UNIVERSITY OF CALIFORNIA SANTA CRUZ

East Campus Infill Project

FINAL

ENVIRONMENTAL IMPACT REPORT

SCH# 2008092089

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INTRODUCTION

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INTRODUCTION

This document is a project-level Environmental Impact Report (EIR) for the proposed East Campus Infill Housing Project ("ECI Project"). The proposed ECI Project consists of the construction of a new housing complex in the central area of UC Santa Cruz campus near Crown and Merrill Colleges, which would include two seven- to eight-story apartment buildings, and outdoor community spaces and service facilities. The facility would provide on-campus housing for approximately 600 UC Santa Cruz students in approximately 100 apartment-style units, and would require a staff of about 10 professional employees, two of whom would reside in the facility.

The proposed project is an element of the program of development on the campus through 2020-21 that is described in the campus's 2005 Long Range Development Plan ("2005 LRDP") and analyzed in the 2005 LRDP EIR (State Clearinghouse No. 2005012113, UCSC 2006), which is incorporated in this document by reference. The ECI Project EIR also takes into account the provisions of the August 2008 Comprehensive Settlement Agreement ("Settlement Agreement") that resolved litigation concerning the 2005 LRDP EIR with respect to traffic mitigation, off-campus housing impacts, and water supply, as explained below.

As required by the California Environmental Quality Act ("CEQA"), this ~~Draft~~ EIR: (1) assesses the potentially significant environmental effects of the proposed project as well as the potentially significant cumulative impacts of the project in conjunction with other regional growth; (2) identifies feasible means of avoiding or substantially lessening significant adverse impacts; and (3) evaluates a range of reasonable alternatives to the proposed project, including the required No Project Alternative. The University is the "lead agency" for the ECI project. The Board of Regents of the University of California ("The Regents") has the principal responsibility for approving the project.

PURPOSE OF THE EIR

The University has prepared this EIR for the following purposes:

- <u>To inform the general public; the local community; and responsible, trustee, and federal public agencies of the nature of the proposed project, its potentially significant environmental effects, feasible measures to mitigate those effects, and a range of reasonable and feasible alternatives</u>
- <u>To enable the University to consider the environmental consequences of approving the proposed project</u>
- <u>For consideration by responsible agencies in issuing permits and approvals for the proposed project</u>
- <u>To satisfy CEQA requirements</u>
- <u>To describe provisions of the 2005 LRDP EIR Settlement Agreement that are pertinent to the analysis of this and future projects</u>

As described in CEQA and the CEQA Guidelines, public agencies are charged with the duty to avoid or substantially lessen significant environmental effects, where feasible. This EIR is an informational document, the purpose of which is to identify the potentially significant effects of the proposed project on the environment, to indicate the manner in which those significant effects can be avoided or significantly lessened, to identify any significant and unavoidable adverse impacts that cannot be mitigated, and to identify reasonable and feasible alternatives to the proposed project that would eliminate any significant adverse environmental effects or reduce the impacts to a less-than-significant level.

The lead agency is required to consider the information in the EIR, along with any other relevant information, in making its decision on the proposed ECI Project. Although the EIR does not determine the ultimate decision that will be made regarding implementation of the project, CEQA requires the University to consider the information in the EIR and make findings regarding each significant effect identified in the EIR.

The Regents will certify the Final EIR prior to approving the proposed ECI Project. Other agencies may also use this EIR in their review and approval processes.

2005 LRDP LITIGATION AND SETTLEMENT

In August 2007, the Superior Court of Santa Cruz County ruled that the 2005 LRDP EIR was deficient in three respects: 1) its analysis of off-campus housing impacts failed to identify the probable locations of housing necessary to serve the LRDP and growth that is contemplated by the plan, and the environmental impacts of the development of housing at those locations; 2) its analysis of water supply did not include an appropriate analysis of the likelihood that the water supply needed to support the growth contemplated by the LRDP will be available to serve LRDP demand, to the disclose the degree of uncertainty that sufficient water will be available to serve the project, and to identify alternative sources of water and the environmental impacts of developing those sources of water for campus use; and 3) the mitigation measure committing the University to contribute its fair share of the costs of traffic improvements was not fully enforceable because the EIR provided insufficient information on how the University's fair share will be calculated, and was therefore invalid.[1]

On August 15, 2008, the University entered into a Comprehensive Settlement Agreement ("Settlement Agreement") with the City of Santa Cruz, the County of Santa Cruz, two community associations, and 11 individuals to resolve this litigation with respect to The Regents' approval of the 2005 LRDP. The Settlement Agreement is provided as Appendix A of this EIR. As part of the Settlement Agreement, the University agreed not to tier from or otherwise rely on two of the analyses presented in the 2005 LRDP EIR, those regarding water supply and off-campus housing development. Provisions of the Settlement Agreement that are pertinent to the ECI Project are reflected in the analyses presented in the ECI EIR, and are presented and discussed in the relevant resource area sections below.

The Settlement Agreement reflects the campus's commitment to increase the amount of housing that will be provided under the 2005 LRDP based on increases in enrollment; the methodology that has been agreed upon to determine the campus's fair share of the cost of traffic improvements to mitigate the projected traffic impacts of 2005 LRDP, and the campus's payment to the City of Santa Cruz of that fair share; and the campus's agreement to pay the City of Santa Cruz incrementally for increased campus

[1] *City of Santa Cruz, et al. v. Regents of the University of California, et al.*, Santa Cruz County Superior Court, Case No. CV155571.

water demand. The ECI EIR addresses provisions of the Settlement Agreement with respect to enrollment and housing in Section 3.11 (*Population and Housing*), with respect to fair share traffic impact mitigation in Section 3.15 (*Traffic and Circulation*), and with respect to water supply in Section 3.16 (*Utilities and Service Systems*).

OVERVIEW OF THE ECI PROJECT

The proposed ECI Project is the development of a new, approximately 196,000-gsf infill student housing complex on the UC Santa Cruz main campus (Figure 1, *Regional Location Map*). The project site is located immediately east of Chinquapin Road between Crown College and the Crown/Merrill Apartments (Figure 2, *Project Location on UC Santa Cruz Campus*). The project would provide common area and support spaces, including student lounges, recreational rooms, laundry rooms, mail rooms, study spaces, and residential program offices. A café and retail space would also be available to provide services for students living in the new complex and in the existing Crown/Merrill Apartments. The project would include parking for students, employees, and service vehicles. See Chapter 2, *Project Description*, for a full description of the proposed project. The proposed area of disturbance is approximately 3.1 acres.

ANALYSIS TIERED FROM THE 2005 LRDP EIR

The proposed ECI Project is an element of the campus's 2005 LRDP program of development, which was analyzed in the 2005 LRDP EIR and approved in September 2006. In order to avoid or reduce the severity of the project's potential environmental impacts, the proposed ECI Project includes applicable 2005 LRDP EIR mitigation measures as elements of the project. The analysis of all environmental issues except climate change, water supply and population/housing is tiered, in this project-level EIR, from the relevant discussion and analysis of these issues in the 2005 LRDP EIR. Environmental setting information presented in the 2005 LRDP also is tiered in this ECI Project EIR to avoid redundant description and discussion, to the extent possible.

EIR REVIEW PROCESS

Public and Agency Review

On September 23, 2008, a Notice of Preparation ("NOP") was published for the ECI Project. The 30-day comment period mandated by CEQA guidelines ended on October 22, 2008. All comments received on the NOP are available on file with UC Santa Cruz Physical Planning and Construction. An EIR scoping meeting was held on October 1, 2008, at the Bay Tree Conference Center on the UC Santa Cruz campus to solicit input from interested agencies, individuals, and organizations. Summaries of pertinent comments received on the NOP are included in each resource section of Chapter 3, *Environmental Setting, Impacts, and Mitigation*, and in Chapter 4, *Alternatives*.

The Draft EIR for the ECI Project was circulated for 45 days, from March 20. 2009 to May 4, 2009. This Final EIR has been prepared to respond to agency and public comments received on the Draft EIR. The comments received and the University's responses are presented in Chapter 8 of this Final EIR. The Final

EIR includes only minor changes to the Draft EIR, consisting of corrections of errors and minor changes to the project description that reflect refinements to the project during detailed project design. The changes are shown throughout this document in underline/strikeout format. ~~This Draft EIR, reference material used in the preparation of this EIR, and other documents that provide information regarding the proposed project are available for review during normal business hours at UC Santa Cruz Physical Planning and Construction, Barn G, UC Santa Cruz. Copies of the EIR are also available for review at the McHenry Library and the Science and Engineering Library on the campus and at the Central Branch of the Santa Cruz City/County Library in downtown Santa Cruz. The EIR is also available on the UC Santa Cruz web site, at http:/ppc.ucsc.edu.~~

Project Refinements

Since the Draft EIR was circulated for public review, there have been minor changes to the project as part of the design development process. These changes are presented in strikeout/redline format in Chapter 2, *Project Description*, and in relevant sections of Chapter 3, *Environmental Setting*, *Impacts and Mitigation*s. None of these changes to the project would result in new significant environmental impacts or increase the severity of environmental impacts analyzed in the Draft EIR. The changes are described briefly below:

- The proposed color palette has been refined to include grays in addition to browns and greens, but is still designed to blend with the surrounding natural environment.
- The new buildings would be designed and constructed to allow for future use of greywater collected from bathroom basins and showers for use in toilet flushing. The Campus would install the additional wastewater collection and distribution piping required for this but may choose to delay the design and installation of a treatment system until State standards for treating greywater for indoor use are established.
- The proposed project would exceed the Title 24 energy efficiency standard to a lesser extent than stated in the Draft EIR. The Campus has determined that it is not technically possible for project energy efficiency to exceed the Title 24 standard by 28 percent, as stated in the Draft EIR, without including either air conditioning or on-site renewable energy in the project. The project would meet the University standard of exceeding the Title 24 standard by 20 percent, by taking into account the fact that not including air conditioning reduces energy consumption (which is not reflected in the Title 24 calculations), and, if necessary, by utilizing solar energy for heating domestic hot water.
- An improvement to a natural gas distribution line in Hagar Drive may be required to provide service to the proposed project. The Campus is conducting a study to evaluate whether the natural gas line in Chinquapin Road, which would serve the proposed project, has adequate pressure to meet the project demand. If the pressure is not adequate, the Campus would replace approximately 100 linear feet of existing pipeline in Hagar Drive between Steinhart Drive and McLaughlin Drive with a larger pipeline. The work would be within an existing roadway.
- To provide adequate service to the proposed development, the electrical lines in Chinquapin Road would be upgraded by installing new cable in existing conduit down Chinquapin Road to McLaughlin

Drive, and in McLaughlin Drive from Chinquapin Road to Hagar Drive. Two new switchboxes would be installed underground beneath McLaughlin Drive.

Project Approvals

~~Following the close of the public and agency comment period on this Draft EIR (Monday, May 4, 2009), the University will prepare responses to all written comments and to oral comments received at the public hearing that raise CEQA-related environmental issues regarding the project. The responses will be published in the Final EIR.~~ The Final EIR will be considered by The Regents in a public meeting and the EIR will be certified if it is determined by The Regents to be in compliance with CEQA. Upon certification of the EIR, The Regents will consider the ECI Project for design approval. The Campus anticipates that the project will be considered for approval in July 2009.

USES OF THE EIR

The Regents will use this EIR to evaluate the significant environmental effects of approving the proposed ECI Project. This EIR also may be used by responsible agencies with permitting or approval authority over the proposed ECI Project~~ and/or subsequent projects tiered from the LRDP EIR~~, to assess the environmental effects of the project with respect to resource issues within each agency's permitting or approval authority.

OTHER AGENCY APPROVALS

The approval of the proposed ECI Project is within the authority of The Regents. The Campus also has ~~will apply~~ applied to the California Department of Forestry and Fire Protection (CALFIRE) for a Timberland Conversion Permit and prepare a Timber Harvest Plan for the trees that would be removed as part of the ECI Project. The Campus will submit a Notice of Intent to the State Water Resources Control Board and obtain coverage under the General Permit for Discharge of Storm Water Associated with Construction Activity for the proposed project.

LEVELS OF SIGNIFICANCE

This EIR uses a variety of terms to describe the levels of significance of adverse impacts identified during the course of the environmental analysis. The following are definitions of terms used in this EIR:

Significant and Unavoidable Impact. Impacts that exceed the defined thresholds of significance and that cannot be eliminated or reduced to a less-than-significant level through the implementation of feasible mitigation measures.

Significant Impact. Impacts that exceed the defined thresholds of significance and that can be eliminated or reduced to a less-than-significant level through the implementation of feasible mitigation measures.

Potentially Significant Impact. Significant impacts that ultimately may be determined to be less than significant; the level of significance may be reduced by feasible mitigation measures, or through further resolution of the details of the project. Potentially Significant impacts may also be impacts about which there is not enough information to draw a final conclusion; however, for the purpose of this EIR, they are considered significant. Such impacts are equivalent to Significant Impacts and require the identification of feasible mitigation measures.

Less-Than-Significant Impact. Impacts that are adverse but not substantial because they do not exceed the specified thresholds of significance.

ORGANIZATION OF THE ~~DRAFT~~ FINAL EIR

Chapter 1, Summary of Environmental Impacts and Mitigation Measures. Summarizes environmental impacts that would result from development of the ECI Project, describes proposed mitigation measures, and indicates the level of significance of impacts after mitigation.

Chapter 2, Project Description. Provides a detailed description of the proposed ECI Project.

Chapter 3, Environmental Setting, Impacts, and Mitigation. Contains the individual and cumulative analysis of environmental effects of the proposed ECI Project by resource area. The following resource areas are addressed in this chapter:

- Aesthetics
- Agricultural Resources
- Air Quality and Climate Change
- Biological Resources
- Cultural Resources
- Geology, Soils, and Seismicity
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Population and Housing
- Public Services
- Recreation
- Traffic, Circulation, and Parking
- Utilities

The 2005 LRDP EIR determined that there is no potential for campus development to results in adverse effects with respect to Mineral Resources, so this CEQA resource issue is not addressed in this EIR.

The subsection for each environmental issue contains an Introduction that includes a summary of scoping comments relevant to the environmental issue area, an Environmental Setting section that describes baseline environmental information as of project baseline, that is academic year 2007-08, a Project Impacts and Mitigation Measures section that describes the project impacts and mitigation measures for the proposed project, and a Cumulative Impacts and Mitigation Measures section that describes the cumulative impacts of the proposed ECI Project in conjunction with other regional growth at the time of the full development and occupation of the project, academic year 2011-12.

Chapter 4, Alternatives. Describes and compares the environmental impacts of alternatives to the proposed ECI Project and assesses the ability of each alternative to meet project objectives.

Chapter 5, Other CEQA Considerations. Provides discussions of other topics required by CEQA regarding impacts that would result from the proposed ECI Project, including a summary of significant unavoidable impacts, significant irreversible changes, and growth-inducing impacts.

Chapter 6, Consultation and Coordination. Provides a list of persons and agencies contacted.

Chapter 7, List of Preparers and Contributors. Identifies the persons who prepared the EIR and those who were consulted during its preparation.

Chapter 8, Response to Comments. Presents all comments received by the University on the Draft EIR and the University's responses.

Chapter 9, Changes to the Draft EIR, lists pages in each chapter in which changes to the text appear (as strike-out or underlined text).

Chapter 10, Mitigation Monitoring Program. Presents the mitigation monitoring program (MMP) for the proposed ECI Project.

Appendix A, 2008 Comprehensive Settlement Agreement.

Appendix B, LRDP Mitigations Applicable to the Proposed Project.

Appendix C, Air Quality Model Results.

Appendix D, Project Greenhouse Gas Emissions Calculations.

Appendix E, Storm Water Runoff Calculations.

Appendix F, Traffic Model Output.

REGIONAL LOCATION MAP

FIGURE 1

PROJECT LOCATION ON UC SANTA CRUZ CAMPUS

CHAPTER 1 EXECUTIVE SUMMARY

TABLES

Executive Summary

1.1 INTRODUCTION

This Environmental Impact Report (EIR) evaluates the potential for significant environmental effects (impacts) due to development of the East Campus Infill Project (“ECI Project”), University of California, Santa Cruz (UC Santa Cruz). This summary highlights the major areas of importance in the environmental analysis for the proposed project, as required by Section 15123 of the California Environmental Quality Act (CEQA) Guidelines. It also provides a brief description of the East Campus Infill Project, project objectives, a summary of comments on the Notice of Preparation, alternatives to the project, and areas of controversy known to the University. In addition, this chapter provides a table summarizing: (1) the potentially significant environmental impacts that would occur as the result of project development; (2) the level of significance of impacts before mitigation; (3) the recommended mitigation measures that would avoid or reduce significant environmental impacts; and (4) the level of significance of impacts after mitigation measures are implemented.

1.2 PROJECT DESCRIPTION

The proposed ECI Project is the development of a new, approximately 196,000-gsf infill student housing complex on the UCSC main campus (see *Introduction*, Figure 1, *Regional Location Map*). The project site is located immediately east of Chinquapin Road, between Crown College and the Crown/Merrill Apartments (*Introduction*, Figure 2, *Project Location on UC Santa Cruz Campus*). The project would consist of two seven- and eight-story apartment buildings, which would provide campus housing about 600 students and two facility staff in about 100 apartments. Staff population would total about 8 to 10 new campus employees. In addition to housing, the project would provide common areas and support spaces, including student lounges, recreational rooms, laundry rooms, mail rooms, study spaces, and residential program offices. The project also would include an outdoor plaza between the two buildings, adjacent to a café and retail space in one of the buildings, and open landscaped areas. These facilities would provide services for students living in the new complex and in the existing Crown/Merrill Apartments. The project would include parking for students, employees, and service vehicles. See Chapter 2, *Project Description*, for a full description of the proposed project. Project construction would disturb an area of approximately 3.1 acres, which, which includes about 2.2 acres of redwood and mixed evergreen forest and oak woodland. Construction would require extensive grading and fill and the removal of about 220 trees.

1.3 PROJECT OBJECTIVES

The objectives of the proposed ECI Project are to:

- Provide sufficient on-campus housing to meet student housing demand

- Provide new on-campus housing on a schedule commensurate with enrollment growth, to meet the campus' obligations under the 2008 Comprehensive Settlement Agreement
- Provide enough student apartment units to keep pace with increasing student demand for this type of housing
- Continue the development of on-campus housing within existing colleges to maintain a supportive and cohesive student community that is well integrated with all aspects of campus life
- Develop in a manner that supports preservation of natural areas and minimizes new development footprint
- Create a strong living community in a desirable living environment for upper division students, with features that encourage the choice of on-campus housing over off-campus alternatives.
- Support and further the campus's transportation demand management goals, in a manner that is consistent with the University's sustainability goals, through development that is well-served by bicycle, pedestrian, and transit facilities integrated with the existing circulation network, and that encourages increased reliance on sustainable transportation modes and reduces the need for residents to have and to use motor vehicles on campus.
- Develop in a manner that encourages efficient use of campus lands

1.4 IMPACT SUMMARY

Table 1-1, at the end of this chapter, provides a complete list of all impacts and mitigation measures. For each impact, Table 1-1 reports the significance of the impact before mitigation, applicable mitigation measures, and the level of significance of the impact after the implementation of the mitigation measures.

1.5 ALTERNATIVES TO THE PROPOSED PROJECT

The following alternatives were analyzed in detail in the EIR and compared to the proposed ECI Project. The objective of the alternatives analysis is to determine whether an alternative would feasibly attain some or most of the project objectives, while avoiding or substantially lessening any of the significant effects of the proposed project.

1.5.1 Alternative 1: West Campus Infill.

Under the West Campus Infill Alternative, the campus would construct approximately the same number of beds as the proposed project in 18 separate, three-story buildings at Oakes College, College Eight and Porter College. The population-related impacts of this alternative (population and housing, recreation, public services) would be the same as those of the proposed project. Although this alternative would increase the density of development in areas that are visible from off-campus or lower campus vantage points, the visual impacts of this likely alternative would not be significant, because the new facilities would blend, visually, into existing development. This alternative would minimize removal of trees, but could remove small areas of coastal prairie, which is a sensitive natural community. It also could affect potential upland movement habitat for California red-legged frog, a federally-listed threatened species. With implementation of previously adopted LRDP mitigations, these biological resources impacts would be mitigated to a less-than-significant level. This alternative would create a larger amount of impervious surface than the proposed project, and would add runoff to drainages with existing erosion conditions. Therefore, the potential for significant impacts on water quality would be greater than under the proposed project.

1.5.2 Alternative 2: Valley Site Plan.

Under the Valley Site Plan Alternative, the campus would construct a smaller project on and adjacent to the proposed project site. Three four- to six-story buildings would be constructed along the toe of the slope of the natural drainage, rather than along the ridge line. These buildings would provide approximately 470 bed spaces. This alternative would reduce the aesthetic impact of the proposed project because the buildings would be less visually prominent. The aesthetic impact likely would be, nonetheless, significant and unavoidable because the new buildings would be more massive than the existing buildings in the area, and could block natural light that reaches lower buildings of the Crown/Merrill complex. This alternative, like the proposed project, would site new buildings close to occupied residential facilities, and thus would not avoid the proposed project's significant and unavoidable construction noise impact on residents of adjacent buildings. The impervious surface area added to the Gully H watershed, and consequently the potential for causing erosion in that drainage, would be similar to the area added under the proposed project. This alternative likely would result in a larger number of off-campus vehicle trips than the proposed project, and greater demand for off-campus housing, as a smaller number of students would be housed on the campus. The alternative would utilize a larger area than the proposed project while providing less housing. Therefore, the alternative provides a lesser benefit than the proposed project with respect to reduction of student demand for off-campus housing, and would necessitate construction of additional housing sooner than the proposed project

1.5.3 Alternative 3: No Project.

Under the No Project Alternative, the ECI Project would not be built. The alternative would eliminate most of the direct environmental impacts of the project impacts but would not contribute to the achievement of any of the project objectives. Furthermore, without the project, 600 students who would reside on the campus under the proposed project, instead would live off campus, and would contribute to off-campus traffic and air quality and climate change impacts related to commuting, and to any environmental impacts associated with the development of housing in the city and county of Santa Cruz that might be undertaken by others to meet local housing demand.

Detailed descriptions and analyses of the potentially significant impacts of each alternative are presented in Chapter 4, *Alternatives*. That chapter also with compares the impacts of each alternative with those of the proposed project, and assesses the ability of each alternative to meet project objectives.

1.5.4 Environmentally Superior Alternative

The Valley Site Plan is the environmentally superior alternative, as it would slightly reduce the significant unavoidable aesthetic impact of the proposed project. The alternative also would result in a larger number of students living off campus than the proposed project, and therefore would diminish potential off-campus housing demand and traffic from the campus to a lesser degree than would the proposed project. While the alternative would absorb a substantial part of the student housing demand associated with projected enrollment growth through 2011, it would meet project objectives to a lesser degree than would the proposed project.

1.6 KNOWN AREAS OF CONTROVERSY

This EIR addresses environmental issues associated with the proposed project that are known to the lead agency or were raised by agencies or interested parties during the public and agency NOP review period. These issues include:

- The potential for increased green house gas emissions
- Consistency with the MBUAPCD air quality plan
- Impacts to biological and hydrological resources from the expansion of campus facilities, including storm water management and removal of trees
- Traffic generated by the project, including pedestrian traffic and potential effects of increased population on transit

More comprehensive and detailed listings of issues raised during scoping are provided in relevant sections, below. Comment letters received and a transcript of comments provided orally during scoping are available for review at the offices of UC Santa Cruz Physical Planning and Construction.

Table 1-1

Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
3.1 Aesthetics					
AES-1	The proposed project would substantially degrade the existing visual character of the area.	AES-5A, AES-5B, AES-5C, AES-5F	S	None available	SU
AES-2	The proposed project could create new sources of substantial light or glare that could adversely affect daytime or nighttime views in the area.	AES-6B, AES-6C, AES-6E	LS	Mitigation not required	NA
3.3 Air Quality and Climate Change					
AIR-1	Construction activities under the proposed project would result in emissions of PM_{10} on a short-term basis.	AIR-1	LS	Mitigation not required	NA
AIR-2	The proposed project may contribute to a violation of air quality standards or hinder attainment of the regional air quality plan.	AIR-2A	LS	Mitigation not required	NA
AIR-3	Natural gas combustion for space and water heating and routine firing of the emergency generators would generate TACs.	AIR-5A	LS	Mitigation not required	NA
AIR-4	Construction activities under the 2005 LRDP could potentially result in a substantial health risk to campus occupants at certain on-campus locations from short-term exposures to TACs.	AIR-6	Speculative	Mitigation not required	NA
AIR-5	The project's incremental increases in GHG emissions associated with construction, vehicle trips, direct and indirect energy use and tree removal would contribute to regional and global increases in GHG emissions and associated climate change effects.	AIR-5A, AIR-6	LS	**ECI AIR-5:** In addition to the new trees included in the proposed project landscaping plan, the campus shall plant 100 redwood trees in locations on campus that were historically redwood forest.	NA

[1]**NA**: Not Applicable; **NI**: No impact; **LS**: Less than significant; **PS**: Potentially significant; **S**: Significant; **SU**: Significant and unavoidable; **SP**: Speculative

Table 1-1

Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
3.4 Biological Resources					
BIO-1	Development of the ECI Project has the potential to introduce or cause the spread of noxious weeds, which could reduce the abundance of native plants and the biological integrity of sensitive natural communities.	BIO-6	~~PS~~LS	Mitigation not required	~~LS~~NA
~~**BIO-2**~~	~~Development of the ECI Project could result in the loss of special-status plants, if any are present on the project site, but would not significantly affect the survival or health of any special-status plant species.~~	~~None~~	~~LS~~	~~**ECI BIO-2:** During the spring blooming season prior to proposed development, a qualified botanist will conduct a botanical survey of the project site. If any specimens of special-status plants are present, the area of the discovery will be protected if possible. If protection is not possible, the plants will be transplanted and/or seeds will be collected for replanting (at the discretion of the project botanist) in a suitable location on or near the project that is not subject to further disturbance.~~	~~LS~~
BIO-3	Development of the ECI Project would result in the loss of up to 2.5 acres of forest habitat that may be used for foraging and roosting by special-status bats and birds.	None	LS	Mitigation not required	NA

[1]**NA**: Not Applicable; **NI**: No impact; **LS**: Less than significant; **PS**: Potentially significant; **S**: Significant; **SU**: Significant and unavoidable; **SP**: Speculative

Table 1-1

Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
BIO-4	Development of the ECI Project could result in the loss or abandonment of active nests of special-status birds, including fully-protected raptors and other native birds protected under Fish and Game code and/or under the Migratory Birds Treaty Act.	For this project, ECI Mitigation BIO-4 will be implemented in lieu of LRDP BIO-11	PS	**ECI BIO-4**: Prior to construction or site preparation activities that may occur during the avian breeding season (typically February 1 through August 31), a qualified biologist shall conduct surveys for nesting special-status raptors such as the long-eared owl, for Vaux's swift colonies or roosts, and for nests of birds protected by the MBTA or the California Fish and Game Code. The survey area shall include all potential nesting habitat on and within 250 ft of the construction boundary for raptors and Vaux's swift colonies and within 50 ft of the construction boundary for other native birds. The survey shall be conducted no more than 14 days prior to commencement of construction activities. If an active nest is found, a buffer of at least 250 ft will be maintained around any raptor nest or nest of a colonial bird and 50 ft around the nest of any other protected bird until the end of the breeding season or until the nest(s) are no longer active, as determined by a qualified biologist. A temporary fence or other means of marking this buffer shall be constructed.	LS

[1]**NA**: Not Applicable; **NI**: No impact; **LS**: Less than significant; **PS**: Potentially significant; **S**: Significant; **SU**: Significant and unavoidable; **SP**: Speculative

Table 1-1

Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
BIO-5	Development of the ECI Project could result in disturbance or abandonment of daytime roost sites of colonially-roosting special-status bats, and maternity roost sites of special-status bats, which could cause a substantial adverse effect on special-status bat species.	For this project, ECI BIO-5A through -5F will be implemented in lieu of LRDP BIO-13A and -13B	PS	**ECI BIO-5A:** If tree removal or construction is slated to begin within bat breeding season (Apr. 1 - Aug. 31) a qualified bat biologist (i.e., a biologist holding a CDFG collection permit and a Memorandum of Understanding with CDFG allowing the biologist to handle and collect bats) will conduct a survey for roosting bats prior to the beginning of the season, in the year in which construction or demolition will occur. Implementing this measure will allow for bat exclusion prior to the breeding season, to minimize bat-related constraints to the timing of tree removal and construction. All trees and structures on and in the vicinity of the project site (i.e., close enough to project areas to be potentially disturbed by project activities, in the opinion of a qualified bat biologist) will be assessed for their suitability for use by roosting bats. Any trees or structures that are identified as being high-potential roost sites will be surveyed more intensively, by eye and using acoustical equipment if needed to determine whether bats are present. If high potential roost sites are identified or if bats are present, the campus may implement exclusion measures as described in Mitigation BIO-4D.	LS
				ECI BIO-5B: If high potential roost sites were identified or exclusion measures were implemented based on the initial survey, and more than 15 days pass without the commencement of construction, demolition or tree removal, pre-construction/pre-demolition bat survey of the high potential roost sites will be repeated within 15 days prior to the commencement of construction or demolition.	

[1]**NA**: Not Applicable; **NI**: No impact; **LS**: Less than significant; **PS**: Potentially significant; **S**: Significant; **SU**: Significant and unavoidable; **SP**: Speculative

Table 1-1

Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
				ECI BIO-5C: If a roost of any kind is found in an area (e.g., a building or tree) that will not be disturbed or can be avoided by construction, the roost structure will be designated for protection and will be avoided during construction.	
				ECI BIO-5D: If a day roost is found in a building or tree that is to be completely removed, bats will be safely evicted under the direction of a qualified bat biologist. Eviction will occur only between September 1 and March 31, to avoid potential for encountering nonflying young, but will not occur during long periods of inclement or cold weather (as determined by the bat biologist) when prey are not available or bats are in torpor, and will occur at night, to minimize potential for predation. If a day roost is found within a building that is to be demolished, eviction (between Sept. 1 and March 31) will occur by opening the roosting area to allow air flow through the cavity for at least one night prior to demolition, to allow bats to leave during dark hours. For roosts found in trees that must be removed or disturbed, bats will be evicted between Sept. 1 and March 31, using one-way doors if feasible. If use of a one-way door is not feasible, or the exact location of the roost entrance in a tree is not known, the trees with roosts that need to be removed will first be disturbed by removal of some of the trees' limbs not containing the bats. Such disturbance will occur at dusk to allow bats to escape during the darker hours. These trees would then be removed the following day. All of these activities will be performed under the supervision of the bat biologist. A qualified bat biologist (in consultation with CDFG)	

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Table 1-1

Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		**Applicable LRDP Mitigation**	**Level of Significance Prior to Project Mitigation** [1]	**Project Mitigation Measures**	**Level of Significance Following Project Mitigation** [1]
				may determine that it is preferable, under the circumstances, to allow roosting bats to continue using a roost while construction is occurring on or near the roost site. For example, if a tree found to contain a day roost is located near the construction area but will not be removed, a qualified bat biologist (in consultation with the CDFG) will determine whether the bats should be evicted or whether they should remain in place. If it is determined that the risks to bats from eviction (e.g., increased predation or exposure, or competition for roost sites) are greater than the risk of colony abandonment, then the bats will not be evicted.	
				ECI BIO-5E: If a maternity roost of any bat species is present on a construction site, the bat biologist will determine the appropriate size of a construction-free buffer around the active roost. This buffer would be maintained from April 1 until Aug. 31, or until the bat biologist has determined that the young are flying	
				ECI BIO-5F: In the event that a roost site that is used as a maternity roost by pallid bats is identified on or adjacent to the project site, and that roost site is abandoned, removed or bats must be evicted as a result of project activities, an alternative roost will be constructed. The design and placement of this structure will be determined by a qualified bat biologist based on the location of the original roost and the habitat conditions in the vicinity. This bat structure will be erected at long as possible in advance of removal of the original roost structure but no less than one month prior, or as soon as possible after a roost site is determined to have been abandoned as a result of project activities. This structure will be checked during the breeding season for up to three years following completion of the project, or until it is found to be	

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Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
				occupied by pallid bats, to provide information for future projects regarding the effectiveness of such structures in minimizing impacts to bats.	
BIO-6	Project development could result in a substantial adverse impact associated with the loss of potential San Francisco dusky-footed woodrat nests.	For this project, ECI Mitigation BIO-6 will be implemented in lieu of LRDP mitigation BIO-14	PS	**ECI BIO-6A:** Within two weeks prior to any clearing of vegetation on the project site, a qualified biologist will conduct a survey for San Francisco dusky-footed woodrat nests. If any nests are identified, ECI Mitigation BIO-6B will be implemented.	LS
				ECI BIO-6B: Where nests are found, a 10 foot buffer will be designated around each nest, and high-visibility exclusion fencing will be erected. Moving or bumping the nests or logs or branches on which the nests rest will be avoided. If this measure is not feasible due to the extent or nature of construction, ECI Mitigation BIO-6C will be implemented.	

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Table 1-1

Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
				ECI BIO-6C: If a nest cannot be avoided, it will be dismantled by a qualified biologist and the nesting material moved to a new location outside the project's impact areas so that it can be used by woodrats to construct new nests. Prior to nest deconstruction, all nearby understory vegetation should be cleared. Then, each active nest should be disturbed by nudging or shaking by a qualified wildlife biologist, so that all woodrats leave the nest and seek refuge outside of the impact area. For tree nests, a tarp should be placed below the nest and the nest dismantled using hand tools (either from the ground or from a lift) to avoid injury to occupants. For any nest, the nest material should then be piled at the base of a nearby hardwood tree (preferably an oak, willow, or other appropriate tree species with potential refuge sites among the tree roots) outside of the impact area. If nearby habitat outside the impact area lacks suitable structure, appropriate materials (e.g., sticks or logs four ft long and six inches in diameter) should be placed in undisturbed riparian or oak woodland habitat nearby and the sticks from the dismantled nests should be placed among these logs. If multiple nests are displaced, the newly placed piles of nest materials should not be less than 100 feet apart.	
BIO-7	Development of the ECI Project would result in the loss of previously fragmented oak woodland/redwood forest that may provide limited movement habitat for mammal and bird species.	None	LS	Mitigation not required	NA

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Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
3.5 Cultural Resources					
CULT-1	Project-related excavation and grading could uncover and disturb or destroy previously-undiscovered archaeological resources or human remains.	CULT-1B, CULT-1F-1H, CULT-4B-4D	LS	Mitigation not required	NA
CULT-2	Project excavation and grading in doline deposits potentially could expose, disturb and destroy significant fossils.	CULT-5C, CULT-5D	LS	Mitigation not required	NA
3.6 Geology, Soils, and Seismicity					
GEO-1	The proposed project would develop structures on geologic materials with a low potential for failure from landslides, lateral spreading, or liquefaction.	GEO-1	LS	Mitigation not required	NA
GEO-2	The proposed project could result in construction of facilities on expansive soil.	GEO-1	LS	Mitigation not required	NA
GEO-3	The proposed East Infill Apartments would be constructed on karst, which could lead to settling or collapse beneath the structures.	GEO-1	LS	Mitigation not required	NA
3.7 Hazards and Hazardous Materials					
HAZ-1	Demolition of the existing Crown College Preceptors Apartment building could potentially expose construction workers and campus occupants to contaminated building materials.	HAZ-7	LS	Mitigation not required	NA

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Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
HAZ-2	Construction activities associated with the proposed project could potentially interfere physically with the campus's Emergency Operations Plan (EOP).	HAZ-9A	PS	**ECI HAZ-2**: If lane closures on Chinquapin Road are required for project construction, the University Representative, the construction contractor and the Fire Marshal will develop specific procedures for traffic controls, and for communication between the UC Santa Cruz Fire Department and on-site contractor or traffic control personnel, to ensure that fire department vehicles are able to exit the station via Chinquapin Road without delays in the event of an emergency.	LS
HAZ-3	~~Construction activities associated with the proposed project could potentially interfere physically with the campus's Emergency Operations Plan (EOP).~~ <u>The proposed project would increase the residential population in an area that is potentially subject to wildfire.</u>	HAZ-10A and HAZ-10D	LS	Not required	NA
3.8 Hydrology and Water Quality					
HYD-1	The proposed project could result in storm water runoff during construction, which could substantially degrade water quality	HYD-2B	LS	None required	NA
HYD-2	The proposed project would increase impervious surface, which would result in an increase in the volume and peak flow rates of storm water runoff, which could exacerbate existing erosion conditions in Gully H, and would increase the amount of urban pollutants in storm water runoff, which could affect water quality.	HYD-3A; HYD-3C; HYD-3D. For this project, mitigation ECI HYD-2 will be implemented in lieu of mitigation LRDP HYD-	PS	**ECI HYD-2**: The stormwater management system for the project shall be designed to release runoff to Gully H from the project site at the following rate. Runoff in excess of the estimated pre-development flow for the 2-, 5- and 10-year design storms shall not exceed 10 percent of the peak flow rate for the 2-year, pre-development design storm**.**	LS

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Summary of ECI Project Impacts and Mitigation Measures

ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
		3C.			
3.10 Noise					
NOIS-1	Construction of the proposed project could expose nearby sensitive receptors to excessive airborne noise but not to excessive groundborne vibration or groundborne noise.	NOIS-1	S	**ECI NOIS-1:** The noise mitigation program required of the project pursuant to LRDP Mitigation NOIS-1 shall be prepared in consultation with the residential staff at Crown/Merrill Apartments and Crown and Merrill Colleges and shall include the following elements in addition to those specified in LRDP Mitigation NOIS-1: • Notices of the dates and hours of anticipated construction shall be posted in the upper quad residence halls at Crown College, the Crown College office and classroom buildings, and Crown/Merrill Apartments Building at the beginning of the fall 2010 quarter. • Residents of Crown/Merrill Apartments and Crown and Merrill Colleges shall be notified of the anticipated construction noise before they move in for the fall 2010 quarter. • The University shall identify staff responsible for communicating with residents of Crown/Merrill Apartments and Crown and Merrill Colleges regarding noise concerns, who shall notify residents of any changes to the posted construction schedule and of particularly noise activities.	SU
NOIS-2	Residents of the ECI complex could be exposed to high noise levels from increased vehicular traffic on the campus road network.	NOIS-3	LS	Mitigation not required	NA
3.14 Traffic, Circulation, and Parking					
TRA-1	Traffic generated by the ECI Project would contribute traffic to on-campus intersections. All on-campus intersections would continue to operate at acceptable levels of service and	None	LS	Mitigation not required	NA

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ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
	none would meet peak hour signal warrants under Cumulative Plus Project Conditions.				
TRA-2	The ECI Project would contribute less than 3 percent of the total projected 2013 traffic at any of the off-campus study intersections during a peak hour in which the intersection would operate at an unacceptable level, and the project's contribution to substandard operations therefore is not cumulatively considerable.	TRA-2A (incorporating Settlement Agreement fair share methodology).	LS	Mitigation not required	NA
TRA-3	The ECI Project would displace existing parking and reduce parking capacity in the project vicinity, and would add to demand for parking within campus Parking Zone 4, but occupation of the project would not result in parking utilization in the parking zone in excess of 90 percent.	None	LS	Mitigation not required	NA
TRA-4	ECI Project construction would result in the temporary loss of about 157 parking spaces in campus Parking Zone 4, which would substantially reduce parking capacity in the project vicinity for a period of about 24 months.	None	LS	Mitigation not required	NA
TRA-5	The ECI Project would contribute to increased demand for on-campus transit service and, simultaneously, to increases in pedestrian traffic at pedestrian crossings of McLaughlin Drive at the Chinquapin intersection, College Nine/Ten/Cowell Health Center transit stops and the Hagar Drive intersection. Increased pedestrian traffic contributes to potential pedestrian/vehicle traffic conflicts and	TRA-4A, TRA-4B and TRA-4C	PS	**ECI TRA-5A:** The Campus will complete new pedestrian counts and an assessment of transit delays and transit cycle time within six months after occupancy of ECI to determine whether, with the increase in pedestrian traffic and transit demand from the ECI Project, the LRDP measures incorporated in the project have been effective in maintaining transit cycle time such that transit travel times between the two most widely-separated colleges	LS

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ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
	hazards, and to crossing-related transit delays, which could further diminish transit capacity. If transit demand exceeds effective transit capacity, this could result in reduced levels of service, which could undermine the effectiveness of alternative transportation modes and conflict with the campus' TDM program.			does not exceed the time interval between class periods. **ECI-TRA-5B:** Beginning in fall 2011, the Campus will prepare and distribute educational materials and implement an educational program regarding pedestrian safety and the adverse effects of illegal pedestrian road crossings on transit cycle times; and will post signs at campus bus shelters and at the Crown/Merrill and College Nine/Ten McLaughlin Drive crossings and the Chinquapin Road crossings regarding road crossing restrictions. **ECI-TRA-5C:** If the study conducted under TRA-5A indicates that transit delays and cycle time have increased, despite implementation of TRA-5B, the Campus will implement additional improvements at the pedestrian crossings of McLaughlin Drive at Hagar Drive, Chinquapin intersection, and the Cowell Health Center/College Ten and Crown/Merrill transit stops to reduce transit delays associated with pedestrian crossings. These improvements may include but are not limited to one or more of the following measures to expedite crossings and reduce transit delays: Installation of barriers along McLaughlin and Hagar Drive, McLaughlin/Chinquapin intersection and College Nine/Ten transit stop on McLaughlin, to control pedestrian flow patterns and to channel pedestrian crossings to the crosswalk and discourage pedestrian crossings outside of the crosswalk. Safety improvements to configuration of crosswalks (particularly at Chinquapin across McLaughlin) Relocation of transit stops Installation of pedestrian crossing or traffic signals that	

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ECI Impact		Applicable LRDP Mitigation	Level of Significance Prior to Project Mitigation [1]	Project Mitigation Measures	Level of Significance Following Project Mitigation [1]
				include an exclusive pedestrian phase, as warranted Employment of a crossing guard to regulate pedestrian traffic across the intersection/street and enforcement of "jay-walking" violations	
3.15 Utilities and Service Systems					
UTIL-1	Development of the proposed project would result in new water demand of approximately 8.0 gallons per year (MGY), but remaining water supplies during average water years are available to serve the project.	UTIL-9A	LS	Mitigation not required	NA
UTIL-2	The proposed project would increase demand on the Campus and regional electricity generation and distribution systems.	UTIL-5	LS	Mitigation not required	NA
UTIL-3	Development of the proposed project, in conjunction with other development in the SCWD service area, would result in additional water demand in a system whose existing supplies are not adequate during drought periods and which may not have adequate in normal water years after 2015. This would be a significant cumulative impact. The contribution of the proposed project to this impact would not be cumulatively considerable.	UTIL-9A	LS	Mitigation not required	NA

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CHAPTER 2 PROJECT DESCRIPTION

TABLE

FIGURES

Chapter 2

Project Description

2.1 PROJECT SUMMARY

2.1.1 Project Overview

The proposed East Campus Infill (ECI) Project is the development of a new student housing complex as infill development on the UC Santa Cruz main campus. The project site is located immediately east of Chinquapin Road between Crown College and the Crown/Merrill Apartments. The project site is one of few potential infill sites for housing in the central campus. Project development at this location would create a social and physical link between the Crown/Merrill Apartments and Crown and Merrill Colleges.

Of the 3.1 acres that would be included in the project work area, about 0.9 acres presently is paved or otherwise developed, with existing development including retaining walls and a small apartment building. The remaining 2.2 acres of the site currently are undeveloped. This undeveloped area is vegetated in redwood and mixed evergreen forest and oak woodland. The majority of the site consists of moderate to steep slopes, some areas of which have been subject to prior excavation or cutting in connection with road, parking lot, or building construction.

The ECI complex, comprising two 7- to 8-story buildings, would provide a total of about 594 student beds in 99 six-bed apartments. The facility also would include two staff apartments for resident Coordinators of Residential Education. The apartment buildings would be connected by a ground-level plaza. The complex also would include landscaped open space, internal pathways, bicycle parking, and storage facilities. Common area support spaces including student lounges, recreational spaces, laundry rooms, mail rooms, study spaces, and residential program offices would be located on the plaza level of the buildings and would connect with outside interactive areas. A café and retail spaces would also be available to provide services for the over the more than 1,200 residents in the vicinity, including those who would be living in the new complex and those already residing in the existing Crown/Merrill Apartments. The project would also include <u>accessible </u>parking ~~for students, employees, the campus car-share program, ~~and <u>parking for </u>service vehicles.

The project would include re<u>location </u>~~configuration~~ of a roadway that currently provides access from Chinquapin Road to Parking Lot 111 and also to the main entry to Crown College. The project would replace this roadway with two new driveways from Chinquapin Road. One driveway at the north end of ECI Building B,~~ north of the present entry to Parking Lot 111,~~ would provide access to the~~ reconfigured~~ <u>existing </u>parking lot. A second drive way at the south end of ECI Building B, ~~south of the present entry,~~ would replace the present entry to Crown College. The existing Crown Circle would be preserved. The upper terrace of Parking Lot 111 and several small parking bays along the existing Crown College access road, and the small Crown College Preceptor Apartment building that presently provides six student beds, would be displaced by the project. The two lower segments of Parking Lot 111 would be used for staging during construction, but would be returned to service at the conclusion of construction. Some additional

~~resident and~~ ADA-accessible and service vehicle parking would be provided on~~-streets within the development~~ these two new access roads.

The project would include construction of ~~off-site and on-site~~ storm water infrastructure improvements that would capture storm water flow from areas north and south of the complex and from the complex itself, and divert it to new detention and infiltration facilities on-site. The storm water management system for the proposed project includes a series of detention and bioretention features that would reduce the volume and rate of runoff leaving the site while improving the water quality through biofiltration. These features are described in more detail in Section 3.8 (*Hydrology and Water Quality*) and also are illustrated in Figures 3.8-3 and 3.8-4 of that section. Storm water control features would include a 5,750-square-foot (sf) vegetated roof area, bioswales and rain gardens adjacent to the buildings and in the plaza, and a terraced bioretention area between the plaza and the lower terraces of Parking Lot 111, underlain by underground detention vaults.

Under a separate safety improvement project, Chinquapin Road is being widened to accommodate a new pedestrian sidewalk and uphill bike lane. Pedestrian traffic between the Crown/Merrill Apartments and Crown College, which currently crosses through the project site, would be rerouted along the new Chinquapin sidewalk west of the site and around the east end of the project site during the construction period. Pedestrian routes across the project site would again be available after ECI Project construction is complete.

It is anticipated that construction of the ECI Project would begin in July 2009 and would be complete in time for occupancy for the fall quarter in September 2011.

2.1.2 Campus Housing Supply and Demand Issues

The UC Santa Cruz campus has experienced significant enrollment growth in recent years, and the student demand for housing on campus and in the local community has exceeded the supply of available housing. The increased demand stems both from campus enrollment growth and the impact of the housing market crisis of the last two years on the local demand for rental living space.

In order to help attract new students to the campus, UC Santa Cruz has guaranteed housing to new freshmen and transfer undergraduates for two years. However, the current supply of on-campus housing inventory is just sufficient to meet the demand for guaranteed housing, and housing cannot be provided to most students who do not qualify for a guarantee. For example, as of September 2008, 275 continuing students without housing guarantees who had applied for housing for the 2008-09 academic year were on a waiting list. Currently, sufficient housing inventory is available to accommodate about 50 percent of the undergraduate population, but the demand for additional housing remains strong as evidenced by the number of wait-listed continuing students. (CUHS 2008).

Future campus enrollment growth is expected to increase demand for on-campus housing. As part of the August 2008 Comprehensive Settlement Agreement on litigation over the 2005 LRDP EIR (Appendix A of this document), the Campus has committed to provide housing capacity for 67 percent of all new students above the 15,000 full-time equivalent enrollment level; that is, 10,125 total student beds if enrollment reaches 19,500 as projected in the 2005 LRDP.

In addition, students with a second year housing guarantee, as well as older students, are generally looking for housing that offers more independent lifestyles than can be offered in residence halls. The supply of on-campus student apartments is insufficient to meet student demand for this housing type.

In addition to constructing new housing, one strategy to allow the campus to meet demand has been the conversion of double rooms to triples and of lounges and other common areas to bedrooms. This short-term strategy has allowed the campus to accommodate additional students to meet increased demand for campus housing. However, even with these adjustments and additions, the campus will need to continue to add new bed spaces to ensure an adequate supply of on-campus housing as enrollment grows.

2.1.3 East Campus Infill Project Goals and Objectives

Taking into account the issues and principles discussed above, the objectives of the proposed ECI Project are to:

- Provide sufficient on-campus housing to meet student housing demand
- Provide new on-campus housing on a schedule commensurate with enrollment growth, to meet the campus' obligations under the 2008 Comprehensive Settlement Agreement
- Provide enough student apartment units to keep pace with increasing student demand for this type of housing
- Continue the development of on-campus housing within existing colleges to maintain a supportive and cohesive student community that is well integrated with all aspects of campus life
- Develop in a manner that supports preservation of natural areas and minimizes new development footprint
- Create a strong living community in a desirable living environment for upper division students, with features that encourage the choice of on-campus housing over off-campus alternatives.
- Support and further the campus's transportation demand management goals, in a manner that is consistent with the University's sustainability goals, through development that is well-served by bicycle, pedestrian, and transit facilities integrated with the existing circulation network, and that encourages increased reliance on sustainable transportation modes and reduces the need for residents to have and to use motor vehicles on campus.
- Develop in a manner that encourages efficient use of campus lands.

2.2 DETAILED PROJECT DESCRIPTION

2.2.1 Project Site

The proposed project site consists of a 3.1-acre area in the northeastern part of the developed central campus on land designated in UC Santa Cruz's 2005 LRDP as Colleges and Student Housing (Figure 2-1, *Project Site: Existing Conditions*). The site is bounded on the west by Chinquapin Road, on the north by the Crown/Merrill Apartments (three-story wood structures), and on the south by Crown College, a complex of three-story wood structures covered in stucco, and Merrill College, which consists of five-story concrete buildings. Chinquapin Road runs along a ridgetop east of Jordan Gulch. Project development would be located along the crest and east slope of the ridge, and would displace the uppermost terrace of existing Parking Lot 111. The two lower terraces of that parking lot would be used for construction staging, but are not included in the project area of disturbance. The lots would be closed during construction, then recoated with asphalt slurry~~paved~~ and restriped for parking at the conclusion of construction.

Chinquapin Road, the western boundary of the project site, runs along the north-south trending ridge that locally forms the divide between upper Jordan Gulch and the San Lorenzo River watershed. The ridgeline and Chinquapin Road ascend fairly steeply northward from McLaughlin Drive. From the ridge, the site slopes steeply to the east down into a broad drainage swale that descends toward a narrow ravine known as Gully H. The Crown/Merrill Apartments complex is situated along the northern margin of this drainage, and Crown and Merrill Colleges are located on an east-west trending ridge that forms the southern margin of the swale. Crown College is adjacent to the south part of the project site, and the five-story concrete Merrill residence hall structures are on the ridge southeast of the project site, east of Crown and Merrill Colleges. The elevation difference between the highest and lowest points on the project site is about 40 feet.

The natural drainage swale at the project site was partially filled in the past to produce a series of level terraces. East of the lowest lot, Gully H drops eastward through the forest and extends downward toward Pogonip City Park in the San Lorenzo River drainage. Water flows in Gully H only during storms.

The slopes and other unpaved areas around Parking Lot 111 and its access roads presently are forested, primarily in redwoods, Douglas firs, oaks, and bay trees. Most of the site is heavily shaded.

Site vegetation, hydrology, and topography are characterized in more detail in sections below, including Section 3.4 (*Biological Resources*), Section 3.6 (*Geology, Soils, and Seismicity*), and Section 3.8 (*Hydrology and Water Quality*).

2.2.2 Existing Facilities on the Project Site

Parking Lot 111 consists of three linked parking lot areas that descend eastward from Chinquapin Road down the natural ravine north of Crown College, and five small parking bays distributed along the north side of the Crown College access road (Figure 2-1, *Project Site: Existing Conditions*). The three linked lots are accessed via a paved drive that intersects the east side of Chinquapin Road just south of the campus fire house. Altogether, the lot presently provides 160 parking spaces. The small parking bays along the Crown College access road, and the uppermost terrace of the three larger lots would be displaced by the proposed project. After construction, the remaining lots would be restriped and, with a few additional parking spaces along the access roads, would provide a total of 95 net parking spaces in Lot 111, for a net reduction of 65 spaces in campus parking Zone 4.

One small (938-sf) single-story building, the Crown College Preceptor Apartment, located adjacent to Chinquapin Road at the northwest~~east~~ end of Crown College, would be removed as part of the proposed project. The building presently provides six student beds in a two-bedroom apartment and attached suite. Two other one- to two-story pole buildings—the KZSC radio station building and the Lionel Cantu

Center—adjacent to the southern edge of the project site on the slope below Crown College would be retained. Several pedestrian paths and stairways presently provide access between Crown and Merrill Colleges and the Crown/Merrill Apartments, and between these facilities and Chinquapin Road.

2.2.3 Site Arrangement and Project Components

2.2.3.1 Site Selection and Layout

Figure 2-2, *Proposed Site Plan*, provides a site plan of the proposed project. Siting considerations for the project included proximity to colleges and other college housing, access to transit, minimization of footprint and new land disturbance, and maximizing the housing yield of the site. Consistent with the principles of the 2005 LRDP and with 2005 LRDP Mitigation AES-5B, which is incorporated in the project, project buildings were designed to be no higher than the height of the surrounding trees. Consistent with LRDP Mitigation AES-5C, also incorporated in the project, the goal of preserving healthy mature trees was taken into account as the development was sited and designed. For example, the project was sited to avoid a higher quality redwood grove east of the site. Project modifications were undertaken at several stages of design in order to preserve individual trees and tree clusters ~~tree~~ wherever possible. Design modifications included redesign and minor rerouting of the Crown College access road; a minor reorientation of Building A; relocation of decks, stairways and a service area associated with Building A; a relocation of Building B northward; and reconfiguration of the proposed bioretention area. Use of this site would require removal of about 220 trees, including about 178 redwoods, 20 oaks and 12 firs. More detail about these trees is provided in Section 3.4 (*Biological Resources*). The site layout preserves groves of trees around the site and screens of trees to the north, south, and east, and preserved trees will be protected with a buffer and fencing during construction.

The proposed site plan is designed to take advantage of the natural topography, with buildings "stepped" with the slope, such that maximum heights are lower than the tallest surrounding trees that would remain around the site. The project location is well served by existing utility infrastructure.

As described in detail below, the project would include two apartment buildings. The two ECI buildings would be situated near the crest of the Chinquapin ridge, along the east side of Chinquapin Road, at ground level elevations between 790 and 800 feet above sea level. Under the proposed project, the upper part of eastern slope of the ridge would be terraced to provide a public plaza. At the east edge of the plaza, the slope would drop steeply toward the existing parking lot in the lower part of the basin, which would be retained. The proposed project would realign a portion of the Crown access road, which would also form the southern entry to the complex. A northern access road to the complex would be constructed, leaving Chinquapin Road just north of the campus fire station and descending into the basin to the middle and lower terraces of Parking Lot 111.

ECI Building A (140 ft. long and 62 ft. wide) would be set at a diagonal to the relocated Crown access road, with the narrower side closest to the road. Building B (approximately 348 ft. long by 64 ft wide~~300 feet in length~~) would be located along Chinquapin Road between the two project access roads, with its longest dimension parallel with Chinquapin Road. The upper terrace of that existing parking lot would be eliminated by regrading, and is partially within the footprint of Building B. The terraced public plaza would form an elongate triangular space west and north of Building A and east of Building B, which would provide pedestrian and emergency access to the buildings from both access roads and is part of the overall pedestrian circulation that is intended to improve the link from Crown and Merrill Colleges to the Crown/Merrill Apartments. The plaza would be framed by the two buildings, and would include landscaping, outdoor seating, and access to the public areas on the ground floors of the buildings.

Redwood and mixed evergreen forest areas northeast of Building A would be preserved. The topography of the swale immediately east of Building B~~Chinquapin Road~~ and south of the northern access road, including the uppermost terrace of Parking Lot 111, would be graded to create a terraced bioretention area that would include a small turf area and native plantings. The lower two terraces of existing Parking Lot 111 would be used for construction staging, but would be returned to use as parking subsequent to construction, with access via the new northern project access road. Additional special-use parking would be provided in small bays along the project access roads and in proximity to buildings A and B.

2.2.3.2 Apartment Buildings

In the proposed site plan (Figure 2-2), the line of Building B would undulate slightly, with setbacks from the street varying between about 20 feet and 35 feet. Building A would be located just north of the Crown College entry and Crown Circle. The buildings as planned would vary in footprint, with the footprint of Building A at about 8,~~650~~445 sf and Building B at about 19,700 sf. Overall building footprints would total about 28,~~400~~120 sf. The buildings together would provide about ~~136,000~~ 136,600 assignable square feet (asf) (1~~96,000~~ 228,340 gross square feet [gsf]) of new student housing development space, with ~~37,000~~36,420 asf (~~50,000~~ 65,750 gsf)/144 beds in Building A and ~~121,000~~ 100,160 asf (~~146,000~~ 162,600 gsf)/450 beds in Building B. ~~Both buildings would vary from seven to eight stories in height~~. Building A would be a consistent seven-stories high. To improve conformity with existing grades and to avoid high rise construction, Building B would be stepped, with the entire west half of the building ~~such that the north end of the building would be one story higher than the south end, and (~~the Chinquapin side) ~~of the building would be~~ at eight stories, one floor higher than its seven-story east side. The highest floor of the building would be approximately 74 feet above the adjacent grade. Since the project site is sloped, both east-west and north-south, total building height above grade will vary between 85 feet and 91 feet. Figure 2-3, *Proposed Site Sections,* illustrates the proposed building elevations.

The proposed color scheme for the exterior surfaces would consist of browns, grays and greens, drawing inspiration from the natural colors surrounding the site. A portion of the roof of Building B would be a "green roof," a vegetated area that would function as part of the project's storm water management system; part of this would be an accessible deck. A main entry plaza between the two buildings would be visually paired with the Crown entry. The two apartment buildings, flanking the terrace between the buildings, would frame an entrance to the ECI complex.

Both buildings would be situated on cut and fill. The foundation for the proposed buildings would be designed to address potential karst hazards, as discussed in Section 3.6 (*Geology, Soils, and Seismicity*), below. Due to the site's complex geology and soils, the foundation system would consist of drilled piers (up to 90 feet deep) with column caps, grade beams, and a matt and reinforced concrete slab, designed to span over potential subsurface voids. Soils under the mat slab would require lime treatment to reduce the expansion potential of clay soils. It is not anticipated that compaction grouting of soft soil zones would be required. The buildings would be constructed on top of these foundation elements using structural steel columns, beams and diagonal brace frames, with concrete-filled metal floor and roof decks and light gauge steel infill framing. ~~The foundation system for each building is expected to consist of drilled piers up to 125 feet deep and column caps, and a reinforced concrete mat, designed to span over potential subsurface voids. Soils under the mat may require lime treatment to reduce the expansion potential of clay soils. It is not anticipated that compaction grouting of soft soil zones would be required.~~

~~The buildings would be constructed on steel frames with concrete structural walls. Vertical and horizontal expanses of low-emittance window glazing on the face of each building would be separated by horizontal bands of stained board-form concrete, fritted (opaque) glazing and cement plaster, and vertical metal panels.~~

The ground floor levels of both buildings would house community programs such as mail room, laundry, administrative offices, café, store, lounge, and meeting spaces. As an accessible corridor through the development and directly adjacent to the Crown College pedestrian areas, these spaces are intended to attract pedestrians both from the ECI development and from the adjacent Crown College pedestrian areas. ~~Each floor would be divided into three- or four-bedroom apartments or a mixture of the two.~~ Student apartments typically would consist of four-bedrooms, designed to house six persons, which would include two double rooms and two single rooms.

2.2.3.3 Circulation

The project site would be provided with two motor vehicle access roads from Chinquapin Road. The existing entry road to Crown College would be demolished and a ~~reconfiguration of the~~ new entry drive to Crown College, which would intersect Chinquapin Road about 220 feet south of the current entry drive, would provide access to Building A at the southern end of the complex, and to the entry to the main plaza~~/terrace~~ area. A second access road at the north of ECI Building B, intersecting the east side of Chinquapin Road opposite the campus fire station, would provide access to the north end of the complex and to the lower terraces of Parking Lot 111. A ramp along the east edge of the ECI plaza, connecting to both the north and south access roads, would provide emergency vehicle access to the east side of Building B and the west side and north end of Building A and along the length of the east side of the site

The~~ terrace~~ plaza also would provide an emergency vehicle access and pedestrian route along the length of the east side of Building B~~the facility~~, which would ~~be~~ link~~ed to both~~ the new northern and southern motor vehicle access roads. Crosswalks across Chinquapin Road would direct pedestrians to the pedestrian sidewalk along the west side of Chinquapin Road and thence to a sidewalk along the north side of McLaughlin Drive and to McLaughlin Drive transit stops. Secure bicycle storage would be provided ~~adjacent to the buildings in a bike parking area.~~in a basement at the southern end of Building B.

Existing pedestrian stairways and paths between Crown and Merrill Colleges and the Crown/Merrill Apartments, which presently lead across the middle and lower terraces of Parking Lot 111, would be rerouted temporarily during construction, and a temporary pedestrian route would be designated around the east and west edges of the construction area ~~end of the lower terrace of Parking Lot 111~~. After the project is completed, the new plaza and adjacent landscaped terraces would improve pedestrian access across the site.

2.2.3.4 Parking

The ECI Project site includes a portion of Parking Lot 111, and project construction will require temporary use of the entire lot for staging. Project regrading and development of the site would eliminate the uppermost terrace of Parking Lot 111 and all four parking bays along the Crown College access road, and would result in a net reduction in the capacity of parking in campus Parking Zone 4 of 65 parking spaces. The project would develop new parking bays along the north access road and the Crown access road. The Crown/Merrill Apartments and Crown and Merrill Colleges each have additional parking lots.

2.2.3.5 Landscaping, Community, and Open Spaces

Community and Open Spaces. The plaza and landscaped ~~multi-level~~ terraces between Buildings A and B would provide outdoor extensions of the public lower floor areas of Building B. The proposed terraced bioretention area would be landscaped and would provide both naturalized open space for community use and storm water infiltration and detention. Retaining walls along the edge of the terrace and in the bioretention area would provide seating, and these areas would be interconnected with each other and with the parking areas by stairways, access ramps, and paths.

Landscaping. Proposed landscaping plan (see Figure 2-2, *Proposed Site Plan)* includes shade trees, evergreen trees, and specimen trees. The trees would be planted along Chinquapin Road adjacent to Building B, around the bioretention area, and in the plaza between the two apartment buildings. Native shrubs, ground cover, and grasses would be planted among the trees and around the project site. Landscaping is planned to integrate the project margins with the surrounding forest and woodland, while also providing open sunny areas to enhance use of the exterior areas by residents. Landscaping also would include turf plantings in the bioretention area to provide sunny ground-seating. Irrigation for the landscaping would be required for plant establishment but has been designed for minimal on-going water requirement. If a passive irrigation system is included as part of the project's storm water management, stored rainwater would provide a portion of the turf's irrigation needs.

Lighting. In accordance with the UC Santa Cruz Campus Standards and Design Guidelines, pole lighting utilizing shielded and cutoff type fixtures with high-intensity discharge lamps would be used for parking and walkways to minimize glare and off-site light spill. A photocell and automatic lighting control system would be used to turn lights on and off.

2.2.4 Public Services

Fire protection for the complex would be provided by the UC Santa Cruz Fire Department from the campus fire station which is located on Chinquapin Road immediately opposite the project site, and by the City of Santa Cruz Fire department, under its mutual aid agreement with the Campus. The City of Santa Cruz would provide a ladder truck, if needed. Suitable smoke and fire detectors would be installed in both buildings. The buildings' fire alarm system would tie in to the existing campus fire protection system. Both buildings would be equipped with automatic fire sprinklers, as well as with all fire-protection features required by code.

Police services would be provided by the UC Santa Cruz Police Department from the central campus police station located near the campus main entrance, about 1.5 miles from the project site.

2.2.5 Utilities

Sustainable development principles have been taken into account in the design of the proposed project, in particular with respect to features incorporated in the project to reduce utility demand. The project incorporates design elements to conserve water and energy, increase the effectiveness of utility use, and reduce disposal and waste, as described in Section 2.2.7, below. Conservation features are described in more detail by utility area.

The project would be connected to existing underground water, gas, electrical and telephone lines that run along Chinquapin Road from services under McLaughlin Drive. No off-site upgrades to utility systems would be required to provide service to the project.

Table 2-1, below, shows the projected annual and peak demands for each utility.

Table 2-1
Projected Utility Demand

Utility	Peak Demand	Annual Demand
Domestic water (gpd)	NA	8.0 million gallons
Sanitary sewer (gpd)	NA	6.1 million gallons
Electricity	Building A: 330 KW, Building B: 852 KW	1.6 million kWH
Natural Gas (therms)	20.5 MBTU/hr.	153,000 therms

Note: Gpd = gallons per day

2.2.5.1 Domestic Water and Fire Water

Water conservation strategies included in the proposed design include the use of highly efficient plumbing fixtures, including low-flow showers, high-efficiency (dual-flush) toilets, and water-efficient washing machines. Landscaping would consist of drought resistant and native plantings.

Domestic water lines for the new facilities would connect to an existing campus water main in Chinquapin Road. To provide adequate pressure, the fire water line for the new buildings would ~~either~~ connect to the existing domestic water main upstream of a pressure-reducing valve just north of the fire station parking lot (Figure 2-2)~~, or would connect to the campus domestic water main in Chinquapin Road adjacent to the project site. If connection to the area north of the fire station is required, the~~ This new fire water line would be located in areas that are already paved or otherwise disturbed. Each project building, and the irrigation system, would be provided with a separate water meter to facilitate monitoring of water consumption.

2.2.5.2 Storm Water

At present, runoff from the project site, as well as runoff from portions of the Crown/Merrill Apartments and from all of Parking Lot 111, flows overland or via drainage culverts, without detention, to an outfall at the head of Gully H. Storm water runoff is directed under the paved parts of the lots in culverts, flows above ground in two open forested basins within the parking lot, then continues through a culvert under the east end of the lowest terrace and paved drainage swales along its margins to Gully H. The gully slopes steeply eastward from the project site toward the Pogonip City Park in the San Lorenzo River drainage basin. Gully H carries water only during storm events and then only about as far as the eastern boundary of the campus, about 1,100 feet downstream from the project site. A short distance east of this point, the slope levels out, and flows tend to dissipate. There is no continuous surface channel connecting Gully H to the San Lorenzo River or any of its tributaries (H.T. Harvey & Associates 2008). The proposed project also would direct runoff to Gully H.

The existing impervious areas on the project site total about 0.9 acres. Development of the proposed project would increase the impervious surface area (pavement or buildings with traditional roofs) on the 3.1-acre site to 1.63 acres. The remainder of the site surfaces would be pervious, including 0.26 acre of pervious concrete and 0.13 acre of green/living rooftop, in addition to traditional landscaping, bioswales, and bioretention areas. The storm water management system for the proposed project includes a series of detention and bioretention features that would reduce the volume and rate of runoff leaving the site while improving the water quality through biofiltration. These features are illustrated in Section 3.8 (*Hydrology and Water Quality*), Figures 3.8-3 and 3.8-4, and are described below.

The 0.13-acre (5,750-sf) green/living roof would be located on the eastern portion of Building B. The vegetated roof would consist of a waterproof membrane, an “egg-crate” water retention layer, a root barrier, a growing medium, and highly drought-resistant ground cover plants. The green roof would slow down the concentration of storm water flows from the rooftop. The evapotranspiration of some of the water retained in the soil profile would reduce the total volume of runoff from the roof, and the soil and vegetation would absorb pollutants.

In large storm events, when the rainfall on the vegetated roof exceeds the capacity of the soil and vegetation to hold water, the excess flows would overflow down roof leaders and be directed to the bioretention~~/bioswales~~ and rain gardens adjacent to the building and in the plaza. These features would provide initial storm water quality treatment to runoff from the traditional, impervious roofs on Building A and a portion of Building B, and some reduction in runoff volume through evapotranspiration. In large storms, the excess runoff to these features would be collected in perforated piping within the drain rock, and piped to ~~the bioretention area east of Building B or~~ to underground detention vaults.

Paving in the plaza adjacent to Building B would be pervious. The pavement would be provided with an underdrain to prevent saturation of the subgrade soils. The underdrain system would drain the overflow storm water via pipe to the detention vaults~~bioretention area northeast of the plaza~~. ~~This consists of swale configured as a series of terraces that would be separated by curving retaining walls and planted in turf. Runoff that reaches the bioretention area would be handled either through a passive irrigation system underlain by underground storage tanks to capture excess flows, or simply would be captured in underground tanks without the overlying irrigation system. In either case, the w~~Water stored in the tanks would be discharged to the existing culverts that run beneath the two lower terraces of Parking Lot 111 to the existing outfall at the head of Gully H. More detail on the features of this system is presented in Section 3.8 (*Hydrology and Water Quality*).

2.2.5.3 Wastewater

Wastewater collection, disposal, and treatment demands are directly related to indoor consumption of domestic water. The project's potential wastewater discharge would be reduced commensurate with the water conservation features and measures included in the project, as described above. The existing pipelines have adequate capacity to serve the project.

Wastewater from the ECI site would be collected and discharged via gravity flow into the existing campus sewer line that extends down Chinquapin Road to Jordan Gulch and discharges into the city's sewer system at Bay and High streets. The City of Santa Cruz provides municipal wastewater treatment services for the entire UC Santa Cruz campus.

2.2.5.4 Telecommunications

Wireline communications services are provided to the campus by an outside provider, through a single point of connection at the main entrance to the campus. The on-campus wireline communications system is owned by the University and managed by UC Santa Cruz Information Technology Services (ITS). ITS also manages CruzNet, the UC Santa Cruz wireless network on campus. Residence hall Ethernet and network connections are administered by ResNet, a joint effort between ITS and the Colleges and University Housing Services (CUHS). Off-campus connectivity to the campus network is currently provided via Gigaman service, also provided through an outside provider.

The campus is served out of seven second-tier area facilities. Telephone, television, and LAN fiber radiate out of seven second-tier facilities to third-tier distribution points, typically individual building entrances.

A telecommunications service conduit runs underground to the site along Chinquapin Road and then along the south side of the existing Crown College access road. Each apartment in the ECI Project would be provided with ~~cable and/or~~ internet-ready connections. Cable television (CATV) service also would be provided to each apartment in the ECI complex by UC Santa Cruz ITS Media Services. The proposed project would add new lines, with points of connection for both buildings on ~~Chinquapin for Building B and on~~ the Crown access road~~ for Building A~~. Cell phone service in this area of campus is facilitated by cell antennae on the campus a short distance uphill from the Crown/Merrill Apartments.

2.2.5.5 Electricity and Natural Gas

Electricity and natural gas service would be provided to the ECI complex through the campus by a main service from PG&E. Electrical and natural gas lines currently extend past the project site along Chinquapin Road. ~~Underground conduit in Chinquapin has sufficient capacity to provide electrical service to the proposed project.~~ The electrical lines in Chinquapin Road would be upgraded by installing new cable in existing conduit down Chinquapin Road to McLaughlin Drive, and in McLaughlin Drive from Chinquapin Road to Hagar Drive. Two new switchboxes would be installed underground beneath McLaughlin Drive. Points of connection ~~likely would be similar to those for telephone and cable lines~~ for electricity and gas would be at a utility service yard at the northwest end of Building B. Power would be distributed through Building B and the project site to Building A.

2.2.5.6 Solid Waste

The proposed project would generate general household trash, such as paper scrap and packaging materials, as well as food waste from food service facilities and apartments, and electronic and other waste. Refuse collection and recycling for the facility would be provided by UC Santa Cruz Physical Plant, which services refuse and cardboard dumpsters on the ground floor of each building. Each building would be provided with separate dumpsters for trash, mixed recycling, and cardboard.

2.2.6 Population

The proposed project would house a student population of about 600, including 594 students (of whom 17 would be student resident assistants), and two resident staff who would reside in apartments in the facility. The facility would be supported by a full-time equivalent non-resident staff of about 8 additional employees. It is anticipated that most residents would be undergraduate students, primarily in their second and third years, but this composition could vary over time and from year to year. It is anticipated that the project would provide housing primarily for students associated with Crown and Merrill Colleges.

2.2.7 Sustainability and Carbon Footprint

Consistent with the stated planning principles of the 2005 LRDP and of the commitments of the University of California and the campus to sustainable development and to greenhouse gas reductions, the project has been planned and sited in such as way as to minimize its carbon footprint and the project's environmental impacts. The proposed project targets a minimum U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) Silver certification[1].

Two elements that received extensive consideration in project siting and the design of the development were the trees on the project site, and potential storm water flows from the site. As described in Section 2.2.5.2, above, and detailed in Section 3.8 (*Hydrology and Water Quality*), project design includes the use of pervious paving, a green roof, and bioretention areas to reduce the rate and volume of storm water runoff from the site and to remove pollutants. Runoff from the site would be released at rates lower than the estimated pre-development (i.e., pre-UC Santa Cruz) peak flow rates. The project would also provide underground detention vaults designed to reduce existing peak-runoff flow rates from other existing development in the Gully H watershed. These features will result in a net benefit from the project with respect to improved water quality and reduced erosion potential.

As described ~~as described~~ in Section (*Site Selection and Layout*), project siting and design were analyzed and adjusted to avoid removal of trees where possible. As described in Section 2.2.8.1, below (*Demolition, Grading and Fill, and Site Preparation*), the trees identified for preservation and an

[1] A green building rating system developed by the U.S. Green Building Design, which assigns a point value to each "green feature" included in the project.

appropriate buffer around each tree will be protected from heavy vehicle traffic and other potential damage during construction. Subsequent to development, approximately 50 trees will be planted on site.

Additional project elements oriented toward sustainability include high-density development on a previously developed site to minimize new intrusion into undeveloped areas and high quality natural habitat; design of grading and building height to be compatible with the existing topography and backdrop of trees; and use of shielded and cutoff lighting. Design will also incorporate heat-reflective roofing to minimize heat absorption; low-emittance double paned windows and insulation in both exterior and interior walls to minimize heat loss and gain; use of energy-efficient boilers and ENERGY STAR appliances to minimize project energy demands; incorporation of the project's heating and ventilation system into the campus's Building Management System; and design and use of water-efficient landscaping, irrigation systems and plumbing fixtures (including plumbing for a future greywater system) to minimize water demand from the project.

The project design will also incorporate the use of locally produced materials and other environmentally preferred materials wherever possible. For example, site furniture, such as wooden seating, railings and signs, would be constructed from wood harvested from the site. Project landscape treatments will reduce storm water runoff and provide biofiltration of runoff. In addition, the construction contractor would be required to prepare a waste management plan to divert at least 75 percent of construction waste from landfill disposal. In addition, most of the trees that would have to be removed from the site to accommodate development would be stockpiled on campus for on-site or local milling, and the lumber would be reused for other campus projects.

Consistent with the University's sustainability goals, the development would be served by bicycle lanes, pedestrian paths and transit facilities that are integrated with the existing circulation network to encourage increased reliance on sustainable transportation modes, reduce the need for residents to have and to use motor vehicles on campus, and support the reduction of transportation-related greenhouse gas emissions. The project, like the rest of the campus, would be subject to a rigorous transportation demand program to reduce motor vehicle trips.

2.2.8 Project Construction

2.2.8.1 Demolition, Grading and Fill, and Site Preparation

Prior to the beginning of construction, the project work area, including Parking Lot 111, would be closed and fenced, and pedestrian paths around the west and east ends of the work area would be identified and protected to provide alternative travel routes during construction.

Early in the project design process, the Campus Arborist undertook a detailed assessment of trees on the project site and around its margins, and determined the size of the buffer from heavy vehicle traffic that is needed to ensure the future health of each tree. This assessment was taken into account in project design, as described above, to identify project design modifications and facility siting adjustments that could be made to protect trees within and on the margins of the construction site. Trees that could be preserved, and the protection buffer, were then identified on the tree removal plan. Prior to the start of construction, a fence would be erected to delineate the protection buffer for each preserved tree to prohibit use of heavy equipment within the buffer zones. Construction would then proceed with removal of those trees and shrubs that cannot be preserved. Development of the project site would require extensive cut and fill, and this would necessitate removal of most of the trees within the site work area, a total of about 220 trees.

Next, a new access road into Crown College, which also would serve as the south access road to the project site, would be constructed and paved and the existing Preceptors' Apartment building would be demolished, along with parking areas, roadways, and utilities within the project footprint that are not designated to remain, with the exception of the existing parking and access road to Crown College. A new access road into Crown College, which also would serve as the south access road to the project site, would be constructed and paved and put into service, and the existing Crown access road would then be demolished. Organic topsoil from the site would be removed, stockpiled, and protected for future landscaping. Site grading would entail 5,900 cubic yards (cy) of cut and 9,050 cy of fill.

Demolition would require a crane and excavators, and probably jackhammers, as well as loaders and dump trucks. Other equipment that would be operated on the site during grading and site preparation would include backhoes, scrapers, loaders, forklifts, and possibly a crane. It is anticipated that heavy equipment would be operating daily on the site during at least the initial ~~12~~ 9 months of development, and less intensively for the following six months. Smaller equipment and power tools would be expected to operate throughout construction. Construction during the academic year would be confined to daytime hours on weekdays, but would be extended to weekends if necessary, during some academic holiday periods. A Storm Water Pollution Prevention Plan would be prepared and implemented to comply with the requirements of the State Water Resources Control Board general permit for construction activities. It is not envisioned that any areas within the development site would remain undeveloped for any length of time after grading.

One lane of Chinquapin Road would be closed during some periods for construction of underground utilities. Electrical and gas service along Chinquapin would be interrupted briefly while project utilities are connected. ~~No interruptions of existing utility service are anticipated.~~

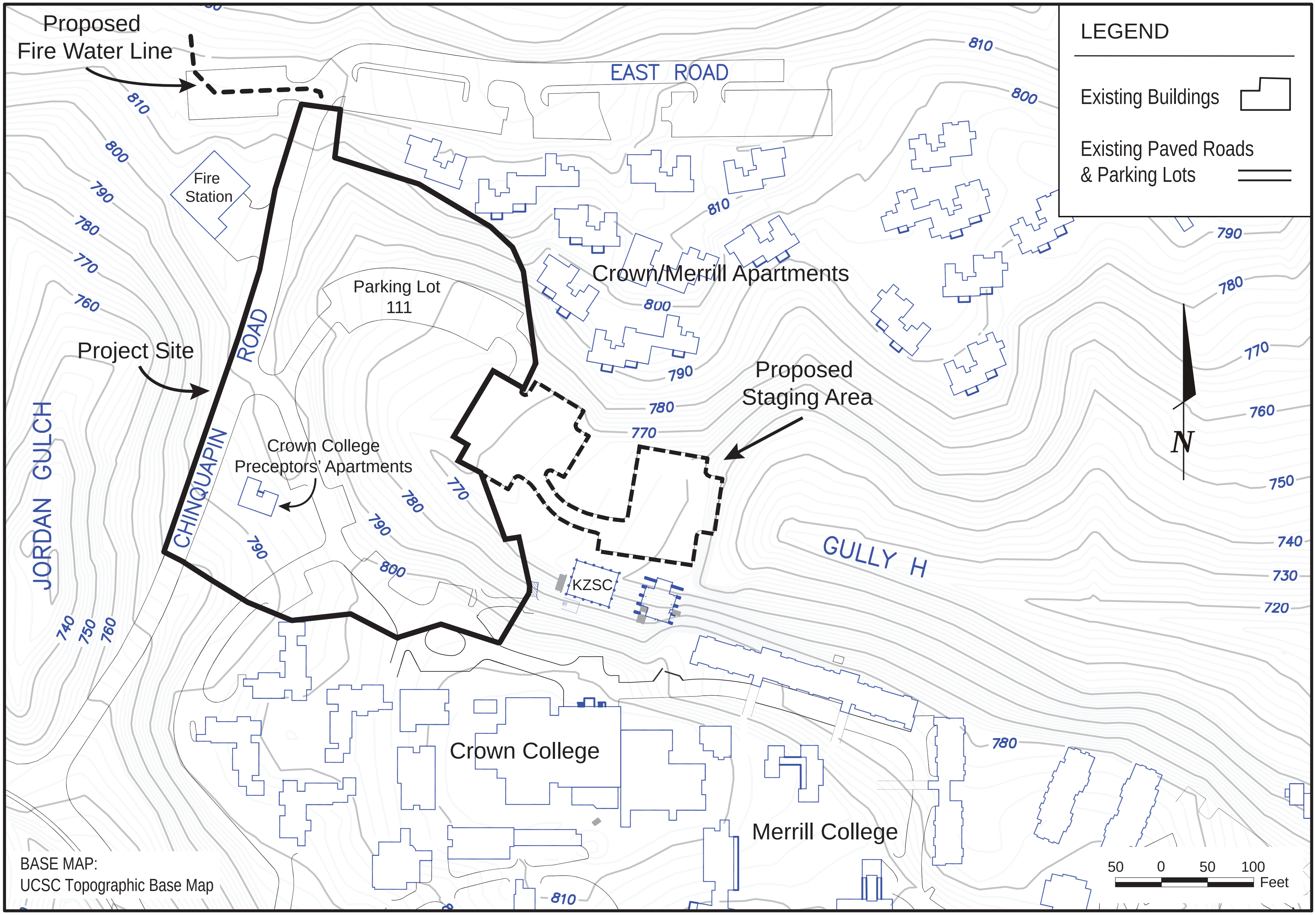
2.2.8.2 Construction and Occupancy Schedule

It is anticipated that construction would begin in approximately July 2009 and that the facility would be occupied in fall term 2011.

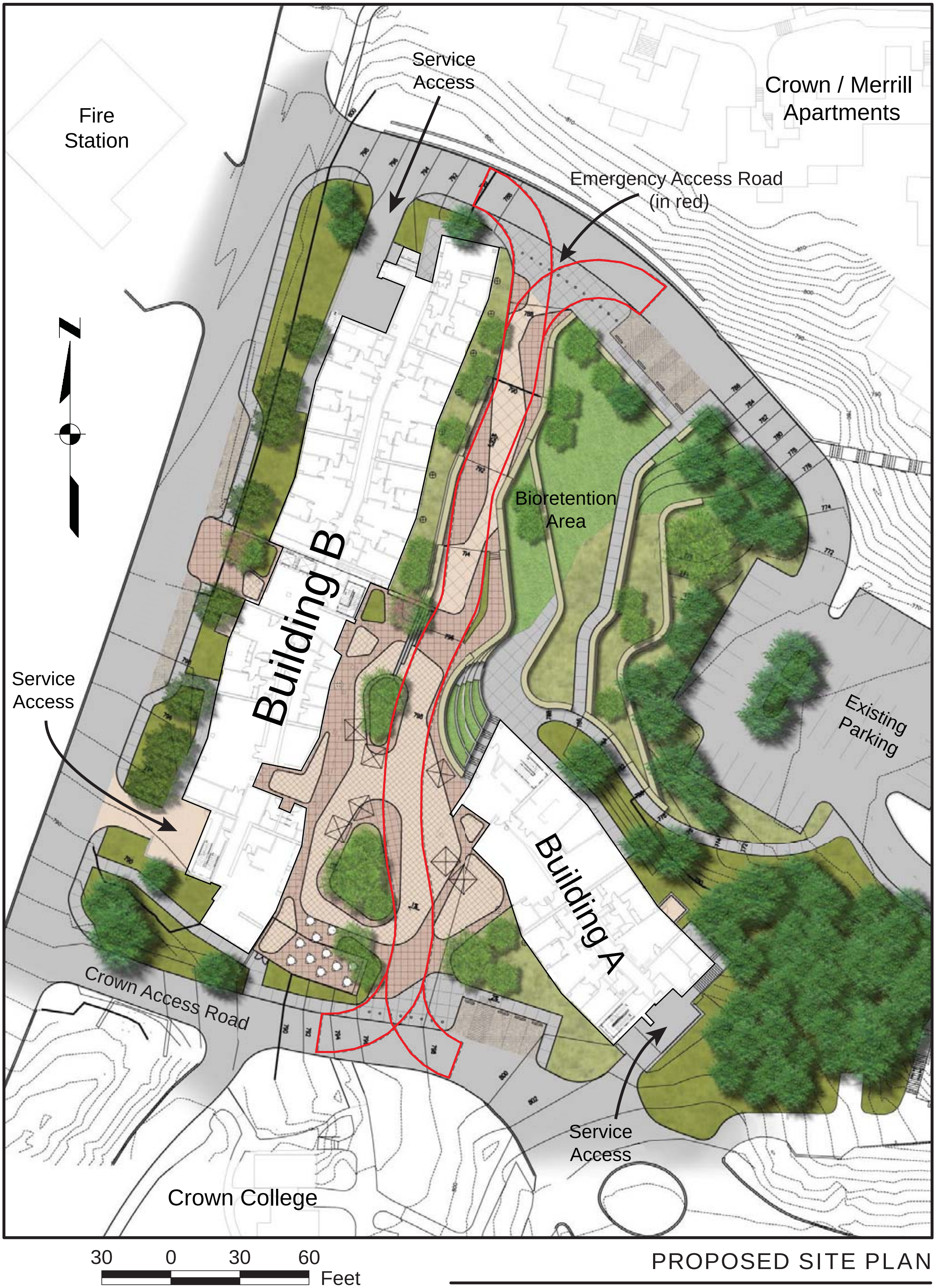
2.3 REFERENCES

CUHS (Colleges and University Housing Services). 2008. E-mail correspondence from Kevin Tresham, UC Santa Cruz CUHS to Sally Morgan, Physical Planning and Construction. November 17.

H. T. Harvey & Associates. 2008. Wildlife Surveys and Waters of the U.S. Assessment. U.C. Santa Cruz East Campus Infill Housing, Chinquapin Road Parking Lot, and Chinquapin Road Widening Projects. On file, UC Santa Cruz Physical Planning and Construction. December.

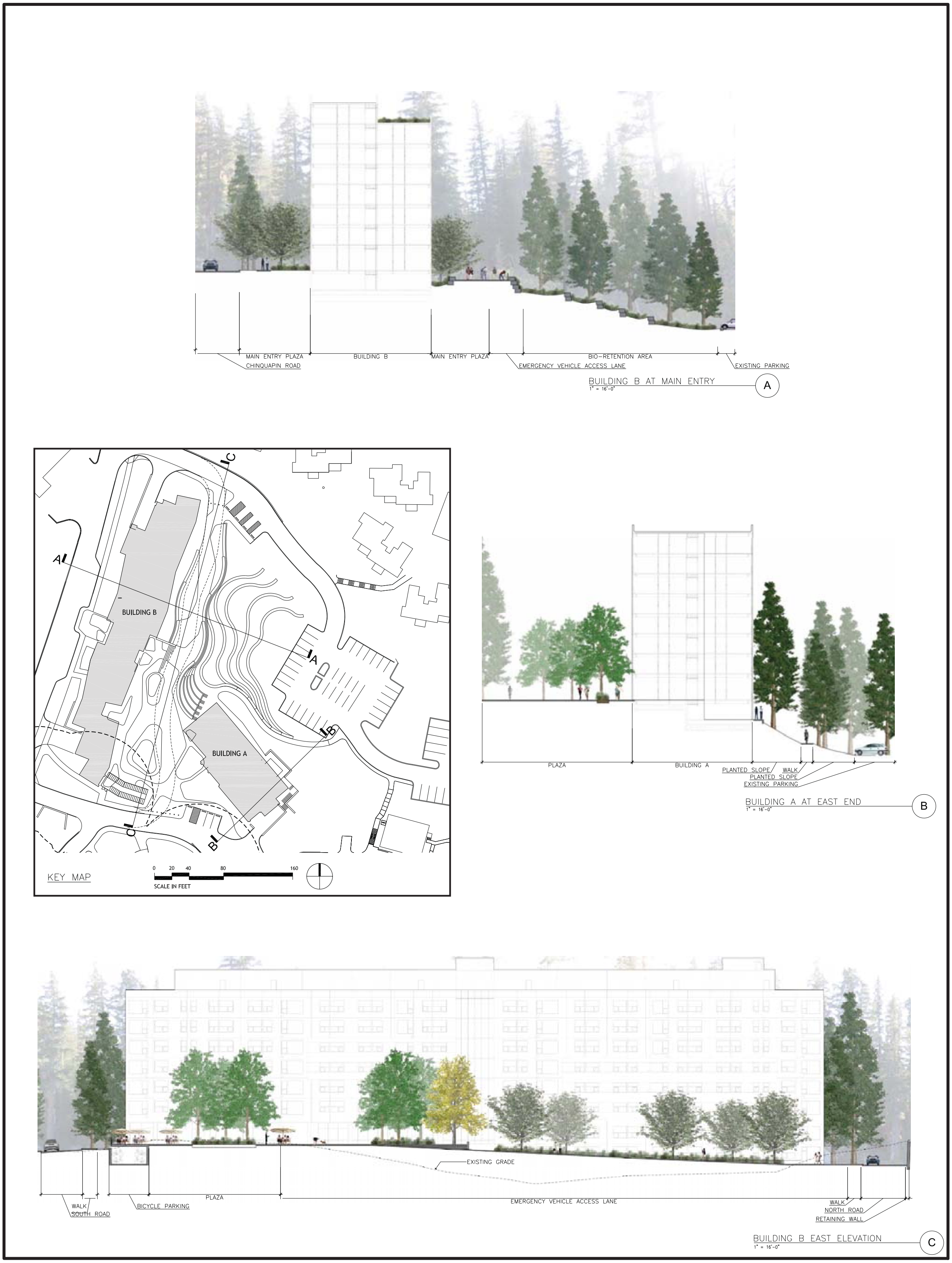


PROJECT SITE: EXISTING CONDITIONS FIGURE 2-1



PROPOSED SITE PLAN

FIGURE 2-2



PROPOSED SITE SECTIONS

FIGURE 2-3

CHAPTER 3 ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION

TABLES

Chapter 3

Environmental Setting, Impacts, and Mitigation

This chapter of the EIR presents potential environmental impacts of the proposed ECI Project. The scope of the analysis and key attributes of the analytical approach are presented below to assist readers in understanding the manner in which the impact analyses have been conducted in this EIR.

SCOPE OF THE ENVIRONMENTAL IMPACT ANALYSIS

In accordance with Appendix G of the CEQA Guidelines, the potential environmental effects of the proposed project are analyzed for the following resource areas:

- Aesthetics
- Agricultural Resources
- Air Quality and Climate Change
- Biological Resources
- Cultural Resources
- Geology, Soils, and Seismicity
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Population and Housing
- Public Services
- Recreation
- Traffic, Circulation, and Parking
- Utilities

An Initial Study for the 2005 LRDP determined that no impacts to Mineral Resources would occur as a result of any of the development under the 2005 LRDP, of which the proposed project is an element. Accordingly, Mineral Resources are not discussed further in this EIR.

Definition of Baseline or Existing Conditions

According to Section 15125 (Environmental Setting) of the CEQA Guidelines, an EIR must include a description of the existing physical environmental conditions in the vicinity of the project to provide the "baseline physical conditions" against which project-related changes can be compared. The baseline condition is the physical condition that exists when the Notice of Preparation (NOP) is published. The NOP for the proposed ECI Project was published on September 22, 2008. The baseline for this EIR therefore is September 2008. For analyses that refer to academic year, such as campus population, the baseline year is the closest year to the baseline for which complete data are available, in this case, academic year 2007-08. For analyses that require data for a full calendar year, 2007 is the baseline year.

Definition of Study Area

The extent of the study area varies among resources, depending on the extent of the area in which impacts could be expected. For example, for traffic impacts the study area includes not just the campus but also roadways and intersections in the city and county of Santa Cruz that might experience traffic from the project, whereas cultural resource impacts are assessed only for the project site and immediate vicinity, which are the only areas in which cultural resources could be affected by the project. The study area for each resource area is defined in the pertinent sections of this chapter.

CUMULATIVE IMPACTS

CEQA requires that in addition to project impacts, an EIR must discuss cumulative impacts. According to Section 15355 of the CEQA Guidelines:

'Cumulative impacts' refer to two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.

(a) The individual effects may be changes resulting from a single project or a number of separate projects.

(b) The cumulative impact from several projects is the change in the environment, which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.

Section 15130(a) of the CEQA Guidelines clarifies a number of issues with respect to cumulative impacts, as follows.

- An EIR should not discuss cumulative impacts to which the project would not contribute.
- If the combined cumulative impact (impacts from other projects combined with the impact from the proposed project) is not significant, then the EIR should briefly indicate why the impact is not significant, and no further evaluation is necessary.
- If the combined cumulative impact is significant, the EIR discussion must reflect the severity of the impact and the likelihood of its occurrence.
- If the combined cumulative impact is significant, the EIR also must indicate whether the project's contribution to that significant cumulative impact will or will not be cumulatively considerable.
- An EIR may determine that the project's contribution is rendered less than cumulatively considerable if the project is required to implement or fund its fair share of a mitigation measure or measures designed to alleviate the cumulative impact.

Section 15130(b) of the CEQA Guidelines provides additional guidance with respect to how an adequate cumulative impact analysis might be completed and notes that this may be based on:

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

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.

To evaluate the regional cumulative impacts of the proposed project, this EIR uses a list of past, present and probable future projects including: UC Santa Cruz projects in the University's Five-Year Capital Plan; and a list of City and County projects that were recently constructed, are under construction, have been approved, or have pending applications as of the ECI Project baseline, September 2008. That list is presented in Table 3.0-1, below.

Table 3.0-1
Pending, Approved, or Reasonably Foreseeable Projects

NAME/ADDRESS	DESCRIPTION	STATUS
City of Santa Cruz Projects		
Recently Constructed		
2027 N. Pacific Avenue	3,720 square feet (sf) commercial & 4 condo units	Units Being Occupied
125 River Street & N. Pacific Avenue	70 condos & 5,522 sf commercial	Units Being Occupied
108-122 Second Street	Demolish 17 apts. and construct 44 SRO units	Units Being Occupied
250 Cardiff Place	23 MFR units	Units Being Occupied
1606 Soquel Avenue	36 SROs, 1 manager unit	Units Being Occupied
Under Construction		
1375 Pacific Avenue	36,177 sf retail & 54,265 sf office	Under Construction
Tannery Arts Center	100 residential units & 120,000 sf Art Center	Under Construction
Ocean Street Hotel 1410 Ocean Street	100 hotel rooms	Under Construction
121, 131, 134 Kennan St.	14 townhouses / demo. three units	Under Construction
132 Clay Street	16 condos	Under Construction
METRO Base	Transit facility at two sites	Under Construction
1804 Mission Street	18 MFD & 1,617 sf commercial	Under Construction
New Leaf Market 1101 Fair Avenue	17,778 square feet grocery store; attached 3,000 sf tenant space	Under Construction
211 Grant Street	4 townhouses	Under Construction
229 Encinal Street	New industrial building (5,376 sf)	Under Construction
Almar Center Expansion	Proposal to demolish and replace Safeway (27,000 sf)	Under Construction
Approved		
1547 Pacific Avenue	58 residential units and 11,500 sf commercial/restaurant	Approved
408 Broadway	2 townhouses	Approved

Table 3.0-1
Pending, Approved, or Reasonably Foreseeable Projects

NAME/ADDRESS	DESCRIPTION	STATUS
555 Pacific Avenue	82-room hotel	Approved
706-708 Frederick Street	22 condos & 1,600 sf office	Approved
605/636 Pacific Avenue	9-unit hotel and tea room	Approved
716-720-724 Seabright Avenue	12 condominiums	Approved
1335 Branciforte Avenue Subdivision	3 net lots	Approved
527 Sumner Avenue	3 townhouses and SFD demo	Approved
Misty Court 114 Rapetta Road	4-lot minor land division	Approved
Sea and Sand Inn 176 W. Cliff Drive	Remodel with 2 new motel rooms	Approved
550 Second Street	13-room addition to existing 21-room hotel	Approved
119 Ortalon Circle	8-lot subdivision & demolition of 1 SFD	Approved
627-629 Seabright Ave.	6 townhouse units & demolition of 2 SFD	Approved
Branciforte Creek Subdivision	40 SFD	Approved
2200 Delaware Avenue	395,400 sf industrial; 248 maximum residential units (197,100 sf)	Approved
224 Laurel Street	16 MFD & 10,150 sf commercial	Approved
611 Broadway	3 condo units	Approved
170 Frederick Street	9 SFD & 3 ADU	Approved
1101 Ocean Street	975 sf commercial; 6 1-br & 3 studio units	Approved
111 Frederick Street	Demolish SFD and construct 4 townhouses	Approved
1024 Soquel Avenue	2 commercial condos with 4 residential condos above	Approved
410 Dakota Avenue	Demolish SFD and construct 4 townhouses	Approved
1016 W. Cliff Drive	3-lot minor land division	Approved
555 Meder Street	3-lot minor land division	Approved
2232 Mission Street	11 MFD & 574 sf commercial	Approved
110 Lindberg Street	21 MFD	Approved
Marine Sanctuary Exploration Center	Public education/visitor center, approx. 10,000 sf	Approved
517 Cedar Street	17 SROs	Approved
719 Darwin Street	Demo SFD and construct 3 condos	Approved
5 Isbel Drive	39 units (townhouses and single family lots)	Approved
212 Mora Street	4 townhouses	Approved
605 Pacific Avenue	8 SOUs and 344 sf commercial	Approved
150 Fernside Street	Demolish SFD and construct 6 townhouses	Approved
Pending Applications		
313-321-325 Riverside Avenue	155-room hotel with 200-seat banquet hall, café, pool, exercise room – replace 3 existing motels (64 rooms and manager unit) for net increase in 91 rooms and new ancillary facilities	Pending Application

Table 3.0-1
Pending, Approved, or Reasonably Foreseeable Projects

NAME/ADDRESS	DESCRIPTION	STATUS
La Bahia 215 Beach Street	Convert 44 unit apts. to 118 hotel units	Pending Application
1412-16 Seabright Ave.	10 condo units	Pending Application
340 Highland Avenue	Demo 13 MFD and replace with 18 townhouse units	Pending Application
Blackburn Street	9 condo/townhouse units	Pending Application
1314 Ocean Street	14 condos, 4 townhouses, 1 SFD, 1591 sf commercial	Pending Application
350 Ocean Street	82 condo units (with demolition of 24 existing MFD & 2 SFD) and 8,870 sf retail and 7,495 sf spa	Pending Application
1224 Escalona Drive	2-lot tentative map; net increase of 1 SFD	Pending Application
1013 Pacific Avenue	Demolish existing mixed-use building and construct 17 condos	Pending Application
44 Front Street	2 condos and 400 sf commercial	Pending Application
433 Ocean Street	Demo gas station and construct 45 hotel rooms/restaurant	Pending Application
352 Market Street	4 townhouses	Pending Application
City of Capitola Projects		
Various projects	82-room hotel and 2 single-family dwellings	Various
County of Santa Cruz Projects		
Various project	68 single-family dwellings/lots, 146 multi-family dwellings; 215,276 sf commercial, 100,453 sf low-use (church/ storage); 2 parks; extension of service to an existing residential subdivision development (Rolling Woods)	Various
UCSC On-Campus – 2007-08 Five-Year Major Capital Improvements		
UCSC Ranch View Terrace	84 SFD	Under Construction – 1st Phase (45 units); occupancy in 2008-2009 planned – 2nd Phase (39 units) timeline pending
McHenry Library	Renovation and 85,400 new assignable square feet (asf)	Under Construction; occupancy in 2008-2009
Digital Arts Facility	Teaching, research labs, offices – 24,000 new asf	Under Construction; occupancy in 2008-2009
Cowell Student Health Center	Renovation and 7,600 new asf	Under Construction, occupancy in 2008-2009
Biomedical Sciences Facility	Research labs and offices: 57,200 asf	Approved; estimated occupancy in 2011-12
Porter B Student Residence Hall Addition/Dining	Student housing (120 beds) and dining hall	Approved; estimated occupancy in 2009-10
Porter A Student Residence Addition	Student housing (178 beds)	Planned, estimated occupancy 2010-11
Social Sciences Facility Phase 1	Teaching, research labs & offices – 25,000 new sf	Planned; estimated occupancy in 2015-16
Chinquapin Sidewalks	800 ft of sidewalks and road widening for a bike lane	Planned; est. construction spring and summer 2009

Table 3.0-1
Pending, Approved, or Reasonably Foreseeable Projects

NAME/ADDRESS	DESCRIPTION	STATUS
Infrastructure Improvements I	Cooling tower	Under Construction
UCSC Off-Campus – 2007-08 Five-Year Major Capital Improvements		
Environmental Sciences 1 – Marine Sciences Campus	Research labs and offices – new 25,000 asf	Planned; estimated occupancy in 2011-12

3.1 AESTHETICS

FIGURES

3.1 AESTHETICS

This section describes the existing visual setting of the project site and surrounding areas, and evaluates the potential for changes in the visual character of the area due to the proposed project. This section provides project-level analysis and additional detail regarding aesthetics and augments and supplements, pursuant to CEQA Guidelines Section 15152, the analysis provided in Section 4.1, Volume I, of UC Santa Cruz' 2005 LRDP EIR.

3.1.1 Environmental Setting

See 2005 LRDP EIR Section 4.1.1 for a comprehensive discussion of the aesthetic setting of the entire campus.

3.1.1.1 Local and Regional Setting

UC Santa Cruz is known for the outstanding natural beauty of the campus landscape and the quality of the campus's built environment. The scenic and aesthetic quality of the campus is largely a function of the campus's natural setting and the diversity of its natural features but is also influenced by the built environment. The visual character of the campus is defined by relatively dense building clusters connected by pathways through natural open spaces. In some areas of the central campus, development is fairly dense and somewhat urban in impression.

Second growth redwood and mixed evergreen forest dominates the central campus and areas north of the existing developed campus core. Deep ravines cut down the campus slopes and provide varied and visually interesting landscapes. There are three large meadows on the lower campus and three smaller meadows (Porter, Crown, and Kerr) in the central and north campus. The smaller meadows are ringed by forest lands. Several undeveloped open space areas are valued scenic or natural resources on campus and have been designated as Protected Landscapes, Campus Natural Reserve, or Campus Habitat Reserve in the 2005 LRDP. Protected Landscapes on campus include a large portion of the Great Meadow and the areas in the lower campus.

Most campus buildings, including the residential colleges, are located in the forested central campus; most structures in this area are not visible from the lower campus because they are screened by trees. Buildings have deliberately been designed not to extend above trees. By contrast, the lower campus is largely open space, dominated by the Great Meadow, East Meadow, and the large meadow to the west of Empire Grade Road. On-campus buildings in the grasslands tend to be visually prominent except as screened by topography. Developed open spaces such as plazas, courtyards, gardens/cultivated areas, and recreational areas contribute to the overall visual character of the campus and of the more localized areas in which they are situated and provide visually unobtrusive open areas that do not detract from more distant scenic views.

The campus is regarded by local residents as an important visual resource for the city because it provides an open backdrop for developed areas of western Santa Cruz. The lower campus grasslands and the forest canopy of the upper campus are visible from various points throughout the city of Santa Cruz, including the wharf, the Boardwalk, and Highway 1. Because most campus buildings are located in the forested central campus, few campus buildings can be seen from these points. The most notable exceptions are the Music Center and Baskin Visual Arts Center, which can be seen from lower elevations and the coastline because they are situated at the edge of the forested central campus overlooking the Great Meadow. The light color of the buildings against the darker backdrop of the forest also contributes to their off-campus visibility. Some of the buildings of Cowell and Stevenson Colleges can also be seen from off-campus locations, although they are partially screened by vegetation.

3.1.1.2 Site Characteristics

The project site is located within the forested central campus, near the northeast edge of existing campus development. The site lies at the head of a natural ravine that was partly filled in the 1960s for construction of Parking Lot 111. The slopes of the ravine are largely wooded, and existing trees provide a screen between the parking lots and most of the development to the north and south. The Crown/Merrill Apartments to the north of the project site are three-story wood construction. The buildings that comprise Crown College to the south are three-story wood structures covered in stucco. Two redwood pole buildings lie along the southern slope of the ravine above the lowest parking lot. The proposed site of Building A is on the wooded southern slope of the ravine; the proposed site of Building B includes the existing parking lot access road, a portion of the upper terrace of Parking Lot 111, a portion of the existing access road to Crown College, and the site of the existing Crown College Preceptors' Apartments.

Views from the Project Site

Because of the topography and existing vegetation, views from the site are limited to the buildings, parking lots, and trees in the immediate vicinity. The primary views from the site are into the surrounding redwood groves, toward existing buildings on the slopes of the drainage, or up to open sky. Some of the Crown/Merrill Apartments are visible from the site, and some Crown College buildings are partly visible through the intervening trees. Chinquapin Road, a portion of the forested Jordan Gulch corridor, and the fire station are visible from the western end of the site.

Views of the Project Site

As illustrated in 2005 LRDP EIR Figures 4.1-12 through 4.1-15, the portions of the campus that are visible from off-campus does not include the project site. Most of the project site is visible from Chinquapin Road, and some units in the Crown/Merrill Apartments. Views of the site from Crown College are largely screened by vegetation.

The views from the vantage points used in the visual simulations of the proposed project are considered to be representative of the more publicly available views of the site. Figure 3.1-1, *Key to Visual Simulations*, shows the locations of the vantage points from which the photos were taken. The photos are shown in Figures 3.1-2a through 3.1.2c. A description of the existing views of the project site as seen in these figures is provided below.

Figure 3.1-2a shows the existing view from the circle at the entrance to Crown College. The project site is largely hidden by the dense trees on the slope to the south of the circle. The Crown College Preceptors' Apartment building at the southeast corner of the project site is visible behind a few small trees. Vehicles parked in one of the small parking lots along the Crown access road, which would be relocated as part of the project, are partly visible. The Preceptors' Apartment building is dwarfed by the taller trees to the right, left, and in the background.

Figure 3.1-2b shows the existing view from the west end of the Crown/Merrill Apartments parking lot, north of the proposed Building B. From this viewpoint, the view is generally of forest, with glimpses of the vehicles in the upper terrace of Parking Lot 111. Beyond the parking lot, the trees to the south provide a wooded background.

Figure 3.1-2c shows the existing view from Chinquapin Road, at the location of the proposed new Crown College access road. The stop sign, light standard and sign at the existing Crown College access road are visible in the background. Beyond the existing intersection, Chinquapin Road descends out of view and distant trees are visible in the background. The Crown College Preceptors' Apartment building is partly hidden by the dense redwood trees along the east side of Chinquapin.

Scenic Vistas

Scenic views that offer impressive long-range views of Santa Cruz, Monterey Bay, and adjacent hillsides are available from several prominent vantage points on campus. From the central campus, vantage points along the southern forest edge generally offer unbroken and sweeping views towards Monterey Bay. The campus is regarded by local residents as an important visual resource for the city because it provides a natural backdrop for developed areas of western Santa Cruz. The lower campus grasslands and forest canopy of the upper campus are visible from various points throughout the city of Santa Cruz, including the wharf, the Boardwalk and Highway 1. Because most campus buildings are located in the forested central campus, only a few campus buildings at the edge of the forest and in the lower campus meadows can be seen from these points. At night, lighting from the East Remote parking lot and along footpaths to the lot; headlights of cars traveling on Glenn Coolidge Drive, Empire Grade Road, and Heller Drive; and lighting from portions of Cowell and Stevenson Colleges, the East Field House, and the Arts Area are visible from off-campus locations. There is some night sky glow from campus, particularly in fog.

Short-range views on campus vary in character, depending on topography, the type, height and density of vegetation, and the density of buildings. Some locations provide short-range scenic views and vistas that include small meadows surrounded by forests or buildings, and relatively open meadowland vegetated with oaks and madrones. Short-range views through forested areas of ravines and pathways are available in some areas as well.

The project site does not offer on- or off-campus long-distance views, and existing development on the site and in the immediate vicinity is not visible from off-campus or in long-range views from campus vantage points.

Visual Character

The visual character of the project site and surrounding area are defined by both natural and built features, including the bowl-shaped topography of the head of the ravine, the steep, wooded slopes to the north and south of the parking lots, the flat, uniform surfaces of the parking lots, and the low-rise buildings scattered among trees of varying size and type.

Aesthetically Valuable Trees

Although the project site is in a developed area, the trees on the site contribute to the visual character and quality of the setting of the nearby buildings. Trees contribute to the visual character of the central campus in several ways. First, forested areas in the ravines and between clusters of buildings contribute to the sense that the campus is integrated into the natural setting. A pedestrian journeying through the campus passes through a variety of natural and built environments. Second, on a smaller scale, trees provide screens between buildings, break up views of expansive building surface, create visual interest, and reduce glare. Third, in developed areas of the central campus, individual redwood circles or large redwoods that create deep shadows within larger groves of smaller trees and cast heavy shade over nearby open spaces may be an important component of the landscape. Large trees that are unhealthy and have thinner foliage than healthy, mature trees create less dramatic shadows and silhouettes against the backdrop of the sky and, therefore, tend to be less visually striking. Finally, in meadows and other open areas, individual mature oaks, redwoods, or madrones that form distinctive shapes can be visually significant.

The Campus Arborist has surveyed each grove of trees on the project site for health, structure, and potential suitability for retention in proximity to development. The redwood groves immediately north of Crown Circle and those extending down the slope to the west of the KZSC building are generally considered good quality, as are the small redwood groves south of the existing upper parking lot, and some of the redwoods, oaks and madrones on the north slope of the ravine, south and southwest of Crown/Merrill Apartments. Trees assessed as fair to poor quality include the large grove of oak and fir trees and some of the redwoods northeast of the Crown College Preceptors' Apartments, and some of the oak, madrone, and fir trees, and the cluster of four large redwood trees northwest of the existing upper parking lot.

In views from Crown Circle, the dense redwoods on the south slope of the ravine hide most of Parking Lot 111. These trees provide shade for the small lawn at the center of the circle and also create the impression that the circle is at the border between urban development and the forest. As is typical of the central campus, the pedestrian paths from Crown and Merrill Colleges to Crown/Merrill Apartments travel through developed areas (the colleges, apartment buildings, and parking lots) interspersed with forested areas (on the ravine slopes). Chinquapin Road offers the experience of arriving at the edge of an urban area (Figure 3.1-23c). Undeveloped redwood forest rises to the north, Jordan Gulch to the west is heavily wooded, and Crown College and Crown/Merrill Apartments appear as relatively small-scale buildings against a forested background. The south-facing units in the Crown/Merrill Apartments have views across the ravine towards the wooded southern slope where trees largely hide the low-rise buildings of Crown and Merrill Colleges. For some of these units, the view across the ravine is filtered through the trees on the northern slope of the ravine.

Light and Glare

At night, lights from some locations on campus are visible from off-campus locations. These lights include lighting for the East Remote parking lot and along footpaths to that lot, headlights of cars traveling on Glenn Coolidge Drive, Empire Grade Road, and Heller Drive, and lighting from portions of Cowell and Stevenson Colleges, the East Field House, and the Arts Area. There is some night sky glow from campus, particularly in fog.

Lights from the project site and adjacent buildings are not visible from off-campus. The Crown/Merrill Apartment and Crown College buildings adjacent to the project site are relatively small and do not have large expanses of glass or other reflective surfaces that would create significant glare. Glare on the site is also limited by the existing trees and topography, which limit the amount of direct sunlight that reaches the building surfaces and parking lots.

3.1.1.3 Campus Policies

2005 LRDP

The 2005 LRDP recognizes the importance of the campus's natural setting in shaping UC Santa Cruz's physical and academic development. The 2005 LRDP identifies several visual elements on the campus as valued elements of the visual landscape. Long-range views identified as prominent include central campus vantage points from Cowell College plaza, Baskin Visual Arts Center, University House, the knoll at Porter College, and the field at Oakes College. Important vantage points from the lower campus looking across open space areas towards the upper campus include points along Empire Grade Road, Glenn Coolidge Drive, and Hagar Drive (UCSC 2006).

The Physical Planning Principles and Guidelines listed in Section 4 of the 2005 LRDP that are particularly relevant to the aesthetic quality and visual character of the campus include the following:

- Respect the natural environment and preserving open space as much as possible
- Integrate the natural and built environment
- Respect major landscape and vegetation features
- Maintain continuity of wildlife habitats
- Design exterior landscaping to be compatible with surrounding native plant communities

The 2005 LRDP's landscape and open space framework reflects the above guidelines. This framework builds on the current pattern of development clusters carefully placed through a balance of programmatic need and ecological sensitivity. In summary, the framework proposes to maintain the Great Meadow, retain natural open space between development clusters within the campus core, sensitively site new development parcels to the north of the existing core, and keep the far north campus as undeveloped open space.

As required by Campus Standards (http://ppc.ucsc.edu/standards), site lighting with nonglare, down-lighting characteristics is generally used on campus, especially in housing areas. Paths in forest areas are typically illuminated with nondirectional fixtures, as these increase a sense of security on pathways. There is some night sky glow from campus, particularly in fog.

Campus Standards Handbook

The UC Santa Cruz Campus Standards Handbook (http://ppc.ucsc.edu/standards) is provided to UC Santa Cruz consultants for guidance in preparation of construction documents for projects. The handbook outlines building and site specification requirements related to products and design constraints for all construction. The requirements may be modified by the Project Manager to meet the specific project program requirements. While most of the standards focus on areas of functionality and durability, Standards related to site requirements, such as tree protection, landscaping, planting, and trash collection, affect campus aesthetics.

Design Review Process

Current University policy requires independent architectural design review and independent cost estimates of projects with a total project cost over $5 million. The policy requires design reviews to be performed early in the design process at suitable intervals during design and at the time of completion of design. The review focuses on, but need not be limited to, the compatibility of the design with its setting and the suitability of the design to its functional program and project budget.

At UC Santa Cruz, design review is conducted by the UC Santa Cruz Design Advisory Board, whose members are appointed by the Chancellor. At a minimum, consultation with the Design Advisory Board for major projects normally occurs at the beginning of schematic design, midway through schematic design, and midway through design development (http://ppc.ucsc.edu/standards).

3.1.1.4 Regional Aesthetics Policies

As a state entity, UC Santa Cruz is not subject to municipal land use enactments such as the City and County General Plans. Nevertheless, such planning policies are of interest to the University because the University development and local development will be coincident. Therefore, the University seeks to plan and develop its projects in a manner that is consistent with local plans and policies, where feasible.

County General Plan

The County of Santa Cruz General Plan (County of Santa Cruz 1994) includes a Conservation and Open Space Element that designates scenic roads. The Element identifies Empire Grade Road, from the northern Santa Cruz city limits to the north end of Empire Grade Road, as a scenic road that is valued for its vistas. Three segments of the southernmost portion of Empire Grade Road are bounded by UC Santa Cruz on both sides. From the southern portion of Empire Grade, there are views of the southern and western portions of the developed campus. The associated policy calls for the protection of public vistas from the designated roads. The Element includes additional policies about scenic protection, including policies to protect public and ocean vistas.

City General Plan

Program 1.3.4 in the Community Design Element of the City of Santa Cruz General Plan supports campus efforts to preserve open space (City of Santa Cruz 1994). Policy 3.3 encourages UC Santa Cruz to maintain the visual quality and character of the campus, such as the campus's natural skyline as seen from the city. Policy 3.4 supports maintaining and developing visual and physical connections between the campus and the downtown. To further protect the natural state of the area, the Element includes Program 1.2.1, which directs the City to annex UC Santa Cruz lands outside of the Coastal Zone.

3.1.2 Relevant Project Characteristics

The proposed project would construct two seven- to eight-story buildings, a new access road, a plaza, and landscaped open space on the site of the existing upper parking lot and the surrounding wooded slopes. A portion of the Crown College access road would be realigned to the south. The Crown College Preceptors' Apartment building would be demolished. Most of the trees to the south of the westernmost Crown/Merrill Apartment building, to the northeast of Crown Circle, in the area around the Preceptors' Apartment building, would be removed.

The building heights would range from 85 to 91 feet. The buildings would be stepped to take into account the natural topography (i.e., Building B would be stepped so that both the ground floor and the roof of the western half would be one story higher than the ground floor and roof of the eastern half). The building color palette would consist of natural colors, such as browns, grays, and greens. Vertical and horizontal expanses of low-emittance window glazing on the face of each building would be separated by horizontal bands of colored stucco.

The proposed landscaping plan (Figure 2-4) includes shade trees and evergreen trees at the south end of the plaza between the two new apartment buildings, along the east and west sides of Building B, and at the northwest and southwest corners of Building B. Native shrubs, ground cover, and grasses would be planted among the trees. The storm water retention area would be planted with native materials.

Outdoor lighting for the project would be directional and would be shielded to minimize light spillage and minimize atmospheric light pollution. In addition, the project would be designed to meet the requirements of LEED v.2.2 Credit 8, Light Pollution Reduction. These requirements include guidelines for interior lighting to prevent interior lighting from exiting through the windows and standards for exterior lighting designed to minimize light pollution.

3.1.3 Applicable LRDP Mitigation Measures

The following, previously adopted, 2005 LRDP EIR mitigation measures are applicable to and incorporated into the proposed project:

LRDP AES-5A: Prior to design approval of development projects under the 2005 LRDP, the UC Santa Cruz Design Advisory Board shall review project designs for consistency with the valued elements of the visual landscape identified in the 2005 LRDP, as well as the character of surrounding development, so that the visual character and quality of the project area are not substantially degraded.

LRDP AES-5B: For projects in redwood forest areas that are visible from areas outside the forest, building heights will be designed to be no higher than the height of the surrounding trees. If a building taller than all the surrounding trees is proposed for construction in a redwood forest area, visual simulations shall be prepared. If the proposed design is determined, in consultation between the visual consultant and the Campus, to be degrading to the visual character of the campus, the design will be modified to reduce the visual obtrusiveness of the proposed project.

LRDP AES-5C: Campus development shall be designed and construction activities shall be undertaken in a manner that shall minimize removal of healthy and mature trees around new projects, except where the proximity of adjacent mature trees to new development is expected to result in a safety hazard or the ultimate decline of the trees.

LRDP AES-5F: Trees identified for removal will be evaluated for their aesthetic value as part of the environmental review process of individual projects.

Individual construction projects that result in the removal of large oak trees or other large unique trees considered to be aesthetically valuable components of the landscape shall replace such trees at a 1-to-1 ratio, either on site, or elsewhere on campus via a contribution to the campus's Site Stewardship program for planting replacement trees.

LRDP AES-6B: Lighting for new development projects shall be designed to include directional lighting methods shielded to minimize light spillage and minimize atmospheric light pollution. This lighting should be compatible with the visual character of the project site and meet the UC Regents' Green Building Policies [now renamed the UC Policy on Sustainable Practices].

LRDP AES-6C: As part of the design review process, the UC Santa Cruz Design Advisory Board shall consider project-related light and glare and the Campus shall require the incorporation of measures into the project design to limit both to the extent allowed by code.

LRDP AES-6E: As part of the design review process, UC Santa Cruz Design Advisory Board shall review outdoor lighting fixtures for roads, pathways, and parking facilities to ensure that the minimum amount of lighting needed to achieve safe routes is used, and to ensure that the proposed illumination limits adverse effects on nighttime views.

3.1.4 Project Impacts and Mitigation Measures

3.1.4.1 Standards of Significance

For the purposes of this EIR, the project would have a significant impact with regard to aesthetics if it would:

- Have a substantial adverse effect on a scenic vista as defined in the 2005 LRDP EIR
- Substantially damage scenic resources as defined in the 2005 LRDP EIR, including, but not limited to trees, rock outcroppings, or historic buildings within a state scenic highway
- Substantially degrade the existing visual character or quality of the site and its surroundings
- Create a new source of substantial light or glare that would adversely affect daytime or nighttime views in the area

The 2005 LRDP EIR (Section 4.1.1.3) defines a scenic vista as an expansive view of a highly valued landscape, as observable from a public accessible vantage point. Important scenic vistas include views of the Monterey Bay as viewed from Cowell College plaza, Baskin Visual Arts Center, University House, the knoll at Porter College, Stevenson College knoll, and the field at Oakes College; and views across the campus and wooded backdrop as viewed from locations along Empire Grade Road between Western Drive and the campus west entrance, Glenn Coolidge Drive between Hagar Drive and Cowell College, and Hagar Drive between Glenn Coolidge Drive and the East Remote parking lot.

The 2005 LRDP EIR Section 4.1.2.4 defines scenic resources to include Cowell Lime Works Historic District buildings and structures, rock exposures in the main entrance area, and all of the meadows on the lower campus, including Great Meadow, East Meadow, and the meadow west of Empire Grade Road. Meadows on the central campus (Kerr, Crown, Porter) are not considered scenic resources because these are not of a significant scale or part of a scenic vista, and are evaluated in this EIR for their value as recreational open space.

3.1.4.2 Analytical Method

To determine the significance of the project's potential effects on scenic vistas and the visual quality of the campus, the analysis considers the nature and magnitude of anticipated visual change resulting from the proposed project, the number of public vantage points from which this change would be visible, and the number of viewers who would be affected by this change.

To assess the potential effects of the project on the visual character and quality of the project site and its surroundings, a computer model of the project site was created and the proposed buildings and superimposed images of the new buildings on digital photos of the site, electronically removing trees that would be removed for project construction. The visual simulations illustrate "before" and "after" conditions from three viewpoints near the project site: Crown Circle, Chinquapin Road at the entrance to Crown College, and the west end of the Crown/Merrill Apartments parking lot. The photos of the existing views of the project site from these locations are presented in Figures 3.1-2a through 3.1-2c. The simulations focus on general building massing, height, and likely range of colors, and provide information to allow assessment of potential visual impacts. They are not intended to present a full and precise illustration of each building's architectural details. The simulations include the trees that would be planted as part of the project's landscaping but do not show other details of the proposed landscaping.

3.1.4.3 ~~2005 LRDP~~ Project Impacts and Mitigation Measures

Scenic Vistas

The project site is visible only from Chinquapin Road, portions of Crown and Merrill Colleges and Crown/Merrill Apartments, and the lower terraces of Parking Lot 111. The southern end of the site is visible from some of the east-facing windows on the top floor of the University Center at Colleges Nine and Ten. The project site does not offer on- or off-campus long-distance views, and existing development on the site and in the immediate vicinity is not visible from off campus or in long-range views from campus vantage points.

The proposed buildings would be visible only from Chinquapin Road and buildings and facilities surrounding the project site. Portions of the buildings would be visible from some of the east-facing windows on the top floor of the University Center; from that location, the new buildings would be framed by the redwood forest along the Jordan Gulch corridor west of Chinquapin Road. Off-site views of the campus are from below the elevation of the project site; because of the topography and existing forest on the slopes surrounding the site, the new buildings would not be visible from off campus.

The project would not create impacts to scenic vistas. No mitigation is required.

Visual Character

ECI Impact AES-1:	The proposed project would substantially degrade the existing visual character of the area.
Applicable LRDP Mitigations:	AES-5A, AES-5B, AES-5C, AES-5F
Significance:	Significant
Project Mitigation:	None available
Residual Significance:	Significant and unavoidable

The proposed project would alter the visual character of the project site by removing trees and constructing buildings that are much taller and more massive than the existing buildings in the area. In existing views that include the project site (Figures 3.1-3a through 3.1-3c), development is dwarfed by and viewed through trees, and is set against a forested background.

The design of the proposed ECI buildings includes color banding in a palette that reflects the natural landscape, and the 300-foot-long façade of Building B along Chinquapin Road would undulate. These design features would visually break up the building masses to some extent. However, with the proposed project, views of the project site would be dominated by the masses of the two new buildings. New trees would be planted around the new buildings. However, from ground level, the building mass will be more prominent than these trees, and distant forest would not be visible beyond the buildings. The visual character of the circle at Crown College, where dense redwoods on the slope to the north now hide most of Parking Lot 111 and create the impression of a forest edge, would be significantly altered (Figure 3.1-3a). Although trees would still border the circle on the northeast, the view to the northeast would be more urbanized than the current condition. From Crown/Merrill Apartments, where trees now hide most of the parking lot, some remaining trees would form a screen that would soften the masses of the new buildings and tall trees remaining to the south (in Crown College), to the east (in Jordan Gulch), and to the west (around the lower terraces of Parking Lot 111) would frame the view (Figure 3.1-3b). From Chinquapin Road, from which the existing small-scale development is surrounded by and viewed through trees, the new buildings would appear to dwarf the trees in the background, particularly when approaching from the south, even though the Jordan Gulch corridor to the west would still be wooded (Figure 3.1-3c). As is evident in the visual simulations (Figures 3.1-3a through 3.1-3c), the new buildings would be lower than the surrounding trees that would remain, so that the visual impact would be limited to the immediate vicinity. Portions of the new buildings would be visible from some of the east-facing windows at the University Center, but the trees in Jordan Gulch would hide much of the building mass.

The 2005 LRDP EIR (Section 4.2.2.3) analyzed the potential impacts of infill development on the visual character and quality of the campus. The LRDP EIR concluded that the impact would be less than significant with mitigation. The LRDP EIR mitigation measures incorporated into the project would ensure that project design preserves the valued visual elements of the landscape; that new buildings do not obtrude above the redwood canopy; and that the Campus would only selectively remove trees from project sites, retain a screen of mature trees where feasible, and continue its practice of tree plantings and maintenance. In addition, the 2005 LRDP guidelines state that development would include a reasonable buffer between new buildings and major roads where possible. According to the LRDP EIR, these measures would help maintain the visual continuity of forested areas to the extent feasible and would also ensure that, from off-campus locations and from vantage points in the lower campus area, the forest areas would not appear substantially changed as a result of development under 2005 LRDP.

LRDP EIR Mitigations AES-5A through -5C and AES-5F are incorporated into the project and were implemented during the siting and schematic design phases of the project. Several alternate schemes for building layout were evaluated for their potential to retain large stands of trees, to maintain natural light on existing buildings, and to provide views between buildings. The Campus Arborist conducted a survey of the quality of the trees on the site, and campus staff met with members of the design team to identify adjustments to the locations of the new buildings, roads, paths, and utilities that would allow for retention of individual trees. The UC Santa Cruz Design Advisory Board also reviewed the project periodically throughout the detailed design process. In addition, the overall footprint of the project was reduced during the design process.

Even with incorporation of the LRDP mitigation measures described above, the project would substantially alter the visual character of the area by removing trees that are a significant element in the existing visual landscape and by constructing buildings whose mass and height are inconsistent with the scale of existing development. As described in Section 3.1.2.2, the aesthetic value of the trees on the project site is provided not primarily by individual large or distinctive trees but by groups of trees that provide screens between buildings, break up views of expansive building surfaces, create visual interest, and reduce glare. Several new trees would be planted between Crown Circle and the new buildings, but this would not recreate the impression of a forest edge, and would only partly mitigate the loss of the dense trees in that area. Similarly, new trees would be planted along Chinquapin, which would soften the stark mass of Building B as shown on Figure 3.1-3c; however, the ECI building would still dwarf the trees.

The visual impact would be limited to views from Chinquapin Road, south-facing portions of the Crown/Merrill Apartments, and the northern edge of Crown College. The main existing outdoor public spaces in the area (the lawn to the north of the Crown/Merrill Apartments Community Room, and, at Crown College, the upper quad and the plaza outside the dining commons), are surrounded by existing buildings, such that the immediate visual character would not be significantly affected. The new buildings would not be visible from other locations on the central campus or from off-campus. Although the visual character impact would be limited to a relatively small area, it would be significant. The design review process may result in minor alterations to the building facades, landscaping, and other site amenities, but these would not reduce the building mass or enable the Campus to preserve more of the trees on the site. The only potential alteration to the project that would reduce the visual impact would be to reduce the size of the buildings and/or eliminate one of the buildings, which would reduce the ability of the project to meet the project objectives. No further feasible mitigation is available; therefore, the impact on visual character in the immediate vicinity of the proposed project would be significant and unavoidable.

Light and Glare

ECI Impact AES-2:	The proposed project could create new sources of substantial light or glare that could adversely affect daytime or nighttime views in the area.
Applicable LRDP Mitigations:	AES-6B, AES-6C, AES-6E
Significance:	Less than significant
Project Mitigation:	None

The proposed project would include exterior lighting for walkways, which could contribute to atmospheric light pollution that can hinder observation and enjoyment of the night sky. This lighting would not be visible from off-campus. There is already some lighting in the immediate vicinity of the project site, from existing roads, pathways and parking lots, but the proposed project would increase the number of light sources in the area. Consistent with LRDP mitigation measure AES-6B, exterior lighting would be directional and would be shielded to minimize light spillage and minimize atmospheric light pollution. As required by LRDP mitigation measures AES-6C and AES-6E, site lighting would be considered during the project design review process. In addition, the project would be designed to meet the requirements of LEED v.2.2 Credit 8, Light Pollution Reduction. These requirements include guidelines for interior lighting to prevent it exiting through the windows, and standards for exterior lighting designed to minimize light pollution. The building façade would consist of board-form cement and cement plaster in greens, grays, and browns, interspersed with glazing. The cement and plaster surfaces would not be highly reflective and the façades would not include large expanses of glazing.

The 2005 LRDP EIR identified the contribution of new outdoor lighting to light pollution and glare as a potentially significant impact but concluded that the impact would be less than significant with mitigation. The proposed project is within the scope of the development analyzed in the 2005 LRDP EIR, incorporates the relevant LRDP mitigations, and would be designed to meet the LEED v. 2.2 standards for reducing light pollution. Therefore, the project impact would be less than significant.

3.1.4.4 Cumulative Impacts and Mitigation Measures

Visual Character and Quality

As discussed in Section 3.1.3.3, above, the project's impact on the visual character and quality of the immediate vicinity of the project site would be significant and unavoidable. None of the reasonably foreseeable campus projects would be visible from the project area and none would construct new buildings of a scale inconsistent with existing central campus development. As the proposed buildings would not be visible from other locations on the campus or from off-campus, the project impact on visual character and quality would be local and would not contribute to a cumulative impact to the visual character and quality of the campus.

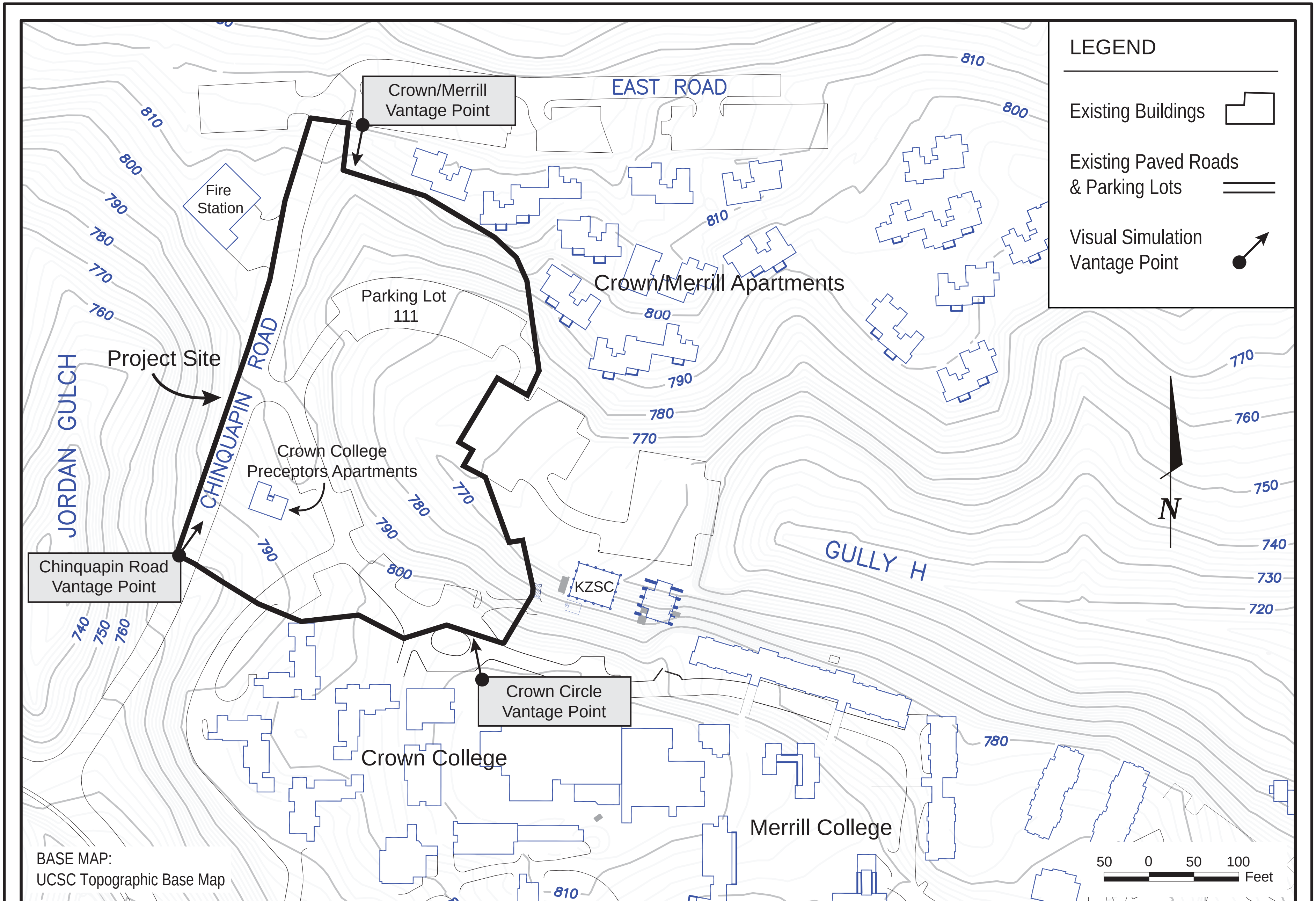
Light and Glare

The 2005 LRDP EIR analyzed the potential that the 2005 LRDP and other future development in the Santa Cruz region could result in new sources of substantial light and glare that could adversely affect nighttime views in the area. The LRDP EIR concluded that the cumulative impact would be less than significant because relatively little growth is planned for the city and county, design standards with respect to potential light and glare impacts are regulated by both the City and County general plans, and implementation of LRDP Mitigations AES-6A through AES-6E would serve to reduce the effects of lighting and glare due to on-campus development to a less-than-significant level. The proposed project is within the scope of development analyzed in the 2005 LRDP EIR; therefore, the project would not contribute to a significant cumulative impact on light and glare.

3.1.5 References

City of Santa Cruz. 1994. *General Plan and Local Coastal Program, 1990-2005*, Adopted October 27, 1992, last amended October 25, 1994.

County of Santa Cruz. 1994. *General Plan/Local Coastal Program.*



KEY TO VISUAL SIMULATIONS

FIGURE 3.1-1

UC Santa Cruz — East Campus Infill Housing Project EIR, Santa Cruz, California — March 2009

VIEW FROM CROWN CIRCLE:
EXISTING CONDITIONS

FIGURE 3.1-2a

VIEW FROM CROWN/MERRILL APARTMENTS:
EXISTING CONDITIONS

FIGURE 3.1-2b

VIEW FROM CHINQUAPIN ROAD:
EXISTING CONDITIONS

FIGURE 3.1-2c

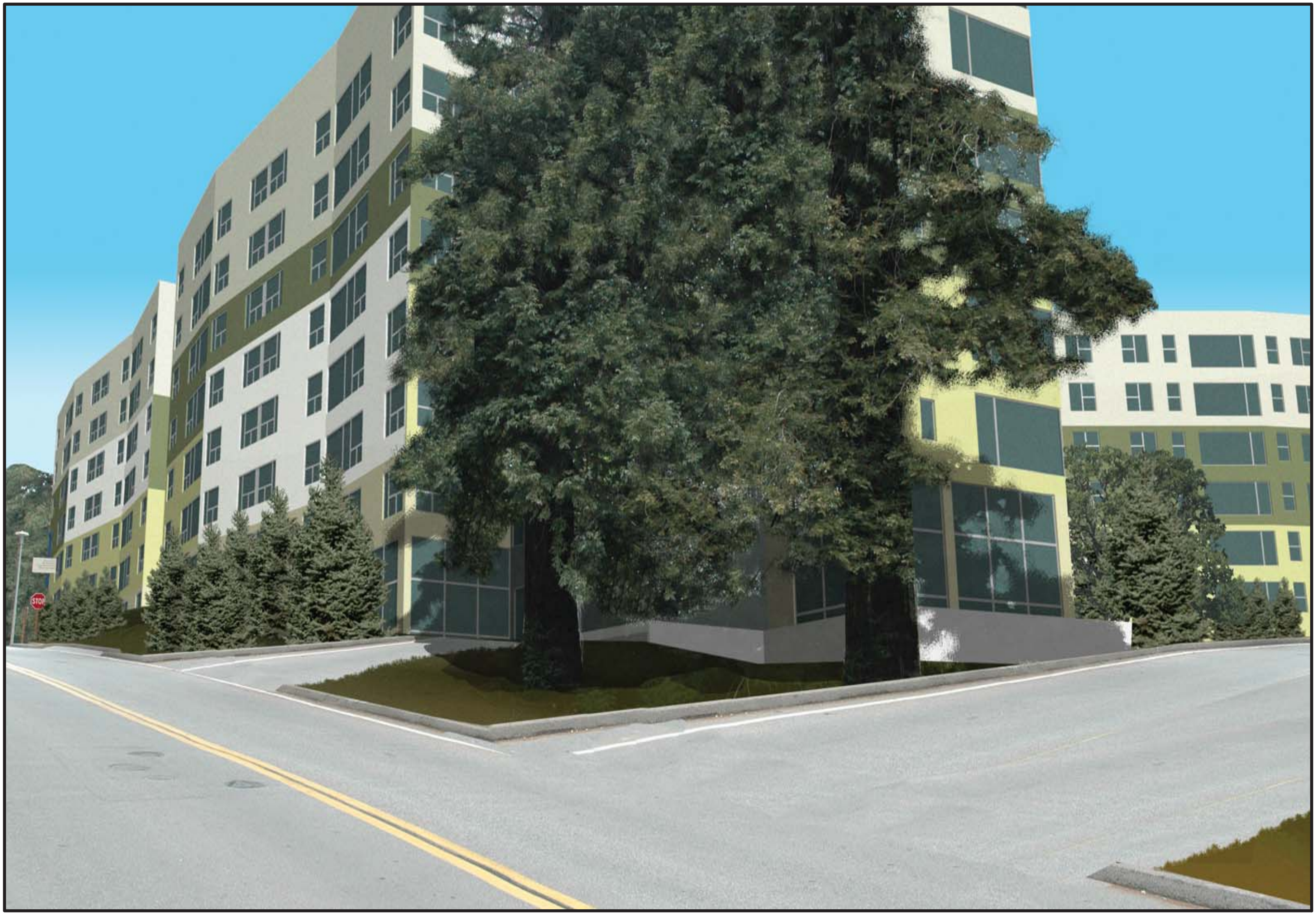
UC Santa Cruz — East Campus Infill Housing Project EIR, Santa Cruz, California — March 2009

VIEW FROM CROWN CIRCLE:
WITH PROJECT

FIGURE 3.1-3a

VIEW FROM CROWN/MERRILL APARTMENTS:
WITH PROJECT

FIGURE 3.1-3b



VIEW FROM CHINQUAPIN ROAD:
WITH PROJECT

FIGURE 3.1-3c

3.2 AGRICULTURAL RESOURCES

3.2 AGRICULTURAL RESOURCES

This section evaluates the potential direct and indirect impacts from development of the proposed ECI Project on regional and on-campus agricultural resources, including designated farmland, land zoned for agricultural use, or land under Williamson Act contract. The Preliminary Draft CEQA Guideline Amendments for Greenhouse Gas Emissions published by the Governor's Office of Planning and Research (OPR) in January 2009 propose the addition to and modification of the CEQA Checklist questions under Agricultural Resources to address conversion of forest land or timberland to nonforest use. In this EIR, the greenhouse gas emissions that would result from the removal of trees under the proposed project are analyzed in Section 3.3, *Air Quality and Climate Change*. The biological resources impacts of timberland conversion are analyzed in Section 3.4, *Biological Resources*. This section provides project-level analysis and additional detail regarding agricultural resources and supplements and augments, pursuant to CEQA Guidelines Section 15152, the analysis provided in Section 4.2, Volume I, of UC Santa Cruz' 2005 LRDP EIR.

3.2.1 Environmental Setting

3.2.1.1 Regulatory Background

State Programs

The California Department of Conservation is charged with developing programs for the protection of the agricultural resources of the state. Based on data from the Natural Resources Conservation Service of the U.S. Department of Agriculture, the California Department of Conservation has developed a Farmland Mapping and Monitoring Program (FMMP) to classify agricultural soil types based on their ability to sustain agricultural crops (CDC 2003). The FMMP was created to assess the location, quality, and quantity of agricultural lands to deal with the loss of important farmland to development. The FMMP produces Important Farmland maps and statistical data for every county in the state that show the amount of land under agricultural and nonagricultural land use categories. The Department of Conservation defines the following categories for purposes of FMMP Important Farmland maps:

- **Prime Farmland** is land with the best combination of physical and chemical features for the long-term production of agricultural crops. This land can economically produce sustained high yields when treated and managed according to modern farming methods. The land must have been used for the production of irrigated crops at some time during the two update cycles prior to the mapping date.
- **Farmland of Statewide Importance** is land with a good combination of physical and chemical features but with minor shortcomings such as greater slopes or with less ability to hold and store moisture. Crops must have been grown on the land at some time prior to the mapping date.
- **Unique Farmland** is land with lesser-quality soils used for the production of the state's leading agricultural cash crops. This land is usually irrigated but may include nonirrigated orchards. Crops must have been grown on the land at some time prior to the mapping date.

- **Farmland of Local Importance** is pastureland and other agricultural land identified by the local jurisdiction as being important.
- **Grazing Land** is land on which the existing vegetation is suited to the grazing of livestock.
- **Urban and Built-Up** is land occupied by structures with a building density of at least one unit to 1.5 acres, or approximately six structures to a 10-acre parcel.
- **Other Land** is land that does not meet the criteria of any other category.
- **Land Committed to Nonagricultural Use** is existing farm land, grazing land, and vacant areas that have a permanent commitment for development.

The FMMP updates maps every two years. The mapping program is used under CEQA and other state laws (including Government Code Section 65561) to measure the impact of eliminating different kinds of lands on the production of food and other agricultural products. Appendix G of the CEQA Guidelines also recommends the use of FMMP mapping for the evaluation of impacts on agricultural resources.

California Land Conservation Act (Williamson Act)

The California Land Conservation Act (LCA), better known as the Williamson Act, allows for property taxation based on agricultural productivity and not on surrounding urban land values for lands that are under Williamson Act contracts. Due to the specific tax-exempt status of the University of California, land owned by the University is not subject to Williamson Act contracts.

Local Programs

Because of their interest in agricultural open space protection, and because significant portions of income and employment in many counties of California are derived from agriculture, local governments have also developed agricultural land protection tools in the form of general plan policies and zoning. As a State entity, the University is not subject to such local land use policies and laws. Nevertheless, the University seeks to work cooperatively with the County and the City to ensure that, where feasible, campus land uses and policies are consistent with local plans and policies for adjacent noncampus lands.

Santa Cruz County Programs. The Santa Cruz County General Plan (County of Santa Cruz 1994) includes numerous goals and policies to protect and preserve agricultural resources, including an Agricultural Resource land use designation. The County zoning code defines a Commercial Agricultural (CA) Zone District for lands that are intended to be maintained exclusively for long-term commercial agricultural land use designations.

City of Santa Cruz Program. The City of Santa Cruz General Plan Agricultural Element includes the following goal:

- Protect the quality of, and prevent significant new incursion of urban development into areas designated as open space or agricultural lands.

The City of Santa Cruz General Plan also contains other policies for the protection of agriculture. City Land Use Policy 3.1.3 supports County of Santa Cruz policies and programs aimed at preservation of agricultural/grazing land. The City Land Use Policy 3.1.3.1 encourages organic farming practices on agricultural lands.

3.2.1.2 Conditions at and around UC Santa Cruz

Main Campus

No land on the UC Santa Cruz campus is defined by the FMMP as Prime Farmland, Farmland of Statewide Importance, or Farmland of Local Importance. The Center for Agroecology and Sustainable Food Systems farms approximately 25 acres in the lower campus. Approximately 16 acres of this land are designated Unique Farmland in the FMMP. Unique Farmland is land with lesser quality soils used for the production of cash crops. On the campus, this land is used for agriculture and for research, training, and teaching concerning organic production methods.

A total of about 350 acres of Grazing Land exist on the lower campus and in the far northwest corner of the campus. The remainder of the campus is classified by the FMMP as Other Land, the designation used mainly for forested areas, or Urban and Built-Up Land.

Lands Adjacent to the Campus

According to the FMMP, there is no Prime Farmland or Unique Farmland mapped within 1 mile of the campus boundary. Forested lands adjoining the campus to the north, east, and west are designated Other Land. Some grazing land is identified within Wilder Ranch State Park. The lands to the south and southeast of the campus, which are mostly residential and commercial properties, are classified almost entirely as Urban and Built-Up Land, with some smaller parcels of Other Land in the vicinity of Moore Creek in west Santa Cruz. The Cave Gulch neighborhood is mapped as Other Land. A small area (about 17.5 acres) on Golf Club Drive north of Harvey West Park is mapped as Farmland of Statewide Importance, and another nearby parcel (about 36 acres) is designated as Prime Farmland.

3.2.2 Relevant Project Characteristics

The proposed project would construct student housing on land designated in the FMMP as Urban and Built-Up Land. The 2005 LRDP land-use designation for the project site is Colleges and University Housing.

3.2.2.1 Applicable LRDP Mitigation Measures

There are no LRDP mitigation measures related to agricultural resources that are applicable to the proposed project.

3.2.3 Impacts and Mitigation Measures

3.2.3.1 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, the project would have a significant impact with regard to agricultural resources if it would:

- Convert to nonagricultural use Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Important Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency.
- Involve other changes in the existing environment, which due to their location or nature, could result in conversion of farmland considered Prime, Unique, or of Statewide Importance to nonagricultural use.

The Appendix G standard addressing zoning for agricultural use or a Williamson Act contract is not addressed below. The University of California is not subject to city or county zoning. Due to the specific tax-exempt status of the University of California, land owned by the University of California is not subject to Williamson Act contracts. Accordingly, the proposed project would not conflict with existing zoning or with Williamson Act contracts.

3.2.3.2 Project Impacts and Mitigation Measures

Conversion of Important Farmland to Nonagricultural Uses

The proposed project is on land classified by the FMMP as Urban and Built-Up. Therefore, the proposed project would not convert Important Farmland to nonagricultural uses. There would be no impact.

Indirect Impacts on Agricultural Lands

Indirect impacts on agricultural lands can occur under two types of conditions: (1) Urban development can place pressure on adjacent agricultural lands to convert to nonagricultural uses; and (2) location of urban uses adjacent to existing agricultural uses can create conflicts between the two types of uses, which can, in extreme cases, result in the abandonment of agriculture in the zone of conflict. The 2005 LRDP EIR analyzed the potential that campus development under the 2005 LRDP would result in such direct impacts. The LRDP EIR concluded that the 2005 LRDP would have no indirect impacts on agricultural lands because no lands within a 1-mile radius of the campus are designated Important Farmland, most of the land adjoining the campus is within state or city parks and is unlikely to be developed for other uses, and there are no on-going agricultural operations on any of the lands that adjoin the campus other than grazing on the grasslands to the west of the campus. While a parcel of land that is currently being used for agricultural purposes east of Pogonip City Park is classified as Farmland of Statewide Importance, this parcel is too far from the campus to be indirectly affected by any development on the campus. The proposed ECI Project is within the development program analyzed in the 2005 LRDP. Therefore, the project would have no impact related to indirect conversion of farmland, and no mitigation is required.

3.2.3.3 Cumulative Impacts and Mitigation Measures

As discussed above, the proposed project would not directly or indirectly result in the conversion of Important Farmland to nonagricultural uses, and therefore would not directly contribute to the cumulative loss of Important Farmland in the county. The 2005 LRDP EIR analyzed the potential that new population added to the region as a result of campus growth under the 2005 LRDP, in conjunction with other growth in the region, would increase the demand for housing, retail, and other services in the study area communities and thereby result in conversion of agricultural lands in the county to nonagricultural uses. The 2005 LRDP EIR concluded that the conversion of agricultural lands in the county to nonagricultural uses in the near term is considered unlikely because local jurisdictions expect to handle the demand for housing by infilling and increasing the density of development rather than by development of agricultural or other undeveloped land. Moreover, the County General Plan states specifically that prime agricultural lands and lands that are economically productive when used for agriculture shall be preserved for agricultural use. Furthermore, most of the remaining parcels of Prime Farmland or other Important Farmlands in the areas surrounding the City of Santa Cruz and other communities in the north and central portions of Santa Cruz County are afforded protection from urban development under the County General Plan and/or the California Coastal Act. Therefore, the 2005 LRDP EIR concluded that the cumulative impact on agricultural lands of growth under the 2005 LRDP in conjunction with other growth in the region would be less-than-significant. The proposed project is within the development program analyzed in the 2005 LRDP EIR. Furthermore, the project would construct student housing on the campus; only the small number of new campus employees associated with the proposed project would contribute to the population growth in the region. Therefore, the proposed project would not contribute to a significant cumulative impact on agricultural land.

3.2.4 References

CDC (California Department of Conservation). 2003. *Farmland Mapping and Monitoring Program, Santa Cruz County*. U.S. Department of Agriculture, Natural Resources Conservation Service.

County of Santa Cruz. 1994. *General Plan/Local Coastal Program*.

3.3 AIR QUALITY AND CLIMATE CHANGE

TABLES

3.3 AIR QUALITY AND CLIMATE CHANGE

The section characterizes existing air quality in the project area and evaluates the potential effects of the proposed ECI Project on regional and local air quality and on global climate change. For air quality, this section provides project-level analysis and additional detail, and supplements and augments, pursuant to CEQA Guidelines Section 15142 the analysis set forth in the 2005 LRDP EIR Section 4.3, Volume I. The climate change analysis is not tiered from the 2005 LRDP EIR and this EIR provides a stand-alone analysis.

Public comments in response to the Notice of Preparation of this EIR requested that the following issues be addressed in the EIR:

- Project’s cumulative impact on regional ozone levels;
- Monterey Bay Unified Air Pollution Control District (MBUAPCD) permitting requirements for lift stations and reconfigured sewer lines, to ensure that the populations to be served by wastewater or sewage treatment facilities are consistent with the population forecasts included in the District’s Air Quality Management Plan;
- Project’s localized air quality impact on carbon monoxide levels;
- Potential for impacts with respect to odors, nuisances and sensitive receptors, if project includes a land use redesignation that would place incompatible uses in proximity to one another;
- Need for mitigation measures for any significant impacts on air quality;
- Evaluation of project air quality impacts in relation to the significance thresholds established by the MBUAPCD
- Offsets to additions to the regional emissions inventory
- Air pollution impacts resulting from traffic
- Air quality impacts associated with construction
- Contribution to climate change and consideration of California’s goals to reduce greenhouse gases
- Alternative building design and operational strategies to create a carbon-neutral facility, including on-site energy production

All of these issues are addressed in this section except the permitting requirements for lift stations and reconfigured sewer lines, which are not discussed further because they are not part of the proposed project. While at an early stage in project planning, the Campus anticipated that a new sewage lift station would be required to serve the project, the Campus has determined that this would not be necessary. The proposed project does not include a sewage lift station, and does not include reconfiguration of sewer lines other than the installation of new lines off the sewer main in Chinquapin Road to serve the proposed project.

3.3.1 Environmental Setting

See 2005 LRDP EIR Section 4.3.1 for a comprehensive discussion of the air quality setting of the entire campus.

3.3.1.1 Study Area

The proposed project is located in the city and county of Santa Cruz and is within the North Central Coast Air Basin ("Basin"). The Basin includes Santa Cruz, Monterey, and San Benito counties.

Air pollutants are emitted by a variety of sources, including mobile sources such as automobiles, stationary sources such as manufacturing facilities, power plants and laboratories, and area sources such as homes and commercial buildings. While some of the air pollutants that are emitted need to be examined at the local level, others are predominately an issue at the regional level. For instance, ozone (O_3) is formed in the atmosphere in the presence of sunlight by a series of chemical reactions involving oxides of nitrogen (NO_x) and reactive organic gases (ROG). Because these reactions are broad-scale in effects, ozone is typically analyzed at the regional level (i.e., in the Basin) rather than the local level. On the other hand, other air pollutants such as sulfur dioxide (SO_2), respirable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), carbon monoxide (CO), lead (Pb), and toxic air contaminants (TAC) are a potential concern in the immediate vicinity of the pollutant source because the pollutants are emitted directly or are formed close to the source. Therefore, the study area for emissions of SO_2, PM_{10}, $PM_{2.5}$, CO, Pb, and TAC is the local area nearest the source, such as in the vicinity of congested intersections, whereas the study area for regional pollutants such as NO_x and ROG is the entire Basin.

3.3.1.2 Climate and Topography

Air quality in the Basin is affected by topographical and meteorological features that influence the migration of pollutants. The Basin is located along the central coast of California, with the northwest portion of the basin dominated by the Santa Cruz Mountains and the northeast bounded by the Diablo Range. San Benito Valley, a southern extension of the Santa Clara Valley, runs northwest-southeast and lies in the eastern portion of the basin. In the summer, a high-pressure system over the eastern Pacific generally results in persistent west and northwest winds along the coast. The northwest-southeast orientation of the mountains also restricts and channels onshore air currents in summer.

Winter winds from the north and east tend to transport pollutants from the San Francisco Bay area or the Central Valley into the Santa Cruz region. Less frequent inversion layers along with storms and the influence of the coastal mountains on atmospheric circulation generally result in good air quality in the Santa Cruz region during this season.

In addition to winds, precipitation also impacts air quality. For example, rains can help wash out particulate matter from the atmosphere. Table 3.3-1 shows that the average monthly rainfall in Santa Cruz historically has been the heaviest in January and the lightest in July. Annual average rainfall ranges between about 30 to 45 inches in the Santa Cruz area, with the higher rainfall levels at higher elevations away from the coast.

Table 3.3-1
Historical Monthly Average Precipitation in the Santa Cruz Vicinity

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Inches of Rain	6.20	5.42	4.37	1.92	0.81	0.23	0.06	0.07	0.43	1.35	3.35	5.24

Source: Western Regional Climate Center, Santa Cruz, California Station. 1893-2007 (http://www.wrcc.dri.edu, accessed August 18, 2008)

3.3.1.3 Regulatory Setting and Existing Air Quality

The project area is subject to air quality planning programs by both the federal Clean Air Act (CAA) and the California Clean Air Act (CCAA). Both the federal and state statutes provide for ambient air quality standards to protect public health, timetables for progressing toward achieving and maintaining ambient standards, and the development of plans to guide the air quality improvement efforts of state and local agencies. Within the project vicinity, air quality is monitored, evaluated, and controlled by the U.S. EPA, CARB, and the Monterey Bay Unified Air Pollution Control District (MBUAPCD).

The CARB regulates mobile emissions sources, oversees the activities of county and regional Air Pollution Control Districts and Air Quality Management Districts, and implements the CCAA. CARB regulates local air quality indirectly by establishing state ambient air quality standards and vehicle emission standards, by conducting research activities, and through its planning and coordinating activities.

The MBUAPCD is one of 35 districts established to protect air quality in the state. The MBUAPCD has jurisdiction over air quality in Monterey, Santa Cruz, and San Benito Counties, including the proposed project area. The MBUAPCD regulates most air pollutant sources in the Basin, with the exception of motor vehicles, aircraft, and agricultural equipment, which are regulated by the CARB or the U.S. EPA. State and local government projects, as well as projects proposed by the private sector, are subject to requirements of the local air district and the CCAA. In addition, the MBUAPCD and the CARB maintain ambient air quality monitoring stations at numerous locations throughout the Basin. The MBUAPCD's "CEQA Air Quality Guidelines" (MBUAPCD 2008b) contains guidance for analysis of the impacts on air quality of land development projects. The guidelines include thresholds above which a project's air emissions contributions are considered significant (see Section 3.3.2.1, below, for a summary of these significance thresholds).

Air pollutants typically are categorized as either criteria pollutants or toxic air contaminants (TAC). The criteria pollutants are those regulated at the federal level by the U.S. Environmental Protection Agency (U.S. EPA) and at the state level by the CARB) These include O_3, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and Pb. TACs are airborne pollutants for which there are no ambient air quality standards but that are known to have adverse human health effects.

Criteria Pollutants

The federal and state governments have established separate ambient air quality standards. The U.S. EPA has established primary and secondary National Ambient Air Quality Standards (NAAQS) that specify allowable ambient concentrations for criteria pollutants under the provisions of the Clean Air Act (CAA). Primary NAAQS are established at levels necessary, with an adequate margin of safety, to protect the public health, including the health of sensitive populations such as asthmatics, children and the elderly. Healthy adults can generally tolerate periodic exposure to air pollution levels somewhat above these standards before adverse health effects are observed. Secondary NAAQS specify the levels of air quality determined appropriate to protect the public welfare from any known or anticipated indirect adverse effects associated with air pollutants, such as damage to farm crops and vegetation and damage to buildings**.** Allowable ambient concentrations have been established for O_3, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and Pb. Table 3.3-2 summarizes the NAAQS for these pollutants.

In California, the CARB, which is part of the California Environmental Protection Agency, has promulgated ambient air quality standards for O_3, PM_{10}, $PM_{2.5}$, CO, NO_2, SO_2, and Pb that are more stringent than U.S. EPA's standards, as shown in Table 3.3-2. These standards were formally approved by the Office of Administrative Law on June 7, 2004. The CARB has also developed standards for annual $PM_{2.5,}$ and for visibility-reducing particles, sulfates, hydrogen sulfide, and vinyl chloride.

Counties and metropolitan areas are classified as being in attainment, nonattainment, or unclassified with respect to these federal and state ambient pollutant standards. The state also has a designation of nonattainment-transitional for areas that are in nonattainment with state standards but are close to attaining these standards. Area are designated unclassified if they do not have adequate air quality data available to ascertain a nonattainment or attainment designation.[1] Maintenance areas are those that were previously in nonattainment but have been redesignated as attainment. An area's classification is determined by comparing actual monitored air pollutant concentrations with federal and state standards. More than 200 air monitoring stations located in California are part of the State and Local Air Monitoring Network. These stations are operated by the CARB, local APCDs or AQMDs, private contractors, and the National Park Service. Based on pollutant concentrations measured at monitoring stations within the Basin, the Basin is in attainment or unclassifiable for all standards except for the state O_3 and PM_{10} standards (see Table 3.3-3). The area was redesignated from nonattainment to attainment of the federal O_3 standards and therefore is identified as a maintenance area (Table 3.3-3).

[1] According to the MBUAPCD, EPA generally designates an area as either nonattainment or unclassified/attainment and does not officially distinguish between unclassified and attainment. From a planning perspective, "unclassified" and "attainment" have the same implications, i.e., an Air Quality Plan for the pollutant thus classified is not needed.

Table 3.3-2
State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[a]	National Standards[b]	
		Concentrations[c]	Primary[c, d]	Secondary[c, e]
Ozone (O_3)	8-hour 1-hour	0.070 ppm 0.09 ppm	0.075 ppm --	Same as Primary Same as Primary
Respirable Particulate Matter (PM_{10})	Annual Mean 24-hour	20 $\mu g/m^3$ 50 $\mu g/m^3$	-- 150 $\mu g/m^3$	Same as Primary Same as Primary
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean 24-hour	12 $\mu g/m^3$ --	15 $\mu g/m^3$ 35 $\mu g/m^3$	Same as Primary Same as Primary
Carbon Monoxide (CO)	8-hour 1-hour	9.0 ppm 20.0 ppm	9 ppm 35 ppm	None None
Nitrogen Dioxide (NO_2)	Annual Mean 1-hour	-- 0.25 ppm	0.053 ppm --	Same as Primary
Sulfur Dioxide (SO_2)	Annual Mean 24-hour 3-hour 1-hour	-- 0.04 ppm -- 0.25 ppm	0.03 ppm 0.14 ppm -- --	-- -- 0.5 ppm --
Lead (Pb)	30 Day Average Calendar Quarter	1.5 $\mu g/m^3$ --	-- 1.5 $\mu g/m^3$	-- Same as Primary
Visibility Reducing Particles	8-hour	Extinction Coefficient of 0.23 per kilometer-visibility of ten miles or more due to particles when relative humidity is less than 70 percent	None	None
Sulfates	24-hour	25 $\mu g/m^3$	None	None
Hydrogen Sulfide	1-hour	0.03 ppm (42 $\mu g/m^3$)	None	None
Vinyl Chloride	24-hour	0.01 ppm (26 $\mu g/m^3$)	None	None

Source: California Air Resources Board air quality standards. http://www.arb.ca.gov/aqs/aaqs2.pdf

Notes: ppm = parts per million, $\mu g/m^3$ = micrograms per cubic meter

(a) California standards for O_3, CO, SO_2 (1 and 24 hour), NO_2, PM_{10}, and $PM_{2.5}$ are not to be exceeded. All others are not to be equaled or exceeded.

(b) Other than O_3, $PM_{2.5}$ and PM_{10}, and those standards based on annual averages, national standards (NAAQS) are not to be exceeded more than once a year. The 1-hour O_3 standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one. The 8-hour O_3 standard is attained when the 3-year average of the annual fourth highest daily maximum concentration is less than the standard. The 24-hour PM_{10} standard is attained when the expected number of days per calendar year with a 24-hour average concentration above the standard is equal to or less than one. The 24-hour $PM_{2.5}$ standard is attained when the 98th percentile of 24-hour $PM_{2.5}$ concentrations in a year, averaged over 3 years, at the population-oriented monitoring site with the highest measured values in the area, is equal to or less than the standard. The annual average $PM_{2.5}$ standard is attained when the 3-year average of the annual arithmetic mean $PM_{2.5}$ concentrations, from single or multiple community-oriented monitors, is less than or equal to the standard.

(c) All measurements of air quality are to be corrected to a reference temperature of 25° C and a reference pressure of 760 mm of mercury (Hg) (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

(d) National Primary Standards: The levels of air quality deemed necessary by the federal government, with an adequate margin of safety, to protect the public health.

(e) National Secondary Standards: The levels of air quality deemed necessary by the federal government to protect the public welfare from any known or anticipated adverse effects of a pollutant.

Table 3.3-3
Attainment Status for the North Central Coast Air Basin

Pollutant	Averaging Time	State Status	Federal Status
Ozone (O_3)	8-hour 1-hour	Not Applicable Nonattainment-Transitional	Unclassified/Attainment Maintenance
Respirable Particulate Matter (PM_{10})	Annual Mean Annual Geometric Mean 24-hour	Nonattainment	Unclassified/Attainment
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	Unclassified	Unclassified/Attainment
Carbon Monoxide (CO)	8-hour 1-hour	Unclassified (Santa Clara County)/Attainment (Monterey County)	Unclassified/Attainment
Nitrogen Dioxide (NO_2)	Annual Mean 1-hour	Attainment	Unclassified/Attainment
Sulfur Dioxide (SO_2)	Annual Mean 24-hour 3-hour 1-hour	Attainment	Unclassified

Source: Monterey Bay Unified Air Pollution Control District (MBUACD 2008b).
Note: Status shown as of April 2005. State attainment status for state $PM_{2.5}$ is expected to be changed from unclassified to attainment.

For areas designated as nonattainment, the 1990 Clean Air Act Amendments (CAAA) require that each state have an air pollution control plan called the State Implementation Plan (SIP). The SIP includes strategies and control measures to attain the NAAQS by deadlines established by the CAA. The U.S. EPA reviews the SIPs to determine whether the plans would conform to the CAAA and achieve the air quality goals. The U.S. EPA may prepare a Federal Implementation Plan for a nonattainment area if the EPA determines a SIP to be inadequate.

The CCAA requires that air districts design a plan to achieve an annual reduction in district wide emissions of 5 percent or more for each nonattainment criteria pollutant or its precursor(s). These plans include the following: emission control standards that require local districts to stringently control emissions through stationary and mobile source control programs; application of additional control measures if a regional AQMD or unified APCD contributes to downwind nonattainment areas; cost-effectiveness estimates for all proposed emission control measures; and development and implementation of transportation controls for cities and counties to enforce. The Air Quality Management Plan for the Basin was developed by MBUAPCD in 1991 and has been updated every three years. The latest update was in 2008 (MBUAPCD 2008a).

The 1990 CAAA also require emission controls on factories, businesses, and automobiles to reduce criteria pollutant emissions. The CAAA regulate automobiles by lowering the permissible limits on ROG and NO_x emissions, requiring the phasing-in of alternative-fuel cars, requiring on-board canisters to capture vapors during refueling, and extending emission-control warranties

The two ambient pollutant monitoring stations closest to the proposed project site are located at 2544 Soquel Avenue in Santa Cruz and at the intersection of Marine View and Center Avenue in Davenport. Table 3.3-4 summarizes measured criteria pollutant concentrations over the past five years at these stations.

Table 3.3-4
Maximum Measured Pollutant Concentrations at Nearby Monitoring Stations

Pollutant	Averaging Time	Units	Standards		Maximum Measured Concentration				
			State	Federal	2004	2005	2006	2007	2008
O_3	1 hour	ppm	0.09	None	0.085	0.071	0.067	0.072	0.086
	8 hours	ppm	None	0.075	0.077	0.055	0.057	0.066	0.066
PM_{10}	24 hours	$\mu g/m^3$	50	150	34	46	37	32	44
	Annual Average	$\mu g/m^3$	20	None	NA[b]	17.5	18.4	18	NA[b]
$PM_{2.5}$	24 hours	$\mu g/m^3$	None	35	22.6	21.7	12.6	18.3	12.5
	Annual Average[a]	$\mu g/m^3$	12	15	NA[b]	NA[b]	6.9	6.3	NA[b]
CO	1 hour	ppm	20	35	2.1	1.6	1.3	1.7	7.6
	8 hours	ppm	9.0	9	1.03	0.90	0.83	0.95	1.30
NO_2	1 hour	ppm	0.25	None	0.032	0.030	0.030	0.029	0.034
	Annual Average	ppm	None	0.053	0.004	0.004	0.004	0.004	0.004
SO_2	24 hours	ppm	0.04	0.14	0.005	0.004	0.005	0.004	0.005

Source: CARB 2009. CARB Air Quality Data Statistics, ADAM web site, http://www.arb.ca.gov/adam, accessed on January 30, 3009. O_3, PM_{10}, and $PM_{2.5}$ monitoring station located at 2544 Soquel Ave., Santa Cruz, CA. CO, NO_2, and SO_2 monitoring station located at Marine View and Center Avenue, Davenport, CA.

Notes:

(a) Annual average data available differ between state and national annual averages due to differences in method of obtaining such averages. Numbers shown above are based on national average, except in the case of PM, for which the national standard for annual average has been rescinded.

(b) NA = not available

The following paragraphs the characteristics, health effects, and local measured concentrations of O_3, PM_{10}, $PM_{2.5}$, CO, NO_2, and SO_2. Sulfates, Pb, and hydrogen sulfide are the pollutants of least concern in this project area because recorded levels are well below standards and no major sources of these pollutants exist in the project area.

Ozone

O_3 is a colorless gas that has a pungent odor and causes eye and lung irritation, visibility reduction, chemical deterioration of various materials, and crop damage. As mentioned previously, a primary constituent of smog, O_3 is a secondary pollutant formed in the atmosphere in the presence of sunlight by a series of chemical reactions involving NO_x and ROG[2]. Because these reactions occur on a regional scale, ozone is considered a regional air pollutant. Motor vehicles are primary sources of NO_x and ROG.

[2] Reactive organic gases (ROG) are organic gases that form ozone by means of a photochemical reaction. ROG are emitted to the atmosphere by motor vehicles, solvents, certain consumer products, and the petroleum industry.

As shown in Table 3.3-4, O_3 concentrations have not exceeded federal and state ambient air quality standards at the nearby monitoring station in the past five years, although the Basin as a whole is considered to be a nonattainment-transitional area for the state O_3 standard[3].

Particulate Matter

Particulate matter is generally composed of particles in the air such as dust, soot, aerosols, fumes, and mists. Of particular concern are inhalable particulates, which have aerodynamic diameters of 10 micrometers or less (PM_{10}). PM_{10} is generated by sources such as windblown dust from agricultural fields, and dust from vehicular traffic on unpaved roads. PM_{10} affects breathing and the respiratory system, and, in particular, can damage lung tissue and contribute to cancer and premature death. Other effects include visibility reduction, and corrosion and soiling of structures, which has economic effects.

A subgroup of PM_{10} is fine particulates, PM_{25}. These are particles with aerodynamic diameters less than 2.5 micrometers. $PM_{2.5}$ has different characteristics, sources, and potential health effects from PM_{10} as a whole. $PM_{2.5}$ is generally emitted from sources such as industrial combustion, vehicle exhaust, and residential wood-burning stoves and fireplaces. $PM_{2.5}$ is also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds emitted by combustion activities are transformed by chemical reactions in the air. Separate standards for $PM_{2.5}$ were established in 1997 because these smaller particles can penetrate deep into the respiratory tract and cause unique adverse health effects.

Measured concentrations at the monitoring stations near UC Santa Cruz have not exceeded federal or state PM_{10} or $PM_{2.5}$ standards in the past five years. However, the Basin has been designated as nonattainment for the state PM_{10} standard on account of exceedances at other monitoring stations in the Basin (the Pinnacles, Hollister and Scotts Valley). The Basin is designated as unclassified/attainment and unclassified for federal and state PM_{25} standards, respectively.

Carbon Monoxide

CO is an odorless, colorless gas that can impair the transport of oxygen in the bloodstream, aggravate cardiovascular disease, and cause fatigue, headache, confusion, and dizziness. CO forms through incomplete combustion of fuels in vehicles, wood stoves, industrial operations and fireplaces. In Santa Cruz County, vehicular exhaust is a major source of CO. CO tends to dissipate rapidly into the atmosphere and consequently is a concern primarily at the local level, particularly at major road intersections during peak hour traffic conditions.

Table 3.3-4 shows that the nearby monitoring station has measured CO concentrations well below the federal and state standards. The Basin is designated as unclassified/attainment for the federal and state CO standards.

Nitrogen Dioxide

NO_2 is a brownish, highly reactive gas that can irritate the lungs, cause pneumonia, and lower resistance to respiratory infections. Chronic exposure to oxides of nitrogen, or NO_x, which include NO_2, may lead to irritation of eyes and mucus membranes along with pulmonary dysfunction. Airborne NO_x can also impair

[3] The maximum measured 8-hour ozone concentration in 2004 did not exceed the federal standard that was applicable at the time (0.08) ppm, although it did slightly exceed the new federal standard of 0.075.

visibility. NO_x is a key precursor to O_3 and acid rain. NO_x forms when fuel is burned at high temperatures, and principally comes from transportation sources and stationary fuel combustion sources such as electric utilities and industrial boilers.

Table 3.3-4 shows that measured concentrations of NO_2 have consistently remained well below the federal and state standards at the nearby monitoring station. With similar trends throughout the region (and state), the Basin is well within federal and state NO_2 standards.

Sulfur Dioxide

SO_2 is a colorless acidic gas with a strong odor. High concentrations of SO_2 affect breathing and may aggravate existing respiratory and cardiovascular disease. SO_2 is also a primary contributor to acid deposition, which causes acidification of lakes and streams and can damage trees, crops, building materials, and statues. In addition, sulfur compounds in the air can contribute to visibility impairment. The major source category for SO_2 is equipment that burns sulfur-containing fossil fuels.

The nearby monitoring station that measures SO_2 has not shown an exceedance of the federal or state SO_2 standard for the last five years. The Basin as a whole is designated as attainment for the state SO_2 standard and unclassified for the federal SO_2 standard.

Other State-Regulated Pollutants

In addition to the criteria pollutants discussed above that are regulated by both the state and federal governments, four pollutants are regulated by the state only: sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. These other pollutants are not a major concern in the Basin.

The state has instituted a visibility standard to monitor visibility impairment due to regional haze caused by particulate matter present in air. Visibility is affected by the absorption of light by dark particles in the air and (such as soot), and by light-scattering particles, particularly those that are greater than or equal to the size of the visible spectrum wavelength. The standard is defined in terms of the extinction coefficient, which is a measure of how much light is being scattered or absorbed. The standard is exceeded if sufficient particulates are present in the air to result in an extinction coefficient higher than 0.23 per kilometer (equal to having a visibility of less than 10 miles when relative humidity is less than 70 percent). Sources of visibility-reducing particles include motor vehicles, industrial processes, power plants, and naturally occurring particles (such as dust). The area is designated as unclassified for this standard.

Toxic Air Contaminants

Toxic air contaminants (TACs) are a category of airborne pollutants that have been shown to have an impact on human health but are not classified as criteria pollutants. Some examples of TACs are certain aromatic and chlorinated hydrocarbons, certain metals, and asbestos. Adverse health effects of toxic air contaminants can be carcinogenic (cancer-causing), short-term (acute) noncarcinogenic, and long-term (chronic) noncarcinogenic. TACs are generated by a number of sources, including stationary sources such as dry cleaners, gas stations, combustion sources, and laboratories; mobile sources, such as automobiles and trucks, particularly diesel-fueled vehicles; and area sources such as farms, landfills, construction sites, and residential areas. Sources of TACs around and within the UC Santa Cruz campus include diesel buses and trucks, laboratory fume hoods, campus Central Heating Plant boilers, boilers in individual buildings, the campus cogeneration facility, emergency generators, and painting operations.

At the federal level, air toxics are identified as hazardous air pollutants (HAPs). HAPs have been regulated at the federal level since the CAA of 1977. Following the passage of this law, regulations for seven HAPs were promulgated as National Emission Standards for Hazardous Air Pollutants (NESHAP) over a 13-year period. The 1990 CAA amendments revamped the NESHAP program to offer a technology-based approach for reducing the emissions of a greater number of HAPs. Under the 1990 CAAA, 189 substances were identified as HAPs and slated for regulation. The program requires certain facilities to control toxic air emissions by the installation of Maximum Achievable Control Technology (MACT), which is implemented and enforced in the MBUAPCD through Rule 218, *Title V: Federal Operating Permits*, which administers the federal operating permits program established by the 1990 CAAA.

California's TAC control program began in 1983 with the passage of the Toxic Air Contaminant Identification and Control Act, better known as Assembly Bill 1807 (AB 1807) or the Tanner Bill. The Tanner Bill established a regulatory process for the scientific and public review of individual toxic compounds. When a compound becomes listed as a TAC under the Tanner process, the CARB normally establishes minimum statewide emission control measures to be adopted by local air pollution control districts.

The second major component of California's air toxics program, supplementing the Tanner process, was provided by the passage of AB 2588, the Air Toxics "Hot Spots" Information and Assessment Act of 1987. AB 2588 currently regulates over 600 air compounds, including all of the Tanner-designated TACs. Under AB 2588, specified facilities must quantify emissions of regulated air toxics and report them to the local APCD. If the APCD determines that a potentially significant public health risk is posed by a given facility, the facility is required to perform a health risk assessment (HRA) and notify the public in the affected area if the calculated risks exceed specified criteria. The MBUAPCD's implementation of AB 2588 is discussed below.

On August 27, 1998, the CARB formally identified particulate matter emitted by diesel-fueled engines as a TAC (CARB 1998). The CARB action will lead to additional control of diesel engine emissions in coming years by the CARB. The EPA has also begun an evaluation of both the cancer and noncancer health effects of diesel exhaust. In September 2000, the CARB approved the *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles* (Diesel Risk Reduction Plan). This plan outlines a comprehensive and ambitious program that includes the development of numerous new control measures over the next several years aimed at substantially reducing emissions from new and existing on-road vehicles (e.g., heavy-duty trucks and buses), off-road equipment (e.g., graders, tractors, forklifts, sweepers, and boats), portable equipment (e.g., pumps), and stationary engines (e.g., stand-by power generators).

In compliance with federal law, MBUAPCD Rule 218 implements federal NESHAP and MACT requirements through the federal operating permit program. The MBUAPCD has also developed various rules for specific source categories pursuant to the Tanner process under MBUAPCD Regulation IV, *Prohibitions*. Dust from construction and demolition activities is addressed by MBUAPCD Rule 402, *Nuisances*, which states that sources cannot emit air contaminants that cause nuisances to “any considerable number of persons or to the public.”

The MBUAPCD’s permitting program also includes a “Best Control Technology” (BCT) review under MBUAPCD Rule 1000, *Permit Guidelines and Requirements for Sources Emitting Toxic Air Contaminants.*

In compliance with state law, the MBUAPCD also administers the AB 2588 Air Toxics “Hot Spots” Program. Facilities must report their TAC emissions and if the MBUAPCD determines the facility poses a potential public health risk, the facility must perform a HRA. An HRA includes an analysis of TAC emissions and characterizes human health risks as a result of the estimated TAC exposures. If the estimated health risks exceed threshold levels, the public in the affected area must be notified and steps taken to reduce emissions. For carcinogens, the MBUAPCD uses a 70-year cancer risk level of 10 in one million as the AB 2588 public notification level. For noncarcinogens, public health risk is assessed by the “hazard index” for both long-term (chronic) and short-term (acute) exposures. A hazard index is the sum of the ratios of each chemical’s actual exposures to acceptable exposures. Hazard index values less than 1.0 indicate an acceptable noncancer health risk. The MBUAPCD uses a hazard index threshold of 1.0 as the AB 2588 public notification level for noncancer toxicants. On account of campus facilities such as the cogeneration plant and Central Heating Plant boilers, UC Santa Cruz is subject to AB 2588 requirements.

CARB has prepared a stationary source air toxics emissions inventory. There are no stations that monitor toxic air contaminants in the Basin. The San Francisco Air Basin toxic monitoring data is the closest to the North Central Coast Air Basin and is also near the coast. *The 2008 California Almanac of Emissions and Air Quality* (CARB 2008) presents annual average concentrations, emissions, and health risks for California air basins. Table 3.3-6 presents CARB’s estimates of background TAC concentrations and 70-year cancer risks in the San Francisco Bay Area Air Basin for the year 2006 for the 10 TACs that pose the greatest health risk, based on monitored values from throughout the basin. CARB estimates a risk of 150 in one million from ambient air toxics without considering diesel particulate.

Table 3.3-5
Average Ambient Concentrations of Toxic Air Contaminants in the San Francisco Bay Area Air Basin in 2006

Compound	Concentration (ppb)	Unit Risk[3]	Cancer Risk (Chances in One Million)
Gaseous TACs			
Acetaldehyde	0.66	2.7	3
Benzene	0.33	29	30
1,3-Butadiene	0.07	170	26
Carbon Tetrachloride[1]	0.10	42	25
Para-Dichlorobenzene	0.15	11	10
Formaldehyde	1.59	6	12
Methylene Chloride	0.16	1	<1
Perchloroethylene	0.03	5.9	1
Compound	**Concentration (ng/m^3)**	**Unit Risk ($(\mu g/m^3)^{-1}$)**	**Cancer Risk (Chances in One Million)**
Particulate TACs			
Chromium (Hexavalent)	0.08	150,000	12
Diesel Exhaust Particulate Matter[2]	1,600	300	480
Total Risk for All TACs			**660**

Source: CARB 2008.

[1]Data is from the year 2003 since more recent data is unavailable.

[2]Data is from the year 2000 since more recent data is unavailable.

[3] The Unit Risk represents the number of excess cancer cases per million people per microgram per cubic meter TAC concentration over a 70-year, lifetime exposure.

Since 1990, annual average concentrations of TACs in the San Francisco Bay Area Air Basin have declined due to the implementation of air toxics control programs. The estimated cancer risk associated with diesel particulate matter for the San Francisco Bay Area Air Basin was 750 in one million in 1990 and 480 in one million in 2000 (CARB 2005). The estimated combined cancer risk for the 10 TACs for the San Francisco Bay Area Air Basin was 1,153 in one million in 1990, 659 in one million in 2000, and 630 in one million in 2005 (CARB 2005).

3.3.1.4 Sensitive Receptors

Some groups of people are considered more sensitive to adverse effects from air pollution than the general population. These groups are termed sensitive receptors. Sensitive receptors include children, the elderly, and people with existing health problems, who are more often susceptible to respiratory infections and other air-quality-related health problems. Schools, childcare centers, hospitals, and nursing homes are all considered sensitive receptors. There are two childcare centers on campus: one is located on the western edge of the central campus within the Family Student Housing area, and the other is located near the campus main entrance. The two nearest off-campus schools are West Lake Elementary School and the Santa Cruz Waldorf School. West Lake Elementary School is located just south of the campus on High Street at a distance of about 2,000 feet from the campus entrance and 6,000 feet from the nearest portion of the campus core. The Santa Cruz Waldorf School is located just west of the campus on Empire Grade Road approximately 10,000 feet from the main entrance and about 2,500 feet from the nearest portion of the campus core. There are no hospitals or nursing homes in the project vicinity.

3.3.1.5 Climate Change

Heat retention within the atmosphere is an essential process to sustain life on Earth. The natural process through which heat is retained in the troposphere[4] is called the "greenhouse effect." The greenhouse effect traps heat in the troposphere through a threefold process as follows: Short-wave radiation emitted by the sun is absorbed by the earth; the earth emits a portion of this energy in the form of long-wave radiation; and greenhouse gases (GHGs) in the upper atmosphere absorb this long-wave radiation and emit this long-wave radiation into space and toward the earth. This "trapping" of the long-wave (thermal) radiation emitted back toward the earth is the underlying process of the greenhouse effect. Without the greenhouse effect, the earth's average temperature would be approximately -18 degrees Celsius (0 degrees Fahrenheit) instead of its present 14 degrees Celsius (57 degrees Fahrenheit) (National Climatic Data Center 2008). The most abundant GHGs are water vapor and carbon dioxide. Many other trace gases have greater ability to absorb and re-radiate long-wave radiation; however, these gases are not as plentiful. For this reason, and to gauge the potency of GHGs, scientists have established a global warming potential (GWP) for each GHG based on its ability to absorb and re-radiate long-wave radiation. The GWP of a gas is determined by comparing it to the reference gas, carbon dioxide, which has a GWP of 1.

Carbon dioxide is generated primarily by fossil fuel combustion in stationary and mobile sources. Due to the emergence of industrial facilities and mobile sources in the past 250 years, the concentration of carbon dioxide in the atmosphere has increased 35 percent (U.S. Environmental Protection Agency [U.S. EPA] 2008). Carbon dioxide is the most widely emitted GHG and is the reference gas (GWP of 1) for determining GWPs for other GHGs. In 2004, 83.8 percent of California's GHG emissions were carbon dioxide (California Energy Commission [CEC] 2006).

Methane (CH4)

Methane is emitted from biogenic sources, incomplete combustion in forest fires, landfills, manure management, and leaks in natural gas pipelines. In the United States, the top three sources of methane are landfills, natural gas systems, and enteric fermentation (U.S. EPA 2006). Methane is the primary component of natural gas, which is used for space and water heating, steam production, and power generation. The GWP of methane is 21.

Nitrous** oxide **(N20)

Nitrous oxide is produced by both natural and human-related sources. Primary human-related sources include agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuel, adipic acid production, and nitric acid production. The GWP of nitrous oxide is 310.

[4] The troposphere is the bottom layer of the atmosphere, which varies in height from the Earth's surface up to 10–12 kilometers.

Sources of Greenhouse Gas Emissions

Anthropogenic GHG emissions worldwide as of 2005 totaled approximately 30,800 CO_2 equivalent million metric tons ($MMTCO_2E$).[5] The United States was the top producer of greenhouse gas emissions as of 2005. The primary greenhouse gas emitted by human activities in the United States was CO_2, representing approximately 84 percent of total greenhouse gas emissions (U.S. EPA 2008). Carbon dioxide from fossil fuel combustion, the largest source of U.S. greenhouse gas emissions, accounted for approximately 80 percent of U.S. GHG emissions (U.S. EPA 2008).

The 2004 GHG inventory data compiled by the California Air Resources Board (CARB) for California estimated GHG emissions as 484 $MMTCO_2E$ (CARB 2007). A California Energy Commission (CEC) emissions inventory report placed CO_2 produced by fossil fuel combustion in California as the largest source of GHG emissions in 2004, accounting for 81 percent of the total GHG emissions (CEC 2006). CO_2 emissions from other sources contributed 2.8 percent of the total GHG emissions, methane emissions contributed 5.7 percent, nitrous oxide emissions contributed 6.8 percent, and the remaining 2.9 percent was composed of emissions of high-GWP gases (CEC 2006). These high-GWP gases are largely composed of refrigerants, with a small contribution of sulfur hexafluoride (SF_6) that is used as an insulator in electricity transmission and distribution.

The primary contributors to GHG emissions in California are transportation, electric power production from both in state and out-of-state sources, industry, agriculture and forestry, and other sources, which include commercial and residential activities. These primary contributors to California's GHG emissions and their relative contributions are presented in Table 3.3-6.

Table 3.3-6. Greenhouse Gas (GHG) Sources in California, 2004

Source Category	Annual GHG Emissions ($MMTCO_2E$)	Percent of Total
Agriculture	27.9	5.8
Commercial Uses	12.8	2.6
Electricity Generation	119.8	24.7
Forestry Activities	0.2	0.0
Industrial Uses	96.2	19.9
Residential Uses	29.1	6.0
Transportation	182.4	37.7
Other	16.0	3.3
Totals	484.4	100.0

Source: CARB 2007.

[5] The CO_2 equivalent emissions are commonly expressed as "million metric tons of carbon dioxide equivalent ($MMTCO_2E$)." The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP, such that $MMTCO_2E$ = (million metric tons of a GHG) × (GWP of the GHG). For example, the GWP for methane is 21. This means that emissions of one million metric tons of methane are equivalent to emissions of 21 million metric tons of CO_2.

Effects of Climate Change

Climate change refers to any substantial change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer) (U.S. EPA 2008). Climate change may result from:

- natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- natural processes within the climate system (e.g., changes in ocean circulation, reduction in sunlight from the addition of GHG and other gases to the atmosphere from volcanic eruptions); and
- human activities that change the atmosphere's composition (e.g., through burning fossil fuels) and the land surface (e.g., deforestation, reforestation, urbanization, desertification).

Indications of Anthropogenic Influences

The impact of anthropogenic activities on global climate change is readily apparent in the observational record. For example, surface temperature data shows that 11 of the 12 years from 1995 to 2006 rank among the 12 warmest since 1850, the beginning of the instrumental record for global surface temperature (IPCC 2007). In addition, the atmospheric water vapor content has increased since at least the 1980s over land, sea, and in the upper atmosphere, consistent with the capacity of warmer air to hold more water vapor; ocean temperatures are warmer to depths of 3,000 feet; and a marked decline has occurred in mountain glaciers and snowpack in both hemispheres, and in polar ice and ice sheets in both the Arctic and Antarctic regions (IPCC 2007).

Influence of Industrialization

Air trapped by ice has been extracted from core samples taken from polar ice sheets to determine the global atmospheric variation of carbon dioxide, methane, and nitrous oxide from before the start of the industrialization, around 1750, to over 650,000 years ago. For that period, it was found that carbon dioxide concentrations ranged from 180 ppm to 300 ppm. For the period from around 1750 to the present, global carbon dioxide concentrations increased from a pre-industrialization period concentration of 280 ppm to 379 ppm in 2005, with the 2005 value far exceeding the upper end of the pre-industrial period range (IPCC 2007). Global methane and nitrous oxide concentrations show similar increases for the same period.

Secondary Effects of Global Climate Change

The primary effect of global climate change has been a rise in average global tropospheric temperature of 0.21 Celsius per decade, determined from meteorological measurements worldwide between 1990 and 2005 (IPCC 2007). Climate change modeling using 2000 emission rates shows that further warming would occur, which would induce further changes in the global climate system during the current century (IPCC 2007). Changes to the global climate system and ecosystems and to California would include, but would not be limited to:

- the loss of sea ice and mountain snowpack resulting in higher sea levels and higher sea surface evaporation rates with a corresponding increase in tropospheric water vapor due to the atmosphere's ability to hold more water vapor at higher temperatures; (IPCC 2007)

- a rise in global average sea level primarily due to thermal expansion and melting of glaciers and ice caps, the Greenland and Antarctic ice sheets (IPCC 2007)
- changes in weather that include widespread changes in precipitation, ocean salinity, and wind patterns, and more energetic aspects of extreme weather including droughts, heavy precipitation, heat waves, extreme cold, and the intensity of tropical cyclones; (IPCC 2007)
- the decline of Sierra snowpack, which accounts for approximately half of the surface water storage in California, by 70 percent to as much as 90 percent over the next 100 years; (California EPA [Cal/EPA] Climate Action Team 2006)
- an increase in the number of days conducive to ozone formation by 25 to 85 percent (depending on the future temperature scenario) in high ozone areas of Los Angeles and the San Joaquin Valley by the end of the 21st century ([Cal/EPA] Climate Action Team 2006); and
- high potential for erosion of California's coastlines and sea water intrusion into the Delta and associated levee systems due to the rise in sea level ([Cal/EPA] Climate Action Team 2006).

Regulatory Setting

California has enacted several legislative bills and executive orders aimed at reducing the state's greenhouse gas inventory and its impact on global climate change. Each of these discussed below.

Assembly Bill 32

Assembly Bill 32, the California Global Warming Solutions Act of 2006, which Governor Schwarzenegger signed on September 27, 2006 represents the first enforceable statewide program to limit GHG emissions from all major industries with penalties for noncompliance.

CARB has been assigned to carry out and develop the programs and requirements necessary to achieve the goals of AB 32. The foremost objective of CARB is to adopt regulations that require the reporting and verification of statewide GHG emissions. This program will be used to monitor and enforce compliance with the established standards. The first GHG emissions limit is equivalent to the 1990 levels, which are to be achieved by 2020. CARB is also required to adopt rules and regulations to achieve the maximum technologically feasible and cost-effective GHG emission reductions. Finally, CARB is ultimately responsible for monitoring compliance and enforcing any rule, regulation, order, emission limitation, emission reduction measure, or market-based compliance mechanism adopted. By January 2008, the first deadline for AB 32, a statewide cap for 2020 emissions based on 1990 levels and mandatory reporting rules for significant sources of GHGs was adopted. The following year CARB must adopt a scoping plan indicating how reductions in significant GHG sources will be achieved through regulations, market mechanisms, and other actions.

The first action under AB 32 resulted in the adoption of a report listing early action greenhouse gas emission reduction measures on June 21, 2007. The early actions include three specific GHG control rules. On October 25, 2007, CARB approved an additional six early action GHG reduction measures under AB 32. These early action GHG reduction measures are to be adopted and enforced before January 1, 2010, along with 32 other climate-protecting measures CARB is developing between now and 2011.

As required under AB 32, on December 6, 2007, CARB approved the 1990 greenhouse gas emissions inventory, thereby establishing the emissions limit for 2020. The 2020 emissions limit was set at 427 $MMTCO_2E$. The inventory revealed that in 1990 accounted for 35 percent of the state's total emissions and was the largest single sector, followed by industrial emissions (24 percent); imported electricity (14 percent); in-state electricity generation (11 percent); residential use (7 percent); agriculture (5 percent); and commercial uses (3 percent).

After receiving public input on their discussion draft of the Proposed Scoping Plan released in June 2008, CARB staff released the Climate Change Proposed Scoping Plan in October 2008 that contains an outline of the proposed State strategies to achieve the 2020 greenhouse gas emission limits. The Scoping Plan was approved by the CARB Governing Board on December 11, 2008. Key elements of the Scoping Plan include the following recommendations:

- expand and strengthen existing energy efficiency programs as well as building and appliance standards
- achieve a statewide renewables energy mix of 33 percent
- develop a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system
- establish targets for transportation-related greenhouse gas emissions for regions throughout California and pursue policies and incentives to achieve those targets
- adopt and implement measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard
- create targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the state's long-term commitment to AB 32 implementation

Under the Scoping Plan, approximately 85 percent of the state's emissions are subject to a cap-and-trade program where covered sectors are placed under a declining emissions cap. The emissions cap incorporates a margin of safety such that the 2020 emissions limit will still be achieved even in the event that uncapped sectors do not fully meet their anticipated emission reductions. Emission reductions will be achieved through regulatory requirements and the option to reduce emissions further or purchase allowances to cover compliance obligations.

Senate Bill 1368

SB 1368 requires the California Energy Commission (CEC) to develop and adopt regulations for GHG emissions performance standards for the long-term procurement of electricity by local publicly owned utilities. These standards must be consistent with the standards adopted by the Public Utilities Commission. This effort will help to protect energy customers from financial risks associated with investments in carbon-intensive generation by allowing new capital investments in power plants that have GHG emissions as low as or lower than new combined-cycle natural gas plants, by requiring imported electricity to meet GHG performance standards in California and requiring that the standards be developed and adopted in a public process.

Senate Bill 97

SB 97 directs the Governor's Office of Planning and Research (OPR) to develop guidelines under CEQA for the mitigation of greenhouse gas emissions. OPR is to develop proposed guidelines by July 1, 2009, and the Resources Agency is directed to adopt guidelines by January 1, 2010. On June 19, 2008, OPR issued a technical advisory as interim guidance regarding the analysis of GHG emissions in CEQA documents (OPR 2008). The advisory indicated that a project's GHG emissions, including those associated with vehicular traffic, energy consumption, water usage, and construction activities, should be identified and estimated. The advisory further recommended that the lead agency determine significance of the impacts and impose all mitigation measures that are necessary to reduce GHG emissions to a less than significant level. The advisory did not recommend a specific threshold of significance (either quantitative or qualitative), but left this to the lead agency's judgment and discretion, based upon factual data and guidance from regulatory agencies and other sources where available and applicable.

On January 8, 2009, OPR issued its Preliminary Draft CEQA Guideline Amendments for Greenhouse Gas Emissions. OPR scheduled two workshops on the preliminary draft Guidelines in January 2009 before submitting its proposals to the Resources Agency. Although these guidelines have not yet been adopted, the preliminary draft GHG emissions guidelines that would be applicable to the assessment of future development under the proposed 2005 LRDP include the following, which are addressed in this analysis as described below:

I. Additions to Appendix G, VII: GREENHOUSE GAS EMISSIONS - - *Would the project:*

A. Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment, based on any applicable threshold of significance?

B. Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emission of greenhouse gases?

These new Appendix G, VII questions are addressed in the climate change analysis in Section 3.3.4, below.

II. New Section 15064.4 - - Determining the Significance of Impacts from Greenhouse Gas Emissions

A. In assessing significance, the lead agency should consider the extent to which the project:

1. "…could help or hinder the attainment of the state's goals of reducing [GHG] emissions to 1990 levels by the year 2020 as stated in [AB32]"; a project may satisfy this standard "by being consistent with an adopted statewide 2020 [GHG] emissions limit or the plans, programs, and regulations adopted to implement [AB 32];"

2. "…may increase the consumption of fuels or other energy resources, especially fossil fuels that contribute to [GHG] emissions when consumed;"

3. "…may result in increased energy efficiency or in a reduction in overall greenhouse gas emissions from an existing facility;"

4. "…exceed any threshold of significance that applies to the project."

B. The lead agency should make a good-faith effort, based on available information, to describe, calculate or estimate the amount of [GHG] emissions, including emissions from energy *consumption and vehicular traffic, using modeling, other quantitative methods, or "qualitative or other performance based standards for estimating the significance of [GHG] emissions."*

These proposed requirements are addressed in this EIR in Section 3.3.3.4.

III. Additions to Section 15064 - - Determining the Significance of the Environmental Effects Caused by a Project.

Subsection (h)(3) states that a lead agency may determine that a project's incremental contribution to a significant cumulative impact is not cumulatively considerable if the project "will comply with the requirements of a previously approved plan or mitigation program (e.g., …city or county general plan or specific plan …climate action plan…sustainable community strategy, statewide plan of mitigation for greenhouse gas emissions) which provide specific requirements that will avoid or substantially lessen the cumulative problem within the geographic area in which the project is located."

These proposed requirements are addressed in this Section 3.3 through analysis of the project's consistency with the UCOP Policy Guidelines for Sustainable Practices (Section 3.3.3.4).

Senate Bill 375

SB 375 requires CARB to set regional greenhouse gas reduction targets after consultation with local governments. The target must then be incorporated within that region's Regional Transportation Plan (RTP), which is used for long-term transportation planning, in a Sustainable Communities Strategy. SB 375 also requires each region's Regional Housing Needs Assessment (RHNA) to be adjusted based on the Sustainable Communities Strategy in its RTP. Additionally, SB 375 will reform the environmental review process to create incentives to implement the strategy, especially transit priority projects.

Executive Order S-3-05

In June 2005, Governor Schwarzenegger established California's GHG emissions reduction targets in Executive Order S-3-05. The Executive Order established the following goals: GHG emissions should be reduced to 2000 levels by 2010; GHG emissions should be reduced to 1990 levels by 2020; and GHG emissions should be reduced to 80 percent below 1990 levels by 2050. The secretary of Cal/EPA is required to coordinate efforts of various agencies in order to collectively and efficiently reduce GHGs. Some of the agency representatives involved in the GHG reduction plan include the secretary of the Business, Transportation and Housing Agency; the secretary of the Department of Food and Agriculture, the secretary of the Resources Agency, the Chairperson of CARB; the chairperson of the CEC; and the president of the Public Utilities Commission. Representatives from each of the aforementioned agencies comprise the Climate Action Team. The Climate Action Team is responsible for implementing global warming emissions reduction programs. The Cal/EPA secretary is required to submit a biannual progress report from the Climate Action Team to the governor and state legislature disclosing the progress made toward GHG emission reduction targets. In addition, another biannual report must be submitted illustrating the impacts of global warming on California's water supply, public health, agriculture, the coastline, and forestry, and reporting possible mitigation and adaptation plans to combat these impacts. The Climate Action Team has fulfilled both of these report requirements through its March 2006 Climate Action Team Report to Governor Schwarzenegger and the legislature (Cal/EPA Climate Action Team 2006).

Executive Order S-1-07

Executive Order S-1-07 sets a new Low Carbon Fuel Standard measured in CO_2-equivalent gram per unit of fuel energy sold in California. The target of the LCFS is to reduce the carbon intensity of California passenger vehicle fuels by at least 10 percent by 2020. The Executive Order requires the secretary of Cal/EPA to coordinate with actions of the CEC, CARB, the University of California, and other agencies to develop a protocol to measure the "life-cycle carbon intensity" of transportation fuels.

CAPCOA CEQA and Climate Change White Paper

The California Air Pollution Control Officers Association (CAPCOA) prepared a white paper on CEQA and climate change in January 2008 (CAPCOA 2008). The white paper is intended to be used as a resource by lead agencies when considering policy options and not as a guidance document. Specifically, the white paper discusses three possible approaches to evaluating the significance of GHG emissions and possible mitigation measures; however, CAPCOA does not endorse any particular approach. The three alternative significance approaches are: (1) determining significance without establishing a significance threshold for GHG emissions; (2) setting the GHG emission threshold at zero; and (3) setting the GHG emission threshold at some nonzero level. The white paper evaluates potential considerations and pitfalls associated with the three approaches. At the end of the white paper, CAPCOA provides a list of potential mitigation measures and discusses each in terms of emissions reduction effectiveness, cost effectiveness, and technical and logistical feasibility.

California Climate Action Registry

The California Climate Action Registry (CCAR) is a private nonprofit organization formed by the State of California and serves as a voluntary GHG registry to protect and promote early actions to reduce GHG emissions by organizations. The CCAR began with 23 Charter Members and currently has over 300 corporations, universities, cities and counties, government agencies and environment organizations voluntarily measuring, monitoring, and publicly reporting their GHG emissions using the CCAR protocols. The CCAR has published a General Reporting Protocol, as well as project- and industry-specific protocols for landfill activities, livestock activities, the cement sector, the power/utility sector, and the forest sector. The protocols provide the principles, approach, methodology, and procedures required for participation in the CCAR.

University and Campus Policies and Procedures

UC Policy on Sustainable Practices

The UC Policy on Sustainable Practices, adopted by the Regents on in 2006 and revised in March 2007, includes the following statement on climate protection practices:

> With an overall goal of reducing greenhouse gas (GHG) emissions while maintaining enrollment accessibility for every eligible student, enhancing research, promoting community service and operating campus facilities more efficiently, the University will develop a long term strategy for voluntarily meeting the State of California's goal, pursuant to the "California Global Warming Solutions Act of 2006;" that is, by 2020, to reduce GHG emissions to 1990 levels. In addition, consistent with the Clean Energy

Standard sections a., b. and c. of this document, the University will pursue the goal of reducing GHG emissions to 2000 levels by 2014 and provide an action plan for becoming climate neutral as specified in the Implementation Procedures below.

- By December 2008, the University will develop an action plan for becoming climate neutral which will include: a feasibility study for meeting the 2014 and 2020 goals stated in the Policy Guidelines, a target date for achieving climate neutrality as soon as possible while maintaining the University's overall mission, and a needs assessment of the resources required to successfully achieve these goals. Climate neutrality means that the University will have a net zero impact on the Earth's climate, and will be achieved by minimizing GHG emissions as much as possible and using carbon offsets or other measures to mitigate the remaining GHG emissions.
- Each UC campus will pursue individual membership with the California Climate Action Registry. The Senior Vice President, Business and Finance, in coordination with campus administration, faculty, students and other stakeholders will form a Climate Change Working Group that will develop a protocol to allow for growth adjustment and normalization of data and accurate reporting procedures. The Climate Change Working Group will monitor progress toward reaching the stated goals for GHG reduction, and will evaluate suggestions for programs to reach these goals.

The University has set the following emissions reduction goals:

- Reduce GHG emissions to 2000 level by the year 2014;
- By 2020, reduce GHG emissions to 1990 level;
- By 2050, reduce to 80% below 1990 levels.

American College and Universities Presidents Climate Commitment

The University of California, as a ten-institution system, has signed the American College and University Presidents Climate Commitment (ACUPCC). Each signatory to this document commits to completing an inventory of greenhouse gas emissions within one year, and to developing, within two years, an institutional plan to achieve climate neutrality as soon as possible. The commitment also includes specific interim actions, including requiring that new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent; purchasing Energy Star appliances; offsetting greenhouse gas emissions generated by institutional air travel; encouraging and providing access to public transportation; purchasing or producing at least 15 percent of the institution's electricity consumption from renewable sources; supporting climate and sustainability shareholder proposals at companies where the institution's endowment is invested; and adopting measures to reduce waste.

Santa Cruz Climate Action Compact

The UC Santa Cruz Chancellor and representatives of the city and county of Santa Cruz signed a Climate Action Compact in September 2007. The partners in this compact agreed to:

- Set and present a GHG reduction goal for their organizations;

- Identify specific inter-institutional cooperative projects that reduce GHG emissions, stimulate investment in the community and foster economic development;
- Present a comprehensive GHG reduction action plan for their organization; and
- Immediately invite others from the public, private, and nonprofit sectors in the region to join in the effort.

UC Santa Cruz Policies

The Chancellor's Council on Climate Change, which was created in January 2008, is currently working on a Climate Action Plan for the campus. The plan will set a target date for climate neutrality by quantifying emission sources, identifying projects to reduce those emissions, and implementing the projects.

UC Santa Cruz completed its first year of third-party-certified GHG reporting for the year 2006, through the California Climate Action Registry. For that report, the Campus reported direct emissions, including those from University vehicles, space and water heating, and emissions from purchased electricity, which is considered indirect. The 2006 inventory reported a total of approximately 40,000 metric tons of GHG emissions. The 2006 inventory did not include emissions from air travel, commuting and purchases. The Campus has completed a draft inventory for 2007, which includes air travel and nonfleet mobile sources such as commuters, METRO buses, delivery vehicles, but does not include emissions associated with purchased goods. The campus's estimated emissions for 2007 were 70,000 to 80,000 metric tons of CO_2.

3.3.2 Relevant Project Characteristics

The proposed project would construct two new seven- to eight-story apartment buildings that would provide a total of 196,000 gross square feet [gsf] of on-campus housing and related services for UC Santa Cruz students. The buildings would be constructed on a 3.1-acres site that is partly developed with a parking lot, and a small apartment building that would be removed by the project. The buildings would accommodate approximately 100 apartments, a laundry room, a computer gaming room, lounges and a cafe. Space and domestic water heating would be provided by natural gas-fueled boilers. Electricity would be used for indoor and outdoor lighting, cooking, and the residents' personal electronic equipment. Three dual-fuel natural gas and liquid propane generators, each with a capacity of 150 KW, would be installed to provide emergency power for the two buildings. The total natural gas usage for the project would be approximately 153,000 therms/year. The estimated electricity usage for the proposed project would be approximately 1.6 million kW/year. <u>In compliance with the UC Policy on Sustainable Practices, t</u>~~T~~he project is being designed to exceed Title 24 energy efficiency standards by ~~28~~ <u>at least 20</u> percent.

The project would generate an estimated 804 daily vehicle trips. Two bus stops that are used by Santa Cruz METRO buses and campus shuttles are located with ¼-mile of the project site. On weekdays during the school year, more than 200 buses stop at these locations, providing direct access to other locations on campus and to the west side and downtown Santa Cruz, and through the Santa Cruz METRO station to locations throughout Santa Cruz county and to downtown San Jose. Pedestrian access to the site from the bus stop is available through Crown and Merrill Colleges. Currently, Chinquapin Road does not have sidewalks; the Campus is planning to install a sidewalk along the west side of Chinquapin Road in summer 2009 as part of a separate project. There are no bike lanes on McLaughlin Drive or Chinquapin Road.

Project construction would involve demolition of a 938-square foot (sf) apartment building as well as parking lots and roadways. Two existing asphalt parking lots would be used for staging. These would be repaved and re-striped after project construction has been completed.

The project would remove approximately 220 trees; approximately 50 trees would be planted as part of the project's landscaping.

3.3.2.1 Applicable LRDP EIR Mitigation Measures

The following, previously adopted, 2005 LRDP EIR mitigation measures are applicable to and incorporated into the proposed project:

LRDP Mitigation AIR-1: The Campus shall apply standard MBUAPCD-recommended mitigation measures during construction of new facilities under the 2005 LRDP, as appropriate:

- Water all active construction areas at least twice daily.
- Prohibit all grading activities during periods of high wind (over 15 mph).
- Apply chemical soil stabilizers on inactive construction areas (disturbed lands within construction projects that are unused for at least four consecutive days).
- Apply nontoxic binders (e.g., latex acrylic copolymer), as appropriate, to exposed areas after cut and fill operations and hydroseed area.
- Require haul trucks to maintain at least 2 feet of freeboard.
- Cover all trucks hauling dirt, sand, or loose materials.
- Plant vegetative ground cover in disturbed areas as soon as possible.
- Cover inactive storage piles.
- Install wheel washers at the entrances to construction sites for all exiting trucks.
- Pave all roads on construction sites.
- Damp-sweep streets if visible soil material is carried out from the construction site.
- Post a publicly visible sign that specifies the telephone number and person to contact regarding dust complaints. This person shall respond to complaints and take corrective action within 48 hours. The phone number of the Monterey Bay Unified Air Pollution Control District shall be visible to ensure compliance with Rule 402.
- Each project shall limit the area under construction at any one time.

LRDP Mitigation AIR-2A: The Campus shall incorporate in each new project design and construction features that conserve natural gas and/or minimize air pollutant emissions from space and water heating. Specific measures that will be considered for each project include, but are not limited to the following:

- Orientation of buildings to optimize solar heating and natural cooling;
- Use of solar or low-emission water heaters in new buildings; and/or

- Installation of best available wall and attic insulation in new buildings

LRDP Mitigation AIR-5A: The Campus shall develop and implement an emergency generator maintenance testing schedule consistent with Table 4.3-22 [in the 2005 LRDP EIR].

LRDP Mitigation AIR-6: The Campus will minimize construction emissions by implementing measures such as those listed below:

- Require the use of cleaner fuels (e.g., natural gas, ethanol) in construction equipment
- Require that construction contractors use electrical equipment where possible
- Require construction contractors to minimize the simultaneous operation of multiple pieces equipment at a construction site
- Minimize idling time to a maximum of 5 minutes when construction equipment is not in use
- Schedule operations of construction equipment to minimize exposure to emissions from construction equipment

3.3.3 Impacts and Mitigation Measures

3.3.3.1 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines and significance thresholds recommended by the MBUAPCD in its 2008 CEQA Air Quality Guidelines.

Criteria Pollutants

For the purposes of this EIR, an impact is considered significant if the implementation of the proposed project would:

- Conflict with or obstruct implementation of the applicable air quality plan
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)
- Expose sensitive receptors to substantial pollutant concentrations
- Create objectionable odors affecting a substantial number of people

All of these issues were evaluated in the 2005 LRDP EIR, except objectionable odors. None of the new facilities that would be built on campus under the 2005 LRDP, including the proposed project, would involve a source of objectionable odors.

To determine the significance of an air quality impact, the following thresholds recommended by the MBUAPCD are used in this EIR:

- During construction, PM_{10} emissions of 82 pounds per day (lb/day) or more
- During operations, increase in emissions of:
  - 137 lb/day or more of volatile organic compounds (VOC) or NO_x (from direct and indirect sources)
  - 82 lb/day or more of PM_{10} (from direct sources)
  - 550 lb/day or more of CO (from direct sources, not from vehicle emissions)
  - 150 lb/day or more of sulfur oxides (SO_x) (from direct sources)

Direct emissions are emitted on site. Indirect emissions come from mobile sources that may be emitted on and off site.

Toxic Air Contaminants

An impact would be considered significant if the implementation of the proposed project would:

- Contribute to the probability of contracting cancer for the Maximally Exposed Individual (MEI) exceeding the AB 2588 threshold of 10 in 1 million
- Result in a noncarcinogenic (chronic and acute) health hazard index greater than the AB 2588 threshold of 1.0

Greenhouse Gas Emissions

To date, no local or state air quality agency has adopted significance criteria for GHG emissions. On January 8, 2009, OPR issued draft CEQA Guidelines covering GHG emissions, but these proposed amendments to the State CEQA Guidelines do not specify significance thresholds for GHG emissions. Instead, OPR has asked CARB staff to suggest thresholds of significant (OPR 2009). These draft guidelines are undergoing public review and, pursuant to SB 97, must be adopted by the Secretary of Resources no later than July 1, 2009.

As discussed in Section 3.3.1.7, above, OPR, CARB staff and CAPCOA all have issued technical advisories, white papers and proposals with suggested methods for analyzing the impacts of GHG emissions, with and without a GHG emissions significance threshold.

For purposes of this EIR, the impact of the proposed project with respect to global climate change would be considered significant if implementation of the proposed projects would:

- Impede or conflict with the emissions reduction targets and strategies prescribed in or developed to implement AB 32.
- Impede or conflict with the UC Policy on Sustainable Practices.

The proposed project will be considered not to impede the emissions reduction targets developed by the state pursuant to AB 32 if it is consistent with applicable AB 32 Scoping Plan measures. The proposed project will be considered not to conflict with the UC Policy on Sustainable Practices if the project design is consistent with the Green Building Design Guidelines contained in the Policy.

3.3.3.2 Analytical Method

Criteria Pollutant Emissions from Construction Activities

Construction activities generate short-term fugitive dust emissions, equipment exhaust emissions, and worker vehicle exhaust emissions. The term "fugitive dust emissions" refers to particulate matter ("dust") emitted from an open area (i.e., not through a stack or an exhaust vent) due to ground disturbance activities. A portion of the fugitive dust includes PM_{10} (approximately 64 percent [by weight] according to the MBUAPCD CEQA Guidelines).

URBEMIS2007 was used to estimate criteria pollutants from construction activities, including $PM_{10,}$ equipment usage and worker vehicle emissions. The model estimates construction equipment usage and worker trips based on the project acreage and building square footage. PM_{10} emissions from fugitive dust, equipment exhaust, and worker vehicle exhaust were totaled and compared with the threshold of 82 pounds per day to evaluate the level of significance of construction activities. The results of this analysis are described under Section 3.3.3.3, *Project Impacts and Mitigation Measures*, below. The URBEMIS2007 results are included in Appendix C.

According to MBUAPCD CEQA guidelines, temporary exhaust emissions of VOC and NO_x from typical construction equipment are accounted for in the air quality plans, and quantification of these emissions are not needed. Construction activities for the proposed project would be conducted with typical construction equipment, and thus exhaust emissions are not quantified here.

Criteria Pollutant Emissions from Project Operations

URBEMIS2007 was also used to estimate emissions from project operations, including:

- Space and water heating from boilers fueled by natural gas
- Residential consumer products (e.g., VOC emissions from household cleaners)
- The emergency generators fueled by natural gas and propane
- Motor vehicle trips that would be generated by the project

The emissions from stationary, area, and mobile sources were added and compared to the emission thresholds identified in Section 3.3.2.1, *Standards of Significance*, above. The URBEMIS2007 results are included in Appendix C.

Local Carbon Monoxide Concentrations

MBUAPCD CEQA Guidelines contain the following guidance for when traffic emissions at an intersection may exceed CO standards and may require detailed modeling:

- Intersections or road segments that operate at LOS D or better that would operate at LOS E or F with the project's traffic,
- Intersections or road segments that operate at LOS E or F where the volume-to-capacity (V/C) ratio would increase 0.05 or more with the project's traffic, or

- Intersections that operate at LOS E or F where delay would increase by 10 seconds or more with the project's traffic.

As part of the 2005 LRDP EIR's analysis of the impacts on air quality, six intersections considered to be the "worst" intersections were modeled using the California Department of Transportation CALINE4 dispersion model. The potential for project-related traffic to cause CO exceedances at study area intersections was examined based on the traffic study prepared for the proposed project and the CALINE modeling conducted for the 2005 LRDP EIR.

Toxic Air Contaminant Emissions

The boilers and emergency generators that would be installed as part of the project would generate TACs. Since there are no ambient standards for toxic air contaminants, evaluation of impacts is based upon a health risk assessment. An air toxics health risk assessment for the University of California Santa Cruz 2005 Long Range Development Plan (URS 2005) that assessed total campus health risks associated with full development under the 2005 LRDP was prepared as part of the 2005 LRDP EIR air quality analysis. The analysis of the potential for project TAC emissions to create a significant health risk is based on the health risk assessment prepared for the 2005 LRDP EIR.

Greenhouse Gases

No guidance exists to indicate what level of GHG emissions would be considered substantial enough to result in a significant adverse impact on global climate. However, it is generally the case that an individual project of any size is of insufficient magnitude by itself to influence climate change or result in a substantial contribution to the global GHG inventory. Thus, GHG impacts are recognized as exclusively cumulative impacts: there are no non-cumulative GHG emission impacts from a climate change perspective (CAPCOA 2008). Accordingly, discussion of the GHG emissions that would result from the proposed project and their impact on global climate are addressed in terms of the project's contribution to a cumulative impact on global climate.

OPR's technical advisory states that "the most common GHG that results from human activity is carbon dioxide, followed by methane and nitrous oxide" (OPR 2008). The informal guidelines also advise that lead agencies should calculate, or estimate, emissions from vehicular traffic, energy consumption, water usage and construction activities. The calculation presented below includes construction and operational emissions in terms of CO_2-equivalent emissions from construction, increased vehicular traffic, area source, and energy consumption.

Construction Emissions

The URBEMIS2007 program was used to calculate construction emissions of carbon dioxide from site grading, construction of buildings, roads and parking lots, including importation of soil to the site by truck. The analysis used URBEMIS2007 default estimates of equipment usage and construction-related vehicle trips were used. The URBEMIS2007 results are included in Appendix C.

Emissions of methane and nitrous oxide were estimated separately based on the URBEMIS2007 estimates of carbon dioxide from diesel construction vehicles and equipment. Published methane and nitrous oxide emission factors were utilized to estimate project emissions of these gases based on the estimated carbon dioxide emissions (BAAQMD 2006). Because these gases are more powerful global warming gases, the estimated emissions of methane and nitrous oxide were multiplied by a correction factor to estimate "carbon dioxide equivalents." Methane was assumed to have a global warming potential of 21 times that of CO_2, while nitrous oxide was assumed to have a global warming potential of 310 times that of CO_2. The conversion calculations are included in Appendix D of this EIR.

Direct Emissions from Mobile Sources

The URBEMIS2007 program was used to estimate carbon dioxide generated by project traffic (Appendix C of this EIR). Published methane and nitrous oxide emission factors were utilized to estimate project emissions of these gases based on the estimated carbon dioxide emissions.

Direct Emissions from Area Sources

Area source emissions of carbon dioxide were also quantified by the URBEMIS2007 program. The URBEMIS program identifies five categories of area source emissions: natural gas combustion, hearth emissions, landscaping emissions, architectural coatings, and consumer products. Natural gas emissions result from the combustion of natural gas for cooking, space heating and water heating. Estimated natural gas usage was based on actual usage at several recently constructed student apartment buildings on campus. This estimate of natural gas usage does not take into account the greater energy efficiency of the proposed project, which must comply with current UC policy requiring that new buildings ~~is being designed to~~ exceed the energy efficiency standards of Title 24 by at least ~~28~~20 percent. Hearth emissions consist of emissions from wood stoves, wood fireplaces, and natural gas fireplaces related to residential uses. The project would not emit emissions from these sources.

URBEMIS2007 calculates emissions from fuel combustion and evaporation of unburned fuel by landscape maintenance equipment. Equipment in this category includes lawn mowers, rotor tillers, shredders/grinders, blowers, trimmers, chain saws, and hedge trimmers used in residential and commercial applications. This category also includes air compressors, generators, and pumps used primarily in commercial applications.

Consumer product emissions are generated by a wide range of product categories, including air fresheners, automotive products, household cleaners and personal care products. Emissions associated with these products primarily depend on the increased population associated with residential development. In URBEMIS2007, these sources generate ROG emissions but not carbon dioxide.

Architectural coating emissions result from the evaporation of solvents contained in paints, varnished, primers and other surface coatings associated with maintenance of residential and nonresidential structures. In URBEMIS2007, this source generates ROG emissions but not carbon dioxide.

Indirect Emissions

Emissions of GHGs emitted off the project site and not directly related to project activities are considered indirect emissions. The largest of this type of source is the electricity used by the project, a portion of which is generated by fossil-fueled power plants that generate global warming gases. Global warming gas emissions related to electricity use were estimated using average annual electrical consumption at similar facilities on campus. Emission rates for carbon dioxide, methane and nitrous oxide per megawatt hour were taken from the California Climate Action Registry General Reporting Protocol, Version 3.0 (California

Climate Action Registry 2008). Project electrical usage was multiplied by emission rates per megawatt hour to obtain annual emissions. These emissions were converted to CO_2 equivalents.

The treatment and delivery of drinking water is another indirect source of greenhouse gases. An emission factor was created by dividing current estimated greenhouse gas emissions for the Santa Cruz municipal water system of 2,119 metric tons per year (CO_2 equivalent) by the system's annual throughput of 3.9 billion gallons (City of Santa Cruz 2008). This per-gallon factor was multiplied by the estimated annual project water demand of 7.7 million gallons to obtain an estimate of the GHG emissions that would result indirectly from the project's water use.

Wastewater treatment and solid waste disposal in landfills are sometimes considered to be indirect sources of GHG emissions that can be linked to new development. The breakdown of organic materials at wastewater treatment facilities and solid waste landfills normally generates methane, which is a GHG with a Global Warming Potential (GWP) 21 times that of CO_2, so methane emissions associated with the wastewater and solid waste generated by a project could be calculated. Wastewater treatment also removes nitrogen in the form of ammonium and nitrate, which is generally released into the atmosphere as N_2O. However, methane is captured at the Santa Cruz city landfill and wastewater treatment plant, and is used to generate electricity. The City of Santa Cruz *Greenhouse Gas Emissions Inventory* estimates that capture of methane at the city landfill and wastewater treatment plant, and its use to generate electricity, results in an avoided emission that exceeds actual emissions (City of Santa Cruz 2008). This avoidance is accomplished by converting methane emissions into CO_2 emissions (with a much lower Global Warming Potential) and by creating electricity that offsets production of GHG emissions at power plants. Because, at least in Santa Cruz, the net effect of wastewater treatment and landfill operations is to result in avoided GHG emissions, the project would not generate new emissions from these sources.

Loss of Biological Carbon Sequestration

Carbon sequestration is the retention, capture or placement of CO_2 into a repository, such that it is removed from the atmosphere. Plants and microorganisms in the soil remove CO_2 from the atmosphere as they grow, which constitutes biological carbon sequestration. Removal of trees at the project site and replacement with developed urban surfaces would result in a loss of the CO_2 sequestration on the site that is afforded by the existing trees, although the new trees planted as part of project landscaping would sequester CO_2 as they grow. The net change in CO_2 sequestration due to the removal of trees at the proposed project site is the difference between the carbon stock associated with the existing ecosystem at the site, and that associated with the proposed project site after development.

The biomass of the existing on-site trees that would be removed as part of the project and the future biomass of the new trees were estimated using carbon stock rates and other factors from the California Climate Action Registry Forest Project Protocol, Version 2.1 (California Climate Action Registry 2007). The technical report describing the carbon sequestration calculations for the project is included in Appendix D of this EIR. The carbon stock equations estimate above-ground tree biomass from individual tree diameter measurements. The above-ground biomass is then used to estimate below-ground biomass. A carbon fraction factor is then applied to the total biomass in order to convert the amount of biomass matter to carbon. In the case of the project trees, all of the carbon content in the biomass is assumed to originate from CO_2 in the atmosphere. In the case of the existing trees, a portion of the carbon stock would remain as carbon in the form of furniture and other wood products. The carbon stock associated with these wood products would not immediately convert to atmospheric CO_2. The conversion from stored carbon to CO_2 would take place over time as the wood products slowly decay and eventually end their useful lives. The CCAR Forest Project Protocol contains equations for estimating the carbon stored in wood products from trees, and the rate of the decay that results in gradual conversion to CO_2. The analysis also took into account the loss of future sequestration by the trees on the project site. At full maturity, trees reach an equilibrium point whereby carbon loss through decay and oxidation is equal to the carbon gain through photosynthesis. The age at which trees reach this equilibrium point varies by species; redwoods, which make up most of the trees on the project site, continue to increase their carbon sequestration for a longer time period than most other species. For this analysis, the future sequestration was estimated using standard redwood yield tables, adjusted for regional conditions by using inventory and growth data from comparable stands in the Santa Cruz Mountains.

3.3.3.3 Project Impacts and Mitigation Measures

Construction Emissions

ECI Impact AIR-1:	Construction activities under the proposed project would result in emissions of PM_{10} on a short-term basis.
Applicable LRDP Mitigation:	AIR-1
Significance:	Less than significant
Project Mitigation:	None
Residual Significance:	Not applicable

Daily emissions of PM_{10} were estimated using URBEMIS2007 for each of the four major phases of project construction (grading, building construction, paving, and architectural coating). The maximum daily PM_{10} emissions from the project, which would be during the grading phase, would be 17.37 lbs/day, including 15.95 lbs/day from fugitive dust and 1.42 lbs/day from exhaust. The construction emissions estimated by URBEMIS2007 did not assume any mitigation to reduce fugitive dust. With implementation of the measures listed under LRDP Mitigation AIR-1, which are incorporated into the proposed project, would reduce PM_{10} emissions by more than 50 percent. However, even without the measures listed under LRDP Mitigation AIR-1, emissions would be less than the MBUAPCD significance threshold of 82 lbs/day and the project impact would be less than significant.

Project Operational Emissions of Criteria Pollutants

ECI Impact AIR-2:	The proposed project may contribute to a violation of air quality standards or hinder attainment of the regional air quality plan.
Applicable LRDP Mitigation:	AIR-2A
Significance:	Less than significant
Project Mitigation:	None

Natural gas combustion for space and water heating and for routine testing of emergency generators, consumer products, and vehicle trips generated by the proposed project would increase regional emissions of criteria pollutants. The natural gas boilers used for residential space and water heating, the emergency generators, and consumer products are considered area sources; and the projected vehicle trips associated with project operations are the mobile sources. All of these emissions were estimated using URBEMIS2007. The estimated emissions are presented in Table 3.3-7.

Table 3.3-7
Estimated Criteria Pollutant Emissions from Project Operations

Source	ROG	NO_x	PM_{10}	CO	SO_x	Units
Area Sources	5.46	0.92	0.01	1.93	0.00	lb/day
Mobile Sources	10.51	15.14	14.00	120.27	0.07	lb/day
Total	**15.97**	**16.06**	**14.01**	**122.20**	**0.07**	**lb/day**
Significance Thresholds	***137***	***137***	***82***	***550***	***150***	***lb/day***

As Table 3.3-7 shows, criteria pollutant emissions from the project operations would not exceed MBUAPCD thresholds and the project impact would be less than significant.

Vehicle CO Emissions

As part of the air quality analysis for the 2005 LRDP EIR (Section 4.14), CO concentrations were evaluated for future CO concentrations at six intersections where, in 2020, the screening thresholds identified in Section 3.3.2.2 of this EIR would be exceeded. CO concentrations at these six intersections were modeled using the California Department of Transportation CALINE4 dispersion model. The intersections selected for modeling were the three intersections with the highest delay and the three intersections with the highest traffic volume. The modeling took into account traffic that would be generated by both development under the 2005 LRDP and other projected regional development.

The results of the CALINE modeling for the 2005 LRDP EIR showed that predicted CO concentrations would be less than significant at all six intersections analyzed. As discussed in Section 3.14, *Transportation and Circulation*, the vehicle trips generated by the proposed project would be within the number of vehicle trips projected for campus development under the 2005 LRDP. Therefore, project CO emissions would not exceed CO standards and the impact would be less than significant.

Consistency with Air Quality Management Plan

The MBUAPCD considers any project that is not consistent with the Air Quality Management Plan (AQMP) to be cumulatively significant. AQMP are developed for regions that do not meet ambient air quality standards. The region currently is not in attainment of the state ozone and PM_{10} standards. To satisfy the California Clean Air Act, the MBUAPCD has developed an AQMP to show how the region would comply with the state ozone standard. The AQMP projects ozone precursor emissions (VOC and NO_x) from stationary, area, and mobile sources in the region, and develops mitigation measures to reduce such emissions so that the region can eventually achieve attainment of the ozone standard. The plan was last updated in 2008 (MBUAPCD 2008a).

The AQMP is based on population forecasts prepared by the Association of Monterey Bay Area Governments (AMBAG). In a consistency determination performed at the request of the Campus, AMBAG determined that the proposed project is consistent with the 2008 regional population forecasts and with the 2008 AQMP (AMBAG 2008).[6] Therefore, the project would not create an impact with respect to consistency with the AQMP.

Operational Emissions of TACs

ECI Impact AIR-3:	Natural gas combustion for space and water heating and routine firing of the emergency generators would generate TACs.
Applicable LRDP Mitigation:	AIR-5A
Significance:	Less than significant
Project Mitigation:	None
Residual Significance:	Not applicable

Natural gas combustion for space and water heating and for routine firing of the emergency generators for maintenance and testing would result in emissions of TACs. UC Santa Cruz conducted an HRA to identify potential human health risks associated with routine operations anticipated to occur under the 2005 LRDP (URS 2005). An HRA characterizes human health risks as a result of exposure to toxic substances. In order to assess potential health risks associated with the full development under the 2005 LRDP, total health risks for the academic year 2020-2021 were evaluated for existing routine campus routine operations combined with routine operations associated with future development. The HRA included TAC emissions associated with existing and future (1) laboratory operations; (2) natural gas and diesel fired stationary combustion sources (such as boilers at the Central Heating Plant, boilers in individual buildings, internal combustion engines at the Cogeneration Plant, and routine firing of back-up emergency generators for maintenance and testing purposes); (3) diesel-fueled mobile sources (delivery trucks, METRO buses and campus shuttles) on campus roadways; and (4) painting operations. The methodology and results of the HRA are described in detail in the 2005 LRDP EIR (Section 4.3).

The HRA predicted that the total estimated cancer risk from UC Santa Cruz routine campus operations for academic year 2020-2021 would be below the threshold of 10 in one million for both the off-campus and on-campus receptors. Similarly, the total estimated long-term (chronic) non-cancer hazard indices for academic year 2020-2021 are projected to be below the significance threshold for both on-campus and off-campus receptors. The HRA also found that the total estimated short-term (acute) noncancer hazard index for academic year 2020-2021 for off-campus receptors would be below the significance threshold. However, the HRA found that the short-term (acute) hazard index would exceed the significance threshold at three locations on the campus.

6 In a consistency determination performed for the 2005 LRDP in 2005, AMBAG determined that the growth of the campus projected under the 2005 LRDP had not been accounted for in AMBAG’s 2004 forecasts and that the 2005 LRDP therefore would not be consistent with the AQMP. The 2005 LRDP EIR identified this conflict with the AQMP as a significant and unavoidable impact. After the 2005 LRDP was approved, the Campus worked with AMBAG to ensure that projected UC Santa Cruz growth was included in the 2008 population forecasts which were used to develop the 2008 AQMP.

The HRA conservatively assumed that as part of the routine maintenance program, all back-up/emergency generators would be tested at the same time during a 1-hour period. The emission sources that together would cause almost 40 percent of this risk are the diesel-fueled emergency generator at the Central Heating Plant and 14 new emergency generators in new buildings in the northern portion of the campus core. Because this impact is the result of exposure to concentrated emissions in one hour, this impact can be avoided by limiting the number of emergency generators in the central campus that are operated simultaneously in one hour. The 2005 LRDP EIR concluded that this impact would be reduced to a less-than-significant level by LRDP Mitigation AIR-5A, requiring the Campus to develop and implement an emergency generator maintenance testing schedule; and LRDP Mitigation AIR-5B, which requires future testing and, if necessary, replacement of the Campus's cogeneration plant equipment. The two new emergency generators that would be installed as part of the proposed project would be incorporated into the Campus's emergency generator testing schedule. Furthermore, as shown in Table 4.3-20 in Section 4.3 of the 2005 LRDP EIR, small boilers and generators such as those that would be included in the proposed project contribute less than one percent of the estimated risk. The activities associated with the proposed project are within the development parameters assumed for the 2005 LRDP HRA. Therefore, TAC emissions from the proposed project would not result in significant health risk and the project impact would be less than significant.

Construction TAC Emissions

ECI Impact AIR-4:	Construction activities under the 2005 LRDP could potentially result in a substantial health risk to campus occupants at certain on-campus locations from short-term exposures to TACs.
Applicable LRDP Mitigation:	AIR-6
Significance:	Speculative
Project Mitigation:	None

Equipment used in construction of the proposed project would emit toxic air contaminants. For the 2005 LRDP EIR, the MBUAPCD asked that UC Santa Cruz conduct a HRA to identify potential health risks associated with emissions of TACs from potential construction projects in the future. UC Santa Cruz conducted the requested analysis as part of the 2005 LRDP EIR, even though there is no established methodology to model human health risk from future construction activities that would occur under a development program such as the 2005 LRDP. Unlike stationary sources that emit TACs from fixed locations, construction activity under the 2005 LRDP would not remain at any location for the entire length of time that is modeled for exposure. Therefore, there is no reasonable way to model the effects of construction activities without making certain simplifying assumptions, which then provide results that are not reliable.

Despite the uncertainties inherent in the analysis, UC Santa Cruz developed estimates of potential human health effects from future construction activities on the campus, assuming three hypothetical construction projects covering a total area of 6.75 acres of land, and a total building area of about 270,000 square feet (URS 2005). These results of the analysis predicted that the total estimated cancer risk and the chronic noncancer risk from projected construction projects at UC Santa Cruz over the 15-year LRDP period would be below the relevant significance thresholds both on- and off-campus. However, the acute noncancer index would exceed the significance threshold value of one at both on- and off-campus locations.

The acute hazard index is driven by acrolein emissions from off-road equipment doing building construction. There is a high level of uncertainty with respect to the emissions of acrolein from construction equipment. Therefore, the 2005 LRDP EIR concluded that no conclusion as to the significance of the impact could be reached because the reliability of this analysis was uncertain. The Campus nonetheless implements LRDP Mitigation AIR-6 in conjunction with construction projects on the campus to minimize TAC emissions to the maximum extent feasible.

The MBUAPCD suspended application of the reference exposure level (REL, i.e., threshold) for acute impacts of acrolein in June 2007 and the MBUAPCD's 2008 CEQA Guidelines state that the MBUAPCD's comment letters on projects subject to CEQA will not address the short-term impacts of acrolein from diesel equipment. TACs from construction equipment were not quantified for the proposed ECI Project. However, LRDP Mitigation AIR-6 is incorporated into the proposed project and would minimize TC emissions to the extent feasible.

3.3.3.4 Cumulative Impacts and Mitigation Measures

Criteria Pollutants

According to MBUAPCD CEQA Guidelines, "A consistency analysis and determination serve as the project's analysis of cumulative impacts on regional air quality. Project emissions which are not consistent with the AQMP are not accommodated in the AQMP and will have a significant cumulative impact unless offset." The analysis of consistency is performed by AMBAG for population-related projects and by the Air District for all others. As discussed above under Consistency with Air Quality Management Plan, AMBAG has determined that the proposed project is consistent with the AQMP, and therefore would not result in a cumulatively considerable contribution of ozone precursors to the regional air basin.

The 2005 LRDP EIR (Section 4.15) analyzed PM_{10} emissions from ongoing construction activities on campus, consisting of three hypothetical construction projects covering a total area of 6.75 acres of land, and a total building area of about 270,000 square feet. The LRDP EIR concluded that this construction PM_{10} emissions under this hypothetical scenario would not be significant. Construction of the proposed project could overlap with two other construction projects on the central campus: the Biomedical Sciences Facility Project, the building construction phase of the Cowell Student Health Center Expansion and Renovation Project, and the Chinquapin Sidewalk Project. The total potential area of disturbance for these projects would be approximately 6 acres; and the total area of new building construction would be approximately 298,000 gsf, which is slightly more building space than was assumed for the LRDP EIR analysis. Daily PM_{10} emissions from construction of the Biomedical Sciences Facility, without mitigation, were estimated at 62 lbs/day (UC Santa Cruz 2006). PM_{10} emissions for the building construction phase of the Cowell Student Health Center Expansion and Renovation Project were estimated at 1.1 lbs/day, without mitigation (UC Santa Cruz 2007). Total PM_{10} emissions for the three projects, without mitigation, could reach 80 lbs day, which is near the significance threshold of 82 lbs/day. However, all three projects would implement the measures listed in LRDP Mitigation AIR-1, which would reduce PM_{10} emissions by more than 50 percent.

Therefore, the total PM_{10} emissions for the three projects on the central campus would not result in a significant cumulative impact.

The analysis of CO concentrations provided in Section 3.3.3.3, *Project Impacts and Mitigation*, is based on the CALINE modeling performed for the 2005 LRDP EIR, which analyzed a cumulative CO impact, which is less than significant. Additional analysis of cumulative CO concentrations is not required.

Toxic Air Contaminants

The 2005 LRDP EIR concluded that TAC emissions associated with development under the 2005 LRDP in conjunction with other regional growth, would not result in a significant cumulative impact for the following reasons: 1) new technologies to reduce air toxics, particularly from diesel engines; 2) CARB and U.S. EPA are developing substantial programs to reduce air toxics; 3) CARB estimates that full implementation of its Risk Reduction Plan for all covered emissions units will reduce diesel emissions in the year 2010 by 75 percent over year 2000 levels; and 3) because air toxics impacts generally are localized around emission sources, so impacts do not generally cumulate at a substantial distance and there are no reasonably foreseeable developments in the vicinity of the campus that would be significant sources of air toxics. As discussed in the discussion of ECI Impact AIR-3 in Section 3.3.2, the proposed project would make a small contribution to the estimated future health risk associated with campus operations and the activities associated with the proposed project are within the development parameters assumed for the2005 LRDP HRA. The impact was adequately analyzed in the 2005 LRDP EIR, and the proposed project would not change the conclusion that the cumulative impact would be less than significant.

Climate Change

ECI Impact AIR-5:	The project's incremental increases in GHG emissions associated with construction, vehicle trips, direct and indirect energy use, and tree removal would contribute to regional and global increases in GHG emissions and associated climate change effects.
Applicable LRDP Mitigation:	AIR-5A, AIR-6
Significance:	Less than significant
ECI Mitigation AIR-5:	In addition to the new trees included in the proposed project landscaping plan, the campus shall plant 100 redwood trees in locations on campus that were historically redwood forest.

The total estimated GHG emissions associated with construction and operation of the project are shown in Table 3.3-8.

Table 3.3-8
Estimated Project Greenhouse Gas Emissions

Construction (metric tons CO_2E)[1]	**336.30**
Tree Removal (metric tons CO_2E)[2]	**1,182.53**
Operation (metric tons/year CO_2E)	
Transportation	1,266.96
Area sources	238.84
Electricity	333.97
Water treatment/delivery	8.37
Total for Operation	**1,848.14**

Notes:

[1]Construction emissions and annual emissions are not added since one represents a one-time amount while the other represents an annual rate. Construction emissions are one-time emissions that occur prior to building occupancy during a two-year period. Annual emissions occur only after construction of the proposed project and are expected to occur annually for the life of the project.

[2]Emissions from tree removal also are not added to the project's annual GHG emissions rate because they are a one-time occurrence that would occur gradually over a period of 30 years. These emissions are due to loss of future sequestration by the existing trees, the gradual decay of lumber from the existing trees that would be incorporated into wood products, the faster decay of the existing tree biomass that is not suitable for lumber. The emissions are partly offset by the carbon sequestered by the landscape trees as they grow.

The total GHG emissions from construction activities are estimated to be about 336 metric tons CO_2E. These are one-time emissions that would occur over the course of the two-year construction period. The annual operational emissions are estimated to be approximately 1,848 metric tons CO_2E. Approximately two thirds of the emissions are from vehicle trips associated with the project. As noted in Section 3.3.3.2, the estimate of emissions from area sources is conservatively high, as it does not fully reflect the energy efficiency. The project would involve removing approximately 220 trees, and project landscaping would include approximately 50 new trees. The GHG emissions resulting from the removal of trees from the project site would be partly offset by the planting of new trees as part of the project's landscaping, and would result in net CO_2 emissions of approximately 1,182 metric tons CO_2E, or an average of 39 metric tons CO_2E over a 30-year period. This would represent about 2 percent of the total annual GHG emissions of the project.

The project's incremental increases in GHG emissions associated with construction, increased traffic, direct and indirect energy use would contribute to regional and global increases in GHG emissions and associated climate change effects. As noted above, the project's contribution to the global cumulative impact is evaluated in this EIR by determining whether it would conflict with programs and measures that the state is developing to comply with AB 32 and with the elements of the UC Policy on Sustainable Practices that are relevant to global climate change. Towards this end, Table 3.3-9 provides an evaluation of the project's consistency with applicable AB 32 Scoping Plan Measures. Table 3.3-10 provides an evaluation of the project's consistency with the relevant elements of the UC Policy on Sustainable Practices.

As shown in Table 3.3-9, the project would comply with most of the applicable Scoping Plan measures. ~~Although the project does not include solar water heating,~~In compliance with the UC Policy on Sustainable Practices, the new buildings will be designed to exceed Title 24 energy efficiency standards by ~~28%~~at least 20 percent. This would be achieved in part by ~~In addition, the project would~~ complying with Campus policy of not providing air conditioning for comfort, ~~which be an additional energy savings compared to business-~~

~~as-usual development that~~ , although this is not technically reflected in the Title 24 calculations. In addition, the project may include solar heating for domestic hot water.

As shown in Table 3.3-10, the project does not involve development of renewable power. The project would be consistent with all applicable elements of the UC Policy on Sustainable Practices related to green building design and sustainable transportation practices. UC Santa Cruz supports the goal of achieving a 33 percent renewable energy mix statewide by purchasing Green-e Certified Renewable Energy credits for 100% of its energy needs. Green-e energy sources include wind, solar, geothermal, hydropower, biomass and landfill gas. These renewable energy credits are not direct carbon offsets for the GHG's generated by campus energy use, but they will support the development of renewable energy sources by helping to build a market for these sources. The Campus has committed to report its greenhouse gas emissions to the California Climate Action Registry, and has submitted reports for 2006 and 2007.

The project consists of infill development that would provide on-campus housing for UC Santa Cruz students. Its location on campus would reduce reliance on cars and provides opportunities for pedestrian or bicycle travel not present at an off-campus location. The project would take advantage of the campus's transportation demand management (TDM) program, which has reduced vehicle trips to the campus by 60 percent. The Campus's TDM program is described in Section 3.14.1.3. Other sustainable features of the project that contribute to reducing GHG emissions include plumbing fixtures exceeding the applicable code requirements for water efficiency, a highly efficient irrigation system that automatically adjusts irrigation schedules based on actual weather conditions, and a vegetated roof. The project contract documents require 75% diversion of project construction waste. The project design includes separate chutes for trash and mixed recyclables as well as a dedicated cardboard dumpster.

Overall, the project minimizes GHG emissions in a manner that is consistent with the AB 32 Scoping Plan and the UC Policy on Sustainable Practices. Therefore, this impact would be less than significant. Nonetheless, to further reduce the impact, the campus would implement ECI Mitigation AIR-5, which requires the campus to plant 100 redwood trees on the campus, in addition to the trees planted as part of the project landscaping. Over time these planted trees would partly offset the minor contribution of tree removal to the project's GHG emissions.

Table 3.3-9
Project Consistency with AB 32 Scoping Plan Measures

Scoping Plan Measure	Description	Project Consistency
SPM-1: California Cap-and-Trade Program linked to Western Climate Initiative	Implement a broad-based cap-and-trade program that links with other Western Climate Initiative Partner programs to create a regional market system.	Not Applicable
SPM-2: California Light-Duty Vehicle GHG Standards	Implement adopted Pavley (AB 1493) standards and planned second phase of the program. If the Pavley standards do not remain in effect, CARB shall implement equivalent or greater alternative regulations to control mobile source emissions.	Not Applicable
SPM-3: Energy Efficiency	Maximize energy efficiency building and appliance standards and pursue additional efficiency efforts. The proposed Scoping Plan considers green building standards as a framework to achieve reductions in other sectors, such as electricity.	Project is being designed to exceed Title 24 energy efficiency standard ~~by 28%~~ and will comply with Campus policy of not providing air conditioning for comfort.
SPM-4: Renewables Portfolio Standard	Achieve 33 percent Renewables Portfolio Standard by both investor-owned and publicly owned utilities.	The University of California Santa Cruz purchases Green-e Certified Renewable Energy credits for 100% of its energy needs. Green-e energy sources include wind, solar, geothermal, hydropower, biomass and landfill gas.
SPM-5: Low Carbon Fuel Standard	Develop and adopt the Low Carbon Fuel Standard.	Not Applicable
SPM-6: Regional Transportation-Related Greenhouse Gas Targets	Develop regional greenhouse gas targets for passenger vehicles. SB 375 requires CARB to develop, in consultation with metropolitan planning organizations, passenger vehicle greenhouse gas emissions reduction targets for 2020 and 2035 by September 30, 2010.	The project is an infill development providing on-campus housing. Its location on campus would reduce reliance on cars and provides opportunities for pedestrian or bicycle travel not present at an off-campus location.
SPM-7: Vehicle Efficiency Measures	Develop additional measures to reduce light-duty vehicle greenhouse gas emissions, including measures to promote proper tire inflation.	Not Applicable
SPM-8: Goods Movement	Implement adopted regulations for the use of shore power for ships at berth Improve efficiency in goods movement activities.	Not Applicable

Table 3.3-9
Project Consistency with AB 32 Scoping Plan Measures

Scoping Plan Measure	Description	Project Consistency
SPM-9: Million Solar Roofs Program	Install 3,000 MW of solar-electric capacity under California's existing solar programs. The Million Solar Roofs Program requires publicly-owned utilities to adopt, implement and finance a solar incentive program.	Solar roof is not included in the project.
SPM-10: Heavy-Medium Duty Vehicles	Adopt medium and heavy-duty vehicle efficiency measures.	Not Applicable
SPM-11: Industrial Emissions	Require assessment of large industrial sources to determine whether individual sources within a facility can cost-effectively reduce greenhouse gas emissions and provide other pollution reduction co-benefits. Reduce greenhouse gas emissions from fugitive emissions from oil and gas extraction and gas transmission. Adopt and implement regulations to control fugitive methane emissions and reduce flaring at refineries.	Not Applicable
SPM-12: High Speed Rail	Support implementation of a high speed rail system.	Not Applicable
SPM-13: Green Building Strategy	Expand the use of green building practices to reduce the carbon footprint of California's new and existing inventory of buildings.	Project is being designed to meet requirements for LEED Silver certification. Energy efficiency of the building and water efficiency of plumbing fixtures would exceed applicable codes. Project includes vegetated roof and ~~storm water system that utilizes rainwater for passive irrigation~~ <u>the new buildings would be plumbed to allow for future use of greywater for toilet flushing</u>.
SPM-14: High GWP Gases	Adopt measures to reduce high global-warming-potential gases used in applications such as refrigeration, air conditioning systems, fire suppression systems, and the production of insulating foam.	Not Applicable
SPM-15: Recycling and Waste	Reduce methane emissions at landfills. Increase waste diversion, composting, and commercial recycling. Move toward zero-waste.	Project includes recycling of all soil from construction and 75% diversion of other construction waste. Project design includes separate chutes for trash and mixed recyclables as well as a dedicated cardboard dumpster.
SPM-16: Sustainable Forests	Preserve forest sequestration and encourage the use of biomass for sustainable energy generation.	CO_2 emissions from lost forest sequestration would be approximately 2 percent of total annual project emissions for 30 years. Mitigation is included to offset these emissions in part.

Table 3.3-9
Project Consistency with AB 32 Scoping Plan Measures

Scoping Plan Measure	Description	Project Consistency
SPM-17: Water	Continue efficiency programs and use cleaner energy sources to move and treat water.	Project includes high-efficiency plumbing fixtures, very low-water-use landscaping, and a highly efficient irrigation system that automatically adjusts irrigation schedules based on actual weather conditions. The new buildings would be plumbed to allow for future use of greywater for toilet flushing.
SPM-18: Agriculture	In the near term, encourage investment in manure digesters and at the five-year Scoping Plan update determine if the program should be made mandatory by 2020. Increase efficiency and encourage use of agricultural biomass for sustainable energy production.	Not Applicable

Table 3.3-10
Project Consistency with Relevant Portions of the UC Policy on Sustainable Practices

Topic	Policy	Project Consistency
Green Building Design	All new building projects, other than acute care facilities, will outperform the required provisions of the California Energy Code (Title 24) energy efficiency standards by at least 20 percent.	Project will exceed Title 24 energy efficiency standards by ~~28~~ at least 20 percent.
	The University will design and build all new buildings, except for laboratory and acute care facilities, to a minimum standard equivalent to a LEED™ 2.1 “Certified” rating.	Project will be designed and constructed to a standard of LEED™2.2 “Silver” rating.
	Campuses will strive to achieve a standard equivalent to a LEED™ “Silver” rating or higher, whenever possible within the constraints of program needs and standard budget parameters.	Project will be designed and constructed to a standard of LEED™2.2 “Silver” rating.
Clean Energy Standard	The University will develop a strategic plan for siting renewable power projects in existing and new facilities with a goal of providing up to 10 megawatts of local renewable power by 2014.	The project does not include development of renewable energy.
Sustainable Transportation Practices	Incorporate alternative means of transportation to/from and within the campus to improve the quality of life on campus and in the surrounding community. The campuses will continue their strong commitment to provide affordable on-campus housing, in order to reduce the volume of commutes to and from the campus. These housing goals are detailed in the campus’s Long Range Development Plan.	The proposed project would provide on-campus housing students and will help the campus meet its housing goals.
Environmentally Preferable Purchasing Policies	For products and services requiring the use of water, the University will give preference to technologies that ensure the efficient use of water resources.	The proposed project would install high-efficiency toilets, low-flow showerhead, low-water-use landscape, and a highly efficient irrigation control system. The buildings would be plumbed to allow for future use of greywater for toilet flushing.

Based on the project's consistency with the applicable AB 32 Scoping Plan Measures as described in Table 3.3-9, the proposed project is considered not to impede the emissions reduction targets developed by the state pursuant to AB 32. The project's contribution to global climate change would not be cumulatively considerable.

3.3.4 References

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TABLES

3.4 BIOLOGICAL RESOURCES

This section describes the potential for the East Campus Infill Project to affect biological resources. This section provides project-level analysis and additional detail on the biological setting of the project site, as informed by site-specific biological resources surveys and assessments in October and November, 2008 (Biotic Resources Group 2008; H.T. Harvey & Associates 2008), to supplement and augment Section 4.4, Volume I of UCSC's 2005 LRDP EIR, pursuant to CEQA guidelines 15152. This section includes the following components:

- Description of the existing biological setting, including natural communities, vegetation and animal life characteristic of those communities, natural communities present on the site, special-status plants and animals that could be present, common wildlife likely to be present, and potential wildlife corridors
- Assessment of potential impacts to these biological resources and of their significance under CEQA
- Proposed mitigation measures to reduce significant impacts.

The following public comments, concerns and questions were received in response to the Notice of Preparation:

- Commenter(s) inquired regarding the number of trees that would be removed for the project and whether they would be replaced with the same number and species or with similar plantings.
- Commenter(s) noted that mitigation measures proposed in the document should be consistent with California Department of Fish and Game (CDFG) and U.S. Fish and Wildlife Service (USFWS) policies and regulations for all species, including but not limited to golden eagles, burrowing owls, and bats, and that significant elimination of special status species habitat is considered a take of the relevant species of concern or listed species.
- Commenter(s) noted the need or requirement for a campus-wide Habitat Conservation Plan (HCP) and for campus-wide wetland delineation in order to avoid piecemealing or segmenting impacts, increase effectiveness of mitigation planning and avoid inefficiency in agency reviews by USFWS, CDFG, California Department of Forestry, U.S. Army Corps of Engineers, and the Regional Water Quality Control Board.

This section addresses all biological resources scoping comments that are relevant to the proposed project and specifically addresses the potential for impacts to all special-status species potentially affected by the proposed project, including those cited in public comments. Note that regulations regarding species "take" apply only to formally listed species, and not to species of concern. The latter are addressed in this section, but have no formal regulatory status. Destruction of a listed species' habitat, moreover, is not in itself a "take" under the California Endangered Species Act, although it is considered a "take" under the federal Endangered Species Act.

As reported and discussed below, the proposed project would not itself result in adverse effects to wetlands, or eliminate or substantially reduce the availability of significant habitat for any special status species; nor would it make a cumulatively considerable contribution to any such impact of overall campus development. The project therefore would not result in a requirement to develop a Habitat Conservation Plan (HCP) or wetland delineation for the project site. The 2005 LRDP EIR addresses the anticipated environmental impacts of the entire program of development envisioned in the 2005 LRDP, of which the proposed ECI Project is an element. The 2005 LRDP EIR provides biological mitigation measures applicable to all relevant projects developed under the LRDP, which would reduce impacts of the LRDP program of development to less-than-significant levels. The separate analysis of the project-specific impacts of the ECI Project in a project-specific EIR is an aspect of tiered environmental review, and does not represent segmentation or piecemealing. Habitat issues related to tree removal and replanting are addressed in this section. Aesthetic issues related to tree removal are addressed in Section 3.1 (*Aesthetics*), above.

3.4.1 Environmental Setting

3.4.1.1 Study Area

The study area for biological resource impacts includes the proposed ECI Project site and associated staging areas and any new utility alignments, as well as all off-site areas adjacent to the site where storm water handling improvements may be carried out. Figure 2-1 in *Project Description,* above, shows the project site and vicinity.

The UC Santa Cruz main campus can be considered as four areas; the central campus, the lower campus, the north campus, and the upper campus. The proposed project is located in the central campus area. The other areas also are described below as context for the analysis.

- **Central Campus.** This area, also referred to as the campus core, is the primary developed center of the campus. The southern corners of this area are defined by the West and East Remote parking lots (excluding areas of the Great Meadow). The northern margin of the central campus takes in existing development northwest of the McLaughlin Drive/Heller intersection, including Kresge College; and existing development north of McLaughlin Drive, including Science Hill development, College Nine and Ten, Crown and Merrill Colleges, the Crown Merrill Apartments, and the proposed ECI Project site.

- **Lower Campus**. This area consists of campus lands from the campus main entrance northward to the East and West Remote Collector parking lots. Existing campus development in this area includes campus administrative and physical plant buildings, and faculty and staff housing. The Cowell Lime Works Historic District also is located in this area.

- **North Campus.** This area extends northward from just north of existing campus development north of McLaughlin Drive to the Seven Springs area of the campus, and westward from Kresge College to the western boundary of the University. This area currently is essentially undeveloped except for a few service roads, trails, and a water tank

- **Upper Campus.** This area consists of all University-owned lands to the north of the narrowest portion of the campus (Seven Springs area), extending to the northern boundary of the campus. This area is undeveloped except for service roads and trails.

3.4.1.2 Regional Setting

The UC Santa Cruz campus is situated on the coastal terraces at the western base of the Santa Cruz Mountains; campus elevations range from approximately 300 to 1,200 feet above sea level. As reported in the 2005 LRDP EIR, Section 3.4, this ecological subregion is classified as the Santa Cruz Mountains Subsection of the California Central Coast ~~Section~~. The area is characterized by a Mediterranean climate moderated by proximity to the Pacific Ocean. Temperatures generally range between 45°F and 60°F, and summer fog is common. Rainfall averages about 30 to 45 inches annually; most of the rainfall occurs between November and April. Summer fog is common and provides moisture to soil and vegetation through fog drip, which is produced when moisture condenses on trees and other plants.

As reported in the 2005 LRDP EIR, the Santa Cruz Mountains are located within the Central Western California region and San Francisco Bay subregion of the California Floristic Province. The province, which is the portion of the state west of the Sierra Nevada crest, is known to be particularly rich in endemic or native plant species relative to the rest of California. The province is considered to have a high level of biological diversity, where species diversity and endemism[1] are high and threats to this diversity of species are also high. The Santa Cruz Mountains region's exceptionally high levels of biodiversity and endemism (nearly 1,800 species of plants and 400 species of vertebrates) can be attributed to a combination of topographic diversity and numerous microclimates, which create an unusually diverse array of habitats. The major plant communities in the region are grassland, redwood forest, mixed evergreen forest, oak woodland, and chaparral. All are represented on the Santa Cruz campus.

3.4.1.3 Project Site

The project site is located near the northeastern corner of the central campus area, north of McLaughlin Drive and east of Chinquapin Road, at an elevation of about 790 feet above sea level. About 1 acre of the 3-acre site has previously been developed, and is built up or paved. The remainder of the site is vegetated, primarily in redwoods, mixed evergreens, and oaks.

Geologically, the project site is characterized by karst[2] conditions including doline fill. Marble and schist bedrock underlie the project site, and some of the lower areas of the site include artificial fill, which was placed in the 1970s to create a level area for Parking Lot 111. Chinquapin Road rises from McLaughlin Drive along a narrow ridge line, with steep slopes descending westward from the ridge toward the east fork of Jordan Gulch, and eastward toward the San Lorenzo River drainage. At the north and south ends of the project site, ridges running perpendicular to the Chinquapin ridge extend out toward the San Lorenzo drainage. The Crown/Merrill Apartments occupy the ridge north of the site and Crown and Merrill Colleges occupy the ridge south of the site. The natural drainage between the two ridges was partially filled several decades ago to accommodate paved parking lots. Runoff from the three terraces of Parking Lot 111 is discharged by way of a series of subsurface storm water pipes and asphalt and concrete

[1] Endemism refers to species that are native to and restricted to a particular area.

[2] Karst features are distinctive surficial and subterranean features developed by solution of carbonate and other rocks and characterized by closed depressions, sinking streams, and cavern openings. "Karst" is derived from the geographical name *Kars,* a limestone plateau in Slovenia.

swales to an outfall at the head of Gully H**.** In addition to the runoff from these parking lots, runoff from a portion of Crown/Merrill Apartments, two of the three parking lots north of Crown/Merrill Apartments, and the northeast portion of Crown College (including the Dining Commons) are also piped and channeled to this outfall. The runoff onto the project site from Crown/Merrill Apartments presently flows down the slope through a small swale in the woodlands east of Chinquapin Road. This flow is channeled to the culvert at the east end of the lowest terrace of Parking Lot 111, and into Gully H. Although a few, scattered wetland plants were observed beneath a heavy tree canopy in the drainage area in the woodlands east of Chinquapin Road, soil test pits in this area did not reveal any evidence of wetland soil characteristics.

Water flows in Gully H only during storms. The uppermost portion of Gully H is a well-defined, steeply sloping channel. Near the Lime Kiln Trail that runs near the eastern boundary of the UC Santa Cruz property, Gully H is a very small swale with no clearly defined bank. There is no culvert beneath this trail/access road, which suggests that surface flows in Gully H at this location are minimal. East of the UC Santa Cruz property boundary line, in Pogonip Park, Gully H becomes a continuous and well defined channel known as Redwood Creek, which is fed by springs as well as surface runoff. Redwood Creek drains into the San Lorenzo River approximately one mile and several hundred vertical feet below the campus boundary. Although some of the flow in Gully H percolates to the subsurface before reaching Redwood Creek, in large storm events surface runoff from the campus may flow overland to the creek.

The upper reach of the East Fork of Jordan Gulch, the drainage west of the project site, carries water only during storms. Most surface flows in this reach drain into a sinkhole a short distance north of McLaughlin Drive. Overflow runs through a culvert under McLaughlin Drive and continues down Jordan Gulch, where it infiltrates into the karst aquifer within the margin of the campus. Water from the karst aquifer feeds springs off campus at lower elevations. There are several small seasonal seeps on a slope about 200 feet north of the closest margin of the project that support some wetland plants, but do not produce flows that connect with any drainage that crosses the project site.

3.4.1.4 Regulatory Setting

The following provides an overview of regulations relevant to biological resources.

Federal Laws and Regulations

Federal Endangered Species Act. Section 9 of the federal Endangered Species Act (ESA) prohibits the "take" of federally listed threatened and endangered species. The ESA defines "take" as any action that would harass, harm, pursue, hunt, shoot, wound, kill, injure, trap, capture, or collect any listed species. "Harm" includes significant habitat modification that could result in injury or death to a species. Federal projects, federally funded projects, or projects requiring a federal permit must comply with the ESA through a consultation with the U.S. Fish and Wildlife Service or the National Oceanic and Atmospheric Administration-National Marine Fisheries Service (NOAA-Fisheries), or both, under Section 7 of ESA. If a proposed nonfederal project may result in take of a listed species, and there is no nexus with any federal agency, an Incidental Take Permit under Section 10(a)(1)(B) of the ESA is required; a Habitat Conservation Plan (HCP) must accompany this permit application.

Clean Water Act (Section 404). Areas meeting the regulatory definition of "*waters of the United States*" (jurisdictional waters) are subject to the jurisdiction of the U.S. Army Corps of Engineers (USACE). These waters may include waters "such as intrastate lakes, rivers, streams (including intermittent streams) mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce, as well as tributaries to such waters and wetlands adjacent to other waters of the United States defined as waters of the United States, tributaries of waters otherwise defined as waters of the United States, the territorial seas, and wetlands adjacent to waters of the United States" (33 CFR, Part 328, Section 328.3). USACE, under provisions of Section 404 of the Clean Water Act (1972) (CWA) and Section 10 of the Rivers and Harbors Act (1899), has jurisdiction over waters of the United States. Waters thus regulated are termed "jurisdictional waters." Impacts to jurisdictional waters, including wetlands (a special category of water of the United States), require a permit from USACE and typically require mitigation. Impacts to wetlands often require compensation in kind to ensure no net loss of extent and function of wetlands.

Water Quality Certification (CWA Section 401). Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain water quality certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect water quality (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401.

Migratory Bird Treaty Act. The federal Migratory Bird Treaty Act (MBTA)(16 USC §703, Supp. I, 1989) prohibits killing, possessing, or trading in migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. This act encompasses whole birds, parts of birds, bird nests, and eggs. Disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment, and this could be a violation of the MBTA.

Bald Eagle and Golden Eagle Protection Act. The Bald Eagle and Golden Eagle Protection Act prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions. Under the Act, it is a violation to "…take, possess, sell, purchase, barter, offer to sell, transport, export or import, at any time or in any manner, any bald eagle commonly known as the American eagle, or golden eagle, alive or dead, or any part, nest, or egg, thereof…" "Take" is defined to include pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, and disturb.

State Laws and Regulations

California Endangered Species Act. Section 2080 of the California Endangered Species Act (CESA) prohibits the "take" of state-listed threatened and endangered species. The CESA defines "take" as any action or attempt to hunt, pursue, catch, capture, or kill any listed species. If a proposed project may result in "take" of a listed species, a permit pursuant to Section 2081 of CESA is required from the California Department of Fish and Game (CDFG). Take can also be authorized through Section 2835 with an approved Natural Community Conservation Plan.

Porter-Cologne Water Quality Control Act. Areas meeting the regulatory definition of "waters of the state" are subject to the jurisdiction of the California Regional Water Quality Control Board. "Waters of the state" means any surface water or groundwater, including saline waters, within the boundaries of the state [California Water Code, Chapter 2, 13050(e)]. Any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of the waters of the state, other than into a community sewer system, must file a report of waste discharge with the appropriate regional board [California Water Code, Article 4, 13260(a)(1)]. The Central Coast Regional Water Quality Control Board administers this Act in Santa Cruz County.

California Fully Protected Species. In the 1960s, before CESA was enacted, the California Legislature identified species for specific protection under the California Fish and Game Code. These *fully protected* species may not be taken or possessed at any time, and no licenses or permits may be issued for their take except for collecting these species for necessary scientific research, and relocation of the bird species for the protection of livestock. Fully protected species are described in Sections 3511 *et sequim* (birds), 4700 (mammals), 5050 (reptiles and amphibians), and 5515 (fish) of the California Fish and Game Code. These protections state that "…no provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected [bird], [mammal], [reptile or amphibian], or [fish]."

California Fish and Game Code Section 1602. Activities that result in the diversion or obstruction of the natural flow of a stream, substantially change its bed, channel or bank, or utilize any materials (including vegetation) from the streambed, require that the project applicant enter into a Streambed Alteration Agreement with CDFG pursuant to Sections 1602 of the California Fish and Game Code (CDFG 2003). The definition of streams includes "intermittent and ephemeral streams, rivers, creeks, dry washes, sloughs, blue-line streams, and watercourses with subsurface flows." Canals, aqueducts, irrigation ditches, and other means of water conveyance can also be considered streams if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife.

California Fish and Game Code Section 3503 (Bird Nests and Birds of Prey). Bird nests are protected in California under Section 3503 of the California Fish and Game Code (CDFG 2003). Section 3503 states that it is "unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto." Disturbance during the breeding season can result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered take by CDFG. CDFG may issue permits authorizing take.

Section 3503.5 of the Code specifies that "It is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto."

Z'Berg-Nejedly Forest Practice Act. The Z'berg-Nejedly Forest Practice Act (PRC §4511-4628) was enacted in 1973 to "encourage prudent and responsible forest resource management calculated to serve the public's need for timber and other forest products, while giving consideration to the public's need for watershed protection, fisheries and wildlife, and recreational opportunities." The California

Forest Practice Rules (14 CCR 895-1110) implement the Z'berg-Nejedly Forest Practice Act and are enforced by the California Department of Forestry and Fire Protection (CAL FIRE). The California Forest Practice Rules require that an owner of timberland obtain a Timberland Conversion Permit (TCP) from CAL FIRE before removing trees or other forest products during the conversion of timberlands to land uses other than the growing of timber. In addition, a Timber Harvesting Plan (THP) must be filed and must be approved by CAL FIRE before timber operations may begin.

3.4.1.5 Natural Communities

The vegetation communities present on the project site are described below. Additional detail regarding the distribution and constituents of these communities on the campus is summarized in Section 4.4 of the 2005 LRDP EIR.

About 1 acre of the ECI Project site presently is paved or otherwise developed, with development that includes roads and parking lots, walkways and stairways, retaining walls, landscaping, and a small apartment building. Of the unpaved area, about three-quarters is redwood forest, and the remainder is divided between patches of grassland comprised primarily of non-native grasses, and oak woodland. Much of the site has been subject to grading, fill or other disturbance in conjunction with the existing development.

Vegetation Communities

Redwood Forest. The project area is dominated by upland redwood forest, which occupies the area around and between the buildings and parking lots associated with the existing Crown and Merrill Colleges and extends eastward along Gully H. Redwood forest covers approximately 457 acres of the UC Santa Cruz campus and represents about 22.5 percent of the total campus area. The dominant species in redwood forest areas is coast redwood (*Sequoia sempervirens*).

Redwood forest intergrades on the site with the mixed evergreen forest and oak woodland. The forest is of mixed age, as evidenced by the range in tree sizes in the vicinity. On the project site, about 12 percent of the redwood trees are 12 inches in diameter or smaller, about 47 percent are in the range between 13 inches and 24 inches in diameter, 37 percent are in the range of between 25 inches and 48 inches in diameter, and about 4 percent (8 trees) are more than 48 inches in diameter[3]. Many of the trees occur as clusters or are multi-trunked. Associated tree species on the ECI Project site include Douglas fir (*Pseudotsuga menziesii*), madrone (*Arbutus menziesii*), coast live oak (*Quercus agrifolia*), big-leaf maple (*Acer macrophyllum*) and California bay (*Umbellularia californica*). The understory, which is generally open, includes patches of small trees of hazel (*Corylus cornata*), red elderberry (*Sambucus racemosa var. racemosa*) and tan bark oak (*Lithocarpus densiflorus*). Subshrubs and herbaceous plants also are present. Commonly observed species include creeping snowberry (*Symphoricarpos mollis*), bracken fern (*Pteridium aquilinum*), California blackberry (*Rubus ursinus*), yerba buena (*Satureja douglasii*), and sword fern (*Polysticum munitum*).

[3] Tree diameters based on standard measurement methodology: tree diameter is measured at breast height (dbh), which is defined as a point 4.5 feet (1.37m) above the forest floor on the uphill side of the tree.

Almost all the redwood forests on campus were logged during the second half of the 19th century and early decades of the 20th century (Warrick 1982). The quality of the resulting second-growth habitat on campus varies immensely. Some forest groves exhibit a complex understory (e.g., north and west of Marshall Field) while others, like the project site and other sites on the central campus, have lesser cover of vegetation at ground level. Redwood forest habitat provides shade, moisture, food, cover, and special habitat elements for many wildlife species. Forest habitats with a well-developed understory support many more wildlife species than habitats lacking understory communities because they provide better cover and more abundant food sources.

Grassland. Grassland covers approximately 462 acres of UC Santa Cruz, about 23 percent of the total area of the campus, including much of the lower campus. The project site includes two open grassy areas situated between the forest and woodland area around the northwest quadrant of the site. Grassland on the slope immediately east of Chinquapin Road is dominated by non-native grasses and forbs, including wild oats (*Avena barbata*), English plantain (*Plantago lanceolata*) and velvet grass (*Holcus lanatus*). Some native grasses, including California brome (*Bromus carinatus*) and patches of purple needlegrass (*Nassella pulchra*) also area present. This area also includes mowed areas of poison oak (*Toxicodendron diversilobum*), blackberry (*Rubus diversiloba*), and scattered coast live oaks.

The south-facing steeply-graded slope near the Crown/Merrill Apartments also supports non-native grassland intermixed, in this area, with oak woodland species and clusters of and redwoods. This grassland area includes blue wild rye (*Elymus glaucus*), purple needlegrass, deerweed (*Lotus scarparius*), Italian thistle (*Carduus pycnochephalus*), rattlesnake grass (*Briza maxima*), dogtail grass (*Cynosurus echinatus*), California milkwort (*Poygala californica*), and cat's ear (*Hypochaeris radicata* and *H. glabra*).

Oak Woodland. There is a small area of oak woodland on the project site on the south-facing slope adjacent to the Crown Merrill Apartments, just east of Chinquapin Road. In this area, coast live oak and madrone trees intermix with shrubs including California blackberry, mugwort (*Artemesia douglasiana*), coyote brush (*Bacharris pilularus*), nettles, and ferns. A seasonal drainage with sparsely scattered wetland plants extends through this oak woodland area, between Chinquapin Road and the uppermost terrace of existing Parking Lot 111.

Wildlife

Most of the wildlife species occurring on the project site are common, widespread species typical of redwood forest and mixed coniferous woodland habitats in the Santa Cruz Mountains. Duff and woody debris on the forest floor provide refugia appropriate for a variety of herpetofauna, and support abundant insect and small mammal life that serves as a prey base. Representative reptiles and amphibians occurring on or near these sites include the ringneck snake (*Diadophus punctatus*), common kingsnake (*Lampropeltis getulus*), gopher snake (*Pituophis melanoleucus*), western fence lizard (*Sceloporus occidentalis*), California slender salamander (*Batrachoseps attenuatus*), and California newt (*Taricha torosa*).

The forest in and around the project site provides suitable nesting habitat for a number of breeding coniferous forest bird species such as Vaux's swift (*Chaetura vauxi*), brown creeper (*Certhia americana*), pygmy nuthatch (*Sitta pygmaea*), chestnut-backed chickadee (*Poecile rufescens*), olive-sided flycatcher (*Contopus cooperi*), and dark-eyed junco (*Junco hyemalis*). More generalist species, including Anna's hummingbird (*Calypte anna*), downy woodpecker (*Picoides pubescens*), northern flicker (*Colaptes auratus*), western wood-pewee (*Contopus sordidulus*), Steller's jay (*Cyanocitta stelleri*), Hutton's vireo (*Vireo huttoni*), house wren (*Troglodytes aedon*), American robin (*Turdus migratorius*), and house finch (*Carpodacus mexicanus*) also breed in the habitats present on the project site. Temperate migrant birds such as Townsend's warbler (*Dendroica townsendi*), yellow-rumped warbler (*Dendroica coronata*), golden-crowned sparrow (*Zonotrichia atricapilla*), and fox sparrow (*Passerella iliaca*) occur in this area during migration and/or in winter. Residential and other developed areas around the project site, as well as adjacent forested areas, may also support non-native species such as the European starling (*Sturnus vulgaris*) and house sparrow (*Passer domesticus*).

The redwood and mixed hardwood forest habitats that occupy portions of the project site provide suitable breeding and resting habitat for a variety of mammalian species. Buildings on and around the project site may provide additional shelter for some species, such as roosting bats. Mammals observed on the project site included the brush rabbit (*Sylvilagus bachmani*), fox squirrel (*Sciurus niger*), California ground squirrel (*Spermophilus beecheyi*), and mule deer (*Odocoileus hemionus*). Woodrat nests (*Neotoma spp.*) were observed adjacent to the limits of the ECI site. Other mammals that have been observed on the UC Santa Cruz campus and are likely to occur on the project site include several bat species, raccoon (*Procyon lotor*), coyote (*Canis latrans*), grey fox (*Urocyon cinereoargenteus*), bobcat (*Lynx rufus*), and striped skunk (*Mephitis mephitis*) (H.T. Harvey & Associates 2008).

3.4.1.6 Sensitive Natural Communities

CEQA Guidelines Appendix G requires consideration of impacts to sensitive natural communities, including "any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFG or USFWS" (Section [IV (b)]). The loss or degradation of a sensitive natural community could result in adverse environmental effects, such as impacts to special-status species[4] or their habitat, reduced biodiversity, or degradation or destruction of a rare or regionally-restricted natural community type.

Natural communities considered sensitive include, but are not limited to, those listed on the California Natural Diversity Database (CNDDB) working list of "high priority" habitats (i.e., those habitats that are considered rare or endangered within California) (CNDDB 2008). The CNDDB is a program administered by CDFG that inventories the status and locations of rare plants, animals, and natural communities in California.

Wetlands that meet the criteria for jurisdictional wetlands of the state or federal government under Section 404 of the federal CWA or the Porter-Cologne Act also are considered sensitive.

The 2005 LRDP EIR identifies three sensitive natural communities on the UC Santa Cruz campus: northern maritime chaparral, coastal prairie, and riparian woodland and scrub. The project site does not

[4] *Special-status species* are species listed as rare, threatened, or endangered or proposed for this status by the federal or state government, wildlife species listed as *species of special concern* by the state or *species of concern* by USFWS, and plants on the California Native Plant Society List 1B or 2 (CNPS 2008). Additional criteria are listed under *Riparian Woodland and Scrub*.

include any chaparral community. Coastal prairie refers to grasslands largely dominated by native perennial bunchgrasses and having a higher proportion of native herb species. The small areas of grassland on the project site are dominated by non-native species. Although some native species are present, there are no areas on the site in which the relative abundance and variety of native species is sufficient to constitute coastal prairie. As discussed below, there are no riparian corridors on the project site, and no riparian woodland or scrub is present.

3.4.1.7 Wetlands and Jurisdictional Waters

Wetlands are defined as areas regularly saturated by surface water or groundwater and therefore dominated by vegetation that is adapted for saturated-soil conditions that provide wetland functions and value. Wetlands may qualify as jurisdictional wetlands under the Clean Water Act or the Porter-Cologne Water Quality Act if they meet all three criteria based on water content, soil characteristics, and vegetation types that are present. Any wetland that meets the definition of jurisdictional by the state or federal government (U.S. Army Corps of Engineers [USACE] 1987) is considered a sensitive natural community, and project effects to any such wetland could be a significant impact.

A few plants of species that favor hydric conditions were noted in the understory in the woodland area between Chinquapin Road and the uppermost terrace of Parking Lot 111. These plants are sparsely distributed and do not form a dense monoculture, such as would be characteristic of a wetland that would provide wetland functions and values. No wetlands are present on the project site.

Three small potential seep areas were identified in the general project vicinity, outside of the project site all at the top of a cut bank about 200 feet north of the northern margin of the project site. Based on assessment of surface hydrology, plant species, types and densities present; and soil profiles by wetland biologists, none of these areas appears to meet the USACE criteria for jurisdictional wetlands. These features likely provide only limited wetland functions and values: for example, they are not expected to provide breeding habitat for amphibians requiring streams and pools (H.T. Harvey & Associates 2008). These seep areas are well outside the project work area and would not be affected by the proposed project, either directly or indirectly.

Gully H, the drainage channel and natural drainage that drains storm water flows from the project site and vicinity, begins on the slope just below (southeast of) the intersection of Chinquapin Road with Parking Lot 155 about 75 feet north of the northern margin of the project site, and extends diagonally across the three terraces of Parking Lot 111 via culverts. Between the parking lot terraces—which were created by filling in the drainage swale at the time the parking lots were built—the drainage runs along a topographic depression that includes one or more probable sinkholes. At the east end of Parking Lot 111, storm water flows from the upper reach are conducted down a steep bank, via a culvert, to Gully H proper. This gully continues downslope to the campus margin at the edge of Pogonip City Park as a relatively steep and generally narrow channel (see Figure 2-2 in *Project Description*, above). Because the proposed project ~~would~~ could include some rock emplacement or other minor manual work around the culvert in Gully H, to improve erosion protection in this area, and because storm water from the project site flows to Gully H, the gully was assessed to determine whether it exhibits wetland characteristics or meets the criteria of a jurisdictional wetland.

Gully H receives runoff during winter storm events from three locations: 1) a small swale-like feature at the intersection of Chinquapin Road and East Avenue north of the project site; 2) an 18-inch-diameter culvert that drains sheet flow and surface water runoff from rainfall and landscape irrigation away from the Crown/ Merrill Apartments, sidewalks and parking lots adjacent to East Avenue, north of the project site; and 3) a 12-inch-diameter culvert that also drains developed areas including the KZSC Building southeast of the project site. Sheet flow also collects in asphalt gutters and along footpaths and sidewalks around each of the Crown/Merrill parking lots, and is shunted to Gully H via a series of culverts, asphalt gutters, and cement spillways. Collectively, the features in this section of Gully H comprise the "headwaters" of the drainage. The reach of Gully H within the boundary of the UC Santa Cruz campus comprises a shallow channel that lacks a well-formed incision and an ordinary high water mark.

Gully H becomes a very small swale (meaning a drainage feature with no clear defined bank) near the Lime Kiln Trail that lies along the eastern boundary of the UC Santa Cruz property. There is no culvert beneath this trail/access road, which suggests that flows through Gully H at this location are minimal. In contrast, east of the UC Santa Cruz property boundary line, in Pogonip Park, Gully H becomes a continuous and well defined channel that includes numerous active springs and intermittent wetlands throughout its entire lower reach before it empties directly into the San Lorenzo River approximately one mile and several hundred vertical feet below the campus boundary.

USACE guidance pertinent to the issue of incisions, in accordance with 33 CFR Part 328, "Definition of Waters of the United States," is as follows:

Section 328.4 Limits of Jurisdiction: Section 328.4 (c)(1) defines the lateral limit of jurisdiction in non-tidal waters as the ordinary high water mark provided the jurisdiction is not extended by the presence of wetlands. Therefore, it should be concluded that in the absence of wetlands the upstream limit of Corps jurisdiction also stops when the ordinary high water mark is no longer perceptible.

After review of site conditions, including extensive field surveys on- and off-site, and taking into consideration several other factors discussed in greater detail below, it was concluded that Gully H on the UC Santa Cruz campus lacks the defining characteristics of wetlands or characteristics such as the ordinary high water marks (OHWM) used by the USACE in establishing jurisdiction. Any channel incisions observed within the portions of Gully H on the UC Santa Cruz campus are best characterized as strictly erosional features. These down-cuts in the channel occur as the result of high rainfall events (i.e., several inches of rain in a few days) and are very different from natural low-flow channels that develop in creeks, rivers, and other waterways resulting from what the USACE terms "ordinary flow."[5] The delineation process is detailed in USACE reports that are companion documents to the USACE wetland delineation manuals (Lichvar and Wekeley 2004; Lichvar and Wekeley 2007).

Several lines of evidence support the conclusion that the on-campus portion of Gully H should not be considered USACE-jurisdictional. Incisions within Gully H are generally "slope-driven." That is to say,

[5] As used in USACE guidelines (Lichvar and Wekeley, eds. 2004), "ordinary flow" refers to the conditions that create the physical features that characterize the ordinary high water mark used to define jurisdictional boundaries. The ordinary high water mark results from "ordinary flows"—that is, flows from storms with a recurrence interval of around 2 years. OHWM is not defined on the basis of the erosional features that may be created by storms with a recurrence interval of 10 years or 100 years.

where the slopes are relatively flat, the channels are swale-like in cross-section; where the slope increases, the incision increases. In typical drainages with "ordinary flows", an incision, representing the ordinary high water mark, is continuous and unbroken. The critical point is that USACE jurisdiction is established by "ordinary flows" (i.e., a 2-year frequency event), not high-flow events (i.e., 10-year frequency event or above). Secondly, as is characteristic of the channel incisions that are erosional features rather than jurisdictional drainage features that were created by "ordinary flows", the width of the incision varies between a few inches to a few feet, all within a linear distance of only 50 or 100 feet.

Another important site characteristic relevant to this determination is the soil type. Soils on the UC Santa Cruz campus property, and in the rest of Santa Cruz County, were mapped by the SCS (now Natural Resources Conservation Service, NRCS) in the mid-to-late 1970s. This information is compiled in their report entitled *Soils of Santa Cruz County* (1976). That report describes most of the Gully H parcel as being underlain by Lompico soil series that consist of moderately deep, well-drained soils on mountains. This soil type is described as having relatively high permeability (2.0 to 6.0 inches per hour) and rapid to very rapid surface runoff. The physical characteristics of soils found within Gully H contrast sharply with the physical characteristics of soil types that commonly support wetlands and riparian habitats. The free-draining soils in Gully H, combined with a relatively small watershed, are not characteristics that typically support extensive wetland habitats or free-flowing water in channels for long duration. The channel features observed within the campus likely have developed as a result of a cumulative increase in runoff in the drainage as a result of hardscape development.

Field characteristics used by the USACE in establishing jurisdiction are entirely absent from the site. Nowhere within Gully H was there a co-occurrence of the requisite three parameters (hydrophytic vegetation, hydric soils, and wetland hydrology) for jurisdictional wetlands. Gully H should not be considered a wetland within the meaning of the federal Clean Water Act.

3.4.1.8 Identification of Special-Status Species

Special-status species are defined as plants and animals that are protected under the California or federal Endangered Species Acts or other regulations, and species that are considered sufficiently rare by the scientific community to qualify for such listing. Special-status plants, animals, and fish are species in the following categories:

- Species listed or proposed for listing as threatened or endangered under the federal ESA (50 CFR 17.12 [listed plants], 50 CFR 17.11 [listed animals]), and various notices in the Federal Register ([FR] [proposed species])
- Species that are candidates for possible future listing as threatened or endangered under the ESA, including federal species of concern[6] (61 FR 40 7596–7613, February 28, 1996)
- Species listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (14 CCR 670.5)

[6] "*Species of concern*" is an informal term used by the USFWS that refers to those species believed by each field office of USFWS to be in decline or in need of concentrated conservation actions to prevent decline. Species of concern receive no federal legal protection.

- Species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380)
- U.S. Fish and Wildlife Service (USFWS) List of Federal Endangered and Threatened Species that Occur in or May be Affected by Projects in Santa Cruz County, accessed October 2008 (USFWS 2008).
- The California Native Plant Society's (CNPS) Electronic Inventory of Rare and Endangered Vascular Plants of California (CNPS 2008)
- Plants listed as rare or endangered under the California Native Plant Protection Act (California Fish and Game Code, Sections 1900 et seq.)
- The California Department of Fish and Game's (CDFG) Natural Diversity Database query results for the U.S. Geological Survey's 7.5-minute quadrangles of Santa Cruz and Felton (CNDDB 2008)
- Animal species of special concern to the CDFG as identified in CDFG's Special Animals List (CDFG 2008). "Species of Special Concern" is a California Department of Fish and Game administrative designation given to vertebrate species that appear to be vulnerable to extinction because of declining populations, limited ranges, and/or continuing threats. Some species may be just starting to decline, while others may have already reached the point where they may meet the criteria for listing as a threatened or endangered species.
- Bird species that are CDFG first- and second-category species of special concern. Third-priority species are not included because, as stated in the CDFG list, they, "are not in any present danger of extirpation and their populations within most of their range do not appear to be declining seriously; however, simply by virtue of their small populations in California, they are vulnerable to extirpation should a threat materialize."
- Animals fully protected in California (California Fish and Game Code, Sections 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians])
- Bat species designated as high or medium priority by the Western Bat Working Group (WBWG 2005). The WBWG is a partner in the Coalition of North American Bat Working Groups. The WBWG is comprised of bat experts from agencies, organizations, and research groups interested in bat research, management, and conservation from 13 western states and the Canadian provinces of British Columbia and Alberta. High-priority bat species are those species which, based on available information on distribution, status, ecology, and known threats, should be considered the highest priority for funding, planning, and conservation actions. These species are imperiled or are at high risk of imperilment. Medium-priority species are those species that are considered to warrant closer evaluation (both of the species and of possible threats), more research, and conservation actions.

3.4.1.9 Special-Status Plant Species

The UC Santa Cruz flora is fairly species rich. As reported in the 2005 LRDP, one researcher attributed this local species diversity to the diverse soil types, topography, and plant communities present on the campus, and to the favorable climate in the Santa Cruz area. As the result of historic and recent activity in the area, about 30 percent of the taxa that are present are nonnative.

Special Status Plant Species Known to Occur on the Campus

Special-status plants that are known to occur or have the potential to occur on the campus or vicinity are listed in Table 3.4-1 (located at the end of this section). As detailed in the 2005 LRDP EIR, four special-status plants are known to occur on campus: Santa Cruz manzanita, Point Reyes horkleia, marsh microseris, and San Francisco popcorn flower. Santa Cruz manzanita occurs in chaparral and mixed evergreen forest on the campus. The three other plants occur in Marshall Field on the upper campus. Marsh microseris has been identified in coastal prairie area on the southwestern part of the campus. An undescribed sedge that may merit protection, but the taxonomic status of which is currently undetermined, also has been noted in seep areas on campus.

Results of Botanical Survey and Assessment of the Project Site

No special status plant species have been recorded previously from the East Campus Infill project area and none was observed during an October 2008 botanical field survey of the site, or during a subsequent spring botanical survey (Biotic Resources Group 2008, Biotic Resources Group 2009). ~~The project botanical survey was conducted outside of the blooming season for most herbaceous plant species. A spring season plant survey would be necessary to confirm definitively the presence or absence of special status plant species; however,~~ Based on evaluation of the site by the project botanist, the potential for special status plant species to occur in the project area is low due to the absence of suitable habitat on the site for any of the special status plants known or likely to occur on the campus (see Table 3.4.2, at the end of this chapter).

3.4.1.10 Special-Status Wildlife Species

Special Status Wildlife Species Known to Occur or with High to Moderate Potential to Occur on the Campus

Special-status wildlife species identified as having the potential to occur in northern Santa Cruz County or occurring on or having a moderate to high potential to occur on the campus are listed in Table 3.4-1 at the end of this section. Note that sharp-shinned hawk (*Accipiter striatus*) and ferruginous hawk (*Buteo regalis*), which are listed in the 2005 LRDP EIR as CDFG species of special concern, have been delisted by CDFG, and the olive-sided flycatcher (*Contopus cooperii*) has been added to the CDFG list. Special status wildlife species observed at UC Santa Cruz in the last decade include the golden eagle (*Aquila chrysaetos*), white-tailed kite (*Elanus caerules*), northern harrier (*Circus cyaneus*), woodrat (*Neotoma* spp.) (nests), and Ohlone tiger beetle (*Cicindela ohlone*). As reported in the 2005 LRDP EIR, Section 4.4, Vaux's swifts are regularly observed foraging on the campus, which suggests that there may be breeding sites nearby.

As reported in the 2005 LRDP EIR, Western burrowing owl (*Athene cunicularia hypugea*) was recorded in the past on the campus, in the area east of Hagar Drive and in the Great Meadow. Local birders sighted a single burrowing owl in this area in November of 2008 (Wilson 2009). However, the species is no longer listed as breeding in Santa Cruz County. A badger (*Taxidea taxus*) skull found in the Great

Meadow in 2004 is the only evidence of the presence of badgers on the campus. Because there have been no reports of living badgers on the campus, it is likely that the badger is an infrequent resident or occasional migrant through the campus.

Results of Wildlife Survey and Assessment of Project Site

Species Not Likely to be Present on or Adjacent to the Project Site. Based on assessment by the project wildlife biologists (H.T. Harvey & Associates 2008), many of the special status wildlife species present in the region or on the campus are not expected to be present on the project site due to the absence or fragmentation of suitable habitat or the presence of existing development. These include the Ohlone tiger beetle (*Cicindela ohlone*), Smith's blue butterfly (*Euphilotes enoptes smithi*), Mount Hermon June beetle (*Polyphylla barbata*), Zayante band-winged grasshopper (*Trimerotropis infantilis*), Central California Coast coho salmon (*Oncorhynchus kisutch*), Central California Coast steelhead (*Oncorhynchus mykiss*), western pond turtle (*Actinemys marmorata*), Santa Cruz long-toed salamander (*Ambystoma macrodactylum croceum*), foothill yellow-legged frog (*Rana boylii*), coast horned lizard (*Phrynosoma coronatum frontale*), white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), western snowy plover (*Charadrius alexandrinus nivosus*), marbled murrelet (*Brachyramphus marmoratus*), black swift (*Cypseloides niger*), willow flycatcher (*Empidonax traillii*), loggerhead shrike (*Lanius ludovicianus*), San Francisco common yellowthroat (*Geothlypis trichas sinuosa*), yellow-breasted chat (*Icteria virens*), tricolored blackbird (*Agelaius bicolor*), and American badger (*Taxidea taxus*).

The California red-legged frog (CRLF) (*Rana aurora draytonii*), which is federally listed as threatened, is not expected to be present on the project site. This species is known to occur on the UC Santa Cruz campus in the Moore Creek drainage, where it breeds in the Arboretum Pond. Red-legged frogs are not expected to breed in any reach of Jordan Gulch, located west of the project site, or Gully H, in whose watershed the project site occurs, because these ephemeral drainages do not provide the deep, long-lasting pools that red-legged frogs require for breeding. As reported in the H.T. Harvey & Associates report for the project, although red-legged frogs regularly disperse overland between breeding and nonbreeding locations, and/or aestivate in upland areas or in intermittent stream channels, there is an extremely low probability that red-legged frogs would reach this project site due to its distance from potential breeding habitat, and significant barriers to movement between the known breeding habitat and the project site. The project site is approximately 1.5 miles (mi) from the Arboretum Pond (the closest location at which red-legged frogs are known to breed) and 1.0 mi from the closest reach of the San Lorenzo River. As there are no CNDDB records of CRLF from this part of the San Lorenzo River, it is unlikely that red-legged frogs are present there in any numbers. Because CRLF have been known to disperse to distances of up to 2 miles, the potential for the occasional occurrence of a red-legged frog within the project area cannot be discounted. However, given the distance between the project site and potential breeding habitat, the lack of high-quality aquatic non-breeding habitat (e.g., resting pools) between the site and potential breeding habitat due to the ephemeral nature of Jordan Gulch and Gully H, and the low likelihood that breeding red-legged frogs are present in the closest reach of the San Lorenzo River (based on the lack of CNDDB records), it is very unlikely that red-legged frogs move between the San Lorenzo River and the Arboretum Pond through the project site. As a result, there is no expectation of ecologically important use of the site (e.g., for breeding, cover, foraging, or dispersal) by frogs breeding in or moving between the San Lorenzo River and the Arboretum Pond.

Species Potentially Present but Unlikely to Breed on the Project Site. Several special-status species, including the golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), yellow warbler (*Dendroica petechia*), and ringtail (*Bassariscus astutus*), may visit the project area occasionally but are unlikely to breed on the project site due to lack of suitable breeding habitat, or to be present in large numbers because the potential habitat on the project site is not particularly suitable to support large numbers of the species. These species, therefore, are unlikely to be significantly affected by the proposed project.

Special status species present or likely to be present on the project site include San Francisco dusky-footed woodrat (*Neotoma fuscipes annectens*), a number of special-status bat species, and several special-status birds, including long-eared owl (*Asio otus*), Vaux's swift (*Chaetura vauxi*), and olive-sided flycatcher (*Contopus cooperi*). Several species of raptors, which are protected under the California Fish and Game code and the MBTA, and a number of common bird species, the nests and eggs of which are protected under the MBTA, also could forage or nest on the site. Species present or likely to be present are detailed below.

San Francisco dusky-footed woodrat. The San Francisco dusky-footed woodrat, a subspecies of dusky-footed woodrat, inhabits mixed hardwood, coniferous, and riparian forests as well as scrub habitats throughout the San Francisco Bay area and the adjacent coast range south through the northern half of the Monterey Bay area. The San Francisco subspecies is listed as a California species of special concern due to its restricted range and sensitivity to disturbance. The range of the San Francisco dusky-footed woodrat includes the UC Santa Cruz campus, and thus any dusky-footed woodrats on the campus may be of this subspecies. Woodrats are known to occur on campus (CNDDB 2008). Woodland within the project area provides suitable woodrat habitat. The habitat within the footprint of the proposed ECI Project is fragmented by existing roads, trails, parking lots, and structures, and understory is mostly sparse. As a result, the existing habitat on that portion of the ECI Project site is of relatively low quality for woodrats. Gully H provides suitable woodrat habitat, with connectivity to large forest patches, areas of moderately dense understory, and preferred tree species such as tanoak (*Lithocarpus densiflorus*) and madrone (*Arbutus menziesii*). The focused woodrat nest survey, in October 2008, resulted in the discovery of one woodrat nest in a forest patch in the northeastern corner of the ECI footprint, and another in Gully H east of the existing parking lots.

Special-status bats. Several special-status bats are known to occur on the UC Santa Cruz campus and vicinity (UCSC 2005, CNDDB 2008), including the pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and western red bat (*Lasiurus blossevillii*), all of which are California species of special concern. Other bat species known or likely to occur on campus include the long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), and more common species such as Yuma myotis (*Myotis yumanensis*), big brown bat (*Eptesicus fuscus*), and Mexican free-tailed bat (*Tadarida brasiliensis*). The long-eared myotis, long-legged myotis, and fringed myotis are listed as medium or high-priority conservation species by the Western Bat Working Group (WBWG 2005) and are included in the UCSC 2005 LDRP EIR as species of concern.

Cavities, crevices, and foliage of trees in the mixed hardwood and redwood forests, buildings, and rock piles in the project vicinity may provide roosting habitat for these special-status and priority bat species.

Townsend's big-eared bats could potentially forage within the project area, but no suitable roost sites (e.g., caves or huge, cavernous redwood snags) are present on or in close proximity to the project site, and thus this species is not expected to roost there. Western red bats may roost in trees on the project site, but this species is solitary species and does not form large communal roosts, and thus the number of individuals present on the project sites would be small; this species is also not expected to breed in the study area. Pallid bats utilize a variety of habitat types, are likely to roost in some areas of the UC Santa Cruz campus, and could potentially form maternity roosts in large redwood trees in areas where roads or other clearings allow them access to the forest. The long-eared, long-legged, and fringed myotis are associated with coniferous forests and, according to the 2005 LRDP EIR, are documented as occurring on campus. These species may roost in tree cavities, in bark crevices, or in buildings (WBWG 2005) during both breeding and nonbreeding seasons. These and other bat species may also occur as migrants or overwintering individuals.

The October 2008 reconnaissance-level wildlife survey (H.T Harvey & Associates 2008) determined that the ECI Project area and Gully H provide suitable habitat for all of the above-listed bat species. Seven trees, most of which are oaks, exhibited cavities or crevices that appear to be suitable as roosts for pallid bats and other species of cavity roosting bats. Additionally, many of the mature redwoods on the project site feature heavily corrugated bark that can provide roosting habitat for nonbreeding pallid bats. Buildings in the project vicinity also provide potential nonbreeding roost sites for many bat species.

A focused survey of the project site in March 2009, which included several nights of acoustic monitoring of the trees considered by a bat specialist to have the highest potential for bat roosting, did not detect any bats within the project area (H.T. Harvey and Associates 2009). Nonetheless, several oak trees on the site were assessed as suitable for use as bat maternity roosts that potentially could be used during the maternity season (approximately April through August).

Nesting special-status birds, including raptors. Based on the biological assessment of the project area (H.T. Harvey & Associates 2008), special-status birds that occur on the UC Santa Cruz campus and could be present in the project area include three California species of special concern: the long-eared owl (*Asio otus*), Vaux's swift (*Chaetura vauxi*), and olive-sided flycatcher (*Contopus cooperi*). The project area provides large trees and open edges of the kind preferred by nesting and foraging olive-sided flycatchers. Vaux's swifts prefer large redwoods, and often nest semi-communally, sometimes roosting in numbers ranging from hundreds to thousands in the same tree. They have been documented nesting in urban and suburban areas and thus do not appear to avoid developed areas. Long-eared owls are very sparsely distributed in the Santa Cruz Mountains, but there is some potential for a pair to nest in the study area. Other raptors that could nest in the project areas and are protected under Fish and Game code include the sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), great horned owl (*Bubo virginianus*), barn owl (*Tyto alba*), northern pygmy-owl (*Glaucidium gnoma*), northern saw-whet owl (*Aegolius acadicus*), and western screech-owl (*Otus kennicottii*). The canopy and snags of the mixed hardwood and redwood forests in the project vicinity provide suitable nesting habitat for all of these species.

No old raptor nests were detected within the ECI Project area during the October 2008 reconnaissance survey (H.T. Harvey & Associates 2008), but forest fragments in the currently developed area, as well as Gully H, provide suitable nesting habitat for diurnal raptors (i.e., hawks) and olive-sided flycatcher, and could provide nesting habitat for Vaux's swifts and owls if cavities are present in any of the trees.

Other nesting migratory birds. All native bird species are protected under the California Fish and Game Code and the federal MBTA). The oak woodland and redwood forest fragments surrounded by the currently developed portion of the proposed project component, as well as the forest habitat in Gully H, provide suitable nesting habitat for numerous native bird species. A number of common bird species were detected during the October 2008 reconnaissance survey (H.T. Harvey & Associates 2008), all of which are year-round residents likely to breed in the project vicinity. Most of these are common species with stable or increasing populations in the region.

3.4.1.11 Wildlife Movement

CEQA Guidelines state that a project would have a significant impact if it would "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."

Areas that provide routes that wildlife may use to travel between distinct habitat areas (such as a breeding area and a foraging area) are known as habitat linkages or wildlife corridors. These corridors are particularly important where habitat important to a particular species has been separated or fragmented by topography, changes in vegetation, or other natural or human disturbances or land use changes. In the absence of corridors through which wildlife can move comfortably between use areas, the fragmentation of natural habitat creates isolated "islands" of vegetation that may not provide sufficient area or resources to accommodate sustainable populations for a number of species. This may result in adverse effects with respect to both species diversity and to genetic diversity within a species.

Corridors mitigate the adverse effects of habitat fragmentation by: (1) allowing animals to move between remaining habitats to replenish depleted populations and increase the available gene pool; (2) providing escape routes from fire, predators, and human disturbances, thus reducing the risk that catastrophic events (such as fire or disease) will result in population or species extinction; and (3) serving as travel paths for individual animals moving throughout their home range in search of food, water, mates, and other needs, or for juveniles dispersing in search of new home ranges. A summary of movement patterns for some common wildlife species on the UC Santa Cruz campus is included in the 2005 LRDP EIR, Section 4.4.

Migration is the seasonal or periodic movement of individuals one from area to another, typically over long distances. Migration typically occurs in response to seasonal changes in abundance or distribution of food sources or available breeding habitat. Examples of migratory species include many songbirds, mammals such as mule deer, and Monarch butterflies. There is no evidence that any nonflying species use UC Santa Cruz for regular migration. Migratory songbirds are common on campus, as are Monarch butterflies and other migratory invertebrates. There is abundant habitat for migratory birds on the campus. The project site may provide nesting habitat for some migratory birds, as described above.

The UC Santa Cruz campus is surrounded by relatively undisturbed mixed hardwood forest, redwood forest, annual grassland, and some riparian habitat. Habitats on campus provide connectivity between Wilder Ranch State Park to the west and Henry Cowell State Park to the north, as well as with Pogonip City Park to the east. Moore Creek and Jordan Gulch provide connectivity between the grasslands and riparian areas of the south campus, the mixed hardwood and redwood forests of the north campus, and the state and local parks adjacent to campus; these drainages were identified in the 2005 LRDP EIR as the two primary wildlife movement corridors on campus. A variety of wildlife species, including the mule deer, raccoon, coyote, grey fox, bobcat, and striped skunk, are likely to range throughout these habitats. Reptiles and amphibians may also move from drainage to drainage during dispersal periods.

The proposed project site provides limited habitat connectivity for small animals moving between Jordan Gulch and Gully H, since the habitat on and around the site is already fragmented by buildings and parking lots, such that the site is not a significant wildlife movement corridor. Gully H itself provides a suitable wildlife corridor from the eastern edge of campus development into the forested portions of the northern campus and undeveloped areas on the eastern side of the UC Santa Cruz property and beyond. This corridor may be used by small and large animals, but has limited value for movement of species requiring open water because flows are present only ephemerally.

3.4.1.12 Applicable Plans and Policies/Habitat Conservation Plans

Habitat Conservation Plans/Natural Community Conservation Plans

Pursuant to an Implementing Agreement and Habitat Conservation Plan (HCP) that has been executed by the University and by the U.S. Fish and Wildlife Service. As reported in the 2005 LRDP EIR, Section 4.4, The Regents has committed to protect 13.0 acres in the southwestern corner of the campus in perpetuity as habitat for the California red-legged frog (*Rana aurora draytonii*) and Ohlone tiger beetle (*Cicendela ohlone*). The Regents will also protect 12.5 acres adjacent to the Ranch View Terrace Housing Project as habitat for the California red-legged frog and as potential habitat for the Ohlone tiger beetle. Long-term management and monitoring is provided on both sites under the agreement. The proposed project would not affect either of these species or their habitat, and would not conflict with UC Santa Cruz's HCP. No Natural Community Conservation Plan exists for the campus, nor is there any such plan that is applicable to the proposed project.

2005 LRDP

Campus growth through 2020 will be guided by the 2005 LRDP. The 2005 LRDP (pp. 49-50) includes goals and principles for land use and development practices for the protection of biological resources, as summarized below.

- **Respect the natural environment and preserve open space as much as possible:** Development will rely on careful infill and clustering of new facilities to promote efficient land use, [and] retain valuable visual and environmental features.

The proposed project consists of dense infill development, in part on existing driveways and parking lots. The use of this site minimizes new development of natural open space.

- **Respect major landscape and vegetation features.** Development will be sensitive to preservation of UC Santa Cruz's distinctive physical features, including ravines, major grasslands, chaparral, and areas of redwood and mixed evergreen forests.

The ECI Project would include development in an area that includes redwood and mixed evergreen forest and oak woodlands, and would remove coast redwood trees and other trees. However, the project was sited as infill, in part to minimize new development in undeveloped areas of the campus. The project would add almost 600 new beds to the campus, with a limited area of site disturbance and no major road construction.

- **Maintain continuity of wildlife habitats.** To the extent possible, development will minimize interruption of wildlife movement and fragmentation of habitats.

Habitat on the project site is already fragmented by prior development. The primary wildlife corridors in the site vicinity—Jordan Gulch and Gully H—would not be affected by the proposed project.

- **Design exterior landscaping to be compatible with surrounding native plant communities:** As much as possible, landscaping will favor the use of native plants, as well as non-invasive, drought-tolerant, and fire-resistant species.

<u>With the exception of a small area of turf,</u> the proposed project will be landscaped in native, non-invasive and drought-tolerant species. The building and facilities have been designed and sites to save as many of the existing trees around site margins as possible.

- **Maintain natural surface drainage flows as much as possible.**

UC Santa Cruz will use financially viable sustainable design strategies to manage storm water, thereby preserving groundwater supplies, major springs, seep zones, year round springs, and major drainage channels, while at the same time preventing slope erosion.

The project has been sited on a location that already includes substantial impervious surface area, which would be replaced by the project, such that the increase in such area would be minimized. In addition, the proposed project includes design elements such as pervious paving, bioswales, bioretention areas, and a green roof to maximize onsite infiltration of storm water.

The project would not alter existing conditions or remove vegetation in Gully H. Storm water that presently drains through the project site from upslope development at the Crown/Merrill Apartments and Crown College would be detained on site in underground storage tanks and metered out to bioretention areas that would be constructed (see Figure 2-2, above).

3.4.2 Impacts and Mitigation Measures

3.4.2.1 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For purposes of this EIR, development of the proposed project would have a significant adverse impact on biological resources if it would:

- Result in a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the CDFG or USFWS
- Result in a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA or state protected wetlands as defined by the Porter-Cologne Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- Result in a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species (as defined above) in local or regional plans, policies, or regulations, or by the CDFG or USFWS
- 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
- Conflict with any local applicable policies protecting biological resources
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan (NCCP), or other applicable habitat conservation plan

All of the items above are addressed in the impact assessment below with the exception of the CEQA checklist question related to conflict with local applicable policies. As explained in Section 3.4.1.2, above, the only plan that is applicable to the project is the 2005 LRDP. The proposed project is consistent with the land use designations and policies of that plan.

3.4.2.2 Analytical Method

Potential biological impacts of the proposed project are evaluated based on a review of the available literature regarding the status and known distribution of the special-status species within the campus, including the project area, as reported in the 2005 LRDP EIR, and on botanical, wildlife and wetland field surveys conducted for the proposed project (Biotic Resources Group 2008 and 2009; H.T. Harvey & Associates 2008 and 2009). Additional selected sources used in the impact analysis include the following:

- U.S. Fish and Wildlife Service (USFWS) List of Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in Santa Cruz County, accessed October 2008 (USFWS 2008).
- The CDFG Natural Diversity Database: query results for the U.S. Geological Survey's 7.5-minute quadrangles of Santa Cruz and Felton (CNDDB 2008)
- The California Native Plant Society's (CNPS) Electronic Inventory of Rare and Endangered Vascular Plants of California (CNPS 2008)

Once all data sources were reviewed, a final list of special-status species with moderate or greater potential to occur in the vicinity of the project area was compiled. Field surveys included assessment of whether the site includes suitable habitat for each of these species, and a search for evidence of the presence of each species. Special-status plant species that may occur anywhere on the campus are presented in Table 3.4-1 at the end of this chapter. Table 3.4-2, which follows Table 3.4-1, presents special-status wildlife species. These tables also include, for informational purposes, species with no or low potential to occur on campus.

In order to refine the list of species potentially affected by development under the 2005 LRDP, species listed in Tables 3.4-1 and 3.4-2 were rated for their potential to occur on the project site. Species rated as having low potential to occur include species whose known distribution does not include the campus; and species for which little appropriate habitat or only marginal habitat is present on the project site, and which have not been observed either in recent surveys or during biological surveys conducted for the ECI Project. Species noted as having moderate or high potential to occur include those species for which suitable habitat is present on the project site, even though the species may not have been detected during focused surveys. Also noted is whether the site provides breeding or foraging habitat for the species. The table also notes the species observed to be present on the site and in the close vicinity.

Species rated as having moderate or high potential to occur or known to occur on the project site are considered in the impact analysis that follows. For impacts determined to be significant or potentially significant, mitigation measures are identified to reduce these impacts to a less-than-significant level.

Biological surveys also assessed whether any of the sensitive natural communities identified in the 2005 LRDP—coastal prairie, northern maritime chaparral, northern maritime chaparral, coastal prairie, and riparian woodland and scrub—are present on or near the project site, based on plant communities and species present, and the hydrology of the site.

3.4.2.3 Applicable 2005 LRDP EIR Mitigations

The following, previously adopted 2005 LRDP EIR mitigation measures are applicable to and incorporated into the proposed project:

LRDP Mitigation BIO-3A: At the time that a specific development project is proposed, the Campus shall conduct a site reconnaissance to determine whether wetlands are present on the site. If no potential wetlands are found, no further mitigation is necessary.

LRDP Mitigation BIO-6: To avoid or minimize the introduction or spread of noxious weeds, sudden oak death or pitch canker into uninfested areas, UC Santa Cruz shall incorporate the following measures into project plans and specifications for work on the north campus to be conducted under the 2005 LRDP

- Only certified, weed-free materials shall be used for erosion control.
- UC Santa Cruz shall identify appropriate best management practices to avoid the dispersal of noxious weeds, sudden oak death and pitch canker. The Campus shall then include appropriate practices in Campus Standards for construction to be implemented during construction in all north campus areas. Typical best management practices include the use of weed-free erosion control materials and revegetation of disturbed areas with seed mixes that include native species and exclude invasive non-natives. Best management practices to avoid the spread of sudden oak death and pitch pine canker will be determined in consultation with the California Department of Forestry.

- In uninfested areas, topsoil removed during excavation shall be stockpiled and used to refill the trench on site if it is suitable as backfill.

LRDP Mitigation BIO-11: Prior to construction or site preparation activities, a qualified biologist shall be retained to conduct nest surveys at each site that has appropriate nesting habitat. The survey shall be required for only those projects that will be constructed during the nesting/breeding season of sharp-shinned hawk, golden eagle, northern harrier, long-eared owl, or white-tailed kite (typically February 1 through August 31).The survey area shall include all potential nesting habitat, including mixed evergreen forest, redwood forest, and isolated trees that are within 200 feet of the proposed project grading boundaries. The survey shall be conducted no more than 14 days prior to commencement of construction activities. If active nests of sharp-shinned hawk, Cooper's hawk, golden eagle, northern harrier, Vaux's swift, long-eared owl, and white-tailed kite (or other species protected under the Migratory Bird Treaty Act and the California Fish and Game Code) are present in the construction zone or within 200 feet of the construction zone, a temporary fence shall be erected at a distance of 200 feet around the nest site (or less if determined to be appropriate by the biologist according to the species and site conditions). Clearing and construction within the fenced area shall be postponed until juveniles have fledged and there is no evidence of a second nesting attempt as determined by the biologist.

As described below in Section 3.4.2.4, below, in the discussion of ECI Impact BIO-4, ECI Mitigation BIO-4 will be implemented for the ECI Project in lieu of LRDP Mitigation BIO-11, for increased applicability to this site.

LRDP Mitigation BIO-13A: If tree removal or grading activity commences on a project site in the north campus during the breeding season of native bat species (April 1 through August 31), a field survey shall be conducted by a qualified biologist to determine whether active roosts of special-status bats (pallid bat, Pacific Townsend's big-eared bat, western red bat, long-eared myotis, fringed myotis, long-legged myotis, yuma myotis, or greater western mastiff bat) are present on the project site or in areas containing suitable roosting habitat within 50 feet of the project site.

Field surveys shall be conducted in late April or early May in the season before construction begins, when bats are establishing maternity roosts but before pregnant females give birth. If no roosting bats are found, no further mitigation would be required.

LRDP Mitigation BIO-13B: If roosting bats are found, disturbance of the maternity roosts shall be avoided by halting construction until either (1) the end of the breeding season or, (2) a qualified biologist removes and relocates the roosting bats in accordance with CDFG requirements.

As described below in Section 3.4.2.4, below, in the discussion of ECI Impact BIO-5, ECI Mitigation BIO-5A through -5F will be implemented for the ECI Project in lieu of LRDP Mitigations BIO-13A and -13B, for increased applicability to this site.

LRDP Mitigation BIO-14: A pre-construction/grading survey of all suitable San Francisco dusky-footed woodrat habitat within 100 feet of the proposed grading footprint shall be conducted by a qualified biologist to detect any woodrat nests.

The survey shall be conducted no more than 14 days prior to commencement of construction activities. If active nests (stick houses) are identified within the construction zone or within 100 feet of the construction zone, a fence shall be erected around the nest site with a 100-foot minimum buffer from construction activities. At the discretion of the biologist, clearing and construction within the fenced area would be postponed or halted until juveniles have left the nest. The biologist shall serve as a construction monitor during those periods when construction activities will occur near active nest areas to ensure that no inadvertent impacts on these nests will occur. If any woodrat is observed within the grading footprint outside of the breeding period, individuals shall be trapped and relocated to a suitable location in proximity to the project site by a qualified biologist in accordance with CDFG requirements, and the nest dismantled so it cannot be reoccupied.

As described below in Section 3.4.2.4, in the discussion of ECI Impact BIO-6, ECI Mitigation BIO-6A through -6C will be implemented for the ECI Project in lieu of LRDP Mitigation BIO-14, for increased applicability to this site.

3.4.2.4 Project Impacts and Mitigation Measures

Sensitive Natural Communities

ECI Impact BIO-1:	Development of the ECI Project has the potential to introduce or cause the spread of noxious weeds or of sudden oak death, which could reduce the abundance of native plants and the biological integrity of sensitive natural communities.
Significance:	Potentially significant
Applicable LRDP EIR Mitigation:	LRDP Mitigation BIO-6
Residual Significance:	Less than significant

Noxious weeds are defined as plants on the California Department of Food and Agriculture's List A or B of Noxious Weeds; or weeds rated as high or moderate by the California Invasive Plant Council (CDFA 2005; Cal-IPC 2005). Construction activities associated with the proposed project could inadvertently introduce noxious weeds or result in their spread into relatively uninfested areas adjacent to the project site, notably the forested areas east of the site. Plant parts or seeds of noxious weeds could be dispersed via construction equipment or personnel if appropriate measures are not implemented. The project also could result in the spread of sudden oak death in association with the removal of oaks form the site.

The introduction or spread of noxious weeds or sudden oak death could reduce the abundance or vigor of common and sensitive biological resources and cause the long-term degradation of a sensitive natural community (e.g., coastal prairie and northern maritime chaparral). This would represent a substantially adverse impact to these sensitive natural communities. Therefore, the impact is considered potentially significant. Implementation of LRDP Mitigation BIO-6, which is incorporated in the proposed ECI Project, would reduce this potential indirect impact to a less-than-significant level. The project would not directly affect any sensitive natural community, as no such community is present or in the immediate vicinity of the project site.

Wetlands

As described in Section 3.4.1.7, above, the project site does not include any wetlands or riparian areas nor would it affect any wetlands, including any jurisdictional wetlands. No impact would occur.

Special Status Species and Their Habitat

Special Status Plants

~~**ECI Impact BIO-2:**~~	~~Development of the ECI Project could result in the loss of special status plants, if any are present on the project site, but would not significantly affect the survival or health of any special status plant species.~~
~~**Significance:**~~	~~Less than significant~~
~~**ECI Mitigation BIO-2**~~	~~During the spring blooming season prior to proposed development, a qualified botanist will conduct a botanical survey of the project site. If any specimens of special status plants are present, the area of the discovery will be protected if possible. If protection is not possible, the plants will be transplanted and/or seeds will be collected for replanting (at the discretion of the project botanist) in a suitable location on or near the project that is not subject to further disturbance.~~

~~A b~~Botanical surveys of the project site ~~was~~were conducted in October 2008 and April 2009 (Biotic Resources Group 2008 and 2009), as reported in Section 3.4.1.9, above. No special status plants were identified on or near the project site and, in the assessment of the project botanist, the site does not appear to include suitable habitat for any of the special status plant species known or considered likely to be present on the campus, including Santa Cruz manzanita, Point Reyes horkleia, marsh microseris, San Francisco popcorn flower, and an undescribed sedge. ~~However, it is recognized that some of these species may be difficult or impossible to recognize outside of the blooming season. Project development would require grading and clearing that could destroy individuals or colonies or protected plants, should any such plants be present. While destruction of individual plants would not constitute a substantial adverse effect to the species and would be a less-than-significant impact under CEQA, preservation of small outlying colonies is desirable. Therefore, under ECI Mitigation BIO-2, a spring blooming season botanical survey would be conducted to identify any such specimens. Any specimens or colonies discovered would be protected if possible, or relocated to suitable habitat nearby. The implementation of this measure would further reduce the less-than-significant impact.~~ Therefore, no impacts to special status plants would occur.

Foraging Habitat of Special Status Wildlife

ECI Impact BIO-3:	Development of the ECI Project would result in the loss of up to 2.2 acres of forest habitat that may be used for foraging and roosting by special status bats and birds.

Significance:	Less than significant
Mitigation:	None required

As described in background Section 3.4.1.5, above, the project site includes oak woodland and redwood/ mixed evergreen forest that provides potential foraging and roosting habitat for special status birds and bats. As described under ECI Impact BIO-3, above, this habitat represents a very small part of the total acreage of oak woodland and redwood forest habitat areas remaining on campus. The Santa Cruz region includes substantial woodland area, including thousands of parklands and preserves that will not be developed. The habitat lost on the project site represents a very small fraction of a percent of total foraging habitat of these types in the region. Similar habitat is available in close proximity to the project site. The impact with respect to loss of foraging and roosting habitat would be less than significant.

Nesting Birds

ECI Impact BIO-4:	Development of the ECI Project would result in the loss of potential nesting habitat, and the potential loss or abandonment of active nests of special-status birds, including fully-protected raptors and other native birds protected under the California Fish and Game code and/or the federal Migratory Birds Treaty Act.
Significance:	Potentially significant
Applicable LRDP EIR Mitigation:	ECI Mitigation BIO-4 will be implemented in lieu of LRDP Mitigation BIO-11
ECI Mitigation BIO-4:	Prior to construction or site preparation activities that may occur during the avian breeding season (typically February 1 through August 31), a qualified biologist shall conduct surveys for nesting special-status raptors such as the long-eared owl, for Vaux's swift colonies or roosts, and for nests of birds protected by the MBTA or the California Fish and Game Code. The survey area shall include all potential nesting habitat on and within 250 ft of the construction boundary for raptors and Vaux's swift colonies, and within 50 ft of the construction boundary for other native birds. The survey shall be conducted no more than 14 days prior to commencement of construction activities. If an active nest is found, a buffer of at least 250 ft will be maintained around any raptor nest or nest of a colonial bird and 50 ft around the nest of any other protected bird until the end of the breeding season or until the nest(s) are no longer active, as determined by a qualified biologist. A temporary fence or other means of marking this buffer shall be constructed.

Residual Significance:	Less than significant

Construction of the proposed project would involve removal of most of the trees on the project site. If construction begins during avian nesting season (approximately Feb. 1 through Aug. 31), this could result in direct take of nesting birds or active nests. In addition, noise and activity associated with project construction could result in the abandonment of nests or breeding failure among protected birds nesting off site in the project vicinity, a potentially significant impact.

Trees on and adjacent to the project site may provide nesting habitat for three California species of special concern: the long-eared owl (*Asio otus*), Vaux's swift (*Chaetura vauxi*) and olive-sided flycatcher (*Contopus cooperi*). No trees of the types that typically serve as communal nesting locations or roosts for Vaux's swifts—trees with large hollows, such as large, burnt out redwoods—are present on the project site, but if any suitable trees are present in the project area and are in use by Vaux's swifts, removal or disturbance could result in potentially significant impacts to local Vaux's swift populations due to the number of individuals that potentially could be disturbed.

Tree removal for ECI Project construction would not affect a substantial amount of nesting habitat for forest raptors or olive-sided flycatchers, as the territorial requirements of these species (H.T. Harvey & Associates) preclude large numbers of nests in such a small area. Similarly, habitat for more common bird species also would be lost as a result of project construction, but such impacts would not be significant because the project would affect only an extremely limited amount of such habitat relative to regional availability. As noted above, the project site represents less than one-quarter of one percent of similar habitat types on the campus, and these habitat types are widespread and abundant in the region. Direct destruction of nests or indirect disturbance of nests by construction activities could also result in impacts to these birds, if such impacts occur during the nesting season. Again, due to the small size of the project site relative to the amount of similar habitat available in the region, the project's effects with respect to loss of nesting habitat would be quite limited and would not be significant. However, any loss of nests would violate the federal MBTA and the California Fish and Game Code, both of which explicitly protect birds, including eggs and young, from any take.

Implementation of ECI Mitigation BIO-4 would reduce potentially significant impacts to nesting special status birds, including raptors, and to other birds protected by Fish and Game Code and the MBTA to less-than-significant levels.

Bat Daytime and Maternity Roosts

ECI Impact BIO-5:	Development of the ECI Project could result in disturbance or abandonment of daytime roost sites of colonially-roosting special status bats, and maternity roost sites of special-status bats, which could cause a substantial adverse effect on special status bat species.
Significance:	Potentially significant
Applicable LRDP Mitigations:	ECI Mitigations BIO-5A through -5F will be implemented for this

	project in lieu of LRDP Mitigations BIO-13A and -13B
ECI Mitigation BIO-5A:	Prior to any tree removal or construction that may occur during bat breeding season (April 1 through August 31), but no more than 3 months before the beginning of the breeding season, a qualified bat biologist (i.e., a biologist holding a CDFG collection permit and a Memorandum of Understanding with CDFG allowing the biologist to handle and collect bats) will conduct a survey for roosting bats and potential roosting sites. All trees and structures on and in the vicinity of the project site (i.e., close enough to project areas to be potentially disturbed by project activities, in the opinion of a qualified bat biologist) will be assessed for their suitability for use by roosting bats. Any trees or structures that are identified as being high-potential roost sites will be surveyed more intensively, by eye and using acoustical equipment if needed to determine whether bats are present. If high-potential roost sites are identified or if bats are present, the campus shall implement exclusion measures as described in Mitigation BIO-5D.
ECI Mitigation BIO-5B:	If high-potential roost sites are identified or exclusion measures are implemented based on the initial survey, and more than 15 days pass without the commencement of construction, demolition or tree removal, pre-construction/pre-demolition bat survey of the high-potential roost sites will be repeated within 15 days prior to the commencement of construction or demolition.
ECI Mitigation BIO-5C:	If a roost of any kind is found in an area (e.g., a building or tree) that will not be disturbed or can be avoided by construction, the roost structure will be designated for protection and will be avoided during construction.
ECI Mitigation BIO-5D:	If a day roost is found in a building or tree that is to be completely removed, bats will be safely evicted under the direction of a qualified bat biologist. Eviction will occur only between September 1 and March 31, to avoid potential for encountering nonflying young, but will not occur during long periods of inclement or cold weather (as determined by the bat biologist) when prey are not available or bats are in torpor, and will occur at night, to minimize potential for predation. If a day roost is found within a building that is to be demolished, eviction (between September 1 and March 31) will occur by opening the roosting area to allow air flow through the cavity for

	at least one night prior to demolition, to allow bats to leave during dark hours. For roosts found in trees that must be removed or disturbed, bats will be evicted between September 1 and March 31, using one-way doors if feasible. If use of a one-way door is not feasible, or the exact location of the roost entrance in a tree is not known, the trees with roosts that need to be removed will first be disturbed by removal of some of the trees' limbs not containing the bats. Such disturbance will occur at dusk to allow bats to escape during the darker hours. These trees will then be removed the following day. All of these activities will be performed under the supervision of the bat biologist. A qualified bat biologist (in consultation with CDFG) may determine that it is preferable, under the circumstances, to allow roosting bats to continue using a roost while construction is occurring on or near the roost site. For example, if a tree found to contain a day roost is located near the construction area but will not be removed, a qualified bat biologist (in consultation with the CDFG) will determine whether the bats should be evicted or whether they should remain in place. If it is determined that the risks to bats from eviction (e.g., increased predation or exposure, or competition for roost sites) are greater than the risk of colony abandonment, then the bats will not be evicted.
ECI Mitigation BIO-5E:	If a maternity roost of any bat species is present on a construction site, the bat biologist will determine the appropriate size of a construction-free buffer around the active roost. This buffer would be maintained from April 1 until Aug. 31, or until the bat biologist has determined that the young are flying.
ECI Mitigation BIO-5F:	In the event that a roost site used as a maternity roost by pallid bats is identified on or adjacent to the project site, and that roost site is abandoned, removed or bats must be evicted as a result of project activities, an alternative roost will be constructed. The design and placement of this structure will be determined by a qualified bat biologist based on the location of the original roost and the habitat conditions in the vicinity. This bat structure will be erected as long as possible in advance of removal of the original roost structure but no less than one month prior, or as soon as possible after a roost site is determined to have been abandoned as a result of project activities. This structure will be checked during the breeding season for up to three years following completion of

	the project, or until it is found to be occupied by pallid bats, to provide information for future projects regarding the effectiveness of such structures in minimizing impacts to bats.
Residual Significance:	Less than significant

Several special-status bats are known to occur on the UC Santa Cruz campus and vicinity (UCSC 2006, CNDDB 2008), including the pallid bat (*Antrozous pallidus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and western red bat (*Lasiurus blossevillii*), all of which are California species of special concern. Other bat species known or likely to occur on campus include the long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), and more common species such as Yuma myotis (*Myotis yumanensis*), big brown bat (*Eptesicus fuscus*), and Mexican free-tailed bat (*Tadarida brasiliensis*). The long-eared myotis, long-legged myotis, and fringed myotis are listed as medium or high-priority conservation species by the Western Bat Working Group (WBWG 2005) and are included in the UCSC 2005 LDRP EIR as species of concern. Cavities, crevices, and foliage of trees in the mixed hardwood and redwood forests, buildings, and rock piles in the project vicinity may provide roosting habitat for these special-status and priority bat species.

Townsend's big-eared bats could potentially forage within the project area, but no suitable roost sites (e.g., caves or huge, cavernous redwood snags) are present on or in close proximity to the project site, and thus this species is not expected to roost there. Western red bats may roost in trees on the project site, but these solitary species do not form large communal roosts, and thus the number of roosting individuals present on the project site would be small; this species is also not expected to breed in the study area. Pallid bats utilize a variety of habitat types, are likely to roost in some areas of the UC Santa Cruz campus, and potentially could form maternity roosts in large redwood trees in areas, like the project site, where roads or other clearings allow them access to the forest. As discussed in the 2005 LRDP EIR, the long-eared, long-legged, and fringed myotis are associated with coniferous forests, and are documented as occurring on campus. These species may roost in tree cavities, in bark crevices, or in buildings during both breeding and nonbreeding seasons (WBWG 2005). These and other bat species may also occur on the campus as migrants or overwintering individuals.

The reconnaissance-level wildlife survey of the ECI Project site (H.T. Harvey 2008) determined that the ECI Project area provides habitat that may be suitable for all of the above-listed bat species. A more intensive survey and acoustical monitoring in March 2009 did not find any bats within the project area, but bat specialist Dr. Dave Johnston identified several oaks on the site whose configuration appeared to provide suitable maternity roost habitat. ~~Many trees exhibit deep crevices suitable as roosts for pallid bats and other species of cavity roosting bats. Additionally, many of the mature redwoods on the project site feature heavily corrugated bark that could provide roosting habitat for nonbreeding pallid bats. Buildings in the project vicinity also provide potential nonbreeding roost sites for many bat species.~~

The project would result in the loss of trees that could potentially serve as bat roosts, and thus will result in the loss of a small amount of bat habitat. If any bat roosts are present in or very close to project impact areas during construction, their disturbance could result in roost abandonment and possibly the loss of individuals (e.g., the loss of young if a maternity roost is abandoned, or the loss of individuals to predation if bats are dislocated during the day). The disturbance of bat roosts was considered a potentially significant impact by the 2005 LRDP EIR (LRDP Impact BIO-13).

No roosting Townsend's big-eared bats are expected to occur in or near the ECI Project area, and the numbers of roosting nonbreeding western red bats on the project site would not be large enough to result in a substantial adverse effect to this species. However, if a tree or trees within the project footprint support a pallid bat maternity colony or large colony of another special status species, removal of such a tree could constitute a substantial adverse effect. Additionally, construction activities may cause noise, vibrations, and other disturbances that could cause bats roosting within or immediately adjacent to the project site to abandon their roosts. Abandonment of maternity roosts would likely cause mortality of many young bats. As identified in the 2005 LRDP EIR, disturbance of roosts of special-status species such as the pallid bat, or disturbance of large roosts of other special status species, would result in a significant impact under CEQA.

ECI Mitigations BIO-5A through -5H, will be implemented in conjunction with the proposed project in order to reduce the potential for impacts to roosts of roosting or breeding bats. <u>Another acoustical survey would be conducted on the site prior to tree removal if removal is scheduled prior to the end of the maternity season, with follow-on mitigation as described above, if bats are present.</u> Implementation of ECI Mitigations BIO-5A through -5H would reduce potential development-related impacts to roosting and breeding special-status bat species to a less-than-significant level.

Woodrat Nests

ECI Impact BIO-6:	Project development could result in a substantial adverse impact associated with the loss of potential San Francisco dusky-footed woodrat nests.
Significance:	Potentially significant
Applicable LRDP Mitigation Measure:	ECI Mitigation BIO-6 will be implemented in lieu of LRDP Mitigation BIO-14
ECI Mitigation BIO-6A:	Within two weeks prior to any clearing of vegetation on the project site, a wildlife biologist will conduct a survey for San Francisco dusky-footed woodrat nests. If any nests are identified, ECI Mitigation BIO-6B will be implemented.
ECI Mitigation BIO-6B:	Where nests are found, a 10 foot buffer will be designated around each nest, and high-visibility exclusion fencing will be erected. Moving or bumping the nests or logs or branches on which the nests rest will be avoided. If this measure is not feasible due to the extent or nature of construction, ECI Mitigation BIO-6C will be implemented.
ECI Mitigation BIO-6C:	If a nest cannot be avoided, it will be dismantled by a qualified biologist and the nesting material moved to a new location outside

	the project's impact areas so that it can be used by woodrats to construct new nests. Prior to nest deconstruction, all nearby understory vegetation will be cleared. Then, each active nest will be disturbed by nudging or shaking by a qualified wildlife biologist, so that all woodrats leave the nest and seek refuge outside of the impact area. For tree nests, a tarp will be placed below the nest and the nest dismantled using hand tools (either from the ground or from a lift) to avoid injury to occupants. For any nest, the nest material will then be piled at the base of a nearby hardwood tree (preferably an oak, willow, or other appropriate tree species with potential refuge sites among the tree roots) outside of the impact area. If nearby habitat outside the impact area lacks suitable structure, appropriate materials (e.g., sticks or logs four ft long and six inches in diameter) will be placed in undisturbed riparian or oak woodland habitat nearby and the sticks from the dismantled nests will be placed among these logs. If multiple nests are displaced, the newly placed piles of nest materials will not be less than 100 feet apart.
Residual Significance:	Less than significant

The San Francisco dusky-footed woodrat, a denizen of mixed hardwood, coniferous, and riparian forests as well as scrub habitats throughout the San Francisco Bay area and the adjacent coast range south through the northern half of the Monterey Bay area, is listed as a California species of special concern due to its restricted range and sensitivity to disturbance. The range of the San Francisco dusky-footed woodrat includes the UC Santa Cruz campus, where the species is known to occur (CNDDB 2008). Because the San Francisco subspecies can only be distinguished from other dusky-footed woodrats by examination of the skull, all dusky-footed woodrats on the campus conservatively will be assumed of the San Francisco subspecies. The ECI Project site and vicinity provides suitable woodrat habitat.

Consistent with LRDP Mitigation BIO-14, project wildlife biologists conducted a survey for evidence of San Francisco dusky-footed woodrats in the project area and vicinity. The habitat within the footprint of the proposed ECI Project is fragmented by existing roads, trails, parking lots, and structures, and understory is mostly sparse. As a result, the existing habitat on the footprint portion of the ECI Project site is of relatively low quality for woodrats. Gully H provides more suitable woodrat habitat, with connectivity to large forest patches, areas of moderately dense understory, and preferred tree species such as tanoak (*Lithocarpus densiflorus*) and madrone (*Arbutus menziesii*). The focused woodrat nest survey of the project site on October 9, 2008 (H.T. Harvey & Associates 2008) resulted in the discovery of one woodrat nest in a forest patch a short distance northeast of the ECI footprint, and another offsite in the Gully H drainage, just above the inlet of a secondary drainage downslope from (east of) the existing parking lots. Construction would not harm any nests in these areas, which are outside the project limit of work.

The project would result in the loss of a relatively limited amount of San Francisco dusky-footed woodrat habitat and could potentially result in the loss of individuals and nests during construction. While the loss of one or two individuals would not constitute a substantial adverse effect to the species, the ECI Project would contribute to the cumulative effect of the 2005 LRDP program, the development of which could result in potentially significant impacts to San Francisco dusky-footed woodrats, as identified in the 2005 LRDP EIR (Impact BIO-14 in UCSC 2005). ECI Mitigation BIO-6 would reduce this impact to a less-than-significant level.

Wildlife Movement

ECI Impact BIO-7:	Development of the ECI Project would result in the loss of previously fragmented oak woodland/redwood forest that may provide limited movement corridors for mammal and bird wildlife species.
Significance:	Less than significant
Mitigation:	None required

As described in Section 3.4.1.11, above, habitat on the project site has been fragmented by prior development of the site as parking lots, and by adjacent development. There is water on the project site only during storms. The site lies on the ridge east of the Jordan Gulch drainage, which was identified as a wildlife corridor in the 2005 LRDP EIR, but the project would not affect wildlife movement in that corridor. The existing parking lots that lie across the uppermost reach of the Gully H drainage likely impede movement across the project site for some species under existing conditions. Gully H, which extends into the San Lorenzo drainage from the east end of the parking lots adjacent to the project site, may serve as a corridor for movement by some large and small mammals moving through the woodlands along the eastern margin of the campus. The proposed project would not diminish the habitat characteristics of Gully H that could provide a wildlife movement corridor along Gully H. The impact of the proposed project with respect to wildlife movement would be less than significant and no mitigation is required.

3.4.2.5 Cumulative Impacts and Mitigation Measures

All of the biological impacts of the proposed project would be reduced to less-than-significant levels by the application of mitigation measures. As detailed in the following sections, the project would not result in a cumulatively considerable contribution to any cumulative biological impact identified in the 2005 LRDP EIR.

Sensitive Natural Communities

The 2005 LRDP EIR determined that campus development under the 2005 LRDP, in conjunction with other regional development in northern Santa Cruz County, would not result in a substantial adverse cumulative impact on sensitive natural communities (LRDP Impact BIO-17).

The proposed ECI Project would not result in impacts to coastal prairie, northern maritime chaparral, or wetlands. While the 2005 LRDP would result in direct and indirect impacts to these communities on campus, which could contribute to a cumulative impact to these communities when viewed on a regional scale, the proposed project would not contribute to these cumulative impacts.

Special Status Wildlife and Wildlife Breeding

The 2005 LRDP EIR determined that development under the 2005 LRDP, in conjunction with other regional development, would not result in a substantial adverse cumulative impact on any other special-status wildlife species or wildlife movement (LRDP Impact BIO-17).

Karst Invertebrates. The 2005 LRDP EIR determined that increased campus population associated with development under the 2005 LRDP could result in increased visitation to sensitive cave habitats in the lower Cave Gulch watershed, but that this impact would be less than significant because this recreational use is generally confined to the cave entrance and immediate vicinity and any potential damage to the habitat near the cave mouth may already have occurred: therefore, an increase in use as a result of a larger campus population may have little or no additional adverse effect. This less-than-significant LRDP impact would be further reduced through the application of programmatic mitigation measure LRDP Mitigation BIO-8, which was adopted in conjunction with the approval of the 2005 LRDP. The proposed project, as part of the development included in the 2005 LRDP program, would contribute incrementally to the less-than-significant program-level impact. However, as explained in the 2005 LRDP EIR, Section 4.4.2.5, the karst geology that provides habitat for these species (Santa Cruz telemid spider, Dollof Cave spider, Empire Cave pseudoscorpion, or Mackenzie's Cave amphipod) is limited to the vicinity of UC Santa Cruz and off-campus areas in the lower Cave Gulch watershed in Wilder Ranch State Park. No future development, outside of that envisioned in the 2005 LRDP, is anticipated to impact the habitat of karst invertebrates. Thus, there would not be any significant cumulative impacts to karst invertebrates.

California red-legged frog. The 2005 LRDP EIR identified that development under the LRDP could result in potentially significant impacts to California red-legged frogs (CRLF) in the lower Moore Creek drainage. 2005 LRDP impacts would be reduced to less-than-significant levels by LRDP Mitigation BIO-9, which was adopted in conjunction with approval of the 2005 LRDP. With respect to cumulative impacts, the lower Moore Creek drainage provides the only known occupied breeding habitat for CRLF in the city of Santa Cruz. Additional breeding and aestivation habitat for CRLF is found in Santa Cruz County west and southeast of the city of Santa Cruz. Development is proposed within the city of Santa Cruz within the Moore Creek drainage, but the areas proposed for development are largely already disturbed or do not support CRLF. The city of Santa Cruz is largely built out east of Moore Creek. The remaining undeveloped areas of the Moore Creek watershed are either protected (e.g., Wilder Ranch State Park, Natural Bridges State Park, Younger Lagoon Natural Reserve, Antonelli Pond Preserve, and Moore Creek Preserve), or are being used for agriculture. Thus, impacts to the species are isolated to those potentially associated with the 2005 LRDP and are not cumulative in nature. The proposed project would not contribute to this impact, as there is no suitable habitat for CRLF on the ECI Project site.

Nesting birds, including special-status raptors. While the development envisioned under the 2005 LRDP, including the proposed project, would reduce the amount of foraging and nesting habitat of special-status raptors and migratory birds, including sharp-shinned hawk, golden eagle, northern harrier, long-eared owl, white-tailed kite and others, no development is proposed in adjacent or nearby off-campus open space (e.g., Wilder Ranch State Park, Henry Cowell Redwoods State Park, Pogonip City

Park, or Moore Creek Preserve) that would result in a cumulative reduction of habitat for migratory birds or special-status raptors. LRDP Mitigation BIO-11, which was adopted in conjunction with the approval of the 2005 LRDP, and ECI Mitigation BIO-4, which the Campus will implement in lieu of the 2005 LRDP mitigation measure, reduce the program and project-level impacts to a less-than-significant level.

Western burrowing owl. The Western burrowing owl is known to occur on campus but is not expected to be adversely affected by the loss of habitat along the edge of the East Meadow that could occur as part of the 2005 LRDP program of development. There is no suitable habitat for Western burrowing owl on the ECI Project site, so the proposed project would not contribute to the program-level impacts. LRDP Mitigation BIO-12, which was included in the 2005 LRDP EIR and adopted as part of the approval of that project, would protect the species burrows during the breeding season and thus development under the 2005 LRDP would not contribute to a cumulative loss of breeding habitat.

Bat species. While the development envisioned under the 2005 LRDP, including the proposed ECI Project, would reduce the amount of foraging, roosting, and nesting habitat of special-status bats, including pallid bat, Pacific Townsend's big-eared bat, western red bat, long-eared myotis, fringed myotis, long-legged myotis, yuma myotis, and greater western mastiff bat, no development is proposed in adjacent or nearby off-campus open space (e.g., Wilder Ranch State Park, Henry Cowell Redwoods State Park, and Pogonip City Park) that would result in a cumulative reduction of habitat for these species. LRDP Mitigation BIO-13, which was included in the 2005 LRDP EIR and adopted as part of the approval of the 2005 LRDP, and ECI Mitigation BIO-5, which the Campus will implement in lieu of the 2005 LRDP EIR mitigation measures, would reduce the program and project-level impacts to a less-than-significant level.

San Francisco dusky-footed woodrat. While the subspecies has not been confirmed to occur on the UC Santa Cruz campus, it is likely that the subspecies comprises a portion of the UC Santa Cruz woodrat population. LRDP Mitigation BIO-14, which was adopted in conjunction with the approval of the 2005 LRDP, and ECI Mitigation BIO-6, which the Campus will implement in lieu of the 2005 LRDP EIR mitigation measure, would protect the species' nests, if they are present, and thus development under the 2005 LRDP, including the ECI Project, would not contribute to a cumulative loss of nesting habitat. Additionally, no development is proposed in adjacent or nearby off-campus open space (e.g., Wilder Ranch State Park, Henry Cowell Redwoods State Park, and Pogonip City Park) that would result in a cumulative reduction of habitat for the San Francisco dusky-footed woodrat.

Ohlone tiger beetle. The 2005 LRDP EIR determined that campus population growth under the 2005 LRDP program of development (of which the proposed project is a part), in conjunction with other regional population growth, would result in a substantial adverse cumulative impact to Ohlone tiger beetle populations on campus from increased bicycle traffic on trails suitable for this species. It subsequently was determined that some bicycle traffic might, in fact, play a beneficial role, in providing areas of bare or sparsely vegetated ground, which are preferred by the beetle. The UC Santa Cruz Ranch View Terrace HCP protects Ohlone tiger beetle habitat at UC Santa Cruz. In addition, LRDP Mitigation BIO-7 would reduce the impact of campus development upon Ohlone tiger beetles to a less-than-significant level. With implementation of LRDP Mitigations BIO-7A and BIO-7B, which were adopted in conjunction with the approval of the 2005 LRDP, the cumulative impact to Ohlone tiger beetle, both due to population growth under the 2005 LRDP and increased use of campus lands by the off-campus population, will be reduced to less-than-significant level.

Wildlife Movement

While the development envisioned under the 2005 LRDP would reduce the amount of unfragmented habitat in the local portions of the Santa Cruz Mountains, no substantial development is proposed in adjacent or nearby open space (e.g., Wilder Ranch State Park, Henry Cowell Redwoods State Park, or Pogonip City Park), or in the Cave Gulch neighborhood, that would result in a cumulative reduction of migration, movement, and habitat linkages in the area. The habitat represented by the ECI Project site already is fragmented, and development of the proposed ECI Project would not interfere with movement along established wildlife movement corridors on the campus.

3.4.2.6 Effects of Timberland Conversion

Development of the proposed project would entail the conversion to developed uses of land that could be classified as timberland, although not all of the trees within this area would be removed. The project site area that would be subject to development is about 3.1 acres in size. A portion of the project site is already developed and therefore does not meet the definition of timberland. The Z'berg-Nejedly Forest Practice Act (Section 4526) defines "timberland"[7] as "land……which is available for and capable of growing a crop of trees of any commercial species used to produce lumber and other forest products…." As described in Section 3.4.2.4, under ECI Impact BIO-3, 2.2 acres of the project site are forested in patches of evergreen and hardwood trees that are distributed around and between parking lots and roads and among buildings. These include trees of species considered to be commercial species under the Forest Practices Act (including redwood, fir, and oak). The majority of the site therefore could be classified as timberland; however, no part of the site is zoned as a Timberland Protection Zone (TPZ)[8].

Timberland conversion is defined in the California Forest Practice Rules (Article 7, 1100 (g)) as "transforming timberland to a non-timber growing use through timber operations." Development of the project site would be considered under the Forest Practices Act to be conversion of timberland to University uses. The area included in the Timberland Conversion Permit for the proposed project is 2.5 acres, but not all of the trees within this area would be removed. Development of the ECI Project would necessitate removal of the majority of the trees within the approximately 3-acre limits of site work, as site development would require extensive grading, fill and soil lime treatment for densification of expansive soils.

Timberland conversion and tree removal for the proposed project would not remove substantial redwood or mixed evergreen forest habitat, and therefore would not constitute significant impacts to biological resources under CEQA. In total, the project would remove up to 2.2 acres of redwood forest/mixed evergreen forest and oak woodland within the 2.5 acres of timber conversion area. This represents less than 0.25 percent of the acreage of these habitats on the UC Santa Cruz campus. Redwood forests and

[7] This definition applies to timberland that is not within non-Timberland Production Zone [TPZ].

[8] A "Timberland Production Zone" is a zoning district established consistent with the mandates of the Forest Taxation Reform Act of 1976 and administered by each County with timberland.

mixed evergreen forest are abundant in the region and are not considered sensitive natural communities by CDFG. Redwoods and firs are widespread throughout the Santa Cruz Mountains, occurring on most of the more than 150,000 acres of conifer and mixed evergreen timberland reported in the timber inventory prepared for the Santa Cruz County Planning Department in 1979, as reported in the 2005 LRDP EIR. Oak woodland also is common both on the campus and in the region. Potential impacts of project tree removal activities on sensitive habitats, native plants, special-status wildlife species that could be found in forest habitat, and wildlife movement, are analyzed above, and mitigation measures are identified that would reduce the impacts of the proposed project to a less-than-significant level at both the project and the cumulative level.

In addition to the biological issues, other potential effects of timber removal, such as erosion of soils on slopes, adverse effects to water quality and increases in runoff, aesthetic effects, emissions and noise from trucks and construction equipment, greenhouse gas emissions, ground-disturbing impacts to significant cultural resources, fire hazards and use of hazardous materials, are included in the analyses and mitigation measures presented in the relevant sections of this EIR.

The Forest Practice Rules require that an owner of land that meets the definition of timberland obtain a Timberland Conversion Permit (TCP) from CAL FIRE before removing trees or other forest products. In addition, a Timber Harvesting Plan (THP) must be filed and must be approved by CAL FIRE before timber operations (removal of trees) may begin. The THP process has been certified as a CEQA-equivalent process pursuant to PRC Section 21080.5, and THPs must include feasible mitigation measures or alternatives that would substantially lessen or avoid significant adverse impacts that the timber operations may have on the environment. Development of the proposed project would require preparation of a TCP to convert site timberland to nontimberland status, and a THP for removal of trees.

3.4.3 References

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Table 3.4-1
List of Special Status Plant Species Evaluated for Potential to Occur within the East Campus Infill Site, UC Santa Cruz

Species	CNPS	State Status	Federal Status	Blooming Season	Habitat Type Known Occurrence in Vicinity? Potential Occurrence on Site?
Anomobryum filiforme moss without common name	List 2	None	None	May–Sep	Broadleaf upland forest, lower montane coniferous forest, North Coast coniferous forest, on damp rocks and soil on outcrops; Potential habitat present in mixed evergreen forest and redwood forest
Blasdale's bent grass (*Agrostis blasdalei*)	List 1B.2	None	None	N/A	Grassland and coastal scrub; recorded from 1.8 miles SE of Swanton Road Not observed within project area; low potential due to poor habitat conditions
Bent-flowered fiddleneck (*Amsinkia lunaris*)	List 1B.2	None	None	Mar–June	Grasslands; historic record from Scott's Valley area (Polo Ranch), Davenport, SW of Swanton; 1986 record from UCSC Not observed within project area; low potential due to poor habitat conditions
Santa Cruz (Anderson's) manzanita (*Arctostaphylos andersonii*)	List 1B.2	None	None	Nov–Apr	Maritime chaparral and intermixes with woodlands; recorded from Ben Lomond, Empire Grade, Pine Flat Road, UCSC Reserve/North Campus, Bonny Doon Reserve Not observed in project area; known from forest northeast of project area
Schreiber's manzanita (*Arctostaphylos glutinosa*)	List 1B.2	None	None	Nov–Apr	Maritime chaparral and intermixes with woodlands; recorded from Ben Lomond Mtn, Swanton area, Big Creek area Not observed
Pajaro manzanita (*Arctostaphylos pajaroensis*)	List 1B.1	None	None	Dec–Mar	Maritime chaparral and intermixes with woodlands; recorded from SE of Eagle Rock (1966), Ice Cream Grade (1966); erroneous? Not observed
Bonny Doon manzanita (*Arctostaphylos silvicola*)	List 1B.2	None	None	Feb–Mar	Maritime chaparral within Zayante sands; often intermixed with ponderosa pine forest; recorded from Scotts Valley, Ben Lomond, Bonny Doon, Felton, Zayante No suitable habitat; not observed
Marsh sandwort (*Arenaria paludicola*)	List 1B.1	Endangered	Endangered	May–Aug	Seasonal wetlands; historic record from NW of Camp Evers in Scotts Valley (1976); extirpated Not observed within project area; low potential due to poor habitat conditions
Santa Cruz cypress (*Callitropsis abramsiana*)	List 1B.2	Endangered	Endangered	N/A	Chaparral and pine forest; recorded from Eagle Rock, Majors Creek area; Bonny Doon Reserve, Bracken Brae Not observed
Santa Cruz pussypaws (*Calyptridium parryi var. hesseae*)	List 1B1	None	None	May–Aug	Chaparral and pine forest; recorded from W of Crest Ranch Ben Lomond Mtn. No suitable habitat; not observed

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Species	CNPS	State Status	Federal Status	Blooming Season	Habitat Type Known Occurrence in Vicinity? Potential Occurrence on Site?
Swamp harebell (*Campanula californica*)	List 1B.2	None	None	Jun–Oct	Seasonal wetlands; historic record from near Camp Evers in Scotts Valley (1944); extirpated? Not observed within project area; low potential due to poor habitat conditions
Deceiving sedge (*Carex saliniformis*)	List 1B.2	None	None	June	Seasonal wetlands; historic record from near Camp Evers in Scotts Valley (1944); extirpated Not observed within project area; low potential due to poor habitat conditions
Ben Lomond spineflower (*Chorizanthe pungens var.hartwegiana*)	List 1B.1	None	Endangered	Apr–Jul	Zayante sand, intermixed with chaparral and Ponderosa pine forest; recorded from Felton, Ben Lomond, Mt. Hermon, Zayante, Bonny Doon Reserve No suitable habitat; not observed
Scotts Valley spineflower (*Chorizanthe robusta var.hartwegii*)	List 1B.1	None	Endangered	Apr–Jul	Exposed sandstone/ mudstone; recorded from Scotts Valley (Glenwood) No suitable habitat; not observed
Robust spineflower (*Chorizanthe robusta var. robusta*)	List 1B.1	None	Endangered	Apr–Sept	Sandy slopes, often intermixed with oak woodland/maritime chaparral; recorded from Market Street, Pogonip, end of Paul Sweet Road, N. Rodeo Gulch, Valencia Creek, Freedom Blvd, Baldwin Creek No suitable habitat; not observed
San Francisco collinsia (*Collinsia multicolor*)	List 1B.2	None	None	Mar–May	Pine forest, coastal scrub and grassland; recorded from Swanton Road area Not observed within project area; low potential due to poor habitat conditions
Tear drop moss (*Dacryophyllum falcifolium*)	List 1B.3	None	None	N/A	Rocky cliff, sandstone outcrops; recorded from Fall Creek, Cave Gulch (UCSC) Not observed within project area; low potential due to poor habitat conditions
California bottlebrush grass (*Elymus californicus*)	List 4	None	None	May–Nov	Cismontane woodland, North Coast coniferous forest, broadleafed upland forest, riparian woodland; Reported from campus in Buck (1986), but no specific location given and no occurrences presently known
Ben Lomond buckwheat (*Eriogonum nudum var. decurrens*)	List 1B.1	None	None	Jun–Oct	Zayante sand, intermixed with chaparral and Ponderosa pine forest; recorded from Felton, Ben Lomond, Zayante No suitable habitat; not observed
Santa Cruz wallflower (*Erysimum teretifolium*)	List 1B.1	Endangered	Endangered	Mar–Jul	Zayante sand, intermixed with chaparral and Ponderosa pine forest; recorded from Felton, Ben Lomond, Zayante, Mt. Hermon, Bonny Doon, Bean Creek area No suitable habitat; not observed

Table 3.4-1
List of Special Status Plant Species Evaluated for Potential to Occur within the East Campus Infill Site, UC Santa Cruz

Species	CNPS	State Status	Federal Status	Blooming Season	Habitat Type Known Occurrence in Vicinity? Potential Occurrence on Site?
Minute pocket moss (*Fissidens pauperculus*)	List 1B.2	None	None	N/A	Coniferous forests in damp soil; recorded from Nisene Marks SP Not observed within project area; low potential due to marginal habitat conditions
Santa Cruz tarplant (*Holocarpha macradenia*)	List 1B.1	Endangered	Threatened	Jun−Oct	Grasslands Known from Arana Gulch Greenbelt, Twin Lakes State Beach (upper Schwann Lagoon), Anna Jean Cummings Park (Soquel), Fairway Drive Area (Soquel) and Watsonville Not observed within project area; no suitable habitat
Kellogg's horkelia (*Horkelia cuneata ssp. sericea*)	List 1B.1	None	None	Apr−Sept	Oak woodland, scrub, and edges of grasslands; recorded from Graham Hill Road (1964), Eccles (1936) Not observed within project area; low potential due to poor habitat conditions
Point Reyes horkelia (*Horkelia marinensis*)	List 1B.2	None	None	May−Sept	Coastal scrub, prairie, and grasslands; recorded from Marshal Field (UCSC), between Scott and Waddell Creek Not observed within project area; low potential due to poor habitat conditions
Arcuate bush-mallow (*Malacothamnus arcuatus*)	List 1B.2	None	None	Apr−Sept	Coastal scrub and chaparral; recorded from Mt. Bache Road Not observed
Marsh microseris (*Microseris paludosa*)	List 1B.2	None	None	Apr−June	Coastal scrub and grasslands; moist areas; recorded from Graham Hill, lower UCSC (mima mounds), Swanton area Not observed within project area; low potential due to poor habitat conditions
Dudley’s lousewort (*Pedicularis dudleyi*)	List 1B.2	Rare	None	Apr−June	Coniferous forest, maritime chaparral; historic record ((1884) from Aptos Not observed within project area; low potential due to marginal habitat conditions
Santa Cruz Mountains beardtongue (*Penstemon rattanii var. kleei*)	List 1B.2	None	None	May−June	Sandy soil in chaparral or burned chaparral, coniferous forests Historic (1922) collection from headwaters of Aptos Creek; Ben Lomond Mtn, Eagle Rock area Not observed within project area; low potential due to marginal habitat conditions
White-rayed pentachaeta (*Pentachaeta bellidiflora*)	List 1B.1	Endangered	Endangered	Mar−May	Grasslands, often ultramafic; recorded from Boulder Creek area (1893), beach cliffs near Santa Cruz (1933); btwn Scotts Creek and Mill Creek Not observed within project area; low potential due to poor habitat conditions
Monterey pine (*Pinus radiata*)	List 1B.1	None	None	N/A	Coastal region; native colony recorded from Ano Nuevo to Scotts Creek near Swanton No native trees of this species observed

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Species	CNPS	State Status	Federal Status	Blooming Season	Habitat Type Known Occurrence in Vicinity? Potential Occurrence on Site?
White-flowered piperia (*Piperia candida*)	List 1B.2	None	None	May–Sept	Shaded areas in coniferous and mixed evergreen forests; recorded from Boulder Creek area Not observed within project area; low potential due to poor habitat conditions
Choris' popcorn flower (*Plagiobothrys chorisianus var. chorisianus*)	List 1B.2	None	None	Mar–Jun	Seasonally moist grasslands/prairie; recorded from Scotts Valley, SE of Greyhound Rock Not observed within project area; low potential due to poor habitat conditions
San Francisco popcorn flower (*Plagiobothrys diffusus*)	List 1B	Endangered	None	Mar–Jun	Seasonally moist grasslands/prairie Known from west side of Santa Cruz, along Graham Hill Road, Scott's Valley, Fairway Drive area of Soquel, Marshal Field (UCSC), Moore Creek Greenbelt, near Wilder Creek, Pogonip Not observed within project area; low potential due to poor habitat conditions
Scotts Valley polygonum (*Polygonum hickmanii*)	List 1B.1	Endangered	Endangered	May–Aug	Exposed sandstone/ mudstone; recorded from Scotts Valley (Glenwood and Polo Ranch) No suitable habitat; not observed
Pine rose (*Rosa pinetorum*)	List 1B.2	None	None	May–July	Pine forest and scrub; recorded from Mt. Hermon area (1944) Not observed within project area; low potential due to poor habitat conditions
Santa Cruz microseris (*Stebbinoseris decipiens*)	List 1B.2	None	None	Apr–May	Grasslands, often on coastal terrace deposits; recorded from 6 mi NW of Davenport, btn Scott and Mill Creek, SSW of Eagle Rock, N of Davenport Not observed within project area; low potential due to poor habitat conditions
Santa Cruz Clover (*Trifolium buckwestiorum*)	List 1B	None	None	Apr–Oct	Seasonally moist grasslands/prairie Known from Soquel, Graham Hill Road area, Glenwood area of Scott's Valley, Swanton, SE of Greyhound Rock, Pogonip Not observed within project area; low potential due to poor habitat conditions

Note: Shaded cell = species known to occur on UC Santa Cruz campus

Table 3.4-2
Special-status Animal Species Reported for the Campus Vicinity and Potential for Occurrence on the UC Santa Cruz East Campus Infill Housing Site

NAME	*STATUS	HABITAT	POTENTIAL FOR OCCURRENCE ON SITE
Federally or California State Threatened or Endangered Species			
Mount Hermon June Beetle (*Polyphylla barbata*)	FE	Sparsely vegetated areas in ponderosa pine chaparral; Zayante sand hills.	Known to occur only in the Zayante sand hills east of the UCSC campus. No campus records. No suitable habitat within project areas. Presumed absent.
Ohlone Tiger Beetle (*Cicindelia ohlone*)	FE	Coastal prairie and open grasslands on Watsonville loam soils; barren areas for foraging.	Known to occur on UCSC in the southwestern corner of campus and in Marshall Field; no records from other parts of the campus. No suitable habitat in Project area.
Smith's blue butterfly (*Euphilotes enoptes smithi*)	FE	Coastal dunes and chaparral supporting native buckwheat hostplants.	No suitable habitat on site; presumed absent.
Zayante Band-winged Grasshopper (*Trimerotropis infantilis*)	FE	Zayante sand hills; open, sandy areas with sparse vegetation cover.	Known to occur only in the Zayante sand hills east of the UCSC campus. No campus records. No suitable habitat within project areas. Presumed absent.
Central California Coast ESU Coho Salmon (*Oncorhynchus kisutch*)	FE	Spawns in clear, cool perennial streams with deep, well-shaded pools and riffles over loose, coarse, silt-free gravel for egg-laying; adults forage in marine habitats.	Occurs in nearby San Lorenzo River and other creeks within the San Lorenzo Watershed. No suitable habitat on campus, and no connectivity between campus and occupied waters. Presumed absent.
Central California Coast ESU Steelhead (*Oncorhynchus mykiss*)	FT	Spawns in clear, cool perennial streams with deep, well-shaded pools and riffles over loose, coarse, silt-free gravel for egg-laying; adults forage in marine habitats.	Occurs in nearby San Lorenzo River and other creeks within the San Lorenzo Watershed. No suitable habitat on campus, and no connectivity to occupied waters. Presumed absent.
Santa Cruz Long-toed Salamander (*Ambystoma macrodactylum croceum*)	FE, SE	Breeds in streams, ponds or lagoons in a restricted region of northern Monterey and southern Santa Cruz counties.	No suitable habitat on project site; presumed absent.
California Red-legged Frog (*Rana aurora draytonii*)	FT, CSSC	Breeds in freshwater ponds and still pools in streams.	Known to breed on UCSC campus only in the Arboretum pond, and recorded along lower Moore Creek drainage. No records from project vicinity, and very low probability of occurrence on project sites.
Marbled Murrelet (*Brachyramphus marmoratus*)	FT, SE	Nests in coastal old-growth redwood and other old-growth coniferous forests, forages in nearshore marine habitats.	No records on campus; no suitable nesting habitat. Presumed absent.
Bald Eagle (*Haliaeetus leucocephalus*)	SE, SP	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, a reservoir, a stream, or the ocean.	No records of breeding in the Santa Cruz campus area (high level of human disturbance most likely precludes nesting); outside of current breeding range in California.

Table 3.4-2
Special-status Animal Species Reported for the Campus Vicinity and Potential for Occurrence on the UC Santa Cruz East Campus Infill Housing Site

NAME	*STATUS	HABITAT	POTENTIAL FOR OCCURRENCE ON SITE
American Peregrine Falcon (*Falco peregrinus*)	SE, SP, CDFG delisted 2007	Forages in a variety of habitats; nests on cliffs and on similar human-made structures.	No suitable nesting habitat on project site, but may occasionally forage on or over these sites.
Western Snowy Plover (*Charadrius alexandrinus*)	FT	Nests and forages on barren to partly vegetated coastal sand beaches, dry salt flats, and barrier beaches.	No suitable nesting or nonbreeding habitat on campus. Presumed absent.
Willow Flycatcher (*Empidonax trailli*)	FE (*extimus*), SE	Riparian areas, especially wet meadows with an abundance of willows.	While willow flycatchers of other subspecies may forage in the Project area occasionally during migration, no individuals of the listed subspecies are expected to occur on project site due to absence of suitable habitat; presumed absent.
California State Species of Special Concern			
Western Pond Turtle (*Actinemys marmorata*)	CSSC	Inhabits permanent or nearly permanent fresh or brackish water in a variety of habitats.	No suitable habitat on project site; presumed absent.
Foothill Yellow-legged Frog (*Rana boylii*)	CSSC	Breeds in freshwater perennial streams with cobbles and boulders, and emergent or overhanging vegetation. During the nonbreeding season, occupies upland aestivation sites near breeding habitat.	No suitable habitat on project site; presumed absent.
Coast Horned Lizard (*Phrynosoma coronatum blainvillii*)	CSSC	Inhabits sandy soils, usually in dry creek channels or coastal dunes; also found in grasslands and brushlands with sandy soils.	No suitable habitat on project site; presumed absent.
Southwestern pond turtle (Clemmys marmorata pallida)	CSSC	Woodlands, grasslands, and open forests; aquatic habitats, such as ponds, marshes, or streams, with rocky or muddy bottoms and vegetation for cover and food.	Potential habitat in Arboretum Pond and lower Moore Creek; CNDDB lists an adult turtle in Moore Creek just south of the campus; no potential habitat on project site.
Northern Harrier (*Circus cyaneus*)	CSSC	Nests in marshes and moist fields, forages over open areas.	No suitable habitat on project site; presumed absent.
Burrowing Owl (*Athene cunicularia*)	CSSC	Nests in open grasslands and ruderal habitats having suitable burrows.	No suitable habitat on project site; presumed absent.
Long-eared Owl (*Asio otus*)	CSSC	Nests in dense woodland, including riparian woodland, forages in open habitats.	Sparsely distributed in Santa Cruz Mountains, but there is some potential for a single pair to nest in the study area based on potentially suitable habitat.

Table 3.4-2
Special-status Animal Species Reported for the Campus Vicinity and Potential for Occurrence on the UC Santa Cruz East Campus Infill Housing Site

NAME	*STATUS	HABITAT	POTENTIAL FOR OCCURRENCE ON SITE
Short-eared Owl (*Asio flammeus*)	CSSC	Nests and forages in open habitats including marshes, grasslands, and cismontane woodlands.	No suitable habitat on project site; presumed absent.
Black Swift (*Cypseloides niger*)	CSSC	Nests in coastal cliffs and under tall waterfalls.	No suitable habitat on project site; presumed absent.
Vaux's Swift (*Chaetura vauxi*)	CSSC	Nests in coastal and montane coniferous forest, with preference for large redwoods.	Although no high-quality nest sites (e.g., very large redwood trees, especially snags) are present on the project site, there is some potential for this species to nest in trees on or near the site.
Loggerhead Shrike (*Lanius ludovicianus*)	CSSC	Nests in tall shrubs and dense trees, forages in grasslands, marshes, and ruderal habitats.	No suitable habitat on project site; presumed absent.
Olive-sided Flycatcher (*Contopus cooperi*)	CSSC	Nests in montane forests.	Potential breeding habitat exists on project site; may breed here.
San Francisco Common Yellowthroat (*Geothlypis trichas sinuosa*)	CSSC	Nests in brackish and freshwater emergent vegetation in and around San Francisco Bay area.	No suitable habitat on project site; presumed absent.
Yellow Warbler (*Dendroica petechia*)	CSSC	Nests in riparian habitats, particularly those dominated by cottonwoods and willows.	No suitable nesting habitat on project site; occasional migrants may forage on site.
Yellow-breasted Chat (*Icteria virens*)	CSSC	Nests in dense riparian habitats.	No suitable habitat on project site; presumed absent.
Tricolored Blackbird (*Agelaius tricolor*)	CSSC	Nests near fresh water in dense emergent vegetation.	No suitable habitat on project site; presumed absent.
Pallid Bat (*Antrozous pallidus*)	CSSC	Forages in a variety of habitats; requires cavities, crevices, buildings, or large tree cavities for roosting.	Although no high-quality roost sites were identified during surveys, there is some potential for this species to roost and/or forage on the project site.
Townsend's Big-eared Bat (*Corynorhinus townsendii*)	CSSC	Roosts primarily in caves, mines, attics, abandoned buildings and large trees with bowls such as found in burned old-growth redwoods. Forages over many habitats.	No suitable roost sites on or near project site, but may forage in project areas.
Western Red Bat (*Lasiurus blossevillii*)	CSSC	Often found in forest or woodlands, especially in or adjacent to riparian habitat.	May roost in low numbers in foliage of trees in project area.
Greater Western Mastiff Bat (*Eumops perotis californicus*)	CSSC, WBWG HP	Roosts and breeds in deep, narrow rock crevices; may also use crevices in trees, buildings, and tunnels; forages in a variety of semiarid to arid habitats.	Although ostensibly suitable foraging and roosting habitat is present on the UCSC campus, there are no records from the vicinity, which is more mesic than areas typically occupied by the species; presumed absent.

Table 3.4-2 Special-status Animal Species Reported for the Campus Vicinity and Potential for Occurrence on the UC Santa Cruz East Campus Infill Housing Site			
NAME	***STATUS**	**HABITAT**	**POTENTIAL FOR OCCURRENCE ON SITE**
San Francisco Dusky-footed Woodrat (*Neotoma fuscipes annectens*)	CSSC	Occurs in a variety of scrub and woodland habitats around the San Francisco Bay area.	Suitable habitat occurs on project site, and nests were observed on the project site.
American Badger (*Taxidea taxus*)	CSSC	Dens and forages in extensive grasslands.	No suitable habitat on project site; presumed absent.
California State Fully Protected Species			
Golden Eagle (*Aquila chrysaetos*)	SP	Nests in tall trees or other tall, sturdy substrates in open habitats such as grasslands and shrublands. Forages in open grasslands and steppes, hunting small mammals such as ground squirrels.	No suitable nesting habitat on project site, but may occasionally forage on or near site.
Ringtail (*Bassariscus astutus*)	SP	Occurs in riparian and heavily wooded habitats near water, and on rocky talus slopes.	No suitable denning habitat on project site, but may occasionally forage on or near site.
White-tailed Kite (*Elanus leucurus*)	SP	Nests in tall shrubs and trees, forages in grasslands, marshes, and ruderal habitats.	No suitable habitat on project site; presumed absent.
Other Species of Conservation Concern			
Stohbeen's parnassian butterfly (*Parnassius clodius strohbeeni*)	Former Federal Listing Candidate	Associated with riparian forests, especially redwood riparian areas.	Thought to be extinct; not expected to occur on project site.
Dolloff Cave spider (*Meta dolloff*)	FSC	Known from Empire and Dolloff Caves.	No suitable habitat on project site; presumed absent.
Empire Cave pseudoscorpion (*Microcraegris imperialis*)	FSC	Known only from Empire Cave.	No suitable habitat on project site; presumed absent.
MacKenzie's cave amphipod (*Stygobromus mackenze*)	FSC	Known only from Empire Cave.	No suitable habitat on project site; presumed absent.
Monarch butterfly (*Danaus plexippus*)	FSC	Groves of trees, especially eucalyptus, Monterey pine, and Monterey cypress.	No areas on the project site provide high-quality winter roost sites with eucalyptus, pine, or cypress. Likely occurs in low numbers in project area, but roosts supporting large numbers of individuals are presumed absent from the site.
San Francisco lacewing (*Nothochrysa californica*)	FSC	Associated with riparian areas, oak woodlands, and coastal scrub habitats.	Last observed on campus in 1965 near Empire Grade. Not observed in 2003 during focused surveys (Entomological Consulting Services 2003), but suitable habitat is present in upper and lower campus areas. May occur on project site.

Table 3.4-2
Special-status Animal Species Reported for the Campus Vicinity and Potential for Occurrence on the UC Santa Cruz East Campus Infill Housing Site

NAME	*STATUS	HABITAT	POTENTIAL FOR OCCURRENCE ON SITE
Santa Cruz rain beetle (*Pleocoma conjungens conjungens*)	FSC	Sandy soils, especially in sand parkland habitat. The Waddell Creek collection was in coastal sage scrub and redwood forest habitat.	No suitable habitat on project site; presumed absent.
Santa Cruz telemid spider (*Telemid* sp.)	FSC	Known only from Empire Cave.	No suitable habitat on project site; presumed absent.
Unsilvered fritillary butterfly (*Speyeria adiaste adiaste*)	FSC	Grasslands in or near redwood forests or in oak woodlands. Larval food plant is *Viola pedunculata*.	No suitable habitat on project site; presumed absent.
Yuma myotis (*Myotis yumanensis*)	FSC	Roosts colonially in a variety of natural and human made sites including caves, mines, buildings, bridges, and trees; in northern California, maternity colonies are usually in fire-scarred redwoods, pines, and oaks; forages for insects over bodies of water.	Recorded on campus. Suitable foraging and roosting habitat is present in trees on the project site.
Long-eared myotis (*Myotis evotis*)	FSC	Forages in woodlands; roosts in a variety of habitats including mines, buildings, caves, bridges, and rock crevices.	Recorded on campus; could potentially forage in project area, but unlikely to roost here given the lack of crevices and cavities.
Fringed myotis (*Myotis thysanodes*)	FSC, WBWG HP	Forages in open woodlands; roosts in buildings, mines, caves bridges, conifer snags, and caves.	Recorded on campus. Could possibly forage and roost in the project site.
Long-legged myotis (*Myotis volans*)	FSC, WBWG HP	Most common in woodlands and forests above 4,000 feet, but occurs from sea level to 11,000 feet.	Recorded on campus. Could possibly forage and roost in the project site.
Ferruginous hawk (nesting and wintering) (*Buteo regalis*)	FSC, former CSSC	Open terrain in plains and foothills where ground squirrels and other prey are available.	Does not nest in California. Uncommon to rare winter visitor in Santa Cruz County where large open areas for foraging are available. No suitable habitat on project site; presumed absent.

Table 3.4-2
Special-status Animal Species Reported for the Campus Vicinity and Potential for Occurrence on the UC Santa Cruz East Campus Infill Housing Site

NAME	*STATUS	HABITAT	POTENTIAL FOR OCCURRENCE ON SITE
Sharp-shinned hawk (*Accipiter striatus*)	Former CSSC (delisted 2007)	Permanent resident in the Sierra Nevada, Cascade, Klamath, and North Coast Ranges at mid-elevations and along the coast in Marin, San Francisco, San Mateo, Santa Cruz, and Monterey Counties; winters over the rest of the state except at very high elevations; Dense canopy ponderosa pine or mixed-conifer forest and riparian habitats.	Known to nest near the Baskin Engineering building on UCSC campus; suitable nesting and foraging habitat throughout the campus area.
Cooper's hawk (*Accipiter cooperi*)	Former CSSC (delisted 2007)	Semi-permanent breeding resident in most wooded areas throughout California Deciduous trees, usually near streams or other open water.	Known to nest in second growth conifer stands or in deciduous riparian areas on Campus. Also known to nest in urban areas. Project site provides potential foraging habitat and nesting habitat.

3.5 CULTURAL RESOURCES

3.5 CULTURAL RESOURCES

This section reviews existing historic and archaeological data about the project site and vicinity, reports the results of an archaeological survey of the project site, and provides project-level analysis and additional detail regarding the project site and the potential for project construction to affect cultural resources. Pursuant to Section 15152 of the CEQA Guidelines, this section supplements and augments the analysis provided in Section 4.5, Volume I of UC Santa Cruz' 2005 LRDP EIR. No comments on cultural resources issues were received during scoping.

3.5.1 Regulatory Context

CEQA requires that projects address impacts to significant archaeological and historic resources, which it terms "historical resources"; to unique archaeological, paleontological, and geologic resources; and to historic and prehistoric-period human remains, whether found in a cemetery or in an archaeological context (Public Resources Code [PRC] §21083.2, 21084.1; CEQA Guidelines §15064.5 and Appendix G, V). Determination of whether a project has a potential for significant cultural resources impacts is a two-step process. First, a cultural resources inventory of the project area is conducted to determine whether any cultural resources are present. Second, the historical significance of each identified resource is assessed relative to CEQA significance criteria. Project impact assessment focuses only on those resources that meet CEQA criteria as significant cultural resources.

3.5.1.1 Historical Resources

Under CEQA §15064.5(a)(3), an historical resource is defined as "any object, building, structure, site, area, place, record or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military or cultural annals of California." PRC §5024 mandates that state agencies inventory all state-owned buildings over 50 years of age. This 50-year standard is commonly used in determining which buildings should be assessed under CEQA; a building less than 50 years of age may qualify as an historical resource if it is exceptionally significant. "Historical resource" refers both to significant historic buildings and features, and to significant archaeological resources of both the historic and prehistoric period.

PRC §5024.1, which establishes the California Register of Historical Resources (CRHR), defines an historical resource as: a resource listed in, or determined to be eligible for listing in, the CRHR; included in a local register of historical resources**;** or deemed significant pursuant to CRHR criteria. All California properties already listed in the National Register of Historic Places (NRHP), formally determined to be eligible for the NRHP, and specific listings of State Historical Landmarks and State Points of Historical Interest, are automatically included in the CRHR. A resource may be listed in or determined eligible to be listed in the CRHR if it meets any of the following criteria:

- Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage

- Is associated with the lives of persons important in our past
- Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values
- Has yielded, or may be likely to yield, information important in prehistory or history.

Archaeological deposits that have been extensively disturbed or redeposited, or historic features and buildings that have been substantially altered or moved, may not be eligible for listing in the CRHR due to loss of integrity to the historic period.

Cultural resources that are not eligible for the CRHR generally are not considered further under CEQA unless they qualify as unique resources (see below).

3.5.1.2 Unique Archaeological, Paleontological and Geologic Resources

Under PRC § 21083.2(g), a "unique archaeological resource" is a resource for which it can be clearly demonstrated that—without merely adding to the current body of knowledge—there is a high probability that it:

- Contains information needed to answer important scientific questions and there is a demonstrable public interest in that information
- Is directly associated with a scientifically recognized important prehistoric event
- Has a special and particular quality, such as being the oldest of its type or the best available example of its type.

While CEQA Guidelines Appendix G refers to unique paleontological and geologic resources, CEQA does not define these terms. For the purposes of this EIR, the relevant provisions of the statute used to define a unique archaeological resource are employed. In addition, state law explicitly considers vertebrate paleontological sites and fossil footprints and provides for their recordation (Archaeological, Paleontological and Historic Sites Statute at PRC §5097 *et seq*.).

It may not be possible to ascertain without extensive excavation whether significant fossils are present within a geologic formation at a specific project location. Therefore, paleontological resource significance assessment generally is not conducted in advance of construction. A project site may be considered to be paleontologically sensitive if it includes geologic formations or rock units that have yielded significant fossils elsewhere in the region.

3.5.1.3 Human Remains and Sacred Sites

Also considered under CEQA guidelines for cultural resources assessments are human remains, including those interred outside of a formal cemetery. These may include historic period burials or graveyards and Native American burials, which most often are encountered within or near archaeological deposits. PRC

§5098.98 sets forth procedures for the protection and treatment of Native American burials. California State Health and Safety Code §7050.5 includes requirements that apply upon the discovery of human remains, including Native American remains in an archaeological context, and provides for local Native American participation in decisions regarding treatment and reinterment of Native American remains and grave-associated artifacts.

PRC §5097.9 prohibits the severe or irreparable damage to any Native American sanctified cemetery, place of worship, religious or ceremonial site, or sacred shrine located on public property.

3.5.2 Environmental Setting

The section below synopsizes cultural resources information relevant to the project site and vicinity. More detail on the environmental setting for cultural resources on the campus is provided in Section 4.5.1 of the 2005 LRDP EIR.

3.5.2.1 Prehistoric and Historic Setting

Prehistoric Context. The earliest confirmed evidence of prehistoric occupation in the Santa Cruz region comes from an archaeological site located 4 miles northeast of the campus in the Santa Cruz Mountains near Scotts Valley. This deeply buried site has been dated to 8000 BC (Cartier 1993). A few other sites have been identified in the Santa Cruz area that date to the period before 5000 BC. However, numerous sites have been dated to the Middle Archaic (3000 to 1000 BC) and Late Archaic (1000 BC to 1000 AD). The Late Prehistoric Period (1000 AD to about 1800 AD) has been identified from at least one site near Santa Cruz (Fitzgerald and Ruby 1997; Hylkema 1991), and there are a number of known protohistoric period sites—dating to around the time of first European contact. Archaeological testing at several sites on the UC Santa Cruz campus has resulted in recovery of two human burials and nearly 1,300 artifacts. Artifact types and radiocarbon dates suggest occupation of campus land from as early as 3500 BC to 1750 AD, or from around the beginning of the Middle Archaic Period into the Protohistoric Period.

The Monterey Bay area provided a wide range of resources that were important to Native Americans. Subsistence practices included hunting large and small terrestrial and marine animals, fishing and shell fishing, and plant foods gathering and processing, with technological expertise in bow making (after about 500 AD), basketry, and the use of boats. As throughout much of central California, acorns were an important plant food staple. In addition to the well-known plant and animal foods, important resources available locally included Monterey banded chert, which was used for the manufacture of chipped stone tools such as arrowheads. The Bay was also an exceptional source of abalone (*Haliotis* sp.) and olive snail (*Olivella*) shells, raw material for the manufacture of shell ornaments and beads that were traded throughout California and much of the West, and were important wealth items that often were deposited in graves. Archaeological evidence indicates that native groups of the region participated in extensive trade networks.

Spanish missions were established in the Santa Cruz region beginning in 1770 AD. The Spanish referred to the indigenous population in this region as *Costaño* or “coast people”; subsequently, *Costanoan*. Levy

(1978:485) suggests that in 1770, just before missionization, the Costanoan group was made up of approximately 50 politically autonomous nations and tribelets. The Santa Cruz area was occupied by a group known as the *Awaswas*.

Mission life, nonnative diseases and cultural disruption took a severe toll on the Costanoan population. One effect was that groups of mixed ethnicity congregated in a few native communities. In many cases, these individuals are identified in records (such as those of the Indian Land Claims Act) only as “Mission Indian”—thus, it is now often difficult or impossible to trace descendants from a specific locale. Many descendants of the San Francisco Bay Region and Monterey Bay Region now identify themselves as *Ohlone*, in preference to the Spanish *Costanoan*. The federal government currently does not formally recognize any of the tribal groups in the Santa Cruz region, but several groups are pursuing federal recognition, which provides legal status in decision making with respect to treatment of human remains and items of cultural patrimony recovered from federal lands. The closest known prehistoric archaeological site, a shell midden and shell bead manufacturing site, is about 1,500 feet distant from the project site.

Historic Context. Spanish explorers first entered the Santa Cruz area in 1769. A mission was established in Santa Cruz near the San Lorenzo River in 1791. Campus lands likely were used by the mission for grazing and agricultural fields during the Mission period (Rodrigues et al. 1992; Hoover et al. 1966; Edwards and Kimbro 1986), and later were parts of several Mexican-period land grants. It is possible that lime for plaster and whitewash might have been produced locally at this time by burning limestone in wood-fueled kilns using the lime rock and redwood timber that were locally abundant (Rodrigues et al. 1992; Piwarzyk 1994).

Shortly before California became a state, gold was discovered near Sacramento in 1848. Thousands of gold-seekers from all over the world began a rush to California. This major influx of population into California resulted in a rapid increase in demand for goods and services and dramatically increased the local demand for construction materials. At that time, quicklime, a key ingredient in mortar, plaster, and stucco for the construction of buildings, was being shipped from the east around Cape Horn and was very expensive. High-quality limestone and the large quantities of wood fuel needed to convert it into quicklime were naturally abundant in Santa Cruz. In 1851, entrepreneurs Isaac Davis and Albion Jordan bought a 160-acre parcel on the future campus site, and constructed three lime kilns near High and Bay Streets. Davis and Jordan produced 21,000 barrels of lime in 1855 (Rodrigues et al. 1992), shipping it to San Francisco and throughout the west coast. Later, entrepreneur Henry Cowell acquired the business, and by 1865 the Cowell and Davis Lime Company was operating several kilns, including the complex near the campus’s main entrance, and three kilns in Jordan Gulch on the central part of the campus. By 1880, the company had become one of the three largest lime companies in California (Rodrigues et al. 1992; Eselius 2003). The business included quarrying and lumbering operations, a wooden tramway for hauling limestone and lumber, a cooperage to manufacture barrels for shipping (all located on the campus), a drayage operation to transport the barrels to the warehouse and wharf, and company schooners to transport the material to San Francisco for shipping. Other facilities on the campus site included a ranch house for the foreman or owner, workers’ cabins and a cookhouse to feed the workers, a carriage house, and a complex of stock and agricultural barns in support of the operations. The central complex of facilities, near what is now the campus main entrance, was listed on the National Register of Historic Places in 2007 as the Cowell Lime Works Historic District.

Henry Cowell took control of the entire lime company operation and land holdings when Jordan died in 1881, renaming it Henry Cowell Company (later, the Henry Cowell Lime and Cement Company). When Henry Cowell died in 1903, his son, Ernest Cowell, took over management of the family business. However, production of quicklime became increasingly expensive, as most of the accessible timber needed to fire the kilns had been logged. Further, the demand for quicklime had begun to decline. The Santa Cruz Portland Cement Company, which opened in Davenport in 1905, began producing cement with superior building qualities. Around the same time, the devastating 1906 San Francisco earthquake demonstrated that brick and mortar were not the best building materials for this region. The lime kiln complex near the campus entrance was shut down during the early decades of the 20th century, although the Upper Quarry and other kilns on the campus site continued in operation until 1946 and quarrying continued sporadically for several decades (Rodrigues et al. 1992). Agricultural operations continued on the lower ranch through the 1950s. The Cowell Lime Works Historic District, a 30-acre site that encompasses the complex of historic buildings and features around the campus main entrance, was placed on the National Register of Historic Places in 2007. This district is well over a mile distant from the project site; however, one of the historic lime kilns outside the district is about 175 feet from the project margin, and there is a historic quarry about 0.25 miles distant.

In 1961, the Board of Regents of the University of California system chose Santa Cruz as the location of a new campus. The proposed project site is located between the campus's Crown College, constructed in 1967-68, and the Crown/Merrill Apartments, constructed in 1986, and is across the street from the campus fire station, constructed in 1975.

Cultural Resources Inventory Results. According to campus records, the only structure on the project site, the Crown Provost Apartment building, was built in 1967-68. The adjacent Crown College buildings, KZSC radio station building, and Lionel Cantu Center building also were built in 1967-68; the adjacent fire station was built in 1975; and the nearby Crown/Merrill Apartments were built in 1986. Because the oldest of these buildings is only 40 years of age, and none will have reached 50 years of age as of the date of proposed project completion, they were not assessed as potential historic structures.

An archaeological records search of the campus database revealed two previously recorded resources within 0.5 miles of the project site. CA-SCR-160, a late prehistoric period archaeological shell midden and shell bead manufacturing site, is about 0.2 miles distant from the project site. CA-SCR-361H, an historic-period lime kiln, is located about 250 feet from the closest margin of the project site. The locations of archaeological sites are kept confidential to protect the sites from illicit collection or excavation. Federal and state regulations prohibit the dissemination of documents related to the specific location of archaeological resources; these documents are not within the purview of the Freedom of Information Act (FOIA). This EIR, therefore, does not provide specific locational information for the archaeological sites in proximity to the project site.

A complete intensive archaeological survey was conducted of the project site, including all staging areas and potential locations for storm water improvements associated with site development (Morgan 2009).

The survey was conducted in transects at approximately 10 m (32 ft) intervals along the topographic contours of the site in all unpaved areas. Ground visibility was moderate to poor due to ground cover of redwood duff in most areas. No evidence of archaeological deposits, features or artifacts was observed. Although CA-SCR-361H, the historic lime kiln noted above, is in relatively close proximity to the project margin, it is separated from the project site by a two-lane paved road and a steep wooded slope.

3.5.2.2 Geological and Paleontological Setting

Geologic and Paleontological Context. The geologic setting of the Santa Cruz Mountains region, including the campus area, is detailed in Section 3.6 (*Geology, Soils and Seismicity*) of this EIR. The locations of geologic formations on the campus overall are illustrated in Figure 4.6-4 (*Site Geologic Map*), in Section 4.6 of the 2005 LRDP EIR.

The Santa Cruz region provides a record of geologic and paleontologic history that spans more than 120 million years beginning in the late Cretaceous period.[1] In the Santa Cruz region, fossil discoveries investigated since the early 1900s (Branner et al. 1909), have occurred almost exclusively in marine sediments. Santa Margarita sandstone and Santa Cruz mudstone, in this region of Santa Cruz County, have yielded significant invertebrate and vertebrate fossils, including several taxa of marine mammals. Marine formations on the Santa Cruz campus include Santa Margarita sandstone, Santa Cruz mudstone, and Quaternary marine terrace deposits. Although the project site may include small remnants of Quaternary marine deposits, the more sensitive marine deposits are not present.

The central and southern portions of the main campus, including the project site, are underlain by crystalline basement rock mapped as pre-Mesozoic marble and schist, with small remnants of younger (late Tertiary and Quaternary age) sedimentary rocks. Erosion of the marble and limestone underlying the central and lower campus has resulted in formation of karst topography, which includes sedimentary doline fill (alluvial fill deposited in sinkholes). Schists, which are metamorphic rocks composed of layers of mostly micaceous minerals, are found throughout the central and upper campus, interbedded with the marble bedrock. The project area is underlain by an undulating marble bedrock surface that varies from 20 feet to over 100 feet below the ground surface. It is likely that thin tabular dikes of granitic rock also cut across both the marble and the schist bedrocks. The marble and schist bedrock are overlain by a blanket of surficial deposits of varying thickness composed of colluvium, marine terrace deposits, and undifferentiated doline fill. Refer to Section 3.6 of this EIR, *Geology, Soils and Seismicity*, for further description.

Dolines—or sinkholes—are a characteristic feature of karst topography. The topography in the Santa Cruz campus area developed during the Pleistocene and Holocene as the result of dissolution of marble, which is soluble in acidic water. The marble bedrock, which tends to be fractured in subsurface blocks, does not weather gradually down from the surface, but dissolves wherever acidic water touches it, which

[1] The geology of the region is mapped on the San Francisco Sheet of the Geologic Map of California (Jennings and Burnett 1961). In 1968, the geology of the northern Santa Cruz Mountains was synthesized in a report by Cummings, Touring and Brabb (1962). In 1981, Clark thoroughly reviewed the geology of the central Santa Cruz Mountains and revised the mapping, stratigraphy, and paleontology of this region of the Coast Ranges.

may be along the ground surface and through the underground fracture system. Over hundreds of thousands to millions of years, this weathering creates highly irregular interconnected solution cavities, underground channels, or caverns. The collapse or subsidence of the surface soils and rock into these underlying solution cavities creates the dolines that are characteristic of karst topography. Dolines, once formed, act as surface drains and tend to collect sediment and decomposed rock.

Although there have been no such finds to date in the coastal California region, some of the best preserved late Pleistocene vertebrate fossils recovered in regions of high precipitation or dense vegetation elsewhere in California have been from caves developed in limestone and marble. Remains of animals trapped in or washed into a sinkhole or transported into an underground cavern by flowing water or as a result of collapse may be mineralized and preserved. Although mineralized remains would not be expected to occur in recent near-surface fill deposits in dolines, fossil remains may occur in interstices and caverns in the karst material or in the older levels of sinkhole deposits. Vertebrate or plant fossils present in doline fills on campus would be considered potentially scientifically significant because of the relative rarity of such finds. Dolines occur in numerous locations on the central and southern portions of the campus, including the project site, and there has been extensive campus development in these areas. To date, no fossils have been revealed by campus excavations in these areas. This suggests that this setting is not paleontologically sensitive on campus, or that fossils in this setting are rare. In either case, the potential to encounter fossils in these formations on the campus appears to be low.

Unique Geologic Resources. Santa Cruz County includes in its Geographic Information System (GIS) database significant hydrological, geological, and paleontological features "which stand out as rare or unique and representative in Santa Cruz County because of their scarcity, scientific or educational value, aesthetic quality or cultural significance" (Santa Cruz County 2005). The County database identifies "a concentration of limestone caves worth protecting" in the Wilder Creek area, and the existing Campus Natural Reserve includes limestone caves along Cave Gulch on the western margin of the campus. These caves may qualify as unique geologic features because of their scientific value and because such caves are relatively rare. Some of the caves, which possess unusual hydrological and lithologic features, also host several special status species. These are described in Section 3.4, *Biological Resources*. No known caverns or other unique geologic features are present in or near the project area.

Paleontological Sensitivity of the Project Site. No field surveys were undertaken to identify paleontological resources on the project site, since resources of this kind are unlikely to be encountered on the surface in the absence of exposed bedrock. Geologic mapping of the campus (cf. Figure 4.6-4 in Section 4.6 of the 2005 LRDP EIR) was consulted to determine whether the geologic formation and rock units determined to be fossiliferous (i.e., fossil-bearing) in the region are present on the site. As confirmed by site geotechnical studies, the site includes doline fill and small remnants of Quaternary marine deposits. Although doline deposits and marine terrace deposit such as those that occur on the project site may be fossiliferous, no fossils have been found in these deposits on campus. The potential for fossils to be encountered on the project site appears to be low, based on the absence to date of paleontological discoveries despite extensive excavations for other campus development on similar formations in the project vicinity.

3.5.3 Impacts and Mitigation Measures

This section of the EIR assesses the potential for development of the proposed ECI Project to result in impacts upon significant cultural resources—i.e. historical resources and unique archaeological, paleontological and geological resources—or to disturb human remains.

3.5.3.1 Applicable LRDP Mitigation Measures

Previously adopted 2005 LRDP EIR mitigation measures below are applicable to and incorporated into the proposed project:

LRDP Mitigation CULT-1A: As early as possible in the project planning process, the Campus shall define the project's area of potential effects (APE) for archaeological resources based on the extent of ground disturbance and site modifications anticipated for the proposed project. The Campus shall also review confidential resource records to determine whether complete intensive archaeological survey has been performed on the site and whether any previously recorded cultural resources are present.

LRDP Mitigation CULT-1B: Where native soils will be disturbed, the Campus shall provide and shall require contractor crews to attend an informal training session regarding how to recognize archaeological sites and artifacts prior to the start of earth moving. In addition, campus employees whose work routinely involves disturbing the soil shall be informed how to recognize evidence of potential archaeological sites and artifacts. Prior to disturbing the soil, contractors shall be notified that they are required to watch for potential archaeological sites and artifacts and to notify the Campus if any are found. In the event of a find, the Campus shall implement LRDP Mitigation CULT-1G, below.

LRDP Mitigation CULT-1C: For project sites that have not been subject to prior complete intensive archaeological survey, the Campus shall ensure that a complete intensive surface survey is conducted by a qualified archaeologist during project planning and design and prior to soil disturbing activities. If an archaeological deposit is discovered, the archaeologist will prepare a site record and file it with the California Historical Resource Information System. In the event of a find within the area of potential effects, the Campus shall consult with a qualified archaeologist to design and conduct an archaeological subsurface investigation and/or a construction monitoring plan of the project site to ascertain the extent of the deposit relative to the project's area of potential effects, to ensure that impacts to potential buried resources are avoided.

LRDP Mitigation CULT-1F (applicable in the event of a discovery during construction)**:** If avoidance or substantial preservation in place is not possible for an archaeological site that has been determined to meet CEQA significance criteria, the Campus shall retain a qualified archaeologist who, in consultation with the Campus, shall prepare a research design, and plan and conduct archaeological data recovery and monitoring that will capture those categories of data for which the site is significant prior to or during development of the site. The Campus shall also ensure that appropriate technical analyses are performed, and a full written report is prepared and filed with the California Historical Resources Information System, and also shall provide for the permanent curation of recovered materials.

LRDP Mitigation CULT-1G: If an archaeological resource is discovered during construction (whether or not an archaeologist is present), all soil disturbing work within 100 feet of the find shall cease. The

Campus shall contact a qualified archaeologist to provide and implement a plan for survey, conduct a subsurface investigation as needed to define the extent of the deposit, and assess the remainder of the site within the project area to determine whether the resource is significant and would be affected by the project. LRDP Mitigation CULT-1F shall also be implemented.

LRDP Mitigation CULT-1H (applicable in the event of a significant discovery)**:** If, in the opinion of the qualified archaeologist and in light of the data available, the significance of the site is such that data recovery cannot capture the values that qualify the site for inclusion on the CRHR, the Campus shall reconsider project plans in light of the high value of the resource, and implement more substantial modifications to the proposed project that would allow the site to be preserved intact, such as project redesign, placement of fill, or project relocation or abandonment. If no such measures are feasible, the Campus shall implement LRDP Mitigation CULT-3A.

LRDP Mitigation CULT-2B: As early as possible in the project planning process, the Campus shall define the project's area of potential effects (APE) for historic structures. The Campus shall determine the potential for the project to result in impacts to or alteration of historic structures based on the extent of site and building modifications anticipated for the proposed project.

LRDP Mitigation CULT-3A (in the event of discovery during construction of a significant archaeological resource that cannot be preserved)**:** If a significant archaeological resource cannot be preserved intact before the property is damaged or destroyed, the Campus shall ensure that the resource is appropriately documented by implementing a program of research-directed data recovery consistent with LRDP Mitigation CULT-1F.

LRDP Mitigation CULT-4A: The Campus shall implement LRDP Mitigations CULT-1A through CULT-1H to minimize the potential for disturbance or destruction of human remains in an archaeological context and to preserve them in place, if feasible.

LRDP Mitigation CULT-4B (in the event of the discovery during construction of a Native American archaeological site that cannot be preserved intact)**:** The Campus shall provide a representative of the local Native American community an opportunity to monitor any excavation (including archaeological excavation) within the boundaries of a known Native American archaeological site.

LRDP Mitigation CULT-4C: In the event of a discovery on campus of human bone, suspected human bone, or a burial, the campus shall ensure that all excavation in the vicinity halts immediately and the area of the find is protected until a qualified archaeologist determines whether the bone is human. If the qualified archaeologist determines the bone is human, or if a qualified archaeologist is not present, the Campus will notify the Santa Cruz County Coroner of the find and protect the find without further disturbance until the Coroner has made a finding relative to PRC §5097 procedures. If it is determined that the find is of Native American origin, the Campus will comply with the provisions of PRC §5097.98 regarding identification and involvement of the Native American Most Likely Descendant (MLD).

LRDP Mitigation CULT-4D (in the event of the discovery during construction of human remains)**:** If human remains cannot be left in place, the Campus shall ensure that the qualified archaeologist and the MLD are provided an opportunity to confer on archaeological treatment of human remains, and that appropriate studies, as identified through this consultation, are carried out. The Campus shall provide results of all such for local Native American involvement in any interpretative reporting. As required by the provisions of the California Native American Graves Protection and Repatriation Act (NAGPRA), the Campus shall ensure that human remains and associated artifacts recovered from campus projects on state lands are repatriated to the appropriate local tribal group, if requested, provided that the appropriate group can be identified through California NAGPRA procedures.

LRDP Mitigation CULT-5A: During project planning, the Project Manager shall consult the most recent campus Soils and Geology map to determine whether the proposed project is underlain by a formation that is known to be sensitive for paleontological resources.

LRDP Mitigation CULT-5C: In the event of a discovery of a paleontological resource on campus, work within 50 feet of the find shall halt until a qualified paleontologist has examined and assessed the find and, if the resource is determined to be a unique paleontological resource, the resource is recovered. The campus shall ensure that all finds are adequately documented, analyzed, and curated at an appropriate institution.

LRDP Mitigation CULT-5D (applicable in the event of a paleontological discovery during construction)**:** In the event that a proposed project would result in impacts to a unique paleontological resource, the project planning team shall work together to reduce impacts to the find through design and construction modifications, to the extent feasible.

3.5.3.2 Standards of Significance

A project may have significant impacts upon historical resources or unique archaeological, paleontological or geologic resources if it would:

- Cause a substantial adverse change in the significance of a unique archaeological resources or an archaeological resource eligible for listing on the CRHR
- Cause a substantial adverse change in the significance of an historical resource
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature
- Disturb any human remains, including those interred outside of formal cemeteries.

CEQA §21084.1 provides that a project that may cause a substantial adverse change in the significance of an historical resource may have a significant effect upon the environment. CEQA Guidelines §15064.5(b) defines a substantial adverse change as “physical demolition, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired.” The significance of an historical resource is materially impaired when a project demolishes or materially alters in an adverse manner those physical characteristics of the resource that convey its historical significance and that justify its inclusion in, or eligibility for inclusion in, the CRHR as determined by a lead agency for purposes of CEQA.

CEQA Guidelines §21083.2 state that if the lead agency determines that the project may have an effect on unique archaeological resources, the environmental impact report shall address the issue of those resources. The section further states that, if it can be demonstrated that the project will cause damage to a unique archaeological resource, the lead agency may require reasonable efforts to preserve the resources in place or leave them undisturbed, including such measures as avoidance through project design or capping with soil. Data recovery archaeological excavation is also cited as appropriate mitigation under certain conditions.

CEQA Guidelines §15126.4(b) states that public agencies should, whenever feasible, seek to avoid damaging effects on any historical resource of an archaeological nature and stipulates that preservation in place is the preferred mitigation through such measures as planned avoidance, incorporation within open space, or covering with soil. The section further states that when data recovery through excavation is the only feasible mitigation, this work shall be directed by a data recovery plan that provides for adequate recovery of the scientifically consequential information from and about the historical resource. Results of studies are to be filed with the Californian Historical Resources Information Center (CHRIS). Human remains encountered during excavation shall be treated in accordance with the provisions of Section 7050.5 of the Health and Safety Code.

3.5.3.3 Potential Archaeological Resources Impacts

ECI Impact CULT-1:	Project-related excavation and grading could uncover and disturb or destroy previously undiscovered archaeological resources or human remains.
Applicable LRDP EIR Mitigation:	CULT-1B and -1F through -1H, -4B, -4C and -4D
Significance with LRDP EIR Mitigation:	Less than significant
Project Mitigation:	No additional mitigation required
Residual Significance:	Not applicable

Any ground-disturbing work has some potential to result in impacts to archaeological resources. Because archaeological resources often are buried or cannot be fully defined or assessed on the basis of surface manifestations, substantial ground-disturbing work may have the potential to uncover previously undiscovered resources, including archaeological deposits and human remains, even in areas where surveys have previously been conducted with negative results.

As reported in Section 3.5.2.1, above, consistent with 2005 LRDP Mitigation CULT-1A, -1C and -4A, an archaeological records search and survey were carried out on the project site. There are no previously identified archaeological resources on or adjacent to the project site, nor were any archaeological materials or deposits identified during the archaeological survey. While there is always a possibility that archaeological materials are present that could not be identified because of poor ground visibility, a substantial part of the project site has previously been subject to excavation, grading, paving or fill. Since these past activities did not expose archaeological materials, the potential for undiscovered deposits to be present on the site appears to be slight. In summary, no archaeological resources have been recorded or observed on the site, and the potential for the presence of undiscovered resources appears to be low.

While no impacts are anticipated, there is slight potential that project grading or excavation could uncover and disturb undiscovered archaeological deposits or human remains. Prehistoric archaeological site CA-SCR-160 is 0.5 miles distant from the project site and would not be affected by project activity in any way. No impact to this site would occur.

LRDP Mitigation CULT-1B, -1F through -1H, and -4B, -4C and -4D require that projects involving excavation include provisions to protect significant archaeological resources or human remains in the event of a discovery during construction, including stop-work provisions, significance assessment and data recovery if warranted, and appropriate Native American consultation on the treatment of human remains. With the incorporation of these mitigations in the proposed project, the project's potential to result in adverse impacts to archaeological resources would be less than significant.

3.5.3.4 Potential Impacts to Historic Structures and Features

Consistent with 2005 LRDP Mitigation CULT-2B, an inventory of buildings on and around the project site was conducted to determine whether any of these was potentially historic. As discussed above, none of the buildings on the site or in the site vicinity has reached 50 years of age. The project would not result in any impacts with respect to historic buildings.

The historic-period lime kiln, CA-SCR-361H ("Elfland Kiln") is located only about 250 feet distant from the margin of the project site. The project would not result in any direct or indirect effects to the kiln site. The kiln is separated from the project site by a paved road and a steep, wooded slope (which would not be altered in any way by the proposed project), and is not visible from the project site. Although they would be tall, Project Buildings A and B would not be visible from the location of the historic feature because of intervening topography and dense screen of trees on the slope adjacent to the kiln. The proposed project, therefore, would not affect the integrity of setting of the kiln. No impacts would occur.

3.5.3.5 Potential Impacts to Unique Paleontological Resources

ECI Impact CULT-2:	Project excavation and grading in doline deposits potentially could expose, disturb, and destroy significant fossils.
Applicable LRDP EIR Mitigation:	CULT-5C and -5D
Significance with LRDP EIR Mitigation:	Less than significant
Project Mitigation:	Project level mitigation not required
Residual Significance:	Not applicable

For paleontological resources, it is important to consider that the abundance and diversity of fossils varies widely from place to place, even within fossiliferous formations. The actual potential for a project to result in impacts to fossils is difficult to determine even when fossiliferous formations are known to be present at the project site. It may not be possible to ascertain without extensive excavation whether significant fossils are present at a specific project location within a sensitive formation. Consistent with LRDP Mitigation CULT-5A, the geology of the project site was assessed to determine whether the site is paleontologically sensitive. Doline deposits such as those that are present on the project site have the potential to yield significant fossils. However, substantial prior excavation in doline deposits on campus, including on and around the project site, has not uncovered any fossils. Therefore, the potential for fossils to be uncovered on the project site appears to be relatively low. Nonetheless, the proposed project would require some deep excavation and cutting, which carries some potential to uncover and disturb or destroy undiscovered fossils.

LRDP Mitigation CULT-5C and -5D require that projects that would include excavation in potentially significant paleontological formations include provisions to protect significant resources in the event of a discovery during construction, including construction crew information, stop-work provisions, significance assessment, and data recovery if warranted. With the incorporation of these mitigations in the proposed project, the project's potential to result in adverse impacts to paleontological resources would be less than significant.

3.5.3.6 Potential Impacts to Unique Geologic Resources

There are no known limestone caves or other unique geologic features in the project vicinity, nor would the project have any potential to affect the caves in the Cave Gulch/Wilder Creek area. No impact would occur.

3.5.3.7 Cumulative Impacts and Mitigation Measures

Any disturbance of native soils or excavation in paleontologically sensitive formations carries the potential to result in impacts to archaeological resources. These impacts may be significant if a significant resource is disturbed or destroyed, particularly if the significant information represented by the resource is not adequately recovered. Over time, development in the Santa Cruz region has resulted in some significant impacts to historical resources and unique archaeological resources because, in some cases, significant buildings have been substantially altered or demolished, or archaeological sites destroyed without data recovery due to past policies that did not adequately protect the resources.

However, the project is not anticipated to result in any significant impacts to cultural resources and includes measures to minimize the potential to encounter cultural resources or to result in significant impacts to any resources that might unexpectedly be encountered. In recent decades, the campus cultural resources mitigation program has proven effective in preventing or mitigating additional damage to unique archaeological resources, human remains, and historical resources. Therefore, the project is not expected to result in a cumulatively considerable contribution to any regional cultural resources impact.

3.5.4 References

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3.6 GEOLOGY, SOILS, AND SEISMICITY

3.6 GEOLOGY, SOILS, AND SEISMICITY

This section of the EIR presents a description of the existing geology, soils, and seismic conditions in the project area and analyzes potential physical environmental effects of the proposed project related to seismic hazards, underlying soil characteristics, slope stability, erosion, and excavation of soils. This section provides project-level analysis and additional detail regarding geology and soils and supplements and augments the analysis provided in Section 4.6, Volume I, of UC Santa Cruz' 2005 LRDP EIR, pursuant to CEQA Guidelines Section 15152.

3.6.1 Environmental Setting

See 2005 LRDP EIR Section 4.6.1 for a comprehensive discussion of the geologic setting of the entire campus.

3.6.1.1 Geologic Setting of the UC Santa Cruz Campus

The UC Santa Cruz campus is located in the central portion of the Coast Ranges Physiographic Province of California. This province, a subdivision of the Pacific Mountain System as defined by the U.S. Geological Survey, parallels the coastline and stretches from the California/Oregon border to Santa Barbara. It contains a series of northwest-southeast-trending coastal mountain ranges, the structures of which are primarily controlled by faulting along a complex of faults that forms the San Andreas Fault System (Nolan, Zinn & Associates 2005). The campus is located on the southwest end of Ben Lomond Mountain, one of the ranges that make up the Santa Cruz Mountains. Ben Lomond Mountain consists of a series of broad, gently sloping marine terraces stepping upward from the shoreline to a height of 2,600 feet at the summit in the northwest. At least five terraces stranded above the present sea level by episodic uplifting have been identified. The UC Santa Cruz campus slopes upward from an elevation of 300 feet at its southern boundary on High Street to an elevation of 1,200 feet at its northwestern corner. The terraces correspond roughly with lower, central, north, and upper campus areas.

Ben Lomond Mountain is situated within the structurally complex granitic and metamorphic basement rock complex of the Salinian block, a large structural feature bounded on the east by the San Andreas Fault zone and on the west by the Sur-Nacimiento and San Gregorio fault zones. The "basement complex" consists of plutonic igneous and metamorphic rocks. Metamorphic rocks (which include quartz-mica schist, limestone marble, and small amounts of quartzite and gneiss) underlie most of the campus. The metamorphic rocks are surrounded and have been invaded by a variety of intrusive granitic rocks.

Beneath the surface soils and sedimentary rocks on campus, the geologic basement complex consists of two major rock types: a marble/schist substrate and a granitic substrate. The marble/schist substrate underlies most of the campus, including the central, lower, and north campus. Granitic rock underlies the upper campus area and the north campus west of Cave Gulch, and also forms intrusions into the marble in the central and lower campus.

The geologic structure of the UC Santa Cruz campus is dominated by two major orthogonal, mutually independent, fracture systems that trend approximately north-south and east-west. A secondary set of fractures is orientated northwest-southeast. A significant proportion of the fractures deviate from the predominant pattern. East of the campus, almost along the campus boundary, the basement complex is bounded by a large vertical fault, the Ben Lomond Fault (Nolan, Zinn & Associates 2005). This fault is important in that it probably provides a barrier to eastward movement of groundwater and controls the locations of spring-fed ponds in the West Lake area.

Marble Bedrock. The marble bedrock underlying the campus is a limestone marble composed primarily of calcite. The marble is dense and solid in some areas and highly fractured in others. The extent of the marble on campus can be distinguished on the surface by the development of "karst topography," a landscape unique to limestone and few other highly soluble rocks. Karst features include ravines, sinkholes, closed depressions, swallow holes, underground streams, and caverns—all of which develop in areas of fracture, joints, and faults where groundwater flow dissolves the marble. Sinkholes form through the collapse of caverns or from the gradual settling of the ground surface over an area of dissolving marble. Karst topography is characterized by the absence of an integrated surface drainage system and the presence of sinkholes, which form closed depressions (see Section 3.8, *Hydrology and Water Quality*, for further detail). Karst features are readily apparent in the lower campus and are also present in parts of the middle or central campus. The karst terrain is also deeply incised by the three major campus drainages that extend through the southern two-thirds of campus in a north/south direction: Cave Gulch, Moore Creek, and Jordan Gulch.

The solution cavities within the marble form underground channels that store groundwater and allow for its transport. The locations of these channels are predominantly determined by bedrock fractures that provide zones where water can penetrate, weather, and dissolve the rock, eventually widening the fracture. Most surface drainage on the central and lower campus is captured by the karst system and is discharged in springs at lower elevations. Depth to groundwater in the fractured marble aquifer system is highly variable; at some locations it was encountered at approximately 100 feet below ground surface (bgs) while at other locations, groundwater was not encountered even at 300 feet bgs.

Schists. Schists, which are metamorphic rocks composed of layers of mostly micaceous minerals, are found throughout the central and upper campus, interbedded with the marble bedrock. The schist found on campus is a gray to medium-brown quartz mica schist, although where it is deeply weathered and oxidized it becomes red or red-brown.

Geologic Structure. The geologic structure of the campus, as mentioned above, is dominated by two major orthogonal fracture systems and one secondary set. High-angle reverse and normal faulting has occurred parallel to the two major fracture orientations. The east-west faults are offset by the north-south faults indicating the relative ages of the two faulting events. There are no known active faults on the campus (Nolan, Zinn & Associates 2005).

3.6.1.2 Project Site

The soils mapped at the project site are the Nisene-Aptos Complex, which consists of Aptos fine sandy loam and Nisene loam. The Nisene-Aptos complex is mainly found on foot slopes of the Santa Cruz Mountains and is composed of material eroded from sandstone, siltstone, or shale. It is typically about 5 to 9 feet thick. Permeability of Nisene-Aptos soil is moderate and the erosion hazard is moderate to high.

A geotechnical investigation was completed for the proposed project in November 2008 (Pacific Crest Engineering 2008b). This study found that the project area is underlain by an undulating marble bedrock surface that varies from 20 to over 100 feet below the ground surface. It is likely that thin tabular dikes of granitic rock also cut across both bedrock types. The marble and schist bedrock are overlain by a blanket of surficial deposits of varying thickness composed of colluvium, marine terrace deposits, and undifferentiated doline fill. These surficial deposits consist of silts, clays, and medium- to fine-grained sands with a significant fines content. Groundwater was not encountered in any of the 43 test borings that were advanced as part of the investigation.

As described in Section 3.8, *Hydrology and Water Quality*, storm water runoff on the central and lower campus generally drains to the natural subsurface drainage system. Runoff from most of the project site, as well as runoff from the lower two terraces of Parking Lot 111 and portions of Crown/Merrill Apartments and Crown College, is discharged by way of a series of subsurface storm water pipes and asphalt and concrete swales to an outfall at the head of Gully H. An area of 0.64 acre at the southwest corner of the project site, including the Crown College Preceptors’ Apartment, drains toward Chinquapin Road. A portion of this runoff is captured in a drainage inlet in Chinquapin Road and discharges to the east fork of Jordan Gulch. The remainder of the runoff flows overland down Chinquapin, partly on the road surface and partly in a shallow ditch along the east side of the road, to storm drain inlets on McLaughlin that discharge to the main stem of Jordan Gulch below Quarry Plaza.

Geologic Hazards

Landslides. The potential for landslides on the campus is generally low because much of the campus is underlain by hard, stable granitic and metamorphic rocks. Potential hazards from landslides are present only in small areas where steep slopes are overlain by substantial thicknesses of colluvium and soil, generally only along the larger stream drainages and in the old marble quarries. The potential for landslides on the project site is low (Pacific Crest Engineering 2008a).

Expansive Soils. Expansive soils (soils that shrink and swell depending on moisture level) are present on parts of the campus. The distribution of expansive soils is highly variable across the campus on a smaller scale and even across building sites. Such soils can damage building foundations if they are inadequately designed for expansive soil conditions. Soils at the project site are moderately to very highly expansive (Pacific Crest Engineering 2008b).

Seismicity. Because ground fault rupture occurs during seismic events along active faults and there are no known active faults on the campus, the potential for ground rupture on the project site is low.

The UC Santa Cruz campus, including the project site, could experience significant seismically induced ground shaking from one or more of the active faults in the region, with more intense shaking on thick soil sequences than on bedrock. The geotechnical investigation for the proposed project included a ground motion analysis for the site, based on the assumption that the building foundations will consist of concrete piers founded in bedrock, for a ground acceleration with a 2 percent chance of exceedance in 50 years. The results of this analysis will be taken into account in the structural design of the buildings.

Liquefaction, Seismically Induced Lateral Spreading. Liquefaction of soils occurs when fine-grained saturated loose soils experience seismic shaking. Lateral spreading occurs when a liquefied soil mass fails toward an open slope or on an inclined topographic surface. Based on the nature of the subsurface soils at the site and the absence of groundwater to a depth of 75 feet, the potential for liquefaction and liquefaction-induced lateral spreading at the site is low (Pacific Crest Engineering 2008a). Because of the low potential for liquefaction on the project site, the potential for seismically induced lateral spreading is also low.

Karst Hazards. Construction in karst terrain can result in settling and/or collapse beneath a structure if subsurface zones of solution or collapse of overlying sediments into voids ("sinkholes" or "dolines") are not identified and addressed in the foundation design. In addition to the potential structural failure of the roof of a cavern, dissolution of the marble surface below the overlying soils creates regions of soft weak soils that may have inadequate bearing capacity for construction, and apparently intact schist, granite, or marble may slide into a doline cavity. Such soils may also contain marble rubble, overlain by more consolidated soils supported by soil arching. Settling and/or collapse can occur beneath a structure above an undetected cavity.

Underground cavities may be completely roofed or loosely filled with sediment, and may not be visible at the ground surface. Based on previous mapping and aerial photographs analysis, dolines are most likely to develop along faults or other major fracture systems on campus, but the inferred locations of these lineaments are not always a reliable indicator of all solution channels or cavities. A number of doline features that have affected building designs in the past were not located on previously mapped faults or fractures or on readily visible lineaments (Nolan, Zinn & Associates 2005). Doline fill encountered in soil borings can also be difficult to differentiate from weathered schist or granitic bedrock. Finally, the marble bedrock on the campus is cut by many granitic dikes, so a boring encountering granitic material may be a few feet away from marble, either laterally or vertically.

Therefore, detailed, site-specific subsurface investigations are required in areas of potential karst hazards to identify the doline features (Nolan, Zinn & Associates 2005). If project site conditions are adequately characterized, the foundation design can take the doline features into account and successfully prevent settlement or collapse of building structures. Typical solutions include excavation of soft soil and rubble zones, structural mat foundation bearing on chemically treated soils, a deep foundation system bearing upon competent marble, or some combination of these.

Nolan, Zinn & Associates (2005) prepared a karst hazards zone map for the campus. The map separates the campus into four hazard level zones based on the character of bedrock and the results of previous geotechnical investigations. The zones are defined by Nolan, Zinn & Associates (2005) as:

- **Zone 1** – Areas underlain by granitic rocks with no karst-related hazards. No special precautions or recommendations specific to karst processes are necessary. This zone encompasses areas underlain by granitic rocks.
- **Zone 2** – Areas with low potential for karst-related hazards. These are underlain by schist, where no marble or evidence for sinkhole activity has been observed, either in boreholes or at the surface. This zone was created by applying a 50-foot buffer beyond the contacts for the applicable earth material units as shown on the current campus geologic map. The buffers were included to account for the inherent uncertainty in locating borings and earth materials contacts portrayed by consultants in the many previous reports on which the campus geologic map is based. Zone 2 represents areas with a higher hazard level than Zone 1 because marble can occur as isolated lenses or pods, or may occur at depth.
- **Zone 3** – Areas underlain directly or at shallow depth by marble but lack any direct indication of doline formation or other solution collapse of site soils in either surface or surface data. Site investigations in this zone should include subsurface investigations appropriate for this geologic setting. A 50-foot buffer has been applied to the margins of the zone as described above.
- **Zone 4** – Areas with a high potential for hazards due to karst conditions. This includes areas underlain by marble with evidence of doline formation. A 100-foot buffer has been applied to the margins of the zone as described above. Note that the buffer for this zone is larger than for other zones because of the higher hazard level.

Most of the existing campus core buildings are located in Karst Hazard Zones 3 and 4. To address the karst hazard, most existing construction on the UC Santa Cruz campus includes conventional spread footing foundations, which are adequate where building pressures are light and low-density zones or solution cavities are relatively deep. Other foundation construction techniques that have been used in karst areas include spread footings with grade beams to span low-density zones, structural mats and post-tensioned slabs, pier and grade beam foundations with either end-bearing or side-wall friction for support, driven piles, geotextile-reinforced compacted fill, pressure or compaction grouting of underlying sediments combined with the aforementioned footings, and deep dynamic compaction (Nolan, Zinn & Associates 2005).

The project site is located in Zone 4 and the project geotechnical investigation identified filled dolines beneath both of the proposed building sites. The locations of the test borings were constrained by existing vegetation and topography; the geotechnical investigation report recommends that additional test borings be advanced within the building footprints after trees and other vegetation have been removed, to allow more precise interpretation of the topography of the bedrock surface.

3.6.1.3 Regulatory Setting

The following laws, ordinances, regulations, and standards would apply to campus development and would minimize the potential for impacts related to geology and soils.

Federal

Clean Water Act. The Clean Water Act empowers the U.S. EPA with regulation of wastewater and storm water discharges into surface waters by using National Pollutant Discharge Elimination System permits and pretreatment standards. At the state level, these permits are issued by the Regional Water Quality Control Boards, but the U.S. EPA may retain jurisdiction at its discretion. The Clean Water Act's primary application for geology and soils is with respect to the control of soil erosion during construction.

State

California Building Code. The California Building Code (CBC) contains the minimum standards for grading, building siting, development, seismic design, and construction in California. Local standards other than the CBC may be adopted if those standards are stricter. The current edition of the CBC was approved in 2007, and is based on the 2006 International Building Code.

Alquist-Priolo Earthquake Fault Zoning Act. The Alquist-Priolo Earthquake Fault Zoning Act (California Public Resources Code Section 25523(a); 20 CCR 1752(b) and (c); 1972 [amended 1994]) was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that a proposed building will not be constructed across active faults. An evaluation and written report of a specific site must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back from the fault, generally 50 feet.

Seismic Hazards Mapping Act. The California Public Resources Code Chapter 7.8, 1990 Seismic Hazards Mapping Act allows the lead agency to withhold permits until geologic investigations are conducted and mitigation measures are incorporated into plans. The Seismic Hazards Mapping Act addresses not only seismically induced hazards but also expansive soils, settlement, and slope stability. The Seismic Hazards Mapping Act will be relevant to soil conditions at some future facility sites.

Local

University of California Policy. The University of California Policy on Seismic Safety (revised 1995) requires that new structures be designed to comply with the current seismic provisions of the CBC or local seismic requirements, whichever are more stringent. The policy also requires that nonstructural elements be anchored for seismic resistance, and that independent review of the structural seismic design of all capital improvement projects for human occupancy or that affect human safety must be performed.

UC Santa Cruz Campus Standards Handbook. The Campus Standards Handbook (http://ppc.ucsc.edu/standards) contains a set of standards that are provided to UC Santa Cruz consultants for guidance in the preparation of construction documents. The Handbook includes building and site requirements, as well as standards for soil treatment, earthwork, and erosion control.

City of Santa Cruz. The City of Santa Cruz seismic hazard policy requires a site-specific geologic investigation be performed by qualified professionals for developments in known potential liquefaction and other seismic hazard areas, and requires developments to incorporate the mitigations recommended by the investigations. The policy also requires that all new construction conform to the latest edition of the CBC. According to the University's policy described above, local seismic requirements are applicable only if they are more stringent than the CBC.

The City of Santa Cruz Seismic Hazards Ordinance (Municipal Code Chapter 24.14, Section 70) applies to projects in areas with potential for liquefaction, as designated in the Safety Element of the General Plan (Map S-6). UC Santa Cruz is not identified on the map as having liquefaction potential.

3.6.2 Relevant Project Characteristics

The proposed project would construct two seven- to eight-story buildings. The footprint Building A would be approximately 8,700 square feet (sf); the footprint of Building B would be approximately 20,000 sf. The buildings would be designed to comply with the latest edition of the California Building Code (2007) based on the International Building Code 2006 with California Amendments. The foundation for the proposed project would be designed and constructed in accordance with the recommendations of the detailed geotechnical investigation conducted for the proposed project (Pacific Crest Engineering 2008b). As recommended by this investigation, the foundation system for the proposed project would consist of drilled, cast-in-place concrete piers socketed into marble bedrock, in conjunction with reinforced concrete grade beams and a structural mat spanning between the grade beams. The geotechnical investigation recommends that additional borings be drilled within the final building envelopes, once the sites have been cleared and grubbed, to assist the University in more precisely defining the depth to the marble surface. Expansive soils beneath the grade beams would be removed or treated with lime to reduce their expansion potential. The geotechnical investigation also provides specific design criteria for the drilled pier and grade beam foundations, detailed recommendations for site preparation and excavation, requirements for compaction of soils and for imported fill, maximum gradients for cut and fill slopes, and guidelines for erosion control and temporary shoring (Pacific Crest Engineering 2008b).

3.6.2.1 Applicable LRDP EIR Mitigation Measures

The following, previously adopted, 2005 LRDP EIR mitigation measure is applicable to and incorporated into the proposed project:

LRDP Mitigation GEO-1: Where existing information is not adequate, detailed geotechnical studies shall be performed for areas that will support buildings or foundations. Recommendations of the geotechnical investigations will be incorporated into project design.

3.6.3 Impacts and Mitigation Measures

3.6.3.1 Standards of Significance

The following standards of significance are based on Appendix G (CEQA Checklist) of the CEQA Guidelines. For the purposes of this EIR, the project would have a significant impact with regard to geology, soils, or seismicity if it would:

- Expose people or structures to potential substantial adverse effects involving strong seismic ground shaking
- Expose people or structures to potential substantial adverse effects involving seismic-related ground failure, including liquefaction
- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides
- Result in substantial soil erosion or the loss of topsoil
- Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction, or collapse
- Be located on expansive soil, creating substantial risks to life or property.

The impacts from soil erosion and loss of topsoil on water quality are addressed in Section 3.8, *Hydrology and Water Quality*.

CEQA checklist items addressing construction in an Alquist-Priolo Earthquake Fault Zoning Map and the adequacy of site soils for supporting the use of septic tanks or alternative wastewater disposal systems are not addressed below. The UC Santa Cruz campus is not within or near an Alquist-Priolo Earthquake Fault Zone, and the campus does not have any septic tanks or alternative wastewater systems and none would be developed as part of the proposed project.

3.6.3.2 Analytical Method

The potential for impacts associated with site geologic conditions were evaluated through review of the existing information on the geologic setting and geological hazards on campus and on the project site, and the proposed project plans.

3.6.3.3 Project Impacts and Mitigation Measures

Landslides, Lateral Spreading, and Liquefaction

ECI Impact GEO-1:	The proposed project would develop structures on geologic materials with a low potential for failure from landslides, lateral spreading, or liquefaction.
Applicable LRDP EIR Mitigation:	GEO-1
Significance with LRDP EIR Mitigation:	Less than significant
Project Mitigation:	Mitigation not required
Residual Significance:	Not applicable

Consistent with 2005 LRDP Mitigation GEO-1, a detailed geotechnical investigation has been performed for the proposed project (Pacific Crest Engineering 2008b). Based on the nature of the subsurface soils on the site, and the depth to groundwater, the potential for liquefaction and liquefaction-induced lateral spreading on the project site are low. The potential for landslides on the proposed site is low because of the topography surrounding the site (Pacific Crest Engineering 2008a).

Therefore, the proposed project does not pose a significant hazard to life or property resulting from liquefaction, lateral spreading, or seismically induced landslides. Furthermore, the project is required to implement 2005 LRDP Mitigation GEO-1, which would ensure that the recommendations of the project geotechnical investigation are incorporated into the project design and construction. The impact would be less than significant and project-specific mitigation is not required. The potential for subsidence of soft soil zones within the doline fill is analyzed below, under *Karst Hazards*.

Expansive Soils

ECI Impact GEO-2:	The proposed project could result in construction of facilities on expansive soil.
Applicable LRDP Mitigation:	GEO-1
Significance with LRDP Mitigation:	Less than significant
Project Mitigation:	Not required
Residual Significance:	Not applicable

The silt and clay soils overlying the marble bedrock on the project site can be moderately or highly expansive (Pacific Crest Engineering 2008b). Expansive soils shrink and swell as a result of moisture changes. This can cause heaving and cracking of concrete slabs, pavements, and structures founded on shallow foundations if they are inadequately designed for these conditions. Potential risk to life and property can result if buildings were constructed on expansive soils without appropriate design. These risks can be avoided through the use of engineering solutions such as replacement of expansive soils with fill, lime treatment of soils, or deepening of foundations.

The 2005 LRDP EIR concluded that, with implementation of 2005 LRDP Mitigation GEO-1, in conjunction with Campus Standards Handbook and compliance with the CBC, construction of campus facilities on expansive soils under the 2005 LRDP would be a less-than-significant impact.

Consistent with 2005 LRDP Mitigation GEO-1, a detailed geotechnical investigation has been conducted for the proposed project and its recommendations will be incorporated into project design and construction. These recommendations include excavation of expansive soils to a depth of 4 feet below the floor slabs and grade beams, and replacing these soils with a non-expansive import, or chemically treated, engineered fill composed of site soils (Pacific Crest Engineering 2008b). These requirements will ensure that the project incorporates appropriate soil treatment and/or foundation design. Therefore, the impact would be less than significant and no project-level mitigation is required.

Construction-Related Erosion

Soils at the project site are considered moderately to very highly erodible, based on U.S. Soil Conservation Service classification (SCS 1980). The effects of alterations to predevelopment storm water runoff patterns and the potential for construction activities to degrade water quality are discussed in more detail in Section 3.8, *Hydrology and Water Quality*.

The 2005 LRDP concluded that although construction of new facilities under the 2005 LRDP would result in short-term soil-disturbing activities that could lead to increased erosion, including cut and fill, grading, trenching, boring, and removal of trees and other vegetation, the impact would be less than significant because all projects would be required to implement appropriate erosion control measures required for compliance with the campus's erosion control requirements and with National Pollutant Discharge Elimination System (NPDES) requirements for construction site storm water discharges.

The Campus Standards Handbook incorporates language to ensure erosion and sediment controls as well as construction site waste controls (http://ppc.ucsc.edu/standards). Additional controls over the construction process result from the construction contract, which is a legally binding document between the contractor and UC Santa Cruz. Since primary control of construction sites belongs to the contractor during construction, UC Santa Cruz uses the construction contract document package to ensure that adequate storm water controls are in place.

To comply with the NPDES requirements, the construction contractor for the proposed project would be required to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP) using a template provided by UC Santa Cruz (http://ppc.ucsc.edu/standards/swppptemplate/). Appropriate erosion-control measures would be incorporated into the SWPPP and implemented during site preparation, grading, and construction. These measures will include but are not limited to the following: design and construction of cut and fill slopes in a manner that will minimize erosion, protection of exposed slope areas, control of surface flows over exposed soils, use of wetting or sealing agents or sedimentation ponds, limiting soil excavation in high winds, construction of berms and runoff diversion ditches, and use of sediment traps, such as hay bales.

Implementation of the construction erosion control measures included in Campus Standards Handbook, the SWMP and the NPDES requirements will ensure that construction of the proposed project does not result in significant soil erosion. The impact would be less than significant and no project-level mitigation is required.

Karst Hazards

ECI Impact GEO-3:	The proposed East Campus Infill Housing Project would be constructed on karst, which could lead to settling or collapse beneath the structures.
Applicable LRDP Mitigation:	GEO-1
Significance:	Less than significant
Project Mitigation:	Project mitigation not required
Residual Significance:	Not applicable

Geotechnical investigations for the project included a total of 43 soil borings to depths ranging from 5 feet to 100 feet. Karst conditions were encountered in all of the borings beneath the proposed building footprints. A highly irregular marble bedrock surface is overlain by sediments of variable engineering properties, including zones of soft soil that could result in subsidence from structural loading, groundwater flow or seismic shaking. The detailed geotechnical report recommends that the building foundations consist of a drilled pier system. The report recommends additional borings within the final building envelopes, once the site has been cleared and grubbed, to provide additional information about the depth to marble bedrock (Pacific Crest Engineering 2008b).

The 2005 LRDP EIR (LRDP Impact GEO-4) concluded that although construction in karst terrain is potentially hazardous because many karst features are not visible at the surface and settling or collapse can occur beneath a structure constructed on karst, campus construction practices have been successful in preventing settlement or collapse of structures. Therefore, implementation of LRDP Mitigation GEO-1, which requires characterization of project site conditions and implementation of the recommendations of the geotechnical investigation, would reduce the LRDP impact to a less-than-significant level.

Consistent with 2005 LRDP Mitigation GEO-1, a detailed geotechnical study has been performed for the proposed project and the recommendations of the study would be incorporated into project design and construction (Pacific Crest Engineering 2008b). These measures would ensure that the project is designed and constructed to prevent damage to life or property, and the impact would be less than significant. No project-level mitigation is required.

Seismic Hazards

There are no Alquist-Priolo Earthquake Fault Zones that affect the city of Santa Cruz (California Geological Survey 2009). Despite the fact that the UC Santa Cruz campus is located in a seismically active region, no active or potentially active faults have been identified on campus. The Ben Lomond Fault, which is the nearest mapped large fault, is inferred to trend north-south along the eastern boundary of the campus, approximately 1,000 feet east of the project site. The Ben Lomond Fault is not known to be active, but, it appears to join the active Zayante Fault at its northwest end (Nolan, Zinn & Associates 2005). However, the campus could experience significant ground shaking associated with a seismic event on nearby active regional faults, including the Zayante and San Andreas faults. This ground shaking could lead to structural damage, and people in the area would be exposed to these hazards. The 2005 LRDP EIR (LRDP Impact GEO-5) concluded that this would be a less-than-significant impact because all project construction must comply with the UC Policy on Seismic Safety and campus policies and practices. The UC Policy on Seismic Safety requires that all project construction must be designed in compliance with the requirements of Title 24 CCR, CBC or local seismic requirements, whichever are more stringent; that, for all capital projects, a licensed structural engineer conduct a review of the structural seismic safety; and that nonstructural building elements such as furnishings, fixtures, material storage facilities, and utilities be anchored. Campus policy requires that each campus department designate a Safety Coordinator to develop and maintain a departmental emergency response plan. The departmental emergency response plans must be submitted to the Emergency Preparedness Policy Group for annual review to ensure consistency with the campus Emergency Operations Plan, which includes seismic safety and building evacuation procedures. The emergency procedures incorporated into departmental emergency response plans further reduce the hazards from seismic shaking by preparing the campus for emergencies. All of these procedures would be implemented in construction and operation of the proposed ECI Project. Therefore, this impact would be less than significant and project-level mitigation is not required.

3.6.3.4 Cumulative Impacts and Mitigation Measures

Most geologic impacts of campus development would be site-specific and would not cumulate. The hazards associated with construction on karst areas are generally confined to the campus. The hazards associated with construction on expansive soils or on unstable geologic units also tend to be localized to the areas where such soils or unstable conditions occur and can be mitigated using standard engineering practices. The 2005 LRDP EIR identified a cumulative impact (LRDP Impact GEO-6) that would result from the exposure of an increased number of people and/or structures at risk of earthquakes and their associated geologic hazards. The 2005 LRDP EIR concluded that this cumulative impact would be less than significant because new commercial and residential development throughout the county would comply with the current seismic provisions of the CBC and local building codes, which are designed to ensure that structures developed in regions prone to significant ground-shaking can withstand the likely stress that would result. The impact was adequately analyzed in the 2005 LRDP EIR, and the proposed project would not change the conclusion that the cumulative impact would be less than significant.

The cumulative impact from erosion and sedimentation on study area drainages and receiving waters is discussed in Section 3.8, *Hydrology and Water Quality*.

3.6.4 References

California Geological Survey. Web site: http://www.conservation.ca.gov/cgs/rghm/ap/Pages/affected.aspx, accessed on February 26, 2009.

Nolan, Zinn & Associates. 2005. *Revised Geology and Geologic Hazards, Santa Cruz Campus University of California.* May.

Pacific Crest Engineering, Inc., 2008a. *Preliminary Geotechnical and Geologic Feasibility Study for Crown/Merrill Apartments, University of California Santa Cruz.* July.

Pacific Crest Engineering, Inc., 2008b. *Geotechnical Investigation for East Campus Infill Housing.* November.

SCS (Soil Conservation Service). 1980. *Soil Survey of Santa Cruz County, California.* U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service. Web site: http://www.ca.nrcs.usda.gov/mlra02/stcruz/.

UC Santa Cruz. *Campus Standards Handbook.* Office of Physical Planning and Construction. Web site: http://ppc.ucsc.edu/standards.

3.7 HAZARDS AND HAZARDOUS MATERIALS

3.7 HAZARDS AND HAZARDOUS MATERIALS

This section evaluates the potential impacts related to hazards and hazardous materials that could result from construction and occupancy of the proposed ECI Project. This section provides project-level analysis and additional detail regarding hazards and hazardous materials and supplements and augments, pursuant to CEQA Guidelines Section 15152, the analysis provided in Section 4.7, Volume I, of UC Santa Cruz' 2005 LRDP EIR.

In response to the Notice of Preparation, the following concern was raised by commenters regarding hazards and hazardous materials:

- Earthquake and fire hazards associated with high rise housing.

Earthquake-related hazards are analyzed in Section 3.6, *Geology and Soils.* Fire hazards are analyzed in this section.

3.7.1 Environmental Setting

3.7.1.1 Definitions

This EIR uses the definition of "hazardous material" given in California Health and Safety Code Section 25501(n) and (o), which defines hazardous material as:

> *[A]ny material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. "Hazardous materials" include, but are not limited to, hazardous substances, hazardous wastes, and any material which a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment.*

By convention, most hazardous materials are thought to be hazardous chemicals, but certain radioactive materials and biohazardous materials are also hazardous, as defined here. This EIR considers hazardous materials to include hazardous chemicals, radioactive materials, and biohazardous materials.

3.7.1.2 Regulatory Context

UC Santa Cruz is subject to substantial government health and safety regulations applicable to the use and disposal of all forms of hazardous materials. This section provides an overview of the regulatory setting applicable to health and safety at UC Santa Cruz and introduces its established health and safety policies and procedures.

Research activities are subject to numerous laws and regulations at all levels of government. In order to provide relief to businesses complying with the overlapping and sometimes conflicting requirements of formerly independently managed programs, the State of California developed the Unified Program to consolidate, coordinate, and make consistent the administrative requirements, permits, inspections, and enforcement activities for certain environmental and emergency management programs. The Unified Program is implemented at the local government level by Certified Unified Program Agencies (CUPA). Certain state regulations have been delegated to Santa Cruz County through the CUPA program, including the Business Plan, the Hazardous Waste Control Law, and the Underground Storage Tank (UST) program. A summary of applicable laws and regulations related to the storage, use, and disposal of hazardous materials and to safety hazards at the project site and a summary of campus policies and procedures is provided below.

Applicable Regulations

Worker Safety Requirements. The California Occupational Safety and Health Administration (Cal/OSHA) and the Federal Occupational Safety and Health Administration (Fed/OSHA) are the agencies responsible for ensuring worker safety in the handling and use of chemicals in the workplace. In California, Cal/OSHA assumes primary responsibility for developing and enforcing workplace safety regulations. These regulations concern the use of hazardous materials in the workplace, including requirements for employee safety training; availability of safety equipment; accident and illness prevention programs; hazardous substance exposure warnings; and emergency action and fire prevention plan preparation. Cal/OSHA also enforces hazard communication program regulations, including procedures for identifying and labeling hazardous substances, and requires Material Safety Data Sheets (MSDSs) to be available for employee information and training programs.

Hazardous Materials Management Planning. State law requires detailed planning to ensure that hazardous materials are properly handled, used, stored and disposed of, and to prevent or mitigate injury to health or the environment in the event that such materials are accidentally released. The California Office of Emergency Services implements these requirements. Federal laws such as the Emergency Planning and Community-Right-To-Know Act of 1986 (also known as Title III of the Superfund Amendments and Reauthorization Act or SARA) impose similar requirements.

The State Hazardous Materials Release Response Plans and Inventory Law of 1985 (Business Plan Act) requires that any business that handles hazardous materials prepare a Business Plan, which must include an inventory of hazardous materials that are handled or stored on the site, an emergency response plan, and a training program. Under the Business Plan Act, state agencies are required to submit business plans to designated local agencies. For UC Santa Cruz, the designated local agency is the Santa Cruz County Department of Environmental Health.

Hazardous Substances Transportation. Under Title 49 of the Code of Federal Regulations (CFR), the U.S. Department of Transportation (DOT) has the regulatory responsibility for the safe transportation of hazardous materials between states and to foreign countries. DOT regulations govern all means of transportation, except for those packages shipped by mail, which are covered by U.S. Postal Service regulations. The federal Resource Conservation and Recovery Act of 1976 (RCRA) imposes additional standards for the transport of hazardous wastes. The California Highway Patrol (CHP) and the

California Department of Transportation (Caltrans) have primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies.

Hazardous Waste Handling Requirements. In 1980, RCRA created a major federal hazardous waste regulatory program that is administered by the U.S. Environmental Protection Agency (U.S. EPA). Under RCRA, EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous wastes from “cradle to grave.” Under RCRA, individual states may implement their own hazardous waste programs. In 1992, EPA approved California’s program called the Hazardous Waste Control Law (HWCL), administered by the California Environmental Protection Agency Department of Toxic Substances Control (DTSC). For UC Santa Cruz, the agency delegated to implement these requirements locally is the Santa Cruz County Department of Environmental Health.

Lead and Asbestos Standards. The removal and handling of asbestos-containing materials is governed primarily by EPA regulations under Title 40 Code of Federal Regulations but is implemented by the Monterey Bay Unified Air Pollution Control District. Fed/OSHA also has a survey requirement under Title 29 Code of Federal Regulations, which is implemented by Cal/OSHA under Title 8 Code of California Regulations. These regulations require facilities to take all necessary precautions to protect employees and the public from exposure to asbestos.

The Cal/OSHA lead standard for construction activities is implemented under Title 8 Code of California Regulations. The standard applies to any construction activity that may release lead dust or fumes, including, but not limited to, manual scraping, manual sanding, heat gun applications, power tool cleaning, rivet busting, abrasive blasting, welding, cutting, or torch burning of lead-based coatings. Unless otherwise determined by approved testing methods, all paints and other surface coatings are assumed to contain lead, depending on the application date of the paint or coating.

Water Quality Control Standards. The Porter-Cologne Water Quality Control Act, codified in the California Water Code, authorizes the State Water Resources Control Board to implement programs to control pollution into state waters. This law, in part, implements the requirements of the Federal Clean Water Act. The Regional Water Quality Control Board (RWQCB) establishes the allowable concentrations of a number of specific hazardous substances in treated wastewater discharged from the campus. Wastewater produced on campus is conveyed via the campus sewer system, without treatment, to the City of Santa Cruz Wastewater Treatment Plant under a waste discharge permit issued by the City. The permit establishes effluent limitations that apply to all dischargers and includes certain specific limitations for the campus. It also requires that the Campus collect and analyze samples of the wastewater leaving campus.

UC Santa Cruz Policies and Procedures

Campus Hazardous Materials Handling. UC Santa Cruz has charged the campus office of Environmental Health and Safety (EH&S) with compliance monitoring to ensure a safe and healthy campus environment and with coordinating the management of hazardous materials on campus. EH&S has the authority to require abatement of any condition or operation that could endanger people or facilities on campus or result in violations of pertinent federal or state laws or campus policies concerning health and safety. EH&S develops specific policies and programs in the following areas: industrial hygiene, chemical safety, physical safety, radiation safety, biohazard safety, hazardous waste management, and environmental protection.

EH&S facilitates Cal/OSHA and Fed/OSHA compliance efforts on campus. EH&S prepared model Injury and Illness Prevention Plans which are used by individual campus units as the basis for preparing unit-specific plans; these plans set forth processes and procedures for employee training and the safe use of hazardous materials. Emergency response plans are also prepared by individual units and by the campus as a whole.

To support compliance with all applicable health and safety policies and regulations, EH&S distributes written guidelines addressing health and safety issues (e.g., the use and handling of hazardous materials, including radioactive materials). Individual departments are assigned the responsibility for implementing specific training programs. In addition, EH&S publishes information (e.g., newsletters and fact sheets) for distribution to Injury and Illness Prevention Plan coordinators. EH&S also maintains a web page that contains a variety of health and safety information.

In accordance with the Business Plan Act, the Campus has prepared a business plan that has been submitted to the Santa Cruz County Department of Environmental Health. Routine audits are performed by County inspectors.

The EH&S Chemical Spill Response Team has been operating for the past 11 years. As reported in the 2005 LRDP EIR, the team responds to an average of 10 spills per year. Most occurred inside laboratories or were related to minor vehicle fuel or oil releases. No significant spills have occurred on the campus. Rapid response and thorough containment of small spills has been the norm at UC Santa Cruz.

<u>Campus Hazardous Waste Disposal</u>. UC Santa Cruz complies with all of the requirements of RCRA and the HWCL, which govern the generation, storage, transport, and disposal of hazardous wastes. Hazardous wastes are collected by EH&S, brought to a central hazardous waste storage area (where materials are held for less than 90 days), packaged in accordance with federal and state requirements, and shipped via authorized transport services for recycling, treatment, and/or disposal at authorized sites. UC Santa Cruz also implements a household hazardous materials education program, and conducts a campus household hazardous waste collection and disposal program.

<u>Campus Emergency Response/Evacuation Planning</u>. UC Santa Cruz maintains an Emergency Management Plan describing the roles and operation of the different units of the University during an emergency. The Plan sets forth standard operating procedures adopted by UC Santa Cruz for handling emergencies resulting from fires, floods, storms, earthquakes, hazardous material incidents and other potential disasters. The Emergency Response Plan uses a management system widely known as the Incident Command System (ICS). The ICS provides an organizational structure capable of responding to all levels of emergencies from simple to complex. It also provides the flexibility to respond to an incident as it escalates in severity. All employees are expected to be familiar with campus, building, and unit emergency plans, including evacuation procedures. Each building has a Building Coordinator responsible for preparing a Building Emergency Plan and an Emergency Assembly Point. Each Unit Coordinator is responsible for ensuring the safe evacuation of unit personnel.

UC Santa Cruz has mutual aid agreements with other public safety agencies and UC campuses that come into effect in the event of an emergency. For instance, the City of Santa Cruz Fire Department provides secondary support for structural fires, while wildfires are responded to by California Department of Forestry. Personnel may be required to evacuate a building, a region of campus, or the entire campus. The decision to evacuate generally resides with the Disaster Director, though lower levels of personnel such as Fire, Police, or EH&S officials may order evacuation if the incident requires it.

In preparation for a Stage 2 evacuation, which involves evacuation of a region of the campus or the entire campus, the campus has been divided into nine geographical regions. In the event of an evacuation, personnel are to move to their region’s designated evacuation point. Commuting personnel may be asked to leave the campus entirely if time and traffic permits. The main route in and out of the west side of the campus is via Heller Drive, whereas the majority of the central, east, and south campus areas would evacuate via Glenn Coolidge and Hagar Drives.

3.7.1.4 Existing Conditions

Hazardous Materials Use, Storage, and Disposal

This section describes the existing hazardous material use, storage, and disposal for the campus and the existing controls in place to reduce the risks.

Hazardous Chemicals. Hazardous chemicals are currently stored, used, and disposed of by three broad groups on the campus: the Division of Physical and Biological Sciences research and teaching laboratories, other academic and administrative units, and the Physical Plant. The largest user and generator of hazardous wastes is the Division of Physical and Biological Sciences. Campus maintenance work involves small quantities of hazardous materials. The custodial staff uses substances such as bleaches and wax strippers. The campus garage uses various petroleum products and solvents. The paint shop annually uses very small amounts of solvents and oil-based paint. The Central Heat Plant uses water treatment chemicals such as nitrates, biocides, sulfuric acid, and calcium hypochlorite. Photographic laboratories used for teaching and photographic production generate hazardous waste as a byproduct of the photographic process, such as photographic fixers (which contain heavy metals), developers, and other chemicals. The Agroecology program and the Arboretum staff use small quantities of pesticides, fertilizers, and herbicides. Office administrative staff use very small quantities of hazardous materials, primarily solvent-containing materials such as rubber cement.

As reported in the 2005 LRDP EIR, chemical use at UC Santa Cruz resulted in the generation of approximately 100,000 pounds of hazardous wastes in 2003, based on 2003 Uniform Hazardous Waste Manifests maintained by EH&S. Hazardous waste storage areas are periodically inspected by EH&S and the Santa Cruz County Department of Environmental Health. The waste materials are recycled, treated, and/or disposed of off-site at licensed facilities.

UC Santa Cruz operates four underground storage tanks for the safe storage of petroleum products. Two tanks, located at fleet services in the south campus, are used to fuel campus vehicles. The other two tanks are located at the Fackler Cogeneration Plant, where they store pilot fuel for routine operation and for emergency operation of the cogeneration engine should the supply of primary engine fuel (natural gas) be interrupted.

3.7.1.5 On- and Off-Campus Contamination

Campus

As reported in the 2005 LRDP EIR, there are no known contaminated sites on the main campus. UC Santa Cruz closed eight underground storage tanks (USTs) on the campus between 1989 and 1999. Two tanks were closed-in-place at the Central Heat Plant in 1992, three tanks were removed from the Barn G facility in 1989, and three were removed from the Central Garage Facility in 1999. Soil surrounding the former USTs was tested at that time and found to be contaminated. In each case, UC Santa Cruz implemented a remediation plan consisting of over-excavation of the soil surrounding the former USTs. Following each over-excavation event, soil sampling showed that remaining native soil was not contaminated, and that over-excavation activities had been successful.

Nearby Off-Campus Sites

There are no known concerns about contamination of the campus from off-campus sites. UC Santa Cruz is located north of the city of Santa Cruz at a higher elevation than the City. Development upgradient of campus is primarily residential; there is currently no development upgradient of the campus that poses a potential hazard to the campus.

3.7.1.6 Wildland Fire Hazards

For a discussion of fire services, see Section 3.12, *Public Services*. Development on the UC Santa Cruz main campus is concentrated in the central campus where colleges and buildings are built at the edge of or within the redwood forests. It has been campus practice to minimize the removal of mature trees and natural vegetation; therefore, buildings on the central campus are surrounded by trees and grasslands. Although the redwood forests generally have relatively low fuel loads for wildland fires because of the absence of an understory, these areas are at risk from wildland fires. The hazard is greater in grassland and riparian areas. The Moore Creek corridor that runs north-south through the campus area is identified as a fire hazard area on Map S-11 of the City of Santa Cruz General Plan’s Safety Element.

UC Santa Cruz implements several programs designed to limit the possibility of dangerous wildfires. The campus Fire Department oversees annual inspections of all laboratories and residential buildings to help evaluate wildfire dangers. All other campus buildings are inspected every other year. These inspections cover both building interiors and exteriors. Interior inspections ensure that fires originating within the buildings are avoided. Exterior inspections evaluate the dangers posed by vegetation in close proximity to the buildings. If the inspector determines that the vegetation is a danger, the vegetation is cleared. Public Resources Code Section 4291 requires clearance of vegetation within 30 to 100 feet surrounding all buildings, depending on the slope of the terrain. Furthermore, all new buildings constructed on campus must be fitted with sprinklers and the plans must be reviewed and approved by the campus fire marshal.

Several grasslands (meadows) are interspersed throughout the campus. These meadows are mowed annually. Chain saws and similar equipment are used for larger bushes and vegetation. Firebreaks are installed in larger meadows to protect against fires. The Campus leases land to ranchers for grazing cattle, which also limits vegetation growth. Because there are no buildings in the upper and north campuses, the Campus has not actively managed the vegetation in those portions of the campus, except that it regularly clears vegetation within 15 to 20 feet of all paved and unpaved roads throughout the campus to ensure access in the event of a fire. The Uniform Wildlife Interface Code (UWIC), which establishes requirements for structures within urban-wildlife interface areas, including vegetation clearance and fuel modification, is adopted as part of this campus's Fire Protection Policy.

UC Santa Cruz maintains a 1-million-gallon water tank at the north end of the campus that provides fire suppression water for the central campus. This tank is filled by booster pumps from reservoirs located at lower elevations along Empire Grade Road. The booster pumps between the lower reservoirs and the 1-million-gallon water tank are electrical and are equipped with backup power generators.

As discussed in the Section 3.12, *Public Services,* several fire departments are responsible for responding to fires on or near campus. The University of Santa Cruz Fire Department has de facto primary responsibility for responding to all fires on campus land. The northern portion of the campus lies in a State Response Area (SRA), and therefore the California Department of Forestry is the official primary responder for this area; however, in practice the campus fire department acts as the first responder for any fire on campus. In the event that a fire is beyond the immediate response capacity of the campus fire department, secondary responders may be called in. The City of Santa Cruz Fire Department provides secondary support for structural fires, while the California Department of Forestry responds to wildfires.

While wildfires in California are common, the climate of the Santa Cruz region is not particularly susceptible to wildfire, due primarily to high humidity. As reported in the 2005 LRDP EIR, in the past 11 years, wildfires occurred on campus only in 1997; these were due to the actions of a single arsonist.

3.7.1.7 Relevant Project Characteristics

There are no hazardous materials used on or in the immediate vicinity of the project site, other than materials commonly used in household cleaning and in building and landscape maintenance. No hazardous materials are stored on the site.

The site consists of a parking lot and paved roadways, the adjacent wooded slopes, and a small apartment building. There is no known contaminated soil or groundwater on the site and past uses of the site are not likely to have resulted in such contamination. One building, the Crown College Preceptors' Apartments, which was built in 1968, would be demolished as part of the project. Based on its age, it is possible that lead paint and asbestos-containing building materials are present in this building.

The proposed project would construct two seven- to eight-story buildings that would provide housing for approximately 600 students in apartment-style units. Common areas, including laundry rooms, recreation rooms, lounges, and a café/grille would be provided on the ground floors of the two buildings.

3.7.1.8 Applicable LRDP Mitigation Measures

The following, previously adopted 2005 LRDP EIR mitigation measures are applicable to and incorporated into the proposed project:

LRDP Mitigation HAZ-7: The Campus shall survey buildings for potential contamination before any demolition or renovation work is performed. If contamination is discovered, appropriate remediation will be completed.

LRDP Mitigation HAZ-9A: The Campus shall continue to include the following requirements in its Campus Standards Handbook and implement them under the 2005 LRDP:

- Construction work shall be conducted so as to ensure the least possible obstruction to traffic.
- Contractors shall notify the University's representative at least two weeks before any road closure.
- When paths, lanes, or roadways are blocked, detour signs must be installed to clearly designate an alternate route. Fire hydrants shall be kept accessible to fire fighting equipment at all times. To ensure adequate access for emergency vehicles when construction projects would result in temporary lane or roadway closures, Physical Plant and Physical Planning and Construction shall continue to require that construction and maintenance project managers notify campus police and fire departments and the campus dispatchers of the closures and alternative travel routes.

LRDP Mitigation HAZ-10A: UC Santa Cruz Fire Department will continue to conduct annual inspections of all residential and laboratory buildings and biennial inspections of all other buildings.

LRDP Mitigation HAZ-10D: Building component protection as prescribed in the International Uniform Wildland Interface Code (UWIC) shall be required where appropriate as determined by the Campus Fire Marshal. All building construction shall comply with the minimum requirements adopted by the State Fire Marshal's Office.

3.7.2 Impacts and Mitigation Measures

3.7.2.1 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, an impact is considered significant if campus growth under the 2005 LRDP would:

- Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials
- 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
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school

- Be located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan
- Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

The campus is not within 2 miles of a public airport or near a private airstrip. Therefore, the CEQA Checklist items that address safety hazards associated with airports are not analyzed below.

3.7.2.2 Project Impacts and Mitigation Measures

Hazardous Materials

The proposed project would not involve the use of hazardous materials other than those routinely used in household cleaning and in building and landscape maintenance. This would not create significant hazards to the public or the environment. The impact would be less than significant and no mitigation is required.

Contaminated Soil and Groundwater

The 2005 LRDP EIR (Section 4.7, Volume I) concluded, due to the low probability of any remaining contaminated locations on campus, the potential for construction and demolition activities under the 2005 LRDP to expose construction workers and campus occupants to contaminated soil or groundwater would be a less-than-significant impact. There are no known sites with soil or groundwater contamination on the main campus. Areas with contaminated soil at several former UST sites on campus have been remediated and contamination is no longer a concern. The past uses of the campus are well-known and are not likely to have resulted in further soil or groundwater contamination. The project site consists of a parking lot and other paved surfaces, the surrounding wooded slopes, and an existing student apartment building. These facilities were developed in the late 1960s on land that had not been previously developed, although most of the campus was logged in the late nineteenth century. The potential for encountering contaminated soil or groundwater on the site is low and the project impact would be less than significant.

Contaminated Building Materials

ECI Impact HAZ-1:	Demolition of the existing Crown College Preceptors' Apartment building could potentially expose construction workers and campus occupants to contaminated building materials.
Applicable LRDP EIR Mitigation:	LRDP Mitigation HAZ-7
Significance with LRDP EIR Mitigation:	Less than significant
Project Mitigation:	Not required

The Crown College Preceptors' Apartment building, which would be demolished as part of the proposed project, was constructed in 1968. Based on its age, lead paints and/or asbestos-containing building materials may be present. The 2005 LRDP EIR analyzed the potential that hazardous materials encountered in campus buildings when they are demolished or remodeled under the 2005 LRDP could expose construction workers and campus occupants to contaminated building materials. The 2005 LRDP EIR concluded that the impact would be less than significant because compliance with federal and state regulations, campus policies, and current procedures of UC Santa Cruz Environmental Health and Safety minimize the potential for exposure of workers to these materials. To further reduce this less-than-significant impact, the Campus implements LRDP Mitigation HAZ-7, which requires the Campus to continue its practice of surveying buildings for potential contamination and completing appropriate mitigation before any demolition or renovation work is performed. This mitigation is applicable to the proposed project. The proposed project is within the scope of the LRDP EIR analysis; therefore, this impact was adequately analyzed in the 2005 LRDP EIR.

Interference with an Emergency Operations Plan

ECI Impact HAZ-2:	Construction activities associated with the proposed project could potentially interfere physically with the campus's Emergency Operations Plan (EOP).
Applicable LRDP EIR Mitigation:	LRDP Mitigation HAZ-9A
Significance with LRDP EIR Mitigation:	Potentially significant
Project Mitigation:	**ECI Mitigation HAZ-1:** If lane closures on Chinquapin Road are required for project construction, the campus's project manager, the construction contractor, and the Fire Marshal will develop specific procedures for traffic controls, and for communication between the UC Santa Cruz Fire Department and on-site contractor or traffic control personnel, to ensure that fire department vehicles are able to exit the station via Chinquapin Road without delay in the event of an emergency.
Residual Significance:	Less than significant

Construction for the proposed project could result in temporary lane closures on Chinquapin Road, which could potentially result in delays to emergency vehicles leaving the UC Santa Cruz fire station. The 2005 LRDP EIR analyzed the potential that development under the 2005 LRDP, including construction-related road closures, would interfere with the campus's Emergency Operations Plan. The LRDP EIR concluded that the impact would be less than significant with mitigation, including LRDP Mitigation HAZ-9A, which requires that the Campus continue its current policies regarding construction road closures. Under these policies, contractors must complete work with the least possible obstruction to traffic and must keep fire hydrants accessible at all times. The Campus must be notified of all road closures in writing at least two weeks in advance. The campus police and fire departments, EH&S, and Transportation and Parking Services (TAPS) are all notified of any road closures. LRDP Mitigation HAZ-9A is incorporated into the proposed project. However, because Chinquapin Road is the only access road to the UC Santa Cruz fire station, emergency vehicles could potentially encounter delays, even with advance notification of road closures. This would be a potentially significant impact. Therefore, the Campus would implement ECI Mitigation HAZ-1. This mitigation would ensure that specific procedures, including direct communication between the UC Santa Cruz Fire Department and on-site contractor or traffic control personnel, are in place to ensure that fire station vehicles are able to exit the station via Chinquapin Road without delays in the event of an emergency. This mitigation would reduce the impact to a less-than-significant level.

Fire Hazards

ECI Impact HAZ-3:	~~Construction activities associated with the proposed project could potentially interfere physically with the campus's Emergency Operations Plan (EOP).~~The proposed project would increase the residential population in an area that is potentially subject to wildfire.
Applicable LRDP EIR Mitigations:	LRDP Mitigation HAZ-10A and HAZ-10D
Significance with LRDP EIR Mitigation:	Less than significant
Project Mitigation:	Not required

The proposed project would be infill residential development on the central campus, although it would be near wooded areas of Jordan Gulch and Gully H. As discussed in the 2005 LRDP EIR (Section 4.7), UC Santa Cruz uses several methods to prevent wildfires on campus. As required by law, the UC Santa Cruz Fire Department performs annual inspections of residential and laboratory buildings, and biennial inspections of other buildings on campus, for internal (i.e., improper use of extension cords) and external (i.e., vegetation) fire hazards. In addition, the Fire Marshal reviews and approves all building plans. Meadow perimeters are mowed seasonally, and firebreaks are cut through larger meadows. Ranchers lease portions of the Great Meadow for cattle grazing, and this helps prevent buildup of the vegetative fuel load. Equipment such as chainsaws and mowers is used to clear brush.

Public Resources Code Section 4291 requires fire breaks 30 to 100 feet from buildings to provide responders with room to work. Areas on steeper slopes require more room. This requirement does not apply to single specimen trees or to ornamental shrubbery that does not provide a means of rapidly transmitting fire. UC Santa Cruz fulfills the requirements where they are applicable. The International Wildland Urban Interface Code, which the campus has adopted and incorporated into the campus Fire Protection Policy, requires a minimum of 10 feet of clearance on each side of fire access roads. UC Santa Cruz maintains clearance of 15 to 20 feet between vegetation and roads that may be used by fire department vehicles.

The proposed buildings would be constructed according to applicable standards of the California Fire Code and National Fire Protection Association. A dedicated fire water line with a fire pump and jockey pump assembly would be provided to the new buildings to supply the standpipe system in each stairwell. Automatic fire sprinklers would also be provided, consistent with Campus Standards. The buildings would also have fire detection and alarm systems that would transmit alarms to the campus public safety dispatch center. First response to fires at the proposed facility would be provided by the campus fire department; however, the campus fire department does not have a ladder truck, which could be required to reach the upper floors of the building. Under and existing mutual aid agreement, the City of Santa Cruz would respond to fires at the facility with a ladder truck (Rodewald 2008).

Current UC Santa Cruz fire management procedures have been successful at controlling fires on campus in the past decades and the construction of the proposed project within the central campus would not increase the risk of wildfire. In addition, by developing some of the forested areas remaining within the developed area of the campus, the proposed project would decrease, rather than increase, the risk of wildland fires. The impact would be less than significant.

3.7.2.3 Cumulative Impacts and Mitigation Measures

Construction and occupancy of the proposed project would not involve hazardous materials use, storage or disposal of hazardous materials other than those routinely used in construction and household cleaning and maintenance. Therefore, the project would not contribute to a cumulative impact related to hazardous materials use. By developing some of the forested areas remaining within the developed area of the campus, the proposed project, like other infill development on the campus and in the city of Santa Cruz, would decrease, rather than increase, the risk of wildland fires. Access to McLaughlin Drive for emergency response vehicles would also be affected by the Chinquapin sidewalk project. However, construction of these two projects would not overlap. Therefore, there would be no cumulative impact related to emergency response operations.

3.7.3 References

Rodewald, Rick, UC Santa Cruz Assistant Fire Chief. 2008. Personal communication with Alisa Klaus, UC Santa Cruz Physical Planning and Construction. December 12.

3.8 HYDROLOGY AND WATER QUALITY

FIGURES

3.8 HYDROLOGY AND WATER QUALITY

This section of the EIR addresses the potential impacts on hydrology and water quality from the development of the proposed ECI Project. It includes an assessment of the effects of the project on on-site and off-site groundwater resources, surface water resources, campus drainage patterns, erosion and sedimentation. Information was obtained primarily from the following geologic, hydrogeologic and drainage plans and studies of the project site, the UC Santa Cruz campus and nearby areas:

- Aley and Weber & Associates, 1994. Results of a Groundwater Tracing Study – UC Santa Cruz
- Bowman & Williams, 1995. Pogonip Storm Drainage Study for City of Santa Cruz, County of Santa Cruz and University of California, Santa Cruz
- Johnson and Weber & Associates, 1989. Evaluation of Groundwater Resources at UCSC
- Kennedy/Jenks Associates 2004. UC Santa Cruz Storm Water and Drainage Master Plan
- H.T. Harvey 2008. Wildlife Surveys and Waters of the U.S. Assessment. U.C. Santa Cruz East Campus Infill Housing, Chinquapin Road Parking Lot, and Chinquapin Road Widening Projects
- Kennedy/Jenks Associates, 2009. UCSC ECI-Project Site Stormwater Calculations (included in Appendix E of this EIR)
- Nolan Associates, 2000. Geologic, Hydrologic and Groundwater Resource Assessment for the North Campus Planning Area – Santa Cruz Campus

This section provides project-level analysis and additional detail regarding hydrology and water quality and, pursuant to Section 15152 of the CEQA Guidelines, supplements and augments the analysis provided in Section 4.8, Volume II of UC Santa Cruz' 2005 LRDP EIR.

Public comments related to hydrology and water quality received during the scoping period of this EIR requested that the EIR address the following issues:

- Impacts on streams and creeks on and below the east side of campus.
- Impacts on surface and groundwater quality and availability.
- Drainage and flood control
- Campus compliance with federal and state regulations for management of wastewater and runoff
- Increased runoff and potential for increased erosion on- and off-campus from increase in impermeable surfaces (roofs, walkways, roadways)
- Potential for construction during the rainy season to create soil erosion
- Consistency of project storm water management with new standards called for in UC Santa Cruz Draft Storm Water Management Plan
- Cumulative effects on degradation of water quality and watersheds through increased volume or intensity of storm water runoff

All of these issues are addressed in the analysis in this section.

3.8.1 Setting

See 2005 LRDP EIR Section 4.8.1 for a comprehensive discussion of the hydrology and water quality setting of the entire campus. The hydrology and water quality setting for the proposed ECI Project is described below.

3.8.1.1 Regulatory Context

Water quality objectives for all California waters are established under the Federal Clean Water Act (CWA) and California's Porter-Cologne Water Quality Control Act. Discharges to surface or groundwater are also covered by regional basin plans. These regulations are described below.

Clean Water Act

The CWA (United States Code, Title 33) requires the EPA to establish effluent limitations for municipal sewage plant and industrial facility discharges. The CWA provides for two types of pollution control limits:

- Limits to the quantity of pollutants discharged from a point source such as pipe, ditch, or tunnel into a navigable body of water. These limits are established through a nationwide assessment of what is technologically and economically feasible with respect to pollution control for a particular industry.
- Ambient water quality standards for navigable waters of the United States that are based on beneficial uses and require more stringent control of discharge if necessary to achieve water quality objectives. For example, the EPA sets water quality limits to control pollution discharged to waters designated by the states for beneficial uses including drinking, fishing, or recreation.

In addition to these point source and ambient water quality control limits, Section 319 of the CWA provides direction for state regulation of nonpoint source discharges. Nonpoint source pollution comes from diffuse sources such as urban runoff, agricultural runoff, or construction site runoff. This section requires each state to submit a report that identifies: navigable waters that are expected to achieve applicable water quality standards or goals; categories of nonpoint or specific sources that add significant pollution to contribute to non-attainment of water quality standards or goals; and a process to develop best management practices (BMPs) and measures to control each category of nonpoint or specific sources. Each state is then required to develop a management program that proposes to implement the nonpoint source control program.

Section 303(d) of the CWA requires states to identify waters that are not expected to meet water quality standards after effluent limitations for point sources are implemented, develop a priority ranking to determine the order in which Total Maximum Daily Load (TMDL) should be developed for these impaired water bodies, and determine the TMDLs of specific pollutants that may be discharged into the water body. TMDLs are developed as part of a program to examine water quality problems, identify sources of pollutants, and specify actions that create solutions.

The primary method by which the CWA imposes pollutant control limits is the National Pollutant Discharge Elimination System (NPDES) permit program established under Section 402 of the act. Under the NPDES program, any point source discharge of a pollutant or pollutants into any waters of the United States is subject to a permit. In California, the state's Regional Water Quality Control Boards (RWQCBs) are responsible for administering the NPDES program. The NPDES program was initially established to regulate the quality of effluent discharge from wastewater treatment plants. Through the NPDES Waste

Discharge Requirements, the RWQCB sets limits on the levels of pollutants that may be discharged into navigable waters of the United States. The limits are designed to meet the water quality objectives established in the Basin Plan.

The 1972 amendments to the CWA prohibit the discharge of pollutants to navigable waters from a point source unless the discharge is authorized by an NPDES permit. In 1987, in recognition that diffuse, or nonpoint, sources were significantly impairing surface water quality Congress amended the CWA to address nonpoint-source storm water runoff pollution in a phased program requiring NPDES permits for operators of municipal separate storm sewer systems (MS4s), construction projects and industrial facilities. Phase I, promulgated in 1990, required permits for facilities of these types generally serving populations over 100,000, construction permits for projects disturbing 5 acres or more of land, and industrial permits for certain industries. UC Santa Cruz construction projects that disturb more than 5 acres are regulated under the Phase I NPDES rule.

The Phase II NPDES program, which was promulgated in 1999, expands on the Phase I program by requiring operators of small MS4s in urbanized areas and operators of small construction sites, through the use of NPDES permits, to implement programs and practices to control polluted storm water runoff. Under Phase II, the State Water Resources Control Board (SWRCB) has issued three general permits: (1) Municipal permits – required for operators of small MS4s, including universities, (2) Construction permits – required for projects involving one acre or more of construction activity, and (3) Industrial permits. The municipal permit requires development and implementation of a Storm Water Management Program (SWMP). The purpose of the SWMP is: (1) to identify pollutant sources potentially affecting the quality and quantity of storm water discharges; (2) to provide Best Management Practices (BMPs) for municipal and small construction activities; and (3) to provide measurable goals for the implementation of the SWMP to reduce the discharge of the identified pollutants into the storm drain system and associated water ways. The goal of the SWMP is to reduce the discharge of pollutants to the Maximum Extent Practicable (MEP), as defined by the EPA. "Minimum Control Measures" (MCMs) is the term used by the EPA for the six MS4 program elements aimed at achieving improved water quality through NPDES Phase II requirements.

The SWRCB's general permit for construction activities requires that for projects that disturb more than one acre of soil, a Storm Water Pollution Prevention Plan (SWPPP) be developed and implemented. The SWPPP must identify potential sources of pollution and describe runoff controls that will be implemented both during construction and after the building is complete.

Porter Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1969 authorized the SWRCB to provide comprehensive protection for California's waters through water allocation and water quality protection. The SWRCB implements the requirement of CWA Section 303 that water quality standards be set for certain waters by adopting water quality control plans under the Porter-Cologne Act. In addition, the Porter-Cologne Act established the responsibilities and authorities of the nine RWQCBs, which include preparing water quality plans for areas within the region (Basin Plans), identifying water quality objectives, and issuing NPDES permits and Waste Discharge Requirements (WDRs). Water quality objectives are defined as limits or levels of water quality constituents and characteristics established for reasonable protection of beneficial uses or prevention of nuisance. NPDES permits, issued by RWQCBs pursuant to the CWA, also serve as WDRs issued pursuant to the Porter-Cologne Act. WDRs are also issued for discharges that are exempt from the

CWA NPDES permitting program, discharges that may affect waters of the state that are not waters of the United States (i.e., groundwater), and/or wastes that may be discharged in a diffused manner. WDRs are established and implemented to achieve the water quality objectives (WQOs) for receiving waters as established in the Basin Plans, as described below. Sometimes they are combined WDRs/NPDES permits.

In 2006, the SWRCB issued Order No. 2006-0003-DWQ, State General Waste Discharge Requirements for Sanitary Sewer Systems. This Order prohibits sanitary sewer overflows that result in discharge of untreated or partially treated wastewater to waters of the U.S. and discharges of untreated or partially treated wastewater that create a nuisance. All sanitary sewer overflows must be reported to the RWQCB. All public agencies that own or operate a sanitary sewer system that is comprised of more than one mile of pipes or sewer lines which conveys wastewater to a publicly owned treatment facility must apply for coverage under the Sanitary Sewer Order. Each of these public agencies must develop and implement a Sewer System Master Plans (SSMP) that includes provisions for proper and efficient management, operation and maintenance of sanitary sewer systems to reduce and prevent sanitary sewer overflows, and a spill response plan. UC Santa Cruz owns and operates more than one mile of sewer pipeline and therefore is subject to this requirement.

Central Coast Regional Water Quality Control Plan

The UC Santa Cruz campus is within the jurisdiction of the Central Coast (CC) RWQCB (Region 3). The CCRWQCB has the authority to implement water quality protection standards through the issuance of permits for discharges to waters located within its jurisdiction. Beneficial uses of inland surface waters and water quality objectives for the region are specified in *The Water Quality Control Plan for the Central Coast Basin* ("Basin Plan") prepared by the CCRWQCB in compliance with the federal CWA and the State Porter-Cologne Water Quality Control Act. The objective of the Basin Plan is to show how the quality of the surface and ground waters in the Central Coast Region should be managed to provide the highest water quality reasonably possible. The RWQCB implements the Basin Plan by issuing and enforcing waste discharge requirements to individuals, communities, or businesses whose waste discharges can affect water quality. These requirements can be either State WDRs for discharges to land, or federally delegated permits for discharges to surface water. The CCRWQCB has issued TMDLs for nitrate and sediment in the San Lorenzo River watershed in order to restore beneficial uses within the watershed.

City of Santa Cruz Wastewater Discharge Permit

The Campus discharges wastewater to the City's sewer system under a waste discharge permit issued by the City. The permit specifies effluent limitations that apply to all dischargers and as well as certain specific limitations for the campus. It also requires that the Campus collect and analyze samples for prescribed components on a quarterly basis. Over the course of its monitoring history, the Campus has generally been in compliance with the effluent limits. There have been a few exceedances in the past 15 years: one for silver in 1991, and two exceedances for oil and grease in 1995 and 2002. All exceedances were promptly remedied and the Campus has not had an exceedance since 2002 (Blunk 2009).

Campus Storm Water Management Program

Under the Phase II NPDES storm water program, UC Santa Cruz is required to prepare and implement a SWMP. In April 2004, the Campus submitted a first draft of its SWMP to the CCRWQCB. In September 2008, after several rounds of review and revision, the Campus submitted a Final Draft SWMP, which was posted by the CCRWQCB for public review from November 4, 2008 to January 5, 2009. The Campus anticipates the SWMP will be approved in March 2009.

In addition to the six Minimum Control Measures (MCMs) mandated by EPA, the UC Santa Cruz Final Draft SWMP includes an MCM that identifies measures specific to UC Santa Cruz. The BMPs in MCM #7 include but are not limited to the proposed storm water infrastructure improvements, measures to encourage alternative transportation, and storm water-related research. Because a portion of the eastern side of the campus drains to the San Lorenzo watershed, and the San Lorenzo River has been designated under the Clean Water Act as an impaired water body for sediment and pathogens, the SWMP includes restrictions intended to improve water quality in the San Lorenzo. These restrictions apply to activities throughout the campus, regardless of watershed.

The BMPs included in the SWMP are to be implemented by UC Santa Cruz staff and construction contractors and, to a lesser extent, by students, faculty and other members of the UC Santa Cruz community. Whenever UC Santa Cruz staff or contractors perform work at UC Santa Cruz, steps outlined in each relevant BMP, or other proven techniques that reach the same goal, must be used in order to ensure compliance with storm water management regulations. UC Santa Cruz has already initiated many of the listed BMPs. However, full development and implementation of BMPs will be completed following approval of the final SWMP through a 5-year implementation plan that will be included in the SWMP.

For campus construction projects, the Campus Standards Handbook is the equivalent of municipal building codes and ordinances. The University has an extensive plan review process to ensure that project design conforms to the Campus Standards. Construction contract administration procedures and on-site University inspectors ensure that construction conforms to the approved plans and specifications.

Primary control of construction sites belongs to the contractor during construction; UC Santa Cruz uses the construction contract document package, which is a legally binding document between the contractor and UC Santa Cruz, to ensure that adequate storm water controls are in place. Language in the standard campus contract specifications requires contractors to control erosion and sediment and construction site waste is incorporated into the SWMP and the construction contract. The University has an extensive plan review process to ensure that project design conforms to the Campus Standards. Construction contract administration procedures and on-site University inspectors ensure that construction conforms to the approved plans.

The Final Draft SWMP commits the Campus to adopting, in the first year after the SWMP is approved, specific design standards to provide source control for potential contaminants such as sediment, oil and grease, and bacteria that area typically found in urban runoff. Under the SWMP, the Campus will be required to develop design criteria for storm water management systems for new development to control hydromodification[1] and protect the biological and physical integrity of the University's individual watersheds. In addition, new development projects will be required to maximize infiltration on-site and approximate natural infiltration levels to the maximum extent practicable and to implement applicable low-impact development (LID) strategies. LID is an approach to storm water management that manages storm

[1] Hydromodification is defined as any activity that increases the velocity, volume or timing of runoff. Such activities include urbanization or other land use changes that result in increased stream flows and changes in sediment transport, as well as alteration of stream and river channels, installation of dams and water impoundments, and excessive stream bank and shoreline erosion.

water at the source rather than conveying if off site, by integrating site hydrologic and environmental functions into the development design. By minimizing directly connected impervious area and promoting infiltration, LID features such as vegetated roofs, bioswales, and bioretention areas, and pervious pavement, mimic natural hydrologic conditions to counteract the hydrologic effects of development. For example, LID strategies focus on disconnecting roofs and paved areas from traditional drainage infrastructure and instead conveying runoff to bioretention areas, swales, and vegetated open spaces. LID also strives to prevent the generation of runoff by reducing the impervious footprint of a site, thereby reducing the amount of water that flows off site, and that requires treatment to remove pollutants. The end hydrological results are a reduction in runoff volume, an increased time of concentration, reduced duration and peak rate of flows, and improved water quality. Because more water is retained on-site and in distributed facilities, the rate of discharge is less critical for LID facilities, since different facilities will discharge into the stream system at different times.

Campus Sanitary Sewer Master Plan

UC Santa Cruz is developing and implementing a Sewer System Management Plan (SSMP) pursuant to State Water Resources Control Board Order 2006-0003, Statewide General Waste Discharge Requirements for Sanitary Sewer Systems. The goal of the UCSC SSMP is to provide a plan and schedule to properly manage, operate, and maintain all parts of the sanitary sewer system. This will help reduce and prevent sanitary sewer overflows (SSOs), as well as mitigate potential impacts of any SSOs that do occur. The development process began in summer 2007 and the SSMP is expected to be complete by August 2009. Since May 2007, UC Santa Cruz has reported SSO's electronically to the California Integrated Water Quality System (CIWQS).

3.8.1.2 Local and Regional Context

Physiography and Climate

The campus is located within the Big Basin Hydrologic Unit, as defined by the RWQCB. The UC Santa Cruz campus slopes upward in a series of marine terraces from an elevation of 300 feet at its southern boundary on High Street to an elevation of about 1,200 feet at its northwestern boundary. The average north-south gradient is slightly more than 5 percent. Along the eastern and western flanks of the campus and along the numerous stream drainages that cross the campus, gradients generally range from about 25 to about 70 percent.

Rainfall levels vary considerably on campus with elevation; the lower campus receives an average of 30 inches of rainfall annually, while the upper campus receives 40 to 45 inches or more (Johnson and Weber & Associates 1989). Average evapotranspiration[2] is estimated to be 19.7 inches per year (Johnson and Weber & Associates 1989).

Surface Water Drainage

The campus is drained through both surface and subsurface drainages that originate within the campus boundaries. The assignment of surface water runoff to a particular watershed is based on topographic

[2] Evapotranspiration refers to the loss of water by evaporation from soil and transpiration from plants.

features of the campus; however, flows captured by the karst aquifer or by the campus storm water drainage system may be transferred from one watershed to another.

The geology of the northern one-third of the campus consists of weathered schist and granitic rocks, which are overlain in some areas by thin (5- to 30-feet thick) remnants of Santa Margarita sandstone and marine terrace deposits. The topographic surfaces in most of this portion of the campus are broad and gently sloping. Surface drainage from these areas occurs as overland flow and rills. Drainage divides are poorly defined, but surface flow eventually collects in a few well-defined drainages along the margins of the flats. The dispersed surface flow encourages percolation of rainwater, recharging a shallow groundwater system which in turn feeds springs and seeps located along the southern and eastern edge of the north campus.

The hydrologic system of the upper and north campus is dominated by broad, gently sloping topographic surfaces where surface drainage occurs as overland flow and rills. Drainage divides are poorly defined, but surface flow eventually collects in a few well-defined drainages along the margins of the flats. The dispersion of surface flow encourages infiltration of rainwater, recharging the shallow groundwater system, which in turn feeds springs and seeps located throughout the area. Many forest springs are perennial (i.e., flow throughout the year) during years of average rainfall. Surface runoff toward the south and west eventually enters the karst (marble) aquifer system of the central and lower campus via Cave Gulch, Moore Creek and Jordan Gulch. Surface flow toward the east enters tributary drainages of the San Lorenzo River system.

The southern two-thirds of the campus is underlain by marble and schist bedrock overlain by deposits of residual soils and colluvium. Karst topography has developed in these areas as a result of the dissolution of marble along faults and fractures. Sinkholes, sinks, closed depressions and swallow holes caused by subsidence or collapse of subsurface solution cavities in karst terrain are collectively known as dolines, which are a fundamental feature of karst topography (Bloom 1978). Karst topography is characterized by: (1) a relative absence of surface streams and drainage channels, with most precipitation discharging to the subsurface through fractures, and (2) the presence of sinkholes, closed depressions, and swallow holes (i.e., the location in karst limestone at which a surface stream goes underground [Sweeting 1973]).

Very little storm water from the central and lower campus is conveyed by surface streams to channels downstream of the campus. Instead, storm water is captured by the karst aquifer, stored and transmitted via solution channels, and discharged in springs at lower elevations to the east, south and west of the campus. The marble area on campus contains more than 50 sinkholes which appear to capture as much as 40 percent of campus runoff.

Three watersheds, Cave Gulch, Moore Creek and Jordan Gulch, drain approximately 1,100 acres in the central portion of the campus. All three stream channels are aligned north-south and are controlled by the major geologic fracture systems on the campus. Cave Gulch, which drains most of the northwestern portions of the campus, joins Wilder Creek immediately west of the campus. Moore Creek, which drains the central portions of the campus, discharges into Antonelli Pond near the coast. Jordan Gulch drains the central and eastern portions of the campus (Figure 3.8-1). Most of the flow in Moore Creek and Jordan Gulch is captured by swallow holes in the lower campus, even during extreme storm events.

Areas of the campus not drained by the three major watersheds are drained by a number of creeks and gullies that originate along the campus boundary. Much of the western boundary of the campus, including portions of the upper and north campus, is drained by Wilder Creek. Runoff from the southern campus flows into four small drainages: a western tributary of Moore Creek that joins to Moore Creek downstream from the UC Santa Cruz campus boundary; Arroyo Seco; the City storm water drainage system on High Street; and Kalkar Quarry Pond (a spring-fed pond occupying a former marble quarry). The eastern boundary of the campus is in the San Lorenzo River watershed; the southeastern portion of the campus drains to a series of hillslope drainages within the San Lorenzo River watershed, designated as gullies A through H.

Natural drainages are the primary means used to manage storm water runoff on the campus. Within the developed portions of the campus, storm drains have been installed to capture and convey storm water. These are generally small systems that locally capture runoff and convey it to detention basins from which the water is then discharged into the nearest drainage through culverts of lined ditches. Since 1989, new construction has included detention and sediment filtration facilities to detain excess runoff and slowly release runoff at predevelopment rates in order to avoid increasing peak flows and to remove suspended sediment. In some areas with older development, the collected water is discharged without detention.

Groundwater Conditions

Regional

The UC Santa Cruz campus is roughly divided into two hydrogeologic systems: upper/north campus system and central/lower campus system. These two hydrogeologic systems are closely associated with campus geology (i.e., rock types, faults and fracture zones). Each of these systems is discussed below.

Upper/North Campus

The upper/north campus hydrogeologic system (generally north of McLaughlin Drive) includes shallow water-bearing zones of moderate permeability consisting of Santa Margarita sandstone and weathered schist and quartz diorite (a granitic rock), which overlie relatively impermeable unweathered schist and granitic rocks. Depth to groundwater throughout most of the north campus ranges from about 2 to 16 feet below ground surface (bgs) (Nolan Associates 2000). The shallow groundwater system is recharged through the infiltration of rainfall into the permeable sandstone and weathered schist and granitic rocks. The springs and seeps bordering the north campus at higher elevations originate from shallow aquifers within thin layers of Santa Margarita sandstone and the schist and granitic basement rocks, which intersect steep slopes along the San Lorenzo River drainages.

Central/Lower Campus

An extensive underground drainage network of subterranean caverns and channels has formed in the central and lower campus through the dissolution of marble by groundwater. The locations of the subsurface channels are predominantly governed by bedrock fractures that provide zones where water can penetrate, weather and dissolve the rock, eventually widening the fractures. Dissolution of the marble can only take place where water can flow. Nonfractured, crystalline marble will not be readily weathered or dissolved, because unlike sandstone, for example, it does not have space between grains (inter-granular porosity) that would allow water penetration in any appreciable amounts. Much of the marble on campus is dense and has no inter-granular porosity or permeability. Nonfractured areas in between areas of fractured limestone are typically dry (Johnson and Weber & Associates 1989).

The two main underground channels on the campus lie beneath Jordan Gulch and Moore Creek, where they coincide with two north-south trending fault/fracture systems. In addition, there are several east-west fractures in the central and southern portions of the campus (Johnson and Weber & Associates 1989; Weber and Associates 1994). Underground channels are inferred to be present along the alignments of these fractures. Groundwater from the campus discharges to surface water in the surrounding areas by way of numerous springs and seeps feeding drainages in the San Lorenzo River watershed to the north and east of the campus; the Cave Gulch and Wilder Creek watersheds to the west of the campus; and the Moore Creek, Arroyo Seco, and Jordan Gulch/Neary Lagoon watersheds south to southwest of the campus.

Water in the karst aquifer is of excellent quality and has the potential to supply a portion of the campus' water demand (URS 2008; Weber Hayes & Associates 2007). However, groundwater is not extracted on the campus for any purpose at this time and the Campus depends on the City's domestic water supply for both domestic and irrigation water. Surface streams fed by some of the springs are used by owners of neighboring properties for recreation and landscape irrigation (Johnson and Weber & Associates 1989). A clubhouse in the Pogonip City Park, which has not been in use in more than 15 years, historically had used springs in the Pogonip as a water supply.

Surface Water and Groundwater Quality

Since 1989, water quality monitoring has been conducted annually at one groundwater well, four spring and surface water locations, and three parking lots (including the Crown/Merrill parking lot). The samples are analyzed for general mineral, physical and inorganic constituents; parking lot samples are also analyzed for petroleum hydrocarbons. The analytical results are compared against performance criteria (e.g., water quality standards, guidelines, and benchmarks) and the beneficial uses identified for the surface water bodies on and near the campus. As discussed in the 2005 LRDP EIR (Section 4.8.1.8) the historical water quality data does not indicate an increase in urban runoff pollutants over time in the waters that are sampled.

3.8.1.3 Site Characteristics

Existing Surface Water Drainage Patterns

With the exception of the 0.64 acre area at the western edge of the site, which drains to Jordan Gulch, the project site is within the San Lorenzo watershed, in the San Lorenzo-Pogonip sub-watershed. Surface runoff from the larger portion of the project site, which is in the San Lorenzo watershed, drains to Gully H, one of several drainage swales that originate on the campus and carry flows into the Pogonip City Park. The San Lorenzo River, which discharges to Monterey Bay, lies approximately 2.2 miles southeast of the campus. As discussed in the 2005 LRDP EIR (Section 4.8.1.3), the San Lorenzo watershed encompasses an area of approximately 87,000 acres, of which approximately 510 acres are on the UC Santa Cruz campus.

The San Lorenzo – Pogonip sub-watershed drains most of the eastern portion of the campus east of Hagar Drive, from north of the Crown/Merrill Apartments south to the southern boundary of the campus. The sub-watershed is divided into eight sub-areas, each associated with one of the gullies (gullies A through H) that drain to the east. The southernmost sub-area, which includes the East Remote parking lot and the East Field area, is drained by sinkholes. Some of the runoff in the other sub-areas, including Gully H, percolates into permeable hillslopes along the boundary between the campus and the Pogonip.

Runoff that drains to the subsurface via sinkholes on campus contributes to several springs located south and east of the campus. The two surface streams in the Pogonip, Redwood Creek and Pogonip Creek, are fed by springs that discharge groundwater derived at least in part from campus runoff. Gully H is in the surface watershed of Redwood Creek, which flows to the San Lorenzo River (Johnson and Weber & Associates 1989). However, as shown by a dye tracing study conducted by the campus in 1992, runoff on campus can travel by way of subsurface flow from one surface watershed to another. For example, dye injected into the East Remote sinkhole, which receives runoff from Gully B, was detected in several springs to the south of campus (in the Moore Creek, Jordan Gulch, High Street and Kalkar Quarry watersheds) (Aley 1994).

Gully H has a tributary area of approximately 40 acres (Kennedy/Jenks 2004). UC Santa Cruz development in the Gully H watershed consists of Crown/Merrill Apartments and portions of Merrill and Crown Colleges, including Parking Lot 111 and portions of the fire station. The uppermost portion of Gully H is a well-defined, steeply sloping channel. Near the Lime Kiln Trail that runs near the eastern boundary of the UC Santa Cruz property, Gully H is a very small swale with no clearly defined bank. There is no culvert beneath this trail/access road, which suggests that surface flows in Gully H at this location are minimal (H.T. Harvey 2008). East of the UC Santa Cruz property boundary line, in Pogonip Park, Gully H becomes a continuous and well defined channel known as Redwood Creek, which is fed by springs as well as surface runoff. Redwood Creek drains into the San Lorenzo River approximately one mile east of and several hundred vertical feet below the campus boundary. Although some of the flow in Gully H percolates to the subsurface before reaching Redwood Creek, in large storm events surface runoff from the campus may flow overland to the creek (Johnson and Weber & Associates 1989).

Runoff from the three terraces of Parking Lot 111 is discharged by way of a series of subsurface storm water pipes and asphalt and concrete swales to an outfall at the head of Gully H**.** In addition to the runoff from these parking lots, runoff from a portion of Crown/Merrill Apartments, two of the three parking lots north of Crown/Merrill Apartments, and the northeast portion of Crown College (including the Dining Commons) are also piped and channeled to this outfall (Figure 3.8-2). Runoff from rooftops and pavement in the northern portion of Merrill College (to the south of Gully H) and the remainder of the runoff from Crown/Merrill Apartments and the parking lots to the north discharge to the banks of Gully H at a series of smaller outfalls along the northern and southern slopes of the drainage.

An area of 0.64 acres at the southwest corner of the project site, including the Crown College Preceptors' Apartment, drains toward Chinquapin Road. A portion of this runoff is captured in a drainage inlet in Chinquapin Road and discharges to the east fork of Jordan Gulch. The remainder of the runoff flows overland down Chinquapin, partly on the road surface and partly in a shallow ditch along the east side of the road, to storm drain inlets on McLaughlin that discharge to the main stem of Jordan Gulch below Quarry Plaza.

The east fork of Jordan Gulch, which is fed by springs north of Colleges Nine and Ten, flows toward the south between Crown College and College Nine west of Chinquapin Road, and terminates in the McLaughlin sinkhole immediately above McLaughlin Drive. The drainage area of the east fork is approximately 30 acres. The McLaughlin sinkhole appears to have a very low infiltration capacity as a result of fine-grained sediments that appear to have been deposited in the sinkhole as a result of historic land uses associated with the lime industry (Kennedy/Jenks 2004). During winter storms, water ponds in the sinkholes. In large storm events the level of the ponded water can exceed the level of the inlet to the culvert beneath McLaughlin Drive and the water can spill into the main stem of Jordan Gulch.

Erosion Potential

As discussed in detail in the 2005 LRDP EIR (Section 4.8.1.3), the potential for erosion by storm water runoff is generally high in the central campus as a result of steep gradients and the presence of fractured rocks, and soils that are highly susceptible to erosion. Historical uses, including logging, quarrying, and grazing that occurred prior to development of the UC Santa Cruz campus, disturbed the natural vegetation and landscape, thereby increasing erosion and sedimentation rates within the campus watersheds. The potential for erosion on the central and lower campus has been exacerbated by the addition of impervious surface as the central campus has developed over the years.

Since 1989, the construction of detention systems as part of new development on campus has helped to reduce slope erosion and the rates at which runoff flows to off-campus areas; however, detention systems do not address runoff from development constructed before 1989. Unprotected trunk channels have been adversely affected by erosion and sedimentation.

All of the existing development within the Gully H sub-watershed was constructed before 1989, and the storm water drainage systems in this area, therefore, do not include any detention. Channel conditions in the San Lorenzo–Pogonip watershed, including the campus portion of the watershed, vary from location to location but are in general fair to poor. The campus's Storm Water and Drainage Master Plan (Kennedy/Jenks 2004) identified two areas with existing erosion conditions in Gully H. The first area (GH-A) was approximately 200 feet downstream of the easternmost existing parking lot on the project site and was characterized by several active knickpoints[3] between 1 and 2 feet in height. The second area (GH-B), approximately 200 feet downstream of GH-A, was characterized as a steep, actively eroding gully on the valley slope, caused by concentrated runoff from a residence hall and parking area within Merrill College. The Storm Water and Drainage Master Plan recommended two improvements to address these erosion conditions: 1) installation of a detention vault in the lower terrace of Parking Lot 111 to reduce peak flows to Gully H; and 2) extension of the culvert that discharges runoff onto the slope above Gully H from the Merrill College residence halls, and installation of an energy dissipation apron at the end of the culvert.

There are existing erosion problems in the main stem of Jordan Gulch between Quarry Plaza and the junction with the Middle Fork of Jordan Gulch, approximately 1,300 feet downstream; below that junction, the main stem is in good condition (Kennedy/Jenks 2004). This outfall receives a mix of detained and undetained runoff from the Jordan Gulch watershed, including portions of McLaughlin Drive, Chinquapin Road, Crown College, and Quarry Plaza. As recommended by the 2004 Campus Storm Water Drainage and Master Plan (Kennedy/Jenks 2004), the campus is beginning to implement the suggested projects in Jordan Gulch as part of the previously-approved Infrastructure Improvements Project (IIP) Phase 1. A portion of the runoff (up to approximately 13 cubic feet per second [cfs] in a 2-year storm) that currently discharges to the outfall south of Quarry Plaza will be diverted to the Upper Quarry sinkhole. A second improvement project would divert approximately 5 cfs from the Middle Fork of Jordan Gulch to the Upper Quarry sinkhole. The campus Storm Water and Drainage Master Plan identified the Upper Quarry sinkhole as one location with capacity for infiltration of additional runoff, and recommended the diversion. The IIP Phase 1 was approved in February 2007. Construction of the Phase 1 storm water drainage improvements, including the Middle Fork and Upper Quarry diversions, is scheduled for construction in summer 2009.

[3] A knickpoint is an abrupt discontinuity in the slope of a channel bed.

3.8.2 Relevant Project Characteristics

Development of the proposed project would increase the impervious surface area (pavement or buildings with traditional roofs) on the 3.1-acre ECI Project site, from 0.88 acre to 1.63 acres. The remainder of the site surfaces would be pervious, including 0.26 acre of pervious concrete, and 0.13 acre of green/living rooftop, in addition to traditional landscaping, bioswales, and bioretention areas. The storm water management system for the proposed project includes a series of detention and bioretention features that would reduce the volume and rate of runoff leaving the site while improving the water quality through biofiltration. To avoid concentration of runoff~~ to the filled doline beneath the existing parking lot, which could potentially result in reactivation of this feature,~~ adjacent to the buildings, the proposed storm water management features would be lined with impermeable barriers; the other retention areas would not be lined ~~(Pacific Crest Engineering 2008b)~~. These features are illustrated in Figures 3.8-3 and 3.8.4 and described below.

The 0.13-acre (5,750-sf) green/living roof would be located on the eastern portion of Building B. The vegetated roof would consist of a waterproof membrane, an "egg-crate" water retention layer, a root barrier, a growing medium consisting of an engineered blend of inorganic and organic contents, and highly drought-resistant ground cover plants. The depth of the soil profile is limited to 8 inches to minimize the impact on the structural system of the building. The green roof would slow down the concentration of storm water flows from the rooftop. The evapotranspiration of some of the water retained in the soil profile would reduce the total volume of runoff from the roof, and the soil and vegetation would absorb pollutants. In large storm events, when the rainfall on the vegetated roof exceeds the capacity of the soil and vegetation to hold water, the excess flows would overflow down roof leaders and be directed to the bioretention/bioswales and rain gardens adjacent to the building and in the plaza.

Bioretention bioswales and rain gardens adjacent to Building B and in the plaza would consist of an impervious liner, a 6-inch layer of drain rock, and 18 inches of engineered soil. These features would provide initial storm water quality treatment for runoff from the traditional, impervious roofs on Building A and a portion of Building B. These would also provide some reduction in runoff volume through evapotranspiration. In large storms, the excess runoff to these features would be collected in perforated piping within the drain rock, and piped to the ~~bioretention~~ landscaped area east of Building B or to underground detention vaults.

Pervious paving in the plaza adjacent to Building B would be a mixture of porous concrete and open-jointed pavers. The porous concrete would consist of 8 inches of porous concrete underlain by 6 inches of drain rock, and an underdrain system. ~~The pervious pavement system would be lined with an impervious liner to prevent saturation of the subgrade soils.~~ The underdrain system would drain the overflow storm water via pipe to the bioretention area northeast of the plaza.

The Campus is considering two options for management of runoff ~~that reaches the bioretention area northeast of the plaza~~ discharged to Gully H. Under Option 1, a passive irrigation system would be installed beneath a ~~landscaped open space~~ bioretention area east of Building B. In this system, storm water runoff would infiltrate through the landscaping and would be stored in a sand profile underlain by an impervious liner. As the surface soil dries, water retained in the sand layer would be drawn into the root zone through capillary action. In the 2-year, 5-year and 10-year design storms, excess storm water would be stored in underground tanks below the bioretention area. The tanks would be designed to hold the volume of runoff in excess of the estimated runoff volume for these design storms under pre-development (i.e., pre-UC Santa Cruz development) conditions. The water stored in these tanks would be discharged to the culverts that run beneath the two lower terraces of Parking Lot 111 to the existing outfall at the head of Gully H. However, this system could also be designed to circulate a portion of the water back into the bioretention area as the sand dries out, where it would be available to the plants.

Under Option 2, the ~~bioretention area~~ landscaped area east of Building B would consist of conventional landscaping and would not include a passive irrigation system. Instead, runoff ~~filtered through the bioretention area~~ would be stored in underground tanks that would discharge to two 5,000-gallon cisterns. The cisterns would store runoff for use in landscape irrigation, which would offset a small portion of the project's irrigation water demand. The underground tanks would be sized to contain the excess runoff from the 2-year, 5-year and 10-year storms. Overflow in excess of the 10-year design storm beyond the capacity of the cisterns would discharge to Gully H through the culverts beneath the lower parking lot terraces.

Under both options, the rate of runoff discharged to the culvert would not exceed 10 percent of the estimated flow for the 2-year design storm under pre-development (i.e., pre-UC Santa Cruz) conditions. The rationale for selecting this discharge rate is discussed in Section 3.8.3.3, in the discussion of ECI Impact HYD-2. The size of the underground tanks would depend on which option is selected and on details of the design of the bioretention area but would be approximately 10,000 to 13, 000 gallons.

In addition to the storm water management system for the proposed project, the project would implement two improvements to address the existing erosion conditions in Gully H identified in the 2004 Campus Storm Water and Drainage Master Plan. As discussed in Section 3.8.1.3, above, the 2004 Storm Water Master Plan recommended two improvements in the Gully H watershed: 1) installation of a detention vault in the lower parking lot to reduce peak flows to Gully H; and 2) extension of the culvert discharging runoff onto the slope above Gully H from the Merrill College residence halls, with an energy dissipation apron at the end. To implement the first of these recommendations, the proposed project would construct detention tanks on the project site (rather than in the lower parking lot) to reduce peak flows from existing development in the Gully H watershed. The detention tanks would discharge to the proposed bioretention area, which would provide treatment to remove pollutants from this runoff. The Campus has determined that the second of the two recommendations is no longer required, as erosion is no longer evident at the outfall from the residence halls.

3.8.2.1 Applicable LRDP Mitigation Measures

The following, previously adopted, 2005 LRDP EIR mitigation measures are applicable to and incorporated into the proposed project:

HYD-2B: No grading shall be conducted on hillsides (sites with slopes greater than 10 percent) during the wet season (October 1 through May 31) unless controls that prevent sediment from leaving the site are implemented. Erosion control measures, such as erosion control blankets, seeding, or other stabilizing mechanisms shall be incorporated into the project erosion control plan or SWPPP and applied to graded hillsides prior to predicted storm events.

HYD-3A: The Campus shall install additional signs and expand the public education program to inform and educate the campus population about the importance of staying on paved roads and approved paths to prevent vegetation disturbance and soil erosion.

HYD-3C: Each new capital project proposed under the 2005 LRDP that creates new impervious surface shall include design measures to ensure that post-development peak flows from 2-, 5- and 10-year storms do not exceed the 2-, 5-, and 10-year pre-development peak flows and that post-development peak flows from a 25-year storm do not exceed the pre-development peak flow from a 10-year storm.

As described below in Section 3.8.3.3, in the discussion of ECI Impact HYD-2, the new ECI Mitigation HYD-2 will be implemented in lieu of LRDP Mitigation HYD-3C, to provide a more effective and applicable performance standard.

HYD-3D: The Campus shall require each new capital project to include design measures to minimize, to the maximum extent practicable, the increase in the volume of storm water runoff discharged from the project site to sinkholes or natural drainages. These design measures shall include features that maximize infiltration and dissipation of runoff, preferably near the area where new runoff is generated, and may include, but will not be limited to: vegetated swales, bioretention areas, infiltration trenches and basins, level spreaders, permeable pavement, minimizing directly connected impervious surfaces, storage and re-use of roof runoff, and green roofs. Within one year following approval of the 2005 LRDP, the Campus shall provide a protocol for design consultants to use in demonstrating that measures to reduce runoff are included in the project design to the maximum extent practicable.

HYD-5B: For projects involving construction on karst, if: (a) groundwater is encountered beneath the building site during the geotechnical investigation, and (b) the proposed foundation type would require pressure grouting, the Campus will follow the procedures outlined below:

- Perform a dye tracing study to determine if there is a potential for pressure grouting to affect water quality in springs and seeps around the UC Santa Cruz campus. If a potential impact is indicated, alternative building foundation plans will be considered.
- As an alternative, the Campus may conduct a preliminary hydrogeological study to evaluate whether the groundwater zone encountered during the geotechnical investigation is hydraulically connected to the karst aquifer. If the hydrogeological study indicates that the groundwater zone is hydraulically independent of the karst aquifer, such that there is no potential for grout injected during construction to affect karst water quality, a dye tracing study need not be performed. If results of the hydrogeological study indicate hydraulic connectivity between the groundwater encountered beneath the site and the karst aquifer, the Campus shall conduct a dye tracing study as described above.

3.8.3 Impacts and Mitigation Measures

3.8.3.1 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, hydrology and water quality impacts would be considered significant if the proposed project would:

- Violate any water quality standards or waste discharge requirements
- Substantially deplete groundwater supplies 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
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on site or off site
- Substantially alter the existing drainage pattern 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 flooding on site or off site
- Create or contribute runoff water that would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff
- Otherwise substantially degrade water quality

No areas proposed for development under the 2005 LRDP, including the proposed project site, are within a 100-year flood hazard area, or an area subject to inundation as a result of dam failure, seiche, tsunami or mudflow. The following CEQA checklist items identified in Appendix G of the CEQA Guidelines were not analyzed in the 2005 LRDP EIR and are not analyzed in the discussion below because the proposed project would not:

- 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
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows
- 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, or inundation by seiche, tsunami or mudflow

3.8.3.2 Analytical Method

Surface Water

The effects of the increase in impervious surface that would result from redevelopment of the project site were analyzed by: 1) comparing hydrographs for runoff from the project site under existing conditions and after project construction is completed; 2) calculating the total effective impervious area for the project site after construction; and 3) comparing the time of concentration for project site runoff under existing conditions and after project construction is completed. Each of these procedures is described below.

Hydrographs show the rate of storm water discharge during a storm event of a given intensity and duration. Individual points on the hydrograph represent the rate of storm water discharge at a given time. The area under the curve, in the hydrograph, is the total volume of storm water discharged during the storm event.

Hydrographs were prepared for the project site for 1-, 2-, 5-, and 10-year events, each of 10 minutes duration. Peak flows were estimated using the Modified Rational Unit Hydrograph Method and the time of concentration was estimated by using the overland velocity guidelines found in SCS Technical Report 55 (USDA, SCS 1975). The rainfall intensity for each of the model storms was derived from an intensity-duration-frequency curve obtained from rainfall data from rain gauges in the city of Santa Cruz and Skyline Ridge in San Mateo County.

Effective impervious area is that portion of the impervious area that drains directly to a receiving surface water body via a hardened storm drain conveyance without first draining to a pervious area. Impervious area that collects and drains the water directly to a stream or wetland system via pipes or sheet flow is considered "effective impervious area." Impervious area that drains to landscaping, swales or other impervious areas is not considered "effective" because the water is allowed to infiltrate through the soil, without a direct connection to the stream or wetland. Effective impervious area can be reduced through project design features that disconnect impervious surfaces such as sidewalks, rooftops, parking areas, and streets, from the drainage system so that runoff does not flow directly to streams. Disconnecting the storm water system allows the watersheds' hydrologic cycle to respond in a manner that more closely reflects pre-development conditions.

The time of concentration is generally defined as the time required for a drop of water to travel from the most hydrologically remote point in the drainage area to the point of collection. It represents the time to reach the maximum discharge rate. In a natural setting, the initial rainfall is absorbed by soil and vegetation. Runoff occurs only after the soil is saturated. The time of concentration typically is shorter after a site is developed, because impervious surfaces such as buildings and pavement do not allow rainfall to infiltrate. This can increase the potential for flooding.

3.8.3.3 Project Impacts and Mitigation Measures

Wastewater Discharge Requirements

Wastewater from the proposed project would be discharged to the campus sewer conveyance system. Campus wastewater is discharged to the City of Santa Cruz sewer system and is treated at the City's wastewater treatment plant. The UC Santa Cruz campus does not discharge wastewater directly to any receiving water bodies but must comply with the effluent limitations specified in the waste discharge permit issued by the City. As explained in Section 3.8.1.1, above, the Campus is also subject to the State General Waste Discharge Requirements for Sanitary Sewer Systems, which prohibit sanitary sewer overflows that result in discharge of untreated or partially treated wastewater to waters of the U.S. and discharges of untreated or partially treated wastewater that create a nuisance. To comply with these requirements, the Campus is in the process of developing a SSMP, which will include a plan and schedule for management, operation, and maintenance of the Campus' sanitary sewer system.

The 2005 LRDP EIR analyzed the potential for campus wastewater discharge to cause a violation of the waste discharge requirements of the City's wastewater treatment plant. Although the amount of wastewater discharged by the campus would increase, the types of activities and uses on the campus would remain unchanged; therefore, the quality of wastewater that is discharged to the sewer system would not change. Therefore, the LRDP EIR concluded that the impact with respect to wastewater discharge requirements would be less than significant. The proposed project is within the development program analyzed in the LRDP EIR and would not change the conclusion of the LRDP EIR that the impact would be less than significant.

The 2005 LRDP EIR did not discuss the State General Waste Discharge Requirements for Sanitary Sewer Systems, as these were not in effect at the time the EIR was prepared. As discussed in Section 3.16, *Utilities* *and Service Systems*, the campus sanitary sewer system has adequate capacity to handle the wastewater flow from the proposed ECI projects. Therefore, construction and operation of the proposed project would not increase the potential for a sanitary sewer overflow which would violate the general waste discharge requirements. The project impact would be less than significant.

Construction Storm Water Quality

ECI Impact HYD-1:	The proposed project could result in storm water runoff during construction, which could substantially degrade water quality.
Applicable LRDP EIR Mitigation:	HYD-2B
Significance with LRDP EIR Mitigation:	Less than significant
Project Mitigation:	Mitigation not required

Project construction activities, including grading and excavation for utilities and building foundations, could cause erosion during storm events that would discharge sediment into Gully H or Jordan Gulch. Other pollutants such as fuels, paints, and solvents, could be accidentally released and could affect the quality of surface flow in these drainages. Surface flow in both Gully H and Jordan Gulch is ephemeral and generally infiltrates into the ground before reaching downstream receiving waters. However, in an extreme storm event surface flow in Gully H may reach Redwood Creek, which is a tributary to the San Lorenzo River. Thus, pollutants could affect water quality and other beneficial uses of the San Lorenzo River and Monterey Bay. In addition, pollutants in storm water runoff from the project site could reach groundwater in the karst aquifer via dissolution features in the karst system. These pollutants, if soluble, could be discharged to surface water by way of springs fed by the karst aquifer.

The 2005 LRDP EIR identified the potential for construction activities under the 2005 LRDP to degrade water quality as a potentially significant impact that would be reduced to a less-than-significant level by mitigation. Because the Campus is required by law to implement SWPPPs for all construction sites that disturb one acre or more, the potential for construction activities to cause erosion and other water quality impacts is low. However, construction on steep slopes and/or on erosive soils, and numerous small projects that would not be subject to the SWPPP requirement, could result in a significant impact. LRDP Mitigation HYD-2B, which specifies requirements for construction on steep slopes, is applicable to and is incorporated into the proposed project. The proposed project is within the building program analyzed in the 2005 LRDP EIR. Therefore, the project impact would be less than significant.

Surface Water Quality

ECI Impact HYD-2:	The proposed project would increase impervious surface, which would result in an increase in the volume and peak flow rates of storm water runoff, which could exacerbate existing erosion conditions in Gully H, and would increase the amount of urban pollutants in storm water runoff, which could affect water quality.
Applicable LRDP EIR Mitigations	HYD-3A; HYD-3C; HYD-3D. For this project, ECI Mitigation HYD-2 will be implemented in lieu of LRDP Mitigation HYD-3C.
Significance with LRDP: EIR Mitigation:	Potentially significant
ECI Mitigation HYD-2:	The storm water management system for the project shall be designed to release runoff to Gully H from the project site at the following rate: Runoff in excess of the estimated pre-development flow for the 2-, 5- and 10-year design storms shall not exceed 10 percent of the peak flow rate for the 2-year, pre-development design storm.
Residual Significance:	Less than significant

Impacts from Increased Impervious Surface

The proposed project would increase the impervious surface on the project site by 32,113 sf, including 8,998 sf in the Jordan Gulch watershed and 23,115 sf in the Gully H watershed. This would increase the volume of storm water runoff, which, if not properly managed, could cause erosion and sedimentation in Jordan Gulch and/or Gully H.

Consistent with LRDP Mitigation HYD-3D, the project includes several LID features. Runoff from the new parking spaces and pathways, the building roofs, and most of the new roadways created by the project would drain through the vegetated roof, pervious pavement, bioswales and/or bioretention areas before being discharged to Gully H or Jordan Gulch. This would reduce the effective impervious surface to 5,870 sf, which is less than five percent of the total project area of 136,230 sf. The pervious pavement, vegetated roof, bioswales and bioretention areas would increase the time of concentration and flow rates of runoff from the site. In addition, some of the runoff flowing to the vegetated roof and bioretention areas would be retained in the soil and then lost to evapotranspiration, and some would be stored for later use in landscape irrigation. However, there would still be a net increase in the volume of runoff from the project site for the 2-, 5- and 10-year design storms.

The proposed project includes two design options for storm water management. As described in Section 3.8.2, above, the Campus is considering two options for management of runoff ~~that reaches the bioretention area northeast of the plaza~~ discharged to Gully H. Under Option 1, a passive irrigation system would be installed beneath ~~the~~a bioretention area east of Building B. In this system, storm water runoff that infiltrated through the landscaping in this area would be stored in a sand profile underlain by an impervious liner. As the surface soil dried, water retained in the sand layer would be drawn into the root zone through capillary action. Under Option 2, ~~bioretention area~~ landscaped area east of Building B would consist of conventional landscaping and would not include a passive irrigation system. Instead, runoff ~~filtered through the bioretention area~~ would be stored in underground tanks that would discharge to two 5,000-gallon cisterns. The cisterns would store runoff for use in landscape irrigation, which would offset a small portion of the project's irrigation water demand. The underground tanks would be sized to contain the excess runoff from the 2-year, 5-year and 10-year storms. Overflow in excess of the 10-year design storm beyond the capacity of the cisterns would discharge to Gully H through the culverts beneath the lower parking lot terraces. Under either option, the system would be designed to release the stored runoff to the culvert underneath the two lower parking lots that discharges to Gully H at a rate of no more than 0.099 cfs, which is 10 percent of the estimated 2-year flow from the project site to Gully H before UC Santa Cruz development.

The project would increase the peak rate of runoff flow from the project site to the east fork of Jordan Gulch by up to approximately 1 cfs, in the 10-year design storm. As described in Section 3.8.1.3, above, the Campus is preparing, under a previously approved project, to address existing erosion conditions in Jordan Gulch by diverting up to approximately 13.2 cfs of runoff from the East Fork and the Middle Fork of Jordan Gulch. This is one of the storm water drainage improvements recommended by the Campus' 2004 Storm Water and Drainage Master Plan. The increased runoff from the proposed ECI Project would not significantly reduce the effectiveness of this diversion.

The 2005 LRDP EIR estimated that, under the 2005 LRDP, 58 acres would be added to the existing impervious surfaces in the San Lorenzo-Pogonip watershed, for a total of 100 acres (2005 LRDP EIR, Section 4.8.2.4, LRDP Impact HYD-3). The LRDP EIR concluded that implementation of LRDP Mitigations HYD-3A through HYD-3E would reduce the impact to a less-than-significant level if they could be implemented for all future development projects under all conditions. However, the LRDP EIR concludes that the impact would be significant and unavoidable, despite implementation of these mitigation measures because it cannot be determined that, for all future projects, design measures will be available that would decrease the volume of flow to the extent needed to avoid all increases in erosion.

The Campus proposes to implement ECI Mitigation HYD-2 in lieu of LRDP Mitigation HYD-3C to identify more effective and applicable performance standards for storm water management for the proposed project. The requirements for limiting peak flow embodied in LRDP Mitigation HYD-3C are standards the Campus adopted in the late 1980s, consistent with standard engineering practices developed to avoid flooding. Conventional flood control detention basins are designed to control peak flows for large events to pre-project levels and to meter the excess runoff out over a longer period. This approach can increase the duration of small but still erosive flows and can cause extensive channel erosion.

In recent years, storm water standards for new development have focused increasingly on the prevention of hydrograph modification, or hydromodification, by avoiding increases in the rate and duration of storm water flows. Hydromodification refers to changes in the magnitude and frequency of stream flows as a result of urbanization, and the resulting impacts on the receiving channels in terms of erosion, sedimentation and degradation of instream habitat. The degree to which a channel will erode is a function of the increase in driving forces (shear stress), the resistance of the channel (critical shear stress), the change in sediment delivery, and the geomorphic condition of the channel. Critical shear stress is the stress threshold above which erosion occurs. Only those flows that are large enough to generate shear stress in excess of the critical shear stress of the bank and bed materials cause erosion. This increases the shear stress exerted on the channel by stream flows and can trigger erosion in the form of incision (channel downcutting) or widening (bank erosion) or both. Increases in flow below critical shear stress levels have little or no effect on the channel.

The stream flows that are most important for erosion are those that are both large enough to move an appreciable amount of sediment and frequent enough to have a significant cumulative impact, generally around the 1- to 5-year recurrence interval. Much of the impact of hydrograph modification is an increase in the frequency of geomorphically effective flows.

One way to manage hydrograph modification is to control site runoff to levels that are equal to or less than pre-project runoff. There is a general consensus that both the frequency and duration of flows must be controlled. It is also generally accepted that events smaller than those with a 10-year recurrence level are the most critical for hydrograph modification management. Hydrograph modification plans (HMPs) developed by counties and cities in the San Francisco Bay Area and other parts of California take varied approaches. For example, the Contra Costa HMP strongly emphasizes the use of LID for hydrograph modification management, while the Santa Clara Valley Urban Runoff Pollution Prevention Program focuses on the use of detention basins for hydrograph modification management and requires that post-project runoff not exceed estimated pre-project rates and durations within a critical range.

Within one year after the campus' SWMP takes effect, the campus will be required to develop its own interim hydromodification standards for new development. These hydromodification criteria will identify a range of runoff flow rates and durations for post-project runoff that will not result in off-site erosion or other significant adverse impacts to beneficial uses. In Gully H, the primary concern for storm water management is hydromodification, as flooding is not a problem in this drainage. Until the SWMP has been approved and the campus has developed its interim hydromodification criteria, project-by-project hydromodification criteria will be used. The critical shear stress level, and, therefore, the minimum flow that can cause or exacerbate erosion, varies by drainage. Data on the critical shear stress for Gully H is not available. Therefore, for the ECI Project, the campus is proposing to set a performance standard that requires that runoff from the project site be released at a rate that is low enough to be below the erosive threshold, based on the lowest flows for which HMPs developed by other agencies in the region require controls.

The Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) HMP defines its lower flow control limit as the minimum flow that could initiate erosion in the channel bed and banks; in technical terms, this is the storm that generates the critical shear stress on a channel (Qc). Based on an estimate of bed and bank material shear resistance at selected cross sections in two creeks, SCVURPPP estimated Qc to be ten percent of the flow that would recur, on average, every two years (represented as Q2), (Santa Clara Urban Runoff Pollution Prevention Program, 2005). As a result of the SCVURPPP study, both the Santa Clara and Alameda HMPs adopted ten percent of Q2 as the lower limit for flow control regulation. Recently, the San Francisco Bay Regional Water Quality Control Board issued an order to the San Francisco Public Utilities Commission for their controlled release operations in which threshold of flow that would cause excessive erosion was defined as 20 percent of Q2 (Order No. <R2-2008-XXX>).

Consistent with the findings of these agencies, ECI Mitigation HYD-2 requires that runoff from the project site be released at a rate that does not exceed 10 percent of the pre-development peak flow for the 2-year design storm. Although the duration of storm water flows would increase (to a maximum of about 5 hours for the 10-year storm) under ECI Project conditions, the flows would be released at rates that would not cause channel erosion.

Impacts from Increased Human Activity

The proposed project would result in increased human activity and vehicle traffic in the project area, which would generate urban pollutants that could be discharged into storm water runoff, including petroleum products and heavy metals from parking lots and loading/unloading areas, and phosphates and nitrates from landscape maintenance activities. Although the proposed project would reduce the total number of parking spaces on the project site, the additional population associated with the project could result in an increase in the number of vehicle trips to the site, including trips by residents as well as delivery, garbage and other service vehicles. All of the new parking spaces and all of the service drives that would be constructed on the project site, except the loading dock for the café, would drain to the bioretention area. According to U.S. EPA standards for the sizing of bioretention areas, the project would require 3,028 sf of bioretention area to provide adequate treatment of the storm water runoff from the site (U.S. EPA 1999). Under Option 1, the proposed project would include 19,638 sf of bioretention area; Option 2, the size of the bioretention area would be 6,558 sf, which would be more than adequate to treat the runoff generated on the site.

The LRDP EIR discussed the potential for increased use of undesignated trails in the central and lower campus by pedestrians and bicyclists to result in disturbance of vegetative cover and consequently in erosion and sedimentation. Some of these trails are close to creeks and streams. One such informal trail runs from Crown/Merrill Apartments to Colleges Nine and Ten across the east fork of Jordan Gulch. Campus Site Stewardship program has done some erosion repair along that informal trail. Currently, the formal pedestrian route requires traveling south and east through Crown College to McLaughlin Drive, then proceeding west on McLaughlin Drive, and two crossings of McLaughlin Drive. The previously approved Chinquapin Sidewalk Project, planned for construction in the spring and summer of 2009, will construct a sidewalk on the west side of Chinquapin Road between the fire station and McLaughlin. This will provide a safe, formal pedestrian route from the project site, as well as from Crown/Merrill Apartments, to Colleges Nine and Ten. Consistent with LRDP Mitigation HYD-3A, the campus will also provide signage at entrances to the informal pathway, and educate residents of new and existing buildings in the area about the importance of staying on formal pathways.

In conclusion, the proposed project would result in increased storm water flows to Gully H, but the runoff would be released at non-erosive rates by means of the storm water management features included in the project. The project would include low-impact development measures that would minimize the effective impervious surface, increase the time of concentration, and remove pollutants from runoff. The increase in runoff to Jordan Gulch would not exacerbate the existing erosion conditions in that drainage. Therefore, the project would not contribute to the significant and unavoidable impact on water quality identified in the 2005 LRDP EIR.

Flooding

The proposed project would increase the impervious surface area on the project site. However, flooding is not a concern in Gully H, where most runoff infiltrates into the ground surface before leaving the campus; only in very large storms is there surface flow from Gully H into Redwood Creek. Storm water flows from the project site to Gully H would be released at a very slow rate. In addition, the proposed project would provide detention for runoff from other developed areas in the Gully H watershed. These measures would reduce the frequency of high flows in Gully H.

The proposed project would slightly increase runoff to the east fork of Jordan Gulch. As discussed in the 2005 LRDP (Section 4.18-8), the sinkhole close to the project site, in this drainage, is one of several campus sinkholes that are showing signs of having limited remaining capacity. This sinkhole has been observed to overflow into downstream reaches of Jordan Gulch. The proposed project would discharge runoff downstream of this sinkhole and therefore would not contribute to the potential for the sinkhole to overtop.

Groundwater

The proposed project would not involve or result in withdrawal of groundwater from a local aquifer. The project would increase impervious surface area on the project site, which could potentially result in a decrease in groundwater recharge on the site. Most of the runoff in the Gully H watershed, including the project site, infiltrates into the karst aquifer, which feeds off-campus springs south, southeast and southwest of the campus, including those in the Pogonip. Under the proposed project, runoff from the project site would be released at very slow rates, which would still allow most of the runoff to infiltrate into the ground surface. Similarly, the additional runoff from the project site to Jordan Gulch would infiltrate into the karst aquifer, either at the Upper Quarry sinkhole, or in sinkholes in the main stem of Jordan Gulch. Therefore, the proposed project would not reduce groundwater recharge from the project site.

Zones of soft soil within doline fill were encountered in exploratory borings for the project geotechnical study. Pressure grouting is frequently used in construction on campus to densify and stabilize such soft soils. The geotechnical report for the proposed project recommends that the building foundation consist of drilled, cast-in-place concrete piers founded in marble bedrock, in conjunction with reinforced concrete grade beams and a structural slab (Pacific Crest Engineering 2008b). This type of foundation does not require pressure grouting of the soft soils. However, if the final project design includes a structural mat foundation for one or more of the site structures, it is possible that pressure grouting would be required.

The 2005 LRDP EIR analyzed the potential that pressure grouting for building foundations in areas of karst could affect groundwater quality. The LRDP EIR concluded that pressure grouting could potentially affect water quality if grout were to be injected where groundwater is present but that this impact would be reduced to a less-than-significant level by implementation of LRDP Mitigation HYD-3A. This mitigation requires that the Campus conduct a dye tracing study or hydrogeological analysis if groundwater is encountered in the geotechnical borings for the project to evaluate hydraulic connectivity with the karst aquifer and associated springs. Groundwater was not encountered in any of the 43 borings conducted at the project site. Therefore, even if pressure grouting were used for the building foundations at the site, further investigation is not required.

3.8.3.4 Cumulative Impacts and Mitigations

The potential hydrology and water quality impacts of the proposed project would generally be limited to Gully H except that, in extreme storm events, runoff from the project site could flow overland to Redwood Creek and thus affect water quality in the San Lorenzo River and Monterey Bay. There are no other currently planned (reasonably foreseeable) projects on the portion of the campus that is in the Pogonip/San Lorenzo watershed. There are three projects under construction in the Harvey West area of the city of Santa Cruz, which are in the Pogonip/San Lorenzo watershed: the Tannery Arts Center, which includes 100 residential units and a 120,000-sf arts center; a new, 5,376-sf industrial building at 229 Encinal Street; and the MetroBase project, which consists of construction of bus maintenance and fueling facilities for Santa Cruz Metropolitan Transit District.

As discussed in Section 3.8.3.4, above, the proposed project would not result in increased erosion in Gully H. The 2005 LRDP EIR identified cumulative impacts to water quality in the San Lorenzo watershed related primarily to the increase in discharge of urban pollutants as the population, level of development and urban activities in the area increase. Because the City of Santa Cruz and the Campus would implement storm water management plans to control nonpoint source pollution and to comply with NPDES Phase II regulations and the TMDL for sediment and nitrates in the San Lorenzo River watershed, the quality of runoff from the watershed should improve over current conditions. However, because of the existing water quality problems in the San Lorenzo River, the cumulative impact of development on water quality in the watershed would be significant. The 58 acres on campus that could be developed under the 2005 LRDP would be a very small portion of the of the 74,000 acre watershed. Furthermore, the Campus would implement LRDP Mitigation HYD-2A and 2B, and LRDP Mitigation HYD-3A through HYD-3D to minimize water quality impacts. Therefore, the contribution of development under the 2005 LRDP to this cumulative impact would not be cumulatively considerable. The proposed project site, which is 3.1 acres in size, is well within the development analyzed in the 2005 LRDP EIR and, furthermore, would project would implement all applicable LRDP EIR mitigation measures. Therefore, the proposed project would not make a cumulatively considerable contribution to cumulative impacts on the San Lorenzo watershed.

The project would result in increased flows to Jordan Gulch. Other projects contributing runoff to Jordan Gulch are the Cowell Student Health Center Expansion and Renovation Project (CSHC Project), which is currently under construction, and the Chinquapin Sidewalk Project, which is planned for construction in the spring and summer of 2009. The Chinquapin Sidewalk Project could result in increased storm water runoff in the east fork of Jordan Gulch watershed. However, the additional runoff from the Chinquapin Sidewalk Project will be dissipated by level spreaders in relatively level areas above the channel, which would allow the runoff to infiltrate into the ground. The CSHC Project will result in an increase in the volume of runoff to a storm drain pipe that discharges to the main stem of Jordan Gulch below Quarry Plaza. However, that project also will provide detention for runoff from a portion of the existing health center building, and this will result in a net decrease in peak flows to Jordan Gulch. In addition, a portion of the storm water flow from the CSHC storm drain pipe will be diverted to the Upper Quarry sinkhole as part of the previously-approved Infrastructure Improvements Projects Phase 1. Therefore, the Chinquapin Sidewalk and CSHC projects would not result in increased flows in Jordan Gulch and the cumulative impact would be less than significant.

3.8.4 References

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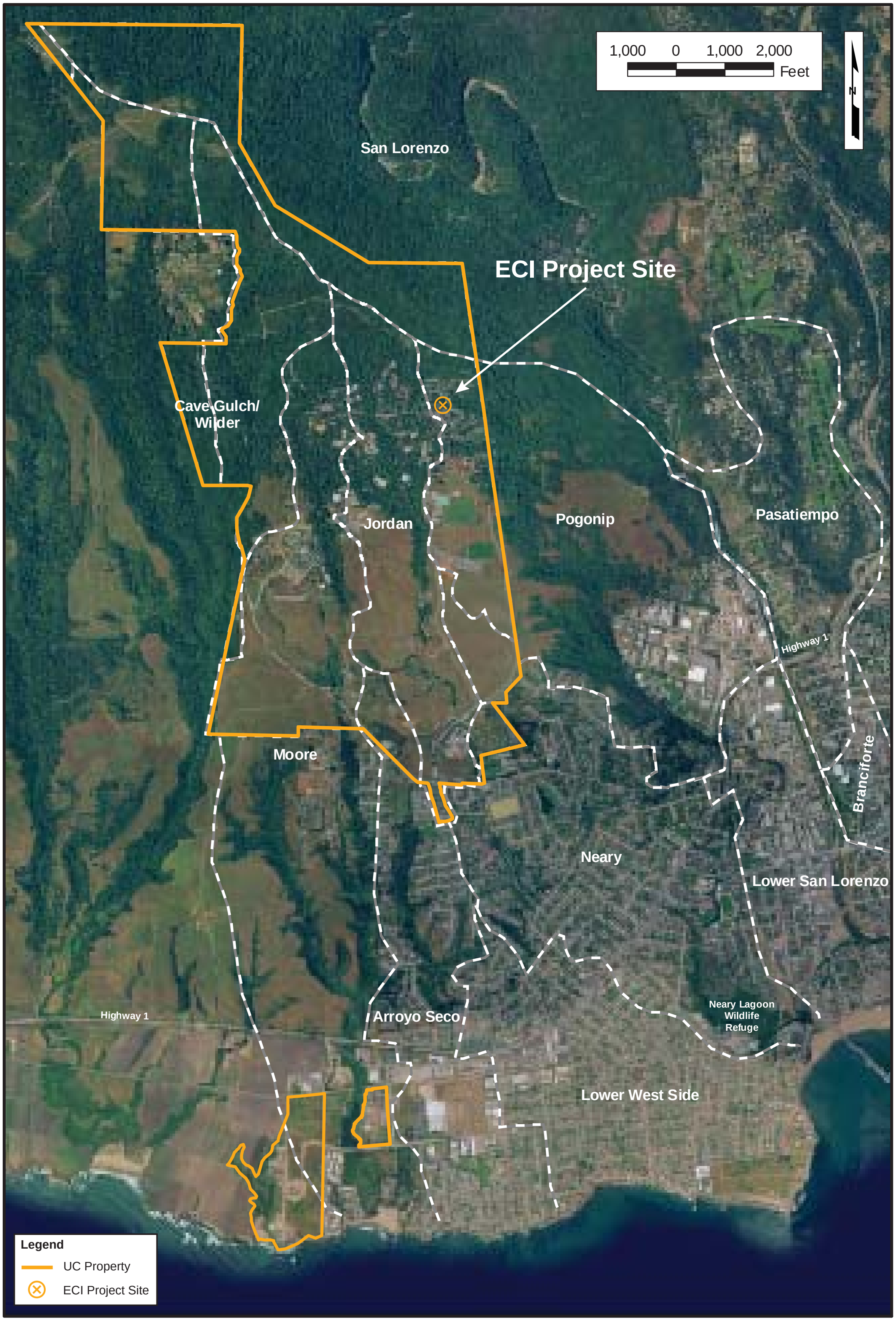
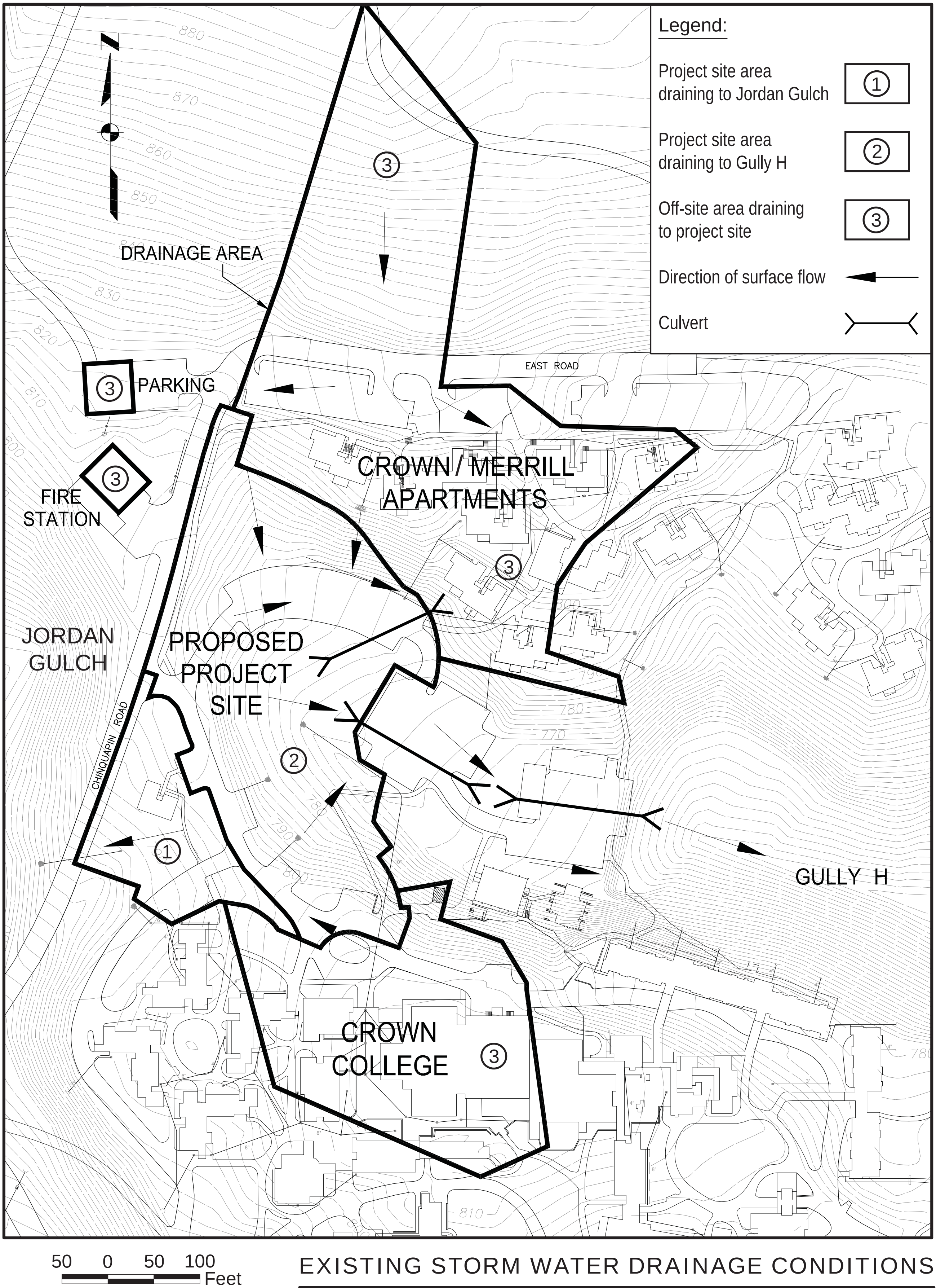
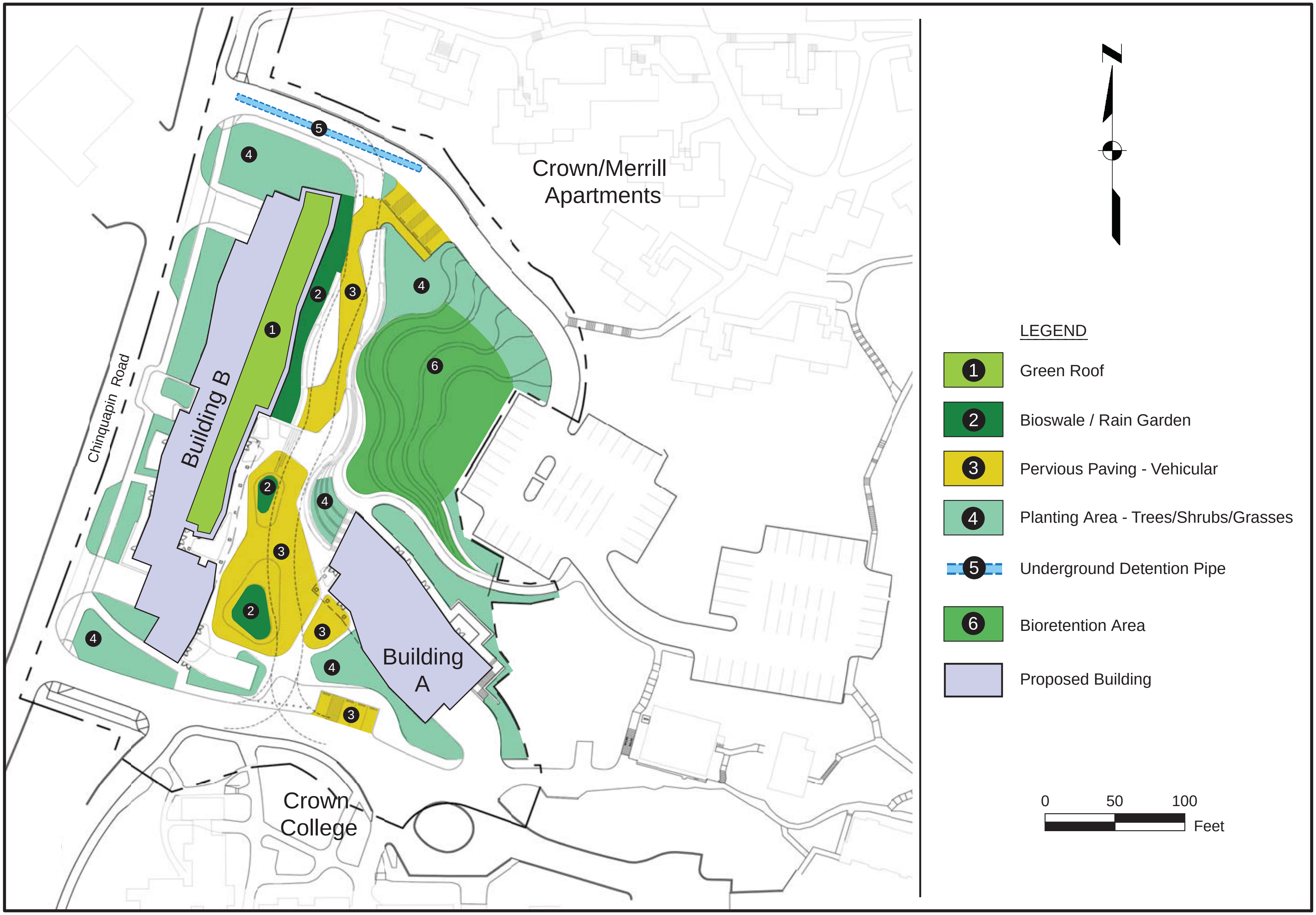


WATERSHEDS IN THE GREATER VICINITY OF THE UC SANTA CRUZ CAMPUS



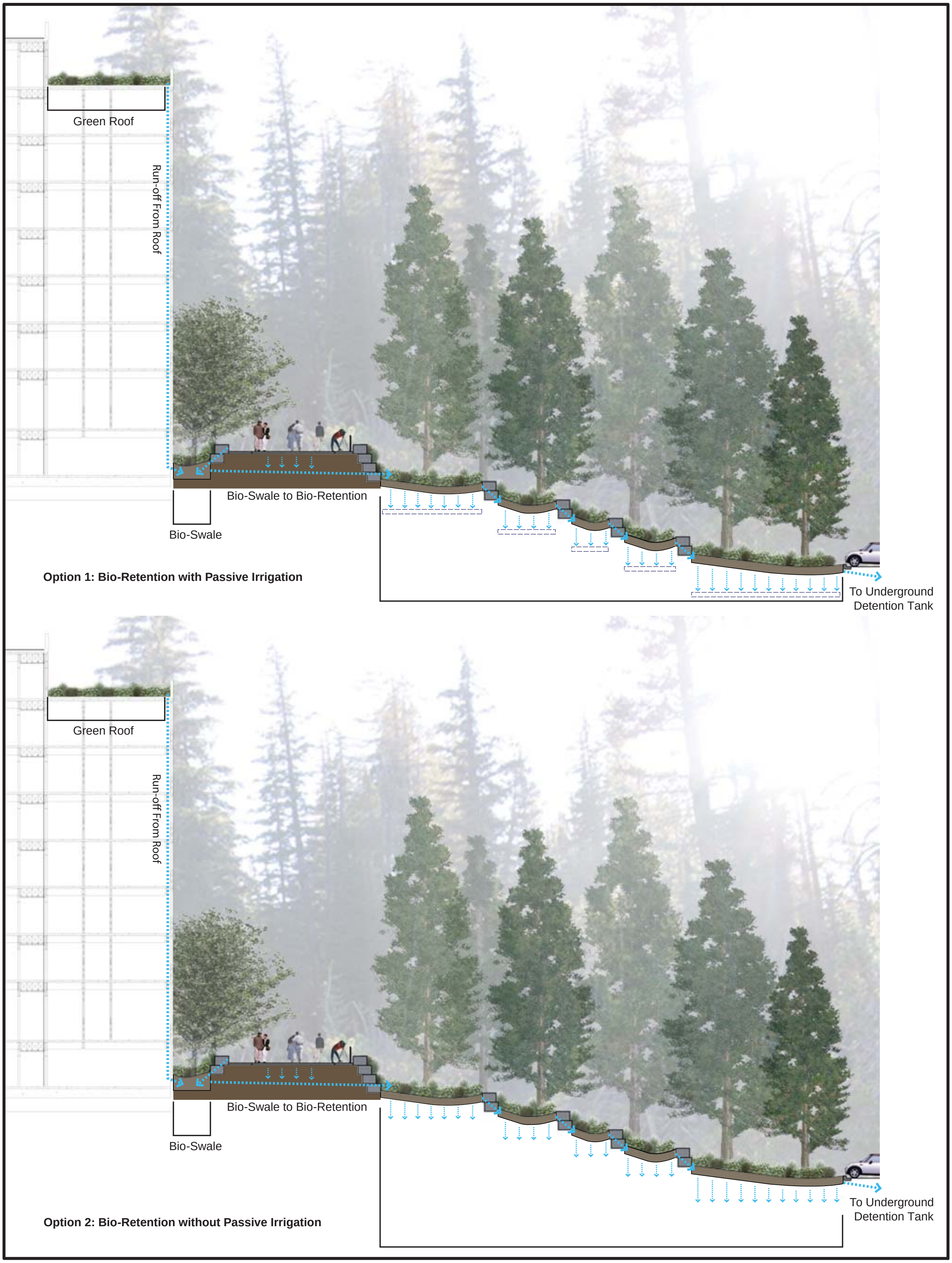
EXISTING STORM WATER DRAINAGE CONDITIONS

FIGURE 3.8-2



PROPOSED STORM WATER MANAGEMENT FEATURES

FIGURE 3.8-3



PROPOSED STORM WATER SYSTEM, SECTIONS

FIGURE 3.8-4

3.9 LAND USE AND PLANNING

3.9 LAND USE AND PLANNING

This section describes the existing land uses on and around the project site, and evaluates the potential effects of the proposed East Campus Infill Project on those land uses. Impacts on agricultural and recreational land uses are discussed in Sections 3.2, *Agricultural Resources*, and 3.13, *Recreation*, respectively. This section provides project-level analysis and additional detail regarding land use and planning and supplements and augments, pursuant to CEQA Guidelines Section 15152, the analysis provided in Section 4.9, Volume II, of UC Santa Cruz's 2005 LRDP EIR. The land-use plan applicable to the proposed project is the 2005 LRDP.

3.9.1 Environmental Setting

3.9.1.1 Existing Land Uses

The project site is within the northeastern section of the central campus where existing development consists of multiple buildings that make up two of the campus's residential colleges scattered among redwood groves. A portion of the site is used as a parking lot that primarily serves Crown College and Merrill College. The Crown College Preceptors' Apartment building, which would be demolished as part of the proposed project, houses approximately six students. Crown College and Merrill College are located south of the project site. Each of these colleges has a mixture of academic space, student housing and related facilities, and parking. The Crown/Merrill Apartments complex, to the north of the proposed project site, consists of 15 buildings that house a total of approximately 385 upper-division undergraduate students. The UC Santa Cruz Fire Station is located northwest of the project site directly across Chinquapin Road from the Crown/Merrill Apartments. To the north of the fire station, Chinquapin Road becomes an unpaved fire road that is used by campus affiliates and community members for recreational bicycling and walking.

Vehicle access to the project site is provided by McLaughlin Drive and Chinquapin Road. The project site is used by pedestrians travelling to Crown/Merrill Apartments from Crown College, Merrill College, and McLaughlin Drive.

3.9.1.2 Planned/Proposed Land-Use Changes in the Project Vicinity

As part of a separate project, the campus is planning to install a sidewalk and a bike lane on Chinquapin Road from McLaughlin Drive to Crown/Merrill Apartments in summer 2009. The 2005 LRDP land use envisions the extension of Chinquapin Road to provide access, as part of a North Loop Road, to future development on the north campus.

3.9.2 LRDP Land-Use Plan and Guidelines

The 2005 LRDP land-use plan guides capital construction and infrastructure development to accommodate a building program for the 2005 LRDP building program, which is intended to accommodate anticipated campus growth through 2020. The land-use plan identifies 10 land-use designations and describes which program elements may be constructed under each designation. The 2005 LRDP also estimates the amount of new building space required to support the projected growth in campus population and to enable expanded and new program initiatives. The 2005 LRDP building program includes both new space that will be needed as the campus enrollment increases and space to address current shortfalls.

3.9.2.1 Project Site

The 2005 LRDP land-use designation for the project site is Colleges and Student Housing (CHS). The LRDP designates approximately 235 acres as CSH land (UCSC 2006). The CSH land-use designation includes graduate and undergraduate housing, food services, related physical education and recreational facilities, student services, academic support, family student housing, and child care facilities. It also includes some instruction and research space for the academic divisions. The CSH areas that are already developed with these land uses form an arc that surrounds the Academic Core to the east, north, and west (UCSC 2006). The 2005 LRDP anticipates that some of the development of new colleges and student housing would occur as infill within the currently designated areas, and also identifies three new areas along the North Loop Road where CSH land uses could be developed. The proposed project would consist of infill student housing development and recreational amenities for student residents in one of the existing, developed CSH areas, which is consistent with the LRDP land-use designation.

3.9.2.2 Adjacent Sites

The areas to the north and south of the project site, including Crown/Merrill Apartments and Crown and Merrill Colleges and Parking Lot 111, are also designated CSH. The fire station and its immediate surroundings are designated Campus Support. The Jordan Gulch and Gully H corridors to the east and west of the project site, and the area to the north of Crown/Merrill Apartments, are designated Protected Landscape (PL). The Campus Support designation is provided to accommodate support facilities such as the central heating and cogeneration plants, maintenance shops, and equipment storage areas; buildings that house campus support departments, including Physical Plant, Purchasing and Business Contracts, Physical Planning and Construction, University Police and Fire Departments, child care centers and University Relations; and other support and service facilities. The PL land-use designation is assigned to lands on the campus that are valued for their scenic properties and to lands that support wildlife movement or special plant species. Any development within lands designated PL must not impinge on the protected landscape's overall character.

3.9.2.3 Other LRDP Guidelines

The 2005 LRDP articulates a number of planning principles and guidelines that are designed to protect the campus's natural and cultural features and to maintain the campus's unique character and quality of life (UCSC 2006). The campus uses these principles and guidelines to guide future planning of individual projects so that new facilities under the 2005 LRDP are developed in a manner that is sensitive to the environment and the community. LRDP principles and guidelines that are relevant to the proposed project include:

- Sustainability
  - Promote sustainable practices in campus development
  - Promote sustainable practices in campus operations
  - Encourage broad-based sustainability initiatives
- Land-use Patterns
  - Respect the natural environment and preserve open space as much as possible
  - Integrate the natural and built environment
  - Maintain UC Santa Cruz's core configuration
  - Encourage sustainability and efficiency in building layouts
- Natural and Cultural Resources
  - Respect major landscape and vegetation features
  - Maintain continuity of wildlife habitat
  - Design exterior landscaping to be compatible with surrounding native plant communities
  - Maintain natural surface drainage flows as much as possible
  - Protect historic and prehistoric cultural resources
- Access and Transportation
  - Promote a walkable campus
  - Discourage automobile use to and on the campus
  - Consolidate parking facilities at perimeter campus locations
- Campus Life
  - Offer university housing opportunities for students and employees
  - Create an array of facilities that enrich the quality of campus life

3.9.2.4 State and Local Plans and Policies

As a state entity, the University of California is constitutionally exempt from local land-use controls such as the Santa Cruz County and City General Plans. However, UC Santa Cruz recognizes its interrelationship with the larger community and endeavors to work with the City and County whenever feasible. In developing the 2005 LRDP, the University sought to coordinate the planning of campus growth with the anticipated 2020 planning horizon of the City's new General Plan.

Santa Cruz County General Plan

The Santa Cruz County 1994 General Plan/Local Coastal Program (LCP) outlines policies and programs to guide future growth and development in a manner consistent with the goals and quality of life desired by Santa Cruz County citizens. The County General Plan was most recently amended in 1994 and has a 20-year horizon. Although the County is not currently working on an update to the General Plan, proposed revisions to the Housing Element were published in September 2006.

The County General Plan/LCP recognizes the significance of the University to the Santa Cruz community and the importance of cooperation to maximize area wide benefits, but does not include specific policies regarding the UC Santa Cruz campus.

Land-use Designations. The portion of the UC Santa Cruz main campus outside the city of Santa Cruz is designated as Public Facilities in the 1994 County General Plan/LCP (Santa Cruz County Land Use Designation Map 2005).

Policies. The County General Plan/LCP specifically lists as one of its objectives, "…to ensure adequate present and future availability of land for both public and quasi-public facility uses including schools and University facilities, fire stations, churches, hospitals, cemeteries, sanitary landfills, and water supply and treatment facilities." County General Plan/LCP Policy 2.21.1 acknowledges the potential expansion of public facilities, but also limits development to fit into the context of existing environments. Policy 2.21.5 requires that long-term Master Plans be written for public facilities prior to new development or expansions, in part to coordinate with adjacent uses and take into consideration potential impacts on neighboring development.

City of Santa Cruz General Plan/Local Coastal Plan

The remainder of the campus is within the city limits of the city of Santa Cruz. The City's 1990-2005 General Plan/LCP was adopted on October 27, 1992, and was most recently amended on October 25, 1994. The update process for this plan is presently underway. The General Plan includes goals and policies that are intended to coordinate efforts of the City, the University, and other appropriate entities on issues such as public transportation, pedestrian and bicycle access and safety, preservation of open space and natural resources, public services and facilities, housing, utilities, and other items of mutual interest.

Land-use Designations. The City of Santa Cruz General Plan/LCP assigns three land-use designations to UC Santa Cruz lands that reflect the 1988 LRDP land-use designations (City of Santa Cruz 1994): UC Santa Cruz Development, Agriculture/Grazing, and Natural Areas. The developed areas of campus are primarily designated UC Santa Cruz Development. Land uses in the UC Santa Cruz Development designation include student dormitories, single-family homes, apartments, research laboratories, auditoriums, libraries, indoor and outdoor recreational facilities, an extensive natural reserve, classrooms, offices, police and fire stations, an agroecology farm, and grasslands for cattle grazing. The open space areas of the campus are designated as either Agriculture/Grazing or Natural Areas.

Policies. Elements of the City of Santa Cruz General Plan/LCP that establish land-use and growth management goals, policies, and standards that are relevant to UC Santa Cruz are Environmental Quality, Land Use, Community Design, Housing, Economic Development, Community Facilities and Services, Parks and Recreation, Cultural Resources, Safety, and Circulation. The relevant policies support cooperation between the City and UC Santa Cruz to address issues of mutual concern such as energy efficiency, business development, the development of community and public services, recreational facilities, water supply, fire protection, and transportation. These policies also encourage UC Santa Cruz to maintain the visual quality and character of the campus, and to reach its goals for on-campus housing.

3.9.2.5 Habitat Conservation Plan

Pursuant to an Implementing Agreement and Habitat Conservation Plan (HCP) that was approved by the University in July 2005 in conjunction with an Incidental Take Permit issued by the U.S. Fish and Wildlife Service, the University has agreed to protect two areas as habitat for the California red-legged frog and Ohlone tiger beetle (Jones & Stokes 2004). The parcels are designated as Campus Habitat Reserve on the 2005 LRDP land-use map. One is a 13-acre parcel adjacent to Wilder Creek in the southwestern corner of the campus. The second is a 12.5-acre parcel along the University’s southern border just west of the main entrance (UC Santa Cruz 2006). The HCP does not apply to the proposed project site. There is no Natural Community Conservation Plan (NCCP) that applies to the site.

3.9.3 Relevant Project Characteristics

The proposed project consists of construction of two buildings that would provide approximately 196,000 gross square feet (gsf) of building space, to accommodate bed spaces for approximately 600 upper-division undergraduate students. The project would include common areas and support spaces including student lounges, recreational spaces, laundry rooms, mail rooms, study spaces, and residential program offices. A café and retail spaces would also be available to provide services for the over 1,200 residents in the vicinity, including those who would be living in the new complex and those already residing in the existing Crown/Merrill Apartments. The project would also include parking for students, employees, the campus car-share program, and service vehicles.

3.9.3.1 Applicable LRDP EIR Mitigation Measures

There are no 2005 LRDP EIR mitigation measures related to land use that are applicable to the proposed project.

3.9.4 Impacts and Mitigation Measures

3.9.4.1 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, implementation of the proposed project would have a significant impact with regard to land use if it would:

- 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

- Result in development of land uses that are substantially incompatible with existing adjacent land uses or with planned uses
- Conflict with any applicable habitat conservation plan or natural community conservation plan

The CEQA checklist item related to physical division of an established community is not analyzed below. The 2005 LRDP would not include development outside of established campus properties or boundaries, nor would there be incursion into, or division of, the surrounding communities. The 2005 LRDP, including the proposed project, would not include any physical barriers such as roads or other infrastructure that would divide an established community.

3.9.4.2 Project Impacts and Mitigation Measures

Conflict with Applicable Land-use Plan

LRDP Land-use Designations. The proposed project would construct student housing facilities within a land-use area designated CSH, Colleges and Student Housing. The project is consistent with the CSH land-use designation.

Other LRDP Guidelines. LRDP policies and planning principles that are relevant to the proposed project are listed in Section 3.9.2.3, above. The 2005 LRDP calls for sustainable practices in campus development, including efficiency in building layouts; land-use patterns that respect the natural environment and maintain the campus' core configuration; design of exterior landscaping to be compatible with surrounding native plant communities; maintenance of natural surface drainage flows as much as possible; promotion of a walkable campus and consolidation of parking facilities at perimeter campus locations; an array of housing opportunities for students and employees; and facilities that enrich the quality of campus life. The 2005 LRDP provides for construction of new student housing by expansion of existing colleges through infill as well as construction of new colleges.

The proposed project would provide apartments for upper-division students, a cafe, and an outdoor plaza, which would be consistent with the LRDP policies of providing an array of housing opportunities for students and facilities that enrich the quality of campus life. The proposed project design, which minimizes the building footprint and associated environmental impacts while not exceeding the height of the surrounding trees, would be consistent with the campus goal of efficiency in building layout. The proposed landscape design and storm water management features would replace some existing storm water piping and hard surfaces with bioretention areas and vegetated swales, which would be consistent with the LRDP policies of including sustainable practices in campus development and maintenance of natural surface drainage flows. The project would consist of infill development that would maintain the campus's core configuration and would take advantage of existing public transportation and promote a walkable campus.

New Building Space. The 2005 LRDP allows for construction of 3,175,000 gsf of new building space, including 1,196,000 gsf of student and employee housing. The proposed project would construct 196,000 gsf of student housing. The Porter College House B Addition Project, currently under construction, will add 18,715 gsf of student housing to an existing building. The Porter College House A

Project, which is currently in the design stage but has not yet been approved, would construct 30,500 gsf of new student housing space. No other student housing has been added under the 2005 LRDP. Together, the two Porter College projects and the proposed ECI Project would construct 242,215 gsf of student housing space. No other student housing has been approved or is proposed under the 2005 LRDP at this time. Therefore, project development, in conjunction with other planned and approved projects, would be consistent with the approved 2005 LRDP building program.

City and County Plans and Policies. The City zoning designation for all UCSC land is P-F (Public Facilities). The project would be consistent with that designation. The project would provide on-campus housing for UC Santa Cruz students, which is consistent with policies of the City's General Plan to encourage UC Santa Cruz to meet its on-campus housing goals. As discussed in Section 3.1, *Aesthetics*, the project would not affect the visual quality of the campus as viewed from outside the campus or otherwise affect off-campus land uses. Therefore, the project would not conflict with the applicable land-use plan or with local policies that have been adopted for the purpose of avoiding or mitigating environmental effects.

Incompatibility with Existing or Planned Land Uses

The existing land uses adjacent to the project site are the Crown/Merrill Apartments, Crown College, parking that primarily serves Crown and Merrill Colleges, and academic and support facilities at Crown and Merrill Colleges. Any future development on these adjacent sites would be compatible with the CSH land-use designation. The proposed project would provide student housing and provide a grill and outdoor gathering space that could be used by residents of the adjacent housing and academic facilities as well as the residents of the new buildings. The Jordan Gulch corridor to the west of the project site, which is designated Protected Landscape because of its role in wildlife movement and surface drainage, would not be altered by the proposed project. The UC Santa Cruz Fire Department maintains two fire engines, and responds to approximately 700 to 800 calls per year (Rodewald 2009). As discussed in Section 3.10, *Noise*, potential impacts on the future residents of the new buildings from noise associated with fire department operations would be less than significant. Therefore, the proposed project would not be incompatible with adjacent existing or planned land uses.

Conflict with Habitat Conservation Plan or Natural Community Conservation Plan

No Natural Community Conservation Plans are applicable to the main campus. No HCP is applicable to the 2300 Delaware Avenue site. Two 2005 LRDP land-use areas, one near the southwestern corner of the campus, and one near the main entrance, are protected under an HCP that was approved in 2005. The proposed project site is not on or adjacent to lands that are protected under the HCP.

3.9.4.3 Cumulative Impacts and Mitigation Measures

As discussed above, the proposed project would not divide an established community or introduce any land uses that would be incompatible with surrounding land uses on the campus or on off-campus lands at the periphery of the campus. Off-campus projects would be subject to City General Plan and zoning requirements and would be compatible with adjacent land uses. Therefore, the proposed project, in conjunction with other past, present, and reasonably foreseeable development would not contribute to a significant impact related to land use.

3.9.5 References

City of Santa Cruz. 1994. *General Plan and Local Coastal Program, 1990-2005*. Adopted October 27, 1992. Last amended October 25, 1994.

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Santa Cruz County. 2006. *Proposed Housing Element Revisions*.

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3.10 NOISE

TABLES

FIGURES

This section describes the existing ambient noise environment of the project vicinity, including the sources of noise in the area of the proposed project and the current locations of noise-sensitive land uses that potentially would be affected by the proposed project. The relevant noise standards and guidelines are described. Potential project-related noise sources, including construction activity, are discussed. The changes in estimated noise levels due to the proposed project are compared to thresholds of significance to determine the significance of the changes in the ambient noise environment that are anticipated to result from implementation of the proposed project. This section provides project-level analysis and additional detail regarding noise and, pursuant to CEQA Guidelines Section 15152, augments and supplements the analysis provided in Section 4.10, Volume II, of UC Santa Cruz' 2005 LRDP EIR.

3.10.1 Environmental Setting

3.10.1.1 Fundamentals of Environmental Noise

What is commonly referred to as "noise" is actually airborne noise. It is noise that travels through the air—such as the sound of traffic on a nearby roadway, or children playing on a playground. Groundborne noise is the rumbling sound caused by vibration or oscillatory motion. With groundborne noise, buildings and other structures act like speakers for low amplitude noise. As an example, groundborne noise is the low rumbling sound that occurs within a building as a train passes beneath or when a structure is close to a heavy construction activity such as pile driving. Unless indicated otherwise, "noise" as analyzed in the rest of this section, refers to airborne noise.

The human response to noise is subjective and varies considerably from individual to individual. The effects of noise can range from interference with sleep, concentration, and communication, to hearing loss as a result of exposure at the highest levels. Although they have not been quantified, the adverse human health effects caused by increased environmental noise are suspected to be substantial.

Sound is described technically in terms of amplitude (loudness) and frequency (pitch). The standard unit of sound amplitude measurement is the decibel (dB). Because the human ear is not equally sensitive to sound at all frequencies, a frequency-dependent rating scale has been devised to relate noise to human auditory sensitivity. The decibel scale adjusted for A (audibility)-weighting (dBA) provides this compensation by discriminating among frequencies in a manner approximating the sensitivity of the human ear. Over the audible range of pitch, the human ear is less sensitive to low frequencies and very high-pitched sound and is more sensitive to mid-frequency sounds. Figure 3.10-1, *Common Noise Levels by Source*, lists A-weighted noise levels for common noise events in the environment and industry.

Community Noise

Community noise refers to the base of steady background ("ambient") noise that is the sum of many distant and indistinguishable noise sources, plus, superimposed on the distant background noise, the sound from individual local sources.

A number of noise descriptors are used to analyze the adverse effect of community noise on people. To account for the varying nature of environmental noise, these descriptors consider that the potential effect of noise upon people is largely dependent upon the total acoustical energy content of the noise, the context of the noise occurrence, and the time of day when the noise occurs. Common noise descriptors include the following:

- L_{eq}, the equivalent energy noise level, is the average acoustic energy content of noise, measured during a prescribed period (typically 1 hour). Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during the exposure period. L_{eq} values do not include a penalty for noise that might occur at night.
- L_{dn}, the Day-Night Average Sound Level (also abbreviated as DNL), is a 24-hour-average L_{eq} with a 10 dBA "penalty" added to noise occurring during the hours of 10:00 PM to 7:00 AM to account for the greater nocturnal noise sensitivity of people.
- CNEL, the Community Noise Equivalent Level, is also a 24-hour-average L_{eq} with no penalty added to noise during the daytime hours between 7:00 AM and 7:00 PM, a penalty of 5 dB added to evening noise occurring between 7:00 PM and 10:00 PM, and a penalty of 10 dB added to nighttime noise occurring between 10:00 PM and 7:00 AM.

Other noise descriptors (or metrics) give information on the range of instantaneous noise levels experienced over time. Examples include:

- L_{max}, the highest energy noise level experienced during a given period, usually a single event such as an aircraft overflight.
- L_{min}, the lowest energy noise level experienced during a given period during a complete lull in noise-producing activity.

L_n values (centiles) indicate noise levels that were exceeded "n" percent of the time during a specified period. For instance, L_{50} is the noise level that was exceeded for a cumulative 50 percent of the time during a measurement period (e.g., 30 cumulative minutes during a 1-hour measurement period).

Community noise environments are typically represented by noise levels measured for brief periods throughout the day and night, or during a 24-hour period (i.e., by L_{dn} or CNEL). The 1-hour period is especially useful for characterizing noise caused by short-term events, such as operation of construction equipment or concert noise (i.e., with L_{eq}). Community noise levels are generally perceived as quiet when the L_{dn} is below 50 dBA, moderate in the 50 to 60 dBA L_{dn} range, and loud above 60 dBA L_{dn}. Noisy urban residential areas are usually above 65 dBA L_{dn}. Along major thoroughfares, roadside noise levels are typically between 65 and 75 dBA L_{dn}. Interior noise levels above 40 dBA L_{eq} at night can disrupt sleep, and levels greater than 85 dBA L_{eq} can cause temporary or permanent hearing loss.

Noise levels from a source diminish as distance to the receptor increases. Other factors such as noise-reflecting surfaces or shielding from barriers also help intensify or reduce noise levels at any given location. A commonly used rule of thumb for traffic noise is that for every doubling of distance from the road, the noise level is reduced by 3 to 4.5 dBA. For a single source of noise, such as a piece of stationary equipment, the noise is reduced by 6 dBA for each doubling of distance away from the source. Noise levels may also be reduced by intervening structures; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA.

Community reaction to a change in noise levels varies, depending upon the magnitude of the change. In general, a difference of 3 dBA is a minimally perceptible change, while a 5 dBA difference is the typical threshold that would cause a change in community reaction. An increase of 10 dBA would be perceived by people as a doubling of loudness. A doubling of traffic flow on any given roadway would cause a noise increase of approximately 3 dBA. Similarly, doubling the amount of railroad activity would increase the rail contribution to community noise level by 3 dBA.

For typical residential construction (i.e., light-frame construction with ordinary sash windows), the minimum amount of exterior-to-interior noise reduction is 20 dBA with exterior doors and windows closed. With windows open, the typical amount of exterior-to-interior noise reduction that can be expected is approximately 13 dBA. Buildings constructed of masonry with dual-glazed windows and solid core exterior doors can be expected to achieve an exterior-to-interior noise reduction of approximately 25 dBA or more.

3.10.1.2 Regulatory Background

Federal and state laws have led to the establishment of noise guidelines for the protection of the population from adverse effects of environmental noise. Local noise compatibility guidelines are often based on the broader guidelines of state and federal agencies. Many local noise goals are implemented as planning guidelines and by enforceable noise ordinances.

Federal

Among other guidance, the Noise Control Act of 1972 directed the U.S. Environmental Protection Agency (U.S. EPA) to develop noise level guidelines that would protect the population from the adverse effects of environmental noise. The U.S. EPA published a guideline (U.S. EPA 1974) containing recommendations of 55 dBA L_{dn} outdoors and 45 dBA L_{dn} indoors as a goal for residential land uses. The agency is careful to stress that the recommendations contain a factor of safety and do not consider technical or economic feasibility issues, and should not be construed as standards or regulations.

The Department of Housing and Urban Development (HUD) standards define L_{dn} levels below 65 dBA outdoors as acceptable for residential use. Outdoor levels up to 75 dBA L_{dn} may be made acceptable through the use of insulation in buildings.

State

The pertinent California regulations are contained in the California Code of Regulations (CCR). Title 24 “Noise Insulation Standards” establish the acceptable interior environmental noise level (45 dBA L_{dn}) for multi-family dwellings (that may be extended by local legislative action to include single-family dwellings). Section 65302(f) of the CCR establishes the requirement that local land use planning jurisdictions prepare a General Plan. The Noise Element is a mandatory component of the General Plan. It may include general community noise guidelines developed by the California Department of Health Services and specific planning guidelines for noise/land use compatibility developed by the local jurisdiction (OPR 2003). The state guidelines also recommend that the local jurisdiction consider adopting a local nuisance noise control ordinance. The California Department of Health Services has developed guidelines for community noise acceptability with which given uses are compatible for planning use by local agencies (OPR 2003). For these purposes, selected relevant noise level guidelines include:

- CNEL[1] below 60 dBA—normally acceptable for low-density residential use
- CNEL of 55 to 70 dBA—conditionally acceptable for low-density residential use
- CNEL below 65 dBA—normally acceptable for high-density residential use
- CNEL of 60 to 70 dBA—conditionally acceptable for high-density residential, transient lodging, churches, and educational and medical facilities
- CNEL below 70 dBA—normally acceptable for playgrounds and neighborhood parks.

"Normally acceptable" noise levels are defined as levels satisfactory for the specified land use, assuming that conventional construction is used in buildings. "Conditionally acceptable" noise levels may require some additional noise attenuation or special study. Note that, under most of these land use categories, overlapping ranges of acceptability and unacceptability are presented, leaving some ambiguity in areas where noise levels fall within the overlapping range.

The State of California additionally regulates the noise emission levels of licensed motor vehicles traveling on public thoroughfares, sets noise emission limits for certain off-road vehicles and watercraft, and sets required sound levels for light-rail transit vehicle warning signals. The extensive state regulations pertaining to worker noise exposure are for the most part applicable only to the construction phase of any project (e.g., California Occupational Safety and Health Administration Occupational Noise Exposure Regulations [8 CCR, General Industrial Safety Orders, Article 105, Control of Noise Exposure, §5095, et seq.]) or for workers in a "central plant" or a maintenance facility, or involved in the use of landscape maintenance equipment or heavy machinery.

The 2007 California State Building Code (Section 1207.11.2), which the University follows, specifies that interior noise levels attributable to exterior noise sources shall not exceed 45 dB (either L_{dn} or CNEL) in any habitable room. Worst-case noise levels, either existing or future, must be used as the basis for determining compliance with this requirement; future noise levels must be predicted for a period of at least 10 years. If the allowable interior noise level can only be met with inoperable or closed windows, then the design for the structure must provide a ventilation or air conditioning system to provide a habitable interior environment.

Local

Although the University, as a state entity, is not subject to local regulation, local standards are a subject of importance to the University in evaluating impacts. It is University policy to seek consistency with local plans and policies where feasible. The State of California Governor's Office of Planning and Research (OPR) has developed specific planning guidelines for noise/land use compatibility, which have been

[1] L_{dn} may be considered nearly equal to CNEL.

adopted by the City of Santa Cruz in the Noise Element of its General Plan (1994). These standards are shown in Table 3.10-1.

Table 3.10-1 City of Santa Cruz Acceptable Noise Levels for Land Use Categories

Land Use Category	Levels of Acceptability[a], Ldn[b] or CNEL[c] (dBA)[d]			
	Normally Acceptable	Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Residential – Low Density Single Family, Duplex, Mobile Homes	Less than 60	55 to 70	70 to 75	More than 75
Residential – Multi-Family	Less than 65	60 to 70	70 to 75	More than 75
Transient Lodging – Motels, Hotels	Less than 65	60 to 70	70 to 80	More than 80
Schools, Libraries, Churches, Hospitals, Nursing Homes	Less than 70	60 to 70	70 to 80	More than 80
Auditoriums, Concert Halls, Amphitheaters	NA	Less than 70	NA	More than 65
Sports Arena, Outdoor Spectator Sports	NA	Less than 75	NA	More than 70
Playgrounds, Neighborhood Parks	Less than 70	NA	67 to 75	More than 73
Golf Courses, Riding Stables, Water Recreation, Cemeteries	Less than 75	NA	70 to 80	More than 80
Office Buildings, Business Commercial and Professional	Less than 70	68 to 73	More than 75	NA
Industrial, Manufacturing, Utilities, Agriculture	Less than 75	70 to 80	More than 75	NA

Source: OPR 2003.

Notes: (a) Levels of Acceptability are defined as follows:

Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction with closed windows and fresh air supply systems or air conditioning will normally suffice.

Normally Unacceptable: New construction or development should be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable: New construction or development clearly should not be undertaken.

(b) Day-Night Level (DNL) is a descriptor of the community noise environment that represents the energy average of the A-weighted sound levels occurring during a 24-hour period, and that accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night (“penalizing” nighttime noises). Noise between 10:00 PM and 7:00 AM is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

(c) Community Noise Equivalent Level (CNEL) is the average A-weighted noise level during a 24-hour day, obtained by the addition of 5 decibels in the evening from 7:00 to 10:00 PM, and the addition of 10 decibels in the night between 10:00 PM and 7:00 AM.

(d) dBA is the decibel scale adjusted for audibility (A-weighted).

In locating low-density residential uses, normally acceptable existing exterior noise levels are those below 60 dBA L_{dn} or CNEL. For multi-family residences, normally acceptable noise levels are those below 65 dBA L_{dn} or CNEL. Most of the on-campus housing, including the proposed ECI Project, falls into the category of multi-family housing (medium- to high-density) and would be subject to the 65 dBA acceptability level for normally acceptable noise levels. Offices, laboratories, and academic buildings on campus would be subject to the 70 dBA acceptability level for normally acceptable noise levels, which is the threshold for schools and office buildings.

Apart from the noise/land use compatibility levels listed in the City's General Plan, the City has a noise control ordinance (Municipal Code Section 24.14.260) which states that noise levels shall not exceed the local ambient noise level on residential property by more than 5 dBA, or the local ambient noise level on nonresidential property by more than 6 dBA. Furthermore, Section 9.36.010 of the Santa Cruz Municipal Code prohibits production of offensive noise from 10:00 PM to 8:00 AM within 100 feet of any building or place regularly used for sleeping purposes, or that disturbs or would tend to disturb any person within hearing distance of such noise. The Municipal Code defines "offensive noise" as any noise that is likely to disturb people in the vicinity of such noise, and includes, but is not limited to, noise made by any device, structure, machine, or construction.

3.10.1.3 Noise-Sensitive Land Uses in the Project Area

For purposes of this analysis, noise-sensitive receptors include residences, daycare centers, schools, hospitals and parks. Noise-sensitive receptors in the vicinity of the proposed project are the Crown/Merrill Apartments north of the proposed buildings, the residence halls in the upper quad at Crown College, and the office and classroom buildings at Crown College.

The project could cause noise impacts affecting sensitive receptors adjacent to roadways used by project-related motor vehicle traffic. There are residences off-campus to the south and southeast of the campus. There are single- and multi-family residences on both sides of High Street, Bay Street, and in some locations on Mission Street. Single-family residences are also located along Western Drive. Western Drive may be used for personal vehicle travel between the main campus and UC Santa Cruz-owned/leased facilities in the lower west side of Santa Cruz but would not be used by campus trucks because the use of trucks on this street is restricted to deliveries at addresses on Western Drive. The Santa Cruz Waldorf School and residences in the Cave Gulch neighborhood are adjacent to Empire Grade Road to the west of the UC Santa Cruz campus. No noise-sensitive receptors were identified east or north of the campus.

3.10.1.4 Noise Sources

The primary existing noise source in the project vicinity is motor vehicle traffic. Because they represent a relatively high percentage of the vehicle mix, buses are a large contributor to the motor vehicle noise on the campus, although the only transit service on Chinquapin Road is a campus shuttle that operates only at night. The Central Heating Plant cooling towers also contribute to ambient noise in the central campus. Fire station operations intermittently contribute to the noise at the project site. Secondary, intermittent sources of noise include distant aircraft noise, sounds from parking lots, and noise from recreational activities.

Roadways

The most pervasive noise sources in developed areas are related to transportation. Vehicle noise along heavily traveled roadways commonly causes sustained elevated noise levels. In densely developed communities, traffic noise often occurs in close proximity to land uses where people are sensitive to noise.

Most of the vehicles traveling to and from the main campus take High Street or Bay Street. Within the campus, the main traffic circulation loops around the campus starting at the intersection of Bay Street and High Street, and then follows a loop formed by Glenn Coolidge Drive, Hagar Drive, McLaughlin Drive, and Heller Drive. Buses travel in both directions around the campus loop. These roadways tend to be heavily traveled during the daytime, at moderate vehicle speeds, and handle buses and medium-duty trucks but generally few heavy-duty trucks. Currently, there is little traffic on Chinquapin Road; however, the 2005 LRDP envisions that this roadway will be extended to the north and would become one of two roadways connecting existing campus development to new housing and academic facilities on the north campus.

Stationary Sources

Stationary noise sources include common building or home mechanical equipment, such as air conditioners, ventilation systems, pool pumps, and institutional and agricultural operations. These noise sources may result in environmental effects when they are in proximity of land uses where people are likely to be sensitive to noise. No major industrial or manufacturing facilities are presently located in the project area. At the project site, fire station operations contribute intermittently to the ambient noise. An exhaust fan at the station that is audible at the project site, runs for approximately half an hour each morning during daily engine checks, and also runs briefly each time an engine is started up inside the station to respond to a callout. The engines themselves run intermittently during the daily checks. The engines' sirens start up as soon as the engines exit the station onto Chinquapin Road to respond to a callout. The fire department responded to 701 calls in 2007 and 788 calls in 2008 (Rodewald 2009). The cooling towers, cogeneration plant, and other infrastructure machinery at the Central Heating Plant to the west of Colleges Nine and Ten contribute slightly to the ambient noise at the project site.

Construction Activity

Construction traffic and equipment operation at construction sites temporarily elevates noise levels at the individual project site and in its vicinity. Construction noise is typically most noticeable in quieter residential areas that are in proximity to project construction locations. Noise levels vary depending on the distance between construction activity and the receptors, and the type of equipment used, how the equipment is operated, and how well it is maintained.

3.10.1.5 Ambient Noise Levels in the Project Area

Short-term noise measurements were taken at the Crown/Merrill Apartments parking lot in February 2005 as part of the noise analysis for the 2005 LRDP EIR. The measurements were taken on a weekday at 8:45 in the morning when traffic on campus is heavy. The noise levels recorded by the sound meter were used to estimate L_{eq} as well as other noise metrics. The estimated noise metrics are shown in Table 3.10-2.

Table 3.10-2 2005 Short-Term Noise Measurement Results

Site ID	Location	Measurement Period			Noise Sources	Measurement Results (dBA)					
		Date	Time	Duration (minutes)		L_{eq}	L_{max}	L_{min}	L_{90}	L_{50}	L_{10}
ST-3	Crown/Merrill Apartments, adjacent to parking lot	2/23/2005	8:45	15	Distant aircraft overhead, bell tower, trash truck, security truck, parking lot activities	43.2	59.4	32.4	34	37.5	46.5

Notes: Leq= equivalent energy noise level; Lmax = highest energy noise level experienced during a given period; Lmin= lowest energy noise level experienced during a given period; L10 =noise levels exceeded 10 percent of the time during a given period; L50= noise levels exceeded 50 percent of the time during a given period; L90= noise levels exceeded 90 percent of the time during a given period.

To evaluate the noise levels at the project site from the fire station exhaust fan, noise measurements were made in January 2009 at the northeast corner of the project site, the nearest point to the fire station on the project site. Noise levels were measured intermittently over a 15-minute period at 1:15 PM, with and without the exhaust fan. Without the exhaust fan, the primary source of noise was from traffic on McLaughlin Drive and Chinquapin Road. The noise level without the exhaust fan ranged from less than 60 dBA during periods when there was no traffic on Chinquapin Road to 75 dBA as a car passed the noise measurement location on Chinquapin Road. With the fire station exhaust fan on, the noise level was measured at 70 dBA for a few seconds as the fan started up, then at 65 dBA.

3.10.2 Relevant Project Characteristics

Project construction activities would generate noise at the project site and the proposed staging area at the two lower terraces of Parking Lot 111 (Figure 2-1) during the two-year construction period. The noisiest activities, including demolition, grading, drilling for the foundation piers, and paving would occur during the first and last few months of construction. The project would not include significant sources of ambient noise, although potentially noticeable noise would be generated intermittently at the project site by the operation of building mechanical equipment inside the buildings, operation of a limited number of service vehicles, students entering and exiting proposed buildings and using common outdoor areas, students playing music and making noise when windows are open, collection of garbage at trash collection areas, and use of emergency generators during power outages. Noise associated with parking lot activities in the vicinity of the project site would be reduced as result of the project because the number of parking space on and adjacent to the site would be reduced.

Project-related vehicle trips would contribute to an increase in traffic noise on campus and on city streets. Fire station operational noise and existing and future traffic on Chinquapin Road constitute the primary sources of noise that could affect residents of the proposed buildings.

3.10.3 Applicable LRDP EIR Mitigation Measures

The following, previously adopted, 2005 LRDP EIR mitigation measures are applicable to and incorporated into the proposed project:

LRDP Mitigation NOIS-1: Prior to initiation of construction of a specific development project, the Campus shall approve a construction noise mitigation program that shall be implemented for each construction project. This shall include but not be limited to the following:

- Construction equipment used on campus is properly maintained and has been outfitted with feasible noise-reduction devices to minimize construction-generated noise.
- Laydown and construction vehicle staging areas shall be located at least 100 feet away from noise-sensitive land uses as feasible.
- Stationary noise sources such as generators or pumps shall be located at least 100 feet away from noise-sensitive land uses as feasible.
- Notices of the dates and hours of anticipated construction shall be posted in academic, administrative, and residential buildings within 100 feet of construction noise sources at least a week before the start of each construction project.
- Loud construction activity (i.e., construction activity such as jack hammering, concrete sawing, asphalt removal, and large-scale grading operations) within 100 feet of a residential or academic building shall not be scheduled during finals week.
- Loud construction activity as described above within 100 feet of an academic or residential use shall, to the extent feasible, be scheduled during holidays, Thanksgiving break, Christmas break, Spring break, or Summer break.
- Loud construction activity within 100 feet of a residential building shall be restricted to the hours between 7:30 AM and 7:30 PM, Monday through Saturday.
- Loud construction activity within 100 feet of an academic building shall be scheduled to the extent feasible on weekends.

LRDP Mitigation NOIS-2: Campus Standards shall be amended to include a requirement to be imposed on all campus contracts that only City-designated truck routes shall be used for contractor truck trips accessing the campus.

LRDP Mitigation NOIS-3: For future noise-sensitive land uses, such as Family Student Housing and other housing complexes that would be constructed under the 2005 LRDP, building and area layouts shall incorporate noise control as a design feature, as feasible. Noise control features would include increased setbacks, landscaped berms or vegetation screens, and building placement to shield noise-sensitive exterior areas from direct roadway exposures. The Campus may also use other noise attenuation measures such as double-pane windows and insulation to minimize interior noise levels.

3.10.4 Impacts and Mitigation Measures

3.10.4.1 Standards of Significance

The following standards of significance are based on guidance provided by Appendix G of the CEQA Guidelines. For the purposes of this EIR, the project would have a significant impact with regard to noise if it would result in any of the following:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

  For purposes of evaluating noise impacts from project traffic and other permanent noise sources, the following noise standards consistent with state guidelines and City of Santa Cruz General Plan were used:

  - 60 dBA CNEL for single-family residences
  - 65 dBA CNEL for multi-family residences
  - 70 dBA CNEL for schools and parks

- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.

  A substantial permanent increase in noise was evaluated based on the following criteria:

  - A 3 dBA or greater increase if CNEL for Without Project scenario is equal to or greater than 65 dBA
  - A 5 dBA or greater increase if CNEL for Without Project scenario is 50–65 dBA
  - A 10 dBA or greater increase if CNEL for Without Project is < 50 dBA

- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project

  A substantial temporary increase in ambient noise levels (associated mainly with construction activities) was evaluated based on the following criteria:

  - 80 dBA Leq (8h)[2] daytime
  - 80 dBA Leq (8h) evening
  - 70 dBA Leq (8h) nighttime

[2] $L_{eq(8h)}$ is an average measurement over an eight-hour period.

Note that all impacts were estimated and evaluated not at the source of noise but at the site where the nearest noise-sensitive receptor is located.

Non-Traffic Noise

Thresholds for periodic, intermittent, or temporary noise sources such as sports events, construction activities, and other fixed noise sources employ forms of the hourly Equivalent Sound Level (L_{eq}) for different periods of the day. Noise from sports events and construction activities cannot be evaluated with CNEL/DNL metrics because, by their nature, the noise from these sources is typically of short duration and occurs only intermittently. Therefore, to evaluate construction noise, an 8-hour L_{eq} was employed. Construction noise impacts would be significant if noise levels experienced at the nearest sensitive receptors exceeded 80 dBA $L_{eq\ (8h)}$ during the daytime and in the evening or exceeded 70 dBA $L_{eq\ (8h)}$ at night. Because construction activity generally increases the noise levels substantially over a short period of time, the impact is typically not evaluated in terms of a substantial increase.

Traffic Noise and Other Stationary Sources

Thresholds for road traffic sources or other permanent stationary sources such as generators and cooling towers employ long-term noise metrics such as CNEL. For these noise sources, the thresholds of significance are:

- 60 dBA CNEL for single-family residences; 65 dBA CNEL for multi-family residences; and 70 dBA CNEL for schools/parks, or
- Increases of 10 dBA CNEL, 5 dBA CNEL and 3 dBA CNEL, respectively, for receptors whose predicted (without project) CNEL would be less than 50 dBA CNEL, between 50 and 65 dBA CNEL, and greater than or equal to 65 dBA CNEL, respectively.

These thresholds would apply to the effects of road traffic noise on both on- and off-campus noise-sensitive land uses, as well as to effects of traffic and other permanent noise sources on sensitive land uses on campus. In this EIR, an increase of 3 decibels is considered a substantial noise increase in areas where the ambient or background noise levels under Without Project conditions are above the city and state noise thresholds for affected land uses. In areas where the ambient or background noise levels Without Project conditions are low or moderate, increases of 5 and 10 decibels are considered substantial. The use of this "sliding scale" is appropriate because where ambient/background levels are low, an increase of over 3 decibels would be perceptible but would not cause annoyance or activity interference and would not be considered significant. In contrast, if the ambient/background noise levels are high (above 60 dBA in single-family residential areas), any perceptible increase may cause an increase in annoyance.

3.10.4.2 CEQA Checklist Items

The following checklist items under Appendix G of the CEQA Guidelines related to noise are not discussed in the following analysis because they are not relevant to the proposed project for the reasons discussed below.

- For a project located within an airport land use plan, or where such a plan has not been adopted, within 2 miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels.

  The campus is not located within an airport land use plan or within 2 miles of a public airport or public use airport. No impact would occur and no additional analysis is needed.

- For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.

  The campus is not located within 2 miles of a private airstrip. There would be no impact and no additional analysis is needed.

3.10.4.3 Analytical Method

Construction

Potential noise effects from construction activities were assessed using a standard reference for construction noise (U.S. EPA 1971). The U.S. EPA has compiled data related to the noise-generating characteristics of specific types of construction equipment and noise levels that can be achieved with implementation of feasible control measures. These data are presented in Table 3.10-3. As shown, heavy equipment can generate noise levels ranging from approximately 76 dBA to 89 dBA when measured at 50 feet, and 70 dBA to 83 dBA when measured at 100 feet, without implementation of noise reduction measures. The noisiest pieces of equipment that would be used during the project's construction phase include jackhammers and pavers, which produce noise levels of approximately 75 and 80 dBA at 50 feet with implementation of the required feasible noise reduction control measures, as shown in Table 3.10-3. As with all construction equipment noise, these noise levels would diminish rapidly with distance from the construction site, with a decrease of approximately 6 dBA per doubling of distance. The sensitive receptors closest to the project site are the Crown/Merrill Apartments and the Crown College upper quad residence halls, which are 30 and 40 feet from the project site, respectively.

Table 3.10-3 Noise Levels and Abatement Potential of Construction Equipment Noise at 50 and 100 Feet

Equipment	Noise Level at 50 Feet		Noise Level at 100 Feet	
	Without Controls	With Controls[a]	Without Controls	With Controls[a]
Earthmoving	dBA			
Front Loaders	79	75	73	69
Backhoes	85	75	79	69
Dozers	80	75	74	69
Tractors	80	75	74	69
Graders	85	75	79	69
Pavers	89	80	83	74
Trucks	82	75	76	69
Materials Handling				
Concrete Mixers	85	75	79	69
Concrete Pump	82	75	76	69
Crane	83	75	77	69
Concrete Crushers	85	75	79	69
Stationary				
Pumps	76	75	70	69
Generator	78	75	72	69
Compressors	81	75	75	69
Impact				
Jack Hammers	88	75	82	69
Pneumatic Tools	86	80	80	74
Other				
Saws	78	75	72	69
Vibrators	76	75	70	69

Source: U.S. EPA 1971.

Note: (a) Noise levels that can be achieved with implementation of feasible noise controls. Feasible noise controls include selecting quieter procedures or machines and implementing noise-control features requiring no major redesign or extreme cost (e.g., improved mufflers, equipment redesign, use of silencers, shields, shrouds, ducts, and engine enclosures).

Traffic

The 2005 LRDP EIR (Section 4.10) estimated potential increases in noise levels from vehicular traffic on and off campus using the Federal Highway Administration Traffic Noise Model (FHWA-TNM), Version 2.0. The traffic noise impacts of the 2005 LRDP were calculated by comparing the existing 2004 baseline conditions, the 2020 Without Project scenario, and the 2020 With Project scenario (full development under the 2005 LRDP) to identify both the potential initial noise impact resulting from increased road traffic that would occur without implementation of the 2005 LRDP, and the total impact that could occur through 2020 including the traffic associated with campus growth under the 2005 LRDP.

Exposure of Project Residents to Noise

As required by the 2007 California Building Code Section 1207, as part of the project design process, acoustic modeling of the proposed project was conducted to determine whether projected noise levels at the project site would warrant installation of mechanical ventilation to meet indoor air quality standards. The modeling took into account projected traffic on Chinquapin Road in 2020, as projected by the traffic analysis for the 2005 LRDP EIR. That analysis assumed that the extension of Chinquapin Road and the North Loop Road would be in place by 2020.

3.10.4.4 Project Impacts and Mitigation Measures

Exposure to Groundborne Noise

ECI Impact NOIS-1:	Construction of the proposed project could expose nearby sensitive receptors to excessive airborne noise but not to excessive groundborne vibration or groundborne noise.
Applicable LRDP Mitigation:	NOIS-1
Significance:	Significant
Project Mitigation:	**ECI Mitigation NOIS-1:** The noise mitigation program required of the project pursuant to LRDP Mitigation NOIS-1 shall be prepared in consultation with the residential staff at Crown/Merrill Apartments and Crown and Merrill Colleges and shall include the following elements in addition to those specified in LRDP Mitigation NOIS-1: • Notices of the dates and hours of anticipated construction shall be posted in the upper quad residence halls at Crown College, the Crown College office and classroom buildings, and Crown/Merrill Apartments Building at the beginning of the fall 2010 quarter. • Residents of Crown/Merrill Apartments and Crown and Merrill Colleges shall be notified of the anticipated construction noise before they move in for the fall 2010 quarter. • The University shall identify staff responsible for communicating with residents of Crown/Merrill Apartments and Crown and Merrill Colleges regarding noise concerns, who shall notify residents of any changes to the posted construction schedule and of particularly noise activities.
Residual Significance:	Significant and unavoidable

Normal construction activities using conventional construction techniques and equipment would not generate substantial levels of vibration or groundborne noise. Pile driving, blasting, or other special construction techniques are not anticipated to be used for construction of the proposed project. Therefore, excessive ground vibration and groundborne noise would not be generated.

As explained in the 2005 LRDP EIR (Section 4.10.2.4), routine airborne noise levels from conventional construction activities (with a typical number of pieces of equipment operating on the site) range from 75 to 86 dBA L_{eq} at a distance of 50 feet. Due to improvements in construction equipment silencing technology developed during the past 30 years, these sound levels are 3 decibels less than the noise levels reported in the U.S. EPA 1971 reference study cited in Table 3.10-3. Typically, the loudest phases of construction are grading and finishing, which produce noise levels of 86 dBA L_{eq} at 50 feet. Foundation construction, which is generally the least noisy phase, produces noise levels of 75 dBA L_{eq} at 50 feet. However, foundation construction for the proposed project would include drilling into bedrock for piers, which would generate higher noise levels than typical foundation construction.

Noise levels from construction activities generally decrease at a rate of 6 dB per doubling of distance from the activity. Thus, at a distance of 100 feet from the center of construction activities, construction noise levels would range from 69 to 80 dBA L_{eq}. At a distance of 500 feet from the center of construction activities, construction noise during the noisiest phases of construction would range from 55 to 66 dBA L_{eq}. At a distance of 1,000 feet, construction noise ranging between 48 dBA L_{eq} and 60 dBA L_{eq} could be experienced, but actual noise levels would likely be lower due to additional attenuation from ground effects, air absorption, and shielding by miscellaneous intervening structures.

Therefore, at distances of less than 100 feet from the construction activity, noise from project construction is likely to exceed the significance criteria of 80 dBA L_{eq} daytime. Sensitive receptors within 50 feet of the project site, including some residents of the western buildings of Crown/Merrill Apartments and of the northernmost residence hall at Crown College, could be exposed to noise levels exceeding 86 dBA.

LRDP Mitigation NOIS-1, which requires the use of noise controls on construction equipment, operational procedures to minimize noise levels, notification of residents of nearby buildings, and adjustment of construction schedules to minimize disturbance to residents, is incorporated into the proposed project. This mitigation requires that loud construction activity within 100 feet of a residential or academic building shall not be scheduled during finals week, and that loud construction activity within 100 feet of a residential building shall be restricted to the hours between 7:30 AM and 7:30 PM, Monday through Saturday.

However, even with these measures, project construction could expose nearby residents to noise levels exceeding the applicable standard. ECI Mitigation NOIS-1 specifies particular measures to ensure that residents are adequately informed of planned construction schedules. However, this mitigation would not reduce the actual noise levels to which residents are exposed. The 2005 LRDP EIR identified construction noise as a significant and unavoidable impact because construction of new facilities on infill sites on the central campus would occur at distances less than 100 feet from existing and future sensitive receptors on the campus, and would result in noise levels that exceed the criteria at these nearby receptors. The residual impact, although temporary, is significant and unavoidable.

Project Contribution to Vehicle Traffic Noise on the Regional Road Network

As discussed in Section 3.14, the proposed project would generate an estimated 804 daily vehicle trips to the project site and parking lots in other parts of the campus. The 2005 LRDP EIR (Section 4.10) used a noise prediction model to estimate future community noise levels from traffic under existing conditions, under a 2020 Without Project (i.e., without the 2005 LRDP) scenario, and under a 2020 With Project (i.e., with 2005 LRDP development) scenario. The 2020 Without Project scenario includes all traffic that is projected to result from population and employment growth within the county but does not include the additional vehicle trips that would be made to the campus as a result of campus growth through 2020. The 2020 With Project scenario includes the other regional traffic growth described above and the additional trips added by campus growth through 2020.

The LRDP EIR traffic noise model calculated noise levels for the noisiest hour at six off-campus locations that are representative of areas expected to experience the greatest project-related traffic increases under the proposed 2005 LRDP. The information provided by this modeling, along with the results from the ambient noise survey measurements, was compared to the noise impact significance criteria to assess whether and where project-related traffic noise would cause a significant impact. The 2005 LRDP EIR concluded that the project increase in noise would not exceed the significance thresholds and that the projected increase in noise would be a less-than-significant impact. The proposed ECI Project and the vehicle trips that would be generated by the project are within the scope of the development and vehicle trips analyzed in the 2005 LRDP EIR. Therefore, the noise impact of project-related traffic with respect to increased traffic noise on the regional road network would not be significant.

Traffic Noise Effects on ECI Residents

ECI Impact NOIS-2:	Residents of the ECI complex could be exposed to high noise levels from increased vehicular traffic on the campus road network.
Applicable LRDP Mitigation:	NOIS-3
Significance:	Less than significant
Project Mitigation:	Not required

Existing ambient noise levels in the project area, as measured at the Crown/Merrill Apartments, are below 60 dBA, which, as discussed in Section 3.10.1.2, is generally considered an acceptable outdoor noise level for high-density residential development. For periods of about half an hour each day, and for short periods when fire vehicles prepare to leave the station, the fire station exhaust fan elevates the ambient noise level at the northwest corner of the project site to approximately 65 dBA. Traffic volumes on Chinquapin Road are light under existing conditions, as this roadway only provides access to small parking lots and a pedestrian entrance to Crown College, Parking Lot #111, Crown/Merrill Apartments, and the fire station. However, the 2005 LRDP envisions that this roadway will be extended to the north and would become one of two roadways connecting existing campus development to new housing and academic facilities on the north campus. The projected increase in traffic on Chinquapin Road was taken into account in the acoustic modeling for the proposed project. The California Building Code requires that interior noise levels in new multi-family construction be limited to 45 dB DNL if the exterior noise environment is above 60 dB DNL. If the interior noise standard can only be met with closed windows, then an alternative means of fresh air must be provided.

The acoustical analysis for the proposed project concluded that exterior noise levels would exceed 60 db DNL on the west façade of Building B but not on the other facades of Building B or on any façade of Building A. The project would meet the interior noise standard for the impacted area by providing dual-pane windows. A mechanical ventilation system providing fresh air when the windows are closed would be provided for the west-facing rooms in Building B.

The 2005 LRDP EIR anticipated that residents of new infill housing would be located close to campus roads, which could potentially expose residents to elevated noise levels from traffic. As the specific locations of infill housing had not been identified at the time the LRDP EIR was prepared, the analysis was based on estimated future noise levels at two locations on Heller Drive where the increase in traffic would be relatively large. The LRDP EIR projected that future noise levels at these locations would not exceed the standard of 65 dBA CNEL and that the increase in traffic noise would likely be even less at other locations on campus. The LRDP EIR, therefore, concluded that the impact would be less than significant, but nonetheless identified a mitigation measure (LRDP Mitigation NOIS-3) to further reduce potential noise impacts. LRDP Mitigation NOIS-3 is incorporated into the proposed project and will be implemented through compliance with the sound transmission control requirements of the California Building Code. This will ensure that, even if exterior noise levels exceed 65 dBA CNEL, residents of the new buildings would not be exposed to excessive interior noise levels, such that the impact would be less than significant.

3.10.4.5 Cumulative Impacts and Mitigation Measures

The LRDP EIR analysis of traffic noise impacts summarized, above, in the discussion of ECI Impact NOIS-1, above, evaluated the increase in noise in 2020 and reflects the increased traffic that would result from all projected population and employment growth in the study area through 2020. That analysis, therefore, presents the cumulative noise impacts in the study area. Further evaluation is not required.

3.10.5 References

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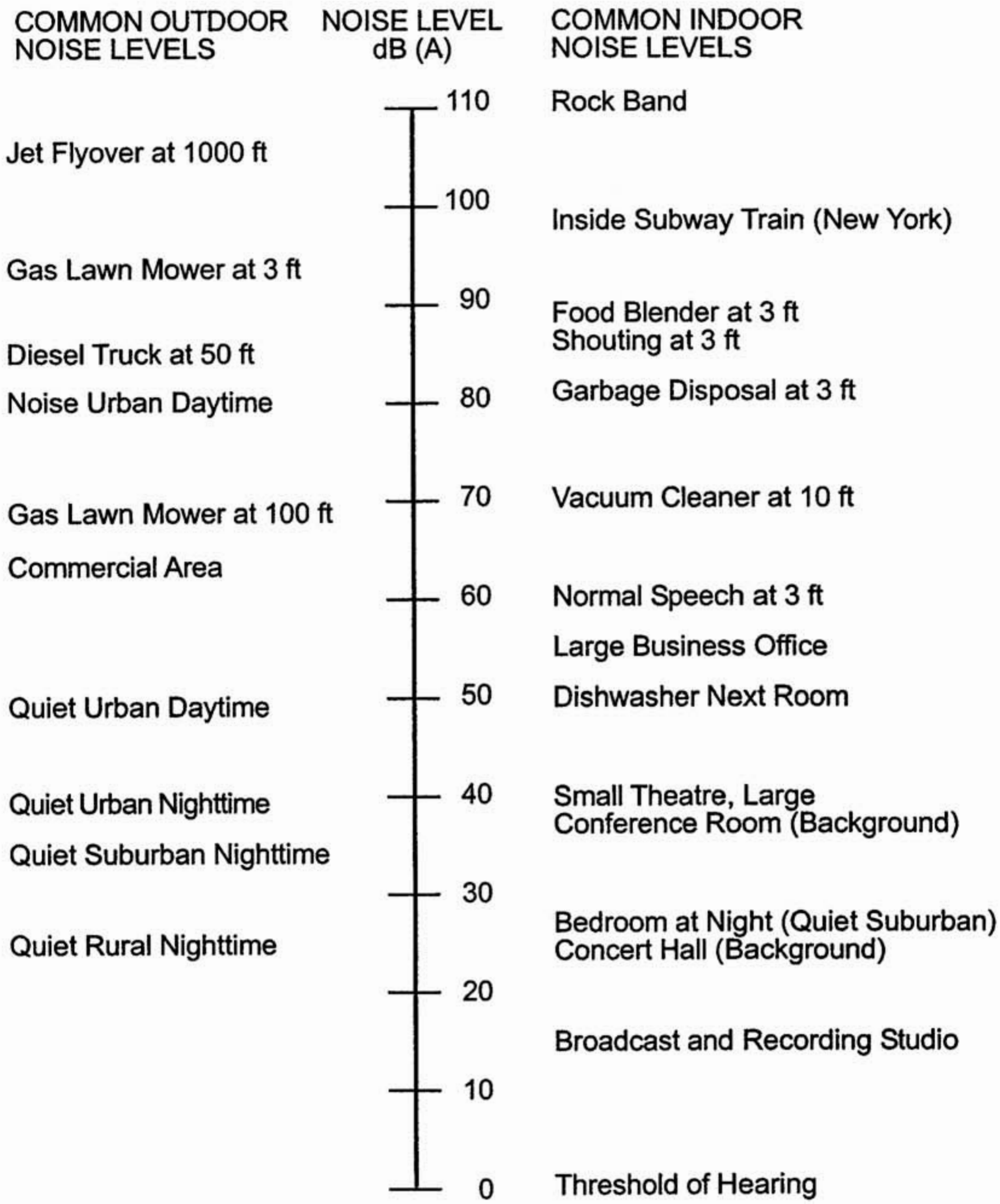

COMMON NOISE LEVELS BY SOURCE

3.11 POPULATION AND HOUSING

TABLES

FIGURES

3.11 POPULATION AND HOUSING

This section summarizes population and housing conditions at UC Santa Cruz and in surrounding communities, including the city of Santa Cruz and other central, north and south Santa Cruz County communities, as of the date of the Notice of Preparation (NOP) for this EIR, September 2008. UC Santa Cruz campus population and housing baseline data are provided for academic year 2007-08, the baseline year of this EIR.

This section also describes projected growth on the campus and in local and regional population between academic year 2007-08, the baseline for the proposed ECI Project, and 2011-12, the academic year in which the proposed project would be completed and occupied. California State Department of Finance (DOF) (DOF 2005, 2008) estimates and the projections of the Association of Monterey Bay Area Governments (AMBAG) (AMBAG 2008) provide regional baseline data for population and housing. Campus baseline data and campus housing and enrollment projections for this analysis were supplied by UC Santa Cruz's Institute of Research and Policy Studies (Fernald 2009) and UC Santa Cruz's Colleges and University Housing Services (CUHS) (CUHS 2008a, 2008b). The analysis considers growth in campus and regional population, employment and housing between 2007-08 and 2011-12, and assesses the potential for the proposed ECI Project to result in or contribute to adverse environmental effects associated with campus and regional population and housing growth.

The ECI Project is part of the previously-approved program of development and population growth envisioned in the 2005 LRDP, and the potential indirect and induced impacts of the project are within the scope of the program analysis presented in the 2005 LRDP EIR which is incorporated herein by reference. As an on-campus housing project with only 8 to 10 employees, two of whom would reside in the on-campus development, the proposed project would not make a cumulatively considerable contribution to the demand for off-campus housing that was identified as a program-level impact in the 2005 LRDP EIR. The portion of the 2005 LRDP EIR analysis that assesses the potential impacts of the LRDP program with respect to development of off-campus housing to accommodate LRDP growth is not incorporated in this EIR by reference; nor is the project analysis of off-campus housing demand tiered from that analysis.

Changes in population, employment, and housing demand are social and economic effects, not environmental effects. Section 15382 of the CEQA Guidelines states: "An economic or social change by itself shall not be considered a significant effect on the environment." According to CEQA, these effects should be considered in an EIR only to the extent that they create adverse impacts on the physical environment.

The proposed ECI Project would provide about 600 beds of on-campus housing for students already enrolled or projected to be enrolled at UC Santa Cruz based on the campus's previously certified 2005-2020 Long Range Development Plan, the program-level environmental impacts of which were analyzed in the 2005 LRDP EIR. The ECI Project would provide student beds on campus to accommodate on-going and increasing student demand for on-campus housing, but would not result in or induce increased enrollment because campus enrollment planning is program driven and is not subject to the availability of housing. The new on-campus beds that would be provided by the project would help to meet the campus's commitment, under the August 2008 Settlement Agreement (Settlement Agreement) (a copy of which is provided as Appendix A of this EIR), to provide campus housing for 67 percent of new student enrollment above 15,000 students. The project would not contribute to the demand for off-campus student housing. The applicability of the Settlement Agreement to the current project is discussed in the introduction to this EIR.

Operation of the proposed project would require about 8 to 10 full-time equivalent staff persons. In addition, 17 student Resident Assistants would be residents in the ECI development. These are counted as students, and not as employees, in the project population as analyzed in this EIR. The 8 to 10 professional employees of the project would include two Coordinators for Residential Education (CREs) who also would reside in the facility in apartments designated as employee housing units. The increase in UC Santa Cruz staff associated with the project is within the increased employee population included in the 2005 LRDP program of campus growth and analyzed in the 2005 LRDP EIR. The small contribution of the employees of the proposed project to off-campus housing demand is considered in the project-level impact analysis, below. The persons added to UC Santa Cruz staff to provide staffing for the ECI Project, and related indirect population (associated family members), would result in an estimated demand of approximately 8 units of off-campus housing. This small contribution to regional housing demand (about 0.3 to 0.4 percent of the housing units expected to be developed during the project horizon) is analyzed in Section 3.11.3 (*Impacts and Mitigation*), below. The project also would make a less-than-cumulatively considerable contribution to induced growth in campus and regional populations during the same period. These effects of the proposed project are analyzed in Chapter 5 of this EIR, *Other CEQA Considerations*.

Public comments related to population and housing, which were received from one agency and one member of the public during the scoping period, are summarized as follows:

- The Monterey Bay Area Unified Air Pollution Control District (MBUAPCD) requested that UC Santa Cruz obtain a consistency determination for the proposed project from the Association of Monterey Bay Area Governments (AMBAG), to facilitate analysis of whether transportation demand and air quality modeling for the project would be consistent with regional planning.
- The Campus should restrict enrollment to levels that can be accommodated by existing campus housing relative to the housing goals presented in the campus's 1988 LRDP; in other words, consider delaying enrollment increases until housing needs of students, faculty and staff can be met according to the 1988 LRDP stated assumptions of housing 70 percent of students on campus. Students who cannot be accommodated at UC Santa Cruz should be directed to other campuses or the University should build additional campuses elsewhere to accommodate enrollment demand.
- Housing demand in the City of Santa Cruz has grown steadily and made housing unaffordable for an increasingly large fraction of the non-University population. The result has been crowding in houses, changes in the character of neighborhoods, and deterioration of the quality of life for families. Mitigation of these impacts must be identified as well as alternatives including providing housing for all new students and faculty through University-funded programs, subsidies, land contributions, and other measures.

- Provide assessment of the project's contribution to community housing impacts

These issues are addressed, to the extent that they are relevant to the proposed project, as follows:

UC Santa Cruz consulted AMBAG, and AMBAG confirmed in a letter on October 28, 2008, that the project is consistent with AMBAG population and housing projections. The project therefore is consistent with AMBAG's travel demand model and MBUAPCD's air emissions planning (AMBAG 2008b).

As described above, the project's direct contribution to the demand for off-campus housing and it potential to contribute to community housing impacts would be very small. As also noted above, the project would further the campus's commitment under its Settlement Agreement to provide on-campus housing sufficient to accommodate 67 percent of the new enrollment above 15,000 anticipated in the campus's 2005 LRDP, and therefore would reduce the demand for off-campus housing compared to the analysis presented in Volume II, Section 4.11 (*Population and Housing*) and Volume IV, Chapter 2 (*Project Refinements*) of the 2005 LRDP Final EIR. The 2005 LRDP was approved by The Regents in 2006, and it supersedes the 1988 LRDP (to which the commenter refers).

As described above, the proposed project would not entail enrollment growth or accommodate student enrollment beyond the levels already analyzed in UC Santa Cruz's previously certified 2005 LRDP EIR. With regard to the commenter's suggestions regarding zero or lower enrollment growth, placement of the growth in satellite campuses or other UC campuses, and provision of more on-campus housing, the commenter is referred to Volume II, Chapter 5 in the 2005 LRDP EIR, *Alternatives*, and Chapter 4 (*Alternatives*), below, respectively, for a discussion of alternatives to the 2005 LRDP that were previously considered and rejected, the alternatives to the 2005 LRDP that were analyzed, and the alternatives to the proposed housing project analyzed in this EIR.

3.11.1 Environmental Setting

3.11.1.1 Study Area

The study area for the evaluation of population and housing impacts of the proposed project includes the UC Santa Cruz main campus and all incorporated and unincorporated communities in Santa Cruz County (see Figure 3.11-1, *Study Area for Population and Housing*). Based on historic and current residence patterns of UC Santa Cruz students, faculty, and staff (discussed further in Section 3.11.1.5, below), an estimated 6 percent of the 2005 LRDP-related additional enrolled new students and 13 percent of new employees are expected to reside in communities outside Santa Cruz County, particularly in Monterey and Santa Clara counties. This population, when distributed among the various communities in those counties, represents a very small portion of the total populations of these communities and would not result in measurable impacts in those communities. Therefore, areas outside of Santa Cruz County are not included in the study area for this project, because the project-induced demand for new housing in these more distant areas would be even smaller.

3.11.1.2 Campus and Project Population

Campus population relevant to the analysis in this section consists of students and staff. The project would not include or result in any increase in faculty population. Project staffing would require eight to ten additional full-time equivalent[1] (FTE) staff (residential managers, senior building maintenance worker, Campus Safety Officer, Grounds staff, and staff for the project café). Two of these staff persons would reside in the facility in apartments designated as employee housing units. In addition, project population would include about 17 student Resident Assistants, student employees who staff campus housing facilities at a ratio of about 1:35 students and reside in the facility (Houser 2009). These positions would be filled by students already enrolled on campus, who are taken into account in existing and projected enrollment on the campus.

Table 3.11-1, below, shows the population totals for student enrollment and UC Santa Cruz employees for the baseline academic year for this project, academic year 2007-08, and projected campus populations in 2011-12, the academic year in which the proposed project would be completed and occupied, and calculates projected campus population growth during this period. The term "employee," as used in Table 3.11-1, includes both faculty and staff, although this particular project would not entail any increase in the faculty population. The total population reported in this table and discussed in this chapter includes employees and students associated with the main campus, 2300 Delaware Avenue, and leased spaces in the City. Population associated with the Marine Science Campus is covered by a separate Coastal Long Range Development Plan for that campus, and population associated with the campus's MBEST and Silicon Valley Center facilities are outside of the project study area.

Table 3.11-1
Existing and Projected UC Santa Cruz Campus Population during ECI Project Horizon

Population	2005 LRDP Baseline	East Campus Infill Baseline	East Campus Infill Development Horizon (projected)	Projected Growth During ECI Project Horizon	2005 LRDP Development Horizon
	2003-04	2007-08	2011-12	2007-08 to 2011-12	2020-21
Students (3-quarter av. headcount)	14,087	15,000	16,300	1,300	19,500
Employees (3-quarter av. FTE)	3,213	3,436	4,097	661	4,463
Total UCSC Population	17,300	18,436	20,397	1,961	23,963

Note: All data from "UC Santa Cruz Student, Faculty and Staff 3-Quarter Headcount and FTE Projections", revised February 2009, provided by Julian Fernald, UC Santa Cruz Institutional Research and Policy Studies (Fernald 2009).

[1] Enrollment at UC Santa Cruz varies each quarter. The Campus uses an average of the student enrollment levels in the three primary quarters (fall, winter and spring) to track changes in enrollment from one year to another. That average is referred to as the three-quarter average enrollment, which may be applied either to headcount or to FTE populations.

Table 3.11-1 also provides 2003-04 baseline data and 2020-21 projections for campus population and housing, as background for the cumulative analysis presented here. The student and employee populations differ slightly from (but do not exceed) the numbers reported in the 2005 LRDP EIR for the years 2003-04 and 2020-21, based on updated accounting, and also due to a change from reporting on headcount populations to reporting full-time-equivalent populations[2] for UC Santa Cruz employees. The campus recently adopted full-time equivalency (FTE)[3] as the most accurate method for accounting for employee population. As explained below, the use of FTE population numbers for employees more accurately represents the actual population of the campus, and is a better measure of off-campus impacts.

As stated above, previous campus environmental analyses have used headcount to quantify enrollment and employee numbers for purposes of analyzing population-related impacts. The current analysis assesses population growth based on headcount for students, but based on FTE counts for employees for the reasons explained below. This accounting change, which alters the total population increase associated with the 2005 LRDP by 0.5 to 0.7 percent, does not alter the conclusions of population-related analyses presented in this EIR, or in the 2005 LRDP EIR, for the following reasons. Historically, student enrollment numbers at UC Santa Cruz, headcount and FTE, have been nearly identical, as was reported in Section 3 (*Project Description*), of the 2005 LRDP EIR. Small differences between student headcount and FTE relate primarily to changes in the status of certain advanced graduate students over the course of the year. Based on final data, the 2005 LRDP EIR baseline student enrollment for the 2003-04 baseline year was 14,087, rather than 14,050, as estimated in the 2005 LRDP EIR. The enrollment projected in 2020-21 has not changed but, due to this small increase in the baseline headcount for students, total enrollment growth between 2003-04 and 2020-21 is now projected as 5,413, rather than 5,450, as reported in the 2005 LRDP EIR, a change of about 0.7 percent.

Similarly, for enrollment numbers, there is little difference between faculty headcount and FTE numbers. However, headcount numbers may overcount staff, (which include lecturers and other non-Senate faculty), for several reasons. First, in addition to regular full-time staff, many departments employ part-time staff persons, each of whom could be counted as a headcount employee but represents only a fraction of an FTE. Second, an individual who is employed for only part of a year, such as a lecturer who teaches only one quarter or one class per year, would be counted as a headcount employee but would represent only a fraction of an FTE employee. Many persons regularly work only part time or intermittently for UC Santa Cruz.

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[2] "Headcount" accounts for every student enrolled, irrespective of the number of units in which the student is enrolled. Thus, a full-time student and a student who took only one class during the year each would be counted as one person in headcount enrollment accounting. Similarly, employee headcount accounts equally for a full-time staff person and for a person employed for only one quarter or for a few hours per week.

[3] "Full-time equivalent" (FTE) accounting considers the proportion of the year for which the student is enrolled at the campus or the employee works at the campus. Thus, a student enrolled half time or an employee employed half time would each be accounted for as 0.5 FTE persons. For student enrollment and faculty accounting, whether headcount or FTE, counts are based on a three-quarter average, since the academic year is comprised of three quarters. Thus, a student who is enrolled full time for three quarters would be considered as 1 FTE, in accounting for enrollment. A faculty member who taught full time during one quarter would be accounted for as 0.33 FTE

How population is counted has implications in the analysis of traffic generation and related air quality impacts, demand for on- and off-campus housing, demand for public services and for recreation facilities, and utility demand, including water demand. The population-related environmental impacts of a project are based on the increase in project-associated population from project baseline (that is, the year in which the project is proposed) to full development of the project. For that reason, it is key to the analysis that the same criteria are used to define the baseline population and the full development population. The analysis presented here revisits population numbers presented in the 2005 LRDP, and consistently presents baseline, interim year and full development employee population numbers as FTE. The projected employee population increase during the term of the 2005 LRDP, based on FTE (the current accounting method) is 1,249 persons; based on headcount, the increase in employees over the term of the 2005 LRDP would be 1,323 persons. FTE accounting, thus, indicates a population increase of 74 fewer persons than does the headcount accounting; that is, about 0.5 percent fewer persons over the term of the 2005 LRDP. This small difference, distributed over the 15 year term of the LRDP—about 5 persons per year—does not alter any of the conclusions of the analysis presented here or in the 2005 LRDP EIR.

Under UC Santa Cruz's 2008 Settlement Agreement, mitigation for off-campus traffic impacts of the entire 2005 LRDP program is based on total vehicle trips through the campus gates. Gate counts capture all trips to and from the main campus, irrespective of campus population. The campus has prepaid its fair share of the cost of mitigating the impacts up to 3,900 new trips generated. Therefore, whether campus population is counted by headcount or FTE would not affect off-campus traffic impact assessment or mitigation.

For project-specific assessments, project trip generation (which can identify impacts at specific locations) is based on building space and types of use (Institute of Transportation Engineers criteria), as well as the population of the facility. Where facility population is used in estimating future trip generation, this calculation is based on workspaces or bed spaces, or housing units in the case of employee and family student housing. Therefore, whether employee population is counted by headcount or FTE is not significant to trip generation in this analysis.

Off-campus housing demand that might be generated by UC Santa Cruz population is measured in terms of the number of housing units needed to house UC Santa Cruz employees. Most part-time lecturers and other part-time employees have other jobs, and the housing demand associated with those persons, therefore, is attributable both to UC Santa Cruz and to the individual's employment, proportionally. In other words, part of the demand would be attributable to UC Santa Cruz and part to other employment held by that individual. Further, it would be financially impracticable for an employee to move to Santa Cruz solely to take a part-time job at UC Santa Cruz. Most part-time employees either already reside in Santa Cruz at the time they are employed, or commute to Santa Cruz from outside the study area for the periods for which they are employed. These individuals, therefore, may not contribute to new demand for housing units in the study area. The use of FTE to count employees for purposes of housing unit demand reflects the proportional share of the new demand that is attributable to UC Santa Cruz.

The demand generated by the 2005 LRDP for public services and recreational facilities is closely related to the population contributing to off-campus housing demand. Therefore, it is appropriate to track the employee component of this population as FTE for the same reasons that apply to housing demand.

The 2005 LRDP EIR identified that UC Santa Cruz development through 2020 would contribute to water shortages under cumulative conditions after 2015. In the Settlement Agreement, UC Santa Cruz agreed to pay the city a fee (in addition to water use rates), to be used for the development of additional water supply and system improvements. This fee is tied to the actual additional water use at the campus over the baseline amount, taking into account the projected water demand from the campus. The Campus also committed not to increase campus demand for City water in the event of a water supply emergency. Further, the campus water demand projections used in the LRDP EIR and provided in this EIR (in Section 3.16, *Utilities and Service Systems*) are based on building square footage and housing units, and do not depend on how population is counted. With respect to off-campus water demand from population associated with the proposed ECI Project, the project would result in only a very small increase in off-campus population, since the project includes only about 8 to 10 new employees, two of whom would reside on campus. This small increase is well within the projected regional population and is consistent with regional planning, as assessed by AMBAG (AMBAG 2008a).

As shown in Table 3.11-1, above, UC Santa Cruz main campus three-quarter average FTE enrollment in 2007-08 was about 15,000 students. Undergraduate students constituted about 90 percent of total enrollment, and graduate students made up about 10 percent of the total. The UC Santa Cruz main campus had about 3,436 FTE employees in 2007-08, not including students who are also employees.

As shown on Table 3.11-1, it is projected that campus enrollment will grow by about 1,300 students between the ECI baseline year, 2007-08, and the time at which the proposed project would be occupied, academic year 2011-12. During the same period, the campus employee population is projected to increase by about 661 persons.

Table 3.11-1 also provides population data for the 2005 LRDP baseline year (2003-04) and full development year (2020-21), for contextual information purposes only. These numbers differ slightly from those provided in the 2005 LRDP EIR, for the reasons detailed above. As shown in the table, during the remainder of the 2005 LRDP projected development period, that is between academic years 2007-08 and 2020-21, campus enrollment is projected to increase to 19,500 students, an increase of about 4,500 persons over the 2007-08 enrollment. During the same period, the campus employee population is projected to increase to about 4,463 employees, an increase of 1,027 employees over the 2007-08 level.

3.11.1.3 Regional Population

Table 3.11-2, below, updates regional population data presented in the 2005 LRDP EIR to reflect AMBAG's 2008 population and forecasts, and California Department of Finance (DOF) population estimates for the region as of January 1, 2008. The 2008 AMBAG forecast indicates a lower annual growth rate and less total population and employment growth in the region than did the 2004 forecast, with Santa Cruz the slowest-growing county in the region (AMBAG 2008a: Executive Summary).

However, compared with AMBAG's 2004 forecast, the 2008 AMBAG forecast for the population of the city of Santa Cruz reflects a substantially higher rate of annual growth than projected in 2004, and a total population growth of nearly 4,000 more persons than indicated by AMBAG's 2004 forecast. This change likely reflects more accurate inclusion in the forecast of UC Santa Cruz's projected enrollment growth during this period. Most other County municipalities, the unincorporated areas in the county, and the County overall are projected to grow at slower rates than projected in AMBAG's 2004 forecast. DOF 2005 and 2008 population estimates suggest a higher growth rate in the city of Santa Cruz, the county overall, unincorporated areas of the county and the city of Watsonville than is indicated by straightline projections based on AMBAG's 2005 to 2020 growth projections in the agency's most recent (2008) forecast.

For purposes of the ECI Project cumulative analysis, Table 3.11-2, below, provides a midpoint extrapolation of AMBAG's projections based on a straightline projection between AMBAG's 2005 and 2020 population data, to reflect the projected populations in the County in 2011-12, the cumulative horizon of the proposed ECI Project. Based on these updated data, the rate of population growth in most localities in the county, including the city of Santa Cruz, appears to be higher than projected by AMBAG in 2004 and reported in the 2005 LRDP EIR.

Table 3.11-2
Historical, Existing and Projected Population in the Study Area

	AMBAG Forecast (2008) Population [a]						Estimated Population Growth [c]		Projected Growth [d]
	2005 [a]	2008 [b]	2010 [a]	2012 [e]	2015 [a]	2020 [a]	2005-2008	2008-2012	2005-2020
City of Santa Cruz									
Population	56,421	58,125	58,919	60,670	62,420	63265	1,704	2,545	6,844
Capitola									
Population	9,918	10,015	10,124	10,173	10,222	10,693	97	158	775
Scotts Valley									
Population	11,565	11,697	11,923	12,025	12,126	12,311	132	328	746
Watsonville									
Population	49,571	51,703	51,903	53,380	54,857	56,544	2,132	1,677	6,973
Unincorporated areas in Santa Cruz County									
Population	132,617	134,979	135,173	135,235	135,297	137,681	2,362	256	5,064
Santa Cruz County									
Population	260,092	266,519	268,041	271,012	273,983	280,493	6,427	4,493	20,401

Sources:

(a) AMBAG 2008 Population and Housing Forecast for 2005, 2010, 2015 and 2020.

(b) CA State Dept of Finance 1/1/08 (estimate).

(c) Based on AMBAG (2008) projections, DOF estimate for 2008, and extrapolated population for 2012. Note that project baseline is academic year 2007-08 and project horizon is academic year 2011-12. The years 2008 and 2012 are assumed to most closely approximate regional populations for these academic years.

(d) Based on AMBAG (2008) projections.

(e) Straightline projection between 2010 and 2015 based on AMBAG 2008 Forecast.

UC Santa Cruz provided input to AMBAG during the 2008 population forecast and regional housing needs assessment process to ensure that UC Santa Cruz's population growth and housing development were taken into account in the current population and housing projections and travel demand modeling, in particular for the City of Santa Cruz. UC Santa Cruz also formally requested that AMBAG review the proposed ECI Project for consistency with regional planning. AMBAG determined that the project is consistent with the population and housing unit growth projected in the 2008 forecasts (AMBAG 2008b). AMBAG also has indicated previously that UC Santa Cruz's projected growth has been taken into account in AMBAG's travel demand model (Santa Cruz Regional Transportation Commission 2007). The inclusion of UC Santa Cruz growth projections appears to be reflected in a projected annual growth rate in City of Santa Cruz population more than twice as high in the AMBAG 2008 forecasts as was projected by AMBAG in 2004. This revision reflects the fact that the earlier AMBAG projections did not fully consider UC Santa Cruz's projected enrollment growth.

3.11.1.4 UC Santa Cruz Housing and Residence Patterns

This section describes the UC-owned or leased housing both on and off campus in the city of Santa Cruz, campus housing data, and off-campus residence patterns of UC Santa Cruz students and employees. This section does not discuss housing related to the UC Santa Cruz Marine Science campus, as that campus is subject to a separate LRDP.

UC housing is self supporting, i.e., state funding is not provided to the campuses to build housing. Instead, the cost associated with the construction of new housing is recovered through rents. As a result, decisions to provide more housing on the campus are based on demand. Demand for on-campus housing tends to fluctuate, depending on the relative availability and costs of on- and off-campus rental housing. Employee housing on campus typically has been fully occupied. The occupancy levels of student housing fluctuate from year to year in response to the comparative availability and cost of housing on campus and in the City of Santa Cruz and other nearby communities. Historical data over the past 15 years indicate that student housing occupancy rates on campus have fluctuated between 93 percent and 100 percent.

Table 3.11-3, below, provides campus student and employee housing data for the 2007-08 ECI baseline year, and housing projections for the development horizon of the proposed project, 2011-12. Campus housing statistics have been updated from those presented in Section 4.11 (*Population and Housing*) of the 2005 LRDP EIR to provide more accurate accounting. As shown in Table 3.11-3, consistent with the Settlement Agreement (see Appendix A of this EIR), the campus has committed to provide a total of 10,125 student bed spaces if UC Santa Cruz enrollment reaches 19,500 by 2020-21; that is, a sufficient number of additional beds over a baseline of 7,125 to accommodate 67 percent of new enrollment above 15,000 students. The table presents both the number of campus housing units and beds available, and the number of employees and students actually residing in or projected to reside in those housing units or beds. The occupancy numbers are presented in order to more accurately characterize off-campus housing demand likely to be generated by the campus population.

Table 3.11-3
UC Santa Cruz Campus Housing

CAMPUS HOUSING	Actual		Projected		INCREASE		
					Actual	Projected	
	2003-2004	2007-2008	2011-2012	2020-2021	Baseline to Present	Present to ECI Horizon	2005 LRDP Total
					2003-04 to 2007-08	2007-08 to 2011-12	2003-04 to 2020-21
Student Housing							
Total Student Bed spaces	6,912	7,385	8,648	10,125	473	1,263	3,213
Student Bed Occupancy	6,050	7,009	8,216	9,619	959	1,207	3,569
Employee Housing							
Employee Housing Units	241	238	318	443	-3	80	202
Employees Housed	254	280	350[a]	487[a]	26	70	233
Total Campus Affiliates in Campus Housing	6,332	7,289	8,566	10,106	985	1,277	3,802
Total Dependents in Campus Housing	492	490	589	998	-2	99	506
Total Population in Campus Housing	6,824	7,779	9,155	11,104	983	1,376	4,308

Note: (a) Based on 1.1 UC Santa Cruz employees per housing unit. Actual rate in 2007-08 was about 1.15 UC Santa Cruz employees per UC Santa Cruz employee housing unit. On this basis, it is likely that a higher number of employees would be housed in employee housing on campus in academic year 2011-12. The projection is conservatively low.

Student Housing

On average over the last decade, the Campus has maintained the capacity to provide housing for approximately 50 percent of undergraduate students, or about 41 percent of all students currently enrolled. Under the Settlement Agreement, discussed in the Introduction to this EIR, the University committed to provide campus housing, above a baseline inventory of 7,125 beds, for 67 percent of the campus's enrollment above 15,000 students. As shown in Table 3.11-3, above, in 2007-08 UC Santa Cruz had a total University-managed student housing capacity of 7,385 beds in residence halls and student apartments on campus and at campus facilities in downtown Santa Cruz (that is, the UC Santa Cruz Inn and University Town Center). A total of 7,009 students resided in campus housing, for about 95 percent occupancy of campus student bedspace capacity. Thus, about 47 percent of all students were housed on campus in 2007-08. In addition, about 287 other adults and children resided in Family Student Housing apartments on campus.

The campus projects a total bedspace capacity in 2011-12 of approximately 8,648 student beds, taking into account bed spaces that would be provided by the previously-approved construction of the Porter B addition project, the proposed Porter A addition project, and the proposed ECI project. Based on this projection, and assuming that campus bedspace occupancy is maintained at the current 95 percent occupancy rate, about 8,216 students, or about 50 percent of all students, will be housed on campus in academic year 2011-12.

During the term of the ECI Project, campus enrollment is projected to increase from 15,000 to 16,300, an increase of about 1,300 students. In the Settlement Agreement, the campus committed to provide campus housing for 67 percent of student enrollment over 15,000, from a base line of 7,125 campus bed spaces. For the projected 1,300 enrollment increase, this equates with 871 new beds, or a minimum total of 7,996 beds to house 67 percent of the new enrollment. The 8,648 bed spaces projected in 2011-12 represents 1,523 bed spaces above the 7,125 baseline agreed upon in the Settlement Agreement, concurrent with an enrollment increase of 1,300. Thus, the campus's projected housing stock in 2011-12 would house more than 100 percent of new the enrollment increase above 15,000.

Historically, almost all first-year undergraduates have resided on campus, while the proportion of older undergraduates who choose to reside on campus tends to decline with each subsequent class year. The campus currently is in the process of adding a floor to the Porter B residence hall to provide 122 additional student bed spaces, which will be available in fall 2009, and has proposed an addition to the Porter A residence hall that, if approved, would provide an additional 177 student beds. These residence hall beds would be occupied primarily by first and second year undergraduates. The proposed ECI Project would construct apartments on campus that provide greater opportunities for independent living and that may be more desirable for older undergraduate students, while also providing the conveniences of residing on campus such as proximity to campus facilities and reduced transportation costs.

Employee Housing

In 2007-08, the campus housing inventory included 238 units of employee housing, which were occupied by a total of 280 faculty and staff persons, and an additional 209 other adults and children. All employee housing units were occupied, with an average of about 2.08 persons per employee household, including an average of about 1.15 employees per household. In total, about 8 percent of campus employees resided in campus housing. There has been a substantial increase in the number of staff persons living in campus housing: the 2005 LRDP estimated that fewer than 50 staff persons were housed on campus in 2004, while 120 staff persons resided in campus housing in 2007-08.

Campus employee housing capacity is projected to increase to about 318 units by academic year 2011-12, with the projected completion of the previously-approved Ranch View Terrace project, which will provide 84 new employee housing units. (During the same period, a few housing units within the colleges that currently are classified as employee units may be reclassified as student housing, but some new student housing developments would include apartments for Coordinators for Residential Education [staff employees], which would balance the loss of the reclassified units). Based on historical data, about 1.1 employees will reside in each employee housing unit, for a total of about 350 employee residents on campus. This represents an increase by about 70 persons in the number of employees housed on campus.

The ratio of 1.1 employees per employee housing unit may be conservatively low. As noted above, in 2007-08 the average employee residential unit on campus housed 1.15 employees.

Regional Residence Patterns of UC Santa Cruz Affiliates

It is anticipated that population growth during the development horizon of the proposed ECI Project would be consistent with the patterns and amounts of housing demand reported in the 2005 LRDP EIR (Volume II, Section 4.14, Table 4.11-4). Table 3.11-4, below, presents data on recent and historic residence patterns of UC Santa Cruz affiliates (students and employees).

Table 3.11-4
Residence Distribution Patterns of UC Santa Cruz Affiliates

Population	2007-2008 (based on historical patterns)		2011-2012 (projected)	
	Students	Employees	Students	Employees
Total Population	15,000	3,436	16,360	4,097
Distribution by Percentage of Total Population				
On-campus resident	46.73 percent	8.15 percent	50.22 percent	8.54 percent
Off-campus resident	53.27 percent	91.85 percent	49.78 percent	91.46 percent
Out-of-county Commuters	6.00 percent	13.00 percent	6.00 percent	13.00 percent
In-county Commuters	47.27 percent	78.65 percent	43.61 percent	78.46 percent
Off-Campus in Study Area				
Santa Cruz	35.50 percent	46.53 percent	32.75 percent	46.41 percent
Davenport	0.45 percent	0.38 percent	0.41 percent	0.38 percent
Ben Lomond	0.45 percent	1.42 percent	0.41 percent	1.42 percent
Boulder Creek	0.27 percent	1.33 percent	0.25 percent	1.32 percent
Felton	0.62 percent	1.90 percent	0.58 percent	1.89 percent
Mt. Hermon	0.71 percent	0.19 percent	0.66 percent	0.19 percent
Scotts Valley	0.80 percent	2.94 percent	0.74 percent	2.93 percent
Capitola	1.25 percent	2.37 percent	1.15 percent	2.36 percent
Live Oak	4.37 percent	7.11 percent	4.03 percent	7.09 percent
Soquel	0.89 percent	2.75 percent	0.82 percent	2.74 percent
Aptos	1.07 percent	5.12 percent	0.99 percent	5.10 percent
Watsonville	0.71 percent	6.06 percent	0.66 percent	6.05 percent
Brookdale	0.00 percent	0.19 percent	0.00 percent	0.19 percent
Freedom	0.00 percent	0.46 percent	0.00 percent	0.47 percent

As shown in Table 3.11-4, more than 46 percent of the student population and 8 percent of the employee population lived on campus in 2007-08. These percentages are expected to increase to about 50 percent and 8.5 percent, respectively, during the development horizon of the ECI Project, based on the number of campus housing units that are projected by the campus, and on expected occupancy rates. During the same period, assuming that the number of persons who would commute to the campus from outside the study area remains constant, the percentage of employees projected to reside off campus in the study area is expected to decrease slightly, while the percentage of students expected to reside off campus in the study are is expected to decrease by about 3 percent. The distribution of UC Santa Cruz population among off-campus study area communities is expected to remain proportional to the historical distribution, but the percentage of the total UC Santa Cruz population residing in each of these communities is projected to decline over time, commensurate with the increase in the percentage of the UC Santa Cruz population housed on campus.

Table 3.11-5, below, estimates the number of housing units in each study area community likely to be taken up by UC Santa Cruz affiliates during the development horizon of the proposed ECI Project. These numbers are based on the residential distribution percentages provided in Table 3.11-4, above.

Table 3.11-5
UC Santa Cruz Off-Campus Housing Demand in Study Area Communities during the ECI Development Horizon

Population (persons)	2007-2008	2011-2012	Projected Increase 2007-08 to 2011-12
Total Students	15,000	16,300	1,300
Total Employees	3,436	4,097	661
Student Bedspace Occupancy	7,009	8,216	1,207
Employee On-campus Residents	280	350	70
On-campus Resident	7,289	8,566	1,277
Off-campus Resident	11,147	11,831	684
Out-of-county Commuters	1,347	1,515	168
In-county Commuters	9,800	10,376	576
Project Housing Unit Demand in Study Area Communities (housing units)			
Santa Cruz	3,228	3,515	286
Davenport	34	37	2
Ben Lomond	67	75	9
Boulder Creek	55	63	8
Felton	90	102	11
Mt. Hermon	42	43	1
Scotts Valley	132	150	18
Capitola	136	151	14
Live Oak	441	484	43
Soquel	130	147	17
Aptos	213	244	31
Watsonville	225	261	36
Brookdale	6	7	1
Freedom	15	18	3
Total UCSC Demand for Off-campus Housing Units	4,814	5,295	481

As shown in Table 3.11-5, it is projected that the off-campus housing demand that would result from UC Santa Cruz population increases during the ECI development horizon would be about 481 housing units. Because the projected increase in on-campus student beds during this period would be nearly as great as the increase in student enrollment, the projected increase in the number of students who would seek housing off-campus in the study area is less than 100. This would be expressed as demand for fewer than 35 additional off-campus housing units in the study area. The majority of the increase in housing demand during this period would derive from increased employee population.

The increase in off-campus housing demand projected during the ECI development horizon is within the total increase projected in the 2005 LRDP EIR.

3.11.1.5 Regional Housing

Although for sale housing prices in Santa Cruz have declined substantially in recent months, the median home value in Santa Cruz remains substantially higher than the statewide average. Rental costs in the region have continued to increase, and rental vacancy rates in Santa Cruz are low. There has been substantial demand for UC Santa Cruz campus rental housing: occupancy rates are at 95 percent and appear to be increasing.

Projections of new housing in the city of Santa Cruz generally are available from three sources: the City's General Plan Housing Element, AMBAG 2008 forecasts, and California Department of Finance (DOF) annual estimates. The City's most recent housing element addresses the period between 2002 and 2007 and has not yet been updated. Table 3.11-6, below, presents projections for future housing units likely to be developed off-campus in the study area between 2008 and 2012. Published regional projections are based on calendar years rather than academic years. DOF provides annual population and housing estimates on January 1 of each year (for example, the 2005 estimate was published on January 1 of 2005). The DOF estimates are the source baseline data for the AMBAG projections. Therefore, calendar year 2008, as used in Table 3.11-6, is assumed to approximate conditions for the project baseline academic year 2007-08, and the calendar year 2012 approximates conditions in 2011-12, the academic year in which the proposed ECI Project would be completed and occupied.

Two potential rates of growth are considered in the table. One growth rate is based on AMBAG's Monterey Bay Area 2008 Regional Forecast, which projects regional population, housing units and employment at five-year intervals from 2005 through 2035 (AMBAG 2008a). The annual housing growth rate attributed to AMBAG, in the table, is calculated as the percent-per-year housing stock increase in the County and in each community, and as units per year, based on AMBAG's 2008 population and housing forecast for housing growth between 2005 and 2020. Table 3.11-6 also present an estimated alternative growth rate for the County and each community, based on the difference between the California Department of Finance (DOF) estimate of actual housing units in the study area as of January 1, 2005, and the actual number of units in the study area as of January 1, 2008. This rate is then used to calculate potential new units per year. Because the growth rate derived from the AMBAG projections differs from the rate of growth derived from DOF's 2005 and 2008 estimates, the result of the calculations described above is two different estimates of the amount of housing that might be developed between 2007-08 and

2011-12. Table 3.11-6 identifies a range in the number of housing units that might be expected to be developed between 2008 (the closest projection year to project baseline, academic year 2007-08) and 2012 (the closest projection year to the academic year in which the project would be occupied, academic year 2011-12). The rate at which units will actually be developed is subject to market and other economic conditions; therefore, using a range of projected total new units is reasonable.

As shown in Table 3.11-6, it is estimated that the number of housing units that will be added to the housing stock in Santa Cruz County between 2008 and 2012 will be within the range of 1,940 to 2,143 units. Between approximately 328 and 444 of these units are expected to be added in the City of Santa Cruz, and between approximately 1,496 and 1,815 in other study area communities and the unincorporated area of Santa Cruz County during this period. About 25 percent of these new units would be added in Watsonville and about 40 percent are projected for unincorporated areas of the county. AMBAG's Regional Forecast (AMBAG 2008a) projects very limited housing growth in Capitola and Scotts Valley, the two other incorporated municipalities in the study area.

Table 3.11-6
Projected Growth in Housing Units in Study Area Communities during ECI Development Horizon

Area	DOF[a] and AMBAG[c]	DOF Housing Unit Est. (units)	AMBAG Housing Unit Projection (units)	Estimated Housing Unit Growth (units)	Projected Housing Unit Growth (units)	Housing Unit Growth rate (percent per annum)	Extrapolated Annual Growth based on 2005-20 Projection	Extrapolated Annual Growth based on 2005-08 Est.	Extrapolated Growth, 2008 to 2012 (units)	
Data Source		DOF[b]	AMBAG[c]	DOF[a]	AMBAG[c]	AMBAG[c]	AMBAG[c]	DOF[a, b]	At Growth Rate from AMBAG Forecast	At Growth Rate based on DOF 05-08 Est.
	2005	2008	2020	2005-2008	2005-2020	2005-2020	units/year	units/year	units	units
County of Santa Cruz	102,872	104,479	110,143	1,607	7,271	0.47	485	536	1,940	2,143
City of Santa Cruz	23,133	23,379	24,794	246	1,661	0.48	111	82	444	328
Capitola	5,387	5,412	5,763	25	376	0.47	25	8	100	33
Scotts Valley	4,616	4,646	4,919	30	303	0.44	20	10	80	40
Watsonville	13,463	14,066	15,347	603	1,884	0.93	126	201	504	804
Balance of County	56,273	56,976	59,321	703	3,048	0.35	203	234	812	937

Sources: (a) State of California Department of Finance (DOF). 2005.

(b) State of California Department of Finance (DOF). 2008.

(c) Association of Monterey Bay Area Governments (AMBAG). 2008a

3.11.1.6 Relevant Project Characteristics

The proposed ECI Project consists of two seven- to eight-story apartment buildings that would provide two employee apartments, and 99 student apartments with a total about 594 student beds. The project would be constructed as infill development within the campus core of the main UC Santa Cruz campus, within the city limits of the City of Santa Cruz. The project site would displace a small apartment building at Crown College, which currently houses seven students, and portions of an underutilized campus parking lot. The facility would require a full-time equivalent staff of about 8 to 10 persons to manage, operate and maintain the housing facilities and associated retail component (including a café), and to assist student residents. About 17 student Resident Assistants would be among the student residents of the facility. The project would accommodate student population already enrolled or projected to be enrolled at the campus by the time the project would be complete and occupied, in fall 2011 (academic year 2011-12). The project thus would not result in an increase in student enrollment, but would increase the number of students who would live on campus rather than off campus.

In its consistency determination for the ECI Project, AMBAG assessed the consistency of the proposed project with regional planning (AMBAG 2008b), with assumptions that it would add 600 persons and 600 housing units to the City of Santa Cruz, and determined that the proposed project is consistent with the population and housing projections presented in the AMBAG regional forecasts for the City (AMBAG 2008a). The population associated with the ECI Project (approximately 594 students and 10 employees) and its bedspace capacity (594 student beds and two employee housing units) are well within the total campus population increase considered in the 2005 LRDP EIR and the housing development projected for the campus in the 2005 LRDP EIR as amended by the Settlement Agreement. The ECI student population would not contribute to off-campus housing demand in the region, and the employee population associated with the project would contribute only minimally to off-campus housing demand. The project would not reduce the inventory of housing available off-campus in the region.

3.11.2 Impacts and Mitigation Measures

3.11.2.1 Applicable LRDP EIR Mitigation Measures

The following previously-adopted 2005 LRDP EIR mitigation measures have been implemented to reduce the impact of 2005 LRDP development, including the proposed project, on the cumulative demand for housing in excess of projected supply within the study area.

LRDP Mitigation POP-3A: The Campus will continue to monitor demand for student housing on an annual basis, and will ensure that a sufficient number of students beds are available on campus, through a combination of new housing construction and temporary modification of existing housing space ("overflow housing"), to accommodate at least 50 percent of undergraduate student enrollment and 25 percent of graduate student enrollment, as demand dictates.

LRDP Mitigation POP-3B: Within one year following approval of the 2005 LRDP, the Campus will fund and carry out a study to identify ways in which the Campus can collaborate with other large employers, the City of Santa Cruz, and the County of Santa Cruz to assist in providing wider access to available housing for UC employees and affiliates and other community members, through mechanisms such as a jointly-funded housing trust augmented by grants and other funding sources.

LRDP Mitigation POP-3C: The Campus will consult with the City and County of Santa Cruz on data needs and potential future joint projects and, within one year following approval of the 2005 LRDP, the Campus will fund and carry out a market analysis of the local housing market, including demand for housing by housing type and other demand factors, costs, vacancy, and occupancy rates, to provide data to assist the City in its planning activities related to housing needs, to assist the Campus in planning Campus housing, and to assist in the planning of potential joint projects. The Campus will update this study at no greater than five-year intervals.

The Campus will continue to monitor LRDP Mitigation POP-3A. However, the campus housing provisions described in this measure subsequently were augmented by the Campus's commitment in the Settlement Agreement to provide campus housing for 67 percent of students enrolled above a baseline enrollment of 15,000 for the term of the 2005 LRDP, or 10,125 campus beds if campus enrollment reaches 19,500. The study required by LRDP Mitigation POP-3C will be updated every five years, as required.

3.11.2.2 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, the proposed project would have a significant impact on population and housing if it would:

- Directly induce substantial population growth in the area by proposing new housing and employment
- Indirectly induce substantial population growth in an area (for example, through extension of roads or other infrastructure)
- Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere
- Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere
- Contribute substantially to a cumulative demand for housing that could not be accommodated by local jurisdictions

3.11.2.3 Analytical Method

The impact analysis presented below examines the population and housing impacts on the campus and in the study area that would result from the development and operation of the proposed ECI Project. The indirect and induced employment[4] and population growth that would result from the program of enrollment growth and campus development under the 2005 LRDP (of which the proposed ECI Project is an element) is discussed in Section 6.3 of the 2005 LRDP EIR, *Growth Inducing Impacts*. Regional population and housing data presented in this EIR are based on AMBAG's most recent forecast (AMBAG 2008a), which updates data from AMBAG's previous forecast (AMBAG 2004), that provided regional baseline date presented in the 2005 LRDP EIR. Campus housing projections presented in this EIR reflect the campus's Settlement Agreement (see Appendix A), which increases the amount of on-campus housing included in the 2005 LRDP development program.

3.11.2.4 ECI Project Impacts and Mitigation Measures

Displacement of Substantial Numbers of People or Housing

The proposed ECI Project would displace an existing apartment building on the project site that would be demolished to accommodate construction of the proposed project. The building presently provides bed spaces that house six students. This number of students and bed spaces is not significant in the context of overall student housing on the campus, which included over 7,000 bed spaces in 2007-08. The proposed project would add 594 bed spaces of similar campus housing to the housing stock in the immediate vicinity of the displaced housing. Therefore, the proposed project would not displace substantial numbers of existing housing units or people.

Directly Population Growth Inducement

The 2005 LRDP EIR, Section 4.11, LRDP Impact POP-1, identified, as a significant impact of campus development under the 2005 LRDP program of growth, that the 2005 LRDP would directly induce substantial population growth in the Santa Cruz region. Because no mitigation was available the impact was considered significant and unavoidable. The proposed ECI Project would contribute to LRDP Impact POP-1, in that it would provide up to 10 new jobs on campus, which could directly induce population growth in the study area. As analyzed in Section 4.11 of the 2005 LRDP EIR, under a worst-case scenario none of the staff persons employed for the project would already be resident in the region at the time they are employed. Based on a household size of 2.3 persons, it is estimated that about 13 household members could be associated with the 10 new employees. The project would result in the addition of up to 23 persons to the region. As discussed above, anticipated population growth in Santa Cruz County between 2008 (the closest projection year to the project baseline, academic year 2007-08) and 2012 (the closest projection year to the academic year in which the project would be completed and occupied, 2011-12), is estimated at about 4,493 persons, and growth in the city of Santa Cruz is estimated at about 2,545. The population potentially added by the proposed project staff and their households under this worst-case scenario, therefore, would represent approximately 0.4 percent of total growth in the county between 2008 and 2012. If all new employees were to reside in the city of Santa Cruz, they would represent less

[4] Indirect employment refers to jobs that are created or supported by direct jobs or direct spending of the campus. For instance, an indirect job is created/supported in an office supply store when the Campus buys office supplies locally. Induced employment, on the other hand, refers to jobs that are created/supported when persons employed in direct and indirect jobs spend their wage incomes to purchase goods and services. A job in a grocery store would be considered an induced job.

than 1 percent of the anticipated population growth in the city during that period. This small contribution to population growth would not be considered substantial and would not constitute a significant impact with respect to population growth. Furthermore, as explained in the 2005 LRDP EIR, 10 years of campus hiring history indicates that about 68 percent of new UC Santa Cruz employees are hired from within the county, and only 31 percent from outside the county. If this pattern continues, the new employment offered by the ECI Project would add only about 12 new persons to the study area (three employees and their dependents), or about one-quarter of one percent of the population anticipated to be added to the study area between 2008 and 2012. However, even in the worst case the population growth associated with project staff and their families would be a very small part of the overall population growth anticipated in the region and would not constitute substantial population growth.

With respect to the potential to induce substantial employment growth, AMBAG's 2008 population and housing forecasts (AMBAG 2008a), show a decline in jobs throughout the county between 2005 and 2010, followed by increased employment between 2010 and 2015. Based on extrapolation from AMBAG's forecast, there would be a total of about 34,500 jobs in the City of Santa Cruz in 2012, the closest projection year to the academic year (2011-12) when ECI employment would begin, an increase of about 675 jobs over projected 2010 levels. The 10 ECI jobs are well within this projection. They also are well within the total new UC Santa Cruz employment projected for the campus under the 2005 LRDP, as shown in Table 3.11-1, above.

The proposed project would not generate or accommodate new enrollment, but would provide housing for students already enrolled or included in campus enrollment planning under the 2005 LRDP. All of the 600 students accommodated by the proposed ECI Project would reside on-campus in the proposed project. Since the project provides only single-student housing, no additional household members would be associated with the ECI residents. Therefore, the students housed on the campus would not result in any residential population increase off-campus in the City of Santa Cruz. The project would not result in increased student demand for off-campus housing in the city of Santa Cruz or the wider region, and the on-campus student housing that would be provided by the project is within the previously-approved 2005 LRDP program of development. The population that would reside in the project is taken into account in the overall enrollment projections for the campus, as presented in the 2005 LRDP EIR (see Table 3.11-1, above). Furthermore, AMBAG (2008b) has determined that the proposed project is consistent with its 2008 population projections and related traffic modeling.

The proposed project would not result in a substantial population increase in the region, and its contribution to LRDP Impact POP-1 therefore would not be cumulatively considerable.

Note that regional growth induced by the 2005 LRDP program of development by means of the income and employment multiplier process is addressed in Section 5.3 of this EIR, *Growth-Inducing Impacts.* The proposed project, as an element of the program of growth envisioned in the 2005 LRDP, would contribute to the LRDP's growth inducing impacts, but the project's contribution would not be cumulatively considerable.

Population Growth Inducement through Extension of Roads or Infrastructure

Additional growth beyond that directly associated with the proposed project may be triggered if the infrastructure to serve the proposed project is constructed with excess capacity, or where the lack of infrastructure is an obstacle to growth, that obstacle is removed by the project.

As discussed in Section 3.15, *Utilities and Service Systems*, the project site currently is served by existing campus utility distribution systems. The proposed project would not entail or require the extension of utilities and infrastructure, because the utility connections necessary to serve the site are present in the roadways adjacent to the site. The proposed ECI Project would not indirectly induce substantial population growth through the extension of roads and utilities or through growth pressures.

3.11.2.5 Cumulative Impacts and Mitigation Measures

Cumulative Demand for Housing

The 2005 LRDP EIR identified, in LRDP Impact POP-3, that growth of the campus under the 2005 LRDP, in conjunction with other regional growth, would create a demand for housing that, combined with other regional housing demand, would exceed the supply, which would be a significant impact.

As discussed above, the proposed ECI Project would employ about 10 new staff persons. If all of these new employees were hired from outside the study area and moved into the study area (a worst case assumption), this would result in a demand for 9 to 10 housing units in the study area in academic year 2011-12. Two of the employees would be housed on campus in the proposed project. On the basis of extrapolation from AMBAG forecasts and DOF projections of housing unit development, as shown in Table 3.11-6, above, between 1,940 and 2,143 new housing units will be developed annually in the study area between 2007-08 and 2011-12, the period during which new employees associated with the ECI Project would require housing in the study area. The project's contribution to additional off-campus housing demand in the study area (no more than 8 units) would constitute about 0.4 percent of the total housing units likely to be developed in the region in that year based on AMBAG projections and DOF data. This small number of new units, dispersed among study area communities, does not represent a substantial contribution to a cumulative demand for housing that could not be accommodated by local jurisdictions.

Although the proposed ECI Project, as an element of the program of growth envisioned in the 2005 LRDP, would contribute to the previously identified impact, POP-3, the project's contribution to the cumulative demand is slight, and is not considered cumulatively considerable. The campus has implemented LRDP Mitigations POP-3A, -3B and -3C and, further, has committed to increase the amount of campus housing provided for students above the levels described in the 2005 LRDP EIR. Further, the increased on-campus student housing being provided under the Settlement Agreement, including projects such as the proposed ECI Project, will reduce the overall demand for off-campus from population associated with the program of growth envisioned in the LRDP.

Therefore, the contribution of the project to cumulative demand for housing would not be cumulatively considerable.

3.11.3 References

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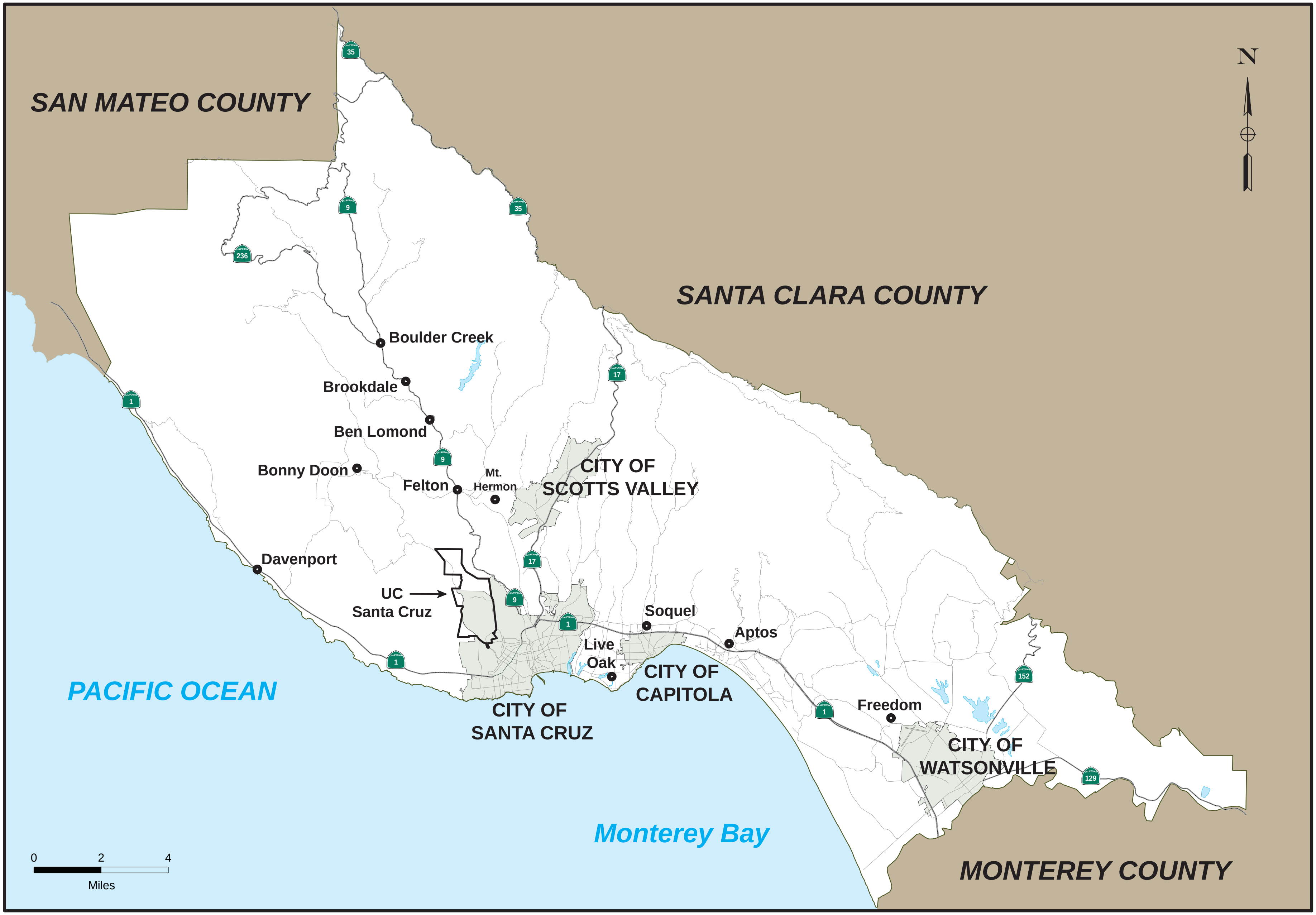

UC Santa Cruz — East Campus Infill Housing Project EIR, Santa Cruz, California — March 2009 **STUDY AREA FOR POPULATION & HOUSING** FIGURE 3.11-1

3.12 PUBLIC SERVICES

3.12 PUBLIC SERVICES

This section describes the existing public services that serve UC Santa Cruz, including police, fire protection, and emergency services; schools; and libraries; and evaluates potential changes to the physical environment that may result from the construction of new or expanded public service facilities needed to serve the proposed project. This section provides project-level analysis and additional detail regarding public services and supplements and augments, pursuant to CEQA Guidelines Section 15152, the analysis provided in Section 4.12, Volume II, of UC Santa Cruz' 2005 LRDP EIR.

During the scoping process for this EIR, no comments were received regarding the public services topics discussed herein.

3.12.1 Environmental Setting

3.12.1.1 Study Area

For purposes of evaluating impacts of the population growth and development under the 2005 LRDP on public services, the study area is defined to include all of the UC Santa Cruz main campus; 2300 Delaware Avenue; the cities of Santa Cruz, Capitola, and Scotts Valley; and unincorporated Santa Cruz County.

3.12.1.2 Law Enforcement

UC Santa Cruz Police Department

The UC Santa Cruz Police Department is the sole provider of police protection services on campus and at UC facilities on the west side of the city of Santa Cruz, except when specific calls for assistance are made to other law enforcement agencies based on a mutual aid memorandum. The UC Santa Cruz Police Department has one station, which is located at the recently completed Emergency Response Center near the main entrance to the campus.

City of Santa Cruz Police Department

The City of Santa Cruz Police Department serves University-owned or -leased facilities in downtown Santa Cruz. When required, the UC Santa Cruz Police Department and City of Santa Cruz Police Department (SCPD) provide mutual support, as stipulated in a memorandum of understanding between the two agencies signed in 1971. The SCPD headquarters is located at 155 Center Street, about 2 miles or a 5-minute response time from the closest edge of UC Santa Cruz's campus. There is only one station for the City of Santa Cruz, and all calls to the SCPD regarding the campus are handled from this station.

County of Santa Cruz Sheriff's Office

The County of Santa Cruz Sheriff's Office is located at 701 Ocean Street in the City of Santa Cruz, about 2.5 to 3 miles from any part of the UC Santa Cruz campus. The Sheriff's Office provides services to County residents living in unincorporated areas of the County, including UC Santa Cruz students, faculty and staff living off-campus, and assists the UC Santa Cruz Police Department on campus upon request. Such assistance usually consists of crime investigation support, crowd control, and coroner's duties.

3.12.1.3 Fire Protection

As explained in the 2005 LRDP EIR (Section 4.12), fire protection and emergency medical services on the UC Santa Cruz campus are provided by three agencies. The UC Santa Cruz Fire Department provides first response for all emergencies on University property. Under a mutual aid agreement, the City of Santa Cruz Fire Department (SCFD) is also responsible for providing fire suppression services to the campus at the same level of service as it provides to the city at large, and typically assists the UC Santa Cruz Fire Department with structural fires. The California Department of Forestry and Fire Protection (CAL FIRE) responds to all wildfires in unincorporated areas of Santa Cruz County, including the portion of the UC Santa Cruz campus that is in unincorporated Santa Cruz County. Each of these agencies is described below.

UC Santa Cruz Fire Department

The UC Santa Cruz Fire Department headquarters (Fire House) is located off of Chinquapin Road. As of February 2005, the UC Santa Cruz Fire Department employs 18 sworn employees and one administrative assistant. A minimum of four firefighters is on duty at all times (UC Santa Cruz Fire Department web site).

City of Santa Cruz Fire Protection and Emergency Services

The SCFD provides backup fire suppression and other emergency services to the UC Santa Cruz Fire Department. The SCFD headquarters are located at 23 Walnut Avenue in Santa Cruz. Three SCFD stations serve the UC Santa Cruz campus and respond in the following rank-order according to location: Fire Station #3 at 335 Younglove Avenue, Fire Station #1 at 711 Center Street, and Fire Station #2 at 1103 Soquel Avenue. All three stations were renovated between 2000 and 2001.

California Department of Forestry and Fire Protection

CAL FIRE responds to all wildland fires within unincorporated Santa Cruz County, which includes the upper and north portion of the UC Santa Cruz campus. CAL FIRE is also called in to assist with incidents throughout the campus when emergencies require more effort than the UC Santa Cruz Fire Department can handle.

Bonny Doon Station #32 at 975 Martin Road in Santa Cruz, which is staffed by volunteers, and the Big Creek facility in Davenport, which has paid staff present at all times, are open year-round regardless of seasonal fire risk levels. At least three firefighters staff the Big Creek station at any given time. During the declared fire season, typically May through October, two extra fire stations are put in service: Felton Station (full-time staff) at 6509 Highway 9 and Soquel Station (volunteer staff) at 4750 Old San Jose Road.

3.12.1.4 Schools

Santa Cruz City Schools District

The Santa Cruz City Schools District (SCSD) is composed of two separate districts: the Elementary District (K-6) and the High School District (7-12). The two districts are governed by a common board and administration, and have a total of 14 public schools, including an adult school, between them.

Total district school enrollment for the 2004-05 school year was 7,765 students. Total enrollment for the 2007-08 school year was 6,983 students (Ed-Data web site). As reported in the 2005 LRDP EIR, projected enrollments for academic year 2013-14 anticipate a drop from current levels to 1,974 elementary, 966 middle, and 3,715 high school students, for a total of 6,655 students.

3.12.1.5 Libraries

UC Santa Cruz University Library

The UC Santa Cruz University Library has two facilities: McHenry Library and the Science & Engineering Library. The University Library primarily serves UC Santa Cruz students, faculty and staff; however, its collections are also made available to the general public through the Friends of the Library program. In addition to the main campus libraries, four of the campus's residential colleges have their own smaller libraries that serve affiliates of those colleges.

The McHenry Library is a 114,000-square-foot facility that houses the Arts, Humanities and Social Science collections. The McHenry Library project, which is currently under construction, will add approximately 81,600 assignable square feet to the original building. When completed, the space will be able to accommodate a growing print collection, state-of-the-art electronic collections, and an upgraded infrastructure that will provide students with access to the latest technology. The Science & Engineering Library is a 55,160-assignable-square-foot (76,800-gross-square-foot) facility that houses the campus's natural sciences and engineering collections.

Santa Cruz Public Library System

Library service in Santa Cruz County is provided primarily by the Santa Cruz Public Library system and the Watsonville Public Library. In addition, county residents are served by the UC Santa Cruz Library, Cabrillo College Library in Aptos, Ben Lomond Library in Ben Lomond, and Porter Memorial Library in Soquel. The Santa Cruz Public Library System consists of 10 libraries in three different service areas, comprising about 92,000 square feet. The public libraries closest to the UC Santa Cruz campus are the Central Branch Library at 224 Church Street and the Garfield Park Branch Library at 705 Woodrow Avenue. Between February 2003 and February 2005, 1,854 UC Santa Cruz students were registered as borrowers from the Santa Cruz Public Library System.

Capital projects for the library system that could be completed during the next five years include expanding the Aptos Branch parking lot, building a replacement branch in Felton, and assisting Capitola and Scotts Valley with the construction of new facilities in their communities. Other future plans include expanding the Aptos branch and renovating the Central branch (Santa Cruz Public Libraries web site).

3.12.2 Relevant Project Characteristics

The proposed project would construct two buildings that would range from seven to eight stories and would house approximately 600 students. The project would construct a total of 196,000 gross square feet (gsf) of new building space. A total of approximately 10 new campus staff would be needed to maintain the new facilities and provide services to the residents. The UC Santa Cruz Fire Department would provide first response for all emergencies at the site. Emergency access to the new buildings would be provided by the new access roads along the north and south ends of the site, and a service access driveway adjacent to the new plaza. This would provide a looped configuration that would allow fire trucks to drive through the site.

3.12.2.1 Applicable LRDP EIR Mitigations

There are no LRDP EIR mitigations that are applicable to the proposed project.

3.12.3 Impacts and Mitigation Measures

3.12.3.1 Standards of Significance

The following standard of significance is based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, public services impacts are considered significant if the proposed project would:

- Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services (police, fire, schools, and libraries).

Effects associated with recreation services are evaluated in Section 3.13, *Recreation*, and effects associated with the capacity of the domestic fire water system to provide adequate fire protection are evaluated in Section 3.15, *Utilities and Service Systems*.

3.12.3.2 Analytical Method

This analysis evaluates the potential for adverse physical impacts to occur as a result of the provision of new or altered public service facilities to serve the proposed new buildings, including facilities or facility expansions needed to accommodate increases in demand for services and service personnel, or to enable service providers to maintain level of service standards. The increased workload or hiring of additional staff is an economic impact, but is not a physical effect on the environment and thus is not within the purview of this EIR.

The project's new building space would result in increased demand for fire protection. The approximately 600 new residents would increase demand for police services. In addition to this on-campus demand, the ten additional employees required to maintain the new facilities and provide services to the residents would live off-campus in the city of Santa Cruz and the surrounding communities. The effects of the project-related off-campus population on services is analyzed as part of the cumulative impacts discussion in this section.

3.12.3.3 Project Impacts and Mitigation Measures

Police Services

As explained above, in Section 3.12.1.2, law enforcement on campus is handled solely by the UC Santa Cruz Police Department. Occasionally, as determined by a 1971 mutual aid agreement between the departments, the City of Santa Cruz Police Department provides assistance to the campus if required and vice versa. The County Sheriff's Department generally only helps with occasional criminal investigations or coroner duties on campus. The new residential population associated with the proposed project would result in an increase in the demand for on-campus police services. The 2005 LRDP EIR (LRDP EIR Impact PUB-1) analyzed the potential environmental impacts of the increased demand for police services under the 2005 LRDP and concluded that the impact would be less than significant because the existing Emergency Response Center would be able to accommodate any needed staffing increases through 2020. The SCPD and the County Sheriff's Office do not provide regular service to the UC Santa Cruz main campus, so these agencies would not be affected by the campus's projected growth under the 2005 LRDP.

The building space and residential population associated with the proposed project are within the building program analyzed in the 2005 LRDP EIR. Therefore, the project impact would be less than significant.

Fire Protection

First-response fire protection, emergency medical service and hazardous material incident response on the main campus are handled by the UC Santa Cruz Fire Department. Additional fire protection and emergency medical treatment assistance would be provided as needed by the SCFD. The new building space associated with the proposed project would result in an increase in the demand for on-campus fire protection services by these entities. The 2005 LRDP EIR (LRDP EIR Impact PUB-2) analyzed the potential environmental impacts of the increased demand for on-campus fire protection services and concluded that the UC Santa Cruz Fire Department would need to add approximately five staff and expand the existing fire station to include an additional fire engine bay but that the potential impacts of this addition would be less than significant with incorporation of mitigation measures discussed in the biological resources and cultural resources sections of the 2005 LRDP EIR. The additional employees that could be required to staff the Fire Department employee growth were included in the growth projections of the 2005 LRDP and considered in the 2005 LRDP EIR evaluation of population, housing, traffic, and other population-related impacts. The SCFD generally assists in fighting structural fires on the campus and its ladder truck would be required to reach the upper floors of the proposed project. However, because the SCFD does not provide first response to the main campus, the increased on-campus population under the 2005 LRDP would not necessitate an expansion in SCFD facilities.

The building space and residential population associated with the proposed project are within the development program analyzed in the LRDP EIR. Therefore, the project impact would be less than significant.

Schools

The Santa Cruz City Schools District operates a total of 14 public schools and one adult school to serve local residents. As reported in the 2005 LRDP EIR (Section 4.12, Volume II), all SCSD schools were operating below capacity in 2004-05 and the SCSD anticipated a continued decline in enrollment through 2014. In 2005, the system had room for 1,290 additional students. Between 2004-05 and 2007-08, the total enrollment for the district had declined by 421 students (Ed-Data web site).

Applying SCSD student generation rates to the 326 additional on-campus dwelling units for faculty, staff, and student families planned under the 2005 LRDP, the campus would add approximately 85 kindergarten through 12th-grade students to the SCSD system by 2020.

The residents of the proposed project would be single students who would not contribute to demand for public schools. The 10 new staff associated with the proposed project, who would live off-campus, are within the off-campus population in the development program analyzed in the LRDP EIR. Therefore, the project impact would be less than significant.

Library Facilities

The proposed project would increase the on-campus residential population and could result in an increased demand for library services. The 2005 LRDP EIR analyzed the potential for the construction of new library facilities to meet the demand associated with on-campus population growth under the 2005 LRDP and concluded that the impact would be less than significant because the LRDP designates adequate land for the expansion of the campus libraries as infill development. Environmental effects of construction activities related to the expansion of on-campus library facilities, such as possible habitat loss, are addressed in the following sections of the 2005 LRDP EIR: 4.1 (*Aesthetics*), 4.2 (*Agricultural Resources*), 4.3 (*Air Quality*), 4.4 (*Biological Resources*), 4.5 (*Cultural Resources*), 4.6 (*Geology and Soils*), 4.7 (*Hazards and Hazardous Materials*), 4.8 (*Hydrology and Water Quality*), 4.10 (*Noise*), 4.13 (*Recreation*), and 4.15 (*Utilities and Service Systems*).

As discussed in the 2005 LRDP EIR (Section 4.12, Volume II), although a small portion of the increased UC Santa Cruz population also would become cardholders in the Santa Cruz Public Library System, the majority of increased library use would still occur on campus. Therefore, although regional population growth may result in the need for new or expanded libraries in the City or the County of Santa Cruz, growth associated with the 2005 LRDP would not contribute to the need for these library facilities. Therefore, the 2005 LRDP concluded that, to the extent that there are adverse environmental impacts from the construction of new or expanded library facilities, campus growth under the 2005 LRDP would not contribute to such impacts.

3.12.3.4 Cumulative Impacts and Mitigation Measures

Police and Fire Services

The approximately 10 new campus employees who would maintain the proposed East Campus Infill complex and provide services to the residents would contribute to increased demand for police and fire services that would result from increased population in the city of Santa Cruz and surrounding communities. The 2005 LRDP EIR analyzed the potential that the construction of new or altered police and fire facilities required to serve the projected population growth could result in adverse physical environmental effects. The LRDP EIR concluded that although growth under the 2005 LRDP would result in additional residents in the city of Santa Cruz and the surrounding communities, the affected police departments either have determined that either they have adequate facilities or do not have plans for expansion of facilities. Therefore, there would be no environmental impacts from the provision of new police facilities to serve LRDP-related population growth and other regional growth, and the cumulative impact would be less than significant.

The cumulative demand for fire protection could require the construction of new or expanded fire department facilities in the study area, but the only fire departments in the LRDP EIR study area with plans for expansion during the LRDP planning horizon were the Central Fire District and the Scotts Valley Fire Department. The LRDP EIR concluded that environmental impacts from the development of these facilities are not known at this time, but the new facilities would be constructed on small (generally less than 0.5 acre) infill sites in suburban areas, and the potential for significant impacts on the environment, such as impacts on biological and cultural resources, is low. Therefore, the cumulative impact would be less than significant. In addition, the contribution of 2005 LRDP-related population to the need for these facilities would be small.

The new employee population associated with the proposed project is within the LRDP-related population analyzed in the 2005 LRDP EIR. Therefore, the project would not contribute to a significant cumulative impact.

Schools

The residents of the proposed ECI Project would be single undergraduate students who would not contribute to demand for public schools. The new campus employees associated with the proposed project could result in a small increase in demand for schools. The 2005 LRDP EIR projected that the increase in campus-related population under the 2005 LRDP, including campus-affiliated families living off campus, could result in the addition of 261 students to the SCSD by 2020. The SCSD included anticipated growth under the 2005 LRDP in its assessment of future enrollment and planning; even with the LRDP-related population, the district anticipated a continued drop in enrollment through its projection timeline of 2014. As discussed in Section 3.12.3.3, above, enrollment in the SCSD declined by over 400 students in 2004-05 and 2007-08. No new school facilities are anticipated during the lifetime of the 2005 LRDP, and SCSD capacity would absorb the growth without the need for new or expanded facilities.

Under the 2005 LRDP, a total of about 555 new UC Santa Cruz employee households would live within the county in communities other than Santa Cruz. These households would be distributed among a large number of communities in the county. Based on current capacities, the 2005 LRDP EIR concluded that new facilities would not be needed to serve the projected growth in public school enrollment, including that resulting from campus growth under the 2005 LRDP. In summary, school-age children added to study area schools, as a result of campus growth in conjunction with regional growth, would not require the construction of new facilities and there would not be a significant cumulative environmental impact from construction of new school facilities.

The new employee population associated with the proposed project is within the LRDP-related population analyzed in the 2005 LRDP EIR. Therefore, the project would not contribute to a significant cumulative impact.

Library Facilities

The 2005 LRDP EIR (Section 4.12, Volume II) analyzed potential impacts of regional population growth, including the 2005 LRDP-related population growth, on the Santa Cruz Public Library System, a City-County system that includes libraries throughout Santa Cruz County. The 2005 LRDP EIR concluded that, although regional population growth may result in the need for new or expanded libraries in the City or the County of Santa Cruz, growth associated with the 2005 LRDP would not contribute to the need for these library facilities because most of the LRDP-related population would rely primarily on the UC Santa Cruz libraries. To the extent that there are adverse environmental impacts from the construction of new or expanded public library facilities, the project would not contribute to such impacts.

3.12.4 References

Ed-Data. Web site, http://www.ed-data.k12.ca.us/, accessed January 15, 2008.

Santa Cruz Public Libraries. Web site, http://www.santacruzpl.org/libraryadmin/sysfacts.shtml, accessed January 15, 2009.

UC Santa Cruz Fire Department. Web site, http://www2.ucsc.edu/fire_dept/, accessed October 10, 2008.

3.13 RECREATION

3.13 RECREATION

This section of the EIR describes the current recreational resources on the UC Santa Cruz campus and surrounding area and evaluates whether the proposed project could lead to physical deterioration of existing recreation facilities or the construction or expansion of recreation facilities that might have an adverse physical effect on the environment. This section provides project-level analysis and additional detail regarding recreation and supplements and augments, pursuant to CEQA Guidelines Section 15152, the analysis provided in Section 4.13, Volume II, of UC Santa Cruz' 2005 LRDP EIR.

3.13.1 Environmental Setting

3.13.1.1 Campus Recreation Facilities

UC Santa Cruz offers many amenities for active and passive recreation on the main campus. Facilities for organized recreation activities include playing fields and a swimming pool. Facilities for informal recreation include natural areas, such as trails, paths, and undeveloped open space. All main campus lands, including undeveloped areas, such as meadows and forests, are available to campus affiliates (spouses, domestic partners and children of faculty, staff, and students) and the public during daylight hours.

Formal Recreational Facilities

The Office of Physical Education, Recreation and Sports (OPERS) provides an array of recreational activities for students and the surrounding community, including rock climbing, surfing, kayaking, mountain biking, and other outdoor activities. OPERS also manages the formal recreational and athletic facilities on the campus, which include indoor and outdoor facilities that are used for physical education, intercollegiate athletics, intramural sports, sports clubs, and general recreation. Most of the recreation facilities on campus are located south of Cowell College in the area of the East Field House. The East Field complex includes a gymnasium, indoor racquetball and basketball courts, martial arts and dance studios, a swimming pool, tennis and volleyball courts, the Wellness Center, East Field, and East Remote Field. The Wellness Center offers a variety of activities, from equipment orientation to personal training and fitness testing. Another smaller complex of facilities is located near College Eight at the West Field House. This complex includes a gymnasium, basketball, volleyball and tennis courts, a weight room, and a playing field. A third playing field is located south of the Family Student Housing complex. The general public may purchase an annual, quarterly or day-use pass for use of these campus formal recreation facilities.

Indoor and outdoor spaces that students can use for relaxation and recreation are provided at each of the colleges. Each college has a quadrangle and courtyard with outdoor seating, which students use for studying, socializing, relaxing, and dining. Each of the colleges either has or shares game rooms, media rooms, and computer laboratories. These rooms are open during the day and late into the evening, and can be used by any student.

Some campus housing incorporates community open space within the complex for recreational use by the residents. For instance, a playing field is associated with the Family Student Housing complex. Existing employee housing near the main entrance to the campus includes recreational open space for use by the residents. Ranch View Terrace, an employee housing complex that is currently under construction, will also incorporate recreational spaces for its residents.

Through its academic arts programs, the campus also provides recreation related to music, visual, and performing arts, including art exhibitions and stage performances that are open to the campus and the community. Members of the public also visit the UC Santa Cruz Arboretum, the Center for Agroecology and Sustainable Food Systems (CASFS), the Chadwick Garden, and the Cowell Ranch Historic District.

Numerous trails are located in the north campus and the upper campus. Some are designated for specific uses and are maintained by the campus. Other trails have resulted from ad hoc use and are not designated or maintained. Mountain biking has become an increasingly popular recreational activity and sport in the past decade, and there is substantial mountain biking use of many campus trails. There are many undesignated bicycle trails in some areas of the north campus. The multi-use Cowell Wilder Regional Trail (open to hikers, bicyclists, and equestrians), located on the north campus, connects Wilder Ranch Park to the west of the campus with Pogonip City Park, to the east of the campus, and to Henry Cowell Park, farther north.

3.13.1.2 Off-Campus Recreation Facilities

As described in the 2005 LRDP EIR, the Santa Cruz area offers a large variety of both public and privately managed recreational facilities, including neighborhood parks, community parks, and community gardens; regional parks with overnight camping facilities, trails, and picnic facilities; natural areas such as redwood forests, beaches, ocean cliffs, rolling foothills; and other coastal/waterfront facilities such as the Boardwalk, the Wharf, and the Yacht Harbor. Santa Cruz County includes almost 44,000 acres of State Park lands—over 15 percent of all lands in the county—and over 4,500 acres of county and city parks (including land held in partnership with other agencies). There were approximately 55 acres of open space lands in the county that are preserved as parks and land trusts total per 1,000 population in 2004. These facilities are used by both locals and by the numerous visitors to Santa Cruz.

The City of Santa Cruz Parks and Recreation Department manages 29 neighborhood and community parks, five regional parks, municipal beaches, two city museums, two community centers, a civic auditorium, and a golf course. There are also several natural areas in the city that are available for formal and informal recreation. These areas include Antonelli Pond and Lighthouse Field, on the lower west side of the city, the Pogonip City Park, which borders the eastern edge of the campus, and the Moore Creek Preserve, a 246-acre greenbelt on the west side of the city. Due to limited availability of suitable land for new recreational development, the City anticipates that existing park facilities will see increasing intensity of use over time.

Santa Cruz County Department of Parks, Open Space and Cultural Services maintains more than 30 parks and other recreational facilities throughout the county. None of the County-owned and operated recreation facilities is within 1 mile of the campus. The Santa Cruz district of the California State Park System manages almost 44,000 acres of state parks and beaches located in Santa Cruz County. Those in the vicinity of the main campus include Henry Cowell State Park and Wilder Ranch State Park.

3.13.2 Relevant Project Characteristics

The proposed project would provide on-campus housing for approximately 600 upper-division undergraduate students and would require approximately 10 new staff. The project includes a plaza that would be designed as an informal seating and gathering space. The project would provide indoor recreational space, including a lounge, a computer gaming room, an exercise room, and a cafe.

3.13.2.1 Applicable LRDP Mitigation Measures

There are no 2005 LRDP EIR mitigation measures related to recreation that are applicable to the proposed project. The following LRDP EIR mitigation measures are implemented as part of general campus operations.

LRDP Mitigation REC-2C: To discourage the illegal use of bicycles on trails in Pogonip City Park, the Campus shall: (1) install signage on campus property near entrances to the park indicating that trail users are leaving University property and that bicycles are prohibited on some trails in the park; (2) maintain fencing and signage on University property at the Coolidge Drive lookout as needed to discourage unauthorized access into the park from the University; (3) work with campus and other local outdoor recreation groups to undertake measures to regularly inform and educate students, faculty, and staff about caretaking of the regional trail system and regional open spaces; and (4) revise campus bicycle maps to explicitly identify the park boundary and Pogonip City Park rules regarding bicycle use.

LRDP Mitigation REC-2D: The Campus shall coordinate with the City of Santa Cruz’s efforts in organizing an annual or semi-annual volunteer trail maintenance day, and shall assist in the recruitment of volunteers for these events from the UC Santa Cruz campus through campus advertising and education efforts.

LRDP Mitigation REC-4: The Campus will continue to make campus recreational facilities available to the public, and will provide casual recreation amenities, such as walking paths and picnic tables, that will be available for public use.

3.13.3 Impacts and Mitigation Measures

3.13.3.1 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, an impact on recreational facilities would be considered significant if the proposed project would:

- Increase the use of existing neighborhood and regional parks or other recreation facilities such that substantial physical deterioration of the facility would occur or be accelerated

- Propose the construction of recreation facilities or require the expansion of recreation facilities that might have an adverse physical effect on the environment.

3.13.3.2 Analytical Method

The analysis in this section focuses on (1) the need for new recreational facilities as a result of the increase in campus population, and (2) the potential for increased intensity of use, due to the population associated with the proposed project, to lead to the deterioration of recreational facilities both on and off campus.

Impacts that stem directly from activities on the campus or from the new daytime population added to the campus under the 2005 LRDP, which includes new campus population from the proposed project, are addressed in the analysis below as project impacts (ECI Impacts REC-1 through REC-3). Some of the new staff associated with the proposed project would live off campus in nearby communities and would also use recreational facilities primarily, although not solely, in those communities. The effect on recreational facilities of the project-related population that would live off campus is analyzed under cumulative impacts (~~ECI Impacts REC-4 and REC-5~~Section 3.13.3.4).

3.13.3.3 Project Impacts and Mitigation Measures

Construction of New Recreational Facilities

The residents of the proposed East Campus Infill Project would result in increased demand for recreational facilities on campus and in the city of Santa Cruz. The 2005 LRDP EIR (Section 4.13, Volume II) analyzed whether the increase in on-campus population associated with the 2005 LRDP would result in a demand for on- or off-campus recreational facilities. The LRDP EIR concluded that new on-campus recreational facilities would be needed under the 2005 LRDP. This increased demand is taken into account in the 2005 LRDP, which designates almost 86 acres of land for Physical Education and Recreation. The potential environmental effects of the construction of new recreation facilities were analyzed in other sections of the LRDP EIR and would be less than significant with implementation of LRDP mitigation measures.

The 2005 LRDP EIR also concluded that because adequate recreational facilities are available on the campus, and new campus recreational facilities would be added as the on-campus daytime and residential population grows under the 2005 LRDP, the on-campus population would not contribute to the need for new recreational facilities in the city of Santa Cruz. Furthermore, the City has indicated that it does not expect to develop substantial new park acreage, because only limited land area is available in the city for this type of development. Therefore, the growth in the on-campus daytime and residential population would not trigger the construction of new City parks and recreational facilities, which could result in environmental impacts. The program impact would be less than significant.

The residential population associated with the proposed project is within the population analyzed in the 2005 LRDP EIR. Therefore, the project impact would be less than significant.

Deterioration of Recreational Facilities

The new on-campus population that would live in the proposed ECI Project would contribute to increased use of recreational facilities on the campus and in the city of Santa Cruz. The 2005 LRDP EIR analyzed the potential impact on existing recreational facilities from the increase in on-campus population under the 2005 LRDP. The LRDP EIR concluded that this impact would be potentially significant for the following reasons:

- The new recreational and athletic facilities that would be constructed on campus under the 2005 LRDP would not satisfy the demand for family recreation facilities, such as neighborhood parks and tot lots.
- Increased recreational use of unpaved campus fire roads that are used as trails and undesignated, unauthorized trails could result in degradation of soils and vegetation.
- Increased use of the Pogonip City Park by campus residents, particularly the illicit use of bicycles, could lead to the physical deterioration of this facility.

The proposed project would house single students on campus and, therefore, would not contribute to the demand for family recreation facilities in the city of Santa Cruz. The project would, however, contribute to the increased use of unpaved fire roads and unofficial trails on the campus, and to the increased use of the Pogonip City Park. The LRDP EIR concluded that these impacts would be reduced to a less-than-significant level by two mitigations that the campus implements on an ongoing basis: LRDP Mitigation REC-2C, which requires that the Campus work with the City of Santa Cruz and other local outdoor recreation groups to discourage illegal use of bicycles on trails and to inform and educate students, faculty, and staff about caretaking of the regional trail system and regional open spaces; and LRDP Mitigation REC-2D, which requires that the Campus coordinate with the City of Santa Cruz's efforts in organizing volunteer trail maintenance days.

The increase in on-campus population associated with the proposed project is within the on-campus population analyzed in the LRDP EIR. Therefore, the project impact would be less than significant.

3.13.3.4 Cumulative Impacts and Mitigation Measures

Some or all of the approximately ten new staff associated with the proposed project would live off campus and contribute to demand for off-campus recreational facilities. The 2005 LRDP EIR concluded that cumulative growth in study area population, including 2005 LRDP-related off-campus population, could result in the development of new off-campus recreation facilities, but the construction of these facilities would not result in significant environmental impacts. Because the city of Santa Cruz is largely built out, a large increase in parkland within the city is not feasible, even should the City identify a need for new facilities, and development of parks on the available land would have a low potential for significant environmental impacts. The LRDP-related population would not make a cumulatively considerable contribution to the impact associated with potential new park development in other communities in the county.

Because the 2005 LRDP-related population would represent a small portion of the overall population expected to use the city parks and beaches, the contribution of the project to the cumulative impact would not be cumulatively considerable. Although the population growth associated with 2005 LRDP would not make a cumulatively considerable contribution to a significant cumulative impact on off-campus recreation facilities, the LRDP identified LRDP Mitigation REC-4 to further reduce the less-than-significant impact. This mitigation, which the campus implements on an ongoing basis, requires that the campus make campus recreational facilities available for public use.

The off-campus population associated with the proposed ECI Project is well within the population analyzed in the 2005 LRDP EIR. Therefore, the impact was adequately analyzed in the LRDP EIR and the proposed project would not change the conclusion that the cumulative impact would be less than significant.

3.14 TRAFFIC, CIRCULATION, AND PARKING

TABLES

FIGURES

3.14 TRAFFIC, CIRCULATION, AND PARKING

This section of the EIR evaluates the potential traffic, circulation, and parking effects from development of the East Campus Infill project. The section describes potential impacts of the project with respect to access, local and regional vehicular circulation, parking, pedestrian and bicycle facilities, and transit service. This section provides project-level analysis and additional detail on the campus and regional roadway, transit, bicycle and pedestrian systems, to supplement and augment Section 4.14, Volume II of UCSC's 2005 LRDP EIR (UCSC 2006), pursuant to CEQA guidelines 15152. This section also provides a detailed description of the methodology though which the Campus's fair share of the cost of off-campus traffic improvements needed in part to address traffic generated by UCSC development under the 2005 LRDP is calculated and paid.

Data used in traffic modeling, and data output from traffic modeling and signal warrant analysis are provided in Appendix E. That appendix is not included in the printed version of this document, but is available for review of the offices of Physical Planning and Construction at UC Santa Cruz, and is included in the electronic document file, which is available at http://ppc.ucsc.edu/cp/planning/cp/projects.

Comments regarding the scope of the transportation analysis were received in response to the Notice of Preparation. These comments, summarized below, requested that the EIR consider:

- Providing alternative transportation to reduce or eliminate increased impacts on traffic.
- Providing more direct access to the eastern campus to accommodate increased vehicle trips and avoiding contributing to traffic on Bay Street and High Street
- Traffic effects of increased bus trips to accommodate increased population
- Increased demand on METRO buses from project population
- Traffic-related air emissions from the project including but not limited to construction traffic and operational traffic
- Effects of increased High Street traffic upon alternative routes, including west side residential streets and downtown Santa Cruz.

All of the scoping comments above are within the scope of the analysis present in this section, with the exception of the comment regarding an eastern access to the campus. An eastern access is discussed in the 2005 LRDP EIR in Volume II, Section 4.14.

Comments related to the potential traffic impacts of the Cave Gulch bridge envisioned in the 2005 LRDP are not relevant to the proposed project, as this bridge is not currently proposed and is not an element of the proposed project. Since the envisioned campus entrance that would be provided by this bridge is not in place or proposed at this time, neither construction nor operation of the proposed project would be expected to result in an increase in heavy vehicle traffic on Empire Grade Road west of the campus west entrance. Construction and delivery traffic to the project site would access the project site via the campus main entrance and Glenn Coolidge Drive.

This section evaluates the effects of projected increases in traffic associated with the occupation of the proposed project, and the cumulative effects of project traffic in combination with traffic associated with other projected campus growth, and with other anticipated development elsewhere in the city of Santa Cruz through 2013, the year after the project would be fully occupied. The cumulative scenario takes into account the Campus's current five-year capital plan, the City's current cumulative project list (project's planned, approved or under construction), as of the date of the project Notice of Preparation, (September 2008), and background traffic growth as projected in the most recent version of the AMBAG travel demand model (AMBAG 2008). Traffic level-of-service analysis was conducted at 19 signalized and unsignalized intersections, including seven on the campus and 12 off campus in the city of Santa Cruz, using the 2000 Highway Capacity Manual operations method.[1] The off-campus analysis forecasts traffic volumes on streets in the neighborhoods that surround the campus. On-campus evaluation includes parking supply and demand, evaluation of project circulation, and anticipated project effects on bicycle, pedestrian and transit systems.

3.14.1 Environmental Setting

3.14.1.1 Study Area

The focus of the analyses reported here is the transportation effects of development and occupation of the East Campus Infill project, a proposed on-campus student apartment complex to be constructed as infill development on the UC Santa Cruz main campus. The project study area for traffic and transportation analysis includes the main campus and the city of Santa Cruz, including all roadways surrounding the campus and the following corridors:

- Campus Loop – Heller Drive, McLaughlin Drive, Hagar Drive, and Glenn Coolidge Drive
- Empire Grade Road – Bay Street to the existing west entrance to the campus
- Bay Street/Bay Drive – High Street to West Cliff Drive
- Mission Street – Western Drive to Front Street
- Chestnut Street – Mission Street to Laurel Street

Intersections for the project-specific Traffic Impact Study (URS 2009) were selected based on the projected number and distribution of trips associated with the proposed project, with particular consideration of intersections at which transportation impacts were identified in the program-level analysis presented in the 2005 LRDP EIR. These intersections are listed in Section 3.14.2.6 (*Project Study Intersections*), and the results of analysis are presented in Section 3.14.2 (*Impacts and Mitigations Measures*), below.

Figure 3.14-1, *Vicinity Map*, shows the existing circulation network within the study area and identifies the intersections analyzed in the study.

[1] *2000 Highway Capacity Manual*, Special Report 209, Transportation Research Board (Chapter 10).

3.14.1.2 Roadway System

Main Campus Roadway System

The main campus is served by two roadway entrances: the main entrance at the Bay and High Street intersection and the west entrance at Empire Grade Road and Heller Drive. From the campus main entrance at High Street/Glenn Coolidge Drive, the project site may be accessed via Glenn Coolidge Drive and McLaughlin Drive, with a right turn onto Chinquapin Road, or via Glenn Coolidge Drive, Hagar Drive and McLaughlin Drive, with a right turn onto Chinquapin Road. From the campus west entrance at Empire Grade Road and Heller Drive, the site may be accessed via Heller Drive and McLaughlin Drive, with a left turn onto Chinquapin Road. The project site is located on the east side of Chinquapin Road.

Internal circulation on the campus is provided by the following roadways, listed alphabetically:

- Glenn Coolidge Drive is a County-owned arterial road that extends north into the campus from the main entrance, forms a portion of the eastern perimeter of the campus and then curves west to terminate at McLaughlin Drive, a campus roadway. Glenn Coolidge Drive is a two-lane street with bike lanes on each side and no on-street parking. The speed limit near the central campus is 25 miles per hour (mph). Between Hagar Drive and McLaughlin Drive the speed limit is 45 mph.

- Chinquapin Road extends north from McLaughlin Dive, from a point east of the intersection of Hagar Drive and McLaughlin Drive. This road presently provides access to the campus fire station, as well as to Crown College and to the Crown/Merrill Apartments. North of the Crown/Merrill Apartments, Chinquapin Road is becomes a gravel/dirt road, which is used as a walking trail. Vehicular access to this part of the road is available only to emergency vehicles, University maintenance vehicles, and similar official traffic.

- Hagar Drive is a north-south roadway from Glenn Coolidge Drive to McLaughlin Drive. Hagar Drive is a two-lane road. There are bike lanes and pedestrian paths along Hagar from Glenn Coolidge Drive to the entrance to the East Remote parking lot, and additional bike paths and pedestrian paths connect the Hagar paths with other parts of the campus. No on-street parking is permitted along Hagar Drive.

- Heller Drive is a two-lane street that extends north-northeast from the west campus entrance at the Empire Grade Road intersection. The street experiences high volumes of pedestrian crossings and transit vehicles in the vicinity of College Eight and Porter College. Heller Drive has discontinuous sidewalks in some areas, but is served by a series of off-street paths that parallel Heller Drive, or connect Heller Drive to other parts of the campus. On-street parking is not permitted on Heller Drive. The campus's West Remote and North Remote parking lots are accessed from Heller Drive.

- McLaughlin Drive is the primary east-west street serving the central campus. It completes the campus loop, connecting with Heller Drive at its west end and Glenn Coolidge Drive at its east end. The north end of Hagar Drive also intersects McLaughlin Drive. It is a two-lane street that experiences high volumes of use by campus pedestrians, bicycles, and transit vehicles. McLaughlin Drive provides sidewalks on both sides of the street and crosswalks at intersections. There are currently no bike lanes on McLaughlin Drive.

- Meyer Drive is a two-lane east-west road from Heller Drive to the Music Facility and the McHenry Library. Meyer Drive does not presently provide a through connection between Heller Drive and Hagar Drive. Meyer Drive does not have bike lanes.
- Steinhart Drive is a two-lane east-west controlled access service road extending through the central campus core from Hagar Drive to McLaughlin Drive that experiences high volumes of pedestrians, bicycles and transit vehicles.

Regional Network and Off-Campus Streets and Highways

Regional access to the city of Santa Cruz and the campus is extensive. Highway 1 travels through the city, providing access to Monterey to the south and San Francisco to the north. Highway 1 connects to SR 129 and SR 152 in Watsonville, providing a connection to Highway 101 to the east. SR 9, a two-lane arterial, provides access to the North Mountain area of the county and the Santa Cruz Mountains. SR 17, a four-lane controlled access highway and a major access road to the area, connects Santa Cruz to San Jose and the San Francisco Bay Area.

Local access to the campus is provided on two primary routes: Mission Street to Bay Street and Mission Street to Highland Avenue to High Street to Bay Street. Bay Drive crosses High Street and becomes Glenn Coolidge Drive at the campus's main entrance. High Street continues west past Bay Drive and becomes Empire Grade Road, which provides access to the campus west entrance at Heller Drive. Mission Street is accessible by many of the regional access routes described above. High Street is accessed from Mission Street via King Street and Storey Street. Secondary access routes include Western Drive and Empire Grade Road. County roads near or within the campus have posted speed limits of 40 mph, while City of Santa Cruz roadways have posted speed limits of 25 mph or 30 mph.

A few of the key off-campus streets used by traffic associated with the main campus are listed below in alphabetical order.

- Bay Street is a northwest/southeast, two-lane arterial street within the city. North of Mission Street, Bay Street is a two to four-lane road and serves as one of the primary access routes to and from the campus. The two-lane section between Mission Street and Escalona Drive serves residential land uses and has houses fronting on the street. North of Escalona Drive, Bay Street becomes Bay Drive, a four-lane divided street with limited access to adjacent properties. South of Mission Street, Bay Street serves primarily residential uses and allows on-street parking while also providing access to a public elementary school and several churches. Bicycle lanes are provided in both directions from High Street to West Cliff Drive.
- California Street is a two-lane, north-south collector serving primarily residential uses and Santa Cruz High School. On-street parking is permitted on some portions of the street.
- Chestnut Street extends north-south and is a primarily a two-lane collector street from Mission Street to south of Laurel Street. It serves a mix of residential and commercial uses and provides a primary access route to downtown. On-street parking and a bike lane are provided north of Laurel Street.

- Empire Grade Road is an arterial County road that extends northwest-southeast from the campus entry at Bay Drive and High Street to Alba Road in the North Mountain area of the county. It provides access to small rural communities north of the campus including Cave Gulch and Bonny Doon. Empire Grade Road is classified as an arterial street, and has bike lanes and shoulders south of Heller Drive. North of Heller Drive, Empire Grade Road becomes a winding roadway with relatively steep grades on some sections. The posted speed limit is 40 mph.
- Escalona Drive is a two-lane residential collector street with on-street parking.
- High Street is an east-west two-lane arterial street with bike lanes and limited on-street parking. High Street, along with Bay Street/Drive, is one of the primary access routes to and from the campus. High Street also provides access to a public elementary school and numerous churches. Significant campus traffic and through traffic utilize High Street to access Mission Street via Storey and King Streets, causing peak-period congestion along this corridor.
- King Street is a northeast-southwest two-lane collector street with on-street parking that serves primarily residential land uses and a local school. King Street parallels Mission Street and historically experienced cut-through traffic and speeding until the City installed speed bumps. The eastern end of King Street currently experiences congestion as traffic accessing Mission Street feeds onto King Street from Storey Street and High Street.
- Laurel Street is classified as a collector west of Mission Street and as an arterial street through downtown between Mission Street and Broadway. It is a two-lane east-west street, with speed bumps and on-street parking within residential neighborhoods. South and east of Mission Street, Laurel Street serves a mix of uses and accommodates the most heavily traveled Santa Cruz Metropolitan Transit District (SCMTD) transit route that serves the campus.
- Mission Street (Highway 1) is an arterial highway under the jurisdiction of Caltrans. Highway 1 parallels the coast, curving north and then east through the city of Santa Cruz around the shore of Monterey Bay. West and north of the city, Highway 1 is a two-lane rural highway. East of Swift Street, Highway 1 is a four-lane street. East of the Highway 1/SR 17 interchange, the highway becomes a controlled access freeway. Mission Street was recently fully widened to four lanes from Swift Street to Chestnut Street, with turning bays at selected intersections. Many of the intersections on Mission Street within the study area are signalized. The traffic signals were interconnected during recent construction.
- River Street extends north-south through the city of Santa Cruz and becomes SR 9 at the Highway 1/Mission Street junction. South of Highway 1, River Street is a two- to four-lane arterial street with bike lanes and limited on-street parking. River Street serves primarily commercial and industrial uses both north and south of Highway 1, and is a primary access route to the downtown.
- Storey Street is a two-lane arterial street extending north-south from High Street to King Street. On-street parking serves a number of fronting residences. Storey Street currently experiences long peak-hour vehicle queues at its stop-controlled intersection with King Street.

- Walnut Avenue is classified as a collector west of Mission Street and as an arterial street elsewhere. West of Mission Street, it is a two-lane residential street with speed bumps and on-street parking. East of Mission Street, Walnut Street has bike lanes and serves Santa Cruz High School and a mix of residential and commercial uses within the downtown.
- Western Drive extends north-south from Mission Street to Empire Grade Road and the west entrance of the campus. It is a two-lane collector with adjacent residential land uses intermittent on street parking and a relatively steep grade adjacent to Mission Street.

Figure 3.14-1 illustrates the local and regional circulation network.

The City has designated Mission Street (Highway 1), Bay Street/Drive, Empire Grade Road, and River Street/SR 9 as truck routes.

3.14.1.3 Campus Traffic Generation

Campus Trip Generation

In 2007-08, UC Santa Cruz population totaled approximately 15,000 full time equivalent three-quarter average students and 3,436 faculty and staff. UC Santa Cruz Transportation and Parking Services (TAPS) conducts periodic traffic counts on Campus roadways and at the main and west gates of the main campus. Two weeks of traffic counts were collected at the two campus entrances during fall 2007 and again during spring 2008. In 2007-08,[2] gate counts recorded 21,900 average daily vehicle trips traveling into and out of the campus on an average weekday. This represents a decrease of almost 2,900 average daily trips to the campus since the 2005 LRDP baseline reporting year of 2003-04, despite a campus population increase since that time of more than 1,100 persons.

Campus Transportation Demand Management

Transportation Demand Management (TDM) emphasizes the movement of people and goods rather than motor vehicles, and gives priority to public transit, ridesharing, and non-motorized travel, particularly under congested traffic conditions. Many different TDM strategies have been developed to serve a variety of outcomes, from improving the reliability of transportation options to changing trip travel times, routes or modes, to increasing vehicle occupancy and reducing parking demand. Each TDM strategy may change travel patterns of only a small number of people; however, on a larger scale, the effects with respect to congestion management and other benefits can be significant.

Both the City of Santa Cruz (2003) and UCSC have identified TDM as an important strategy to change travel behavior and sustain the City’s and the Campus’s transportation system over the long term.

Campus TDM goals include:

- Reduce the number of peak-hour vehicle trips;

[2] Traffic volumes cited are from traffic counts conducted in fall 2007 and spring 2008 by TAPS (Pageler 2009a). The counts reflect the average of Monday/Wednesday/Friday and Tuesday/Thursday traffic, which varies due to class schedule, and the average of fall and spring counts because counts vary from academic quarter to quarter.

- Shift trips to nonpeak times;
- Increase vehicle occupancy by promoting carpooling, vanpooling, ride sharing and transit; and
- Increase the percentage of people bicycling, walking, ride sharing, or using transit.

UC Santa Cruz has a highly successful TDM program that has been effective in reducing vehicle trips to the campus even as campus population has grown in the past five years. These include the use of parking policies, permits, and fees that restrict parking on campus, are preferential to carpools and vanpools, emphasize use of remote lots on campus and strictly limit parking in close proximity to new campus facilities; programs that encourage the use of bicycles on campus, including bicycle shuttles from Mission Street and Ocean Street to the campus, bicycle parking, and showers; student-fee-funded City transit passes and a free campus shuttle bus system; and a recently-initiated Carshare program, which provides student- and employee-access to shared cars on an hourly basis to help alleviate the need for individuals to bring cars to campus. An important measure of the effectiveness of TDM programs is the proportion of trips to the campus that are made using transportation modes other than single-occupant vehicles.

Campus Mode Share

Mode share refers to the proportion of trips through the campus gates made using each transportation mode, including single occupant vehicles, carpools, motorcycles, bicycles, pedestrians, regional buses, and construction/service vehicles. Counts in fall 2007 and spring 2008 of persons accessing the campus at the two main entrances by mode (Pageler 2009a), indicates that, in the 2007-8 academic year, single occupant vehicle travel accounted for 37 to 38 percent of all passenger trips to and from the campus. Carpools comprised 22 to 25 percent; regional buses comprised 26 to 27 percent; UCSC-operated programs, such as commuter vanpools, the bike shuttle, and Campus Transit shuttles, accounted for 4 to 5 percent; and bicycles, pedestrians, motorcycles, and service/construction vehicles comprise the remaining 8 percent of trips accessing the campus. On this basis, campus TDM programs appear to be highly effective.

3.14.1.4 Parking

On-Campus Parking Management

The 2005 LRDP includes planning principles to discourage automobile use to and on the campus, and to consolidate parking facilities at perimeter campus locations. However, under the Campus's 1999 Parking Facilities Replacement Policy, the Campus also recognizes that access to the campus by automobile is a necessary alternative for faculty, staff and students; that parking facilities must be maintained to ensure vehicular access to the campus; and that parking is an element of capital development projects. Under this, UC Santa Cruz's Transportation and Parking Services (TAPS) department plans, manages, maintains, and monitors the campus parking supply. The goals of parking management and monitoring are to ensure that excess parking capacity does not encourage single-occupant vehicle use, and that existing parking capacity is well-utilized before additional parking is constructed. Parking permits are priced strategically, with lower costs for carpool, vanpool and remote permits, and higher costs for all varieties of close-in permits.

Parking management distinguishes between close-in and remote parking on the campus, and the use of these locations is strictly regulated by permit. By campus policy, freshman and sophomore students who reside on campus are not eligible to purchase campus parking permits of any kind. Upper-division students (i.e. junior and senior students) who do not reside on campus may purchase permits for parking in the campus remote lots (East, West and North Remote), or in lots affiliated with their college zone (divided between colleges on the east side and the west side of campus). The number of available college-affiliate permits is limited—these are allocated by college and sold to eligible students on a first-come, first-served basis. Junior, senior, and transfer students residing in Crown/Merrill or Kresge East Apartments may purchase apartment parking permits, which are valid only in the corresponding apartment lots and the remote lots. Parking in apartment lots is limited; when an apartment lot is full, students are expected to park in the college parking lots that the corresponding permit allows or in the remote lots. Like the college permits, apartment permits are limited in number and are sold on a first-come, first-served basis until sold out.

Under current CEQA Guidelines, transportation analysis includes consideration of whether a project would result in inadequate parking capacity. The 2005 LRDP EIR identified that campus development could result in demand for parking in excess of capacity (LRDP Impact TRA-3). Previously-adopted LRDP Mitigation TRA-3B requires the Campus to monitor on-campus parking utilization rates annually, and construct additional parking when average utilization in a parking zone reaches 90 percent of capacity, based on annual parking utilization surveys by TAPS. Draft revisions of CEQA guidelines (Governor’s Office of Planning and Research 2008) that would implement Assembly Bill 32, the California Global Warming Solutions Act of 2006, are currently under consideration. These would revise several sections of the CEQA Guidelines Appendix and environmental checklist, to encourage project designs that would diminish reliance on motor vehicles, particularly personal vehicles. If these revisions are adopted, the parking capacity impact criterion would be eliminated. Reducing reliance on personal motor vehicles is consistent with the Campus’s existing TDM programs, including the Campus’s parking management programs, and it is likely that campus parking standards will continue to change to reflect emerging greenhouse gas reduction standards. However, the potential parking impacts is analyzed for the purposes of this EIR.

Parking Supply and Utilization in the Proposed Project Vicinity

The ECI Project site, located along the east side of Chinquapin Road between the Crown/Merrill Apartments and Crown College, is within Campus Parking Zone 4. This zone provides a total of 393 parking spaces, of which 261 are permit-controlled and 132 are reserved for various categories of use—e.g. handicapped, campus vehicles, service parking, time-limited parking for Crown College (Parking Lot 111), Merrill College (Parking Lot 119), the Crown/Merrill Apartments (lots 152, 153, 154, 155 and 156), and the campus Fire House. A parking utilization survey in spring 2008 indicated about 54 percent utilization of parking spaces in Zone 4. Parking in this zone therefore has been characterized as underutilized. The proposed project site includes portions of Parking Lot 111, which presently provides about 160 parking spaces in three terraces and their interconnecting access roads, located between Crown

College and the Crown/Merrill Apartments, and in a series of small parking bays along the Crown College access road. Spring 2008 parking utilization in Parking Lot 111 averaged about 44 percent (Pageler 2008a).

Off-Campus Parking Supply

The City of Santa Cruz has a number of fee or time-regulated parking lots in the downtown area. All downtown on-street parking is subject to the Downtown Parking Permit Program. The City of Santa Cruz also operates parking permit programs throughout the city in the West Side, Beach Area, Lighthouse/Cowell Beach, East Side and Seabright.

The West Side Residential Parking Permit Program (RPP), which covers the residential neighborhoods closest to the UCSC campus, is designed to address the problem of nonresidents, such as UC commuters using residential street parking to avoid campus fees and restrictions, and then using public transit to access the campus. The program restricts parking on certain west side residential streets to residents or short-term, nonresidential parking through a permit-controlled program. The West Side RPP is enforced Monday through Friday during the academic year (September 15th - June 30th). As part of the 2008 Settlement Agreement (see Appendix A of this document), UC Santa Cruz agreed to a three-year pilot program, under which UCSC would contribute $50,000 annually to the City toward the cost of implementing the West Side RPP.

3.14.1.5 Transit Serving the Project Site

UCSC's Transportation and Parking Services (TAPS) operates Campus Transit, a free campus shuttle bus system that serves the main campus and other UC Santa Cruz facilities in the city of Santa Cruz. TAPS also works closely with other regional transit agencies to coordinate services. UC Santa Cruz Campus Transit provides weekday daytime routes that loop the entire campus and the campus core at frequent intervals, and night time service throughout the main campus. The Day Core route includes stops on McLaughlin Drive that serve the ECI Project site, although there currently is no bus service along Chinquapin Drive.

The METRO bus system, operated by Santa Cruz Metropolitan Transit District (SCMTD) as the public transit system for Santa Cruz County, provides regional transit access to and through the campus. Student fees include a free METRO pass, and faculty and staff are eligible for a METRO bus pass at a discounted rate.

The SCMTD provides bus service throughout the county, as well as transit links to Monterey Transit. METRO also runs a Highway 17 Express from the METRO Center to San Jose Caltrans Station and San Jose State University.

UC Santa Cruz offers a for-fee weekend shuttle between the main campus and the Fremont Bay Area Rapid Transit (BART) station, the closest station to Santa Cruz. BART offers rail service to most parts of the San Francisco Bay Area including San Francisco, the San Francisco Airport, Berkeley, Concord, Pittsburg, Richmond, and Pleasanton/Dublin. Greyhound, a privately operated bus service with a bus terminal located in downtown Santa Cruz, provides additional links to the wider transportation network.

3.14.1.6 Bicycle and Pedestrian Network

Campus Bicycle Facilities

Both the Campus and the City of Santa Cruz provide bicycle lanes and bicycle and pedestrian paths, but some of the routes are discontinuous.

The Campus provides bike lanes on two of the primary access roads serving the campus. Bicycle lanes, continuous from the City's bike lanes on Bay Drive and High Street, are provided on Glenn Coolidge Drive from High Street to McLaughlin Drive, and on Hagar Drive from Glenn Coolidge Drive to the entrance of the East Field House, on Hagar Drive in the central campus. An off-street bicycle path connects Glenn Coolidge Drive south of Hagar Drive to Meyer Drive, through the Great Meadow. Additional off-street paths are located throughout the campus, including unpaved fire roads and the U-Con trail in the north part of the campus which are used recreationally. Once bicyclists reach the ends of the bike lanes on Glenn Coolidge and Hagar Drives, they share the road with vehicles. At many locations, campus roadways have narrow or no shoulders, and there are substantial uphill grades from both campus entrances. Bicyclists generally require more width riding uphill. The narrower roadway sections present a potential for conflicts between bicycle and vehicular traffic.

A bicycle lane has been proposed and approved for Heller Drive from the campus west entrance to Mayer Drive, but it awaits funding. A bicycle lane also has been proposed for the uphill direction on Chinquapin from McLaughlin to the Crown/Merrill Apartments. If approved, the new bike lane likely would be complete prior to the occupancy of the proposed ECI Project.

The Campus provides bike racks at transit stops on campus and near most major buildings. The Campus operates a number of programs to encourage and support the use of bikes on campus, including a weekly bicycle maintenance clinic and a program that provides free showers at campus recreational facilities for bike commuters.

Because there are steep uphill grades up to and through the campus, TAPS operates bicycle shuttle service with trailers from Olive Street/Mission Street and Dakota Avenue/Ocean Street to the central campus on weekday mornings to encourage bicycle use as an alternative to motorized vehicles. Campus Transit allows bikes to be loaded onto front-loading bike racks that carry two bicycles at a time. The UC Santa Cruz BART Connector buses and Santa Cruz METRO buses have front-loading bicycle racks that carry 2-3 bicycles at a time.

Campus Pedestrian Circulation and Service Issues

While only one percent of the trips accessing the campus are made by walking, the provision of pedestrian facilities is important. Since most campus facilities provide only limited close-in parking, most trips among facilities on campus are on foot or via transit. The Campus provides a pedestrian circulation network of pathways through forests and grasslands, and on sidewalks attached to roadways. Pedestrian activity is highest during class change times. During this times, large number of pedestrians cross campus roadways between campus facilities and near shuttle stops. Pedestrian crossings during these times have been described as "swarms," when a continuous stream of students may cross over a wide area of the intersection, such that vehicles can proceed only very sporadically.

In February 2004, UC Santa Cruz collected counts of pedestrians at 10 pedestrian roadway crossings on the main campus from 9:00 AM to 5:00 PM (Urbitran 2004). The study evaluated level of service (LOS) at several on-campus intersections and concluded that crosswalk capacity was adequate at the locations studied. The study also evaluated vehicular delay caused by high levels of pedestrian crossings. Most of the 10 locations studied experienced vehicular delays of less than 60 seconds. However, the study determined that pedestrian crossings were the main contributor to increased vehicular delay at these locations during class change times, and that this was a significant factor in transit delays. Transit delays effectively reduce transit capacity, since the number of cycles a bus can make during a period of time determines the total passenger capacity along the route.

3.14.1.7 Transportation Oversight in the Santa Cruz Region

Association of Monterey Bay Area Governments

Association of Monterey Bay Area Governments (AMBAG) is an organization composed of city governments in Monterey, San Benito, and Santa Cruz Counties. This organization addresses regional transportation and air quality issues. AMBAG facilitates and coordinates the programming and budgeting of all regional transportation planning and projects. In addition, AMBAG develops and maintains a travel demand model for use in Santa Cruz and the surrounding region.

California Department of Transportation

The California Department of Transportation (Caltrans) is responsible for the design, construction, maintenance, and operation of the California State Highway System and Interstate System in California. This agency's goals include roadway safety, minimizing traveler delays, making transit a more practical travel option, and improving the efficiency of the California transportation system. In the project vicinity, Caltrans is responsible for Highway 1 (Mission Street), SR 9, and SR 17.

Monterey Bay Unified Air Pollution Control District

Monterey Bay Unified Air Pollution Control District (MBUAPCD) is an 11-member elected governing body responsible for the Air Quality Management Program under the California Clean Air Act. The MBUAPCD monitors air quality including emissions from mobile sources and adopts transportation control measures to reduce air emissions. The measures include expanding TDM programs, improving transit services, traffic-efficient operational improvements (e.g., signal synchronization), park and ride lots, and use of alternative fuels.

Santa Cruz Area Transportation Management Association

Santa Cruz Area Transportation Management Association (SCATMA) is composed of businesses and government agencies working to address transportation problems in the northern part of Santa Cruz County. One SCATMA goal is to encourage more efficient use of the transportation system.

Santa Cruz County Regional Transportation Commission

Santa Cruz County Regional Transportation Commission (SCCRTC) sets priorities for major capital improvements, allocates funding for the transportation system, adopts policies and plans future projects to improve mobility, access, and air quality, and encourages the use of alternative transportation. This agency is responsible for preparing the County's Regional Transportation Plan and Transportation Improvement Program. In addition, SCCRTC also manages the Commute Solutions Program.

Santa Cruz Metropolitan Transit District

SCMTD provides the mass transit (METRO bus) system for Santa Cruz County. In addition, it is responsible for developing the Short Range Transit Plan for the area.

UC Santa Cruz Transportation and Parking Services

TAPS is responsible for transportation services for students, faculty, and staff. TAPS oversees transit services and parking permits, facilitates and implements TDM measures, and manages the campus bicycle, pedestrian and vehicle circulation systems and sources.

City of Santa Cruz and City/UCSC Joint Initiatives

The City of Santa Cruz Department of Public Works manages City-owned public parking and is responsible for engineering and maintenance of city streets. Under the 2008 Settlement Agreement (see Appendix A of this EIR), UCSC has contributed a share of the funding of a previously-completed Mission Street widening project and of street repairs and repaving on Bay Street/Drive.

Traffic Impact Fee Program. The City of Santa Cruz has collected Traffic Impact Fees from new development within the city since 2006. The City assesses a one-time fee for each proposed new development at the time of project approval, based on the projected number of daily trips. The amount of the fee, which is adjusted annually, is based on the cost of the transportation improvements in the city of Santa Cruz, which have been prioritized to maximize traffic and transit benefits, and are scheduled for implementation in the City's 10-year capital improvement plan.

As described in Section 3.14.2.15 (*UCSC Cost Share of Off-Campus Traffic Improvements*), below, and in accordance with the University's commitment under the Settlement Agreement (see Appendix A), UCSC has contributed an amount equivalent to the City's Traffic Impact Fee for campus trips, in advance, for all new vehicle trips projected to be generated by the campus under the 2005 LRDP, including the trips that would be generated by the proposed project.

Joint UCSC/City Initiatives. In April 2000, the City of Santa Cruz and the University of California at Santa Cruz initiated a partnership to jointly fund a community-based approach to planning the city's transportation future. The Master Transportation Study (MTS) integrates pedestrian, bicycle, transit, and street transportation plans and programs as a foundation for updating the City's General Plan, City zoning ordinance, UC Santa Cruz's LRDP, and other city and regional transportation planning documents.

The MTS recommends three actions:

- Adopt a series of 12 strategic initiatives concerning land use, transit, pedestrian systems, bicycles, Transportation Systems Management (TSM) measures, parking and TDM, regional planning, and education
- Adopt an aggressive multi-faceted campaign including TDM measures and short distance local transit services, to increase person-trip mobility by 19 percent over 2000's level while increasing vehicle trips during the peak hour by only 7 percent
- Adopt 2020 target mode splits for internal and external travel

UCSC and the City currently are collaborating on and jointly funding studies to assist in defining realistic transportation solutions and trip reduction improvements, and presently are in the process of implementing, or are considering the following projects for implementation/study:

- A signal timing analysis and plan for Bay/Mission corridors;
- Integration of signal pre-emption for SCMTD to allow SCMTD buses to move more quickly through intersections;
- Expand SCMTD service to the campus including Express Bus service;
- On-going GIS analysis of UCSC residential patterns to identify opportunities for new or expanded SCMTD transit routes to and from the campus;
- Locate "Park and Ride" opportunities around/within City of Santa Cruz for UCSC commuters;
- Locate long-term "storage" parking areas for UCSC students; and
- Expand existing ZipCar carshare programs.

3.14.1.8 Mitigation of Off-Campus Traffic Impacts

The 2005 LRDP EIR concluded that traffic generated by campus growth would make cumulatively considerable contributions to significant peak hour level of service impacts at 10 off-campus intersections in the city of Santa Cruz, and that traffic associated with special events on the campus also could contribute to significant level of service impacts at off-campus intersections. The 2005 LRDP EIR identifies intersection improvements that would reduce most of these impacts to less-than-significant levels. However, because the affected intersections are within the jurisdiction of the City of Santa Cruz (and in some cases Caltrans) and the University has no authority to implement the needed improvements, the 2005 LRDP EIR identified the following cost-sharing measure to mitigate for its proportionate traffic contribution to cumulative impacts at off-campus intersections:

LRDP Mitigation TRA-2A: UC Santa Cruz shall, at intervals of no more than three years or increments of no more than 1,000 students in enrollment growth (whichever occurs first), conduct traffic counts at the identified intersections to determine if the additional traffic generated by campus growth or a specific project would trigger the need for [specific improvements identified in the 2005 LRDP EIR] or other improvements to achieve the City's level of service standards. If the analysis indicates that, with the traffic contribution of campus growth or of a specific proposed project, the levels of service would degrade to unacceptable levels, the Campus shall inform the City of this conclusion, and contribute its "fair share" (as defined below) of the cost of the needed improvements.

LRDP Mitigation TRA-5A: The Campus shall implement LRDP Mitigations TRA-2A, TRA-2B, TRA-3B, TRA-3C, and TRA-4A through -4E.

As stated in the LRDP EIR (Volume IV: page 3-46):

"… 'Fair Share' is defined to mean that the University has agreed to negotiate for a contribution to the identified improvement pursuant to procedures similar to those described in Government Code Sections 54999 et seq. for contributions to utilities. In addition, in each case a fair-share payment is agreed upon, the University will pay its fair share only if the applicable jurisdiction has established and implemented a mechanism for collecting funds from any other developers and entities contributing to the identified impacts, and only if the jurisdiction has committed to building the identified improvements."

The Santa Cruz County Superior Court (Case No. CV 155583, filed December 18, 2007, Paragraph 2.b), the Court found "that Mitigation Measure TRA-2, and the portion of Mitigation Measure TRA-5 that relies on TRA-2A, do not constitute feasible enforceable measures for ensuring the Respondent's payment of fair share contributions to transportation improvements under the control of Petitioner City of Santa Cruz".

According to the transcript of the August 28, 2007 hearing on the case, the Court found the 2005 LRDP EIR to be deficient due to "its failure to adopt feasible and enforceable mitigation measures as it relates to traffic impacts," in that it did not provide sufficient information as to how the Regents' commitment to pay its fair share cost for road improvements will be calculated, or include specific performance criteria against which the Regents' liability for its fair share cost may be determined and enforced. The Court, therefore, determined that the mitigation measure as formulated in LRDP Mitigation TRA-2A is not fully enforceable.

Revision of LRDP Traffic Mitigation under the Comprehensive Settlement Agreement

In August 2008, the University, the City of Santa Cruz, and other parties to the lawsuit challenging the 2005 LRDP entered into a Comprehensive Settlement Agreement ("Settlement Agreement") regarding traffic fair share and other issues. In this agreement, the University and the City agreed to a method for calculation of the university share of trips through off-campus intersections, and for determining the University's fair share of the needed intersection improvements. The agreed methodology is described below.

Determining University Share of Trips

The 2005 LRDP EIR traffic study projected that the main campus would generate up to 6,678 new average daily trips (ADT) to and from the campus under the 2005 LRDP program of development. Under the Settlement Agreement, UCSC agreed that campus traffic would not exceed 3,900 new ADT above the 2005 LRDP baseline for as long as the 2005 LRDP is in effect.

The Settlement Agreement allocates University main campus trips on the basis of gate count, rather than the standard method of using square footage of development to estimate trip generation, in recognition of access constraints unique to the UCSC main campus. These constraints include: campus access dependence upon two arterial roadways (Bay Street and Empire Grade) and two collector roads (High Street and Western Drive) traversing residential neighborhoods; an incomplete roadway network relative to the network envisioned in the original campus planning; the absence of any direct campus access route from State Route 9 or Highway 1; reliance on only two entrance gates to the campus; adjacent state and city parklands and open space that surround the main campus on three sides; and the geographic and topographic distance of the main campus from commercial service areas within the city.

The Campus has routinely conducted vehicle counts at campus entrances over the past ten years, as one means of gauging the effectiveness of campus transportation demand management measures. In order to determine the annual ADT, under the Settlement Agreement, the Campus has committed to count combined total vehicle trips though the campus Main and West entrances for a two-week period, Monday through Friday, beginning in the fourth week of the fall and the spring academic quarters (when school is in session for an entire week) each year.

Although the 2005 LRDP EIR projects that the campus will generate over 6,600 new ADT by 2020-21, over the 2004 baseline of 24,830 trips (for a total of 28,700 ADT), the Campus commits in the Settlement Agreement to generate only 3,900 additional ADT, and to pay penalties if the campus generates more than the agreed upon number of trips. The recent campus gate count data indicate that, rather than increasing as projected, campus trip generation has decreased substantially compared to the baseline of the 2005 LRDP. In 2007-2008, the campus generated 21,900 ADT, a reduction of more than 2,900 ADT since the 2005 LRDP baseline.

The Settlement Agreement provides that trip generation may be revisited over time, by mutual agreement among the parties to the agreement, as it is possible that significant shifts in current modes may occur due to changes in alternative transportation modes and/or transit services as a result of technological, financial, or other conditions.

UCSC also has committed to work cooperatively with the City to review, revise, and maintain the City’s traffic model following completion of the City’s General Plan update. UCSC’s trip generation rates and distribution will be updated every three years using the traffic model adopted as part of the City’s General Plan update. At intervals of no more than three years or increments of no more than 1,000 students in enrollment growth (whichever occurs first), the University also will conduct traffic counts at a mutually agreed number of intersections for the purpose of updating the City’s traffic model (to adjust trip distribution) and to identify locations at which additional improvements are required to accommodate the projected traffic demand.

Calculation and Payment of Fair Share Cost

As described above, the City of Santa Cruz has operated a Traffic Impact Fee (TIF) program for new development within the city since 2006. The City assesses a one-time fee per projected daily trip for proposed new development. The amount of the per-trip fee is based on the total cost of needed transportation improvements in the city of Santa Cruz, divided by the number of new projected trips based on travel demand modeling. Necessary transportation improvements are identified and prioritized by the City to maximize traffic and transit benefits in the city, and the City schedules highest priority improvements for implementation in its 10-year capital improvement plan. The TIF is adjusted annually by the City based on the results of ongoing monitoring and modeling and the cost of improvements added to the high priority list.

As agreed in the Settlement Agreement, UCSC made a contribution to the City in 2008 in an amount equivalent to the City's Traffic Impact Fee per trip for 3,900 projected additional average daily trips through the main campus gates. This contribution accounts for all new main campus vehicle trips projected to be generated by the campus during the period covered by the 2005 LRDP up to a total of 28,700 main campus ADT, as described above.

Enforceability

Under the Settlement Agreement, if the allocated trips are exceeded during the term of the LRDP, UCSC will reduce ADT by one or more of the following measures: adjusting enrollment, adjusting on-campus workforce, or through implementation of other ADT reducing measure(s). When UCSC main campus trips are within 1,500 of the allocated trips, UCSC will hold a meeting to solicit public input regarding measures for the reduction of ADT. In addition, if the allocated ADT are exceeded, UCSC will make a penalty payment in an amount equal to three times the City's citywide TIF then in effect for every ADT in excess of the commitment, and will make these payment annually until ADT is equal to or below the 28,700 total to which the Campus has committed. Any penalty funds will be deposited into a dedicated account for use by the City and UCSC to reduce ADT to UCSC. UCSC and the City will work cooperatively to identify appropriate and effective trip reduction programs, including, but not limited to, increased SCMTD transit service to the UCSC campus, with the expenditure of funds being subject to the approval by the City.

UCSC's payment described above fulfills UCSC's "fair share" commitment in 2005 LRDP mitigation measure TRA-2A and the portion of TRA-5A that relies on TRA-2A for off-campus traffic impacts associated with a total campus ADT of 28,700.

Additional Measures to Reduce Off-Campus Traffic Impacts

Under the Settlement Agreement, UCSC and the City have agreed to work together on strategies to reduce peak hour traffic impacts and overall traffic volumes in the city and region, as described in a preceding section. The City and UCSC will continue to work cooperatively with other Bus Rapid Transit (BRT) Task Force members to develop BRT improvements and other feasible alternative transit systems that could effectively reduce peak hour impacts and have the greatest potential to be funded and implemented, and have agreed to meet to identify additional improvements that are not included in the City's current TIF program, or conduct an integrated sequence of transportation studies to explore alternative transportation solutions for immediate implementation.

UCSC and the City also will continue efforts to jointly plan and implement a public transportation system capable of reducing the use of and traffic congestion on City streets. Specific tasks that make up this planning effort (as far as financially feasible with available funds) will include, but not be limited to, identification of preferred technologies, routes, and rights of way, and identification of probable ridership and financing.

In addition, UCSC will continue to implement and expand its existing Transportation Demand Management (TDM) programs with the objectives of increasing sustainable transportation modes (use of modes other than single-occupant vehicles) above 55 percent, reducing peak hour traffic volumes and addressing increases in traffic overall, all as required under 2005 LRDP Mitigation TRA-2B.

3.14.1.9 Relevant Project Characteristics

Population

The proposed ECI Project would provide about 100 student apartments in two mid- to high-rise buildings, to accommodate a population of about 594 resident students. It is anticipated that the majority of student residents would be sophomores and juniors, although the facility also would be available to Crown College and Merrill College students in other class years. The total estimated project population includes a staff of about 17 resident assistants, who would live in the complex and are counted as student residents, and eight to ten professional staff, two of whom would reside in the complex.

Project Circulation

The proposed project would include two access roads, both of which would leave the east side of Chinquapin Road north of McLaughlin Drive. Both would include sidewalks along one side. The existing access road from Chinquapin Road to Crown College would be relocated a short distance to the south of the existing intersection, and would pass the north end of ECI Building B, the main pedestrian entry to the ECI plaza, and the front of Building A, to join the existing Crown College access road at Crown Circle, which would be preserved. A small parking bay adjacent to this access road would provide four special use parking spaces. The principal pedestrian entry to the ECI plaza would be via stairs and a ramp from this access road at a point between the south ends of ECI buildings A and B. A service drive for Building A would leave this access road near the east end of Building A. A long paved ramp along the east edge of the ECI plaza would provide an emergency access road, as well as ADA access along the length of the plaza, and would provide vehicular access between the two access roads. The second project access road would leave Chinquapin Road just north of the north end of Building B. It would replace the existing entry to the main part of Parking Lot 111, and provide access to the lower two terraces of the lot, which would be preserved. This northern road also would provide access to a service drive at the north end of ECI Building B. A small parking bay adjacent to this road would provide four additional reserved/handicapped parking spaces.

Project Bicycle and Pedestrian Facilities and Access to Transit

The proposed project includes a pedestrian plaza between the two project buildings, which extends between the project's two access roads. Pedestrian paths and/or stairways from points east of Building A and from the north end of the pedestrian plaza would provide access to the lower terraces of Parking Lot

111, and from there to the Crown/Merrill Apartments. There also would be a sidewalk along the west side of Building B on Chinquapin Road.

Under existing conditions, stairways and switchback paths from Crown and Merrill Colleges and from the Crown/Merrill Apartments provide access to the lower terraces of Parking Lot 111 and between the facilities. During construction, these parking lot terraces, and the adjacent stairways and pedestrian paths, would be fenced off. Two routes for pedestrian access between the apartments and Crown and Merrill Colleges would be available during construction. A temporary protected pedestrian route would be designated at the east end of the lowest terrace of the parking lot, connected with existing stairways or paths. A second route would be provided along the west side of Chinquapin Road via a crosswalk and sidewalk that will be constructed in the summer of 2009 under a separate, recently-approved safety project. This sidewalk will turn east at the Chinquapin Road/McLaughlin Drive intersection, and continue east along the north side of McLaughlin Drive to a transit stop on the north side of McLaughlin Drive.

At present, bicycles access Crown College and the Crown/Merrill Apartments via Chinquapin Road. In conjunction with the recently-approved Chinquapin sidewalk project, the Campus is preparing to designate an uphill bike lane along the east side of Chinquapin Road from McLaughlin Drive to the Crown/Merrill Apartments to improve bicycle safety in this area. Paved access roads and paths within the Crown/Merrill Apartment complex and Crown and Merrill Colleges also provide bicycle access. There are bicycle parking facilities within all three complexes. Bicycle access to the proposed project would be provided by the north and south access roads, as well as along the vehicle ramp along the east side of the interior plaza. The project includes covered bicycle parking for 90 bicycles, for residents, and an additional 150 exterior bicycle parking spaces at various locations around the edges of the plaza.

Campus shuttle and METRO buses travel both directions along McLaughlin Drive to provide service to the entire campus via the campus loop route. Neither the campus shuttle nor Santa Cruz METRO provides service along Chinquapin Road. The McLaughlin Drive intersection lies about 600 feet south along Chinquapin Road from the proposed project entry. From the Chinquapin intersection, westbound transit stops are available on the north side of McLaughlin Drive at points 500 feet east (Crown/Merrill College stop), or about an equal distance west (the College Nine/Ten stop). Eastbound stops are available opposite the College Nine/Ten stop, adjacent to the Cowell Health Center, or on Hagar Drive, south of the McLaughlin Drive/Hagar Drive intersection. The Core Campus transit route may be accessed at the Bay Tree Plaza on Steinhart Way, a short distance south of the McLaughlin Drive/Hagar Drive intersection. Figure 3.14-9, *Pedestrian Routes and Transit Stops in the ECI Project Vicinity*, shows the location of transit stops and pedestrian crossings in the project vicinity.

There are several possible routes between the project site and the closest transit stops. From the project site, users could cross Chinquapin Road on a new crosswalk adjacent to the fire station, and follow the new Chinquapin sidewalk down to McLaughlin Drive. From that intersection, transit users may head west along McLaughlin Drive to the westbound College Nine/Ten transit stop, and cross McLaughlin Drive at the College Nine/Ten stop to reach the eastbound stop at the Health Center; or cross Chinquapin Road and follow the new McLaughlin sidewalk east to the Crown/Merrill stop. Pedestrians can then cross McLaughlin Drive at the Crown/Merrill stop to access southbound stops on Hagar Drive or the Core

Loop on Steinhart Way. From the ECI site, pedestrian paths through Crown College would provide an alternative route to the Crown/Merrill College stop on McLaughlin Drive.

Project Parking Facilities

The ECI Project site is located in campus Parking Zone 4, which currently includes 393 parking spaces, including 261 permit-designated spaces, and 132 parking spaces reserved for special uses, such as for service or University vehicles, for handicapped or medical use, timed loading and unloading, or guest use (parking meters). A spring 2008 parking utilization survey indicated average daily parking use in this zone of about 213 spaces. Crown College's Parking Lot 111, part of which is included in the proposed project site work area, and most of the remainder of which would be taken out of service during construction for use in project staging, presently provides 160 automobile parking spaces, all of which are either permit-controlled spaces or reserved for various users (e.g. metered or time-restricted, University vehicles, handicapped and medical permits, and service vehicles). The construction of the proposed project would permanently remove the upper terrace of Parking Lot 111 (44 spaces), and several small parking bays along the Crown access road that provide another 21 parking spaces. The lower two terraces of the lot, which presently together provide 86 parking spaces, would be used for ECI construction staging, such that no parking would be available in the entire lot for the duration of the project.

The project would include repaving and restriping of the access road and two lower terraces of Parking Lot 111 subsequent to construction, as well as construction of a few new spaces along the new project access roads, to provide a total of 95 parking spaces in Parking Lot 111 at the conclusion of construction. This represents a net reduction in the capacity of the lot by 65 automobile parking spaces. The net parking capacity of Zone 4 subsequent to ECI Project construction would be about 323.

As described in 3.14.1.4 above, the allocation of parking permits is managed under campus policy. Any freshman and sophomore students who might reside in the ECI complex would not be permitted to purchase on-campus parking permits of any kind except by individual permission for special cases (e.g. medical or handicapped permits). Resident juniors and seniors would be eligible to purchase close-in apartment parking permits or, for a substantially lower fee, a permit for Remote campus lots. Permit sales and close-in use are on a first-come first-served basis. Those who did not obtain a close-in permit would be eligible for a Remote permit; those with close-in permits also would be permitted to use the Remote lots when the close-in lots are full.

The Campus is preparing to locate several Carshare cars (under the Campus's existing ZipCar program) within campus Parking Zone 4. Carshare is an element of the Campus's TDM program under which registered members may rent a car by the hour as an alternative to bringing a personal car to the campus or to Santa Cruz. UCSC students 18 years of age or older, all faculty and staff, and community members 21 years of age or older are eligible to participate in the program.

3.14.2 Impacts and Mitigation Measures

3.14.2.1 Applicable LRDP Mitigation Measures

The following previously-adopted 2005 LRDP EIR mitigation measures are applicable to and incorporated into the proposed project:

LRDP Mitigation TRA-2A: UC Santa Cruz shall, at intervals of no more than three years or increments of no more than 1,000 students in enrollment growth (whichever occurs first), conduct traffic counts at the identified intersections to determine if the additional traffic generated by campus growth or a specific project would trigger the need for the specific intersection improvements listed in Table 4.14-18 [see Table 3.14-9, below] or other improvements to achieve the City's level of service standards. If the analysis indicates that, with the traffic contribution of campus growth or of a specific proposed project the levels service would degrade to unacceptable levels, the Campus shall inform the City of this conclusion and contribute its "fair share"[3] of the cost to the needed improvements.

This mitigation measure is further described and amended consistent with the Settlement Agreement, as reflected in Section 3.14.1.8, above,

LRDP Mitigation TRA-2B: UC Santa Cruz shall continue to implement and will expand its existing Transportation Demand Management programs with the objectives of increasing sustainable transportation modes (use of modes other than single-occupant vehicles) above 55 percent during the planning horizon of the 2005 LRDP and reducing peak-hour traffic volumes. [Potential measures that the Campus will consider for achieving this objective are listed in 2005 LRDP EIR Vol. II, Table 3.14-19. They include expansion of campus vanpool and carpool programs and establishment of a Carshare program].

LRDP Mitigation TRA-3B: The Campus shall monitor on-campus parking utilization rates annually and will construct additional parking when demand approaches capacity. The Campus will use projected average daytime utilization rate in excess of 90 percent in a given parking zone as a measure of parking capacity.

LRDP Mitigation TRA-4A: UC Santa Cruz shall monitor campus and METRO transit service and other alternative modes of transportation on an annual basis to assess the need for improvements in campus circulation to accommodate changes in campus-related circulation demands.

LRDP Mitigation TRA-4B: Based on results of LRDP Mitigation TRA-4A, the Campus shall improve the operational efficiency and capacity of the campus transit system as needed to maintain transit cycle time, and shall work with SCMTD and other agencies to maintain and improve efficiency and capacity of the public transit system serving University facilities.

LRDP Mitigation TRA-4C: Based on the results of LRDP Mitigation TRA-4A, the Campus shall implement measures, including physical and operational improvements, that will ensure transit travel

[3] As defined in the August 2008 Settlement Agreement and discussed in Section 3.14.1.8, above.

times between the two most widely-separated colleges do not exceed the time interval between class periods. These measures may include, but are not limited to channelization of pedestrian crossings, installation of signal-controlled pedestrian crossings, and grade-separated pedestrian crossings where appropriate.

LRDP Mitigation TRA-4D: The Campus shall coordinate implementation of needed campus roadway and circulation improvements identified in the 2005 LRDP with the pace of campus development.

LRDP Mitigation TRA-4E: Based on the results of LRDP Mitigation TRA-4A, the Campus shall implement the bicycle circulation elements of the 2005 LRDP as needed to maintain and enhance the effectiveness of bicycles as a transportation mode.

LRDP Mitigation TRA-4F: The Campus shall implement integrated transit, bicycle and pedestrian way-finding systems on the main campus.

3.14.2.2 CEQA Checklist Items Not Applicable to the Project

- 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
- Result in inadequate emergency access

The proposed project has no potential to affect air traffic patterns, and would not be located within an air safety zone that would require restrictions on development. Potential impacts with respect to emergency access are addressed in Section 3.7, *Hazards and Hazardous Materials*.

3.14.2.3 Standards of Significance

The following standards of significance are based on Appendix G of the CEQA Guidelines. For the purposes of this EIR, an impact to transportation/traffic would be considered significant if the proposed project would:

- Cause an increase in the traffic that is substantial in relation to the existing traffic load and capacity of the street system (as indicated by level of service standards for congestion at intersections)
- Exceed, either individually or cumulatively, a level of service standard established by the County Congestion Management Agency for designated roads or highways
- Substantially increase hazards due to a design feature or incompatible uses
- Result in inadequate parking capacity
- Conflict with applicable adopted policies, plans, or programs supporting alternative transportation

The Governor’s Office of Planning and Research has proposed “Preliminary Draft CEQA Guideline Amendments for Greenhouse Gas Emissions” (released in January 2009). These revisions focus on the reduction of greenhouse gas emissions, to which the use of motor vehicles is a major contributor. If these amended guidelines are adopted, the traffic and transportation thresholds of significance would be changed to reflect the de-emphasis of facilities that favor or facilitate the use of automobiles:

The proposed revisions would not consider increases in traffic as measured by traffic load, street capacity, or intersection levels of service to be significance effects on the environment. The project's trip contributions instead would be considered under the following standard: Would the project result in a substantial increase in the number of vehicle trips, roadway vehicle volumes or vehicle miles traveled.

The proposed revisions also would eliminate the threshold regarding the provision of adequate parking capacity.

The analysis presented here relies on the existing CEQA thresholds of significance as currently adopted. However, the proposed revised traffic thresholds are discussed, as applicable, in the following sections.

Significance Thresholds for Intersection Levels of Service (LOS)

The following thresholds were used in this section to evaluate whether the project would cause an increase in traffic that is substantial in relation to the traffic load and the capacity of the street system. There are no designated congestion management program facilities in the project study area. The City of Santa Cruz uses the thresholds listed below to determine whether projects within the jurisdiction of the City would result in a significant adverse effect on traffic conditions at an intersection, and these same thresholds were used in the analysis of the traffic impacts of UCSC's 2005 LRDP. This EIR also uses these thresholds in the assessment of project study intersections:

A project causes a substantial increase in traffic if:

- The peak hour level of service (LOS) (defined in Section 3.14.2.9, below) at a signalized intersection degrades from an acceptable level to an unacceptable level due to the increase in traffic generated by the proposed project and the project increases the traffic volume in that intersection by more than three percent, or
- The project increases the traffic volume by more than three percent at a signalized intersection that already operates at an unacceptable level without the project, or
- An unsignalized intersection meets the Caltrans peak hour signal warrant with the addition of project-generated traffic and the project increases the traffic volume by more than 3 percent.

With respect to the proposed revision of significance guidelines relative to traffic levels, which would assess whether the project would result in a substantial increase in the number of vehicle trips, roadway vehicle volume, or vehicle miles traveled, the Campus's highly effective TDM program is designed specifically to reduce vehicle trips to campus and to encourage the use of alternative forms of transportation that would reduce total vehicle miles traveled and the number of vehicle trips. This program is consistent with the greenhouse gas reduction goals that underlie the proposed revision in traffic impact significance standards.

Campus Intersections. UCSC has established LOS D as the minimum acceptable LOS for intersections in the lower campus and LOS E as the minimum acceptable LOS for intersections in the central and north campus areas.

City of Santa Cruz Intersections. The City of Santa Cruz General Plan considers LOS D to be the minimum acceptable LOS for most City streets and intersections during the PM peak hours. The acceptable level of service for city streets and intersections in the city's Central Core Area from Downtown to the Beach Area during the PM peak hour is LOS E. This area is bordered by Highway 1, Chestnut Street, Ocean Street, and the beach. The acceptable level of service for Mission Street, Ocean Street, Riverside Street, Beach Street, Front Street from Soquel Avenue to Beach Street, Soquel Avenue from Ocean Street to Front Street, Barson Street from Ocean Street to Riverside Street, and the intersections on those streets during weekend peak hours is LOS E.

Caltrans Facilities. Caltrans considers LOS C/D to be the acceptable threshold; LOS C is acceptable in all cases, and LOS D is acceptable on a case-by-case basis. This standard is applicable to project off-campus study intersections along Mission Street (State Route 1).

3.14.2.4 Project Trip Generation

Trip generation projections for the proposed ECI Project were based on UCSC data on student travel behavior and parking demand, including parking utilization, parking permit purchases, and daily trips through the campus gates. Based on these data, it is projected that the approximately 600 persons who would reside in the proposed ECI facility would generate approximately 804 net daily trips, 67 net trips occurring during the AM peak hour and 96 net trips occurring during the PM peak hour. These trip generation projections are based on the schedules published in ITE Trip Generation Manual 7th Edition (Institute of Transportation Engineers) for high-rise apartment buildings. A high rise apartment building with a population of 600 typically would generate about 2,010 daily trips. However, as a campus facility, the project's trip generation would be substantially reduced because students would both reside and attend school on the campus and are unlikely to drive from the residences to classes or other on-campus activities due to parking restrictions, and the availability of pedestrian bike routes and the convenience of transit. Further, the proportion of students projected to bring an automobile to campus would be expected to be substantially reduced, relative to ITE standards, as a result of the Campus's highly effective TDM programs. These programs (described in Section 3.14.1.3, above) provide alternatives to maintaining and using personal vehicles on campus, and also provide cost and convenience disincentives in the form of parking fees and restrictions. As indicated by UCSC mode share gate counts (described in Section 3.14.1.3, above), implementation of TDM measures at UCSC has resulted in approximately 60 percent fewer trips than the average for similar types of land uses (Pageler 2008b). Based on the existing TDM measures it is assumed that the total trip generation based on ITE Trip Generation rates would be reduced by 60 percent. Table 3.14-1, below, summarizes the projected trip generation for the ECI Project.

Table 3.14-1. East Campus Infill Projected Trip Generation

Students	Daily Trips		AM Peak Hour					PM Peak Hour				
	Rate	Total	Rate	In:Out	In	Out	Total	Rate	In:Out	In	Out	Total
600	3.35	2,010	0.28	0.92986	35	133	168	0.4	65:35:00	156	84	240
Subtotal		2,010			35	133	168			156	84	240
TDM Reduction -60%		1,206			21	80	101			94	50	144
Net Total		**804**			**14**	**53**	**67**			**62**	**34**	**96**

Source: Institute of Transportation Engineers (ITE). 2007. Trip Generation, 7th Edition: An ITE Informational Report. *ITE Journal.*

3.14.2.5 Project Trip Distribution

Directional trip distribution and assignment of projected traffic generated by the proposed project was developed using existing traffic counts, assessment of existing and projected traffic flows and travel patterns, vicinity and location of the project, and the Regional Travel Demand Model data for the proposed project was determined using the Association of Monterey Bay Area Governments (AMBAG) Regional Travel Demand Model forecasting model developed in 2008 (AMBAG 2008). The projected distribution of trips generated by the proposed project is illustrated in Figure 3.14-4, *Trip Distribution*. The projected traffic from the proposed project was assigned to the study intersections based on the projected directional trip distribution. Figure 3.14-5, *Project Only Trips* illustrates the project-only peak hour trips at the study intersections based on proposed trip distribution.

In addition, modeled project trip distribution internal to the campus takes into account Campus parking controls applicable to the project, the project site, and the project population, which would limit the number of daily and peak hour trips originating and terminating at the project site. It is projected that the majority of the project's vehicle trips would start and end at UCSC campus remote parking lots, primarily the East Remote lot (which is closest to the site) but also potentially the North Remote lot and West Remote lot, rather than at the project site. Based on this condition, only a portion of project trips would pass through the on-campus intersections closest to the project site; that is, the Chinquapin/McLaughlin, McLaughlin/Hagar, and Hagar/Steinhart intersections. Conversely, a larger percentage of the projected trips would pass through the Hagar/East Remote parking lot intersection.

3.14.2.6 Project Study Intersections

Based on the traffic generation and trip distribution projected for the proposed project, and taking into account intersections where significant impacts were identified in the 2005 LRDP EIR, a subset of 19 study intersections was selected for study in this project EIR. Because the proposed project provides housing on campus, it is not anticipated that residents would contribute significantly to regional commute traffic on the wider regional network (e.g. freeway on-ramps on SR 1 south of Santa Cruz and on SR 17), so these are not included in the analyses presented here.

The selected on-campus and off-campus project study intersections are listed below and shown in Figures 3.14-1 (*Vicinity Map)* and 3.14-2 (*Existing Lane Geometries*).

On-Campus Study Intersections

1 Heller Drive/McLaughlin Drive
2 Heller Drive/Meyer Drive
3 Chinquapin/McLaughlin Drive
4 Hagar Drive/McLaughlin Drive
5 Hagar Drive/Glenn Coolidge Drive
6 Glenn Coolidge Drive/High Street
7 Hagar Drive/East Remote

Off-Campus Study Intersections

8 Western Drive/Empire Grade
9 Laurent Street/High Street
10 Bay Drive/Iowa Drive
11 Bay Drive/Escalona Drive
12 Bay Street/King Street
13 Bay Street/Mission Street
14 Mission Street/Laurel Street
15 Walnut Street/Mission Street
16 Bay Street/California Street
17 King Street/Mission Street
18 Chestnut Street/Mission St.
19 Highway 1/River Street

3.14.2.7 Analytical Scenarios for Traffic Operations

Traffic conditions at the study intersections were analyzed for the weekday AM and PM peak hours of traffic. The AM peak hour of traffic is generally between 7:00 and 9:00 AM, and the PM peak hour is typically between 4:00 and 6:00 PM. It is during these periods that the most congested traffic conditions occur on an average weekday. The Traffic Impact Study prepared for the project (URS 2009) projected future traffic volumes, and analyzed intersection levels of service (described in Section 3.14.2.9, below) and whether study intersections met signal warrants under the following scenarios:

- Existing Conditions – Evaluate traffic conditions based on existing lane geometries, traffic controls, and traffic volumes

- Existing Plus Project Conditions – Evaluates traffic conditions with traffic generated from proposed project
- Cumulative Conditions – Evaluates traffic conditions for Cumulative Year (2012-13) Conditions with traffic projected from other development but without project
- Cumulative Plus Project Conditions – Evaluates traffic conditions for cumulative year with projected cumulative traffic and proposed project

Data used in the traffic impact study, and the data provided by traffic modeling, are provided in Appendix F of this EIR. Appendix F is not included in the printed version of this document, but is available for review at the offices of Physical Planning and Construction, UC Santa Cruz, and is included in the electronic version of the document that is posted on the UCSC website at http://ppc.ucsc.edu/cp/planning/docs.

3.14.2.8 Cumulative Future Conditions

Project construction would be completed by 2011 and the project would be fully operational during the 2011-2012 academic year. This EIR, therefore, considers traffic conditions in 2013. It calculates Cumulative Conditions (traffic levels without the ECI Project but with other growth in the region) and Cumulative Plus Project Conditions. To do so, the analysis projects the volume of traffic in 2013 at each study intersection.

Projection of cumulative conditions begins with current conditions (2008, the baseline year) and adds traffic attributable to reasonably foreseeable growth. This growth has two components: growth attributable to specific reasonably foreseeable projects and background growth. To determine the growth related to other projects, this analysis considers approved campus projects and the City of Santa Cruz's list of projects approved, under construction, or under consideration. The following projects are located within a mile of the proposed project and are projected to generate significant additional trips at the study intersections:

1. 1804 Mission Street – 18 multi-family residential units and 1,617 square feet of commercial development
2. 2232 Mission Street – 11 multi-family residential units and 574 square feet of commercial development
3. Almar Center Development – 27,000 square feet of commercial development
4. UC Santa Cruz Biomedical Science Facility – facility to accommodate 141 students and 59 faculty and employees
5. UC Santa Cruz Digital Arts Facility – 25,600 assignable square feet (asf) of teaching, research, and administrative space for the Arts division and a 1,199 asf addition to the Black Box Theater

Standard ITE trip generation rates were used to develop Year-2013 traffic volumes attributable to these projects.

To account for cumulative background growth not associated with these specific projects, this analysis also adds a further 1 percent growth per year over the period from the baseline year to 2013. The 1 percent rate was derived by comparison of the Base Year and Future Year projections from the Regional Traffic Demand Model maintained by AMBAG, which show a 1 percent annual growth in background traffic.

3.14.2.9 Analytical Method for Evaluation of Intersection Operations

Level of Service Analysis

This section summarizes the methodologies used to perform peak hour intersection capacity analysis at signalized and unsignalized intersections, consistent with Caltrans guidance on preparing traffic impact studies (Caltrans 2002). Level of service analysis was conducted based on traffic counts provided by UCSC (TDS 2007) using SYNCHRO software for signalized and unsignalized intersections based on the operations methodology described in the Transportation Research Board *2000 Highway Capacity Manual* (HCM).

“Levels of Service” (LOS) is a measure of congestion that ranges from LOS A (free-flow condition) to LOS F (highly congested condition). LOS calculations utilize the *2000 Highway Capacity Manual* methodology (Transportation Research Board [TRB] 2000, Chapter 10) for signalized intersections. LOS analysis at signalized intersections presented here were conducted using procedures outlined in Chapter 16 of the *2000 Highway Capacity Manual* (TRB 2000). This method defines Level of Service in terms of delay at intersections, specifically in terms of average stopped delay per vehicle. LOS quantifies levels of delay and congestions, which are a measure of driver and/or passenger discomfort, frustration, fuel consumption and lost travel time. This technique uses 1,900 vehicles per hour per lane (vphpl) as the maximum saturation volume at a signalized intersection. This saturation volume is adjusted to account for lane width, on-street parking, pedestrians, traffic composition (i.e., percent trucks), and shared lane movements. Table 3.14-2, below, summarizes the relationship between the level of service rating for signalized intersections and the average control delay per vehicle.

Table 3.14-2
Level of Service Definitions for Signalized Intersections

Level of Service	Average Control Delay Per Vehicle (seconds)	Description
A	≤ 10.0	Operations with very low delay occurring with favorable progression and/or short cycle length.
B	10.1 to 20.0	Operations with low delay occurring with good progression and/or short cycle lengths.
C	20.1 to 35.0	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.
D	35.1 to 55.0	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, and high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.
E	55.1 to 80.0	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.
F	> 80.0	Operations with delays unacceptable to most drivers occurring due to over-saturation, poor progression, or very long cycle lengths.

Source: Chapter 16, *2000 Highway Capacity Manual*, Transportation Research Board (TRB), National Research Council, Washington, D.C. 2000.

Notes: Cycle length refers to the time (in seconds) for traffic signal to complete a cycle of green indications for all movements.

Cycle failure refers to conditions when traffic congestion reaches a level where some vehicles cannot pass through the intersection in one or more cycles.

The evaluation of unsignalized intersections also relies on the operations method of the *2000 Highway Capacity Manual* (TRB 2000). The methodology used to analyze unsignalized intersections calculates the average total delay per vehicle for each minor street movement and for the major street left-turn movements based on the availability of adequate gaps in the main street through traffic. A level of service designation is assigned to individual movements or to combinations of movements (in the case of shared lanes) based upon delay. Unsignalized intersection levels of service reported herein are for each movement (or group of movements) based upon the respective average delay per vehicle. For two-way stop-controlled intersections, the average control delay for the worst approach is reported. For all-way stop-controlled intersections, the weighted average delay[4] for the entire intersection is reported.

Table 3.14-3, below, summarizes the average delay criteria used to determine the level of service at unsignalized intersections.

[4] Weighted average is defined as the average vehicle delay experienced at each intersection approach. The average is weighted by the volume of traffic using each approach.

Table 3.14-3
Level of Service Definitions for Unsignalized Intersections

Level of Service	Average Control Delay Per Vehicle (seconds)
A	≤ 10
B	10.1 to 15.0
C	15.1 to 25.0
D	25.1 to 35.0
E	35.1 to 50.0
F	> 50.0

Source: Chapter 17, *2000 Highway Capacity Manual*, Transportation Research Board (TRB), National Research Council, Washington, D.C. 2000

Signal Warrant Analysis

Signal warrant analysis, based on existing peak hour turning movement volumes, was conducted at all unsignalized study intersections using Caltrans' *Manual on Uniform Traffic Control Devices for Streets and Highways* (Caltrans 2003, 2004), Warrant No. 3, Peak Hour signal warrant. An intersection meets a signal warrant if a traffic signal light would improve safety or operating conditions at the intersection.

3.14.2.10 Intersection Operations under Existing Conditions

Updated peak-hour turning movement counts[5] for all of the 2005 LRDP EIR study intersections, including all of the ECI Project intersections, were conducted in October/November of 2007 (TDS 2007). Figure 3.14-2, *Existing Lane Geometries* show the existing lane configurations at each ECI study intersection, and Figure 3.14-3, *Existing Volumes,* show the peak hour volumes in each turning movement in each study intersection during under existing conditions.

Table 3.14-4, below, shows the results of analysis of on-campus study intersections and off-campus study intersections, based on traffic counts conducted in 2007 (TDS 2007). For each intersection, the table indicates existing intersection controls, the calculated LOS and average seconds of delay in both AM and PM peak hours, and whether or not the intersection meets Caltrans' peak hour signal warrants under existing conditions. Shading indicates that the intersection already meets the signal warrant or operates as an unacceptable LOS without the project.

[5] Number of cars making various turns at an intersection during the traffic peak hours.

Table 3.14-4
Peak Hour Intersection Levels of Service, On-Campus Intersections: Existing Conditions

#	Intersection	Unsignalized Intersection Meets Signal Warrants	Type of Control	AM		PM	
				Delay	LOS	Delay	LOS
On-Campus Intersection							
1	Heller Drive/McLaughlin Drive	No	AWSC	8.0	A	10.4	B
2	Heller Drive/Meyer Drive	No	AWSC	9.1	A	13.0	B
3	Chinquapin Rd./McLaughlin Dr.	No	AWSC	10.2	B	11.3	B
4	Hagar Drive/McLaughlin Drive	No	AWSC	8.7	A	11.3	B
5	Hagar Drive/Glenn Coolidge Dr.	n/a	Signal	6.1	A	17.8	B
6	Glenn Coolidge Drive/High St.	n/a	Signal	22.7	C	24.8	C
7	Hagar Drive/East Remote Lot	No	OWSC	10.7	B	11.9	B
Off-Campus Intersections							
8	Western Drive/Empire Grade Rd.	Yes	OWSC	23.5	C	>50.0	F
9	Laurent Street/High Street	No	AWSC	40.4	E	17.6	C
10	Bay Drive/Iowa Drive	n/a	Signal	26.1	C	17.0	B
11	Bay Drive/Escalona Drive	Yes (AM)	TWSC	23.8	C	44.1	E
12	Bay Street/King Street	n/a	Signal	15.1	B	12.7	B
13	Bay Street/Mission Street	n/a	Signal	>80.0	F	>80.0	F
14	Mission Street/Laurel Street	n/a	Signal	41.3	D	>80.0	F
15	Walnut Street/Mission Street	n/a	Signal	66.9	E	>80.0	F
16	Bay Street/California Street	Yes	TWSC	70.2	F	>80.0	F
17	King Street/Mission Street	n/a	Signal	8.9	A	7.1	A
18	Chestnut Street/Mission Street	n/a	Signal	79.5	E	>80.0	F
19	Highway 1/River Street	n/a	Signal	>80.0	F	>80.0	F

Notes: TWSC – Two-Way Signal Controlled; OWSC – One-Way Signal-Controlled; AWSC – All-Way Signal Controlled.
Shaded cells indicate that intersection operates under substandard LOS.

As shown in the table above, under Existing Conditions all on-campus study intersections currently are operating at acceptable levels. Nine off-campus study intersections are operating at unacceptable levels of service during one or both peak hours: Western Drive/Empire Grade Road; Laurent Street/High Street;

Bay Drive/Escalona Drive; Bay Street/Mission Street; Mission Street/Laurel Street; Walnut Street/Mission Street; Bay Street/California Street; Chestnut Street/Mission Street; and Highway 1/River Street.

As also shown in the table, the unsignalized off-campus intersections of Western Drive/Empire Grade Road, Bay Drive/Escalona Drive, and Bay Street/California Street currently meet a signal warrant (Warrant No. 3: Peak Hour Warrant) based on existing peak hour traffic volumes. None of the on-campus study intersections currently meets signal warrants.

Based on these findings, the Western Drive/Empire Grade Road, Bay Drive/Escalona Drive, and Bay Street/California Street intersections operate unacceptably under existing conditions, based on the applicable significance thresholds and without the addition of project traffic.

3.14.2.11 Intersection Operations under Existing Plus Project Conditions

This section presents the results of analysis of intersection operations if projected project traffic were added to the intersections under existing conditions. Figure 3.11-4, at the end of this chapter, illustrates peak hour trips that would be added to study intersections by the proposed project.

Table 3.14-5, below, shows the results of analysis of on-campus and off-campus study intersections under Existing Plus Project Conditions. For each intersection, the table indicates existing intersection controls, the calculated LOS and average seconds of delay in both AM and PM peak hours, and whether or not the intersection meets Caltrans' peak hour signal warrants under existing conditions or with the addition of project traffic. Figure 3.14-6 presents peak hour trip volumes at the study intersections under Existing Plus Project Conditions.

Table 3.14-5. Peak Hour Intersection Level of Service: Existing Plus Project Conditions

#	Intersection	Type of Control	AM		PM		Project Contribution	
			Delay	LOS	Delay	LOS	AM	PM
On-Campus Intersections								
1	Heller Drive/McLaughlin Drive	All-Way STOP	8	A	10.4	B	0%	0%
2	Heller Drive/Meyer Drive	All-Way STOP	9.1	A	13	A	0%	3%
3	Chinquapin/McLaughlin Drive	All-Way STOP	10.5	B	11.7	B	3%	3%
4	Hagar Drive/McLaughlin Drive	All-Way STOP	8.8	A	11.6	B	3%	3%
5	Hagar Drive/Glenn Coolidge Dr.	Signal	7.1	A	23	B	4%	4%
6	Glenn Coolidge Drive/High St.	Signal	23.4	C	25.2	C	3%	4%
7	Hagar/East Remote	One-Way STOP	11.2	B	12.5	B	8%	8%

Table 3.14-5. Peak Hour Intersection Level of Service: Existing Plus Project Conditions

#	Intersection	Type of Control	AM		PM		Project Contribution	
			Delay	LOS	Delay	LOS	AM	PM
Off-Campus Intersections								
8	Western Drive/Empire Grade**	One-Way STOP	24.6	C	>50.0	F	0%	0%
9	Laurent Street/High Street	All-Way STOP	>50.0	F	21	C	2%	4%
10	Bay Drive/Iowa Drive	Signal	26.8	C	17.6	B	3%	3%
11	Bay Drive/Escalona Drive**	Two-Way STOP	25.4	D	>50.0	F	3%	3%
12	Bay Street/King Street	Signal	12.1	B	13.9	B	3%	3%
13	Bay Street/Mission Street	Signal	>80.0	F	>80.0	F	1%	2%
14	Mission Street/Laurel Street	Signal	42.2	D	>80.0	F	1%	1%
15	Walnut Street/Mission Street	Signal	67.6	E	>80.0	F	1%	1%
16	Bay Street/California Street**	One-Way STOP	72.2	F	>50.0	F	1%	1%
17	King Street/Mission Street	Signal	9.8	A	7.2	A	3%	3%
18	Chestnut Street/Mission Street	Signal	>80.0	F	>80.0	F	1%	1%
19	Highway 1/River Street	Signal	>80.0	F	>80.0	F	1%	1%

Note: Delay is in seconds/vehicle for signalized intersections and All-Way STOP intersections.

Delay at intersections with One-Way STOP and Two-Way STOP Control represents maximum approach delay.

** Intersection meets signal warrants under existing conditions

Shade cell indicates intersection operates at substandard LOS under existing conditions.

Under Existing Plus Project Conditions, as under Existing Conditions, all on-campus intersections would operate at acceptable levels of service and none would meet peak hour signal warrants. The same nine off-campus intersections would operate below the acceptable LOS threshold under Existing Plus Project Conditions as under Existing Conditions. No additional off-campus intersections would meet signal warrants through the addition of project traffic to existing traffic, nor would the level of service at any intersection that currently operates at an acceptable level of service decline to an unacceptable level as the result of the addition of ECI Project traffic.

3.14.2.12 Intersection Operations under Cumulative Conditions Without Project and Plus Project

Table 3.14-6, below, presents the results of intersection analysis for cumulative future traffic conditions (2013) at the project study intersections, both on-campus and off-campus, and both with and without the addition of projected project traffic. The table includes AM and PM peak levels of service, delay times, and whether unsignalized intersections meet signal warrants. Figure 3.14-7 illustrates peak hour turning movement traffic volumes at study intersections under Cumulative Conditions Without Project. Figure 3.14-8 illustrates peak hour turning movement traffic volumes at study intersection under Cumulative Conditions Plus Project.

Cumulative Conditions Without Project

As indicated in Table 3.14-6, below, under Cumulative Conditions Without Project the same nine off-campus study intersections would operate at unacceptable levels of service as under Existing Without Project Conditions: Western Drive/Empire Grade; Laurent Street/High Street; Bay Street/Escalona Drive; Bay Street/Mission Street; Mission Street/Laurel Street; Walnut Street/Mission Street; Bay Street/California Street; Chestnut Street/Mission Street; and Highway 1/River Street. Under Cumulative Conditions Without Project, the same off-campus intersections also would meet signal warrants as under Existing Without Project Conditions. All other off-campus study intersections and all on-campus study intersections would operate at acceptable LOS. No on-campus intersections would meet signal warrants.

Cumulative Conditions Plus Project

As indicated in Table 3.14-6, below, under Cumulative Plus Project Conditions the same nine off-campus study intersections would operate at unacceptable levels of service as under Existing Without Project Conditions. All other study intersections, both on-campus and off-campus, would operate at acceptable levels of service, although LOS would decline from C to D at one on-campus intersection, Hagar Drive/East Remote. With respect to signal warrants, the same currently-unsignalized off-campus intersections that meet peak hour signal warrants under Existing Conditions Without Project—Bay/California, Bay/Escalona and Western Drive/Empire Grade—also would meet those warrants under Cumulative Plus Project Conditions. One additional intersection, High Street/Laurent Street, would meet peak hour signal warrants during the AM peak hour and the intersection would operate at a substandard LOS F at that time under both Cumulative and Cumulative Plus Project Conditions. However, the traffic would contribute only 2 percent of the cumulative traffic during this period, so the project's contribution to the cumulative impact would be less than significant. No on-campus intersections would meet peak hour signal warrants, and all on-campus intersections would continue to operate at acceptable LOS under Cumulative and Cumulative Plus Project Conditions.

While the proposed project is projected to add more than 3 percent traffic at the intersection of Laurent Street/High Street (approximately 4 percent) during the PM peak hour under Cumulative Plus Project Conditions, the intersection is projected to operate at acceptable levels during the PM peak hour under Cumulative and Cumulative Plus Project Conditions; therefore the project's contribution would not result in a significant impact.

Based on these analyses, it is projected that the proposed project's contribution would not result in a significant cumulative impact at any of the off-campus or on-campus study intersections.

Table 3.14-6. Peak Hour Intersection Level of Service: Cumulative and Cumulative Plus Project Conditions

#	Intersection	Type of Control	Cumulative Conditions				Cumulative Plus Project Conditions				Project Contribution	
			AM		PM		AM		PM			
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	AM	PM
On-Campus Intersections												
1	Heller Dr/McLaughlin Dr	All-Way STOP	8.1	A	10.7	B	8.1	A	10.8	B	<1%	<1%
2	Heller Drive/Meyer Drive	All-Way STOP	9.5	A	14.2	B	9.5	A	14.3	B	<1%	3%
3	Chinquapin/McLaughlin	All-Way STOP	10.7	B	11.8	B	10.9	B	11.8	B	3%	3%
4	Hagar Dr/McLaughlin Dr	All-Way STOP	8.9	A	11.9	B	9	A	12.2	B	3%	3%
5	Hagar Dr/Glenn Coolidge	Signal	7.1	A	23.4	C	8	A	27.1	C	4%	4%
6	Glenn Coolidge Dr/High St	Signal	26.9	C	27.3	C	26.5	C	28.1	C	3%	4%
7	Hagar/East Remote	1-Way STOP	10.9	B	17.6	C	11.5	B	26.9	D	7%	7%
Off-Campus Intersections												
8	Western Dr/Empire Grade*	1-Way STOP	28	D	>50.0	F	29.6	D	>50.0	F	<1%	<1%
9	Laurent Street/High Street	All-Way STOP	>50.0	F	20.2	C	>50.0	F	20.2	C	2%	4%
10	Bay Drive/Iowa Drive	Signal	27.1	C	17.8	B	27.1	C	18.4	B	3%	3%
11	Bay Drive/Escalona Drive*	2-Way STOP	28	D	>50.0	F	30.4	D	>50.0	F	3%	3%
12	Bay Street/King Street	Signal	12.7	B	13.4	B	12.8	B	14.4	B	3%	3%
13	Bay Street/Mission Street	Signal	>80.0	F	>80.0	F	>80.0	F	>80.0	F	1%	2%
14	Mission St/Laurel Street	Signal	46.2	D	>80.0	F	45.9	D	>80.0	F	1%	1%
15	Walnut Street/Mission St	Signal	>80.0	F	>80.0	F	>80.0	F	>80.0	F	1%	1%
16	Bay St/California St*	1-Way STOP	>80.0	F	>80.0	F	>80.0	F	>80.0	F	1%	1%
17	King Street/Mission Street	Signal	9.3	A	7.3	A	10.1	B	8.2	A	3%	3%
18	Chestnut Street/Mission St	Signal	>80.0	F	>80.0	F	>80.0	F	>80.0	F	1%	1%
19	Highway 1/River Street	Signal	>80.0	F	>80.0	F	>80.0	F	>80.0	F	1%	1%

Notes: Delay is in seconds/vehicle for signalized intersections and All-Way STOP intersections; Delay at intersections with One-Way STOP and Two-Way STOP Control represents maximum approach delay.* Intersection meets signal warrants under existing conditions.

3.14.2.13 Summary of Project Effects at Study Intersections

Based on the significance criteria cited above, in order for a project's impact to be considered significant at a signalized intersection, the intersection must operate at unacceptable LOS under Cumulative Plus Project Conditions, and the project must contribute more than 3 percent of the total traffic. For unsignalized intersections, a significant impact is identified if the project would contribute more than 3 percent of the total traffic, the intersection LOS would degrade to below an acceptable level, <u>and</u> the intersection would meet warrants for installation of a traffic signal. Table 3.14-7, below, summarizes project effects at each of the on-campus and off-campus project study intersections under Cumulative Plus Project Conditions for AM and for PM peak hours. As indicated in the table, the project would not result in any significant intersection impacts under Cumulative Plus Project Conditions, and its contribution to LOS impacts in 2013 would not be cumulatively considerable.

Table 3.14-7. Cumulative Plus Project Impact Assessment

#	Intersection	Type of Control	Peak Hour	LOS Standard	Cumulative Plus Project		Project % of Cumulative Traffic	Unsignalized Intersection Met Signal Warrant	Significant Impact
					Delay (sec)	LOS			
On-Campus Intersections									
1	Heller Dr./McLaughlin	AWSC	AM	E	8.1	A	<1	NO	NO
			PM		10.8	B	<1	NO	NO
2	Heller Dr./Meyer Dr.	AWSC	AM	E	9.5	A	<1	NO	NO
			PM		14.3	B	3	NO	NO
3	Chinquapin/McLaughlin	AWSC	AM	E	10.9	B	3	NO	NO
			PM		11.8	B	3	NO	
4	Hagar Dr./McLaughlin Dr.	AWSC	AM	E	9	A	3	NO	NO
			PM		12.2	B	3	NO	
5	Hagar/Glenn Coolidge	Signal	AM	D	6	A	4		NO
			PM		27.1	C	4		NO
6	Glenn Coolidge/High St.	Signal	AM	D	26.5	C	3		NO
			PM		28.1	C	4		NO
7	Hagar Dr./East Remote	TWSC	AM	E	11.5	B	7		NO
			PM		26.9	D	7		
Off-Campus Intersections									
8	Western/Empire Grade	OWSC	AM	D	29.6	D	<1	YES	NO
			PM		>50.0	**F**	<1	YES	NO
9	Laurent St./High Street	AWSC	AM	D	>50.0	**F**	2	YES	NO
			PM		20.2	C	4	NO	NO
10	Bay Drive/Iowa Drive	Signal	AM	D	27.1	C	3		NO
			PM		18.4	B	3		NO
11	Bay Drive/Escalona Dr.	TWSC	AM	D	30.4	D	3	YES	NO
			PM		>50.0	**F**	3	NO	NO
12	Bay Street/King Street	Signal	AM	D	12.8	B	3		NO
			PM		14.4	B	3		NO

Table 3.14-7. Cumulative Plus Project Impact Assessment

#	Intersection	Type of Control	Peak Hour	LOS Standard	Cumulative Plus Project		Project % of Cumulative Traffic	Unsignalized Intersection Met Signal Warrant	Significant Impact
					Delay (sec)	LOS			
13	Bay Street/Mission St.	Signal	AM	C/D	>80.0	**F**	1		NO
			PM		>80.0	**F**	2		NO
14	Mission St./Laurel Street	Signal	AM	C/D	45.9	**D**	1		NO
			PM		>85.0	**F**	1		NO
15	Walnut St./Mission St.	Signal	AM	C/D	>80.0	**F**	1		NO
			PM		>80.0	**F**	1		NO
16	Bay St./California St.	TWSC	AM	D	>80.0	**F**	1	YES	NO
			PM		>80.0	**F**	1	YES	NO
17	King Street/Mission St.	Signal	AM	D	10.1	B	3		NO
			PM		8.2	A	3		NO
18	Chestnut St./Mission St.	Signal	AM	D	>80.0	**F**	1		NO
			PM		>80.0	**F**	1		NO
19	Highway 1/River Street	Signal	AM	C/D	>80.0	**F**	1		NO
			PM		>80.0	**F**	1		NO

Notes: TWSC – Two-Way Stop-Controlled; AWSC – All-Way Stop-Controlled.

Signal Warrant Analysis was only performed on unsignalized intersections operating below the LOS standard with a project percent of total traffic greater than 3%.

Bold font indicates an unacceptable LOS.

3.14.2.14 Pedestrian Analysis

Pedestrians traveling between the project site and McLaughlin Drive would use a new sidewalk along the west side of Chinquapin Road. The new sidewalk will be constructed as part of the recently approved Chinquapin Sidewalk Project, which will construct pedestrian and bicycle safety improvements on Chinquapin Road and McLaughlin Drive. The Chinquapin Sidewalk project also includes a new bicycle lane along the east side of Chinquapin Road and a new sidewalk along the north side of McLaughlin between Chinquapin Road and the transit stop on McLaughlin Drive at the pedestrian path to Crown College. It is anticipated that the construction of this pedestrian and bicycle safety project will be complete by July 2009, prior to the proposed start of ECI construction in July 2009.

New crosswalks across Chinquapin Road would connect pedestrians from the project site to the sidewalk along the west side of Chinquapin Road and thence to sidewalks on McLaughlin Drive. Pedestrian traffic between the Crown/Merrill Apartments and Crown and Merrill Colleges currently crosses through the project site via stairways and footpaths through Parking Lot 111. During construction, pedestrian traffic between the Crown/Merrill Apartments and Crown and Merrill Colleges would be rerouted west of the project site along the new Chinquapin sidewalk and around the east end of the project site via a temporary designated pedestrian route. Pedestrian routes across the project site would again be available after project construction is complete, and new pathways also would connect the ECI pedestrian plaza with the adjacent facilities at Crown College and Crown/Merrill Apartments.

McLaughlin Drive is the transit route and principal east-west thoroughfare in the project vicinity. There are three pedestrian crossings of McLaughlin Drive and one crossing of Hagar Drive at the McLaughlin/Hagar intersection within 1,000 feet (Figure 3.14-9) of the project site. The closest intersection to the project is Chinquapin Road/McLaughlin Drive, a T-intersection with a pedestrian crossing across Chinquapin Road. A crosswalk across McLaughlin Drive east of Chinquapin Road conducts pedestrians across McLaughlin Drive from a footpath from Crown College. About 450 feet eastward along McLaughlin Drive from the Chinquapin intersection, , just west of the Hagar intersection, there is another pedestrian crossing across McLaughlin Drive which conducts pedestrians from a footpath from Crown and Merrill colleges to a stairway and bus stops around Quarry Plaza. The Hagar pedestrian crossing at this same intersection also crosses the principal transit route. About 450 feet westward along McLaughlin Drive from the Chinquapin Road intersection, east of the College Ten entry road, there is another crosswalk across McLaughlin Drive which provides access to the Cowell Student Health Center, an eastbound bus stop, and a footpath into the central campus. These features are shown on Figure 3.14-9.

The 2004 Pedestrian Data Collection and Analysis Report prepared for the UCSC campus (Urbitran 2004), which included counts of pedestrians at each crossing in 15-minute intervals, as well as transit timing, identified pedestrian crossings during class change times as a major contributor to transit delays. Delays were associated with pedestrian "swarm" behavior, in which a continuous stream of pedestrians crosses a transit route, both inside and outside of crosswalks. Pedestrian crossings, along with delays associated with bus loading and unloading, result in transit and other vehicle delays, particularly during class change times. Such delays lead to bus bunching, and reduce transit capacity.

The campus currently has no data to predict which routes pedestrians associated with the proposed project would use. However, it is anticipated that a substantial number of the pedestrians associated with the project would cross McLaughlin Drive at one or more of these crossings. The crossings described above are three of the four locations identified in the 2004 report, where transit experienced delays in excess of 30 seconds during class change times.[6] In 2004, eastbound transit delays associated with pedestrian crossing and transit boarding and off-boarding for a single transit run during class change times totaled 106 seconds, for the 1,000-foot segment of McLaughlin Drive in the ECI Project vicinity (between Hagar Drive and the College Ten transit stops), Westbound delays in the same stretch totaled 78 seconds.[7]

Pedestrian crossing data were collected in 2008 for the intersections in the vicinity of the project site (TDS 2008). Transit delays were not timed as part of that data collection, but it was observed, qualitatively, that pedestrian behavior continued to contribute to transit delays and that delays appear to be worsening. The 2004 pedestrian data and 2008 pedestrian data are reported in Table 3.14-8, below, which also reports transit delays in 2004, and extrapolates these delays to 2008 and 2012 based on pedestrian data.

[6] The 2004 study did not calculate delays separately for the Hagar crossing, but analyzed it in conjunction with the other pedestrian crossings at the McLaughlin/Hagar intersection.

[7] Both delays were calculated by averaging delays at each of the intersections for all of the 15-minute peak hour class change periods.

Based on the 2004 pedestrian counts (Urbitran 2004), it is projected that the highest peak hour pedestrian demand in the immediate vicinity of the project would be approximately 20 percent of the total students living at the proposed project; that is, about 120 persons. Assuming that, during any particular peak hour, half of the total additional pedestrians associated with the ECI Project would remain on the north side of McLaughlin to access westbound transit, and the other half would cross the crosswalk at Chinquapin/McLaughlin Drive intersection to reach eastbound transit stops or other pedestrian destinations on the central campus, an additional 60 pedestrians[8] would cross McLaughlin Drive during the peak hour, compared with existing conditions. The actual travel patterns are conjectural, but with students walking or riding the campus shuttle to and from classes throughout the campus, it can be assumed that pedestrians associated with the ECI Project are likely to cross McLaughlin Drive more than once during the day, primarily during the peak class change times. Thus, the same population could contribute to peak hour pedestrian traffic at each of the three affected McLaughlin crosswalks, as well as at other crosswalks during different hours, since the peak hour and peak 15 minutes differs from crossing to crossing. Further, transit delays occur during each class change period and not only during the highest daily peak hour or peak 15 minutes. These pedestrians thus could contribute to delays at more than one intersection during more than one peak period, which would result in longer cumulative delays over the road segment.

Table 3.14-8, below, presents 2004 and 2008 pedestrian and transit delay data and examines one scenario for the ECI Project, in which 60 pedestrians[9] associated with the project cross each of the McLaughlin crosswalks closest to the project site during a peak 15 minute class change period at that crosswalk, and that half of these 60 pedestrians (30 pedestrians)[10] cross Hagar at McLaughlin during a 15 minute peak class change period. The calculations in the table assume that transit delays at these crossings would cumulate for delays along the affected road segment, since all the pedestrians would be crossing the same street within a distance of only about 1,000 feet.

[8] Fifty percent of the 120 pedestrians associated with the proposed project assumed, in this scenario to be walking during any particular peak hour.

[9] This would be 20 percent of the ECI population.

[10] This would be 10 percent of the ECI population.

Table 3.14-8. Historical, Existing and Projected Pedestrian Traffic and Transit Delays at Intersections in the Project Vicinity

Pedestrian Crossing in Project Vicinity	2004				2008			2012		
	Peak Hour Peds	Peak 15-Min Peds	Total Transit Delay (sec.)	Sec Delay/Pk 15 Min Ped	Peak Hour Peds	Peak 15-Min Peds	Seconds of Delay	Peak Hour Peds	Peak 15-Min Peds	Seconds of Delay
Hagar at McLaughlin	150	100	--	--	744	384	--	774	399	--
McLaughlin at Hagar	417	245	--	--	334	151	--	394	178	--
(Subtotal McLaughlin/Hagar)	567	345	56	0.16	1,078	535	87	1,168	578	94
McLaughlin at Chinquapin	217	132	48	0.36	282	137	50	342	166	60
McLaughlin at College Ten	482	184	80	0.43	501	268	117	561	300	130
Totals	1,266	661	184		1,861	940	253	2,071	1,044	285
Increase in Pedestrian during Peak 15 Minutes						279			104	
Increase in Seconds of Delay during Peak 15 Minutes							69			31

As shown in Table 3.14-8, above, based on the 2004 Pedestrian Data Collection and Analysis Report, the peak hour pedestrian demand crossing McLaughlin Drive at Chinquapin Road was approximately 217 in 2004, or about 3.6 pedestrian crossings per minute. Nearly half of those pedestrians (132 persons) crossed during the peak 15 minutes, with 8.8 pedestrian crossings per minute, or more than double the peak hour average. Pedestrian counts in fall 2008 (TDS 2008) revealed that peak hour pedestrian crossings of McLaughlin Drive at this location had increased to 282, or about 4.7 pedestrian crossings per minute during the peak hour. About half of these (137 persons) crossed during the peak 15 minutes, for an average of 9.1 pedestrians per minute during the peak 15 minutes. Thus, there was a substantial increase in pedestrian traffic in this area between 2004 and 2008. The addition of approximately 60 peak hour pedestrian crossings associated with the proposed ECI Project would result in cumulative pedestrian demand of 342 pedestrians crossing McLaughlin Drive during the peak hour, equating with approximately 5.7 pedestrians per minute during the pedestrian peak hour. If, as under existing conditions, 50 percent of those crossing occur during the peak 15 minutes, the proposed project could result in 29 additional crossings during the peak 15 minutes, for a total of 11 pedestrians per minute during the peak 15 minutes. The proposed project, thus, would increase the pedestrian stream during the peak hour and during the peak 15 minutes by about 21 percent over 2008 levels.

As shown in Table 3.14-8, in 2004, transit delays associated with pedestrian crossings in the affected segment of McLaughlin totaled 184 seconds during the worst peak 15 minutes for a single transit run. The table uses 2004 pedestrian and transit delay data for each intersection to extrapolate a rate of seconds of delay per pedestrian at each intersection. This rate is then applied to 2008 pedestrian counts and extrapolated ECI pedestrian data to derive total seconds of transit delay for 2008, and total seconds of transit delay that could result from projected pedestrian traffic from the ECI Project in 2012. Based on these calculations, as shown in the table, if transit delay is indeed proportional to the pedestrian increase related to the ECI Project, the project alone could result in a cumulative increase of 30 seconds of transit delay in the affected segment of McLaughlin Drive. This delay is significant in the context of continuing background growth in pedestrian traffic and transit delay, such as has occurred between 2004 and the present, as shown in the table.

The data clearly indicate ongoing increases in pedestrian traffic. Current qualitative observations by TAPS staff, which are supported by the 2004 study, strongly suggest that increases in pedestrian traffic, have the potential to result in increased transit delays. In addition to the potential to result in increased transit delay, the increase in pedestrian traffic at the Chinquapin/McLaughlin intersection also may exacerbate a potential hazard associated with the existing McLaughlin crosswalk. This crosswalk originates, at its north end, at a footpath that is a major pedestrian route from Crown College. The existing footpath meets McLaughlin Drive at an acute angle, and the crosswalk across McLaughlin continues across McLaughlin at the same angle. Because the crosswalk crosses McLaughlin diagonally, a pedestrian crossing in either direction would need to look over his shoulder to see on-coming traffic in the near lane. Many pedestrians therefore step into the roadway without first looking in that direction. The 2004 pedestrian study recommended that, to improve the safety of this intersection, the Crown College path should be rerouted to encounter McLaughlin Drive at a perpendicular, and that the crosswalk then be restriped at a perpendicular to the roadway, to eliminate the angled crossing.

3.14.2.15 ECI Project Impacts and Mitigation Measures

Operations at On-Campus Intersections

ECI Impact TRA-1:	Traffic generated by the ECI Project would contribute traffic to on-campus intersections. All on-campus intersections would continue to operate at acceptable levels of service and none would meet peak hour signal warrants under Cumulative Plus Project Conditions.
Significance:	Less than significant
ECI Mitigation:	No mitigation required

As described above, trip generation from the proposed project would contribute to increased traffic at on-campus intersections, but level of service would not decline to unacceptable levels under Cumulative Plus Project Conditions, nor would any on-campus intersection meet signal warrants. Therefore, the project's impact at on-campus intersections would be less than significant and no mitigation is required.

Operations of Off-Campus Intersections

ECI Impact TRA-2:	The ECI Project would contribute less than 3 percent of the total projected 2013 traffic at any of the off-campus study intersections during a peak hour in which the intersection would operate at an unacceptable level, and the project's contribution to substandard operations therefore is not cumulatively considerable.
Significance:	Less than significant
Applicable LRDP EIR Mitigation:	LRDP Mitigation TRA-2A (incorporating fair share methodology described above) has been implemented. No additional mitigation is available that would diminish the program impact to a less-than-significant level
ECI Mitigation TRA-2:	No additional project-level mitigation is required.
Residual Significance	Less than significant

The proposed project is projected to generate about 804 average daily trips. As analyzed above, both under existing conditions and in the context of projected cumulative development by 2013, the ECI project would contribute less than 3 percent of the total projected traffic at any study intersection during a peak hour in which that intersection would operate at substandard LOS. Therefore, consistent with the impact significance thresholds stated in Section 3.14.2.3, above, the ECI project would not result in significant impacts at any of the off-campus study intersections, as demonstrated in Table 3.14-7, above.

The ECI project, as part of the 2005 LRDP program of development, would contribute to the significant 2020-2021 cumulative intersection impacts at ten off-campus intersections that were identified in the 2005 LRDP EIR:

- Empire Grade/Western Dr
- Empire Grade/Heller Dr.
- Mission Street/Bay Street
- Laurel Street/Mission Street
- King Street – Union Street/Mission Street
- Mission Street/Chestnut St.
- Highway 1/River Street
- Storey Street/King Street
- King Street (W.)/Mission Street
- Mission Street/Almar – Younglove Avenue

The 2005 LRDP EIR identified the traffic improvements listed in the following table to address substandard operating conditions at these intersections:

Table 3.14-9. Potential Improvements to Mitigate (2020-2021) Cumulative LOS Impacts at City of Santa Cruz Intersections

Intersection	Improvement	LOS after Improvement
Empire Grade/ Western Drive	Install traffic signal	AM LOS B PM LOS B
Empire Grade/ Heller Drive	Install traffic signal	AM LOS B PM LOS D
Bay Street/ Mission Street	Planned City improvement assumed under 2020 Without LRDP Project and 2020 With LRDP Project scenarios: Re-stripe southbound approach of Bay St. to include a right-turn lane, shared though-left and a dedicated left-turn lane and modify the signal timing as part of implementation of a signal coordination plan.	AM **LOS F** PM **LOS F**
Laurel Street/ Mission Street	Add a southbound right-turn lane (Mission to Laurel) and modify the signal timing as part of implementation of a signal coordination plan. This improvement requires property acquisition and relocation of the existing sidewalk.	AM LOS D PM LOS D
King St-Union St./Mission St	Re-stripe the southbound approach of King Street to include dual left-turn lanes and a shared through-right lane and modify the signal timing of the intersection as part of implementation of a signal coordination plan.	AM **LOS F** PM **LOS F**
Mission Street/ Chestnut Street	Convert southbound dual right-turn lanes on Mission Street to a single-lane “free” right-turn lane and widen the westbound departure leg of the intersection to accommodate a new 500-foot long third lane for merging, or;	AM **LOS F**
	Install a triple southbound right-turn lane on Mission Street, which would also require the new merging lane as described above).	PM **LOS F**
	In both cases, the modifications would require major reconstruction of the intersection, and possibly right-of-way acquisition and building modification/relocation.	
Highway 1/ River Street	Add an eastbound left-turn lane on Highway 1 and modify the signal time, part of implementation of a signal coordination plan.	AM LOS D PM **LOS E**
King Street/ Storey Street	Install traffic signal and reconfigure southbound approach to provide a left and a right-turn lane.	AM LOS B PM LOS B
King Street/ Mission St. W.	Install traffic signal and modify the signal timing as part of implementation of a signal coordination plan along Mission Street.	AM LOS A PM LOS A
Mission Street/ Almar-Younglove Ave.	Modify signal timing and phasing, as part of implementation of signal coordination plan.	PM LOS D

As shown in the last column in Table 3.14-9, the proposed improvements would improve the level of service to LOS D or better at six of the affected intersections, such that the impact would be mitigated to less-than-significant levels. However, at four intersections, as indicated by **bold** text, even with mitigation the levels of service would remain at a substandard E or F during the AM peak hours or PM peak hour or both. If cumulative traffic growth continues as projected in the 2005 LRDP EIR, then the impact at four of the ten intersections to which LRDP traffic would make cumulatively considerable contributions would remain significant even after mitigation in 2020-21. Three of these intersections, Mission St/Bay St, Mission St/Chestnut St and Highway 1/River Street, would operate at LOS F during both AM and PM peak hours under 2013 Cumulative Plus Project conditions, as shown in Table 3.14-7, above. However, as stated above, the ECI Project's contribution to these substandard operations would be less than 3 percent and therefore would not constitute a significant impact under the thresholds set forth above.

Consistent with LRDP Mitigation TRA-2A, the Campus has paid its fair share of the cost of the needed improvements through an enforceable mechanism mutually agreed upon with the City and codified in the Settlement Agreement, as described in Section 3.14.1.8 (*Mitigation of Off-Campus Traffic Impacts*), above. The City and UCSC have committed to joint identification and prioritization of off-campus traffic improvements, including those listed in Table 3.14-9 above. The University's advance payment of its fair share, therefore, provides a high degree of certainty that the improvements needed to mitigate the traffic contributions of 2005 LRDP development will be implemented. No additional measures have been identified at this time that would improve LOS at the remaining intersections to acceptable levels in 2020. While the contribution of the ECI Project by in the Cumulative Plus Project scenario in 2013 is not significant, UCSC's prepayment of fees to the city acknowledges the incremental contribution of traffic associated with on-going development under the 2005 LRDP (including that of the proposed project) to the unacceptable intersection operation identified in the 2005 LRDP EIR at the cumulative 2020-2021 horizon

In 2003-04, the baseline year for the 2005 LRDP EIR, the campus gate count was 24,830. As described in Section 3.14.1.3, above, average daily gate count for both campus entrances in 2007-2008 totaled about 21,900 (Pageler 2009a). Based on these data, trips through the campus gates have decreased by over 2,900 trips since 2003-04. Even with the addition of the 800 trips projected to be generated by the ECI Project, total trips through the campus gates would still be well below 2003-04 levels. If this downward trend in campus trip generation continues, the contribution of 2005 LRDP-related traffic to the significant cumulative LOS impacts identified above may not reach a level that is cumulatively considerable.

Potential Future Change in Traffic Impact Significance Criteria

With respect to the proposed revision of Appendix G of the CEQA Guidelines related to significance thresholds for traffic impacts, which would assess whether the project would result in a substantial increase in the number of vehicle trips, roadway vehicle volume or vehicle miles traveled, the Campus's highly effective TDM program is designed specifically to reduce vehicle trips to campus and to encourage the use of alternative forms of transportation that would reduce total vehicle miles traveled and the number of vehicle trips. This program is consistent with the greenhouse gas reduction goals that underlie the proposed revision in traffic impact significance standards. Residents of the proposed project would have access to all elements of the Campus's TDM program, which is expected to reduce vehicle trips potentially associated with the project and thereby would reduce the project's contribution to this type of traffic impact at both on-campus and off-campus intersections.

Parking

3.14.2.15.1.1 Project Parking Capacity and Demand

ECI Impact TRA-3:	The ECI Project would displace existing parking and reduce parking capacity in the project vicinity, and would add to demand for parking within campus Parking Zone 4, but occupation of the project would not result in parking utilization in the parking zone in excess of 90 percent.
Significance:	Less than significant
ECI Mitigation TRA-3:	No mitigation required

The proposed project would displace portions of existing Parking Lot 111, which would result in a net reduction of approximately 65 parking spaces in the immediate vicinity of the project. Under existing conditions, 393 parking spaces are available in campus Parking Zone 4, in which the proposed project is located. This zone includes parking associated with Crown and Merrill Colleges, the Crown/Merrill Apartments and the campus fire house. Based on a spring 2008 parking utilization survey by TAPS, current parking utilization in this zone is approximately 54.2 percent of the available parking spaces (Pageler 2008a): On a typical day under existing conditions, approximately 180 parking spaces are available in the vicinity. Part of Parking Lot 111 would be removed to accommodate the proposed project. Average daily parking utilization in the lot has ranged between about 42 percent (68 spaces) and 60 percent (97 spaces) over the past five years. The daily average utilization in spring 2008 was about 44 percent, or 73 spaces. Upon completion of the ECI Project, parking capacity in Parking Lot 111 would be approximately 98 spaces, and there would be a net total of about 328 spaces in Parking Zone 4. Based on current utilization rates, about 213 of the Zone 4 spaces would be used by existing residents and other campus users. Therefore, there would be about 115 spaces of parking capacity available in the parking zone for ECI Project residents.

Permits for fifty close-in parking spaces (within Zone 4) will be available for ECI residents who wish to park on campus. In addition, 10 parking spaces in the immediate vicinity of the project will be set aside for service vehicles, medical and handicapped permits, and other special uses. Close-in permits will be sold to eligible residents on a first-come first-served basis. Those who are eligible for a permit but do not receive a close-in permit would be eligible to purchase a parking permit for campus remote lots. In spring 2008, utilization of the closest remote lot to the project, the East Remote lot, was at 80.36 percent, with 189 of 963 spaces vacant (Pageler 2009b). These spaces provide sufficient capacity to accommodate demand from the project that might not be accommodated on site or in the “close-in” zone.

Daily demand in Lot 111 averaged about 73 spaces in spring 2008. With 60 close-in spaces allocated to the ECI Project, net total demand in this immediate vicinity could be as high as 133. With a post-project capacity for Lot 111 of 98, demand for this lot could exceed capacity. However, for Zone 4 overall, total parking capacity at project completion would be 323 parking spaces. With average daily demand in Zone 4 at 213 spaces, 110 spaces would be available in Zone 4 overall to accommodate the project demand of 60 spaces. At current utilization rates, the net demand in Parking Zone 4 thus would be about 273 parking spaces (213 current demand plus 60 ECI demand). Supply in Zone 4 will be 328 spaces. Therefore, the project will not contribute to a parking shortage, nor is it likely to lead to campus affiliates parking in off-campus neighborhoods.

Under 2005 LRDP Mitigation TRA-3B, the Campus commits to build new parking when capacity in a zone exceeds 90 percent. Utilization of 273 of 323 available spaces yields a net parking utilization rate of about 83 percent in Parking Zone 4. The impacts of project operation upon parking therefore would be less than significant and no mitigation is required.

3.14.2.15.1.2 Temporary Loss of Parking During Construction

ECI Impact TRA-4:	ECI Project construction would result in the temporary loss of about 157 parking spaces in campus Parking Zone 4, which would substantially reduce parking capacity in the project vicinity for a period of about 24 months.
Significance:	Less than significant
ECI Mitigation TRA-4:	No mitigation required

Campus Parking Zone 4, in which the project is located, includes 393 parking spaces, including 161 in Parking Lot 111. During project construction, 157 of the spaces in Parking Lot 111 would be unavailable for parking due to construction activity and use of the site for construction staging, which would result in a net capacity in the zone during construction of 236 spaces. As discussed above, a spring 2008 parking utilization survey (Pageler 2008a) indicated average daily use of about 54 percent of the parking capacity in the zone, or about 213, with about 180 spaces excess capacity on an average day. Assuming that the spring 2008 parking utilization rate remains constant during construction, with a continuing average parking demand of about 213 spaces out of 236 total parking capacity, utilization in the zone would total 90.25 percent: 23 vacant spaces would be available in the zone on the average day. Therefore, although those who customarily use Parking Lot 111 would be temporarily inconvenienced by the unavailability of the lot during ECI construction, they would be able to find parking elsewhere in the zone. The impact therefore would be less than significant and no mitigation is required.

Effectiveness of Alternative Means of Transportation

3.14.2.15.1.3 Increased Pedestrian Traffic and Transit Demand and Reduced Transit Capacity

ECI Impact TRA-5:	The ECI Project would contribute to increased demand for on-campus transit service and, simultaneously, to increases in pedestrian traffic at pedestrian crossings of McLaughlin Drive at the Chinquapin intersection, College Nine/Ten/Cowell Health Center transit stops and the Hagar Drive intersection. Increased pedestrian traffic contributes to potential pedestrian/vehicle traffic conflicts and hazards, and to crossing-related transit delays, which could further diminish transit

	capacity. If transit demand exceeds effective transit capacity, this could result in reduced levels of service, which could undermine the effectiveness of alternative transportation modes and conflict with the campus' TDM program.
Significance:	Potentially significant
Applicable LRDP EIR Mitigations:	LRDP Mitigation TRA-4A, TRA-4B and TRA-4C
ECI Mitigation TRA-5A:	The Campus will complete new pedestrian counts and an assessment of transit delays and transit cycle time within six months after occupancy of ECI to determine whether, with the increase in pedestrian traffic and transit demand from the ECI Project, the LRDP measures incorporated in the project have been effective in maintaining transit cycle time such that transit travel times between the two most widely-separated colleges does not exceed the time interval between class periods.
ECI Mitigation TRA-5B:	Beginning in fall 2011, the Campus will prepare and distribute educational materials and implement an educational program regarding pedestrian safety and the adverse effects of illegal pedestrian road crossings on transit cycle times; and will post signs at campus bus shelters and at the Crown/Merrill and College Nine/Ten McLaughlin Drive crossings and the Chinquapin Road crossings regarding road crossing restrictions.
ECI Mitigation TRA-5C:	If the study conducted under TRA-5A indicates that transit delays and cycle time have increased, despite implementation of TRA-5B, the Campus will implement additional improvements at the pedestrian crossings of McLaughlin Drive at Hagar Drive, Chinquapin intersection, and the Cowell Health Center/College Ten and Crown/Merrill transit stops to reduce transit delays associated with pedestrian crossings. These improvements may include but are not limited to one or more of the following measures to expedite crossings and reduce transit delays: Installation of barriers along McLaughlin and Hagar Drive, McLaughlin/Chinquapin intersection and College Nine/Ten transit stop on McLaughlin, to control pedestrian flow patterns and to channel pedestrian crossings to the crosswalk and discourage pedestrian crossings outside of the crosswalk. Safety improvements to configuration of crosswalks (particularly at Chinquapin across McLaughlin) Relocation of transit stops

	Installation of pedestrian crossing or traffic signals that include an exclusive pedestrian phase, as warranted Employment of a crossing guard to regulate pedestrian traffic across the intersection/street and enforcement of “jay-walking” violations
Residual Significance:	Less than significant

The proposed project would increase the resident population of the campus in the vicinity of the Chinquapin/McLaughlin intersection by almost 600 students in fall 2011. These new residents would contribute to the increasing campus-wide demand for campus shuttle and METRO bus service that is an on-going effect of increasing campus enrollment (independent of the proposed project). Increased pedestrian congestion and associated increases in the time required for transit loading and unloading contribute to transit delays, which effectively decrease transit capacity. As observed in the 2004 pedestrian report (Urbitran 2004), pedestrian “swarm” behavior appears to be contributing to transit delays on campus. This is characterized by uncontrolled and continuous crossings by pedestrian groups and individuals, often outside the crosswalks, such that it may not be safe for cars and transit vehicles to proceed without jeopardizing pedestrian safety. This pedestrian behavior typically occurs during class change times. The increase in pedestrian traffic associated with the project also would contribute to potential congestion on campus shuttles and buses, specifically in relation to transit demand at the transit stops closest to the ECI facility, that is, the College Nine/Ten and Cowell Health Center stops on McLaughlin, the Crown/Merrill College stop on McLaughlin, and the Hagar/McLaughlin stops.

If transit has insufficient capacity to meet demand or cannot provide timely service, such that travel time between the two most widely spaced classrooms on campus exceeds the class passing period, this would be a potentially significant cumulative impact with respect to the success of alternative modes of transportation and the campus’ TDM program. The proposed project’s impact would be significant.

The proposed project incorporates LRDP Mitigation TRA-4A, TRA-4B and TRA-4C, which require that the Campus monitor campus and METRO transit service annually to assess the need for campus circulation improvements to accommodate changes in campus-related transit demands; implement improvements to the operational efficiency and capacity of campus transit as needed to maintain transit cycle time; work with SCMTD and other agencies to maintain and improve efficiency and capacity of the public transit system serving University facilities; and use the results of transit monitoring to identify and implement physical and operational improvements that will ensure that transit travel times between the two most widely-separated colleges does not exceed the time interval between class periods.

ECI Mitigations TRA-5A, TRA-5B and TRA-5C implement LRDP Mitigation TRA-4A, -4B and -4C at the project level to address the contribution of the proposed project to transit capacity and cycle time impacts and to identify measures that will reduce pedestrian-related transit delays, including pedestrian improvements specific to the intersections potentially most affected by the proposed project. With the implementation of these measures, the potential for the project to result in transit capacity impacts would be reduced to a less-than-significant level.

3.14.3 References

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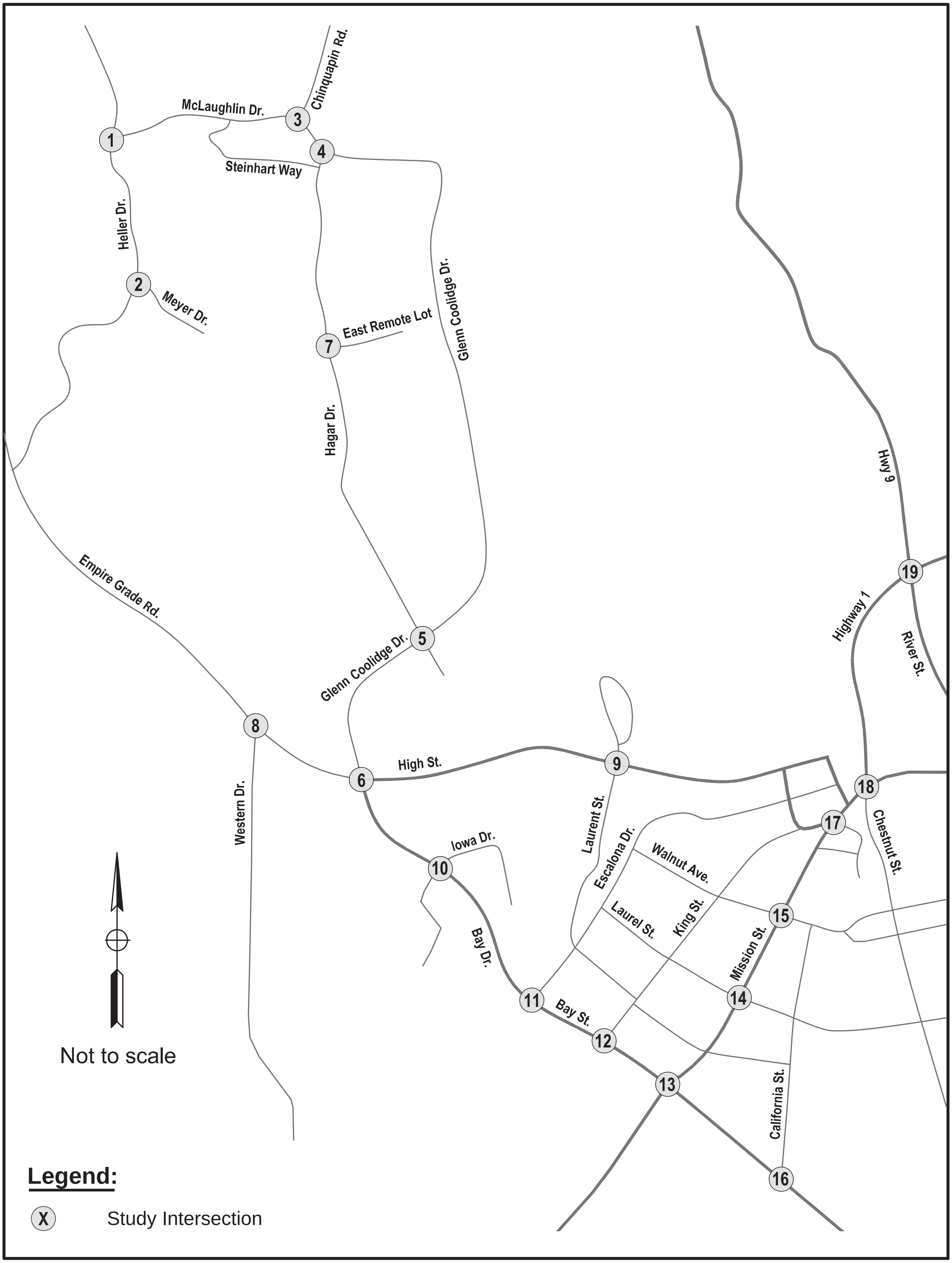
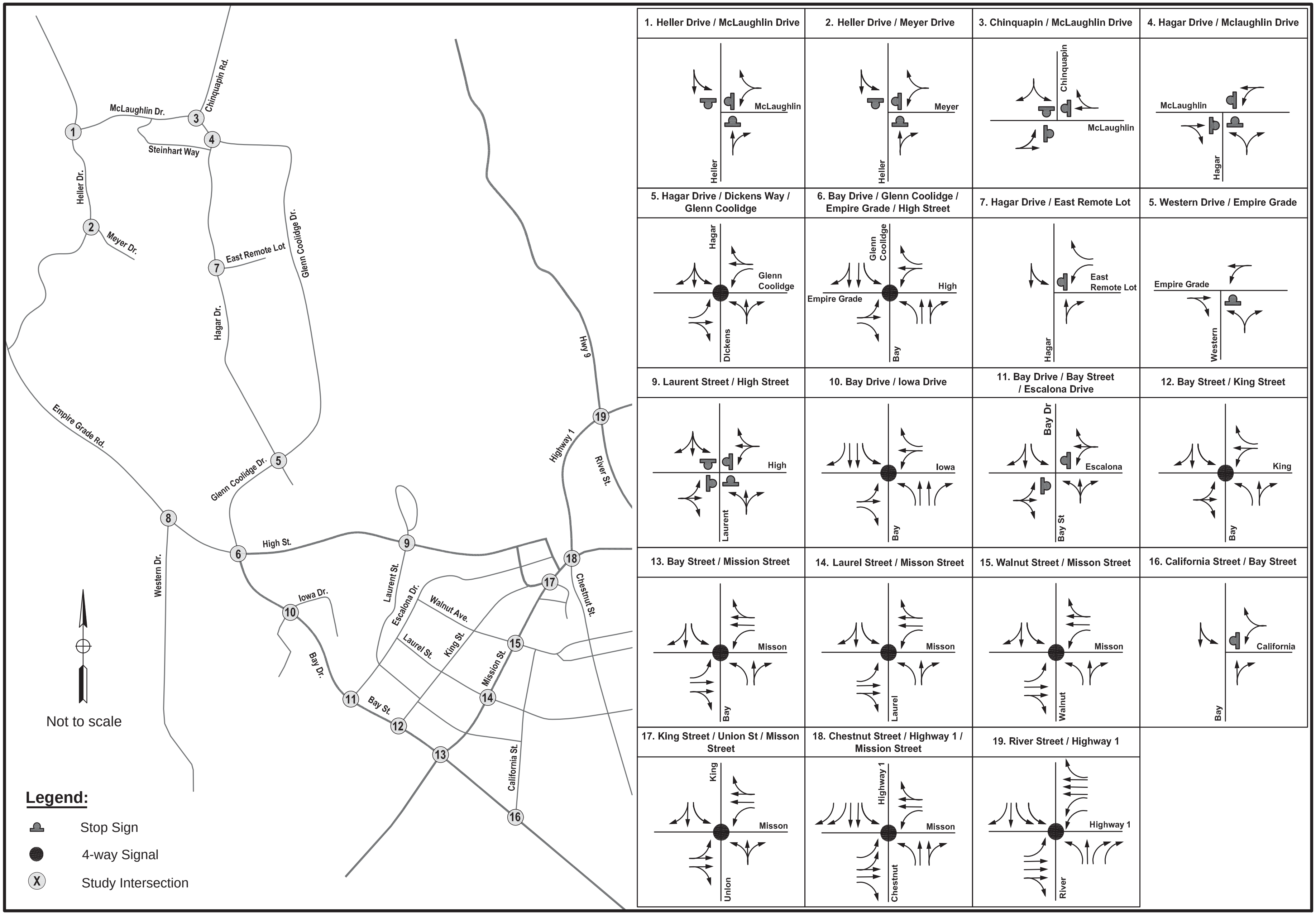
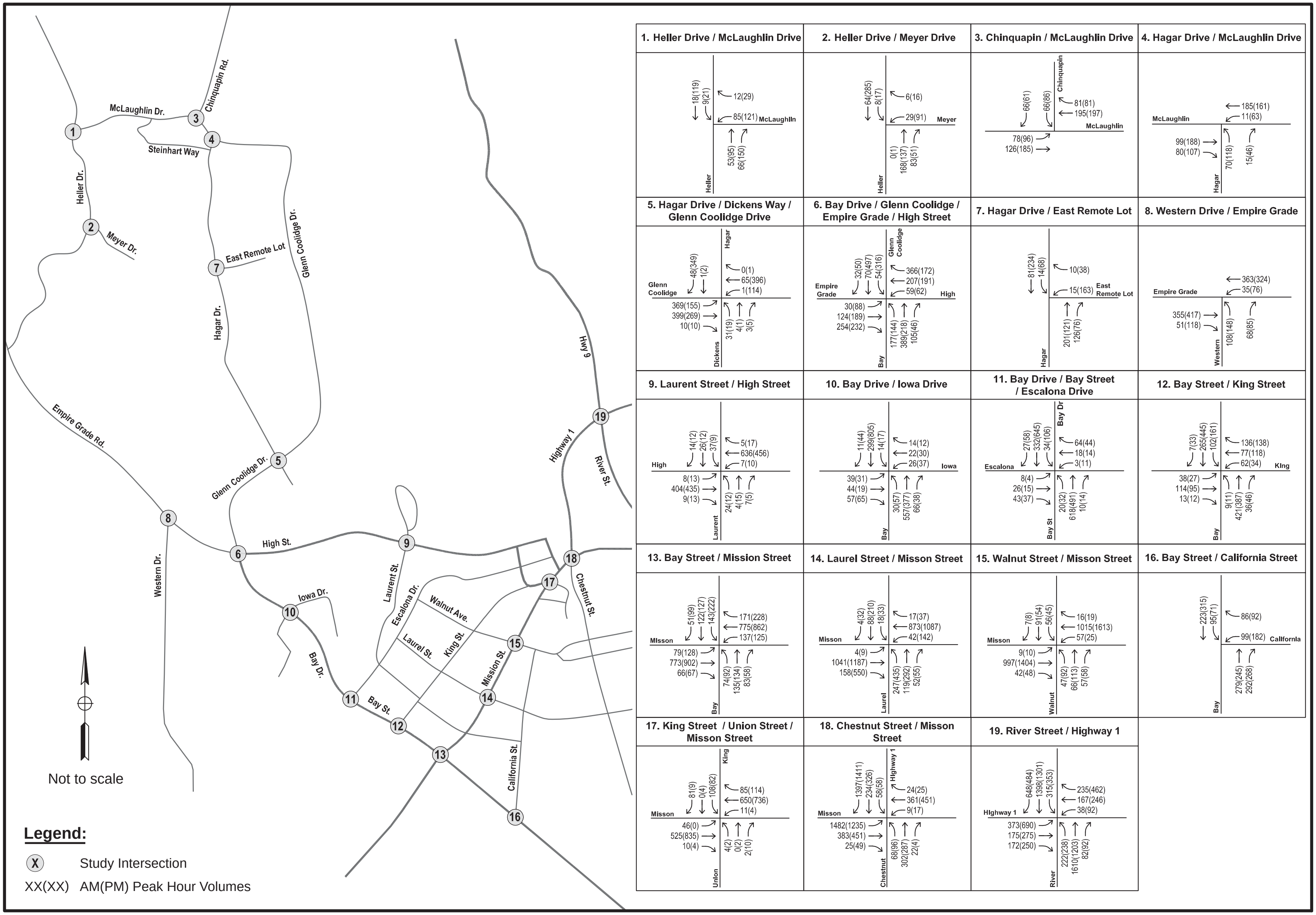


VICINITY MAP

FIGURE 3.14-1

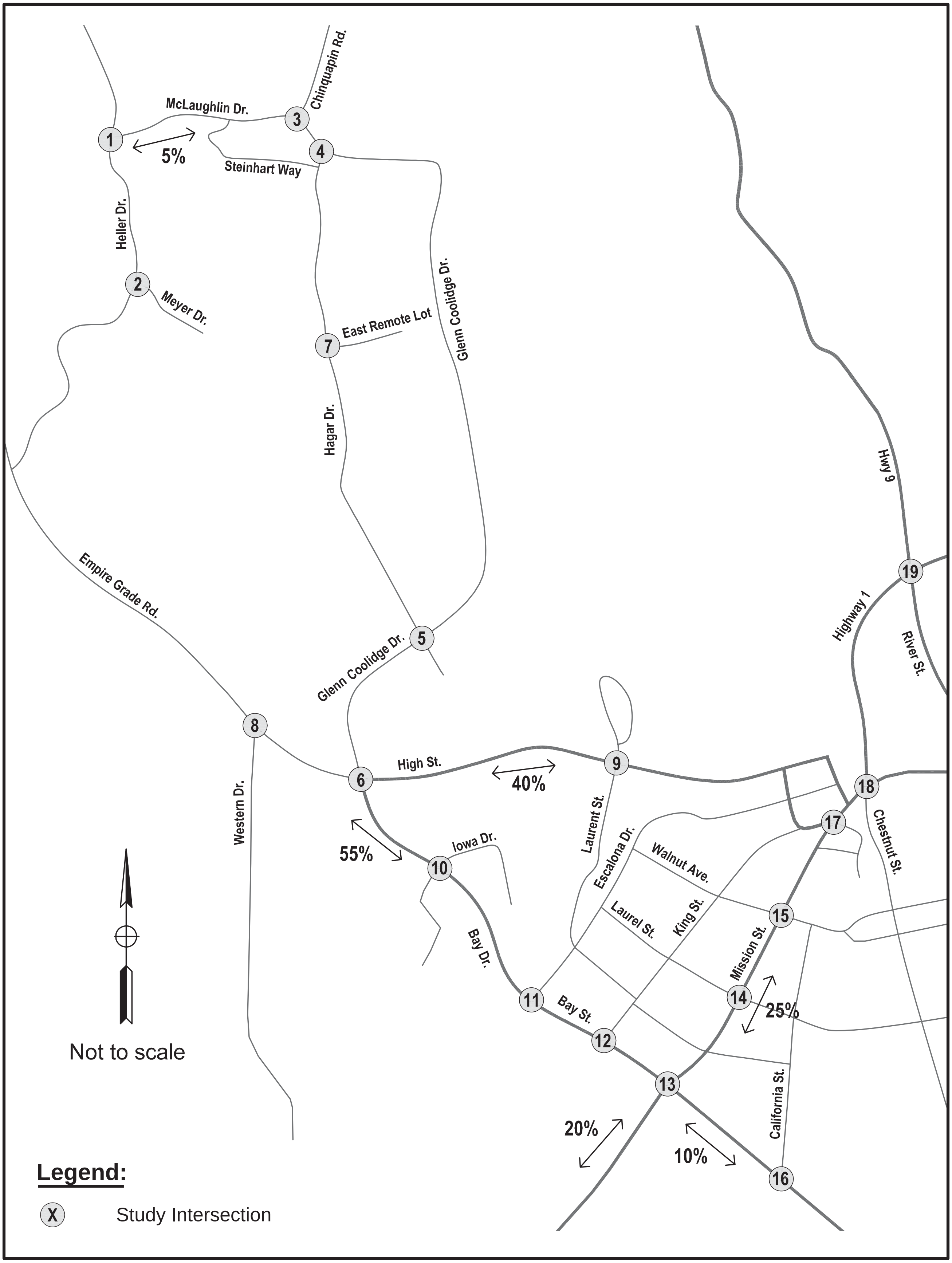


UC Santa Cruz — East Campus Infill Housing Project EIR, Santa Cruz, California — March 2009 EXISTING LANE GEOMETRIES FIGURE 3.14-2

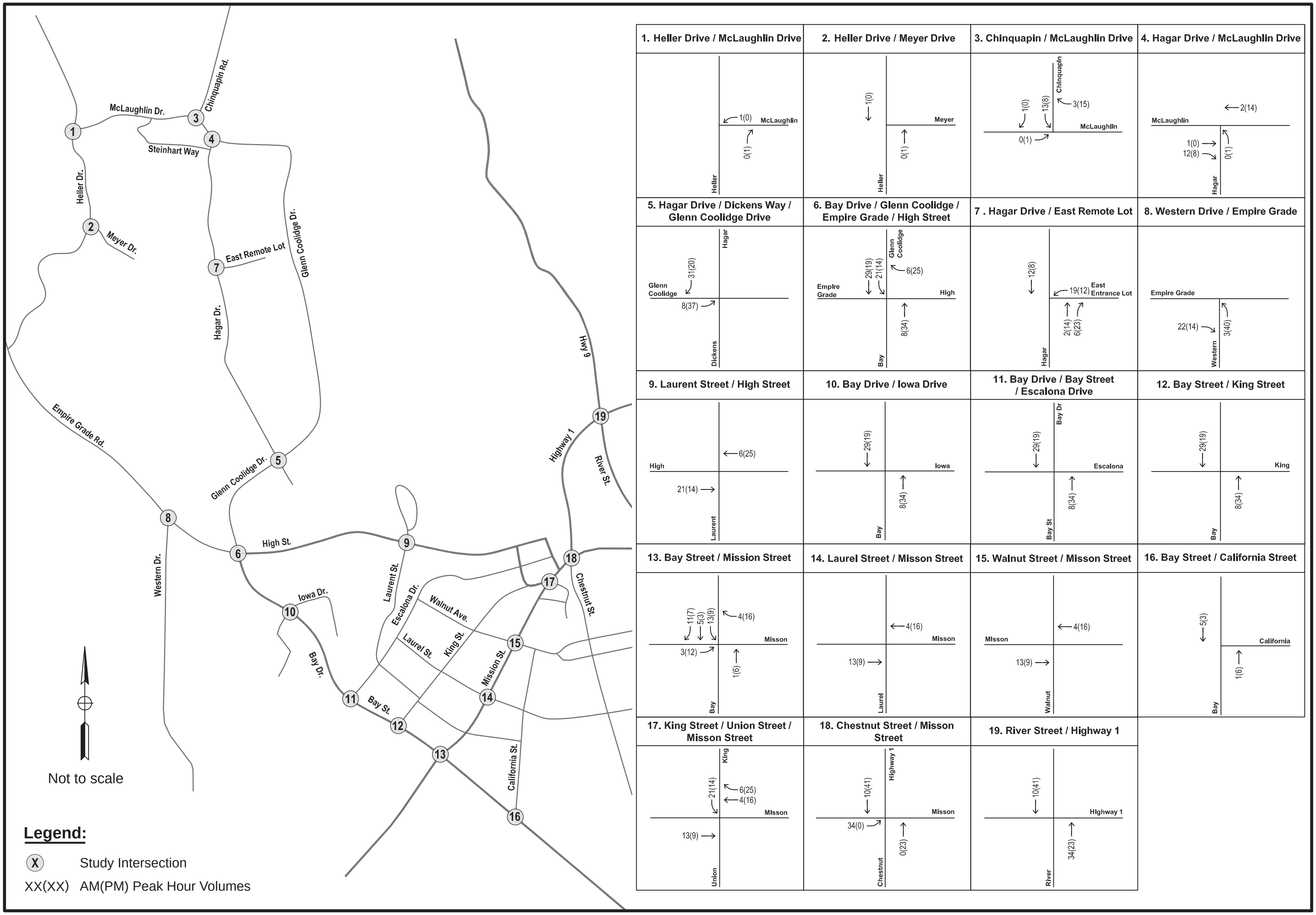


EXISTING VOLUMES

FIGURE 3.14-3



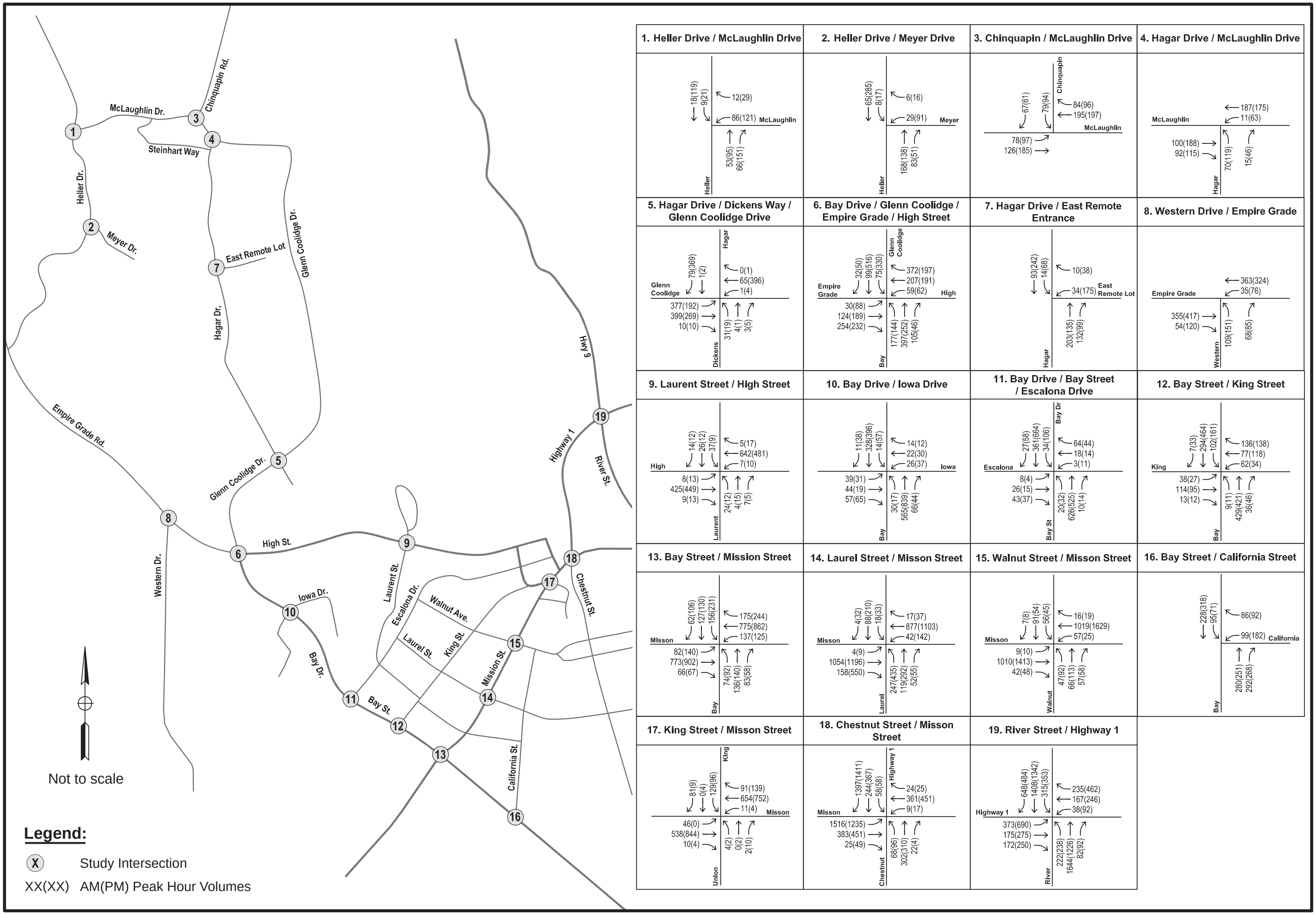
TRIP DISTRIBUTION



UC Santa Cruz — East Campus Infill Housing Project EIR, Santa Cruz, California — March 2009

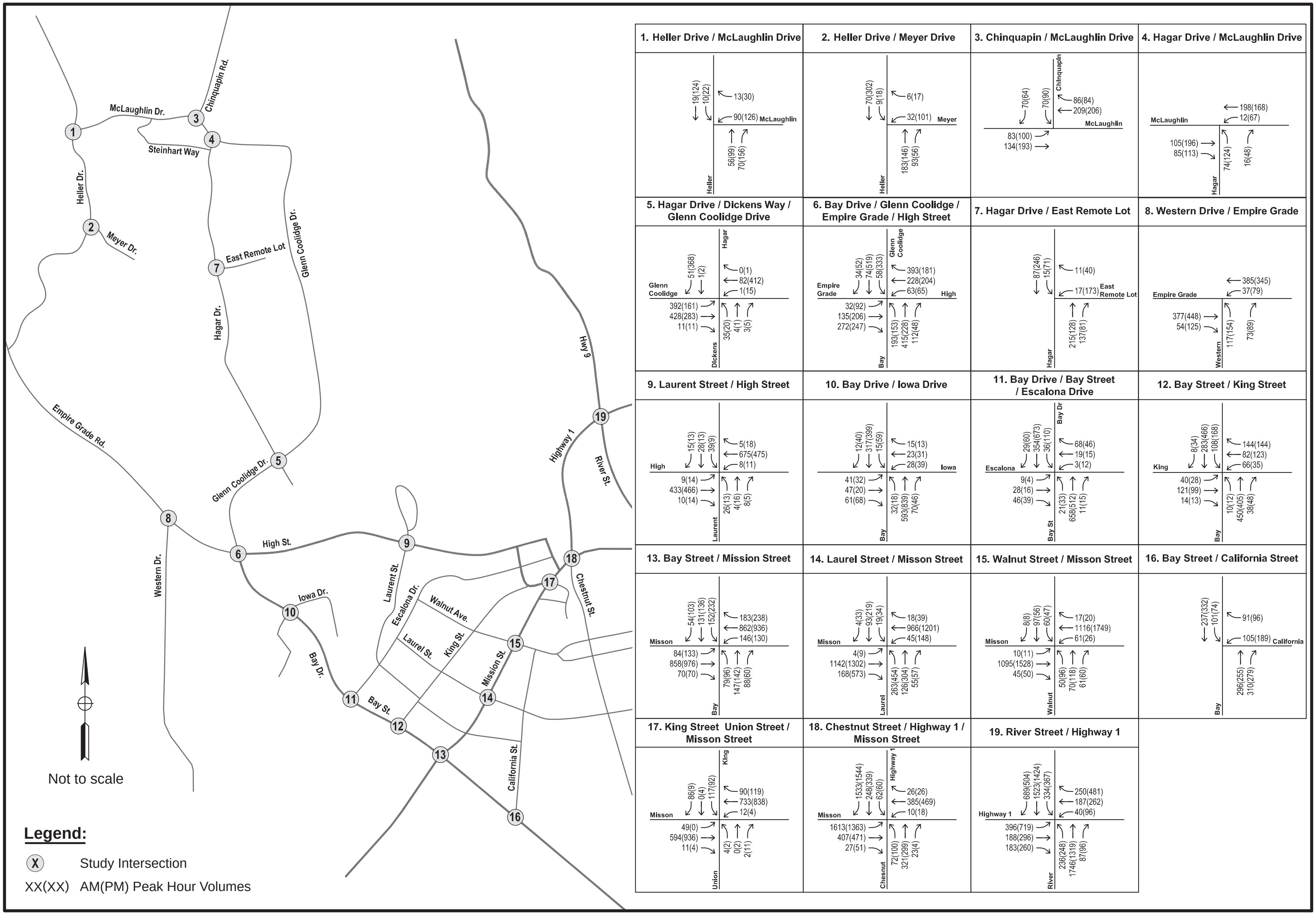
PROJECT ONLY TRIPS

FIGURE 3.14-5

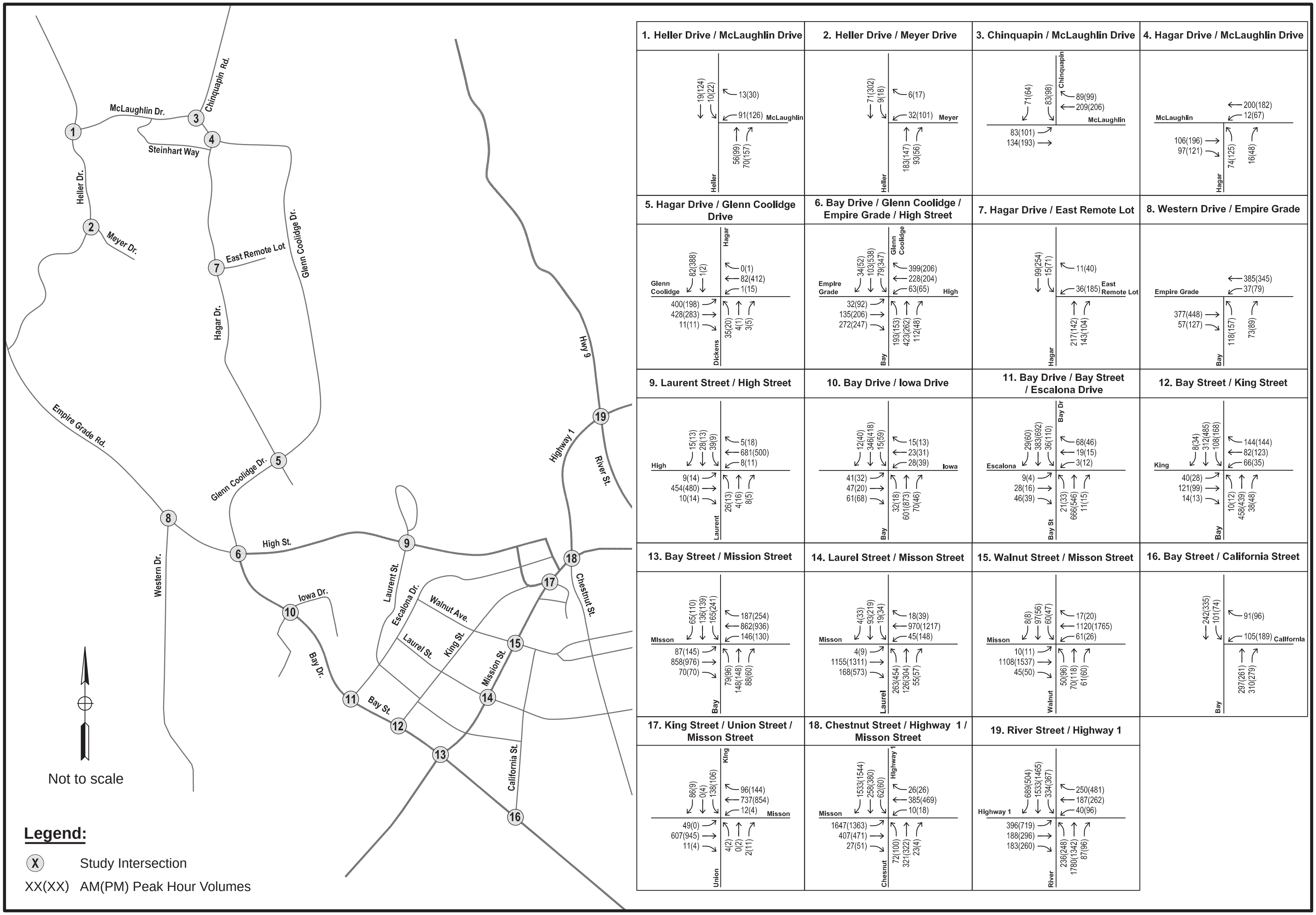


EXISTING PLUS PROJECT

FIGURE 3.14-6

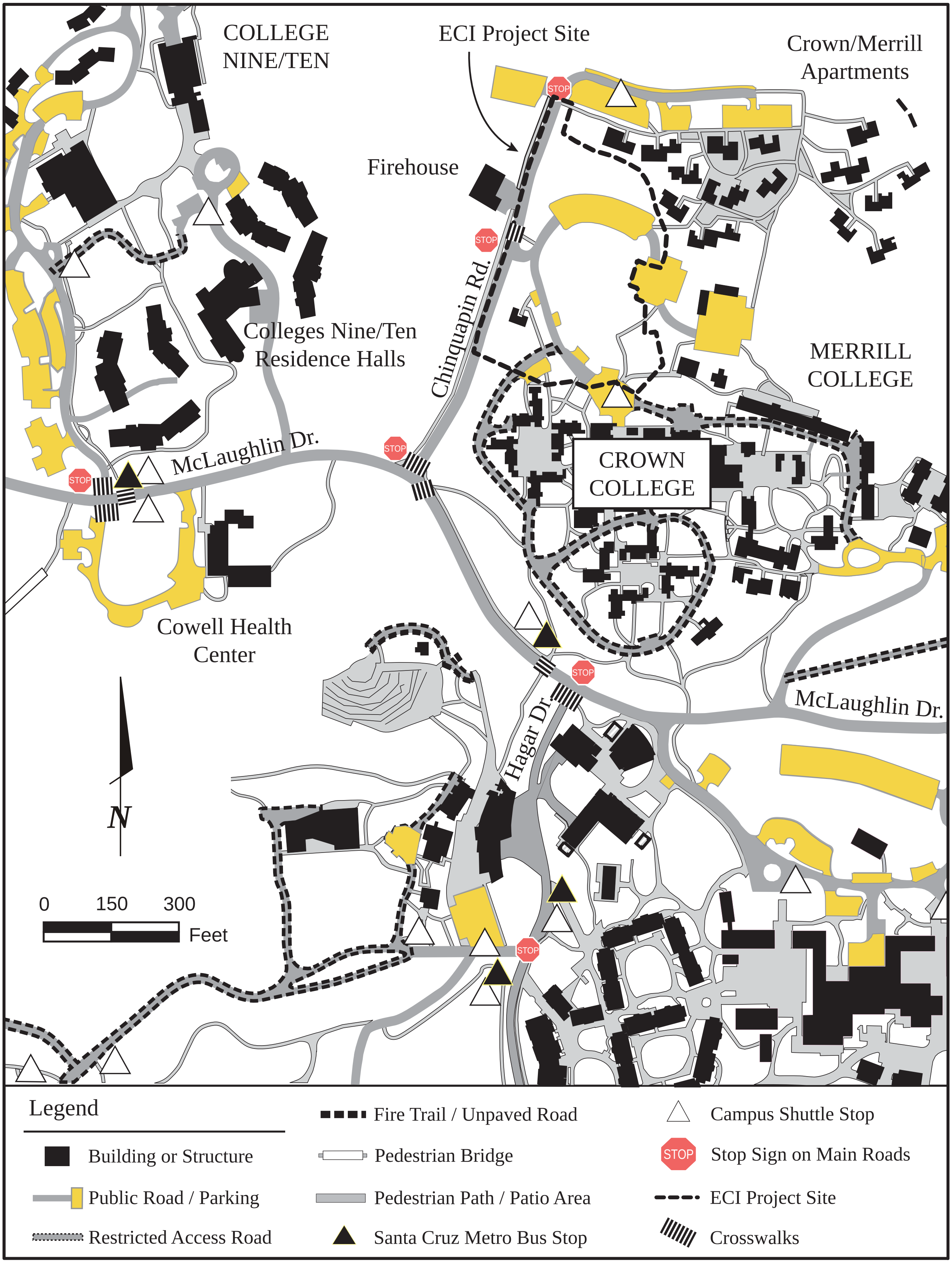


UC Santa Cruz — East Campus Infill Housing Project EIR, Santa Cruz, California — March 2009 CUMULATIVE (2013) CONDITIONS FIGURE 3.14-7



CUMULATIVE (2013) PLUS PROJECT

FIGURE 3.14-8



PEDESTRIAN ROUTES AND TRANSIT STOPS IN THE ECI PROJECT VICINITY

3.15 UTILITIES AND SERVICE SYSTEMS

TABLES

3.15 UTILITIES AND SERVICE SYSTEMS

This section characterizes existing utilities and service systems serving UC Santa Cruz and evaluates the effects on these systems from the proposed East Campus Infill Project. This section describes and evaluates the following utilities and service systems: water supply, wastewater, storm water drainage, solid waste, electricity and natural gas, and telecommunications. This section provides project-level analysis and additional detail for each of these topics, and supplements/augments pursuant to CEQA Guidelines Section 15152 the analysis set forth in the LRDP EIR's Section 4.15, Volume II, with exception of the top of water supply. The water supply analysis is not tiered from the 2005 LRDP EIR: For this topic, this EIR provides a stand-alone analysis. The contribution of the project's energy use to global climate change is analyzed in Section 3.3, *Air Quality and Climate Change*. Energy, and energy conservation is discussed in Chapter 5, *Other CEQA Considerations*.

During the scoping process for this EIR, comments were received regarding:

- MBUAPCD permitting requirements that apply to wastewater and sewage treatment facilities
- the ability of the University to pay for the capital and operating costs of the additional wastewater burdens at the municipal treatment plant
- any necessary increase in carrying capacity of the wastewater piping
- the environmental impacts of any construction as well as the impacts on water leaving the outfall

The erosion impacts of utility construction are analyzed in Section 3.6, *Geology, Soils, and Seismicity;* impacts on water quality are analyzed in Section 3.8, *Hydrology and Water Quality*. Permitting requirements and the need for improvements to wastewater pipelines and the City's treatment plant are addressed in the analysis provided below.

3.15.1 Environmental Setting

3.15.1.1 Study Area

For purposes of evaluating impacts of the proposed project on utilities and services systems, the study area is defined to include all of the UC Santa Cruz main campus and other areas served by the Santa Cruz Water District (SCWD), Santa Cruz Municipal Utilities (SCMU), and local facilities of the Pacific Gas and Electric Company (PG&E).

3.15.1.2 Water Supply

Regulatory Setting

The SCWD is a municipal utility that is owned and operated by the City of Santa Cruz. The governing body for the SCWD is the City Council. The SCWD provides water service to an area of approximately 30 square miles that includes the entire City of Santa Cruz, adjoining unincorporated areas of Santa Cruz County, a small part of the City of Capitola, and coastal agricultural lands north of the City. Under the terms of 1962 agreement between the City of Santa Cruz and the University, the SCWD provides water service to the University and water and sewer lines up to the boundaries of the campus.

The SCWD service area includes the portion of the UC Santa Cruz campus that is within the Santa Cruz city limits, which includes the project site. Under the 2008 Settlement Agreement, which is discussed in the Introduction to this volume and included in this EIR as Appendix A, the University agreed to contribute funds to the City proportionate to the campus' increased demand on City water sources. The Campus' payments to the City are based on the City's System Development Charges for other new development in the City's service area. These payments are in addition to water use rates paid by the University on the same terms as other users in the SCWD service area. In addition, the University agreed that it will not increase its water demands on the City water system if the City establishes a service area-wide moratorium on new connections because of water shortage emergency conditions[1]; and that it will comply with any service area-wide water restrictions or mandatory use curtailment imposed by the City in response to a declaration of water shortage emergency conditions. Under the 2008 Settlement Agreement, the University also agreed to implement all of the high priority conservation measures recommended by a 2007 water efficiency study of the campus (Maddaus 2007).

The City's water planning process is governed in part by State laws. The Urban Water Management Planning Act, which became part of the California Water Code with the passage of Assembly Bill 797 in 1983, requires that every urban water supplier providing water for municipal purposes to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually prepare and adopt an urban water management plan, and update it every five years. Urban Water Management Plans have taken on a new significance in recent years under related legislation enacted in 2001 that changes the way land use decisions are linked to water supply availability. Senate Bills 610 and 221 require water agencies to provide detailed assessments of their long-term water supplies to city and county decision makers prior to the approval of certain development projects. The bills also require cities and counties to make findings to verify that adequate water supplies are available before development can proceed. These statutes cite Urban Water Management Plans as a key source of information for preparing assessments and verifications of water supply. The City updated its Urban Water Management Plan (UWMP) in 2005 (City of Santa Cruz 2006). The City Council approved the 2005 UWMP in February 2006.

The California Water Code law requires all public water suppliers to develop contingency plans for situations of up to a 50 percent shortage in water supply and to describe the actions and consumption reduction methods that apply to each stage of the plan. The City of Santa Cruz adopted a new water shortage contingency plan in March 2009.

[1] This does not apply to any UC Santa Cruz housing project under development at the time the moratorium is established.

Existing and Planned Water Supply

Existing Water Supply

The following description of the City's water supply system summarizes information presented in the 2005 UWMP (City of Santa Cruz 2006). The SCWD relies entirely on rainfall, surface runoff, and groundwater infiltration occurring within watersheds located in Santa Cruz County. No water is purchased from state or federal sources or imported to the region from outside the Santa Cruz area. The City currently obtains water from four sources:

- diversions from three streams (Reggiardo Creek, Laguna Creek, and Majors Creek) and one natural spring (Liddell Spring) on Santa Cruz County's North Coast
- the San Lorenzo River
- Loch Lomond Reservoir
- Live Oak (Beltz) wells

Water is diverted from the San Lorenzo River at two locations: at Tait Street near the City's northern boundary, by way of a surface water diversion and two shallow wells; and at the Felton Diversion Station, about six miles upstream from the Tait Street Diversion. Water from the Felton Diversion is pumped to Loch Lomond Reservoir, located on Newell Creek near the community of Ben Lomond. That reservoir also captures and stores runoff flowing into the reservoir directly from the Newell Creek watershed. The 9-mile Newell Creek pipeline carries water from Loch Lomond Reservoir to the City's Graham Hill Water Treatment Plant. The three Live Oak wells in the southeastern portion of the City's water service area draw from the Purisima groundwater basin. The City's use of groundwater from this basin is governed by a cooperative agreement with the Soquel Creek and Central water districts and the County of Santa Cruz for groundwater management within the Soquel-Aptos Basin, which includes the Purisima formation.

All surface water is treated at the Graham Hill Water Treatment Plan, which has a capacity of about 20 million gallons per day (mgd) (City of Santa Cruz 2006). The Live Oak Treatment Plant treats groundwater from the Live Oak wells to remove manganese and iron, and has a capacity of approximately 2 mgd.

According to the 2005 UWMP, about 32 percent of the water produced in the SCWD service area between 2000 and 2004 was obtained from the North Coast diversions, about 47 percent from the San Lorenzo River, about 17 percent from Loch Lomond, and about 4 percent from the Live Oaks wells. This is reflective of the manner in which water is obtained in normal water years and during the majority of the year. Because of the lower cost of production, excellent water quality and fewer water rights limitations, the North Coast sources are used to the greatest extent possible, followed by diversion from the San Lorenzo River. During drier years and summer months, more water is obtained from Loch Lomond and the groundwater wells.

The SCWD shares the San Lorenzo River watershed, its primary source for drinking water, with three other water districts, several private water companies, and individual property owners.

Groundwater from the Purisima formation is used not only by the SCWD but also by the Soquel Creek Water District (SqCWD), Central Water District, and numerous private property owners (City of Santa Cruz 2006).

The total capacity of the City's existing water supply sources in normal water years is approximately 4.3 billion gallons per year, as shown in Table 3.15-1, below. Net water production averaged about 3.9 billion gallons per year between 2000 and 2004.

Table 3.15-1
Capacity of Existing SCWD Water Supplies, by Source

Source	Groundwater	North Coast Diversions	San Lorenzo River	Loch Lomond Reservoir	Total
Annual water production (millions of gallons)*	187	1,007	2,008	1,042	4,314

Note: Assumes normal water conditions and no change to current operations or water rights. Source: City of Santa Cruz, 2006.

Supply projections provided in the 2005 UWMP assume that the City would continue to use its existing supply sources as in the past. However, the 2005 UWMP identifies some ongoing "challenges", which could potentially result in some loss of supply. These sources of uncertainty, which are described in more detail below, are: 1) the City's permit application under Section 10 of the federal Endangered Species Act and its accompanying proposed habitat conservation plan (HCP) for operations of the City Water and Public Works departments; 2) a Water Rights Conformance Proposal related to the City's rights to divert water from Newell Creek and San Lorenzo River at Felton; 3) the City's petition to the State Water Resources Control Board to extend the time the City is allowed for putting to full beneficial use its permit to divert to the Loch Lomond Reservoir, water from the San Lorenzo River at Felton; 4) seawater intrusion into the Purisima aquifer; and 5) water quality issues.

Habitat Conservation Plan

The City has commenced a federal Endangered Species Act Section 10 permit process to address the effects of City activities, including surface water diversion facilities and pipelines on endangered species. The City is in the early stages of developing the Habitat Conservation Plan (HCP) that will be filed as part of the permit application. The HCP would address anadromous salmonids (coho and steelhead) that inhabit the San Lorenzo River, California red-legged frog (CRLF) that inhabit small coastal streams and ponds, and Pacific pond turtles, which breed at Loch Lomond. Requirement of the HCO could result in changes in the City's operation and management activities and the timing and use of these existing surface water supply sources. However, according to the 2005 UWMP, the effect of HCP requirements, if any, on the City's water supply will not be known for several years (City of Santa Cruz 2006).

Newell Creek Water Rights Conformance

The City is in the process of applying to the SWRCB to rectify a technical deficiency in its Newell Creek water rights. The current water rights allow the City to use Loch Lomond only for storage of water diverted from the San Lorenzo River by way of the Felton Diversion, and not for use of the water that flows directly to Loch Lomond from the Newell Creek watershed. The City's application requests that the water rights be amended to allow for direct diversion of runoff, consistent with historic practice. The proposed direct diversion rights are limited to the same volume of water as the existing rights. Approval of the City's application would bring the current operations into conformance with the water rights. If the SWRCB does not approve the City's application, the City would not be permitted to divert water from Newell Creek under certain conditions. Although this would not reduce the total amount of water available to the City, it would reduce the system's operational flexibility (City of Santa Cruz 2006).

Extension for Felton Diversion

The City also is applying for an extension of time to make full use of its right to divert water from the San Lorenzo River at Felton. If approved, this extension would provide the City with an opportunity to exercise its rights to divert a larger amount of water from the San Lorenzo River at Felton than the City has diverted historically. The City expects to need the full amount of its rights from the Felton Diversion to meet water demand during operational outages, changes in operations in response to environmental concerns, and dry and drought periods, as well as to meet projected future water demand.

Seawater Intrusion

Production of groundwater from the Purisima aquifer may be compromised by seawater intrusion. In normal years, the City pumps approximately 1mgd from this aquifer. Historically, during drought conditions the City has used up to 2 mgd. According to the 2005 UWMP, if all users continue to pump groundwater at the present rate, then the City's future use of the Live Oak wells at 2 mgd may not be possible without exacerbating conditions that could lead to seawater intrusion.

Water Quality Issues

The 2005 UWMP identifies two water quality management issues that may affect supply reliability. First, the quality of the water from Liddell Spring, one of the North Coast sources, is potentially threatened by expansion of a nearby quarry operation. The City is working with the quarry owner to ensure that the long-term quality of this water source is not impaired. Second, the UWMP notes that the Graham Hill Water Treatment Plant cannot at this time operate at its original design capacity because of state and federal drinking water quality regulations and new regulations that require increased disinfection for microbial pathogens. The City is planning construction of the required upgrades in 2011-2012.

Planned Desalination Plant

Since 1997, the City of Santa Cruz has been considering options for both decreasing demand and increasing supply in order to address the problem of water shortage during drought and to plan for future growth. In November 2005, the City Council adopted the Integrated Water Plan (IWP), which included three components: 1) water conservation programs that will result in long-term savings of nearly 300 million gallons per year; 2) use curtailments of up to 15 percent in drought years; and 3) a seawater desalination plant to provide a backup source of water for drought. The adopted IWP includes an option under which the desalination plant would be constructed and operated in cooperation with the SqCWD so that SqCWD can use up to 1.25 mgd (456 mgy) of the plant's capacity when the City does not need it (City of Santa Cruz 2006). The City plans to build the plant with the capacity to produce 2.5 million gallons of water per day (mgd) initially, with the potential for expansion in 1 mgd increments to 4.5 mgd in the future as needed to avoid greater use curtailments as demand grows and to meet demand in normal water years in the future.

The 2005 UWMP estimates that the desalination plant would be on-line around the year 2010, pending numerous regulatory agency approvals. However, the City's current schedule anticipates that construction of the full-scale desalination plant will begin in 2012 and will be complete in 2015. (http://www.scwd2desal.org/schedule.html). Even this longer-term schedule is subject to change, however, and the desalination plant has a number of hurdles to clear before final project approval, including technical review of the results of the pilot test and approval by regulatory agencies. The City acknowledges that there is uncertainty with respect to construction of the permanent facility, because design, environmental review and permitting must still be performed, and there is uncertainty as to whether the Coastal Commission will approve the project. Therefore, the desalination plant is not yet "reasonably likely." Nevertheless, the City is actively planning and pursuing development of the desalination plant and has identified desalination as the only feasible option for developing a new water source in the near term.

Campus Water Demand

In 2007, the UC Santa Cruz main campus used approximately 200 million gallons of water. This was approximately 5 percent of the total demand in the service area of the SCWD. Residential water use on campus accounts for approximately 46 percent of UC Santa Cruz's total consumption. Academic, administrative and support uses account for approximately 22 percent of campus water use. Irrigation water use accounts for another 22 percent. Dining halls and mechanical systems account for the remaining 10 percent of campus water use (Maddaus Water Management 2007).

The Campus projects that water use at the main campus will increase to approximately 342 mgy by 2020, an increase of 142 mgy compared to 2007. This demand projection is based on water demand projections developed by the campus in 2006 for the 2005 LRDP EIR (ARUP 2006), with the addition of an estimated 14.1 mgy for the additional student housing the campus agreed to provide under the 2008 Settlement Agreement. In addition, the campus projects that expansion of the campus' summer session and redevelopment of the University's facility at 2300 Delaware Avenue, would result in an additional demand of approximately 11 mgy between 2007 and 2020 with implementation of the "high priority" conservation measures discussed below.

In 2007, UC Santa Cruz conducted a study of water use efficiency on the UC Santa Cruz main campus. The final report identified 19 "high-priority" measures that together would reduce current water use in existing facilities by up to about 15 percent, or nearly 30 mgy. As part of the 2008 Settlement Agreement, the Campus has agreed to implement these measures over the next five years. Table 3.15-2 shows the projected increase in campus water demand by 2020.

Table 3.15-2 includes the Marine Science Campus, although that campus is not covered by the 2005 LRDP.[2] The total projected UC Santa Cruz demand in 2020 is 345.3 mgy, an increase of approximately 124 mg/year over 2007 demand.

Table 3.15-2
Existing and Projected Annual UC Santa Cruz Water Demand, 2007-2020
(in million gallons per year)

Location	Actual Demand 2007	Projected Demand 2020	2007-2020 Increase
Main Campus (w/o summer student residents)	200	328	128
Additional Housing	0	14.1	14.1
Summer Session (with summer student residents)	0	10	10
2300 Delaware Avenue	2.4	3.4	1
Water conservation measures	NA	-30	-30
LRDP Subtotal	***202***	***326***	***124***
Marine Science Campus	10.3	19.8	9.5
UCSC Total	***212.3***	***345.3***	***134***

Existing and Projected Demand in the SCWD Service Area

The City's most recent water planning document, the 2005 Urban Water Management Plan (UWMP), adopted in February 2006, presents two future demand scenarios for the City's water service area through 2020 (City of Santa Cruz 2006). Both scenarios use 2005 as the baseline year. The first scenario assumes that water use by the three major user groups (single-family residential, multi-family residential, and businesses) will grow at an annual rate of about 0.8 percent based on the amount of growth envisioned in the existing housing elements of jurisdictions that are all or partly within the SCWD service area (Santa Cruz County and the cities of Santa Cruz and Capitola); and water use at the campus will grow at the rate projected in the Draft 2005 LRDP EIR. The second scenario is based on lower growth rate projections: about 0.4 percent for the City's three major user groups (based on actual growth rates between 1997 and 2005), and an increase in campus water use

[2] A separate LRDP, the Coastal LRDP ("CLRDP") was prepared for the Marine Science Campus. The Regents certified the CLRDP EIR (SCH No. 2001112014) and approved the CLRDP in September 2004 (http://www.universityofcalifornia.edu/regents/regmeet/sep04/108.pdf). The University approved revisions and amendments to the CLRDP in November 2006. The CLRDP was certified by the California Coastal Commission in January 2009.

that is half that projected in the Draft 2005 LRDP EIR. Under both scenarios, projected demand was adjusted downward to reflect 130 million gallons per year of estimated savings from conservation programs. The 2005 UWMP concludes that under the lower growth scenario, the total cumulative water demand would "increase slightly" from 3.9 billion gallons in 2005 to just over 4 billion gallons a year by 2020, and under the higher growth scenario it would increase to over 4.3 billion gallons by 2020 (City of Santa Cruz 2006).

The demand projections presented in the 2005 UWMP take into account the full amount of UC Santa Cruz' projected demand under the 2005 LRDP. The 2005 UWMP used the projected UC Santa Cruz demand projections presented in the 2005 LRDP Draft EIR, stating that the UC Santa Cruz main campus, the Marine Science Campus and other UC Santa Cruz facilities in the city of Santa Cruz would use "nearly 400 mgy" by 2020.[3]

As shown in Table 3.15-2, above, the campus has since revised the projections presented in the Draft 2005 LRDP EIR to reflect 1) the adoption of the Final 2005 LRDP, which would accommodate an on-campus enrollment of 19,500 students by 2020 rather than 21,000 students as originally proposed; 2) the additional student housing that the Campus has committed to build under the 2008 Settlement Agreement; and 3) projected improvements in campus water use efficiency. Under the Campus' revised projections, total UC Santa Cruz water demand would grow to 345 mgy by 2020, or about 54 mgy less than the amount assumed in the 2005 UWMP higher growth scenario.

Overall Adequacy of Existing Supply to Meet Demand

Normal Water Years

As shown on Table 3.15-1, above, the total capacity of existing SCWD supplies in normal water years is 4,314 mgy. The City estimates that, without the development of new supplies, approximately 300 mgy of this existing capacity is actually available for allocation to new development (City of Santa Cruz 2006).[4] Using the larger of the two growth scenarios presented in the 2005 UWMP, the UWMP projects that water demand within the service area will increase from 3,900 mgy in 2005 to 4,345 mgy in 2020, an increase of 445 mgy. If the revised UC Santa Cruz demand projections presented in Table 3.15-2, above, are taken into account, projected total 2020 demand (from all users) would be only 4,291 mgy. This would represent an increase in demand of 391 mgy throughout the SCWD service area compared to 2005 demand. This demand would exceed the remaining capacity of the City's existing water supply by 91 mgy. The 2005 UWMP projects that existing supplies, with a total capacity of 4,314 mgy, will be adequate to meet demand in normal water years through 2015, but demand could exceed the supplies by sometime between 2015 and 2020.

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[3] The 2005 LRDP Draft EIR (UC Santa Cruz 2005) analyzed the significant environmental effects of a version of the 2005 LRDP that would accommodate an on-campus enrollment of 21,000 students by 2020. The 2005 LRDP Draft EIR projected that total UC Santa Cruz water demand would grow to 399 mgy by 2020.

[4] In January 20, 2008, e-mail to Dean Fitch of UC Santa Cruz Physical Planning and Construction, Bill Kocher, Director of the SCWD, confirmed that the SCWD still considers 300 million gallons to be an accurate estimate of remaining system capacity.

If the desalination plant is constructed as planned, it would have the capacity to produce 2.5 mgd, or a total of 913 mgy, which would be more than adequate to meet the projected demand.

Drought Years

In drought periods, production from the City's existing sources is reduced because the yield of surface water sources is lower and because the City has limited storage capacity. The 2005 UWMP estimates that in a single dry water year the total water supply would be reduced to 3,800 mgy, which is not adequate to meet the existing annual demand of approximately 3,900 million gallons. In the second year of a prolonged drought, the supply would be reduced to 2,700 million gallons. According to the 2005 UWMP, in an extreme two-year drought similar to the 1976-1977 event, there could be a peak-season water supply shortfall of 45 percent under existing demand conditions.

Based on historical variation in annual rainfall, the UWMP concludes that, statistically, the likelihood of experiencing a shortage of greater than 10 percent is about one in 10. The likelihood of a shortage occurring would increase as system demand increases. If demand increases as projected in the UWMP and the City does not develop new supplies, the maximum peak season shortage would increase to a shortfall of 56 percent by 2020. The frequency of shortages of lesser magnitude would also increase (City of Santa Cruz 2004).

The City's 2009 Water Shortage Contingency Plan recommends a five-stage approach that classifies shortage events into one of five levels. These range from a Water Shortage Alert for a shortage of less than five percent (Stage 1) to a Critical Water Shortage Emergency for a shortage of 35 to 50 percent (Stage 5) (City of Santa Cruz 2009). At all levels, water uses necessary for health and safety are given the highest priority, business uses the second priority and all irrigation uses the lowest priority. In all cases except the most extreme (50% shortage), the allocation for residential customers would be adequate to meet essential health and safety needs, assuming the use of water conserving fixtures and minimal leakage. Irrigation use would be subject to the largest reductions, ranging from 30 percent in Stage 2 (15 percent system shortage) to 100 percent in Stage 5. With a system shortage of 50 percent, residential allocations would allow only about 40 gallons per person per day, which would require substantial conservation efforts even for efficient households. At this stage, all outdoor uses, including irrigation and car washing would be prohibited and facilities such as public showers, public pools and hot tubs would likely be forced to close. Local parks and playing fields might also have to be closed. A shortage of 50 percent could constitute a natural disaster and might require management under the state Standardized Emergency Management Plan (City of Santa Cruz 2009).

The City's Water Shortage Contingency Plan includes curtailment allocations for the UC Santa Cruz campus. These allocations, which the City developed in consultation with Campus staff, are based on correlation of UC Santa Cruz water use with those of other user classes (e.g., multi-family residential, commercial, irrigation, etc.). Under these allocations, UC Santa Cruz would be required to reduce water use by a percentage approximately equal to the system shortfall. For example, in the event of a 25 percent shortfall, UC Santa Cruz would be required to reduce use by 24 percent; in a system shortfall of 50 percent, UC Santa Cruz would be required to reduce water use by 48 percent.

3.15.1.3 Wastewater

UC Santa Cruz

Wastewater produced on campus is conveyed via the campus sewer system, without treatment, to the City of Santa Cruz system. At the time that it was constructed, the existing on-campus sanitary sewer system was sized for a campus of 27,500 students and associated faculty and staff, according to the engineering standards current at the time.

There are two major trunk sewers on the UC Santa Cruz campus, one on Empire Grade Road and the other along Jordan Gulch, that combine into a single sewer near the lower end of Coolidge Drive. This discharges into the City's sewer system at the intersection of Bay and High streets. The wastewater is then transported through the sewer system to the City of Santa Cruz Wastewater Treatment Plant, where it is treated before being discharged to Monterey Bay. The City regulates the contents of the wastewater discharged by the campus to ensure it can be properly treated it before it is discharged to Monterey Bay. Campus wastewater is routinely tested to ensure that the campus complies with the City's wastewater discharge limitations (UC Santa Cruz EH&S Waste Water Discharge web site 2008). In 2006 main campus generated a total of approximately 130 million gallons of wastewater, or about 355,260 gpd (Testoni 2007).

The City's Wastewater Treatment Plant is located near Neary Lagoon and Bay Street. The current rated design capacity of the treatment plant is 17 million gpd. On average, the plant has a daily flow of 10 million gpd. The plant's design capacity for wet weather flow is 81 million gpd (City of Santa Cruz Public Works Department web site 2008). The plant currently operates at approximately 60 percent of capacity. The City maintains over 200 miles of sewer pipes ranging from 6 to 54 inches in diameter (City of Santa Cruz Public Works Department web site 2008). As part of the 2008 Settlement Agreement, the University agreed to pay its proportionate share of the cost of any upgrades to the City's Wastewater Treatment Plant that are necessary to serve the main campus.

The City is in the process of updating its Sewer System Master Plan, which was last updated in 1984. Segments of the Oxford Street main and the Arroyo Seco main, which serve the UC Santa Cruz campus, theoretically have been operating over design capacity since the 1980s but have not yet been improved. The City is planning upgrades to the Arroyo Seco main in 2009. As part of the 2008 Settlement Agreement, the University agreed to pay its proportionate share of the cost of this upgrade necessary to serve the main campus.

3.15.1.4 Storm Water Drainage

This section describes the existing storm water drainage system at UC Santa Cruz. Campus hydrology and the potential for flooding are discussed in Section 3.8, *Hydrology and Water Quality*.

Storm Water Drainage at UC Santa Cruz

The campus storm water conveyance system consists of engineered detention basins and settling tanks serving localized building clusters, catch basins, and storm water piping and surface drainage channels that direct storm water from developed areas to natural drainages. Runoff from most parking lots on the campus is filtered to remove typical urban contaminants. A relatively small amount of storm water leaves the campus as surface flow because most of the flow in the natural drainages is captured by sinkholes and enters the karst aquifer. Water in surface drainages fed by the karst aquifer, as well as water flowing off the campus as surface flow, drains to the Monterey Bay. See Section 3.8, *Hydrology and Water Quality* for more details.

While the existing campus storm drainage system meets current overall capacity requirements, there are localized areas of concern. The UC Santa Cruz Storm Water and Drainage Master Plan, prepared in 2004, included a channel stability field survey of all the campus drainages and a hydrology field survey of the Baskin Engineering and Jordan Gulch Middle fork sinkholes. The plan identified several problems with the existing system; in particular, surface flooding, concentrated flows resulting in erosion, sedimentation of sinkholes, and potential habitat degradation. The plan identifies master planning issues for the system and includes recommendations to address deficiencies in the storm water drainage system. In addition, the Plan recommends a variety of management practices for improving the quality of storm water runoff. The campus is planning to implement a series of capital improvements to address the existing erosion conditions identified by the Plan. Construction of the first phase of storm water improvements is planned for 2009.

UC Santa Cruz Storm Water Master Plan

The campus is required to prepare a Storm Water Management Plan (SWMP) under the U.S. EPA Phase II Storm Water regulations, promulgated under the Clean Water Act, and implemented in California by the California Water Resources Control Board's General Permit for the Discharge of Storm Water from Small Municipal Separate Storm Sewer Systems (MS4).

The SWMP identifies potential contaminant sources and other water quality issues of concern potentially affecting the quality and quantity of storm water discharges; provides Best Management Practices (BMPs) for UC Santa Cruz planning, design, construction, maintenance and operation activities; and provides measurable goals for the implementation of the BMPs. The campus has submitted a Final Draft SWMP and anticipates that the SWMP will be approved in March 2009.

Campus Standards Handbook

The Campus Standards Handbook includes site requirements that address drainage issues. Among the requirements most relevant to storm water drainage are the following:

- Protect all major springs, seep zones, drainage channels, year-round streams, and natural superficial drainage patterns from alteration.
- Design for high levels of absorption in all identifiable groundwater recharge areas (use of flatter slopes is encouraged to maximize absorption rates).
- Provide for detention of storm water runoff to ensure that peak post-development runoff flow rates do not exceed pre-development runoff rates. Dissipate and diffuse storm runoff when possible. Ensure that storm water detention does not saturate the ground at building foundations.

The Campus Standards Handbook also includes design parameters for storm water drainage systems.

3.15.1.5 Solid Waste

This section provides an overview of applicable solid waste regulations and describes existing solid waste and recycling collection services on the UC Santa Cruz campus.

Regulatory Framework

The California Integrated Waste Management Act of 1989 (Assembly Bill [AB] 939) required the implementation of integrated waste management plans and mandated that county and local governments divert at least 50 percent of all solid waste generated, starting January 1, 2000. The University of California is exempt from this Act. However, in 1989, Assembly Concurrent Resolution (ACR) 149 was passed, requesting that the University of California abide by the diversion benchmarks established in AB 939. It is University policy to comply with ACR 149.

Waste Disposal

The City of Santa Cruz has its own municipal landfill, located three miles west of the city limits, that serves the entire incorporated city, including UC Santa Cruz. As of 2005, the City of Santa Cruz Public Works Department indicated that this landfill has a total capacity of 10,484,325 cubic yards and a remaining capacity of 6,029,272 cubic yards (58 percent). The landfill is not expected to reach capacity until 2037. The City had a waste diversion rate of 62 percent (CIWMB web site 2008).

In 2003, the City landfill accepted 56,100 tons of solid waste. The UC Santa Cruz campus disposed directly of about 2,450 tons of solid waste in the City landfill in 2003.[5] This represents about 4 percent of the total waste disposed at the landfill.

Recycling

Campus-wide refuse collection is performed six days a week by the UC Santa Cruz Physical Plant-Grounds Services. Recycling has been in place at UC Santa Cruz since 1989. Campus recycling is overseen by Physical Plant-Ground Services, which collects materials from recycling bins throughout the campus, including cardboard; mixed paper; clear and colored glass; aluminum, tin, and steel cans; and plastic. The Campus also collects green-waste, such as tree trimmings and lawn waste, from the campus groundskeepers (UC Santa Cruz Physical Plant web site 2008). The UC Santa Cruz campus also has an E-Waste recycling program for consumer electronic devices. Collected equipment is recycled through certified recyclers (UC Santa Cruz Physical Plant web site 2008). UC Santa Cruz has steadily increased the percentage of its waste stream that is recycled, from 24 percent in 2002 to 45 percent in FY 2007-2008 (Raven 2009). This is still below the goal of a 50 percent diversion rate by June 2008 established by the UC Policy on Sustainable Practices. Beginning in July 2008, the UC Santa Cruz Dining Services, Physical Plant, and the Student Environmental Center initiated a pilot collaborative composting project with the County of Santa Cruz. Dining hall staff collect post-

[5] Materials sent to the landfill include refuse, barnyard and miscellaneous refuse, and surplus waste materials.

consumer food scraps, which are then transported by Physical Plant's recycling staff to a compost facility at the Buena Vista Landfill in Watsonville.

3.15.1.6 Electricity and Natural Gas

Pacific Gas and Electric (PG&E) provides gas and electric services to the UC Santa Cruz campus. In addition, the campus Central Heating Plant is a cogeneration facility that produces electricity for the campus. These services are described below.

Electricity

The campus cogeneration facility generates approximately one-third of the campus electrical load; the remainder is purchased from PG&E. Through the purchase of Renewable Energy Credits to augment the portion of PG&E's power that is generated from renewable sources, 100 percent of the campus electrical load comes directly or indirectly from renewable sources (wind, solar, biogas, small-scale hydroelectric, and geothermal). The Renewable Energy Credit purchase was made possible by a student fee referendum passed in 2006. The current Green Certificate Master Purchase Agreement is effective through November 12, 2010.

UC Santa Cruz's electricity distribution network is campus-owned and mostly underground. Most of UC Santa Cruz's electricity is received from PG&E at 21,000 volts (21 kV or kilovolts). The PG&E point of service connection (known as the Slug Substation) is located at the southeast corner of the campus. Power is distributed from the point of service to the Merrill Substation, located near Merrill College, where the voltage is reduced to 12 kV by two transformers. Four campus electrical feeders branch out from this location to provide dual power connections to most of the campus' buildings. Power to the lower campus buildings comes from a separate, single PG&E line. Family Student Housing and employee housing complexes on the campus are served by separate PG&E connections.

The Central Heating Plant, which provides heating to the campus core, includes a cogeneration system that produces electricity. The cogeneration system has the capability of operating independently of the PG&E grid, and provides back-up power for the campus core area labs and other facilities that have critical power needs. The cogeneration system is capable of providing approximately 2.6 megawatts (MW) of power but it operates at 2.3 MW due to restrictions imposed by the Monterey Bay Area Unified Air Pollution Control District (Testoni 2005). On average, the cogeneration plant provides about one-third of the main campus electricity.

Electrical system peak total demand in 2008 was approximately 8.9 megavolt-amperes (MVA), for which the campus electrical system had adequate capacity and back-up capacity (Tramble 2008). This reflects an increase of 0.4 MVA since 2003.

Natural Gas

UC Santa Cruz is a member of the state buying pool for natural gas through the Department of General Services Gas Procurement Program (UC Santa Cruz Physical Plant – Utility Providers web site 2008).

The campus natural gas distribution system is owned and maintained by UC Santa Cruz. The gas distribution system serves the natural gas needs of the entire campus except for Family Student Housing on the west side of the campus and employee housing on the south end (Rogers & Associates, 2004). Peak demand in 2003 was 656 therms per hour. The single biggest consumer of natural gas on campus is the Central Heating Plant (Rogers & Associates 2004; Testoni 2005).

PG&E provides natural gas to the campus via a 3-inch pipeline routed up Bay Street and High Street to the service connection at the site of the former Liquefied Petroleum Gas standby facility on the campus on Empire Grade Road near Western Drive. The 3-inch PG&E line comes off of a utility distribution main beneath Mission Street and serves a portion of the City of Santa Cruz as well as the campus (Rogers & Associates 2004). Approximately 12 miles of gas distribution pipelines extend up both the east and west sides of the campus from the service connection, with crossties delivering gas to the various campus facilities (Rogers & Associates 2004). The system includes two pressure-reducing stations: one at the supply point and the other near the College Eight access road. From the College Eight station, a dedicated, unregulated higher pressure gas main is routed north and supplies the cogeneration plant.

Campus Energy Conservation

Total campus energy use increased by 30.3 percent between 1993-1994 and 2006-2007, but energy use per square foot of building space decreased by about 9 percent through increased energy efficiency (UC Santa Cruz, 2007.)

Campus Standards Handbook

The energy standards contained in CCR Title 24 set the minimum energy efficiency design criteria for all campus construction. The Campus Standards Handbook formalizes UC Santa Cruz's interest in pursuing cost effective energy conservation measures over and above the requirements of Title 24. In particular, the Handbook suggests energy-saving design alternatives that could be incorporated into building design and includes guidelines to reduce the cost of energy over the life of a building. For example, all major energy-consuming equipment permanently installed in buildings is to be controlled and monitored by the Campus Energy Management System. In addition, UC Santa Cruz has a policy of providing air conditioning only as needed for proper functioning and protection of equipment or materials; for environmental control for research if it can be clearly determined that it is more energy efficient to provide cooling than to provide mechanical ventilation in order to meet applicable health and safety standards; and for small temporary units (portables or trailers). To provide for human comfort during the cooling season, Campus Standards require that natural or forced ventilation shall be used to provide cooling in buildings not programmed for air conditioning; and that building designs include provisions to minimize and delay heat gain through the building envelope and maximize ventilation efficiency.

The Regents Policy on Sustainable Practices

The University of California Policy on Sustainable Practices recommends that university operations:

- Incorporate the principles of energy efficiency and sustainability in all capital projects within budgetary constraints and programmatic requirements.
- Minimize the use of nonrenewable energy sources on behalf of the University's built environment by creating a portfolio approach to energy use, including the use of local renewable energy and purchase of green power from the grid as well as conservation measures that reduce energy consumption.

3.15.1.7 Telecommunications

Wireline communications services are provided to the campus by AT&T through a single point of connection at the main entrance to the campus. The on-campus wireline communications system is owned by the University and managed by UC Santa Cruz Information Technology Services (ITS). ITS is located in the Communications Building on campus and provides telephone services, campus voicemail, two-way radio communications, a micro-cell telephone network and a call center for students, faculty and staff of UC Santa Cruz.

ITS also manages CruzNet, the UC Santa Cruz wireless network on campus. Residence hall Ethernet and network connections are administered by ResNet, a joint effort between ITS and the Colleges and University Housing Services (CUHS). Off-campus connectivity to the campus network is currently provided via Gigaman service from AT&T. ITS also offers a departmental dial-in modem service where phone lines and modems are reserved for the exclusive use of subscribers.

The campus is served out of seven second-tier area facilities. Telephone, television, and LAN fiber radiate out of each area facility to third-tier distribution points, typically individual building entrances.

3.15.2 Relevant Features of the Project

The ECI complex, comprising two seven- to eight-story buildings, would provide 99 student apartments, each of which would house four to six students, for a total of about 600 student beds, and two employee apartments. Electricity would be used in the new buildings for ventilation fans, elevators, fire alarms, lighting, kitchen ranges and refrigerators, and residents' personal electronic equipment. Natural gas would be used for space and water heating. Water conservation strategies included in the proposed design include the use of highly efficient plumbing fixtures, including low-flow showers, high-efficiency (dual-flush) toilets and water-efficient washing machines. Landscaping would consist primarily of drought resistant and native plantings, with the exception of approximately 4,300 sf of turf in the bioretention area to provide an outdoor area that could be used by student for recreation. The project would be connected to existing underground water, gas, electrical and telephone lines that run along Chinquapin Road from services under McLaughlin Drive. To provide adequate pressure for fire water flows, the fire water line for the proposed project may connect to a campus water main north of the fire station parking lot (Figure 2-2). The trenching for the fire water line would be within previously disturbed areas in and adjacent to the fire station parking lot.

To comply with the UC Policy on Sustainable Practices, the new buildings will be designed to outperform the required provisions of the California Energy Code (Title 24) energy-efficiency standards by at least 20 percent, and must be designed and constructed to a minimum standard equivalent to a LEED™ 2.1 "Certified" rating. The project would be designed and constructed to meet the requirements for LEED™ "Silver" rating.

3.15.2.1 Water

Domestic and fire water for the new buildings would be provided through new 6-inch service laterals from the existing 12-inch water main that runs beneath Chinquapin Road and an 8-inch water main beneath the Crown access road.

The primary indoor water uses associated with the proposed project would be apartment bathrooms and kitchens, and clothes washing by students. The project café would use water for cooking, cleaning and dishwashing. Custodial cleaning of common areas would also use a small amount of water. The project would include high-efficiency fixtures in the bathrooms (dual-flush toilets, 2-gpm showers, and 0.5-gpm faucets in public restrooms). The project would include 1.34 acres of landscaping, consisting primarily of native or ecologically-adaptive vegetation. The irrigation management system for the project would include a RainMaster Evolution Satellite controller that would be tied into the existing campus centralized irrigation control system, which automatically adjusts irrigation schedules according to the actual weather conditions monitored at a weather station on the campus. Landscape irrigation would require approximately 710,000 gallons per year.

Indoor water demand for the proposed project was estimated using water demand factors for new campus housing at UC Santa Cruz developed for the 2005 LRDP EIR based on historical data on water use in existing buildings (ARUP 2006). For this analysis, the demand factor of 34.7 gallons per day per bed was adjusted to take into account the high-efficiency toilets that are proposed for the new buildings.[6] Water use for the proposed café was assumed to be the same as known water use for a similar café on campus.[7] Landscaping for the proposed project would consist of 1.24 acres of low-water-use plantings, including the vegetated roof, and approximately 0.1 acre of turf. Table 3.15-3 shows the projected water use for the proposed project.

Table 3.15-3. Project Water Use

Use	Demand (million gallons per year)
Indoor (apartments)	7.2
Indoor (café)	0.15
Landscape irrigation	0.71
TOTAL	**8.1**

[6] ARUP (2006) assumed toilets meeting the current standard of 1.6 gallons per flush (gpf). The proposed project would include dual-flush (0.9 gpf/1.6 gpf) fixtures.

[7] Joe's Pizza is 2,761 sf; the café included in the proposed project would be 1,680 sf.

3.15.2.2 Wastewater

The sewer lines for the new buildings would connect to an existing campus sanitary sewer line in Chinquapin Road near the southern end of the project site. This line connects to the eastern campus sewer main in Jordan Gulch. Total annual wastewater discharge is assumed to be 90 percent of indoor water use, or 7.2 mgy.

3.15.2.3 Storm Water

The storm water management system for the proposed project includes a series of detention and bioretention features that would reduce the volume and rate of runoff leaving the site while improving the water quality through biofiltration. These features include a 0.13-acre green/living roof on a portion of Building B, bioretention bioswales and rain gardens adjacent to Building B and in the plaza, pervious paving, and a bioretention area in the northeast portion of the site. To avoid concentration of runoff to the filled doline (sinkhole) beneath the existing parking lot, which could potentially result in reactivation of this feature, the proposed storm water management features would be lined with impermeable barriers. Excess runoff and runoff that flows through the green/living roof, the bioretention bioswales and the pervious pavement, would flow to the bioretention area in the northeast portion of the project site.

The Campus is considering two options for management of runoff that reaches this bioretention area. Under Option 1, a passive irrigation system would be installed beneath the bioretention area. Under Option 2, the bioretention area would not include a passive irrigation system. Instead, runoff filtered through the bioretention area would be stored in a cistern. Under both options, in the 2-year, 5-year and 10-year design storms, excess storm water would be stored in underground tanks below the bioretention area. The tanks would be designed to hold the volume of runoff in excess of the estimated runoff volume for these design storms under pre-development (i.e., pre-UC Santa Cruz development) conditions. The water stored in these tanks would be discharged to the culverts beneath the two lower terraces of Parking Lot 111 to the existing outfall at the head of Gully H. The size of the underground tanks would depend on details of the design of the bioretention area but would be approximately 10,000 to 13, 000 gallons. Under both options, the rate of runoff discharged to the culvert would not exceed 10 percent of the estimated flow for the 2-year design storm under pre-development (i.e., pre-UC Santa Cruz) conditions. A detailed description of the proposed storm water management system is described in Section 3.8.2.

3.15.2.4 Electricity

Electricity would be used in the new buildings for ventilation fans, elevators, fire alarms, lighting, kitchen ranges and refrigerators, and residents' personal electronic equipment. Electrical demand would be 330 kW for Building A and 852 kW for Building B. The estimated electricity usage for the proposed project (based on metered electricity usage for the existing College Infill Apartments) would be approximately 1.6 million kW/year. Electrical service for the proposed development would connect to the 12KV underground campus utility distribution system in Chinquapin Road. The electrical lines in Chinquapin Road would be upgraded by installing new cable in existing conduit down Chinquapin Road to McLaughlin Drive, and in McLaughlin Drive from Chinquapin Road to Hagar Drive. Two new switchboxes would be installed underground beneath McLaughlin Drive.

Three dual-fuel natural gas and liquid propane generators, each with a capacity of 150 KW, would be installed to provide emergency life safety power for the two buildings.

3.15.2.5 Natural Gas

Natural gas would be used for the space and hot water heating in the new buildings and for the emergency generators. The natural gas demand for the project would be 20.5 MBTU/hr. The total natural gas usage for the project would be approximately 153,000 therms/year (based on metered usage at other, similar college infill apartments on campus). Natural gas for the project would be provided by PG&E through the campus distribution system. The point(s) of connection would be made along existing gas lines in Chinquapin Road and/or along the northern edge of Crown College. Natural gas would be used within the proposed new development for space and water heating and to fuel the emergency generators.

The Campus is evaluating whether the natural gas line in Chinquapin Road, which would serve the proposed project, has adequate pressure to meet the project demand. If the pressure is not adequate, the Campus would upgrade approximately 100 linear feet of existing pipeline in Hagar Drive between Steinhart Drive and McLaughlin Drive, where there is a constriction that resulted from a previous repair. The work would be within the existing roadway.

3.15.2.6 Telecommunications

Telecommunications and cable television service will be provided from the existing underground campus infrastructure in ~~Chinquapin Road~~ the Crown access road. New conduit would be installed in a trench in the Crown access road from the Crown Circle east for approximately 100 feet, to the north side of the Crown/Merrill Dining Commons building.

3.15.2.7 Solid Waste

Project operations would generate approximately 6,660 cubic yards (uncompacted) of solid waste each year, of which about 4,057 cubic yards would go to the Santa Cruz landfill.[8] Using a conversion rate of 300 lbs/cubic yard for uncompacted residential waste (U.S. EPA web site 2005), the project would generate approximately 290 tons/year of landfill waste.

[8] Based on waste collected and diversion rate at Porter-Kresge Infill Apartments in 2008 (Dean Raven, UC Santa Cruz Physical Plant, personal communication with Alisa Klaus, UC Santa Cruz Physical Planning and Construction, November 24, 2008).

Demolition and grading for project construction would generate a variety of waste, including vegetation, asphalt, concrete, soil, and building debris. The project contract documents require that the contractor prepare a construction waste management plan and that a minimum of 75 percent of construction waste from the project be diverted from the landfill.

3.15.3 Applicable 2005 LRDP EIR Mitigation Measures

The following, previously adopted, 2005 LRDP EIR mitigation measures are applicable to and incorporated into the proposed project:

LRDP Mitigation UTIL-4: The Campus will continue to improve its recycling and waste reduction programs and identify additional means of reducing waste.

LRDP Mitigation UTIL-5: Where feasible, new campus buildings will be added to the Campus Energy Management System and heating and cooling will be controlled based on time of use of building and outside temperature.

LRDP Mitigation UTIL-9A: The Campus shall continue to implement and improve all current water conservation strategies to reduce demand for water, including the following [only the relevant elements of this measure are listed below]:

- Require that new contracts for washing machines in student residences be certified by the Consortium on Energy Efficiency 6 to have a water factor of 5.5 or less or meet an equivalent standard.
- Incorporate water-efficient landscaping practices in all new landscape installations. Water-conservative landscaping practices shall include, but will not be limited to the following: use of water-efficient plants, temporary irrigation systems for plant establishment areas where mature plants will be able to survive without regular irrigation, grouping of plants according to their water requirements, design of planting areas to maximize irrigation pattern efficiency, and mulch covering in planting areas.
- To facilitate monitoring of water usage in all new development, the Campus shall: (1) install separate meters on water lines for individual buildings and (2) install meters on irrigation lines where one point of connection irrigates 1 acre 5,000 sf or more.

3.15.4 Impacts and Mitigation Measures

3.15.4.1 Standards of Significance

For the purposes of this EIR, the proposed project would have a significant impact with regard to utilities and service systems if it would:

- Exceed the Central Coast Regional Water Quality Control Board’s wastewater treatment requirement
- Require or result in the construction or expansion of water or wastewater treatment facilities, which would cause significant environmental effects

- Require or result in the construction or expansion of storm water drainage facilities, which could cause significant environmental effects
- Result in the need for new or expanded water supply entitlements due to insufficient water supplies available to serve the project from existing entitlements and resources
- Exceed available wastewater treatment capacity
- Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs
- Fail to comply with applicable federal, state, and local statutes and regulations related to solid waste
- Require or result in the construction or expansion of electrical, natural gas, cooling water, or heating water facilities, which would cause significant environmental impacts
- Require or result in the construction or expansion of telecommunication facilities, which would cause significant environmental impacts.

Impacts with respect to each of the standards listed above are addressed in the discussion that follows except the first standard, which relates to water quality effects from the discharge of treated effluent. That is addressed in Section 3.8, *Hydrology and Water Quality*. The impacts of the proposed project's natural gas and electricity demand on global warming are analyzed in Section 3.3, *Air Quality and Climate Change*.

3.15.4.2 Project Impacts and Mitigation Measures

On-Campus Water Infrastructure

Domestic and fire water would be supplied to the new buildings via new water lines from an existing water main in Chinquapin Road. To ensure adequate pressure, the fire water line may connect to an existing campus water main north of the fire station parking lot (Figure 2-2). The new water lines would be within the project site as shown on Figure 2-2 and included in the analysis of project "footprint" and construction impacts in Sections 3.3 (*Air Quality and Climate Change*), 3.4 (*Biological Resources*), 3.5 (*Cultural Resources*), 3.6 (*Geology, Soils, and Seismicity*), and 3.8 (*Hydrology and Water Quality*). As described in these sections, the impacts would be less than significant with mitigation. No off-site improvements to the on-campus water distribution system would be required.

Off-Campus Water Infrastructure

According to the 2005 LRDP EIR, no major improvements to off-campus water distribution facilities would be needed to serve projected campus growth through 2020. The pumping capacity of Pump Stations 2 and 6 will need to be increased to supply more water to the campus**,** based on projected growth, at some point before 2020. This would be achieved by either adding more pumps to the two stations or replacing existing pumps with larger capacity pumps, neither of which option is likely to result in environmental impacts because the improvements would be located at existing developed stations. As part of the 2008 Settlement Agreement, the University confirmed its commitment to pay a share of the cost of the pump station upgrades that serve the campus directly as specified in a 1996 memorandum of understanding between the City and the University.

The future improvements to Pump Station 2 will be triggered when pumping at this station reaches 826,000 gpd. Improvements to Pump Station 6 will be triggered when pumping at this station reaches 494,000 gpd. In 2007, pumping was 563,000 gpd at Pump Station 2 and 430,000 gpd at Pump Station 6. The City does not anticipate that the upgrades will be needed in the near future (Almond 2009).

The 2005 LRDP EIR (Section 4.15) concluded that the impact of campus growth under the 2005 LRDP on domestic/fire water conveyance systems would be less than significant. The proposed project is within the development program analyzed in the 2005 LRDP EIR; therefore, the project impact would be less than significant.

Water Supply

ECI Impact UTIL-1:	Development of the proposed project would result in new water demand of approximately 8.0 million gallons per year (mgy), but water supplies during normal water years are available to serve the project.
Applicable LRDP Mitigation:	UTIL-9A
Significance with LRDP Mitigation:	Less than significant
Project Mitigation:	Not required

The projected water demand for the proposed project would be approximately 8.1 mgy**.** The project would include high-efficiency (dual-flush) toilets and low-flow (2-gallon per minute) showerheads. The project may include a passive irrigation system that would use stored rainwater for a small portion of the landscape irrigation demand. In compliance with LRDP Mitigation UTIL-9A, washing machines in the new housing would be certified by the Consortium on Energy Efficiency 6 to have a water factor of 5.5 or less or meet an equivalent standard.[9] The irrigation controller would be connected to the Campus' central controller, and would automatically adjust the irrigation schedule to compensate for daily fluctuations in the weather and associated irrigation requirements. The controller would also have the capacity to detect leaks in the irrigation lines shut off automatically if leaks were detected.

As described in Section 3.15.1.2, the City estimates that the current remaining capacity of the existing water supply system in normal water years, which is available for new development, is 300 mgy. The project water demand represents less than 3 percent of this remaining capacity, and about

[9] The water factor is the number of gallons required for each cubic foot of laundry.

0.2 percent of the existing system demand. Existing, available, certain water supplies are sufficient to provide water to the proposed project in normal water years.

New water demand associated with the project water use would also add to overall water demand during drought periods, when supplies are not adequate to meet existing demand. UC Santa Cruz' share of peak-season system-wide demand is approximately 5 percent. Under drought conditions, the campus would reduce its use of water from the City consistent with the curtailments required of other similar users under the City's Water Shortage Contingency Plan, which would range from would range from 15 percent to 52 percent for the campus as a whole, depending on the severity of the drought (City of Santa Cruz 2009). Such curtailments would ensure that demand, including project demand, is within available supplies in drought years.

The project impact is less than significant and project mitigation is not required. Cumulative water supply impacts are analyzed below, in Section 3.15.4.3.

On-Campus Wastewater Conveyance

Wastewater from the proposed ECI Project would discharge via gravity flow to an existing campus sewer line in Chinquapin Road adjacent to the project site. The new wastewater lines would be within the project area shown on Figure 2-2 and included in the analysis of project "footprint" and construction impacts in Sections 3.3 (*Air Quality and Climate Change*), 3.4 (*Biological Resources*), 3.5 (*Cultural Resources*), 3.6 (*Geology, Soils, and Seismicity*), and 3.8 (*Hydrology and Water Quality*). No off-site improvements to the on-campus wastewater conveyance system would be required.

Off-Campus Wastewater Treatment and Conveyance

Wastewater flows from the proposed new apartments would be conveyed to the City's wastewater treatment plant. The treatment plant has a design capacity of 17 million gpd and current average daily flow of 10 million gpd. The 2005 LRDP EIR estimated that wastewater flows projected under the 2005 LRDP would account for less than 6 percent of average daily flow at the plant and there would be adequate capacity to serve the campus. Even with increases in flows from other sources, the City has indicated that the wastewater treatment plant will have adequate capacity to serve the projected campus demand through 2020. The project is within the development analyzed in the 2005 LRDP EIR; therefore, the project impact would be less than significant.

As discussed above, wastewater from the campus flows into a City sewer line that runs down Bay Street for a short distance, runs to the west and then through the Arroyo Seco canyon. A portion of that line is considered to be undersized (and has been considered undersized since 1988). The City is currently planning upgrades to the Arroyo Seco line. Government Code Section 54999 authorizes public utilities to charge the University a limited capital facilities fee under certain circumstances. The University will comply with its obligations as authorized under Section 54999. As part of the 2008 Settlement Agreement, the University agreed to pay its proportional share of the cost of the Arroyo Seco sewer line improvements that serve the campus directly. These fees will cover the Campus's share of the cost of mitigation measures to address environmental impacts from the construction of these improvements. The 2005 LRDP EIR stated that these upgrades may entail ground disturbing activities that could potentially affect archaeological resources and biological resources, and potentially result in short-term air, noise and water quality impacts. In July 2008, the City Council approved a project that will re-establish the creek and access road as needed to maintain and rehabilitate the sewer main. This will involve removing trees from the Arroyo Seco creek bed, clearing the creek of brush and woody debris, removing silt and rock from the creek, replacing three culverts, and rebuilding the access road (City of Santa Cruz 2008). This work will be permitted under a five-year maintenance agreement with the California Department of Fish and Game. The preliminary design of the improvements to the sewer line itself call for lining the existing sewer pipeline and manholes and replacing the existing manhole frames and covers (City of Santa Cruz 2008). Once the access road is in place, these activities would not involve extensive additional vegetation removal or ground disturbance. Therefore, it is likely that the environmental impacts of making improvements to the sewer line itself be could be mitigated to a less-than-significant level, and the project impacts related to off-campus wastewater conveyance would be less than significant.

Storm Water Drainage

Construction of the proposed project would increase the amount of impervious surface on the site. As described in Section 3.15.2.3, the storm water management system for the proposed project includes a series of detention and bioretention features that would reduce the volume and rate of runoff leaving the site while improving the water quality through biofiltration. Impacts of the discharge of runoff from the proposed site into the natural drainages are analyzed in Section 3.8, *Hydrology and Water Quality*. The bioretention area and detention vaults would be within the project area of disturbance shown on Figure 2-2 and included in the analysis of project "footprint" and construction impacts in Sections 3.3 (*Air Quality and Climate Change*), 3.4 (*Biological Resources*), 3.5 (*Cultural Resources*), 3.6 (*Geology and Soils*), and 3.8 (*Hydrology and Water Quality*). As discussed in those sections, the impacts would be less than significant with mitigation. The proposed project would not require improvements to the campus storm water drainage system other than those that would be constructed on the project site.

Solid Waste

The contractor would be required to divert from landfills a minimum of 75 percent of nonhazardous project construction waste, other than excavated soil and land clearing debris. All excavated soil would be recycled or re-used.

Project operations would generate approximately 290 tons of landfill waste annually. The 2005 LRDP EIR estimated that at full development under the 2005 LRDP the campus would dispose of a total of 3,585 tons per year by 2020. During the lifetime of the 2005 LRDP, Campus waste would constitute approximately two percent of the remaining capacity of the City's landfill in 2005. Furthermore, to further reduce the less-than-significant LRDP impact, the Campus implements LRDP Mitigation UTIL-4, which requires that the Campus continue to improve its recycling and waste reduction programs and identify additional means of reducing waste. UC Santa Cruz has steadily increased the percentage of its waste stream that is recycled, from 24 percent in 2002 to 45 percent in FY 2007-2008 (Raven 2009). Since the landfill has adequate capacity to handle projected waste disposal volumes generated from campus growth under the 2005 LRDP, including the proposed project, no expansion of the landfill would be required and the project impact would be less than significant.

ECI Impact UTIL-2:	The proposed project would increase demand on the Campus and regional electricity generation and distribution systems.
Applicable LRDP Mitigation:	UTIL-5
Significance with LRDP Mitigation:	Less than significant
Project Mitigation:	Not required

Electricity

The combined, estimated electricity demand[10] of the two project buildings is 1,192 kW (330 kW for Building A and 852 kW for Building B) and the projected annual electricity usage is 841,500 million kWh. Electric lines for the proposed project would connect to the existing campus 12KV underground electrical distribution system in Chinquapin Road adjacent to the project site. With the exception of a segment approximately 60 feet, which would be installed in a trench across the west end of the central parking lot, ~~T~~the new electric lines would be within the project area of disturbance shown on Figure 2-2 and included in the analysis of project "footprint" and construction impacts in Sections 3.3 (*Air Quality and Climate Change*), 3.4 (*Biological Resources*), 3.5 (*Cultural Resources*), 3.6 (*Geology, Soils, and Seismicity*), and 3.8 (*Hydrology and Water Quality*). ~~No off-site improvements to the campus electrical distribution system would be required to serve the proposed project.~~ As described in Section 3.15.2.4, off-site upgrades to the electrical lines in Chinquapin Road would be limited to the installation of new cable in existing conduit and two new underground switch boxes beneath McLaughlin Drive. These improvements would not result in disturbance of biological resources or the addition of new impervious surface and therefore would not result in significant environmental impacts.

The existing electrical service to the campus has adequate capacity to serve the proposed project. Therefore, the proposed project would not require the construction of off-campus electrical system improvements that would have the potential to cause environmental impacts. The 2005 LRDP EIR projected that campus peak electrical demand would increase from 9.49 MVA in 2003 to 21.01 MVA in 2020. The LRDP EIR concluded that the environmental impacts of the construction of new on- and off-campus electrical facilities to meet this demand would not be significant. LRDP Mitigation UTIL-5 requires that new campus buildings be added to the Campus' Energy Management System, whenever feasible, to further reduce this less-than-significant impact. This mitigation is applicable to and incorporated into the proposed project. The project impact would be less than significant and no project mitigation is required.

[10] Electricity demand is a measure of the rate at which electricity is used.

Natural Gas

The combined, estimated natural gas demand of the proposed project is 20.5 therms (5.5 therms for Building A and 20.5 therms for Building B), and the projected annual natural gas use is 72,150 therms. Natural gas lines for the proposed project would connect to the existing campus gas main in Chinquapin Road. The new gas lines would be within the project site as shown on Figure 2-2 and included in the analysis of project "footprint" and construction impacts in Sections 3.3 (*Air Quality and Climate Change*), 3.4 (*Biological Resources*), 3.5 (*Cultural Resources*), 3.6 (*Geology, Soils, and Seismicity*), and 3.8 (*Hydrology and Water Quality*). No off-site improvements to the campus natural gas distribution system would be required to serve the proposed project.

The existing natural gas service to the campus has adequate capacity to serve the proposed project. Therefore, the proposed project would not require the construction of off-campus natural gas system improvements that would have the potential to cause environmental impacts. As explained in Section 3.5.1.2.5, above, replacement of a constricted segment of natural gas pipeline in Hagar Drive between Steinhart Way and McLaughlin Drive may be required to provide adequate pressure in the gas line in Chinquapin Road to which the project would connect. This improvement would entail replacing or bypassing the constricted segment with a new, 6-inch pipeline. The work would be limited to the existing roadway and would not result in significant environmental impacts. The project impact would be less than significant and no mitigation is required.

Telecommunications

Telecommunications service for the proposed project would connect to existing underground lines in Chinquapin Road. The new lines would be within the project site as shown on Figure 2-2 and included in the analysis of project "footprint" and construction impacts in Sections 3.3 (*Air Quality and Climate Change*), 3.4 (*Biological Resources*), 3.5 (*Cultural Resources*), 3.6 (*Geology, Soils, and Seismicity*), and 3.8 (*Hydrology and Water Quality*). ~~No o~~Off-site improvements to the campus telecommunications system would be limited to trenching and installation of new conduit in the existing Crown access road, and no improvements to off-campus telecommunications facilities would be required to serve the proposed project.

3.15.4.3 Cumulative Impacts and Mitigation Measures

ECI Impact UTIL-3:	Development of the proposed project, in conjunction with other development in the SCWD service area, would result in additional water demand in a system that has inadequate supplies during drought periods and that may not have adequate supplies in normal water years after 2015. The contribution of the proposed project to this impact would not be cumulatively considerable.
Applicable LRDP EIR Mitigation:	UTIL-9A

Significance with LRDP Mitigation:	Less than significant
Project Mitigation:	Not required

As discussed under ECI Impact UTIL-1 in Section 3.15.14.2, above, existing water supplies are adequate to serve the proposed ECI Project during normal water years, and in drought years the campus would reduce its use of water from the City consistent with the curtailments required of other similar users. Therefore, the project impact is less than significant. The cumulative impact would be considered significant if the cumulative water demand would trigger the need for new or expanded water resources, the development of which would have significant environmental impacts.

As explained in Section 3.0, cumulative analysis in this EIR is based on a list of past, present, and probable future projects producing related or cumulative impacts. The study area for the analysis of cumulative water impacts is the area within the City of Santa Cruz water service boundaries, which includes UC Santa Cruz, the city of Santa Cruz, a portion of the city of Capitola, and some unincorporated areas of Santa Cruz County. UC Santa Cruz and City of Santa Cruz projects that would contribute to this impact are listed in Table 3.0-1. For the analysis of cumulative water supply impacts, an estimate of water demand for reasonably foreseeable projects in areas outside the City that are within the City's water service area was obtained from the City of Santa Cruz Planning Department.

The City of Santa Cruz estimates that City of Santa Cruz, City of Capitola, and County projects that have been approved, are under construction, or have pending applications would result in a cumulative additional water demand of approximately 160 mgy (Strelow 2009). The University estimates that the water demand from reasonably foreseeable campus projects, including the ECI Project, would be approximately 33 mgy (Table 3.15-4). Therefore, the total cumulative water demand would be approximately 193 mgy.

Table 3.15-4
Projected Water Demand, Pending or Approved Reasonably Foreseeable Projects

NAME/ADDRESS	DESCRIPTION	PROJECTED WATER DEMAND (MGY)
City of Santa Cruz projects	See list in Table 3.0-1	103.4
City of Capitola projects	82-room hotel and 2 single-family dwellings	2.6
County of Santa Cruz projects	68 single-family dwellings/lots, 146 multi-family dwellings; 215,276 sf commercial, 100,453 sf low-use (church & storage); two parks; and extension of service to an existing residential subdivision development (Rolling Woods)	54
Subtotal, non-UC Projects		**160**
UC SANTA CRUZ PROJECTS		
ECI Project	Student housing (600 beds)	8.1
Infrastructure Improvements, Phase 1 (cooling tower)	Improvements to campus cooling water system, including new evaporative cooling tower	4
UCSC Ranch View Terrace	84 single-family dwellings	10.7

McHenry Library	Renovation and 85,400 new asf	2.6
Digital Arts Facility	Teaching, research labs, offices – 24,000 new asf	1.2
Cowell Student Health Center	Renovation and 7,600 new asf	0
Biomedical Sciences Facility	Research labs and offices: 57,200 asf	1.9
Porter A and B Student Residence Hall Additions	Student housing (298 beds)	1.8
Social Sciences Facility Phase 1	Teaching, research labs & offices – 25,000 new sf	1.2
Environmental Sciences 1 – Marine Sciences Campus	Research labs and offices – new 25,000 asf	1.2
Subtotal, UC Projects		**33**

Sources: Estimated water demand for City of Santa Cruz, City of Capitola and County of Santa Cruz projects was provided by Strelow, 2009. Estimated water use for UC Santa Cruz projects was obtained from the relevant project CEQA documents, with the exception of the Social Sciences Facility Phase 1 and Environmental Sciences Project. For these two projects, the water demand was assumed to be similar to that of the Digital Arts Facility, which will be approximately the same size.

As discussed in Section 3.15.1.2, in normal water years the City estimates that there is approximately 300 mgy of remaining water supply capacity for allocation to new development with the City's existing water sources and infrastructure (City of Santa Cruz 2006). Therefore, in normal water years, existing water supplies will be adequate to serve the projected cumulative demand of projects through 2015, along with the demand associated with the ECI Project (which would be occupied beginning in 2011).

The City's existing supplies are not, however, adequate to meet current demand in drought years. Increase in water demand associated with reasonably foreseeable future projects and background population growth would result in a significant cumulative impact related to this shortfall. As described in Section 3.15.1.2, the City is actively implementing effective water conservation programs.

The City is also pursuing development of a desalination plant to provide a supplemental water source for drought conditions, with potential for expansion to accommodate future growth. Because the project-specific details of the proposed desalination plant have not been developed by the City and the City has not selected a preferred site, the program EIR prepared for the City's Integrated Water Plan (IWP pEIR) does not evaluate the project-specific impacts of a desalination plant. Hence, any attempt by the University to do so at this time would be speculative. When the City proposes a specific desalination facility project, the City will conduct project-level environmental review, which will assess site-specific impacts of the plant design, provide details of a pipeline route and right-of-way if necessary, re-evaluate the growth projections, confirm the timing and level of expansion for the next increment of water supply, and readjust the capacity and timing of the future expansion.

The IWP pEIR does, however, consider the impacts of desalination plant development at a program level (EDAW 2005).The IWP pEIR identified one significant and unavoidable impact at the project level of the desalination plant: the noise associated with the construction of new water conveyance pipelines, within existing roadways where noise-sensitive receptors include residences, schools, churches and facilities. Although this impact would be temporary, it cannot be mitigated. The IWP pEIR identified the following potentially significant impacts associated with the desalination plant that would be reduced to a less-than-significant level by mitigation:

- Effects on surface and ocean water quality from construction, from storage, use and disposal of chemicals, and from the discharge of seawater concentrate
- Placement of structures in flooding hazard zones, which could expose people and structures to the risk of injury or loss, or could alter drainage and runoff characteristics such that downstream flood hazards would be increased
- Disturbance to offshore habitat by construction or by anchors or moorings
- Construction and operational impacts to adjacent land uses and conflicts with existing land use designations and goals, policies, and programs of affected jurisdictions
- Impairment by construction activities of recreation facilities and activities in the ocean and at parks adjacent to the desalination plant and pipeline corridors
- Preclusion of future development at the selected desalination area
- Impacts to special-status plant species, and to special-status birds, reptiles and/or amphibians, and mammals
- Input of sediment and/or pollutants into steelhead habitat
- Increased sedimentation, erosion, and/or pollution into wetland and/or waters of the U.S
- Air emissions from project construction air emissions and from storage and use of hazardous chemicals in desalination plant processing
- Potential damage to proposed Program facilities and/or persons involved in construction and operation of facilities (including loss, injury or death) due to seismic hazards
- Potential for soil erosion and sedimentation from construction activities
- Damage to Program facilities from corrosive or expansive soils
- Destruction or damage to known cultural resources from construction of pipelines and to as-yet undiscovered/unrecorded archaeological sites and human remains
- Damage to or interference with existing utility lines from construction activities
- Generation of a large volume of waste materials from construction and operation of the desalination plant and conveyance facilities
- Conversion of the abandoned wastewater treatment plant pipeline and outfall for use as the intake for the desalination plant would preclude its use for future emergency effluent flows
- Adverse effects of construction on the visual character of adjacent land uses
- Degradation of the existing visual character of the area near the desalination plant
- Potential for light and glare from the desalination plant
- Accidental release of hazardous materials, resulting from construction or from operation of the desalination plant

- Construction-related disturbance of existing contaminated soils and/or groundwater
- Increase in traffic volume associated with desalination facility operations
- Construction traffic impacts, increase in traffic, short-term traffic delays for vehicles travelling past construction zones, safety problems on adjacent land uses or streets, increase in wear and tear on the designated haul routes, temporary disruption to bus service, and effects on rail operations

The projected water demand of the proposed ECI Project is approximately 8.1 mgy, which is approximately 2.7 percent of the City's remaining water supply capacity. Project demand would be minimized with high-efficiency plumbing fixtures, low-water-use landscaping, and an extremely efficient irrigation system. As part of the 2008 Settlement Agreement, the University will pay fees equivalent to the City's System Development Charges for Equivalent Residential Units for increases in campus water demand[11]. The System Development Charges are used in part to implement conservation programs and to provide funding for new water sources including the planned desalination plant.

Under the 2008 Settlement Agreement, the University agreed to implement, over the next five years, a list of water conservation projects identified in the 2007 campus water efficiency study (Maddaus 2007). The City's UWMP demand projections assume approximately 2.3 mgy in conservation savings at UC Santa Cruz. However, the campus anticipates that these projects would result in a reduction in water use by existing campus facilities of approximately 30 mgy (Maddaus 2007). Therefore, these savings would offset approximately 27 mgy of the projected 32 mgy demand from the campus projects included in this cumulative analysis. Accordingly, although total demand in the service area could exceed existing supplies after 2015, new campus demand would account for 5 mgy, or 1.7 percent of the remaining 300 mgy capacity. Like other City customers, under drought conditions the campus would be required to curtail water use by varying amounts, depending on the severity of the drought. The water efficiency measures included in the proposed project would minimize the project's incremental contribution to the cumulative water supply impact, and the conservation measures the campus has agreed to implement over the next five years would partly offset the project's demand.

The project's demand, as reduced by the conservation measures described above, would not be a cumulatively considerable contribution to overall demand in the City service area. The project, therefore, would not make a cumulatively considerable contribution to the significant cumulative impacts related to drought-year shortfalls, including the potential impacts of the desalination plant.

Wastewater

The 2005 LRDP EIR concluded that wastewater generated by campus development under the 2005 LRDP, in conjunction with other regional development, would not exceed the capacity of the City of Santa Cruz wastewater treatment plant. At full development, the campus would generate 557,535 gpd

[11] An Equivalent Residential Unit is the average amount of water used annually by a single-family residence in the SCWD service area.

or 0.56 million gpd of wastewater. The treatment plant has a remaining capacity of 7 million gpd, is currently operating at about 60 percent of capacity and is projected to have available capacity to treat wastewater from its service area through 2020. Therefore, the cumulative impact would not be significant.

Solid Waste

The 2005 LRDP EIR concluded that solid waste generated by development under the 2005 LRDP in conjunction with other regional development, would not exceed the capacity of the City of Santa Cruz landfill. The City landfill at present has a remaining capacity of 58 percent of its total capacity and is not projected to reach capacity until 2037, well beyond the horizon year of the 2005 LRDP. Because the landfill is for the exclusive use of the City and its residents, cumulative disposal needs from areas outside the city are not considered to apply to that landfill. On-going City and campus recycling programs would help to minimize the amount of solid waste disposed of at the landfill. The proposed project is within the scope of the development analyzed in the 2005 LRDP. Therefore, the cumulative impact would not be significant.

Electricity

Peak campus electricity demand in 2008 was 8.9 megavolt-amperes (MVA) (Tramble 2009).The 2005 LRDP EIR projected that peak campus electricity demand would increase to approximately 21.01 MVA in 2020. The increased demand for electricity under the 2005 LRDP, in conjunction with other regional demand, could result in the need for more regional electricity generation capacity and for local upgrades to off-campus electrical lines, including an upgraded PG&E service to the campus substation. The upgraded service would be provided by re-conductoring existing power lines within city streets, along Highway 1 and through the Pogonip using existing electrical poles. The 2005 LRDP EIR concluded that because the construction of off-campus electrical system improvements would occur within existing utility corridors, which are already disturbed areas, such improvements would be anticipated to result in less-than-significant impacts on biological and cultural resources. In addition, because of the small scale of the likely improvements, potential air, noise or water quality impacts from construction activities would also be limited and less than significant, and in any case would be expected to be mitigated to a less-than-significant level. The proposed project is within the scope of the development analyzed in the 2005 LRDP EIR. Therefore, the project would not contribute to a significant cumulative environmental impact with respect to demand for improvements to electrical generation and distribution facilities.

Natural Gas

The 2005 LRDP projected that peak campus natural gas demand in 2020 would increase from 656 therms/hour in 2003 to 1,850 therms/hour in 2020. This may result in the need for a new underground pipeline from Mission Street on the lower west side of Santa Cruz, to deliver natural gas to the campus at adequate pressure. Possible routes for this pipeline include a short segment of High Street, and Bay Street or Western Drive down to Mission Street. The proposed project would contribute to the need for the new pipeline. The 2005 LRDP EIR concluded that since the likely improvements would occur within existing utility corridors, which have been previously disturbed, and because the scale of the improvements would be small, the potential air, noise or water quality impacts from construction activities and the impacts on biological and cultural resources would likely be less than significant, and in any case could be mitigated to a less-than-significant level. The proposed project would not change the conclusions of the 2005 LRDP EIR. Therefore, the project would not contribute to a significant impact related to construction of improvements to natural gas distribution systems.

Telecommunications

New and expanded telecommunication facilities and infrastructure would be built in conjunction with new development under the 2005 LRDP to serve areas of the campus not currently served. The proposed project would not contribute to the need for new or expanded telecommunications facilities, on or off campus. Therefore, the proposed project would not contribute to a cumulative environmental impact from construction of new telecommunications facilities and infrastructure.

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CHAPTER 4 ALTERNATIVES

TABLES

FIGURES

Chapter 4

Alternatives

CEQA requires an EIR to describe and evaluate a range of alternatives to the proposed project, or alternatives to the location of the proposed project. The purpose of the alternatives analysis is to explore ways that the project objectives could be attained while reducing or avoiding significant environmental impacts of the project as proposed. This process is intended to foster informed decision-making and public participation in the environmental process.

During the scoping process for this EIR, the following comments were received:

- Consider alternatives to the project including reducing enrollment to levels that can be accommodated by currently available housing
- Locating increased UC enrollment on other existing campuses or at new campuses in larger communities
- Completing mitigations of existing impacts prior to further growth in enrollment or construction of additional facilities
- Delaying enrollment increases until housing needs of students, faculty and staff can be met according to the 1988 LRDP goal of housing 70 percent of students

These comments are addressed in this section.

4.1 PROJECT OBJECTIVES

Alternatives considered in the EIR should be feasible, and should attain most of the basic project objectives. The objectives of the proposed ECI Project are:

- Provide sufficient on-campus housing to meet existing and projected student housing demand
- Provide new on-campus housing on a schedule commensurate with enrollment growth, to meet the campus's obligations under the 2008 Comprehensive Settlement Agreement
- Provide enough student apartment units to keep pace with increasing student demand for this type of housing
- Continue the development of on-campus housing within existing colleges to maintain a supportive and cohesive student community that is well integrated with all aspects of campus life.
- Develop in a manner that supports preservation of previously undeveloped natural areas and minimizes new development footprint
- Create a strong living community in a desirable living environment for upper division students, with features that encourage the choice of on-campus housing over off-campus alternatives.

- Support and further the campus's transportation demand management goals, in a manner that is consistent with the University's sustainability goals, through development that is well-served by bicycle, pedestrian, and transit facilities integrated with the existing circulation network, and that encourages increased reliance on sustainable transportation modes and reduces the need for residents to have and to use motor vehicles on campus.
- Develop in a manner that encourages efficient use of campus lands.

Three alternatives are analyzed in this section:

1) West Campus Infill
2) Valley Site Plan
3) No Project

4.2 OVERVIEW OF SIGNIFICANT IMPACTS OF THE PROPOSED ECI PROJECT

The range of alternatives studied in the EIR must be broad enough to permit a reasoned choice by decision-makers when considering the merits of the project. The analysis should focus on alternatives that are feasible; i.e., that may be accomplished in a successful manner within a reasonable period of time; and that take economic, environmental, social and technological factors into account. Under CEQA, alternatives that are remote or speculative should not be discussed in the alternatives analysis. Furthermore, alternatives should focus on reducing or avoiding significant environmental impacts associated with the project as proposed.

As described in the EIR, the project (with mitigations) would result in a significant unavoidable adverse impact on the on-campus visual character and quality of the project area and a significant temporary impact on ambient noise during project construction. The EIR also identifies some potentially significant impacts, which would be reduced to less-than-significant levels after mitigation; some of these impacts may also be reduced by adopting alternatives to the proposed project. This discussion will focus on alternatives which have the potential to address significant and potentially significant impacts in the following categories: aesthetics, biological resources, hydrology, and transportation and circulation.

The analysis below presents the alternatives that were considered for this project. As required by the CEQA Guidelines, a No Project Alternative is also analyzed. Each alternative is examined for its ability to reduce environmental impacts relative to the proposed project, feasibility of implementation, and ability to meet project objectives.

4.3 ALTERNATIVES CONSIDERED BUT REJECTED AS INFEASIBLE

This section discusses alternatives that were considered for the project but were rejected because (a) they did not meet project objectives, (b) or were found to be infeasible for technical, environmental, or social reasons, or (c) would cause additional potentially significant adverse environmental impacts beyond the proposed project's potential impacts. A discussion of rejected alternatives is provided below.

- **Alternative footprint at the same site.** The Campus considered building the same number of bedspaces at the same site, with two 10-story high rises and five buildings ranging from four to eight stories. This scheme would have broken the buildings into smaller masses, allowing for cross-pedestrian circulation, light, and views through the spaces between the buildings. This alternative would remove all of Parking Lot 111, necessitating construction of replacement parking on nearby undeveloped land. The Campus rejected this alternative for several reasons. First, this alternative would not reduce the significant and unavoidable aesthetic impacts of the proposed project. Second, construction of this alternative would be more expensive than the proposed project, which could result in higher housing costs for students, which would in turn make the housing less desirable as an alternative to off-campus housing. Third, this alternative would remove all of Parking Lot 111, necessitating the construction of replacement parking on undeveloped, partly forested land north of the fire station parking lot. Therefore, this alternative would disturb a larger area of undeveloped land, add more impervious surface, and require removal of a larger number of trees than the proposed project, thus increasing the project's potential to cause biological and water quality impacts.

- **Smaller buildings at the project site.** The Campus studied the possibility of building eight to 11 apartment buildings similar in size to the Crown/Merrill Apartment buildings (three stories) on the proposed project site. This alternative would provide only 220 beds, which would not meet the project objectives, while removing all of Parking Lot 111. This would necessitate construction of replacement parking nearby, in the same manner as described above for the alternative footprint at the same site.

- **New housing on north campus.** Under this alternative, the Campus would construct the project on land in the north campus that the 2005 LRDP designates Colleges and Student Housing. This would require construction of an extension to Chinquapin Road and could necessitate construction of an additional emergency entrance/egress route to Empire Grade Road including a new bridge across Cave Gulch. Planning, design and construction of these new roads would take several years, and funding is not yet available for them. In addition, as part of the 2008 Settlement Agreement, the University agreed to initiate development of new housing within the existing developed campus environs before developing new bed spaces in the north campus. Any proposal to implement development on the north campus would involve multiple responsible agency approvals and infrastructure improvements, thereby causing significant delay in the campus's ability to provide additional on-campus student housing.

- **Alternative location west of Porter College.** During development of the 2005 LRDP, the Campus evaluated the potential for development of student housing west of Porter College and south of Kresge College. A portion of this site is designated College and Student Housing in the 2005 LRDP; the remainder is designated Campus Resource Land. Like the proposed project, this alternative could have visual impacts and would require removal of trees and a timberland conversion permit and timber harvest plan. The project would also require an amendment to the 2005 LRDP to allow development of student housing on land currently designated as Campus Resource Land. As part of a larger west campus area plan, the Campus is considering development of housing at this location in the future. This alternative was not considered as an alternative to the proposed project because it would require an LRDP amendment, and because a two year planning effort is underway to explore a comprehensive development plan for the site. To maximize in-fill development and to ensure the efficient use of campus lands, it would be premature to propose a single development project before the west campus area plan is completed.

- **Alternate location at Cowell-Stevenson parking lot.** The Cowell-Stevenson parking lot, which is located south of McLaughlin Drive opposite Crown and Merrill Colleges, is designated in the 2005 LRDP as Colleges and University Housing. This site is also considered a possible location for future collector parking because of its proximity to the Humanities buildings and Quarry Plaza, and because the existing trees and topography would minimize the visibility of a parking structure. The Campus evaluated building three stories of student housing over a two-story parking structure at this location. This would accommodate only 108 beds, which would fall far short of meeting the project objectives of providing additional student housing commensurate with the demand for student apartments.

- **Alternate location north of Kresge College.** A 19-acre wooded area west of the North Remote Parking Lot and north of Kresge College is designated Colleges and Student Housing and considered a good location for a future residential college. This site includes the existing 42-unit Camper Park. This site is large enough to accommodate the proposed project but would not meet the project objectives of providing housing in conjunction with an existing college, preserving the natural environment and minimizing the footprint of new development. Furthermore, construction of the proposed project on this site would constrain the options for future development of new colleges consistent with the objectives of the 2005 LRDP.

- **Adding floors to existing residence halls.** The Porter College House B Addition project, currently under construction, will provide additional housing by adding a new floor to an existing residence hall. The Campus also has proposed to add two floors to Porter College House A. These building additions are feasible because the existing concrete structures (with seismic retrofits that are required in any case) are capable of supporting the additional load. In addition, extensive renovation and structural work is required for major maintenance, which has resulted in the need to vacate each building for an entire year. Most of the remaining student housing buildings, including Crown/Merrill Apartments, are wood frame and would not support additional floors without complete reconstruction. The other student housing buildings that have concrete structures are residence halls rather than apartments, and/or are relatively new and not in need of the major renovation and structural work that would make the addition of new floors feasible.

The following alternatives proposed by commenters during the scoping period are not analyzed in detail because they would not achieve any of the objectives of the project:

- Reducing enrollment to levels that can be accommodated by currently available housing

- Locating increased UC enrollment on other existing campuses or at new campuses in larger communities

- Delaying enrollment increases until housing needs of students, faculty and staff can be met according to the 1988 LRDP goal of housing 70 percent of students

4.4 SUMMARY OF ALTERNATIVES

The alternatives presented below represent a reasonable range of alternatives that would permit the campus to achieve most of the proposed project's objectives while potentially reducing some of the environmental impacts of the project. The proposed project would have a significant unavoidable adverse impact on the visual character and quality of the project area, and a significant unavoidable temporary noise impact from construction activities. The proposed project would also have potentially significant impacts on land use, biological resources, hydrology, and transportation that could be reduced to less-than-significant levels through the adoption of mitigation measures. Some of those impacts might also potentially be reduced by the development of alternatives to the project.

Alternative 1, West Campus Infill, would construct approximately the same number of beds as the proposed project in 18 separate, three-story buildings at Oakes College, College Eight and Porter College. The population-related impacts of this alternative (population and housing, recreation, public services) would be the same as those of the proposed project. This alternative would increase the density of development in areas that are visible from off-campus or lower campus vantage points. However, it is likely that the visual impacts of this alternative would not be significant, as the scale of the new buildings would be similar to that of existing buildings nearby and the alternative would not extend development into large areas of previously undeveloped open grassland. This alternative would not entail removal of commercial tree species. The West Campus Infill Alternative could remove small areas of coastal prairie, which is a sensitive natural community, and could affect potential upland movement habitat for California red-legged frog, a federally-listed threatened species. With implementation of previously adopted LRDP mitigations, these biological resources impacts would be mitigated to a less-than-significant level. This alternative would create a larger amount of impervious surface than the proposed project, and would add runoff to drainages with existing erosion conditions. Therefore, the potential for significant impacts on water quality would be greater than under the proposed project.

Alternative 2, Valley Site Plan, would construct a smaller project on and adjacent to the project site. Under this alternative, three four- to six-story buildings would be constructed along the toe of the slope of the natural drainage, rather than along the ridge line. These buildings would include approximately 470 bed spaces. This alternative would reduce the aesthetic impact of the proposed project because the buildings would be less visually prominent, but the impact may still be considered significant and unavoidable because the new buildings would be more massive than the existing buildings in the area. The proximity of the buildings to Crown/Merrill Apartments could diminish the natural light that reaches the lower buildings of that complex. This alternative, like the proposed project, would be close to occupied residential facilities, and thus would not avoid the proposed project's significant and unavoidable construction noise impact on residents of adjacent buildings. The impervious surface area added to the Gully H watershed, and consequently the potential for causing erosion in that drainage, would be similar to the area added under the proposed project. This alternative likely would result in a larger number of off-campus vehicle trips than the proposed project, as a smaller number of students would be housed on the campus. The alternative would utilize a larger area than the proposed project while providing less housing. Therefore, the alternative provides a lesser benefit than the proposed project with respect to reduction of student demand for off-campus housing, and would necessitate construction of additional housing sooner than the proposed project.

Alternative 3, the No Project Alternative, would eliminate most of the direct environmental impacts of the project impacts but would not contribute to the achievement of any of the project objectives. Furthermore, without the project, 600 students who would reside on the campus under the proposed project, instead would live off campus, and would contribute to off-campus traffic and air quality and climate change impacts related to commuting, and to any environmental impacts associated with the development of housing in the city and county of Santa Cruz that might be undertaken by others to meet local housing demand.

The following subsections describe the alternatives evaluated in this EIR in greater detail. Following the description of each alternative is an evaluation of the impacts of the alternative as they differ from those of the proposed project and an evaluation of the ability of each alternative to fulfill project objectives. Table 4-1 presents a summary of the impacts of each alternative compared to those of the proposed project, assuming that reasonable mitigation measures are implemented for each. Table 4-2 summarizes the ability of each alternative to achieve the stated project objectives. Alternative 2 is the environmentally superior alternative.

Table 4-1
Comparison of Impacts of Project Alternatives (After Mitigation)

Environmental Issue Area	Proposed Project	Alternative 1 West Campus Infill	Alternative 2 Valley Site Plan	Alternative 3 No Project
Aesthetics	SU	–	=/–	–
Agricultural Resources	No impact	=	=	=
Air Quality and Climate Change	LS	+	=	+
Biological Resources	LS	=	=	–
Cultural Resources	LS	=	=	–
Geology and Soils	LS	=	=	–
Hazards and Hazardous Materials	LS	=	=	–
Hydrology and Water Quality	LS	+	=	–
Land Use	No impact	+	=	=
Noise	SU	=	=	–
Population and Housing	LS	=	=/+	+
Public Services	LS	=	=	=
Recreation	LS	=	=	=
Transportation and Circulation	LS	=	=/+	+
Utilities and Service Systems	LS	=	–	–

Notes: LS: less than significant; SU: significant and unavoidable. +: alternative would have greater environmental impacts than the project; – : alternative would have reduced environmental impacts than the project; =: impacts of the alternative would be the same as or similar to those of the project.

Table 4-2
Relationship of Alternatives to Project Objectives

Project Objectives	Proposed Project	Alternative 1 West Campus Infill	Alternative 2 Valley Site Plan	Alternative 4 No Project
Provide sufficient on-campus housing to meet student housing demand.	X	X	P	0
Provide new on-campus housing on a schedule commensurate with enrollment growth, to meet the campus's obligations under the 2008 Comprehensive Settlement Agreement.	X	X	P	0
Satisfy student demand for apartment units.	X	X	P	0
Continue the development of on-campus housing within existing colleges to maintain a supportive and cohesive student community that is well integrated with all aspects of campus life.	X	0	X	0
Develop in a manner that supports preservation of natural areas and minimizes new development footprint.	X	P	X	0
Create a strong living community in a desirable living environment for upper division students, with features that encourage the choice of on-campus housing over off-campus alternatives.	X	0	P	0
Support and further the campus's transportation demand management goals.	X	X	P	0
Develop in a manner that encourages efficient use of campus lands.	X	0	P	0

Notes: X=fully meets project objectives; P=partly meets project objectives; 0 = does not meet project objectives

For each alternative, a brief description is first presented, followed by a summary impact analysis of the alternative in comparison to proposed project, and an assessment of the degree to which the alternative would meet project objectives.

4.4.1 Alternative 1. West Campus Infill

4.4.1.1 Project Characteristics

Under Alternative 1, West Campus Infill, the Campus would develop a total of about 600 beds of apartment-style student housing as infill development at Oakes College, College Eight, and Porter College. Under this alternative, the new buildings would be similar in size and appearance to the existing buildings at each of the colleges, which are generally two to three stories. These areas are all designated Colleges and Student Housing in the 2005 LRDP.

A total of 19 buildings would be constructed. At Oakes College, three buildings would be constructed: one in open grassland northwest of the existing residence halls, south of the Oakes/College Eight parking lot; one in a landscaped area north of the existing service road for the residence halls; and one at the head of a small tributary to Moore Creek, just north of the existing pedestrian bridge between the residence halls and the amphitheater. At College Eight, 11 buildings would be constructed around the existing development surrounding the lower and upper quads. This alternative would remove all of Parking Lot 160 and the upper tier of Parking Lot 162, a total of approximately 60 spaces but would not construct replacement parking. It would develop most of the open meadow between College Eight and Heller Drive, as well as landscaped areas northeast and northwest of the upper quad. At Porter College, the West Campus Infill Alternative, five buildings would be constructed on the knoll south of the Porter Dining Common and Academic buildings, north of Heller Drive.

Service and emergency access for the building sites would likely be provided on existing access roads, except at Porter, where a new service road would be constructed across the meadow from the existing parking lot to the new buildings. This alternative would not create a central outdoor space and would not include a new café or other public spaces. Laundry facilities would be incorporated into at least one of the new buildings at each college.

4.4.1.2 Setting

All of the West Campus Infill Alternative sites are visible from Heller Drive and from various points along Empire Grade. As shown on Figures 4.1.2 and 4.1.12 (Volume II) in the LRDP EIR, the existing buildings in this area are shorter than the trees in the nearby forests, which, under existing conditions, are visible between and above the buildings. The 2005 LRDP identifies the knoll at Porter College and the Oakes field as prominent vantage points for sweeping views of Monterey Bay.

All of the sites that would be developed under this alternative are underlain by schist. All of the sites are in the Moore Creek watershed, except the western portion of the Porter College site, which is in the Cave Gulch watershed. The Oakes College site drains to the Middle Fork of Moore Creek, a small drainage that originates on the project site and flows to the Arboretum pond. The College Eight site drains to the West

Entrance Fork of Moore Creek, by way of the College Eight detention basin, which is located southwest of the intersection of Heller Drive and Lower Koshland Way. A small spring is located just east of Heller Drive adjacent to the College Eight site. Severe erosion conditions are present in the West Entrance Fork. These conditions are at least partly a result of the sediment and vegetation that has filled the College Eight detention basin. The Porter College site discharges to two sinkholes that also capture runoff from a portion of the Family Student Housing complex.

The Porter College site and the western portion of the Oakes and College Eight sites are grassland; the remainder of the Oakes and College Eight sites are landscaped. The grasslands on the campus are generally dominated by nonnative annual grasses, including wild oats (*Avena barbata*), brome grasses (*Bromus* spp.), and rattlesnake grass (*Briza maxima*). Nonnative forbs, such as English plantain (*Plantago lanceolata*) and bristly ox-tongue (*Picris echioides*), are also common in these areas. Small areas of coastal prairie, a unique and sensitive grassland type that supports a diverse assemblage of native perennials, have been identified on the Porter College site (Biotic Resources Group 2008b). On the east side of Heller Drive, adjacent to the College Eight site, an area kept moist by the small spring described above supports willow riparian woodland, which is considered a sensitive natural community (Biotic Resources Group 2006). Suitable breeding and movement habitat for California red-legged frog, a federally-listed threatened species, is present within the Moore Creek watershed along Moore Creek and its tributaries and in the Arboretum Pond. Red-legged frogs have been observed in the East Fork of Moore Creek, southeast of Oakes College, and in the West Entrance Fork, near the West Remote Parking Lot. Red-legged frogs may also occur in marginal upland habitats adjacent to Moore Creek during juvenile dispersal or adult aestivation. The UC Santa Cruz campus has been surveyed for the presence of cultural resources, and no historic or prehistoric resources are known to be present on any of the sites or in its immediate vicinity.

4.4.1.3 Impact Analysis

Aesthetics

The West Campus Infill Alternative would have reduced visual impacts relative to the proposed project. The proposed project would remove patches of redwood forest and introduce buildings that are more massive than the existing development in the vicinity and would substantially degrade the visual character of the project site. This alternative would increase the density of development in the west campus area, and the new buildings would be visible from points along Empire Grade and Heller Drive. However, the new buildings would not significantly affect the views from Empire Grade, because the buildings would be similar in scale to the existing development and would be interspersed among several existing developments over a wide area. The added buildings at Porter would obstruct long-range views from rooms along the south side of the Porter Academic Building and from the patio at the Porter Dining Commons. Long-range scenic views of Monterey Bay would still be available from the southern end of the knoll, which would not be developed.

Agricultural Resources

There is no agricultural land on or near the project site. Neither the proposed project nor the West Campus Infill Alternative would create any significant impacts on agricultural resources.

Air Quality and Climate Change

The West Campus Infill Alternative would have a larger area of disturbance than the proposed project, which could create greater construction air quality impacts than the proposed project, because multiple projects would be carried out at several locations simultaneously. This alternative would avoid the minor contribution to project greenhouse gas emissions that would result from the tree removal under the proposed project. However, overall, the operational air quality and climate change impacts of the proposed project would be somewhat greater those of the proposed project because larger, compact buildings such as those that would be constructed under the proposed project are inherently more energy efficient than a larger number of smaller buildings such as those included in this alternative.

Biological Resources

The West Campus Infill Alternative would have less potential to result in impacts to bats, nesting birds, and San Francisco dusky-footed woodrat than the proposed project, as the alternative sites mostly lack the appropriate forested habitat. This alternative, however, would remove or disturb temporarily small areas of coastal prairie, which could require mitigation. The 2005 LRDP EIR concluded that impacts to coastal prairie would be mitigated to a less-than-significant level through implementation of LRDP Mitigation BIO-2A and BIO-2B, which require restoration of coastal prairie elsewhere on the campus. The alternative project sites in the Moore Creek watershed are suitable breeding and movement habitat for California red-legged frog. The alternative would affect potential upland movement habitat for California red-legged frog, which would be mitigated to a less-than-significant impact through implementation of LRDP Mitigation BIO-9.

Cultural Resources

There are no historic resources and no known archaeological resources on either the proposed project site or the West Campus Infill Alternative sites. Neither the proposed project nor the alternative would result in significant cultural resources impacts.

Geology, Soils and Seismicity

Based on existing information, all of the sites that would be developed under the West Campus Infill Alternative are underlain by schist, which is considered to have a low potential for karst hazards (Nolan Zinn 2005). There is some potential for karst hazards, as marble may occur as isolated lenses or pods, or at depth. At both the proposed project site and the alternative site, implementation of LRDP Mitigation GEO-1 would reduce the impact to a less-than-significant level.

Hazards and Hazardous Materials

There are no hazardous materials used on or in the immediate vicinity of the West Campus Infill Alternative project sites, other than materials commonly used in household cleaning and in building and landscape maintenance. No hazardous materials are stored on the sites. Under this alternative, no existing buildings would be demolished, so the less-than-significant project impact associated with asbestos- and lead-containing building materials in the preceptor house that would be demolished as part of the proposed project would not occur with this alternative. The potentially significant temporary impact on fire department operations, related to the proximity of the proposed project site to the campus fire station, would not occur under this alternative, and ECI Mitigation HAZ-1 would not be required. West Campus

Infill Alternative would be constructed in grassland areas, where the wildland fire hazard is greater than in the campus's redwood forest areas. This alternative would also be constructed in proximity to the Moore Creek corridor, which is designated as a fire hazard area in the City's General Plan Hazard Element. However, the project would increase the density of development within already-developed grassland areas, which would decrease the potential for wildland fires, and the impact would be less than significant.

Hydrology and Water Quality

The West Campus Infill Alternative would add approximately 3.1 acres of new impervious surface to the campus, nearly three times as much as the proposed project. Under this alternative, the new impervious surface would result in increased runoff in the Moore Creek watershed, where existing erosion problems have been identified. If not properly managed, the additional storm water runoff could exacerbate the existing erosion conditions in that drainage, which would be a potentially significant impact. The sites where the new buildings would be constructed under this alternative are underlain by schist, which offers greater opportunities for storm water infiltration than the marble that underlies the proposed project site. The nearby grassland areas (west of Porter College and the north of the West Remote Parking Lot and south of Oakes College) potentially could be used for infiltration. However, because of the large amount of impervious surface and the existing erosion conditions in the Moore Creek watershed, the potential for significant impacts on water quality would be greater than under the proposed project.

Land Use and Planning

The West Campus Infill Alternative sites and the areas surrounding these sites are all designated Colleges and Student Housing under the 2005 LRDP. Therefore the West Campus Infill Alternative would be consistent with the LRDP land use designation and would be compatible with the adjacent existing and future development. The building program would be the same as the proposed project and would be consistent with the building program outlined in the 2005 LRDP. Like the proposed project, the alternative would be consistent with LRDP policies of providing an array of housing opportunities for students and facilities that enrich the quality of campus life and of including sustainable practices in campus development and maintenance of natural surface drainage flows. Similar to the proposed project, the alternative would maintain the campus's core configuration, and would take advantage of existing public transportation and promote a walkable campus. However, the footprint of the West Campus Infill Alternative would be approximately twice as large as that of the proposed project, which would not be consistent with the campus LRDP goal of efficiency in building layout and minimizing new use of natural areas.

Unlike the proposed project, the West Campus Infill Alternative would construct buildings that would be visible from off-campus locations along Empire Grade, a widely accessible viewpoint. However, the new buildings would not significantly affect those views because they would be similar in scale to the existing development and would not be perceived as a large locus of new development, but would be distributed among existing development over a wide area. The alternative sites are not in or adjacent to lands protected by the campus's HCP; therefore, like the proposed project, the alternative would not conflict with a Habitat Conservation Plan or a Natural Community Conservation Plan.

Noise

Like the proposed project, this alternative would involve construction within close proximity to existing residential facilities; it is likely that the short-term construction noise impacts of the alternative would be significant and unavoidable, as for the proposed project. Similar to the proposed project, the West Campus Infill Alternative would not add significant new sources of operational noise. Traffic is the dominant noise in the vicinity of the alternative sites. The background noise level measured in the area in 2005 (adjacent to Family Student Housing above Heller Drive) was 58 dBA L_{dn} (averaged day/night noise level), which would not exceed the City of Santa Cruz's exterior noise standard of 65 dBA L_{dn} for multi-family residential areas or 60 dBA L_{dn} for single-family residential areas. The 2005 LRDP EIR (Section 4.9) modeled future noise levels at the same location and concluded that these noise levels would not be incompatible with residential construction. Development at the proposed project site would expose residents to noise associated with fire department operations, but this impact would be less than significant with mitigation. The West Campus Infill alternative would not expose residents of the new buildings to fire department operational noise or sirens.

Population and Housing

The West Campus Infill Alternative would accommodate the same population as the proposed project. Therefore, this alternative reduces the potential for off-campus housing impacts associated with enrollment growth under the 2005 LRDP to the same degree as the proposed project. The alternative, like the proposed project would not make a cumulatively considerable contribution to significant cumulative impacts on off-campus housing supply.

Public Services

The demand for public services would be the same under the West Campus Infill Alternative as under the proposed project. Existing public services are adequate to serve the new population and building space, and neither the proposed project nor this alternative would have a significant impact on public services.

Recreation

The demand for on- and off-campus recreation facilities would be the same under the West Campus Infill Alternative as under the proposed project. Existing public services are adequate to serve the new population and building space, and neither would have a significant impact on public services.

Traffic, Circulation and Parking

The West Campus Infill Alternative would generate the same number of trips to the campus as the proposed project, although the trip distribution would be slightly different because it is likely that a larger share of the trips would use the campus's west entrance than under the proposed project. This alternative would add less traffic to the campus's east side intersections (Chinquapin/McLaughlin and Hagar/McLaughlin) than the proposed project but would contribute more traffic than the proposed project to west side campus intersections, including Heller/Meyer and Heller/College Eight.

This alternative would make a similar contribution to the significant impact on off-campus intersection operations identified in the 2005 LRDP EIR as the proposed project, except that more of the traffic associated with this alternative would use the west entrance to campus, which would add more traffic to the Heller/Empire Grade intersection than the proposed project. The Campus is planning to install a signal at that intersection in summer 2009, which would mitigate the projected impacts of 2005 LRDP development to that intersection to a less-than-significant level. The alternative also would contribute traffic to the Empire Grade/Western Drive intersection, which also is operating at substandard levels of service, while the proposed project would contribute very little traffic to that intersection.

The West Campus Infill Alternative would displace approximately 60 of the 251 existing spaces in Parking Zone 7 (Oakes and College Eight). The new demand for close-in parking associated with the project would be 60 spaces, which would be divided between Zone 6 (Porter College) and Zone 7. The current parking utilization rates in these zones are 64 percent and 50 percent, respectively. With the addition of the demand for close-in parking associated with the proposed project, parking demand would increase the overall utilization rate for these two zones to 85 percent. Under Campus parking policy, this level of utilization would not warrant construction of additional parking. The remainder of the project parking demand (about 50 spaces) would be accommodated in the remote lots. The closest remote lot to the West Campus Infill Alternative sites, the West Remote lot, has only 17 spaces available on average; therefore, under this alternative, residents would be obliged to park in more distant remote lots elsewhere on campus.

Under this alternative, construction-phase impacts on parking would be greater than under the proposed project because multiple staging areas would be required for the dispersed construction site. It is possible that the potential parking supply impacts associated with staging could be mitigated by use of open meadow areas near the construction sites to accommodate some of the staging; however, this would carry a potential for biological resources impacts.

The impacts of this alternative on transit delays would be similar to the proposed project.

Utilities

The demand for utilities would be the same under the West Campus Infill Alternative as under the proposed project. The utility lines necessary to serve the new buildings are present in the surrounding developed areas.

4.4.1.4 Ability to Accomplish Project Objectives

The West Campus Infill Alternative would accomplish the following project objectives: providing sufficient on-campus housing to meet student demand; providing housing to meet the Campus commitment under the 2008 Settlement Agreement; and satisfying student demand for apartment units. This alternative would also support and further the campus's transportation demand management goals by constructing new housing in locations that are already well served by existing transportation systems and is within walking distance of facilities in the core campus. Although this alternative would support preservation of natural areas by constructing infill development within already-developed areas, it would not minimize the footprint of new development to the extent that the proposed project would. This alternative would not meet the objective of creating a strong living community and desirable living environment for upper division students, as the housing would be scattered among existing college facilities. The West Campus Alternative also would not meet the project objective of developing in a manner that encourages efficient use of campus lands, as it would use twice as much land as the proposed project to provide the same number of bed spaces.

4.4.2 Alternative 2. Valley Site Plan

4.4.2.1 Project Characteristics

The Valley Site Plan Alternative would construct a smaller project on and adjacent to the same site as the proposed project (Figure 4-2). This alternative would situate the buildings at a lower and less prominent elevation along the toe of the slope of the project site's natural drainage. The alternative would also reduce the potential visual impact by breaking up the building mass into three buildings rather than two, and by retaining large stands of redwood trees near Chinquapin Road, which would provide a partial screen for the new development from this direction. In this scheme, three four- to six-story buildings would accommodate a total of approximately 470 beds, approximately 130 fewer than the proposed project. The total building area (for three buildings) would be approximately 192,820 gsf. This alternative would remove all three terraces of Parking Lot 111; 40 new parking spaces for the new buildings would be provided beneath one of the buildings. Additional parking would be added in a series of small parking lots along the Crown College access road. A lounge, retail space and laundry would be provided in a separate community building.

This alternative would retain the Crown College Preceptors' Apartment building, and would realign a smaller portion of the Crown College access road than the proposed project; therefore, this alternative would avoid removal of some of the trees in this area. The natural drainage that currently is channeled beneath the parking lots via underground pipes would be restored and the stream corridor would be integrated into the open space along the central axis of the site. The Crown College access road and a new access road along the northern perimeter of the site would provide emergency and service access to the new buildings. Pedestrian access to the buildings from Chinquapin Road would be by way of a pathway along the north side of the drainage. Pedestrian travel between Crown/Merrill Apartments and Crown College would be provided through the gap between the two northern buildings and a pedestrian bridge across the restored drainage.

4.4.2.2 Setting

The setting for the Valley Site Plan Alternative would be similar to the setting for the proposed project. This alternative would utilize a portion of the proposed project site but would not include the Crown College Preceptors' Apartment site and would displace all three terraces of Parking Lot 111, a total of about 160 parking spaces. The Valley Site Plan Alternative would develop approximately 470 beds of apartment-style student housing in three four- to six-story buildings. Two buildings would be constructed along the toe of the northern slope of the natural drainage and one along the toe of the southern slope. The natural drainage that currently is channeled beneath the parking lots via underground pipes would be restored and the stream corridor would be integrated into the open space along the central axis of the site. Like the proposed project, the site for this alternative drains to Gully H. The biological and cultural resources surveys for the proposed project covered this area (Biotic Resources Group 2008a; H.T. Harvey 2008; Morgan 2008), and no significant biological or cultural resources impacts were identified. The biological setting would be similar to that of the proposed project site, which consists of redwood forest, non-native grassland and oak woodland interspersed with development. There are no historic resources or known archaeological resources on the site.

4.4.2.3 Impact Analysis

Aesthetics

Under the Valley Site Plan Alternative, the masses of the new buildings would be somewhat smaller than under the existing project, as the buildings would be only four to six stories (compared with seven to eight stories for the proposed project). Under this alternative, the stands of large redwoods along Chinquapin Road would be retained, but many of the trees near the top of the slope below the Crown access road would be removed for construction of new parking spaces, and most of the trees between Crown/Merrill Apartments and the existing parking lots would be removed to allow for construction of the new service/emergency access road. The tops of the new buildings would be taller than the adjacent buildings of Crown/Merrill College and could diminish the natural light that reaches these buildings. Like those of the proposed project, the new buildings would be substantially larger in scale and mass than the existing buildings in the area. The aesthetic impacts of this alternative would be equal to or slightly less than those of the proposed project.

Agricultural Resources

Neither the proposed project nor this alternative would result in any significant impacts with respect to agricultural resources.

Air Quality and Climate Change

The Valley Site Plan Alternative would result in a smaller increase in campus population and a smaller building area than with the proposed project. Therefore, the emissions of criteria pollutants and greenhouse gases associated with building energy use would be reduced. However, the campus population that was not housed on campus would find housing in other regional communities, so the net effect in the region would be similar. Under this alternative, the total building footprint would be slightly larger than under the proposed project, so fugitive dust emissions from construction may be greater, but the building area would be smaller, which would reduce other construction-phase air pollutant emissions. Under this alternative, more students would live off campus than with the proposed project, which could increase the number of vehicle trips and the emissions of criteria pollutants and greenhouse gases associated with these vehicle trips. The air quality impacts of both the proposed project and the Valley Site Plan Alternative would be less than significant with mitigation.

The Valley Site Plan Alternative and the proposed project would result in similar greenhouse gas emissions from project construction, operations and tree removal.

Biological Resources

Impacts to biological resources would be similar to those of the proposed project and the same mitigations would be required. The biological resources impacts of both the proposed project and the Valley Site Plan Alternative would be less than significant with mitigation.

Cultural Resources

Neither the proposed project nor this alternative would create significant cultural resources impacts as no cultural resources are present on either the project site or the alternative site.

Geology, Soils and Seismicity

Like the proposed project, the West Campus Infill Alternative would be constructed on geologic materials where karst hazards are present; however, in both cases, this impact would be less than significant.

Hazards and Hazardous Materials

The reduction in the size of the project and the modified site layout would not reduce the potential temporary impact of construction on fire station operations associated with the proposed project. Under both the proposed project and the Valley Site Plan Alternative, mitigation would reduce this impact to a less-than-significant level. The Valley Site Plan Alternative would not displace the Crown College Preceptors' Apartment Building; therefore, the less-than-significant impact associated with the presence of asbestos- or lead-contaminated building materials would not occur under this alternative.

Hydrology and Water Quality

The Valley Site Plan Alternative would add approximately the same amount of new impervious surface (approximately 1 acre) to Gully H as the proposed project. Both the proposed project and the alternative would include storm water system designs to protect water quality and minimize site runoff. Therefore, similar to the proposed project, the impact would be less than significant.

Land Use and Planning

Neither the proposed project nor the Valley Site Plan Alternative would create any significant land use impacts.

Noise

Neither the Valley Site Plan Alternative nor the proposed project would add significant new sources of operational noise. This alternative would construct new buildings in close proximity to existing residential facilities; therefore, like the proposed project, construction noise impacts would likely be significant and unavoidable.

This alternative would generate fewer vehicle trips to the project site but would result in a larger number of commute trips to campus by students living off campus. Therefore, the alternative could make a smaller contribution than the proposed project to the less-than-significant impact associated with new vehicle trips under the 2005 LRDP. Under this alternative, the buildings would be further from Chinquapin Road and from the fire station**;** however, under both the proposed project and the alternative, the operational noise impact would be less than significant.

Population and Housing

The Valley Site Plan Alternative would add fewer housing units than the proposed project, which could result in a larger number of students seeking housing off-campus. However, neither the proposed project nor the Valley Site Plan Alternative would create any significant population and housing impacts at the project level, and the campus would still be able to meet its housing commitment under the 2008 Settlement Agreement.

Public Services

Neither the proposed project nor the Valley Site Plan Alternative would result in any potentially significant impacts on public services.

Recreation

Neither the proposed project nor the Valley Site Plan Alternative would result in potentially significant impacts related to recreation.

Traffic, Circulation and Parking

The Valley Site Plan Alternative would generate approximately 630 vehicle trips associated with students living in the new buildings, compared with 804 for the proposed project. However, because the alternative would house fewer students, a larger number of students would seek housing off-campus and commute to campus. Therefore, this alternative would make a smaller direct contribution than the proposed project to the significant cumulative impacts on off-campus intersections identified in the 2005 LRDP; indirectly, however, the alternative would make a larger contribution to traffic in these intersections than the proposed project, since more students would commute to the campus under the alternative, while none of the students would commute under the proposed project.

The Valley Site Plan Alternative would remove all three terraces of Parking Lot 111 but would construct new parking beneath one of the buildings. This alternative would result in a net loss of 53 parking spaces, compared with 65 for the proposed project; the direct parking demand from the project would also be smaller under this alternative. The parking impact would be less than significant for both the alternative and the proposed project. However, under the alternative, more students would commute to the campus and overall demand for parking on the campus therefore could be higher.

Utilities

Because the on-campus population associated with the Valley Site Plan Alternative would be smaller, the demand for all utilities under this alternative would be smaller than under the proposed project. However, neither the proposed project nor this alternative would create significant impacts with respect to utilities.

4.4.2.4 Ability to Accomplish Project Objectives

The Valley Site Plan Alternative would provide on-campus housing to meet the Campus's commitment under the 2008 Settlement Agreement through 2013, and would satisfy the current student demand for apartment units. However, this alternative would meet the related objectives to a lesser degree than the proposed project because it would necessitate the completion of the next housing project sooner than would the proposed project. Furthermore, the Valley Site Plan Alternative would provide fewer beds than the proposed project while utilizing a larger area and therefore would not maximize the potential use of the site. This alternative would meet the project objective of co-locating student housing with a college. However, while this alternative would co-locate housing within the campus precinct of an existing college, the east-west alignment of long buildings does not allow for strong connectivity among the project, the Crown/Merrill Apartments, and the existing Crown/Merrill college buildings. This site plan for this alternative also would not include a central outdoor space. Instead, bridges would need to be constructed to connect the Crown/Merrill Apartments with the colleges with no gathering space for social interaction, a key element of all student housing projects. This alternative would have a larger footprint than the proposed project while providing fewer student beds, and therefore would meet the project objective of developing in a manner that encourages efficient use of campus lands to a lesser degree than the proposed project. This alternative would meet the other project objectives to the same extent as the proposed project.

4.4.3 Alternative 3. No Project

4.4.3.1 Setting

The setting for the No Project Alternative would be the same as that described for the proposed project. Additional detailed information on site conditions is provided in the topic sections of the EIR (e.g., *Hydrology and Water Quality*, *Biological Resources*, *Cultural Resources*, *Aesthetics*, *Land Use*, *Noise*, etc.).

4.4.3.2 Project Characteristics

Under the No Project Alternative, the proposed ECI Project, with approximately 600 student beds, would not be constructed at the proposed project site, and the amount of student housing on campus would not be increased accordingly.

4.4.3.3 Impact Analysis

The No Project Alternative would not create any of the significant or potentially significant “footprint” impacts of the proposed project, including the significant and unavoidable aesthetics and construction noise impacts and potentially significant biological resources impacts. The No Project Alternative would result in increased commute traffic relative to the proposed project, because more students would live off campus and commute to the campus for classes and other activities. The No Project Alternative therefore would make a greater contribution than the proposed project to LOS impacts at off-campus intersections. Similarly, because a larger number of students would seek housing off campus, the No Project Alternative would contribute to the significant and unavoidable off-campus housing impact of cumulative development under the 2005 LRDP EIR. The proposed project’s contribution to that impact would be negligible, because the project would include only about eight new employees who would seek housing off campus, and there will be sufficient housing stock in the region at the time the project is developed to accommodate that demand. The No Project Alternative would avoid the greenhouse gas emissions associated with energy use by the new buildings and with tree removal. However, as shown in Table 3.3-8 in Section 3.1, *Air Quality and Climate Change*, by far the largest source of greenhouse gas emissions associated with the proposed project is vehicle trips. Therefore, the larger number of vehicle trips generated by the campus under the No Project Alternative would result in greater climate change impacts.

4.4.3.4 Ability to Accomplish Project Objectives

The No Project Alternative would not meet any of the project objectives. Under this alternative, the Campus may not be able to meet student demand for on-campus housing or to meet the demand for campus apartment units. Without the housing provided by the project, the campus might not be able to provide a sufficient number of housing units to meet the Settlement Agreement commitment for projected enrollment in 2011-12. The No Project Alternative also would not support the Campus's transportation demand management goals, as a larger number of students would live off campus and would not be able to walk to their classes and other campus facilities. This would result in a larger number of vehicle trips to the campus, greater demand for parking, and greater demand on regional public transit.

4.5 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

Table 4-2, at the end of this section, provides a summary comparison of the alternatives with the proposed project, with the purpose of highlighting whether the alternative would result in a similar, greater or lesser environmental impact than the proposed project.

The Valley Site Plan is the environmentally superior alternative, as it would slightly reduce the aesthetic impact of the proposed project. Although it would result in a larger number of students living off campus than the proposed project, and therefore would diminish potential off-campus housing demand and traffic from the campus to a lesser degree than would the proposed project, the alternative still would absorb a substantial part of the student housing demand associated with projected enrollment growth through 2012.

The No Project Alternative would avoid both of the significant and unavoidable aesthetics and construction noise impacts of the proposed project and the potentially significant impact on special status bird species and bat maternity colonies. However , because enrollment increases will occur irrespective of whether the proposed project is constructed, the No Project Alternative could result in greater impacts on off-campus intersections associated with student commute traffic than the proposed project, and the increase in the number of students seeking off-campus housing would contribute to the significant and unavoidable LRDP impact on housing supply. Furthermore, the No Project Alternative would not meet any of the project objectives.

The West Campus Infill Alternative would avoid the significant and unavoidable aesthetic impact of the proposed project but could create significant impacts on water quality.

4.6 REFERENCES

Biotic Resource Group. 2006. Botanical Survey Report, Heller Drive Bike Lane Project. October 20.

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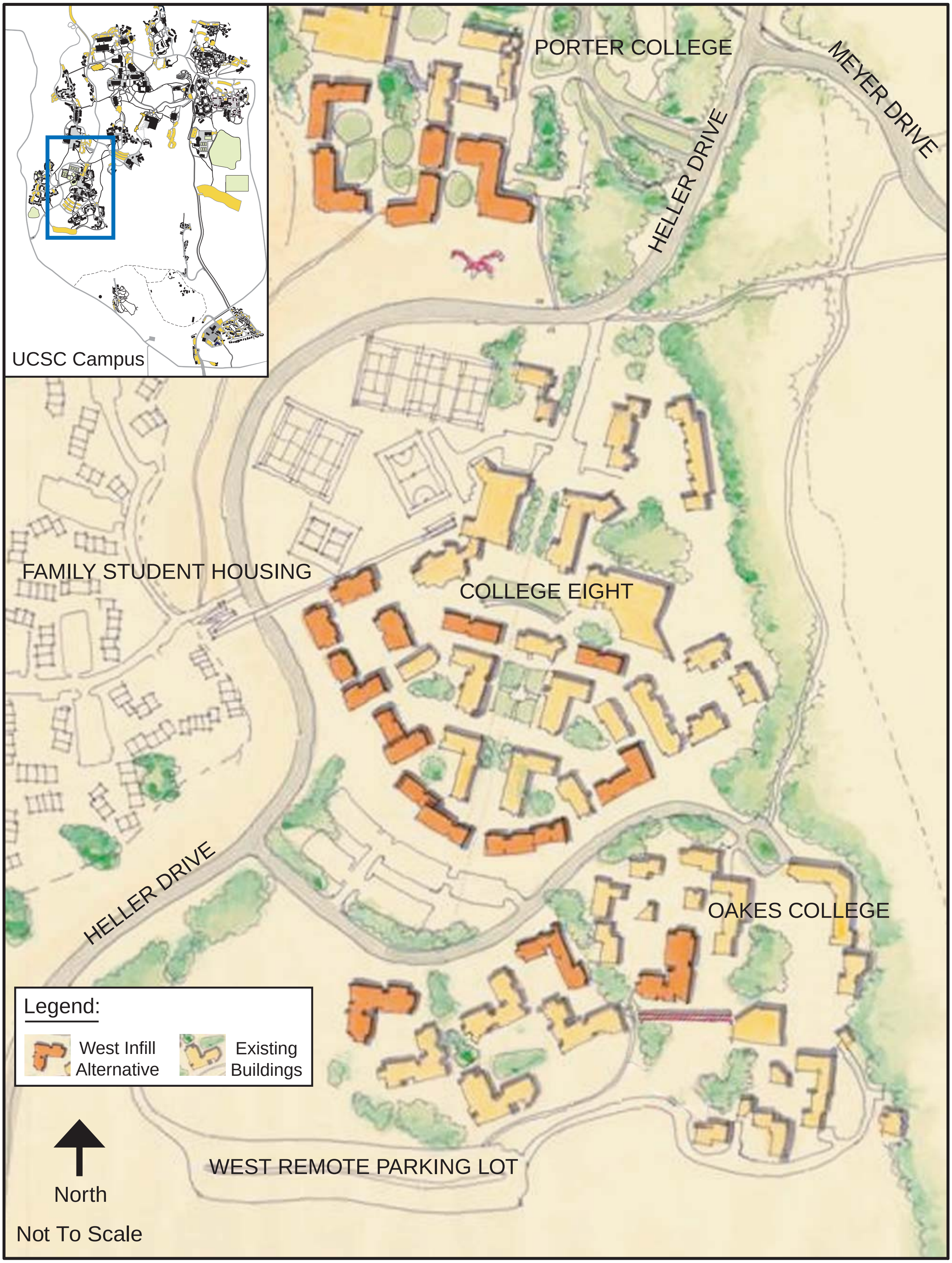
Biotic Resources Group. 2008b. Porter College Storm Water Outfall Improvements and Seismic Work Staging Area: Results of Biological Review. May.

H. T. Harvey & Associates. 2008. Wildlife Surveys and Waters of the U.S. Assessment. U.C. Santa Cruz East Campus Infill Housing, Chinquapin Road Parking Lot, and Chinquapin Road Widening Projects. On file, UC Santa Cruz Physical Planning & Construction. December.

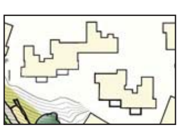
Morgan, Sally S. 2008. Memo report of archaeological survey of East Campus Infill Project site. December 15, 2008. On file, Physical Planning & Construction, UC Santa Cruz.



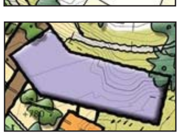
ALTERNATIVE 1: WEST CAMPUS INFILL

FIGURE 4-1

Legend:



Existing Buildings



New Buildings under Valley Alternative

50 0 50 100 Feet

ALTERNATIVE 2: VALLEY SITE PLAN

FIGURE 4-2

CHAPTER 5 OTHER CEQA CONSIDERATIONS

Other CEQA Considerations

Section 15126 of the California Environmental Quality Act (CEQA) Guidelines requires that all aspects of a project be considered when evaluating its impact on the environment, including planning, acquisition, development and operation. As part of this analysis, the EIR must identify the following three types of impacts:

- Significant environmental effects that cannot be avoided if the proposed project is implemented;
- Significant irreversible environmental effects that would be involved in the proposed project should it be implemented; and
- Growth-inducing impacts of the proposed project.

The following sections identify each of these types of impacts based on analyses contained in Chapter 3, *Environmental Setting, Impacts, and Mitigation*. The potential that the project would result in wasteful use of energy is discussed in Section 5.2, *Significant Irreversible Environmental Effects*.

5.1 SIGNIFICANT AND UNAVOIDABLE ENVIRONMENTAL EFFECTS

This section identifies significant impacts that could not be eliminated or reduced to a less-than-significant level by mitigation measures imposed by the University. The final determination of significance of impacts and of the feasibility of mitigation measures will be made by the Board of Regents of the University of California as part of its certification action for the EIR.

A summary of the environmental impacts of the project and proposed mitigation measures is contained in Chapter 1 (*Executive Summary*) of this EIR. Sections 3.1 through 3.15 provide a comprehensive identification of the proposed project's environmental effects, including the level of significance both before and after mitigation.

The following significant and unavoidable impacts would result from development of the proposed ECI Project:

ECI Impact AES-1:	The proposed project would substantially degrade the existing visual character of the area.
ECI Impact NOIS-1:	Construction of the proposed project could expose nearby sensitive receptors to excessive airborne noise but not to excessive groundborne vibration or groundborne noise.

5.2 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL EFFECTS

Section 15126.2(c) of the CEQA Guidelines requires a discussion of any significant irreversible environmental changes that would be caused by the proposed project. Specifically, Section 15126.2(c) states:

> *Uses of nonrenewable resources during the initial and continued phases of the project may be irreversible, since a large commitment of such resources makes removal or nonuse thereafter unlikely. Primary impacts and, particularly, secondary impacts (such as highway improvement which provides access to a previously inaccessible area) generally commit future generations to similar uses. Also, irreversible damage can result from environmental accidents associated with the project. Irretrievable commitments of resources should be evaluated to assure that such current consumption is justified.*

Generally, a project would result in significant irreversible environmental changes if:

- The primary and secondary impacts would generally commit future generations to similar uses.
- The proposed consumption of resources is not justified (e.g., the project involves the wasteful use of energy).
- The project would involve a large commitment of nonrenewable resources.
- The project involves uses in which irreversible damage could result from any potential environmental accidents associated with the project.

This project would construct two apartment buildings on a site that is currently partly developed as a parking lot. The structures are permanent buildings—their installation would constitute an irreversible change in the use of this land, as it is unlikely that the structures would be removed in the foreseeable future. The proposed project would irretrievably commit materials to the construction and maintenance of the new facility. Development of the site would result in the removal of approximately 220 trees. Although the Campus would plant approximately 50 new trees as part of the project landscaping on the site or at other locations, this would not fully compensate for the impact on the visual character of the project area.

Resources that would be permanently and continually consumed by project implementation include water, electricity, natural gas, and fossil fuels; however, the consumption of these resources would not represent unnecessary, inefficient, or wasteful use of resources. The project would provide on-campus housing to respond to the growth in student enrollment that is projected as a result of population growth that has already occurred in the state and that is projected at the UC Santa Cruz campus in the previously-approved 2005 LRDP. Natural resources are currently being consumed by this demographic group and would continue to be consumed by this group at some location, irrespective of whether these students enroll at UC Santa Cruz. Students living in the on-campus housing that the project would construct would consume smaller amounts of fossil fuels for transportation than the same students living off-campus and commuting to the campus on a daily basis. The project is being designed to exceed the energy efficiency requirements of Title 24 by at least 28 percent. In addition, the project would comply with the campus policy of not providing air conditioning except as needed for life safety or in support of research. The proposed project therefore would not include air conditioning, which would result in additional energy savings that are not reflected in the Title 24 calculations.

The energy use for the proposed project would emit greenhouse gases that could contribute to global climate change. However, as discussed in Section 3.3, *Air Quality and Climate Change*, the project would not conflict with the efforts of the State to meet its goals for the reduction of greenhouse gas emissions. Further, under ECI Mitigation AIR-5, in addition to the new trees included in the proposed project landscaping plan, the campus has committed to plant 100 redwood trees in locations on campus that historically were redwood forest. This would partly offset the minor contribution of tree removal to the project's GHG emissions. Elements of the proposed project such as high-efficiency plumbing fixtures, an irrigation system that adjusts its schedule automatically in response to variations in evapotranspiration rates, and landscaping that consists primarily of low water use plantings would ensure that the project does not result in inefficient use of water. Nonetheless, construction activities related to the proposed project would result in the irretrievable commitment of nonrenewable energy resources, primarily in the form of fossil fuels (including fuel oil, natural gas, and gasoline) for automobiles and construction equipment.

The CEQA Guidelines also require a discussion of the potential for irreversible environmental damage caused by an accident associated with the project. The project is not expected to result in any activities, such as large-scale hazardous materials storage or transportation, that are likely to result in accidents that could lead to irreversible environmental damage.

5.3 GROWTH-INDUCING IMPACTS

As required by the CEQA Guidelines, an EIR must discuss ways in which a potential project could induce growth. A project may be growth inducing if it directly or indirectly fosters economic or population growth or the construction of new housing, removes obstacles to population growth, or requires or encourages the construction of new facilities. According to CEQA Guidelines Section 15126.2(d), "it must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment."

The effect of new population directly added by the proposed project is evaluated in Section 3.11, *Population and Housing*. The proposed project would not directly enable enrollment increases at UC Santa Cruz, because it would not construct new academic facilities.[1] Additionally, the project includes only about 8 to 10 new employees. While the project would add to the housing stock in the city of Santa Cruz (since this project site is within the city boundaries), this housing would be available only to students enrolled at UC Santa Cruz. The project would reduce potential demand on the local housing market that otherwise would have resulted from these students' enrollment. Nevertheless, under AMBAG's approach the proposed project would be classified as contributing to population growth in the region by adding to the housing stock of the city of Santa Cruz.

5.3.1 Impacts Associated with Full-Implementation of the 2005 LRDP

The growth-inducing effects of development under the 2005 LRDP were analyzed in the 2005 LRDP (Section 6.3). The 2005 LRDP, as updated by revised population data provided in Section 3.11

[1] The proposed ECI Project would provide about 600 beds of on-campus housing for students already enrolled or projected to be enrolled at UC Santa Cruz based on the campus's previously certified 2005-2020 Long Range Development Plan, the program-level environmental impacts of which were analyzed in the 2005 LRDP EIR. As an on-campus housing project, the proposed ECI Project would not contribute to the need for off-campus student housing. It would provide student beds on campus to accommodate on-going and increasing student demand for on-campus housing, but would not result in or induce increased enrollment because campus enrollment planning is program driven and is not subject to the availability of housing.

(Population and Housing) of this EIR, estimates an on-campus increase in enrollment of 5,413 students over 2003-04 enrollment levels, to a total projected enrollment of 19,500 students by 2020-21. It also anticipates an increase of about 1,250 in faculty and staff population during this period for a total of 4,463 faculty and staff, and an increase of about 200 in non-UC Santa Cruz employees working on campus, for a total of about 750 by 2020-21. LRDP development between the LRDP baseline academic year, 2003-04, and the 2020-21 LRDP development horizon, including the additional student housing the Campus agreed to construct under the 2008 Settlement Agreement, would increase the residential holding capacity of the area by permitting the construction of new on-campus housing that would accommodate as many as 3,569 additional students, 233 employees, and their 500 dependents, for a total increase in resident population on the campus of about 4,300.

As discussed in the LRDP EIR (Section 6.3.2.1), overall campus growth under the 2005 LRDP would contribute to the regional demand for new housing and urban amenities, which would in turn contribute to the environmental impacts of the overall growth in regional housing and other urban amenities. In addition to impacts from the development of new off-campus housing, LRDP-related population that would reside off campus in regional communities would place a demand on utilities and services such as water, sewer, schools, and parks in these affected communities.

5.3.2 Impacts Associated with Implementation of ECI

As an on-campus student housing project that implements, in part, the 2005 LRDP, the ECI Project would meet the housing demand of about 600 students who would otherwise live in the city of Santa Cruz and other local communities. These students would not contribute directly to the regional demand for off-campus housing.

The ECI Project would employ up to 10 new employees, two of whom would live on-site. Up to eight new employees might seek housing in the region (if all new employees were new to the region, a worst-case scenario) and, with their projected households, could add a total of up to 23 persons and demand for up to 8 housing units to the region. As analyzed in Section 3.11 (*Population and Housing*), this represent about 0.5 percent of the projected increase in population in the student area during the development horizon of the proposed project (that is, 2007-08 through 2011-12) and between 0.3 percent and 0.4 percent of the projected increase in housing units in the study area during the same period. This small direct increase in off-campus regional population and small contribution to regional housing demand would not make a cumulatively considerable contribution to the regional impacts of off-campus housing demand identified in the 2005 LRDP EIR. The impact of the proposed project on utilities and services in the affected communities are discussed in Section 3.12, *Public Services;* Section 3.13, *Recreation;* and Section 3.15, *Utilities and Service Systems*.

The proposed project would contribute indirectly to additional changes in regional population that would result as campus-serving businesses or other businesses move into the area or expand in response to the increased demand for goods and services. The employment growth that would result indirectly from campus growth under the 2005 LRDP is analyzed in Section 6.3.2.2 of the 2005 LRDP EIR. Based on a multiplier of 1.74 indirect/induced jobs for every new direct job on the campus, the LRDP EIR estimated that about 2,645 indirect and induced jobs would be created or supported in the county as a result of campus growth. Based on revised population estimates presented in Section 3.11 (*Population and*

Housing), above, about 2,175 indirect and inducted jobs would be created or supported. About 17 of these indirect and induced jobs (10 ECI employees × 1.74) would be attributable to the ECI Project. Most of these indirect and induced jobs would be created in the food, entertainment, and service sectors within the city of Santa Cruz, where about 35 percent of UC Santa Cruz students and 46 percent of UC Santa Cruz employees currently reside (as shown in Table 3.11-4, Section 3.11 of this EIR), and where most of the local purchasing by students, faculty, and staff occurs. Assuming that about half of the induced population associated with the ECI Project (that is, 8 to 9 of the 17 induced employees) would reside in the city of Santa Cruz, and that all would be new to the area and would contribute to the demand for housing (a conservatively worst-case assumption), this would equate with demand for between 2 percent and 2.7 percent of the new housing units projected in Santa Cruz during the ECI development horizon. This level of demand would not be expected to result in new housing construction not anticipated in local planning.

The indirect and induced employment that would result from the implementation of the proposed 2005 LRDP could in turn result in additional population growth as individuals move into the study area to fill these jobs (2005 LRDP EIR, Section 6.3.2.3). However, because most of the new jobs would be in the service, retail and entertainment industry, rather than in specialized or highly skilled professions such as might attract employees to relocate, the 2005 LRDP EIR concluded that most of the new jobs would be filled by current residents of Santa Cruz County, or by students or by dependents/spouses of persons who move to the area to fill jobs on the campus. Assuming, conservatively, that half of the indirect and induced jobs would be filled by persons seeking jobs closer to home, unemployed persons already residing in the study area, or students and dependents of campus employees, it is estimated that about 1,088 new persons (half of 2,175 indirect and induced jobs) and their dependents would move into the study area as a result of the indirect/induced jobs supported by campus growth in the study area. At this ratio, about 8 to 9 persons (one half of the 17 jobs induced by the ECI Project) might move to the study area as the result of the new jobs provided by the ECI Project. This small population increase would represent about 0.2 percent of the projected population increase in the study area during the ECI Project horizon, which would not be a cumulatively considerable contribution to regional population growth. The demand that this population would place on utilities and services such as sewer, schools, and parks in these affected communities is accounted for in the cumulative analyses contained in the 2005 LRDP EIR (Section 4.12, *Public Services*; Section 4.13, *Recreation*; and Section 4.15, *Utilities and Service Systems*).

The proposed project is within the scope of development analyzed in the 2005 LRDP EIR. The contribution of the proposed ECI Project to region-wide growth-related impacts would not be cumulatively considerable. Additional analysis of the growth-inducing impacts of the proposed project is not necessary.

CONSULTATION AND COORDINATION

The following individuals and organizations were consulted during the preparation of this EIR.

Allen, N. — Sasaki Associates, Inc.

Amin, N. — URS Consultants

Barnes, J. — UC Santa Cruz Physical Planning & Construction

Berger, C. — Kennedy/Jenks Consultants

Blunk, D. — UC Santa Cruz Office of Environmental Health & Safety

Bozkurt, S. — PWA Consulting

Chamberlain, J. — Kennedy/Jenks Consultants

Currie, U. — EHDD Architecture

Getchell, J. — Monterey Bay Unified Air Pollution Control District

Goddard, T. — City of Santa Cruz Water Department

Fernald, J. — UC Santa Cruz Institutional Research & Policy Studies

Halkett, J. — UC Santa Cruz Physical Planning & Construction

Hoffman, B. — UC Santa Cruz Physical Planning & Construction

Houser, S. — UC Santa Cruz Colleges and University Housing Services

Kocher, B. — City of Santa Cruz Water Department

Matthews, S. — UC Santa Cruz Colleges and University Housing Services

Pageler, L. — UC Santa Cruz Transportation and Parking Services

Paul, S. — UC Santa Cruz Physical Planning & Construction

Rabiah, T. — UC Santa Cruz Physical Planning & Construction

Raven, D. — UC Santa Cruz Grounds Services

Robertson, A. — California Department of Forestry and Fire Protection

Staub, S. — Staub Forestry and Environmental Consulting

Strelow, S. — Strelow Consulting

Testoni, P. — UC Santa Cruz Physical Plant

Thomas, K. — City of Santa Cruz Office of Planning and Building

Trapp, J. — UC Santa Cruz Fire Department

Trask, C. — UC Santa Cruz Physical Planning & Construction

Tresham, K. — UC Santa Cruz Colleges and University Housing Services

Wickizer, D. — California Department of Forestry and Fire Protection

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List of Preparers and Contributors

7.1 LEAD AGENCY

University of California

7.1.1 University of California, Santa Cruz

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CHAPTER 8 RESPONSE TO COMMENTS

TABLE

Response to Comments

8.1 INDEX TO COMMENTS

All comments on the Draft EIR received either in writing or orally at the public hearings on the Draft EIR have been coded. The codes assigned to each comment are indicated on the written communication and the public hearing transcripts that follow. All agencies, organizations and individuals who commented on the Draft EIR are listed below.

Table 8-1

Index to Comments

Commenter Code	**Agency/Organization/Individual Name**
SA-1	California Department of Transportation
LA-1	City of Santa Cruz
I-1	Fung, Patricia
PH-1	Warner, Jim
PH-2	Heitel, Alyssa
PH-3	O'Brien, Mackenzie
PH-4	Heitel, Alyssa
PH-5	O'Brien, Mackenzie
PH-6	Spangler, Will
PH-7	Fung, Patricia
PH-8	Heitel, Alyssa

8.2 RESPONSES TO COMMENTS

This section presents all written comments received on the Draft EIR and the University's responses. Comments received at the Draft EIR public hearings are contained in the public hearing transcripts. Responses to the public hearing comments are presented on the pages that follow the two transcripts.

DEPARTMENT OF TRANSPORTATION
50 HIGUERA STREET
SAN LUIS OBISPO, CA 93401-5415
PHONE (805) 549-3101
FAX (805) 549-3329
TDD (805) 549-3259
http://www.dot.ca.gov/dist05/

SA-1

Flex your power!
Be energy efficient!

May 18, 2009

SCr-1-18.06
SCH# 2008092089

Ms. Sally Morgan
Physical Planning & Construction, Barn G
University of California, Santa Cruz (UCSC)
1156 High Street
Santa Cruz, CA 95064

Dear Ms. Morgan:

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT (DEIR) FOR THE EAST CAMPUS INFILL PROJECT

The California Department of Transportation (Department), District 5, Development Review, has reviewed the above referenced project and has the following comments:

1. The Department supports local development that is consistent with State planning priorities intended to promote equity, strengthen the economy, protect the environment, and promote public health and safety. We accomplish this by working with local jurisdictions to achieve a shared vision of how the transportation system should and can accommodate interregional and local travel and development. SA-1-1

2. The Project Description in Chapter 2.2.1 of the DEIR (page 2-1, 3rd paragraph) indicates that the project includes a café, retail spaces, and offices, but these facilities are not included into the trip generation rate. SA-1-2

3. We do not agree with the methodology used to determine the project's trip generation rate. UCSC incorrectly applied a 60% reduction (mathematical error) to a land use type that is not directly related to the project. SA-1-3

   For example, Chapter 3.14.1.3 of the DEIR asserts that UCSC produces 60% less traffic then that reported by the Institute of Transportation Engineers (ITE) *Trip Generation 7th Ed.*, and then subsequently applies the reduction to the project's trip generation as reflected in Table 3.14-1. The percentage is based on "mode share gate counts" and ITE project trips. The actual difference is approximately 40% less then trips projected by ITE. Please note the following calculation:

SA-1, cont.

i. ITE with 15,000 students = 35,700 projected trips (ITE)
ii. UCSC with 15,000 students reported 21,900 actual trips (DEIR, Page 3.14-6)
iii. [35,700-21,900] ÷ 35,700 ≈ **38.6%**

The DEIR incorrectly concludes that the trips generated by the project are 60% less then the ITE projected trips; and that the deduction be applied to the residential high-rise apartment ITE rate. Residential trips and college student body/facility trips are not directly related. SA-1-3

5. Chapter 3.14.2.15 of the DEIR asserts that mitigation is not needed because all impacts to the State intersection are less then 3 percent. This concept is referred to as a "ratio theory" and is not supported by the Department. California Environmental Quality Act court cases validate our position: SA-1-4

   ~~ *Kings County Farm Bureau* v. *City of Hanford* (5th District 1990); the *Los Angeles Unified School District* v. *City of Los Angeles* (2nd District 1997); *Communities for A Better Environment* v. *California Resources Agency* (3rd District 2002). These court rulings invalidated the use of a "ratio theory" or "comparative approach" criterion because they improperly measure a proposed project's incremental impact relative to the existing cumulative effect rather than focus on the combined effects of the project and other relevant past, present, and future projects.

6. The DEIR did not provide an analysis of mainline highway operations, which currently operate at a Level of Service (LOS) F. When a State highway facility is operating at an unacceptable LOS, any additional trips are considered significant and must be mitigated accordingly. A freeway segment analysis is needed to accurately depict the project generated traffic impacts to the State Highway System. SA-1-5

Thank you for your consideration and action upon these issues. If you have any questions or need additional clarification on any of the items addressed, please contact me at (805) 549-3099 or e-mail: jennifer.calate@dot.ca.gov.

Sincerely,

JENNIFER CALATÉ
Associate Transportation Planner
District 5 Development Review Coordinator

Response to Comment SA-1

Response to Comment SA-1-1. UCSC also is working with local jurisdictions, the City and County of Santa Cruz and the Association of Monterey Bay Area Governments to identify and implement transportation solutions.

Response to Comment SA-1-2. The café, retail space and offices included in the proposed project will provide small scale services for the residents of the East Campus Infill housing project and adjacent facilities within walking distance. It is anticipated that these facilities would see only incidental use, at most, by others (such as visitors who are on the campus for tours or students from other areas of the campus), and these project components therefore are not expected to generate additional trips on the off-campus road network.

Response to Comment SA-1-3. As explained in Section 3.14.2.4 of the EIR, counts of actual traffic to and from the campus demonstrate that the campus as a whole generates car trips at a rate lower than that predicted by ITE trip generation rates. As also reported in the ECI EIR, UCSC's transportation demand management (TDM) program has been very successful in reducing trips to the campus, such that only about 40% of trips to campus are made by single occupant vehicles, as demonstrated by semi-annual gate counts and mode share counts at campus entrances. In 2007-08, campus gate counts indicated that there were about 21,900 average daily trips through the campus gates, by a campus population that averaged about 15,000 students and 3,436 employees. (Note that the commenter's calculation of trip generation per person for the campus overall considered only the student population of the campus and not the employees). This represents about 1.19 daily trips per person in the campus population for the campus overall. The ITE rate quoted by the commenter (35,700 daily trips for a population of 15,000 students) yields a trip generation rate of 2.38 trips per person for the campus overall. The actual trip generation for the campus overall of 1.19 trips per person thus represents about 50% of the ITE rate.

Based on its consultation with transportation and traffic consultants, Larry Pageler (UCSC, Director of Transportation and Parking Services), and Nayan Amin (Transportation Engineer, URS Corporation), the Campus has determined that the project's trip generation is likely to be further reduced, relative to ITE rates, because of the composition of the project population. About 18% of the total campus population is employees, and about 82% is students. A higher proportion of employees than of students typically commute to the campus by car on a daily basis. Thus, the expected trip generation per student is lower than the average rate for the campus population overall. In contrast with the makeup of the general population of the campus, more than 98% of the population associated with the ECI facility would consist of resident students, and less than 2% would be employees. The students, residing in what is effectively a live-work facility, would not commute to campus or contribute to peak hour traffic. Thus, the trip generation rate for the ECI facility would be expected to be lower than the already atypically-low rate (relative to ITE predictions) for the campus overall.

Campus parking data also support the reduced trip generation rate used in the EIR. ITE rates are based on the typical trip generation of persons using or residing in a particular type of building. However, the trip generation of residents of the ECI project is expected to be atypically low for a mid- to high-rise facility because the proposed project is subject to stringent parking regulation: far fewer cars than people would be associated with the ECI project. Due to parking restrictions and parking costs the number of on-campus residents who bring cars to the campus is limited. First and second-year undergraduates who reside on campus are not allowed to park cars on campus and therefore typically do not generate vehicle trips. Based on historical data on demand for parking permits, only about one-third of junior and senior-level student residents (who are expected to be the principal residents of the ECI facility) bring cars to the campus; the remaining two-thirds of the residents rely on mass transit and other transportation alternatives.

At this rate of one car per three student residents, plus up to 10 cars for staff (based on historical parking permit data), 200 to 210 cars would be associated with the ECI project. The EIR estimates 804 daily trips for the project; which represents 4 trips per day per car. The ITE rate, by contrast, estimates 3.35 trips per person for a high rise building.

Given the effectiveness of campus TDM measures and the small number of cars that are expected to be associated with the project, the EIR's analysis reasonably relied on expert traffic and transportation consultants' opinion that analysis of traffic associated with the ECI project should use a reduced trip generation rate.

Response to Comment SA-1-4. The Draft EIR uses the City of Santa Cruz standards of significance to evaluate operational traffic impacts of the ECI project, as follows:

The project's impact would be considered significant if:

- the peak hour level of service (LOS) at a signalized intersection degrades from an acceptable level to an unacceptable level due to the increase in traffic generated by the proposed project and the project increases the traffic volume by more than three percent, or
- the project increases the traffic volume by more than three percent at a signalized intersection that already operates at an unacceptable level without the project, or
- an unsignalized intersection meets the Caltrans peak hour signal warrant with the addition of project-generated traffic and the project increases the traffic volume by more than three percent

Thus, pursuant to the City's established standards, a project does not have a significant impact on an intersection if it contributes less than three percent of the intersection's future volume. By considering all future volume at the intersection, including growth caused by past, present, and future projects, these standards account for the project's contribution to cumulative impacts.

CEQA supports the use of established level of service standards as a method of determining significant impacts. See CEQA Guidelines, Appendix G, Introduction, Item 6 ("Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts….").

Moreover, the use of the three percent criterion in the Draft EIR is consistent with recent environmental documents prepared for the City of Santa Cruz (for example, the Draft EIR for the 2120 Delaware Mixed Use Project, March 2008).

Response to Comment SA-1-5. Traffic generated by the ECI project is a part of the traffic that would be generated by the overall program of development under the 2005 LRDP. Impacts of traffic associated with development under the LRDP upon state highway facilities, including the traffic that would be generated by the ECI project, were analyzed in the 2005 LRDP EIR. The 2005 LRDP EIR determined that the 2005 LRDP would not result in a significant impact to mainline highway operations under future cumulative conditions. Cumulative impacts, to which the 2005 LRDP would make cumulatively considerable contributions, were identified at six freeway on or off-ramps on SR-1 south of the city of Santa Cruz. The University committed in the 2005 LRDP EIR to pay its proportional share of the cost of highway improvements needed to address these impacts at such time as the state or a regional transportation management agency implements a program to collect the proportional share of the cost from all traffic generators, and implements the required traffic improvements. The campus would make such payments based on the 2005 LRDP's traffic contributions. Any 2005 LRDP traffic improvement payments would encompass mitigation for the proportional share of traffic that would be generated by the ECI project. This impact and associated mitigation was fully analyzed at the LRDP program level and no further analysis is warranted, nor is additional mitigation available.

LA-1

CITY OF SANTA CRUZ

PARKS & RECREATION DEPARTMENT

May 4, 2009

Sally Morgan
UC Santa Cruz
Physical Planning and Construction
1156 High Street, Barn G
Santa Cruz, CA 95064

RE: Draft Environmental Impact Report – East Campus Infill Apartments

Dear Ms. Morgan:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Report (DEIR) for the proposed East Campus Infill Apartments (ECI) project.

The City's concern is that the project will decrease vegetation coverage in the project area while increasing impervious surface areas, rate of surface water runoff volume and flow levels and could exacerbate existing erosion conditions in Gulch "H". In addition the project could increase urban pollutants in storm water runoff impacting water quality. The City has experienced significant storm water runoff concerns historically and we hope to work with the University to circumvent any further potential environmental impacts to the Pogonip open space located adjacent to the University.

The following are specific comments regarding project drainage and water quality relevant to the DEIR.

The Storm Water Management System (SWMS) designed for the project appears adequate in the EIR and should be further evaluated for design adequacy and monitored on a continuing basis into the future to determine if it is satisfactory or if modification and/or enhancement is required. The design details need to include water flow containment, flow regulation, identification of runoff and pollutant sources and separation of pollutants. Best Management Practice implementation should be established for ongoing compliance including discharge reductions goals. LA-1-1

The Campus Storm Water & Drainage Master Plan 2004 (SWDMP) recommendations for improvement as outlined should be funded and implemented as part of ECI project given the high potential for erosion by storm water runoff as stated in Section 3.8.1.3 *Erosion Potential.* It is stated that runoff is only storm related however all runoff potential i.e. utilities, human activity, etc should be considered as non-point source run off potential. LA-1-2

LA-1, cont.

The majority of storm water from the project site and adjacent areas is currently over land and channeled without detention to an outfall at the head of Gulch "H'. These impacts should be adequately addressed and mitigated through implementation of the SWMS, SWDMP and standard best management practices. Runoff potentially impacting down slope areas from the underground detention tanks should be discharging into a secondary bio-retention area to treat and remove pollutants as needed (Figures 3.8-33.8-4). Additional retention or an energy dissipation apron should be reconsidered as needed or future needs for this addition may be determined through system monitoring. The existing pre-construction flow rates determined to be minimal in the DEIR should remain minimal post construction if mitigations as stated in EIR are implemented successfully. LA-1-3

In Section 3.4.1.7, the head waters for drainage at Gulch "H" are defined as 1-3. These areas should be maintained, monitored and the sources should limit sediment into the headwaters of Gulch "H". The project site development area would contribute to these headwaters. Existing natural surface drainage flows should be maintained or lessened from the proposed project through the use of design elements i.e. pervious paving, bio-swales, bio-retention areas, appropriate plantings and green roofs to maximize on-site infiltration rates. Offsite infiltration should be implemented & monitored to ensure appropriate rates of flow and control sedimentation into Gulch "H". LA-1-4

In Section 3.8, the items listed 1-8 are concerns of the Parks and Recreation Department. These concerns are addressed in the EIR but need to be followed up on, implemented and continually monitored as conditions of project approval. LA-1-5

Again, thank you for the opportunity to provide comments on the DEIR. The Parks Department staff is available to provide additional background or clarification of any of items broached in this letter. We also request the opportunity to review and comments on engineered drawings regarding drainage concerns into the open space. LA-1-6

Sincerely,

Dannettee Shoemaker

Dannettee Shoemaker
Director

Copy to:

Juliana Rebagliati, Director of Planning and Community Development
John Barisone, City Attorney
Martin Bernal, Assistant City Manager

Response to Comment LA-1

Response to Comment LA-1-1: The project Mitigation Monitoring Plan (MMP) presented in Chapter 10 of the Final EIR outlines the process that the campus would follow to confirm that the storm water management system, including the retention and detention facilities that would provide flow containment and flow regulation, is designed and constructed as specified in ECI Mitigation HYD-1. The new facilities would also be monitored and maintained as part of UC Santa Cruz Grounds Services preventive maintenance program. This includes annual inspection of storm drain facilities, cleaning of engineered detention facilities if needed, and weekly inspections by area groundskeepers during the rainy season. The groundskeepers clean the catch basin grates and outfalls as needed; during storm events, the groundskeepers check their area storm drains several times a day and equipment operators respond to area concerns as needed with specialized storm drain clearing equipment. Natural drainages are included in the storm event inspections whenever possible.

Potential pollutants and the adequacy of the proposed bioretention area to provide treatment of the runoff from the project site are discussed on page 3.8-21 of the Draft EIR.

Response to Comment LA-1-2: As discussed on page 3.8-13 of the Draft EIR, the project design includes installation of a detention vault to reduce peak flows to Gully H from existing development. This would implement one of the two improvements recommended to address erosion conditions in Gully H that were identified in the 2004 Campus Stormwater and Drainage Master Plan. The other recommended improvement was the extension of a culvert discharging runoff onto the slope above Gully H from the Merrill College residence halls. The project civil engineer and Campus staff determined that the slope above Gully H has stabilized and vegetation has been established. Therefore, the culvert extension is no longer necessary and disturbance of the area could reverse the improvement in its condition. Thus, the culvert extension is not included in the ECI Project.

The following activities are potential sources of non-storm water discharges from the proposed project: landscape irrigation and water line flushing. The UC Santa Cruz Storm Water Management Plan (http://cleanwater.ucsc.edu/swmp/index.html) includes “Best Management Practices” to address both of these types of non-storm discharges, as well as a field screening program to monitor all outfalls for non-storm water discharges.

Response to Comment LA-1-3: Storm water runoff from the project area will be detained before discharge into Gully H. All runoff discharged from the new development to Gully H would flow through pervious pavement, bioretention areas or the vegetated roof before reaching the detention tanks. As discussed on page 3.8-21 of the Draft EIR, the proposed bioretention areas are sized to provide adequate treatment of the storm water runoff from the project site. In addition to the storm water management system for the proposed new development, the project includes additional detention tanks that would detain runoff from existing development in Crown College and at Crown/Merrill Apartments would provide detention. Space is not available to provide additional bioretention areas to treat the runoff from this existing development as part of the proposed project.

Response to Comment LA-1-4: The proposed storm water management for the project is described in Section 3.8.2 (pages 3.8-12 to 3.8-13) of the Draft EIR. As explained in that section, the project includes pervious paving, bioswales, bioretention areas and a green roof. The proposed project design maximizes on-site infiltration through the use of bioretention areas, except those located adjacent to the building, which would be lined with impermeable barriers. The turf area east of Building B would also allow infiltration of runoff. In addition, the pervious pavement would be underlain by a permeable liner, which would permit some infiltration, although the infiltration rate would be limited by the properties of the underlying clay soil. The potential for additional infiltration off-site is minimal, as the area downgradient of the site consists of a paved parking lot that is not being altered by the project. Please see Response to Comment LA-1-1 regarding the Campus' storm water drainage preventive maintenance program.

Response to Comment LA-1-5: Regarding follow-up, implementation, and monitoring of the storm water management system for the proposed project, please see Response to Comment LA-1-1. The commenter has not provided items 1-8 to which the comment refers; however, the reference may be to the bulleted list of scoping comments on page 3.8-1. All of these items are addressed in the analysis on pages 3.8-16 to 3.8-23 of the Draft EIR.

Response to Comment LA-1-6: UC Santa Cruz projects are not subject to local plan review**.**

I-1

Comment I-1
Received by email:

patricia.s.fung@gmail.com
5/3/2009 1:04 PM

Hi,

The following are comments that I have regarding the Draft EIR for the East Campus Infill Project:

- If trees are to be replanted to replace the trees from the project site, what measures will be taken to ensure that the replanted trees will survive? I-1-1
- Given the shortage of water in the region, will grey water systems be implemented? If not, why not? I-1-2
- As mentioned in a previous comment, the USGBC offers Gold and Platinum LEED Certification, which would reduce even more environmental impacts from the building itself. Why is Silver LEED certification being pursued rather than Gold or Platinum? I-1-3
- Will there be significant impacts from the construction of new sewage lines connecting it to the lines leading to the city sewage treatment plant? How would the sewage from the significantly large increase in residents at the proposed project site impact the city's water treatment plant and the subsequent release of treated water into the Monterey Bay? I-1-4

Thank you.
Patricia Fung

Responses to Comment I-1

Response to Comment I-1-1. As noted in the Mitigation Monitoring Program (Chapter 10), the UCSC Grounds Services will work with Campus Planning determine appropriate locations for the trees to be replanted and an appropriate regime of maintenance for each tree and species. This would include temporary irrigation if irrigation is needed to ensure survival of the trees and if irrigation water is available at the location. Trees that do not survive the first season would be replaced.

Response to Comment I-1-2. Greywater re-use may mitigate a project's impacts related to water supply and wastewater treatment. Because the project's impacts in these areas will be less than significant after the implementation of identified mitigation, no further mitigation is required. The campus is nevertheless evaluating the use of greywater (waste from bathroom basins and showers) for flushing toilets in the new buildings. Current State greywater use regulations govern only outdoor uses. In the absence of State regulations regarding indoor use, local permitting authorities (in this case, the Campus) currently may set standards for and permit use of greywater for such indoor non-potable uses as toilet flushing. This would require a system to treat the greywater and the installation of piping to collect waste from basins and showers and to distribute the treated greywater to the toilets. The Campus plans, at a minimum, to install the necessary piping, but may delay the installation of a treatment system until State regulations have been adopted. For further information regarding the project's greywater system, please see Response to Comment PH-2-1.

Response to Comment I-1-3. The ECI Project includes the goal of achieving at least a LEED™ Silver certification. The design features that will achieve this certification have been taken into account in each of the relevant impact analyses. The Campus' current LEED™ assessment of the project suggests that the design will provide LEED™ points sufficient to achieve a Gold rating. However, this could change during final design and construction and will depend on design considerations, cost and the practicability of using certain technologies. Neither of the project's significant and unavoidable impacts (impacts relating to aesthetics and construction noise) would be reduced or avoided by features that would achieve additional LEED™ points.

Response to Comment I-1-4. As reported in Section 3.15 of the Draft EIR, the sewer lines for the new buildings would connect to an existing campus sanitary sewer line in Chinquapin Road near the southern end of the project site. No environmental impacts were identified in association with this roadway connection. The Chinquapin sewer line connects to the eastern campus sewer main in Jordan Gulch and is then conveyed to the City's mainline near Bay and High Streets.

As reported in the campus 2005 LRDP EIR (Section 4.5.1.3), the City of Santa Cruz provides municipal wastewater treatment services to the UC Santa Cruz campus through the Santa Cruz Wastewater Treatment Plant. The current rated design capacity is 17 million gpd. On average, the plant had a daily flow of 10 million gpd in 2005, or 60 percent of capacity. Total annual wastewater discharge from the ECI project is assumed to be 90 percent of indoor water use, or 7.2 mgy (that is, about 19,726 gpd). This is well within the remaining capacity of the city's wastewater treatment plant.

The City's 1984 Sewer System Master Plan Update identified sewer system constraints and necessary improvements. Some improvements to the system have been made, but segments of the Oxford Street main and the Arroyo Seco main, which serve the UC Santa Cruz campus, and operate over design capacity, have not yet been improved. These sewer segments have not yet exhibited any functional problems. The City has been monitoring the Arroyo Seco line and plans to carry out improvements there in 2009. As reported in Section 3.15 of the Draft EIR, the University has committed to pay its proportionate share of the cost of needed improvements when they are carried out.

UNIVERSITY OF CALIFORNIA SANTA CRUZ

SANTA CRUZ, CALIFORNIA

EAST CAMPUS INFILL HOUSING

ENVIRONMENTAL IMPACT REPORT

PUBLIC HEARING

BAY TREE CONFERENCE CENTER
UNIVERSITY OF CALIFORNIA SANTA CRUZ
SANTA CRUZ, CALIFORNIA

APRIL 23, 2009

SANTA CRUZ, CALIFORNIA, APRIL 23, 2009

JOHN BARNES: Good evening. My name is John Barnes. I'm the Director of Campus Planning with Physical Planning and Construction at UCSC. Our unit oversees general campus planning including the preparation of Environmental Impact Reports, or EIRs, and other environmental documents to ensure that the campus projects comply with CEQA, the California Environmental Quality Act.

I will be conducting the public hearing tonight to receive public testimony on the draft EIR for the proposed East Campus Infill Project.

The draft EIR is available to the public for a 45-day review period that began on March 20. The review period is scheduled to end on May 4, 2009. The purpose of the review period is to allow public agencies and members of the public an opportunity to review and provide comments on the draft EIR for the proposed project.

Tonight's hearing will be recorded by a court reporter and a transcript of the hearing will be included in the final EIR. All written correspondence received during the public review period, as well as all testimony given tonight will be made a part of the record of public input for the project. All comments will be considered carefully and responses to all comments will be provided in the final EIR.

Tonight I will briefly describe the East Campus

Infill Project, the EIR process to date and the conclusions presented in the draft EIR. However, the purpose of tonight's hearing is to receive public testimony on the draft EIR for the project rather than to engage in discussion of the project.

The University's presentation will be brief. Staff will answer procedural questions regarding tonight's hearing if they arise, but will not respond to questions about the project during public testimony.

If you wish to speak tonight, we ask that you fill out a Request to Speak form. Those are available on the back table. Comments may also be submitted by mail or e-mail to the addresses provided in the information handout on the back table. Comments will be accepted through the end of the comment period, which ends on May 4th.

Before taking public testimony, I'll briefly describe the project. I will then describe the CEQA process to date and summarize the process of the EIR.

The proposed development consists of seven four-to-eight story apartment buildings that would house approximately 600 upper division students in a sustainable LEED project. The sent acre project is Chinquapin Road between Crown College and the Crown-Merrill Apartments. About point nine acres of the project site is presently paved or otherwise developed. The existing development on the site includes a parking lot and access road, part of the Crown College access road and the Crown College preceptor apartment building. The remaining 2.2 acres of the site are undeveloped, and include redwood and mixed evergreen forest. Project construction would require removal of most of the trees within this area.

The project would pay for planting 50 trees at the project site and a hundred redwoods in locations on campus that are appropriate for redwoods. Construction of the project would commence in summer 2009 and be completed by fall 2011.

The project would reconfigure the project parking lot No. 111, the terraced parking lot north of the Crown College entry road and to the main entry to Crown College. The two lower segments of Parking Lot 111 would be used for staging during construction, but would be returned to service at the conclusion of construction.

The uppermost terrace of the lot is part of the project site and would be removed by the project. Some resident and ADA acceptable parking would be provided within the development.

In addition to housing, the project would provide common areas and support spaces including student lodgings. Part of the space will remain study spaces and residential areas. The project also would include an outdoor plaza between the two buildings, a small cafe and retail space, and open landscaped areas.

The stormwater management system for the proposed project includes a green roof on one of the buildings, bio-swales and rain gardens adjacent to the buildings and to the plazas and terrace; the bioretention area, other solar water heating, high-efficiency boilers and a provision for a future gray-water system. The campus will apply for LEED silver certification.

Now let me describe the CEQA process for this project to date. On September 23, 2008, a Notice of Preparation, or NOP, was published for the East Campus Infill Project. An EIR scoping meeting was held on October 1, 2008 to solicit input from interested agencies, individuals and organizations, and a transcript of that meeting was prepared. Written comments also were solicited.

The 30-day scoping period mandated by CEQA Guidelines ended October 22, 2008. All comments received during the scoping period are on file with U.C. Physical Planning and Construction and are summarized in the draft EIR. These comments were taken into account in preparing the draft EIR. The draft EIR was filed with the State Clearing House, and published on the UCSC website on March 20th and is currently being circulated for public review. The draft EIR review period ends October 4, 2009.

Following the end of the public review period, a final EIR will be prepared. The final EIR will include a transcript of this public hearing, comments of -- any public comments on the draft EIR and responses to all oral and written comments received during the public review period on environmental issues relevant to the project.

The U.C. Regents will review and consider the final EIR prior to any consideration to approve, revise or reject the proposed project. The draft EIR is a project EIR that is tiered from the campus's 2005 Long-Range Development Plan EIR. The 2005 Long-Range Development Plan EIR was certified by the Regents in 2006. The 2005 LRDP EIR assessed the impacts of UCSC growth to 19,500 by the year 2020 at a programmatic level.

The East Campus Project is an element of the project development analyzed in the 2005 LRDP EIR. The Infill Project EIR assessed site specific impacts of the proposed East Campus Infill Project that were not addressed in the 2005 LRDP EIR in order to provide or reduce the severity. Produced environmental impact of the proposed Campus Infill Project includes 2005 LRDP mitigation measures as part of the project.

The East Campus Infill EIR identifies two significant and unavoidable impacts of the proposed project: Construction noise and impacts on the visual character of the project site vicinity. The construction noise impact will occur because some of the buildings in the Crown-Merrill apartments and one of the Crown College residence halls would experience noise levels exceeding the applicable standard during certain phases of construction. This construction period impact is considered unavoidable despite the conclusions without the drainage in close proximity to the site of other occupied facilities.

The project would adversely affect the visual character of the area by removing trees and constructing buildings whose mass and height, seven to eight stories, are inconsistent with the nearby existing development. Although all feasible design and siting modifications have been included in the project to preserve trees and minimize the visual impact of the program, it could not reduce the necessary prominence along Chinquapin Drive, and to topographic and other constraints.

The EIR identifies other project impacts that are considered potentially significant but that would be reduced to a less-than-significant level by mitigation measures included in the project. Additional potentially significant impacts are: Potential construction period impacts to nesting birds, special status bat species and San Francisco dusky-footed woodrats that could be present on the site;

Construction period impacts on fire station operations, increased runoff from new impervious surfaces that could result in erosion and reduced water quality, and potential transportation delays resulting from increased numbers of pedestrian foot traffic related to traffic and water supply by concluding that the incremental contribution the proposed project would make to these projects would not be cumulatively considerable.

The EIR evaluates three project alternatives: Alternative one, West Campus Infill Alternative. The campus would construct approximately the same number of beds as the proposed project in 18 separate three-story buildings at Oaks College, College Eight and Porter College. This alternative would reduce the significant and unavoidable visual impact of the proposed project to a less-than-significant level.

However, this alternative would create a larger amount of impervious surfaces than the proposed project with runoff to drainage and existing erosion. The potential for significant impacts on the water quality would be greater than under the proposed project.

Under Alternative Site 2 Site Plan Alternative, the campus would construct a smaller project adjacent to the same site as the proposed project. Three four-and six-story buildings would be construction along the foot of the slope with natural drainage. Rather than 470 bed spaces, under this alternative the buildings would be less visually prominent than the proposed project, but the buildings would still be more massive than existing buildings in the area and could block the light that reaches into the Crown College complex. These aesthetic changes will likely be significant and unavoidable.

This alternative would not avoid the project's significant and unavoidable construction noise impact. This alternative likely would result in a larger number of off-campus vehicle trips than the proposed project and a greater demand for off-campus housing as a smaller number of units would be housed on campus than the proposed project.

Alternative four would use larger property with less new housing. This alternative provides a lesser benefit than the proposed project with increased student demand for off-campus housing, and would necessitate construction of additional housing sooner than the proposed project.

The third alternative, the no-project alternative, would eliminate most of the direct environmental impacts of the proposed project, including the significant and unavoidable impacts on the visual character of the area and of construction noise. However, without the project, 600 students who otherwise would have resided on campus instead would live off campus, and would need to commute to campus.

So, therefore, under the no-project alternative, the number of vehicle trips to the campus would be larger than the proposed project, which would result in greater impacts on off-campus intersections and impacts on air quality and climate change.

The student demand for off-campus housing would also contribute to any environmental impacts associated with the development of housing in the City and County of Santa Cruz that might be undertaken by others to meet local housing demand, including demand from UCSC affiliates. The details of all project impacts, project mitigation measures and alternatives to the projects are provided in the draft EIR.

The draft EIR is available for review at the UCSC McHenry Library, the UCSC Science and Engineering Library and the main branch of the Santa Cruz Public Library. The EIR is also posted on the UCSC website. More information on the project and a link to the EIR can be viewed at -- and I'll write this up on the board: *http:\\ucsc.edu.eci.* This web address also is provided in the handout which is available on the table near the door.

If you wish to provide a written comment on the document, you may submit comments by e-mail to: *eircomment@at ucsc.edu.* Please indicate "ECI comment" in the subject line. You may also mail written comments to the University Physical Planning and Construction, 1156 High Street, Santa Cruz, 95064. These addresses are also provided in the handout. All comments should be received by May 4th, 2009.

As I indicated earlier, because the purpose of tonight's hearing is to receive public testimony on the draft EIR for the project, staff will not comment on the project or respond to questions from the public tonight. The final EIR will include responses to all oral comments received tonight and all written comments received during the review period.

If you wish to speak tonight, we will ask that you fill out the Request to Speak form. These are available on the back table as I mentioned before.

So I'm curious, how many people roughly plan on speaking tonight, just to get a sense? Two or three. Okay.

Why don't we just call on those people in the order that you just submitted the forms to me, and then we'll go on from there. The hearing will close at 8 p.m., or earlier if there are no further comments.

So are there any questions about how this is going to go?

(No response.)

MR. BARNES: Okay. Why don't we start taking comments. Do you want to begin?

MR. JIM WARNER: It would be great if I could say I thoroughly studied the draft EIR --

MR. BARNES: Why don't you state your name?

MR. JIM WARNER: Oh, Jim Warner, and I'm an employee of the University. I work for the Computer Department, ITS.

PH-1-1

And so while I've looked through the EIR, the draft EIR, one of the things that concerns me is that the draft EIR doesn't discuss how vehicles are going to get to and from Crown College during the construction.

There does not appear to be a diagram that shows a construction fence and a driveway that provides access for emergency vehicles and food deliveries. And it's a very constricted area, and that would be a truly frightening impact if -- if the driveway was completely closed off. So, thanks.

MR. BARNES: Thank you. Would somebody else like to speak?

MS. HEITE: There's more stuff, more from you, but I was -- the project of, like, wound up with you.

PH-2-1

The future gray water system, I was kind of wondering about what that means and why it wouldn't be in place when the buildings go up. Why would that be delayed?

PH-2-1

And then along with other existing problems like the building height adding to other heights to other buildings, I'm kind going in that sort of direction.

PH-2-3

And I'm also curious about the unavoidable things that you're talking about. What's really unavoidable, and how we can work with those?

MR. BARNES: If I could get a form. Just fill out your name and we will give it to the reporter.

All right. McKenzie, what's your last name?

MS. McKENZIE O'BRIEN: O'Brien, McKenzie O'Brien.

MR. BARNES: Go ahead.

PH-3-1

MS. McKENZIE O'BRIEN: Well, there's, like, a huge list of concerns that I have, but two that I'd like to speak to now is how the EIR will address the California Air Quality Act, the quality, especially since most of the concerns in the three project proposals do address the air quality.

PH-3-2

Also I'd like to see how this building will be funded given the cutbacks.

MR. BARNES: Okay. Anybody else like to speak? We can have a Quaker meeting for a while.

PH-4-1

MS. HEITE: I was wondering who's going to be instructing and kind of looking over the replanting of any trees and who's going to be making sure that that happens?

And then this one, it says the project would pay for planting an equal number of trees, but it doesn't list specific trees, which I find interesting.

And to just kind of the idea, what's coming from replacing one ecosystem with another, and how that's being managed, and who's overseeing that.

Just hearing about different things, you know, topsoil, bottom soil are totally different things. So I was

PH-4-1 (cont)

just kind of wanting to see where that's coming from, but replacing one ecosystem and planting new trees, how that's becoming equal?

MR. BARNES: Any other comments?

PH-5-1

MS. McKENZIE O'BRIEN: I'll speak another time. Part of the LEEDS certification requires habitats to be replaced that are being displaced, plants and animals. I was wondering where these habitats will be placed and where will the animals and plants be relocated in the LEEDS recertification?

MR. BARNES: Yes. Let me get your form.

PH-6-1

MR. WILL SPANGLER: My name's Will Spangler. And I guess my questionis, this is across the street from the fire department. And I haven't looked closely at the EIR, whether there's a comment on that, but especially with tall buildings, that brings up fire concerns and just how that affects the campus fire department might be addressed.

MR. BARNES: Any other comments? Would you like to speak?

MS. FUNG: Yes.

MR. BARNES: I'm really encouraging comments, so please feel free to speak.

PH-7-1

MS. FUNG: I know there's different levels of LEED certification, and I was wondering why silver was chosen to be the choice for this project?

MR. BARNES: Okay. Next.

PH-8-1

MS. HEITE: I guess, also something you brought up. With the budget cuts, where the money is coming from? Like, you know, we're going to be getting independent money from different companies, and I understand that goes to different departments of the school. But I guess, like, where does this fit into maintaining and excelling in the programs that are already going?

And the students that are already here are feeling like their education is being undermined and less valued now with the kind of new buildings going up. Trying to make sure the people that are already enrolled and already paying their tuition, keep the prestige that they originally had when they came here without cutting other programs? How are we going to add this?

MR. BARNES: Would anybody else like to speak?

(No response.)

MR. BARNES: With that, I think I'll close the hearing.

Thank you very much for coming. We appreciate all your comments.

(End of record, 6:37 p.m.)

STATE OF CALIFORNIA)
) ss.
COUNTY OF MONTEREY)

I, JOANNE C. BUSHAW, a Certified Shorthand Reporter, License No. 4334, duly certified by the State of California, do hereby certify:

That the foregoing proceedings, being pages 1 through 15 only, were taken before me at the time and place first herein set forth;

That the foregoing transcript is a true and correct record of all proceedings had at the time and place of this public hearing, as recorded by me stenographically, to the best of my ability, and thereafter prepared in transcript form under my direction;

I further certify that I am a disinterested person, and that I am in no way interested in the outcome of said meeting.

DATED this 5th of May, 2009.

____
Certified Shorthand Reporter
State of California

Responses to Comments at Public Hearing

Response to Comment PH-1-1: Access to Crown College from Chinquapin Road would be maintained throughout construction. The existing access road would not be demolished until the new access road is in place.

Response to comment PH-2-1: The new building would be plumbed to allow for future use of greywater, by installing dedicated piping both to collect waste from basins and showers and to distribute the treated greywater to the toilets. However, because there currently are no State standards governing indoor use of greywater, to avoid the risk of installing an expensive treatment system that may not meet the State standards that are ultimately adopted, the Campus may delay the installation of a treatment system until State regulations for treatment of indoor water use have been adopted. For further information regarding the project's greywater system, please see Response to Comment I-1-2.

Response to Comment PH-2-2: The visual impacts of the project, including the building heights, are analyzed on pages 3.1-10 to 3.1-11 of the Draft EIR. The project would substantially alter the visual character of the area by removing trees that are a significant element in the existing visual landscape and by constructing buildings whose mass and height are inconsistent with the scale of existing development. The EIR concludes that this impact would be significant and unavoidable.

Response to Comment PH-2-3: The EIR identifies two significant and unavoidable impacts of the project: degradation of the existing visual character of the area and construction noise. The impact on the visual character of the project area is analyzed under ECI Impact AES-1, on pages 3.1-10 to 3.1-11 of the Draft EIR (see Response to Comment PH-2-2). This impact is considered significant and unavoidable because the only way to reduce the impact to a less-than-significant level would be to reduce the size of the buildings and/or eliminate one of the buildings, which would reduce the ability of the project to meet the basic project objectives.

Construction noise is analyzed under ECI Impact NOIS-1, on pages 3.10-14 to 3.10-15 of the Draft EIR. This impact is considered significant and unavoidable because even with implementation of the available mitigations, including the use of noise controls on construction equipment, operational procedures to minimize noise levels, and adjustment of construction schedules to minimize disturbance to nearby building occupants, noise from project construction is still likely to exceed the applicable noise standard at some of the buildings in Crown/Merrill Apartments and Crown College.

CEQA provides that a public agency may determine that the significant and unavoidable impacts of a project are outweighed by specific legal, social, technological or other benefits of the project. If The Regents approve the project, the record of project approval must include a statement of overriding considerations that presents the specific reasons why The Regents has decided to approve the project despite its environmental effects.

Response to Comment PH-3-1: The potential air quality impacts of the project, including emissions of air pollutants regulated under the California Clean Air Act, are analyzed in Section 3.3 of the Draft EIR. With implementation of mitigation measures, none of these impacts would be significant.

Response to Comment PH-3-2: The proposed project, like all UC housing projects, is funded by student housing fees and not by State funds. Funds for the project would be provided by a combination of existing Housing Reserve funds and external financing. The University would repay the external financing through future student housing fees. The Regents approved the financing plan for the project in March 2009.

Response to Comment PH-4-1: Tree replacement is both part of the ECI project design and, additionally, required by ECI Mitigation AIR-5. This tree replacement would be overseen by the UC Santa Cruz Grounds Services. The replacement trees would be species native to the campus, including redwood and California live oak. These new trees would not replace existing ecosystems, but would be planted in locations on the campus that already have suitable soils and where the same tree species have grown in the past and/or are currently growing.

Response to Comment PH-5-1: LEED™ certification does not require relocation of habitat, plants or animals that have been displaced by a project. The LEED™ certification process requires that each project meet certain "pre-requisite" standards, but beyond these "pre-requisites," the project team selects from a list of possible points to pursue for a particular project. The Campus is planning to pursue Sustainable Site Credit 5.1 (Site Development, Protect or Restore Habitat). To meet the requirements of this credit for a previously developed site, such as the proposed ECI project site, a minimum of 50 percent of the site area (excluding the building footprint) must be restored or protected with native or adapted vegetation. The project would meet this requirement through the proposed landscaping plan which, with the exception of a small area of turf consists, entirely of native species and other species adapted to the local climate.

Response to Comment PH-6-1: Potential effects of the proposed project on fire station operations are analyzed under ECI Impact HAZ-2 (pages 3.7-10 to 3.7-11 of the Draft EIR) and ECI Impact HAZ-3 (pages 3.7-11 to 3.7-12 of the Draft EIR). The discussion under ECI Impact HAZ-2 addresses the potential for construction-related road closures to interfere with fire department vehicles exiting the station via Chinquapin Road. The EIR concludes that this impact would be less than significant with implementation of ECI Mitigation HAZ-1, which requires that the Campus' project manager, the construction contractor, and the Fire Marshal develop specific procedures for traffic controls and for communication between the fire department and the contractor or traffic control personnel.

As discussed on page 3.12-5 of the Draft EIR, the City of Santa Cruz Fire Department generally assists the UC Santa Cruz Fire Department in fighting structural fires on the campus and the City's ladder truck would be required to reach the upper floors of the proposed project.

The discussion under ECI Impact HAZ-3 describes the procedures that the Campus follows during project design and construction to minimize potential for wildland fires to affect new buildings, and the elements included in the project to address fire codes and to facilitate fire department response to fires in the new buildings.

Response to Comment PH-7-1: The UC Policy on Sustainable Practices requires that all new projects (other than laboratories and acute care facilities) must, at a minimum, be LEED™ certified, and that campuses strive to achieve a standard equivalent to a LEED™ "Silver" rating or higher, whenever possible, within the constraints of program needs and standard budget parameters. The project is targeting at least a LEED™ Silver certification, taking into account design considerations, project cost and the practicability of using certain technologies that could make it difficult to achieve higher LEED™ levels. The current LEED™ assessment of the project suggests that the design will provide LEED™ points sufficient to achieve a Gold rating.

Response to Comment PH-8-1: As described in response to comment PH-3-2, above, the proposed project would not be funded by the State. Construction of the project would not affect funding for any existing or future academic programs.

CHAPTER 9 CHANGES TO THE DRAFT EIR

TABLE

CHAPTER 9

Changes to the Draft EIR

The text of the Draft EIR has been revised to make insignificant modifications and corrections to the Draft EIR. The changes reflect the minor changes to the project made during design development, as described in Chapter 1, *Introduction*, and corrections to the text of the Draft EIR. Changes are shown throughout the EIR in underscore and strikeout format, so that the original and revised text may be compared. Table 9-1 lists the pages of the Draft EIR on which changes have been made.

Table 9-1

Summary of Revisions to the Draft EIR

Section	Page number(s)	Revision
0.0., *Introduction*	3	The following text is revised as shown: The analysis of all environmental issues except climate change, water supply and population/housing is tiered, in this project-level EIR, from the relevant discussion and analysis of these issues in the 2005 LRDP EIR.
0.0., *Introduction*	5	The following text is revised as shown, to correct an editorial error in the Draft EIR: This EIR also may be used by responsible agencies with permitting or approval authority over the proposed ECI Project~~ and/or subsequent projects tiered from the LRDP EIR~~, to assess the environmental effects of the project with respect to resource issues within each agency's permitting or approval authority.
1.0, *Executive Summary*	1-6	In Table 1-1, in the row labeled "BIO-1," the text in the column labeled "Level of Significance Prior to Project Mitigation is revised as follows, to correct an editorial error in the Draft EIR: ~~PS~~LS In Table 1-1, the row labeled "BIO-2" is deleted.
1.0, *Executive Summary*	1-14	In Table 1-1, the description of EIC Impact HAZ-3 is revised as shown, to correct an editorial error in the Draft EIR: ~~Construction activities associated with the proposed project could potentially interfere physically with the campus's Emergency Operations Plan (EOP).~~ The proposed project would increase the residential population in an area that is potentially subject to wildfire.
1.0, *Executive Summary*	1-15	In Table 1-1, in the row labeled "TRA-1," the following text is added to the column labeled "Applicable LRDP Mitigation:" None.
2.0, *Project Description*	2-1	The following text is revised as shown: The project would also include accessible parking ~~for students, employees, the campus car-share program,~~ and parking for service vehicles.
2.0, *Project Description*	2-1	The fourth paragraph is revised as follows: The project would include relocation ~~configuration~~ of a roadway that currently provides access from Chinquapin Road to Parking Lot 111 and also to the main entry to Crown College. One driveway at the north end of ECI Building B~~, north of the present entry to Parking Lot 111,~~ would provide access to the ~~reconfigured~~ existing parking lot. A second driveway at the south end of ECI Building B, ~~south of the present entry,~~ would replace the present entry to Crown College…Some

Table 9-1

Summary of Revisions to the Draft EIR

		additional ~~resident and~~ ADA-accessible and service vehicle parking would be provided on~~-streets within the development~~ these two new access roads.
2.0, *Project Description*	2-2	The first sentence of the first full paragraph is revised as follows: The project would include construction of ~~off-site and on-site~~ storm water infrastructure improvements that would capture storm water flow from areas north and south of the complex and from the complex itself, and divert it to new detention and infiltration facilities on-site.
2.0, *Project Description*	2-4	The following text is revised as shown: The two lower terraces of that parking lot would be used for construction staging, but are not included in the project area of disturbance. The lots would be closed during construction, then recoated with asphalt slurry~~paved~~ and restriped for parking at the conclusion of construction.
2.0, *Project Description*	2-4	The following text is corrected as shown: One small (938-sf) single-story building, the Crown College Preceptor Apartment, located adjacent to Chinquapin Road at the northwest~~east~~ end of Crown College, would be removed as part of the proposed project.
2.0, *Project Description*	2-5	The following text is revised as shown: ECI Building A (140 ft. long and 62 ft. wide) would be set at a diagonal to the relocated Crown access road, with the narrower side closest to the road. Building B (approximately 348 ft. long by 64 ft wide~~300 feet in length~~) would be located along Chinquapin Road between the two project access roads, with its longest dimension parallel with Chinquapin Road.
2.0, *Project Description*	2-6	The following text is revised as shown: Redwood and mixed evergreen forest areas northeast of Building A would be preserved. The topography of the swale immediately east of Building B~~Chinquapin Road~~ and south of the northern access road, including the uppermost terrace of Parking Lot 111, would be graded to create a terraced bioretention area that would include a small turf area and native plantings.
2.0, *Project Description*	2-6	The following text is revised as shown: The buildings as planned would vary in footprint, with the footprint of Building A at about 8,~~650~~445 sf and Building B at about 19,700 sf. Overall building footprints would total about 28,~~400~~120 sf. The buildings together would provide about ~~136,000~~ 136,600 assignable square feet (asf) (1~~96,000~~ 228,340 gross square feet [gsf]) of new student housing development space, with ~~37,000~~36,420 asf (~~50,000~~ 65,750 gsf)/144 beds in Building A and ~~121,000~~ 100,160 asf (~~146,000~~ 162,600 gsf)/450 beds in Building B. ~~Both buildings would vary from seven to eight stories in height~~. Building A would be a consistent seven-stories high. To improve conformity with existing grades and to avoid high rise construction, Building B would be stepped, with the entire west half of the building ~~such that the north end of the building would be one story higher than the south end, and (~~the Chinquapin side) ~~of the building would be~~ at eight stories, one floor higher than its seven-story east side.
2.0, *Project Description*	2-6	The following text is revised as shown: The proposed color scheme for the exterior surfaces would consist of browns, grays and greens, drawing inspiration from the natural colors

Table 9-1

Summary of Revisions to the Draft EIR

		surrounding the site.
2.0, *Project Description*	2-6 to 2-7	
2.0, *Project Description*		The following text is revised a shown: Due to the site's complex geology and soils, the foundation system would consist of drilled piers (up to 90 feet deep) with column caps, grade beams, and a matt and reinforced concrete slab, designed to span over potential subsurface voids. Soils under the mat slab would require lime treatment to reduce the expansion potential of clay soils. It is not anticipated that compaction grouting of soft soil zones would be required. The buildings would be constructed on top of these foundation elements using structural steel columns, beams and diagonal brace frames, with concrete-filled metal floor and roof decks and light gauge steel infill framing. The foundation system for each building is expected to ~~consist of drilled piers up to 125 feet deep and column caps, and a reinforced concrete mat, designed to span over potential subsurface voids. Soils under the mat may require lime treatment to reduce the expansion potential of clay soils. It is not anticipated that compaction grouting of soft soil zones would be required.~~ ~~The buildings would be constructed on steel frames with concrete structural walls. Vertical and horizontal expanses of low-emittance window glazing on the face of each building would be separated by horizontal bands of stained board-form concrete, fritted (opaque) glazing and cement plaster, and vertical metal panels.~~
2.0, *Project Description*	2-7	The following text is deleted: Each floor would be divided into three- or four-bedroom apartments or a mixture of the two.
2.0, *Project Description*	2-7 to 2-8	The following text is revised as shown: The existing entry road to Crown College would be demolished and a ~~reconfiguration of the~~ new entry drive to Crown College, which would intersect Chinquapin Road about 220 feet south of the current entry drive, would provide access to Building A at the southern end of the complex, and to the entry to the main plaza~~/terrace~~ area…A ramp along the east edge of the ECI plaza, connecting to both the north and south access roads, would provide emergency vehicle access to the east side of Building B and the west side and north end of Building A and along the length of the east side of the site The ~~terrace~~ plaza also would provide an emergency vehicle access and pedestrian route along the length of the east side of Building B~~the facility~~, which would ~~be~~ link~~ed to both~~ the new northern and southern motor vehicle access roads…Secure bicycle storage would be provided ~~adjacent to the buildings in a bike parking area.~~in a basement at the southern end of Building B. Existing pedestrian stairways and paths between Crown and Merrill Colleges and the Crown/Merrill Apartments, which presently lead across the middle and lower terraces of Parking Lot 111, would be rerouted temporarily during construction, and a temporary pedestrian route would be

Table 9-1 **Summary of Revisions to the Draft EIR**		
		designated around the east <u>and west edges of the construction area </u>~~end of the lower terrace of Parking Lot 111~~. After the project is completed, the new plaza <u>and adjacent landscaped terraces </u>would improve pedestrian access across the site.
2.0, *Project Description*	2-9	The following text is revised as shown: To provide adequate pressure, the fire water line for the new buildings would ~~either~~ connect to the existing domestic water main upstream of a pressure-reducing valve just north of the fire station parking lot (Figure 2-2)~~, or would connect to the campus domestic water main in Chinquapin Road adjacent to the project site. If connection to the area north of the fire station is required, the~~ <u>This </u>new fire water line would be<u> located</u> in areas that are already paved or otherwise disturbed. Each project building, and the irrigation system, would be provided with a separate water meter to facilitate monitoring of water consumption.
2.0, *Project Description*	2-9 to 2-10	The vegetated roof would consist of a waterproof membrane, <u>an "egg-crate" water retention layer, </u>a root barrier, a growing medium, and highly drought-resistant ground cover plants.. In large storm events, when the rainfall on the vegetated roof exceeds the capacity of the soil and vegetation to hold water, the excess flows would overflow down roof leaders and be directed to the bioretention~~/bioswales~~ and rain gardens adjacent to the building and in the plaza…In large storms, the excess runoff to these features would be collected in perforated piping within the drain rock, and piped to ~~the bioretention area east of Building B or~~ to underground detention vaults. Paving in the plaza adjacent to Building B would be pervious. The pavement would be <u>provided with an underdrain</u> to prevent saturation of the subgrade soils. The underdrain system would drain the overflow storm water via pipe to the detention vaults~~bioretention area northeast of the plaza~~. ~~This consists of swale configured as a series of terraces that would be separated by curving retaining walls and planted in turf. Runoff that reaches the bioretention area would be handled either through a passive irrigation system underlain by underground storage tanks to capture excess flows, or simply would be captured in underground tanks without the overlying irrigation system. In either case, the w~~Water stored in the tanks would be discharged to the existing culverts that run beneath the two lower terraces of
2.0, *Project Description*	2-11	The following text is revised as shown: Each apartment in the ECI Project would be provided with ~~cable and/or~~ internet-ready connections. Cable television (CATV) service <u>also</u> would be provided to <u>each apartment in </u>the ECI complex by UC Santa Cruz ITS Media Services. The proposed project would add new lines, with points of connection <u>for both buildings </u>on ~~Chinquapin for Building B and on~~ the Crown access road~~ for Building A~~. Cell phone service in this area of campus is facilitated by cell antennae on the campus a short distance uphill from the Crown/Merrill Apartments.
2.0, *Project Description*	2-11 to 2-12	The following text is revised as shown: ~~Underground conduit in Chinquapin has sufficient capacity to provide electrical service to the proposed project.~~ <u>The electrical lines in Chinquapin Road would be upgraded by installing new cable</u>

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		in existing conduit down Chinquapin Road to McLaughlin Drive, and in McLaughlin Drive from Chinquapin Road to Hagar Drive. Two new switchboxes would be installed underground beneath McLaughlin Drive. Points of connection ~~likely would be similar to those for telephone and cable lines~~ for electricity and gas would be at a utility service yard at the northwest end of Building B. Power would be distributed through Building B and the project site to Building A.
2.0, *Project Description*	2-13	The following text is revised as shown: Design will also incorporate.. design and use of water-efficient landscaping, irrigation systems and plumbing fixtures (including plumbing for a future greywater system) to minimize water demand from the project.
2.0, *Project Description*	2-14	The following text is revised as shown: Next, a new access road into Crown College, which also would serve as the south access road to the project site, would be constructed and paved and the existing Preceptors' Apartment building would be demolished, along with parking areas, roadways, and utilities within the project footprint that are not designated to remain, with the exception of the existing parking and access road to Crown College. A new access road into Crown College, which also would serve as the south access road to the project site, would be constructed and paved and put into service, and the existing Crown access road would then be demolished. Organic topsoil from the site would be removed, stockpiled, and protected for future landscaping. Site grading would entail 5,900 cubic yards (cy) of cut and 9,050 cy of fill.
2.0, *Project Description*	2-14	The following text is revised as shown: It is anticipated that heavy equipment would be operating daily on the site during at least the initial ~~12~~ 9 months of development, and less intensively for the following six months.
2.0, *Project Description*	2-14	The following text is revised as shown: Electrical and gas service along Chinquapin would be interrupted briefly while project utilities are connected. ~~No interruptions of existing utility service are anticipated.~~
3.1, *Aesthetics*	3.1-7	The following text is revised as shown: The building color palette would consist of natural colors, such as browns, grays, and greens.
3.1, *Aesthetics*	3.1-9	The title of subheading 3.1.4.3 is revised as shown to correct an editorial error in the Draft EIR: ~~2005 LRDP~~ Project Impacts and Mitigation Measures
3.1, *Aesthetics*	3.1-12	The following text is revised as shown: The building color palette would consist of natural colors, such as browns, grays, and greens.
3.3, *Air Quality and Climate Change*	3.3-28	The following text is revised as shown: This estimate of natural gas usage does not take into account the greater energy efficiency of the proposed project, which must comply with current UC policy requiring that new buildings ~~is being designed to~~ exceed the energy efficiency standards of Title 24 by at least ~~28~~20 percent.
3.3, *Air Quality and Climate Change*	3.3-31	The following text is revised as shown, to correct a typographical error: MBUAPCD

Table 9-1 **Summary of Revisions to the Draft EIR**		
3.3, *Air Quality and Climate Change*	3.3-36 to 3.3-37	The following text is revised as shown: ~~Although the project does not include solar water heating,~~ In compliance with the UC Policy on Sustainable Practices, the new buildings will be designed to exceed Title 24 energy efficiency standards by ~~28%~~at least 20 percent. This would be achieved in part by ~~In addition, the project would~~ complying with Campus policy of not providing air conditioning for comfort, ~~which be an~~ additional energy savings compared to business ~~as-usual development that ,~~ although this is not technically reflected in the Title 24 calculations. In addition, the project may include solar heating for domestic hot water.
3.3, *Air Quality and Climate Change*	3.3-38	The following text is added to Table 3.3-9 in the row labeled"SPM-17: Water:" The new buildings would be plumbed to allow for future use of greywater for toilet flushing.
3.3, *Air Quality and Climate Change*	3.3-39	Text in Table 3.3-9, in the row labeled "Green Building Design," is revised as follows: Project will exceed Title 24 energy efficiency standards by ~~28~~ at least 20 percent. The following text is added Table 3.3-9, in the row labeled "Environmentally Preferable Purchasing Policies:" The buildings would be plumbed to allow for future use of greywater for toilet flushing.
3.4, *Biological Resources*	3.4-3	The following text is revised as shown: As reported in the 2005 LRDP EIR, Section 3.4, this ecological subregion is classified as the Santa Cruz Mountains Subsection of the California Central Coast ~~Section~~.
3.4, *Biological Resources*	3.4-10	The following text is revised as shown: Because the proposed project ~~would~~ could include some rock emplacement or other minor manual work around the culvert in Gully H, to improve erosion protection in this area, and because storm water from the project site flows to Gully H, the gully was assessed to determine whether it exhibits wetland characteristics or meets the criteria of a jurisdictional wetland.
3.4, *Biological Resources*	3.4-14	The following text is revised as shown: No special status plant species have been recorded previously from the East Campus Infill project area and none was observed during an October 2008 botanical field survey of the site, or during a subsequent spring botanical survey (Biotic Resources Group 2008, Biotic Resources Group 2009). ~~The project botanical survey was conducted outside of the blooming season for most herbaceous plant species. A spring season plant survey would be necessary to confirm definitively the presence or absence of special status plant species; however,~~
3.4, *Biological Resources*	3.4-17	The following text is revised as shown: The October 2008 reconnaissance-level wildlife survey (H.T Harvey & Associates 2008) determined that the ECI Project area and Gully H provide suitable habitat for all of the above-listed bat species.
3.4, *Biological Resources*	3.4-20	The following text is revised as shown: With the exception of a small area of turf, the proposed project will be landscaped in native, non-invasive and drought-tolerant species.
3.4, *Biological Resources*	3.4-21	The following text is revised as shown: Potential biological impacts of the proposed project are evaluated based on a

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		review of the available literature regarding the status and known distribution of the special-status species within the campus, including the project area, as reported in the 2005 LRDP EIR, and on botanical, wildlife and wetland field surveys conducted for the proposed project (Biotic Resources Group 2008 and 2009; H.T. Harvey & Associates 2008 and 2009).
3.4, *Biological Resources*	3.4-25	The impact summary table for ECI Impact BIO-2 is deleted and the following text is revised as shown: ~~A b~~Botanical surveys of the project site wa~~s~~ere conducted in October 2008 and April 2009 (Biotic Resources Group 2008 and 2009), as reported in Section 3.4.1.9, above. No special status plants were identified on or near the project site and, in the assessment of the project botanist, the site does not appear to include suitable habitat for any of the special status plant species known or considered likely to be present on the campus, including Santa Cruz manzanita, Point Reyes horkleia, marsh microseris, San Francisco popcorn flower, and an undescribed sedge. ~~However, it is recognized that some of these species may be difficult or impossible to recognize outside of the blooming season. Project development would require grading and clearing that could destroy individuals or colonies or protected plants, should any such plants be present. While destruction of individual plants would not constitute a substantial adverse effect to the species and would be a less-than-significant impact under CEQA, preservation of small outlying colonies is desirable. Therefore, under ECI Mitigation BIO-2, a spring blooming season botanical survey would be conducted to identify any such specimens. Any specimens or colonies discovered would be protected if possible, or relocated to suitable habitat nearby. The implementation of this measure would further reduce the less-than-significant impact.~~ Therefore, no impacts to special status plants would occur.
3.4, *Biological Resources*	3.4-30	The third paragraph is revised as shown: The reconnaissance-level wildlife survey of the ECI Project site (H.T. Harvey 2008) determined that the ECI Project area provides habitat that may be suitable for all of the above-listed bat species. A more intensive survey and acoustical monitoring in March 2009 did not find any bats within the project area, but bat specialist Dr. Dave Johnston identified several oaks on the site whose configuration appeared to provide suitable maternity roost habitat. ~~Many trees exhibit deep crevices suitable as roosts for pallid bats and other species of cavity roosting bats. Additionally, many of the mature redwoods on the project site feature heavily corrugated bark that could provide roosting habitat for nonbreeding pallid bats. Buildings in the project vicinity also provide potential nonbreeding roost sites for many bat species.~~
3.4, *Biological Resources*	3.4-31	The following text is added: Another acoustical survey would be conducted on the site prior to tree removal if removal is scheduled prior to the end of the maternity season, with follow-on mitigation as described above, if bats are present.
3.5, *Cultural Resources*	3.5-14	The following revision is made under "References:" Eselius, D. 2003. Letter to UC Santa Cruz Environmental Group

Table 9-1 Summary of Revisions to the Draft EIR		
		regarding "UCSC Proposed Humanities and Social Sciences Facility Environmental Impact Assessment." On file at UCSC Physical Planning and Construction~~Pacific Legacy, Inc., Santa Cruz~~. April 25.
3.7, *Hazards and Hazardous Materials*	3.7-11	The description of ECI Impact HAZ-3 is revised as follows to correct an editorial error in the Draft EIR: ~~Construction activities associated with the proposed project could potentially interfere physically with the campus's Emergency Operations Plan (EOP).~~The proposed project would increase the residential population in an area that is potentially subject to wildfire.
3.8, *Hydrology and Water Quality*	3.8.12	The following text is revised as shown: To avoid concentration of runoff ~~to the filled doline beneath the existing parking lot, which could potentially result in reactivation of this feature,~~ adjacent to the buildings, the proposed storm water management features would be lined with impermeable barriers; the other retention areas would not be lined ~~(Pacific Crest Engineering 2008b)~~.
3.8, *Hydrology and Water Quality*	3.8.12	The following text is revised as shown: The 0.13-acre (5,750-sf) green/living roof would be located on the eastern portion of Building B. The vegetated roof would consist of a waterproof membrane, an "egg-crate" water retention layer, a root barrier, a growing medium consisting of an engineered blend of inorganic and organic contents, and highly drought-resistant ground cover plants.
3.8, *Hydrology and Water Quality*	3.8.12	The following text is revised as shown: These would also provide some reduction in runoff volume through evapotranspiration. In large storms, the excess runoff to these features would be collected in perforated piping within the drain rock, and piped to the ~~bioretention~~ landscaped area east of Building B or to underground detention vaults.
3.8, *Hydrology and Water Quality*	3.8.12	The following text is revised as shown: Pervious paving in the plaza adjacent to Building B would be a mixture of porous concrete and open-jointed pavers. The porous concrete would consist of 8 inches of porous concrete underlain by 6 inches of drain rock, and an underdrain system. ~~The pervious pavement system would be lined with an impervious liner to prevent saturation of the subgrade soils.~~
3.8, *Hydrology and Water Quality*	3.8.12	The following change is revised as shown: The Campus is considering two options for management of runoff ~~that reaches the bioretention area northeast of the plaza~~ discharged to Gully H. Under Option 1, a passive irrigation system would be installed beneath a ~~landscaped open space~~ bioretention area east of Building B.
3.8, *Hydrology and Water Quality*	3.8.13	The following text is revised as shown: Under Option 2, the ~~bioretention area~~ landscaped area east of Building B would consist of conventional landscaping and would not include a passive irrigation system. Instead, runoff ~~filtered through the bioretention area~~ would be stored in underground tanks that would discharge to two 5,000-gallon cisterns. The cisterns would store runoff for use in landscape irrigation, which would offset a small portion of the project's irrigation water demand. The underground tanks would be sized to contain

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		the excess runoff from the 2-year, 5-year and 10-year storms. Overflow in excess of the 10-year design storm beyond the capacity of the cisterns would discharge to Gully H through the culverts beneath the lower parking lot terraces.
3.8, *Hydrology and Water Quality*	3.8.18	The following text is revised as shown: In addition, some of the runoff flowing to the vegetated roof and bioretention areas would be retained in the soil and then lost to evapotranspiration, and some would be stored for later use in landscape irrigation.
3.8, *Hydrology and Water Quality*	3.8.18	The following text is revised as shown: As described in Section 3.8.2, above, the Campus is considering two options for management of runoff ~~that reaches the bioretention area northeast of the plaza~~ discharged to Gully H. Under Option 1, a passive irrigation system would be installed beneath ~~the~~a bioretention area east of Building B…Under Option 2, ~~bioretention area~~ landscaped area east of Building B would consist of conventional landscaping and would not include a passive irrigation system. Instead, runoff ~~filtered through the bioretention area~~ would be stored in underground tanks that would discharge to two 5,000-gallon cisterns. The cisterns would store runoff for use in landscape irrigation, which would offset a small portion of the project's irrigation water demand. The underground tanks would be sized to contain the excess runoff from the 2-year, 5-year and 10-year storms. Overflow in excess of the 10-year design storm beyond the capacity of the cisterns would discharge to Gully H through the culverts beneath the lower parking lot terraces.
3.13, *Recreation*	3.13-4	The following text is revised to correct an editorial error in the Draft EIR: The effect on recreational facilities of the project-related population that would live off campus is analyzed under cumulative impacts (~~ECI Impacts REC-4 and REC-5~~Section 3.13.3.4).
3.15, *Utilities and Service Systems*	3.15-18	The following text is added to the description of electrical service to the proposed development: The electrical lines in Chinquapin Road would be upgraded by installing new cable in existing conduit down Chinquapin Road to McLaughlin Drive, and in McLaughlin Drive from Chinquapin Road to Hagar Drive. Two new switchboxes would be installed underground beneath McLaughlin Drive.
3.15, *Utilities and Service Systems*	3.15-18	The following text is added to the description of natural gas service to the proposed development. The Campus is evaluating whether the natural gas line in Chinquapin Road, which would serve the proposed project, has adequate pressure to meet the project demand. If the pressure is not adequate, the Campus would upgrade approximately 100 linear feet of existing pipeline in Hagar Drive between Steinhart Drive and McLaughlin Drive, where there is a constriction that resulted from a previous repair. The work would be within the existing roadway.

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Summary of Revisions to the Draft EIR

3.15, *Utilities and Service Systems*	3.15-18	The following revision is made to the description of telecommunications service to the proposed development: Telecommunications and cable television service will be provided from the existing underground campus infrastructure in Chinquapin Road and the Crown access road. New conduit would be installed in a trench in the Crown access road from the Crown Circle east for approximately 100 feet, to the north side of the Crown/Merrill Dining Commons building.
3.15, *Utilities and Service Systems*	3.15-25	The first paragraph under ECI Impact UTIL-2 is revised as follows: The combined, estimated electricity demand of the two project buildings is 1,192 kW (330 kW for Building A and 852 kW for Building B) and the projected annual electricity usage is 841,500 million kWh. Electric lines for the proposed project would connect to the existing campus 12KV underground electrical distribution system in Chinquapin Road adjacent to the project site. With the exception of a segment approximately 60 feet, which would be installed in a trench across the west end of the central parking lot, ~~T~~the new electric lines would be within the project area of disturbance shown on Figure 2-2 and included in the analysis of project "footprint" and construction impacts in Sections 3.3...~~No off-site improvements to the campus electrical distribution system would be required to serve the proposed project.~~ As described in Section 3.15.2.4, off-site upgrades to the electrical lines in Chinquapin Road would be limited to the installation of new cable in existing conduit and two new underground switch boxes beneath McLaughlin Drive. These improvements would not result in disturbance of biological resources or the addition of new impervious surface and therefore would not result in significant environmental impacts.
3.15, *Utilities and Service Systems*	3.15-26	The last sentence under "Telecommunications" is revised as follows: ~~No o~~Off-site improvements to the campus telecommunications system would be limited to trenching and installation of new conduit in the existing Crown access road, and no improvements to off-campus telecommunications facilities would be required to serve the proposed project.
3.15, *Utilities and Service Systems*	3.15-26	The following text is added: As explained in Section 3.5.1.2.5, above, replacement of a constricted segment of natural gas pipeline in Hagar Drive between Steinhart Way and McLaughlin Drive may be required to provide adequate pressure in the gas line in Chinquapin Road to which the project would connect. This improvement would entail replacing or bypassing the constricted segment with a new, 6-inch pipeline. The work would be limited to the existing roadway and would not result in significant environmental impacts.

CHAPTER 10 MITIGATION MONITORING PLAN

TABLES

CHAPTER 10

Mitigation Monitoring Program

The California Environmental Quality Act (CEQA) requires that a Lead Agency establish a program to monitor and report on mitigation measures adopted as part of the environmental review process to avoid or reduce the severity and magnitude of potentially significant environmental impacts associated with project implementation. CEQA (Public Resources Code Section 21081.6 (a) (1)) requires that a mitigation monitoring and reporting program be adopted at the time that the agency determines to carry out a project for which an EIR has been prepared to ensure that mitigation measures identified in the EIR are implemented.

The Mitigation Monitoring Program (MMP) for the East Campus Infill (ECI) Project is presented below as a table that includes the full text of the mitigation measures identified in the Final EIR. The Campus may modify the means by which it will implement a mitigation measure, as long as the alternative means of implementing the measure ensures compliance during project implementation. The MMP describes implementation and monitoring procedures, responsibilities, and timing for each mitigation measures identified in the EIR, including:

Mitigation Number: Identifies the number assigned to the mitigation measure in the Final EIR.

Mitigation Procedures: Summarizes the steps to be taken to implement the mitigation measures.

Mitigation Timing: Identifies the stage of the project during which each mitigation action will be taken.

Mitigation Responsibility: Assigns responsibility for implementation of the mitigation measure.

Monitoring and Reporting Procedure: Specifies procedures for documenting and reporting the mitigation implementation.

The responsibilities of mitigation implementation, monitoring and reporting extend to several UC Santa Cruz departments and offices. The Unit Director or department lead officer of the identified unit or department will be directly responsible for ensuring that the responsible party complies with the mitigation. Physical Planning and Construction is responsible for the overall administration of the program and for assisting relevant departments and project managers with their oversight and reporting responsibilities, to ensure that they understand their charge and complete the required procedures accurately and on schedule.

Physical Planning and Construction will maintain mitigation-monitoring records for the proposed project. Mitigation measures from the 2005 LRDP EIR that are applicable to the ECI Project will be implemented pursuant to the previous MMP adopted by the Regents as part of the 2005 LRDP on September 21, 2006. These mitigations are listed in Appendix B and in the relevant sections of Chapter 3 of this EIR. In addition to overseeing the specific procedures identified in the following table for implementation of each mitigation measure, Physical Planning and Construction prepares an Annual Mitigation Monitoring Report, that reports report on progress in implementation of general campus mitigation measures (that is, those measures that are not tied to specific development projects) and documents the status of compliance for each project.

Table 10-1 Mitigation Monitoring Program				
Project-Specific Mitigation Measure	**Mitigation Procedures**	**Mitigation Timing**	**Mitigation Responsibility**	**Monitoring and Reporting Procedure**
ECI Mitigation AIR-5: In addition to the new trees included in the proposed project landscaping plan, the campus shall plant 100 redwood trees in locations on campus that were historically redwood forest.	Coordinate with Grounds Services to select locations for planting. Maintain plants for one year.	Before project occupancy. For one year after trees have been planted.	PP&C/Grounds Services	Document that trees have been planted. Document that trees have been maintained for one year after planting.
ECI Mitigation BIO-4: Prior to construction or site preparation activities that may occur during the avian breeding season (typically February 1 through August 31), a qualified biologist shall conduct surveys for nesting special-status raptors such as the long-eared owl, for Vaux's swift colonies or roosts, and for nests of birds protected by the MBTA or the California Fish and Game Code. The survey area shall include all potential nesting habitat on and within 250 ft of the construction boundary for raptors and Vaux's swift colonies, and within 50 ft of the construction boundary for other native birds. The survey shall be conducted no more than 14 days prior to commencement of construction activities. If an active nest is found, a buffer of at least 250 ft will be maintained around any raptor nest or nest of a colonial bird and 50 ft around the nest of any other protected bird until the end of the breeding season or until the nest(s) are no longer active, as determined by a qualified biologist. A temporary fence or other means of marking this buffer shall be constructed.	Biologist will conduct pre-construction surveys as specified. If nests are found, biologist shall identify appropriate buffer. Procedures to be followed by contractor relative to any buffers shall be included in the project documents. Maintain buffer as specified by biologist.	No more than 14 days prior to construction. During plan review. During construction.	PP&C	Include biologists' report in project file. Document that project documents include the required procedures. Document that buffer is maintained as specified by the biologist.
ECI Mitigation BIO-5A: Prior to any tree removal or construction that may occur during bat breeding season (April 1 through August 31), but no more than 3 months before the beginning of the breeding season, a qualified bat biologist (i.e., a biologist holding a CDFG collection permit and a Memorandum of Understanding with CDFG allowing the biologist to handle and collect bats) will conduct a survey for roosting bats and potential roosting sites. All trees and structures on and in the vicinity of the project site (i.e., close enough to project areas to be potentially disturbed by project activities, in the opinion of a qualified bat biologist) will be	Biologist will conduct survey.	Between Jan. 1 and March 31, in the year during which construction will start..	PP&C	Include biologists' report in project file.

Table 10-1 Mitigation Monitoring Program				
Project-Specific Mitigation Measure	**Mitigation Procedures**	**Mitigation Timing**	**Mitigation Responsibility**	**Monitoring and Reporting Procedure**
assessed for their suitability for use by roosting bats. Any trees or structures that are identified as being high-potential roost sites will be surveyed more intensively, by eye and using acoustical equipment if needed to determine whether bats are present. If high-potential roost sites are identified or if bats are present, the campus shall implement exclusion measures as described in Mitigation BIO-5D.				
ECI Mitigation BIO-5B: If high-potential roost sites are identified or exclusion measures are implemented based on the initial survey, and more than 15 days pass without the commencement of construction, demolition or tree removal, pre-construction/pre-demolition bat survey of the high-potential roost sites will be repeated within 15 days prior to the commencement of construction or demolition.	Biologist will conduct survey	Within 15 days prior construction begins.	PP&C	Include biologist's report in project file.
ECI Mitigation BIO-5C: If a roost of any kind is found in an area (e.g., a building or tree) that will not be disturbed or can be avoided by construction, the roost structure will be designated for protection and will be avoided during construction.	Include procedures to be followed by contractor relative to any buffers in the project documents. Establish and maintain buffer during construction	During construction, if roosts are found. During construction.	PP&C	Document that project documents include the required procedures. Document that buffer is maintained.
ECI Mitigation BIO-5D: If a day roost is found in a building or tree that is to be completely removed, bats will be safely evicted under the direction of a qualified bat biologist. Eviction will occur only between September 1 and March 31, to avoid potential for encountering nonflying young, but will not occur during long periods of inclement or cold weather (as determined by the bat biologist) when prey are not available or bats are in torpor, and will occur at night, to minimize potential for predation. If a day roost is found within a building that is to be demolished, eviction (between September 1 and March 31) will occur by opening the roosting area to allow air flow through the cavity for at least one night prior to demolition, to allow bats to leave during dark hours. For roosts found in trees that must be removed or disturbed, bats will be evicted between September 1 and March 31, using	Biologist remove bats as specified in mitigation.	Prior to construction or demolition activities that could disturb roosts, as determined by the biologist.	PP&C	Include biologist's report in project fie.

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Mitigation Monitoring Program

Project-Specific Mitigation Measure	Mitigation Procedures	Mitigation Timing	Mitigation Responsibility	Monitoring and Reporting Procedure
one-way doors if feasible. If use of a one-way door is not feasible, or the exact location of the roost entrance in a tree is not known, the trees with roosts that need to be removed will first be disturbed by removal of some of the trees' limbs not containing the bats. Such disturbance will occur at dusk to allow bats to escape during the darker hours. These trees will then be removed the following day. All of these activities will be performed under the supervision of the bat biologist. A qualified bat biologist (in consultation with CDFG) may determine that it is preferable, under the circumstances, to allow roosting bats to continue using a roost while construction is occurring on or near the roost site. For example, if a tree found to contain a day roost is located near the construction area but will not be removed, a qualified bat biologist (in consultation with the CDFG) will determine whether the bats should be evicted or whether they should remain in place. If it is determined that the risks to bats from eviction (e.g., increased predation or exposure, or competition for roost sites) are greater than the risk of colony abandonment, then the bats will not be evicted.				
ECI Mitigation BIO-5E. If a maternity roost of any bat species is present on a construction site, the bat biologist will determine the appropriate size of a construction-free buffer around the active roost. This buffer would be maintained from April 1 until Aug. 31, or until the bat biologist has determined that the young are flying.	Include procedures to be followed by contractor relative to any buffers in the project documents. Establish and maintain buffer during construction	During plan review. During construction.	PP&C	Document that project documents include the required procedures. Document that buffer is maintained.
ECI Mitigation BIO-5F: In the event that a roost site used as a maternity roost by pallid bats is identified on or adjacent to the project site, and that roost site is abandoned, removed or bats must be evicted as a result of project activities, an alternative roost will be constructed. The design and placement of this structure will be determined by a qualified bat biologist based on the location of the original roost and the habitat conditions in the vicinity. This bat structure will be erected as long as possible in advance of removal of the original roost structure but no less than one month prior, or as soon as	Construct alternative roost and monitor as specified in the mitigation.	Prior to construction or demolition activities that could disturb roosts, as determined by the biologist. Monitoring is to continue for up to three years following completion of the project.	PP&C	Include biologist's reports, including documentation of the construction of alternative roosts and subsequent monitoring, in project file.

Table 10-1 Mitigation Monitoring Program				
Project-Specific Mitigation Measure	**Mitigation Procedures**	**Mitigation Timing**	**Mitigation Responsibility**	**Monitoring and Reporting Procedure**
possible after a roost site is determined to have been abandoned as a result of project activities. This structure will be checked during the breeding season for up to three years following completion of the project, or until it is found to be occupied by pallid bats, to provide information for future projects regarding the effectiveness of such structures in minimizing impacts to bats.				
ECI Mitigation BIO-6A: Within two weeks prior to any clearing of vegetation on the project site, a wildlife biologist will conduct a survey for San Francisco dusky-footed woodrat nests. If any nests are identified, ECI Mitigation BIO-6B will be implemented.	Biologist will conduct survey	Within two weeks prior construction begins.	PP&C	Include biologist's report in project file.
ECI Mitigation BIO-6B: Where nests are found, a 10 foot buffer will be designated around each nest, and high-visibility exclusion fencing will be erected. Moving or bumping the nests or logs or branches on which the nests rest will be avoided. If this measure is not feasible due to the extent or nature of construction, ECI Mitigation BIO-6C will be implemented.	Include procedures to be followed by contractor relative to any buffers in the project documents. Establish and maintain buffer during construction	During plan review. During construction.	PP&C	Document that project documents include the required procedures. Document that buffer is maintained.
ECI Mitigation BIO-6C: If a nest cannot be avoided, it will be dismantled by a qualified biologist and the nesting material moved to a new location outside the project's impact areas so that it can be used by woodrats to construct new nests. Prior to nest deconstruction, all nearby understory vegetation will be cleared. Then, each active nest will be disturbed by nudging or shaking by a qualified wildlife biologist, so that all woodrats leave the nest and seek refuge outside of the impact area. For tree nests, a tarp will be placed below the nest and the nest dismantled using hand tools (either from the ground or from a lift) to avoid injury to occupants. For any nest, the nest material will then be piled at the base of a nearby hardwood tree (preferably an oak, willow, or	Biologist move nests as specified in mitigation.	Prior to construction or demolition activities that could disturb nests, as determined by the biologist.	PP&C	Include biologist's report in project fie.

Table 10-1

Mitigation Monitoring Program

Project-Specific Mitigation Measure	Mitigation Procedures	Mitigation Timing	Mitigation Responsibility	Monitoring and Reporting Procedure
other appropriate tree species with potential refuge sites among the tree roots) outside of the impact area. If nearby habitat outside the impact area lacks suitable structure, appropriate materials (e.g., sticks or logs four ft long and six inches in diameter) will be placed in undisturbed riparian or oak woodland habitat nearby and the sticks from the dismantled nests will be placed among these logs. If multiple nests are displaced, the newly placed piles of nest materials will not be less than 100 feet apart.				
ECI Mitigation HAZ-1: If lane closures on Chinquapin Road are required for project construction, the campus's project manager, the construction contractor, and the Fire Marshal will develop specific procedures for traffic controls, and for communication between the UC Santa Cruz Fire Department and on-site contractor or traffic control personnel, to ensure that fire department vehicles are able to exit the station via Chinquapin Road without delay in the event of an emergency.	Consult with Fire Marshal and contractor to develop procedures.	Before construction begins.	PP&C	Include documentation of consultation and list of procedures in project file.
ECI Mitigation HYD-2: The storm water management system for the project shall be designed to release runoff to Gully H from the project site at the following rate: Runoff in excess of the estimated pre-development flow for the 2-, 5- and 10-year design storms shall not exceed 10 percent of the peak flow rate for the 2-year, pre-development design storm.	Confirm that final design of storm water management system meets the criteria specified in the mitigation.	During plan review, through completion of construction drawings.	PP&C	Include documentation by project civil engineer that system has been designed to meet the specified criteria, and documentation that campus engineering staff has approved the design.
ECI Mitigation NOIS-1: The noise mitigation program required of the project pursuant to LRDP Mitigation NOIS-1 shall be prepared in consultation with the residential staff at Crown/Merrill Apartments and Crown and Merrill Colleges and shall include the following	Confirm that construction contract specifications include the noise minimization measures specified in the mitigation	During final design review.	PP&C	List relevant specification sections or plan sheets on project mitigation monitoring checklist.

Table 10-1

Mitigation Monitoring Program

Project-Specific Mitigation Measure	Mitigation Procedures	Mitigation Timing	Mitigation Responsibility	Monitoring and Reporting Procedure
elements in addition to those specified in LRDP Mitigation NOIS-1: • Notices of the dates and hours of anticipated construction shall be posted in the upper quad residence halls at Crown College, the Crown College office and classroom buildings, and Crown/Merrill Apartments Building at the beginning of the fall 2010 quarter. • Residents of Crown/Merrill Apartments and Crown and Merrill Colleges shall be notified of the anticipated construction noise before they move in for the fall 2010 quarter. • The University shall identify staff responsible for communicating with residents of Crown/Merrill Apartments and Crown and Merrill Colleges regarding noise concerns, who shall notify residents of any changes to the posted construction schedule and of particularly noise activities.	Identify appropriate staff contacts at Crown/Merrill Apartments and Crown and Merrill colleges and coordinate with contractor on scheduling of loud construction work as specified. Confirm that notices have been posted and noise complaint mechanism is in place.	Prior to the start of construction Throughout construction		Document that consultation has taken place and include list of noise minimization measures in project file. Include confirmation that notices have been posted. Maintain list of noise complaints and their resolution.
ECI Mitigation TRA-5A: The Campus will complete new pedestrian counts and an assessment of transit delays and transit cycle time within six months after occupancy of ECI to determine whether, with the increase in pedestrian traffic and transit demand from the ECI Project, the LRDP measures incorporated in the project have been effective in maintaining transit cycle time such that transit travel times between the two most widely-separated colleges does not exceed the time interval between class periods.	Conduct or hire consultant to conduct study that includes quantification of transit cycle time, and transit delays at transit stops closest to the project site and prepare a report that includes recommendations of effective measures to reduce transit delays.	Within six months after occupancy of the project.	TAPS/ CUHS	Include transit delay study (or a reference to its location) in the project file.
ECI Mitigation TRA-5B: Beginning in fall 2011, the	Prepare and distribute materials	Before and during fall	TAPS/ CUHS	Include materials that were

Table 10-1

Mitigation Monitoring Program

Project-Specific Mitigation Measure	Mitigation Procedures	Mitigation Timing	Mitigation Responsibility	Monitoring and Reporting Procedure
Campus will prepare and distribute educational materials and implement an educational program regarding pedestrian safety and the adverse effects of illegal pedestrian road crossings on transit cycle times; and will post signs at campus bus shelters and at the Crown/Merrill and College Nine/Ten McLaughlin Drive crossings and the Chinquapin Road crossings regarding road crossing restrictions.	to all residents of Crown and Merrill Colleges and Crown/Merrill Apartments. Post signs as specified.	orientation in 2011.		distributed and description of how they were distributed in project file.
ECI Mitigation TRA-5C: If the study conducted under TRA-5A indicates that transit delays and cycle time have increased, despite implementation of TRA-5B, the Campus will implement additional improvements at the pedestrian crossings of McLaughlin Drive at Hagar Drive, Chinquapin intersection, and the Cowell Health Center/College Ten and Crown/Merrill transit stops to reduce transit delays associated with pedestrian crossings. These improvements may include but are not limited to one or more of the following measures to expedite crossings and reduce transit delays: • <u>Installation of barriers along McLaughlin and Hagar Drive, McLaughlin/Chinquapin intersection and College Nine/Ten transit stop on McLaughlin, to control pedestrian flow patterns and to channel pedestrian crossings to the crosswalk and discourage pedestrian crossings outside of the crosswalk.</u> • <u>Safety improvements to configuration of crosswalks (particularly at Chinquapin across McLaughlin)</u> • <u>Relocation of transit stops</u> • <u>Installation of pedestrian crossing or traffic signals that include an exclusive pedestrian phase, as</u>	Select and implement one or more of the measures identified in the report and report implementation in project mitigation monitoring report	Within one year after re-occupancy of ECI project.	TAPS	Select and implement one or more of the measures identified in the report and report implementation in project mitigation monitoring report

Table 10-1 Mitigation Monitoring Program				
Project-Specific Mitigation Measure	**Mitigation Procedures**	**Mitigation Timing**	**Mitigation Responsibility**	**Monitoring and Reporting Procedure**
warranted • Employment of a crossing guard to regulate pedestrian traffic across the intersection/street and enforcement of "jay-walking" violations				

Appendix A

2008 Comprehensive Settlement Agreement

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Exempt from filing fee
(Gov't Code § 6103)

SUPERIOR COURT OF CALIFORNIA

COUNTY OF SANTA CRUZ

CITY OF SANTA CRUZ, a charter city formed pursuant to and in accordance with the constitution and laws of the state of California, and, COUNTY OF SANTA CRUZ, a political subdivision of the State of California,

Petitioner and Plaintiffs,

v.

REGENTS OF THE UNIVERSITY OF CALIFORNIA and GEORGE BLUMENTHAL, Acting Chancellor, University of California, Santa Cruz, in his official capacity,

Respondents and Defendants.

CASE NO. CV155571

G.R.O.
[~~PROPOSED~~] JUDGMENT

FILED BY FAX

Petitioners the City of the Santa Cruz, the County of Santa Cruz, the Coalition for Limiting University Expansion, the Rural Bonny Doon Association, Don Stevens, Peter L. Scott, Hal Levin, Jeffrey M. Arnett, Harry D. Huskey, Kaye Beth, Eric M. Grodberg, Sigrid McLaughlin, Russell B. Weisz, Helen B. Dowling, and John C. Aird, and Respondent The Regents of the University of California[1] have reached a global settlement that resolves all disputes between and among the parties in the following cases:

1. *Regents of the University of California v. City of Santa Cruz*, Santa Cruz Superior Court Case No. 155136, Court of Appeal Case No. H032405;

2. *City of Santa Cruz and County of Santa Cruz v. Regents of the University of California*, Santa Cruz Superior Court Case No. CV155571 (Master);

3. *City of Santa Cruz and County of Santa Cruz v. Regents of the University of* California, Santa Cruz Superior Court Case No. CV156366 (Master);

4. *Don Stevens, Peter L. Scott, Hal Levin, Jeffrey M. Arnett, Harry D. Huskey, Kaye Beth, Eric M. Grodberg, Sigrid McLaughlin, Russell B. Weisz, Helen B. Dowling, and John C. Aird v. University of California Santa Cruz [sic], et al.,* Santa Cruz Superior Court Case No. CV155583 (consolidated with Case No. CV155571); and

5. *Coalition for Limiting University Expansion (CLUE), et al. v. University of California Santa Cruz* [*sic*], *et al.*, Santa Cruz Superior Court Case No. CV156371 (consolidated with Case No. CV156366).

In accordance with the Parties' Settlement Agreement,

IT IS HEREBY ORDERED, ADJUDGED, AND DECREED that all obligations set forth in the Settlement Agreement, which is attached hereto as Exhibit A and incorporated herein by reference, shall be performed in accordance with the terms of the Agreement.

---

[1] Petitioners in Case Nos. CV156366 and CV155571 also named as a respondent "George Blumenthal, acting Chancellor, in his official capacity" as Chancellor of the Santa Cruz campus. Petitioners in Case Nos. CV155583 and CV156371 named as respondents "the University of California, Santa Cruz campus" and "the Office of the President." These respondents were erroneously named. The Regents is the only legal entity that is subject to suit for the challenged actions.

IT IS FURTHER ORDERED, ADJUDGED, AND DECREED that this Court shall retain jurisdiction during the duration of the Settlement Agreement, as provided in the Agreement, for purposes of resolving disputes that may arise in connection with the interpretation or implementation of the Settlement Agreement.

DATED: 9/12/, 2008

HON. PAUL P. BURDICK

SOMACH SIMMONS & DUNN
A Professional Corporation

EXHIBIT "A"

COMPREHENSIVE SETTLEMENT AGREEMENT

This Settlement Agreement ("Agreement") is entered into this 15th day of August 2008, by and between the City of Santa Cruz ("City"), the County of Santa Cruz ("County"), The Regents of the University of California ("Regents") and the University of California, Santa Cruz Campus (the "Campus") (collectively, the "University"), Coalition for Limiting University Expansion ("CLUE"); Don Stevens, Peter L. Scott, Hal Levin, Jeffrey M. Arnett, Harry D. Huskey, Kaye Beth, Eric M. Grodberg, Sigrid McLaughlin, John C. Aird, Russell B. Weisz, Helen B. Dowling, and Rural Bonny Doon Association.

RECITALS

WHEREAS, the City, County and University are governmental agencies that have distinct jurisdictions with overlapping property boundaries in Santa Cruz County, California; and

WHEREAS, CLUE is a non-profit organization of City and County residents interested in and concerned with University growth plans; and

WHEREAS, on September 21, 2006, The Regents approved the 2005 Long Range Development Plan ("LRDP") for the Santa Cruz Campus (the "2005 LRDP") and in conjunction therewith, also certified a Final Environmental Impact Report (the "2005 LRDP EIR"), thereby superseding and replacing the Campus' LRDP approved by The Regents in 1988; and

WHEREAS, on October 23, 2006, petitions for writ of mandate challenging the 2005 LRDP and 2005 LRDP EIR were filed in Santa Cruz Superior Court by the City and County (Case No. CV155571), and Don Stevens, Peter L. Scott, Hal Levin, Jeffrey M. Arnett, Harry D. Husky, Kaye Beth, Eric M. Grodberg, Sigrid McLaughlin and John Aird (Case No. CV155583) (collectively, "Stevens, et al.")(collectively Case No. CV155571 and Case No. CV155583 are referred to herein as the "LRDP Actions"); and

WHEREAS, on January 16, 2007, The Regents approved the Biomedical Sciences Facility Project (the "Biomed Project"), and in conjunction therewith, adopted a Mitigated Negative Declaration tiered from the 2005 LRDP EIR (the "MND"); and

WHEREAS, on February 20, 2007, petitions for writ of mandate challenging the Biomed Project and MND were filed in Santa Cruz Superior Court by the City and County (Case No. CV156366, and Coalition to Limit University Expansion, Don P. Stevens, Peter L. Scott, Hal Levin, Jeffrey M. Arnett, Harry D. Huskey, Kaye Beth, Eric M. Grodberg, Sigrid McLaughlin, John C. Aird, Russell B. Weisz, Helen B. Dowling, and Rural Bonny Doon Association (Case No. CV156371) (collectively, "CLUE, et al.") (collectively Case No. CV156366 and Case No. 156371 are referred to herein as the "Biomed Actions");

WHEREAS, the Santa Cruz Superior Court granted in part and denied in part the petitions in the LRDP Actions and the Biomed Actions; and

WHEREAS, the City, County, University, CLUE, et al., and Stevens, et al. desire to settle all disputes between them with respect to the LRDP Actions and the Biomed Actions on the terms set forth herein.

NOW, THEREFORE, in consideration of the mutual covenants, agreements, representations, and warranties contained in this Agreement, and other good and valuable consideration the receipt and sufficiency of which is hereby acknowledged, the City, County, University, CLUE, et al., and Stevens, et al. agree as follows:

AGREEMENT

For as long as the 2005 LRDP is in effect:

1.0 ENROLLMENT

1.1 Full-time equivalent (FTE)[1] on-campus 3-qtr average (fall-winter-spring) enrollment (hereinafter referred to as "enrollment") for undergraduates will not exceed 17,500. In addition, for purposes of planning implementation of infrastructure development to accommodate enrollment growth, UCSC projects the following on-campus combined graduate and undergraduate enrollment levels:

a. 16,360 in academic year 2011-2012;

b. 17,615 in academic year 2015-2016; and

c. 19,480 in academic year 2020-2021.

---

[1] An FTE student is defined as (1) an undergraduate student who enrolls for 45 credit hours per academic year; or (2) a graduate student (master's level or doctoral student not yet advanced to candidacy) enrolled in 36 hours per year; or (3) a graduate doctoral student who has been advanced to candidacy. This does not include students at locations other than the City and County of Santa Cruz, including, but not limited to, UCSC's MBEST, Silicon Valley Campuses, UC programs in DC or Sacramento, or Education Abroad Programs.

1.2 In recognition that campus population growth may outpace implementation of infrastructure improvements contemplated under this Agreement and that UCSC's ability to meet its housing commitment is dependent on enrollment growth, the parties agree that upon execution of this Agreement:

a. UCSC will immediately initiate planning for on-campus housing on the west Campus;

b. The City and UCSC will immediately comply with the traffic commitments in Section 4.13 of this Agreement; and

c. UCSC has targeted new freshman enrollment growth until at least the commencement of the Fall 2009 Quarter to not exceed the Fall 2007 entering freshman class (3,730) (exclusive of transfer students).

1.3 As a means of enforcing UCSC's housing and water commitments herein, UCSC will adjust enrollment in the next Fall admissions cycle so as not to exceed, within a margin of error defined in Section 1.5 of this Agreement, the enrollment levels of the previous Fall admissions cycle, in the event of one or more of the following:

a. UCSC's housing commitment, described in Section 2.1 of this Agreement, is not met;

b. UCSC increases its water demands on the City water system during a City service area-wide moratorium on new connections because of a water supply emergency declared consistent with State Water law, as described in Section 3.2(a) of this Agreement.

1.4 If the traffic commitment in Section 4.1 is exceeded, the commitment will be enforced by requiring UCSC to reduce ADT by one or more of the following measures: adjusting enrollment, adjusting on-campus workforce, or through implementation of ADT reducing measure(s). The choice will be determined from this list by The Regents or its delegate. When UCSC main campus trips are within 1,500 of the applicable traffic commitment in Section 4.1, UCSC will hold a meeting to solicit public input regarding the choices listed above for the reduction of ADT. Within 90 days of the meeting, UCSC will initiate the process necessary to gain approval from The Regents or its delegate of its selected choice(s) for reduction of ADT. In addition, to further effectuate compliance and enforce the traffic commitment in Section 4.1, UCSC agrees to a penalty payment in an amount equal to three times the City's citywide Traffic Impact Fee (TIF) then in effect for every average daily trip (ADT) in excess of the commitment (i.e., if the City's current citywide TIF were applied the penalty amount would be $1,098 per trip (3x $366)). Penalty payments will be made annually until such time as the ADT is equal to or below the traffic commitment in this Agreement. For purposes of calculating the penalty, ADT will be measured per 4.1 below. Penalty funds will be deposited into a dedicated account for use by the City and UCSC to reduce ADT to UCSC. UCSC and the City will work cooperatively to identify appropriate and effective trip reduction programs, including, but not limited to, increased SCMTD transit service to the UCSC campus, with the expenditure of funds being subject to approval by the City.

1.5 For purposes of 1.2(c) and 1.3, enrollment will be calculated within a 2% margin of error averaged prospectively over three years to account for the fact that the University admits students approximately six months prior to the start of the new fall term based on a projected "take rate" (i.e., the percentage of students that accept an offer of admission). In addition, retention/graduation rates fluctuate. Accordingly, enrollment may fall slightly above or below UCSC's projections within a 2% margin of error. Enrollment levels will be calculated based on the Fall third-week census. UCSC's commitment in 1.3 will take effect the next Fall admissions cycle and all subsequent Fall admissions cycles until the applicable commitment is met.

2.0 HOUSING

2.1 UCSC will provide housing capacity as follows:

a. For enrollment up to 15,000, UCSC will provide 7,125 beds.

b. Additional beds will be available to accommodate 67% of enrollment above 15,000, which equates to 3,000 new beds above the 7,125 beds if enrollment reaches 19,500. New beds will be provided by on-campus new construction, by remodeling or re-assignment resulting in a net increase in new on-campus beds, or through off-campus purchase or lease. An existing room designed as a double will not be converted to an unfilled triple room for the sole purpose of meeting the housing commitment under this Agreement. Except as provided in Section 2.1(d), beds will be available within four years of enrollment in excess of 15,000 until 2018 (i.e., housing in fall 2012 will be available for

67% of 2007-08 enrollment above 15,000). After 2018 and for as long as the 2005 LRDP is in effect, new beds will be available within 2 years of new enrollment growth.

c. UCSC's housing capacity commitment in Section 2.1(b) will be suspended (and its housing capacity commitment as reflected in the 2005 LRDP will be reinstated) for future projects (i.e., approved projects will be completed) in the event of one or more of the following:

i. UCSC's annual room and board rate is the highest and exceeds by 10% all other UC campuses as determined by the "UC On Campus Housing Rate Comparison", published annually by UC's Office of the President which presents a standardized systemwide comparable analysis sheet that presently reflects the cost at each campus for a residence hall room, double occupancy, 19 meals per week board plan, or equivalent;

ii. A legal action, or inaction by an agency, delays a proposal by UCSC for housing development in the North Campus, including, but not limited to, an action challenging a final decision by any agency with approval or permit authority necessary to construct the housing. UCSC commits to make reasonable efforts to expeditiously resolve the litigation.

d. The parties agree that UCSC will not be in violation of Section 2.1(b) or subject to the penalty in Section 1.3 in the event of, and for the time period of, any legal action, or inaction by an agency, including, but not limited to, an action challenging a final decision by any agency with approval or permit authority necessary to construct the housing, that delays a proposal by UCSC to timely fulfill its housing commitment. UCSC commits to make reasonable efforts to expeditiously resolve the litigation.

e. In the event UCSC's housing capacity commitment is suspended as provided for in Section 2.1(c), UCSC will provide written notification within 30 days to the City and County that (1) identifies the date on which the suspension commenced, and (2) the reason(s) for the suspension. On an annual basis following the initial notice of suspension and for as long as the suspension is in effect, UCSC will provide a report identifying the status of the suspension and any efforts by UCSC to end the suspension.

Further, UCSC will provide notification within 30 days of termination of the suspension period.

2.2. UCSC will annually provide, through public posting, its 5 year capital plan and a report on the status of construction and occupancy rates of student housing.

2.3. There will be an annual meeting to review UCSC, County, and City housing plans and capacity for the community workforce and campus affiliates.

2.4. UCSC housing may be accommodated on or off campus (in UC leased or owned property) provided that:

a. For purposes of satisfying the housing commitment in Section 2.1(b) UCSC will limit the number of new off-campus beds created in the City of Santa Cruz after the effective date of this Agreement to no more than 225 beds, which are in addition to the existing off-campus leased beds at UCSC Inn and University Town Center. The number of beds at UCSC Inn and University Town Center may be replaced by UCSC in the City of Santa Cruz without counting against the 225 if, upon expiration of the current lease period, UCSC does not renew the leases. Nothing in this subsection shall be construed to limit the University's ability to build more than 225 off-campus beds in the City of Santa Cruz provided that (i) the additional beds shall not be used to off-set UCSC's housing commitment in Section 2.1(b); (ii) the project is consistent with City zoning; (iii) UCSC first obtains the concurrence of the City; and (iv) UCSC arranges for alternative transportation modes from the project to the campus, if necessary. In the event the project is already readily served by public or other UCSC arranged transportation, no further transportation arrangements as provided for in (iv) shall be required; otherwise such alternative transportation shall be provided.

b. For each UCSC-owned or leased, off-campus student bed that results in a tax revenue loss to the City, the University will contribute funds/per bed to a Housing Impact Fund (HIF) (for July 2008 - June 2009 the HIF will be $199/bed, and in each subsequent University fiscal year will increase by 2%). Funds deposited into the HIF will be used by the City to directly support services serving UCSC's off-campus population, including, but not limited to, public safety, parks and recreation. Payments under this

Section will be made on or before October 1 of the first fiscal year in which UCSC adds new off-campus beds. UCSC will provide the City with an annual accounting of new off-campus beds for purposes of calculating the HIF.

2.5 UCSC will consult with the City, and after consultation, will provide the City with written notification of any intent to purchase property in the City.

2.6 UCSC agrees not to construct high-density off-campus housing in the City of Santa Cruz unless consistent with the City's zoning.

2.7 To assist UCSC in achieving its on-campus housing capacity commitment, the parties agree to the following:

a. The City currently provides water service to UCSC through five (5) connections, the most northern of which is north of the City's limits and was installed by the City in 1973. The City will continue to provide water service to the Campus through the five existing connections, and UCSC may use the water to support development implementing the 2005 LRDP, including the development of housing in the North Campus, consistent with the other provisions of this Agreement.

b. The parties will not oppose housing development west of Porter College as analyzed in the Draft 2005 LRDP EIR (necessary to timely achieve new housing commitment). Housing development in the area west of Porter College shall be initiated before development of new bed spaces in the North Campus Area.

c. The City agrees to propose and enforce City-wide ordinance(s) or municipal code(s) to regulate residential rental properties including, but not limited to, boarding, lodging, or rooming houses. In the event the City does not enact such legislation within two years of the approval of this agreement, UCSC's housing capacity commitment set forth in Section 2.1b above shall be reduced by 450 beds. The City, in consultation with UCSC, further agrees to review within three years of the effective date of this Agreement any such City-wide ordinance(s) or municipal code(s) for effectiveness in regulating residential rental properties and, if necessary, to consider revisions.

2.8 UCSC will apply to LAFCO for extraterritorial water and sewer services (for the development of 3,175,000 gross square feet of additional building space under the 2005 LRDP for the service area below the line identified on the map attached hereto as Exhibit A) from the City of Santa Cruz on the following conditions:

a. The City, County, CLUE, et al. and Stevens, et al., do not object to UCSC's reliance on the 2005 LRDP EIR except as provided in subsection 2.8(b), 2.8(d), 2.8(e), and 2.8(f), below, and/or the City's Integrated Water Plan EIR, or on any applicable CEQA exemption, in support of its LAFCO application, if necessary; and

b. Pursuant to the requirements of Government Code Section 56425, et seq., the City's Sphere of Influence is amended to include the areas designated in the 2005 LRDP presently exclusively within the County limits (as identified in the map attached hereto as Exhibit A), concurrently with the University's application to LAFCO. Pursuant to Government Code Section 56425, et seq., the City and County will negotiate an agreement for the Sphere of Influence amendment to include the area below the line identified on the Exhibit A map. This agreement shall be submitted as part of the City's proposed Sphere of Influence amendment concurrent with UCSC's LAFCO application. UCSC shall initiate its LAFCO application concurrently with the City's proposed Sphere of Influence amendment on or before October 28, 2008, unless an extension of the application date is mutually agreed to by the City and UCSC. In the event the City's Sphere of Influence is not amended or a legal action challenging the amendment is filed, UCSC retains the ability to assert any and all rights or legal positions regarding its ability to develop the North Campus including, but not limited to, the applicability of an exemption or immunity from LAFCO's jurisdiction. Notwithstanding the foregoing, all parties retain the right to assert any and all legal claims or positions regarding any LAFCO decision or UCSC's ability to develop the North Campus; and

c. The City and County provide UCSC with all documentation identified or required by LAFCO as necessary to complete UCSC's application, including, but not limited to, a will serve letter, and will communicate to LAFCO that they do not oppose UCSC's application; and

d. CLUE, et al. and Stevens, et al. reserve the right to participate in the LAFCO proceedings (including raising all issues they feel appropriate), and to file a legal action challenging any final LAFCO decision. The parties agree and acknowledge that UCSC's application to LAFCO shall not be construed as an admission, presumption or inference of admission, or concession by UCSC that it is subject to LAFCO's jurisdiction and that UCSC retains the right to assert any and all legal claims or positions regarding the applicability of an exemption or immunity from LAFCO's jurisdiction over UCSC, or to assert any other defenses, in the event LAFCO denies UCSC's application, conditionally approves the application on terms that are unacceptable to UCSC, or a legal action against LAFCO approval of the application is filed. Likewise, the City, the County, CLUE, et al. and Stevens, et al. retain their rights to assert that the University is subject to LAFCO's jurisdiction for any development outside the City's boundaries irrespective of the outcome of the University's application to LAFCO; and

e. In the event a legal action challenging LAFCO's decision is filed, UCSC's housing commitments shall be suspended during the time it takes for the legal action to be resolved and UCSC may assert its rights to develop the area north of the main campus and outside the City's jurisdictional limits (North Campus). Notwithstanding the foregoing, all parties retain the right to assert any and all legal claims or positions regarding UCSC's ability to develop the North Campus including, but not limited to, LAFCO's decision. If a final judicial determination upholds a LAFCO approval or reverses a LAFCO denial of the application, the housing commitment, if suspended, will be reinstated, and the provisions of Section 2.1(d) shall apply. If a final judicial determination upholds a LAFCO denial or reverses a LAFCO approval of the application so that the University is unable to develop in the North Campus area identified in the attached map, UCSC is excused from the housing commitment in this Agreement and its housing capacity commitment in the 2005 LRDP will be reinstated. The housing commitment will be reinstated if the University is able to obtain legislative or any other legal authority to develop in the North Campus area, irrespective of the LAFCO approval process, and the provisions of Section 2.1(d) shall apply.

f. In the event LAFCO denies UCSC's application, conditionally approves the application on terms that UCSC determines in good faith are unacceptable, delays more than 18 months from the date UCSC makes its initial application in making a decision, the

City fails to amend its Sphere of Influence, or LAFCO otherwise terminates UCSC's application, the City, County, CLUE, et al. and Stevens, et al. agree that UCSC may assert its rights to develop in the North Campus. Notwithstanding the foregoing, all parties retain the right to assert any and all legal claims or positions regarding UCSC's ability to develop the North Campus including, but not limited to, LAFCO's decision.

g. The parties further agree that Section 2.8 of this Agreement does not change, alter, amend, or otherwise supersede the 1962 and 1965 contracts for water and sewer service between the City and County and The Regents.

2.9 In recognition of City-wide zoning, building and municipal code violations in the City's residential neighborhoods attributable to deficient landlord oversight of rental housing (UC and non-UC affiliated), the City and UCSC agree to jointly and equally fund through 2013 a pilot program for two City Code enforcement positions as a means of improving rental property safety and standards. The pilot program will be reviewed after the first 3 years. After review and mutual agreement, the program may be modified. UCSC's commitment to fund its 50% share of the program will not accrue until the City enacts and enforces City-wide ordinance(s) or municipal code(s) consistent with Section 2.7(c), above.

2. 10 The City agrees to incorporate the housing elements of this agreement in its 2008-2009 Housing Element update and the City's update to the General Plan.

3.0 WATER

3.1 For every increment of 85,000/gallons of water used over 206 MGY (2005 LRDP baseline year for the UCSC main campus, each incremental payment resets the baseline), UCSC will contribute funds to the City as follows:

a. The University will pay a fee equivalent to the City's System Development Charges ("SDC's") for Equivalent Residential Units ("ERU") in its service area at the rate in effect on the date of payment (currently $6,530 per ERU (85,000 gallon increment)). The parties acknowledge that the SDC rate is adjusted by the City from time to time in accordance with the procedural and substantive requirements of the Mitigation Fee Act, California Government Code Sections 66000 et seq. It is the intention of the parties that the amount of UCSC's SDC equivalent payments will be proportionate to UCSC's share of use of City developed new water source capacity. The parties acknowledge that this SDC payment term was negotiated and agreed to pursuant to Government Code Section 54999.3(b) and was based on the factors identified in the document entitled "Water Assumptions", attached hereto as Exhibit B and incorporated by reference into this Agreement.

b. The parties agree that UCSC's payment of the fee does not change, modify, or alter the 1962 and 1965 Contracts. UCSC's payment commitment under Section 3.1(a) will remain in effect until such time as a new LRDP is approved for UCSC.

c. The parties agree that payment constitutes UCSC's contribution to finance construction of public facilities needed to serve UCSC's water demands in non-drought years on the main campus (Marine Science Campus payments are governed by the Water System Connections/Construction Agreement, dated May 1997). UCSC pays existing water rates which include development of water supply for drought conditions.

d. The parties acknowledge the City's intention to implement its Integrated Water Plan, including additional water conservation, use curtailment in droughts, and construction of a desalination plant.

3.2 City agrees to treat UCSC as it would any other developer with regard to the remaining excess water supply capacity (300 MGY as estimated by City in 2007) as follows:

a. Except with regard to any UCSC housing projects under development, if the City establishes a service area-wide moratorium on new connections because of a water shortage emergency condition under State Water law, UCSC will not increase its water demands on the City water system from any University-owned properties, including the main campus, 2300 Delaware, and the Marine Sciences Campus, while the moratorium remains in effect. Leased properties will abide by regulations that affect property owners.

b. UCSC will comply with any service area-wide water restrictions or mandatory use curtailment imposed by the City in response to a declaration of water shortage emergency condition under State Water law on the following terms:

i. The City agrees that its Water Conservation staff will meet with University staff to discuss the University's water allocations prior to the effective date of any use curtailment set in accordance with an approved final City Use Curtailment Plan and will accurately correlate the campus uses as much as possible (e.g., campus use allocations for student, faculty and staff housing will reflect the same use curtailment set by the City for its multi-family residential water customers, etc.)

ii. The parties recognize that UCSC's existing and future water demand is for (a) domestic and sanitation uses related to on-campus student and faculty/staff residences, classrooms, and business and support buildings; (b) research facilities; (c) fire protection; and (d) irrigation, and acknowledge that UCSC's unaccounted for water use (e.g., from submeter error, unmetered use, etc.) was less than 7.5% in 2006.

3.3 UCSC agrees that within 5 years of execution of this Agreement it will have implemented all high priority conservation measures recommended by the 2007 engineering audit of campus water use. UCSC's high priority conservation measures are identified in Table 19 of UC Santa Cruz's Water Efficiency Survey (12/2007), attached hereto as Exhibit C.

3.4. For infrastructure improvements required to serve the campus and not included in the City's SDC program, UCSC will contribute its proportionate share of the non-rate funded costs for those improvements according to the previously negotiated 1998 cost-sharing agreement.

3.5 There will be an annual meeting to review the City's plans for implementing additional water supply projects.

3.6 The City will review with UCSC the basis for its sewer service charge.

4.0 TRAFFIC

4.1 UCSC agrees to not exceed 28,700 ADT to the main campus (24,800 ADT 2005 LRDP baseline + 3,900 new ADT) for as long as the 2005 LRDP is in effect. Compliance will be monitored by arriving at an ADT through weekday (Monday – Friday) traffic volume counts at the two campus entrances for at least two weeks beginning on the fourth week of Fall and Spring quarter (when school is in session for the entire week) of each corresponding calendar year.

a. The parties agree that the traffic commitment in Section 4.1 will be increased by 1,300 ADT to a total of 30,000 ADT and that the penalty provisions of Section 1.4 will not apply in the event UCSC is prohibited from developing the North Campus area as identified in the attached map (e.g., a final judicial determination prohibits North Campus development) or the City fails to amend its Sphere of Influence. UCSC agrees to make additional ADT payments associated with an ADT increase of 1,300 under this section based on the citywide TIF fee schedule then in effect (currently $377/trip).The parties acknowledge and agree that 30,000 main campus ADT is 100 ADT lower than estimated by the City for UCSC in its current TIF program.

b. The parties further agree that UCSC will not be in violation of the applicable traffic commitment or subject to the penalty provisions in Section 1.4 in the event of, and for the time period of, one of more of the following:

i. a legal action, or inaction by an agency with approval or permit authority necessary to construct the housing project delays a proposal by UCSC to timely fulfill its housing commitment pursuant to Section 2.1. UCSC commits to make reasonable efforts to expeditiously resolve the litigation;

ii. implementation of an ADT-reducing project not identified in this Agreement is delayed as a result of a legal action or inaction by an agency with approval or permit authority necessary to construct the ADT-reducing project, upon the concurrence of the City.

c. The parties agree that UCSC's ability to meet the applicable traffic commitment in this Section 4.1 requires the City, County and SCMTD to continue existing services and provide transportation enhancements.

d. Should temporary conditions arise that result in anomalous or erroneous weekday ADT measurements (i.e, bus strike, hose counter failure, etc.), as described in Section 4.1, then efforts will be made to re-collect reliable and appropriate data within one month of the initial traffic counts.

e. Should SCMTD transit service to the main campus (excluding Supplemental services provided under the "guaranteed cost" clause of the UCSC/SCMTD contract) be reduced from 2007-08 service hours or capacity, then the commitment in Section 4.1 will be suspended until regular transit service levels to the main campus are restored.

f. In the event UCSC's traffic commitment is suspended as provided for in Sections 4.1(b) and 4.1(e), UCSC will provide written notification within 30 days to the City and County that (1) identifies the date on which the suspension commenced, and (2) the reason(s) for the suspension. On an annual basis following the initial notice of suspension and for as long as the suspension is in effect, UCSC will provide a report identifying the status of the suspension and any efforts by UCSC to end the suspension. Further, UCSC will provide notification within 30 days of termination of the suspension period.

g. Should SCMTD transit service to the main campus (excluding Supplemental services provided under the "guaranteed cost" clause of the UCSC/SCMTD contract) not increase in proportion to campus population growth such that it accommodates at least 25% of all trips to and from UCSC (reflective of 2007-2008 conditions) and UCSC continues to pay the cost of its SCMTD ridership, the applicable ADT commitment will be increased by applying an ADT credit. The ADT credit will be equivalent to 50% of the difference between a calculated 25% UCSC SCMTD mode split (measured in person trips) and the actual UCSC SCMTD mode split (measured in person trips).

h. The parties acknowledge and agree that alternative transportation modes and/or transit services may change over time as a result of technological, financial or other conditions, and to the extent such changes result in a significant shift in current modes, and as such the parties agree that elements of this proposal, by written notice by any party to this agreement, will be revisited and revised, as necessary, and subject to the mutual agreement of the City and UCSC. The parties will attempt to resolve disputes arising pursuant to this section by mediation.

i. The parties agree that the commitments in Section 4.1 are made for the sole and exclusive purpose of settlement and in recognition of access constraints unique to the UCSC main campus. These constraints include: campus access dependence upon two arterial roadways (Bay Street and Empire Grade) and two collector roads (High Street and Western Drive) traversing residential neighborhoods; an incomplete roadway network as envisioned in the original campus planning; the absence of any direct campus access route from State Route 9 or Highway 1; reliance on only two entrance gates to the main campus; State and City parklands and open space adjacency that surrounds the main campus on three sides; and the geographic and topographic distance of the main campus from commercial service areas within the City.

4.2 Within three months from the approval of this Agreement, UCSC agrees to contribute funds in an amount equal to the City's TIF in three consecutive annual payments for off-site traffic improvements for the 3,900 new ADT in Section 4.1, above. UCSC acknowledges that the TIF is revised annually on July 1, based on the Engineering News Record Cost of Construction index, and that as a result, each annual payment will be calculated by the current TIF rate at the time of payment. At its discretion, UCSC may make a one-time payment of $1,427,400 within 15 days of entry of the Agreement as a final judgment, as provided for in Section 7.1. Funds contributed to the City under this section will constitute UCSC's share of the cost of improvements to the Bay Corridor between Mission and High, including improvements to the Bay/Mission and Bay/Escalona intersections and any other intersections identified in the City's TIF program to which UCSC contributes traffic. UCSC's payment is based on the City's 2007-2008 TIF and traffic model.

3,900 ADT x $366/trip = $1,427,400

Within three months of executing this Agreement, the City and UCSC will meet to identify TIF projects for immediate implementation. Identified and agreed upon improvements will be initiated by the City within one year.

4.3 The parties agree that UCSC's payment as set forth in Section 4.2 fulfills UCSC's "fair share" commitment in 2005 LRDP mitigation measure TRA-2A and the portion of TRA-5A that relies on TRA-2A for off-campus traffic impacts associated with campus ADT of 28,700.

4.4 UCSC agrees to make additional ADT payments associated with UCSC's 2300 Delaware property based on the City's methodology (20 trips per 1000 building gross square feet based on office use) and citywide TIF fee schedule (currently $366 per trip). UCSC's payment for existing occupied gross square footage (gsf) at 2300 Delaware (Buildings A and B) is based on the City's 2007-2008 TIF and traffic model as represented by the following calculation:

57,223 gsf @ 20 ADT/1,000 sf = 1,144.45 ADT x $366/ADT = $418,868.70

If UCSC converts Buildings A and B to non-office use resulting in a higher trips per square foot rate, a further ADT payment will be made by UCSC provided that UCSC receives a credit for the above-payment towards any additional calculated TIF associated with the change in use. Payment for buildings A & B will be in addition to, and paid at the same time as, the amount to be paid in Section 4.2, above. Payment for ADT associated with building C or any other development on the 2300 Delaware site will be paid based on the City's methodology and citywide TIF fee schedule in effect at the time of occupancy. The City's TIF accounts for 2,068 total ADT from 2300 Delaware and UCSC's CEQA documentation for the project projected 1,780 total ADT at full build-out and occupancy of buildings A, B, and C.

4.5 UCSC agrees to make additional ADT payments associated with UCSC development at the Marine Science Campus, based on the City's methodology and citywide TIF fee schedule in effect at the time new development receives all required approvals. The City's TIF accounts for 3,120 total ADT from the Marine Science Campus and the University's CEQA documentation projected 2,600 total ADT at full implementation of the CLRDP. UCSC does not anticipate the first major trip generating project to be occupied until 2012.

4.6 The parties agree to the following to reduce peak hour traffic impacts and to reduce overall traffic volumes:

a. The City and UCSC will continue to work cooperatively with other Bus Rapid Transit Task Force members to develop BRT improvements and other alternative transit systems that have the greatest feasibility of reducing peak hour impacts and greatest potential to be funded and implemented. UCSC further agrees to:

i. Continue to fund the current study of BRT opportunities between the campus and downtown Pacific Station; this existing study to be completed in Fall 2008. This study will provide the information to prepare the operational analysis portion of an FTA application by SCMTD for "Very Small Starts" funding corridor improvements.

ii. Commit to include its share of development and construction costs of an on-campus transit hub and related on-campus BRT improvements when calculating the total share/match for the FTA "Very Small Starts" application.

b. UCSC and the City will begin work immediately to mitigate existing and future peak hour traffic demand from UCSC facilities including signal synchronization studies and implementation, to be funded pursuant to Section 4.14, below.

c. UCSC will continue to work with the City and SCMTD to expand and enhance existing public transit service to UCSC facilities in advance of the BRT process (described in (a), above). Enhancements may include pilot projects, evaluated regularly for their effectiveness, such as:

i. "Limited Express" SCMTD service to the campus from downtown and outlying areas of Santa Cruz County funded under UCSC's "guaranteed cost" agreement with SCMTD;

ii. Implementation of electronic boarding passes for UCSC affiliates using SCMTD transit;

iii. On-going GIS analysis of UCSC residential patterns to identify opportunities for new or expanded SCMTD transit routes to and from the campus;

iv. Working with Caltrans to coordinate signal synchronization improvements to the Bay and Mission corridors.

d. UCSC will continue to implement and expand its existing Transportation Demand Management programs with the objective of increasing sustainable transportation modes (use of modes other than single-occupant vehicles) above 55% and to reduce peak hour traffic volumes and address increases in traffic overall.

4.7 UCSC will work cooperatively with the City to review, revise and maintain the City's traffic model following completion of the City's General Plan update. Based on the traffic model adopted as part of the City's General Plan update, UCSC's trip generation rates and distribution will be updated every three years. UCSC agrees to, at intervals of no more than three years or increments of no more than 1,000 students in enrollment growth (whichever occurs first), conduct traffic counts at a mutually agreed number of intersections for the purpose of updating the City's traffic model and Traffic Impact Fee, because the model and additional TIF specified projects are required to accommodate the projected traffic demand.

4.8 UCSC agrees to contribute to the cost of implementing an Off-Campus Parking Permit Program (Upper Westside or potential programs on the lower Westside) in an amount up to $50,000 per year for a pilot period of three years, to be continued, revised, or reallocated by mutual consent.

4.9 UCSC has contributed $216,500 to the Mission Street widening project and agrees to contribute an additional $107,500 to the City, which has been in dispute. Payment will be made within 90 days of execution of this Agreement and the parties agree that the University's obligation under University Assistance Measure 7 is satisfied with this payment.

4.10 UCSC will pay 100% of the cost of Heller/Empire Grade Intersection Improvements at the UCSC west entrance. If UCSC develops an additional entrance/exit to/from the campus along Empire Grade, related intersection improvements will be funded 100% by UCSC. The scope of those improvements will be informed by the project and a CEQA analysis of the associated traffic impacts.

4.11 UCSC will pay 40% of the bid costs of Bay Street Repair project. If, during the term of the 2005 LRDP, Bay Street requires re-surfacing (asphalt over-lay) in addition to the repair described above according to industry standards, UCSC agrees to pay 40% of the re-surfacing costs only. Either party may initiate a study and propose an alternate percentage.

4.12 UCSC will pay 100% of the cost of improvements to the Marine Science Campus entrance at the intersection of Shaffer Road and Delaware Avenue, as well as improvements to Shaffer Road on UCSC property up to the new driveway to Upper Terrace development zone when development occurs in that zone. As identified in implementation measure 5.1.7 of the Marine Science Campus Coastal Long Range Development Plan, UCSC "will collaborate with the City of Santa Cruz on the construction of an emergency grade crossing" over the tracks.

4.13 Within ninety days of execution of this Agreement, the City and UCSC will meet to identify for immediate implementation transportation improvements that are not included in the City's current TIF program or an integrated sequence of transportation studies to explore alternative transportation solutions. Identified and agreed upon improvements will be initiated, and studies will be commissioned, by the City within one year. For purposes of this Section, UCSC and the City each commit up to $500,000 (over a 3 year period) for a total of $1,000,000. Specific milestones and deliverables with which the phasing of funding will be tied will be agreed to by the City and UCSC. Study funds are to be used for appropriate consultant(s) to assist in defining realistic transportation solutions and trip reduction improvements. The City and UCSC have identified the following projects for implementation/study as a starting point for discussion:

a. A signal timing analysis and plan for Bay/Mission corridors;

b. Integration of signal pre-emption for SCMTD to allow SCMTD buses to move more quickly through intersections;

c. Expand SCMTD service to the campus including Express Bus service;

d. On-going GIS analysis of UCSC residential patterns to identify opportunities for new or expanded SCMTD transit routes to and from the campus;

e. Locate "Park and Ride" opportunities around/within City of Santa Cruz for UCSC Commuters;

f. Locate long-term "storage" parking areas for UCSC students; and

g. Expand existing ZipCar carshare programs.

4.14 UCSC and the City and CLUE shall make their best effort to jointly plan and implement a public transportation system capable of reducing the use of City streets and traffic congestion on City streets. Specific tasks of this planning effort (as far as financially feasible with available funds under this Section) will include, but not be limited to, identification of preferred technologies, routes and rights of way, and identification of probable ridership and financing. UCSC and the City will each commit $50,000 towards this effort.

5.0 FUTURE LRDP PROPOSALS

5.1 In recognition of the purpose and intent of Measures I and J, as adopted in November 2006, UCSC agrees that the next major amendment to the 2005 LRDP will include a comprehensive analysis of potentially feasible alternative locations to accommodate proposed UCSC enrollment growth beyond that analyzed in the 2005 LRDP EIR (i.e., satellite campuses, remote-classrooms, etc.) as a means of assessing UCSC's ability to meet the State Mandate for Higher Education while taking into consideration City of Santa Cruz infrastructure including, but not limited to, transportation, water and housing.

6.0 IMPLEMENTATION OF THE 2005 LRDP

6.1 UCSC will continue to fund all warranted University Assistance Measures ("UAMs") from the 1988 LRDP. The 1988 LRDP EIR and subsequent CEQA documents based on the 1988 LRDP adopted 12 traffic-related UAMs – 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, and 19, six utility-related UAMs – 1, 2, 3, 4, 5, and 6, and one UAM related to baseline analysis – UAM 15. With regard to UAM implementation, all parties acknowledge and agree that:

a. UCSC has fulfilled its commitment to implement UAMs 2, 3, 4, 8, 11, 12, 13, 15, 17, and 18;

b. UAM 7 (Mission Street widening), UAM 12 (Heller/Empire signal) and UAM 14 (Bay Street resurfacing) are warranted and will be satisfied by Sections 4.9 through 4.11 of this Agreement, respectively;

c. UAMs 9 and 10 commit UCSC to contribute funds towards the development of an Eastern Access road and are not warranted;

d. UAM 1 (water system improvements) will be satisfied pursuant to Section 3.1 of this Agreement; UAM 16 and UAM 19 (fair share towards signalization of Storey/King and Bay/Escalona, respectively) are warranted, included in the City's TIF program, and will be satisfied upon UCSC's payment in Section 4.2 of this Agreement;

e. UAM 5 (sewer line upgrade) and UAM 6 (waste water plant upgrade) will be satisfied upon payment by UCSC of its proportional share of the cost of the upgrades necessary to serve the main campus, to be negotiated once final cost estimates are completed.

6.2 Except as provided for in this Agreement, for future projects under the 2005 LRDP, UCSC will not "tier" from or otherwise rely on the water or housing analysis in the

LRDP EIR invalidated by the Santa Cruz Superior Court to obtain CEQA compliance. All parties acknowledge that the Santa Cruz Superior Court did not invalidate the LRDP EIR's traffic analysis and that the Superior Court's decision regarding the adequacy of the LRDP EIR's traffic mitigation is resolved by this Agreement. Notwithstanding, UCSC agrees to perform additional traffic analysis, as set forth in Section 4.7.

6.3 UCSC agrees not to locate a Corporation Yard in the "Campus Support" designated area along Empire Grade north of the West Entrance (see Map from 2005 LRDP, attached as Exhibit A). If and when there is a proposal by UCSC for a bridge over Cave Gulch, UCSC commits to perform additional CEQA review and consider limiting the access to egress and emergency access only.

7.0 ENFORCEBILITY/EFFECT OF SETTLEMENT

7.1 The University, City, County, CLUE, et al., and Stevens, et al. agree to take all necessary actions to ensure that the Agreement will be made fully enforceable through its entry as a final judgment.

7.2 The University, City, County and CLUE, et al., agree that all legal challenges to the validity of the Biomed project and associated Mitigated Negative Declaration are fully and finally resolved to the satisfaction of the parties; that additional CEQA review is not required for the Biomed project approval; that the Biomed project approval is deemed final and effective; and that all legal challenges will be resolved and judgment entered consistent with Section 7.1.

7.3 The University, City, County, and Stevens, et al. agree that all legal challenges to the validity of the 2005 LRDP and associated LRDP EIR are fully and finally resolved to the satisfaction of all parties; that additional CEQA review is not required for the 2005 LRDP; that the 2005 LRDP approvals are deemed final and effective; and that all legal challenges will be resolved and judgment entered consistent with Section 7.1.

7.4 The parties agree that the purpose and intent of Measures I and J, as adopted by the City in November 2006, will be satisfied and fulfilled upon finalization of this fully executed settlement agreement for development consistent with the 2005 LRDP. The parties further agree that any additional action to effectuate the intent and purpose of Measures I and J is unnecessary provided that the parties fulfill their commitments under this Agreement.

7.5 The University agrees to dismiss, without prejudice, its legal challenge against the City and LAFCO regarding the 1962 and 1965 water contracts (Santa Cruz Superior Court Case No. CV155995). The University will also dismiss, with prejudice, its currently pending appeal on the issue of attorneys' fees in the Measures I and J litigation (Santa Cruz Superior Court Case No. 155136; Sixth District Court of Appeal Case No. H032405).

7.6 The County Board of Supervisors will rescind its resolution of June 26, 2007, authorizing staff to appeal UCSC THP/Conversion #1-07-062 SCR, and agrees not to appeal or file a legal action challenging any determination by the California Department of Forestry and Fire Protection regarding UCSC THP/Conversion #1-07-062 SCR. CLUE, et al. and Stevens, et al. agree not to file a legal action challenging any determination by the California Department of Forestry and Fire Protection regarding UCSC THP/Conversion #1-07-062 SCR.

7.7 Notwithstanding any determination of "prevailing party" or "successful party", UCSC has agreed to pay reasonable attorneys' fees and costs to the City in the amount of $350,000; to the County in the amount of $50,000; and to CLUE, et al. and Stevens, et al. in the amount of $375,000. The City further commits to pay CLUE, et al. and Stevens, et al. $15,889. Payment under this Section 7.7 will be made within 15 days of entry of the Agreement as a final judgment, as provided for in Section 7.1.

7.8 On or before November 1, 2008, the parties will agree to a format and mechanism for reporting compliance under this Agreement.

8.0 CITY/UCSC PARTNERSHIPS

8.1 UCSC obtained in 1964 a Use Tax Direct Payment Permit from the State of California [7/1/1964 SR ARE 26117705] and regularly prepares the required self-assessment report.

8.2 UCSC will, to the extent feasible and under applicable laws, request its construction contractors to allocate the local sales and use tax derived from construction contracts of $5 million or more to the local jurisdiction where the job site is located. Toward that end, the University will annually invite the City and its consultant(s) to provide materials for linking from a UCSC website as an informational resource for contractors engaged in projects at UCSC.

8.3 UCSC agrees not to renew its lease on the UCSC Inn when it expires in 2011.

UCSC does not intend to lease additional hotel bed space during the term of the 2005 LRDP. Should conditions change that intention, UCSC shall inform the City in writing and will obtain the City's consent prior to Master Leasing additional hotel bed space.

8.4 UCSC will discuss with the City the collection and payment by UCSC of Transient Occupancy Tax and an admissions tax on specified UCSC-sponsored events.

8.5 UCSC and the City will meet on a regular basis to explore opportunities for cooperation in the following areas: economic development, grants, public safety, parks and recreation, and neighborhood issues relating to UCSC.

9.0 GOOD-FAITH OBLIGATIONS

9.1 The City, County, University, CLUE, et al., and Stevens, et al. agree to cooperate fully, expeditiously, reasonably, and in good faith in the implementation of this Agreement; to execute any and all supplemental documents, and to take all additional lawful and reasonable actions, which may be necessary or appropriate to give full force and effect to the terms and to fully implement the goals and intent of this Agreement. The City, County, University, CLUE, et al., and Stevens, et al., also agree to exercise good faith, individually and through counsel, to work out any issues, misunderstandings, or disagreements that may arise with respect to the terms of this Agreement.

10.0 COMPREHENSION OF AGREEMENT

10.1 The City, County, University, CLUE, et al., and Stevens, et al. represent that in entering into this Agreement they have relied upon the legal advice of their attorneys, who are the attorneys of their own choice, and that the terms of the Agreement are fully understood and voluntarily accepted. This Agreement has been jointly drafted by the parties, and its provisions shall not be construed against either party on the basis of authorship.

11.0 GOVERNING LAW

11.1 This Agreement shall be construed and interpreted in accordance with the laws of the State of California.

12.0 NO ADMISSION OF LIABILITY

12.1 This Agreement is not an admission of liability by any party to this Agreement to the any other party or to any third party. It is the intent of the parties that this Agreement is a compromise of disputed claims.

13.0 AUTHORIZATION

13.1 The City, County, University, CLUE, et al., and Stevens, et al., hereby represent and warrant that the execution, delivery, and performance of this Agreement has been duly authorized by all necessary actions, and that the individuals who execute this Agreement on each party's behalf are duly authorized to do so.

14.0 ENTIRE AGREEMENT

14.1 This Agreement constitutes the entire understanding between the City, County, University, CLUE, et al., and Stevens, et al. Any other terms, promises, provisions, obligations or agreements by or between the parties shall be enforceable only as set forth in any other applicable written agreement. If any provision of this Agreement is held to be illegal, invalid or unenforceable, each party agrees that such remaining provisions shall be enforced to the maximum extent permissible so as to effect the intent of the parties, and the validity, legality and enforceability of the remaining provisions of this Agreement shall not in any way be affected or impaired thereby.

15.0 EFFECTIVENESS

15.1 This Agreement shall become effective upon full execution by the City, County, University, CLUE, et al., and Stevens, et al., which may occur in counterparts such that one or more signatures may appear on separate pages. The signatures of counsel may be provided through facsimile transmission.

COMPREHENSIVE SETTLEMENT AGREEMENT

IN WITNESS WHEREOF, the City, County, University, CLUE, et al., and Stevens, et al., have caused this Agreement to be executed as of the date last written below.

CITY OF SANTA CRUZ

By:________________________

Date: 8·13·08

Approved as to form:

________________________ 8-12-08

Counsel to the City of Santa Cruz

COUNTY OF SANTA CRUZ

By:________________________

Date:________________________

Approved as to form:

____

Santa Cruz County Counsel

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

By:________________________

By:________________________

Date:________________________

Approved as to form:

____

Counsel to The Regents

COALITION FOR LIMITING UNIVERSITY EXPANSION

By:________________________

By:________________________

Date:________________________

Approved as to form:

____

Counsel to CLUE

RURAL BONNY DOON ASSOC.

By:________________________

Date:________________________

Approved as to form:

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Counsel to Rural Bonny Doon Assoc.

DON STEVENS

By:________________________

Date:________________________

Approved as to form:

____

Counsel to Don Stevens

PETER L. SCOTT

By:________________________

Date:________________________

Approved as to form:

____

HAL LEVIN

By:________________________

Date:________________________

Approved as to form:

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COMPREHENSIVE SETTLEMENT AGREEMENT

IN WITNESS WHEREOF, the City, County, University, CLUE, et al., and Stevens, et al., have caused this Agreement to be executed as of the date last written below.

CITY OF SANTA CRUZ

By:______________________________

Date:_____________________________

Approved as to form:

____

Counsel to the City of Santa Cruz

COUNTY OF SANTA CRUZ

By: Ellen Pirie

Date: 8/12/08

Approved as to form:

Charles Schlenker

Santa Cruz County Counsel

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

By:______________________________

By:______________________________

Date:_____________________________

Approved as to form:

____

Counsel to The Regents

COALITION FOR LIMITING UNIVERSITY EXPANSION

By:______________________________

By:______________________________

Date:_____________________________

Approved as to form:

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Counsel to CLUE

RURAL BONNY DOON ASSOC.

By:______________________________

Date:_____________________________

Approved as to form:

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Counsel to Rural Bonny Doon Assoc.

DON STEVENS

By:______________________________

Date:_____________________________

Approved as to form:

____

Counsel to Don Stevens

PETER L. SCOTT

By:______________________________

Date:_____________________________

Approved as to form:

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HAL LEVIN

By:______________________________

Date:_____________________________

Approved as to form:

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COMPREHENSIVE SETTLEMENT AGREEMENT

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CITY OF SANTA CRUZ

By:____________________________

Date: 8.13.08

Approved as to form:

____________________________ 8-12-08

Counsel to the City of Santa Cruz

COUNTY OF SANTA CRUZ

By:____________________________

Date:____________________________

Approved as to form:

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Santa Cruz County Counsel

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

By:____________________________

By:____________________________

Date: 8/15/08

Approved as to form:

Kelly L. Drumm

Counsel to The Regents

COALITION FOR LIMITING UNIVERSITY EXPANSION

By:____________________________

By:____________________________

Date:____________________________

Approved as to form:

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Counsel to CLUE

RURAL BONNY DOON ASSOC.

By:____________________________

Date:____________________________

Approved as to form:

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Counsel to Rural Bonny Doon Assoc.

DON STEVENS

By:____________________________

Date:____________________________

Approved as to form:

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Counsel to Don Stevens

PETER L. SCOTT

By:____________________________

Date:____________________________

Approved as to form:

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HAL LEVIN

By:____________________________

Date:____________________________

Approved as to form:

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COMPREHENSIVE SETTLEMENT AGREEMENT

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CITY OF SANTA CRUZ

By:____________________

Date: 8·13·08

Approved as to form:

8-12-08

Counsel to the City of Santa Cruz

COUNTY OF SANTA CRUZ

By:____________________

Date:____________________

Approved as to form:

____

Santa Cruz County Counsel

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

By:____________________

By: George R. Blumenthal

Date: 8/15/08

Approved as to form:

____

Counsel to The Regents

COALITION FOR LIMITING UNIVERSITY EXPANSION

By:____________________

By:____________________

Date:____________________

Approved as to form:

____

Counsel to CLUE

RURAL BONNY DOON ASSOC.

By:____________________

Date:____________________

Approved as to form:

____

Counsel to Rural Bonny Doon Assoc.

DON STEVENS

By:____________________

Date:____________________

Approved as to form:

____

Counsel to Don Stevens

PETER L. SCOTT

By:____________________

Date:____________________

Approved as to form:

____

HAL LEVIN

By:____________________

Date:____________________

Approved as to form:

____

COMPREHENSIVE SETTLEMENT AGREEMENT

IN WITNESS WHEREOF, the City, County, University, CLUE, et al., and Stevens, et al., have caused this Agreement to be executed as of the date last written below.

CITY OF SANTA CRUZ

By:________________________

Date:________________________

Approved as to form:

____

Counsel to the City of Santa Cruz

COUNTY OF SANTA CRUZ

By:________________________

Date:________________________

Approved as to form:

____

Santa Cruz County Counsel

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA

By:________________________

By:________________________

Date:________________________

Approved as to form:

____

Counsel to The Regents

COALITION FOR LIMITING UNIVERSITY EXPANSION

By: [signature] 8/5/08

By: Don Stevens 8-5-08

Date:________________________

Approved as to form:

Stephen C. Volker

Counsel to CLUE

RURAL BONNY DOON ASSOC.

By: Ted Benhari

Date: Aug. 5, 2008

Approved as to form:

Stephen C. Volker

Counsel to Rural Bonny Doon Assoc.

DON STEVENS

By: Don Stevens

Date: 8-5-08

Approved as to form:

Stephen C. Volker

Counsel to Don Stevens

PETER L. SCOTT

By: [signature]

Date: 8/5/08

Approved as to form:

Stephen C. Volker

____

HAL LEVIN

By: Hal Levin

Date: 5 August 2008

Approved as to form:

Stephen C. Volker

____

COMPREHENSIVE SETTLEMENT AGREEMENT

KAYE BETH

By: Kaye Beth

Date: August 11, 2008

Approved as to form:

Stephen C Volk

Counsel to Kaye Beth

ERIC M. GRODBERG

By:____________________________

Date:__________________________

Approved as to form:

____

Counsel to Eric M. Grodberg

SIGRID McLAUGHLIN

By:____________________________

Date:__________________________

Approved as to form:

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Counsel to Sigrid McLaughlin

JOHN C. AIRD

By:____________________________

Date:__________________________

Approved as to form:

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Counsel to John C. Aird

RUSSELL B. WEISZ

By:____________________________

Date:__________________________

Approved as to form:

____

Counsel to Russell B. Weisz

HELEN B. DOWLING

By:____________________________

Date:__________________________

Approved as to form:

____

Counsel to Helen B. Dowling

COMPREHENSIVE SETTLEMENT AGREEMENT

KAYE BETH

By:______________________________

Date:____________________________

Approved as to form:

____

Counsel to Kaye Beth

ERIC M. GRODBERG

By:______________________________

Date:____________________________

Approved as to form:

____

Counsel to Eric M. Grodberg

SIGRID McLAUGHLIN

By: Sigrid McLaughlin

Date: 8-10-08

Approved as to form: Stephen C. Voll

Counsel to Sigrid McLaughlin

JOHN C. AIRD

By:______________________________

Date:____________________________

Approved as to form:

____

Counsel to John C. Aird

RUSSELL B. WEISZ

By: Russell B. Weisz

Date: 8-11-08

Approved as to form: Stephen C. Voll

Counsel to Russell B. Weisz

HELEN B. DOWLING

By: Helen B. Dowling

Date: 8-11-08

Approved as to form: Stephen C. Voll

Counsel to Helen B. Dowling

COMPREHENSIVE SETTLEMENT AGREEMENT

Counsel to Peter L. Scott

Counsel to Hal Levin

JEFFREY M. ARNETT

By:__________________________

Date: 8/05/2008

Approved as to form:

____

Counsel to Jeffrey M. Arnett

HARRY D. HUSKEY

By:__________________________

Date: 8/5/08

Approved as to form:

____

Counsel to Harry D. Huskey

KAYE BETH

By:__________________________

Date:__________________________

Approved as to form:

____

Counsel to Kaye Beth

ERIC M. GRODBERG

By:__________________________

Date: 8/5/08

Approved as to form:

____

Counsel to Eric M. Grodberg

SIGRID McLAUGHLIN

By:__________________________

Date:__________________________

Approved as to form:

____

Counsel to Sigrid McLaughlin

JOHN C. AIRD

By:__________________________

Date: 8/5/08

Approved as to form:

____

Counsel to John C. Aird

RUSSELL B. WEISZ

By:__________________________

Date:__________________________

Approved as to form:

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Counsel to Russell B. Weisz

HELEN B. DOWLING

By:__________________________

Date:__________________________

Approved as to form:

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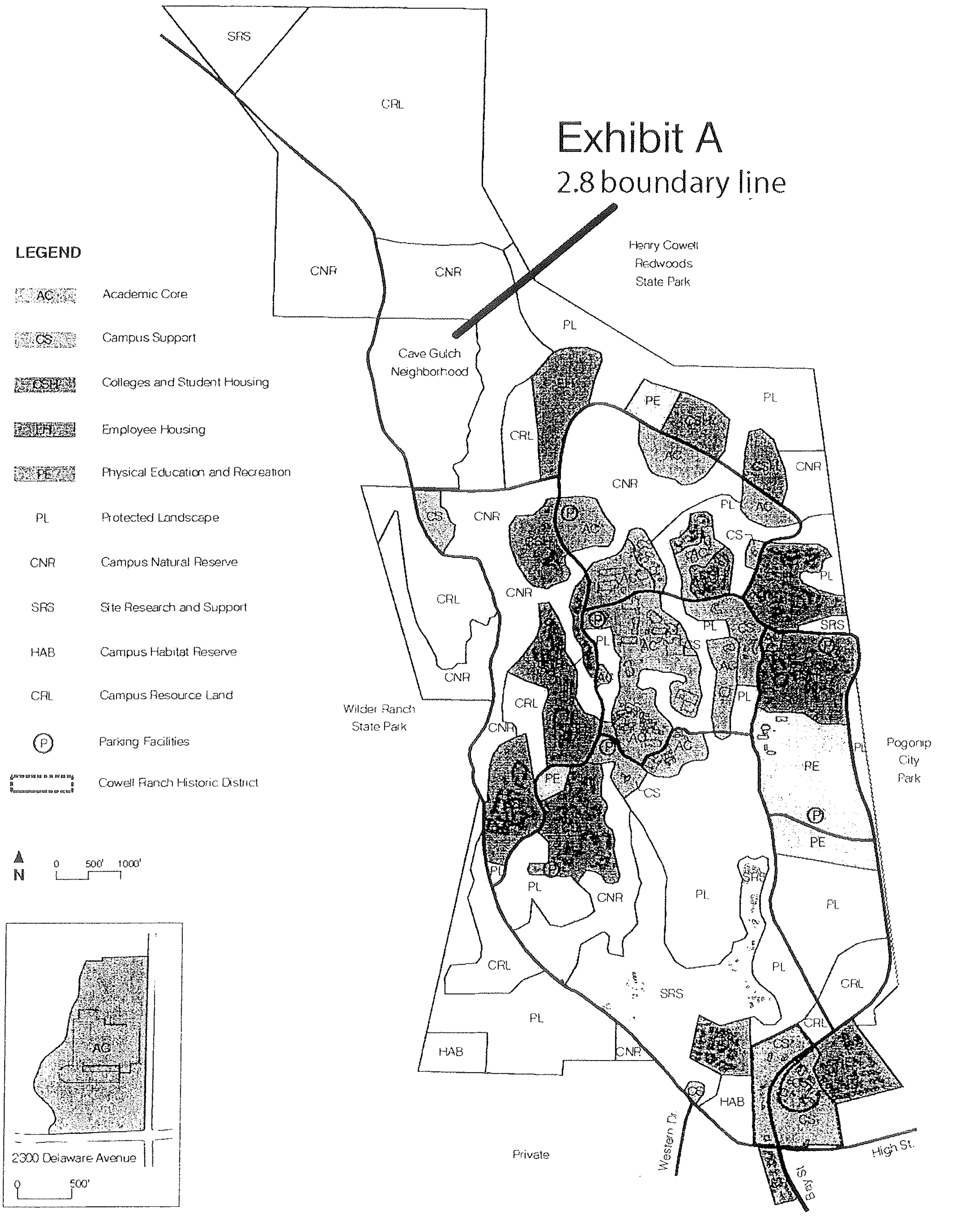
Counsel to Helen B. Dowling



UNIVERSITY OF CALIFORNIA, SANTA CRUZ
LONG-RANGE DEVELOPMENT PLAN 2005-2020
SEPTEMBER 2006

LAND-USE MAP

EXHIBIT B

Water Assumptions

The parties agree that the provisions of section 3.1a are based on the understanding that at the conclusion of the pilot study phase of the desalination plant, the Santa Cruz City Water Department (SCCWD) intends to pursue the phased incremental implementation of a desalination plant on the Westside of Santa Cruz. The parties further agree that the assumptions related to the scope and nature of all phases of the desalination plant are as follows:

Phase One

1. The design of Phase One is presently contemplated to provide water during drought conditions as follows:
    a. roughly 90 % to accommodate existing demand (subsequent to imposed conservation restrictions);
    b. and roughly10 % to accommodate foreseeable growth between now and when the plant is complete.

2. Water rates from existing customers will fund roughly 90 % of system improvements, including Phase One, related to existing demand.

3. System Development Charges (SDC) from future developers and UCSC will fund roughly 10 % of the costs related to foreseeable growth.

4. Future SDCs may be increased to cover escalation in construction costs and other water system improvements necessary to accommodate growth in demand.

5. SCCWD's existing water rates and SDCs have been set on a suite of system improvements that includes, among other things, a desalination plant with a budget forecast of around $40 million for Phase One and project soft costs, including financing.

6. The water rates and SDCs may be adjusted upwards to reflect refinements to the scope and escalating cost of Phase One. It is unlikely that construction costs for Phase One would escalate more than double the current budget forecast.

7. SCCWD anticipates a cost sharing agreement with the Soquel Water District at about a 50% share of the cost of Phase One. In the event the Phase One budget is double the forecast this cost sharing agreement would help offset the increased cost and current rate and SDC charges could be maintained at roughly their current levels.

Phase Two (and subsequent phases)

1. Phase Two and subsequent phases would be implemented to accommodate future growth in system demand.

2. Phase Two expansion (and potential future phases) would be accommodated by adding pumps and modular filtration membranes to the then existing Phase One facility.

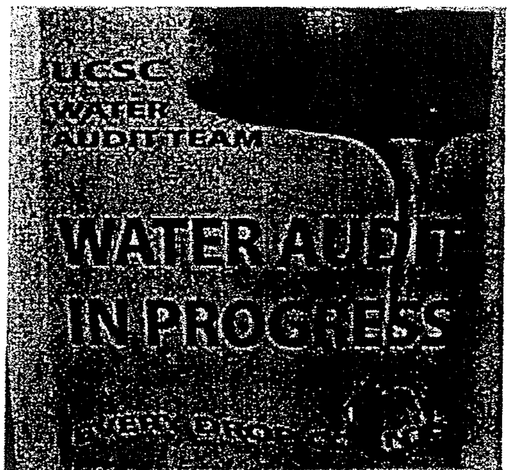
3. SDCs would likely be adjusted upward to reflect the cost of future phases and other system improvements.

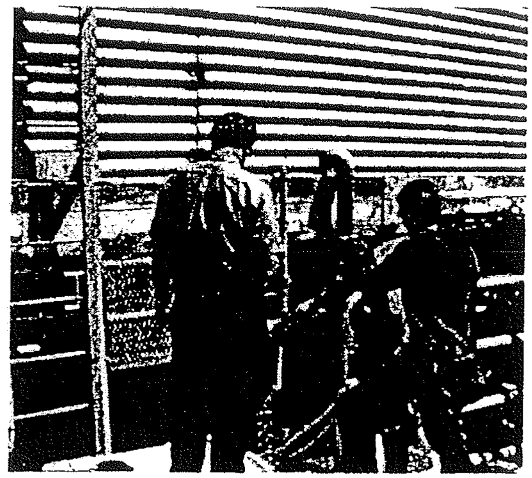
4. If Phase Two were sized to produce 1 mg/day, the projected construction cost in today's dollars would likely be less than $4 million.

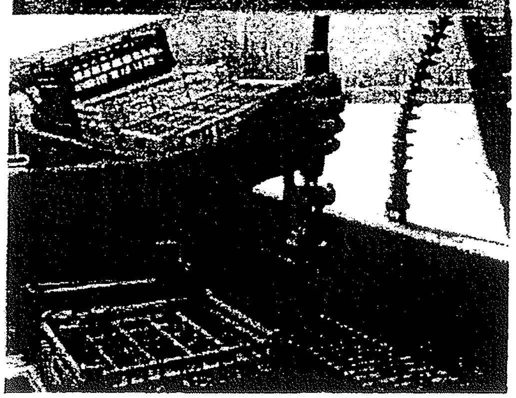
EXHIBIT C

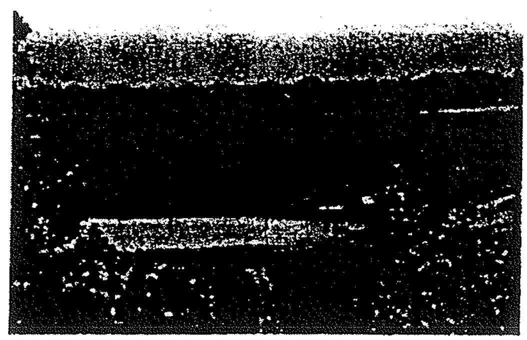
UC SANTA CRUZ
WATER EFFICIENCY SURVEY

FINAL REPORT









December 2007

Prepared By
Maddaus Water Management
and
UC Santa Cruz

UC SANTA CRUZ

Pressure regulators – to help reduce high pressures on drip systems lower part of campus

5.3 Water Conservation Project Costs

A summary matrix of the high priority projects and rough estimates of costs, assuming contractor labor and retail prices, is shown in Table 19. The labor rate for all projects is $85 per hour as provided by Physical Plant staff. Because some of the projects have not been fully designed and detailed cost estimates have not been completed, initial project costing includes a 20% contingency for those projects identified that would require further cost analysis or project management. In addition to the 20% contingency, the $100,000 cost to perform this water efficiency study was spread among all the high priority projects.

Table 19 – High Priority Water Conservation Projects for UC Santa Cruz

Project Number	Potential Water Conservation Project	Number of units to be Replaced or Installed	Unit Cost	Unit Labor hours	Labor Cost	Total Project Cost
	IRRIGATION					
8	Install ET controllers for selected high-water-use areas.	9	$ 2,000	1.0	$ 765	$ 26,683
9	Implement water budgets for individual connection points that appear to be over watering that are not connected to the Central control system	12	$ 500	1.0	$ 1,020	$ 8,578
10	Add wireless rain sensors on existing controllers	70	$ 80	2.0	$ 11,900	$ 24,885
	FARM					
13	Add 10 new PRVs to Farm irrigation system.	10	$ 200			$ 2,444
	ARBORETUM					
14	Use battery-operated timers to shut water off on drip systems.	40	$ 80			$ 3,910
15	Install Arboretum PRVs to reduce water pressure to drip	100	$ 9			$ 1,100

Project Number	Potential Water Conservation Project	Number of units to be Replaced or Installed	Unit Cost	Unit Labor hours	Labor Cost	Total Project Cost
	lines.					
16	Add campus submeters for large un-metered irrigated areas use at Arboretum.	1	$ 3,900			$ 5,546
	FIXTURES					
17	Replace high flow toilets in "high-use" areas with 1.6 gpf or 1.28 gpf toilets.	204	$ 400	3.0	$ 52,020	$ 190,004
19	Replace Flapper Valves and Diaphragms on 1.6 gpf Toilets that tested with high flush volumes.	850	$ 10	0.5	$ 36,125	$ 63,455
20	Install waterless urinals in "high use" restrooms. [A]	65	$ 400	3.0	$ 16,575	$ 60,540
22	Conduct pilot test 1.0 gpm aerators on "high use" restroom faucets.	318	$ 5	0.5	$ 13,515	$ 18,458
23	Replace faucet aerators in non high use restrooms.	2,137	$ 5	0.5	$ 90,823	$ 124,039
24	Replace existing showerheads in "high use" housing and athletic facilities.	40	$ 55	1.0	$ 3,400	$ 6,843
25	Replace existing showerheads in "non high use" housing and athletic facilities.	310	$ 55	1.0	$ 26,350	$ 53,034
26	Replace 9 inefficient spray valves in kitchens, cafes, and restaurants.	9	$ 50	2.0	$ 1,530	$ 2,420
27	Replace hose in College 9/10 Dining Hall kitchen with low flow spray valve.	1	$ 450	8.0	$ 680	$ 1,381
	LABORATORIES					
30	Replace 2 spray valves in steam sterilizer room of Earth and Marine Sciences.	2	$ 50	2.0	$ 340	$ 538
31	Remove Steam Sterilizer from DI Water System in Marine Sciences Building.	1	$ 100	4.0	$ 340	$ 538

Project Number	Potential Water Conservation Project	Number of units to be Replaced or Installed	Unit Cost	Unit Labor hours	Labor Cost	Total Project Cost
	COOLING TOWERS					
48	Change operating procedure of CT-5 from conductivity set point of 1200 to 2000.	0	$ -	80.0	$ 6,800	$ 8,309

A = Does not include cost of replacement cartridges for waterless urinals

5.4 Estimated Water, Sewer, and Energy Savings and Paybacks

Table 20 shows the projected water savings and the associated paybacks for the high priority projects. Projects were identified to be high priority if they had a payback of less than 5 years. The payback is defined as the number of years for the UC Santa Cruz to recover its investment in a given water conservation project, based on the projected water and sewer bill savings associated with implementation of that project. In this case, nineteen water conservation projects identified for the UC Santa Cruz have paybacks which are equal to or less than five years and are recommended.

The value of the saved water for all recommended water conservation projects is an estimated reduction in water, sewer, and energy costs of $542,000 per year (2009 rates). Savings will increase when the UC Santa Cruz's water, sewer and energy rates increase in the future.

Table 20 shows the estimated annual savings achieved by the completion of the recommended water conservation projects. In terms of priorities, projects should be implemented in the order of increasing payback. The total cost to implement the nineteen recommended water conservation projects is estimated to be approximately $603,000. The overall payback for these projects is estimated to be 1.1 years. The cost estimates presented in this report are planning level costs, sufficiently accurate to identify projects with attractive paybacks. The exact costs to the UC Santa Cruz to implement these water conservation projects will depend on the specific number and type of fixtures. In addition, MWM recommends that the UC Santa Cruz adjust the estimates contained herein based on estimates provided by plumbing contractors and engineering staff.

Table 20 - Annual Water, Sewer, Irrigation And Energy Bill Savings for High Priority UC Santa Cruz Projects

Project Number	Project	Annual Water Savings (gpd)	Annual Water Bill Savings, ($/year)	Annual Sewer Bill Savings, ($/year)	Annual Irrigation Bill Savings, ($/year)	Annual Energy Savings ($/year)	Total Savings, ($/year)
	IRRIGATION						
8	Install ET controllers for selected high-water-use areas.	2,613	$ -	$ -	$ 5,355	$ -	$ 5,355

Appendix B
LRDP Mitigations Applicable to the Proposed Project

LRDP Mitigation Measures Applicable to the Project[1]

LRDP Mitigation AES-5A: Prior to design approval of development projects under the 2005 LRDP, the UC Santa Cruz Design Advisory Board shall review project designs for consistency with the valued elements of the visual landscape identified in the 2005 LRDP, and the character of surrounding development so that the visual character and quality of the project area are not substantially degraded.

LRDP Mitigation AES-5B: For projects in redwood forest areas that are visible from areas outside the forest, building heights will be designed to be no higher than the height of the surrounding trees. If a building taller than all the surrounding trees is proposed for construction in a redwood forest area, visual simulations shall be prepared. If the proposed design is determined, in consultation between the visual consultant and the campus, to be degrading to the visual character of the campus, the design will be modified to reduce the visual obtrusiveness of the proposed project.

LRDP Mitigation AES-5C: Campus development shall be designed and construction activities shall be undertaken in a manner that shall minimize removal of healthy and mature trees around new projects, except where the proximity of adjacent mature trees to new development is expected to result in a safety hazard or the ultimate decline of the trees.

LRDP Mitigation AES-5F: Trees identified for removal will be evaluated for their aesthetic value as part of the environmental review process of individual projects.

Individual construction projects that result in the removal of large oak trees or other large unique trees considered to be aesthetically valuable components of the landscape shall replace such trees at a 1-to-1 ratio, either on site, or elsewhere on campus via a contribution to the campus's Site Stewardship program for planting replacement trees.

LRDP Mitigation AES-6B: Lighting for new development projects shall be designed to include directional lighting methods shielded to minimize light spillage and minimize atmospheric light pollution. This lighting should be compatible with the visual character of the project site and meet the UC Regents' Green Building Policies.

LRDP Mitigation AES-6C: As part of the design review process, the UC Santa Cruz Design Advisory Board shall consider project-related light and glare and the Campus shall require the incorporation of measures into the project design to limit both to the extent allowed by code.

LRDP Mitigation AES-6E: As part of the design review process, UC Santa Cruz Design Advisory Board shall review outdoor lighting fixtures for roads, pathways, and parking facilities to ensure that the minimum amount of lighting needed to achieve safe routes is used, and to ensure that the proposed illumination limits adverse effects on nighttime views.

[1] This list only includes LRDP EIR mitigation measures that are applicable to the proposed project and are implemented at the project level. It does not include LRDP EIR mitigation measures that are implemented on an ongoing basis as part of campus operations.

LRDP Mitigation AIR-1: The Campus shall apply standard MBUAPCD-recommended mitigation measures during construction of new facilities under the 2005 LRDP, as appropriate:

- Water all active construction areas at least twice daily.
- Prohibit all grading activities during periods of high wind (over 15 mph).
- Apply chemical soil stabilizers on inactive construction areas (disturbed lands within construction projects that are unused for at least four consecutive days).
- Apply non-toxic binders (e.g., latex acrylic copolymer), as appropriate, to exposed areas after cut and fill operations and hydroseed area.
- Require haul trucks to maintain at least 2 feet of freeboard.
- Cover all trucks hauling dirt, sand, or loose materials.
- Plant vegetative ground cover in disturbed areas as soon as possible.
- Cover inactive storage piles.
- Install wheel washers at the entrances to construction sites for all exiting trucks.
- Pave all roads on construction sites.
- Damp-sweep streets if visible soil material is carried out from the construction site.
- Post a publicly visible sign that specifies the telephone number and person to contact regarding dust complaints. This person shall respond to complaints and take corrective action within 48 hours. The phone number of the Monterey Bay Unified Air Pollution Control District shall be visible to ensure compliance with Rule 402.
- Each project shall limit the area under construction at any one time.

LRDP Mitigation AIR-2A: The Campus shall incorporate in each new project design and construction features that conserve natural gas and/or minimize air pollutant emissions from space and water heating. Specific measures that will be considered for each project include, but are not limited to the following:

- Orientation of buildings to optimize solar heating and natural cooling;
- Use of solar or low-emission water heaters in new buildings; and/or
- Installation of best available wall and attic insulation in new buildings

AIR-5A: The Campus shall develop and implement an emergency generator maintenance-testing schedule consistent with Draft EIR Table 4.3-22.

LRDP Mitigation AIR-6: The Campus will minimize construction emissions by implementing measures such as those listed below:

- Require the use of cleaner fuels (e.g., natural gas, ethanol) in construction equipment
- Require that construction contractors use electrical equipment where possible

- Require construction contractors to minimize the simultaneous operation of multiple pieces equipment at a construction site
- Minimize idling time to a maximum of 5 minutes when construction equipment is not in use
- Schedule operations of construction equipment to minimize exposure to emissions from construction equipment

LRDP Mitigation BIO-3A: At the time that a specific development project is proposed, the Campus shall conduct a site reconnaissance to determine whether wetlands are present on the site. If no potential wetlands are found, no further mitigation is necessary.

LRDP Mitigation BIO-6: To avoid or minimize the introduction or spread of noxious weeds into uninfested areas, UC Santa Cruz shall incorporate the following measures into the project plans and specifications for work on the north campus to be conducted under the 2005 LRDP.

- Only certified, weed-free materials shall be used for erosion control.
- UC Santa Cruz shall identify appropriate best management practices to avoid the dispersal of noxious weeds. The Campus shall then include appropriate practices in construction standards to be implemented during construction in all north campus areas. Typical best management practices include the use of weed-free erosion control materials and revegetation of disturbed areas with seed mixes that include native species and exclude invasive non-natives.
- In uninfested areas, topsoil removed during excavation shall be stockpiled and used to refill the trench on site if it is suitable as backfill.

LRDP Mitigation BIO-11: Prior to construction or site preparation activities, a qualified biologist shall be retained to conduct nest surveys at each site that has appropriate nesting habitat. The survey shall be required for only those projects that will be constructed during the nesting/breeding season of sharp-shinned hawk, golden eagle, northern harrier, long-eared owl, or white-tailed kite (typically February 1 through August 31). The survey area shall include all potential nesting habitat, including mixed evergreen forest, redwood forest, and isolated trees that are within 200 feet of the proposed project grading boundaries. The survey shall be conducted no more than 14 days prior to commencement of construction activities. *Note: As described in this EIR in Section 3.4.2.4, in the discussion of ECI Impact BIO-4, ECI Mitigation BIO-4 will be implemented for the ECI Project in lieu of LRDP Mitigation BIO-11, to provide a more effective and applicable performance standard.*

LRDP Mitigation BIO-13A: If tree removal or grading activity commences on a project site in the north campus during the breeding season of native bat species (April 1 through August 31), a field survey shall be conducted by a qualified biologist to determine whether active roosts of special-status bats (pallid bat, Pacific Townsend’s big-eared bat, western red bat, long-eared myotis, fringed myotis, long-legged myotis, yuma myotis, or greater western mastiff bat) are present on the project site or in areas containing suitable roosting habitat within 50 feet of the project site.

Field surveys shall be conducted in late April or early May in the season before construction begins, when bats are establishing maternity roosts but before pregnant females give birth. If no roosting bats are found, no further mitigation would be required.

LRDP Mitigation BIO-13B: If roosting bats are found, disturbance of the maternity roosts shall be avoided by halting construction until either (1) the end of the breeding season or, (2) a qualified biologist removes and relocates the roosting bats in accordance with CDFG requirements. *Note: As described in this EIR in Section 3.4.2.4, in the discussion of ECI Impact BIO-5, ECI Mitigation BIO-5A through -5F will be implemented for the ECI Project in lieu of LRDP Mitigations BIO-13A and -13B, to provide a more effective and applicable performance standard.*

LRDP Mitigation BIO-14: A pre-construction/grading survey of all suitable San Francisco dusky-footed woodrat habitat within 100 feet of the proposed grading footprint shall be conducted by a qualified biologist to detect any woodrat nests.

The survey shall be conducted no more than 14 days prior to commencement of construction activities. If active nests (stick houses) are identified within the construction zone or within 100 feet of the construction zone, a fence shall be erected around the nest site with a 100-foot minimum buffer from construction activities. At the discretion of the biologist, clearing and construction within the fenced area would be postponed or halted until juveniles have left the nest. The biologist shall serve as a construction monitor during those periods when construction activities will occur near active nest areas to ensure that no inadvertent impacts on these nests will occur. If any woodrat is observed within the grading footprint outside of the breeding period, individuals shall be trapped and relocated to a suitable location in proximity to the project site by a qualified biologist in accordance with CDFG requirements, and the nest dismantled so it cannot be reoccupied. *Note: As described in this EIR in Section 3.4.2.4, in the discussion of ECI Impact BIO-6, ECI Mitigation BIO-6A through -6C will be implemented for the ECI Project in lieu of LRDP Mitigation BIO-14, to provide a more effective and applicable performance standard.*

LRDP Mitigation CULT-1A: As early as possible in the project planning process, the Campus shall define the project's area of potential effects (APE) for archaeological resources based on the extent of ground disturbance and site modifications anticipated for the proposed project. The Campus shall also review confidential resource records to determine whether complete intensive archaeological survey has been performed on the site and whether any previously recorded cultural resources are present.

LRDP Mitigation CULT-1B: Where native soils will be disturbed, the Campus shall provide and shall require contractor crews to attend an informal training session regarding how to recognize archaeological sites and artifacts prior to the start of earth moving. In addition, campus employees whose work routinely involves disturbing the soil shall be informed how to recognize evidence of potential archaeological sites and artifacts. Prior to disturbing the soil, contractors shall be notified that they are required to watch for potential archaeological sites and artifacts and to notify the Campus if any are found. In the event of a find, the Campus shall implement LRDP Mitigation CULT-1G, below.

LRDP Mitigation CULT-1C: For project sites that have not been subject to prior complete intensive archaeological survey, the Campus shall ensure that a complete intensive surface survey is conducted by a qualified archaeologist during project planning and design and prior to soil disturbing activities. If an archaeological deposit is discovered, the archaeologist will prepare a site record and file it with the California Historical Resource Information System. In the event of a find within the area of potential effects, the Campus shall consult with a qualified archaeologist to design and conduct an archaeological subsurface investigation and/or a construction monitoring plan of the project site to ascertain the extent of the deposit relative to the project's area of potential effects, to ensure that impacts to potential buried resources are avoided.

LRDP Mitigation CULT-1F (applicable in the event of a discovery during construction)**:** If avoidance or substantial preservation in place is not possible for an archaeological site that has been determined to meet CEQA significance criteria, the Campus shall retain a qualified archaeologist who, in consultation with the Campus, shall prepare a research design, and plan and conduct archaeological data recovery and monitoring that will capture those categories of data for which the site is significant prior to or during development of the site. The Campus shall also ensure that appropriate technical analyses are performed, and a full written report is prepared and filed with the California Historical Resources Information System, and also shall provide for the permanent curation of recovered materials.

LRDP Mitigation CULT-1G: If an archaeological resource is discovered during construction (whether or not an archaeologist is present), all soil disturbing work within 100 feet of the find shall cease. The Campus shall contact a qualified archaeologist to provide and implement a plan for survey, conduct a subsurface investigation as needed to define the extent of the deposit, and assess the remainder of the site within the project area to determine whether the resource is significant and would be affected by the project. LRDP Mitigation CULT-1F shall also be implemented.

LRDP Mitigation CULT-1H (applicable in the event of a significant discovery)**:** If, in the opinion of the qualified archaeologist and in light of the data available, the significance of the site is such that data recovery cannot capture the values that qualify the site for inclusion on the CRHR, the Campus shall reconsider project plans in light of the high value of the resource, and implement more substantial modifications to the proposed project that would allow the site to be preserved intact, such as project redesign, placement of fill, or project relocation or abandonment. If no such measures are feasible, the Campus shall implement LRDP Mitigation CULT-3A.

LRDP Mitigation CULT-2B: As early as possible in the project planning process, the Campus shall define the project's area of potential effects (APE) for historic structures. The Campus shall determine the potential for the project to result in impacts to or alteration of historic structures based on the extent of site and building modifications anticipated for the proposed project.

LRDP Mitigation CULT-3A (in the event of discovery during construction of a significant archaeological resource that cannot be preserved)**:** If a significant archaeological resource cannot be preserved intact before the property is damaged or destroyed, the Campus shall ensure that the resource is appropriately documented by implementing a program of research-directed data recovery consistent with LRDP Mitigation CULT-1F.

LRDP Mitigation CULT-4A: The Campus shall implement LRDP Mitigations CULT-1A through CULT-1H to minimize the potential for disturbance or destruction of human remains in an archaeological context and to preserve them in place, if feasible.

LRDP Mitigation CULT-4B (in the event of the discovery during construction of a Native American archaeological site that cannot be preserved intact)**:** The Campus shall provide a representative of the local Native American community an opportunity to monitor any excavation (including archaeological excavation) within the boundaries of a known Native American archaeological site.

LRDP Mitigation CULT-4C: In the event of a discovery on campus of human bone, suspected human bone, or a burial, the campus shall ensure that all excavation in the vicinity halts immediately and the area of the find is protected until a qualified archaeologist determines whether the bone is human. If the qualified archaeologist determines the bone is human, or if a qualified archaeologist is not present, the Campus will notify the Santa Cruz County Coroner of the find and protect the find without further disturbance until the Coroner has made a finding relative to PRC §5097 procedures. If it is determined that the find is of Native American origin, the Campus will comply with the provisions of PRC §5097.98 regarding identification and involvement of the Native American Most Likely Descendant (MLD).

LRDP Mitigation CULT-4D (in the event of the discovery during construction of human remains)**:** If human remains cannot be left in place, the Campus shall ensure that the qualified archaeologist and the MLD are provided an opportunity to confer on archaeological treatment of human remains, and that appropriate studies, as identified through this consultation, are carried out. The Campus shall provide results of all such for local Native American involvement in any interpretative reporting. As required by the provisions of the California Native American Graves Protection and Repatriation Act (NAGPRA), the Campus shall ensure that human remains and associated artifacts recovered from campus projects on state lands are repatriated to the appropriate local tribal group, if requested, provided that the appropriate group can be identified through California NAGPRA procedures.

LRDP Mitigation CULT-5A: During project planning, the Project Manager shall consult the most recent campus Soils and Geology map to determine whether the proposed project is underlain by a formation that is known to be sensitive for paleontological resources.

LRDP Mitigation CULT-5C: In the event of a discovery of a paleontological resource on campus, work within 50 feet of the find shall halt until a qualified paleontologist has examined and assessed the find and, if the resource is determined to be a unique paleontological resource, the resource is recovered. The campus shall ensure that all finds are adequately documented, analyzed, and curated at an appropriate institution.

LRDP Mitigation CULT-5D (applicable in the event of a paleontological discovery during construction)**:** In the event that a proposed project would result in impacts to a unique paleontological resource, the project planning team shall work together to reduce impacts to the find through design and construction modifications, to the extent feasible.

LRDP Mitigation GEO-1: Where existing information is not adequate, detailed geotechnical studies shall be performed for areas that will support buildings or foundations. Recommendations of the geotechnical investigations will be incorporated into project design.

LRDP Mitigation HAZ-7: The Campus shall survey buildings for potential contamination before any demolition or renovation work is performed. If contamination is discovered, appropriate remediation will be completed.

LRDP Mitigation HAZ-9A: The Campus shall continue to include the following requirements in its Campus Standards and implement them under the 2005 LRDP:

- Construction work shall be conducted so as to ensure the least possible obstruction to traffic.
- Contractors shall notify the University's Representative at least two weeks before any road closure.
- When paths, lanes, or roadways are blocked, detour signs must be installed to clearly designate an alternate route. Fire hydrants shall be kept accessible to fire fighting equipment at all times. To ensure adequate access for emergency vehicles when construction projects would result in temporary lane or roadway closures, Physical Plant and Physical Planning and Construction shall continue to require that construction and maintenance project managers notify campus police and fire departments and the campus dispatchers of the closures and alternative travel routes.

LRDP Mitigation HAZ-10D: Building component protection as prescribed in the International Uniform Wildland Interface Code (UWIC) shall be required where appropriate as determined by the Campus Fire Marshal. All building construction shall comply with the minimum requirements adopted by the State Fire Marshal's Office.

HYD-2B: No grading shall be conducted on hillsides (sites with slopes greater than 10 percent) during the wet season (October 1 through May 31) unless controls that prevent sediment from leaving the site are implemented. Erosion control measures, such as erosion control blankets, seeding, or other stabilizing mechanisms shall be incorporated into the project erosion control plan or SWPPP and applied to graded hillside prior to predicted storm events.

HYD-3A: The Campus shall install additional signs and expand the public education program to inform and educate the campus population about the importance of staying on paved roads and approved paths to prevent vegetation disturbance and soil erosion.

HYD-3C: Each new capital project proposed under the 2005 LRDP that creates new impervious surface shall include design measures to ensure that post-development peak flows from 2-, 5- and 10-year storms do not exceed the 2-, 5-, and 10-year pre-development peak flows and that post-development peak flows from a 25-year storm do not exceed the pre-development peak flow from a 10-year storm. *Note: As described in this EIR in Section 3.8.3.3, in the discussion of ECI Impact*

HYD-2, the new ECI Mitigation HYD-2 will be implemented in lieu of LRDP Mitigation HYD-3C, to provide a more effective and applicable performance standard.

HYD-3D: The Campus shall require each new capital project to include design measures to minimize, to the maximum extent practicable, the increase in the volume of storm water runoff discharged from the project site to sinkholes or natural drainages. These design measures shall include features that maximize infiltration and dissipation of runoff, preferably near the area where new runoff is generated, and may include, but will not be limited to: vegetated swales, bioretention areas, infiltration trenches and basins, level spreaders, permeable pavement, minimizing directly connected impervious surfaces, storage and re-use of roof runoff, and green roofs. Within one year following approval of the 2005 LRDP, the Campus shall provide a protocol for design consultants to use in demonstrating that measures to reduce runoff are included in the project design to the maximum extent practicable.

HYD-5B: For projects involving construction on karst, if: (a) groundwater is encountered beneath the building site during the geotechnical investigation, and (b) the proposed foundation type would require pressure grouting, the Campus will follow the procedures outlined below:

- Perform a dye tracing study to determine if there is a potential for pressure grouting to affect water quality in springs and seeps around the UC Santa Cruz campus. If a potential impact is indicated, alternative building foundation plans will be considered.
- As an alternative, the Campus may conduct a preliminary hydrogeological study to evaluate whether the groundwater zone encountered during the geotechnical investigation is hydraulically connected to the karst aquifer. If the hydrogeological study indicates that the groundwater zone is hydraulically independent of the karst aquifer, such that there is no potential for grout injected during construction to affect karst water quality, a dye tracing study need not be performed. If results of the hydrogeological study indicate hydraulic connectivity between the groundwater encountered beneath the site and the karst aquifer, the Campus shall conduct a dye tracing study as described above.

LRDP Mitigation NOIS-1: Prior to initiation of construction of a specific development project, the Campus shall approve a construction noise mitigation program that shall be implemented **for** each construction project. This shall include but not be limited to the following:

- Construction equipment used on campus is properly maintained and has been outfitted with feasible noise-reduction devices to minimize construction-generated noise.
- Laydown and construction vehicle staging areas shall be located at least 100 feet away from noise-sensitive land uses as feasible.
- Stationary noise sources such as generators or pumps shall be located at least 100 feet away from noise-sensitive land uses as feasible.
- Notices of the dates and hours of anticipated construction shall be posted in academic, administrative, and residential buildings within 100 feet of construction noise sources at least a week before the start of each construction project.

- Loud construction activity (i.e., construction activity such as jack hammering, concrete sawing, asphalt removal, and large-scale grading operations) within 100 feet of a residential or academic building shall not be scheduled during finals week.
- Loud construction activity as described above within 100 feet of an academic or residential use shall, to the extent feasible, be scheduled during holidays, Thanksgiving break, Christmas break, Spring break, or Summer break.
- Loud construction activity within 100 feet of a residential building shall be restricted to the hours between 7:30 AM and 7:30 PM, Monday through Saturday.
- Loud construction activity within 100 feet of an academic building shall be scheduled to the extent feasible on weekends.

LRDP Mitigation NOIS-2: Campus Standards shall be amended to include a requirement to be imposed on all campus contracts that only City-designated truck routes shall be used for contractor truck trips accessing the campus.

LRDP Mitigation NOIS-3: For future noise-sensitive land uses such as Family Student Housing and other housing complexes that would be constructed under the 2005 LRDP, building and area layouts shall incorporate noise control as a design feature, as feasible. Noise control features would include increased setbacks, landscaped berms or vegetation screens, and building placement to shield noise-sensitive exterior areas from direct roadway exposures. The Campus may also use other noise attenuation measures such as double-pane windows and insulation to minimize interior noise levels.

LRDP Mitigation TRA-2A: In addition to any project- level traffic analyses required by CEQA, UC Santa Cruz shall, at intervals of no more than three years or increments of no more than 1,000 students in enrollment growth (whichever occurs first), conduct traffic counts at the identified intersections to determine if the additional traffic generated by campus growth or a specific project would trigger the need for [specific identified] intersection improvements, or other improvements to achieve the City's level of service standards. If the analysis indicates that, with the traffic contribution of campus growth or of a specific proposed project, the levels of service would degrade to unacceptable levels, the Campus shall inform the City of this conclusion, and contribute its "fair share" [as defined in Part I of this EIR] of the cost of the needed improvements.

LRDP Mitigation TRA-2B: UC Santa Cruz shall continue to implement and will expand its existing Transportation Demand Management programs with the objectives of increasing sustainable transportation modes (use of modes other than single-occupant vehicles) above 55 percent during the planning horizon of the 2005 LRDP and reducing peak hour traffic volumes. [Potential measures that the Campus will consider for achieving this objective are listed in 2005 LRDP EIR Vol. II, Table 3.14-19. They include expansion of campus vanpool and carpool programs and establishment of a carshare program].

LRDP Mitigation TRA-3B: The Campus shall monitor on-campus parking utilization rates annually, and will construct additional parking when demand approaches capacity. The Campus will use projected average daytime utilization rate in excess of 90 percent in a given parking zone as a measure of parking capacity.

LRDP Mitigation TRA-4A: UC Santa Cruz shall monitor campus and Metro transit service and other alternative modes of transportation on an annual basis, to assess the need for improvements in campus circulation to accommodate changes in campus-related circulation demands.

LRDP Mitigation TRA-4B: Based on results of LRDP Mitigation TRA-4A, the Campus shall improve the operational efficiency and capacity of the campus transit system as needed to maintain transit cycle time, and shall work with SCMTD and other agencies to maintain and improve efficiency and capacity of the public transit system serving University facilities.

LRDP Mitigation TRA-4C: Based on the results of LRDP Mitigation TRA-4A, the Campus shall implement measures, including physical and operational improvements, that will ensure that transit travel times between the two most widely-separated colleges does not exceed the time interval between class periods. These measures may include, but are not limited to; channelization of pedestrian crossings, installation of signal-controlled pedestrian crossings, and grade-separated pedestrian crossings where appropriate.

LRDP Mitigation TRA-4D: The Campus shall coordinate implementation of needed campus roadway and circulation improvements identified in the 2005 LRDP with the pace of campus development.

LRDP Mitigation TRA-4E: Based on the results of LRDP Mitigation TRA-4A, the Campus shall implement the bicycle circulation elements of the 2005 LRDP as needed to maintain and enhance the effectiveness of bicycles as a transportation mode.

LRDP Mitigation UTIL-4: The Campus will continue to improve its recycling and waste reduction programs and identify additional means of reducing waste.

LRDP Mitigation UTIL-5: Where feasible, new campus buildings will be added to the Campus Energy Management System and heating and cooling will be controlled based on time of use of building and outside temperature.

LRDP Mitigation UTIL-9A: The Campus shall continue to implement and improve all current water conservation strategies to reduce demand for water, including the following [only the relevant elements of this measure are listed below]:

- Require that new contracts for washing machines in student residences be certified by the Consortium on Energy Efficiency 6 to have a water factor of 5.5 or less or meet an equivalent standard.
- Incorporate water-efficient landscaping practices in all new landscape installations. Water-conservative landscaping practices shall include, but will not be limited to the following: use of water-efficient plants, temporary irrigation systems for plant establishment areas where mature plants will be able to survive without regular irrigation, grouping of plants according to their water requirements, design of planting areas to maximize irrigation pattern efficiency, and mulch covering in planting areas.

- To facilitate monitoring of water usage in all new development, the Campus shall: (1) install separate meters on water lines for individual buildings and (2) install meters on irrigation lines where one point of connection irrigates 1 acre 5,000 sf or more.

Appendix C
Air Quality Model Results

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: C:\Documents and Settings\Don Ballanti\Application Data\Urbemis\Version9a\Projects\ucsc.urb924

Project Name: East Campus Infill Project

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

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Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (tons/year unmitigated)	0.25	1.78	1.55	0.00	0.52	0.10	0.62	0.11	0.09	0.20	196.22
2010 TOTALS (tons/year unmitigated)	0.86	1.11	1.57	0.00	0.00	0.06	0.07	0.00	0.06	0.06	173.78

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (tons/year, unmitigated)	0.99	0.21	0.23	0.00	0.00	0.00	263.60
TOTALS (tons/year, mitigated)	0.98	0.17	0.21	0.00	0.00	0.00	210.93
Percent Reduction	1.01	19.05	8.70	NaN	NaN	NaN	19.98

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (tons/year, unmitigated)	2.02	2.97	22.91	0.01	2.56	0.51	1,399.36

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (tons/year, unmitigated)	3.01	3.18	23.14	0.01	2.56	0.51	1,662.96

Both Area and Operational Mitigation must be turned on to get a combined mitigated total.

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

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2009	0.25	1.78	1.55	0.00	0.52	0.10	0.62	0.11	0.09	0.20	196.22
Mass Grading 04/01/2009-06/30/2009	0.11	0.92	0.49	0.00	0.52	0.05	0.56	0.11	0.04	0.15	82.64
Mass Grading Dust	0.00	0.00	0.00	0.00	0.52	0.00	0.52	0.11	0.00	0.11	0.00
Mass Grading Off Road Diesel	0.10	0.86	0.42	0.00	0.00	0.04	0.04	0.00	0.04	0.04	73.04
Mass Grading On Road Diesel	0.00	0.06	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.68
Mass Grading Worker Trips	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.93
Asphalt 07/01/2009-07/31/2009	0.04	0.20	0.14	0.00	0.00	0.02	0.02	0.00	0.02	0.02	17.13
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.03	0.19	0.11	0.00	0.00	0.02	0.02	0.00	0.02	0.02	14.63
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42
Paving Worker Trips	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.07
Building 08/01/2009-09/30/2010	0.10	0.66	0.92	0.00	0.00	0.04	0.04	0.00	0.04	0.04	96.45
Building Off Road Diesel	0.07	0.53	0.27	0.00	0.00	0.03	0.03	0.00	0.03	0.03	48.69
Building Vendor Trips	0.01	0.08	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.37
Building Worker Trips	0.03	0.05	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35.39
2010	0.86	1.11	1.57	0.00	0.00	0.06	0.07	0.00	0.06	0.06	173.78
Building 08/01/2009-09/30/2010	0.17	1.11	1.55	0.00	0.00	0.06	0.07	0.00	0.06	0.06	172.49
Building Off Road Diesel	0.12	0.89	0.47	0.00	0.00	0.06	0.06	0.00	0.05	0.05	87.11
Building Vendor Trips	0.01	0.14	0.12	0.00	0.00	0.01	0.01	0.00	0.00	0.01	22.13
Building Worker Trips	0.04	0.08	0.96	0.00	0.00	0.00	0.01	0.00	0.00	0.00	63.25
Coating 10/01/2010-11/01/2010	0.69	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29
Architectural Coating	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29

Phase Assumptions

Phase: Mass Grading 4/1/2009 - 6/30/2009 - Default Mass Site Grading Description

Total Acres Disturbed: 3

Maximum Daily Acreage Disturbed: 0.75

Fugitive Dust Level of Detail: Low

Onsite Cut/Fill: 71.6 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day

On Road Truck Travel (VMT): 48.46

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 7/1/2009 - 7/31/2009 - Default Paving Description

Acres to be Paved: 1.13

Off-Road Equipment:

4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Building Construction 8/1/2009 - 9/30/2010 - Default Building Construction Description

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 4 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Architectural Coating 10/1/2010 - 11/1/2010 - Default Architectural Coating Description

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Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.02	0.21	0.09	0.00	0.00	0.00	263.35
Hearth							
Landscape	0.01	0.00	0.14	0.00	0.00	0.00	0.25
Consumer Products	0.89						
Architectural Coatings	0.07						
TOTALS (tons/year, unmitigated)	0.99	0.21	0.23	0.00	0.00	0.00	263.60

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Area Source Mitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Annual Tons Per Year, Mitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.01	0.17	0.07	0.00	0.00	0.00	210.68
Hearth							
Landscape	0.01	0.00	0.14	0.00	0.00	0.00	0.25
Consumer Products	0.89						
Architectural Coatings	0.07						
TOTALS (tons/year, mitigated)	0.98	0.17	0.21	0.00	0.00	0.00	210.93

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments low rise	2.02	2.97	22.91	0.01	2.56	0.51	1,399.36
TOTALS (tons/year, unmitigated)	2.02	2.97	22.91	0.01	2.56	0.51	1,399.36

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Season: Annual

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

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Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments low rise	3.00	8.04	dwelling units	100.00	804.00	8,040.00
					804.00	8,040.00

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.3	1.8	97.5	0.7
Light Truck < 3750 lbs	17.3	2.3	92.5	5.2
Light Truck 3751-5750 lbs	20.0	1.0	98.5	0.5
Med Truck 5751-8500 lbs	8.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.4	0.0	71.4	28.6
Lite-Heavy Truck 10,001-14,000 lbs	0.9	0.0	55.6	44.4
Med-Heavy Truck 14,001-33,000 lbs	1.2	8.3	16.7	75.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.7	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	4.5	68.9	31.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.1	9.1	81.8	9.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.0	10.0	10.0	11.8	4.4	4.4

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\Don Ballanti\Application Data\Urbemis\Version9a\Projects\ucsc.urb924

Project Name: East Campus Infill Project

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

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Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (lbs/day unmitigated)	3.37	28.34	16.82	0.01	15.96	1.48	17.37	3.33	1.36	4.63	2,542.89
2010 TOTALS (lbs/day unmitigated)	62.89	11.37	15.89	0.01	0.04	0.65	0.70	0.01	0.60	0.61	1,769.11

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	5.48	1.15	2.03	0.00	0.01	0.01	1,445.81
TOTALS (lbs/day, mitigated)	5.46	0.92	1.93	0.00	0.01	0.01	1,157.21
Percent Reduction	0.36	20.00	4.93	NaN	0.00	0.00	19.96

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	10.51	15.14	120.27	0.07	14.00	2.81	7,700.85

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	15.99	16.29	122.30	0.07	14.01	2.82	9,146.66

Both Area and Operational Mitigation must be turned on to get a combined mitigated total.

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

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Time Slice 4/1/2009-6/30/2009 Active Days: 65	3.37	**28.34**	15.07	0.00	**15.96**	1.41	**17.37**	**3.33**	1.29	**4.63**	**2,542.89**
Mass Grading 04/01/2009-06/30/2009	3.37	28.34	15.07	0.00	15.96	1.41	17.37	3.33	1.29	4.63	2,542.89
Mass Grading Dust	0.00	0.00	0.00	0.00	15.95	0.00	15.95	3.33	0.00	3.33	0.00
Mass Grading Off Road Diesel	3.18	26.46	12.98	0.00	0.00	1.33	1.33	0.00	1.23	1.23	2,247.32
Mass Grading On Road Diesel	0.12	1.76	0.62	0.00	0.01	0.07	0.08	0.00	0.06	0.07	205.40
Mass Grading Worker Trips	0.07	0.12	1.47	0.00	0.00	0.00	0.01	0.00	0.00	0.00	90.18
Time Slice 7/1/2009-7/31/2009 Active Days: 23	3.09	17.39	12.32	0.00	0.01	**1.48**	1.49	0.00	**1.36**	1.36	1,489.34
Asphalt 07/01/2009-07/31/2009	3.09	17.39	12.32	0.00	0.01	1.48	1.49	0.00	1.36	1.36	1,489.34
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.81	16.83	9.27	0.00	0.00	1.46	1.46	0.00	1.34	1.34	1,272.04
Paving On Road Diesel	0.02	0.32	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	36.95
Paving Worker Trips	0.13	0.24	2.93	0.00	0.01	0.01	0.02	0.00	0.01	0.01	180.35
Time Slice 8/3/2009-12/31/2009 Active Days: 109	1.91	12.18	**16.82**	**0.01**	0.04	0.72	0.76	0.01	0.66	0.67	1,769.66
Building 08/01/2009-09/30/2010	1.91	12.18	16.82	0.01	0.04	0.72	0.76	0.01	0.66	0.67	1,769.66
Building Off Road Diesel	1.30	9.79	4.94	0.00	0.00	0.63	0.63	0.00	0.58	0.58	893.39
Building Vendor Trips	0.14	1.52	1.32	0.00	0.01	0.06	0.07	0.00	0.05	0.06	227.00
Building Worker Trips	0.47	0.87	10.56	0.01	0.03	0.03	0.06	0.01	0.02	0.03	649.27
Time Slice 1/1/2010-9/30/2010 Active Days: 195	1.77	11.37	15.89	**0.01**	0.04	0.65	0.70	0.01	0.60	0.61	1,769.11
Building 08/01/2009-09/30/2010	1.77	11.37	15.89	0.01	0.04	0.65	0.70	0.01	0.60	0.61	1,769.11
Building Off Road Diesel	1.21	9.16	4.81	0.00	0.00	0.58	0.58	0.00	0.53	0.53	893.39
Building Vendor Trips	0.13	1.40	1.23	0.00	0.01	0.05	0.06	0.00	0.05	0.05	227.00
Building Worker Trips	0.44	0.80	9.85	0.01	0.03	0.03	0.06	0.01	0.02	0.03	648.72

Time Slice 10/1/2010-11/1/2010 Active Days: 22	**62.89**	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	117.49
Coating 10/01/2010-11/01/2010	62.89	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	117.49
Architectural Coating	62.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.08	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	117.49

Phase Assumptions

Phase: Mass Grading 4/1/2009 - 6/30/2009 - Default Mass Site Grading Description

Total Acres Disturbed: 3

Maximum Daily Acreage Disturbed: 0.75

Fugitive Dust Level of Detail: Low

Onsite Cut/Fill: 71.6 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day

On Road Truck Travel (VMT): 48.46

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 7/1/2009 - 7/31/2009 - Default Paving Description

Acres to be Paved: 1.13

Off-Road Equipment:

4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Building Construction 8/1/2009 - 9/30/2010 - Default Building Construction Description

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Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 4 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Architectural Coating 10/1/2010 - 11/1/2010 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.09	1.13	0.48	0.00	0.00	0.00	1,443.00
Hearth							
Landscape	0.12	0.02	1.55	0.00	0.01	0.01	2.81
Consumer Products	4.89						
Architectural Coatings	0.38						
TOTALS (lbs/day, unmitigated)	5.48	1.15	2.03	0.00	0.01	0.01	1,445.81

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Area Source Mitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Mitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.07	0.90	0.38	0.00	0.00	0.00	1,154.40
Hearth							
Landscape	0.12	0.02	1.55	0.00	0.01	0.01	2.81
Consumer Products	4.89						
Architectural Coatings	0.38						
TOTALS (lbs/day, mitigated)	5.46	0.92	1.93	0.00	0.01	0.01	1,157.21

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments low rise	10.51	15.14	120.27	0.07	14.00	2.81	7,700.85
TOTALS (lbs/day, unmitigated)	10.51	15.14	120.27	0.07	14.00	2.81	7,700.85

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 70 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

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Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments low rise	3.00	8.04	dwelling units	100.00	804.00	8,040.00
					804.00	8,040.00

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.3	1.8	97.5	0.7
Light Truck < 3750 lbs	17.3	2.3	92.5	5.2
Light Truck 3751-5750 lbs	20.0	1.0	98.5	0.5
Med Truck 5751-8500 lbs	8.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.4	0.0	71.4	28.6
Lite-Heavy Truck 10,001-14,000 lbs	0.9	0.0	55.6	44.4
Med-Heavy Truck 14,001-33,000 lbs	1.2	8.3	16.7	75.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.7	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	4.5	68.9	31.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.1	9.1	81.8	9.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.0	10.0	10.0	11.8	4.4	4.4

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\Don Ballanti\Application Data\Urbemis\Version9a\Projects\ucsc.urb924

Project Name: East Campus Infill Project

Project Location: Monterey Bay Air District

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

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Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2009 TOTALS (lbs/day unmitigated)	3.37	28.34	16.82	0.01	15.96	1.48	17.37	3.33	1.36	4.63	2,542.89
2010 TOTALS (lbs/day unmitigated)	62.89	11.37	15.89	0.01	0.04	0.65	0.70	0.01	0.60	0.61	1,769.11

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	5.36	1.13	0.48	0.00	0.00	0.00	1,443.00
TOTALS (lbs/day, mitigated)	5.34	0.90	0.38	0.00	0.00	0.00	1,154.40
Percent Reduction	0.37	20.35	20.83	NaN	NaN	NaN	20.00

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	12.18	18.58	136.02	0.07	14.00	2.81	7,601.44

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	17.54	19.71	136.50	0.07	14.00	2.81	9,044.44

Both Area and Operational Mitigation must be turned on to get a combined mitigated total.

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

Time Slice 4/1/2009-6/30/2009 Active Days: 65	3.37	**28.34**	15.07	0.00	**15.96**	1.41	**17.37**	**3.33**	1.29	**4.63**	**2,542.89**
Mass Grading 04/01/2009-06/30/2009	3.37	28.34	15.07	0.00	15.96	1.41	17.37	3.33	1.29	4.63	2,542.89
Mass Grading Dust	0.00	0.00	0.00	0.00	15.95	0.00	15.95	3.33	0.00	3.33	0.00
Mass Grading Off Road Diesel	3.18	26.46	12.98	0.00	0.00	1.33	1.33	0.00	1.23	1.23	2,247.32
Mass Grading On Road Diesel	0.12	1.76	0.62	0.00	0.01	0.07	0.08	0.00	0.06	0.07	205.40
Mass Grading Worker Trips	0.07	0.12	1.47	0.00	0.00	0.00	0.01	0.00	0.00	0.00	90.18
Time Slice 7/1/2009-7/31/2009 Active Days: 23	3.09	17.39	12.32	0.00	0.01	**1.48**	1.49	0.00	**1.36**	1.36	1,489.34
Asphalt 07/01/2009-07/31/2009	3.09	17.39	12.32	0.00	0.01	1.48	1.49	0.00	1.36	1.36	1,489.34
Paving Off-Gas	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	2.81	16.83	9.27	0.00	0.00	1.46	1.46	0.00	1.34	1.34	1,272.04
Paving On Road Diesel	0.02	0.32	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	36.95
Paving Worker Trips	0.13	0.24	2.93	0.00	0.01	0.01	0.02	0.00	0.01	0.01	180.35
Time Slice 8/3/2009-12/31/2009 Active Days: 109	1.91	12.18	**16.82**	**0.01**	0.04	0.72	0.76	0.01	0.66	0.67	1,769.66
Building 08/01/2009-09/30/2010	1.91	12.18	16.82	0.01	0.04	0.72	0.76	0.01	0.66	0.67	1,769.66
Building Off Road Diesel	1.30	9.79	4.94	0.00	0.00	0.63	0.63	0.00	0.58	0.58	893.39
Building Vendor Trips	0.14	1.52	1.32	0.00	0.01	0.06	0.07	0.00	0.05	0.06	227.00
Building Worker Trips	0.47	0.87	10.56	0.01	0.03	0.03	0.06	0.01	0.02	0.03	649.27
Time Slice 1/1/2010-9/30/2010 Active Days: 195	1.77	11.37	15.89	**0.01**	0.04	0.65	0.70	0.01	0.60	0.61	1,769.11
Building 08/01/2009-09/30/2010	1.77	11.37	15.89	0.01	0.04	0.65	0.70	0.01	0.60	0.61	1,769.11
Building Off Road Diesel	1.21	9.16	4.81	0.00	0.00	0.58	0.58	0.00	0.53	0.53	893.39
Building Vendor Trips	0.13	1.40	1.23	0.00	0.01	0.05	0.06	0.00	0.05	0.05	227.00
Building Worker Trips	0.44	0.80	9.85	0.01	0.03	0.03	0.06	0.01	0.02	0.03	648.72

Time Slice 10/1/2010-11/1/2010 Active Days: 22	**62.89**	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	117.49
Coating 10/01/2010-11/01/2010	62.89	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	117.49
Architectural Coating	62.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.08	0.15	1.78	0.00	0.01	0.00	0.01	0.00	0.00	0.01	117.49

Phase Assumptions

Phase: Mass Grading 4/1/2009 - 6/30/2009 - Default Mass Site Grading Description

Total Acres Disturbed: 3

Maximum Daily Acreage Disturbed: 0.75

Fugitive Dust Level of Detail: Low

Onsite Cut/Fill: 71.6 cubic yards/day; Offsite Cut/Fill: 0 cubic yards/day

On Road Truck Travel (VMT): 48.46

Off-Road Equipment:

1 Graders (174 hp) operating at a 0.61 load factor for 6 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

Phase: Paving 7/1/2009 - 7/31/2009 - Default Paving Description

Acres to be Paved: 1.13

Off-Road Equipment:

4 Cement and Mortar Mixers (10 hp) operating at a 0.56 load factor for 6 hours per day

1 Pavers (100 hp) operating at a 0.62 load factor for 7 hours per day

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day

1 Rollers (95 hp) operating at a 0.56 load factor for 7 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

Phase: Building Construction 8/1/2009 - 9/30/2010 - Default Building Construction Description

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Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 4 hours per day

2 Forklifts (145 hp) operating at a 0.3 load factor for 6 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

Phase: Architectural Coating 10/1/2010 - 11/1/2010 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 100

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.09	1.13	0.48	0.00	0.00	0.00	1,443.00
Hearth							
Landscaping - No Winter Emissions							
Consumer Products	4.89						
Architectural Coatings	0.38						
TOTALS (lbs/day, unmitigated)	5.36	1.13	0.48	0.00	0.00	0.00	1,443.00

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Area Source Mitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Mitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.07	0.90	0.38	0.00	0.00	0.00	1,154.40
Hearth							
Landscaping - No Winter Emissions							
Consumer Products	4.89						
Architectural Coatings	0.38						
TOTALS (lbs/day, mitigated)	5.34	0.90	0.38	0.00	0.00	0.00	1,154.40

Area Source Changes to Defaults

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Apartments low rise	12.18	18.58	136.02	0.07	14.00	2.81	7,601.44
TOTALS (lbs/day, unmitigated)	12.18	18.58	136.02	0.07	14.00	2.81	7,601.44

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 50 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

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Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Apartments low rise	3.00	8.04	dwelling units	100.00	804.00	8,040.00
					804.00	8,040.00

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	44.3	1.8	97.5	0.7
Light Truck < 3750 lbs	17.3	2.3	92.5	5.2
Light Truck 3751-5750 lbs	20.0	1.0	98.5	0.5
Med Truck 5751-8500 lbs	8.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.4	0.0	71.4	28.6
Lite-Heavy Truck 10,001-14,000 lbs	0.9	0.0	55.6	44.4
Med-Heavy Truck 14,001-33,000 lbs	1.2	8.3	16.7	75.0
Heavy-Heavy Truck 33,001-60,000 lbs	0.7	0.0	0.0	100.0
Other Bus	0.1	0.0	100.0	0.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	4.5	68.9	31.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	1.1	9.1	81.8	9.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.0	10.0	10.0	11.8	4.4	4.4

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Rural Trip Length (miles)	11.8	8.3	7.1	11.8	4.4	4.4
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

Appendix D
Project Greenhouse Gas Emissions Calculations

Project: East Campus Infill Project

Spreadsheet to Calculate CO2-Equivalent Greenhouse Gas Emissions from URBEMIS2007 Output and Emissions from Electrical Use

PROJECT INFORMATION:

Residential Units	100	Dwelling Units		
Retail	0	Sq. Feet		
			CH4 EMISSIONS	N20 EMISSIONS
CONSTRUCTION EMISSIONS				
CONSTRUCTION CO2 EMISSIONS FROM URBEMIS:			CO2 EQUIV.	CO2 EQUIV.
	370	Tons/Year	1.85	0.99
CONSTRUCTION C02 EQUIVALENT	**372.84**	CO2 EQUIV.TONS		
	336.30	CO2- EQUIV. TONNES		
TRANSPORTATION EMISSIONS			CO2 EQUIV.TONS/YEAR	CO2 EQUIV.TONS/YEAR
ANNUAL TRANSPORTATION CO2 EMISSIONS FROM URBEMIS:				
	1399.36	Tons/Year	0.83	4.42
ANNUAL TRANSPORTATION CO2 EQUIV.	**1404.61**	CO2 EQUIV.TONS/YEAR		
	1266.96	CO2 EQUIV. TONNES/YR		
AREA SOURCE EMISSIONS				
ANNUAL AREA SOURCE CO2 EMISSIONS FROM URBEMIS:				
	263.60	Tons/Year	0.08	1.11
ANNUAL AREA SOURCE CO2 EQUIV.	**264.79**	CO2 EQUIV.TONS/YEAR		
	238.84	CO2 EQUIV. TONNES/YR		

Sources and Notes:

CH4 and N2O emission factors from Table 3 in BAAQMD's "Source Inventory of Bay Area Greenhouse Gas Emissions", November 2006.

CH4 assumed to have a Global Warming Potential of 21 times that of CO2.

N2O assumed to have a Global Warming Potential of 310 times that of CO2.

ELECTRICITY CONSUMPTION

LAND USE	UNITS	RATE (MWh/year/unit	ANNUAL USAGE (mWH)
Residential	100	8.415	841.5
			841.5

Emission Rate (lbs./mWH)	Pollutant	Emission (tons/year)	
878.71	CO_2	369.72	
0.0067	CH_4	0.06	
0.0037	N2O	0.48	
		370.26	CO2 EQUIV.TONS/YEAR
		333.97	CO2 EQUIV. TONNES/YR

Sources and Notes:

Residential Electrical use rate based on metered usage at several previously completed UCSC student apartment buildings

Emissions rates for CO2, CH4 and N20 taken from CCAR General Reporting Protocol, Version 3.0, April 2008, Tables C-2 and C-3

Evaluation of Global Climate Change Impacts:

University of California, Santa Cruz

East Campus Infill Apartments – Tree Removal

Prepared for:

University of California, Santa Cruz
Physical Planning and Construction
1156 High Street, Barn G
Santa Cruz, California 95064

Prepared by:

Impact Sciences, Inc.
2101 Webster Street, Suite 1825
Oakland, California 94612

March 2009

EXECUTIVE SUMMARY

The proposed East Campus Infill Apartments project is located at the University of California, Santa Cruz campus east of Chinquapin Road between the existing Crown-Merrill Apartments and Crown College. Construction of the project would require the removal of redwood, oak, madrone, and evergreen trees. The project would include replacement redwood and other deciduous trees. This report identifies the net change in carbon and carbon dioxide (CO_2) sequestration due to the removal of the existing trees on the project site, the conversion of a portion of the logs to furniture and lumber, and the planting of replacement trees.

The primary GHGs associated with plant matter are water vapor and CO_2. The level of water vapor in the atmosphere is largely a function of oceanic and atmospheric temperatures. The control and reduction of water vapor is not within reach of human actions and is not usually included in GHG emissions inventories. The primary GHG emitted by human actions is CO_2. Trees sequester carbon by removing CO_2 from the atmosphere during photosynthesis, converting it to simple sugars and releasing oxygen back to the atmosphere. Conversely, CO_2 is emitted from trees during decomposition and oxidation. Tree decomposition and oxidation can be accelerated as a result of human actions, which break the natural carbon cycle and allow CO_2 to be released and accumulate in the atmosphere.

The net change in CO_2 sequestration due to the removal of trees at the proposed project site is based on the difference between the carbon stock associated with the existing ecosystem and that associated with the proposed project site after development. Carbon stock rates and other factors were obtained from the California Climate Action Registry (CCAR) *Forest Project Protocol*, Version 2.1 (CCAR 2007). The carbon stock equations estimate tree biomass from diameter measurements. The CO_2 sequestered in wood products was estimated by calculating the total carbon from the larger redwood trees with a 60 percent mill efficiency rating.

Based on the CCAR protocol, by removing 261 trees, the project is estimated to remove approximately 1,376 metric tons of sequestered CO_2. During the first year, approximately 29 percent, or 395 metric tons, of this CO_2 would remain sequestered as wood products while the rest would be emitted into the atmosphere. In 2020, due to decay, that value would drop to 23 percent, or 312 metric tons of CO_2. After 2040, all 1,376 metric tons of CO_2 are assumed to be completely emitted. The project would also plant approximately 50 new trees. At full maturity, these new trees would sequester approximately 193 metric tons of CO_2. The net change in long-term CO_2 sequestration, assuming no wood remaining products, would be a loss of CO_2 sequestration approximately equal to 1,183 metric tons.

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1.0 INTRODUCTION

1.1 Project Description

The proposed East Campus Infill Apartments project is located at the University of California, Santa Cruz campus east of Chinquapin Road between the existing Crown-Merrill Apartments and Crown College. The project would replace three existing underutilized parking lots. Construction of the project would require the removal of redwood, oak, madrone, and evergreen trees. The project would include replacement redwood and other deciduous trees.

1.2 Purpose of Report

This report identifies the net change in carbon and carbon dioxide (CO_2) sequestration due to the removal of the existing trees on the project site, the conversion of a portion of the logs to furniture and lumber, and the planting of replacement trees. Combustion-related emissions from heavy-duty equipment that would be used to remove, transport, process, and replace the trees are beyond the scope of this report and are not included. **Section 2.0** provides a brief overview of global climate change and the process of carbon sequestration from woodlands. The section also provides estimated carbon sequestration inventory data for statewide woodlands. **Section 3.0** provides information on the evolving regulatory framework that addresses global climate change, focusing primarily on state efforts to reduce carbon emissions from forested lands. **Section 4.0** describes the methodology used to estimate the net carbon sequestration and associated net carbon dioxide emissions from the removed trees, the conversion to wood products, and the replacement trees. **Section 5.0** concludes the report and summarizes the data presented.

2.0 GLOBAL CLIMATE CHANGE

2.1 Greenhouse Effect

Global climate change refers to any significant change in climate measurements, such as temperature, precipitation, or wind, lasting for an extended period of time (*i.e.*, decades or longer) (U.S. EPA 2008). Climate change may result from:

- Natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- Natural processes within the climate system (*e.g.*, changes in ocean circulation, reduction in sunlight from the addition of GHG and other gases to the atmosphere from volcanic eruptions); and

- Human activities that change the atmosphere's composition (*e.g.*, through burning fossil fuels) and the land surface (*e.g.*, deforestation, reforestation, urbanization, desertification).

The natural process through which heat is retained in the troposphere[1] is called the "greenhouse effect." The greenhouse effect traps heat in the troposphere through a three-fold process as follows: (1) short-wave radiation emitted by the Sun is absorbed by the Earth; (2) long-wave radiation re-emitted by the Earth; and (3) GHGs in the upper atmosphere absorbing or trapping the long-wave radiation and re-emitting it back towards the Earth and into space. This re-emitting of the long-wave (*i.e.*, thermal) radiation by GHGs back towards the Earth is the underlying process of the greenhouse effect. Without the greenhouse effect, the Earth's average temperature would be approximately -18 degrees Celsius (°C) (0° °F) instead of its present 14°C (57°F) (National Climatic Data Center 2008). Water vapor and CO_2 are the most abundant GHGs.

2.2 Greenhouse Gases Relevant to this Report

The primary GHGs associated with plant matter are water vapor and CO_2. Although water vapor has not received the scrutiny of other GHGs, it is the primary contributor to the Earth's natural greenhouse effect. Water vapor and clouds contribute approximately 66 to 85 percent of the greenhouse effect; water vapor alone contributes 36 to 66 percent (Schmidt 2005). Natural processes such as evaporation from oceans and rivers and transpiration from plants contribute 90 percent and 10 percent of the water vapor in our atmosphere, respectively, according to the U.S. Geological Survey (USGS 2007). The primary human-related source of water vapor comes from fuel combustion in motor vehicles; however, this is not believed to contribute a significant amount (less than 1 percent) to atmospheric concentrations, according to the U.S. Energy Information Administration (EIA 2008). In addition, the level of water vapor in the atmosphere is largely a function of oceanic and atmospheric temperatures. Supersaturated air would result in water vapor condensing out as precipitation; subsaturated air would result in increased evaporation and plant transpiration rates until equilibrium is restored. Therefore, the control and reduction of water vapor is not within reach of human actions and is not usually included in GHG emissions inventories.

The primary GHG emitted by human actions is CO_2. It is primarily generated by fossil fuel combustion from stationary and mobile sources. CO_2 is also emitted when trees and other plant matter (*e.g.*, wood, leaves, etc.), which is partially made of elemental carbon, decays or oxidizes. Trees are considered to be carbon "sinks." In other words, trees sequester carbon by removing CO_2 from the atmosphere during

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1 The troposphere is the bottom layer of the atmosphere, which varies in height from the Earth's surface to 10 to 12 kilometers). In general, day-to-day weather is confined to the troposphere (e.g., clouds, rain, convection, etc.).

photosynthesis, converting it to simple sugars and releasing oxygen back to the atmosphere. Conversely, CO_2 is emitted from trees during decomposition and oxidation. In the absence of human actions, trees naturally die off and decompose, allowing new trees to take up the CO_2—this is part of the natural carbon cycle. However, tree decomposition and oxidation as a result of human actions breaks the natural carbon cycle and allows CO_2 to accumulate in the atmosphere at a faster rate. As trees are removed at an accelerated pace from an ecosystem, the total level of photosynthesis is reduced and less CO_2 in the atmosphere is taken up by the plants and converted to sugars and oxygen. Such an ecosystem would represent a loss in carbon sequestration potential and reduce its ability to act as a carbon sink. While other gases emitted by human actions have a greater unitary ability to trap heat, CO_2 is emitted in far greater quantities by several orders of magnitude and has a greater overall effect on the climate. In addition, as temperatures rise with increasing CO_2 (and other GHGs) in the atmosphere, the amount of water vapor also increases. Thus, CO_2 has an amplified effect on the climate.

2.3 Existing California Carbon Sequestration from Woodlands

While it is difficult to precisely quantify how much carbon is sequestered in California woodlands due to the changing environmental landscape, estimates can be made based on inventory and sampling data. As required by the Global Warming Solutions Act of 2006 (also referred to as Assembly Bill [AB] 32), the California Air Resources Board (CARB) adopted the *Climate Change Scoping Plan* that outlines strategies for the state to achieve the 2020 GHG reduction goals. The *Climate Change Scoping Plan* states that forests are currently a net carbon sink in the state sequestering approximately 4.7 million metric tons of carbon dioxide equivalents ($MMTCO_2e$) per year based on inventory data (CARB 2008). The California Climate Action Team (CCAT), which was formed by Executive Order and is made up of representatives from several state agencies including the California Environmental Protection Agency and the Resources Agency, issued several reports in support of the *Climate Change Scoping Plan*. The Forestry Sector report estimated that California contains approximately 33 million acres of forested lands. Approximately 21 million acres of these lands are made of conifer forests and woodlands. Forest biomass is estimated to sequester 426 tons of CO_2 per acre and woodland biomass is estimated to sequester 57 tons of CO_2 per acre (CCAT 2008). Using these very broad factors, California forests are estimated to sequester approximately 12,800 $MMTCO_2e$. Woodlands are estimated to sequester approximately 1,100 $MMTCO_2e$. The overall rate of carbon sequestration is estimated at 4.7 $MMTCO_2e$ annually (CCAT 2008). In comparison, CARB estimated the GHG emissions from human actions at 484 MMTCO2e (including emissions resulting from out-of-state electrical generation) based on the 2004 GHG inventory data (CARB 2007).

2.4 Effects of Global Climate Change

The primary effect of global climate change has been a rise in the average global tropospheric temperature of 0.2° Celsius per decade, determined from meteorological measurements world-wide between 1990 and 2005 (IPCC 2007). Climate change modeling using 2000 emission rates shows that further warming is likely to occur, which would induce further changes in the global climate system during the current century (IPCC 2007). Changes to the global climate system and ecosystems and to California would include, but would not be limited to:

- Declining sea ice and mountain snowpack levels, thereby increasing sea levels and sea surface evaporation rates with a corresponding increase in tropospheric water vapor due to the atmosphere's ability to hold more water vapor at higher temperatures (IPCC 2007);
- Rising average global sea levels primarily due to thermal expansion and the melting of glaciers, ice caps, and the Greenland and Antarctic ice sheets (IPCC 2007);
- Changing weather patterns, including changes to precipitation, ocean salinity, and wind patterns, and more energetic aspects of extreme weather including droughts, heavy precipitation, heat waves, extreme cold, and the intensity of tropical cyclones (IPCC 2007);
- Declining Sierra snowpack levels, which account for approximately half of the surface water storage in California, by 70 percent to as much as 90 percent over the next 100 years (CalEPA 2006);
- Increasing the number of days conducive to ozone formation by 25 to 85 percent (depending on the future temperature scenario) in high ozone areas located in the Southern California area and the San Joaquin Valley by the end of the 21st century (CalEPA 2006);
- Increasing the potential for erosion of California's coastlines and sea water intrusion into the Sacramento and San Joaquin Delta and associated levee systems due to the rise in sea level (CalEPA 2006);
- Increasing pest infestation making California more susceptible to forest fires (CalEPA 2006); and
- Increasing the demand for electricity by 1 to 3 percent by 2020 due to rising temperatures resulting in hundreds of millions of dollars in extra expenditures (CalEPA 2006).

3.0 REGULATORY AND SUSTAINABILITY PROGRAMS

3.1 Assembly Bill 32

The California Global Warming Solutions Act of 2006 was signed into law by the Governor on September 27, 2006. AB 32 represents the first enforceable statewide program to limit GHG emissions from all major industries with penalties for noncompliance. CARB is responsible for carrying out and developing the programs and requirements necessary to achieve the goals of AB 32—the reduction of California's GHG emissions to 1990 levels by 2020.

AB 32 requires CARB to adopt a scoping plan indicating how reductions in significant GHG sources will be achieved through regulations, market mechanisms, and other actions. CARB released the *Climate Change Proposed Scoping Plan* in October 2008, which contains an outline of the proposed State strategies to achieve 1990 levels of greenhouse gas emissions by 2020. The CARB Governing Board approved the Scoping Plan on December 11, 2008. While most of the strategies in the Scoping Plan deal with combustion emissions, sustainable forestry represents a key component of the plan. Under Scoping Plan Measure 16, forest carbon sequestration should be preserved and the use of forest biomass for sustainable energy generation should be encouraged. In addition, the Scoping Plan notes that the Resources Agency supports voluntary actions that promote sustainable forest management and carbon sequestration benefits. Under Scoping Plan Measure 16, current levels of carbon sequestration are to be maintained. Forests are expected to play a greater role in the state's 2050 goal, which requires an 80 percent reduction in GHG emissions from 1990 levels, under the Governor's Executive Order S-03-05.

3.2 Department of Forestry and Fire Protection

The California Department of Forestry and Fire Protection provided information to the public and the CCAT regarding measures that could be considered for inclusion in the Scoping Plan. The Department recommended five measures: (1) Conservation forest management practices; (2) Encouraging less forest conversion to other land uses; (3) Reducing wildfires by removing fuel (*e.g.*, biomass), which can be used as biomass-based energy displacing fossil fuels; (4) Reforestation; and (5) Urban forests.

4.0 PROJECT GREENHOUSE GAS EMISSIONS INVENTORY

4.1 Methodology

The net change in CO_2 sequestration due to the removal of trees at the proposed project site is based on the difference between the carbon stock associated with the existing ecosystem and that associated with the proposed project site after development. The project would replace the existing trees on the 2-acre site with apartment buildings, redwood trees, and other deciduous trees. **Table 1, Existing and Proposed Project Trees**, lists the species and number of existing trees that would be removed to construct the project and proposed trees that would be planted as part of site landscaping.

Table 1
Existing and Proposed Project Trees

Species/Tree Type	Number of Trees
Existing Trees	
Birch	4
Douglas-Fir	13
Madrone	5
Oak	26
Redwood	212
Unknown species	1
Proposed Trees	
Redwood	35
Maple/Sycamore/Cherry	15

Source: University of California, Santa Cruz, Physical Planning and Construction, (2009).

Carbon stock rates and other factors were obtained from the California Climate Action Registry (CCAR) *Forest Project Protocol*, Version 2.1 (CCAR 2007). The CCAR is a private non-profit organization formed by the State of California and serves as a voluntary GHG registry to protect and promote early actions to reduce GHG emissions by organizations. The CCAR was formally established by law through SB 1771 (Sher) and SB 527 (Sher). The CCAR began with 23 Charter Members and currently has over 300 corporations, universities, cities and counties, government agencies, and environment organizations voluntarily measuring, monitoring, and publicly reporting their GHG emissions using the CCAR protocols. The CCAR has published a General Reporting Protocol, as well as project- and industry-specific protocols for landfill activities, livestock activities, the cement sector, the power/utility sector, and the forest sector. The protocols provide the principles, approach, methodology, and procedures required for participation in the CCAR.

The carbon stock equations in the CCAR protocol estimates tree biomass from diameter measurements. The above-ground biomass equation is applied to the individual trees. The below-ground biomass equation must be applied at the plot level (CCAR 2007). This is an important distinction because the below-ground density is dependant upon the natural logarithm of the total above-ground density on a per hectare basis. Therefore, it is necessary to determine the total above-ground biomass, on a per hectare basis, prior to calculating the below-ground biomass. Once the total below-ground biomass is calculated, a linear interpolation is used to allocate below-ground mass to individual trees. A carbon fraction factor is applied to the total biomass in order to convert the amount of biomass matter to carbon. Assuming that all carbon biomass is converted to CO_2, the molecular weight ratio of 44:12 is applied to convert from carbon to CO_2.

In the absence of the project, the existing trees would continue to grow and sequester additional carbon relative to current levels. This is especially true for redwood, which maintains high growth rates over long time periods relative to nearly any other species (Staub 2009). Therefore, future growth projected out to 2040 was estimated for the existing trees along with the associated carbon sequestration.

In the case of the project trees, all of the carbon content in the biomass is assumed to originate from CO_2 in the atmosphere. Therefore, all project trees act as carbon sinks. In the case of the existing trees, a portion of the carbon stock would remain as carbon in the form of furniture and other wood products. According to staff at the University of California, Santa Cruz, approximately half of the 12" to 24" diameter and all larger diameter redwoods would remain as wood products. The carbon stock associated with these wood products would not immediately convert to atmospheric CO_2. The conversion from stored carbon to CO_2 would take place over time as the wood products slowly decay and eventually end their useful lives. The CCAR *Forest Project Protocol* contains equations for estimating the carbon stored in wood products from trees and the slow rate of decay. The protocol also contains useful life estimates for a variety of wood products. Furniture and other miscellaneous wood products are given an estimated 30 years of useful life (CCAR 2007). In other words, at the end of 30 years, any carbon left in furniture or other miscellaneous wood products would be converted to CO_2 and no carbon stock credit would be given under the protocol.

The methodology described above was used to estimate the carbon stock in the existing trees as well as the new trees under the proposed project. In addition, the declining carbon stock associated with the wood products was estimated from year 2010 through 2040, after which time the remaining carbon stock would be emitted as CO_2. The next section discusses the formulas and calculation values used in the analysis.

4.2 Calculations

Carbon sequestration calculations were done separately for the existing trees and the trees associated with the proposed project. Above-ground and below-ground biomass estimates were calculated separately. In addition, the carbon associated with the wood products was calculated separately.

For the existing trees, the CCAR *Forest Project Protocol* contains several formulas for calculating the above-ground biomass. The formulas are based on the diameter of the tree as well as the species. The protocol does not contain formulas for all species; therefore, the CCAR recommends that the formula for the most similar species be used until a more comprehensive list of equations is developed. The following formulas were used in this analysis:

Birch: Above-ground Biomass (kg) = $\text{Exp}(-1.9123 + 2.3651 \times \ln \text{DBH})$

Douglas-Fir: Above-ground Biomass (kg) = $\mathrm{Exp}(-2.2304 + 2.4435 \times \ln \mathrm{DBH})$

Madrone: Above-ground Biomass (kg) = $\mathrm{Exp}(-2.4800 + 2.4835 \times \ln \mathrm{DBH})$

Oak: Above-ground Biomass (kg) = $\mathrm{Exp}(-2.0127 + 2.4342 \times \ln \mathrm{DBH})$

Redwood: Above-ground Biomass (kg) = $\mathrm{Exp}(-2.0336 + 2.2592 \times \ln \mathrm{DBH})$

Unknown: Above-ground Biomass (kg) = $0.5 + ((25000 \times \mathrm{DBH}^{2.5}) \div (\mathrm{DBH}^{2.5} + 246872))$

Where: DBH = tree biomass diameter in centimeters

kg = kilograms

The equations for the birch and unknown species were taken from the source document the CCAR relied upon in their protocol (Winrock International, 2006). The protocol does not contain an equation for madrone trees; therefore, the equation for tanoak trees was applied.

The below-ground biomass was estimated using the equation below. The equation is based on the above-ground biomass and must be applied at the plot level. Therefore, once the above-ground biomass was determined for each tree, the biomass was summed, converted from kilograms to tons, divided by 2 acres to obtain a per acre basis, and then converted to a per hectare basis. The value was then used in the below-ground equation:

Equation: Below-ground Biomass (tons/hectare) = $\mathrm{Exp}(-0.7747 + 0.8836 \times \ln \mathrm{ABD})$

Where: ABD = above-ground biomass density in tons per hectare

Once the below-ground biomass was calculated, the reverse process was used to convert the value back to a kilogram basis and allocated to each individual tree using a linear interpolation based on the ratio of the tree's mass to the total mass of all the trees. The biomass was converted to carbon by multiplying by a factor of 0.5 (CCAR 2007). The carbon was then converted to CO_2 by multiplying by the ratio 44/12, which is the molecular weight ratio of CO_2 to elemental carbon. Refer to **Appendix A** for detailed calculations.

The additional carbon stored as a result of future estimated growth was calculated based on the estimated amount of wood that is expected to be produced over the remaining modeled growth period (i.e., the time between 2009 and 2040, which was selected as the endpoint of the growth model). Based on a review of Lindquist and Palley's Empirical Yield Tables for Young Growth Redwood from the California Agricultural Experiment Station (CAES Bulletin 796, 1963), it is estimated that cubic foot volume growth would average approximately 175 cubic feet per year or a total of some 7,000 cubic feet over the estimated

40 year growth period. A density factor of 28 pounds per cubic feet was used to convert from volume to biomass. Since the estimated volume is based on board-feet, which is usable wood for producing wood products, a mill efficiency of 60 percent was assumed to back calculate the biomass (CCAR 2007). Refer to **Appendix B** for more a detailed analysis of future expected growth.

The equations listed above were also used to calculate the project trees' carbon stock and CO_2 sequestration. However, in the case of the project trees, this assumes that they have grown to full maturity and have reached an equilibrium point whereby carbon loss through decay and oxidation is equal to the carbon gain through photosynthesis.

The CO_2 sequestered in wood products was estimated by calculating the total carbon from the above-ground portion of the larger redwood trees. The protocol assumes 60 percent mill efficiency, with the other 40 percent assumed to be emitted as CO_2 (CCAR 2007). The equation to calculate the remaining carbon after one year of decay is as follows:

Equation: Remaining Wood Products Carbon = $C + (C \times \ln(0.5) \div Z)$

Where: C = Carbon amount (above-ground portion)

Z = Useful life in years (30 years in this analysis)

Using the above equations and calculations, **Table 2, Carbon Sequestration**, summarizes the CO_2 sequestered in the existing trees and the project trees. **Table 3, Carbon Sequestration in Wood Products**, summarizes the CO_2 sequestered in the wood products at every tenth year. Detailed calculations are provided in **Appendix A**. As presented in **Table 2** and **Table 3**, the proposed project would result in a net loss of carbon sequestration.

5.0 SUMMARY

The proposed East Campus Infill Apartments project located at the University of California, Santa Cruz would require the removal of existing redwood, oak, madrone, and evergreen trees from the site. The project would include replacement redwood trees and other deciduous trees. This report identifies the net change in carbon and CO_2 sequestration due to the removal of the existing trees on the project site and the planting of replacement trees. Carbon associated with future growth of the existing redwood trees is included in the analysis in order to account for the true CO_2 sequestration of the existing site in the absence of the project. The amount of CO_2 sequestered in the wood products would change over time upon implementation of the project and is presented in a separate table.

The methodology to calculate the change in CO_2 sequestration is based on the CCAR *Forest Project Protocol*, Version 2.1 (CCAR 2007). The protocol provides equations for calculating above-ground and below-ground biomass and conversion factors for carbon. The protocol also provides equations for calculating the carbon stock of wood products incorporating decay rates and product lifetimes.

The project is estimated to remove approximately 1,376 metric tons of current and future sequestered CO_2. During the first year, approximately 29 percent, or 395 metric tons, of this CO_2 would remain sequestered as wood products. In 2020, that value would drop to 23 percent, or 312 metric tons of CO_2 due to decay. After 2040, the CO_2 in the wood products is assumed to be completely emitted. The project would also plant approximately 50 new trees. At full maturity, these new trees would sequester approximately 193 metric tons of CO_2. The net change in long-term CO_2 sequestration, assuming no remaining wood products, would be a loss of CO_2 sequestration approximately equal to 1,183 metric tons.

Table 2
Carbon Sequestration

Species/Tree Type	CO_2 Sequestered (metric tons)
Existing Trees	
Birch	11.59
Douglas-Fir	32.08
Madrone	10.68
Oak	119.83
Redwood	929.30
Unknown species	0.44
Subtotal (Without future growth)	***1,103.92***
Estimated growth	271.65
Subtotal (With future growth)	***1,375.57***
Proposed Trees (at full maturity)	
Redwood	139.28
Maple/Sycamore/Cherry	53.71
Subtotal	***192.99***
Net Change (Comparison with future growth)	***-1,182.58***

Source: Impact Sciences, Inc., (2009).

Table 3
Carbon Sequestration in Wood Products

Year After Conversion to Wood Products	CO_2 Sequestered (metric tons)
Wood Products	
2010	394.65
2020	312.39
2030	247.27
2040	195.73

Source: Impact Sciences, Inc., (2009).

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APPENDIX A

Greenhouse Gas Emission Calculations

University of California, Santa Cruz
East Campus Infill Apartments Project
Tree Removal Climate Change Impacts

Table A-1
Existing Trees Carbon Stock

Group Number	Species	Number of Trees	DBH[1] (cm)	Status	Above-Ground[2] (kg)	Below-Ground[3] (kg)	Total Biomass (kg)	Mass Carbon[2] (kg)	Mass Carbon (metric tons)	Carbon Dioxide[4] (metric tons)
22	Birch	1	46	L	1,246.85	333.93	1,580.78	790.39	0.79	2.90
24	Birch	1	46	L	1,246.85	333.93	1,580.78	790.39	0.79	2.90
32	Birch	1	46	L	1,246.85	333.93	1,580.78	790.39	0.79	2.90
39	Birch	1	46	L	1,246.85	333.93	1,580.78	790.39	0.79	2.90
	Total Birch	4			4,987.42	1,335.72	6,323.14	3,161.57	3.16	11.59
4	Douglas-Fir	2	46	L	2,448.21	655.67	3,103.89	1,551.94	1.55	5.69
5	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
16	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
19	Douglas-Fir	1	20	L	168.76	45.20	213.95	106.98	0.11	0.39
20	Douglas-Fir	1	20	L	168.76	45.20	213.95	106.98	0.11	0.39
21	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
23	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
25	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
26	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
27	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
30	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
31	Douglas-Fir	1	46	L	1,224.11	327.84	1,551.94	775.97	0.78	2.85
	Total D. Fir	13			13,802.68	3,696.60	17,499.28	8,749.64	8.75	32.08
28	Madrone*	1	20	L	148.31	39.72	188.03	94.02	0.09	0.34
54	Madrone*	1	46	L	1,111.28	297.62	1,408.90	704.45	0.70	2.58
57	Madrone*	1	46	L	1,111.28	297.62	1,408.90	704.45	0.70	2.58
60	Madrone*	1	46	L	1,111.28	297.62	1,408.90	704.45	0.70	2.58
64	Madrone*	1	46	L	1,111.28	297.62	1,408.90	704.45	0.70	2.58
	Total Madrone	5			4,593.43	1,230.20	5,823.63	2,911.82	2.91	10.68
2	Oak	3	46	L	4,406.03	1,180.01	5,586.04	2,793.02	2.79	10.24
3	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
6	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
12	Oak	1	20	L	204.01	54.64	258.64	129.32	0.13	0.47
13	Oak	1	20	L	204.01	54.64	258.64	129.32	0.13	0.47
17	Oak**	1	76	L	5,092.73	1,363.92	6,456.65	3,228.32	3.23	11.84
18	Oak	1	20	L	204.01	54.64	258.64	129.32	0.13	0.47
29	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
40	Oak**	1	107	L	11,551.95	3,093.81	14,645.76	7,322.88	7.32	26.85
41	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
42	Oak	1	20	L	204.01	54.64	258.64	129.32	0.13	0.47
43	Oak**	1	76	L	5,092.73	1,363.92	6,456.65	3,228.32	3.23	11.84
44	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
50	Oak**	1	76	L	5,092.73	1,363.92	6,456.65	3,228.32	3.23	11.84
53	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41

Table A-1
Existing Trees Carbon Stock

Group Number	Species	Number of Trees	DBH[1] (cm)	Status	Above-Ground[2] (kg)	Below-Ground[3] (kg)	Total Biomass (kg)	Mass Carbon[2] (kg)	Mass Carbon (metric tons)	Carbon Dioxide[4] (metric tons)
55	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
58	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
59	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
63	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
76	Oak	1	20	L	204.01	54.64	258.64	129.32	0.13	0.47
76	Oak	1	46	L	1,468.68	393.34	1,862.01	931.01	0.93	3.41
156	Oak	1	20	L	204.01	54.64	258.64	129.32	0.13	0.47
215	Oak	2	46	L	2,937.35	786.67	3,724.03	1,862.01	1.86	6.83
	Total Oak	26			51,552.98	13,806.79	65,359.77	32,679.89	32.68	119.83
1	Redwood	1	137	L	8,815.42	2,360.92	11,176.34	5,588.17	5.59	20.49
7	Redwood	4	46	L	2,947.07	789.28	3,736.35	1,868.17	1.87	6.85
7	Redwood	6	76	L	14,017.89	3,754.24	17,772.13	8,886.06	8.89	32.58
8	Redwood	1	20	L	117.95	31.59	149.53	74.77	0.07	0.27
8	Redwood	14	46	L	10,314.75	2,762.47	13,077.22	6,538.61	6.54	23.97
8	Redwood	9	76	L	21,026.84	5,631.35	26,658.19	13,329.10	13.33	48.87
9	Redwood	1	20	L	117.95	31.59	149.53	74.77	0.07	0.27
9	Redwood	9	46	L	6,630.91	1,775.87	8,406.79	4,203.39	4.20	15.41
9	Redwood	7	76	L	16,354.21	4,379.94	20,734.15	10,367.07	10.37	38.01
10	Redwood	7	20	L	825.62	221.11	1,046.73	523.37	0.52	1.92
10	Redwood	28	46	L	20,629.50	5,524.94	26,154.44	13,077.22	13.08	47.95
10	Redwood	2	76	L	4,672.63	1,251.41	5,924.04	2,962.02	2.96	10.86
11	Redwood	1	137	L	8,815.42	2,360.92	11,176.34	5,588.17	5.59	20.49
14	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
15	Redwood	3	46	L	2,210.30	591.96	2,802.26	1,401.13	1.40	5.14
15	Redwood	2	76	L	4,672.63	1,251.41	5,924.04	2,962.02	2.96	10.86
15	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
28	Redwood	2	20	L	235.89	63.18	299.07	149.53	0.15	0.55
28	Redwood	3	46	L	2,210.30	591.96	2,802.26	1,401.13	1.40	5.14
28	Redwood	5	76	L	11,681.58	3,128.53	14,810.11	7,405.05	7.41	27.15
28	Redwood	3	107	L	14,989.43	4,014.43	19,003.86	9,501.93	9.50	34.84
33	Redwood	4	20	L	471.78	126.35	598.13	299.07	0.30	1.10
33	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
33	Redwood	6	107	L	29,978.86	8,028.86	38,007.72	19,003.86	19.00	69.68
34	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
35	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
36	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
37	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
38	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
49	Redwood	4	137	L	35,261.68	9,443.70	44,705.38	22,352.69	22.35	81.96
51	Redwood	1	137	L	8,815.42	2,360.92	11,176.34	5,588.17	5.59	20.49
52	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
56	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
67	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
67	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61

Table A-1
Existing Trees Carbon Stock

Group Number	Species	Number of Trees	DBH[1] (cm)	Status	Above-Ground[2] (kg)	Below-Ground[3] (kg)	Total Biomass (kg)	Mass Carbon[2] (kg)	Mass Carbon (metric tons)	Carbon Dioxide[4] (metric tons)
157	Redwood	2	46	L	1,473.54	394.64	1,868.17	934.09	0.93	3.42
157	Redwood	2	76	L	4,672.63	1,251.41	5,924.04	2,962.02	2.96	10.86
161	Redwood	1	20	L	117.95	31.59	149.53	74.77	0.07	0.27
161	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
161	Redwood	4	76	L	9,345.26	2,502.82	11,848.08	5,924.04	5.92	21.72
162	Redwood	1	20	L	117.95	31.59	149.53	74.77	0.07	0.27
162	Redwood	4	46	L	2,947.07	789.28	3,736.35	1,868.17	1.87	6.85
162	Redwood	5	76	L	11,681.58	3,128.53	14,810.11	7,405.05	7.41	27.15
162	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
163	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
164	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
165	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
166	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
167	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
168	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
169	Redwood	1	20	L	117.95	31.59	149.53	74.77	0.07	0.27
170	Redwood	1	20	L	117.95	31.59	149.53	74.77	0.07	0.27
171	Redwood	1	20	L	117.95	31.59	149.53	74.77	0.07	0.27
172	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
173	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
174	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
175	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
176	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
177	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
178	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
179	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
180	Redwood	1	137	L	8,815.42	2,360.92	11,176.34	5,588.17	5.59	20.49
181	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
182	Redwood	1	137	L	8,815.42	2,360.92	11,176.34	5,588.17	5.59	20.49
183	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
184	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
185	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
186	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
187	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
188	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
189	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
190	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
191	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
192	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
193	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
194	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
195	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
196	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
197	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43

Table A-1
Existing Trees Carbon Stock

Group Number	Species	Number of Trees	DBH[1] (cm)	Status	Above-Ground[2] (kg)	Below-Ground[3] (kg)	Total Biomass (kg)	Mass Carbon[2] (kg)	Mass Carbon (metric tons)	Carbon Dioxide[4] (metric tons)
198	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
199	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
200	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
201	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
202	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
203	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
204	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
205	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
206	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
207	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
208	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
209	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
210	Redwood	1	107	L	4,996.48	1,338.14	6,334.62	3,167.31	3.17	11.61
211	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
212	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
213	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
214	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
216	Redwood	1	46	L	736.77	197.32	934.09	467.04	0.47	1.71
216	Redwood	1	76	L	2,336.32	625.71	2,962.02	1,481.01	1.48	5.43
217	Redwood	2	46	L	1,473.54	394.64	1,868.17	934.09	0.93	3.42
	Total Redwood	212			399,814.46	107,077.31	506,891.77	253,445.88	253.45	929.30
65	Unknown[5]	1	20	L	187.57	50.24	237.81	118.91	0.12	0.44
	Total Unknown	1			187.57	50.24	237.81	118.91	0.12	0.44
	Total:	**261**			**474,938.55**	**127,196.85**	**602,135.40**	**301,067.70**	**301.07**	**1,103.91**

Sources/Notes:

1. Tree diameters were provided by the project applicant as a range (i.e., <12", 12"-24", >48", etc.). Unless specified, diameters were assumed to be equal to the midpoint for each range. In the case of <12", diameters were assumed to be 8". In the case of >48", diameters were assumed to be 54".
2. California Climate Action Registry, *Forest Project Protocol*, Version 2.1, (2007) 38.
3. Linearly interpolated from the below-ground calculation in Table A-2.
4. Assume all carbon is converted into CO_2. Values are based on the molecular weight ratio of CO_2 to carbon, 44/12.
5. Winrock International, *Sourcebook for Land Use, Land-Use Change, and Forestry Products*,(2006) App. C. The unknown tree utilized the general hardwood equation.

* The Tanoak equation for tree biomass estimate was used as a surrogate for Madrone trees.

** These exceed the set maximum DBH of 73 cm for Oak.

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Table A-2
Existing Site Below-Ground Density Calculation[1]

Above-Ground Totals[2]			Below-Ground Totals		
(kg)	(tons/acre)	(tons/hectare)	(tons/hectare)	(tons/acre)	(kg)
474,938.55	261.76	105.93	28.37	70.10	127,196.85

Sources/Notes:

1. California Climate Action Registry, *Forest Project Protocol*, Version 2.1, (2007) 38. The equation to calculate below-ground density must be done at the plot level.
2. The project site is approximately 2 acres. Therefore, the total kilograms was divided by 2 to obtain a tons per acre value, which is then converted to tons per hectare for use in the below-ground density equation.

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Table A-3
Existing Trees Future Growth Carbon Stock

Species	Growth Period[1] (years)	Annual Growth[1] (ft^3)	Total Growth (ft^3)	Mill Efficiency[2]	Density[3] (lbs/ft^3)	Carbon Fraction[2]	Mass Carbon (metric tons)	Carbon Dioxide (metric tons)
Redwood	40	175	7,000	0.60	28	0.50	74.09	271.65

Sources/Notes:

1. Staub Forestry and Environmental Consulting, *Memorandum RE Projected Forest Growth of Existing TCP/THP Trees for use in GHG Calculations*, (2009). The growth was attributed to redwoods exclusively.
2. California Climate Action Registry, *Forest Project Protocol*, Version 2.1, (2007) 38 and 45-47.
3. Dr. Chris Brinegar, Ph.D., "Semperviens Fund: Ask the Redwood Doctor," http://www.sempervirens.org/doctor.htm. 2007.

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Table A-4
Redwood Conversion to Wood Products

Wood Product	Mass Carbon (metric tons)	Carbon Dioxide[3] (metric tons)
Furniture/Other[1]	179.39	657.75
Less 60% Mill Efficiency[2]	107.63	394.65

Sources/Notes:
1. Based on data from the project applicant. Half of all redwoods in the 12"-24" range and all larger redwoods would be converted to wood product. The mass carbon was calulated using only the above-ground portion of the redwood trees.
2. California Climate Action Registry, *Forest Project Protocol*, Version 2.1, (2007) 45-47.
3. Assume all carbon is converted into CO_2. Values are based on the molecular weight ratio of CO_2 to carbon, 44/12.

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Table A-5
Carbon Stock Remaining in Wood Products

Year	Mass Carbon Sequestered in Wood Product[1] (metric tons)	Carbon Dioxide[2] (metric tons)
2010	**107.63**	**394.65**
2011	105.15	385.53
2012	102.72	376.63
2013	100.34	367.92
2014	98.02	359.42
2015	95.76	351.12
2016	93.55	343.01
2017	91.39	335.08
2018	89.27	327.34
2019	87.21	319.78
2020	**85.20**	**312.39**
2021	83.23	305.17
2022	81.31	298.12
2023	79.43	291.23
2024	77.59	284.50
2025	75.80	277.93
2026	74.05	271.51
2027	72.34	265.23
2028	70.67	259.11
2029	69.03	253.12
2030	**67.44**	**247.27**
2031	65.88	241.56
2032	64.36	235.98
2033	62.87	230.52
2034	61.42	225.20
2035	60.00	220.00
2036	58.61	214.91
2037	57.26	209.95
2038	55.94	205.10
2039	54.64	200.36
2040	**53.38**	**195.73**
2041+	None*	None*

Sources/Notes:

1. California Climate Action Registry, *Forest Project Protocol* , Version 2.1, (2007) 45-47. Annual decay rate is equal to ln(0.5)/Z, where Z is equal to the number of years the wood product is likely to last. Assumes 2010 is the year the trees are removed.
2. Assume all carbon is converted into CO_2. Values are based on the molecular weight ratio of CO_2 to carbon, 44/12.

* For furniture and other wood products, Z is equal to 30 years. After 30 years, no carbon sequestration credit is granted under the protocol.

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Table A-6
Proposed Project Trees Carbon Stock

Species	Number of Trees	DBH[1] (cm)	Status	Above-Ground[2] (kg)	Below-Ground[3] (kg)	Total Biomass (kg)	Mass Carbon[2] (kg)	Mass Carbon (metric tons)	Carbon Dioxide[4] (metric tons)
Redwood	35	65	L	57,125.23	18,847.09	75,972.33	37,986.16	37.99	139.28
Maple/Sycamore/Cherry[5]	15	46	L	22,030.14	7,268.32	29,298.46	14,649.23	14.65	53.71
Total:	**50**			**79,155.38**	**26,115.41**	**105,270.79**	**52,635.39**	**52.64**	**193.00**

Sources/Notes:
1. Tree diameters were assumed to be the average of the existing trees of the same species.
2. California Climate Action Registry, *Forest Project Protocol* , Version 2.1, (2007) 38.
3. Linearly interpolated from the below-ground calculation in Table A-6.
4. Assume all carbon is converted into CO_2. Values are based on the molecular weight ratio of CO_2 to carbon, 44/12.
5. The quercus species equation was used for maple/sycamore/cherry.

* The general hardwood equation was used for the specimen tree.

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Table A-7
Project Below-Ground Density Calculation[1]

Above-Ground Totals[2]			Below-Ground Totals		
(kg)	(tons/acre)	(tons/hectare)	(tons/hectare)	(tons/acre)	(kg)
79,155.38	43.63	17.66	5.82	14.39	26,115.41

Sources/Notes:

1. California Climate Action Registry, *Forest Project Protocol*, Version 2.1, (2007) 38. The equation to calculate below-ground density must be done at the plot level.
2. The project site is approximately 2 acres. Therefore, the total kilograms was divided by 2 to obtain a tons per acre value, which is then converted to tons per hectare for use in the below-ground density equation.

APPENDIX B

Memorandum: Projected Forest Growth of Existing Trees

Staub Forestry &
Environmental Consulting

Memorandum RE Projected Forest Growth of Existing TCP/THP Trees for use in GHG Calculations

February 27, 2009

TO: Alisa Klaus, Associate Environmental Planner, UC Santa Cruz
Alan Sako, Impact Sciences

Per our discussions the other day, we estimate the following parameters for tree growth in stemwood volume on the ECI TCP/THP site based on the list of measured trees and our experience collecting inventory and growth data over the last 30+ years on comparable stands throughout the Santa Cruz Mountains. The majority of data collection has come over the last 15 years as part sustained yield analysis for Nonindustrial Timber Management Plans (NTMPs).

TCP Stand Characteristics	Uncut 100 yr old young growth, 90% redwood by volume
Estimated Site Index	130
Average Basal Area	300
Estimated Current Growth	1200 board feet per acre per year or 190 cu ft/acre/yr

Based on our review of Lindquist and Palley's Empirical Yield Tables for Young Growth Redwood (California Agricultural Experiment Station Bulletin 796, 1963), periodic annual increments of cubic foot volume growth peak at roughly age 70 on such sites while board foot annual growth increments may peak up to 30 years later. Annual cubic foot volume growth is projected to slow only slightly over the next 40+ years because redwood is known to maintain comparatively high growth rates over a longer time period than nearly any other species. Therefore, I would estimate that cubic foot volume growth for the TCP stand over the next 40 years would average approximately 175 cubic feet per year or a total of some 7000 cubic feet over the 40 year period.

These estimates are made in good faith in response to AB 32 but are necessarily speculative for a variety of reasons, and particularly as little or no data on tree and stand growth from ages 100 to 200 years is currently available.

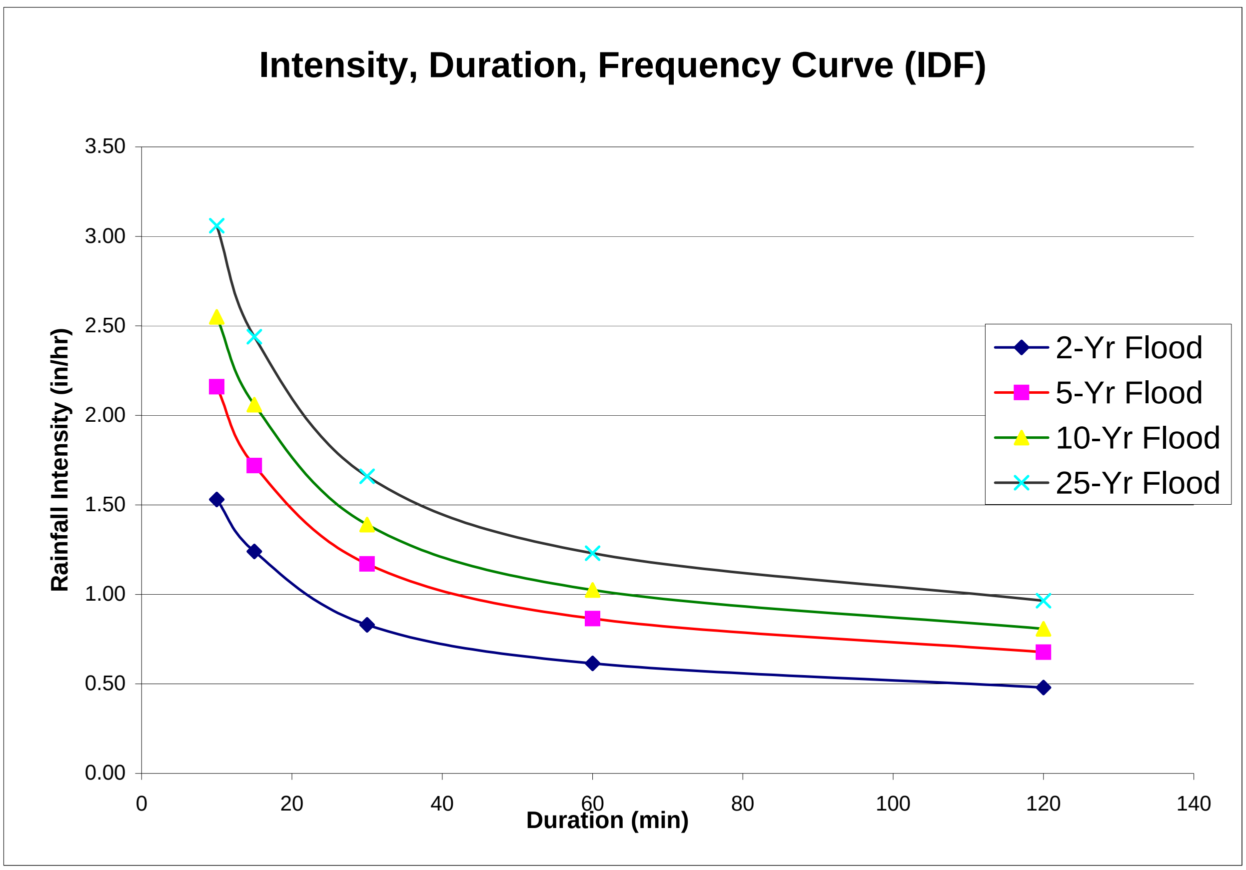
Submitted by:

Stephen R. Staub
Registered Professional Forester
License Number 1911

Appendix E
Storm Water Runoff Calculations

Rain gage data provided by University.

Return (yrs)	Duration (min)	SC Gage (in)[1]	Skyline Gage (in)[1]	Average Intensity (in/hr)
2	10	0.23	0.28	1.53
	15	0.29	0.33	1.24
	30	0.38	0.45	0.83
	60	0.57	0.66	0.62
	120	0.89	1.03	0.48
5	10	0.33	0.39	2.16
	15	0.40	0.46	1.72
	30	0.54	0.63	1.17
	60	0.80	0.93	0.87
	120	1.26	1.45	0.68
10	10	0.39	0.46	2.55
	15	0.48	0.55	2.06
	30	0.64	0.75	1.39
	60	0.95	1.10	1.03
	120	1.50	1.73	0.81
25	10	0.47	0.55	3.06
	15	0.57	0.65	2.44
	30	0.76	0.90	1.66
	60	1.14	1.32	1.23
	120	1.79	2.07	0.97



Pre-University Conditions

Existing conditions drain partially to Jordan Gulch and partially to Gully H.
2.49 acres of the total site's 3.13 acres drains to Gully H

Drainage Path Length (ft)	400
Change in Elevation (ft)	42.9
Slope = D Elev / Length (%)	0.107
K - Intercept Coefficient[1]	0.25
Velocity (ft/s)	0.819

Time of Concentration Calculation

Land Type	Length	Δ Elv	Slope (%)	Velocity (ft/s)	Tc (min)
Overland Flow[1]	100	10	10.00%	-	6.68
Shallow Concentrated Flow[2]	300	32.9	10.97%	0.819	6.11
				Total :	12.79

[1] Tc calculated using the FAA formula: $Tc=[1.8*(1.1-C)(L^{0.5)}] / S^{1/3}$

[2]Table 816.6B Intercept Coefficients for Shallow Concentrated Flow,
June 2006 Highway Design Manual

Land cover/Flow regime	K (ft/s)
Forest with heavy ground litter; hay meadow	0.25
Trash fallow or minimum tillage cultivation; contour or strip cropped; woodland	0.50
Short grass pasture	0.70
Cultivated straight row	0.90
Nearly bare and untilled alluvial fans	1.00
Grassed waterway	1.50

Velocity = $KS^{1/2}$ (ft/s)

	2-year Storm	5-year Storm	10-year Storm
Tc = L / (60V) (min)	12.79	12.79	12.79
Tp = 2/3 * (tc) (min)	8.53	8.53	8.53
C_a (antecedante moisture factor)	1	1	1
I (rainfall intensity in/hr)[3]	1.32	1.85	2.20
A (Area acres)	2.49	2.49	2.49
C (runoff coefficient)	0.3	0.3	0.3
$Qp=C_aiAC$ (cfs)	0.99	1.38	1.64

[3] From the IDF Curve using calculated Tc

Existing Conditions

Existing Project Site Land Use Areas

Type	ft^2	Acres	C	AC
Total Project Site	136230	3.13		
Area Draining to Jordan Gulch	27777	0.64		
Area Draining to Gully H	108453	2.49		
Roads/Walkways				
Traditional Impervious	31126	0.71	0.9	0.64
Pervious Concrete	0	-	-	
Buildings				
Traditional Roof	397	0.01	0.9	0.01
Green/Living Roof	0	-	-	
Landscape				
Traditional Landscaping	75570	1.73	0.3	0.52
Bioretention w/ Passive Irrigation	0	-	-	
Bioretention Bioswale/Raingarden	0	-	-	
		Total weighted AC draining to Gully H		1.17

Time of Concentration Calculation

Length	Land Type	Δ Elv	Slope (%)	Velocity (ft/s)	Tc (min)
180	Heavy Forest / Meadow -Overland flow[1]	29	16.11	-	7.65
187	AC Swale[3]	10	5.35	4.20	0.74
135	18" CMP[2]	0.77	0.57	2.44	0.92
100	Heavy Forest / Meadow[3]	3.07	3.07	0.40	4.17
				Total :	13.48

[1] Tc calculated using the FAA formula: $Tc=[1.8*(1.1-C)(L^{0.5})] / S^{1/3}$

[2] Velocity calculated using mannings equation V=(1.49/n)*(R^(2/3))(S^0.5)

[3]Table 816.6B Intercept Coefficients for Shallow Concentrated Flow, June 2006 Highway Design Manual

	2-year Storm	5-year Storm	10-year Storm
Tc (time of concentration) (min)	13.48	13.48	13.48
Tp (time to peak)= 2/3 * (tc) (min)	8.99	8.99	8.99
C_a (antecedante moisture factor)	1	1	1
I (rainfall intensity in/hr)[4]	1.29	1.80	2.14
A (area acres)	See proposed land use area table		
C (runoff coefficient)	See proposed land use area table		
AC (total weighted AC)	1.17	1.17	1.17
Qp (peak flow)=C_aiAC (cfs)	1.51	2.11	2.51

[4] From the IDF Curve using calculated Tc

Post Construction Conditions

Proposed Project Site Land Use Areas

Type	ft^2	Acres	C_{2-year}	C_{5-year}	$C_{10-year}$
Total Project Site	136230	3.13			
Area Draining to Jordan Gulch	26670	0.61			
Area Draining to Gully H	109560	2.52			
Roads/Walkways/Walls					
Traditional Impervious	32560	0.75	0.90	0.90	0.90
Pervious Concrete	11197	0.26	0.00	0.00	0.00
Buildings					
Traditional Roof	22078	0.51	0.90	0.90	0.90
Green/Living Roof - 8" profile retaining 0.32 gal/sf	5750	0.13	0.10	0.10	0.25
Landscape					
Traditional Landscaping	14807	0.34	0.30	0.30	0.30
Bioretention w/ Passive Irrigation - 24" profile retaining 4 gal/sf	16610	0.38	0.10	0.10	0.10
Bioretention Bioswale/Raingarden	6558	0.15	0.10	0.10	0.10

Time of Concentration Calculation

Land Type	Length	Δ Elv	Slope (%)	Velocity (ft/s)	Tc_{2-year} (min)	Tc_{5-year} (min)	$Tc_{10-year}$ (min)
Green Roof[1]	56	0.28	0.50%	-	16.97	16.97	14.43
Pervious Pavement Underdrain Pipe[2]	33	1	3.03%	4.54	0.12	0.12	0.12
Bioretention w/ Passive Irrigation	160	20	12.50%	0.20	13.33	13.33	13.33
				Total :	30.43	30.43	27.88

[1] Tc calculated using the FAA formula: $Tc=[1.8*(1.1-C)(L^{0.5})] / S^{1/3}$

[2] Velocity calculated using mannings equation

[3] Velocity based on average permeabilty of sand in bioretention system

	2-year Storm	5-year Storm	10-year Storm
Tc (time of concentration) (min)	30.43	30.43	27.88
Tp (time to peak)= 2/3 * (tc) (min)	20.28	20.28	18.59
C_a (antecedante moisture factor)	1	1	1
I (rainfall intensity in/hr)[4]	0.88	1.23	1.52
A (area acres)	See proposed land use area table		
C (runoff coefficient)	See proposed land use area table		
AC (total weighted AC)	1.26	1.26	1.28
Qp (peak flow)=C_aiAC (cfs)	1.10	1.55	1.95

[4] From the IDF Curve using calculated Tc

Post Construction Conditions

Proposed Project Site Land Use Areas

Type	ft^2	Acres	$C_{2\text{-year}}$	$C_{5\text{-year}}$	$C_{10\text{-year}}$
Total Project Site	136230	3.13			
Area Draining to Jordan Gulch	26670	0.61			
Area Draining to Gully H	109560	2.52			
Roads/Walkways/Walls					
Traditional Impervious	32560	0.75	0.90	0.90	0.90
Pervious Concrete	11197	0.26	0.00	0.00	0.00
Buildings					
Traditional Roof	22078	0.51	0.90	0.90	0.90
Green/Living Roof - 8" profile retaining 0.32 gal/sf	5750	0.13	0.10	0.10	0.25
Landscape					
Traditional Landscaping	31417	0.72	0.30	0.30	0.30
Bioretention w/ Passive Irrigation - 24" profile retaining 4 gal/sf	0	0.00	-	-	-
Bioretention Bioswale/Raingarden	6558	0.15	0.10	0.10	0.10

Time of Concentration Calculation

Land Type	Length	Δ Elv	Slope (%)	Velocity (ft/s)	$Tc_{2\text{-year}}$ (min)	$Tc_{5\text{-year}}$ (min)	$Tc_{10\text{-year}}$ (min)
Green Roof[1]	56	0.28	0.50%	-	16.97	16.97	14.43
Pervious Pavement Underdrain Pipe[2]	33	1	3.03%	4.54	0.12	0.12	0.12
Landscaped Slope	160	20	12.50%	2.47	1.08	1.08	1.08
				Total :	18.17	18.17	15.62

[1] Tc calculated using the FAA formula: $Tc=[1.8*(1.1-C)(L^{0.5})] / S^{1/3}$
[2] Velocity calculated using mannings equation

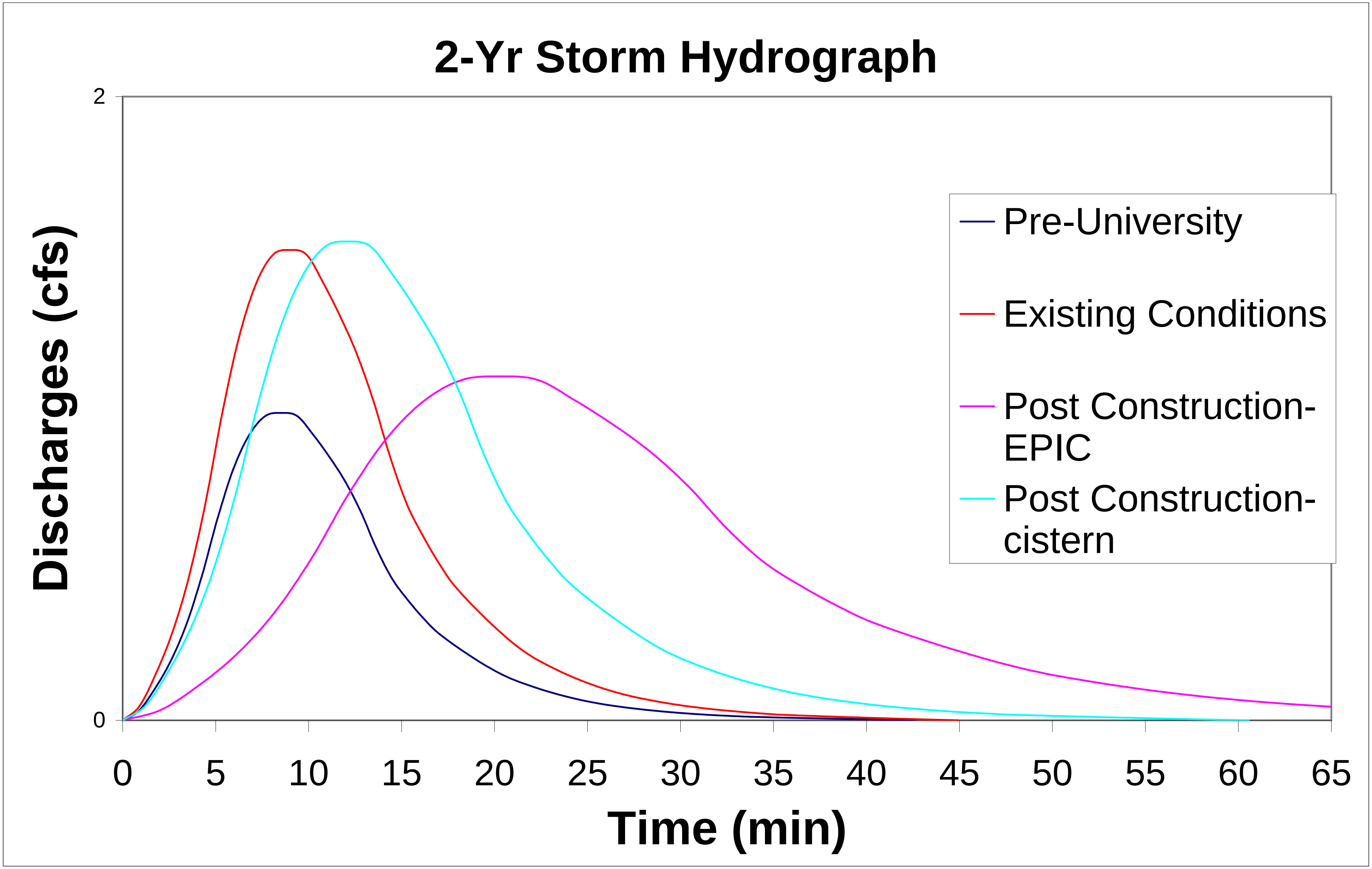
	2-year Storm	5-year Storm	10-year Storm
Tc (time of concentration) (min)	18.17	18.17	15.62
Tp (time to peak)= 2/3 * (tc) (min)	12.11	12.11	10.42
C_a (antecedante moisture factor)	1	1	1
I (rainfall intensity in/hr)[3]	1.12	1.57	2.00
A (area acres)	See proposed land use area table		
C (runoff coefficient)	See proposed land use area table		
AC (total weighted AC)	1.37	1.37	1.39
Qp (peak flow)=C_aiAC (cfs)	1.54	2.15	2.79

[3] From the IDF Curve using calculated Tc

UCSC-ECI
3/9/2009
KJ 0888011

2-Year Storm Hydrograph

SCS Dimension UH		Pre-University			Existing Conditions			Post Construction-EPIC			Post Construction-cistern		
Time Ratio	**Discharge Ratios**	**Time**	**Discharges**	**Volume**	**Time**	**Discharges**	**Volume**	**Time**	**Discharges**	**Volume**	**Time**	**Discharges**	**Volume**
t/Tp	**Q/Qp**	**(min)**	**(cfs)**	**(ft^3)**	**(min)**	**(cfs)**	**(ft^3)**	**(min)**	**(cfs)**	**(ft^3)**	**(min)**	**(cfs)**	**(ft^3)**
0	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.030	0.85	0.03	1.51	0.90	0.05	2.44	2.03	0.03	4.03	1.21	0.05	3.35
0.2	0.100	1.71	0.10	5.04	1.80	0.15	8.13	4.06	0.11	13.42	2.42	0.15	11.16
0.3	0.190	2.56	0.19	9.58	2.70	0.29	15.45	6.09	0.21	25.50	3.63	0.29	21.20
0.4	0.310	3.41	0.31	15.63	3.60	0.47	25.21	8.11	0.34	41.61	4.85	0.48	34.59
0.5	0.470	4.26	0.46	23.70	4.49	0.71	38.23	10.14	0.52	63.08	6.06	0.72	52.44
0.6	0.660	5.12	0.65	33.29	5.39	1.00	53.68	12.17	0.73	88.58	7.27	1.01	73.64
0.7	0.820	5.97	0.81	41.36	6.29	1.24	66.69	14.20	0.90	110.05	8.48	1.26	91.49
0.8	0.930	6.82	0.92	46.90	7.19	1.40	75.64	16.23	1.03	124.82	9.69	1.43	103.76
0.9	0.990	7.67	0.98	49.93	8.09	1.49	80.52	18.26	1.09	132.87	10.90	1.52	110.46
1	1.000	8.53	0.99	50.43	8.99	1.51	81.33	20.28	1.10	134.21	12.11	1.54	111.57
1.1	0.990	9.38	0.98	49.93	9.89	1.49	80.52	22.31	1.09	132.87	13.32	1.52	110.46
1.2	0.930	10.23	0.92	46.90	10.79	1.40	75.64	24.34	1.03	124.82	14.54	1.43	103.76
1.3	0.860	11.09	0.85	43.37	11.68	1.30	69.95	26.37	0.95	115.42	15.75	1.32	95.95
1.4	0.780	11.94	0.77	39.34	12.58	1.18	63.44	28.40	0.86	104.68	16.96	1.20	87.03
1.5	0.680	12.79	0.67	34.30	13.48	1.03	55.31	30.43	0.75	91.26	18.17	1.04	75.87
1.6	0.560	13.64	0.55	28.24	14.38	0.84	45.55	32.45	0.62	75.16	19.38	0.86	62.48
1.7	0.460	14.50	0.45	23.20	15.28	0.69	37.41	34.48	0.51	61.74	20.59	0.71	51.32
1.8	0.390	15.35	0.38	19.67	16.18	0.59	31.72	36.51	0.43	52.34	21.80	0.60	43.51
1.9	0.330	16.20	0.33	16.64	17.08	0.50	26.84	38.54	0.36	44.29	23.01	0.51	36.82
2	0.280	17.06	0.28	14.12	17.98	0.42	22.77	40.57	0.31	37.58	24.23	0.43	31.24
2.2	0.207	18.76	0.20	20.88	19.77	0.31	33.67	44.62	0.23	55.56	26.65	0.32	46.19
2.4	0.147	20.47	0.14	14.83	21.57	0.22	23.91	48.68	0.16	39.46	29.07	0.23	32.80
2.6	0.107	22.17	0.11	10.79	23.37	0.16	17.41	52.74	0.12	28.72	31.49	0.16	23.88
2.8	0.077	23.88	0.08	7.77	25.17	0.12	12.53	56.79	0.08	20.67	33.92	0.12	17.18
3	0.055	25.58	0.05	5.55	26.96	0.08	8.95	60.85	0.06	14.76	36.34	0.08	12.27
3.2	0.040	27.29	0.04	4.03	28.76	0.06	6.51	64.91	0.04	10.74	38.76	0.06	8.93
3.4	0.029	28.99	0.03	2.93	30.56	0.04	4.72	68.96	0.03	7.78	41.18	0.04	6.47
3.6	0.021	30.70	0.02	2.12	32.36	0.03	3.42	73.02	0.02	5.64	43.61	0.03	4.69
3.8	0.015	32.41	0.01	1.51	34.15	0.02	2.44	77.08	0.02	4.03	46.03	0.02	3.35
4	0.011	34.11	0.01	1.11	35.95	0.02	1.79	81.13	0.01	2.95	48.45	0.02	2.45
4.5	0.005	38.37	0.00	1.26	40.44	0.01	2.03	91.28	0.01	3.36	54.51	0.01	2.79
5	0.000	42.64	0.00	0.00	44.94	0.00	0.00	101.42	0.00	0.00	60.56	0.00	0.00
			Total:	**665.88**			**1073.84**			**1771.98**			**1473.10**

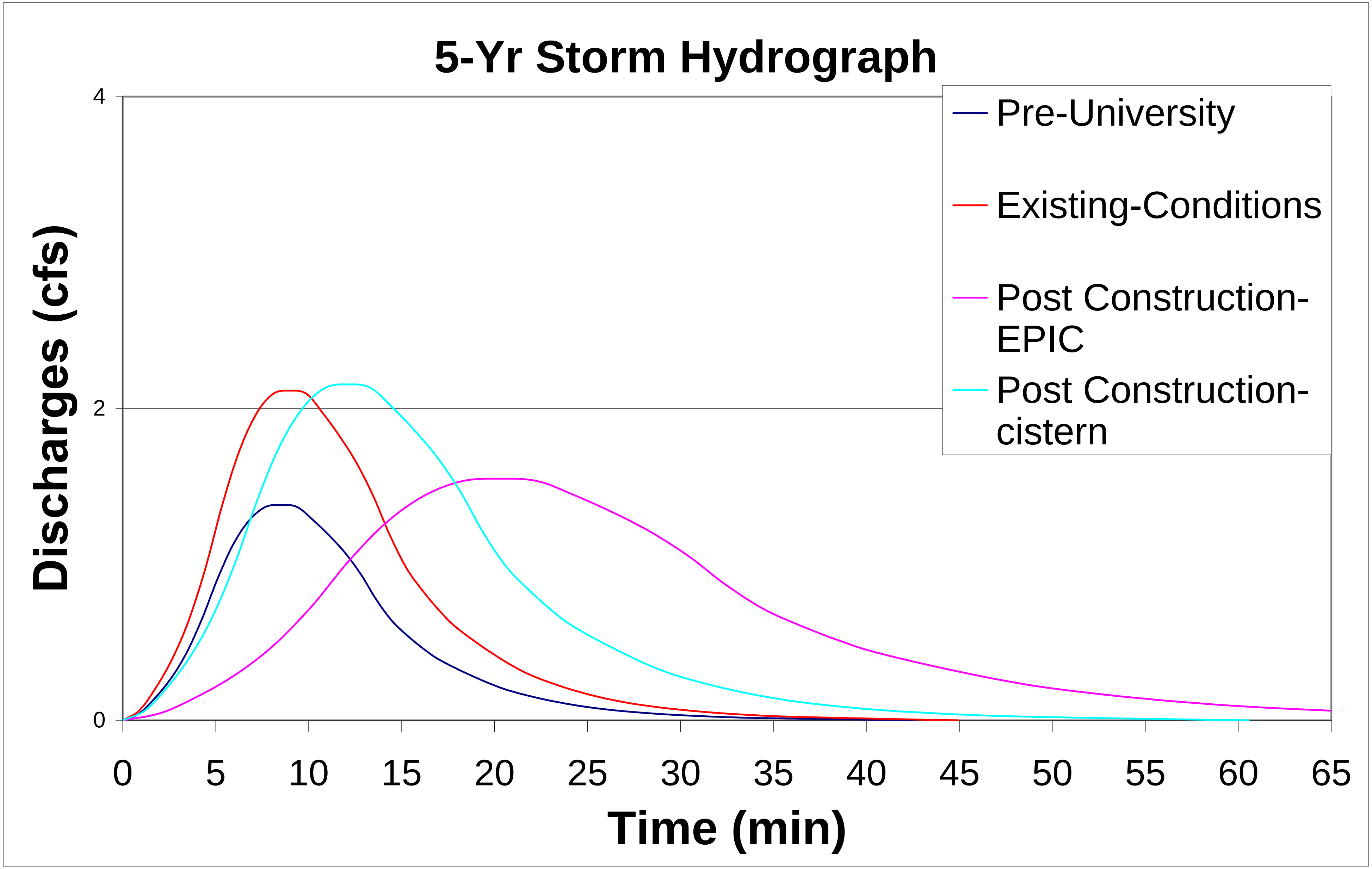


2-Yr Storm Hydrograph
2
0
Discharges (cfs)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
Time (min)
Pre-University
Existing Conditions
Post Construction-EPIC
Post Construction-cistern

UCSC-ECI
3/9/2009
KJ 0888011

5-Year Storm Hydrograph

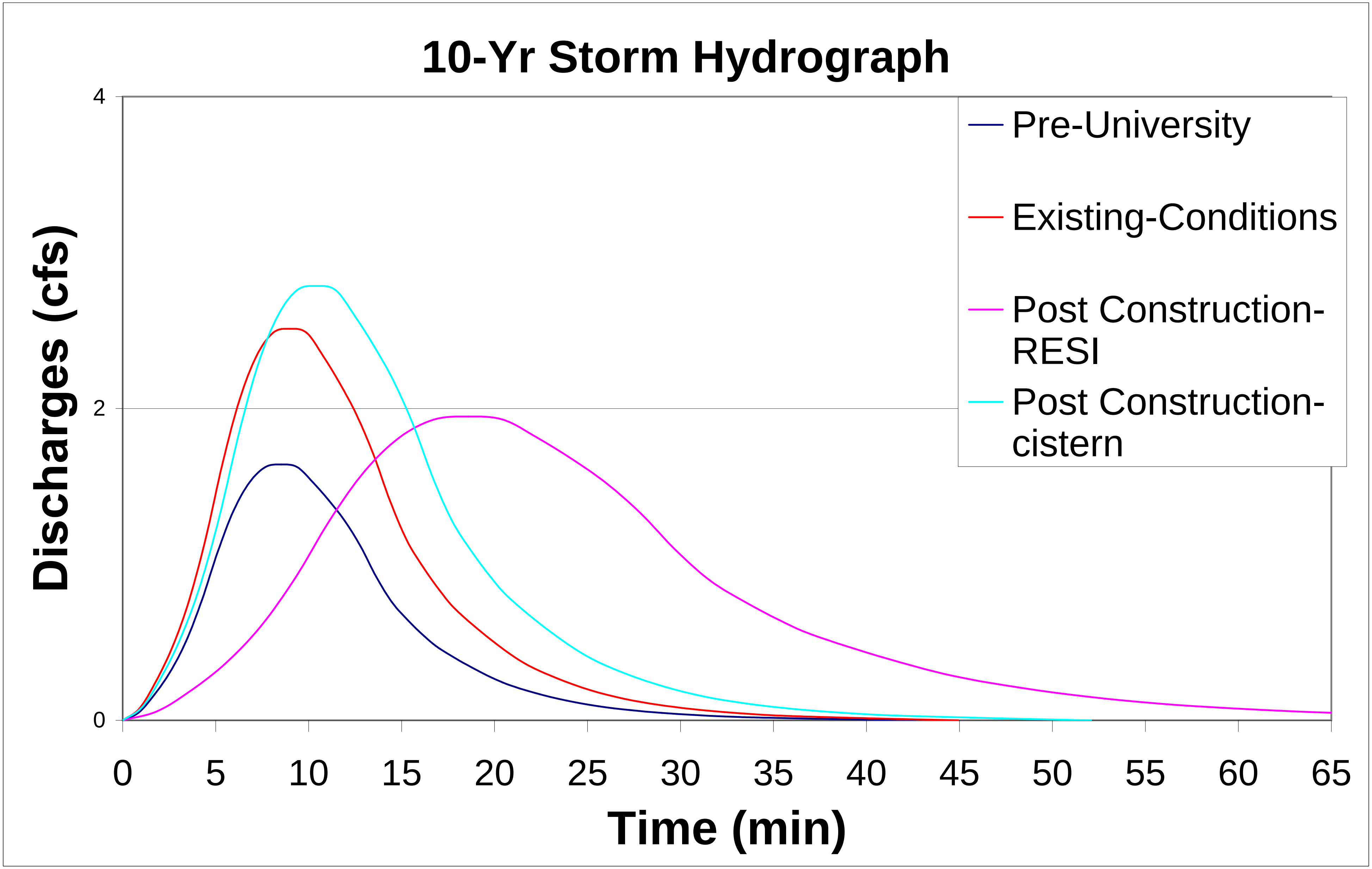
SCS Dimension UH		Pre-University			Existing Conditions			Post Construction-EPIC			Post Construction-cistern		
Time Ratio	Discharge Ratios	Time	Discharges	Volume	Time	Discharges	Volume	Time	Discharges	Volume	Time	Discharges	Volume
t/Tp	Q/Qp	(min)	(cfs)	(ft^3)	(min)	(cfs)	(ft^3)	(min)	(cfs)	(ft^3)	(min)	(cfs)	(ft^3)
0	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.030	0.85	0.04	2.12	0.90	0.06	3.42	2.03	0.05	5.66	1.21	0.06	4.70
0.2	0.100	1.71	0.14	7.07	1.80	0.21	11.40	4.06	0.15	18.86	2.42	0.22	15.66
0.3	0.190	2.56	0.26	13.43	2.70	0.40	21.67	6.09	0.29	35.83	3.63	0.41	29.75
0.4	0.310	3.41	0.43	21.92	3.60	0.66	35.35	8.11	0.48	58.46	4.85	0.67	48.53
0.5	0.470	4.26	0.65	33.23	4.49	0.99	53.60	10.14	0.73	88.63	6.06	1.01	73.58
0.6	0.660	5.12	0.91	46.66	5.39	1.40	75.26	12.17	1.02	124.46	7.27	1.42	103.33
0.7	0.820	5.97	1.13	57.98	6.29	1.73	93.51	14.20	1.27	154.63	8.48	1.77	128.38
0.8	0.930	6.82	1.29	65.75	7.19	1.97	106.05	16.23	1.44	175.37	9.69	2.00	145.60
0.9	0.990	7.67	1.37	70.00	8.09	2.09	112.89	18.26	1.53	186.69	10.90	2.13	154.99
1	1.000	8.53	1.38	70.70	8.99	2.11	114.03	20.28	1.55	188.57	12.11	2.15	156.56
1.1	0.990	9.38	1.37	70.00	9.89	2.09	112.89	22.31	1.53	186.69	13.32	2.13	154.99
1.2	0.930	10.23	1.29	65.75	10.79	1.97	106.05	24.34	1.44	175.37	14.54	2.00	145.60
1.3	0.860	11.09	1.19	60.80	11.68	1.82	98.07	26.37	1.33	162.17	15.75	1.85	134.64
1.4	0.780	11.94	1.08	55.15	12.58	1.65	88.95	28.40	1.21	147.09	16.96	1.68	122.11
1.5	0.680	12.79	0.94	48.08	13.48	1.44	77.54	30.43	1.05	128.23	18.17	1.46	106.46
1.6	0.560	13.64	0.77	39.59	14.38	1.18	63.86	32.45	0.87	105.60	19.38	1.21	87.67
1.7	0.460	14.50	0.64	32.52	15.28	0.97	52.46	34.48	0.71	86.74	20.59	0.99	72.02
1.8	0.390	15.35	0.54	27.57	16.18	0.82	44.47	36.51	0.60	73.54	21.80	0.84	61.06
1.9	0.330	16.20	0.46	23.33	17.08	0.70	37.63	38.54	0.51	62.23	23.01	0.71	51.66
2	0.280	17.06	0.39	19.80	17.98	0.59	31.93	40.57	0.43	52.80	24.23	0.60	43.84
2.2	0.207	18.76	0.29	29.27	19.77	0.44	47.21	44.62	0.32	78.07	26.65	0.45	64.81
2.4	0.147	20.47	0.20	20.79	21.57	0.31	33.53	48.68	0.23	55.44	29.07	0.32	46.03
2.6	0.107	22.17	0.15	15.13	23.37	0.23	24.40	52.74	0.17	40.35	31.49	0.23	33.50
2.8	0.077	23.88	0.11	10.89	25.17	0.16	17.56	56.79	0.12	29.04	33.92	0.17	24.11
3	0.055	25.58	0.08	7.78	26.96	0.12	12.54	60.85	0.09	20.74	36.34	0.12	17.22
3.2	0.040	27.29	0.06	5.66	28.76	0.08	9.12	64.91	0.06	15.09	38.76	0.09	12.52
3.4	0.029	28.99	0.04	4.10	30.56	0.06	6.61	68.96	0.04	10.94	41.18	0.06	9.08
3.6	0.021	30.70	0.03	2.97	32.36	0.04	4.79	73.02	0.03	7.92	43.61	0.05	6.58
3.8	0.015	32.41	0.02	2.12	34.15	0.03	3.42	77.08	0.02	5.66	46.03	0.03	4.70
4	0.011	34.11	0.02	1.56	35.95	0.02	2.51	81.13	0.02	4.15	48.45	0.02	3.44
4.5	0.005	38.37	0.01	1.77	40.44	0.01	2.85	91.28	0.01	4.71	54.51	0.01	3.91
5	0.000	42.64	0.00	0.00	44.94	0.00	0.00	101.42	0.00	0.00	60.56	0.00	0.00
			Total:	**933.48**			**1505.60**			**2489.70**			**2067.00**


5-Yr Storm Hydrograph
Discharges (cfs)
4
2
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
Time (min)
Pre-University
Existing-Conditions
Post Construction-EPIC
Post Construction-cistern

10-Year Storm Hydrograph

SCS Dimension UH		Pre-University			Existing Conditions			Post Construction-RESI			Post Construction-cistern		
Time Ratio	Discharge Ratios	Time	Discharges	Volume	Time	Discharges	Volume	Time	Discharges	Volume	Time	Discharges	Volume
t/Tp	Q/Qp	(min)	(cfs)	(ft^3)	(min)	(cfs)	(ft^3)	(min)	(cfs)	(ft^3)	(min)	(cfs)	(ft^3)
0	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.1	0.030	0.85	0.05	2.52	0.90	0.08	4.06	1.86	0.06	6.52	1.04	0.08	5.22
0.2	0.100	1.71	0.16	8.40	1.80	0.25	13.54	3.72	0.19	21.73	2.08	0.28	17.41
0.3	0.190	2.56	0.31	15.95	2.70	0.48	25.73	5.58	0.37	41.29	3.12	0.53	33.08
0.4	0.310	3.41	0.51	26.03	3.60	0.78	41.98	7.43	0.60	67.36	4.17	0.86	53.98
0.5	0.470	4.26	0.77	39.46	4.49	1.18	63.64	9.29	0.92	102.13	5.21	1.31	81.84
0.6	0.660	5.12	1.08	55.41	5.39	1.66	89.37	11.15	1.29	143.42	6.25	1.84	114.92
0.7	0.820	5.97	1.35	68.84	6.29	2.06	111.04	13.01	1.60	178.19	7.29	2.28	142.78
0.8	0.930	6.82	1.53	78.08	7.19	2.34	125.93	14.87	1.81	202.09	8.33	2.59	161.93
0.9	0.990	7.67	1.62	83.11	8.09	2.49	134.06	16.73	1.93	215.13	9.37	2.76	172.38
1	1.000	8.53	1.64	83.95	8.99	2.51	135.41	18.59	1.95	217.30	10.42	2.79	174.12
1.1	0.990	9.38	1.62	83.11	9.89	2.49	134.06	20.45	1.93	215.13	11.46	2.76	172.38
1.2	0.930	10.23	1.53	78.08	10.79	2.34	125.93	22.30	1.81	202.09	12.50	2.59	161.93
1.3	0.860	11.09	1.41	72.20	11.68	2.16	116.45	24.16	1.68	186.88	13.54	2.40	149.74
1.4	0.780	11.94	1.28	65.48	12.58	1.96	105.62	26.02	1.52	169.49	14.58	2.17	135.81
1.5	0.680	12.79	1.12	57.09	13.48	1.71	92.08	27.88	1.33	147.76	15.62	1.89	118.40
1.6	0.560	13.64	0.92	47.01	14.38	1.41	75.83	29.74	1.09	121.69	16.67	1.56	97.51
1.7	0.460	14.50	0.75	38.62	15.28	1.16	62.29	31.60	0.90	99.96	17.71	1.28	80.09
1.8	0.390	15.35	0.64	32.74	16.18	0.98	52.81	33.46	0.76	84.75	18.75	1.09	67.91
1.9	0.330	16.20	0.54	27.70	17.08	0.83	44.69	35.31	0.64	71.71	19.79	0.92	57.46
2	0.280	17.06	0.46	23.51	17.98	0.70	37.92	37.17	0.55	60.84	20.83	0.78	48.75
2.2	0.207	18.76	0.34	34.76	19.77	0.52	56.06	40.89	0.40	89.96	22.91	0.58	72.08
2.4	0.147	20.47	0.24	24.68	21.57	0.37	39.81	44.61	0.29	63.89	25.00	0.41	51.19
2.6	0.107	22.17	0.18	17.97	23.37	0.27	28.98	48.32	0.21	46.50	27.08	0.30	37.26
2.8	0.077	23.88	0.13	12.93	25.17	0.19	20.85	52.04	0.15	33.46	29.16	0.21	26.81
3	0.055	25.58	0.09	9.23	26.96	0.14	14.90	55.76	0.11	23.90	31.25	0.15	19.15
3.2	0.040	27.29	0.07	6.72	28.76	0.10	10.83	59.48	0.08	17.38	33.33	0.11	13.93
3.4	0.029	28.99	0.05	4.87	30.56	0.07	7.85	63.19	0.06	12.60	35.41	0.08	10.10
3.6	0.021	30.70	0.03	3.53	32.36	0.05	5.69	66.91	0.04	9.13	37.50	0.06	7.31
3.8	0.015	32.41	0.02	2.52	34.15	0.04	4.06	70.63	0.03	6.52	39.58	0.04	5.22
4	0.011	34.11	0.02	1.85	35.95	0.03	2.98	74.35	0.02	4.78	41.66	0.03	3.83
4.5	0.005	38.37	0.01	2.10	40.44	0.01	3.39	83.64	0.01	5.43	46.87	0.01	4.35
5	0.000	42.64	0.00	0.00	44.94	0.00	0.00	92.93	0.00	0.00	52.08	0.00	0.00
			Total:	**1108.43**			**1787.85**			**2869.01**			**2298.88**

UCSC-ECI
3/9/2009
KJ 0888011



Stormwater Summary

2-year storm	Qp (cfs)	Tc (min)	Volume (ft^3)
Pre-University	0.99	12.79	666
Existing Conditions	1.51	13.48	1074
Post Construction - w/ EPIC	1.10	30.43	1772
Post Construction - w/ cistern	1.54	18.17	1473

5-year storm	Qp (cfs)	Tc (min)	Volume (ft^3)
Pre-University	1.38	12.79	933
Existing Conditions	2.11	13.48	1506
Post Construction - w/ EPIC	1.55	30.43	2490
Post Construction - w/ cistern	2.15	18.17	2067

10-year storm	Qp (cfs)	Tc (min)	Volume (ft^3)
Pre-University	1.64	12.79	1108
Existing Conditions	2.51	13.48	1788
Post Construction - w/ EPIC	1.95	27.88	2869
Post Construction - w/ cistern	2.79	15.62	2299

Design Storage	= difference in 10-year storm volume between Pre-University and Post Construction	
Post Construction - w/ EPIC	1761	= 90 LF of 60" pipe
Post Construction - w/ cistern	1190	

Discharge rate of 10% of the 2-year Pre-University flow rate =	0.099	cfs
Time required to empy the tank at design discharge rate =	17861	seconds
	298	minutes
	4.96	hours

Existing Areas Within ECI Limit of Work Draining to Jordan Gulch

Type	ft^2	Acres
Total	27777	0.64
Roads/Walkways	6032	0.14
Buildings	1075	0.02
Landscape	20670	0.47

Proposed Land Use of Areas Draining to Jordan Gulch

Type	ft^2	Acres
Total	26670	0.61
Roads/Walkways	16105	0.37
Buildings	0	0.00
Landscape	10565	0.24

Existing Areas Within ECI Limit of Work Draining to Jordan Gulch

Assumptions:
Buildings are assumed to have traditional roofs, not green roofs. Pavement is assumed to be traditional asphalt or concrete, not porous pavement.

Modified Rational Unit Hydrograph Method

$Q=C_a iAC$

Q = runoff [cfs]
C_a= 1 = antecedante moisture factor (1.1 for 25 yr)
C= runoff coefficient (0.3 for landscaped, 0.9 for paved, 1.0 for building)
i= rainfall intensity [in/hr]
A = area [ac]

Data

Table 1: $Area_{post}$

Location	Area (ac)	C	AC
Pavement	0.14	0.9	0.12
Building	0.02	1.0	0.02
Landscape	0.47	0.3	0.14
	Total weighted AC		0.29

Calculations

Return (yrs)	Duration (min)	SC Gage (in)[1]	Skyline Gage (in)[1]	Average Intensity (in/hr)	Q_{post} (cfs)
2	10	0.23	0.28	1.53	0.446
	15	0.29	0.33	1.24	0.362
	30	0.38	0.45	0.83	0.242
	60	0.57	0.66	0.62	0.179
	120	0.89	1.03	0.48	0.140
5	10	0.33	0.39	2.16	0.630
	15	0.40	0.46	1.72	0.502
	30	0.54	0.63	1.17	0.341
	60	0.80	0.93	0.87	0.252
	120	1.26	1.45	0.68	0.198
10	10	0.39	0.46	2.55	0.744
	15	0.48	0.55	2.06	0.601
	30	0.64	0.75	1.39	0.405
	60	0.95	1.10	1.03	0.299
	120	1.50	1.73	0.81	0.236
25	10	0.47	0.55	3.06	0.982
	15	0.57	0.65	2.44	0.783
	30	0.76	0.90	1.66	0.533
	60	1.14	1.32	1.23	0.395
	120	1.79	2.07	0.97	0.310

Proposed Areas Within ECI Limit of Work Draining to Jordan Gulch

Assumptions:

Building roof leaders are assumed to be routed through bioretention features. Pavement is assumed to be traditional asphalt or concrete, not porous pavement. Landscaping is assumed to be traditional, not bioretention engineered.

Modified Rational Unit Hydrograph Method

$Q=C_a iAC$

Q = runoff [cfs]
C_a= 1 = antecedante moisture factor (1.1 for 25 yr)
C= runoff coefficient (0.3 for landscaped, 0.9 for paved, 1.0 for building)
i= rainfall intensity [in/hr]
A = area [ac]

Data

Table 1: $Area_{post}$

Location	Area (ac)	C	AC
Pavement	0.37	0.9	0.33
Building	0.00	1.0	0.00
Landscape	0.24	0.3	0.07
	Total weighted AC		0.41

Calculations

Return (yrs)	Duration (min)	SC Gage (in)[1]	Skyline Gage (in)[1]	Average Intensity (in/hr)	Q_{post} (cfs)	Increase (cfs)
2	10	0.23	0.28	1.53	0.620	0.174
	15	0.29	0.33	1.24	0.503	0.141
	30	0.38	0.45	0.83	0.337	0.094
	60	0.57	0.66	0.62	0.249	0.070
	120	0.89	1.03	0.48	0.195	0.055
5	10	0.33	0.39	2.16	0.876	0.246
	15	0.40	0.46	1.72	0.697	0.196
	30	0.54	0.63	1.17	0.474	0.133
	60	0.80	0.93	0.87	0.351	0.098
	120	1.26	1.45	0.68	0.275	0.077
10	10	0.39	0.46	2.55	1.034	0.290
	15	0.48	0.55	2.06	0.835	0.235
	30	0.64	0.75	1.39	0.564	0.158
	60	0.95	1.10	1.03	0.416	0.117
	120	1.50	1.73	0.81	0.327	0.092
25	10	0.47	0.55	3.06	1.365	0.383
	15	0.57	0.65	2.44	1.088	0.306
	30	0.76	0.90	1.66	0.740	0.208
	60	1.14	1.32	1.23	0.549	0.154
	120	1.79	2.07	0.97	0.430	0.121

Appendix F
Traffic Data

EXISTING TRAFFIC VOLUMES (2007)

Traffic Data Service

Campbell, CA

(408) 377-2988

tdsbay@cs.com

(1)

File Name : 5AM FINAL
Site Code : 00000005
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	HELLER DR Southbound					McLAUGHLIN DR Westbound					HELLER DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	0	1	1	0	2	2	0	0	0	2	5	3	0	0	8	0	0	0	0	0	12
07:15 AM	0	3	0	0	3	2	0	4	0	6	9	7	0	0	16	0	0	0	0	0	25
07:30 AM	0	0	2	0	2	3	0	8	0	11	13	13	0	0	26	0	0	0	0	0	39
07:45 AM	0	8	3	0	11	7	2	21	0	30	19	25	0	0	44	0	0	0	0	0	85
Total	0	12	6	0	18	14	2	33	0	49	46	48	0	0	94	0	0	0	0	0	161
08:00 AM	0	3	1	0	4	2	0	24	0	26	23	7	0	0	30	0	0	0	0	0	60
08:15 AM	0	2	2	0	4	2	0	22	0	24	12	11	0	0	23	0	0	0	0	0	51
08:30 AM	0	5	3	0	8	1	0	18	0	19	12	10	0	0	22	0	0	0	0	0	49
08:45 AM	0	6	2	0	8	2	1	21	0	24	15	14	0	0	29	0	0	0	0	0	61
Total	0	16	8	0	24	7	1	85	0	93	62	42	0	0	104	0	0	0	0	0	221
Grand Total	0	28	14	0	42	21	3	118	0	142	108	90	0	0	198	0	0	0	0	0	382
Apprch %	0	66.7	33.3	0		14.8	2.1	83.1	0		54.5	45.5	0	0		0	0	0	0		
Total %	0	7.3	3.7	0	11	5.5	0.8	30.9	0	37.2	28.3	23.6	0	0	51.8	0	0	0	0	0	

	HELLER DR Southbound					McLAUGHLIN DR Westbound					HELLER DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	0	8	3	0	11	7	2	21	0	30	19	25	0	0	44	0	0	0	0	0	85
08:00 AM	0	3	1	0	4	2	0	24	0	26	23	7	0	0	30	0	0	0	0	0	60
08:15 AM	0	2	2	0	4	2	0	22	0	24	12	11	0	0	23	0	0	0	0	0	51
08:30 AM	0	5	3	0	8	1	0	18	0	19	12	10	0	0	22	0	0	0	0	0	49
Total Volume	0	18	9	0	27	12	2	85	0	99	66	53	0	0	119	0	0	0	0	0	245
% App. Total	0	66.7	33.3	0		12.1	2	85.9	0		55.5	44.5	0	0		0	0	0	0		
PHF	.000	.563	.750	.000	.614	.429	.250	.885	.000	.825	.717	.530	.000	.000	.676	.000	.000	.000	.000	.000	.721

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Traffic Data Service

Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 5PM FINAL
Site Code : 00000005
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	HELLER DR Southbound					McLAUGHLIN DR Westbound					HELLER DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	0	25	1	0	26	2	0	25	0	27	8	6	0	0	14	0	0	0	0	0	67
04:15 PM	0	16	2	0	18	5	0	24	0	29	23	13	0	0	36	0	0	0	0	0	83
04:30 PM	0	14	7	0	21	5	0	38	0	43	22	5	0	0	27	0	0	0	0	0	91
04:45 PM	0	30	5	0	35	6	0	32	0	38	38	11	0	0	49	0	0	0	0	0	122
Total	0	85	15	0	100	18	0	119	0	137	91	35	0	0	126	0	0	0	0	0	363
05:00 PM	0	36	7	0	43	12	1	39	0	52	45	38	0	0	83	0	0	0	0	0	178
05:15 PM	0	32	6	0	38	5	0	36	0	41	37	24	0	0	61	0	0	0	0	0	140
05:30 PM	0	21	3	0	24	6	0	14	0	20	30	22	2	0	54	0	0	0	0	0	98
05:45 PM	0	25	7	0	32	7	1	27	0	35	32	22	0	0	54	0	0	0	0	0	121
Total	0	114	23	0	137	30	2	116	0	148	144	106	2	0	252	0	0	0	0	0	537
Grand Total	0	199	38	0	237	48	2	235	0	285	235	141	2	0	378	0	0	0	0	0	900
Apprch %	0	84	16	0		16.8	0.7	82.5	0		62.2	37.3	0.5	0		0	0	0	0		
Total %	0	22.1	4.2	0	26.3	5.3	0.2	26.1	0	31.7	26.1	15.7	0.2	0	42	0	0	0	0	0	

	HELLER DR Southbound					McLAUGHLIN DR Westbound					HELLER DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	30	5	0	35	6	0	32	0	38	38	11	0	0	49	0	0	0	0	0	122
05:00 PM	0	36	7	0	43	12	1	39	0	52	45	38	0	0	83	0	0	0	0	0	178
05:15 PM	0	32	6	0	38	5	0	36	0	41	37	24	0	0	61	0	0	0	0	0	140
05:30 PM	0	21	3	0	24	6	0	14	0	20	30	22	2	0	54	0	0	0	0	0	98
Total Volume	0	119	21	0	140	29	1	121	0	151	150	95	2	0	247	0	0	0	0	0	538
% App. Total	0	85	15	0		19.2	0.7	80.1	0		60.7	38.5	0.8	0		0	0	0	0		
PHF	.000	.826	.750	.000	.814	.604	.250	.776	.000	.726	.833	.625	.250	.000	.744	.000	.000	.000	.000	.000	.756

2

Traffic Data Service

Campbell, CA

(408) 377-2988

tdsbay@cs.com

File Name : 6AM FINAL
Site Code : 00000006
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	HELLER DR Southbound					MEYER DR Westbound					HELLER DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	0	6	0	0	6	0	0	1	0	1	8	12	0	0	20	0	0	0	0	0	27
07:15 AM	0	7	1	0	8	3	0	3	0	6	8	22	0	0	30	0	0	0	0	0	44
07:30 AM	0	8	0	0	8	1	0	4	0	5	9	41	0	0	50	0	0	0	0	0	63
07:45 AM	0	27	2	0	29	2	0	2	0	4	23	71	0	0	94	0	0	0	0	0	127
Total	0	48	3	0	51	6	0	10	0	16	48	146	0	0	194	0	0	0	0	0	261
08:00 AM	0	20	0	0	20	1	0	6	0	7	16	41	0	0	57	0	0	0	0	0	84
08:15 AM	0	13	1	0	14	1	0	6	0	7	9	36	0	0	45	0	0	0	0	0	66
08:30 AM	0	11	0	0	11	2	0	4	0	6	22	41	0	0	63	0	0	0	0	0	80
08:45 AM	0	20	7	0	27	2	0	13	0	15	36	50	0	0	86	0	0	0	0	0	128
Total	0	64	8	0	72	6	0	29	0	35	83	168	0	0	251	0	0	0	0	0	358
Grand Total	0	112	11	0	123	12	0	39	0	51	131	314	0	0	445	0	0	0	0	0	619
Apprch %	0	91.1	8.9	0		23.5	0	76.5	0		29.4	70.6	0	0		0	0	0	0		
Total %	0	18.1	1.8	0	19.9	1.9	0	6.3	0	8.2	21.2	50.7	0	0	71.9	0	0	0	0	0	

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 08:00 AM

	HELLER DR Southbound					MEYER DR Westbound					HELLER DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
08:00 AM	0	20	0	0	20	1	0	6	0	7	16	41	0	0	57	0	0	0	0	0	84
08:15 AM	0	13	1	0	14	1	0	6	0	7	9	36	0	0	45	0	0	0	0	0	66
08:30 AM	0	11	0	0	11	2	0	4	0	6	22	41	0	0	63	0	0	0	0	0	80
08:45 AM	0	20	7	0	27	2	0	13	0	15	36	50	0	0	86	0	0	0	0	0	128
Total Volume	0	64	8	0	72	6	0	29	0	35	83	168	0	0	251	0	0	0	0	0	358
% App. Total	0	88.9	11.1	0		17.1	0	82.9	0		33.1	66.9	0	0		0	0	0	0		
PHF	.000	.800	.286	.000	.667	.750	.000	.558	.000	.583	.576	.840	.000	.000	.730	.000	.000	.000	.000	.000	.699

②

Traffic Data Service

Campbell, CA

(408) 377-2988
tdsbay@cs.com

File Name : 6PM FINAL
Site Code : 00000006
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	HELLER DR Southbound					MEYER DR Westbound					HELLER DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	0	46	2	0	48	1	0	20	0	21	9	18	0	0	27	0	0	0	0	0	96
04:15 PM	0	58	8	0	66	6	0	17	0	23	12	28	0	0	40	0	0	0	0	0	129
04:30 PM	0	50	4	0	54	5	0	18	0	23	8	18	1	1	28	0	0	0	0	0	105
04:45 PM	0	88	3	0	91	5	0	17	0	22	13	56	0	0	69	0	0	0	0	0	182
Total	0	242	17	0	259	17	0	72	0	89	42	120	1	1	164	0	0	0	0	0	512
05:00 PM	0	74	2	0	76	4	0	27	0	31	16	35	0	0	51	0	0	0	0	0	158
05:15 PM	0	73	8	0	81	2	0	29	0	31	14	28	0	0	42	0	0	0	0	0	154
05:30 PM	0	47	2	0	49	3	0	12	0	15	12	23	0	0	35	0	0	0	0	0	99
05:45 PM	0	46	3	0	49	1	0	14	0	15	10	18	0	0	28	0	0	0	0	0	92
Total	0	240	15	0	255	10	0	82	0	92	52	104	0	0	156	0	0	0	0	0	503
Grand Total	0	482	32	0	514	27	0	154	0	181	94	224	1	1	320	0	0	0	0	0	1015
Apprch %	0	93.8	6.2	0		14.9	0	85.1	0		29.4	70	0.3	0.3		0	0	0	0		
Total %	0	47.5	3.2	0	50.6	2.7	0	15.2	0	17.8	9.3	22.1	0.1	0.1	31.5	0	0	0	0	0	

	HELLER DR Southbound					MEYER DR Westbound					HELLER DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	0	50	4	0	54	5	0	18	0	23	8	18	1	1	28	0	0	0	0	0	105
04:45 PM	0	88	3	0	91	5	0	17	0	22	13	56	0	0	69	0	0	0	0	0	182
05:00 PM	0	74	2	0	76	4	0	27	0	31	16	35	0	0	51	0	0	0	0	0	158
05:15 PM	0	73	8	0	81	2	0	29	0	31	14	28	0	0	42	0	0	0	0	0	154
Total Volume	0	285	17	0	302	16	0	91	0	107	51	137	1	1	190	0	0	0	0	0	599
% App. Total	0	94.4	5.6	0		15	0	85	0		26.8	72.1	0.5	0.5		0	0	0	0		
PHF	.000	.810	.531	.000	.830	.800	.000	.784	.000	.863	.797	.612	.250	.250	.688	.000	.000	.000	.000	.000	.823

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Traffic Data Service

Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 44AM FINAL
Site Code : 00000044
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	CHINQUAPIN RD Southbound					McLAUGHLIN DR Westbound					Northbound					McLAUGHLIN DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	12	0	12	0	24	12	22	0	0	34	0	0	0	0	0	0	6	10	0	16	74
07:15 AM	9	0	8	0	17	16	26	0	0	42	0	0	0	0	0	0	12	21	0	33	92
07:30 AM	10	0	10	0	20	19	27	0	0	46	0	0	0	0	0	0	15	22	0	37	103
07:45 AM	12	0	9	0	21	15	67	0	0	82	0	0	0	0	0	0	29	17	0	46	149
Total	43	0	39	0	82	62	142	0	0	204	0	0	0	0	0	0	62	70	0	132	418
08:00 AM	17	0	14	0	31	20	40	0	0	60	0	0	0	0	0	0	31	22	0	53	144
08:15 AM	20	0	24	0	44	25	45	0	0	70	0	0	0	0	0	0	36	23	0	59	173
08:30 AM	17	0	19	0	36	21	43	0	0	64	0	0	0	0	0	0	30	16	0	46	146
08:45 AM	12	0	14	0	26	10	28	0	0	38	0	0	0	0	0	0	23	8	0	31	95
Total	66	0	71	0	137	76	156	0	0	232	0	0	0	0	0	0	120	69	0	189	558
Grand Total	109	0	110	0	219	138	298	0	0	436	0	0	0	0	0	0	182	139	0	321	976
Apprch %	49.8	0	50.2	0		31.7	68.3	0	0		0	0	0	0		0	56.7	43.3	0		
Total %	11.2	0	11.3	0	22.4	14.1	30.5	0	0	44.7	0	0	0	0	0	0	18.6	14.2	0	32.9	

	CHINQUAPIN RD Southbound					McLAUGHLIN DR Westbound					Northbound					McLAUGHLIN DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	12	0	9	0	21	15	67	0	0	82	0	0	0	0	0	0	29	17	0	46	149
08:00 AM	17	0	14	0	31	20	40	0	0	60	0	0	0	0	0	0	31	22	0	53	144
08:15 AM	20	0	24	0	44	25	45	0	0	70	0	0	0	0	0	0	36	23	0	59	173
08:30 AM	17	0	19	0	36	21	43	0	0	64	0	0	0	0	0	0	30	16	0	46	146
Total Volume	66	0	66	0	132	81	195	0	0	276	0	0	0	0	0	0	126	78	0	204	612
% App. Total	50	0	50	0		29.3	70.7	0	0		0	0	0	0		0	61.8	38.2	0		
PHF	.825	.000	.688	.000	.750	.810	.728	.000	.000	.841	.000	.000	.000	.000	.000	.000	.875	.848	.000	.864	.884

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Traffic Data Service
Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 44PM FINAL
Site Code : 00000044
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	CHINQUAPIN RD Southbound					McLAUGHLIN RD Westbound					Northbound					McLAUGHLIN RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	9	0	13	0	22	11	23	0	0	34	0	0	0	0	0	0	32	19	0	51	107
04:15 PM	11	0	19	0	30	16	41	0	0	57	0	0	0	0	0	0	31	20	0	51	138
04:30 PM	17	0	20	0	37	17	56	0	0	73	0	0	0	0	0	0	42	22	0	64	174
04:45 PM	14	0	29	0	43	19	63	0	0	82	0	0	0	0	0	0	51	21	0	72	197
Total	51	0	81	0	132	63	183	0	0	246	0	0	0	0	0	0	156	82	0	238	616
05:00 PM	16	0	14	0	30	24	38	0	0	62	0	0	0	0	0	0	46	28	0	74	166
05:15 PM	14	0	23	0	37	21	40	0	0	61	0	0	0	0	0	0	46	25	0	71	169
05:30 PM	13	0	18	0	31	16	24	0	0	40	0	0	0	0	0	0	35	21	0	56	127
05:45 PM	12	0	15	0	27	14	22	0	0	36	0	0	0	0	0	0	28	18	0	46	109
Total	55	0	70	0	125	75	124	0	0	199	0	0	0	0	0	0	155	92	0	247	571
Grand Total	106	0	151	0	257	138	307	0	0	445	0	0	0	0	0	0	311	174	0	485	1187
Apprch %	41.2	0	58.8	0		31	69	0	0		0	0	0	0		0	64.1	35.9	0		
Total %	8.9	0	12.7	0	21.7	11.6	25.9	0	0	37.5	0	0	0	0	0	0	26.2	14.7	0	40.9	

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 04:30 PM

	CHINQUAPIN RD Southbound					McLAUGHLIN RD Westbound					Northbound					McLAUGHLIN RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:30 PM	17	0	20	0	37	17	56	0	0	73	0	0	0	0	0	0	42	22	0	64	174
04:45 PM	14	0	29	0	43	19	63	0	0	82	0	0	0	0	0	0	51	21	0	72	197
05:00 PM	16	0	14	0	30	24	38	0	0	62	0	0	0	0	0	0	46	28	0	74	166
05:15 PM	14	0	23	0	37	21	40	0	0	61	0	0	0	0	0	0	46	25	0	71	169
Total Volume	61	0	86	0	147	81	197	0	0	278	0	0	0	0	0	0	185	96	0	281	706
% App. Total	41.5	0	58.5	0		29.1	70.9	0	0		0	0	0	0		0	65.8	34.2	0		
PHF	.897	.000	.741	.000	.855	.844	.782	.000	.000	.848	.000	.000	.000	.000	.000	.000	.907	.857	.000	.949	.896

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Traffic Data Service

Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 4AM FINAL
Site Code : 00000004
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	Southbound					McLAUGHLIN DR Westbound					HAGAR DR Northbound					McLAUGHLIN DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	0	0	0	0	0	0	27	3	0	30	4	0	10	0	14	9	9	0	0	18	62
07:15 AM	0	0	0	0	0	0	29	1	0	30	5	3	14	0	22	8	7	0	0	15	67
07:30 AM	0	0	0	0	0	0	40	2	0	42	2	0	12	0	14	7	11	0	0	18	74
07:45 AM	0	0	0	0	0	0	54	3	0	57	3	0	14	0	17	12	16	0	0	28	102
Total	0	0	0	0	0	0	150	9	0	159	14	3	50	0	67	36	43	0	0	79	305
08:00 AM	0	0	0	0	0	0	44	5	0	49	4	0	11	0	15	21	22	0	0	43	107
08:15 AM	0	0	0	0	0	0	48	2	0	50	3	0	23	0	26	26	32	0	0	58	134
08:30 AM	0	0	0	0	0	0	39	1	0	40	5	0	22	0	27	21	29	0	0	50	117
08:45 AM	0	0	0	0	0	0	23	8	0	31	1	0	19	0	20	14	24	0	0	38	89
Total	0	0	0	0	0	0	154	16	0	170	13	0	75	0	88	82	107	0	0	189	447
Grand Total	0	0	0	0	0	0	304	25	0	329	27	3	125	0	155	118	150	0	0	268	752
Apprch %	0	0	0	0		0	92.4	7.6	0		17.4	1.9	80.6	0		44	56	0	0		
Total %	0	0	0	0	0	0	40.4	3.3	0	43.8	3.6	0.4	16.6	0	20.6	15.7	19.9	0	0	35.6	

	Southbound					McLAUGHLIN DR Westbound					HAGAR DR Northbound					McLAUGHLIN DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	0	0	0	0	0	0	54	3	0	57	3	0	14	0	17	12	16	0	0	28	102
08:00 AM	0	0	0	0	0	0	44	5	0	49	4	0	11	0	15	21	22	0	0	43	107
08:15 AM	0	0	0	0	0	0	48	2	0	50	3	0	23	0	26	26	32	0	0	58	134
08:30 AM	0	0	0	0	0	0	39	1	0	40	5	0	22	0	27	21	29	0	0	50	117
Total Volume	0	0	0	0	0	0	185	11	0	196	15	0	70	0	85	80	99	0	0	179	460
% App. Total	0	0	0	0		0	94.4	5.6	0		17.6	0	82.4	0		44.7	55.3	0	0		
PHF	.000	.000	.000	.000	.000	.000	.856	.550	.000	.860	.750	.000	.761	.000	.787	.769	.773	.000	.000	.772	.858

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Traffic Data Service

Campbell, CA

(408) 377-2988
tdsbay@cs.com

File Name : 4PM FINAL
Site Code : 00000004
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	Southbound					McLAUGHLIN DR Westbound					HAGAR DR Northbound					McLAUGHLIN DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	0	0	0	0	0	0	15	3	0	18	3	8	17	0	28	12	22	5	0	39	85
04:15 PM	0	0	0	0	0	0	33	3	0	36	3	0	19	0	22	18	36	0	0	54	112
04:30 PM	0	0	0	0	0	0	40	7	0	47	8	0	32	0	40	22	49	0	0	71	158
04:45 PM	0	0	0	0	0	0	53	20	0	73	17	0	38	0	55	29	48	0	0	77	205
Total	0	0	0	0	0	0	141	33	0	174	31	8	106	0	145	81	155	5	0	241	560
05:00 PM	0	0	0	0	0	0	45	17	0	62	10	0	21	0	31	27	46	0	0	73	166
05:15 PM	0	0	0	0	0	0	23	19	0	42	11	0	27	0	38	29	45	0	0	74	154
05:30 PM	0	0	0	0	0	0	29	13	0	42	12	0	21	0	33	21	29	0	0	50	125
05:45 PM	0	0	0	0	0	0	27	12	0	39	17	0	17	0	34	23	26	0	0	49	122
Total	0	0	0	0	0	0	124	61	0	185	50	0	86	0	136	100	146	0	0	246	567
Grand Total	0	0	0	0	0	0	265	94	0	359	81	8	192	0	281	181	301	5	0	487	1127
Apprch %	0	0	0	0		0	73.8	26.2	0		28.8	2.8	68.3	0		37.2	61.8	1	0		
Total %	0	0	0	0	0	0	23.5	8.3	0	31.9	7.2	0.7	17	0	24.9	16.1	26.7	0.4	0	43.2	

	Southbound					McLAUGHLIN DR Westbound					HAGAR DR Northbound					McLAUGHLIN DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	0	0	0	0	0	0	40	7	0	47	8	0	32	0	40	22	49	0	0	71	158
04:45 PM	0	0	0	0	0	0	53	20	0	73	17	0	38	0	55	29	48	0	0	77	205
05:00 PM	0	0	0	0	0	0	45	17	0	62	10	0	21	0	31	27	46	0	0	73	166
05:15 PM	0	0	0	0	0	0	23	19	0	42	11	0	27	0	38	29	45	0	0	74	154
Total Volume	0	0	0	0	0	0	161	63	0	224	46	0	118	0	164	107	188	0	0	295	683
% App. Total	0	0	0	0		0	71.9	28.1	0		28	0	72	0		36.3	63.7	0	0		
PHF	.000	.000	.000	.000	.000	.000	.759	.788	.000	.767	.676	.000	.776	.000	.745	.922	.959	.000	.000	.958	.833

Traffic Data Service
Campbell, CA

(408) 377-2988
tdsbay@cs.com

File Name : 2AM FINAL
Site Code : 00000002
Start Date : 11/14/2007
Page No : 1

Glenn Groups Printed- Vehicles Glenn

	HAGAR DR Southbound					~~GLEN~~ COOLIDGE DR Westbound					HAGAR DR Northbound					~~GLEN~~ COOLIDGE DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	0	6	1	0	7	0	0	6	0	6	1	43	43	0	87	19	0	0	0	19	119
07:15 AM	0	9	0	0	9	0	0	5	0	5	1	67	44	0	112	11	1	0	0	12	138
07:30 AM	0	11	0	0	11	0	2	18	0	20	3	103	74	0	180	8	0	0	0	8	219
07:45 AM	0	21	0	0	21	0	0	1	0	1	1	87	125	0	213	12	0	0	0	12	247
Total	0	47	1	0	48	0	2	30	0	32	6	300	286	0	592	50	1	0	0	51	723
08:00 AM	0	18	1	0	19	0	1	9	0	10	4	91	86	0	181	19	1	0	0	20	230
08:15 AM	0	15	0	0	15	3	1	3	0	7	2	118	84	0	204	9	0	0	0	9	235
08:30 AM	1	14	1	0	16	0	1	10	0	11	3	67	82	0	152	19	0	0	0	19	198
08:45 AM	0	19	0	0	19	1	1	4	0	6	3	43	98	0	144	27	0	0	0	27	196
Total	1	66	2	0	69	4	4	26	0	34	12	319	350	0	681	74	1	0	0	75	859
Grand Total	1	113	3	0	117	4	6	56	0	66	18	619	636	0	1273	124	2	0	0	126	1582
Apprch %	0.9	96.6	2.6	0		6.1	9.1	84.8	0		1.4	48.6	50	0		98.4	1.6	0	0		
Total %	0.1	7.1	0.2	0	7.4	0.3	0.4	3.5	0	4.2	1.1	39.1	40.2	0	80.5	7.8	0.1	0	0	8	

Glenn Glenn

	HAGAR DR Southbound					~~GLEN~~ COOLIDGE DR Westbound					HAGAR DR Northbound					~~GLEN~~ COOLIDGE DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	11	0	0	11	0	2	18	0	20	3	103	74	0	180	8	0	0	0	8	219
07:45 AM	0	21	0	0	21	0	0	1	0	1	1	87	125	0	213	12	0	0	0	12	247
08:00 AM	0	18	1	0	19	0	1	9	0	10	4	91	86	0	181	19	1	0	0	20	230
08:15 AM	0	15	0	0	15	3	1	3	0	7	2	118	84	0	204	9	0	0	0	9	235
Total Volume	0	65	1	0	66	3	4	31	0	38	10	399	369	0	778	48	1	0	0	49	931
% App. Total	0	98.5	1.5	0		7.9	10.5	81.6	0		1.3	51.3	47.4	0		98	2	0	0		
PHF	.000	.774	.250	.000	.786	.250	.500	.431	.000	.475	.625	.845	.738	.000	.913	.632	.250	.000	.000	.613	.942

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Traffic Data Service

Campbell, CA

(408) 377-2988
tdsbay@cs.com

File Name : 2PM FINAL
Site Code : 00000002
Start Date : 11/14/2007
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Glenn Groups Printed- Vehicles Glenn

	HAGAR DR Southbound					Glenn ~~GLEN~~ COOLIDGE DR Westbound					HAGAR DR Northbound					Glenn ~~GLEN~~ COOLIDGE DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	59	0	0	0	59	3	63	3	0	69	0	0	0	0	0	0	35	41	0	76	204
04:15 PM	97	0	2	0	99	2	51	4	0	57	0	0	2	0	2	0	71	39	0	110	268
04:30 PM	104	0	0	0	104	0	62	7	0	69	2	1	0	0	3	0	79	36	0	115	291
04:45 PM	87	0	0	0	87	0	93	2	0	95	1	0	4	0	5	2	67	45	0	114	301
Total	347	0	2	0	349	5	269	16	0	290	3	1	6	0	10	2	252	161	0	415	1064
05:00 PM	82	0	0	0	82	1	118	1	0	120	0	0	3	0	3	2	64	42	0	108	313
05:15 PM	76	2	0	0	78	0	123	4	0	127	2	0	12	0	14	6	59	32	0	97	316
05:30 PM	33	1	0	0	34	0	127	2	0	129	0	0	0	0	0	1	67	33	0	101	264
05:45 PM	43	0	0	0	43	2	143	3	0	148	1	0	3	0	4	8	76	21	0	105	300
Total	234	3	0	0	237	3	511	10	0	524	3	0	18	0	21	17	266	128	0	411	1193
Grand Total	581	3	2	0	586	8	780	26	0	814	6	1	24	0	31	19	518	289	0	826	2257
Apprch %	99.1	0.5	0.3	0		1	95.8	3.2	0		19.4	3.2	77.4	0		2.3	62.7	35	0		
Total %	25.7	0.1	0.1	0	26	0.4	34.6	1.2	0	36.1	0.3	0	1.1	0	1.4	0.8	23	12.8	0	36.6	

Glenn Glenn

	HAGAR DR Southbound					Glenn ~~GLEN~~ COOLIDGE DR Westbound					HAGAR DR Northbound					Glenn ~~GLEN~~ COOLIDGE DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	104	0	0	0	104	0	62	7	0	69	2	1	0	0	3	0	79	36	0	115	291
04:45 PM	87	0	0	0	87	0	93	2	0	95	1	0	4	0	5	2	67	45	0	114	301
05:00 PM	82	0	0	0	82	1	118	1	0	120	0	0	3	0	3	2	64	42	0	108	313
05:15 PM	76	2	0	0	78	0	123	4	0	127	2	0	12	0	14	6	59	32	0	97	316
Total Volume	349	2	0	0	351	1	396	14	0	411	5	1	19	0	25	10	269	155	0	434	1221
% App. Total	99.4	0.6	0	0		0.2	96.4	3.4	0		20	4	76	0		2.3	62	35.7	0		
PHF	.839	.250	.000	.000	.844	.250	.805	.500	.000	.809	.625	.250	.396	.000	.446	.417	.851	.861	.000	.943	.966

Traffic Data Service
Campbell, CA
(408) 377-2988
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File Name : 10AM FINAL
Site Code : 00000010
Start Date : 11/13/2007
Page No : 1

Groups Printed- Vehicles

	COLLIDGE DR Southbound					HIGH ST Westbound					BAY DR Northbound					HIGH ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	9	8	8	0	25	54	25	3	0	82	11	21	8	0	40	19	22	3	0	44	191
07:15 AM	5	14	15	0	34	68	29	1	0	98	9	54	26	0	89	27	28	2	0	57	278
07:30 AM	6	12	16	0	34	88	35	8	0	131	21	90	27	0	138	58	33	3	0	94	397
07:45 AM	8	15	14	0	37	104	48	13	0	165	26	109	50	0	185	54	42	7	0	103	490
Total	28	49	53	0	130	314	137	25	0	476	67	274	111	0	452	158	125	15	0	298	1356
08:00 AM	10	22	8	0	40	96	47	16	0	159	38	110	52	0	200	87	27	7	0	121	520
08:15 AM	8	21	16	0	45	78	77	22	0	177	20	80	48	0	148	55	22	13	0	90	460
08:30 AM	10	22	17	0	49	84	55	10	0	149	15	72	39	0	126	26	31	13	0	70	394
08:45 AM	6	37	17	0	60	75	39	7	0	121	21	82	40	0	143	35	33	6	0	74	398
Total	34	102	58	0	194	333	218	55	0	606	94	344	179	0	617	203	113	39	0	355	1772
Grand Total	62	151	111	0	324	647	355	80	0	1082	161	618	290	0	1069	361	238	54	0	653	3128
Apprch %	19.1	46.6	34.3	0		59.8	32.8	7.4	0		15.1	57.8	27.1	0		55.3	36.4	8.3	0		
Total %	2	4.8	3.5	0	10.4	20.7	11.3	2.6	0	34.6	5.1	19.8	9.3	0	34.2	11.5	7.6	1.7	0	20.9	

	COLLIDGE DR Southbound					HIGH ST Westbound					BAY DR Northbound					HIGH ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	6	12	16	0	34	88	35	8	0	131	21	90	27	0	138	58	33	3	0	94	397
07:45 AM	8	15	14	0	37	104	48	13	0	165	26	109	50	0	185	54	42	7	0	103	490
08:00 AM	10	22	8	0	40	96	47	16	0	159	38	110	52	0	200	87	27	7	0	121	520
08:15 AM	8	21	16	0	45	78	77	22	0	177	20	80	48	0	148	55	22	13	0	90	460
Total Volume	32	70	54	0	156	366	207	59	0	632	105	389	177	0	671	254	124	30	0	408	1867
% App. Total	20.5	44.9	34.6	0		57.9	32.8	9.3	0		15.6	58	26.4	0		62.3	30.4	7.4	0		
PHF	.800	.795	.844	.000	.867	.880	.672	.670	.000	.893	.691	.884	.851	.000	.839	.730	.738	.577	.000	.843	.898

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Traffic Data Service

Campbell, CA

(408) 377-2988

tdsbay@cs.com

File Name : 10PM FINAL
Site Code : 00000010
Start Date : 11/13/2007
Page No : 1

Groups Printed- Vehicles

	COOLIDGE DR Southbound					HIGH ST Westbound					BAY DR Northbound					HIGH ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	6	87	71	0	164	24	31	15	0	70	9	32	23	0	64	34	50	19	0	103	401
04:15 PM	11	68	68	0	147	25	41	14	0	80	10	59	23	0	92	60	36	18	1	115	434
04:30 PM	18	80	54	0	152	34	36	17	0	87	11	67	35	0	113	58	49	7	0	114	466
04:45 PM	6	118	47	0	171	27	39	20	0	86	7	91	27	0	125	39	46	9	0	94	476
Total	41	353	240	0	634	110	147	66	0	323	37	249	108	0	394	191	181	53	1	426	1777
05:00 PM	9	182	77	0	268	44	43	11	0	98	10	69	26	0	105	57	32	25	0	114	585
05:15 PM	12	153	77	0	242	34	47	20	0	101	10	48	33	0	91	60	66	24	0	150	584
05:30 PM	14	88	66	0	168	49	53	14	0	116	16	53	50	0	119	50	42	22	0	114	517
05:45 PM	15	74	96	0	185	45	48	17	0	110	10	48	35	0	93	65	49	17	0	131	519
Total	50	497	316	0	863	172	191	62	0	425	46	218	144	0	408	232	189	88	0	509	2205
Grand Total	91	850	556	0	1497	282	338	128	0	748	83	467	252	0	802	423	370	141	1	935	3982
Apprch %	6.1	56.8	37.1	0		37.7	45.2	17.1	0		10.3	58.2	31.4	0		45.2	39.6	15.1	0.1		
Total %	2.3	21.3	14	0	37.6	7.1	8.5	3.2	0	18.8	2.1	11.7	6.3	0	20.1	10.6	9.3	3.5	0	23.5	

	COOLIDGE DR Southbound					HIGH ST Westbound					BAY DR Northbound					HIGH ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	9	182	77	0	268	44	43	11	0	98	10	69	26	0	105	57	32	25	0	114	585
05:15 PM	12	153	77	0	242	34	47	20	0	101	10	48	33	0	91	60	66	24	0	150	584
05:30 PM	14	88	66	0	168	49	53	14	0	116	16	53	50	0	119	50	42	22	0	114	517
05:45 PM	15	74	96	0	185	45	48	17	0	110	10	48	35	0	93	65	49	17	0	131	519
Total Volume	50	497	316	0	863	172	191	62	0	425	46	218	144	0	408	232	189	88	0	509	2205
% App. Total	5.8	57.6	36.6	0		40.5	44.9	14.6	0		11.3	53.4	35.3	0		45.6	37.1	17.3	0		
PHF	.833	.683	.823	.000	.805	.878	.901	.775	.000	.916	.719	.790	.720	.000	.857	.892	.716	.880	.000	.848	.942

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Traffic Data Service
Campbell, CA
(408) 377-2988
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File Name : 3AM FINAL
Site Code : 00000003
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	HAGAR DR Southbound					EAST REMOTE LOT ENTRANCE Westbound					HAGAR DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	0	19	3	0	22	2	0	1	0	3	9	34	0	0	43	0	0	0	0	0	68
07:15 AM	0	17	4	0	21	0	0	1	0	1	21	20	0	0	41	0	0	0	0	0	63
07:30 AM	0	14	1	0	15	3	0	5	0	8	35	39	0	0	74	0	0	0	0	0	97
07:45 AM	0	10	2	0	12	4	0	3	0	7	49	63	0	0	112	0	0	0	0	0	131
Total	0	60	10	0	70	9	0	10	0	19	114	156	0	0	270	0	0	0	0	0	359
08:00 AM	0	22	5	0	27	3	0	1	0	4	24	60	0	0	84	0	0	0	0	0	115
08:15 AM	0	17	4	0	21	3	0	3	0	6	28	48	0	0	76	0	0	0	0	0	103
08:30 AM	0	19	2	0	21	1	0	4	0	5	29	42	0	0	71	0	0	0	0	0	97
08:45 AM	0	23	3	0	26	3	0	7	0	10	45	51	0	0	96	0	0	0	0	0	132
Total	0	81	14	0	95	10	0	15	0	25	126	201	0	0	327	0	0	0	0	0	447
Grand Total	0	141	24	0	165	19	0	25	0	44	240	357	0	0	597	0	0	0	0	0	806
Apprch %	0	85.5	14.5	0		43.2	0	56.8	0		40.2	59.8	0	0		0	0	0	0		
Total %	0	17.5	3	0	20.5	2.4	0	3.1	0	5.5	29.8	44.3	0	0	74.1	0	0	0	0	0	

	HAGAR DR Southbound					EAST REMOTE LOT ENTRANCE Westbound					HAGAR DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	22	5	0	27	3	0	1	0	4	24	60	0	0	84	0	0	0	0	0	115
08:15 AM	0	17	4	0	21	3	0	3	0	6	28	48	0	0	76	0	0	0	0	0	103
08:30 AM	0	19	2	0	21	1	0	4	0	5	29	42	0	0	71	0	0	0	0	0	97
08:45 AM	0	23	3	0	26	3	0	7	0	10	45	51	0	0	96	0	0	0	0	0	132
Total Volume	0	81	14	0	95	10	0	15	0	25	126	201	0	0	327	0	0	0	0	0	447
% App. Total	0	85.3	14.7	0		40	0	60	0		38.5	61.5	0	0		0	0	0	0		
PHF	.000	.880	.700	.000	.880	.833	.000	.536	.000	.625	.700	.838	.000	.000	.852	.000	.000	.000	.000	.000	.847

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Traffic Data Service
Campbell, CA
(408) 377-2988
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File Name : 3PM FINAL
Site Code : 00000003
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	HAGAR DR Southbound					EAST REMOTE LOT ENTRANCE Westbound					HAGAR DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	0	47	8	0	55	9	0	10	0	19	16	20	0	0	36	0	0	0	0	0	110
04:15 PM	0	87	15	0	102	16	0	15	0	31	18	26	0	0	44	0	0	0	0	0	177
04:30 PM	0	67	17	0	84	11	0	49	0	60	21	25	1	0	47	0	0	0	0	0	191
04:45 PM	0	51	19	0	70	5	0	55	0	60	26	41	0	0	67	0	0	0	0	0	197
Total	0	252	59	0	311	41	0	129	0	170	81	112	1	0	194	0	0	0	0	0	675
05:00 PM	0	29	17	0	46	6	0	44	0	50	11	29	0	0	40	0	0	0	0	0	136
05:15 PM	0	37	8	0	45	8	1	33	0	42	13	30	0	0	43	0	0	0	0	0	130
05:30 PM	0	29	9	0	38	4	0	15	0	19	22	20	0	0	42	0	0	0	0	0	99
05:45 PM	0	32	10	0	42	5	0	31	0	36	11	24	0	0	35	0	0	0	0	0	113
Total	0	127	44	0	171	23	1	123	0	147	57	103	0	0	160	0	0	0	0	0	478
Grand Total	0	379	103	0	482	64	1	252	0	317	138	215	1	0	354	0	0	0	0	0	1153
Apprch %	0	78.6	21.4	0		20.2	0.3	79.5	0		39	60.7	0.3	0		0	0	0	0		
Total %	0	32.9	8.9	0	41.8	5.6	0.1	21.9	0	27.5	12	18.6	0.1	0	30.7	0	0	0	0	0	

	HAGAR DR Southbound					EAST REMOTE LOT ENTRANCE Westbound					HAGAR DR Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	0	**87**	15	0	**102**	**16**	0	15	0	31	18	26	0	0	44	0	0	0	0	0	177
04:30 PM	0	67	17	0	84	11	0	49	0	60	21	25	1	0	47	0	0	0	0	0	191
04:45 PM	0	51	**19**	0	70	5	0	**55**	0	60	**26**	**41**	0	0	**67**	0	0	0	0	0	**197**
05:00 PM	0	29	17	0	46	6	0	44	0	50	11	29	0	0	40	0	0	0	0	0	136
Total Volume	0	234	68	0	302	38	0	163	0	201	76	121	1	0	198	0	0	0	0	0	701
% App. Total	0	77.5	22.5	0		18.9	0	81.1	0		38.4	61.1	0.5	0		0	0	0	0		
PHF	.000	.672	.895	.000	.740	.594	.000	.741	.000	.838	.731	.738	.250	.000	.739	.000	.000	.000	.000	.000	.890

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Traffic Data Service
Campbell, CA
(408) 377-2988
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File Name : 8AM FINAL
Site Code : 00000008
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	Southbound					HIGH ST Westbound					WESTERN DR Northbound					EMPIRE GRADE RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	0	0	0	0	0	0	42	2	0	44	9	0	6	0	15	6	32	0	0	38	97
07:15 AM	0	0	0	0	0	0	58	4	0	62	13	0	6	0	19	6	52	0	0	58	139
07:30 AM	0	0	0	0	0	0	62	8	0	70	18	0	25	0	43	12	100	0	0	112	225
07:45 AM	0	0	0	0	0	0	117	9	0	126	26	0	28	0	54	16	95	0	0	111	291
Total	0	0	0	0	0	0	279	23	0	302	66	0	65	0	131	40	279	0	0	319	752
08:00 AM	0	0	0	0	0	0	81	12	0	93	15	0	20	0	35	12	103	0	0	115	243
08:15 AM	0	0	0	0	0	0	103	6	0	109	9	0	35	0	44	11	57	0	0	68	221
08:30 AM	0	0	0	0	0	0	90	11	0	101	16	0	30	0	46	8	56	0	0	64	211
08:45 AM	0	0	0	0	0	0	97	9	0	106	23	0	34	0	57	15	89	0	0	104	267
Total	0	0	0	0	0	0	371	38	0	409	63	0	119	0	182	46	305	0	0	351	942
Grand Total	0	0	0	0	0	0	650	61	0	711	129	0	184	0	313	86	584	0	0	670	1694
Apprch %	0	0	0	0		0	91.4	8.6	0		41.2	0	58.8	0		12.8	87.2	0	0		
Total %	0	0	0	0	0	0	38.4	3.6	0	42	7.6	0	10.9	0	18.5	5.1	34.5	0	0	39.6	

	Southbound					HIGH ST Westbound					WESTERN DR Northbound					EMPIRE GRADE RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	0	62	8	0	70	18	0	25	0	43	12	100	0	0	112	225
07:45 AM	0	0	0	0	0	0	117	9	0	126	26	0	28	0	54	16	95	0	0	111	291
08:00 AM	0	0	0	0	0	0	81	12	0	93	15	0	20	0	35	12	103	0	0	115	243
08:15 AM	0	0	0	0	0	0	103	6	0	109	9	0	35	0	44	11	57	0	0	68	221
Total Volume	0	0	0	0	0	0	363	35	0	398	68	0	108	0	176	51	355	0	0	406	980
% App. Total	0	0	0	0		0	91.2	8.8	0		38.6	0	61.4	0		12.6	87.4	0	0		
PHF	.000	.000	.000	.000	.000	.000	.776	.729	.000	.790	.654	.000	.771	.000	.815	.797	.862	.000	.000	.883	.842

(8)

Traffic Data Service

Campbell, CA
(408) 377-2988
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File Name : 8PM FINAL
Site Code : 00000008
Start Date : 11/14/2007
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Groups Printed- Vehicles

	Southbound					HIGH ST Westbound					WESTERN DR Northbound					EMPIRE GRADE RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	0	0	0	0	0	0	42	11	0	53	11	0	11	0	22	12	53	0	0	65	140
04:15 PM	0	0	0	0	0	0	79	10	0	89	11	0	24	0	35	10	105	0	0	115	239
04:30 PM	0	0	0	0	0	0	66	13	0	79	28	0	53	0	81	12	69	0	0	81	241
04:45 PM	0	0	0	0	0	0	110	17	0	127	24	0	35	0	59	34	117	0	0	151	337
Total	0	0	0	0	0	0	297	51	0	348	74	0	123	0	197	68	344	0	0	412	957
05:00 PM	0	0	0	0	0	0	63	19	0	82	9	0	23	0	32	34	120	0	0	154	268
05:15 PM	0	0	0	0	0	0	85	27	0	112	24	3	37	0	64	38	111	0	0	149	325
05:30 PM	0	0	0	0	0	0	63	9	0	72	14	0	21	0	35	22	108	0	0	130	237
05:45 PM	0	0	0	0	0	0	72	10	0	82	18	0	30	1	49	19	92	0	0	111	242
Total	0	0	0	0	0	0	283	65	0	348	65	3	111	1	180	113	431	0	0	544	1072
Grand Total	0	0	0	0	0	0	580	116	0	696	139	3	234	1	377	181	775	0	0	956	2029
Apprch %	0	0	0	0		0	83.3	16.7	0		36.9	0.8	62.1	0.3		18.9	81.1	0	0		
Total %	0	0	0	0	0	0	28.6	5.7	0	34.3	6.9	0.1	11.5	0	18.6	8.9	38.2	0	0	47.1	

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 04:30 PM

	Southbound					HIGH ST Westbound					WESTERN DR Northbound					EMPIRE GRADE RD Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:30 PM	0	0	0	0	0	0	66	13	0	79	28	0	53	0	81	12	69	0	0	81	241
04:45 PM	0	0	0	0	0	0	110	17	0	127	24	0	35	0	59	34	117	0	0	151	337
05:00 PM	0	0	0	0	0	0	63	19	0	82	9	0	23	0	32	34	120	0	0	154	268
05:15 PM	0	0	0	0	0	0	85	27	0	112	24	3	37	0	64	38	111	0	0	149	325
Total Volume	0	0	0	0	0	0	324	76	0	400	85	3	148	0	236	118	417	0	0	535	1171
% App. Total	0	0	0	0		0	81	19	0		36	1.3	62.7	0		22.1	77.9	0	0		
PHF	.000	.000	.000	.000	.000	.000	.736	.704	.000	.787	.759	.250	.698	.000	.728	.776	.869	.000	.000	.869	.869

(9)

Traffic Data Service
Campbell, CA

(408) 377-2988
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File Name : 41AM FINAL
Site Code : 00000041
Start Date : 11/13/2007
Page No : 1

Groups Printed- Vehicles

	LAURENT ST Southbound					HIGH ST Westbound					LAURENT ST Northbound					HIGH ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	2	0	4	0	6	1	109	0	0	110	1	1	1	0	3	1	45	0	0	46	165
07:15 AM	2	4	10	0	16	0	104	0	0	104	0	0	1	0	1	1	65	2	0	68	189
07:30 AM	2	8	8	0	18	2	138	0	0	140	2	0	1	0	3	1	86	1	0	88	249
07:45 AM	5	5	13	0	23	1	177	1	0	179	2	0	11	0	13	2	104	3	0	109	324
Total	11	17	35	0	63	4	528	1	0	533	5	1	14	0	20	5	300	6	0	311	927
08:00 AM	4	9	7	0	20	0	168	5	0	173	1	0	9	0	10	3	103	1	0	107	310
08:15 AM	3	4	9	0	16	2	153	1	0	156	2	4	3	0	9	3	111	3	0	117	298
08:30 AM	4	3	9	0	16	0	133	2	0	135	4	1	2	0	7	2	79	2	0	83	241
08:45 AM	1	3	10	0	14	3	109	1	0	113	3	1	3	0	7	3	77	1	0	81	215
Total	12	19	35	0	66	5	563	9	0	577	10	6	17	0	33	11	370	7	0	388	1064
Grand Total	23	36	70	0	129	9	1091	10	0	1110	15	7	31	0	53	16	670	13	0	699	1991
Apprch %	17.8	27.9	54.3	0		0.8	98.3	0.9	0		28.3	13.2	58.5	0		2.3	95.9	1.9	0		
Total %	1.2	1.8	3.5	0	6.5	0.5	54.8	0.5	0	55.8	0.8	0.4	1.6	0	2.7	0.8	33.7	0.7	0	35.1	

	LAURENT ST Southbound					HIGH ST Westbound					LAURENT ST Northbound					HIGH ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	2	8	8	0	18	2	138	0	0	140	2	0	1	0	3	1	86	1	0	88	249
07:45 AM	5	5	13	0	23	1	177	1	0	179	2	0	11	0	13	2	104	3	0	109	324
08:00 AM	4	9	7	0	20	0	168	5	0	173	1	0	9	0	10	3	103	1	0	107	310
08:15 AM	3	4	9	0	16	2	153	1	0	156	2	4	3	0	9	3	111	3	0	117	298
Total Volume	14	26	37	0	77	5	636	7	0	648	7	4	24	0	35	9	404	8	0	421	1181
% App. Total	18.2	33.8	48.1	0		0.8	98.1	1.1	0		20	11.4	68.6	0		2.1	96	1.9	0		
PHF	.700	.722	.712	.000	.837	.625	.898	.350	.000	.905	.875	.250	.545	.000	.673	.750	.910	.667	.000	.900	.911

(9)

Traffic Data Service

Campbell, CA
(408) 377-2988
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File Name : 41PM FINAL
Site Code : 00000041
Start Date : 11/13/2007
Page No : 1

Groups Printed- Vehicles

	LAURENT ST Southbound					HIGH ST Westbound					LAURENT ST Northbound					HIGH ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	3	2	5	0	10	0	93	3	0	96	0	6	4	0	10	7	143	3	0	153	269
04:15 PM	0	2	2	0	4	1	82	3	0	86	2	2	5	0	9	1	120	0	0	121	220
04:30 PM	3	7	4	0	14	0	100	3	0	103	2	3	2	0	7	2	90	2	0	94	218
04:45 PM	2	3	6	0	11	2	95	2	0	99	3	5	2	0	10	1	112	7	0	120	240
Total	8	14	17	0	39	3	370	11	0	384	7	16	13	0	36	11	465	12	0	488	947
05:00 PM	2	3	0	0	5	5	112	5	0	122	1	6	1	0	8	2	104	3	0	109	244
05:15 PM	5	2	2	0	9	5	104	1	0	110	0	2	3	0	5	4	118	4	0	126	250
05:30 PM	2	5	3	0	10	4	127	2	0	133	2	4	2	0	8	5	93	4	0	102	253
05:45 PM	3	2	4	0	9	3	113	2	0	118	2	3	6	0	11	2	120	2	0	124	262
Total	12	12	9	0	33	17	456	10	0	483	5	15	12	0	32	13	435	13	0	461	1009
Grand Total	20	26	26	0	72	20	826	21	0	867	12	31	25	0	68	24	900	25	0	949	1956
Apprch %	27.8	36.1	36.1	0		2.3	95.3	2.4	0		17.6	45.6	36.8	0		2.5	94.8	2.6	0		
Total %	1	1.3	1.3	0	3.7	1	42.2	1.1	0	44.3	0.6	1.6	1.3	0	3.5	1.2	46	1.3	0	48.5	

	LAURENT ST Southbound					HIGH ST Westbound					LAURENT ST Northbound					HIGH ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	2	3	0	0	5	5	112	5	0	122	1	6	1	0	8	2	104	3	0	109	244
05:15 PM	5	2	2	0	9	5	104	1	0	110	0	2	3	0	5	4	118	4	0	126	250
05:30 PM	2	5	3	0	10	4	127	2	0	133	2	4	2	0	8	5	93	4	0	102	253
05:45 PM	3	2	4	0	9	3	113	2	0	118	2	3	6	0	11	2	120	2	0	124	262
Total Volume	12	12	9	0	33	17	456	10	0	483	5	15	12	0	32	13	435	13	0	461	1009
% App. Total	36.4	36.4	27.3	0		3.5	94.4	2.1	0		15.6	46.9	37.5	0		2.8	94.4	2.8	0		
PHF	.600	.600	.563	.000	.825	.850	.898	.500	.000	.908	.625	.625	.500	.000	.727	.650	.906	.813	.000	.915	.963

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Traffic Data Service

Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 11AM FINAL
Site Code : 00000011
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	BAY DR Southbound					IOWA DR Westbound					BAY DR Northbound					NOBEL DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	2	29	1	0	32	5	1	4	0	10	4	38	2	0	44	5	3	1	0	9	95
07:15 AM	3	41	2	0	46	0	1	0	0	1	5	62	5	0	72	12	9	3	0	24	143
07:30 AM	4	62	2	0	68	3	3	6	0	12	9	100	5	0	114	16	15	8	0	39	233
07:45 AM	2	82	1	0	85	1	7	6	0	14	8	163	3	0	174	19	12	15	0	46	319
Total	11	214	6	0	231	9	12	16	0	37	26	363	15	0	404	52	39	27	0	118	790
08:00 AM	5	96	6	0	107	5	5	5	0	15	25	159	12	0	196	16	25	9	0	50	368
08:15 AM	3	59	2	0	64	7	8	11	0	26	9	123	8	0	140	10	2	8	0	20	250
08:30 AM	1	62	5	0	68	1	2	4	0	7	24	112	7	0	143	12	5	7	0	24	242
08:45 AM	3	72	0	0	75	1	5	6	0	12	9	134	9	0	152	10	9	12	0	31	270
Total	12	289	13	0	314	14	20	26	0	60	67	528	36	0	631	48	41	36	0	125	1130
Grand Total	23	503	19	0	545	23	32	42	0	97	93	891	51	0	1035	100	80	63	0	243	1920
Apprch %	4.2	92.3	3.5	0		23.7	33	43.3	0		9	86.1	4.9	0		41.2	32.9	25.9	0		
Total %	1.2	26.2	1	0	28.4	1.2	1.7	2.2	0	5.1	4.8	46.4	2.7	0	53.9	5.2	4.2	3.3	0	12.7	

	BAY DR Southbound					IOWA DR Westbound					BAY DR Northbound					NOBEL DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	2	82	1	0	85	1	7	6	0	14	8	163	3	0	174	19	12	15	0	46	319
08:00 AM	5	96	6	0	107	5	5	5	0	15	25	159	12	0	196	16	25	9	0	50	368
08:15 AM	3	59	2	0	64	7	8	11	0	26	9	123	8	0	140	10	2	8	0	20	250
08:30 AM	1	62	5	0	68	1	2	4	0	7	24	112	7	0	143	12	5	7	0	24	242
Total Volume	11	299	14	0	324	14	22	26	0	62	66	557	30	0	653	57	44	39	0	140	1179
% App. Total	3.4	92.3	4.3	0		22.6	35.5	41.9	0		10.1	85.3	4.6	0		40.7	31.4	27.9	0		
PHF	.550	.779	.583	.000	.757	.500	.688	.591	.000	.596	.660	.854	.625	.000	.833	.750	.440	.650	.000	.700	.801

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Traffic Data Service
Campbell, CA
(408) 377-2988
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File Name : 11PM FINAL
Site Code : 00000011
Start Date : 11/14/2007
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Groups Printed- Vehicles

	BAY DR Southbound					IOWA DR Westbound					BAY DR Northbound					NOBEL DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	7	122	4	0	133	2	13	6	0	21	8	61	5	0	74	12	7	4	0	23	251
04:15 PM	5	111	1	0	117	0	9	9	0	18	9	87	12	0	108	14	3	7	0	24	267
04:30 PM	8	130	3	0	141	3	10	9	0	22	11	113	17	0	141	14	4	6	0	24	328
04:45 PM	12	195	5	0	212	2	11	13	0	26	13	123	8	1	145	11	5	8	0	24	407
Total	32	558	13	0	603	7	43	37	0	87	41	384	42	1	468	51	19	25	0	95	1253
05:00 PM	18	249	3	0	270	5	6	8	0	19	6	74	14	0	94	22	5	5	0	32	415
05:15 PM	4	194	6	0	204	4	9	7	0	20	8	96	17	0	121	12	4	10	0	26	371
05:30 PM	10	167	3	0	180	1	4	9	0	14	11	84	18	1	114	20	5	8	0	33	341
05:45 PM	10	106	4	0	120	1	14	6	0	21	8	73	23	0	104	12	7	9	0	28	273
Total	42	716	16	0	774	11	33	30	0	74	33	327	72	1	433	66	21	32	0	119	1400
Grand Total	74	1274	29	0	1377	18	76	67	0	161	74	711	114	2	901	117	40	57	0	214	2653
Apprch %	5.4	92.5	2.1	0		11.2	47.2	41.6	0		8.2	78.9	12.7	0.2		54.7	18.7	26.6	0		
Total %	2.8	48	1.1	0	51.9	0.7	2.9	2.5	0	6.1	2.8	26.8	4.3	0.1	34	4.4	1.5	2.1	0	8.1	

	BAY DR Southbound					IOWA DR Westbound					BAY DR Northbound					NOBEL DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	12	195	5	0	212	2	11	13	0	26	13	123	8	1	145	11	5	8	0	24	407
05:00 PM	18	249	3	0	270	5	6	8	0	19	6	74	14	0	94	22	5	5	0	32	415
05:15 PM	4	194	6	0	204	4	9	7	0	20	8	96	17	0	121	12	4	10	0	26	371
05:30 PM	10	167	3	0	180	1	4	9	0	14	11	84	18	1	114	20	5	8	0	33	341
Total Volume	44	805	17	0	866	12	30	37	0	79	38	377	57	2	474	65	19	31	0	115	1534
% App. Total	5.1	93	2	0		15.2	38	46.8	0		8	79.5	12	0.4		56.5	16.5	27	0		
PHF	.611	.808	.708	.000	.802	.600	.682	.712	.000	.760	.731	.766	.792	.500	.817	.739	.950	.775	.000	.871	.924

Traffic Data Service
Campbell, CA
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File Name : 12AM FINAL
Site Code : 00000012
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	BAY DR Southbound					ESCALONA DR Westbound					BAY DR Northbound					ESCALONA DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	2	31	5	0	38	4	3	1	0	8	1	50	1	0	52	9	5	0	0	14	112
07:15 AM	4	53	17	0	74	8	0	1	0	9	1	56	7	0	64	11	5	4	0	20	167
07:30 AM	3	67	36	0	106	18	1	0	0	19	5	96	3	0	104	10	5	3	0	18	247
07:45 AM	9	90	17	0	116	20	8	1	0	29	3	174	4	0	181	11	8	4	0	23	349
Total	18	241	75	0	334	50	12	3	0	65	10	376	15	0	401	41	23	11	0	75	875
08:00 AM	8	93	9	0	110	14	4	2	0	20	3	166	4	0	173	12	9	2	0	23	326
08:15 AM	5	68	2	0	75	17	5	0	0	22	1	127	7	0	135	10	5	1	0	16	248
08:30 AM	5	81	6	0	92	13	1	0	0	14	3	151	5	0	159	10	4	1	0	15	280
08:45 AM	4	72	4	0	80	11	1	0	0	12	12	135	5	0	152	2	5	1	0	8	252
Total	22	314	21	0	357	55	11	2	0	68	19	579	21	0	619	34	23	5	0	62	1106
Grand Total	40	555	96	0	691	105	23	5	0	133	29	955	36	0	1020	75	46	16	0	137	1981
Apprch %	5.8	80.3	13.9	0		78.9	17.3	3.8	0		2.8	93.6	3.5	0		54.7	33.6	11.7	0		
Total %	2	28	4.8	0	34.9	5.3	1.2	0.3	0	6.7	1.5	48.2	1.8	0	51.5	3.8	2.3	0.8	0	6.9	

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 07:45 AM

	BAY DR Southbound					ESCALONA DR Westbound					BAY DR Northbound					ESCALONA DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:45 AM	9	90	17	0	116	20	8	1	0	29	3	174	4	0	181	11	8	4	0	23	349
08:00 AM	8	93	9	0	110	14	4	2	0	20	3	166	4	0	173	12	9	2	0	23	326
08:15 AM	5	68	2	0	75	17	5	0	0	22	1	127	7	0	135	10	5	1	0	16	248
08:30 AM	5	81	6	0	92	13	1	0	0	14	3	151	5	0	159	10	4	1	0	15	280
Total Volume	27	332	34	0	393	64	18	3	0	85	10	618	20	0	648	43	26	8	0	77	1203
% App. Total	6.9	84.5	8.7	0		75.3	21.2	3.5	0		1.5	95.4	3.1	0		55.8	33.8	10.4	0		
PHF	.750	.892	.500	.000	.847	.800	.563	.375	.000	.733	.833	.888	.714	.000	.895	.896	.722	.500	.000	.837	.862

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Traffic Data Service

Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 12PM FINAL
Site Code : 00000012
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	BAY DR Southbound					ESCALONA DR Westbound					BAY DR Northbound					ESCALONA DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	11	110	12	0	133	9	3	5	0	17	1	64	9	0	74	7	0	0	0	7	231
04:15 PM	7	136	25	0	168	13	6	1	0	20	5	66	12	0	83	6	0	0	0	6	277
04:30 PM	20	129	21	0	170	4	8	5	0	17	0	88	0	0	88	9	4	2	0	15	290
04:45 PM	28	157	34	0	219	3	5	8	0	16	0	107	2	0	109	8	8	2	0	18	362
Total	66	532	92	0	690	29	22	19	0	70	6	325	23	0	354	30	12	4	0	46	1160
05:00 PM	16	160	31	0	207	10	4	1	0	15	0	123	11	0	134	17	4	0	0	21	377
05:15 PM	7	159	25	0	191	14	2	1	0	17	3	142	8	0	153	7	1	0	0	8	369
05:30 PM	7	169	16	0	192	17	3	1	0	21	11	119	11	0	141	5	2	2	0	9	363
05:45 PM	8	166	14	0	188	7	0	2	0	9	0	85	12	0	97	5	6	2	0	13	307
Total	38	654	86	0	778	48	9	5	0	62	14	469	42	0	525	34	13	4	0	51	1416
Grand Total	104	1186	178	0	1468	77	31	24	0	132	20	794	65	0	879	64	25	8	0	97	2576
Apprch %	7.1	80.8	12.1	0		58.3	23.5	18.2	0		2.3	90.3	7.4	0		66	25.8	8.2	0		
Total %	4	46	6.9	0	57	3	1.2	0.9	0	5.1	0.8	30.8	2.5	0	34.1	2.5	1	0.3	0	3.8	

	BAY DR Southbound					ESCALONA DR Westbound					BAY DR Northbound					ESCALONA DR Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	28	157	34	0	219	3	5	8	0	16	0	107	2	0	109	8	8	2	0	18	362
05:00 PM	16	160	31	0	207	10	4	1	0	15	0	123	11	0	134	17	4	0	0	21	377
05:15 PM	7	159	25	0	191	14	2	1	0	17	3	142	8	0	153	7	1	0	0	8	369
05:30 PM	7	169	16	0	192	17	3	1	0	21	11	119	11	0	141	5	2	2	0	9	363
Total Volume	58	645	106	0	809	44	14	11	0	69	14	491	32	0	537	37	15	4	0	56	1471
% App. Total	7.2	79.7	13.1	0		63.8	20.3	15.9	0		2.6	91.4	6	0		66.1	26.8	7.1	0		
PHF	.518	.954	.779	.000	.924	.647	.700	.344	.000	.821	.318	.864	.727	.000	.877	.544	.469	.500	.000	.667	.975

(12)

Traffic Data Service
Campbell, CA

(408) 377-2988
tdsbay@cs.com

File Name : 13AM FINAL
Site Code : 00000013
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	BAY DR Southbound					KING ST Westbound					BAY DR Northbound					KING ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	1	23	7	0	31	9	8	1	0	18	5	36	0	0	41	1	14	3	0	18	108
07:15 AM	1	29	12	0	42	16	6	7	0	29	3	81	1	0	85	2	21	8	0	31	187
07:30 AM	0	52	19	0	71	25	15	9	0	49	13	97	2	0	112	1	35	2	0	38	270
07:45 AM	2	65	22	0	89	43	17	22	0	82	8	131	2	0	141	2	30	13	0	45	357
Total	4	169	60	0	233	93	46	39	0	178	29	345	5	0	379	6	100	26	0	132	922
08:00 AM	2	78	29	0	109	35	23	15	0	73	8	95	2	0	105	5	27	18	0	50	337
08:15 AM	3	70	32	0	105	33	22	16	0	71	7	98	3	0	108	5	22	5	0	32	316
08:30 AM	2	64	18	0	84	30	20	8	0	58	9	71	2	0	82	4	18	5	0	27	251
08:45 AM	1	62	21	0	84	22	17	4	0	43	13	74	0	0	87	3	29	8	0	40	254
Total	8	274	100	0	382	120	82	43	0	245	37	338	7	0	382	17	96	36	0	149	1158
Grand Total	12	443	160	0	615	213	128	82	0	423	66	683	12	0	761	23	196	62	0	281	2080
Apprch %	2	72	26	0		50.4	30.3	19.4	0		8.7	89.8	1.6	0		8.2	69.8	22.1	0		
Total %	0.6	21.3	7.7	0	29.6	10.2	6.2	3.9	0	20.3	3.2	32.8	0.6	0	36.6	1.1	9.4	3	0	13.5	

Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 07:30 AM

	BAY DR Southbound					KING ST Westbound					BAY DR Northbound					KING ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:30 AM	0	52	19	0	71	25	15	9	0	49	13	97	2	0	112	1	35	2	0	38	270
07:45 AM	2	65	22	0	89	43	17	22	0	82	8	131	2	0	141	2	30	13	0	45	357
08:00 AM	2	78	29	0	109	35	23	15	0	73	8	95	2	0	105	5	27	18	0	50	337
08:15 AM	3	70	32	0	105	33	22	16	0	71	7	98	3	0	108	5	22	5	0	32	316
Total Volume	7	265	102	0	374	136	77	62	0	275	36	421	9	0	466	13	114	38	0	165	1280
% App. Total	1.9	70.9	27.3	0		49.5	28	22.5	0		7.7	90.3	1.9	0		7.9	69.1	23	0		
PHF	.583	.849	.797	.000	.858	.791	.837	.705	.000	.838	.692	.803	.750	.000	.826	.650	.814	.528	.000	.825	.896

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Traffic Data Service

Campbell, CA

(408) 377-2988
tdsbay@cs.com

File Name : 13PM FINAL
Site Code : 00000013
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	BAY DR Southbound					KING ST Westbound					BAY DR Northbound					KING ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	5	77	37	0	119	15	34	26	0	75	13	72	0	0	85	7	27	5	0	39	318
04:15 PM	1	110	36	0	147	25	27	12	0	64	12	83	1	0	96	2	34	9	0	45	352
04:30 PM	0	98	34	0	132	20	34	11	0	65	5	68	3	0	76	6	21	4	0	31	304
04:45 PM	11	124	44	0	179	32	26	12	0	70	8	87	2	0	97	1	27	4	0	32	378
Total	17	409	151	0	577	92	121	61	0	274	38	310	6	0	354	16	109	22	0	147	1352
05:00 PM	4	96	47	0	147	36	33	5	0	74	13	89	4	0	106	4	21	6	0	31	358
05:15 PM	8	112	38	0	158	43	33	8	0	84	14	103	5	0	122	3	24	10	0	37	401
05:30 PM	10	113	32	0	155	27	26	9	0	62	11	108	0	0	119	4	23	7	0	34	370
05:45 PM	7	120	39	0	166	24	29	12	0	65	9	70	4	0	83	2	20	4	0	26	340
Total	29	441	156	0	626	130	121	34	0	285	47	370	13	0	430	13	88	27	0	128	1469
Grand Total	46	850	307	0	1203	222	242	95	0	559	85	680	19	0	784	29	197	49	0	275	2821
Apprch %	3.8	70.7	25.5	0		39.7	43.3	17	0		10.8	86.7	2.4	0		10.5	71.6	17.8	0		
Total %	1.6	30.1	10.9	0	42.6	7.9	8.6	3.4	0	19.8	3	24.1	0.7	0	27.8	1	7	1.7	0	9.7	

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 04:45 PM

	BAY DR Southbound					KING ST Westbound					BAY DR Northbound					KING ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:45 PM	11	124	44	0	179	32	26	12	0	70	8	87	2	0	97	1	27	4	0	32	378
05:00 PM	4	96	47	0	147	36	33	5	0	74	13	89	4	0	106	4	21	6	0	31	358
05:15 PM	8	112	38	0	158	43	33	8	0	84	14	103	5	0	122	3	24	10	0	37	401
05:30 PM	10	113	32	0	155	27	26	9	0	62	11	108	0	0	119	4	23	7	0	34	370
Total Volume	33	445	161	0	639	138	118	34	0	290	46	387	11	0	444	12	95	27	0	134	1507
% App. Total	5.2	69.6	25.2	0		47.6	40.7	11.7	0		10.4	87.2	2.5	0		9	70.9	20.1	0		
PHF	.750	.897	.856	.000	.892	.802	.894	.708	.000	.863	.821	.896	.550	.000	.910	.750	.880	.675	.000	.905	.940

13

Traffic Data Service

Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 14AM FINAL
Site Code : 00000014
Start Date : 10/30/2007
Page No : 1

Groups Printed- Vehicles

	BAY ST Southbound					MISSION ST Westbound					BAY ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	7	9	19	0	35	31	147	6	0	184	22	16	3	0	41	3	134	4	0	141	401
07:15 AM	6	8	15	0	29	57	168	12	0	237	20	23	5	0	48	9	156	11	0	176	490
07:30 AM	6	15	30	0	51	59	197	15	0	271	17	39	6	0	62	5	212	22	1	240	624
07:45 AM	8	35	51	0	94	42	185	35	0	262	18	54	16	0	88	14	213	18	0	245	689
Total	27	67	115	0	209	189	697	68	0	954	77	132	30	0	239	31	715	55	1	802	2204
08:00 AM	12	33	28	0	73	50	204	34	0	288	17	33	20	0	70	14	191	24	0	229	660
08:15 AM	18	34	33	0	85	38	187	38	0	263	26	22	17	0	65	25	175	20	0	220	633
08:30 AM	13	20	31	0	64	41	199	30	0	270	22	26	21	0	69	13	194	17	0	224	627
08:45 AM	18	17	28	0	63	45	167	14	0	226	13	29	9	0	51	12	184	20	0	216	556
Total	61	104	120	0	285	174	757	116	0	1047	78	110	67	0	255	64	744	81	0	889	2476
Grand Total	88	171	235	0	494	363	1454	184	0	2001	155	242	97	0	494	95	1459	136	1	1691	4680
Apprch %	17.8	34.6	47.6	0		18.1	72.7	9.2	0		31.4	49	19.6	0		5.6	86.3	8	0.1		
Total %	1.9	3.7	5	0	10.6	7.8	31.1	3.9	0	42.8	3.3	5.2	2.1	0	10.6	2	31.2	2.9	0	36.1	

	BAY ST Southbound					MISSION ST Westbound					BAY ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	8	35	51	0	94	42	185	35	0	262	18	54	16	0	88	14	213	18	0	245	689
08:00 AM	12	33	28	0	73	50	204	34	0	288	17	33	20	0	70	14	191	24	0	229	660
08:15 AM	18	34	33	0	85	38	187	38	0	263	26	22	17	0	65	25	175	20	0	220	633
08:30 AM	13	20	31	0	64	41	199	30	0	270	22	26	21	0	69	13	194	17	0	224	627
Total Volume	51	122	143	0	316	171	775	137	0	1083	83	135	74	0	292	66	773	79	0	918	2609
% App. Total	16.1	38.6	45.3	0		15.8	71.6	12.7	0		28.4	46.2	25.3	0		7.2	84.2	8.6	0		
PHF	.708	.871	.701	.000	.840	.855	.950	.901	.000	.940	.798	.625	.881	.000	.830	.660	.907	.823	.000	.937	.947

Traffic Data Service

Campbell, CA

(408) 377-2988

tdsbay@cs.com

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File Name : 14PM FINAL
Site Code : 00000014
Start Date : 10/30/2007
Page No : 1

Groups Printed- Vehicles

	BAY ST Southbound					MISSION ST Westbound					BAY ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	32	36	63	0	131	30	248	42	0	320	18	16	24	0	58	9	246	17	0	272	781
04:15 PM	38	32	65	0	135	35	221	26	0	282	14	23	17	0	54	14	193	25	0	232	703
04:30 PM	30	38	57	0	125	30	239	34	0	303	12	25	18	0	55	14	251	25	0	290	773
04:45 PM	29	28	54	0	111	42	222	48	0	312	28	20	20	0	68	11	218	17	0	246	737
Total	129	134	239	0	502	137	930	150	0	1217	72	84	79	0	235	48	908	84	0	1040	2994
05:00 PM	20	28	42	0	90	59	217	28	0	304	11	24	25	0	60	16	239	33	0	288	742
05:15 PM	26	31	58	0	115	51	209	24	0	284	17	26	17	0	60	19	230	33	0	282	741
05:30 PM	24	31	56	0	111	59	229	40	0	328	18	41	28	0	87	17	236	24	0	277	803
05:45 PM	29	37	66	0	132	59	207	33	0	299	12	43	22	0	77	15	197	38	0	250	758
Total	99	127	222	0	448	228	862	125	0	1215	58	134	92	0	284	67	902	128	0	1097	3044
Grand Total	228	261	461	0	950	365	1792	275	0	2432	130	218	171	0	519	115	1810	212	0	2137	6038
Apprch %	24	27.5	48.5	0		15	73.7	11.3	0		25	42	32.9	0		5.4	84.7	9.9	0		
Total %	3.8	4.3	7.6	0	15.7	6	29.7	4.6	0	40.3	2.2	3.6	2.8	0	8.6	1.9	30	3.5	0	35.4	

	BAY ST Southbound					MISSION ST Westbound					BAY ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	20	28	42	0	90	59	217	28	0	304	11	24	25	0	60	16	239	33	0	288	742
05:15 PM	26	31	58	0	115	51	209	24	0	284	17	26	17	0	60	19	230	33	0	282	741
05:30 PM	24	31	56	0	111	59	229	40	0	328	18	41	28	0	87	17	236	24	0	277	803
05:45 PM	29	37	66	0	132	59	207	33	0	299	12	43	22	0	77	15	197	38	0	250	758
Total Volume	99	127	222	0	448	228	862	125	0	1215	58	134	92	0	284	67	902	128	0	1097	3044
% App. Total	22.1	28.3	49.6	0		18.8	70.9	10.3	0		20.4	47.2	32.4	0		6.1	82.2	11.7	0		
PHF	.853	.858	.841	.000	.848	.966	.941	.781	.000	.926	.806	.779	.821	.000	.816	.882	.944	.842	.000	.952	.948

(14)

Traffic Data Service
Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 17AM FINAL (REV)
Site Code : 00000017
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	LAUREL ST Southbound					MISSION ST Westbound					LAUREL ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	4	26	23	0	53	3	174	6	0	183	17	58	61	0	136	34	289	4	0	327	699
07:15 AM	0	28	17	0	45	1	193	2	0	196	13	67	82	0	162	55	233	1	0	289	692
07:30 AM	1	17	10	0	28	0	195	4	0	199	6	29	53	0	88	35	230	6	0	271	586
07:45 AM	2	23	11	0	36	1	228	28	0	257	10	29	73	0	112	31	226	0	0	257	662
Total	7	94	61	0	162	5	790	40	0	835	46	183	269	0	498	155	978	11	0	1144	2639
08:00 AM	2	23	2	0	27	1	225	8	0	234	26	34	61	0	121	40	257	1	0	298	680
08:15 AM	1	28	4	0	33	5	217	11	0	233	10	33	43	0	86	43	259	1	0	303	655
08:30 AM	0	14	1	0	15	7	211	16	0	234	10	24	51	0	85	33	287	1	0	321	655
08:45 AM	1	23	11	0	35	4	220	7	0	231	6	28	92	0	126	42	238	1	0	281	673
Total	4	88	18	0	110	17	873	42	0	932	52	119	247	0	418	158	1041	4	0	1203	2663
Grand Total	11	182	79	0	272	22	1663	82	0	1767	98	302	516	0	916	313	2019	15	0	2347	5302
Apprch %	4	66.9	29	0		1.2	94.1	4.6	0		10.7	33	56.3	0		13.3	86	0.6	0		
Total %	0.2	3.4	1.5	0	5.1	0.4	31.4	1.5	0	33.3	1.8	5.7	9.7	0	17.3	5.9	38.1	0.3	0	44.3	

	LAUREL ST Southbound					MISSION ST Westbound					LAUREL ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	2	23	2	0	27	1	225	8	0	234	26	34	61	0	121	40	257	1	0	298	680
08:15 AM	1	28	4	0	33	5	217	11	0	233	10	33	43	0	86	43	259	1	0	303	655
08:30 AM	0	14	1	0	15	7	211	16	0	234	10	24	51	0	85	33	287	1	0	321	655
08:45 AM	1	23	11	0	35	4	220	7	0	231	6	28	92	0	126	42	238	1	0	281	673
Total Volume	4	88	18	0	110	17	873	42	0	932	52	119	247	0	418	158	1041	4	0	1203	2663
% App. Total	3.6	80	16.4	0		1.8	93.7	4.5	0		12.4	28.5	59.1	0		13.1	86.5	0.3	0		
PHF	.500	.786	.409	.000	.786	.607	.970	.656	.000	.996	.500	.875	.671	.000	.829	.919	.907	1.000	.000	.937	.979

(14)

Traffic Data Service

Campbell, CA
(408) 377-2988
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File Name : 17PM FINAL (REV)
Site Code : 00000017
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	LAUREL ST Southbound					MISSION ST Westbound					LAUREL ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	5	15	3	0	23	3	297	16	0	316	15	52	32	0	99	59	297	10	0	366	804
04:15 PM	5	35	1	0	41	2	321	17	0	340	7	58	88	0	153	69	321	9	0	399	933
04:30 PM	3	28	3	0	34	7	298	13	0	318	5	35	36	0	76	40	336	2	0	378	806
04:45 PM	2	61	9	0	72	9	298	13	0	320	11	69	83	0	163	81	313	2	0	396	951
Total	15	139	16	0	170	21	1214	59	0	1294	38	214	239	0	491	249	1267	23	0	1539	3494
05:00 PM	10	67	5	0	82	6	276	41	0	323	15	57	84	0	156	162	295	6	0	463	1024
05:15 PM	17	53	8	0	78	4	234	36	0	274	21	102	87	0	210	117	251	2	0	370	932
05:30 PM	4	45	17	0	66	10	283	34	0	327	12	86	141	0	239	164	320	1	0	485	1117
05:45 PM	1	45	3	0	49	17	294	31	0	342	7	47	123	0	177	107	321	0	0	428	996
Total	32	210	33	0	275	37	1087	142	0	1266	55	292	435	0	782	550	1187	9	0	1746	4069
Grand Total	47	349	49	0	445	58	2301	201	0	2560	93	506	674	0	1273	799	2454	32	0	3285	7563
Apprch %	10.6	78.4	11	0		2.3	89.9	7.9	0		7.3	39.7	52.9	0		24.3	74.7	1	0		
Total %	0.6	4.6	0.6	0	5.9	0.8	30.4	2.7	0	33.8	1.2	6.7	8.9	0	16.8	10.6	32.4	0.4	0	43.4	

	LAUREL ST Southbound					MISSION ST Westbound					LAUREL ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	10	67	5	0	82	6	276	41	0	323	15	57	84	0	156	162	295	6	0	463	1024
05:15 PM	17	53	8	0	78	4	234	36	0	274	21	102	87	0	210	117	251	2	0	370	932
05:30 PM	4	45	17	0	66	10	283	34	0	327	12	86	141	0	239	164	320	1	0	485	1117
05:45 PM	1	45	3	0	49	17	294	31	0	342	7	47	123	0	177	107	321	0	0	428	996
Total Volume	32	210	33	0	275	37	1087	142	0	1266	55	292	435	0	782	550	1187	9	0	1746	4069
% App. Total	11.6	76.4	12	0		2.9	85.9	11.2	0		7	37.3	55.6	0		31.5	68	0.5	0		
PHF	.471	.784	.485	.000	.838	.544	.924	.866	.000	.925	.655	.716	.771	.000	.818	.838	.924	.375	.000	.900	.911

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Traffic Data Service

Campbell, CA
(408) 377-2988
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File Name : 18AM FINAL (REV)
Site Code : 00000018
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	WALNUT AVE Southbound					MISSION ST Westbound					WALNUT AVE Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	2	13	6	0	21	1	187	15	0	203	11	6	3	0	20	5	213	1	0	219	463
07:15 AM	2	26	10	0	38	2	205	18	0	225	10	1	2	0	13	8	234	3	0	245	521
07:30 AM	1	43	11	0	55	2	234	23	0	259	12	21	10	0	43	16	217	9	0	242	599
07:45 AM	2	32	15	0	49	3	267	26	0	296	19	30	20	0	69	15	215	2	0	232	646
Total	7	114	42	0	163	8	893	82	0	983	52	58	35	0	145	44	879	15	0	938	2229
08:00 AM	2	27	19	0	48	2	251	15	0	268	11	15	8	0	34	9	245	2	0	256	606
08:15 AM	2	21	12	0	35	5	248	6	0	259	15	9	8	0	32	10	261	2	0	273	599
08:30 AM	1	11	10	0	22	6	249	10	0	265	12	12	11	0	35	8	276	3	0	287	609
08:45 AM	4	19	11	0	34	3	251	6	0	260	16	7	6	0	29	1	235	5	0	241	564
Total	9	78	52	0	139	16	999	37	0	1052	54	43	33	0	130	28	1017	12	0	1057	2378
Grand Total	16	192	94	0	302	24	1892	119	0	2035	106	101	68	0	275	72	1896	27	0	1995	4607
Apprch %	5.3	63.6	31.1	0		1.2	93	5.8	0		38.5	36.7	24.7	0		3.6	95	1.4	0		
Total %	0.3	4.2	2	0	6.6	0.5	41.1	2.6	0	44.2	2.3	2.2	1.5	0	6	1.6	41.2	0.6	0	43.3	

	WALNUT AVE Southbound					MISSION ST Westbound					WALNUT AVE Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	2	32	15	0	49	3	267	26	0	296	19	30	20	0	69	15	215	2	0	232	646
08:00 AM	2	27	19	0	48	2	251	15	0	268	11	15	8	0	34	9	245	2	0	256	606
08:15 AM	2	21	12	0	35	5	248	6	0	259	15	9	8	0	32	10	261	2	0	273	599
08:30 AM	1	11	10	0	22	6	249	10	0	265	12	12	11	0	35	8	276	3	0	287	609
Total Volume	7	91	56	0	154	16	1015	57	0	1088	57	66	47	0	170	42	997	9	0	1048	2460
% App. Total	4.5	59.1	36.4	0		1.5	93.3	5.2	0		33.5	38.8	27.6	0		4	95.1	0.9	0		
PHF	.875	.711	.737	.000	.786	.667	.950	.548	.000	.919	.750	.550	.588	.000	.616	.700	.903	.750	.000	.913	.952

Traffic Data Service
Campbell, CA
(408) 377-2988
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File Name : 18PM FINAL (REV)
Site Code : 00000018
Start Date : 11/14/2007
Page No : 1

Groups Printed- Vehicles

	WALNUT AVE Southbound					MISSION ST Westbound					WALNUT AVE Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	2	10	12	0	24	4	324	3	0	331	10	26	16	0	52	9	311	2	0	322	729
04:15 PM	4	16	13	0	33	5	365	1	0	371	17	25	15	0	57	10	355	3	0	368	829
04:30 PM	1	12	15	0	28	4	341	8	0	353	15	26	16	0	57	12	331	1	0	344	782
04:45 PM	5	14	14	0	33	6	341	1	0	348	12	31	15	0	58	12	334	5	0	351	790
Total	12	52	54	0	118	19	1371	13	0	1403	54	108	62	0	224	43	1331	11	0	1385	3130
05:00 PM	1	9	12	0	22	3	467	5	0	475	14	27	20	0	61	15	354	2	0	371	929
05:15 PM	3	16	11	0	30	4	363	3	0	370	16	25	20	0	61	11	341	4	0	356	817
05:30 PM	1	12	10	0	23	2	412	9	0	423	13	25	27	0	65	12	364	1	0	377	888
05:45 PM	3	17	12	0	32	10	371	8	0	389	15	36	25	0	76	10	345	3	0	358	855
Total	8	54	45	0	107	19	1613	25	0	1657	58	113	92	0	263	48	1404	10	0	1462	3489
Grand Total	20	106	99	0	225	38	2984	38	0	3060	112	221	154	0	487	91	2735	21	0	2847	6619
Apprch %	8.9	47.1	44	0		1.2	97.5	1.2	0		23	45.4	31.6	0		3.2	96.1	0.7	0		
Total %	0.3	1.6	1.5	0	3.4	0.6	45.1	0.6	0	46.2	1.7	3.3	2.3	0	7.4	1.4	41.3	0.3	0	43	

Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 05:00 PM

	WALNUT AVE Southbound					MISSION ST Westbound					WALNUT AVE Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
05:00 PM	1	9	12	0	22	3	467	5	0	475	14	27	20	0	61	15	354	2	0	371	929
05:15 PM	3	16	11	0	30	4	363	3	0	370	16	25	20	0	61	11	341	4	0	356	817
05:30 PM	1	12	10	0	23	2	412	9	0	423	13	25	27	0	65	12	364	1	0	377	888
05:45 PM	3	17	12	0	32	10	371	8	0	389	15	36	25	0	76	10	345	3	0	358	855
Total Volume	8	54	45	0	107	19	1613	25	0	1657	58	113	92	0	263	48	1404	10	0	1462	3489
% App. Total	7.5	50.5	42.1	0		1.1	97.3	1.5	0		22.1	43	35	0		3.3	96	0.7	0		
PHF	.667	.794	.938	.000	.836	.475	.863	.694	.000	.872	.906	.785	.852	.000	.865	.800	.964	.625	.000	.969	.939

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Traffic Data Service
Campbell, CA
(408) 377-2988
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File Name : 15AM FINAL
Site Code : 00000015
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	BAY ST Southbound					CALIFORNIA ST Westbound					BAY ST Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	0	18	4	0	22	7	0	20	0	27	87	71	0	0	158	0	0	3	0	3	210
07:15 AM	0	40	20	0	60	28	0	27	0	55	102	105	0	0	207	0	0	0	0	0	322
07:30 AM	0	53	19	0	72	18	0	25	0	43	78	72	0	0	150	0	0	0	0	0	265
07:45 AM	0	75	32	0	107	26	0	18	0	44	53	55	0	0	108	0	0	0	0	0	259
Total	0	186	75	0	261	79	0	90	0	169	320	303	0	0	623	0	0	3	0	3	1056
08:00 AM	0	55	24	0	79	14	0	29	0	43	59	47	0	0	106	0	0	0	0	0	228
08:15 AM	0	37	15	0	52	25	0	18	0	43	59	52	0	0	111	0	0	0	0	0	206
08:30 AM	0	24	8	0	32	5	0	15	0	20	50	48	0	0	98	0	0	0	0	0	150
08:45 AM	0	34	8	0	42	8	0	22	0	30	49	34	0	0	83	0	0	0	0	0	155
Total	0	150	55	0	205	52	0	84	0	136	217	181	0	0	398	0	0	0	0	0	739
Grand Total	0	336	130	0	466	131	0	174	0	305	537	484	0	0	1021	0	0	3	0	3	1795
Apprch %	0	72.1	27.9	0		43	0	57	0		52.6	47.4	0	0		0	0	100	0		
Total %	0	18.7	7.2	0	26	7.3	0	9.7	0	17	29.9	27	0	0	56.9	0	0	0.2	0	0.2	

	BAY ST Southbound					CALIFORNIA ST Westbound					BAY ST Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:15 AM																					
07:15 AM	0	40	20	0	60	28	0	27	0	55	102	105	0	0	207	0	0	0	0	0	322
07:30 AM	0	53	19	0	72	18	0	25	0	43	78	72	0	0	150	0	0	0	0	0	265
07:45 AM	0	75	32	0	107	26	0	18	0	44	53	55	0	0	108	0	0	0	0	0	259
08:00 AM	0	55	24	0	79	14	0	29	0	43	59	47	0	0	106	0	0	0	0	0	228
Total Volume	0	223	95	0	318	86	0	99	0	185	292	279	0	0	571	0	0	0	0	0	1074
% App. Total	0	70.1	29.9	0		46.5	0	53.5	0		51.1	48.9	0	0		0	0	0	0		
PHF	.000	.743	.742	.000	.743	.768	.000	.853	.000	.841	.716	.664	.000	.000	.690	.000	.000	.000	.000	.000	.834

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Traffic Data Service

Campbell, CA

(408) 377-2988

tdsbay@cs.com

File Name : 15PM FINAL
Site Code : 00000015
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	BAY ST Southbound					CALIFORNIA ST Westbound					BAY ST Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	0	71	16	0	87	22	0	32	0	54	52	45	0	0	97	0	0	0	0	0	238
04:15 PM	0	81	14	0	95	21	0	38	0	59	91	56	0	0	147	0	0	0	0	0	301
04:30 PM	0	60	16	0	76	18	0	49	0	67	59	54	0	0	113	0	0	0	0	0	256
04:45 PM	0	79	19	0	98	23	0	42	0	65	77	61	0	0	138	0	0	0	0	0	301
Total	0	291	65	0	356	84	0	161	0	245	279	216	0	0	495	0	0	0	0	0	1096
05:00 PM	0	84	17	0	101	26	0	46	0	72	74	54	0	0	128	0	0	0	0	0	301
05:15 PM	0	73	15	0	88	30	0	51	0	81	51	81	0	0	132	0	0	0	0	0	301
05:30 PM	0	79	20	0	99	13	0	43	0	56	66	49	0	0	115	0	0	0	0	0	270
05:45 PM	0	73	16	0	89	20	0	28	0	48	30	50	0	0	80	0	0	0	0	0	217
Total	0	309	68	0	377	89	0	168	0	257	221	234	0	0	455	0	0	0	0	0	1089
Grand Total	0	600	133	0	733	173	0	329	0	502	500	450	0	0	950	0	0	0	0	0	2185
Apprch %	0	81.9	18.1	0		34.5	0	65.5	0		52.6	47.4	0	0		0	0	0	0		
Total %	0	27.5	6.1	0	33.5	7.9	0	15.1	0	23	22.9	20.6	0	0	43.5	0	0	0	0	0	

	BAY ST Southbound					CALIFORNIA ST Westbound					BAY ST Northbound					Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	79	19	0	98	23	0	42	0	65	77	61	0	0	138	0	0	0	0	0	301
05:00 PM	0	84	17	0	101	26	0	46	0	72	74	54	0	0	128	0	0	0	0	0	301
05:15 PM	0	73	15	0	88	30	0	51	0	81	51	81	0	0	132	0	0	0	0	0	301
05:30 PM	0	79	20	0	99	13	0	43	0	56	66	49	0	0	115	0	0	0	0	0	270
Total Volume	0	315	71	0	386	92	0	182	0	274	268	245	0	0	513	0	0	0	0	0	1173
% App. Total	0	81.6	18.4	0		33.6	0	66.4	0		52.2	47.8	0	0		0	0	0	0		
PHF	.000	.938	.888	.000	.955	.767	.000	.892	.000	.846	.870	.756	.000	.000	.929	.000	.000	.000	.000	.000	.974

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Traffic Data Service
Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 24AM FINAL
Site Code : 00000024
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	KING ST Southbound					MISSION ST Westbound					Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	13	6	26	0	45	27	69	3	0	99	1	0	1	0	2	1	87	13	0	101	247
07:15 AM	15	0	25	0	40	25	113	2	0	140	2	0	2	0	4	0	135	11	0	146	330
07:30 AM	16	0	29	0	45	15	165	1	0	181	0	0	0	0	0	2	145	8	0	155	381
07:45 AM	20	0	22	0	42	21	166	4	0	191	1	0	1	0	2	3	123	15	0	141	376
Total	64	6	102	0	172	88	513	10	0	611	4	0	4	0	8	6	490	47	0	543	1334
08:00 AM	21	0	27	0	48	24	157	5	0	186	1	0	2	0	3	4	131	9	0	144	381
08:15 AM	24	0	30	0	54	25	162	1	0	188	0	0	1	0	1	1	126	14	0	141	384
08:30 AM	23	0	25	0	48	45	115	2	0	162	0	0	4	0	4	0	145	8	0	153	367
08:45 AM	31	0	14	0	45	30	97	3	0	130	3	0	0	0	3	1	167	11	0	179	357
Total	99	0	96	0	195	124	531	11	0	666	4	0	7	0	11	6	569	42	0	617	1489
Grand Total	163	6	198	0	367	212	1044	21	0	1277	8	0	11	0	19	12	1059	89	0	1160	2823
Apprch %	44.4	1.6	54	0		16.6	81.8	1.6	0		42.1	0	57.9	0		1	91.3	7.7	0		
Total %	5.8	0.2	7	0	13	7.5	37	0.7	0	45.2	0.3	0	0.4	0	0.7	0.4	37.5	3.2	0	41.1	

	KING ST Southbound					MISSION ST Westbound					Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	16	0	29	0	45	15	165	1	0	181	0	0	0	0	0	2	145	8	0	155	381
07:45 AM	20	0	22	0	42	21	166	4	0	191	1	0	1	0	2	3	123	15	0	141	376
08:00 AM	21	0	27	0	48	24	157	5	0	186	1	0	2	0	3	4	131	9	0	144	381
08:15 AM	24	0	30	0	54	25	162	1	0	188	0	0	1	0	1	1	126	14	0	141	384
Total Volume	81	0	108	0	189	85	650	11	0	746	2	0	4	0	6	10	525	46	0	581	1522
% App. Total	42.9	0	57.1	0		11.4	87.1	1.5	0		33.3	0	66.7	0		1.7	90.4	7.9	0		
PHF	.844	.000	.900	.000	.875	.850	.979	.550	.000	.976	.500	.000	.500	.000	.500	.625	.905	.767	.000	.937	.991

Traffic Data Service

Campbell, CA

(408) 377-2988

tdsbay@cs.com

File Name : 24PM FINAL
Site Code : 00000024
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	KING ST Southbound					MISSION ST Westbound					Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	1	0	14	0	15	36	144	0	0	180	3	0	2	0	5	2	198	0	0	200	400
04:15 PM	2	0	25	0	27	34	154	0	0	188	3	1	0	0	4	1	213	0	0	214	433
04:30 PM	6	0	36	0	42	35	197	1	0	233	2	0	0	0	2	1	197	0	0	198	475
04:45 PM	3	0	23	0	26	31	176	2	0	209	6	1	1	0	8	2	187	0	0	189	432
Total	12	0	98	0	110	136	671	3	0	810	14	2	3	0	19	6	795	0	0	801	1740
05:00 PM	0	4	11	0	15	27	187	1	0	215	1	1	0	0	2	1	216	0	0	217	449
05:15 PM	0	0	12	0	12	21	176	0	0	197	1	0	1	0	2	0	235	0	0	235	446
05:30 PM	1	0	14	0	15	24	212	1	0	237	0	0	0	0	0	1	215	0	0	216	468
05:45 PM	0	7	10	0	17	23	149	0	0	172	0	1	0	0	1	0	208	0	0	208	398
Total	1	11	47	0	59	95	724	2	0	821	2	2	1	0	5	2	874	0	0	876	1761
Grand Total	13	11	145	0	169	231	1395	5	0	1631	16	4	4	0	24	8	1669	0	0	1677	3501
Apprch %	7.7	6.5	85.8	0		14.2	85.5	0.3	0		66.7	16.7	16.7	0		0.5	99.5	0	0		
Total %	0.4	0.3	4.1	0	4.8	6.6	39.8	0.1	0	46.6	0.5	0.1	0.1	0	0.7	0.2	47.7	0	0	47.9	

	KING ST Southbound					MISSION ST Westbound					Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	6	0	36	0	42	35	197	1	0	233	2	0	0	0	2	1	197	0	0	198	475
04:45 PM	3	0	23	0	26	31	176	2	0	209	6	1	1	0	8	2	187	0	0	189	432
05:00 PM	0	4	11	0	15	27	187	1	0	215	1	1	0	0	2	1	216	0	0	217	449
05:15 PM	0	0	12	0	12	21	176	0	0	197	1	0	1	0	2	0	235	0	0	235	446
Total Volume	9	4	82	0	95	114	736	4	0	854	10	2	2	0	14	4	835	0	0	839	1802
% App. Total	9.5	4.2	86.3	0		13.3	86.2	0.5	0		71.4	14.3	14.3	0		0.5	99.5	0	0		
PHF	.375	.250	.569	.000	.565	.814	.934	.500	.000	.916	.417	.500	.500	.000	.438	.500	.888	.000	.000	.893	.948

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Traffic Data Service

Campbell, CA

(408) 377-2988

tdsbay@cs.com

File Name : 20AM FINAL
Site Code : 00000020
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	SHWY 1 Southbound					WATER ST Westbound					CHESTNUT ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	218	55	5	0	278	0	24	1	0	25	1	30	26	0	57	10	38	253	0	301	661
07:15 AM	277	51	8	0	336	2	52	0	0	54	3	39	2	0	44	2	45	284	0	331	765
07:30 AM	352	46	11	0	409	3	69	3	0	75	4	69	17	0	90	3	73	347	0	423	997
07:45 AM	381	67	27	0	475	8	90	3	0	101	11	82	35	0	128	7	125	409	0	541	1245
Total	1228	219	51	0	1498	13	235	7	0	255	19	220	80	0	319	22	281	1293	0	1596	3668
08:00 AM	352	60	10	0	422	7	104	2	0	113	4	91	10	0	105	5	79	335	0	419	1059
08:15 AM	312	61	10	0	383	6	98	1	0	105	3	60	6	0	69	10	106	391	0	507	1064
08:30 AM	343	59	11	0	413	7	68	4	0	79	4	68	10	0	82	11	80	320	0	411	985
08:45 AM	315	55	10	0	380	6	71	5	0	82	1	75	9	0	85	12	85	362	0	459	1006
Total	1322	235	41	0	1598	26	341	12	0	379	12	294	35	0	341	38	350	1408	0	1796	4114
Grand Total	2550	454	92	0	3096	39	576	19	0	634	31	514	115	0	660	60	631	2701	0	3392	7782
Apprch %	82.4	14.7	3	0		6.2	90.9	3	0		4.7	77.9	17.4	0		1.8	18.6	79.6	0		
Total %	32.8	5.8	1.2	0	39.8	0.5	7.4	0.2	0	8.1	0.4	6.6	1.5	0	8.5	0.8	8.1	34.7	0	43.6	

	SHWY 1 Southbound					WATER ST Westbound					CHESTNUT ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	352	46	11	0	409	3	69	3	0	75	4	69	17	0	90	3	73	347	0	423	997
07:45 AM	381	67	27	0	475	8	90	3	0	101	11	82	35	0	128	7	125	409	0	541	1245
08:00 AM	352	60	10	0	422	7	104	2	0	113	4	91	10	0	105	5	79	335	0	419	1059
08:15 AM	312	61	10	0	383	6	98	1	0	105	3	60	6	0	69	10	106	391	0	507	1064
Total Volume	1397	234	58	0	1689	24	361	9	0	394	22	302	68	0	392	25	383	1482	0	1890	4365
% App. Total	82.7	13.9	3.4	0		6.1	91.6	2.3	0		5.6	77	17.3	0		1.3	20.3	78.4	0		
PHF	.917	.873	.537	.000	.889	.750	.868	.750	.000	.872	.500	.830	.486	.000	.766	.625	.766	.906	.000	.873	.877

(18)

Traffic Data Service
Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 20PM FINAL
Site Code : 00000020
Start Date : 11/8/2007
Page No : 1

Groups Printed- Vehicles

	SHWY 1 Southbound					WATER ST Westbound					CHESTNUT ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	341	60	25	0	426	17	86	2	0	105	1	54	11	0	66	19	137	340	0	496	1093
04:15 PM	315	78	15	0	408	11	91	3	0	105	4	47	15	0	66	10	114	322	0	446	1025
04:30 PM	303	57	14	0	374	9	88	2	0	99	5	51	12	0	68	11	155	360	0	526	1067
04:45 PM	334	81	12	0	427	5	84	3	0	92	3	43	26	0	72	14	108	296	0	418	1009
Total	1293	276	66	0	1635	42	349	10	0	401	13	195	64	0	272	54	514	1318	0	1886	4194
05:00 PM	308	66	17	0	391	10	119	5	0	134	2	83	19	0	104	12	112	309	0	433	1062
05:15 PM	368	94	12	0	474	5	97	7	0	109	0	77	31	0	108	14	115	302	0	431	1122
05:30 PM	363	79	12	0	454	5	122	3	0	130	1	65	24	0	90	12	128	332	0	472	1146
05:45 PM	372	87	17	0	476	5	113	2	0	120	1	62	22	0	85	11	96	292	0	399	1080
Total	1411	326	58	0	1795	25	451	17	0	493	4	287	96	0	387	49	451	1235	0	1735	4410
Grand Total	2704	602	124	0	3430	67	800	27	0	894	17	482	160	0	659	103	965	2553	0	3621	8604
Apprch %	78.8	17.6	3.6	0		7.5	89.5	3	0		2.6	73.1	24.3	0		2.8	26.7	70.5	0		
Total %	31.4	7	1.4	0	39.9	0.8	9.3	0.3	0	10.4	0.2	5.6	1.9	0	7.7	1.2	11.2	29.7	0	42.1	

	SHWY 1 Southbound					WATER ST Westbound					CHESTNUT ST Northbound					MISSION ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	308	66	17	0	391	10	119	5	0	134	2	83	19	0	104	12	112	309	0	433	1062
05:15 PM	368	94	12	0	474	5	97	7	0	109	0	77	31	0	108	14	115	302	0	431	1122
05:30 PM	363	79	12	0	454	5	122	3	0	130	1	65	24	0	90	12	128	332	0	472	1146
05:45 PM	372	87	17	0	476	5	113	2	0	120	1	62	22	0	85	11	96	292	0	399	1080
Total Volume	1411	326	58	0	1795	25	451	17	0	493	4	287	96	0	387	49	451	1235	0	1735	4410
% App. Total	78.6	18.2	3.2	0		5.1	91.5	3.4	0		1	74.2	24.8	0		2.8	26	71.2	0		
PHF	.948	.867	.853	.000	.943	.625	.924	.607	.000	.920	.500	.864	.774	.000	.896	.875	.881	.930	.000	.919	.962

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Traffic Data Service

Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 21AM FINAL
Site Code : 00000021
Start Date : 11/13/2007
Page No : 1

Groups Printed- Vehicles

	SHWY 1 Southbound					RIVER ST Westbound					SHWY 1 Northbound					RIVER ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	122	277	46	0	445	30	17	2	0	49	7	289	27	0	323	25	17	54	0	96	913
07:15 AM	120	316	41	0	477	34	24	6	0	64	10	270	27	0	307	30	15	68	0	113	961
07:30 AM	115	373	57	0	545	41	43	4	0	88	8	387	39	0	434	43	46	88	1	178	1245
07:45 AM	149	393	67	0	609	51	41	5	0	97	23	430	39	0	492	37	36	68	0	141	1339
Total	506	1359	211	0	2076	156	125	17	0	298	48	1376	132	0	1556	135	114	278	1	528	4458
08:00 AM	171	342	75	0	588	53	47	10	0	110	20	430	64	0	514	46	38	107	0	191	1403
08:15 AM	174	331	78	0	583	62	41	8	0	111	18	403	75	0	496	55	48	106	0	209	1399
08:30 AM	154	332	95	0	581	69	38	15	0	122	21	347	44	0	412	34	53	92	0	179	1294
08:45 AM	157	293	96	0	546	69	40	12	0	121	17	311	42	0	370	33	50	139	0	222	1259
Total	656	1298	344	0	2298	253	166	45	0	464	76	1491	225	0	1792	168	189	444	0	801	5355
Grand Total	1162	2657	555	0	4374	409	291	62	0	762	124	2867	357	0	3348	303	303	722	1	1329	9813
Apprch %	26.6	60.7	12.7	0		53.7	38.2	8.1	0		3.7	85.6	10.7	0		22.8	22.8	54.3	0.1		
Total %	11.8	27.1	5.7	0	44.6	4.2	3	0.6	0	7.8	1.3	29.2	3.6	0	34.1	3.1	3.1	7.4	0	13.5	

	SHWY 1 Southbound					RIVER ST Westbound					SHWY 1 Northbound					RIVER ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	149	393	67	0	609	51	41	5	0	97	23	430	39	0	492	37	36	68	0	141	1339
08:00 AM	171	342	75	0	588	53	47	10	0	110	20	430	64	0	514	46	38	107	0	191	1403
08:15 AM	174	331	78	0	583	62	41	8	0	111	18	403	75	0	496	55	48	106	0	209	1399
08:30 AM	154	332	95	0	581	69	38	15	0	122	21	347	44	0	412	34	53	92	0	179	1294
Total Volume	648	1398	315	0	2361	235	167	38	0	440	82	1610	222	0	1914	172	175	373	0	720	5435
% App. Total	27.4	59.2	13.3	0		53.4	38	8.6	0		4.3	84.1	11.6	0		23.9	24.3	51.8	0		
PHF	.931	.889	.829	.000	.969	.851	.888	.633	.000	.902	.891	.936	.740	.000	.931	.782	.825	.871	.000	.861	.968

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Traffic Data Service

Campbell, CA
(408) 377-2988
tdsbay@cs.com

File Name : 21PM FINAL
Site Code : 00000021
Start Date : 11/13/2007
Page No : 1

Groups Printed- Vehicles

	SHWY 1 Southbound					RIVER ST Westbound					SHWY 1 Northbound					RIVER ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
04:00 PM	113	278	93	0	484	94	77	18	0	189	25	279	59	0	363	54	79	183	0	316	1352
04:15 PM	112	326	84	0	522	143	72	22	0	237	32	289	64	0	385	63	58	158	0	279	1423
04:30 PM	124	298	89	0	511	100	57	22	0	179	22	290	52	0	364	54	60	151	0	265	1319
04:45 PM	124	350	99	0	573	90	67	21	0	178	27	314	59	0	400	56	62	139	0	257	1408
Total	473	1252	365	0	2090	427	273	83	0	783	106	1172	234	0	1512	227	259	631	0	1117	5502
05:00 PM	124	327	81	0	532	129	50	27	0	206	11	310	63	0	384	77	95	242	0	414	1536
05:15 PM	96	301	80	0	477	79	60	14	0	153	19	281	62	0	362	81	75	198	0	354	1346
05:30 PM	90	313	85	0	488	82	60	27	0	169	13	283	53	0	349	59	63	143	0	265	1271
05:45 PM	91	316	76	0	483	74	42	25	0	141	11	306	41	0	358	53	53	135	0	241	1223
Total	401	1257	322	0	1980	364	212	93	0	669	54	1180	219	0	1453	270	286	718	0	1274	5376
Grand Total	874	2509	687	0	4070	791	485	176	0	1452	160	2352	453	0	2965	497	545	1349	0	2391	10878
Apprch %	21.5	61.6	16.9	0		54.5	33.4	12.1	0		5.4	79.3	15.3	0		20.8	22.8	56.4	0		
Total %	8	23.1	6.3	0	37.4	7.3	4.5	1.6	0	13.3	1.5	21.6	4.2	0	27.3	4.6	5	12.4	0	22	

	SHWY 1 Southbound					RIVER ST Westbound					SHWY 1 Northbound					RIVER ST Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	112	326	84	0	522	143	72	22	0	237	32	289	64	0	385	63	58	158	0	279	1423
04:30 PM	124	298	89	0	511	100	57	22	0	179	22	290	52	0	364	54	60	151	0	265	1319
04:45 PM	124	350	99	0	573	90	67	21	0	178	27	314	59	0	400	56	62	139	0	257	1408
05:00 PM	124	327	81	0	532	129	50	27	0	206	11	310	63	0	384	77	95	242	0	414	1536
Total Volume	484	1301	353	0	2138	462	246	92	0	800	92	1203	238	0	1533	250	275	690	0	1215	5686
% App. Total	22.6	60.9	16.5	0		57.8	30.8	11.5	0		6	78.5	15.5	0		20.6	22.6	56.8	0		
PHF	.976	.929	.891	.000	.933	.808	.854	.852	.000	.844	.719	.958	.930	.000	.958	.812	.724	.713	.000	.734	.925

SIGNAL WARRANT ANALYSIS

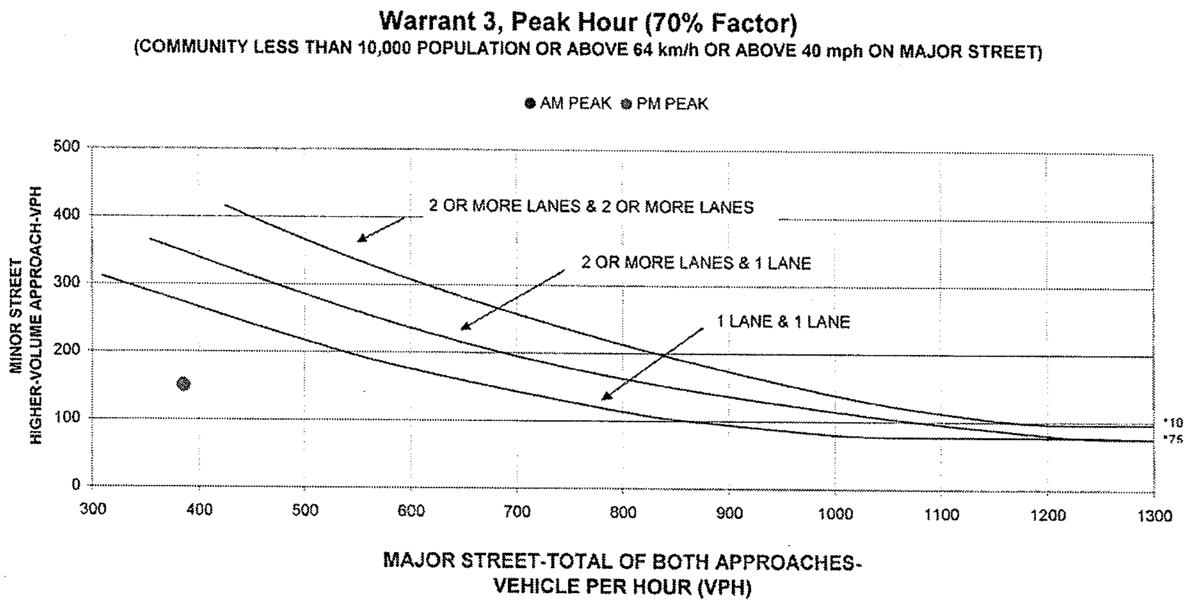
INTERSECTION: Heller Drive / McLaughlin Drive

WARRANT MET: No

CONDITION: Existing Conditions

OF LANES ON MAJOR STREET: 1

OF LANES ON MINOR STREET: 1



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	146	387
MINOR STREET:	99	151

INTERSECTION: Heller Drive / Meyer Drive

OF LANES ON MAJOR STREET: 1

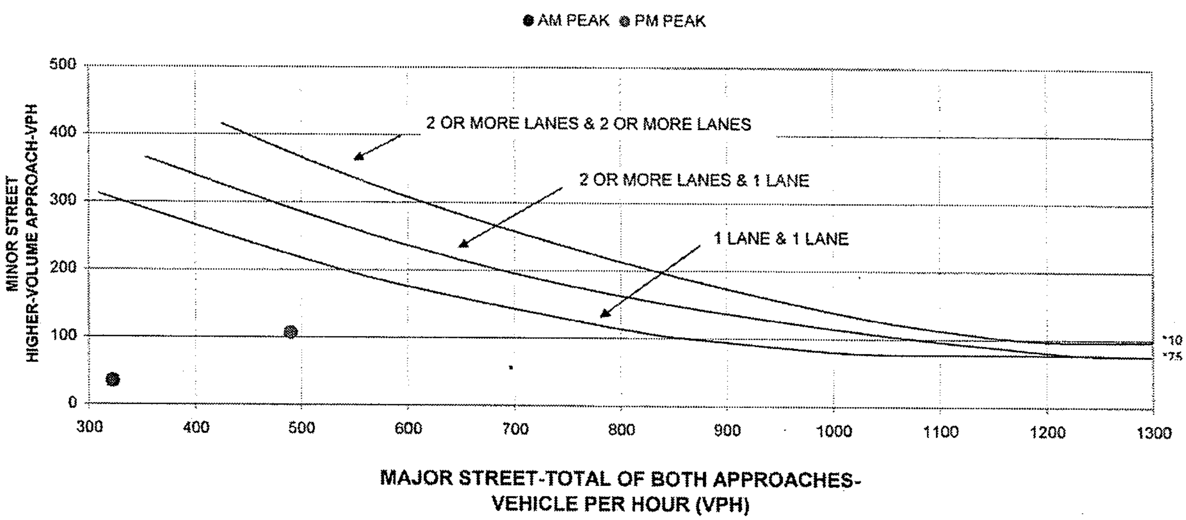
WARRANT MET: No

OF LANES ON MINOR STREET: 1

CONDITION: Existing Conditions

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



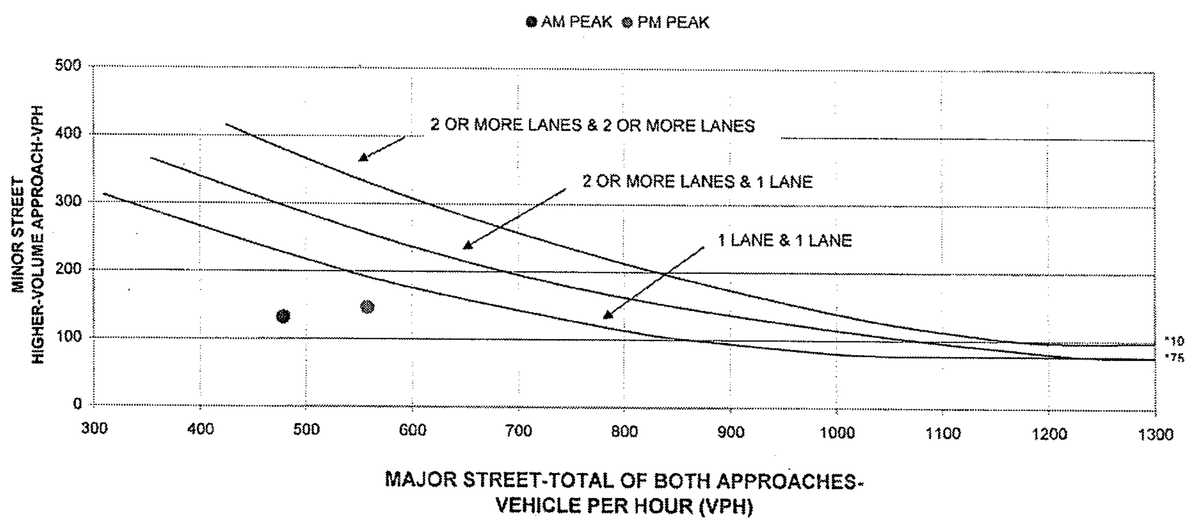
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	323	491
MINOR STREET:	35	107

INTERSECTION:	Chinquapin / McLaughlin Drive	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	No	# OF LANES ON MINOR STREET:	1
CONDITION:	Existing Conditions		

Warrant 3, Peak Hour (70% Factor)

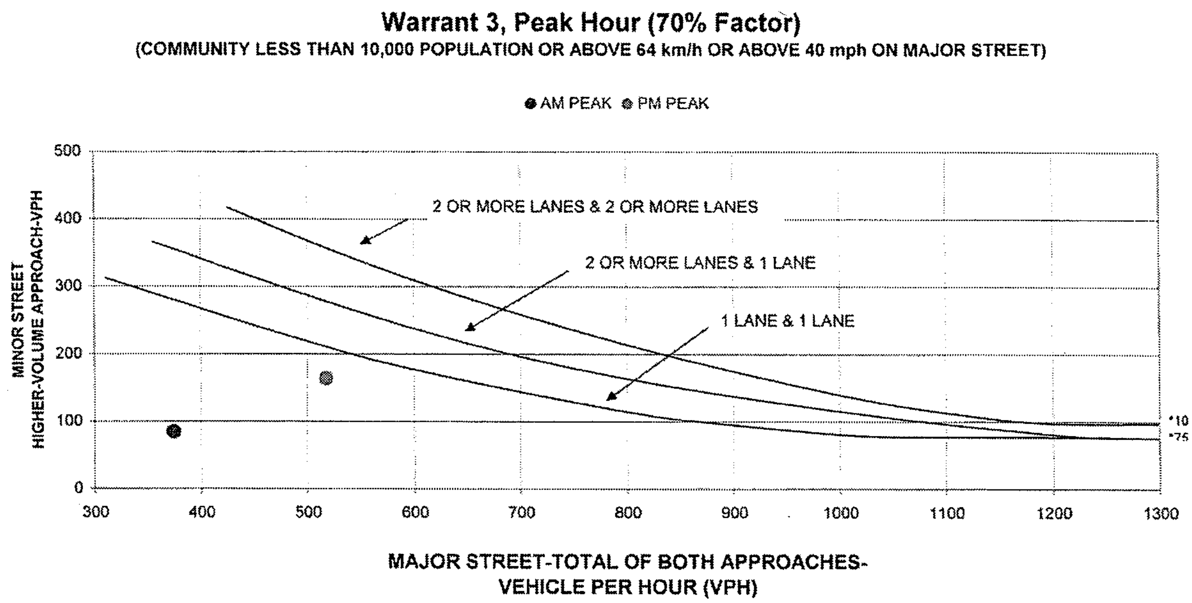
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	480	559
MINOR STREET:	132	147

INTERSECTION:	McLaughlin Drive / Hagar Court	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	No	# OF LANES ON MINOR STREET:	1
CONDITION:	Existing Conditions		



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	375	519
MINOR STREET:	85	164

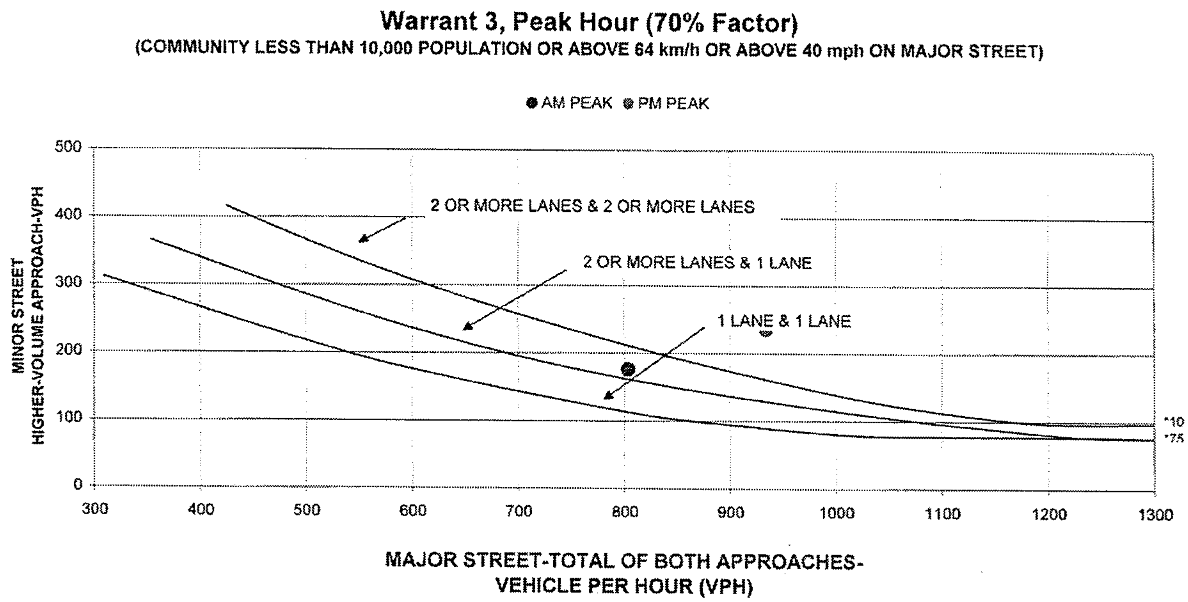
INTERSECTION: Western Drive / Empire Grade

OF LANES ON MAJOR STREET: 1

WARRANT MET: Yes

OF LANES ON MINOR STREET: 1

CONDITION: Existing Conditions



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	804	935
MINOR STREET:	176	236

INTERSECTION: Laurent Street / High Street

OF LANES ON MAJOR STREET: 1

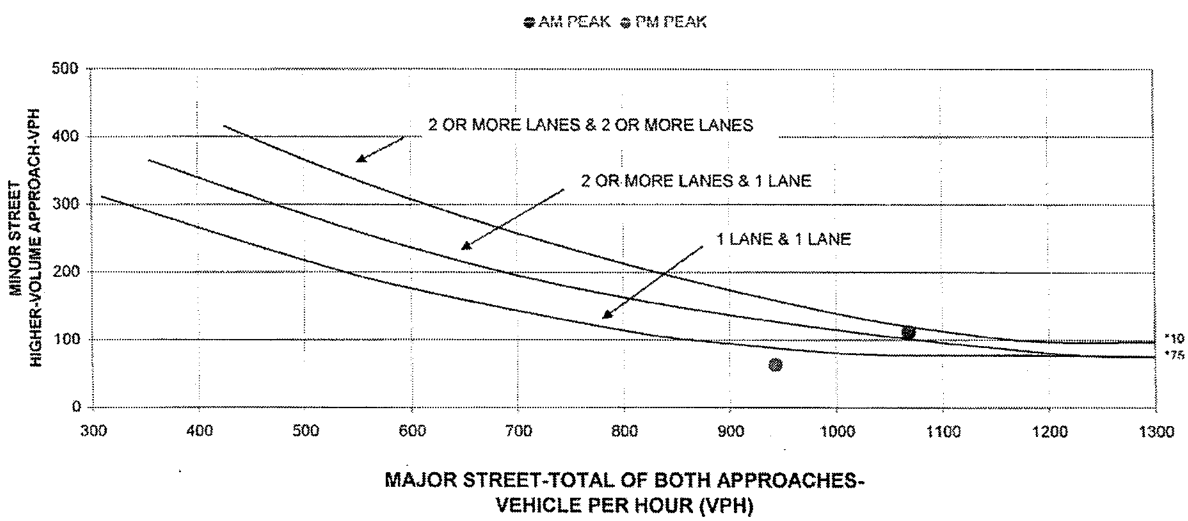
WARRANT MET: Yes

OF LANES ON MINOR STREET: 1

CONDITION: Existing Conditions

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	1069	944
MINOR STREET:	112	65

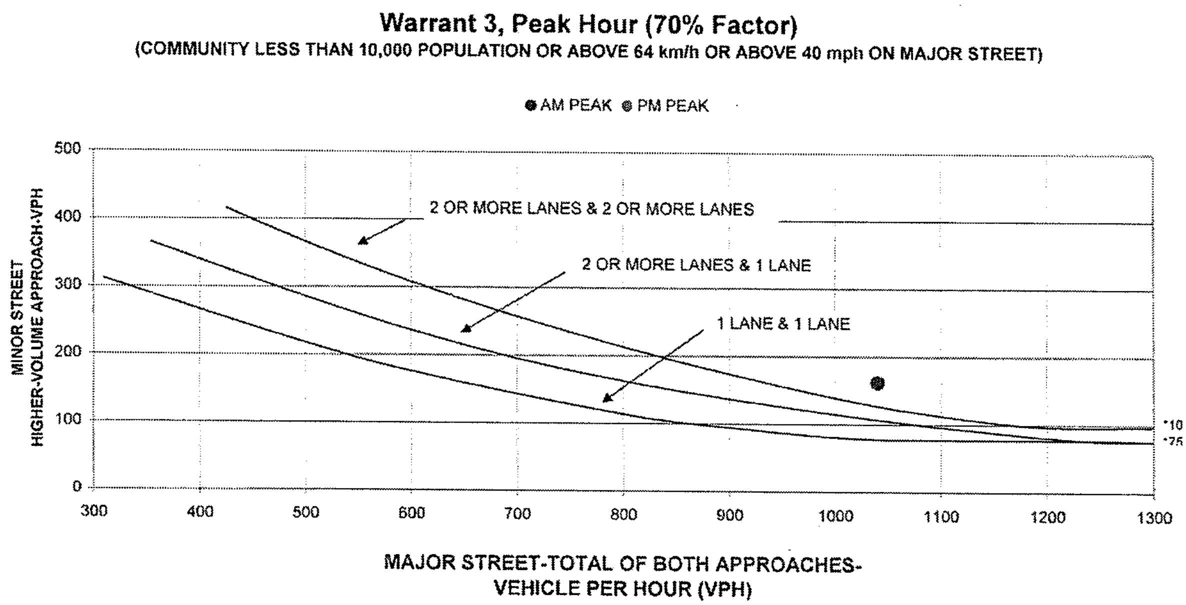
INTERSECTION: Bay Drive / Escalona Drive

OF LANES ON MAJOR STREET: 1

WARRANT MET: Yes

OF LANES ON MINOR STREET: 1

CONDITION: Existing Conditions



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES

	AM PEAK	PM PEAK
MAJOR STREET:	1041	1346
MINOR STREET:	162	125

INTERSECTION: Bay Street / California Street

WARRANT MET: Yes

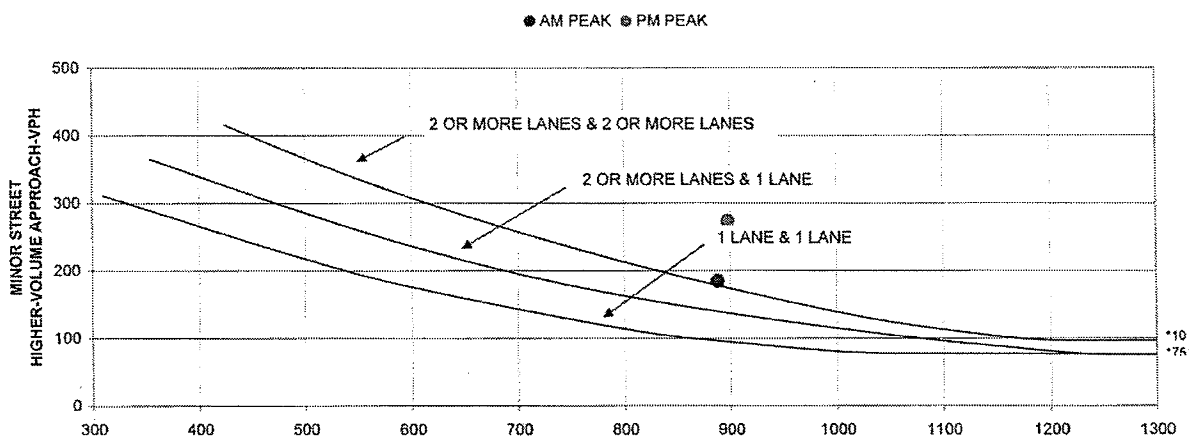
CONDITION: Existing Conditions

\# OF LANES ON MAJOR STREET: 1

\# OF LANES ON MINOR STREET: 1

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)

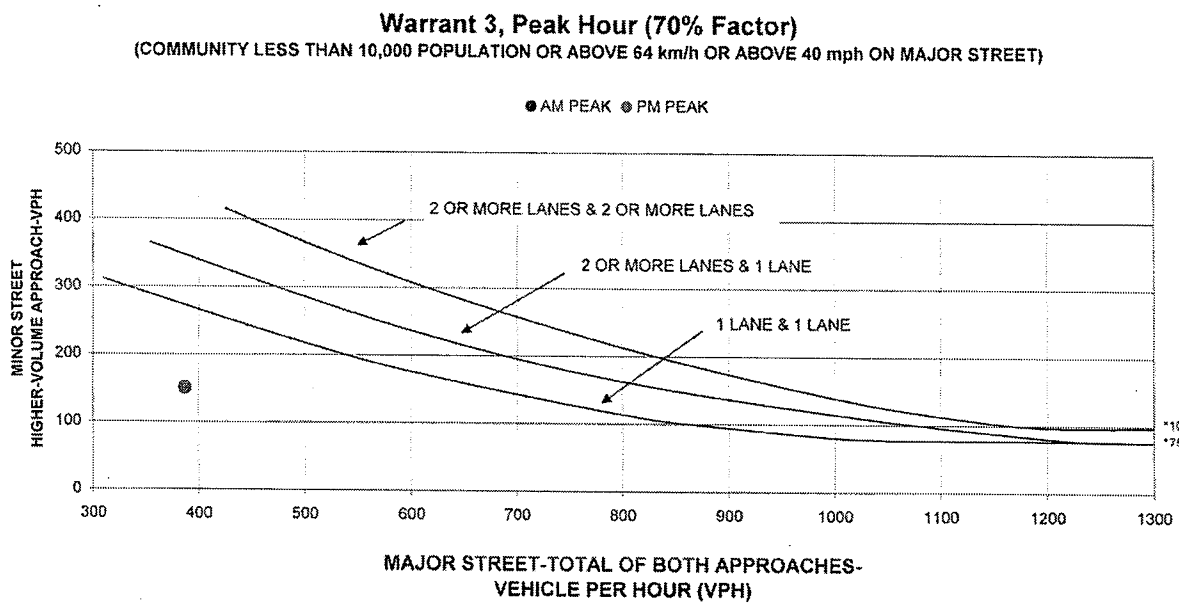


MAJOR STREET-TOTAL OF BOTH APPROACHES-
VEHICLE PER HOUR (VPH)

*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	889	899
MINOR STREET:	185	274

INTERSECTION:	Heller Drive / McLaughlin Drive	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	No	# OF LANES ON MINOR STREET:	1
CONDITION:	Existing Plus Project Conditions		



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES

	AM PEAK	PM PEAK
MAJOR STREET:	146	388
MINOR STREET:	100	151

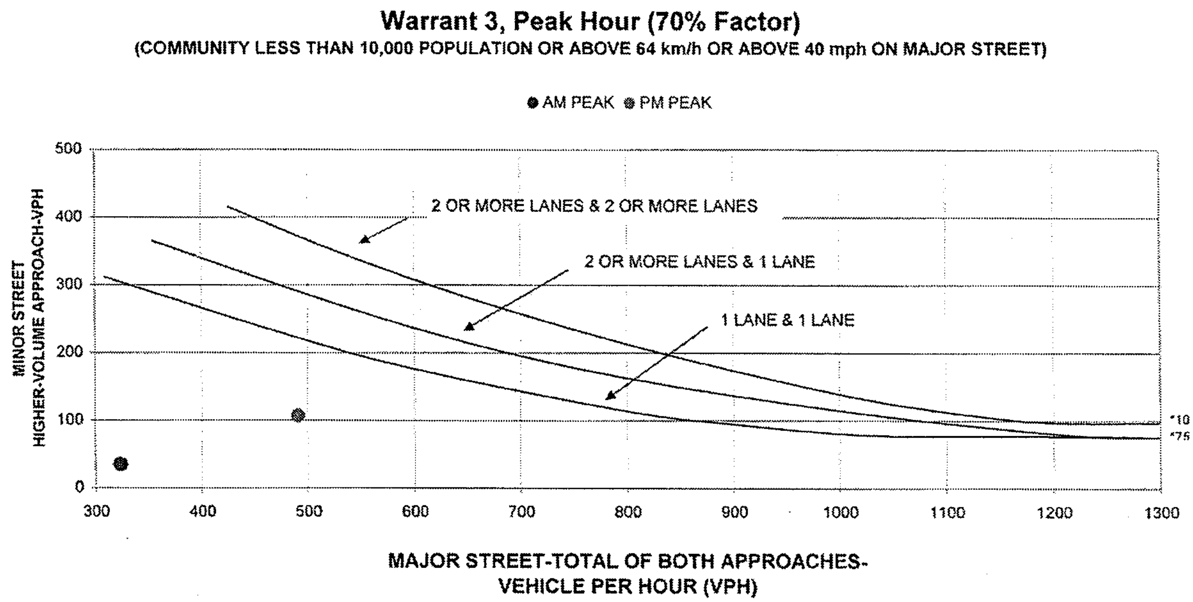
INTERSECTION: Heller Drive / Meyer Drive

OF LANES ON MAJOR STREET: 1

WARRANT MET: No

OF LANES ON MINOR STREET: 1

CONDITION: Existing Plus Project Conditions



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	324	492
MINOR STREET:	35	107

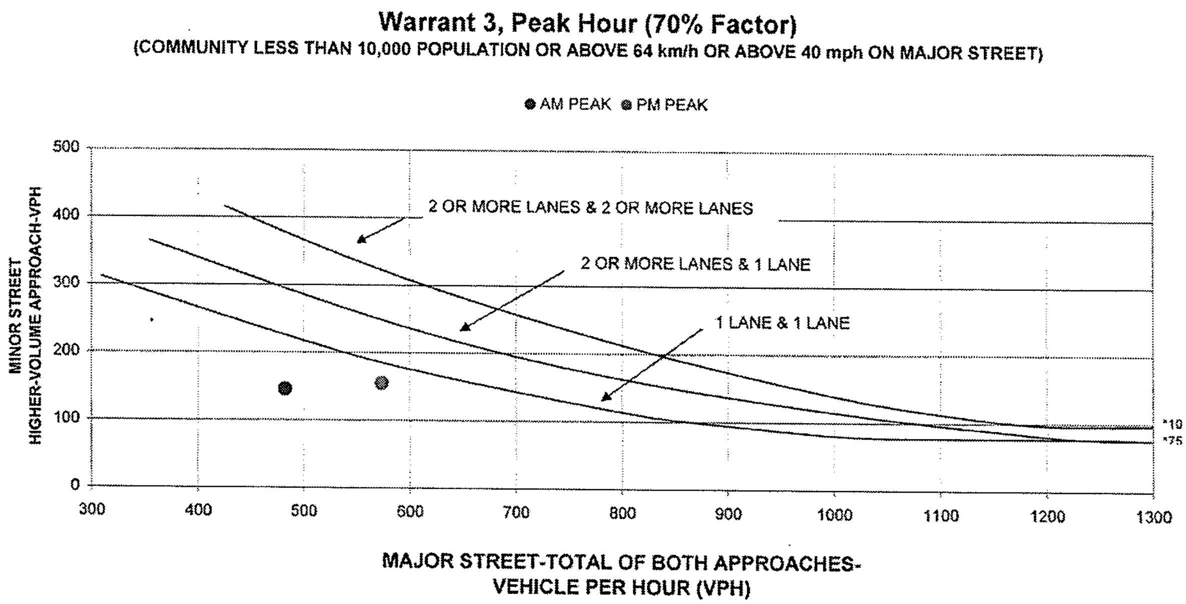
INTERSECTION: Chinquapin / McLaughlin Drive

WARRANT MET: No

CONDITION: Existing Plus Project Conditions

OF LANES ON MAJOR STREET: 1

OF LANES ON MINOR STREET: 1



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

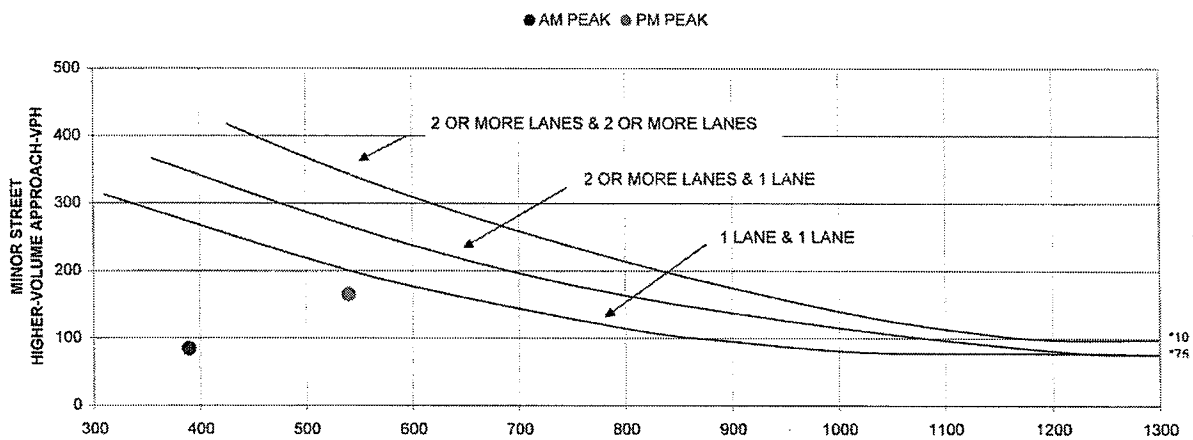
VOLUMES

	AM PEAK	PM PEAK
MAJOR STREET:	483	575
MINOR STREET:	146	155

INTERSECTION:	McLaughlin Drive / Hagar Court	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	No	# OF LANES ON MINOR STREET:	1
CONDITION:	Existing Plus Project Conditions		

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



MAJOR STREET-TOTAL OF BOTH APPROACHES-VEHICLE PER HOUR (VPH)

*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES

	AM PEAK	PM PEAK
MAJOR STREET:	390	541
MINOR STREET:	85	165

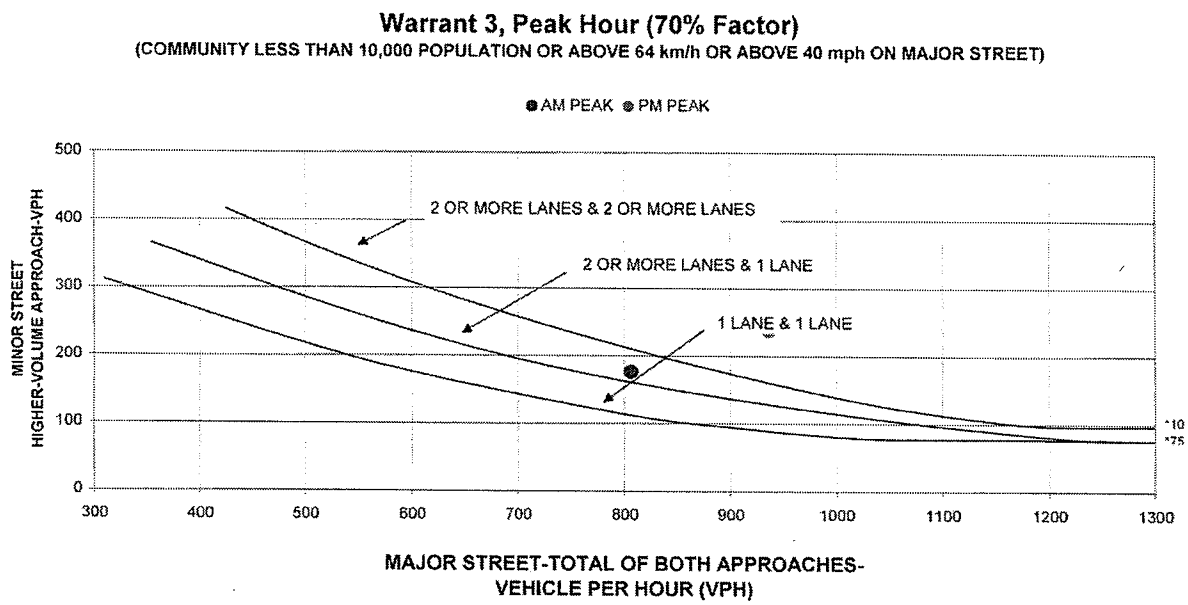
INTERSECTION: Western Drive / Empire Grade

WARRANT MET: Yes

CONDITION: Existing Plus Project Conditions

\# OF LANES ON MAJOR STREET: 1

\# OF LANES ON MINOR STREET: 1



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	807	937
MINOR STREET:	177	239

INTERSECTION: Laurent Street / High Street

\# OF LANES ON MAJOR STREET: 1

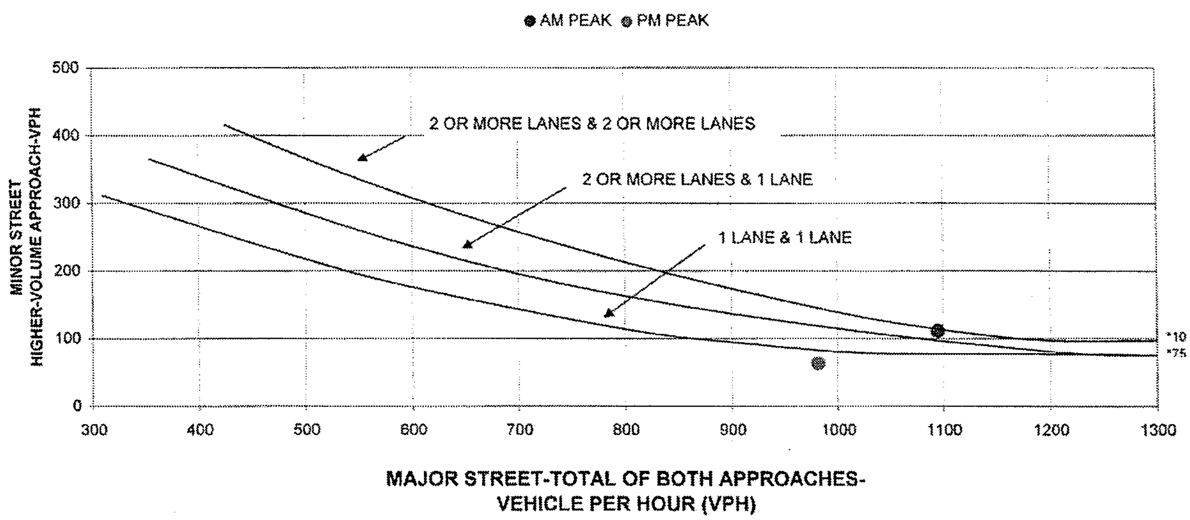
WARRANT MET: Yes

\# OF LANES ON MINOR STREET: 1

CONDITION: Existing Plus Project Conditions

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES

	AM PEAK	PM PEAK
MAJOR STREET:	1096	983
MINOR STREET:	112	65

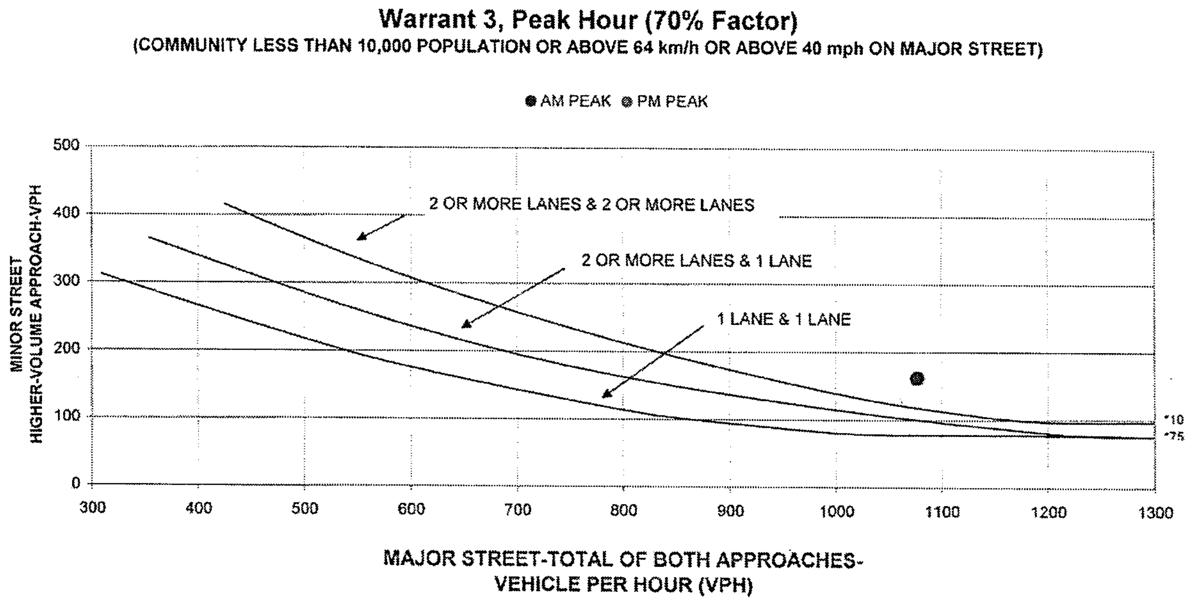
INTERSECTION: Bay Drive / Escalona Drive

WARRANT MET: Yes

CONDITION: Existing Plus Project Conditions

\# OF LANES ON MAJOR STREET: 1

\# OF LANES ON MINOR STREET: 1



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	1078	1399
MINOR STREET:	162	125

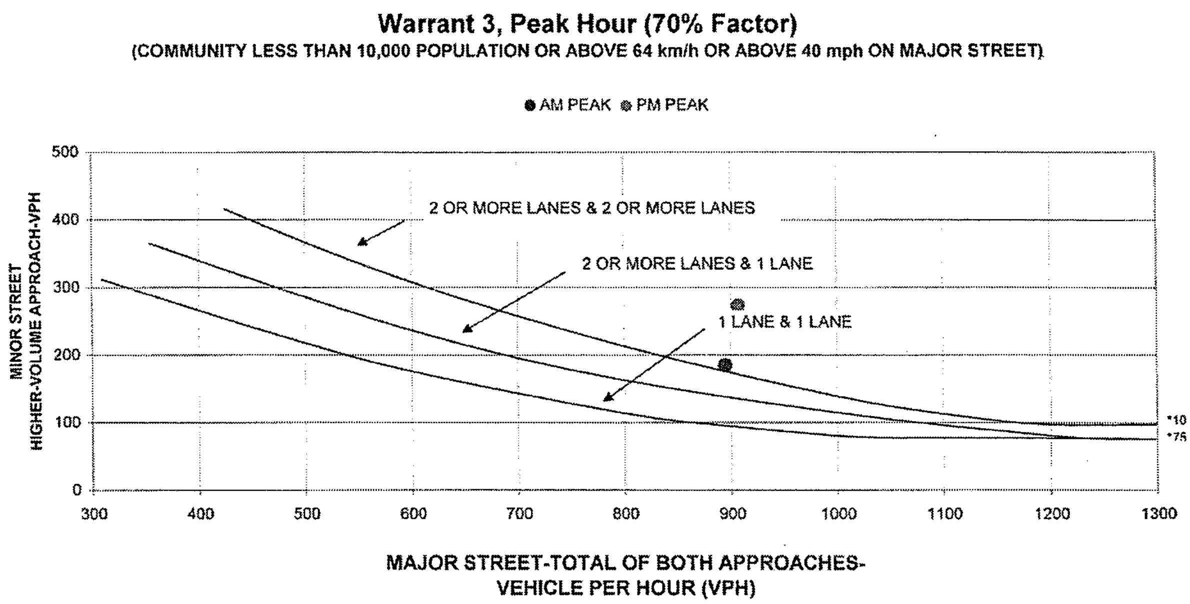
INTERSECTION: Bay Street / California Street

WARRANT MET: Yes

CONDITION: Existing Plus Project Conditions

OF LANES ON MAJOR STREET: 1

OF LANES ON MINOR STREET: 1



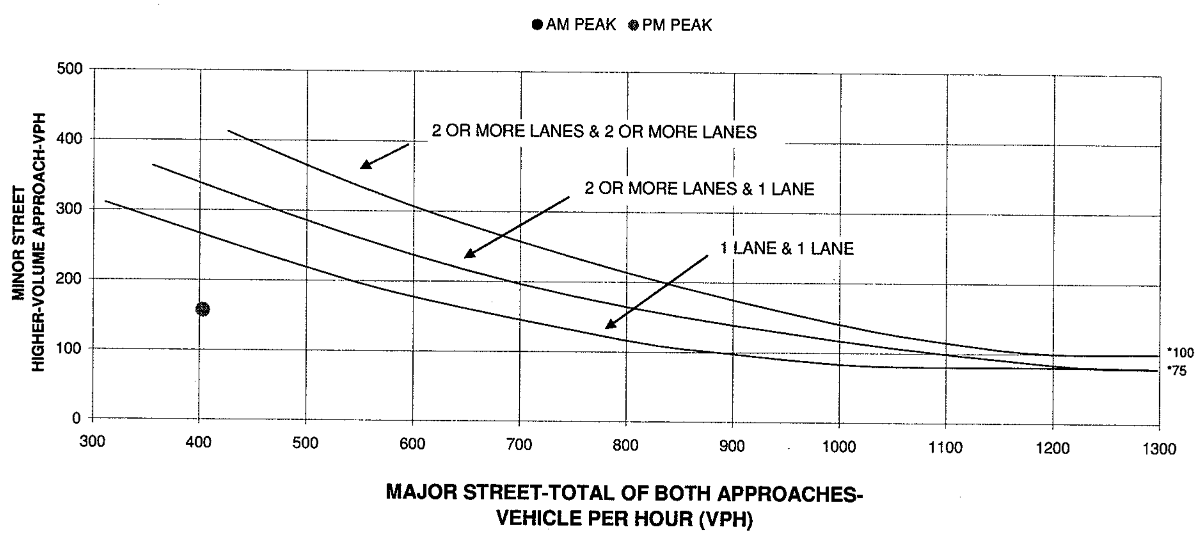
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	895	908
MINOR STREET:	185	274

INTERSECTION:	Heller Drive / McLaughlin Drive	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	No	# OF LANES ON MINOR STREET:	1
CONDITION:	Cumulative 2013 Conditions		

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	155	403
MINOR STREET:	105	157

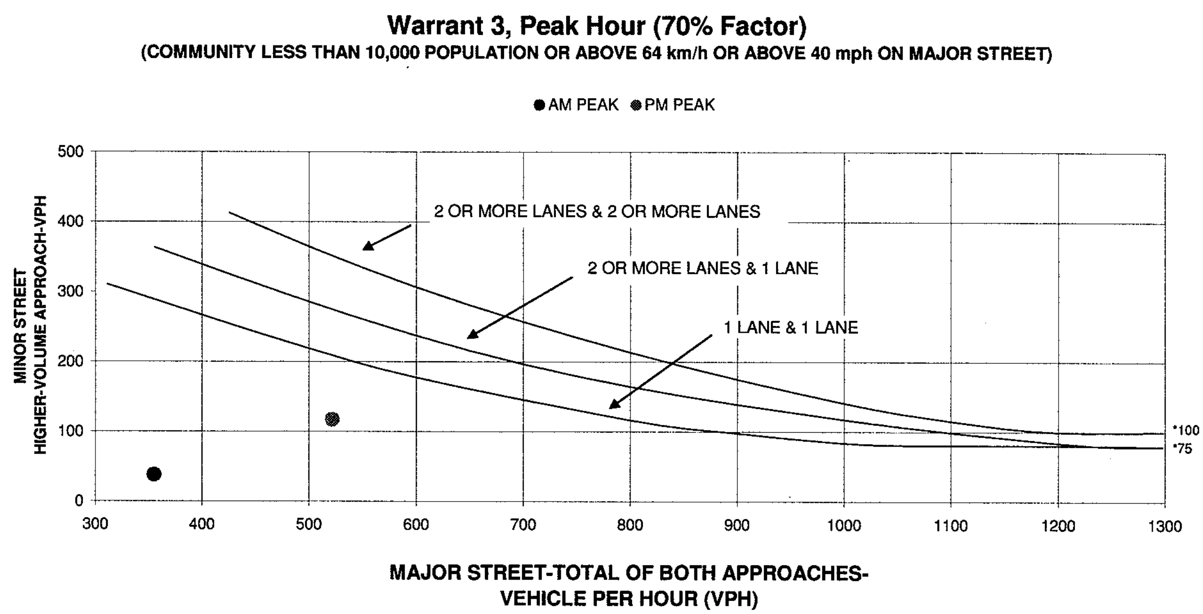
INTERSECTION: Heller Drive / Meyer Drive

OF LANES ON MAJOR STREET: 1

WARRANT MET: No

OF LANES ON MINOR STREET: 1

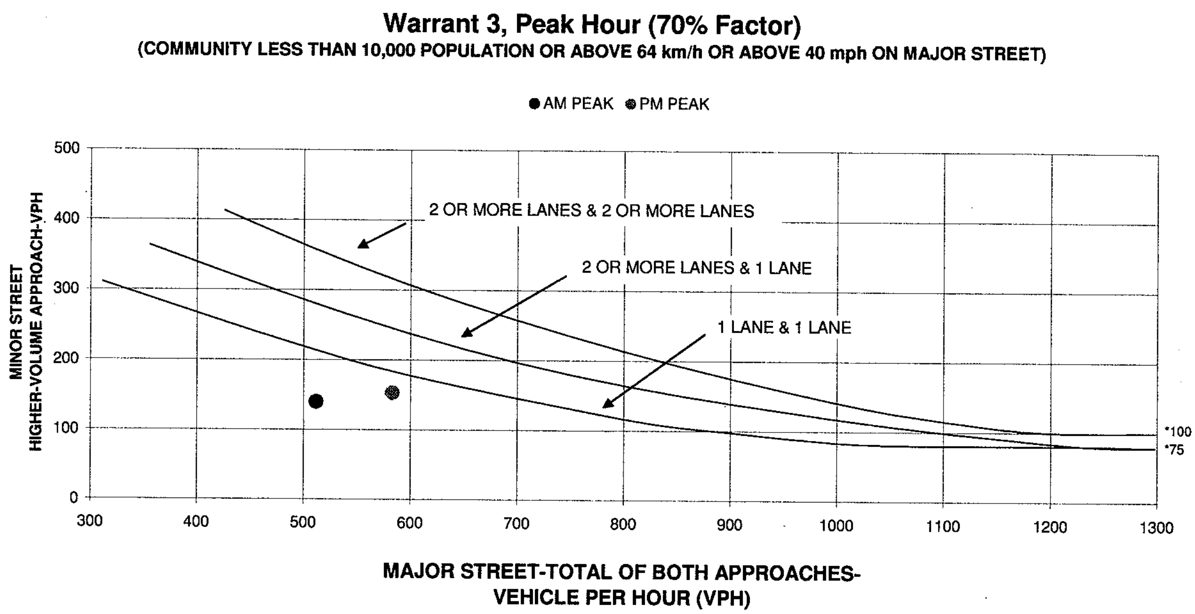
CONDITION: Cumulative 2013 Conditions



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	355	522
MINOR STREET:	38	117

INTERSECTION:	Chinquapin / McLaughlin Drive	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	No	# OF LANES ON MINOR STREET:	1
CONDITION:	Cumulative 2013 Conditions		



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	512	583
MINOR STREET:	140	153

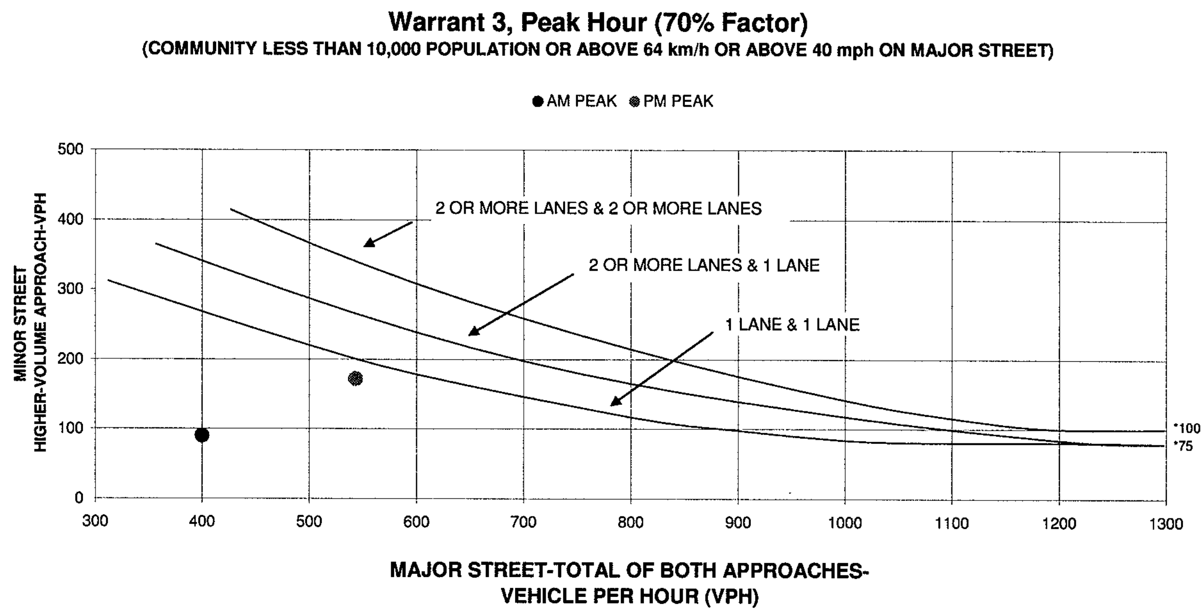
INTERSECTION: McLaughlin Drive / Hagar Court

OF LANES ON MAJOR STREET: 1

WARRANT MET: No

OF LANES ON MINOR STREET: 1

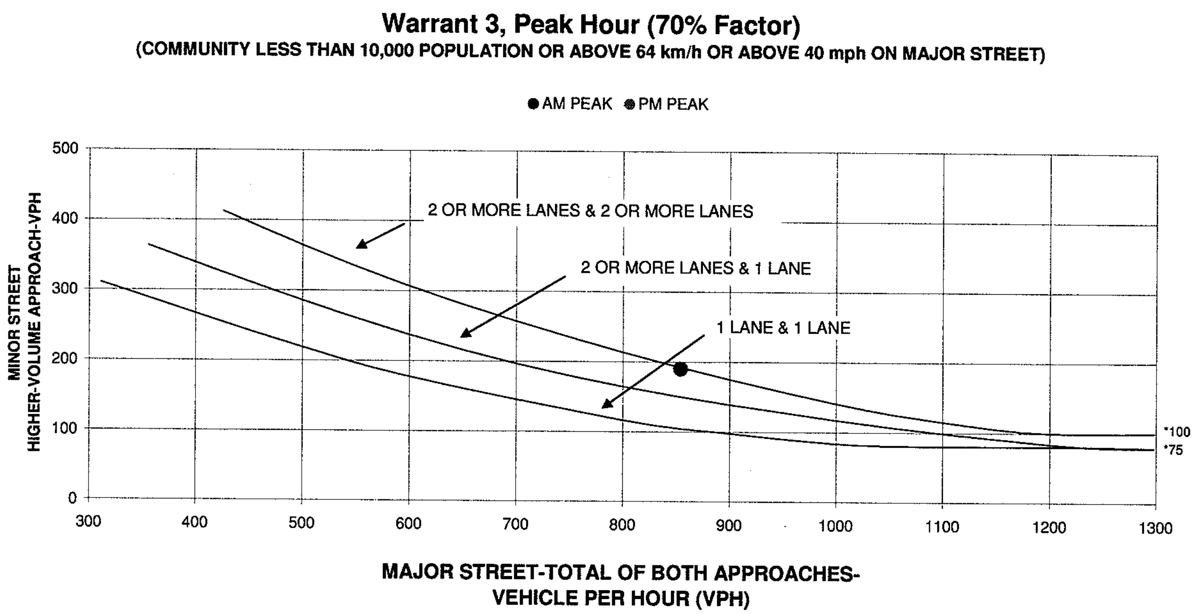
CONDITION: Cumulative 2013 Conditions



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	400	543
MINOR STREET:	90	172

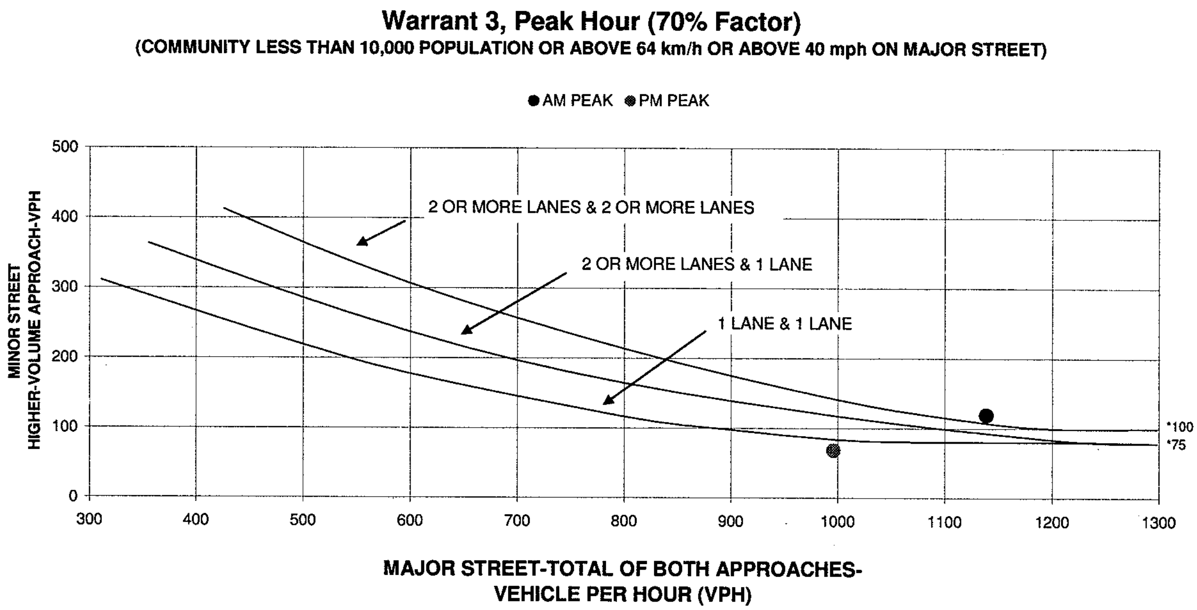
INTERSECTION:	Western Drive / Empire Grade	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	Yes	# OF LANES ON MINOR STREET:	1
CONDITION:	Cumulative 2013 Conditions		



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	854	997
MINOR STREET:	190	246

INTERSECTION:	Laurent Street / High Street	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	Yes	# OF LANES ON MINOR STREET:	1
CONDITION:	Cumulative 2013 Conditions		



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES

	AM PEAK	PM PEAK
MAJOR STREET:	1139	996
MINOR STREET:	119	68

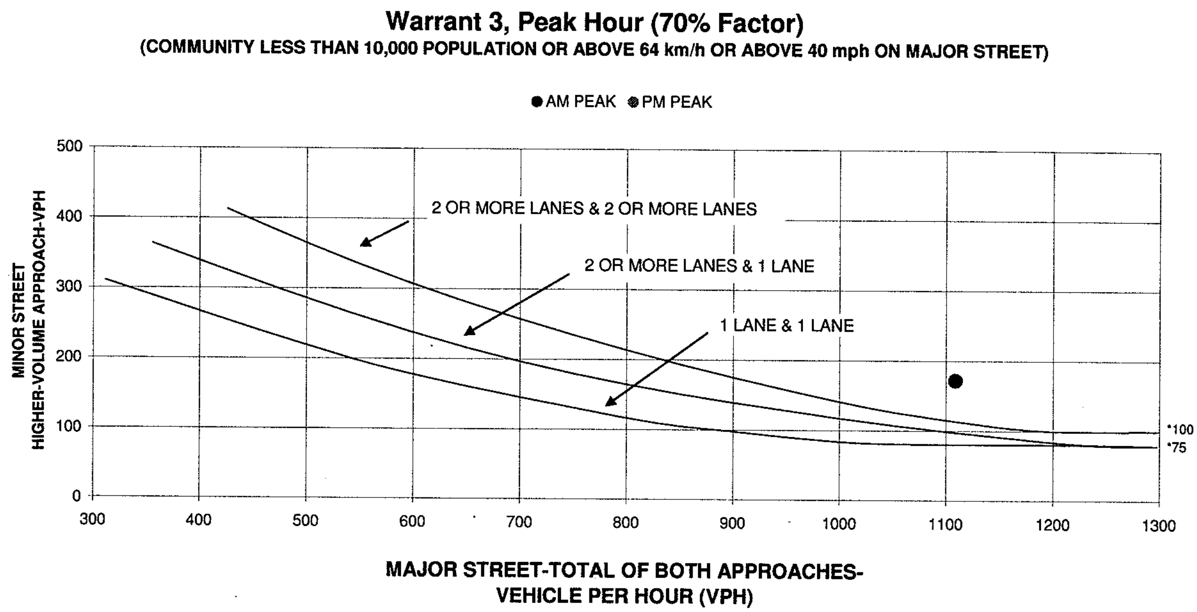
INTERSECTION: Bay Drive / Escalona Drive

WARRANT MET: Yes

CONDITION: Cumulative 2013 Conditions

\# OF LANES ON MAJOR STREET: 1

\# OF LANES ON MINOR STREET: 1



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	1109	1404
MINOR STREET:	172	130

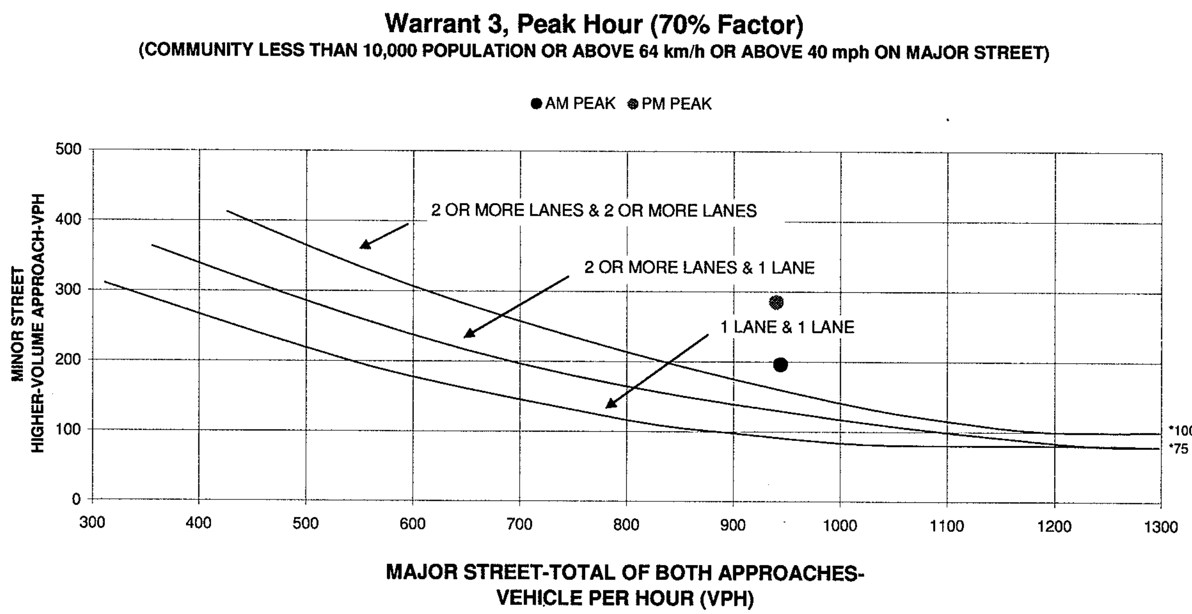
INTERSECTION: Bay Street / California Street

OF LANES ON MAJOR STREET: 1

WARRANT MET: Yes

OF LANES ON MINOR STREET: 1

CONDITION: Cumulative 2013 Conditions



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	944	940
MINOR STREET:	196	285

INTERSECTION: Heller Drive / McLaughlin Drive

WARRANT MET: No

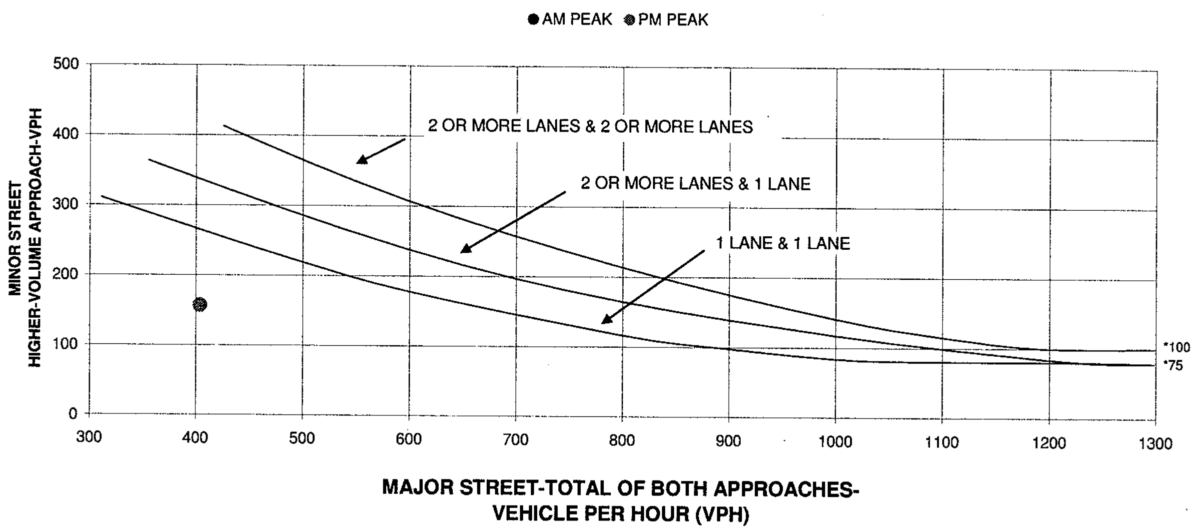
CONDITION: Cumulative 2013 Plus Project Conditions

\# OF LANES ON MAJOR STREET: 1

\# OF LANES ON MINOR STREET: 1

Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	155	404
MINOR STREET:	106	157

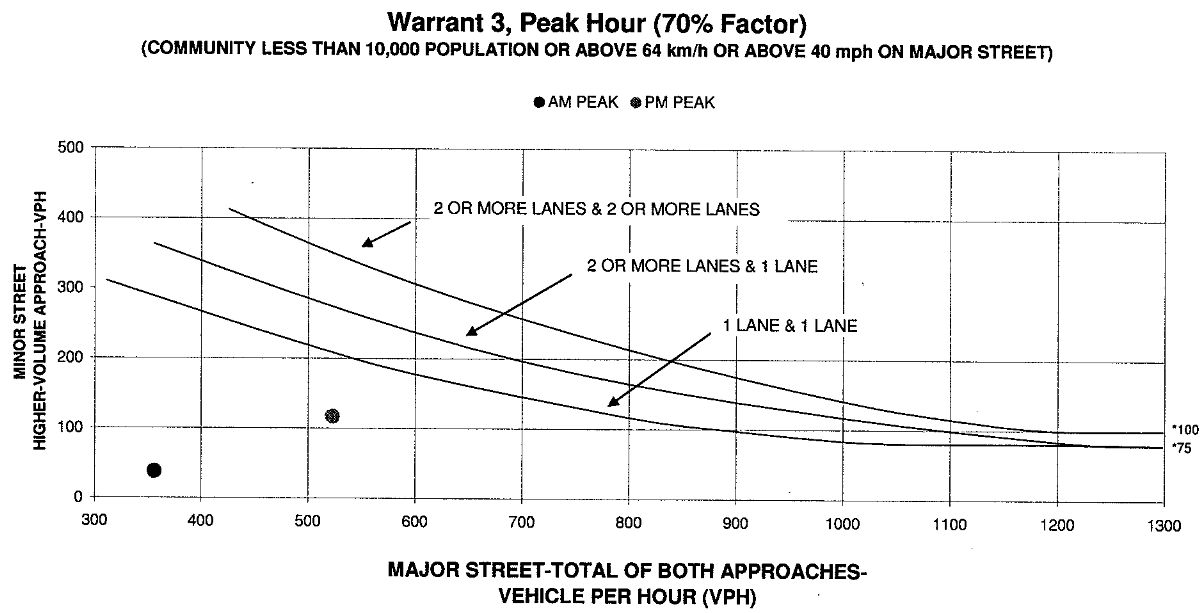
INTERSECTION: Heller Drive / Meyer Drive

OF LANES ON MAJOR STREET: 1

WARRANT MET: No

OF LANES ON MINOR STREET: 1

CONDITION: Cumulative 2013 Plus Project Conditions



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	356	523
MINOR STREET:	38	117

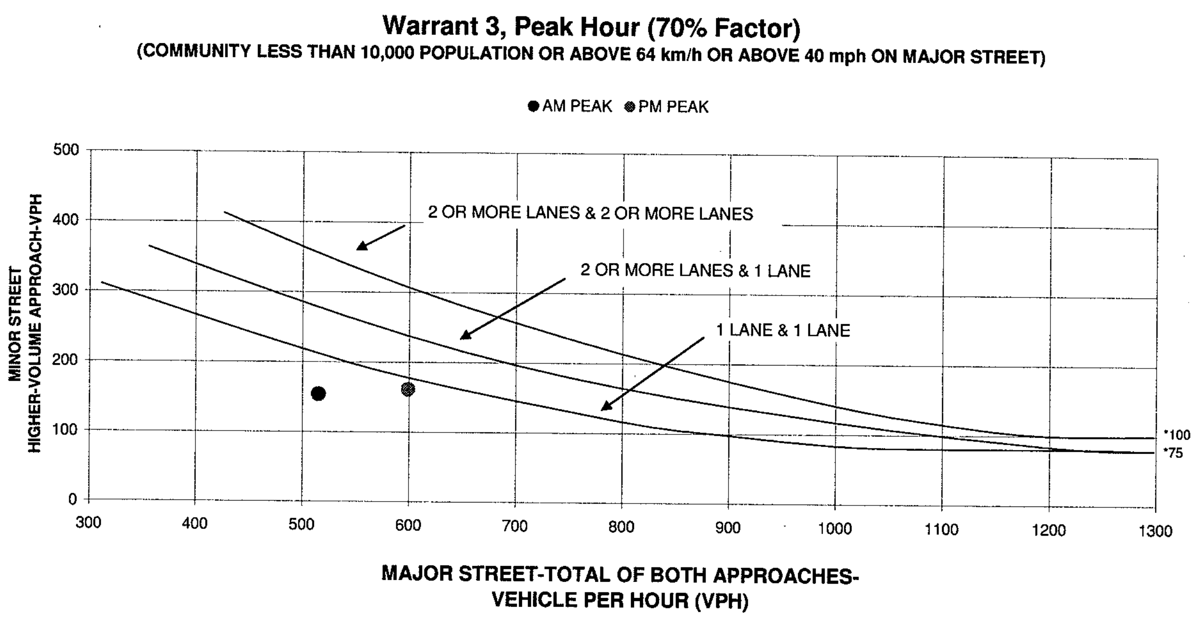
INTERSECTION: Chinquapin / McLaughlin Drive

WARRANT MET: No

CONDITION: Cumulative 2013 Plus Project Conditions

OF LANES ON MAJOR STREET: 1

OF LANES ON MINOR STREET: 1



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES	AM PEAK	PM PEAK
MAJOR STREET:	515	599
MINOR STREET:	154	161

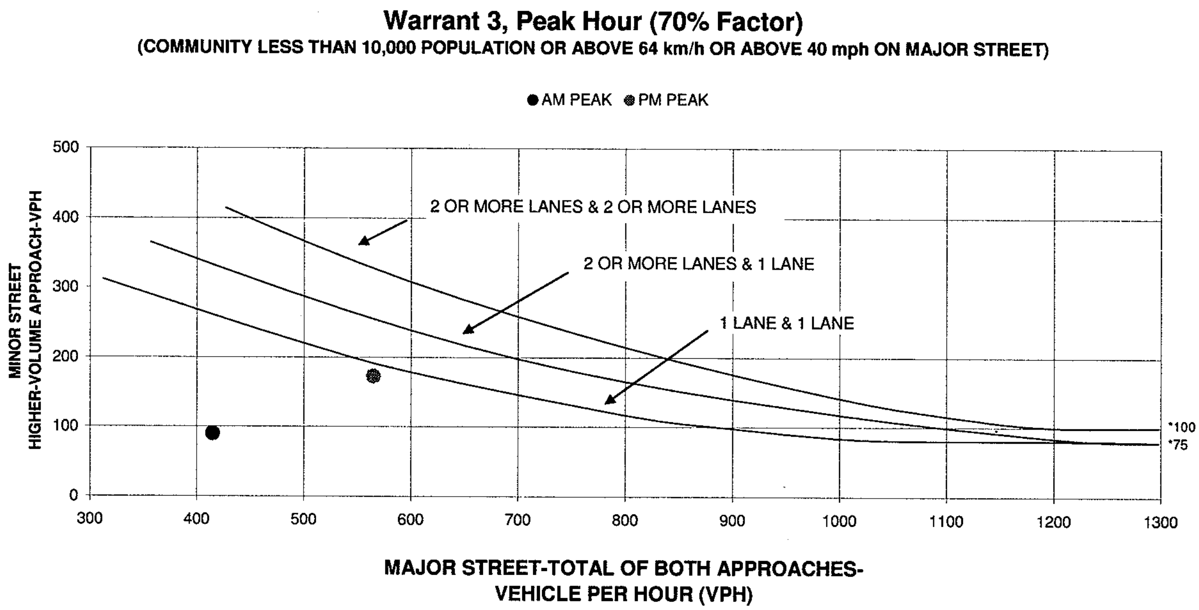
INTERSECTION: McLaughlin Drive / Hagar Court

OF LANES ON MAJOR STREET: 1

WARRANT MET: No

OF LANES ON MINOR STREET: 1

CONDITION: Cumulative 2013 Plus Project Conditions



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	415	565
MINOR STREET:	90	173

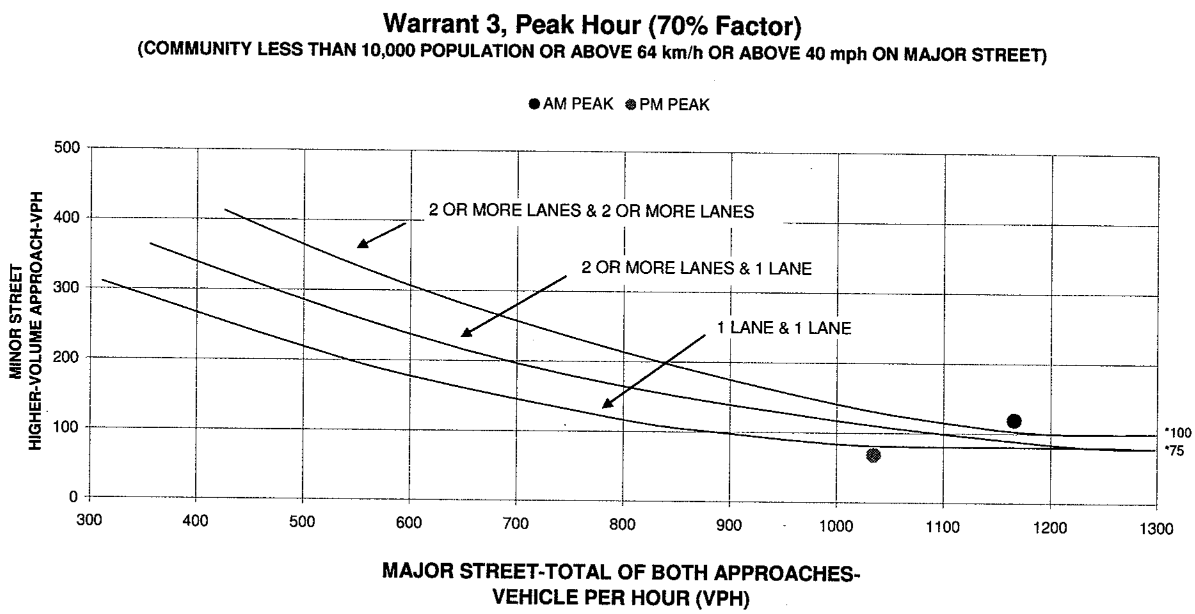
INTERSECTION: Western Drive / Empire Grade

WARRANT MET: Yes

CONDITION: Cumulative 2013 Plus Project Conditions

OF LANES ON MAJOR STREET: 1

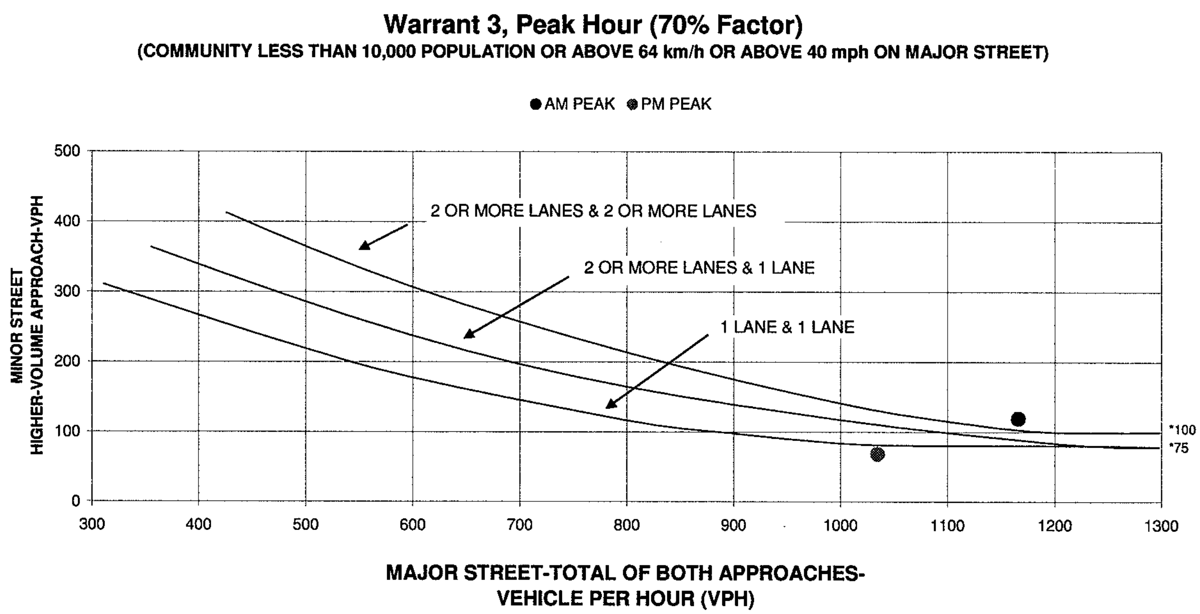
OF LANES ON MINOR STREET: 1



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	1166	1035
MINOR STREET:	119	68

INTERSECTION:	Laurent Street / High Street	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	Yes	# OF LANES ON MINOR STREET:	1
CONDITION:	Cumulative 2013 Plus Project Conditions		



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

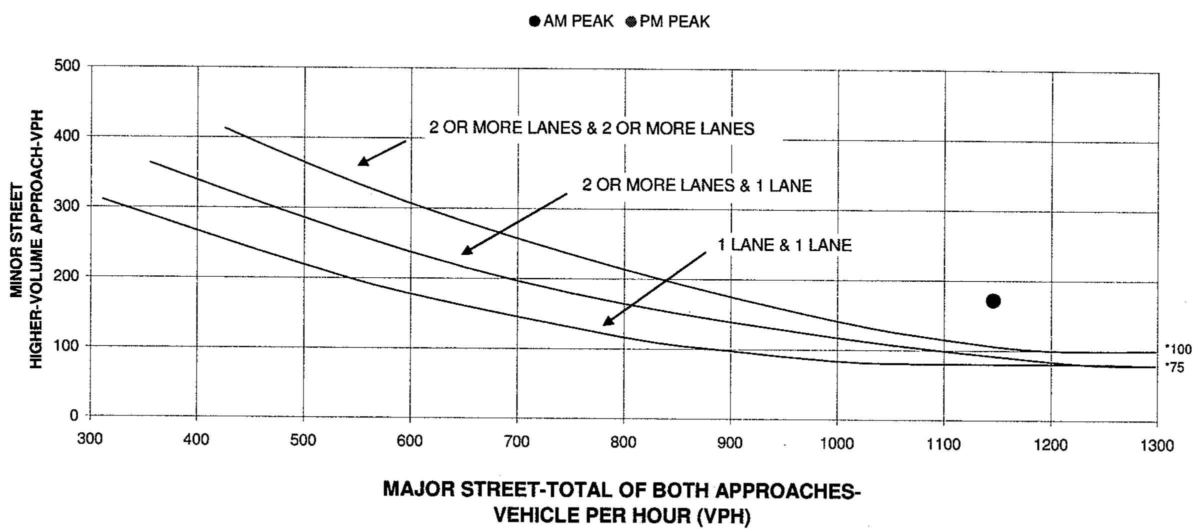
VOLUMES

	AM PEAK	PM PEAK
MAJOR STREET:	1166	1035
MINOR STREET:	119	68

INTERSECTION:	Bay Drive / Escalona Drive	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	Yes	# OF LANES ON MINOR STREET:	1
CONDITION:	Cumulative 2013 Plus Project Conditions		

Warrant 3, Peak Hour (70% Factor)

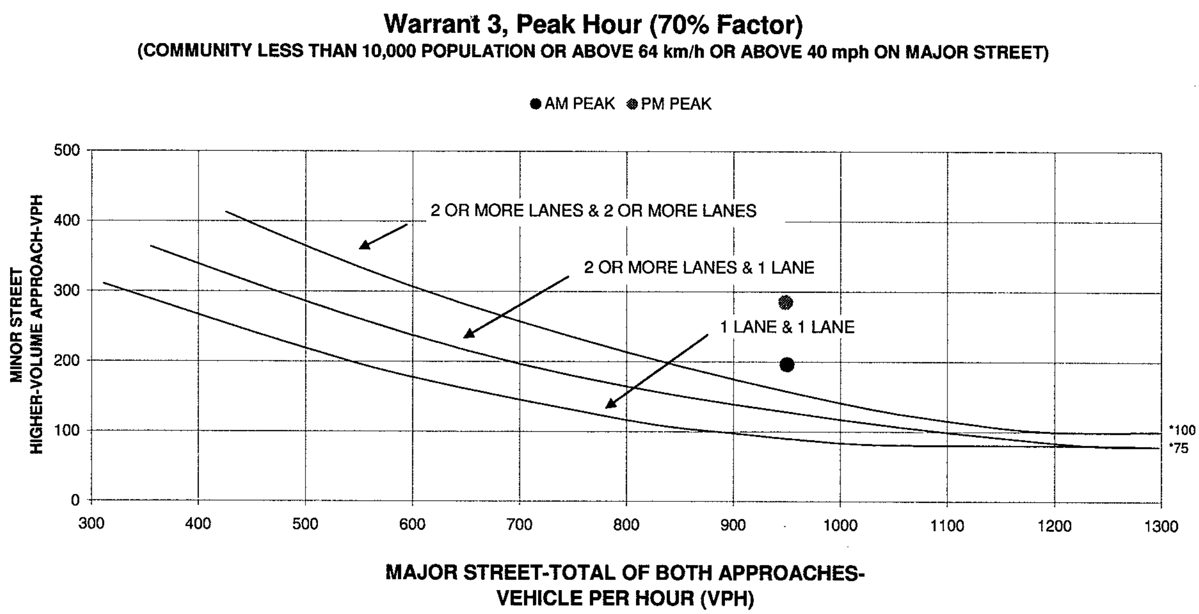
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 64 km/h OR ABOVE 40 mph ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

VOLUMES		
	AM PEAK	PM PEAK
MAJOR STREET:	1146	1457
MINOR STREET:	172	130

INTERSECTION:	Bay Street / California Street	# OF LANES ON MAJOR STREET:	1
WARRANT MET:	Yes	# OF LANES ON MINOR STREET:	1
CONDITION:	Cumulative 2013 Plus Project Conditions		



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane

	VOLUMES	
	AM PEAK	PM PEAK
MAJOR STREET:	950	949
MINOR STREET:	196	285

LEVEL OF SERVICE ANALYSIS
EXISTING CONDITIONS

HCM Unsignalized Intersection Capacity Analysis
1: McLaughlin Dr. & Heller Dr.

1/25/2009

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	85	12	53	66	9	18
Peak Hour Factor	0.83	0.83	0.68	0.68	0.61	0.61
Hourly flow rate (vph)	102	14	78	97	15	30

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	117	175	44
Volume Left (vph)	102	0	15
Volume Right (vph)	14	97	0
Hadj (s)	0.14	-0.30	0.10
Departure Headway (s)	4.5	3.9	4.5
Degree Utilization, x	0.15	0.19	0.05
Capacity (veh/h)	764	883	769
Control Delay (s)	8.3	7.9	7.7
Approach Delay (s)	8.3	7.9	7.7
Approach LOS	A	A	A

Intersection Summary			
Delay	8.0		
HCM Level of Service	A		
Intersection Capacity Utilization	20.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: McLaughlin Dr. & Heller Dr.

1/25/2009

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	121	29	95	150	21	119
Peak Hour Factor	0.83	0.83	0.68	0.68	0.61	0.61
Hourly flow rate (vph)	146	35	140	221	34	195

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	181	360	230
Volume Left (vph)	146	0	34
Volume Right (vph)	35	221	0
Hadj (s)	0.08	-0.33	0.06
Departure Headway (s)	5.3	4.4	4.9
Degree Utilization, x	0.27	0.44	0.31
Capacity (veh/h)	617	792	699
Control Delay (s)	10.2	10.7	10.1
Approach Delay (s)	10.2	10.7	10.1
Approach LOS	B	B	B

Intersection Summary			
Delay	10.4		
HCM Level of Service	B		
Intersection Capacity Utilization	39.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Meyer Dr. & Heller Dr.

1/25/2009

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	29	6	168	83	8	64
Peak Hour Factor	0.58	0.58	0.73	0.73	0.67	0.67
Hourly flow rate (vph)	50	10	230	114	12	96

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	60	344	107
Volume Left (vph)	50	0	12
Volume Right (vph)	10	114	0
Hadj (s)	0.10	-0.16	0.06
Departure Headway (s)	5.0	4.0	4.4
Degree Utilization, x	0.08	0.38	0.13
Capacity (veh/h)	661	879	776
Control Delay (s)	8.4	9.5	8.1
Approach Delay (s)	8.4	9.5	8.1
Approach LOS	A	A	A

Intersection Summary			
Delay	9.1		
HCM Level of Service	A		
Intersection Capacity Utilization	23.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	91	16	137	51	17	285
Peak Hour Factor	0.58	0.58	0.73	0.73	0.67	0.67
Hourly flow rate (vph)	157	28	188	70	25	425

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	184	258	451
Volume Left (vph)	157	0	25
Volume Right (vph)	28	70	0
Hadj (s)	0.11	-0.13	0.05
Departure Headway (s)	5.7	4.9	4.9
Degree Utilization, x	0.29	0.35	0.61
Capacity (veh/h)	574	698	720
Control Delay (s)	11.1	10.6	15.1
Approach Delay (s)	11.1	10.6	15.1
Approach LOS	B	B	C

Intersection Summary			
Delay	13.0		
HCM Level of Service	B		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: McLaughlin Dr. & Chinquapin Rd.

1/25/2009

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	78	126	195	81	66	66
Peak Hour Factor	0.88	0.88	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	89	143	232	96	88	88

Direction, Lane #	SE 1	NW 1	SW 1
Volume Total (vph)	232	329	176
Volume Left (vph)	89	0	88
Volume Right (vph)	0	96	88
Hadj (s)	0.11	-0.14	-0.17
Departure Headway (s)	4.9	4.5	5.0
Degree Utilization, x	0.31	0.41	0.25
Capacity (veh/h)	699	762	645
Control Delay (s)	10.1	10.7	9.7
Approach Delay (s)	10.1	10.7	9.7
Approach LOS	B	B	A

Intersection Summary			
Delay	10.2		
HCM Level of Service	B		
Intersection Capacity Utilization	43.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	96	185	197	81	86	61
Peak Hour Factor	0.88	0.88	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	109	210	235	96	115	81

Direction, Lane #	SE 1	NW 1	SW 1
Volume Total (vph)	319	331	196
Volume Left (vph)	109	0	115
Volume Right (vph)	0	96	81
Hadj (s)	0.10	-0.14	-0.10
Departure Headway (s)	5.0	4.7	5.3
Degree Utilization, x	0.44	0.44	0.29
Capacity (veh/h)	689	726	606
Control Delay (s)	11.8	11.3	10.5
Approach Delay (s)	11.8	11.3	10.5
Approach LOS	B	B	B

Intersection Summary			
Delay	11.3		
HCM Level of Service	B		
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	99	80	11	185	70	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.79	0.79
Hourly flow rate (vph)	115	93	13	215	89	19

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total (vph)	208	228	108
Volume Left (vph)	115	0	89
Volume Right (vph)	93	215	0
Hadj (s)	-0.12	-0.53	0.20
Departure Headway (s)	4.5	4.0	4.8
Degree Utilization, x	0.26	0.25	0.14
Capacity (veh/h)	750	847	695
Control Delay (s)	9.1	8.4	8.7
Approach Delay (s)	9.1	8.4	8.7
Approach LOS	A	A	A

Intersection Summary			
Delay	8.7		
HCM Level of Service	A		
Intersection Capacity Utilization	30.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	188	107	63	161	118	46
Peak Hour Factor	0.86	0.86	0.86	0.86	0.79	0.79
Hourly flow rate (vph)	219	124	73	187	149	58

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total (vph)	343	260	208
Volume Left (vph)	219	0	149
Volume Right (vph)	124	187	0
Hadj (s)	-0.06	-0.40	0.18
Departure Headway (s)	5.0	4.7	5.4
Degree Utilization, x	0.48	0.34	0.31
Capacity (veh/h)	672	709	627
Control Delay (s)	12.5	10.2	10.7
Approach Delay (s)	12.5	10.2	10.7
Approach LOS	B	B	B

Intersection Summary			
Delay	11.3		
HCM Level of Service	B		
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
5: Glenn Coolidge Dr. & Hagar Dr.

3/13/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	369	399	10	10	1	65	31	4	3	0	1	48
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	0.85			0.99			0.87	
Flt Protected	0.95	1.00		0.95	1.00			0.96			1.00	
Satd. Flow (prot)	1770	1856		1770	1587			1771			1615	
Flt Permitted	0.67	1.00		0.49	1.00			0.96			1.00	
Satd. Flow (perm)	1247	1856		908	1587			1771			1615	
Peak-hour factor, PHF	0.94	0.94	0.94	0.48	0.48	0.48	0.91	0.91	0.91	0.79	0.79	0.79
Adj. Flow (vph)	393	424	11	21	2	135	34	4	3	0	1	61
RTOR Reduction (vph)	0	1	0	0	57	0	0	3	0	0	58	0
Lane Group Flow (vph)	393	434	0	21	80	0	0	38	0	0	4	0
Turn Type	Perm			Perm			Split			Split		
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)	21.2	21.2		21.2	21.2			1.8			1.7	
Effective Green, g (s)	21.2	21.2		21.2	21.2			1.8			1.7	
Actuated g/C Ratio	0.58	0.58		0.58	0.58			0.05			0.05	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	720	1072		525	917			87			75	
v/s Ratio Prot		0.23			0.05			c0.02			c0.00	
v/s Ratio Perm	c0.32			0.02								
v/c Ratio	0.55	0.40		0.04	0.09			0.44			0.05	
Uniform Delay, d1	4.8	4.3		3.4	3.4			17.0			16.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.8	0.3		0.0	0.0			3.5			0.3	
Delay (s)	5.6	4.5		3.4	3.5			20.5			17.0	
Level of Service	A	A		A	A			C			B	
Approach Delay (s)		5.0			3.5			20.5			17.0	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	6.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	36.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
5: Glenn Coolidge Dr. & Hagar Dr.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	269	10	14	396	1	19	1	5	0	2	349
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.98			0.87	
Flt Protected	0.95	1.00		0.95	1.00			0.96			1.00	
Satd. Flow (prot)	1770	1852		1770	1862			1748			1613	
Flt Permitted	0.24	1.00		0.56	1.00			0.96			1.00	
Satd. Flow (perm)	452	1852		1052	1862			1748			1613	
Peak-hour factor, PHF	0.94	0.94	0.94	0.48	0.48	0.48	0.91	0.91	0.91	0.79	0.79	0.79
Adj. Flow (vph)	165	286	11	29	825	2	21	1	5	0	3	442
RTOR Reduction (vph)	0	1	0	0	0	0	0	5	0	0	284	0
Lane Group Flow (vph)	165	296	0	29	827	0	0	22	0	0	161	0
Turn Type	Perm			Perm			Split			Split		
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)	62.8	62.8		62.8	62.8			2.9			13.1	
Effective Green, g (s)	62.8	62.8		62.8	62.8			2.9			13.1	
Actuated g/C Ratio	0.69	0.69		0.69	0.69			0.03			0.14	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	313	1281		728	1288			56			233	
v/s Ratio Prot		0.16			c0.44			c0.01			c0.10	
v/s Ratio Perm	0.37			0.03								
v/c Ratio	0.53	0.23		0.04	0.64			0.40			0.69	
Uniform Delay, d1	6.8	5.1		4.4	7.8			43.1			36.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.6	0.1		0.0	1.1			4.6			8.5	
Delay (s)	8.4	5.2		4.5	8.9			47.6			45.4	
Level of Service	A	A		A	A			D			D	
Approach Delay (s)		6.4			8.7			47.6			45.4	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: High St. & Glenn Coolidge Dr.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↑↑↱		↰	↑↑↱	
Volume (vph)	30	124	254	59	207	366	177	389	105	54	70	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	0.97		1.00	0.95	
Flt Protected		0.99	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1845	1583		1842	1583	1770	3426		1770	3371	
Flt Permitted		0.90	1.00		0.89	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1677	1583		1665	1583	1770	3426		1770	3371	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.84	0.84	0.84	0.87	0.87	0.87
Adj. Flow (vph)	33	138	282	66	230	407	211	463	125	62	80	37
RTOR Reduction (vph)	0	0	203	0	0	273	0	33	0	0	23	0
Lane Group Flow (vph)	0	171	79	0	296	134	211	555	0	62	94	0
Turn Type	Perm		Perm	Perm		Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		14.8	14.8		14.8	14.8	6.1	22.6		3.4	19.9	
Effective Green, g (s)		14.8	14.8		14.8	14.8	6.1	22.6		3.4	19.9	
Actuated g/C Ratio		0.28	0.28		0.28	0.28	0.12	0.43		0.06	0.38	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		470	444		467	444	204	1466		114	1271	
v/s Ratio Prot							c0.12	c0.16		0.04	0.03	
v/s Ratio Perm		0.10	0.05		c0.18	0.08						
v/c Ratio		0.36	0.18		0.63	0.30	1.03	0.38		0.54	0.07	
Uniform Delay, d1		15.2	14.4		16.6	14.9	23.4	10.3		23.9	10.5	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.5	0.2		2.8	0.4	72.3	0.7		5.2	0.1	
Delay (s)		15.7	14.6		19.4	15.3	95.6	11.1		29.2	10.7	
Level of Service		B	B		B	B	F	B		C	B	
Approach Delay (s)		15.0			17.1			33.4			17.1	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	52.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	55.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: High St. & Glenn Coolidge Dr.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	88	189	232	62	191	172	144	218	46	316	497	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	0.97		1.00	0.99	
Flt Protected		0.98	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1834	1583		1840	1583	1770	3447		1770	3491	
Flt Permitted		0.67	1.00		0.74	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1257	1583		1371	1583	1770	3447		1770	3491	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.84	0.84	0.84	0.87	0.87	0.87
Adj. Flow (vph)	98	210	258	69	212	191	171	260	55	363	571	57
RTOR Reduction (vph)	0	0	184	0	0	136	0	24	0	0	10	0
Lane Group Flow (vph)	0	308	74	0	281	55	171	291	0	363	618	0
Turn Type	Perm		Perm	Perm		Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		18.4	18.4		18.4	18.4	10.7	18.2		15.5	23.0	
Effective Green, g (s)		18.4	18.4		18.4	18.4	10.7	18.2		15.5	23.0	
Actuated g/C Ratio		0.29	0.29		0.29	0.29	0.17	0.28		0.24	0.36	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		361	454		394	454	295	979		428	1253	
v/s Ratio Prot							0.10	0.08		c0.21	c0.18	
v/s Ratio Perm		c0.24	0.05		0.21	0.03						
v/c Ratio		0.85	0.16		0.71	0.12	0.58	0.30		0.85	0.49	
Uniform Delay, d1		21.6	17.1		20.5	16.9	24.6	17.9		23.2	16.0	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		17.4	0.2		6.0	0.1	2.8	0.8		14.4	1.4	
Delay (s)		39.0	17.3		26.5	17.0	27.4	18.7		37.6	17.4	
Level of Service		D	B		C	B	C	B		D	B	
Approach Delay (s)		29.1			22.7			21.8			24.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	64.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	10	201	126	14	81
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	11	218	137	15	88
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	405	287			355	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	405	287			355	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	99			99	
cM capacity (veh/h)	594	752			1203	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	16	11	355	103
Volume Left	16	0	0	15
Volume Right	0	11	137	0
cSH	594	752	1700	1203
Volume to Capacity	0.03	0.01	0.21	0.01
Queue Length 95th (ft)	2	1	0	1
Control Delay (s)	11.2	9.9	0.0	1.3
Lane LOS	B	A		A
Approach Delay (s)	10.7		0.0	1.3
Approach LOS	B			

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	28.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: East Remote Lot & Hagar Dr

1/25/2009

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	163	38	121	76	68	234
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	177	41	132	83	74	254
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	575	173			214	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	575	173			214	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	61	95			95	
cM capacity (veh/h)	454	871			1356	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	177	41	214	328
Volume Left	177	0	0	74
Volume Right	0	41	83	0
cSH	454	871	1700	1356
Volume to Capacity	0.39	0.05	0.13	0.05
Queue Length 95th (ft)	46	4	0	4
Control Delay (s)	17.9	9.3	0.0	2.1
Lane LOS	C	A		A
Approach Delay (s)	16.3		0.0	2.1
Approach LOS	C			

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Volume (veh/h)	355	51	35	363	108	68
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	386	55	38	395	117	74
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			441		884	414
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			441		884	414
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		62	88
cM capacity (veh/h)			1119		305	639

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total	441	433	191
Volume Left	0	38	117
Volume Right	55	0	74
cSH	1700	1119	382
Volume to Capacity	0.26	0.03	0.50
Queue Length 95th (ft)	0	3	68
Control Delay (s)	0.0	1.1	23.5
Lane LOS		A	C
Approach Delay (s)	0.0	1.1	23.5
Approach LOS			C

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	148	85	417	118	76	324
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.82	0.82	0.84	0.84	0.80	0.80
Hourly flow rate (vph)	180	104	496	140	95	405
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1162	567			637	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1162	567			637	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	7	80			90	
cM capacity (veh/h)	194	523			947	

Direction, Lane #	NB 1	SE 1	NW 1	NW 2
Volume Total	284	637	95	405
Volume Left	180	0	95	0
Volume Right	104	140	0	0
cSH	252	1700	947	1700
Volume to Capacity	1.13	0.37	0.10	0.24
Queue Length 95th (ft)	313	0	8	0
Control Delay (s)	138.2	0.0	9.2	0.0
Lane LOS	F		A	
Approach Delay (s)	138.2	0.0	1.8	
Approach LOS	F			

Intersection Summary			
Average Delay	28.2		
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	8	404	9	7	636	5	24	4	7	37	26	14
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.67	0.67	0.67	0.84	0.84	0.84
Hourly flow rate (vph)	9	444	10	8	699	5	36	6	10	44	31	17

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	463	712	52	92
Volume Left (vph)	9	8	36	44
Volume Right (vph)	10	5	10	17
Hadj (s)	0.02	0.03	0.05	0.02
Departure Headway (s)	5.4	5.1	7.0	6.9
Degree Utilization, x	0.69	1.01	0.10	0.17
Capacity (veh/h)	657	697	470	488
Control Delay (s)	19.4	59.9	10.8	11.3
Approach Delay (s)	19.4	59.9	10.8	11.3
Approach LOS	C	F	B	B

Intersection Summary			
Delay	40.4		
HCM Level of Service	E		
Intersection Capacity Utilization	48.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	13	435	13	10	456	17	12	15	5	9	12	12
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.67	0.67	0.67	0.84	0.84	0.84
Hourly flow rate (vph)	14	478	14	11	501	19	18	22	7	11	14	14

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	507	531	48	39
Volume Left (vph)	14	11	18	11
Volume Right (vph)	14	19	7	14
Hadj (s)	0.02	0.02	0.02	-0.13
Departure Headway (s)	4.9	4.8	6.4	6.3
Degree Utilization, x	0.68	0.71	0.09	0.07
Capacity (veh/h)	720	733	492	492
Control Delay (s)	17.6	18.8	10.0	9.8
Approach Delay (s)	17.6	18.8	10.0	9.8
Approach LOS	C	C	B	A

Intersection Summary			
Delay	17.6		
HCM Level of Service	C		
Intersection Capacity Utilization	40.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
10: Iowa Dr. & Bay St.

1/25/2009

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	39	44	57	26	22	14	14	299	11	30	557	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1820	1583		1814	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.87	1.00		0.85	1.00	0.95	1.00	1.00	0.52	1.00	1.00
Satd. Flow (perm)		1611	1583		1579	1583	1770	3539	1583	968	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.76	0.76	0.76	0.83	0.83	0.83
Adj. Flow (vph)	49	55	71	43	37	23	18	393	14	36	671	80
RTOR Reduction (vph)	0	0	42	0	0	14	0	0	11	0	0	60
Lane Group Flow (vph)	0	104	29	0	80	9	18	393	3	36	671	20
Turn Type	custom		custom	Perm		Perm	Split		Perm	custom		custom
Protected Phases					6		4	4				
Permitted Phases	2	2	2	6		6			4	8	8	8
Actuated Green, G (s)		30.2	30.2		30.2	30.2	13.4	13.4	13.4	18.1	18.1	18.1
Effective Green, g (s)		30.2	30.2		30.2	30.2	13.4	13.4	13.4	18.1	18.1	18.1
Actuated g/C Ratio		0.41	0.41		0.41	0.41	0.18	0.18	0.18	0.25	0.25	0.25
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		660	649		647	649	322	643	288	238	869	389
v/s Ratio Prot							0.01	c0.11				
v/s Ratio Perm		c0.06	0.02		0.05	0.01			0.00	0.04	c0.19	0.01
v/c Ratio		0.16	0.04		0.12	0.01	0.06	0.61	0.01	0.15	0.77	0.05
Uniform Delay, d1		13.7	13.1		13.5	12.9	24.9	27.8	24.7	21.8	25.9	21.2
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.5	0.1		0.4	0.0	0.1	1.7	0.0	0.3	4.3	0.1
Delay (s)		14.2	13.2		13.9	13.0	25.0	29.5	24.7	22.1	30.2	21.3
Level of Service		B	B		B	B	C	C	C	C	C	C
Approach Delay (s)		13.8			13.7			29.1			28.9	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	39.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Iowa Dr. & Bay St.

1/25/2009

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↰	↱		↰	↱	↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	31	19	65	37	30	12	57	377	38	17	805	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1807	1583		1813	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.75	1.00		0.79	1.00	0.95	1.00	1.00	0.47	1.00	1.00
Satd. Flow (perm)		1398	1583		1477	1583	1770	3539	1583	876	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.76	0.76	0.76	0.83	0.83	0.83
Adj. Flow (vph)	39	24	81	62	50	20	75	496	50	20	970	53
RTOR Reduction (vph)	0	0	69	0	0	17	0	0	38	0	0	32
Lane Group Flow (vph)	0	63	12	0	112	3	75	496	12	20	970	21
Turn Type	custom		custom	Perm		Perm	Split		Perm	custom		custom
Protected Phases					6		4	4				
Permitted Phases	2	2	2	6		6			4	8	8	8
Actuated Green, G (s)		7.6	7.6		7.6	7.6	13.1	13.1	13.1	20.8	20.8	20.8
Effective Green, g (s)		7.6	7.6		7.6	7.6	13.1	13.1	13.1	20.8	20.8	20.8
Actuated g/C Ratio		0.14	0.14		0.14	0.14	0.24	0.24	0.24	0.39	0.39	0.39
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		199	225		210	225	433	867	388	341	1376	615
v/s Ratio Prot							0.04	c0.14				
v/s Ratio Perm		0.05	0.01		c0.08	0.00			0.01	0.02	c0.27	0.01
v/c Ratio		0.32	0.05		0.53	0.01	0.17	0.57	0.03	0.06	0.70	0.03
Uniform Delay, d1		20.6	19.8		21.3	19.7	15.9	17.7	15.4	10.2	13.8	10.1
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.9	0.1		2.6	0.0	0.2	0.9	0.0	0.1	1.7	0.0
Delay (s)		21.5	19.9		23.9	19.7	16.1	18.7	15.4	10.3	15.4	10.1
Level of Service		C	B		C	B	B	B	B	B	B	B
Approach Delay (s)		20.6			23.3			18.1			15.1	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	53.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
11: Escalona Dr & Bay St

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	8	26	43	3	18	64	20	618	10	34	332	27
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	28	47	3	20	70	22	672	11	37	361	29
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1249	1176	376	1216	1185	677	390			683		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1249	1176	376	1216	1185	677	390			683		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	84	93	97	89	85	98			96		
cM capacity (veh/h)	111	180	671	124	178	453	1168			910		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	84	92	704	37	390
Volume Left	9	3	22	37	0
Volume Right	47	70	11	0	29
cSH	275	319	1168	910	1700
Volume to Capacity	0.30	0.29	0.02	0.04	0.23
Queue Length 95th (ft)	31	29	1	3	0
Control Delay (s)	23.8	20.9	0.5	9.1	0.0
Lane LOS	C	C	A	A	
Approach Delay (s)	23.8	20.9	0.5	0.8	
Approach LOS	C	C			

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	4	15	37	11	14	44	32	491	14	106	645	58
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	16	40	12	15	48	35	534	15	115	701	63
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1629	1582	733	1591	1605	541	764			549		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1629	1582	733	1591	1605	541	764			549		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	82	90	80	83	91	96			89		
cM capacity (veh/h)	57	93	421	60	89	541	849			1021		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	61	75	584	115	764
Volume Left	4	12	35	115	0
Volume Right	40	48	15	0	63
cSH	175	164	849	1021	1700
Volume to Capacity	0.35	0.46	0.04	0.11	0.45
Queue Length 95th (ft)	36	53	3	10	0
Control Delay (s)	36.1	44.1	1.1	9.0	0.0
Lane LOS	E	E	A	A	
Approach Delay (s)	36.1	44.1	1.1	1.2	
Approach LOS	E	E			

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	WBR2	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	9	421	36	102	265	7	38	114	13	62	77	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.85		1.00	1.00			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	0.95			0.99			0.98	1.00
Satd. Flow (prot)	1770	1583		1770	1769			1823			1822	1583
Flt Permitted	0.53	1.00		0.26	0.95			0.92			0.82	1.00
Satd. Flow (perm)	982	1583		488	1769			1688			1530	1583
Peak-hour factor, PHF	0.83	0.83	0.83	0.86	0.86	0.86	0.90	0.90	0.90	0.84	0.84	0.84
Adj. Flow (vph)	11	507	43	119	308	8	42	127	14	74	92	162
RTOR Reduction (vph)	0	8	0	0	2	0	0	7	0	0	0	96
Lane Group Flow (vph)	11	542	0	119	314	0	0	176	0	0	166	66
Turn Type		custom		Perm			Perm			Perm		Perm
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		6
Actuated Green, G (s)	15.3	15.3		15.3	15.3			16.0			16.0	16.0
Effective Green, g (s)	15.3	15.3		15.3	15.3			16.0			16.0	16.0
Actuated g/C Ratio	0.39	0.39		0.39	0.39			0.41			0.41	0.41
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	382	616		190	689			687			623	644
v/s Ratio Prot		c0.34			0.18							
v/s Ratio Perm	0.01			0.24				0.10			c0.11	0.04
v/c Ratio	0.03	0.88		0.63	0.46			0.26			0.27	0.10
Uniform Delay, d1	7.4	11.1		9.7	8.9			7.7			7.7	7.2
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	0.0	13.6		6.3	0.5			0.9			1.0	0.3
Delay (s)	7.4	24.7		16.0	9.4			8.6			8.8	7.5
Level of Service	A	C		B	A			A			A	A
Approach Delay (s)	24.4				11.2			8.6			8.2	
Approach LOS	C				B			A			A	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	39.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	↱		↰	↱			✣			↰	↱
Volume (vph)	161	445	33	11	387	46	27	95	12	34	118	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.99		1.00	0.98			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	1.00
Satd. Flow (prot)	1770	1844		1770	1833			1822			1842	1583
Flt Permitted	0.31	1.00		0.28	1.00			0.93			0.92	1.00
Satd. Flow (perm)	583	1844		520	1833			1710			1716	1583
Peak-hour factor, PHF	0.86	0.86	0.86	0.83	0.83	0.83	0.90	0.90	0.90	0.84	0.84	0.84
Adj. Flow (vph)	187	517	38	13	466	55	30	106	13	40	140	164
RTOR Reduction (vph)	0	6	0	0	10	0	0	6	0	0	0	100
Lane Group Flow (vph)	187	549	0	13	511	0	0	143	0	0	180	64
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	17.6	17.6		17.6	17.6			16.3			16.3	16.3
Effective Green, g (s)	17.6	17.6		17.6	17.6			16.3			16.3	16.3
Actuated g/C Ratio	0.42	0.42		0.42	0.42			0.39			0.39	0.39
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	245	775		218	770			665			668	616
v/s Ratio Prot		0.30			0.28							
v/s Ratio Perm	c0.32			0.02				0.08			c0.10	0.04
v/c Ratio	0.76	0.71		0.06	0.66			0.21			0.27	0.10
Uniform Delay, d1	10.4	10.0		7.2	9.8			8.5			8.7	8.1
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	13.2	3.0		0.1	2.2			0.7			1.0	0.3
Delay (s)	23.5	13.0		7.3	11.9			9.3			9.7	8.5
Level of Service	C	B		A	B			A			A	A
Approach Delay (s)		15.7			11.8			9.3			9.1	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	41.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Bay St. & Mission St.

1/25/2009

Movement	EBL	EBR	EBR2	NBL	NBR	NBR2	NWL2	NWL	NWR	SWL2	SWL	SWR
Lane Configurations												
Volume (vph)	143	122	51	79	773	66	74	135	83	137	775	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.88		1.00	1.00		1.00	0.97	
Frt	1.00	0.85		1.00	0.85		1.00	0.94		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (prot)	1770	1583		1770	2787		1770	1704		1770	3377	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (perm)	1770	1583		1770	2787		1770	1704		1770	3377	
Peak-hour factor, PHF	0.84	0.84	0.84	0.95	0.95	0.95	0.83	0.83	0.83	0.94	0.94	0.94
Adj. Flow (vph)	170	145	61	83	814	69	89	163	100	146	824	182
RTOR Reduction (vph)	0	10	0	0	3	0	0	15	0	0	13	0
Lane Group Flow (vph)	170	196	0	83	880	0	89	248	0	146	993	0
Turn Type		Perm			Perm		Split			Split		
Protected Phases	4			2			8	8		3	3	
Permitted Phases		4			2							
Actuated Green, G (s)	21.5	21.5		45.1	45.1		23.2	23.2		41.0	41.0	
Effective Green, g (s)	21.5	21.5		45.1	45.1		23.2	23.2		41.0	41.0	
Actuated g/C Ratio	0.15	0.15		0.31	0.31		0.16	0.16		0.28	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	259	232		544	856		280	269		494	943	
v/s Ratio Prot	0.10			0.05			0.05	c0.15		0.08	c0.29	
v/s Ratio Perm		c0.12			c0.32							
v/c Ratio	0.66	0.84		0.15	1.03		0.32	0.92		0.30	1.05	
Uniform Delay, d1	59.2	61.0		37.0	50.8		54.8	60.9		41.6	52.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.9	23.4		0.6	38.0		0.7	34.6		0.3	44.3	
Delay (s)	65.0	84.4		37.6	88.8		55.4	95.5		41.9	97.2	
Level of Service	E	F		D	F		E	F		D	F	
Approach Delay (s)	75.7			84.4				85.4			90.2	
Approach LOS	E			F				F			F	

Intersection Summary			
HCM Average Control Delay	85.7	HCM Level of Service	F
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	146.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	EBR2	NBL	NBR	NBR2	NWL2	NWL	NWR	SWL2	SWL	SWR
Lane Configurations												
Volume (vph)	222	127	99	128	902	67	92	134	58	125	862	228
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.88		1.00	1.00		1.00	0.97	
Frt	1.00	0.85		1.00	0.85		1.00	0.95		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (prot)	1770	1583		1770	2787		1770	1718		1770	3367	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (perm)	1770	1583		1770	2787		1770	1718		1770	3367	
Peak-hour factor, PHF	0.84	0.84	0.84	0.95	0.95	0.95	0.83	0.83	0.83	0.94	0.94	0.94
Adj. Flow (vph)	264	151	118	135	949	71	111	161	70	133	917	243
RTOR Reduction (vph)	0	18	0	0	3	0	0	15	0	0	15	0
Lane Group Flow (vph)	264	251	0	135	1017	0	111	216	0	133	1145	0
Turn Type		Prot			custom		Split			Split		
Protected Phases	1	1		2	2		8	8		3	3	
Permitted Phases					2							
Actuated Green, G (s)	13.0	13.0		26.0	26.0		18.0	18.0		30.1	30.1	
Effective Green, g (s)	13.0	13.0		26.0	26.0		18.0	18.0		30.1	30.1	
Actuated g/C Ratio	0.13	0.13		0.25	0.25		0.17	0.17		0.29	0.29	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	223	200		446	703		309	300		517	983	
v/s Ratio Prot	0.15	c0.16		0.08	c0.36		0.06	c0.13		0.08	c0.34	
v/s Ratio Perm												
v/c Ratio	1.18	1.25		0.30	1.45		0.36	0.72		0.26	1.16	
Uniform Delay, d1	45.0	45.0		31.2	38.6		37.5	40.2		27.9	36.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	118.9	148.2		0.4	209.0		0.7	8.2		0.3	85.5	
Delay (s)	164.0	193.3		31.6	247.5		38.2	48.4		28.2	122.0	
Level of Service	F	F		C	F		D	D		C	F	
Approach Delay (s)	178.7			222.3				45.1			112.3	
Approach LOS	F			F				D			F	

Intersection Summary			
HCM Average Control Delay	154.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	103.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Laurel St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	18	88	4	247	119	52	4	1041	158	42	873	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.95		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1851		1770	1778		1770	3469		1770	3529	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1851		1770	1778		1770	3469		1770	3529	
Peak-hour factor, PHF	0.98	0.98	0.98	1.00	1.00	1.00	0.83	0.83	0.83	0.79	0.79	0.79
Adj. Flow (vph)	18	90	4	247	119	52	5	1254	190	53	1105	22
RTOR Reduction (vph)	0	2	0	0	13	0	0	9	0	0	1	0
Lane Group Flow (vph)	18	92	0	247	158	0	5	1435	0	53	1126	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.0	13.0		17.0	27.0		16.0	47.0		16.0	47.0	
Effective Green, g (s)	3.0	13.0		17.0	27.0		16.0	47.0		16.0	47.0	
Actuated g/C Ratio	0.03	0.12		0.16	0.25		0.15	0.43		0.15	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	49	221		276	440		260	1496		260	1522	
v/s Ratio Prot	0.01	0.05		c0.14	c0.09		0.00	c0.41		c0.03	0.32	
v/s Ratio Perm												
v/c Ratio	0.37	0.42		0.89	0.36		0.02	0.96		0.20	0.74	
Uniform Delay, d1	52.1	44.5		45.1	33.9		39.8	30.1		40.9	25.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.6	1.3		28.5	0.5		0.1	15.4		1.8	3.3	
Delay (s)	56.7	45.8		73.7	34.4		39.9	45.5		42.7	29.2	
Level of Service	E	D		E	C		D	D		D	C	
Approach Delay (s)		47.5			57.6			45.4			29.8	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM Average Control Delay	41.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	109.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Laurel St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	210	32	9	435	292	55	9	1187	550	142	1087	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.97		1.00	0.98		1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1803		1770	1818		1770	3371		1770	3522	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1803		1770	1818		1770	3371		1770	3522	
Peak-hour factor, PHF	0.98	0.98	0.98	1.00	1.00	1.00	0.83	0.83	0.83	0.79	0.79	0.79
Adj. Flow (vph)	214	33	9	435	292	55	11	1430	663	180	1376	47
RTOR Reduction (vph)	0	7	0	0	5	0	0	35	0	0	1	0
Lane Group Flow (vph)	214	35	0	435	342	0	11	2058	0	180	1422	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	19.0	18.4		32.0	31.4		3.0	68.5		16.0	81.5	
Effective Green, g (s)	19.0	18.4		32.0	31.4		3.0	68.5		16.0	81.5	
Actuated g/C Ratio	0.13	0.12		0.21	0.21		0.02	0.45		0.11	0.54	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	223	220		375	378		35	1530		188	1902	
v/s Ratio Prot	0.12	0.02		c0.25	c0.19		0.01	c0.61		c0.10	0.40	
v/s Ratio Perm												
v/c Ratio	0.96	0.16		1.16	0.91		0.31	1.34		0.96	0.75	
Uniform Delay, d1	65.6	59.3		59.4	58.3		72.9	41.2		67.1	26.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	48.3	0.3		97.7	24.4		5.1	159.6		52.8	1.6	
Delay (s)	113.8	59.7		157.1	82.7		78.0	200.8		119.9	28.4	
Level of Service	F	E		F	F		E	F		F	C	
Approach Delay (s)		105.0			124.1			200.2			38.7	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	127.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	150.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
15: Walnut Ave. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↑↱		↰	↑↑↱	
Volume (vph)	56	91	7	47	66	57	9	997	42	57	1015	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.93		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1842		1770	1733		1770	3518		1770	3531	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1842		1770	1733		1770	3518		1770	3531	
Peak-hour factor, PHF	0.79	0.79	0.79	0.62	0.62	0.62	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	71	115	9	76	106	92	9	1049	44	62	1103	17
RTOR Reduction (vph)	0	2	0	0	22	0	0	2	0	0	1	0
Lane Group Flow (vph)	71	122	0	76	176	0	9	1091	0	62	1119	0
Turn Type	Split			Split			Split			Split		
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	14.3	14.3		18.2	18.2		44.2	44.2		42.2	42.2	
Effective Green, g (s)	14.3	14.3		18.2	18.2		44.2	44.2		42.2	42.2	
Actuated g/C Ratio	0.11	0.11		0.13	0.13		0.33	0.33		0.31	0.31	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	188	195		239	234		580	1153		554	1105	
v/s Ratio Prot	0.04	c0.07		0.04	c0.10		0.01	c0.31		0.04	c0.32	
v/s Ratio Perm												
v/c Ratio	0.38	0.63		0.32	0.75		0.02	0.95		0.11	1.01	
Uniform Delay, d1	56.2	57.7		52.7	56.2		30.6	44.2		33.0	46.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	6.2		0.8	12.9		0.0	16.4		0.4	30.3	
Delay (s)	57.4	63.9		53.5	69.1		30.7	60.6		33.4	76.7	
Level of Service	E	E		D	E		C	E		C	E	
Approach Delay (s)		61.5			64.7			60.3			74.4	
Approach LOS		E			E			E			E	

Intersection Summary			
HCM Average Control Delay	66.9	HCM Level of Service	E
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	134.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	54	8	92	113	58	10	1404	48	25	1613	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.95		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1827		1770	1768		1770	3522		1770	3533	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1827		1770	1768		1770	3522		1770	3533	
Peak-hour factor, PHF	0.79	0.79	0.79	0.62	0.62	0.62	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	57	68	10	148	182	94	11	1478	51	27	1753	21
RTOR Reduction (vph)	0	4	0	0	12	0	0	1	0	0	1	0
Lane Group Flow (vph)	57	74	0	148	264	0	11	1528	0	27	1773	0
Turn Type	Split			Split			Split			Split		
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	10.9	10.9		23.3	23.3		41.0	41.0		45.0	45.0	
Effective Green, g (s)	10.9	10.9		23.3	23.3		41.0	41.0		45.0	45.0	
Actuated g/C Ratio	0.08	0.08		0.17	0.17		0.30	0.30		0.33	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	142	146		303	302		533	1060		585	1167	
v/s Ratio Prot	0.03	c0.04		0.08	c0.15		0.01	c0.43		0.02	c0.50	
v/s Ratio Perm												
v/c Ratio	0.40	0.51		0.49	0.87		0.02	1.44		0.05	1.52	
Uniform Delay, d1	59.5	60.1		51.1	55.0		33.5	47.6		31.0	45.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.9	2.8		1.2	23.1		0.0	203.9		0.0	238.2	
Delay (s)	61.4	62.9		52.3	78.1		33.5	251.5		31.0	283.8	
Level of Service	E	E		D	E		C	F		C	F	
Approach Delay (s)		62.2			69.1			250.0			280.0	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	237.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	136.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
16: California St. & Bay St.

1/25/2009

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	99	86	95	223	279	292
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.74	0.74	0.69	0.69
Hourly flow rate (vph)	118	102	128	301	404	423
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1174	616	828			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1174	616	828			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	34	79	84			
cM capacity (veh/h)	178	491	804			

Direction, Lane #	SB 1	SE 1	NW 1
Volume Total	220	430	828
Volume Left	118	128	0
Volume Right	102	0	423
cSH	253	804	1700
Volume to Capacity	0.87	0.16	0.49
Queue Length 95th (ft)	182	14	0
Control Delay (s)	70.2	4.5	0.0
Lane LOS	F	A	
Approach Delay (s)	70.2	4.5	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	11.8		
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
16: California St. & Bay St.

1/25/2009

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	182	92	71	315	245	268
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.74	0.74	0.69	0.69
Hourly flow rate (vph)	217	110	96	426	355	388
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1167	549	743			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1167	549	743			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	80	89			
cM capacity (veh/h)	190	535	864			

Direction, Lane #	SB 1	SE 1	NW 1
Volume Total	326	522	743
Volume Left	217	96	0
Volume Right	110	0	388
cSH	243	864	1700
Volume to Capacity	1.34	0.11	0.44
Queue Length 95th (ft)	436	9	0
Control Delay (s)	219.1	3.0	0.0
Lane LOS	F	A	
Approach Delay (s)	219.1	3.0	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	45.9		
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
17: King St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	✥			✥			↑↱		↰	↑↱	
Volume (vph)	108	0	81	4	0	2	46	525	10	11	650	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00			0.95		1.00	0.95	
Frt	1.00	0.87			0.96			1.00		1.00	0.98	
Flt Protected	0.95	0.99			0.97			1.00		0.95	1.00	
Satd. Flow (prot)	1681	1526			1722			3516		1770	3478	
Flt Permitted	0.95	0.99			0.97			0.87		0.95	1.00	
Satd. Flow (perm)	1681	1526			1722			3061		1770	3478	
Peak-hour factor, PHF	0.88	0.88	0.88	0.50	0.50	0.50	1.00	1.00	1.00	0.98	0.98	0.98
Adj. Flow (vph)	123	0	92	8	0	4	46	525	10	11	663	87
RTOR Reduction (vph)	0	80	0	0	4	0	0	1	0	0	7	0
Lane Group Flow (vph)	111	24	0	0	8	0	0	580	0	11	743	0
Turn Type	Split			Split			Perm			Prot		
Protected Phases	4	4		8	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	7.2	7.2			1.1			29.1		0.7	33.8	
Effective Green, g (s)	7.2	7.2			1.1			29.1		0.7	33.8	
Actuated g/C Ratio	0.13	0.13			0.02			0.54		0.01	0.62	
Clearance Time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	224	203			35			1646		23	2173	
v/s Ratio Prot	c0.07	0.02			c0.00					0.01	c0.21	
v/s Ratio Perm								0.19				
v/c Ratio	0.50	0.12			0.23			0.35		0.48	0.34	
Uniform Delay, d1	21.8	20.7			26.1			7.1		26.5	4.8	
Progression Factor	1.00	1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2	1.7	0.3			3.4			0.6		14.8	0.4	
Delay (s)	23.5	20.9			29.4			7.7		41.4	5.8	
Level of Service	C	C			C			A		D	A	
Approach Delay (s)		22.2			29.4			7.7			5.8	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	54.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	✥			✥		↰	↑↱		↰	↑↱	
Volume (vph)	82	4	9	2	2	10	0	835	4	4	736	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00			0.95		1.00	0.95	
Frt	1.00	0.97			0.90			1.00		1.00	0.98	
Flt Protected	0.95	0.97			0.99			1.00		0.95	1.00	
Satd. Flow (prot)	1681	1660			1671			3537		1770	3468	
Flt Permitted	0.95	0.97			0.99			1.00		0.95	1.00	
Satd. Flow (perm)	1681	1660			1671			3537		1770	3468	
Peak-hour factor, PHF	0.88	0.88	0.88	0.50	0.50	0.50	1.00	1.00	1.00	0.98	0.98	0.98
Adj. Flow (vph)	93	5	10	4	4	20	0	835	4	4	751	116
RTOR Reduction (vph)	0	9	0	0	20	0	0	1	0	0	8	0
Lane Group Flow (vph)	55	44	0	0	8	0	0	838	0	4	859	0
Turn Type	Split			Split			Prot			Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.9	3.9			0.9			20.1		0.5	24.6	
Effective Green, g (s)	3.9	3.9			0.9			20.1		0.5	24.6	
Actuated g/C Ratio	0.09	0.09			0.02			0.49		0.01	0.59	
Clearance Time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	158	156			36			1717		21	2061	
v/s Ratio Prot	c0.03	0.03			c0.01			c0.24		0.00	c0.25	
v/s Ratio Perm												
v/c Ratio	0.35	0.28			0.23			0.49		0.19	0.42	
Uniform Delay, d1	17.6	17.4			19.9			7.2		20.2	4.5	
Progression Factor	1.00	1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2	1.3	1.0			3.3			0.2		4.4	0.1	
Delay (s)	18.9	18.4			23.2			7.4		24.6	4.7	
Level of Service	B	B			C			A		C	A	
Approach Delay (s)		18.7			23.2			7.4			4.8	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	41.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: Mission St. & Chestnut St.

1/25/2009

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER	NER2
Lane Configurations												
Volume (vph)	9	361	24	68	302	22	58	234	1397	1482	383	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.97		1.00	0.95		1.00	0.95	0.88	0.97	0.91	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	0.85	0.85
Flt Protected	0.95	0.96		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3419		1770	3503		1770	3539	2787	3433	1441	1583
Flt Permitted	0.95	0.96		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3419		1770	3503		1770	3539	2787	3433	1441	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.77	0.77	0.77	0.89	0.89	0.89	0.88	0.88	0.88
Adj. Flow (vph)	10	415	28	88	392	29	65	263	1570	1684	435	28
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	971	0	0	15
Lane Group Flow (vph)	10	440	0	88	417	0	65	263	599	1728	391	13
Turn Type	Split			Prot			Prot		Perm		Prot	Perm
Protected Phases	3	3		5	2		1	6		4	4	
Permitted Phases									6			4
Actuated Green, G (s)	23.0	23.0		5.0	31.5		6.3	32.8	32.8	62.1	62.1	62.1
Effective Green, g (s)	23.0	23.0		5.0	31.5		6.3	32.8	32.8	62.1	62.1	62.1
Actuated g/C Ratio	0.17	0.17		0.04	0.23		0.05	0.24	0.24	0.45	0.45	0.45
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	293	566		64	794		80	836	658	1535	644	708
v/s Ratio Prot	0.01	c0.13		c0.05	0.12		0.04	0.07		c0.50	0.27	
v/s Ratio Perm									c0.22			0.01
v/c Ratio	0.03	0.78		1.38	0.53		0.81	0.31	0.91	1.13	0.61	0.02
Uniform Delay, d1	48.6	55.5		67.0	47.1		65.7	43.8	51.6	38.4	29.1	21.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	6.6		241.0	2.5		44.4	1.0	18.9	65.6	1.6	0.0
Delay (s)	48.7	62.1		307.9	49.6		110.2	44.8	70.6	104.0	30.8	21.4
Level of Service	D	E		F	D		F	D	E	F	C	C
Approach Delay (s)		61.8			94.3			68.3		89.6		
Approach LOS		E			F			E		F		

Intersection Summary			
HCM Average Control Delay	79.5	HCM Level of Service	E
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	138.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: Mission St. & Chestnut St.

1/25/2009

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER	NER2
Lane Configurations												
Volume (vph)	17	451	25	96	287	4	58	326	1411	1235	451	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.97		1.00	0.95		1.00	0.95	0.88	0.97	0.91	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	0.99	0.85	0.85
Flt Protected	0.95	0.95		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3423		1770	3532		1770	3539	2787	3429	1441	1583
Flt Permitted	0.95	0.95		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3423		1770	3532		1770	3539	2787	3429	1441	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.77	0.77	0.77	0.89	0.89	0.89	0.88	0.88	0.88
Adj. Flow (vph)	20	518	29	125	373	5	65	366	1585	1403	512	56
RTOR Reduction (vph)	0	3	0	0	1	0	0	0	865	0	0	33
Lane Group Flow (vph)	20	544	0	125	377	0	65	366	720	1454	461	23
Turn Type	Split			Prot			Prot		Perm		Prot	Perm
Protected Phases	3	3		5	2		1	6		4	4	
Permitted Phases									6			4
Actuated Green, G (s)	26.5	26.5		9.0	36.7		8.2	35.9	35.9	55.0	55.0	55.0
Effective Green, g (s)	26.5	26.5		9.0	36.7		8.2	35.9	35.9	55.0	55.0	55.0
Actuated g/C Ratio	0.19	0.19		0.06	0.26		0.06	0.25	0.25	0.39	0.39	0.39
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	329	637		112	910		102	892	703	1324	557	611
v/s Ratio Prot	0.01	c0.16		c0.07	0.11		0.04	0.10		c0.42	0.32	
v/s Ratio Perm									c0.26			0.01
v/c Ratio	0.06	0.85		1.12	0.41		0.64	0.41	1.02	1.10	0.83	0.04
Uniform Delay, d1	47.7	56.1		66.7	43.9		65.6	44.4	53.2	43.7	39.4	27.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	10.8		119.7	1.4		12.3	1.4	40.1	56.1	9.8	0.0
Delay (s)	47.8	66.8		186.4	45.3		78.0	45.8	93.3	99.8	49.2	27.3
Level of Service	D	E		F	D		E	D	F	F	D	C
Approach Delay (s)		66.2			80.4			84.2		85.9		
Approach LOS		E			F			F		F		

Intersection Summary			
HCM Average Control Delay	82.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	142.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	373	175	172	38	167	235	222	1610	82	315	1398	648
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	3433	1863	1583	1770	5048		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	3433	1863	1583	1770	5048		3433	5085	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.90	0.90	0.90	0.93	0.93	0.93	0.97	0.97	0.97
Adj. Flow (vph)	385	180	177	42	186	261	239	1731	88	325	1441	668
RTOR Reduction (vph)	0	0	115	0	0	167	0	4	0	0	0	0
Lane Group Flow (vph)	385	180	62	42	186	94	239	1815	0	325	1441	668
Turn Type	Prot		Perm	Prot		Perm	Split			Split		Free
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases			2			6						Free
Actuated Green, G (s)	24.0	52.8	52.8	4.0	32.8	32.8	44.0	44.0		34.0	34.0	150.8
Effective Green, g (s)	24.0	52.8	52.8	4.0	32.8	32.8	44.0	44.0		34.0	34.0	150.8
Actuated g/C Ratio	0.16	0.35	0.35	0.03	0.22	0.22	0.29	0.29		0.23	0.23	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	282	652	976	91	405	344	516	1473		774	1146	1583
v/s Ratio Prot	c0.22	0.10		0.01	0.10		0.14	c0.36		0.09	c0.28	
v/s Ratio Perm			0.02			0.06						c0.42
v/c Ratio	1.37	0.28	0.06	0.46	0.46	0.27	0.46	1.23		0.42	1.26	0.42
Uniform Delay, d1	63.4	35.3	32.6	72.3	51.3	49.1	43.7	53.4		50.0	58.4	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	185.5	1.0	0.1	3.7	3.7	1.9	0.7	110.7		0.4	123.1	0.8
Delay (s)	248.9	36.3	32.7	76.0	55.0	51.0	44.4	164.1		50.3	181.5	0.8
Level of Service	F	D	C	E	E	D	D	F		D	F	A
Approach Delay (s)		145.8			54.7			150.2			114.4	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	126.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	150.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: River St. & Highway 1 1/25/2009

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	690	275	250	92	246	462	238	1203	92	353	1301	484
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	3433	1863	1583	1770	5031		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	3433	1863	1583	1770	5031		3433	5085	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.90	0.90	0.90	0.93	0.93	0.93	0.97	0.97	0.97
Adj. Flow (vph)	711	284	258	102	273	513	256	1294	99	364	1341	499
RTOR Reduction (vph)	0	0	169	0	0	220	0	6	0	0	0	0
Lane Group Flow (vph)	711	284	89	102	273	293	256	1387	0	364	1341	499
Turn Type	Prot		Perm	Prot		Perm	Split			Split		Free
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases			2			6						Free
Actuated Green, G (s)	28.0	53.0	53.0	5.0	30.0	30.0	44.0	44.0		36.0	36.0	154.0
Effective Green, g (s)	28.0	53.0	53.0	5.0	30.0	30.0	44.0	44.0		36.0	36.0	154.0
Actuated g/C Ratio	0.18	0.34	0.34	0.03	0.19	0.19	0.29	0.29		0.23	0.23	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	322	641	959	111	363	308	506	1437		803	1189	1583
v/s Ratio Prot	c0.40	0.15		0.03	0.15		0.14	c0.28		0.11	c0.26	
v/s Ratio Perm			0.03			c0.19						0.32
v/c Ratio	2.21	0.44	0.09	0.92	0.75	0.95	0.51	0.97		0.45	1.13	0.32
Uniform Delay, d1	63.0	39.1	34.2	74.3	58.5	61.3	45.9	54.2		50.6	59.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	553.7	2.2	0.2	59.7	13.4	40.4	0.8	16.1		0.4	68.7	0.5
Delay (s)	616.7	41.3	34.4	134.0	71.9	101.7	46.7	70.3		51.0	127.7	0.5
Level of Service	F	D	C	F	E	F	D	E		D	F	A
Approach Delay (s)		366.4			96.2			66.7			86.2	
Approach LOS		F			F			E			F	

Intersection Summary			
HCM Average Control Delay	140.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	154.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

LEVEL OF SERVICE ANALYSIS
EXISTING PLUS PROJECT CONDITIONS

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	86	12	53	66	9	18
Peak Hour Factor	0.83	0.83	0.68	0.68	0.61	0.61
Hourly flow rate (vph)	104	14	78	97	15	30

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	118	175	44
Volume Left (vph)	104	0	15
Volume Right (vph)	14	97	0
Hadj (s)	0.14	-0.30	0.10
Departure Headway (s)	4.5	3.9	4.5
Degree Utilization, x	0.15	0.19	0.05
Capacity (veh/h)	764	883	768
Control Delay (s)	8.3	7.9	7.7
Approach Delay (s)	8.3	7.9	7.7
Approach LOS	A	A	A

Intersection Summary			
Delay	8.0		
HCM Level of Service	A		
Intersection Capacity Utilization	20.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	121	29	95	151	21	119
Peak Hour Factor	0.83	0.83	0.68	0.68	0.61	0.61
Hourly flow rate (vph)	146	35	140	222	34	195

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	181	362	230
Volume Left (vph)	146	0	34
Volume Right (vph)	35	222	0
Hadj (s)	0.08	-0.33	0.06
Departure Headway (s)	5.3	4.4	4.9
Degree Utilization, x	0.27	0.44	0.31
Capacity (veh/h)	617	792	698
Control Delay (s)	10.3	10.8	10.1
Approach Delay (s)	10.3	10.8	10.1
Approach LOS	B	B	B

Intersection Summary			
Delay	10.4		
HCM Level of Service	B		
Intersection Capacity Utilization	39.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	29	6	168	83	8	65
Peak Hour Factor	0.58	0.58	0.73	0.73	0.67	0.67
Hourly flow rate (vph)	50	10	230	114	12	97

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	60	344	109
Volume Left (vph)	50	0	12
Volume Right (vph)	10	114	0
Hadj (s)	0.10	-0.16	0.06
Departure Headway (s)	5.0	4.0	4.4
Degree Utilization, x	0.08	0.38	0.13
Capacity (veh/h)	661	879	776
Control Delay (s)	8.4	9.5	8.1
Approach Delay (s)	8.4	9.5	8.1
Approach LOS	A	A	A

Intersection Summary			
Delay	9.1		
HCM Level of Service	A		
Intersection Capacity Utilization	23.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	91	16	138	51	17	285
Peak Hour Factor	0.58	0.58	0.73	0.73	0.67	0.67
Hourly flow rate (vph)	157	28	189	70	25	425

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	184	259	451
Volume Left (vph)	157	0	25
Volume Right (vph)	28	70	0
Hadj (s)	0.11	-0.13	0.05
Departure Headway (s)	5.7	4.9	4.9
Degree Utilization, x	0.29	0.35	0.61
Capacity (veh/h)	573	698	720
Control Delay (s)	11.1	10.6	15.1
Approach Delay (s)	11.1	10.6	15.1
Approach LOS	B	B	C

Intersection Summary			
Delay	13.0		
HCM Level of Service	B		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: McLaughlin Dr. & Chinquapin Rd.

1/25/2009

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	78	126	195	84	79	67
Peak Hour Factor	0.88	0.88	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	89	143	232	100	105	89

Direction, Lane #	SE 1	NW 1	SW 1
Volume Total (vph)	232	332	195
Volume Left (vph)	89	0	105
Volume Right (vph)	0	100	89
Hadj (s)	0.11	-0.15	-0.13
Departure Headway (s)	4.9	4.6	5.1
Degree Utilization, x	0.32	0.42	0.28
Capacity (veh/h)	688	751	641
Control Delay (s)	10.2	10.9	10.0
Approach Delay (s)	10.2	10.9	10.0
Approach LOS	B	B	B

Intersection Summary			
Delay	10.5		
HCM Level of Service	B		
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	97	185	197	96	94	61
Peak Hour Factor	0.88	0.88	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	110	210	235	114	125	81

Direction, Lane #	SE 1	NW 1	SW 1
Volume Total (vph)	320	349	207
Volume Left (vph)	110	0	125
Volume Right (vph)	0	114	81
Hadj (s)	0.10	-0.16	-0.08
Departure Headway (s)	5.0	4.8	5.4
Degree Utilization, x	0.45	0.46	0.31
Capacity (veh/h)	679	722	599
Control Delay (s)	12.1	11.8	10.8
Approach Delay (s)	12.1	11.8	10.8
Approach LOS	B	B	B

Intersection Summary			
Delay	11.7		
HCM Level of Service	B		
Intersection Capacity Utilization	50.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	100	92	11	187	70	15
Peak Hour Factor	0.86	0.86	0.86	0.86	0.79	0.79
Hourly flow rate (vph)	116	107	13	217	89	19

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total (vph)	223	230	108
Volume Left (vph)	116	0	89
Volume Right (vph)	107	217	0
Hadj (s)	-0.15	-0.53	0.20
Departure Headway (s)	4.5	4.0	4.9
Degree Utilization, x	0.28	0.26	0.15
Capacity (veh/h)	754	838	688
Control Delay (s)	9.2	8.5	8.7
Approach Delay (s)	9.2	8.5	8.7
Approach LOS	A	A	A

Intersection Summary			
Delay	8.8		
HCM Level of Service	A		
Intersection Capacity Utilization	30.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	188	115	63	175	119	46
Peak Hour Factor	0.86	0.86	0.86	0.86	0.79	0.79
Hourly flow rate (vph)	219	134	73	203	151	58

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total (vph)	352	277	209
Volume Left (vph)	219	0	151
Volume Right (vph)	134	203	0
Hadj (s)	-0.07	-0.41	0.18
Departure Headway (s)	5.0	4.8	5.4
Degree Utilization, x	0.49	0.37	0.31
Capacity (veh/h)	668	706	620
Control Delay (s)	12.9	10.5	10.9
Approach Delay (s)	12.9	10.5	10.9
Approach LOS	B	B	B

Intersection Summary			
Delay	11.6		
HCM Level of Service	B		
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	377	399	10	1	78	0	31	4	3	0	1	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	1.00			0.99			0.87	
Flt Protected	0.95	1.00		0.95	1.00			0.96			1.00	
Satd. Flow (prot)	1770	1856		1770	1863			1771			1614	
Flt Permitted	0.65	1.00		0.48	1.00			0.96			1.00	
Satd. Flow (perm)	1219	1856		890	1863			1771			1614	
Peak-hour factor, PHF	0.94	0.94	0.94	0.48	0.48	0.48	0.91	0.91	0.91	0.79	0.79	0.79
Adj. Flow (vph)	401	424	11	2	162	0	34	4	3	0	1	100
RTOR Reduction (vph)	0	1	0	0	0	0	0	3	0	0	92	0
Lane Group Flow (vph)	401	434	0	2	162	0	0	38	0	0	9	0
Turn Type	Perm			Perm			Split			Split		
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)	24.0	24.0		24.0	24.0			2.1			3.2	
Effective Green, g (s)	24.0	24.0		24.0	24.0			2.1			3.2	
Actuated g/C Ratio	0.58	0.58		0.58	0.58			0.05			0.08	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	708	1079		517	1083			90			125	
v/s Ratio Prot		0.23			0.09			c0.02			c0.01	
v/s Ratio Perm	c0.33			0.00								
v/c Ratio	0.57	0.40		0.00	0.15			0.42			0.07	
Uniform Delay, d1	5.4	4.7		3.6	4.0			19.0			17.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.0	0.2		0.0	0.1			3.2			0.2	
Delay (s)	6.4	5.0		3.6	4.0			22.2			17.9	
Level of Service	A	A		A	A			C			B	
Approach Delay (s)		5.7			4.0			22.2			17.9	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	7.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	41.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Glenn Coolidge Dr. & Hagar Dr.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	192	269	10	14	396	1	19	1	5	0	2	369
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.98			0.87	
Flt Protected	0.95	1.00		0.95	1.00			0.96			1.00	
Satd. Flow (prot)	1770	1852		1770	1862			1748			1613	
Flt Permitted	0.24	1.00		0.56	1.00			0.96			1.00	
Satd. Flow (perm)	451	1852		1044	1862			1748			1613	
Peak-hour factor, PHF	0.94	0.94	0.94	0.48	0.48	0.48	0.91	0.91	0.91	0.79	0.79	0.79
Adj. Flow (vph)	204	286	11	29	825	2	21	1	5	0	3	467
RTOR Reduction (vph)	0	1	0	0	0	0	0	5	0	0	278	0
Lane Group Flow (vph)	204	296	0	29	827	0	0	22	0	0	192	0
Turn Type	Perm			Perm			Split			Split		
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)	72.6	72.6		72.6	72.6			4.4			15.4	
Effective Green, g (s)	72.6	72.6		72.6	72.6			4.4			15.4	
Actuated g/C Ratio	0.70	0.70		0.70	0.70			0.04			0.15	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	314	1288		726	1295			74			238	
v/s Ratio Prot		0.16			0.44			c0.01			c0.12	
v/s Ratio Perm	c0.45			0.03								
v/c Ratio	0.65	0.23		0.04	0.64			0.30			0.81	
Uniform Delay, d1	8.8	5.8		5.0	8.7			48.5			43.1	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	4.6	0.1		0.0	1.0			2.3			17.8	
Delay (s)	13.4	5.9		5.0	9.8			50.8			60.9	
Level of Service	B	A		A	A			D			E	
Approach Delay (s)		8.9			9.6			50.8			60.9	
Approach LOS		A			A			D			E	

Intersection Summary			
HCM Average Control Delay	23.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	104.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↑↱		↰	↑↱	
Volume (vph)	30	124	254	59	207	372	177	397	105	76	99	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	0.97		1.00	0.96	
Flt Protected		0.99	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1845	1583		1842	1583	1770	3428		1770	3409	
Flt Permitted		0.90	1.00		0.89	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1677	1583		1665	1583	1770	3428		1770	3409	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.84	0.84	0.84	0.87	0.87	0.87
Adj. Flow (vph)	33	138	282	66	230	413	211	473	125	87	114	37
RTOR Reduction (vph)	0	0	203	0	0	270	0	32	0	0	23	0
Lane Group Flow (vph)	0	171	79	0	296	143	211	566	0	87	128	0
Turn Type	Perm		Perm	Perm		Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		14.8	14.8		14.8	14.8	6.1	22.6		3.4	19.9	
Effective Green, g (s)		14.8	14.8		14.8	14.8	6.1	22.6		3.4	19.9	
Actuated g/C Ratio		0.28	0.28		0.28	0.28	0.12	0.43		0.06	0.38	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		470	444		467	444	204	1467		114	1285	
v/s Ratio Prot							c0.12	c0.17		0.05	0.04	
v/s Ratio Perm		0.10	0.05		c0.18	0.09						
v/c Ratio		0.36	0.18		0.63	0.32	1.03	0.39		0.76	0.10	
Uniform Delay, d1		15.2	14.4		16.6	15.0	23.4	10.3		24.3	10.6	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.5	0.2		2.8	0.4	72.3	0.8		25.6	0.2	
Delay (s)		15.7	14.6		19.4	15.5	95.6	11.1		49.9	10.8	
Level of Service		B	B		B	B	F	B		D	B	
Approach Delay (s)		15.0			17.1			33.2			25.1	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	52.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↑↑↱		↰	↑↑↱	
Volume (vph)	88	189	232	62	191	197	144	252	46	330	516	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected		0.98	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1834	1583		1840	1583	1770	3457		1770	3493	
Flt Permitted		0.67	1.00		0.73	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1254	1583		1367	1583	1770	3457		1770	3493	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.84	0.84	0.84	0.87	0.87	0.87
Adj. Flow (vph)	98	210	258	69	212	219	171	300	55	379	593	57
RTOR Reduction (vph)	0	0	184	0	0	156	0	21	0	0	10	0
Lane Group Flow (vph)	0	308	74	0	281	63	171	334	0	379	640	0
Turn Type	Perm		Perm	Perm		Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		18.5	18.5		18.5	18.5	10.7	18.1		15.9	23.3	
Effective Green, g (s)		18.5	18.5		18.5	18.5	10.7	18.1		15.9	23.3	
Actuated g/C Ratio		0.29	0.29		0.29	0.29	0.17	0.28		0.25	0.36	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		360	454		392	454	294	970		436	1262	
v/s Ratio Prot							0.10	0.10		c0.21	c0.18	
v/s Ratio Perm		c0.25	0.05		0.21	0.04						
v/c Ratio		0.86	0.16		0.72	0.14	0.58	0.34		0.87	0.51	
Uniform Delay, d1		21.7	17.2		20.6	17.1	24.8	18.5		23.3	16.1	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		17.7	0.2		6.1	0.1	2.9	1.0		16.6	1.5	
Delay (s)		39.4	17.4		26.8	17.2	27.8	19.4		39.9	17.6	
Level of Service		D	B		C	B	C	B		D	B	
Approach Delay (s)		29.4			22.6			22.1			25.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	64.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	34	10	203	132	14	93
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	37	11	221	143	15	101
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	424	292			364	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	424	292			364	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	99			99	
cM capacity (veh/h)	579	747			1194	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	37	11	364	116
Volume Left	37	0	0	15
Volume Right	0	11	143	0
cSH	579	747	1700	1194
Volume to Capacity	0.06	0.01	0.21	0.01
Queue Length 95th (ft)	5	1	0	1
Control Delay (s)	11.6	9.9	0.0	1.1
Lane LOS	B	A		A
Approach Delay (s)	11.2		0.0	1.1
Approach LOS	B			

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	28.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	175	38	135	99	68	242
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	190	41	147	108	74	263
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	611	201			254	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	611	201			254	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	56	95			94	
cM capacity (veh/h)	431	840			1311	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	190	41	254	337
Volume Left	190	0	0	74
Volume Right	0	41	108	0
cSH	431	840	1700	1311
Volume to Capacity	0.44	0.05	0.15	0.06
Queue Length 95th (ft)	55	4	0	4
Control Delay (s)	19.8	9.5	0.0	2.1
Lane LOS	C	A		A
Approach Delay (s)	17.9		0.0	2.1
Approach LOS	C			

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Volume (veh/h)	355	54	35	363	109	68
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	386	59	38	395	118	74
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			445		886	415
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			445		886	415
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		61	88
cM capacity (veh/h)			1116		304	637

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total	445	433	192
Volume Left	0	38	118
Volume Right	59	0	74
cSH	1700	1116	381
Volume to Capacity	0.26	0.03	0.51
Queue Length 95th (ft)	0	3	69
Control Delay (s)	0.0	1.1	23.7
Lane LOS		A	C
Approach Delay (s)	0.0	1.1	23.7
Approach LOS			C

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	151	85	417	120	76	324
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.82	0.82	0.84	0.84	0.80	0.80
Hourly flow rate (vph)	184	104	496	143	95	405
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1163	568			639	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1163	568			639	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	5	80			90	
cM capacity (veh/h)	194	522			945	

Direction, Lane #	NB 1	SE 1	NW 1	NW 2
Volume Total	288	639	95	405
Volume Left	184	0	95	0
Volume Right	104	143	0	0
cSH	250	1700	945	1700
Volume to Capacity	1.15	0.38	0.10	0.24
Queue Length 95th (ft)	325	0	8	0
Control Delay (s)	145.5	0.0	9.2	0.0
Lane LOS	F		A	
Approach Delay (s)	145.5	0.0	1.8	
Approach LOS	F			

Intersection Summary			
Average Delay	30.0		
Intersection Capacity Utilization	57.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	8	425	9	7	642	5	24	4	7	37	26	14
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.67	0.67	0.67	0.84	0.84	0.84
Hourly flow rate (vph)	9	467	10	8	705	5	36	6	10	44	31	17

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	486	719	52	92
Volume Left (vph)	9	8	36	44
Volume Right (vph)	10	5	10	17
Hadj (s)	0.03	0.03	0.05	0.02
Departure Headway (s)	5.4	5.2	7.1	6.9
Degree Utilization, x	0.72	1.03	0.10	0.18
Capacity (veh/h)	486	691	466	484
Control Delay (s)	21.2	65.1	10.9	11.4
Approach Delay (s)	21.2	65.1	10.9	11.4
Approach LOS	C	F	B	B

Intersection Summary			
Delay	43.5		
HCM Level of Service	E		
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	13	449	13	10	481	17	12	15	5	9	12	12
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.67	0.67	0.67	0.84	0.84	0.84
Hourly flow rate (vph)	14	493	14	11	529	19	18	22	7	11	14	14

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	522	558	48	39
Volume Left (vph)	14	11	18	11
Volume Right (vph)	14	19	7	14
Hadj (s)	0.02	0.02	0.02	-0.13
Departure Headway (s)	4.9	4.9	6.5	6.4
Degree Utilization, x	0.71	0.75	0.09	0.07
Capacity (veh/h)	715	731	491	489
Control Delay (s)	18.9	21.0	10.1	9.9
Approach Delay (s)	18.9	21.0	10.1	9.9
Approach LOS	C	C	B	A

Intersection Summary			
Delay	19.3		
HCM Level of Service	C		
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
10: Iowa Dr. & Bay St.

1/25/2009

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	39	44	57	26	22	14	14	328	11	30	565	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1820	1583		1814	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.86	1.00		0.85	1.00	0.95	1.00	1.00	0.50	1.00	1.00
Satd. Flow (perm)		1610	1583		1578	1583	1770	3539	1583	933	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.76	0.76	0.76	0.83	0.83	0.83
Adj. Flow (vph)	49	55	71	43	37	23	18	432	14	36	681	80
RTOR Reduction (vph)	0	0	42	0	0	14	0	0	11	0	0	60
Lane Group Flow (vph)	0	104	29	0	80	9	18	432	3	36	681	20
Turn Type	custom		custom	Perm		Perm	Split		Perm	custom		custom
Protected Phases					6		4	4				
Permitted Phases	2	2	2	6		6			4	8	8	8
Actuated Green, G (s)		30.1	30.1		30.1	30.1	14.1	14.1	14.1	18.3	18.3	18.3
Effective Green, g (s)		30.1	30.1		30.1	30.1	14.1	14.1	14.1	18.3	18.3	18.3
Actuated g/C Ratio		0.40	0.40		0.40	0.40	0.19	0.19	0.19	0.25	0.25	0.25
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		650	640		638	640	335	670	300	229	869	389
v/s Ratio Prot							0.01	c0.12				
v/s Ratio Perm		c0.06	0.02		0.05	0.01			0.00	0.04	c0.19	0.01
v/c Ratio		0.16	0.04		0.13	0.01	0.05	0.64	0.01	0.16	0.78	0.05
Uniform Delay, d1		14.1	13.5		13.9	13.3	24.7	27.9	24.5	22.0	26.3	21.5
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.5	0.1		0.4	0.0	0.1	2.1	0.0	0.3	4.7	0.1
Delay (s)		14.7	13.6		14.3	13.4	24.8	30.0	24.5	22.4	30.9	21.5
Level of Service		B	B		B	B	C	C	C	C	C	C
Approach Delay (s)		14.2			14.1			29.7			29.6	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	26.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	74.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Iowa Dr. & Bay St.

1/25/2009

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	31	19	65	37	30	12	57	396	38	17	839	44
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1807	1583		1813	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.75	1.00		0.79	1.00	0.95	1.00	1.00	0.46	1.00	1.00
Satd. Flow (perm)		1401	1583		1477	1583	1770	3539	1583	855	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.76	0.76	0.76	0.83	0.83	0.83
Adj. Flow (vph)	39	24	81	62	50	20	75	521	50	20	1011	53
RTOR Reduction (vph)	0	0	69	0	0	17	0	0	38	0	0	33
Lane Group Flow (vph)	0	63	12	0	112	3	75	521	12	20	1011	20
Turn Type	custom		custom	Perm		Perm	Split		Perm	custom		custom
Protected Phases					6		4	4				
Permitted Phases	2	2	2	6		6			4	8	8	8
Actuated Green, G (s)		7.7	7.7		7.7	7.7	13.4	13.4	13.4	20.7	20.7	20.7
Effective Green, g (s)		7.7	7.7		7.7	7.7	13.4	13.4	13.4	20.7	20.7	20.7
Actuated g/C Ratio		0.14	0.14		0.14	0.14	0.25	0.25	0.25	0.38	0.38	0.38
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		201	227		211	227	441	881	394	329	1362	609
v/s Ratio Prot							0.04	c0.15				
v/s Ratio Perm		0.04	0.01		c0.08	0.00			0.01	0.02	c0.29	0.01
v/c Ratio		0.31	0.05		0.53	0.01	0.17	0.59	0.03	0.06	0.74	0.03
Uniform Delay, d1		20.7	19.9		21.4	19.8	15.8	17.8	15.3	10.4	14.3	10.3
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.9	0.1		2.6	0.0	0.2	1.1	0.0	0.1	2.2	0.0
Delay (s)		21.6	20.0		23.9	19.8	16.0	18.9	15.3	10.5	16.5	10.3
Level of Service		C	B		C	B	B	B	B	B	B	B
Approach Delay (s)		20.7			23.3			18.3			16.1	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	53.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣		↰	↱	
Volume (veh/h)	8	26	43	3	18	64	20	626	10	34	361	27
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	28	47	3	20	70	22	680	11	37	392	29
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1290	1216	407	1257	1225	686	422			691		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1290	1216	407	1257	1225	686	422			691		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	83	93	97	88	84	98			96		
cM capacity (veh/h)	103	170	644	115	168	448	1137			904		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	84	92	713	37	422
Volume Left	9	3	22	37	0
Volume Right	47	70	11	0	29
cSH	259	308	1137	904	1700
Volume to Capacity	0.32	0.30	0.02	0.04	0.25
Queue Length 95th (ft)	34	31	1	3	0
Control Delay (s)	25.4	21.6	0.5	9.2	0.0
Lane LOS	D	C	A	A	
Approach Delay (s)	25.4	21.6	0.5	0.7	
Approach LOS	D	C			

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Escalona Dr & Bay St

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣		↰	↱	
Volume (veh/h)	4	15	37	11	14	44	32	525	14	106	664	58
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	16	40	12	15	48	35	571	15	115	722	63
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1687	1639	753	1648	1663	578	785			586		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1687	1639	753	1648	1663	578	785			586		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	81	90	78	81	91	96			88		
cM capacity (veh/h)	51	85	410	54	82	515	834			989		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	61	75	621	115	785
Volume Left	4	12	35	115	0
Volume Right	40	48	15	0	63
cSH	162	150	834	989	1700
Volume to Capacity	0.38	0.50	0.04	0.12	0.46
Queue Length 95th (ft)	40	60	3	10	0
Control Delay (s)	39.9	50.9	1.1	9.1	0.0
Lane LOS	E	F	A	A	
Approach Delay (s)	39.9	50.9	1.1	1.2	
Approach LOS	E	F			

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
12: Bay St. & King St.

1/25/2009

Movement	WBL	WBR	WBR2	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	9	429	36	102	294	7	38	114	13	62	77	136
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.85		1.00	1.00			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	0.95			0.99			0.98	1.00
Satd. Flow (prot)	1770	1583		1770	1770			1823			1822	1583
Flt Permitted	0.50	1.00		0.29	0.95			0.91			0.82	1.00
Satd. Flow (perm)	928	1583		540	1770			1684			1522	1583
Peak-hour factor, PHF	0.83	0.83	0.83	0.86	0.86	0.86	0.90	0.90	0.90	0.84	0.84	0.84
Adj. Flow (vph)	11	517	43	119	342	8	42	127	14	74	92	162
RTOR Reduction (vph)	0	7	0	0	2	0	0	6	0	0	0	101
Lane Group Flow (vph)	11	553	0	119	348	0	0	177	0	0	166	61
Turn Type		custom		Perm			Perm			Perm		Perm
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		6
Actuated Green, G (s)	19.3	19.3		19.3	19.3			16.3			16.3	16.3
Effective Green, g (s)	19.3	19.3		19.3	19.3			16.3			16.3	16.3
Actuated g/C Ratio	0.44	0.44		0.44	0.44			0.37			0.37	0.37
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	411	701		239	784			630			569	592
v/s Ratio Prot		c0.35			0.20							
v/s Ratio Perm	0.01			0.22				0.11			c0.11	0.04
v/c Ratio	0.03	0.79		0.50	0.44			0.28			0.29	0.10
Uniform Delay, d1	6.9	10.4		8.7	8.4			9.6			9.6	8.9
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	0.0	5.9		1.6	0.4			1.1			1.3	0.3
Delay (s)	6.9	16.3		10.3	8.8			10.7			10.9	9.2
Level of Service	A	B		B	A			B			B	A
Approach Delay (s)	16.1				9.2			10.7			10.1	
Approach LOS	B				A			B			B	

Intersection Summary			
HCM Average Control Delay	12.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	43.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	161	464	33	11	421	46	27	95	12	34	118	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.99		1.00	0.99			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	1.00
Satd. Flow (prot)	1770	1844		1770	1835			1822			1842	1583
Flt Permitted	0.28	1.00		0.27	1.00			0.93			0.92	1.00
Satd. Flow (perm)	524	1844		495	1835			1709			1715	1583
Peak-hour factor, PHF	0.86	0.86	0.86	0.83	0.83	0.83	0.90	0.90	0.90	0.84	0.84	0.84
Adj. Flow (vph)	187	540	38	13	507	55	30	106	13	40	140	164
RTOR Reduction (vph)	0	6	0	0	9	0	0	6	0	0	0	102
Lane Group Flow (vph)	187	572	0	13	553	0	0	143	0	0	180	62
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	18.5	18.5		18.5	18.5			16.3			16.3	16.3
Effective Green, g (s)	18.5	18.5		18.5	18.5			16.3			16.3	16.3
Actuated g/C Ratio	0.43	0.43		0.43	0.43			0.38			0.38	0.38
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	226	797		214	793			651			653	603
v/s Ratio Prot		0.31			0.30							
v/s Ratio Perm	c0.36			0.03				0.08			c0.10	0.04
v/c Ratio	0.83	0.72		0.06	0.70			0.22			0.28	0.10
Uniform Delay, d1	10.7	10.0		7.1	9.9			9.0			9.2	8.5
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	21.3	3.1		0.1	2.7			0.8			1.0	0.3
Delay (s)	32.1	13.1		7.2	12.6			9.7			10.2	8.9
Level of Service	C	B		A	B			A			B	A
Approach Delay (s)		17.7			12.4			9.7			9.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	42.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	EBR2	NBL	NBR	NBR2	NWL2	NWL	NWR	SWL2	SWL	SWR
Lane Configurations												
Volume (vph)	156	127	62	82	773	66	74	136	83	137	775	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.88		1.00	1.00		1.00	0.97	
Frt	1.00	0.85		1.00	0.85		1.00	0.94		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (prot)	1770	1583		1770	2787		1770	1704		1770	3376	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (perm)	1770	1583		1770	2787		1770	1704		1770	3376	
Peak-hour factor, PHF	0.84	0.84	0.84	0.95	0.95	0.95	0.83	0.83	0.83	0.94	0.94	0.94
Adj. Flow (vph)	186	151	74	86	814	69	89	164	100	146	824	186
RTOR Reduction (vph)	0	12	0	0	3	0	0	14	0	0	13	0
Lane Group Flow (vph)	186	213	0	86	880	0	89	250	0	146	997	0
Turn Type		Perm			Perm		Split			Split		
Protected Phases	4			2			8	8		3	3	
Permitted Phases		4			2							
Actuated Green, G (s)	22.5	22.5		45.0	45.0		23.3	23.3		41.0	41.0	
Effective Green, g (s)	22.5	22.5		45.0	45.0		23.3	23.3		41.0	41.0	
Actuated g/C Ratio	0.15	0.15		0.30	0.30		0.16	0.16		0.28	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	269	241		539	849		279	269		491	937	
v/s Ratio Prot	0.11			0.05			0.05	c0.15		0.08	c0.30	
v/s Ratio Perm		c0.13			c0.32							
v/c Ratio	0.69	0.88		0.16	1.04		0.32	0.93		0.30	1.06	
Uniform Delay, d1	59.4	61.4		37.6	51.4		55.2	61.4		42.1	53.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.5	29.5		0.6	40.6		0.7	35.8		0.3	48.0	
Delay (s)	66.8	90.8		38.2	92.0		55.9	97.2		42.4	101.4	
Level of Service	E	F		D	F		E	F		D	F	
Approach Delay (s)	80.0			87.2				86.8			93.9	
Approach LOS	E			F				F			F	

Intersection Summary			
HCM Average Control Delay	88.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	147.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	EBR2	NBL	NBR	NBR2	NWL2	NWL	NWR	SWL2	SWL	SWR
Lane Configurations												
Volume (vph)	231	130	106	140	902	67	92	140	58	125	862	244
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.88		1.00	1.00		1.00	0.97	
Frt	1.00	0.85		1.00	0.85		1.00	0.96		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (prot)	1770	1583		1770	2787		1770	1720		1770	3363	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (perm)	1770	1583		1770	2787		1770	1720		1770	3363	
Peak-hour factor, PHF	0.84	0.84	0.84	0.95	0.95	0.95	0.83	0.83	0.83	0.94	0.94	0.94
Adj. Flow (vph)	275	155	126	147	949	71	111	169	70	133	917	260
RTOR Reduction (vph)	0	18	0	0	3	0	0	15	0	0	16	0
Lane Group Flow (vph)	275	263	0	147	1017	0	111	224	0	133	1161	0
Turn Type		Prot			custom		Split			Split		
Protected Phases	1	1		2	2		8	8		3	3	
Permitted Phases					2							
Actuated Green, G (s)	13.0	13.0		26.0	26.0		18.6	18.6		30.1	30.1	
Effective Green, g (s)	13.0	13.0		26.0	26.0		18.6	18.6		30.1	30.1	
Actuated g/C Ratio	0.13	0.13		0.25	0.25		0.18	0.18		0.29	0.29	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	222	198		444	699		317	309		514	976	
v/s Ratio Prot	0.16	c0.17		0.08	c0.36		0.06	c0.13		0.08	c0.35	
v/s Ratio Perm												
v/c Ratio	1.24	1.33		0.33	1.45		0.35	0.73		0.26	1.19	
Uniform Delay, d1	45.4	45.4		31.7	38.8		37.3	40.1		28.2	36.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	139.8	177.5		0.4	212.7		0.7	8.2		0.3	95.8	
Delay (s)	185.1	222.8		32.2	251.5		37.9	48.3		28.5	132.6	
Level of Service	F	F		C	F		D	D		C	F	
Approach Delay (s)	204.2			223.9				45.0			122.0	
Approach LOS	F			F				D			F	

Intersection Summary			
HCM Average Control Delay	162.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	103.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	18	88	4	247	119	52	4	1054	158	42	877	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.95		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1851		1770	1778		1770	3470		1770	3529	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1851		1770	1778		1770	3470		1770	3529	
Peak-hour factor, PHF	0.98	0.98	0.98	1.00	1.00	1.00	0.83	0.83	0.83	0.79	0.79	0.79
Adj. Flow (vph)	18	90	4	247	119	52	5	1270	190	53	1110	22
RTOR Reduction (vph)	0	2	0	0	13	0	0	9	0	0	1	0
Lane Group Flow (vph)	18	92	0	247	158	0	5	1451	0	53	1131	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.0	13.0		17.0	27.0		16.0	47.0		16.0	47.0	
Effective Green, g (s)	3.0	13.0		17.0	27.0		16.0	47.0		16.0	47.0	
Actuated g/C Ratio	0.03	0.12		0.16	0.25		0.15	0.43		0.15	0.43	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	49	221		276	440		260	1496		260	1522	
v/s Ratio Prot	0.01	0.05		c0.14	c0.09		0.00	c0.42		c0.03	0.32	
v/s Ratio Perm												
v/c Ratio	0.37	0.42		0.89	0.36		0.02	0.97		0.20	0.74	
Uniform Delay, d1	52.1	44.5		45.1	33.9		39.8	30.3		40.9	25.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.6	1.3		28.5	0.5		0.1	17.1		1.8	3.3	
Delay (s)	56.7	45.8		73.7	34.4		39.9	47.4		42.7	29.3	
Level of Service	E	D		E	C		D	D		D	C	
Approach Delay (s)		47.5			57.6			47.4			29.9	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM Average Control Delay	42.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	109.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	210	32	9	435	292	55	9	1196	550	142	1103	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.97		1.00	0.98		1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1803		1770	1818		1770	3372		1770	3522	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1803		1770	1818		1770	3372		1770	3522	
Peak-hour factor, PHF	0.98	0.98	0.98	1.00	1.00	1.00	0.83	0.83	0.83	0.79	0.79	0.79
Adj. Flow (vph)	214	33	9	435	292	55	11	1441	663	180	1396	47
RTOR Reduction (vph)	0	7	0	0	5	0	0	35	0	0	1	0
Lane Group Flow (vph)	214	35	0	435	342	0	11	2069	0	180	1442	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	19.0	18.4		32.0	31.4		3.0	68.5		16.0	81.5	
Effective Green, g (s)	19.0	18.4		32.0	31.4		3.0	68.5		16.0	81.5	
Actuated g/C Ratio	0.13	0.12		0.21	0.21		0.02	0.45		0.11	0.54	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	223	220		375	378		35	1531		188	1902	
v/s Ratio Prot	0.12	0.02		c0.25	c0.19		0.01	c0.61		c0.10	0.41	
v/s Ratio Perm												
v/c Ratio	0.96	0.16		1.16	0.91		0.31	1.35		0.96	0.76	
Uniform Delay, d1	65.6	59.3		59.4	58.3		72.9	41.2		67.1	27.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	48.3	0.3		97.7	24.4		5.1	162.5		52.8	1.8	
Delay (s)	113.8	59.7		157.1	82.7		78.0	203.7		119.9	28.8	
Level of Service	F	E		F	F		E	F		F	C	
Approach Delay (s)		105.0			124.1			203.1			38.9	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	129.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	150.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱		↰	↑↑↱		↰	↑↑↱	
Volume (vph)	56	91	7	47	66	57	9	1010	42	57	1019	16
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.93		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1842		1770	1733		1770	3518		1770	3531	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1842		1770	1733		1770	3518		1770	3531	
Peak-hour factor, PHF	0.79	0.79	0.79	0.62	0.62	0.62	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	71	115	9	76	106	92	9	1063	44	62	1108	17
RTOR Reduction (vph)	0	2	0	0	22	0	0	2	0	0	1	0
Lane Group Flow (vph)	71	122	0	76	176	0	9	1105	0	62	1124	0
Turn Type	Split			Split			Split			Split		
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	14.3	14.3		18.2	18.2		43.2	43.2		43.2	43.2	
Effective Green, g (s)	14.3	14.3		18.2	18.2		43.2	43.2		43.2	43.2	
Actuated g/C Ratio	0.11	0.11		0.13	0.13		0.32	0.32		0.32	0.32	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	188	195		239	234		567	1127		567	1131	
v/s Ratio Prot	0.04	c0.07		0.04	c0.10		0.01	c0.31		0.04	c0.32	
v/s Ratio Perm												
v/c Ratio	0.38	0.63		0.32	0.75		0.02	0.98		0.11	0.99	
Uniform Delay, d1	56.2	57.7		52.7	56.2		31.3	45.4		32.3	45.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	6.2		0.8	12.9		0.1	22.5		0.4	25.4	
Delay (s)	57.4	63.9		53.5	69.1		31.4	67.9		32.7	71.1	
Level of Service	E	E		D	E		C	E		C	E	
Approach Delay (s)		61.5			64.7			67.6			69.1	
Approach LOS		E			E			E			E	

Intersection Summary			
HCM Average Control Delay	67.6	HCM Level of Service	E
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	134.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	54	8	92	113	68	10	1413	48	25	1629	19
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.95		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1827		1770	1768		1770	3522		1770	3533	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1827		1770	1768		1770	3522		1770	3533	
Peak-hour factor, PHF	0.79	0.79	0.79	0.62	0.62	0.62	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	57	68	10	148	182	94	11	1487	51	27	1771	21
RTOR Reduction (vph)	0	4	0	0	12	0	0	1	0	0	1	0
Lane Group Flow (vph)	57	74	0	148	264	0	11	1537	0	27	1791	0
Turn Type	Split			Split			Split			Split		
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	10.9	10.9		23.3	23.3		41.0	41.0		45.0	45.0	
Effective Green, g (s)	10.9	10.9		23.3	23.3		41.0	41.0		45.0	45.0	
Actuated g/C Ratio	0.08	0.08		0.17	0.17		0.30	0.30		0.33	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	142	146		303	302		533	1060		585	1167	
v/s Ratio Prot	0.03	c0.04		0.08	c0.15		0.01	c0.44		0.02	c0.51	
v/s Ratio Perm												
v/c Ratio	0.40	0.51		0.49	0.87		0.02	1.45		0.05	1.53	
Uniform Delay, d1	59.5	60.1		51.1	55.0		33.5	47.6		31.0	45.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.9	2.8		1.2	23.1		0.0	207.7		0.0	245.1	
Delay (s)	61.4	62.9		52.3	78.1		33.5	255.3		31.0	290.7	
Level of Service	E	E		D	E		C	F		C	F	
Approach Delay (s)		62.2			69.1			253.7			286.8	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	242.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	136.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	99	86	95	228	280	292
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.74	0.74	0.69	0.69
Hourly flow rate (vph)	118	102	128	308	406	423
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1182	617	829			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1182	617	829			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	33	79	84			
cM capacity (veh/h)	176	490	803			

Direction, Lane #	SB 1	SE 1	NW 1
Volume Total	220	436	829
Volume Left	118	128	0
Volume Right	102	0	423
cSH	251	803	1700
Volume to Capacity	0.88	0.16	0.49
Queue Length 95th (ft)	185	14	0
Control Delay (s)	72.2	4.5	0.0
Lane LOS	F	A	
Approach Delay (s)	72.2	4.5	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	12.0		
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	182	92	71	318	251	268
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.74	0.74	0.69	0.69
Hourly flow rate (vph)	217	110	96	430	364	388
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1180	558	752			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1180	558	752			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	79	89			
cM capacity (veh/h)	187	529	858			

Direction, Lane #	SB 1	SE 1	NW 1
Volume Total	326	526	752
Volume Left	217	96	0
Volume Right	110	0	388
cSH	239	858	1700
Volume to Capacity	1.37	0.11	0.44
Queue Length 95th (ft)	445	9	0
Control Delay (s)	229.4	3.0	0.0
Lane LOS	F	A	
Approach Delay (s)	229.4	3.0	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	47.6		
Intersection Capacity Utilization	76.0%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
17: King St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	✥			✥			↑↱		↰	↑↱	
Volume (vph)	129	0	81	4	0	2	46	538	10	11	654	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00			0.95		1.00	0.95	
Frt	1.00	0.88			0.96			1.00		1.00	0.98	
Flt Protected	0.95	0.99			0.97			1.00		0.95	1.00	
Satd. Flow (prot)	1681	1541			1722			3517		1770	3474	
Flt Permitted	0.95	0.99			0.97			0.87		0.95	1.00	
Satd. Flow (perm)	1681	1541			1722			3058		1770	3474	
Peak-hour factor, PHF	0.88	0.88	0.88	0.50	0.50	0.50	1.00	1.00	1.00	0.98	0.98	0.98
Adj. Flow (vph)	147	0	92	8	0	4	46	538	10	11	667	93
RTOR Reduction (vph)	0	77	0	0	4	0	0	1	0	0	8	0
Lane Group Flow (vph)	125	37	0	0	8	0	0	593	0	11	752	0
Turn Type	Split			Split			Perm			Prot		
Protected Phases	4	4		8	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	9.0	9.0			1.1			28.4		0.7	33.1	
Effective Green, g (s)	9.0	9.0			1.1			28.4		0.7	33.1	
Actuated g/C Ratio	0.16	0.16			0.02			0.51		0.01	0.60	
Clearance Time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	274	251			34			1573		22	2083	
v/s Ratio Prot	c0.07	0.02			c0.00					0.01	c0.22	
v/s Ratio Perm								0.19				
v/c Ratio	0.46	0.15			0.24			0.38		0.50	0.36	
Uniform Delay, d1	20.9	19.8			26.6			8.1		27.1	5.6	
Progression Factor	1.00	1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2	1.2	0.3			3.6			0.7		16.8	0.5	
Delay (s)	22.1	20.1			30.2			8.8		43.8	6.1	
Level of Service	C	C			C			A		D	A	
Approach Delay (s)		21.1			30.2			8.8			6.7	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	55.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: King St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	✥			✥		↰	↑↑↱		↰	↑↑↱	
Volume (vph)	96	4	9	2	2	10	0	844	4	4	752	139
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00			0.95		1.00	0.95	
Frt	1.00	0.98			0.90			1.00		1.00	0.98	
Flt Protected	0.95	0.96			0.99			1.00		0.95	1.00	
Satd. Flow (prot)	1681	1664			1671			3537		1770	3456	
Flt Permitted	0.95	0.96			0.99			1.00		0.95	1.00	
Satd. Flow (perm)	1681	1664			1671			3537		1770	3456	
Peak-hour factor, PHF	0.88	0.88	0.88	0.50	0.50	0.50	1.00	1.00	1.00	0.98	0.98	0.98
Adj. Flow (vph)	109	5	10	4	4	20	0	844	4	4	767	142
RTOR Reduction (vph)	0	9	0	0	20	0	0	1	0	0	10	0
Lane Group Flow (vph)	62	53	0	0	8	0	0	847	0	4	899	0
Turn Type	Split			Split			Prot			Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.0	4.0			0.9			20.1		0.5	24.6	
Effective Green, g (s)	4.0	4.0			0.9			20.1		0.5	24.6	
Actuated g/C Ratio	0.10	0.10			0.02			0.48		0.01	0.59	
Clearance Time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	162	160			36			1713		21	2049	
v/s Ratio Prot	c0.04	0.03			c0.01			c0.24		0.00	c0.26	
v/s Ratio Perm												
v/c Ratio	0.38	0.33			0.23			0.49		0.19	0.44	
Uniform Delay, d1	17.6	17.5			20.0			7.3		20.3	4.7	
Progression Factor	1.00	1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2	1.5	1.2			3.3			0.2		4.4	0.2	
Delay (s)	19.1	18.7			23.3			7.5		24.7	4.8	
Level of Service	B	B			C			A		C	A	
Approach Delay (s)		18.9			23.3			7.5			4.9	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	41.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER	NER2
Lane Configurations												
Volume (vph)	9	361	24	68	302	22	58	244	1397	1516	383	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.97		1.00	0.95		1.00	0.95	0.88	0.97	0.91	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	0.85	0.85
Flt Protected	0.95	0.96		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3419		1770	3503		1770	3539	2787	3433	1441	1583
Flt Permitted	0.95	0.96		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3419		1770	3503		1770	3539	2787	3433	1441	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.77	0.77	0.77	0.89	0.89	0.89	0.88	0.88	0.88
Adj. Flow (vph)	10	415	28	88	392	29	65	274	1570	1723	435	28
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	971	0	0	15
Lane Group Flow (vph)	10	440	0	88	417	0	65	274	599	1767	391	13
Turn Type	Split			Prot			Prot		Perm		Prot	Perm
Protected Phases	3	3		5	2		1	6		4	4	
Permitted Phases									6			4
Actuated Green, G (s)	23.0	23.0		5.0	31.5		6.3	32.8	32.8	62.1	62.1	62.1
Effective Green, g (s)	23.0	23.0		5.0	31.5		6.3	32.8	32.8	62.1	62.1	62.1
Actuated g/C Ratio	0.17	0.17		0.04	0.23		0.05	0.24	0.24	0.45	0.45	0.45
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	293	566		64	794		80	836	658	1535	644	708
v/s Ratio Prot	0.01	c0.13		c0.05	0.12		0.04	0.08		c0.51	0.27	
v/s Ratio Perm									c0.22			0.01
v/c Ratio	0.03	0.78		1.38	0.53		0.81	0.33	0.91	1.15	0.61	0.02
Uniform Delay, d1	48.6	55.5		67.0	47.1		65.7	43.9	51.6	38.4	29.1	21.4
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	6.6		241.0	2.5		44.4	1.0	18.9	76.0	1.6	0.0
Delay (s)	48.7	62.1		307.9	49.6		110.2	45.0	70.6	114.4	30.8	21.4
Level of Service	D	E		F	D		F	D	E	F	C	C
Approach Delay (s)		61.8			94.3			68.2		98.3		
Approach LOS		E			F			E		F		

Intersection Summary			
HCM Average Control Delay	83.3	HCM Level of Service	F
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	138.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER	NER2
Lane Configurations												
Volume (vph)	17	451	25	96	310	4	58	367	1411	1235	451	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.97		1.00	0.95		1.00	0.95	0.88	0.97	0.91	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	0.99	0.85	0.85
Flt Protected	0.95	0.95		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3423		1770	3533		1770	3539	2787	3429	1441	1583
Flt Permitted	0.95	0.95		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3423		1770	3533		1770	3539	2787	3429	1441	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.77	0.77	0.77	0.89	0.89	0.89	0.88	0.88	0.88
Adj. Flow (vph)	20	518	29	125	403	5	65	412	1585	1403	512	56
RTOR Reduction (vph)	0	3	0	0	1	0	0	0	865	0	0	33
Lane Group Flow (vph)	20	544	0	125	407	0	65	412	720	1454	461	23
Turn Type	Split			Prot			Prot		Perm		Prot	Perm
Protected Phases	3	3		5	2		1	6		4	4	
Permitted Phases									6			4
Actuated Green, G (s)	26.5	26.5		9.0	36.7		8.2	35.9	35.9	55.0	55.0	55.0
Effective Green, g (s)	26.5	26.5		9.0	36.7		8.2	35.9	35.9	55.0	55.0	55.0
Actuated g/C Ratio	0.19	0.19		0.06	0.26		0.06	0.25	0.25	0.39	0.39	0.39
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	329	637		112	911		102	892	703	1324	557	611
v/s Ratio Prot	0.01	c0.16		c0.07	0.12		0.04	0.12		c0.42	0.32	
v/s Ratio Perm									c0.26			0.01
v/c Ratio	0.06	0.85		1.12	0.45		0.64	0.46	1.02	1.10	0.83	0.04
Uniform Delay, d1	47.7	56.1		66.7	44.3		65.6	45.1	53.2	43.7	39.4	27.2
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	10.8		119.7	1.6		12.3	1.7	40.1	56.1	9.8	0.0
Delay (s)	47.8	66.8		186.4	45.9		78.0	46.8	93.3	99.8	49.2	27.3
Level of Service	D	E		F	D		E	D	F	F	D	C
Approach Delay (s)		66.2			78.9			83.6		85.9		
Approach LOS		E			E			F		F		

Intersection Summary			
HCM Average Control Delay	82.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	142.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: River St. & Highway 1

1/25/2009

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	373	175	172	38	167	235	222	1644	82	315	1408	648
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	3433	1863	1583	1770	5049		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	3433	1863	1583	1770	5049		3433	5085	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.90	0.90	0.90	0.93	0.93	0.93	0.97	0.97	0.97
Adj. Flow (vph)	385	180	177	42	186	261	239	1768	88	325	1452	668
RTOR Reduction (vph)	0	0	115	0	0	167	0	4	0	0	0	0
Lane Group Flow (vph)	385	180	62	42	186	94	239	1852	0	325	1452	668
Turn Type	Prot		Perm	Prot		Perm	Split			Split		Free
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases			2			6						Free
Actuated Green, G (s)	24.0	52.8	52.8	4.0	32.8	32.8	45.0	45.0		33.0	33.0	150.8
Effective Green, g (s)	24.0	52.8	52.8	4.0	32.8	32.8	45.0	45.0		33.0	33.0	150.8
Actuated g/C Ratio	0.16	0.35	0.35	0.03	0.22	0.22	0.30	0.30		0.22	0.22	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	282	652	976	91	405	344	528	1507		751	1113	1583
v/s Ratio Prot	c0.22	0.10		0.01	0.10		0.14	c0.37		0.09	c0.29	
v/s Ratio Perm			0.02			0.06						c0.42
v/c Ratio	1.37	0.28	0.06	0.46	0.46	0.27	0.45	1.23		0.43	1.30	0.42
Uniform Delay, d1	63.4	35.3	32.6	72.3	51.3	49.1	42.9	52.9		50.8	58.9	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	185.5	1.0	0.1	3.7	3.7	1.9	0.6	109.2		0.4	143.7	0.8
Delay (s)	248.9	36.3	32.7	76.0	55.0	51.0	43.5	162.1		51.2	202.6	0.8
Level of Service	F	D	C	E	E	D	D	F		D	F	A
Approach Delay (s)		145.8			54.7			148.6			127.3	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	131.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	150.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	690	275	250	92	246	462	238	1226	92	353	1342	484
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	3433	1863	1583	1770	5032		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	3433	1863	1583	1770	5032		3433	5085	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.90	0.90	0.90	0.93	0.93	0.93	0.97	0.97	0.97
Adj. Flow (vph)	711	284	258	102	273	513	256	1318	99	364	1384	499
RTOR Reduction (vph)	0	0	154	0	0	241	0	6	0	0	0	0
Lane Group Flow (vph)	711	284	104	102	273	272	256	1411	0	364	1384	499
Turn Type	Prot		Perm	Prot		Perm	Split			Split		Free
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases			2			6						Free
Actuated Green, G (s)	33.0	56.2	56.2	7.8	31.0	31.0	33.0	33.0		27.0	27.0	140.0
Effective Green, g (s)	33.0	56.2	56.2	7.8	31.0	31.0	33.0	33.0		27.0	27.0	140.0
Actuated g/C Ratio	0.24	0.40	0.40	0.06	0.22	0.22	0.24	0.24		0.19	0.19	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	417	748	1119	191	413	351	417	1186		662	981	1583
v/s Ratio Prot	c0.40	0.15		0.03	0.15		0.14	c0.28		0.11	c0.27	
v/s Ratio Perm			0.04			c0.17						0.32
v/c Ratio	1.71	0.38	0.09	0.53	0.66	0.77	0.61	1.19		0.55	1.41	0.32
Uniform Delay, d1	53.5	29.6	26.0	64.3	49.7	51.2	47.8	53.5		51.0	56.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	327.4	1.5	0.2	2.9	8.1	15.3	2.7	94.0		0.9	191.0	0.5
Delay (s)	380.9	31.1	26.2	67.2	57.8	66.5	50.5	147.5		52.0	247.5	0.5
Level of Service	F	C	C	E	E	E	D	F		D	F	A
Approach Delay (s)		228.6			63.9			132.6			161.0	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	152.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

LEVEL OF SERVICE ANALYSIS
CUMULATIVE CONDITIONS

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	90	13	56	70	10	19
Peak Hour Factor	0.83	0.83	0.68	0.68	0.61	0.61
Hourly flow rate (vph)	108	16	82	103	16	31

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	124	185	48
Volume Left (vph)	108	0	16
Volume Right (vph)	16	103	0
Hadj (s)	0.13	-0.30	0.10
Departure Headway (s)	4.5	4.0	4.5
Degree Utilization, x	0.16	0.20	0.06
Capacity (veh/h)	758	878	760
Control Delay (s)	8.4	8.0	7.8
Approach Delay (s)	8.4	8.0	7.8
Approach LOS	A	A	A

Intersection Summary			
Delay	8.1		
HCM Level of Service	A		
Intersection Capacity Utilization	22.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: McLaughlin Dr. & Heller Dr.

1/25/2009

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	126	30	99	156	22	124
Peak Hour Factor	0.83	0.83	0.68	0.68	0.61	0.61
Hourly flow rate (vph)	152	36	146	229	36	203

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	188	375	239
Volume Left (vph)	152	0	36
Volume Right (vph)	36	229	0
Hadj (s)	0.08	-0.33	0.06
Departure Headway (s)	5.4	4.4	4.9
Degree Utilization, x	0.28	0.46	0.33
Capacity (veh/h)	610	784	691
Control Delay (s)	10.5	11.1	10.3
Approach Delay (s)	10.5	11.1	10.3
Approach LOS	B	B	B

Intersection Summary			
Delay	10.7		
HCM Level of Service	B		
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	32	6	183	93	9	70
Peak Hour Factor	0.58	0.58	0.73	0.73	0.67	0.67
Hourly flow rate (vph)	55	10	251	127	13	104

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	66	378	118
Volume Left (vph)	55	0	13
Volume Right (vph)	10	127	0
Hadj (s)	0.11	-0.17	0.06
Departure Headway (s)	5.1	4.0	4.5
Degree Utilization, x	0.09	0.42	0.15
Capacity (veh/h)	645	874	766
Control Delay (s)	8.6	10.0	8.3
Approach Delay (s)	8.6	10.0	8.3
Approach LOS	A	A	A

Intersection Summary			
Delay	9.5		
HCM Level of Service	A		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	101	17	146	56	18	302
Peak Hour Factor	0.58	0.58	0.73	0.73	0.67	0.67
Hourly flow rate (vph)	174	29	200	77	27	451

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	203	277	478
Volume Left (vph)	174	0	27
Volume Right (vph)	29	77	0
Hadj (s)	0.12	-0.13	0.05
Departure Headway (s)	5.9	5.1	5.0
Degree Utilization, x	0.33	0.39	0.66
Capacity (veh/h)	561	680	705
Control Delay (s)	11.7	11.2	17.0
Approach Delay (s)	11.7	11.2	17.0
Approach LOS	B	B	C

Intersection Summary			
Delay	14.2		
HCM Level of Service	B		
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	83	134	209	86	70	70
Peak Hour Factor	0.88	0.88	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	94	152	249	102	93	93

Direction, Lane #	SE 1	NW 1	SW 1
Volume Total (vph)	247	351	187
Volume Left (vph)	94	0	93
Volume Right (vph)	0	102	93
Hadj (s)	0.11	-0.14	-0.17
Departure Headway (s)	4.9	4.6	5.1
Degree Utilization, x	0.34	0.45	0.27
Capacity (veh/h)	689	752	633
Control Delay (s)	10.5	11.3	10.0
Approach Delay (s)	10.5	11.3	10.0
Approach LOS	B	B	A

Intersection Summary			
Delay	10.7		
HCM Level of Service	B		
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	100	193	206	84	90	64
Peak Hour Factor	0.88	0.88	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	114	219	245	100	120	85

Direction, Lane #	SE 1	NW 1	SW 1
Volume Total (vph)	333	345	205
Volume Left (vph)	114	0	120
Volume Right (vph)	0	100	85
Hadj (s)	0.10	-0.14	-0.10
Departure Headway (s)	5.0	4.8	5.4
Degree Utilization, x	0.47	0.46	0.31
Capacity (veh/h)	681	717	598
Control Delay (s)	12.3	11.8	10.8
Approach Delay (s)	12.3	11.8	10.8
Approach LOS	B	B	B

Intersection Summary			
Delay	11.8		
HCM Level of Service	B		
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: McLaughlin Dr. & Hagar Dr.

1/25/2009

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	105	85	12	198	74	16
Peak Hour Factor	0.86	0.86	0.86	0.86	0.79	0.79
Hourly flow rate (vph)	122	99	14	230	94	20

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total (vph)	221	244	114
Volume Left (vph)	122	0	94
Volume Right (vph)	99	230	0
Hadj (s)	-0.12	-0.53	0.20
Departure Headway (s)	4.6	4.1	4.9
Degree Utilization, x	0.28	0.28	0.16
Capacity (veh/h)	740	837	686
Control Delay (s)	9.3	8.6	8.8
Approach Delay (s)	9.3	8.6	8.8
Approach LOS	A	A	A

Intersection Summary			
Delay	8.9		
HCM Level of Service	A		
Intersection Capacity Utilization	32.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: McLaughlin Dr. & Hagar Dr.

1/25/2009

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	196	113	67	168	124	48
Peak Hour Factor	0.86	0.86	0.86	0.86	0.79	0.79
Hourly flow rate (vph)	228	131	78	195	157	61

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total (vph)	359	273	218
Volume Left (vph)	228	0	157
Volume Right (vph)	131	195	0
Hadj (s)	0.06	-0.39	0.18
Departure Headway (s)	5.1	4.8	5.5
Degree Utilization, x	0.51	0.37	0.33
Capacity (veh/h)	664	697	618
Control Delay (s)	13.3	10.6	11.1
Approach Delay (s)	13.3	10.6	11.1
Approach LOS	B	B	B

Intersection Summary			
Delay	11.9		
HCM Level of Service	B		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
5: Glenn Coolidge Dr. & Hagar Dr.

3/13/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	377	403	10	1	78	0	33	4	3	0	1	79
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	1.00			0.99			0.87	
Flt Protected	0.95	1.00		0.95	1.00			0.96			1.00	
Satd. Flow (prot)	1770	1856		1770	1863			1771			1614	
Flt Permitted	0.65	1.00		0.47	1.00			0.96			1.00	
Satd. Flow (perm)	1219	1856		884	1863			1771			1614	
Peak-hour factor, PHF	0.94	0.94	0.94	0.48	0.48	0.48	0.91	0.91	0.91	0.79	0.79	0.79
Adj. Flow (vph)	401	429	11	2	162	0	36	4	3	0	1	100
RTOR Reduction (vph)	0	1	0	0	0	0	0	3	0	0	92	0
Lane Group Flow (vph)	401	439	0	2	162	0	0	40	0	0	9	0
Turn Type	Perm			Perm			Split			Split		
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)	25.0	25.0		25.0	25.0			2.2			3.2	
Effective Green, g (s)	25.0	25.0		25.0	25.0			2.2			3.2	
Actuated g/C Ratio	0.59	0.59		0.59	0.59			0.05			0.08	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	719	1094		521	1098			92			122	
v/s Ratio Prot		0.24			0.09			c0.02			c0.01	
v/s Ratio Perm	c0.33			0.00								
v/c Ratio	0.56	0.40		0.00	0.15			0.44			0.07	
Uniform Delay, d1	5.3	4.7		3.6	3.9			19.5			18.2	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.9	0.2		0.0	0.1			3.3			0.2	
Delay (s)	6.3	4.9		3.6	4.0			22.8			18.5	
Level of Service	A	A		A	A			C			B	
Approach Delay (s)		5.6			4.0			22.8			18.5	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	7.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	42.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱			✥			✥	
Volume (vph)	161	283	11	15	412	1	20	1	5	0	2	368
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.98			0.87	
Flt Protected	0.95	1.00		0.95	1.00			0.96			1.00	
Satd. Flow (prot)	1770	1852		1770	1862			1749			1613	
Flt Permitted	0.22	1.00		0.55	1.00			0.96			1.00	
Satd. Flow (perm)	411	1852		1021	1862			1749			1613	
Peak-hour factor, PHF	0.94	0.94	0.94	0.48	0.48	0.48	0.91	0.91	0.91	0.79	0.79	0.79
Adj. Flow (vph)	171	301	12	31	858	2	22	1	5	0	3	466
RTOR Reduction (vph)	0	1	0	0	0	0	0	5	0	0	266	0
Lane Group Flow (vph)	171	312	0	31	860	0	0	23	0	0	203	0
Turn Type	Perm			Perm			Split			Split		
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)	71.5	71.5		71.5	71.5			4.4			15.9	
Effective Green, g (s)	71.5	71.5		71.5	71.5			4.4			15.9	
Actuated g/C Ratio	0.69	0.69		0.69	0.69			0.04			0.15	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	283	1276		703	1283			74			247	
v/s Ratio Prot		0.17			c0.46			c0.01			c0.13	
v/s Ratio Perm	0.42			0.03								
v/c Ratio	0.60	0.24		0.04	0.67			0.31			0.82	
Uniform Delay, d1	8.6	6.0		5.2	9.3			48.2			42.6	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	3.6	0.1		0.0	1.4			2.4			19.3	
Delay (s)	12.2	6.1		5.2	10.7			50.7			61.9	
Level of Service	B	A		A	B			D			E	
Approach Delay (s)		8.3			10.5			50.7			61.9	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	103.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: High St. & Glenn Coolidge Dr.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑	↱		↰↑	↱	↰	↑↑↱		↰	↑↑↱	
Volume (vph)	32	135	272	63	228	393	193	415	112	58	74	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	0.97		1.00	0.95	
Flt Protected		0.99	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1845	1583		1843	1583	1770	3427		1770	3372	
Flt Permitted		0.89	1.00		0.89	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1666	1583		1663	1583	1770	3427		1770	3372	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.84	0.84	0.84	0.87	0.87	0.87
Adj. Flow (vph)	36	150	302	70	253	437	230	494	133	67	85	39
RTOR Reduction (vph)	0	0	214	0	0	259	0	34	0	0	25	0
Lane Group Flow (vph)	0	186	88	0	323	178	230	593	0	67	99	0
Turn Type	Perm		Perm	Perm		Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		15.7	15.7		15.7	15.7	6.1	22.6		3.4	19.9	
Effective Green, g (s)		15.7	15.7		15.7	15.7	6.1	22.6		3.4	19.9	
Actuated g/C Ratio		0.29	0.29		0.29	0.29	0.11	0.42		0.06	0.37	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		487	463		486	463	201	1442		112	1250	
v/s Ratio Prot							c0.13	c0.17		0.04	0.03	
v/s Ratio Perm		0.11	0.06		c0.19	0.11						
v/c Ratio		0.38	0.19		0.66	0.38	1.14	0.41		0.60	0.08	
Uniform Delay, d1		15.1	14.2		16.7	15.1	23.8	10.9		24.5	11.0	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.5	0.2		3.4	0.5	107.7	0.9		8.3	0.1	
Delay (s)		15.6	14.4		20.1	15.7	131.5	11.8		32.8	11.1	
Level of Service		B	B		C	B	F	B		C	B	
Approach Delay (s)		14.9			17.6			43.9			18.7	
Approach LOS		B			B			D			B	

Intersection Summary			
HCM Average Control Delay	26.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	53.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↑↱		↰	↑↱	
Volume (vph)	92	206	247	65	204	181	153	228	48	333	519	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	0.97		1.00	0.99	
Flt Protected		0.98	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1834	1583		1841	1583	1770	3447		1770	3491	
Flt Permitted		0.66	1.00		0.71	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1233	1583		1329	1583	1770	3447		1770	3491	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.84	0.84	0.84	0.87	0.87	0.87
Adj. Flow (vph)	102	229	274	72	227	201	182	271	57	383	597	60
RTOR Reduction (vph)	0	0	191	0	0	140	0	25	0	0	10	0
Lane Group Flow (vph)	0	331	83	0	299	61	182	303	0	383	647	0
Turn Type	Perm		Perm	Perm		Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		20.0	20.0		20.0	20.0	11.4	18.1		16.0	22.7	
Effective Green, g (s)		20.0	20.0		20.0	20.0	11.4	18.1		16.0	22.7	
Actuated g/C Ratio		0.30	0.30		0.30	0.30	0.17	0.27		0.24	0.34	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		373	479		402	479	305	944		428	1199	
v/s Ratio Prot							0.10	0.09		c0.22	c0.19	
v/s Ratio Perm		c0.27	0.05		0.22	0.04						
v/c Ratio		0.89	0.17		0.74	0.13	0.60	0.32		0.89	0.54	
Uniform Delay, d1		22.0	17.0		20.7	16.7	25.2	19.1		24.2	17.5	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		21.6	0.2		7.3	0.1	3.1	0.9		20.6	1.7	
Delay (s)		43.5	17.1		28.0	16.8	28.4	20.0		44.8	19.2	
Level of Service		D	B		C	B	C	C		D	B	
Approach Delay (s)		31.6			23.5			23.0			28.6	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	27.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	66.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	17	11	215	137	15	87
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	12	234	149	16	95
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	435	308			383	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	435	308			383	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	98			99	
cM capacity (veh/h)	570	732			1176	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	18	12	383	111
Volume Left	18	0	0	16
Volume Right	0	12	149	0
cSH	570	732	1700	1176
Volume to Capacity	0.03	0.02	0.23	0.01
Queue Length 95th (ft)	3	1	0	1
Control Delay (s)	11.5	10.0	0.0	1.3
Lane LOS	B	B		A
Approach Delay (s)	10.9		0.0	1.3
Approach LOS	B			

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: East Remote Entrance & Hagar Dr

1/25/2009

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	173	40	128	81	71	246
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	188	43	139	88	77	267
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	605	183			227	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	605	183			227	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	57	95			94	
cM capacity (veh/h)	434	859			1341	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	188	43	227	345
Volume Left	188	0	0	77
Volume Right	0	43	88	0
cSH	434	859	1700	1341
Volume to Capacity	0.43	0.05	0.13	0.06
Queue Length 95th (ft)	54	4	0	5
Control Delay (s)	19.5	9.4	0.0	2.2
Lane LOS	C	A		A
Approach Delay (s)	17.6		0.0	2.2
Approach LOS	C			

Intersection Summary			
Average Delay	6.0		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Empire Grade & Western Dr.

1/25/2009

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Volume (veh/h)	377	54	37	385	117	73
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	410	59	40	418	127	79
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			468		938	439
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			468		938	439
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		55	87
cM capacity (veh/h)			1093		283	618

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total	468	459	207
Volume Left	0	40	127
Volume Right	59	0	79
cSH	1700	1093	357
Volume to Capacity	0.28	0.04	0.58
Queue Length 95th (ft)	0	3	87
Control Delay (s)	0.0	1.1	28.0
Lane LOS		A	D
Approach Delay (s)	0.0	1.1	28.0
Approach LOS			D

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	154	89	448	125	79	345
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.82	0.82	0.84	0.84	0.80	0.80
Hourly flow rate (vph)	188	109	533	149	99	431
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1236	608			682	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1236	608			682	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	78			89	
cM capacity (veh/h)	173	496			911	

Direction, Lane #	NB 1	SE 1	NW 1	NW 2
Volume Total	296	682	99	431
Volume Left	188	0	99	0
Volume Right	109	149	0	0
cSH	227	1700	911	1700
Volume to Capacity	1.30	0.40	0.11	0.25
Queue Length 95th (ft)	392	0	9	0
Control Delay (s)	206.9	0.0	9.4	0.0
Lane LOS	F		A	
Approach Delay (s)	206.9	0.0	1.8	
Approach LOS	F			

Intersection Summary			
Average Delay	41.3		
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	9	433	10	8	675	5	26	4	8	39	28	15
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.67	0.67	0.67	0.84	0.84	0.84
Hourly flow rate (vph)	10	476	11	9	742	5	39	6	12	46	33	18

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	497	756	57	98
Volume Left (vph)	10	9	39	46
Volume Right (vph)	11	5	12	18
Hadj (s)	0.02	0.03	0.04	0.02
Departure Headway (s)	5.4	5.2	7.1	6.9
Degree Utilization, x	0.75	1.10	0.11	0.19
Capacity (veh/h)	497	682	464	479
Control Delay (s)	22.6	85.9	11.0	11.5
Approach Delay (s)	22.6	85.9	11.0	11.5
Approach LOS	C	F	B	B

Intersection Summary			
Delay	55.4		
HCM Level of Service	F		
Intersection Capacity Utilization	51.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	14	466	14	11	475	18	13	16	5	9	13	13
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.67	0.67	0.67	0.84	0.84	0.84
Hourly flow rate (vph)	15	512	15	12	522	20	19	24	7	11	15	15

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	543	554	51	42
Volume Left (vph)	15	12	19	11
Volume Right (vph)	15	20	7	15
Hadj (s)	0.02	0.02	0.02	-0.14
Departure Headway (s)	4.9	4.9	6.6	6.5
Degree Utilization, x	0.74	0.75	0.09	0.07
Capacity (veh/h)	713	723	490	488
Control Delay (s)	20.7	21.4	10.3	10.0
Approach Delay (s)	20.7	21.4	10.3	10.0
Approach LOS	C	C	B	A

Intersection Summary			
Delay	20.2		
HCM Level of Service	C		
Intersection Capacity Utilization	42.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↰↑	↱		↰↓	↱	↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	41	47	61	28	23	15	15	317	12	32	593	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1821	1583		1813	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.86	1.00		0.84	1.00	0.95	1.00	1.00	0.51	1.00	1.00
Satd. Flow (perm)		1607	1583		1559	1583	1770	3539	1583	946	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.76	0.76	0.76	0.83	0.83	0.83
Adj. Flow (vph)	51	59	76	47	38	25	20	417	16	39	714	84
RTOR Reduction (vph)	0	0	45	0	0	15	0	0	13	0	0	63
Lane Group Flow (vph)	0	110	31	0	85	10	20	417	3	39	714	21
Turn Type	custom		custom	Perm		Perm	Split		Perm	custom		custom
Protected Phases					6		4	4				
Permitted Phases	2	2	2	6		6			4	8	8	8
Actuated Green, G (s)		30.1	30.1		30.1	30.1	13.9	13.9	13.9	18.6	18.6	18.6
Effective Green, g (s)		30.1	30.1		30.1	30.1	13.9	13.9	13.9	18.6	18.6	18.6
Actuated g/C Ratio		0.40	0.40		0.40	0.40	0.19	0.19	0.19	0.25	0.25	0.25
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		648	639		629	639	330	659	295	236	882	395
v/s Ratio Prot							0.01	c0.12				
v/s Ratio Perm		c0.07	0.02		0.05	0.01			0.00	0.04	c0.20	0.01
v/c Ratio		0.17	0.05		0.14	0.02	0.06	0.63	0.01	0.17	0.81	0.05
Uniform Delay, d1		14.2	13.5		14.0	13.4	25.0	28.0	24.7	21.9	26.3	21.3
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.6	0.1		0.4	0.0	0.1	2.0	0.0	0.3	5.5	0.1
Delay (s)		14.8	13.7		14.5	13.4	25.1	30.0	24.8	22.3	31.9	21.4
Level of Service		B	B		B	B	C	C	C	C	C	C
Approach Delay (s)		14.4			14.2			29.6			30.4	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	74.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Iowa Dr. & Bay St.

1/25/2009

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	32	20	68	39	31	13	59	399	40	18	839	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1807	1583		1812	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.75	1.00		0.79	1.00	0.95	1.00	1.00	0.46	1.00	1.00
Satd. Flow (perm)		1401	1583		1474	1583	1770	3539	1583	852	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.76	0.76	0.76	0.83	0.83	0.83
Adj. Flow (vph)	40	25	85	65	52	22	78	525	53	22	1011	55
RTOR Reduction (vph)	0	0	73	0	0	19	0	0	40	0	0	34
Lane Group Flow (vph)	0	65	12	0	117	3	78	525	13	22	1011	21
Turn Type	custom		custom	Perm		Perm	Split		Perm	custom		custom
Protected Phases					6		4	4				
Permitted Phases	2	2	2	6		6			4	8	8	8
Actuated Green, G (s)		7.9	7.9		7.9	7.9	13.5	13.5	13.5	20.8	20.8	20.8
Effective Green, g (s)		7.9	7.9		7.9	7.9	13.5	13.5	13.5	20.8	20.8	20.8
Actuated g/C Ratio		0.15	0.15		0.15	0.15	0.25	0.25	0.25	0.38	0.38	0.38
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		204	231		215	231	441	881	394	327	1358	607
v/s Ratio Prot							0.04	c0.15				
v/s Ratio Perm		0.05	0.01		c0.08	0.00			0.01	0.03	c0.29	0.01
v/c Ratio		0.32	0.05		0.54	0.01	0.18	0.60	0.03	0.07	0.74	0.03
Uniform Delay, d1		20.7	19.9		21.5	19.8	16.0	17.9	15.4	10.6	14.4	10.4
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.9	0.1		2.8	0.0	0.2	1.1	0.0	0.1	2.3	0.0
Delay (s)		21.6	20.0		24.3	19.8	16.2	19.0	15.4	10.7	16.7	10.5
Level of Service		C	C		C	B	B	B	B	B	B	B
Approach Delay (s)		20.7			23.6			18.4			16.2	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	54.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
11: Escalona Dr &

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣		↰	✣	
Volume (veh/h)	9	28	46	3	19	68	21	656	11	36	354	29
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	30	50	3	21	74	23	713	12	39	385	32
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1328	1249	401	1293	1259	719	416			725		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1328	1249	401	1293	1259	719	416			725		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	81	92	97	87	83	98			96		
cM capacity (veh/h)	94	162	649	105	160	428	1143			878		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	90	98	748	26	429
Volume Left	10	3	23	26	13
Volume Right	50	74	12	0	32
cSH	244	294	1143	878	878
Volume to Capacity	0.37	0.33	0.02	0.04	0.04
Queue Length 95th (ft)	40	35	2	3	3
Control Delay (s)	28.1	23.2	0.5	9.3	0.8
Lane LOS	D	C	A	A	A
Approach Delay (s)	28.1	23.2	0.5	1.3	
Approach LOS	D	C			

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥		↰	↱	
Volume (veh/h)	4	16	39	12	15	46	33	512	15	110	673	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	17	42	13	16	50	36	557	16	120	732	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1698	1648	764	1658	1672	565	797			573		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1698	1648	764	1658	1672	565	797			573		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	79	89	75	80	90	96			88		
cM capacity (veh/h)	49	83	404	52	81	525	825			1000		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	64	79	609	120	797
Volume Left	4	13	36	120	0
Volume Right	42	50	16	0	65
cSH	160	144	825	1000	1700
Volume to Capacity	0.40	0.55	0.04	0.12	0.47
Queue Length 95th (ft)	44	69	3	10	0
Control Delay (s)	41.9	56.9	1.2	9.1	0.0
Lane LOS	E	F	A	A	
Approach Delay (s)	41.9	56.9	1.2	1.2	
Approach LOS	E	F			

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	WBR2	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	10	450	38	108	283	8	40	121	14	66	82	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.85		1.00	1.00			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	0.95			0.99			0.98	1.00
Satd. Flow (prot)	1770	1583		1770	1769			1821			1822	1583
Flt Permitted	0.51	1.00		0.27	0.95			0.91			0.81	1.00
Satd. Flow (perm)	956	1583		507	1769			1677			1505	1583
Peak-hour factor, PHF	0.83	0.83	0.83	0.86	0.86	0.86	0.90	0.90	0.90	0.84	0.84	0.84
Adj. Flow (vph)	12	542	46	126	329	9	44	134	16	79	98	171
RTOR Reduction (vph)	0	7	0	0	2	0	0	6	0	0	0	108
Lane Group Flow (vph)	12	581	0	126	336	0	0	188	0	0	177	63
Turn Type		custom		Perm			Perm			Perm		Perm
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		6
Actuated Green, G (s)	20.1	20.1		20.1	20.1			16.2			16.2	16.2
Effective Green, g (s)	20.1	20.1		20.1	20.1			16.2			16.2	16.2
Actuated g/C Ratio	0.45	0.45		0.45	0.45			0.37			0.37	0.37
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	434	718		230	803			613			550	579
v/s Ratio Prot		c0.37			0.19							
v/s Ratio Perm	0.01			0.25				0.11			c0.12	0.04
v/c Ratio	0.03	0.81		0.55	0.42			0.31			0.32	0.11
Uniform Delay, d1	6.7	10.4		8.8	8.2			10.0			10.1	9.3
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	0.0	6.7		2.7	0.4			1.3			1.5	0.4
Delay (s)	6.7	17.1		11.5	8.5			11.3			11.6	9.7
Level of Service	A	B		B	A			B			B	A
Approach Delay (s)	16.9				9.3			11.3			10.7	
Approach LOS	B				A			B			B	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	44.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: Bay St. & King St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	168	466	34	12	405	48	28	99	13	35	123	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.99		1.00	0.98			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	1.00
Satd. Flow (prot)	1770	1844		1770	1833			1822			1842	1583
Flt Permitted	0.30	1.00		0.26	1.00			0.93			0.92	1.00
Satd. Flow (perm)	556	1844		492	1833			1705			1710	1583
Peak-hour factor, PHF	0.86	0.86	0.86	0.83	0.83	0.83	0.90	0.90	0.90	0.84	0.84	0.84
Adj. Flow (vph)	195	542	40	14	488	58	31	110	14	42	146	171
RTOR Reduction (vph)	0	6	0	0	10	0	0	7	0	0	0	106
Lane Group Flow (vph)	195	576	0	14	536	0	0	148	0	0	188	65
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	18.7	18.7		18.7	18.7			16.3			16.3	16.3
Effective Green, g (s)	18.7	18.7		18.7	18.7			16.3			16.3	16.3
Actuated g/C Ratio	0.43	0.43		0.43	0.43			0.38			0.38	0.38
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	242	802		214	797			646			648	600
v/s Ratio Prot		0.31			0.29							
v/s Ratio Perm	c0.35			0.03				0.09			c0.11	0.04
v/c Ratio	0.81	0.72		0.07	0.67			0.23			0.29	0.11
Uniform Delay, d1	10.6	10.0		7.1	9.7			9.1			9.3	8.6
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	17.5	3.1		0.1	2.2			0.8			1.1	0.4
Delay (s)	28.1	13.1		7.2	11.9			9.9			10.4	9.0
Level of Service	C	B		A	B			A			B	A
Approach Delay (s)		16.8			11.8			9.9			9.8	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	13.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	43.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Bay St. & Mission St.

1/25/2009

Movement	EBL	EBR	EBR2	NBL	NBR	NBR2	NWL2	NWL	NWR	SWL2	SWL	SWR
Lane Configurations												
Volume (vph)	152	131	54	84	858	70	79	147	88	146	862	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.88		1.00	1.00		1.00	0.97	
Frt	1.00	0.85		1.00	0.85		1.00	0.94		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (prot)	1770	1583		1770	2787		1770	1705		1770	3379	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (perm)	1770	1583		1770	2787		1770	1705		1770	3379	
Peak-hour factor, PHF	0.84	0.84	0.84	0.95	0.95	0.95	0.83	0.83	0.83	0.94	0.94	0.94
Adj. Flow (vph)	181	156	64	88	903	74	95	177	106	155	917	195
RTOR Reduction (vph)	0	10	0	0	3	0	0	14	0	0	12	0
Lane Group Flow (vph)	181	210	0	88	974	0	95	269	0	155	1100	0
Turn Type		Perm			Perm		Split			Split		
Protected Phases	4			2			8	8		3	3	
Permitted Phases		4			2							
Actuated Green, G (s)	22.3	22.3		46.0	46.0		24.0	24.0		40.0	40.0	
Effective Green, g (s)	22.3	22.3		46.0	46.0		24.0	24.0		40.0	40.0	
Actuated g/C Ratio	0.15	0.15		0.31	0.31		0.16	0.16		0.27	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	266	238		549	864		286	276		477	911	
v/s Ratio Prot	0.10			0.05			0.05	c0.16		0.09	c0.33	
v/s Ratio Perm		c0.13			c0.35							
v/c Ratio	0.68	0.88		0.16	1.13		0.33	0.97		0.32	1.21	
Uniform Delay, d1	59.6	61.7		37.1	51.2		55.1	61.8		43.3	54.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.0	29.3		0.6	71.8		0.7	46.6		0.4	103.5	
Delay (s)	66.6	91.0		37.8	122.9		55.7	108.4		43.7	157.7	
Level of Service	E	F		D	F		E	F		D	F	
Approach Delay (s)	80.0			115.9				95.2			143.7	
Approach LOS	F			F				F			F	

Intersection Summary			
HCM Average Control Delay	120.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	148.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Bay St. & Mission St. 1/25/2009

Movement	EBL	EBR	EBR2	NBL	NBR	NBR2	NWL2	NWL	NWR	SWL2	SWL	SWR
Lane Configurations												
Volume (vph)	232	136	103	133	976	70	96	142	60	130	936	238
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.88		1.00	1.00		1.00	0.97	
Frt	1.00	0.85		1.00	0.85		1.00	0.96		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (prot)	1770	1583		1770	2787		1770	1719		1770	3370	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (perm)	1770	1583		1770	2787		1770	1719		1770	3370	
Peak-hour factor, PHF	0.84	0.84	0.84	0.95	0.95	0.95	0.83	0.83	0.83	0.94	0.94	0.94
Adj. Flow (vph)	276	162	123	140	1027	74	116	171	72	138	996	253
RTOR Reduction (vph)	0	18	0	0	3	0	0	15	0	0	14	0
Lane Group Flow (vph)	276	267	0	140	1098	0	116	228	0	138	1235	0
Turn Type		Prot			custom		Split			Split		
Protected Phases	1	1		2	2		8	8		3	3	
Permitted Phases					2							
Actuated Green, G (s)	12.0	12.0		26.1	26.1		18.8	18.8		31.1	31.1	
Effective Green, g (s)	12.0	12.0		26.1	26.1		18.8	18.8		31.1	31.1	
Actuated g/C Ratio	0.12	0.12		0.25	0.25		0.18	0.18		0.30	0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	204	183		444	699		320	311		529	1008	
v/s Ratio Prot	0.16	c0.17		0.08	c0.39		0.07	c0.13		0.08	c0.37	
v/s Ratio Perm												
v/c Ratio	1.35	1.46		0.32	1.57		0.36	0.73		0.26	1.23	
Uniform Delay, d1	46.0	46.0		31.7	39.0		37.3	40.2		27.7	36.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	187.5	234.8		0.4	263.8		0.7	8.7		0.3	110.3	
Delay (s)	233.5	280.8		32.1	302.7		38.0	48.9		28.0	146.7	
Level of Service	F	F		C	F		D	D		C	F	
Approach Delay (s)	257.5			272.2				45.4			134.9	
Approach LOS	F			F				D			F	

Intersection Summary			
HCM Average Control Delay	193.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	104.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Laurel St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	19	93	4	263	126	55	4	1142	168	45	966	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.95		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1851		1770	1778		1770	3471		1770	3529	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1851		1770	1778		1770	3471		1770	3529	
Peak-hour factor, PHF	0.98	0.98	0.98	1.00	1.00	1.00	0.83	0.83	0.83	0.79	0.79	0.79
Adj. Flow (vph)	19	95	4	263	126	55	5	1376	202	57	1223	23
RTOR Reduction (vph)	0	1	0	0	11	0	0	8	0	0	1	0
Lane Group Flow (vph)	19	98	0	263	170	0	5	1570	0	57	1245	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.2	14.0		19.0	29.8		16.0	55.0		16.0	55.0	
Effective Green, g (s)	3.2	14.0		19.0	29.8		16.0	55.0		16.0	55.0	
Actuated g/C Ratio	0.03	0.12		0.16	0.25		0.13	0.46		0.13	0.46	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	47	216		280	442		236	1591		236	1617	
v/s Ratio Prot	0.01	c0.05		c0.15	0.10		0.00	c0.45		c0.03	0.35	
v/s Ratio Perm												
v/c Ratio	0.40	0.45		0.94	0.38		0.02	0.99		0.24	0.77	
Uniform Delay, d1	57.5	49.4		49.9	37.5		45.2	32.1		46.6	27.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.6	1.5		37.3	0.6		0.2	19.6		2.4	3.6	
Delay (s)	63.1	51.0		87.3	38.0		45.4	51.8		49.0	30.8	
Level of Service	E	D		F	D		D	D		D	C	
Approach Delay (s)		52.9			67.2			51.7			31.6	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM Average Control Delay	46.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Laurel St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	34	219	33	454	304	57	9	1302	573	148	1201	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.98		1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1826		1770	1819		1770	3377		1770	3523	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1826		1770	1819		1770	3377		1770	3523	
Peak-hour factor, PHF	0.98	0.98	0.98	1.00	1.00	1.00	0.83	0.83	0.83	0.79	0.79	0.79
Adj. Flow (vph)	35	223	34	454	304	57	11	1569	690	187	1520	49
RTOR Reduction (vph)	0	3	0	0	4	0	0	33	0	0	1	0
Lane Group Flow (vph)	35	254	0	454	357	0	11	2226	0	187	1568	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	7.3	23.9		28.0	44.6		3.0	68.4		16.0	81.4	
Effective Green, g (s)	7.3	23.9		28.0	44.6		3.0	68.4		16.0	81.4	
Actuated g/C Ratio	0.05	0.16		0.18	0.29		0.02	0.45		0.11	0.53	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	85	287		325	533		35	1517		186	1883	
v/s Ratio Prot	0.02	c0.14		c0.26	0.20		0.01	c0.66		c0.11	0.45	
v/s Ratio Perm												
v/c Ratio	0.41	0.88		1.40	0.67		0.31	1.47		1.01	0.83	
Uniform Delay, d1	70.4	62.8		62.2	47.4		73.6	42.0		68.2	29.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	25.8		196.3	3.2		5.1	214.1		67.4	3.3	
Delay (s)	73.6	88.6		258.5	50.6		78.7	256.1		135.5	33.0	
Level of Service	E	F		F	D		E	F		F	C	
Approach Delay (s)		86.8			166.4			255.2			44.0	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	159.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	152.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	114.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
15: Walnut Ave. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	60	97	8	50	70	61	10	1095	45	61	1116	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.93		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1842		1770	1733		1770	3518		1770	3531	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1842		1770	1733		1770	3518		1770	3531	
Peak-hour factor, PHF	0.79	0.79	0.79	0.62	0.62	0.62	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	76	123	10	81	113	98	11	1153	47	66	1213	18
RTOR Reduction (vph)	0	2	0	0	21	0	0	2	0	0	1	0
Lane Group Flow (vph)	76	131	0	81	190	0	11	1198	0	66	1230	0
Turn Type	Split			Split			Split			Split		
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	15.0	15.0		19.2	19.2		43.2	43.2		43.2	43.2	
Effective Green, g (s)	15.0	15.0		19.2	19.2		43.2	43.2		43.2	43.2	
Actuated g/C Ratio	0.11	0.11		0.14	0.14		0.32	0.32		0.32	0.32	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	194	202		249	244		560	1113		560	1117	
v/s Ratio Prot	0.04	c0.07		0.05	c0.11		0.01	c0.34		0.04	c0.35	
v/s Ratio Perm												
v/c Ratio	0.39	0.65		0.33	0.78		0.02	1.08		0.12	1.10	
Uniform Delay, d1	56.6	58.3		52.9	56.6		32.1	46.7		33.2	46.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	7.0		0.8	14.3		0.1	50.0		0.4	59.2	
Delay (s)	57.9	65.3		53.6	71.0		32.2	96.7		33.6	105.9	
Level of Service	E	E		D	E		C	F		C	F	
Approach Delay (s)		62.6			66.2			96.1			102.2	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	93.5	HCM Level of Service	F
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	136.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	47	56	8	96	118	60	11	1528	50	26	1749	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.95		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1828		1770	1768		1770	3522		1770	3533	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1828		1770	1768		1770	3522		1770	3533	
Peak-hour factor, PHF	0.79	0.79	0.79	0.62	0.62	0.62	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	59	71	10	155	190	97	12	1608	53	28	1901	22
RTOR Reduction (vph)	0	4	0	0	12	0	0	1	0	0	1	0
Lane Group Flow (vph)	59	77	0	155	275	0	12	1660	0	28	1922	0
Turn Type	Split			Split			Split			Split		
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	11.1	11.1		24.0	24.0		41.0	41.0		45.0	45.0	
Effective Green, g (s)	11.1	11.1		24.0	24.0		41.0	41.0		45.0	45.0	
Actuated g/C Ratio	0.08	0.08		0.18	0.18		0.30	0.30		0.33	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	143	148		310	309		529	1053		581	1160	
v/s Ratio Prot	0.03	c0.04		0.09	c0.16		0.01	c0.47		0.02	c0.54	
v/s Ratio Perm												
v/c Ratio	0.41	0.52		0.50	0.89		0.02	1.58		0.05	1.66	
Uniform Delay, d1	59.9	60.5		51.1	55.2		33.9	48.0		31.4	46.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.9	3.3		1.3	25.1		0.0	263.8		0.0	299.6	
Delay (s)	61.8	63.8		52.4	80.3		33.9	311.9		31.5	345.6	
Level of Service	E	E		D	F		C	F		C	F	
Approach Delay (s)		62.9			70.5			309.9			341.1	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	291.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	137.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	105	91	101	237	296	310
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.74	0.74	0.69	0.69
Hourly flow rate (vph)	125	108	136	320	429	449
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1247	654	878			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1247	654	878			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	21	77	82			
cM capacity (veh/h)	158	467	769			

Direction, Lane #	SB 1	SE 1	NW 1
Volume Total	233	457	878
Volume Left	125	136	0
Volume Right	108	0	449
cSH	228	769	1700
Volume to Capacity	1.03	0.18	0.52
Queue Length 95th (ft)	243	16	0
Control Delay (s)	112.1	4.8	0.0
Lane LOS	F	A	
Approach Delay (s)	112.1	4.8	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	18.1		
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
16: California St. & Bay St.

1/25/2009

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	189	96	74	332	255	279
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.74	0.74	0.69	0.69
Hourly flow rate (vph)	225	114	100	449	370	404
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1220	572	774			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1220	572	774			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	78	88			
cM capacity (veh/h)	175	520	842			
Direction, Lane #	**SB 1**	**SE 1**	**NW 1**			
Volume Total	339	549	774			
Volume Left	225	100	0			
Volume Right	114	0	404			
cSH	226	842	1700			
Volume to Capacity	1.50	0.12	0.46			
Queue Length 95th (ft)	511	10	0			
Control Delay (s)	288.4	3.1	0.0			
Lane LOS	F	A				
Approach Delay (s)	288.4	3.1	0.0			
Approach LOS	F					
Intersection Summary						
Average Delay			59.9			
Intersection Capacity Utilization			78.4%	ICU Level of Service		D
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis
17: King St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	117	0	86	4	0	2	49	594	11	12	729	90
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00			0.95		1.00	0.95	
Frt	1.00	0.87			0.96			1.00		1.00	0.98	
Flt Protected	0.95	0.99			0.97			1.00		0.95	1.00	
Satd. Flow (prot)	1681	1526			1722			3517		1770	3481	
Flt Permitted	0.95	0.99			0.97			0.86		0.95	1.00	
Satd. Flow (perm)	1681	1526			1722			3031		1770	3481	
Peak-hour factor, PHF	0.88	0.88	0.88	0.50	0.50	0.50	1.00	1.00	1.00	0.98	0.98	0.98
Adj. Flow (vph)	133	0	98	8	0	4	49	594	11	12	744	92
RTOR Reduction (vph)	0	85	0	0	4	0	0	1	0	0	7	0
Lane Group Flow (vph)	120	26	0	0	8	0	0	653	0	12	829	0
Turn Type	Split			Split			Perm			Prot		
Protected Phases	4	4		8	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	7.4	7.4			1.1			28.9		0.7	33.6	
Effective Green, g (s)	7.4	7.4			1.1			28.9		0.7	33.6	
Actuated g/C Ratio	0.14	0.14			0.02			0.53		0.01	0.62	
Clearance Time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	230	209			35			1619		23	2162	
v/s Ratio Prot	c0.07	0.02			c0.00					0.01	c0.24	
v/s Ratio Perm								0.22				
v/c Ratio	0.52	0.13			0.23			0.40		0.52	0.38	
Uniform Delay, d1	21.7	20.5			26.1			7.5		26.5	5.1	
Progression Factor	1.00	1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2	2.1	0.3			3.4			0.7		19.7	0.5	
Delay (s)	23.8	20.8			29.4			8.2		46.2	5.6	
Level of Service	C	C			C			A		D	A	
Approach Delay (s)		22.4			29.4			8.2			6.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	54.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: King St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	✥			✥		↰	↑↱		↰	↑↱	
Volume (vph)	92	4	9	2	2	11	0	936	4	4	836	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00			0.95		1.00	0.95	
Frt	1.00	0.97			0.90			1.00		1.00	0.98	
Flt Protected	0.95	0.96			0.99			1.00		0.95	1.00	
Satd. Flow (prot)	1681	1663			1667			3537		1770	3473	
Flt Permitted	0.95	0.96			0.99			1.00		0.95	1.00	
Satd. Flow (perm)	1681	1663			1667			3537		1770	3473	
Peak-hour factor, PHF	0.88	0.88	0.88	0.50	0.50	0.50	1.00	1.00	1.00	0.98	0.98	0.98
Adj. Flow (vph)	105	5	10	4	4	22	0	936	4	4	853	121
RTOR Reduction (vph)	0	9	0	0	22	0	0	0	0	0	7	0
Lane Group Flow (vph)	61	50	0	0	8	0	0	940	0	4	967	0
Turn Type	Split			Split			Prot			Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.9	3.9			0.9			20.1		0.5	24.6	
Effective Green, g (s)	3.9	3.9			0.9			20.1		0.5	24.6	
Actuated g/C Ratio	0.09	0.09			0.02			0.49		0.01	0.59	
Clearance Time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	158	157			36			1717		21	2064	
v/s Ratio Prot	c0.04	0.03			c0.01			c0.27		0.00	c0.28	
v/s Ratio Perm												
v/c Ratio	0.39	0.32			0.24			0.55		0.19	0.47	
Uniform Delay, d1	17.6	17.5			19.9			7.5		20.2	4.7	
Progression Factor	1.00	1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2	1.6	1.2			3.4			0.4		4.4	0.2	
Delay (s)	19.2	18.7			23.3			7.8		24.6	4.9	
Level of Service	B	B			C			A		C	A	
Approach Delay (s)		18.9			23.3			7.8			5.0	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	7.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	41.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: Mission St. & Chestnut St.

1/25/2009

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER	NER2
Lane Configurations												
Volume (vph)	10	385	26	72	321	23	62	248	1533	1613	407	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.97		1.00	0.95		1.00	0.95	0.88	0.97	0.91	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	0.85	0.85
Flt Protected	0.95	0.96		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3419		1770	3504		1770	3539	2787	3433	1441	1583
Flt Permitted	0.95	0.96		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3419		1770	3504		1770	3539	2787	3433	1441	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.77	0.77	0.77	0.89	0.89	0.89	0.88	0.88	0.88
Adj. Flow (vph)	11	443	30	94	417	30	70	279	1722	1833	462	31
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	960	0	0	17
Lane Group Flow (vph)	11	470	0	94	443	0	70	279	762	1879	416	14
Turn Type	Split			Prot			Prot		Perm		Prot	Perm
Protected Phases	3	3		5	2		1	6		4	4	
Permitted Phases									6			4
Actuated Green, G (s)	24.0	24.0		6.0	30.2		7.8	32.0	32.0	61.1	61.1	61.1
Effective Green, g (s)	24.0	24.0		6.0	30.2		7.8	32.0	32.0	61.1	61.1	61.1
Actuated g/C Ratio	0.17	0.17		0.04	0.22		0.06	0.23	0.23	0.44	0.44	0.44
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	305	590		76	761		99	814	641	1508	633	695
v/s Ratio Prot	0.01	c0.14		c0.05	0.13		0.04	0.08		c0.55	0.29	
v/s Ratio Perm									c0.27			0.01
v/c Ratio	0.04	0.80		1.24	0.58		0.71	0.34	1.19	1.25	0.66	0.02
Uniform Delay, d1	47.9	55.2		66.6	48.8		64.5	44.8	53.6	39.0	30.7	22.1
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	7.3		179.9	3.2		20.5	1.1	99.9	116.5	2.5	0.0
Delay (s)	48.0	62.5		246.4	52.0		85.0	45.9	153.4	155.5	33.2	22.1
Level of Service	D	E		F	D		F	D	F	F	C	C
Approach Delay (s)		62.2			85.8			136.6		131.8		
Approach LOS		E			F			F		F		

Intersection Summary			
HCM Average Control Delay	122.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	139.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER	NER2
Lane Configurations												
Volume (vph)	18	469	26	100	299	4	60	339	1544	1363	471	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.97		1.00	0.95		1.00	0.95	0.88	0.97	0.91	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	0.99	0.85	0.85
Flt Protected	0.95	0.95		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3423		1770	3532		1770	3539	2787	3430	1441	1583
Flt Permitted	0.95	0.95		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3423		1770	3532		1770	3539	2787	3430	1441	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.77	0.77	0.77	0.89	0.89	0.89	0.88	0.88	0.88
Adj. Flow (vph)	21	539	30	130	388	5	67	381	1735	1549	535	58
RTOR Reduction (vph)	0	3	0	0	1	0	0	0	833	0	0	33
Lane Group Flow (vph)	21	566	0	130	392	0	67	381	902	1603	481	25
Turn Type	Split			Prot			Prot		Perm		Prot	Perm
Protected Phases	3	3		5	2		1	6		4	4	
Permitted Phases									6			4
Actuated Green, G (s)	27.2	27.2		8.0	38.2		8.7	38.9	38.9	53.0	53.0	53.0
Effective Green, g (s)	27.2	27.2		8.0	38.2		8.7	38.9	38.9	53.0	53.0	53.0
Actuated g/C Ratio	0.19	0.19		0.06	0.27		0.06	0.27	0.27	0.37	0.37	0.37
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	336	651		99	943		108	962	758	1270	534	586
v/s Ratio Prot	0.01	c0.17		c0.07	0.11		0.04	0.11		c0.47	0.33	
v/s Ratio Perm									c0.32			0.02
v/c Ratio	0.06	0.87		1.31	0.42		0.62	0.40	1.19	1.26	0.90	0.04
Uniform Delay, d1	47.5	56.2		67.6	43.3		65.6	42.5	52.1	45.0	42.6	28.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	11.9		195.8	1.4		10.6	1.2	98.4	124.5	18.2	0.0
Delay (s)	47.6	68.1		263.3	44.6		76.2	43.7	150.5	169.5	60.8	28.9
Level of Service	D	E		F	D		E	D	F	F	E	C
Approach Delay (s)		67.3			99.0			129.6		141.3		
Approach LOS		E			F			F		F		

Intersection Summary			
HCM Average Control Delay	124.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	143.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	↑	↱↱	↰↰	↑	↱	↰	↑↑↑↱		↰↰	↑↑↑	↱
Volume (vph)	396	188	183	40	187	250	236	1746	87	334	1523	689
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	3433	1863	1583	1770	5049		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	3433	1863	1583	1770	5049		3433	5085	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.90	0.90	0.90	0.93	0.93	0.93	0.97	0.97	0.97
Adj. Flow (vph)	408	194	189	44	208	278	254	1877	94	344	1570	710
RTOR Reduction (vph)	0	0	124	0	0	160	0	4	0	0	0	0
Lane Group Flow (vph)	408	194	65	44	208	118	254	1967	0	344	1570	710
Turn Type	Prot		Perm	Prot		Perm	Split			Split		Free
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases			2			6						Free
Actuated Green, G (s)	23.0	51.8	51.8	4.0	32.8	32.8	45.0	45.0		34.0	34.0	150.8
Effective Green, g (s)	23.0	51.8	51.8	4.0	32.8	32.8	45.0	45.0		34.0	34.0	150.8
Actuated g/C Ratio	0.15	0.34	0.34	0.03	0.22	0.22	0.30	0.30		0.23	0.23	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	270	640	957	91	405	344	528	1507		774	1146	1583
v/s Ratio Prot	c0.23	0.10		0.01	c0.11		0.14	c0.39		0.10	c0.31	
v/s Ratio Perm			0.02			0.07						0.45
v/c Ratio	1.51	0.30	0.07	0.48	0.51	0.34	0.48	1.31		0.44	1.37	0.45
Uniform Delay, d1	63.9	36.3	33.3	72.4	52.0	49.9	43.3	52.9		50.3	58.4	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	248.3	1.2	0.1	4.0	4.6	2.7	0.7	142.4		0.4	172.1	0.9
Delay (s)	312.2	37.5	33.4	76.4	56.6	52.6	44.0	195.3		50.7	230.5	0.9
Level of Service	F	D	C	E	E	D	D	F		D	F	A
Approach Delay (s)		178.2			56.1			178.1			144.8	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	153.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	150.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	719	296	260	96	262	481	248	1319	96	367	1424	504
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	3433	1863	1583	1770	5034		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	3433	1863	1583	1770	5034		3433	5085	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.90	0.90	0.90	0.93	0.93	0.93	0.97	0.97	0.97
Adj. Flow (vph)	741	305	268	107	291	534	267	1418	103	378	1468	520
RTOR Reduction (vph)	0	0	162	0	0	220	0	5	0	0	0	0
Lane Group Flow (vph)	741	305	106	107	291	314	267	1516	0	378	1468	520
Turn Type	Prot		Perm	Prot		Perm	Split			Split		Free
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases			2			6						Free
Actuated Green, G (s)	36.0	59.4	59.4	8.6	32.0	32.0	36.0	36.0		30.0	30.0	150.0
Effective Green, g (s)	36.0	59.4	59.4	8.6	32.0	32.0	36.0	36.0		30.0	30.0	150.0
Actuated g/C Ratio	0.24	0.40	0.40	0.06	0.21	0.21	0.24	0.24		0.20	0.20	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	425	738	1104	197	397	338	425	1208		687	1017	1583
v/s Ratio Prot	c0.42	0.16		0.03	0.16		0.15	c0.30		0.11	c0.29	
v/s Ratio Perm			0.04			c0.20						0.33
v/c Ratio	1.74	0.41	0.10	0.54	0.73	0.93	0.63	1.25		0.55	1.44	0.33
Uniform Delay, d1	57.0	32.7	28.4	68.8	55.0	57.9	51.0	57.0		53.9	60.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	344.2	1.7	0.2	3.0	11.4	33.7	2.9	121.5		1.0	205.2	0.6
Delay (s)	401.2	34.4	28.6	71.8	66.4	91.6	53.9	178.5		54.9	265.2	0.6
Level of Service	F	C	C	E	E	F	D	F		D	F	A
Approach Delay (s)		240.1			81.4			159.9			173.4	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	169.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	108.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

LEVEL OF SERVICE ANALYSIS
CUMULATIVE PLUS PROJECT CONDITIONS

HCM Unsignalized Intersection Capacity Analysis
1: McLaughlin Dr. & Heller Dr.

1/25/2009

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	91	13	56	70	10	19
Peak Hour Factor	0.83	0.83	0.68	0.68	0.61	0.61
Hourly flow rate (vph)	110	16	82	103	16	31

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	125	185	48
Volume Left (vph)	110	0	16
Volume Right (vph)	16	103	0
Hadj (s)	0.13	-0.30	0.10
Departure Headway (s)	4.5	4.0	4.5
Degree Utilization, x	0.16	0.20	0.06
Capacity (veh/h)	757	877	760
Control Delay (s)	8.4	8.0	7.8
Approach Delay (s)	8.4	8.0	7.8
Approach LOS	A	A	A

Intersection Summary			
Delay	8.1		
HCM Level of Service	A		
Intersection Capacity Utilization	22.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	126	30	99	157	22	124
Peak Hour Factor	0.83	0.83	0.68	0.68	0.61	0.61
Hourly flow rate (vph)	152	36	146	231	36	203

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	188	376	239
Volume Left (vph)	152	0	36
Volume Right (vph)	36	231	0
Hadj (s)	0.08	-0.33	0.06
Departure Headway (s)	5.4	4.4	4.9
Degree Utilization, x	0.28	0.46	0.33
Capacity (veh/h)	609	784	691
Control Delay (s)	10.5	11.1	10.3
Approach Delay (s)	10.5	11.1	10.3
Approach LOS	B	B	B

Intersection Summary			
Delay	10.8		
HCM Level of Service	B		
Intersection Capacity Utilization	40.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	32	6	183	93	9	71
Peak Hour Factor	0.58	0.58	0.73	0.73	0.67	0.67
Hourly flow rate (vph)	55	10	251	127	13	106

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	66	378	119
Volume Left (vph)	55	0	13
Volume Right (vph)	10	127	0
Hadj (s)	0.11	-0.17	0.06
Departure Headway (s)	5.1	4.0	4.5
Degree Utilization, x	0.09	0.42	0.15
Capacity (veh/h)	644	873	766
Control Delay (s)	8.6	10.0	8.3
Approach Delay (s)	8.6	10.0	8.3
Approach LOS	A	A	A

Intersection Summary			
Delay	9.5		
HCM Level of Service	A		
Intersection Capacity Utilization	25.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	101	17	149	56	18	302
Peak Hour Factor	0.58	0.58	0.73	0.73	0.67	0.67
Hourly flow rate (vph)	174	29	204	77	27	451

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	203	281	478
Volume Left (vph)	174	0	27
Volume Right (vph)	29	77	0
Hadj (s)	0.12	-0.13	0.05
Departure Headway (s)	5.9	5.1	5.0
Degree Utilization, x	0.33	0.39	0.66
Capacity (veh/h)	560	680	704
Control Delay (s)	11.8	11.3	17.1
Approach Delay (s)	11.8	11.3	17.1
Approach LOS	B	B	C

Intersection Summary			
Delay	14.3		
HCM Level of Service	B		
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations		↰	↱		⋎	
Sign Control		Stop	Stop		Stop	
Volume (vph)	83	134	209	86	83	71
Peak Hour Factor	0.88	0.88	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	94	152	249	102	111	95

Direction, Lane #	SE 1	NW 1	SW 1
Volume Total (vph)	247	351	205
Volume Left (vph)	94	0	111
Volume Right (vph)	0	102	95
Hadj (s)	0.11	-0.14	-0.13
Departure Headway (s)	5.0	4.7	5.2
Degree Utilization, x	0.34	0.45	0.30
Capacity (veh/h)	679	740	630
Control Delay (s)	10.6	11.5	10.3
Approach Delay (s)	10.6	11.5	10.3
Approach LOS	B	B	B

Intersection Summary			
Delay	10.9		
HCM Level of Service	B		
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	100	193	206	84	90	64
Peak Hour Factor	0.88	0.88	0.84	0.84	0.75	0.75
Hourly flow rate (vph)	114	219	245	100	120	85

Direction, Lane #	SE 1	NW 1	SW 1
Volume Total (vph)	333	345	205
Volume Left (vph)	114	0	120
Volume Right (vph)	0	100	85
Hadj (s)	0.10	-0.14	0.10
Departure Headway (s)	5.0	4.8	5.4
Degree Utilization, x	0.47	0.46	0.31
Capacity (veh/h)	681	717	598
Control Delay (s)	12.3	11.8	10.8
Approach Delay (s)	12.3	11.8	10.8
Approach LOS	B	B	B

Intersection Summary			
Delay	11.8		
HCM Level of Service	B		
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: McLaughlin Dr. & Hagar Dr.

1/25/2009

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	106	97	12	200	74	16
Peak Hour Factor	0.86	0.86	0.86	0.86	0.79	0.79
Hourly flow rate (vph)	123	113	14	233	94	20

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total (vph)	236	247	114
Volume Left (vph)	123	0	94
Volume Right (vph)	113	233	0
Hadj (s)	-0.15	-0.53	0.20
Departure Headway (s)	4.6	4.1	4.9
Degree Utilization, x	0.30	0.28	0.16
Capacity (veh/h)	743	827	678
Control Delay (s)	9.5	8.7	8.9
Approach Delay (s)	9.5	8.7	8.9
Approach LOS	A	A	A

Intersection Summary			
Delay	9.0		
HCM Level of Service	A		
Intersection Capacity Utilization	32.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	196	121	67	182	125	48
Peak Hour Factor	0.86	0.86	0.86	0.86	0.79	0.79
Hourly flow rate (vph)	228	141	78	212	158	61

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total (vph)	369	290	219
Volume Left (vph)	228	0	158
Volume Right (vph)	141	212	0
Hadj (s)	-0.07	-0.40	0.18
Departure Headway (s)	5.1	4.9	5.5
Degree Utilization, x	0.53	0.39	0.34
Capacity (veh/h)	661	694	610
Control Delay (s)	13.7	11.0	11.3
Approach Delay (s)	13.7	11.0	11.3
Approach LOS	B	B	B

Intersection Summary			
Delay	12.2		
HCM Level of Service	B		
Intersection Capacity Utilization	50.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
5: Glenn Coolidge Dr. & Hagar Dr. 3/13/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	400	428	11	1	82	0	35	4	3	0	1	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	1.00		1.00	1.00			0.99			0.87	
Flt Protected	0.95	1.00		0.95	1.00			0.96			1.00	
Satd. Flow (prot)	1770	1856		1770	1863			1771			1614	
Flt Permitted	0.65	1.00		0.45	1.00			0.96			1.00	
Satd. Flow (perm)	1209	1856		829	1863			1771			1614	
Peak-hour factor, PHF	0.94	0.94	0.94	0.48	0.48	0.48	0.91	0.91	0.91	0.79	0.79	0.79
Adj. Flow (vph)	426	455	12	2	171	0	38	4	3	0	1	104
RTOR Reduction (vph)	0	1	0	0	0	0	0	3	0	0	93	0
Lane Group Flow (vph)	426	466	0	2	171	0	0	42	0	0	12	0
Turn Type	Perm			Perm			Split			Split		
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)	26.4	26.4		26.4	26.4			2.3			4.7	
Effective Green, g (s)	26.4	26.4		26.4	26.4			2.3			4.7	
Actuated g/C Ratio	0.58	0.58		0.58	0.58			0.05			0.10	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	703	1079		482	1083			90			167	
v/s Ratio Prot		0.25			0.09			c0.02			c0.01	
v/s Ratio Perm	c0.35			0.00								
v/c Ratio	0.61	0.43		0.00	0.16			0.47			0.07	
Uniform Delay, d1	6.1	5.3		4.0	4.4			21.0			18.4	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.5	0.3		0.0	0.1			3.8			0.2	
Delay (s)	7.6	5.6		4.0	4.4			24.8			18.6	
Level of Service	A	A		A	A			C			B	
Approach Delay (s)		6.6			4.4			24.8			18.6	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	8.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	45.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	198	283	11	15	412	1	20	1	5	0	2	388
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.98			0.87	
Flt Protected	0.95	1.00		0.95	1.00			0.96			1.00	
Satd. Flow (prot)	1770	1852		1770	1862			1749			1613	
Flt Permitted	0.21	1.00		0.55	1.00			0.96			1.00	
Satd. Flow (perm)	399	1852		1015	1862			1749			1613	
Peak-hour factor, PHF	0.94	0.94	0.94	0.48	0.48	0.48	0.91	0.91	0.91	0.79	0.79	0.79
Adj. Flow (vph)	211	301	12	31	858	2	22	1	5	0	3	491
RTOR Reduction (vph)	0	1	0	0	0	0	0	5	0	0	262	0
Lane Group Flow (vph)	211	312	0	31	860	0	0	23	0	0	232	0
Turn Type	Perm			Perm			Split			Split		
Protected Phases		4			8		2	2		6	6	
Permitted Phases	4			8								
Actuated Green, G (s)	72.3	72.3		72.3	72.3			4.5			17.6	
Effective Green, g (s)	72.3	72.3		72.3	72.3			4.5			17.6	
Actuated g/C Ratio	0.68	0.68		0.68	0.68			0.04			0.17	
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	271	1258		690	1265			74			267	
v/s Ratio Prot		0.17			0.46			c0.01			c0.14	
v/s Ratio Perm	c0.53			0.03								
v/c Ratio	0.78	0.25		0.04	0.68			0.31			0.87	
Uniform Delay, d1	11.6	6.6		5.6	10.2			49.5			43.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	13.2	0.1		0.0	1.5			2.4			24.5	
Delay (s)	24.8	6.7		5.7	11.6			51.9			67.7	
Level of Service	C	A		A	B			D			E	
Approach Delay (s)		14.0			11.4			51.9			67.7	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	106.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: High St. & Glenn Coolidge Dr.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	135	272	63	228	399	193	423	112	79	103	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	0.97		1.00	0.96	
Flt Protected		0.99	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1845	1583		1843	1583	1770	3428		1770	3407	
Flt Permitted		0.90	1.00		0.89	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1667	1583		1664	1583	1770	3428		1770	3407	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.84	0.84	0.84	0.87	0.87	0.87
Adj. Flow (vph)	36	150	302	70	253	443	230	504	133	91	118	39
RTOR Reduction (vph)	0	0	212	0	0	240	0	35	0	0	25	0
Lane Group Flow (vph)	0	186	90	0	323	203	230	602	0	91	132	0
Turn Type	Perm		Perm	Perm		Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		15.9	15.9		15.9	15.9	6.1	21.3		3.9	19.1	
Effective Green, g (s)		15.9	15.9		15.9	15.9	6.1	21.3		3.9	19.1	
Actuated g/C Ratio		0.30	0.30		0.30	0.30	0.11	0.40		0.07	0.36	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		499	474		498	474	203	1375		130	1225	
v/s Ratio Prot							c0.13	c0.18		0.05	0.04	
v/s Ratio Perm		0.11	0.06		c0.19	0.13						
v/c Ratio		0.37	0.19		0.65	0.43	1.13	0.44		0.70	0.11	
Uniform Delay, d1		14.7	13.8		16.2	15.0	23.5	11.6		24.0	11.3	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.5	0.2		2.9	0.6	103.5	1.0		15.6	0.2	
Delay (s)		15.1	14.0		19.1	15.6	127.0	12.6		39.7	11.5	
Level of Service		B	B		B	B	F	B		D	B	
Approach Delay (s)		14.4			17.1			42.9			21.8	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	53.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
6: High St. & Glenn Coolidge Dr.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱	↰	↑↱		↰	↑↱	
Volume (vph)	92	206	247	65	204	206	153	262	48	347	538	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	0.98		1.00	0.99	
Flt Protected		0.98	1.00		0.99	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1834	1583		1841	1583	1770	3457		1770	3492	
Flt Permitted		0.66	1.00		0.71	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1231	1583		1327	1583	1770	3457		1770	3492	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.84	0.84	0.84	0.87	0.87	0.87
Adj. Flow (vph)	102	229	274	72	227	229	182	312	57	399	618	60
RTOR Reduction (vph)	0	0	191	0	0	160	0	21	0	0	10	0
Lane Group Flow (vph)	0	331	83	0	299	69	182	348	0	399	668	0
Turn Type	Perm		Perm	Perm		Perm	Prot			Prot		
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8						
Actuated Green, G (s)		20.0	20.0		20.0	20.0	11.4	18.1		16.1	22.8	
Effective Green, g (s)		20.0	20.0		20.0	20.0	11.4	18.1		16.1	22.8	
Actuated g/C Ratio		0.30	0.30		0.30	0.30	0.17	0.27		0.24	0.34	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		372	478		401	478	305	945		430	1203	
v/s Ratio Prot							0.10	0.10		c0.23	c0.19	
v/s Ratio Perm		c0.27	0.05		0.23	0.04						
v/c Ratio		0.89	0.17		0.75	0.14	0.60	0.37		0.93	0.56	
Uniform Delay, d1		22.0	17.0		20.8	16.9	25.3	19.4		24.5	17.6	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		21.9	0.2		7.4	0.1	3.1	1.1		26.1	1.9	
Delay (s)		43.9	17.2		28.2	17.0	28.4	20.5		50.5	19.4	
Level of Service		D	B		C	B	C	C		D	B	
Approach Delay (s)		31.8			23.3			23.1			31.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	28.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	66.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	36	11	217	143	15	99
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	39	12	236	155	16	108
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	454	314			391	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	454	314			391	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	98			99	
cM capacity (veh/h)	556	727			1167	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	39	12	391	124
Volume Left	39	0	0	16
Volume Right	0	12	155	0
cSH	556	727	1700	1167
Volume to Capacity	0.07	0.02	0.23	0.01
Queue Length 95th (ft)	6	1	0	1
Control Delay (s)	12.0	10.0	0.0	1.2
Lane LOS	B	B		A
Approach Delay (s)	11.5		0.0	1.2
Approach LOS	B			

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	30.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	185	40	142	104	71	254
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	201	43	154	113	77	276
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	641	211			267	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	641	211			267	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	51	95			94	
cM capacity (veh/h)	413	829			1296	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	201	43	267	353
Volume Left	201	0	0	77
Volume Right	0	43	113	0
cSH	413	829	1700	1296
Volume to Capacity	0.49	0.05	0.16	0.06
Queue Length 95th (ft)	65	4	0	5
Control Delay (s)	21.7	9.6	0.0	2.2
Lane LOS	C	A		A
Approach Delay (s)	19.6		0.0	2.2
Approach LOS	C			

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Empire Grade & Western Dr.

1/25/2009

Movement	SET	SER	NWL	NWT	NEL	NER
Lane Configurations						
Volume (veh/h)	377	57	37	385	118	73
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	410	62	40	418	128	79
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume			472		940	441
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			472		940	441
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			96		55	87
cM capacity (veh/h)			1090		282	616

Direction, Lane #	SE 1	NW 1	NE 1
Volume Total	472	459	208
Volume Left	0	40	128
Volume Right	62	0	79
cSH	1700	1090	356
Volume to Capacity	0.28	0.04	0.58
Queue Length 95th (ft)	0	3	88
Control Delay (s)	0.0	1.1	28.4
Lane LOS		A	D
Approach Delay (s)	0.0	1.1	28.4
Approach LOS			D

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	66.6%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	NBL	NBR	SET	SER	NWL	NWT
Lane Configurations						
Volume (veh/h)	157	89	448	127	79	346
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.82	0.82	0.84	0.84	0.80	0.80
Hourly flow rate (vph)	191	109	533	151	99	431
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1238	609			685	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1238	609			685	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	78			89	
cM capacity (veh/h)	173	495			909	

Direction, Lane #	NB 1	SE 1	NW 1	NW 2
Volume Total	300	685	99	431
Volume Left	191	0	99	0
Volume Right	109	151	0	0
cSH	226	1700	909	1700
Volume to Capacity	1.33	0.40	0.11	0.25
Queue Length 95th (ft)	404	0	9	0
Control Delay (s)	216.3	0.0	9.4	0.0
Lane LOS	F		A	
Approach Delay (s)	216.3	0.0	1.8	
Approach LOS	F			

Intersection Summary			
Average Delay	43.5		
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	9	454	10	8	681	5	26	4	8	39	28	15
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.67	0.67	0.67	0.84	0.84	0.84
Hourly flow rate (vph)	10	499	11	9	748	5	39	6	12	46	33	18

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	520	763	57	98
Volume Left (vph)	10	9	39	46
Volume Right (vph)	11	5	12	18
Hadj (s)	0.03	0.03	0.04	0.02
Departure Headway (s)	5.4	5.3	7.2	7.0
Degree Utilization, x	0.78	1.12	0.11	0.19
Capacity (veh/h)	652	681	463	478
Control Delay (s)	25.0	92.3	11.1	11.6
Approach Delay (s)	25.0	92.3	11.1	11.6
Approach LOS	D	F	B	B

Intersection Summary			
Delay	59.3		
HCM Level of Service	F		
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: High St. & Laurent St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	14	466	14	11	475	18	13	16	5	9	13	13
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.67	0.67	0.67	0.84	0.84	0.84
Hourly flow rate (vph)	15	512	15	12	522	20	19	24	7	11	15	15
Direction, Lane #	**EB 1**	**WB 1**	**NB 1**	**SB 1**								
Volume Total (vph)	543	554	51	42								
Volume Left (vph)	15	12	19	11								
Volume Right (vph)	15	20	7	15								
Hadj (s)	0.02	0.02	0.02	-0.14								
Departure Headway (s)	4.9	4.9	6.6	6.5								
Degree Utilization, x	0.74	0.75	0.09	0.07								
Capacity (veh/h)	713	723	490	488								
Control Delay (s)	20.7	21.4	10.3	10.0								
Approach Delay (s)	20.7	21.4	10.3	10.0								
Approach LOS	C	C	B	A								
Intersection Summary												
Delay			20.2									
HCM Level of Service			C									
Intersection Capacity Utilization			42.3%		ICU Level of Service				A			
Analysis Period (min)			15									

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations		↰↑	↱		↰↑	↱	↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	41	47	61	28	23	15	15	317	12	32	593	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.98	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1821	1583		1813	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.86	1.00		0.84	1.00	0.95	1.00	1.00	0.51	1.00	1.00
Satd. Flow (perm)		1607	1583		1559	1583	1770	3539	1583	946	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.76	0.76	0.76	0.83	0.83	0.83
Adj. Flow (vph)	51	59	76	47	38	25	20	417	16	39	714	84
RTOR Reduction (vph)	0	0	45	0	0	15	0	0	13	0	0	63
Lane Group Flow (vph)	0	110	31	0	85	10	20	417	3	39	714	21
Turn Type	custom		custom	Perm		Perm	Split		Perm	custom		custom
Protected Phases					6		4	4				
Permitted Phases	2	2	2	6		6			4	8	8	8
Actuated Green, G (s)		30.1	30.1		30.1	30.1	13.9	13.9	13.9	18.6	18.6	18.6
Effective Green, g (s)		30.1	30.1		30.1	30.1	13.9	13.9	13.9	18.6	18.6	18.6
Actuated g/C Ratio		0.40	0.40		0.40	0.40	0.19	0.19	0.19	0.25	0.25	0.25
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		648	639		629	639	330	659	295	236	882	395
v/s Ratio Prot							0.01	c0.12				
v/s Ratio Perm		c0.07	0.02		0.05	0.01			0.00	0.04	c0.20	0.01
v/c Ratio		0.17	0.05		0.14	0.02	0.06	0.63	0.01	0.17	0.81	0.05
Uniform Delay, d1		14.2	13.5		14.0	13.4	25.0	28.0	24.7	21.9	26.3	21.3
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.6	0.1		0.4	0.0	0.1	2.0	0.0	0.3	5.5	0.1
Delay (s)		14.8	13.7		14.5	13.4	25.1	30.0	24.8	22.3	31.9	21.4
Level of Service		B	B		B	B	C	C	C	C	C	C
Approach Delay (s)		14.4			14.2			29.6			30.4	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	74.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	41.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Iowa Dr. & Bay St.

1/25/2009

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	32	20	68	39	31	13	59	418	40	18	873	46
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85		1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.97	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1807	1583		1812	1583	1770	3539	1583	1770	3539	1583
Flt Permitted		0.75	1.00		0.79	1.00	0.95	1.00	1.00	0.45	1.00	1.00
Satd. Flow (perm)		1400	1583		1474	1583	1770	3539	1583	831	3539	1583
Peak-hour factor, PHF	0.80	0.80	0.80	0.60	0.60	0.60	0.76	0.76	0.76	0.83	0.83	0.83
Adj. Flow (vph)	40	25	85	65	52	22	78	550	53	22	1052	56
RTOR Reduction (vph)	0	0	73	0	0	19	0	0	40	0	0	34
Lane Group Flow (vph)	0	65	12	0	117	3	78	550	13	22	1052	21
Turn Type	custom		custom	Perm		Perm	Split		Perm	custom		custom
Protected Phases					6		4	4				
Permitted Phases	2	2	2	6		6			4	8	8	8
Actuated Green, G (s)		7.9	7.9		7.9	7.9	13.8	13.8	13.8	20.8	20.8	20.8
Effective Green, g (s)		7.9	7.9		7.9	7.9	13.8	13.8	13.8	20.8	20.8	20.8
Actuated g/C Ratio		0.14	0.14		0.14	0.14	0.25	0.25	0.25	0.38	0.38	0.38
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		203	229		214	229	448	896	401	317	1351	604
v/s Ratio Prot							0.04	c0.16				
v/s Ratio Perm		0.05	0.01		c0.08	0.00			0.01	0.03	c0.30	0.01
v/c Ratio		0.32	0.05		0.55	0.01	0.17	0.61	0.03	0.07	0.78	0.03
Uniform Delay, d1		20.9	20.1		21.6	20.0	15.9	18.0	15.3	10.7	14.8	10.6
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.9	0.1		2.8	0.0	0.2	1.3	0.0	0.1	2.9	0.0
Delay (s)		21.8	20.2		24.5	20.0	16.1	19.2	15.4	10.8	17.7	10.6
Level of Service		C	C		C	B	B	B	B	B	B	B
Approach Delay (s)		20.9			23.8			18.6			17.2	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	54.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	9	28	46	3	19	68	21	666	11	36	383	29
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	10	30	50	3	21	74	23	724	12	39	416	32
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1370	1292	432	1335	1302	730	448			736		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1370	1292	432	1335	1302	730	448			736		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	80	92	97	86	82	98			96		
cM capacity (veh/h)	87	153	623	97	150	422	1112			870		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	90	98	759	39	448
Volume Left	10	3	23	39	0
Volume Right	50	74	12	0	32
cSH	230	283	1112	870	1700
Volume to Capacity	0.39	0.35	0.02	0.04	0.26
Queue Length 95th (ft)	44	37	2	4	0
Control Delay (s)	30.4	24.3	0.5	9.3	0.0
Lane LOS	D	C	A	A	
Approach Delay (s)	30.4	24.3	0.5	0.8	
Approach LOS	D	C			

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
11: Escalona Dr & Bay St

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣		↰	↱	
Volume (veh/h)	4	16	39	12	15	46	33	546	15	110	692	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	17	42	13	16	50	36	593	16	120	752	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1755	1705	785	1716	1730	602	817			610		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1755	1705	785	1716	1730	602	817			610		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	90	77	89	72	78	90	96			88		
cM capacity (veh/h)	44	76	393	46	74	500	811			969		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1	SB 2
Volume Total	64	79	646	120	817
Volume Left	4	13	36	120	0
Volume Right	42	50	16	0	65
cSH	148	131	811	969	1700
Volume to Capacity	0.43	0.60	0.04	0.12	0.48
Queue Length 95th (ft)	49	78	3	11	0
Control Delay (s)	47.0	67.5	1.2	9.2	0.0
Lane LOS	E	F	A	A	
Approach Delay (s)	47.0	67.5	1.2	1.2	
Approach LOS	E	F			

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	WBL	WBR	WBR2	SEL2	SEL	SER	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	10	458	38	108	312	8	40	121	14	66	82	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.85		1.00	1.00			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	0.95			0.99			0.98	1.00
Satd. Flow (prot)	1770	1583		1770	1770			1821			1822	1583
Flt Permitted	0.48	1.00		0.27	0.95			0.91			0.81	1.00
Satd. Flow (perm)	894	1583		498	1770			1676			1504	1583
Peak-hour factor, PHF	0.83	0.83	0.83	0.86	0.86	0.86	0.90	0.90	0.90	0.84	0.84	0.84
Adj. Flow (vph)	12	552	46	126	363	9	44	134	16	79	98	171
RTOR Reduction (vph)	0	6	0	0	2	0	0	6	0	0	0	109
Lane Group Flow (vph)	12	592	0	126	370	0	0	188	0	0	177	62
Turn Type		custom		Perm			Perm			Perm		Perm
Protected Phases		8			4			2			6	
Permitted Phases	8			4			2			6		6
Actuated Green, G (s)	20.6	20.6		20.6	20.6			16.2			16.2	16.2
Effective Green, g (s)	20.6	20.6		20.6	20.6			16.2			16.2	16.2
Actuated g/C Ratio	0.46	0.46		0.46	0.46			0.36			0.36	0.36
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	411	728		229	814			606			544	572
v/s Ratio Prot		c0.37			0.21							
v/s Ratio Perm	0.01			0.25				0.11			c0.12	0.04
v/c Ratio	0.03	0.81		0.55	0.45			0.31			0.33	0.11
Uniform Delay, d1	6.6	10.4		8.7	8.3			10.3			10.3	9.5
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	0.0	6.9		2.8	0.4			1.3			1.6	0.4
Delay (s)	6.7	17.3		11.6	8.7			11.6			11.9	9.9
Level of Service	A	B		B	A			B			B	A
Approach Delay (s)	17.1				9.4			11.6			10.9	
Approach LOS	B				A			B			B	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	44.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	168	485	34	12	439	48	28	99	13	35	123	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Frt	1.00	0.99		1.00	0.99			0.99			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	1.00
Satd. Flow (prot)	1770	1844		1770	1835			1822			1842	1583
Flt Permitted	0.27	1.00		0.26	1.00			0.93			0.92	1.00
Satd. Flow (perm)	505	1844		476	1835			1704			1709	1583
Peak-hour factor, PHF	0.86	0.86	0.86	0.83	0.83	0.83	0.90	0.90	0.90	0.84	0.84	0.84
Adj. Flow (vph)	195	564	40	14	529	58	31	110	14	42	146	171
RTOR Reduction (vph)	0	6	0	0	9	0	0	6	0	0	0	108
Lane Group Flow (vph)	195	598	0	14	578	0	0	149	0	0	188	63
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	20.1	20.1		20.1	20.1			16.4			16.4	16.4
Effective Green, g (s)	20.1	20.1		20.1	20.1			16.4			16.4	16.4
Actuated g/C Ratio	0.45	0.45		0.45	0.45			0.37			0.37	0.37
Clearance Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	228	833		215	829			628			630	583
v/s Ratio Prot		0.32			0.32							
v/s Ratio Perm	c0.39			0.03				0.09			c0.11	0.04
v/c Ratio	0.86	0.72		0.07	0.70			0.24			0.30	0.11
Uniform Delay, d1	10.9	9.9		6.9	9.8			9.7			10.0	9.2
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	25.5	3.0		0.1	2.6			0.9			1.2	0.4
Delay (s)	36.4	12.9		7.0	12.3			10.6			11.2	9.6
Level of Service	D	B		A	B			B			B	A
Approach Delay (s)		18.6			12.2			10.6			10.4	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	44.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	EBR2	NBL	NBR	NBR2	NWL2	NWL	NWR	SWL2	SWL	SWR
Lane Configurations												
Volume (vph)	165	136	65	87	858	70	79	148	88	146	862	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.88		1.00	1.00		1.00	0.97	
Frt	1.00	0.85		1.00	0.85		1.00	0.94		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (prot)	1770	1583		1770	2787		1770	1705		1770	3378	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (perm)	1770	1583		1770	2787		1770	1705		1770	3378	
Peak-hour factor, PHF	0.84	0.84	0.84	0.95	0.95	0.95	0.83	0.83	0.83	0.94	0.94	0.94
Adj. Flow (vph)	196	162	77	92	903	74	95	178	106	155	917	199
RTOR Reduction (vph)	0	12	0	0	3	0	0	14	0	0	12	0
Lane Group Flow (vph)	196	227	0	92	974	0	95	270	0	155	1104	0
Turn Type		Perm			Perm		Split			Split		
Protected Phases	4			2			8	8		3	3	
Permitted Phases		4			2							
Actuated Green, G (s)	23.2	23.2		45.0	45.0		24.0	24.0		41.0	41.0	
Effective Green, g (s)	23.2	23.2		45.0	45.0		24.0	24.0		41.0	41.0	
Actuated g/C Ratio	0.16	0.16		0.30	0.30		0.16	0.16		0.27	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	275	246		534	841		285	274		486	928	
v/s Ratio Prot	0.11			0.05			0.05	c0.16		0.09	c0.33	
v/s Ratio Perm		c0.14			c0.35							
v/c Ratio	0.71	0.92		0.17	1.16		0.33	0.98		0.32	1.19	
Uniform Delay, d1	59.8	62.1		38.4	52.1		55.5	62.4		43.0	54.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.4	37.1		0.7	84.2		0.7	49.7		0.4	96.0	
Delay (s)	68.3	99.2		39.1	136.3		56.2	112.1		43.4	150.1	
Level of Service	E	F		D	F		E	F		D	F	
Approach Delay (s)	85.3			127.9				98.1			137.1	
Approach LOS	F			F				F			F	

Intersection Summary			
HCM Average Control Delay	122.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	149.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	EBR2	NBL	NBR	NBR2	NWL2	NWL	NWR	SWL2	SWL	SWR
Lane Configurations												
Volume (vph)	241	139	110	145	976	70	96	148	60	130	936	254
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	0.88		1.00	1.00		1.00	0.97	
Frt	1.00	0.85		1.00	0.85		1.00	0.96		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (prot)	1770	1583		1770	2787		1770	1721		1770	3366	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97		0.95	0.96	
Satd. Flow (perm)	1770	1583		1770	2787		1770	1721		1770	3366	
Peak-hour factor, PHF	0.84	0.84	0.84	0.95	0.95	0.95	0.83	0.83	0.83	0.94	0.94	0.94
Adj. Flow (vph)	287	165	131	153	1027	74	116	178	72	138	996	270
RTOR Reduction (vph)	0	19	0	0	3	0	0	14	0	0	15	0
Lane Group Flow (vph)	287	277	0	153	1098	0	116	236	0	138	1251	0
Turn Type		Prot			custom		Split			Split		
Protected Phases	1	1		2	2		8	8		3	3	
Permitted Phases					2							
Actuated Green, G (s)	12.0	12.0		26.1	26.1		19.3	19.3		31.1	31.1	
Effective Green, g (s)	12.0	12.0		26.1	26.1		19.3	19.3		31.1	31.1	
Actuated g/C Ratio	0.11	0.11		0.25	0.25		0.18	0.18		0.30	0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	203	182		442	696		327	318		527	1002	
v/s Ratio Prot	0.16	c0.18		0.09	c0.39		0.07	c0.14		0.08	c0.37	
v/s Ratio Perm												
v/c Ratio	1.41	1.52		0.35	1.58		0.35	0.74		0.26	1.25	
Uniform Delay, d1	46.2	46.2		32.2	39.2		37.2	40.3		28.0	36.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	212.7	261.8		0.5	266.8		0.7	9.0		0.3	120.3	
Delay (s)	259.0	308.1		32.7	306.0		37.8	49.3		28.2	157.0	
Level of Service	F	F		C	F		D	D		C	F	
Approach Delay (s)	283.9			272.6				45.7			144.4	
Approach LOS	F			F				D			F	

Intersection Summary			
HCM Average Control Delay	201.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	104.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	19	93	4	263	126	55	4	1155	168	45	970	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.95		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1851		1770	1778		1770	3472		1770	3529	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1851		1770	1778		1770	3472		1770	3529	
Peak-hour factor, PHF	0.98	0.98	0.98	1.00	1.00	1.00	0.83	0.83	0.83	0.79	0.79	0.79
Adj. Flow (vph)	19	95	4	263	126	55	5	1392	202	57	1228	23
RTOR Reduction (vph)	0	1	0	0	11	0	0	8	0	0	1	0
Lane Group Flow (vph)	19	98	0	263	170	0	5	1586	0	57	1250	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	3.2	14.0		18.0	28.8		16.0	56.0		16.0	56.0	
Effective Green, g (s)	3.2	14.0		18.0	28.8		16.0	56.0		16.0	56.0	
Actuated g/C Ratio	0.03	0.12		0.15	0.24		0.13	0.47		0.13	0.47	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	47	216		266	427		236	1620		236	1647	
v/s Ratio Prot	0.01	0.05		c0.15	c0.10		0.00	c0.46		c0.03	0.35	
v/s Ratio Perm												
v/c Ratio	0.40	0.45		0.99	0.40		0.02	0.98		0.24	0.76	
Uniform Delay, d1	57.5	49.4		50.9	38.3		45.2	31.4		46.6	26.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.6	1.5		51.5	0.6		0.2	17.9		2.4	3.3	
Delay (s)	63.1	51.0		102.4	38.9		45.4	49.3		49.0	29.8	
Level of Service	E	D		F	D		D	D		D	C	
Approach Delay (s)		52.9			76.5			49.3			30.6	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM Average Control Delay	45.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Laurel St. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	34	219	33	454	304	57	9	1311	573	148	1217	39
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.98		1.00	0.95		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1826		1770	1819		1770	3378		1770	3523	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1826		1770	1819		1770	3378		1770	3523	
Peak-hour factor, PHF	0.98	0.98	0.98	1.00	1.00	1.00	0.83	0.83	0.83	0.79	0.79	0.79
Adj. Flow (vph)	35	223	34	454	304	57	11	1580	690	187	1541	49
RTOR Reduction (vph)	0	3	0	0	4	0	0	33	0	0	1	0
Lane Group Flow (vph)	35	254	0	454	357	0	11	2237	0	187	1589	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	7.3	23.9		28.0	44.6		3.0	68.4		16.0	81.4	
Effective Green, g (s)	7.3	23.9		28.0	44.6		3.0	68.4		16.0	81.4	
Actuated g/C Ratio	0.05	0.16		0.18	0.29		0.02	0.45		0.11	0.53	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	85	287		325	533		35	1517		186	1883	
v/s Ratio Prot	0.02	c0.14		c0.26	0.20		0.01	c0.66		c0.11	0.45	
v/s Ratio Perm												
v/c Ratio	0.41	0.88		1.40	0.67		0.31	1.47		1.01	0.84	
Uniform Delay, d1	70.4	62.8		62.2	47.4		73.6	42.0		68.2	30.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	25.8		196.3	3.2		5.1	217.4		67.4	3.6	
Delay (s)	73.6	88.6		258.5	50.6		78.7	259.3		135.5	33.7	
Level of Service	E	F		F	D		E	F		F	C	
Approach Delay (s)		86.8			166.4			258.4			44.4	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	160.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	152.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	114.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
15: Walnut Ave. & Mission St.

1/25/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	60	97	8	50	70	61	10	1108	45	61	1120	17
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.99		1.00	0.93		1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1842		1770	1733		1770	3519		1770	3531	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1842		1770	1733		1770	3519		1770	3531	
Peak-hour factor, PHF	0.79	0.79	0.79	0.62	0.62	0.62	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	76	123	10	81	113	98	11	1166	47	66	1217	18
RTOR Reduction (vph)	0	2	0	0	21	0	0	2	0	0	1	0
Lane Group Flow (vph)	76	131	0	81	190	0	11	1211	0	66	1234	0
Turn Type	Split			Split			Split			Split		
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	15.0	15.0		19.2	19.2		44.2	44.2		42.2	42.2	
Effective Green, g (s)	15.0	15.0		19.2	19.2		44.2	44.2		42.2	42.2	
Actuated g/C Ratio	0.11	0.11		0.14	0.14		0.32	0.32		0.31	0.31	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	194	202		249	244		573	1139		547	1091	
v/s Ratio Prot	0.04	c0.07		0.05	c0.11		0.01	c0.34		0.04	c0.35	
v/s Ratio Perm												
v/c Ratio	0.39	0.65		0.33	0.78		0.02	1.06		0.12	1.13	
Uniform Delay, d1	56.6	58.3		52.9	56.6		31.4	46.2		33.9	47.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	7.0		0.8	14.3		0.1	45.2		0.5	70.9	
Delay (s)	57.9	65.3		53.6	71.0		31.5	91.4		34.3	118.1	
Level of Service	E	E		D	E		C	F		C	F	
Approach Delay (s)		62.6			66.2			90.8			113.9	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	96.4	HCM Level of Service	F
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	136.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱		↰	↱		↰	↑↱		↰	↑↱	
Volume (vph)	47	56	8	96	118	60	11	1537	50	26	1765	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.95		1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1828		1770	1768		1770	3522		1770	3533	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1828		1770	1768		1770	3522		1770	3533	
Peak-hour factor, PHF	0.79	0.79	0.79	0.62	0.62	0.62	0.95	0.95	0.95	0.92	0.92	0.92
Adj. Flow (vph)	59	71	10	155	190	97	12	1618	53	28	1918	22
RTOR Reduction (vph)	0	4	0	0	12	0	0	1	0	0	1	0
Lane Group Flow (vph)	59	77	0	155	275	0	12	1670	0	28	1939	0
Turn Type	Split			Split			Split			Split		
Protected Phases	4	4		8	8		2	2		6	6	
Permitted Phases												
Actuated Green, G (s)	11.1	11.1		24.0	24.0		41.0	41.0		45.0	45.0	
Effective Green, g (s)	11.1	11.1		24.0	24.0		41.0	41.0		45.0	45.0	
Actuated g/C Ratio	0.08	0.08		0.18	0.18		0.30	0.30		0.33	0.33	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	143	148		310	309		529	1053		581	1160	
v/s Ratio Prot	0.03	c0.04		0.09	c0.16		0.01	c0.47		0.02	c0.55	
v/s Ratio Perm												
v/c Ratio	0.41	0.52		0.50	0.89		0.02	1.59		0.05	1.67	
Uniform Delay, d1	59.9	60.5		51.1	55.2		33.9	48.0		31.4	46.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.9	3.3		1.3	25.1		0.0	268.1		0.0	306.1	
Delay (s)	61.8	63.8		52.4	80.3		33.9	316.1		31.5	352.2	
Level of Service	E	E		D	F		C	F		C	F	
Approach Delay (s)		62.9			70.5			314.1			347.6	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	295.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	137.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
16: California St. & Bay St.

1/25/2009

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	105	91	101	242	297	310
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.74	0.74	0.69	0.69
Hourly flow rate (vph)	125	108	136	327	430	449
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1255	655	880			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1255	655	880			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	20	77	82			
cM capacity (veh/h)	156	466	768			

Direction, Lane #	SB 1	SE 1	NW 1
Volume Total	233	464	880
Volume Left	125	136	0
Volume Right	108	0	449
cSH	225	768	1700
Volume to Capacity	1.03	0.18	0.52
Queue Length 95th (ft)	247	16	0
Control Delay (s)	115.4	4.8	0.0
Lane LOS	F	A	
Approach Delay (s)	115.4	4.8	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	18.5		
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
16: California St. & Bay St.

1/25/2009

Movement	SBL	SBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	189	96	74	335	261	279
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.84	0.84	0.74	0.74	0.69	0.69
Hourly flow rate (vph)	225	114	100	453	378	404
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1233	580	783			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1233	580	783			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	78	88			
cM capacity (veh/h)	172	514	835			

Direction, Lane #	SB 1	SE 1	NW 1
Volume Total	339	553	783
Volume Left	225	100	0
Volume Right	114	0	404
cSH	222	835	1700
Volume to Capacity	1.53	0.12	0.46
Queue Length 95th (ft)	521	10	0
Control Delay (s)	300.4	3.1	0.0
Lane LOS	F	A	
Approach Delay (s)	300.4	3.1	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	61.9		
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	↔			↔			↑↱		↰	↑↱	
Volume (vph)	138	0	86	4	0	2	49	607	11	12	737	96
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00			0.95		1.00	0.95	
Frt	1.00	0.88			0.96			1.00		1.00	0.98	
Flt Protected	0.95	0.99			0.97			1.00		0.95	1.00	
Satd. Flow (prot)	1681	1541			1722			3518		1770	3478	
Flt Permitted	0.95	0.99			0.97			0.86		0.95	1.00	
Satd. Flow (perm)	1681	1541			1722			3026		1770	3478	
Peak-hour factor, PHF	0.88	0.88	0.88	0.50	0.50	0.50	1.00	1.00	1.00	0.98	0.98	0.98
Adj. Flow (vph)	157	0	98	8	0	4	49	607	11	12	752	98
RTOR Reduction (vph)	0	82	0	0	4	0	0	1	0	0	8	0
Lane Group Flow (vph)	133	40	0	0	8	0	0	666	0	12	842	0
Turn Type	Split			Split			Perm			Prot		
Protected Phases	4	4		8	8			2		1	6	
Permitted Phases							2					
Actuated Green, G (s)	9.2	9.2			1.1			28.2		0.7	32.9	
Effective Green, g (s)	9.2	9.2			1.1			28.2		0.7	32.9	
Actuated g/C Ratio	0.17	0.17			0.02			0.51		0.01	0.60	
Clearance Time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	280	257			34			1546		22	2073	
v/s Ratio Prot	c0.08	0.03			c0.00					0.01	c0.24	
v/s Ratio Perm								0.22				
v/c Ratio	0.48	0.16			0.24			0.43		0.55	0.41	
Uniform Delay, d1	20.8	19.7			26.6			8.5		27.1	5.9	
Progression Factor	1.00	1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2	1.3	0.3			3.6			0.9		24.9	0.6	
Delay (s)	22.1	20.0			30.2			9.3		52.0	6.5	
Level of Service	C	B			C			A		D	A	
Approach Delay (s)		21.1			30.2			9.3			7.2	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	10.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	55.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	✣			✣		↰	↑↱		↰	↑↱	
Volume (vph)	106	4	9	2	2	11	0	945	4	4	854	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Lane Util. Factor	0.95	0.95			1.00			0.95		1.00	0.95	
Frt	1.00	0.98			0.90			1.00		1.00	0.98	
Flt Protected	0.95	0.96			0.99			1.00		0.95	1.00	
Satd. Flow (prot)	1681	1665			1667			3537		1770	3463	
Flt Permitted	0.95	0.96			0.99			1.00		0.95	1.00	
Satd. Flow (perm)	1681	1665			1667			3537		1770	3463	
Peak-hour factor, PHF	0.88	0.88	0.88	0.50	0.50	0.50	1.00	1.00	1.00	0.98	0.98	0.98
Adj. Flow (vph)	120	5	10	4	4	22	0	945	4	4	871	147
RTOR Reduction (vph)	0	8	0	0	22	0	0	0	0	0	9	0
Lane Group Flow (vph)	68	59	0	0	8	0	0	949	0	4	1009	0
Turn Type	Split			Split			Prot			Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	5.8	5.8			0.8			21.0		0.5	25.5	
Effective Green, g (s)	5.8	5.8			0.8			21.0		0.5	25.5	
Actuated g/C Ratio	0.13	0.13			0.02			0.48		0.01	0.58	
Clearance Time (s)	4.0	4.0			4.0			4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0		3.0	3.0	
Lane Grp Cap (vph)	221	219			30			1684		20	2002	
v/s Ratio Prot	c0.04	0.04			c0.01			0.27		0.00	c0.29	
v/s Ratio Perm												
v/c Ratio	0.31	0.27			0.28			0.56		0.20	0.50	
Uniform Delay, d1	17.3	17.2			21.4			8.3		21.6	5.5	
Progression Factor	1.00	1.00			1.00			1.00		1.00	1.00	
Incremental Delay, d2	0.8	0.7			5.1			0.4		4.9	0.2	
Delay (s)	18.1	17.9			26.4			8.7		26.5	5.7	
Level of Service	B	B			C			A		C	A	
Approach Delay (s)		18.0			26.4			8.7			5.8	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	44.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER	NER2
Lane Configurations												
Volume (vph)	10	385	26	72	321	23	62	258	1533	1647	407	27
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.97		1.00	0.95		1.00	0.95	0.88	0.97	0.91	1.00
Frt	1.00	0.99		1.00	0.99		1.00	1.00	0.85	1.00	0.85	0.85
Flt Protected	0.95	0.96		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3419		1770	3504		1770	3539	2787	3433	1441	1583
Flt Permitted	0.95	0.96		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3419		1770	3504		1770	3539	2787	3433	1441	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.77	0.77	0.77	0.89	0.89	0.89	0.88	0.88	0.88
Adj. Flow (vph)	11	443	30	94	417	30	70	290	1722	1872	462	31
RTOR Reduction (vph)	0	3	0	0	4	0	0	0	926	0	0	18
Lane Group Flow (vph)	11	470	0	94	443	0	70	290	796	1918	416	13
Turn Type	Split			Prot			Prot		Perm		Prot	Perm
Protected Phases	3	3		5	2		1	6		4	4	
Permitted Phases									6			4
Actuated Green, G (s)	24.0	24.0		6.0	33.1		7.7	34.8	34.8	59.1	59.1	59.1
Effective Green, g (s)	24.0	24.0		6.0	33.1		7.7	34.8	34.8	59.1	59.1	59.1
Actuated g/C Ratio	0.17	0.17		0.04	0.24		0.06	0.25	0.25	0.42	0.42	0.42
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	304	587		76	829		97	880	693	1450	609	669
v/s Ratio Prot	0.01	c0.14		c0.05	0.13		0.04	0.08		c0.56	0.29	
v/s Ratio Perm									c0.29			0.01
v/c Ratio	0.04	0.80		1.24	0.53		0.72	0.33	1.15	1.32	0.68	0.02
Uniform Delay, d1	48.3	55.6		67.0	46.7		65.0	43.0	52.6	40.4	32.8	23.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.0	7.7		179.9	2.5		23.1	1.0	82.9	150.2	3.2	0.0
Delay (s)	48.4	63.3		246.8	49.1		88.1	44.0	135.4	190.6	36.0	23.5
Level of Service	D	E		F	D		F	D	F	F	D	C
Approach Delay (s)		63.0			83.5			121.1		161.2		
Approach LOS		E			F			F		F		

Intersection Summary			
HCM Average Control Delay	129.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.13		
Actuated Cycle Length (s)	139.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL2	WBL	WBR	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NER	NER2
Lane Configurations												
Volume (vph)	18	469	26	100	322	4	60	380	1544	1363	471	51
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.97		1.00	0.95		1.00	0.95	0.88	0.97	0.91	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85	0.99	0.85	0.85
Flt Protected	0.95	0.95		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3423		1770	3533		1770	3539	2787	3430	1441	1583
Flt Permitted	0.95	0.95		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3423		1770	3533		1770	3539	2787	3430	1441	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.77	0.77	0.77	0.89	0.89	0.89	0.88	0.88	0.88
Adj. Flow (vph)	21	539	30	130	418	5	67	427	1735	1549	535	58
RTOR Reduction (vph)	0	3	0	0	1	0	0	0	833	0	0	33
Lane Group Flow (vph)	21	566	0	130	422	0	67	427	902	1603	481	25
Turn Type	Split			Prot			Prot		Perm		Prot	Perm
Protected Phases	3	3		5	2		1	6		4	4	
Permitted Phases									6			4
Actuated Green, G (s)	27.2	27.2		8.0	38.2		8.7	38.9	38.9	53.0	53.0	53.0
Effective Green, g (s)	27.2	27.2		8.0	38.2		8.7	38.9	38.9	53.0	53.0	53.0
Actuated g/C Ratio	0.19	0.19		0.06	0.27		0.06	0.27	0.27	0.37	0.37	0.37
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	336	651		99	943		108	962	758	1270	534	586
v/s Ratio Prot	0.01	c0.17		c0.07	0.12		0.04	0.12		c0.47	0.33	
v/s Ratio Perm									c0.32			0.02
v/c Ratio	0.06	0.87		1.31	0.45		0.62	0.44	1.19	1.26	0.90	0.04
Uniform Delay, d1	47.5	56.2		67.6	43.7		65.6	43.1	52.1	45.0	42.6	28.8
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.1	11.9		195.8	1.5		10.6	1.5	98.4	124.5	18.2	0.0
Delay (s)	47.6	68.1		263.3	45.2		76.2	44.6	150.5	169.5	60.8	28.9
Level of Service	D	E		F	D		E	D	F	F	E	C
Approach Delay (s)		67.3			96.5			128.0		141.3		
Approach LOS		E			F			F		F		

Intersection Summary			
HCM Average Control Delay	123.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	143.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	396	188	183	40	187	250	236	1780	87	334	1533	689
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	3433	1863	1583	1770	5050		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	3433	1863	1583	1770	5050		3433	5085	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.90	0.90	0.90	0.93	0.93	0.93	0.97	0.97	0.97
Adj. Flow (vph)	408	194	189	44	208	278	254	1914	94	344	1580	710
RTOR Reduction (vph)	0	0	125	0	0	159	0	3	0	0	0	0
Lane Group Flow (vph)	408	194	64	44	208	119	254	2005	0	344	1580	710
Turn Type	Prot		Perm	Prot		Perm	Split			Split		Free
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases			2			6						Free
Actuated Green, G (s)	23.0	50.8	50.8	4.0	31.8	31.8	46.0	46.0		34.0	34.0	150.8
Effective Green, g (s)	23.0	50.8	50.8	4.0	31.8	31.8	46.0	46.0		34.0	34.0	150.8
Actuated g/C Ratio	0.15	0.34	0.34	0.03	0.21	0.21	0.31	0.31		0.23	0.23	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	270	628	939	91	393	334	540	1540		774	1146	1583
v/s Ratio Prot	c0.23	0.10		0.01	c0.11		0.14	c0.40		0.10	c0.31	
v/s Ratio Perm			0.02			0.07						0.45
v/c Ratio	1.51	0.31	0.07	0.48	0.53	0.36	0.47	1.30		0.44	1.38	0.45
Uniform Delay, d1	63.9	37.0	33.9	72.4	52.9	50.8	42.5	52.4		50.3	58.4	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	248.3	1.3	0.1	4.0	5.0	2.9	0.6	140.6		0.4	176.0	0.9
Delay (s)	312.2	38.3	34.1	76.4	57.9	53.7	43.2	193.0		50.7	234.4	0.9
Level of Service	F	D	C	E	E	D	D	F		D	F	A
Approach Delay (s)		178.5			57.2			176.2			147.4	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	154.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	150.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	91.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations	↰	↑	↱↱	↰↰	↑	↱	↰	↑↑↑↱		↰↰	↑↑↑	↱
Volume (vph)	719	296	260	96	262	481	248	1342	96	367	1465	504
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.88	0.97	1.00	1.00	1.00	0.91		0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	2787	3433	1863	1583	1770	5034		3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	2787	3433	1863	1583	1770	5034		3433	5085	1583
Peak-hour factor, PHF	0.97	0.97	0.97	0.90	0.90	0.90	0.93	0.93	0.93	0.97	0.97	0.97
Adj. Flow (vph)	741	305	268	107	291	534	267	1443	103	378	1510	520
RTOR Reduction (vph)	0	0	164	0	0	221	0	5	0	0	0	0
Lane Group Flow (vph)	741	305	104	107	291	313	267	1541	0	378	1510	520
Turn Type	Prot		Perm	Prot		Perm	Split			Split		Free
Protected Phases	5	2		1	6		4	4		8	8	
Permitted Phases			2			6						Free
Actuated Green, G (s)	36.0	58.4	58.4	8.6	31.0	31.0	36.0	36.0		31.0	31.0	150.0
Effective Green, g (s)	36.0	58.4	58.4	8.6	31.0	31.0	36.0	36.0		31.0	31.0	150.0
Actuated g/C Ratio	0.24	0.39	0.39	0.06	0.21	0.21	0.24	0.24		0.21	0.21	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	425	725	1085	197	385	327	425	1208		709	1051	1583
v/s Ratio Prot	c0.42	0.16		0.03	0.16		0.15	c0.31		0.11	c0.30	
v/s Ratio Perm			0.04			c0.20						0.33
v/c Ratio	1.74	0.42	0.10	0.54	0.76	0.96	0.63	1.28		0.53	1.44	0.33
Uniform Delay, d1	57.0	33.4	29.1	68.8	55.9	58.9	51.0	57.0		53.0	59.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	344.2	1.8	0.2	3.0	12.9	40.3	2.9	130.5		0.8	202.0	0.6
Delay (s)	401.2	35.2	29.2	71.8	68.9	99.2	53.9	187.5		53.8	261.5	0.6
Level of Service	F	D	C	E	E	F	D	F		D	F	A
Approach Delay (s)		240.4			86.6			167.8			172.6	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	172.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	109.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			