recovery plan prior to or during development of the site.
- Perform appropriate technical analyses, prepare a full written report and file it with the appropriate information center, and provide for the permanent curation of recovered materials.

GEOLOGY, SEISMICITY AND SOILS

Continuing Best Practice GEO-1-a: UC Berkeley will continue to comply with the California Building Code and the *University Policy on Seismic Safety*.

Continuing Best Practice GEO-1-b: Site-specific geotechnical studies will be conducted under the supervision of a California Registered Engineering Geologist or licensed geotechnical engineer and UC Berkeley will incorporate recommendations for geotechnical hazard prevention and abatement into project design.

Continuing Best Practice GEO-1-c: The Seismic Review Committee (SRC) shall continue to review all seismic and structural engineering design for new and renovated existing buildings on campus and ensure that it conforms to the California Building Code and the *University Policy on Seismic Safety*.

Continuing Best Practice GEO-1-d: UC Berkeley shall continue to use site-specific seismic ground motion specifications developed for analysis and design of campus projects. The information provides much greater detail than conventional codes and is used for performance-based analyses.

Continuing Best Practice GEO-1-g: As stipulated in the *University Policy on Seismic Safety*, the design parameters for specific site peak acceleration and structural reinforcement will be determined by the geotechnical and structural engineer for each new or rehabilitation project proposed under the 2020

LRDP. The acceptable level of actual damage that could be sustained by specific structures would be calculated based on geotechnical information obtained at the specific building site.

Continuing Best Practice GEO-1-i: The site-specific geotechnical studies conducted under GEO-1-b will include an assessment of landslide hazard, including seismic vibration and other factors contributing to slope stability.

Continuing Best Practice GEO-2: Campus construction projects with potential to cause erosion or sediment loss, or discharge of other pollutants, would include the campus Stormwater Pollution Prevention Specification. This specification includes by reference the "Manual of Standards for Erosion and Sediment Control" of the Association of Bay Area Governments and requires that each large and exterior project develop an Erosion Control Plan.

HAZARDOUS MATERIALS

Continuing Best Practice HAZ-4: UC Berkeley shall continue to perform site histories and due diligence assessments of all sites where ground-disturbing construction is proposed, to assess the potential for soil and groundwater contamination resulting from past or current site land uses at the site or in the vicinity. The investigation will include review of regulatory records, historical maps and other historical documents, and inspection of current site conditions. UC Berkeley would act to protect the health and safety of workers or others potentially exposed should hazardous site conditions be found.

Continuing Best Practice HAZ-5: UC Berkeley shall continue to perform hazardous materials surveys prior to capital projects in existing campus buildings. The campus shall continue to comply with federal, state, and local regulations governing the abatement and handling of hazardous building materials and each project shall address this requirement in all construction.

HYDROLOGY AND WATER QUALITY

Continuing Best Practices HYD-1-a: During the plan check review process and construction phase monitoring, UC Berkeley (EH&S) will verify that the proposed project complies with all applicable requirements and BMPs.

Continuing Best Practice HYD-1-b: UC Berkeley shall continue implementing an urban runoff management program containing BMPs as published in the Strawberry Creek Management Plan, and as developed through the campus municipal Stormwater Management Plan (SWMP) completed for its pending Phase II MS4 NPDES permit. UC Berkeley will continue to comply with the NPDES stormwater permitting requirements by implementing construction and post construction control measures and BMPs required by project-specific SWPPPs and, upon its approval, by the Phase II SWMP to control pollution. SWPPPs would be prepared as required by the appropriate regulatory agencies including the Regional Water Quality Control Board and where applicable, according to the UC Berkeley Stormwater Pollution Prevention Specification to prevent discharge of pollutants and to minimize sedimentation resulting from construction and the transport of soils by construction vehicles.

Continuing Best Practice HYD-2-a: In addition to Hydrology Continuing Best Practices 1-a and 1-b above, UC Berkeley will continue to review each development project, to determine whether project runoff would increase pollutant loading. If it is determined that pollutant loading could lead to a violation of the Basin Plan, UC Berkeley would design and implement the necessary improvements to treat stormwater. Such improvements could include grassy swales, detention ponds, continuous centrifugal system units, catch basin oil filters, disconnected downspouts and stormwater planter boxes.

Continuing Best Practice HYD-2-b: Where feasible, parking would be built in covered parking structures and not exposed to rain to address potential stormwater runoff pollutant loads. See also HYD-2-a.

Continuing Best Practice HYD-2-c: Landscaped areas of development sites shall be designed to absorb runoff from rooftops and walkways. The Campus Landscape Architect shall ensure open or porous paving systems be included in project designs wherever feasible, to minimize impervious surfaces and absorb runoff.

Continuing Best Practice HYD-3: In addition to Best Practices 1-a, 1-b, 2-a and 2-c above, UC Berkeley will continue to review each development project, to determine whether rainwater infiltration to groundwater is affected. If it is determined that existing infiltration rates would be adversely affected, UC Berkeley would design and implement the necessary improvements to retain and infiltrate stormwater. Such improvements could include retention basins to collect and retain runoff, grassy swales, infiltration galleries, planter boxes, permeable pavement, or other retention methods. The goal of the improvement should be to ensure that there is no net decrease in the amount of water recharged to groundwater that serves as freshwater replenishment to Strawberry Creek. The improvement should maintain the volume of flows and times of concentration from any given site at pre-development conditions.

Continuing Best Practice HYD-4-a: In addition to Hydrology Continuing Best Practices 1-a, 1-b, and 2-c, the campus storm drain system would be maintained and cleaned to accommodate existing runoff.

Continuing Best Practice HYD-4-b: For 2020 LRDP projects in the City Environs (excluding the Campus Park or Hill Campus) improvements would be coordinated with the City Public Works Department.

Continuing Best Practice HYD-4-e: UC Berkeley shall continue to manage runoff into storm drain systems such that the aggregate effect of projects implementing the 2020 LRDP is no net increase in runoff over existing conditions.

LAND USE

Continuing Best Practice LU-2-b: UC Berkeley would make informational presentations of all major projects in the City Environs in Berkeley to the Berkeley Planning Commission and, if relevant, the Berkeley Landmarks Preservation Commission for comment prior to schematic design review by the

UC Berkeley Design Review Committee. Major projects in the City Environs in Oakland would similarly be presented to the Oakland Planning Commission and, if relevant, to the Oakland Landmarks Preservation Advisory Board. Whenever a project in the City Environs is under consideration by the UC Berkeley DRC, a staff representative designated by the city in which it is located would be invited to attend and comment on the project.

Continuing Best Practice LU-2-c: Each individual project built in the Hill Campus or the City Environs under the 2020 LRDP would be assessed to determine whether it could pose potential significant land use impacts not anticipated in the 2020 LRDP, and if so, the project would be subject to further evaluation under CEQA. In general, a project in the Hill Campus or the City Environs would be assumed to have the potential for significant land use impacts if it:

- Includes a use that is not permitted within the city general plan designation for the project site, or
- Has a greater number of stories and/or lesser setback dimensions than could be permitted for a project under the relevant city zoning ordinance as of July 2003.

NOISE

Continuing Best Practice NOI-2: Mechanical equipment selection and building design shielding would be used, as appropriate, so that noise levels from future building operations would not exceed the City of Berkeley Noise Ordinance limits for commercial areas or residential zones as measured on any commercial or residential property in the area surrounding a project proposed to implement the 2020 LRDP. Controls that would typically be incorporated to attain this outcome include selection of quiet equipment, sound attenuators on fans, sound attenuator packages for cooling towers and emergency generators, acoustical screen walls, and equipment enclosures.

Mitigation Measure NOI-3: The University would comply with building standards that reduce noise impacts to residents of University housing to the full feasible extent; additionally, any housing built in areas where noise exposure levels exceed 60 Ldn would incorporate design features to minimize noise exposures to occupants.

Continuing Best Practice NOI-4-a: The following measures would be included in all construction projects:

- Construction activities will be limited to a schedule that minimizes disruption to uses surrounding the project site as much as possible. Construction outside the Campus Park area will be scheduled within the allowable construction hours designated in the noise ordinance of the local jurisdiction to the full feasible extent, and exceptions will be avoided except where necessary.
- As feasible, construction equipment will be required to be muffled or controlled.
- The intensity of potential noise sources will be reduced where feasible by selection of quieter equipment (e.g. gas or electric equipment instead of diesel powered, low noise air compressors).
- Functions such as concrete mixing and equipment repair will be performed off-site whenever possible.

For projects requiring pile driving:

- With approval of the project structural engineer, pile holes will be pre-drilled to minimize the number of impacts necessary to seat the pile.
- Pile driving will be scheduled to have the least impact on nearby sensitive receptors.
- Pile drivers with the best available noise control technology will be used. For example, pile driving noise control may be achieved by shrouding the pile hammer point of impact, by placing resilient padding directly on top of the pile cap, and/or by reducing exhaust noise with a sound-absorbing muffler.
- Alternatives to impact hammers, such as oscillating or rotating pile installation systems, will be used where possible.

Continuing Best Practice NOI-4-b: UC Berkeley would continue to precede all new construction projects with community outreach and notification, with the purpose of ensuring that the mutual needs of the particular construction project and of those impacted by construction noise are met, to the extent feasible.

Mitigation Measure NOI-4: UC Berkeley will develop a comprehensive construction noise control specification to implement additional noise controls, such as noise attenuation barriers, siting of construction laydown and vehicle staging areas, and the measures outlined in Continuing Best Practice NOI-4-a as appropriate to specific projects. The specification will include such information as general provisions, definitions, submittal requirements, construction limitations, requirements for noise and vibration monitoring and control plans, noise control materials and methods. This documentation will be modified as appropriate for a particular construction project and included within the construction specification.

Mitigation Measure NOI-5: The following measures will be implemented to mitigate construction vibration:

- UC Berkeley will conduct a pre-construction survey prior to the start of pile driving. The survey will address susceptibility ratings of structures, proximity of sensitive receivers and equipment/ operations, and surrounding soil conditions. This survey will document existing conditions as a baseline for determining changes subsequent to pile driving.
- UC Berkeley will establish a vibration checklist for determining whether or not vibration is an issue for a particular project.
- Prior to conducting vibration-causing construction, UC Berkeley will evaluate whether alternative methods are available, such as:
- Using an alternative to impact pile driving such as vibratory pile drivers or oscillating or rotating pile installation methods.
- Jetting or partial jetting of piles into place using a water injection at the tip of the pile.
- If vibration monitoring is deemed necessary, the number, type, and location of vibration sensors would be determined by UC Berkeley.

PUBLIC SERVICES

Continuing Best Practice PUB-1.1: UCPD would continue its partnership with the City of Berkeley police department to review service levels in the City Environs.

Continuing Best Practice PUB-2.1-a: UC Berkeley would continue to comply with Title 19 of the California Code of Regulations, which mandates firebreaks of up to 100 feet around buildings or structures in, upon or adjoining any mountainous, forested, brush- or grass-covered lands.

Continuing Best Practice PUB-2.1-b: UC Berkeley would continue on-going implementation of the Hill Area Fuel Management Program.

Continuing Best Practice PUB-2.1-c: UC Berkeley would continue to plan and implement programs to reduce risk of wildland fires, including plan review and construction inspection programs that ensure that campus projects incorporate fire prevention measures.

Continuing Best Practice PUB-2.3: UC Berkeley would continue its partnership with LBNL, ACFD, and the City of Berkeley to ensure adequate fire and emergency service levels to the campus and UC facilities. This partnership shall include consultation on the adequacy of emergency access routes to all new University buildings.

Mitigation Measure PUB-2.4-a: In order to ensure adequate access for emergency vehicles when construction projects would result in temporary lane or roadway closures, campus project management staff would consult with the UCPD, campus EH&S, the BFD and ACFD to evaluate alternative travel routes and temporary lane or roadway closures prior to the start of construction activity. UC Berkeley will ensure the selected alternative travel routes are not impeded by UC Berkeley activities.

Mitigation Measure PUB-2.4-b: To the extent feasible, the University would maintain at least one unobstructed lane in both directions on campus roadways at all times, including during construction. At any time only a single lane is available due to construction-related road closures, the University would provide a temporary traffic signal, signal carriers (i.e. flagpersons), or other appropriate traffic controls to allow travel in both directions. If construction activities require the complete closure of a roadway, UC Berkeley would provide signage indicating alternative routes. In the case of Centennial Drive, any complete road closure would be limited to brief interruptions of traffic required by construction operations.

Continuing Best Practice PUB-2.4: To the extent feasible, for all projects in the City Environs, the University would include the undergrounding of surface utilities along project street frontages, in support of Berkeley General Plan Policy S-22.

TRANSPORTATION AND TRAFFIC

Continuing Best Practice TRA-1-b: UC Berkeley will continue to do strategic bicycle access planning. Issues addressed include bicycle access, circulation and amenities with the goal of increasing bicycle commuting and safety. Planning considers issues such as bicycle access to the campus from adjacent streets and public transit; bicycle, vehicle, and pedestrian interaction; bicycle parking; bicycle safety; incentive programs; education and enforcement; campus bicycle routes; and amenities such as showers.

Continuing Best Practice TRA-2: The following housing and transportation policies will be continued:

- Except for disabled students, students living in UC Berkeley housing would only be eligible for a daytime student fee lot permit or residence hall parking based upon demonstrated need, which could include medical, employment, academic or other criteria.
- An educational and informational program for students on commute alternatives would be expanded to include all new housing sites.

Mitigation Measure TRA-2: The planned parking supply for University housing projects under the 2020 LRDP would comply with the relevant municipal zoning ordinance as of July 2003. Where the planned parking supply included in a University housing project would make it ineligible for approval under the subject ordinance, UC Berkeley would conduct further review of parking demand and supply in accordance with CEQA.

Continuing Best Practice TRA-3-a: Early in construction period planning UC Berkeley shall meet with the contractor for each construction project to describe and establish best practices for reducing construction-period impacts on circulation and parking in the vicinity of the project site.

Continuing Best Practice TRA-3-b: For each construction project, UC Berkeley will require the prime contractor to prepare a Construction Traffic Management Plan which will include the following elements:

- Proposed truck routes to be used, consistent with the City truck route map.
- Construction hours, including limits on the number of truck trips during the a.m. and p.m. peak traffic periods (7:00 – 9:00 a.m. and 4:00 – 6:00 p.m.), if conditions demonstrate the need.
- Proposed employee parking plan (number of spaces and planned locations).
- Proposed construction equipment and materials staging areas, demonstrating minimal conflicts with circulation patterns.
- Expected traffic detours needed, planned duration of each, and traffic control plans for each.

Continuing Best Practice TRA-3-c: UC Berkeley will manage project schedules to minimize the overlap of excavation or other heavy truck activity periods that have the potential to combine impacts on traffic loads and street system capacity, to the extent feasible.

Continuing Best Practice TRA-5: The University shall continue to work to coordinate local transit services as new academic buildings, parking facilities, and campus housing are completed, in order to accommodate changing demand locations or added demand.

Continuing Best Practice PUB-2.3: UC Berkeley would continue its partnership with LBNL, ACFD, and the City of Berkeley to ensure adequate fire and emergency service levels to the campus and UC facilities. This partnership shall include consultation on the adequacy of emergency access routes to all new University buildings.

UTILITIES AND SERVICE SYSTEMS

Continuing Best Practice USS-1.1: For campus development that increases water demand, UC Berkeley would continue to evaluate the size of existing distribution lines as well as pressure of the specific feed affected by development on a project-by-project basis, and necessary improvements would be incorporated into the scope of work for each project to maintain current service and performance levels. The design of the water distribution system, including fire flow, for new buildings would be coordinated among UC Berkeley staff, EBMUD, and the Berkeley Fire Department.

Continuing Best Practice USS-2.1-a: UC Berkeley will promote and expand the central energy management system (EMS), to tie building water meters into the system for flow monitoring.

Continuing Best Practice USS-2.1-b: UC Berkeley will analyze water and sewer systems on a project-by-project basis to determine specific capacity considerations in the planning of any project proposed 2020 under the LRDP.

Continuing Best Practice USS-2.1-c: UC Berkeley will continue and expand programs retrofitting plumbing in high-occupancy buildings and seek funding for these programs from EBMUD or other outside agencies as appropriate.

Continuing Best Practice USS-2.1-d: UC Berkeley will continue to incorporate specific water conservation measures into project design to reduce water consumption and wastewater generation. This could include the use of special air-flow aerators, water-saving shower heads, flush cycle reducers, low-volume toilets, weather based or evapotranspiration irrigation controllers, drip irrigation systems, the use of drought resistant plantings in landscaped areas, and collaboration with EBMUD to explore suitable uses of recycled water.

Continuing Best Practice USS-3.1: UC Berkeley shall continue to manage runoff into storm drain systems such that the aggregate effect of projects implementing the 2020 LRDP is no net increase in runoff over existing conditions.

Continuing Best Practice USS-3.2: In addition to Best Practice USS-3.1, projects proposed with potential to alter drainage patterns in the Hill Campus would be accompanied by a hydrologic modification analysis, and would incorporate a plan to prevent increases of flow from the project site, preventing downstream flooding and substantial siltation and erosion.

Continuing Best Practice USS-5.1: UC Berkeley would continue to implement a solid waste reduction and recycling program designed to reduce the total quantity of campus solid waste that is disposed of in landfills during implementation of the 2020 LRDP.

Continuing Best Practice USS-5.2: In accordance with the Regents-adopted green building policy and the policies of the 2020 LRDP, the University would develop a method to quantify solid waste diversion. Contractors working for the University would be required under their contracts to report their solid waste diversion according to the University’s waste management reporting requirements.

Mitigation Measure USS-5.2: Contractors on future UC Berkeley projects implemented under the 2020 LRDP will be required to recycle or salvage at least 50% of construction, demolition, or land clearing waste. Calculations may be done by weight or volume but must be consistent throughout.

APPENDIX I

CUMULATIVE PROJECTS LIST

University's Cumulative Project List for Upper Hearst Development for the Goldman School of Public Policy SEIR:

Section 15130 of the CEQA Guidelines suggest that the following elements are necessary to an adequate discussion of significant cumulative impacts: Either

> (A) A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency, or
> (B) a summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or area wide conditions contributing to the cumulative impact. Any such planning document shall be referenced and made available to the public at a location specified by the Lead Agency.

A list of projects that are currently approved, under construction, proposed, or foreseeable follows.

I. LIST OF FORESEEABLE PROJECTS AS OF FEBRUARY 2019:

PROJECTS CURRENTLY APPROVED OR UNDER CONSTRUCTION – UC BERKELEY CAMPUS

Hearst Greek Theatre Upper Lawn Renovation

Located above Piedmont Avenue in the Adjacent Blocks North City Environs, the project is to lower the grade of the lawn area to make it more comfortable for patrons. The project also includes an improved loading dock on the south side of the facility and upgrades to the electrical system.

Hearst Greek Theatre North Restroom Facility

There is also a separate project at the Greek Theatre to construct a new two-story building with a total of 46 restroom stalls that will be up to 7,000 GSF. The project will include a connection plaza, as well as improved concessions and is slated to open in October 2018.

Tolman Hall Demolition

Tolman Hall, built in 1962 and designed by Gardner Dailey, is located within the northwestern edge of the campus and is one of the largest academic buildings on campus and is seismically deficient. Tolman Hall, 8 stories tall and having 247,000 GSF, is scheduled to be demolished starting in October of this year with hard demolition starting spring 2019. Demolition will last up to one year. The building is currently vacant.

Anna Head Complex Buildings B, C and D Facade Improvements
The Anna Head Complex, comprising six buildings, listed in the National Register of Historic Places, occupies the east portion of the property bordered by Bowditch Street, Channing Way and Haste Street within the City of Berkeley. The project would focus on roof replacements and walkway coverings to minimize water intrusion.

2223 Fulton Street Demolition
The project would demolish the building built in 1929 located at the southwest corner of the campus adjacent to Edwards Stadium. The building is 51,814 GSF and has a 'V' seismic rating (poor) and obsolete building systems. The building is currently vacant. Landscaping will temporarily replace the building until the campus determines the best use of the site.   The project will occur in 2018 through January 2019.

Giannini Hall Seismic Corrections
This 68,702 GSF building, which is occupied by the College of Natural Resources and classrooms, has a poor seismic rating. The building was built in 1930 and is listed in the National Register of Historic Places. The project would reinforce Giannini Hall to improve seismic resistance and is scheduled to begin October 2018 and be completed by June 2020.

Proposed or Foreseeable Projects - UCB:

Centennial Bridge Replacement
The project involves replacement of the Centennial Bridge located at the intersection of Centennial Road and Lawrence Road in the Hill Campus. Bridge replacement options include: a) at-grade bridge, b) at-grade intersection and c) a relocated short bridge, among others. The existing bridge has notable landslide-related damage that must be repaired.

Woo Hon Fai/BioEnginuity Hub
A donor development project would seismically retrofit and renovate Woo Hon Fai Hall, located at 2626 Bancroft Way in the City of Berkeley (the former Berkeley Art Museum) as a full-service life science incubator. The building has a 'V' seismic rating (poor). Once renovated, the building will provide wet laboratory and collaborative space and include a 6,600 square foot single-story building office addition.

The building has not been occupied since 2015 and is currently used by the University as storage. Per UC Berkeley building records, the building is 102,794 GSF (58,544 assignable square feet). Woo Hon Fai Hall is a 46-year old building listed in the National Register of Historic Places.

Housing Projects

The University has identified several potential housing locations near campus in traditional residence halls and apartment buildings for students and faculty. Potential housing sites include:

- Channing Ellsworth: located south of campus, this includes a residence hall or apartments with 200-400 beds.
- Oxford Tract: located north of campus, this includes a residence hall or apartment with 1,000-3,000 beds.
- Bancroft and Oxford: located immediately south of campus, this includes 100-200 apartments.
- Unit 3 Densification: located south of campus, this includes adding 650-900 beds to the existing residence hall.
- People’s Park: located south of campus, this includes a residence hall with up to 1,000 beds, as well as a transitional housing component operated by a non-profit, with approximately 100 beds.
- Albany Village: located off campus in Albany, this includes 150-200 apartments.
- Smyth-Fernwald: located adjacent to the Clark Kerr Campus, this involves developing this mostly vacant site with 200-250 apartments.

Minor Hall Optometry Clinic Expansion

The School of Optometry is located in the southwest quadrant of the main campus and consists of Minor Hall, built in 1941 and Minor Hall Addition, added in 1978. The School of Optometry proposes to expand its academic, clinic and circulation space from its current total of 98,100 GSF to approximately 135,800 GSF, an expansion of 37,700 GSF. The proposed expansion would be located immediately north and adjacent to the existing two School of Optometry buildings.

Beach Volleyball Facility

The proposed project would relocate the existing beach volleyball courts on the Clark Kerr Campus to another location on the CKC: the softball field near the intersection of Sports Lane and Dwight Way. The project includes four sand volleyball courts, as well as a locker room building, restrooms, scoreboard and lighting. The new facility would include lawn for spectators. Beach volleyball currently has two courts on CKC.

Levine Fricke Softball Field Replacement

The proposed project involves complete demolition and re-orientation of the existing softball field and its support facilities located in the Hill Campus along Centennial Drive. The proposed project would expand the capacity of the field from about 300 seats to 1,500 permanent seats. The project also includes covered batting cages, locker rooms, video board, restrooms, field lighting and an elevated press box.

Moffitt Undergraduate Library Renovation Phase 2

The project would renovate the interior of the lower three levels of the library located near the center of campus.

Seismic Correction Projects

UC Office of the President has determined that on all UC campuses, including Berkeley, buildings that have a seismic performance rating of V (poor) or worse, the affected campus must develop a prioritization plan that is included annually within the 10-year Capital Financial Plan. The UC Berkeley campus has about 70 seismically deficient buildings. UCOP has stated that all facilities with a seismic performance rating of V or VI cannot be occupied beyond December 31, 2030. The following projects have been identified related to seismic corrections, and there will be other projects as well in the next 10+ years:

- University Hall Seismic Corrections: located on Oxford Street across from the western edge of the campus, this project includes minor upgrades to the building to make it seismically stable.
- Hearst Memorial Gymnasium Seismic Improvements: this project would retrofit the seismically deficient two-story Hearst Memorial Gymnasium building listed in the National Register of Historic Places. The building built in 1926, is located on the southern edge of the campus along Bancroft Way, neighboring Barrows Hall to the northwest. It contains large and small gyms and three swimming pools including an outdoor pool and houses instructional space.
- Evans Hall Seismic Remediation or Replacement: the Campus is evaluating a seismic renovation of Evans Hall or demolishing it and building a replacement facility. Sites considered for a replacement facility include Hearst Field Annex, the Tolman Hall site, Dwinelle Parking Lot, and North Field. Evans Hall, 12-stories tall, was built in 1971 and is located north of the Campanile. The building houses departments of Economics, Mathematics and Statistics and is campus's highest remaining seismic priority and one of the campus's most intensively used buildings, with classroom space highly utilized.
    - An Academic and Classroom Building for surge space will need to be associated with the demolition of Evans Hall. While no location has been identified the surge building would include theoretically 135,000 GSF of

swing space (it would also accommodate other renovation/replacement projects).
- 2111 Bancroft Street (Banway Building) Demolition: located on Bancroft Street, west of campus, this project would demolish this seismically deficient building.

Vegetation Management Projects

The University was awarded a Fire Prevention Grant from the California Department of Forestry and Fire Protection (Cal Fire) to conduct vegetation management activities in 250 acres in the Hill Campus. Activities would reduce wildfire hazard and potential damage to habitable structures, as well as life safety for more than 3,000 residents.

Projects Currently Under Construction - LBNL

IGB construction/operation (Integrative Genomics Building)

This is a 77,000 GSF, 4-story, 333-occupant (mostly existing, though currently located off-site, staff) lab (research and academic use) building that will be completed in 2019 or 2020. The project is located in the Bayview lot area, which is in the interior of the Lab and the site of the former "Bevatron" accelerator facility in the geographic interior of the Berkeley Lab. http://www.lbl.gov/community/integrative-genomics-building/

"Old Town" Demolition

Several buildings that comprise the Lab's "Old Town" area have been, or are in the process of, being demolished and removed, specifically Buildings 4, 5, 7, 7C, 14, 16 and 16A. These buildings are located adjacent to Segre Road in LBNL and between Segre and McMillan Roads. There is legacy contamination in old building materials and underlying soils that require characterization and remediation. This process has been underway for some years and is expected to continue for several more years. See table below listing buildings, GSF, footprint and demolition dates/planned dated.

Bldg #	Description	Gross FT²	Footprint FT²	Demo Date
5	Ion Beam and AFRD Research	7,176	6,515	2015
16	Ion Beam & Mag Fusion Research	11,808	11,808	2015
16A	Building 16 Equipment Annex	339	339	2015

4	ALS Support Facility / Offices	10,176	4,924	2019
14	Earth Sciences and ES&H	4,201	4,201	2019
7	ALS shipping and receiving	21,435	10,718	2020
7C	Building 7 Admin Annex	480	480	2020
Note: The following above-slab building structures were removed during previous efforts; however the floor slabs were removed during the recent Old Town Project on dates shown				
40	Ex-Dry Lab, Assembly & Storage Building slab	0	993	2016
41	Ex-offices & Communication Lab slab	0	995	2016
52	Ex-General Research and Shop Facility	0	6,425	2017
52A	Ex-General Storage Facility	0	516	2017

Notable approved projects, not yet underway:

NERSC-9 (National Energy Research Scientific Computing Center)
This is a new supercomputing system that will be emplaced in the existing Computational Research and Theory (CRT) Building along with some minor building upgrades. NERSC-9 will replace the older NERSC-7 system (while NERSC-8 continues to operate in tandem) and will require a substantial increase in electrical power (triggering an updated GHG analysis) and cooling water over the older system. Construction period is anticipated to be 2019-2021. Construction impacts and deliveries will be relatively minor. The CRT building, aka Wang Hall, is the relatively new 140,000-GSF structure that sits at the Lab's main entrance on Cyclotron Road.
http://www.lbl.gov/community/nersc-9-project/

LBNL Proposed or Foreseeable Projects:

ALS-U (Advanced Light Source -- upgrade)

The "Advanced Light Source" accelerator (housed in the iconic domed building visible from UC Berkeley campus) will be shut down for upgrades. The building is located between Segre and Lawrence Roads. The project will involve taking out old parts and swapping in new parts. On- and (possibly) off-site staging space will be needed. Some slightly activated and/or hazardous material from the current accelerator would need to be processed and then transported out for disposal (at an appropriate facility). Construction will occur between 2021 and 2025.

Hazardous Waste Handling Facility (HWHF) Permit Renewal

Currently LBNL is applying to the Department of Toxic Substances Control (DTSC) for a renewed permit to continue its current HWHF operations. LBNL is completing an (internal draft) Addendum to its original HWHF EIR. DTSC will stage its own public process (featuring the Addendum, as well as its own documentation) per its own CEQA and noticing procedures. This project should have no environmental impacts or changes, but could generate possible controversy as the HWHF has had the attention of local activist groups in the more distant past.

BioEPIC construction/operation

This is a building similar to Integrative Genomics Building (IGB) around 70,000-80,000 GSF, 230 occupants, most already on site and would be situated adjacent to it in the Bayview lot. Construction is likely to begin around 2021 -- 2023. LBNL is beginning a CEQA process and envisions a straight-to-findings CEQA approach that relies on its existing LRDP EIR. A NEPA Categorical Exclusion is likely.

City of Berkeley Public Works Improvements

The City has on-going public works improvement programs, including storm drain and paving. See City scheduled construction activities, regularly updated, here: https://www.cityofberkeley.info/pw/

City of Berkeley Projects

Project address	Status	Use	Dwelling units	Commercial area (sq. Ft.)	Building/ height
2012 Berkeley Way	approved	residential/temporary housing/support services	142	-	6 stories (65 ft.)
1601 Oxford Street	approved	residential	37	-	5 stories (52 ft.)
2072 Addison Street	approved	residential/commercial	66	1,425	7 stories (75 ft.)
2129 Shattuck Avenue	under construction	commercial	-	251,579	16 stories (168 ft.)

Source: City of Berkeley, January 2019