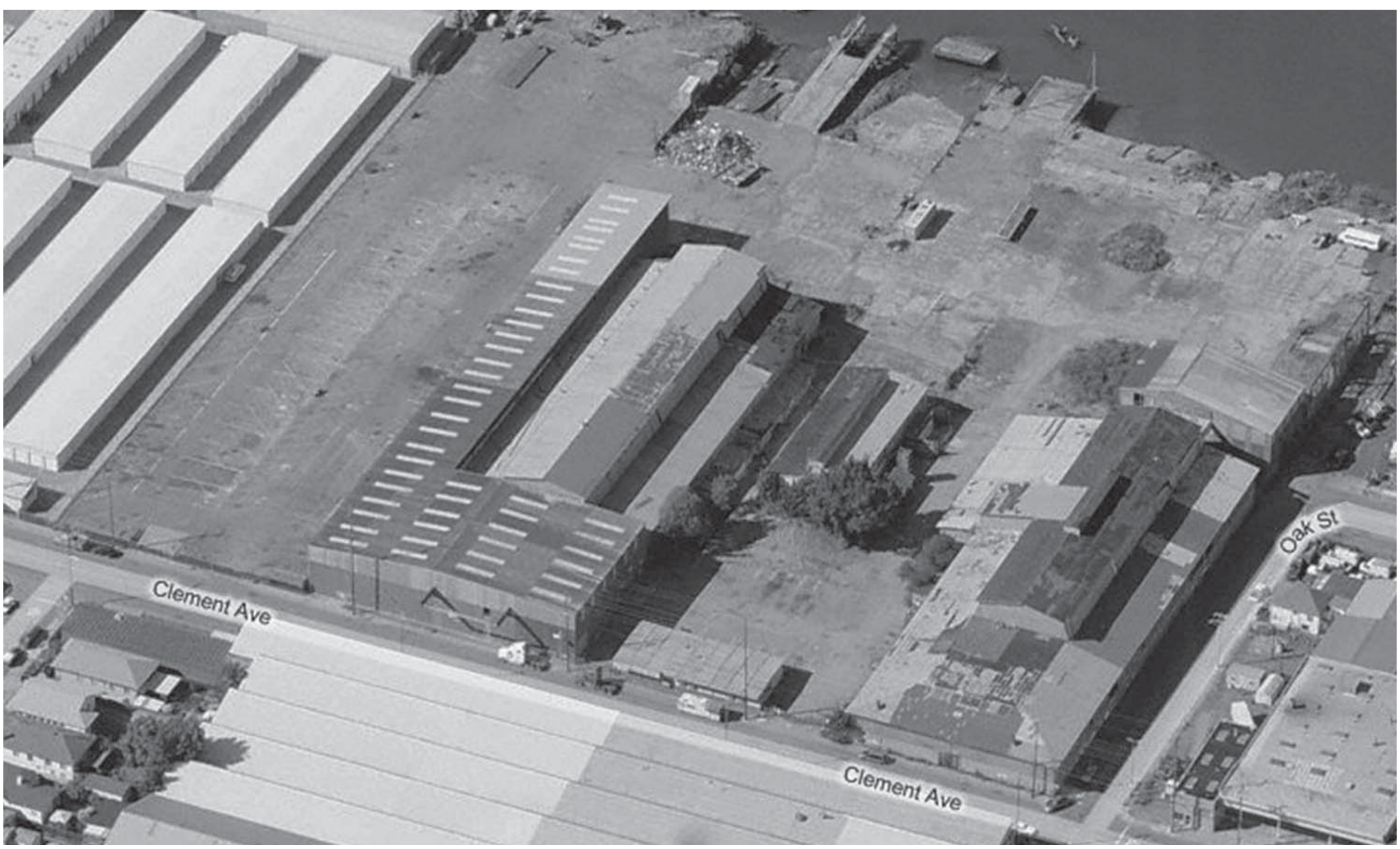
BOATWORKS RESIDENTIAL PROJECT

Draft Environmental Impact Report
SCH No. 2009102040

Prepared for
City of Alameda

March 2010



City of Alameda • California

March 12, 2010

NOTICE OF AVAILABLITY OF A
DRAFT ENVIRONMENTAL IMPACT REPORT
AND PUBLIC HEARING
FOR THE
BOATWORKS RESIDENTIAL PROJECT

NOTICE IS HEREBY GIVEN of the availability of a Draft Environmental Impact Report (DEIR) pursuant to the California Environmental Quality Act for the proposed redevelopment of an approximately 9.5-acre project site located on the northern shore of Alameda Island adjacent to the Oakland Estuary, one block west of the Park Street Bridge. It is bounded by Clement Avenue to the south, Oak Street to the east, and the pierhead line of the Oakland Estuary to the north. The westward boundary of the site aligns approximately with Elm Street. The project site formerly was occupied by industrial manufacturing uses, but is now occupied by five vacant warehouse buildings.

The project applicant proposes to demolish all existing structures, and to construct approximately 242 housing units on the site, 20 percent of which would be affordable to low- and very low-income households, as well as public open space along the waterfront and a 36-berth small boat marina.

Approvals from the City that would be necessary for the proposed residential project include: amending the City's zoning and general plan designations for the property; a tentative map; and design review.

The DEIR examines the potential impacts to the environment that may result from construction and occupancy of the residential project, as well as alternatives to the project.

Applicant: Francis Collins

Project Title: Boatworks Residential Project

Public Review: All persons interested in the DEIR are invited to review it at the Community Development Department office between the hours of 8:30 a.m. and 5:00 p.m. Monday through Friday, in Room 190, 2263 Santa Clara Avenue, Alameda, California 94501 or at any of the City's three libraries. The DEIR is also available upon request by calling the Department at (510) 747-6850. The DEIR may also be viewed on the City of Alameda website at: http://www.ci.alameda.ca.us.

Public Hearing: A public hearing before the Planning Board is scheduled for Monday, April 26, 2010, at 7:00 p.m. in the City Council Chambers, 2263 Santa Clara Avenue, Alameda.

Comment Deadline: Comments on the EIR may be submitted at the Public Hearing on April 26, 2010, or submitted in writing to the Planning and Building Department, attention Andrew Thomas. All comments must be received no later than 5:00 p.m. on Wednesday, April 28, 2010.

Andrew Thomas,
Planning Services Manager

Planning & Building Department
2263 Santa Clara Avenue, Room 190
Alameda, California 94501-4477
510.747.6800 • Fax 510.747.6804 • TDD 510.522.7538

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CHAPTER 1
Introduction

A. Project Overview

The project applicant, Francis Collins, has submitted to the City of Alameda (City) a request for approvals necessary for the redevelopment of an approximately 9.5-acre project site located on the northern shore of Alameda Island adjacent to the Oakland Estuary, one block west of the Park Street Bridge. It is bounded by Clement Avenue to the south, Oak Street to the east, and the Oakland Estuary to the north. The westward boundary of the site aligns approximately with Elm Street (see **Figure 3-1**). The project site formerly was occupied by industrial manufacturing uses, but is now occupied by five vacant warehouse buildings. For detailed location information, please see Chapter 3.

The project applicant proposes to demolish all existing structures, and to construct approximately 242 housing units on the site, 20 percent of which would be affordable to low- and very low-income households, as well as public open space along the waterfront and a 36-berth small boat marina. A detailed project description can be found in Chapter 3.

Approvals from the City that would be necessary for the proposed residential project include: amending the City's zoning and general plan designations for the property; a tentative map; a conditional use permit; and design review. For more discussion on the project approvals, please see Chapter 3.

B. California Environmental Quality Act

The proposed Boatworks Residential Project approvals constitute a "project" as defined by, and is subject to the requirements of, the California Environmental Quality Act (CEQA) (Public Resources Code, Section 21000 et seq.) and the "CEQA Guidelines" (California Code of Regulations, Title 14, Section 15000 et seq.). For purposes of CEQA, the term "project" refers to the whole of an action which has the potential for resulting in a direct physical change or a reasonably foreseeable indirect physical change in the environment (CEQA Guidelines Section 15378). As the principal public agency responsible for approving the Boatworks Residential Project, the City of Alameda is the "lead agency" overseeing and administering the CEQA environmental review process.

As set forth in the provisions of CEQA Guidelines Section 15126.4, before deciding whether to approve a project, public agencies must consider the significant environmental impacts of the project and must identify feasible measures to minimize those impacts. Pursuant to CEQA Guidelines Section 15064, if any aspect of the proposed project, either individually or cumulatively, may cause a significant effect on the environment, regardless of whether the overall effect of the project is adverse or beneficial, an Environmental Impact Report (EIR) must be prepared. The City of Alameda has determined that the size, scale, and potential impacts resulting from the proposed project require the preparation of an EIR.

This EIR is a factual informational document, prepared in conformance with CEQA, and written for the purpose of making the public and decision-makers aware of the environmental consequences of the proposed project. For any consequence, or project impact, that is considered “significant,” the EIR identifies mitigation measures, where feasible, to reduce or avoid the significant impact. The EIR also considers the objectives of the project and identifies whether there might be alternative ways of accomplishing those objectives while substantially reducing the project’s impacts. Before any action may be taken to approve the Boatworks Residential Project, the City of Alameda must certify that it has reviewed and considered the information in the EIR and that the EIR has been completed in conformity with the requirements of CEQA. Certification of the EIR does not approve or deny the proposed project.

C. Environmental Review

Consistent with CEQA, this EIR is a public information document for use by governmental agencies and the public to identify and evaluate potential environmental consequences of the proposed project, to recommend mitigation measures and/or standard conditions of approval to lessen or eliminate adverse impacts, and to examine feasible alternatives to the project (CEQA Guidelines Section 15121(a)).

Notice of Preparation

On October 12, 2009, the City sent a Notice of Preparation (NOP) to responsible and trustee government agencies, organizations, and individuals potentially interested in the project. The NOP is included as **Appendix A** of this EIR. The NOP requested that agencies with regulatory authority over any aspect of the project describe that authority and identify the relevant environmental issues that should be addressed in the EIR. Interested members of the public were also invited to comment. Responses to the NOP are included as **Appendix B**.

This Draft EIR is available for public review for the period identified on the notice inside the front cover of the document, during which time written comments on the Draft EIR may be submitted to the City of Alameda at the address indicated on the notice. Public comments may also be submitted during the public hearing on the Draft EIR. The public hearing will be held on April 26, 2010. Responses to all comments received on environmental issues regarding the Draft EIR and submitted within the specified review period will be prepared and included in the Final EIR.

Initial Study

An Initial Study was prepared to determine if the proposed project would result in a "Potentially Significant" effect on the environment based on the significance standards and the environmental checklist contained in Appendix G to the CEQA Guidelines. The Initial Study is included as **Appendix C** to the EIR.

This EIR was prepared based on the findings of the Initial Study, which determined that the environmental factors not designated with an "X" below would not warrant further discussion in the EIR because they would not involve a potentially significant impact. A summary explanation of why the proposed project would result in no impacts or less-than-significant impacts to those environmental factors follows thereafter.

☐ Aesthetics	☐ Agriculture Resources	☒ Air Quality
☒ Biological Resources	☒ Cultural Resources	☒ Geology / Soils
☒ Hazards & Hazardous Materials	☒ Hydrology / Water Quality	☒ Land Use / Planning
☐ Mineral Resources	☒ Noise	☐ Population / Housing
☐ Public Services	☐ Recreation	☒ Transportation / Traffic
☐ Utilities / Service Systems	☒ Mandatory Findings of Significance	

Aesthetics

The project site does not include any designated scenic vistas, resources or state scenic highways. Underutilized, under-maintained, and vacant former industrial buildings and facilities have substantially degraded the existing visual character and quality at the property. Redevelopment of the site would improve the visual quality and character of the site. Aesthetic impacts would be less than significant.

Mineral Resources

The project site is in a developed urban area and is not a known source of minerals. Implementation of the proposed project would not affect operation of a mine. There would be no impact to mineral resources.

Public Services

The project site is designated for residential redevelopment in the City of Alameda's General Plan and Housing Element. The Housing Element ensures that land use policy is consistent with the City's ability to serve envisioned land uses with transportation, utilities, and other services such as parks and libraries. The proposed 242 dwellings would result in an increase in calls for police and fire service, but the increase would not be sufficient to require construction of new fire and police stations in order to maintain adequate response times. Redevelopment of the site would result in increased tax revenues and school impact fees to pay for police, fire, parks, and public school services. Impacts would be less than significant.

Utilities / Service Systems

The project site is served by sewer, storm drain, water, and power infrastructure. Standard conditions of redevelopment and local and regional permitting would require replacement of all onsite utility systems, including storm drain, sewer, water, and other utilities. New utility systems would be required to meet current building code and regional storm water and waste water standards for new development. Impacts would be less than significant.

Agricultural Resources

The project site is in a developed urban area and is not in an area designated as important farmland. There would be no impact to agricultural resources.

Recreation

See Public Services, above.

Population / Housing

The population growth anticipated as a result of the proposed project is consistent with the population growth projections in the City of Alameda General Plan, the Association of Bay Area Government's and Alameda County Congestion Management Agency's projections, and the State of California's and ABAG's Regional Housing Needs Determinations for the City of Alameda. The site does not currently provide any housing or jobs, so redevelopment of the site would not displace existing residents or businesses. Impacts to population and housing would be less than significant.

Draft EIR

This document constitutes the Draft EIR. The Draft EIR contains a description of the project, description of the environmental setting, identification of project impacts, and mitigation measures for impacts found to be significant, as well as an analysis of project alternatives. Upon completion of the Draft EIR, the City will file the Notice of Completion (NOC) with the Governor's Office of Planning and Research to begin the public review period (Public Resources Code, Section 21161).

Public Notice and Public Review

Concurrent with the NOC, the City will provide public notice of the availability of the Draft EIR for public review, and invite comment from the general public, agencies, organizations, and other interested parties. The public review period will be forty-five (45) days beginning March 8, 2010.

All comments or questions regarding the Draft EIR should be addressed to:

Andrew Thomas, AICP
Planning Services Manager
Planning and Building Department
2263 Santa Clara Avenue, Room 190
Alameda, CA 94501
ATHOMAS@ci.alameda.ca.us

Final EIR and Certification

Following the public review period, a Final EIR will be prepared. The Final EIR will respond to written comments received during the public review period and to oral comments made at the public hearing.

Certification of the EIR and Project Consideration

The City will review and consider the Final EIR. If the City finds that the Final EIR is “adequate and complete,” the City will certify the Final EIR. Upon review and consideration of the Final EIR, the Alameda City Council may take action to approve, conditionally approve, revise, or reject the proposed project. A decision to approve the plan would be accompanied by written findings in accordance with CEQA Guidelines Section 15091, and Section 15093, as applicable. A Mitigation Monitoring Program, as described below, would also be adopted for mitigation measures that have been incorporated into the proposed project or adopted as conditions of approval to reduce or avoid significant effects on the environment. This Mitigation Monitoring Program will be designed to ensure that these measures are carried out during project implementation.

Mitigation Monitoring

Throughout the EIR, mitigation measures have been clearly identified and presented in language that will facilitate establishment of a monitoring and reporting program. CEQA Section 21081.6(a) requires lead agencies to adopt a mitigation monitoring and reporting program to describe measures that have been adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment. The Mitigation Monitoring program will be presented to the City Council for adoption at the time of project approval.

D. Range of Alternatives

CEQA requires that an EIR discuss a reasonable range of alternatives to the proposed project. This EIR describes and analyzes a reasonable range of alternatives, including a “No Project” alternative as required under CEQA (CEQA Guidelines Section 15126.6[e]); compares the environmental effects of each alternative with the effects of the proposed project; and addresses the relationship of each alternative to the project objectives. The determinations of the Lead Agency concerning the feasibility, acceptance, or rejection of each and all alternatives considered in this EIR will be addressed and resolved in the findings, when the City of Alameda considers approval of the project, as required by CEQA.

E. Organization of the Draft EIR

The *Summary* (Chapter 2) includes a brief project description and an overview table of the environmental impacts identified by this EIR. The summary table lists the environmental impacts, proposed mitigation measures (including standard conditions), and the level of significance after mitigation. Detailed analysis of these impacts and mitigations is provided in Chapter 4 (Environmental Setting, Impacts and Mitigation Measures).

The *Project Description* (Chapter 3) describes the project location and boundaries; lists the project objectives; and provides a general description of the technical, economic, and environmental characteristics of the proposed project. This chapter also includes a list of the City's required approvals and other agencies that may be responsible for approving aspects of the project.

Environmental Setting, Impacts and Mitigation Measures (Chapter 4) contains a description of the environmental setting (existing physical environmental conditions), the regulatory framework, and the environmental impacts (including cumulative impacts) that could result from the proposed project. It includes the thresholds of significance used to determine the significance of adverse environmental effects. The chapter also identifies the mitigation measures and/or standard conditions of approval that would reduce or eliminate these significant adverse impacts. The impact discussions disclose the significance of the each impact both with and without implementation of mitigation measures and/or standard conditions.

Alternatives (Chapter 5) evaluates a range of reasonable alternatives to the proposed project and identifies an environmentally superior alternative, consistent with the requirements of CEQA. The alternatives analyzed are: Preservation Alternative, Reduced Density Alternative, Public Park Alternative, and the required No Project / Existing Conditions Alternative.

Other Statutory Sections (Chapter 6) presents growth-inducing effects, significant irreversible changes, cumulative impacts, significant and unavoidable environmental impacts, and effects found to be less than significant.

Report Preparation (Chapter 7) identifies the authors of the EIR. Persons and documents consulted during preparation of the EIR are listed at the end of each analysis section (Sections 4.A through 4.I).

Appendices. The NOP, comment letters received on the NOP, as well as supporting documents and technical information for the impact analyses are presented in Appendices A through H.

All reference documents listed at the end of each analysis section (Chapter 4) are available for review by the public. These documents are available at the City of Alameda Community Development Department, at 2263 Santa Clara Avenue, Alameda, CA 94501, during normal business hours.

F. Intended Uses of the EIR

This EIR provides the CEQA compliance documentation upon which the City of Alameda's consideration of, and action on, all applicable land use permits and other approvals (collectively, "approvals") for the proposed project or an alternate may be based. These include all approvals listed in this EIR, as well as any additional approvals that may be necessary to implement the proposed project or alternative, including activities such as planning, construction, operation and maintenance (e.g., use permits, grading permits, building permits, certificates of occupancy and other development-related approvals).

CHAPTER 2
Summary

A. Project Under Review

The project applicant, Francis Collins, has submitted to the City of Alameda (City) a request for approvals necessary for the redevelopment of an approximately 9.5-acre project site located on the northern shore of Alameda Island adjacent to the Oakland Estuary, one block west of the Park Street Bridge. It is bounded by Clement Avenue to the south, Oak Street to the east, and the Oakland Estuary to the north. The westward boundary of the site aligns approximately with Elm Street (see **Figure 3-1,** on page 3-3). The project site formerly was occupied by industrial manufacturing uses, but is now occupied by five vacant warehouse buildings. For detailed location information, please see Chapter 3.

The project applicant proposes the demolish all existing structures, and the construction of approximately 242 housing units on the site, 20 percent of which would be affordable to low- and very low-income households, as well as public open space along the waterfront and a 36-berth small boat marina. The project site plan is shown in **Figure 3-4**, on page 3-8.

B. Project Objectives

CEQA *Guidelines* Section 15124(b) requires that the *Project Description* of an Environmental Impact Report (EIR) contain a statement of objectives for the proposed project. The project applicant, Francis Collins, seeks to develop a residential project in the City of Alameda. The objectives for the project are the following:

- Eliminate blighting influences and correct environmental deficiencies in the area including, but not limited to, abandoned buildings, incompatible land uses, depreciated or stagnant land values, contamination, inadequate public improvements, facilities and utilities.
- Plan, redesign, and develop an underutilized site approximately 9.5 acres in size to complement the surrounding residential neighborhoods.
- Provide a variety of housing types consistent with City of Alameda General Plan Housing Element goals and objectives.
- Increase the supply of affordable housing in the City of Alameda.
- Reduce the impact of automobile use and energy consumption through site design and by facilitating public transit opportunities, and providing bicycle paths and pedestrian paths through the site and along the waterfront.

- Improve public access to and views of the waterfront by providing a waterfront promenade and allowing views to and through the site to the waterfront from Clement Avenue.

C. Environmental Impacts and Mitigation Measures

Potentially significant environmental impacts of the proposed project are summarized in **Table 2-1**. This table lists impacts and mitigation measures in three major categories: significant impacts that would remain significant even with mitigation (significant and unavoidable); significant impacts that could be mitigated to a less than significant level (significant but mitigable); and impacts that would not be significant (less than significant). For each significant impact, the table includes a summary of feasible mitigation measure(s) and an indication of the level of significance of the impact following implementation of mitigation measures. A complete discussion of each impact and associated mitigation measure is provided in Chapter 4, *Environmental Setting, Impacts, and Mitigation Measures*.

D. Alternatives

Chapter 5 of this EIR analyzes a range of reasonable alternatives to the proposed project, including the No Project / Existing Conditions Alternative (required by the CEQA for all EIRs), a Preservation Alternative, a Reduced Alternative, and a Public Park Alterative. Each is summarized below.

No Project / Existing Conditions Alternative

Under the No Project/Existing Conditions Alternative, the proposed project would not be undertaken, and no change would occur on the site. At the time the NOP was published in October 2009, the site was occupied by five vacant warehouses and the waterfront included dilapidated piers.

Preservation Alternative

The Preservation Alternative would retain and rehabilitate the circa 1910 Steel Fabrication Shop and Warehouse, and the circa 1910 Compressor Room/Storage Building, as well as the open area between the two buildings. This alternative would construct new in-fill residential uses elsewhere on the project site in a manner similar to the proposed project, yet at a reduced size and density: approximately 150 residential units would be developed, compared to 242 units in the proposed project. In addition, the circulation pattern also would be revised to accommodate the existing historic buildings

Reduced Density Alternative

Under the Reduced Density Alternative, the existing buildings would be demolished, and the hardscape and parking areas would be removed, similar to the proposed project. However, the Reduced Project Alternative would construct 175 housing units, internal circulation roadways and pedestrian paths, and a waterfront esplanade.

City Park Alternative

Under the City Park Alternative, the existing buildings would be demolished, and the hardscape and parking areas would be removed. The project site would be developed with 129 housing units, internal circulation roadways and pedestrian paths, and a waterfront esplanade. The waterfront land between the project site and the Oakland Estuary would be purchased, developed and maintained by the City as a public park. The waterfront esplanade would be located within a waterfront park, running from the Estuary in the north 300 feet southward across the project site.

E. Areas of Controversy

CEQA Guidelines Section 15123 specifies that the EIR summary shall identify “areas of controversy” known to the Lead Agency including issues raised by agencies and the public, and issues to be resolved including the choice among alternatives and whether or how to mitigate the significant effects. The following issues are known to the Lead Agency to be controversial or that have the potential to be controversial: building design and character; increased air quality impacts; impacts to biological resources; land use; increased traffic; and, historic context of the site.

The potential impacts associated with all of these areas of controversy are addressed in Chapter 4

TABLE 2-1
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
B. Transportation and Circulation		
B-3: The addition of project-generated traffic would cause the p.m. peak-hour arterial speed on northbound Park Street between Buena Vista Avenue and Blanding Avenue to degrade by about 1.2 mph, a 14 percent decrease, from Baseline conditions. (Significant)	**MM B-3a (TDM):** Prior to project occupancy, the project applicant shall put into place a City-approved Transportation Demand Management program with the goal of reducing the number of **peak** hour trips by 10 percent. This will include the following measures: • Establish a Boatworks Home Owners Association (HOA) and CCRs for the project; • Assess the HOA an annual fee in an amount necessary to provide the following strategies: - EasyPass program (unlimited transit pass, usable on AC Transit buses), two passes per unit, additional passes per unit for residents may be purchased at cost; - Bicycle facilities in each unit; - One car-share membership per residential unit; and - Provide annual funding for transportation coordination services including, but not limited to, promotional information packages and planning services regarding available transportation options, and annual monitoring reports to City regarding effectiveness of programs and recommended enhancements to meet 10% reduction goal. **MM B-3b:** Where feasible, restripe the Park Street intersection approaches between Buena Vista Avenue and Blanding Avenue to provide transit queue jump lanes during the p.m. peak period (southbound) and a.m. peak period (northbound). Regardless of the feasibility of queue jump lanes, modify the traffic signals, controllers, signage, and signal timing at the Park Street intersections at Blanding, Clement, and Buena Vista Avenues to allow for transit signal priority to improve transit flow. Restriping would require the prohibition of on-street parking on the northbound side of the street during the a.m. peak period, and on the southbound side during the p.m. peak period to accommodate the transit queue jump lanes.	Less than Significant (Significant and Unavoidable)

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
B. Transportation and Circulation (cont.)		
B-4: The addition of project-generated traffic would cause level of service at the signalized intersection of Park Street and Blanding Avenue (#1) to degrade from LOS E to LOS F during the a.m. peak hour, and from LOS D to LOS E during the p.m. peak hour. (Significant)	**MM B-4:** The project applicant shall provide full funding to restripe the Blanding Avenue approaches (eastbound and westbound) at Park Street to provide left turn pockets, modify the traffic signal to be fully actuated, provide protected left-turn phasing, modify the traffic control at the private driveway of the Waters Edge Nursing Home to stop-sign control, include audible pedestrian push buttons and pedestrian count down heads, and optimize the signal timing to improve the flow of traffic without causing a significant impact to pedestrian or transit level of service. The restriping would require the removal of 12 on-street parking spaces.	Significant and Unavoidable
B-5: The construction of the proposed project would generated temporary increases in traffic volumes on area roadways. (Potentially Significant)	**MM B-5:** The project applicant and construction contractor(s) shall develop a construction management plan for review and approval by the Public Works Department prior to issuance of any permits. The plan shall include at least the following items and requirements to reduce traffic congestion during construction: 1. A set of comprehensive traffic control measures shall be developed, including scheduling of major truck trips and deliveries to avoid peak traffic hours, detour signs if required, lane closure procedures, signs, cones for drivers, and designated construction access routes. 2. The Construction Management Plan shall identify haul routes for movement of construction vehicles that would minimize impacts on motor vehicle, bicycle, and pedestrian traffic, circulation, and safety, and specifically to minimize impacts to the greatest extent possible on streets in the project area. The haul routes shall be approved by the City. 3. The Construction Management Plan shall provide for notification procedures for adjacent property owners and public safety personnel regarding when major deliveries, detours, and lane closures would occur. 4. The Construction Management Plan shall provide for monitoring surface streets used for haul routes so that any damage and debris attributable to the haul trucks can be identified and corrected by the project applicant	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
B. Transportation and Circulation (cont.)		
B-8: The addition of project-generated traffic would cause the p.m. peak-hour arterial speed on northbound Park Street between Buena Vista Avenue and Blanding Avenue to degrade by about 0.3 mph, which is a 14 percent decrease from Cumulative Baseline conditions. (Significant)	**MM B-8a:** Implement Mitigation Measure 4.B-3a (TDM) **MM B-8b:** Implement Mitigation Measure 4.B-3b (restripe Park Street between Buena Vista and Blanding Avenues to accommodate transit queue jump lanes, and modify the traffic signals and signal timing at the Park Street intersections at Blanding, Clement, and Buena Vista Avenues).	Less than Significant (Significant and Unavoidable)
B-9: The signalized intersection of Park Street and Blanding Avenue (#1) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during both peak hours. (Significant)	**MM B-9:** Implement Mitigation Measure 4.B-4 (restriping the eastbound Blanding Avenue approach at Park Street Blanding Avenue, and, as needed, optimize the signal timing at the intersection of Park Street and Blanding Avenue).	Significant and Unavoidable
B-10: The signalized intersection of Park Street and Clement Avenue (#2) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during the p.m. peak hour. (Significant)	**MM B-10:** The project applicant shall fund a fair share contribution to reconfigure and restripe the intersection of Park Street and Clement Avenue to add dedicated left turn lanes on the eastbound and westbound approaches of Clement Avenue, and a northbound dedicated left turn lane on Park Street, and to modify the traffic signals to include protected left turn phasing for all approaches, fully actuated traffic signal, and audible pedestrian push buttons and pedestrian count down heads. The reconfiguration would require acquisition of property from the northeast and southwest corners and the removal of approximately eight parking spaces.	Significant and Unavoidable
B-11: The all-way stop-control unsignalized intersection of Oak Street and Clement Avenue (#4) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during both peak hours. (Significant)	**B-11:** The project applicant shall fund a fair share contribution to the installation of traffic signals at the intersection of Oak Street and Clement Avenue, and the restriping of the eastbound Clement Avenue approach to provide an exclusive left-turn lane and a shared through/right-turn lane. Because of potential safety concerns with vehicles and bicyclists in the left turn lane driving/riding parallel to the existing railroad tracks, this mitigation also would require that the railroad tracks within the left-turn lane be removed or covered. This mitigation also would require acquisition of the necessary right-of-way from the project at the northwest corner of Park Street and Clement Avenue to install the traffic signal poles, while maintaining ADA access.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
B. Transportation and Circulation (cont.)		
B-12: The Clement Avenue Project Driveway (#12), created as part of the project, would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Base Plus Project conditions. (Significant)	**B-12:** The project applicant shall fund a fair share contribution to the reconfiguration and restriping of Clement Avenue in front of the project site to include an eastbound left turn lane (into the project) and an eastbound center refuge/merge lane (for traffic exiting the project). Because of potential safety concerns with vehicles and bicyclists in the lanes driving/riding parallel to the existing railroad tracks, this mitigation also would require that the railroad tracks within the left-turn lane be removed.	Less than Significant
B-17: The addition of project-generated traffic would increase traffic volumes on Park Street (regional arterial) at the Park Street bridge above that under Baseline Conditions. (Significant)	**MM B-17a:** Widen Park Street bridge to add an additional lane in each direction. Implementation of Mitigation Measure B-17a would mitigate the project impacts to less than significant levels. However, this measure is considered infeasible due to cost and Alameda General Plan Amendment policy EIR-1, which states: "*Roadways will not be widened to create additional automobile travel lanes to accommodate additional automobile traffic volume with the exception of increasing transit exclusive lanes or non-motorized vehicle lanes".* **MM B-17b:** Implement Mitigation Measure 4.B-3a (TDM Program) and 4.B-3b (Park Street Transit Signal Prioritization).	Significant and Unavoidable
B-18: The addition of project-generated traffic would increase traffic volumes in the southbound direction on Park Street (regional arterial) at the Park Street bridge above that under Cumulative Baseline Conditions. (Significant)	**MM B-18a:** Widen Park Street to add an additional lane in the southbound direction. Implementation of Mitigation Measure B-17a would mitigate the project impacts to less than significant levels. However, this measure is considered infeasible due to cost and Alameda General Plan Amendment policy EIR-1, which states: "*Roadways will not be widened to create additional automobile travel lanes to accommodate additional automobile traffic volume with the exception of increasing transit exclusive lanes or non-motorized vehicle lanes".* **MM B-18b:** Implement Mitigation Measure 4.B-3a (TDM Program) and 4.B-3b (Park Street Transit Signal Prioritization).	Significant and Unavoidable

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
C. Air Quality and Climate Change		
C-1: The proposed project would result in an increase in vehicle miles traveled (VMT) that would be greater than the rate of increase in population. Therefore, the proposed project would not be consistent with the ABAG Climate Action Plan. It would not conflict with other regional air quality management plans. (Significant)	**Mitigation Measure 4.C-1: Trip Reduction / TDM:** Prior to project occupancy, the project applicant shall put into place the following strategies, to the extent practicable, to reduce vehicle travel to and from the project site: • Every homeowner pays annual fees for an “EcoPass” unlimited transit pass. • Bicycle Share station. • On-Site Transportation Coordinator to present, advertise, and support the following TDM programs: • Ridematch and Rideshare services; • Promotion of premium parking for rideshare and alternative vehicles as provided by individual property owners or within any shared parking facilities; • Parking information system; • EcoPass program; • School carpool; • Promotional and planning services that include transportation options, and information packages, and website.	Significant and Unavoidable
C-2: Construction of the proposed project would generate short-term emissions of criteria pollutants, including suspended and inhalable particulate matter and equipment exhaust emissions. (Significant)	**MM C-2:** During construction, the project applicant would require the construction contractor to implement BAAQMD’s basic and enhanced dust control procedures required for sites larger than four acres, such as the project site, to maintain project construction-related impacts at acceptable levels; this mitigates the potential impact to less than significant. The “basic” dust control program shall include, but not necessarily be limited to, the following: • Water all active construction areas at least twice daily. Watering should be sufficient to prevent airborne dust from leaving the site. Increased watering frequency may be necessary whenever wind speeds exceed 15 miles per hour. Reclaimed water should be used whenever possible.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
C. Air Quality and Climate Change (cont.)		
C-2 (cont.)	• Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard (i.e., the minimum required space between the top of the load and the top of the trailer). • Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites. • Sweep streets (with water sweepers using reclaimed water if possible) at the end of each day if visible soil material is carried onto adjacent paved roads. • Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites. The “enhanced” dust control measures shall include the following: • Hydroseed or apply non-toxic soil stabilizers to construction areas and previously graded areas inactive for ten days or more • Enclose, cover, water twice daily or apply non-toxic soil binders to exposed stockpiles of dirt, sand, etc. • Limit traffic speeds on unpaved roads to 15 miles per hour (mph) • Install sandbags or other erosion control measures to prevent silt runoff to public roadways • Replant vegetation in disturbed areas as quickly as possible	
C-5: Development proposed as part of the project, when combined with past, present and other reasonably foreseeable development in the vicinity, would result in cumulative air quality impacts. (Significant)	**MM C-1: Trip Reduction / TDM:** Identified above relative to Impact 4.C-1.	Significant and Unavoidable
C-6: Implementation of the proposed project would make a significant contribution to cumulative global climate change. (Significant)	**MM C-1:** Identified above relative to Impact 4.C-1. **MM C-6a:** In order to reduce GHG emissions from energy consumption and to maintain project operations consistent with the initiatives of the LAPCP, the project applicant shall pursue energy conserving building design and alternative energy conservation	Significant and Unavoidable

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
C. Air Quality and Climate Change (cont.)		
C-6 (cont.)	strategies to meet or exceed the most current Uniform Building Code requirements and State energy criteria. **MM C-6b:** In order to maintain project operations consistent with Energy Initiative 6 of the LAPCP, no fireplaces or stoves installed as part of the proposed project may be wood-burning. **MM C-6c:** In order to maintain project operations consistent with Waste and Recycling Initiative 1 of the LAPCP, demolition and construction wastes shall be sorted and recycled to the extent feasible. A demolition recycling plan shall be developed prior to issuance of demolition permits and approved by City Building Department staff.	
D. Noise		
D-1: Project construction would expose persons to or generate noise levels in excess of the City noise standards. (Significant)	**MM D-1:** The project applicant will incorporate the following requirements into the construction contract specifications: • Construction activities will be limited to between the hours of 7:00 am and 7:00 pm Monday through Friday and 8:00 am to 5:00 pm on Saturdays. • Equipment and trucks used for construction will use the industry standard noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically-attenuating shields or shrouds, wherever feasible). • Stationary noise sources will be located as far from adjacent receptors, whenever feasible, and they will be muffled and enclosed within temporary sheds, incorporate insulation barriers, or other measures to the extent feasible.	Less than Significant
D-4: The project would place noise-sensitive multifamily residential uses in a noise environment that would exceed the City's goal for indoor noise exposure. (Significant)	**MM D-4:** If necessary to comply with the interior noise requirements of the State and achieve an acceptable interior noise level, noise reduction in the form of sound-rated assemblies (i.e., windows, exterior doors, and walls) shall be incorporated into project building	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
D. Noise (cont.)		
D-4 (cont.)	design, based upon recommendations of a qualified acoustical engineer. Final recommendations for sound-rated assemblies will depend on the specific building designs and layout of buildings on the site and shall be determined during the design phase. Specific consideration shall be given to window size, degree of sound insulation of exterior walls, which can be increased through staggered- or double-studs, multiple layers of gypsum board, and incorporation of resilient channels.	
E. Cultural Resources		
E-1: Construction of the proposed project would have a significant, adverse impact on significant historic resources through demolition of the circa 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building. (Significant)	**MM E-1:** The project applicants shall document the circa 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building in accordance with the Historic American Building Survey (HABS) Level II documentation standards of the National Park Service. Level II standards include the following: 1. Photographs. Large-format (4 x 5-inch negatives or greater), black and white photographs should be taken of all elevations of the two buildings, plus limited context and detail shots. A limited number of historical photos of the project area buildings, if available, should also be photographically reproduced. All photographs should be printed on acid-free archival bond paper. 2. Written History. Prepare a written history of the project area and buildings using the HABS standard outline format. 3. Drawings. If available, reproduce original building drawings on mylar or through photographic means. 4. Archiving. The completed HABS documentation package (photos, report, and drawings) shall be archived at the City of Alameda, the City of Alameda Public Library, and the Northwest Information Center of Sonoma State University. The project applicant shall also provide an interpretive history exhibit in the form of a plaque or panel to describe the historical importance of the former Dow Company buildings to the general public. Information generated from the documentation effort, such as photographs and historical text, described above, can be utilized for	Significant and Unavoidable

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
E. Cultural Resources		
E-1 (cont.)	this effort as well. The interpretive exhibit can either be placed along the proposed waterfront trail/open space, or at the corner of Clement Avenue and Oak Street. The interpretive exhibit should be designed by a professional architectural historian meeting the qualifications of the Secretary of the Interior's Standards.	
E-2: Construction of the proposed project could result in the inadvertent discovery of archaeological resources. (Significant)	**MM E-2:** If cultural resources are encountered, all activity in the vicinity of the find shall cease until it can be evaluated by a qualified archaeologist and a Native American representative. Prehistoric archaeological materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil ("midden") containing heat-affected rocks, artifacts, or shellfish remains; and stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs); and battered stone tools, such as hammerstones and pitted stones. Historic-era materials might include stone, concrete, or adobe footings and walls; filled wells or privies; and deposits of metal, glass, and/or ceramic refuse. If the archaeologist and Native American representative determine that the resources may be significant, they will notify the project applicant or contractor(s) and the City of Alameda and will develop an appropriate treatment plan for the resources. The archaeologist shall consult with Native American monitors or other appropriate Native American representatives in determining appropriate treatment for unearthed cultural resources if the resources are prehistoric or Native American in nature. In considering any suggested mitigation proposed by the archaeologist and Native American representative in order to mitigate impacts to cultural resources, the project proponent will determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) will be instituted. Work may proceed on other parts of the project area while mitigation for cultural resources is being carried out.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
E. Cultural Resources (cont.)		
E-3: Construction of the proposed project would result in the discovery of unidentified paleontological resources. (Significant)	**MM E-3:** If paleontological resources, such as fossilized bone, teeth, shell, tracks, trails, casts, molds, or impressions are discovered during ground-disturbing construction activities, all such activities within 100 feet of the find shall be halted until a qualified paleontologist can assess the significance of the find and, if necessary, develop appropriate salvage measures in consultation with the City of Alameda and in conformance with Society of Vertebrate Paleontology Guidelines	Less than Significant
E-4: Construction of the proposed project would result in the inadvertent discovery of human remains. (Significant)	**MM E-4:** If human skeletal remains are uncovered during project construction, the project proponent (depending upon the project component) will immediately halt work, contact the Alameda County coroner to evaluate the remains, and follow the procedures and protocols set forth in Section 15064.5 (e)(1) of the CEQA Guidelines. If the County coroner determines that the remains are Native American, the project proponent will contact the Native American Heritage Commission, in accordance with Health and Safety Code Section 7050.5, subdivision (c), and Public Resources Code 5097.98 (as amended by AB 2641). Per Public Resources Code 5097.98, the landowner shall ensure that the immediate vicinity, according to generally accepted cultural or archaeological standards or practices, where the Native American human remains are located, is not damaged or disturbed by further development activity until the landowner has discussed and conferred, as prescribed in this section (PRC 5097.98), with the most likely descendents regarding their recommendations, if applicable, taking into account the possibility of multiple human remains.	Less than Significant
E-5: The proposed project, in conjunction with cumulative development, could adversely affect historic resources in the project vicinity. (Significant)	None Available	Significant and Unavoidable

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
F. Biological Resources		
F-1: The proposed project could result in the take of protected birds or their nests. (Significant)	**MM F-1:** No more than two weeks in advance of any tree or shrub removal, or alteration to structures that would commence during the breeding season (February 1 through August 31), a qualified wildlife biologist shall conduct pre-construction surveys of all potential special-status bird nesting habitat in the vicinity of the planned activity. Pre-construction surveys are not required for construction activities scheduled to occur during the non-breeding season (August 31 through January 31). Construction activities commencing during the non-breeding season and continuing into the breeding season do not require surveys (as it is assumed that any breeding birds taking up nests would be acclimated to project- related activities already under way). Nests initiated during construction activities would be presumed to be unaffected by project activities, and a buffer zone around such nests would not be necessary. However, a nest initiated during construction cannot be moved or altered. If no active nests are found during pre-construction avian surveys, then no further mitigation is required. If active nests are found during pre-construction avian surveys, the results of the surveys shall be discussed with the appropriate resource agency and avoidance procedures shall be adopted, if necessary, on a case-by-case basis. Avoidance measures would most likely include a no-disturbance buffer around the nest, which will be maintained until a qualified biologist determines that the young have fledged or otherwise abandoned the nest. The size of the buffer zones and types of construction activities restricted within them shall be determined through consultation with resource agencies, taking into account factors such as: (1) noise and human disturbance levels at the project site and the nesting site at the time of the survey and the noise and disturbance expected during the construction activity; (2) distance and amount of vegetation or other screening between the project site and the nest; and (3) sensitivity of individual nesting species and behaviors of the nesting birds.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
F. Biological Resources (cont.)		
F-2: The proposed project could result in impacts to migratory or breeding birds and other special-status species due to building configurations and lighting conditions. (Significant)	**MM F-2:** The applicant and project designer shall reduce building lighting from exterior sources by the following measures: • Minimize amount and visual impact of perimeter lighting, through measures such as downward-pointing lights, side shields, visors, and motion-sensor lighting. • Utilize minimum wattage fixtures to achieve required lighting levels. • Use minimum wattage fixtures to achieve required lighting levels. • Avoid placing water features in close proximity to glazed facades. • Design to avoid monolithic, undistinguishable expanses of glazing by maximizing “visual noise” both on the building scale and individual glass units.	Less than Significant
F-3: The proposed project could result in the take of special-status bat species. (Significant)	**MM F-3a:** Potential direct and indirect disturbances to bats shall be identified by locating colonies, and instituting protective measures prior to construction. No more than two weeks in advance of tree removal or demolition of buildings onsite, a qualified bat biologist (e.g., a biologist holding a CDFG collection permit and a Memorandum of Understanding with CDFG allowing the biologist to handle and collect bats) shall conduct pre-construction surveys for bat roosts. No activities that could disturb active roosts shall proceed prior to the completed surveys. **MM F-3b:** If a bat colony is located within the project site during pre-construction surveys, the project shall be redesigned to avoid impacts, and a no-disturbance buffer acceptable in size to the CDFG shall be created around any roosts in the project vicinity, if possible. Bat roosts initiated during construction are presumed to be unaffected, and no buffer is necessary. However, the “take” of individuals is prohibited. If there is a maternity colony present and the project cannot be redesigned to avoid removal of the tree or structure inhabited by the bats, demolition of that tree or structure shall not commence until after young are flying (i.e., after July 31, confirmed by a qualified bat	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
F. Biological Resources (cont.)		
F-3 (cont.)	biologist) or before maternity colonies form the following year (i.e. prior to March 1). If a non-maternity roost must be removed as part of the project, the non-maternity roost shall be evicted prior to building/tree removal by a qualified biologist, using methods such as making holes in the roost to alter the air-flow, or creating one-way funnel exits for the bats. **MM F-3c:** If known bat roosting habitat is destroyed during building/tree removal, artificial bat roosts shall be constructed in an undisturbed area in the project site vicinity away from human activity and at least 200 feet from project demolition/construction activities. The design and location of the artificial bat roost(s) shall be determined by a qualified bat biologist.	
F-4: The proposed project could impact special-status fish species. (Significant)	**MM F-4:** If dredging or pile-driving occurs as part of the project, the project applicant shall implement Best Management Practices (BMPs) for protection of salmonids and Pacific herring, that are identified in the *Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region* (LTMS) (Corps, 2001). BMPs listed in the LTMS include the following: • installation of silt curtains and gunderbooms for filtering sediment; • mechanical dredge operations controls, including increased cycle time, elimination of multiple bucket bites, and elimination of bottom stockpiling; • hydraulic dredge operations controls, including reduction of cutterhead rotation speed, reduction of swing speed, and elimination of bank undercutting; • hopper dredges and barges operational controls, including reduction of hopper overflow, lower hopper fill levels, and use of a water recirculation system; and • use of specialty equipment, including pneuma pumps, closed or environmental buckets, large-capacity dredges, and specialized tools for precision dredging.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
F. Biological Resources (cont.)		
F-4 (cont.)	In addition, dredging or pile-driving in the Oakland Estuary shall minimize impacts on special-status fish through one or more of the following methods: (1) dredging or pile-driving shall only be conducted within work windows designated to cause the least impact on Pacific herring and salmonids (i.e., June through November, see **Table 4.F-1**); (2) dredging or pile-driving shall only produce noise levels below 150 decibels at 30 feet; and/or (3) dredging or pile-driving shall only be conducted in accordance with NMFS directives and Corps permits to reduce potential impacts on fish species.	
F-5: Proposed project activities could have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption, or other means. (Significant)	**MM F-5a:** The project applicant shall implement the following Best Management Practices (BMPs) during construction: 1. Install silt fencing, straw wattles or other appropriate erosion and sediment control methods or devices to prevent sediment from the upland portion of the site from entering the Estuary as a result of project activities. 2. Operate equipment (e.g., backhoes and cranes) that is used for removal or installation of fill and rip-rap along the Estuary shoreline from dry land, where possible. Construction operations within the Oakland Estuary can also be barge-mounted or utilize other water-based equipment such as scows, derrick barges and tugs. 3. Prevent any fueling activity from occurring within 50 feet of the Oakland Estuary. 4. Where applicable, implement BMPs listed under Mitigation Measure 4.F-4 to avoid impacts to water quality resulting from dredging or other activities within open waters, as identified in the *Long-term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region* (LTMS) (Corps, 2001). 5. Test all materials proposed for excavation and dredging for the possible presence of contaminants. Construction practices shall be designed in coordination with the Corps, RWQCB, and other applicable agencies, to minimize the dispersion of contaminants into the water column and ensure proper disposal of contaminated materials.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
F. Biological Resources (cont.)		
F-5 (cont.)	**MM F-5b:** The project applicant shall provide compensatory mitigation (i.e., "no net loss") for any temporary and permanent impacts to wetlands as defined by Section 404 of the Clean Water Act, as required by regulatory permits issued by the Corps, RWQCB, and BCDC. Measures may include but would not be limited to (1) onsite or offsite mitigation through wetland creation or restoration; and (2) development of a Mitigation and Monitoring Plan. • Onsite or Offsite Wetland Creation or Restoration. To the extent practicable, the project applicant shall restore the tidal marsh to the Oakland Estuary shoreline at a minimum 1:1 impact-to-restoration ratio, through activities such as removal of debris and concrete riprap, and revegetating with native tidal marsh species. • If onsite restoration is not feasible, the project applicant shall negotiate compensatory offsite mitigation for wetland losses with applicable regulatory agencies, at a 3:1 impact-to-restoration ratio, or other ratio determined by the agencies. • Mitigation and Monitoring Program. Prior to the start of construction or in coordination with regulatory permit conditions, the project applicant shall prepare and submit for approval to the Corps, RWQCB, and BCDC a mitigation and monitoring program that outlines the mitigation obligations for temporary and permanent impacts to waters of the U.S., including wetlands. The program shall include baseline information from existing conditions, anticipated habitat to be enhanced, thresholds of success, monitoring and reporting requirements, and site-specific plans to compensate for wetland losses resulting from the project. The Boatworks Residential Project Mitigation and Monitoring Plan shall include, but not be limited to, the following: • Clearly stated objectives and goals consistent with regional habitat goals. • Location, size, and type of mitigation wetlands proposed. • A functional assessment of affected jurisdictional waters to ensure that the EPA's "no net loss of wetland value" standard is met. The functional assessment shall also ensure that the	

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
F. Biological Resources (cont.)		
F-5 (cont.)	mitigation provided is commensurate with the adverse impacts on Bay resources in accordance with BCDC mitigation policies. The assessment shall provide sufficient technical detail in the project design including, at a minimum, an engineered grading plan and water control structures, methods for conserving or stockpiling topsoil, a planting program including removal of exotic species, a list of all species to be planted, sources of seeds and/or plants, timing of planting, plant locations and elevations on the mitigation site base map, and maintenance techniques. • Documentation of performance, monitoring, and adaptive management standards that provide a mechanism for making adjustments to the mitigation site. Performance and monitoring standards shall indicate success criteria to be met within 5 years for vegetation, animal use, removal of exotic species, and hydrology. Adaptive management standards shall include contingency measures that outline clear steps to be taken if and when it is determined, through monitoring or other means, that the enhancement or restoration techniques are not meeting success criteria.	
G. Geology, Soils, and Seismicity		
G-1: In the event of a major earthquake in the region, seismic ground-shaking could potentially injure people and cause collapse or structural damage to proposed structures. (Significant)	**MM G-1a:** A site-specific, design-level geotechnical investigation for the project shall be conducted as a condition of building permit. The investigation shall include detailed characterization of the distribution and compositions of subsurface materials and an assessment of their behavior during violent seismic ground-shaking. The analysis shall recommend design parameters that would be necessary to avoid or substantially reduce structural damage under peak ground accelerations of no less than 0.655g. The investigation and recommendations shall be in conformance with all applicable city ordinances and policies and consistent with the design requirements of Seismic Design Category E/F (very high vulnerability) of the California Building Code. The geotechnical report shall be prepared by a registered geotechnical engineer and approved by the City, and all recommendations shall be included in the final design of the project.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
G. Geology, Soils, and Seismicity (cont.)		
G-1 (cont.)	**MM G-1b:** Prior to issuance of occupancy permits, the project applicant shall prepare an earthquake hazards information document to the satisfaction of City staff. This document shall be made available to any potential occupant prior to purchase or rental of the housing units. The document shall describe the potential for strong ground-shaking at the site, potential effects of ground shaking, and earthquake preparedness procedures.	
G-2: In the event of a major earthquake in the region, people and property could be exposed to seismically induced ground failure, including liquefaction, lateral spreading and earthquake-induced settlement. (Significant)	**MM G-2:** Earthwork, foundation and structural design for the proposed project shall be conducted in accordance with all recommendations contained in the required geotechnical investigation (Mitigation Measure 4.G-1a). The investigation must include an assessment of all potentially foreseeable seismically-induced ground failures, including liquefaction, sand boils, lateral spreading and rapid settlement. Mitigation strategies must be designed for the site-specific conditions of the project and must be reviewed for compliance with the guidelines of CGS Special Publication 117 prior to incorporation into the project. Examples of possible strategies include edge containment structures (berms, diked sea walls, retaining structures, compacted soil zones), removal or treatment of liquefiable soils, soil modification, modification of site geometry, lowering the groundwater table, in-situ ground densification, deep foundations, reinforced shallow foundations, and structural design that can accommodate predicted displacements.	Less than Significant
G-3: Continuing consolidation and land subsidence at the project site could result in damage to structures, utilities and pavements. (Significant)	**MM G-3:** The required geotechnical report for the project (Mitigation Measure 4.G-1a) shall determine the susceptibility of the project site to settlement and prescribe appropriate engineering techniques for reducing its effects. Where settlement and/or differential settlement is predicted, mitigation measures—such as lightweight fill, geofoam, surcharging, wick drains, deep foundations, structural slabs, hinged slabs, flexible utility connections, and utility hangers—could be used. These measures shall be evaluated and the most effective, feasible, and economical measures shall be recommended. Engineering recommendations shall be included in the project engineering and design plans, and be reviewed and approved by a registered geotechnical engineer. All construction activities and design criteria shall comply with applicable codes and requirements of the most recent California Building Code, and applicable City construction and grading ordinances.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
H. Hydrology and Water Quality		
H-3: Site development under the proposed project would involve new landscaping and open lawns. If not properly handled, chemicals used to establish and maintain landscaping and open lawn areas, such as pesticides and fertilizers, could flow into the waterways, and result in water quality impacts to the tidal canal and eventually San Francisco Bay. (Significant)	**MM H-3:** An Integrated Pest Management Plan (IPM) shall be prepared and implemented by the project applicant for all common landscaped areas. The IPM shall be prepared by a qualified professional and shall recommend methods of pest prevention and turf grass management that use pesticides as a last resort in pest control. Types and rates of fertilizer and pesticide application shall be specified. The IPM shall specify methods of avoiding runoff of pesticides and nitrates into receiving storm drains and surface watersor leaching into the shallow groundwater table. Pesticides shall be used only in response to a persistent pest problem that cannot be resolved by non-pesticide measures. Preventative chemical use shall not be employed. Cultural and biological approaches to pest control shall be fully integrated into the IPMs, with an emphasis toward reducing pesticide application.	Less than Significant
H-4: Site development under the proposed project could be subjected to flooding as a result of sea level rise. (Less than Significant)	**MM H-4:** The project applicant shall design and construct the proposed seawall such that future adaptive management measures can be implemented to further protect upland areas from potential rising sea levels. Prior to construction, the final seawall design shall be reviewed by BCDC and in accordance with current guidelines regarding protection against sea level rise.	Less than Significant
I. Hazards and Hazardous Materials		
I-1: Demolition of the existing structures that contain hazardous building materials—such as lead-based paint, asbestos, and PCBs—could expose workers, the public, or the environment to these hazardous materials and would generate hazardous waste. (Significant)	**MM I-1a:** Each structure proposed for demolition shall be assessed by qualified licensed contractors for the potential presence of lead-based paint or coatings, asbestos containing materials, and PCB-containing equipment prior to issuance of a demolition permit. **MM I-1b:** If the assessment required by Mitigation Measure 4I-1a finds presence of lead-based paint, asbestos, and/or PCBs, the project applicant shall create and implement a health and safety plan to protect workers from risks associated with hazardous materials during demolition or renovation of affected structures.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
I. Hazards and Hazardous Materials (cont.)		
I-1 (cont.)	**MM I-1c:** If the assessment required by Mitigation Measure 4I-1a finds presence of lead-based paint, the project applicant shall develop and implement a lead-based paint removal plan. The plan shall specify, but not be limited to, the following elements for implementation: • Develop a removal specification approved by a Certified Lead Project Designer. • Ensure that all removal workers are properly trained. • Contain all work areas to prohibit off-site migration of paint chip debris. • Remove all peeling and stratified lead-based paint on building and non-building surfaces to the degree necessary to safely and properly complete demolition activities according to recommendations of the survey. The demolition contractor shall be responsible for the proper containment and disposal of intact lead-based paint on all equipment to be cut and/or removed during the demolition. • Provide on-site personnel and area air monitoring during all removal activities to ensure that workers and the environment are adequately protected by the control measures used. • Clean up and/or vacuum paint chips with a high efficiency particulate air (HEPA) filter. • Collect, segregate, and profile waste for disposal determination. • Properly dispose of all waste. **MM I-1d:** If the assessment required by Mitigation Measure 4.I-a finds asbestos, the project applicant shall ensure that asbestos abatement shall be conducted by a licensed contractor prior to building demolition. Abatement of known or suspected ACMs shall occur prior to demolition or construction activities that would disturb those materials. Pursuant to an asbestos abatement plan developed by a state-certified asbestos consultant and approved by the City, all ACMs shall be removed and appropriately disposed of by a state certified asbestos contractor.	

NOTE: Significance level reflected in parenthetical represents secondary impact.

TABLE 2-1 (Continued)
SUMMARY OF IMPACTS AND MITIGATION MEASURES FOR PROPOSED BOATWORKS RESIDENTIAL PROJECT

POTENTIAL IMPACT	MITIGATION MEASURES	LEVEL OF SIGNIFICANCE *after any recommended mitigation measures*
I. Hazards and Hazardous Materials (cont.)		
I-1 (cont.)	**MM I-1e:** If the assessment required by Mitigation Measure 4I-1a finds PCBs, the project applicant shall ensure that PCB abatement shall be conducted prior to building demolition or renovation. PCBs shall be removed by a qualified contractor and transported in accordance with Caltrans requirements.	
I-2: Construction of the proposed project would disturb soil and groundwater impacted by historic hazardous material use, which could expose construction workers, the pubic, or the environment to adverse conditions related to hazardous materials handling. (Significant)	**MM I-2a:** The project applicant shall prepare a health and safety plan, based on the site conditions and past contaminant release history and remediation, by a licensed industrial hygienist. The health and safety plan shall identify potential contaminants that may be encountered, appropriate personal protective equipment, and worker safety procedures for spills and accidents. **MM I-2b:** To reduce environmental risks associated with encountering contaminated soil discovered during grading and construction, the project applicant shall ensure that any suspected contaminated soil is stockpiled separately, sampled for hazardous material content, and disposed of in accordance with all applicable state, federal, and local laws and regulations. All contaminated soil determined to be hazardous or non-hazardous waste shall have received all laboratory analyses for acceptable disposal as required by the receiving facility before it can be removed from the site. **MM I-2c:** Prior to issuance of any building or grading permits, any areas of identified contamination shall have completed all measures required by ACDEH, DTSC or RWQCB for site closure, and shall be certified for residential use. Where necessary, additional remediation to permit residential use and occupancy of the project shall be accomplished by the project applicant prior to issuance of any building or grading plans.	Less than Significant

NOTE: Significance level reflected in parenthetical represents secondary impact.

CHAPTER 3
Project Description

A. Introduction

The proposed Boatworks Residential Project would entail the construction of 242 housing units on the project site in the City of Alameda. The approximately 9.5-acre project site is located on the northern shore of Alameda Island adjacent to the Oakland Estuary, one block west of the Park Street Bridge. It is bounded by Clement Avenue to the south, Oak Street to the east, and the Oakland Estuary to the north. The westward boundary of the project site aligns approximately with Elm Street. The project would require a General Plan amendment, development plan, and design review approvals.

B. Project Objectives

CEQA *Guidelines* Section 15124(b) requires that the *Project Description* of an Environmental Impact Report (EIR) contain a statement of objectives for the proposed project. The project applicant, Francis Collins, seeks to develop a residential project in the City of Alameda. The objectives for the project are the following:

- Eliminate blighting influences and correct environmental deficiencies in the area including, but not limited to, abandoned buildings, incompatible land uses, depreciated or stagnant land values, contamination, inadequate public improvements, facilities and utilities.
- Plan, redesign, and develop an underutilized site approximately 9.5 acres in size to complement the surrounding residential neighborhoods.
- Provide a variety of housing types consistent with City of Alameda General Plan Housing Element goals and objectives.
- Increase the supply of affordable housing in the City of Alameda.
- Reduce the impact of automobile use and energy consumption though site design and by facilitating public transit opportunities, and providing bicycle paths and pedestrian paths through the site and along the waterfront.
- Improve public access to and views of the waterfront by providing a waterfront promenade and allowing views to and through the site to the waterfront from Clement Avenue.

C. Project Location and Characteristics

Project Location and Setting

The City of Alameda is located in western Alameda County, adjacent to the City of Oakland and the San Francisco Bay. The City of Alameda extends over two islands (Alameda Island and Coast Guard Island) and a portion of a peninsula connected to the mainland (Bay Farm Island).

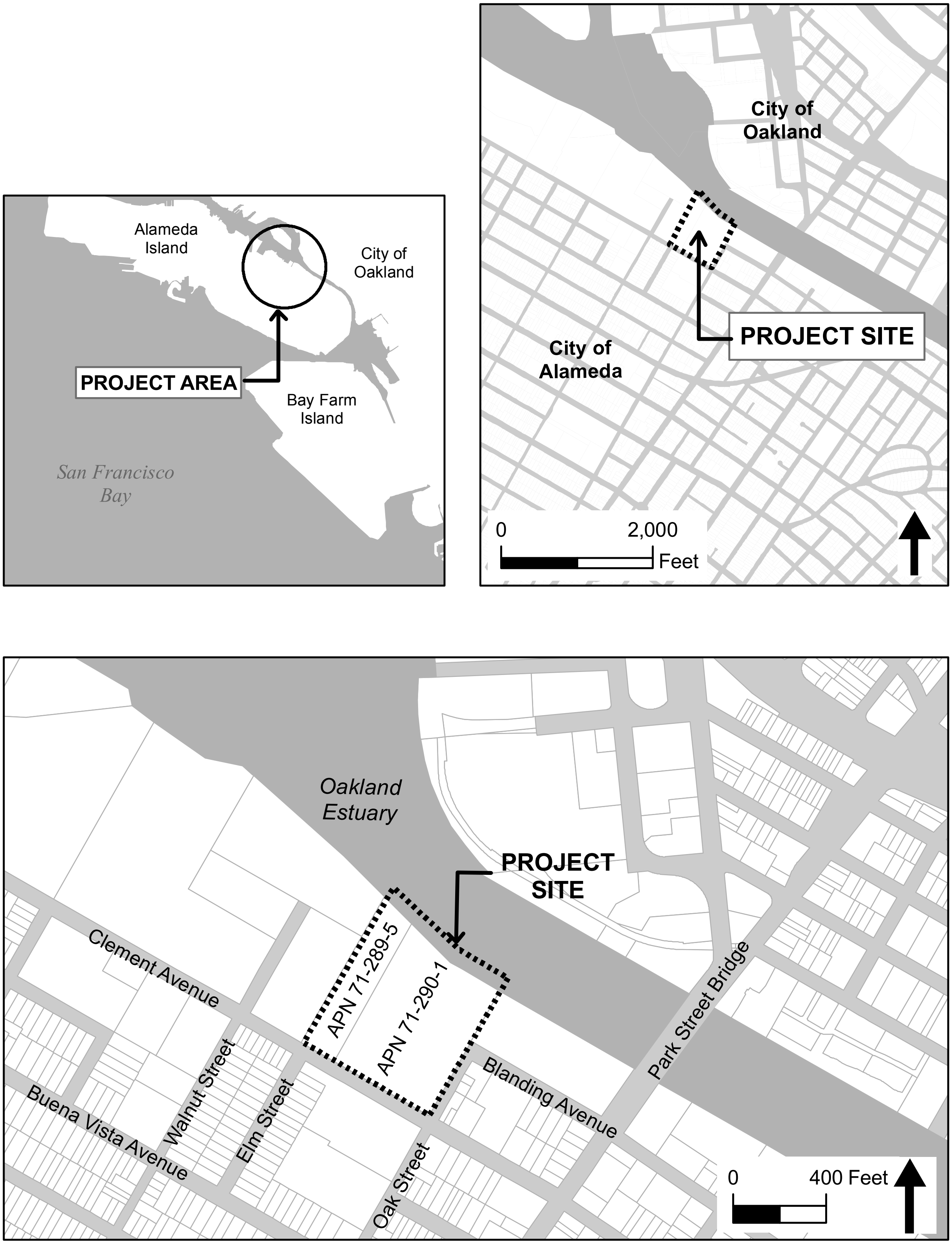
The project site is located on the northern shore of Alameda Island adjacent to the Oakland Estuary, one block west of the Park Street Bridge. The project site is bounded by Clement Avenue to the south, Oak Street to the east, and the pierhead line of the Oakland Estuary to the north, and it extends westward to approximately Elm Street. **Figure 3-1** shows the project location and site boundary. The project applicant, Francis Collins, owns and controls Assessor Parcel Numbers (APNs) 71-289-5 and 71-290-1, which comprise the site.

The U.S. Army Corps of Engineers (USACE) owns and controls a strip of partially underwater land between those parcels and the pierhead line. Any improvements on land owned by the USACE would be undertaken by the Project Applicant, subject to the approval of the applicable property owner (USACE), in addition to regulatory approval by entities including, but not limited to, the USACE, the Regional Water Quality Control Board, the Bay Conservation and Development Commission, and the City of Alameda. **Figure 3-2** illustrates the ownership of the project site.

The project site is located in an area of the city known as the Northern Waterfront, which currently comprises a patchwork of land uses; many former thriving industrial properties are now vacant and underutilized. Directly west of the project site is a modular storage center. South of the project site are commercial, industrial, and residential uses. East of the project site properties have been redeveloped, including the Park Street Landing commercial development and marina, as well as new low-rise commercial office buildings. The project site is currently occupied by a number of vacant warehouses and industrial buildings. A bird’s eye-view of the project site is presented in **Figure 3-3**.

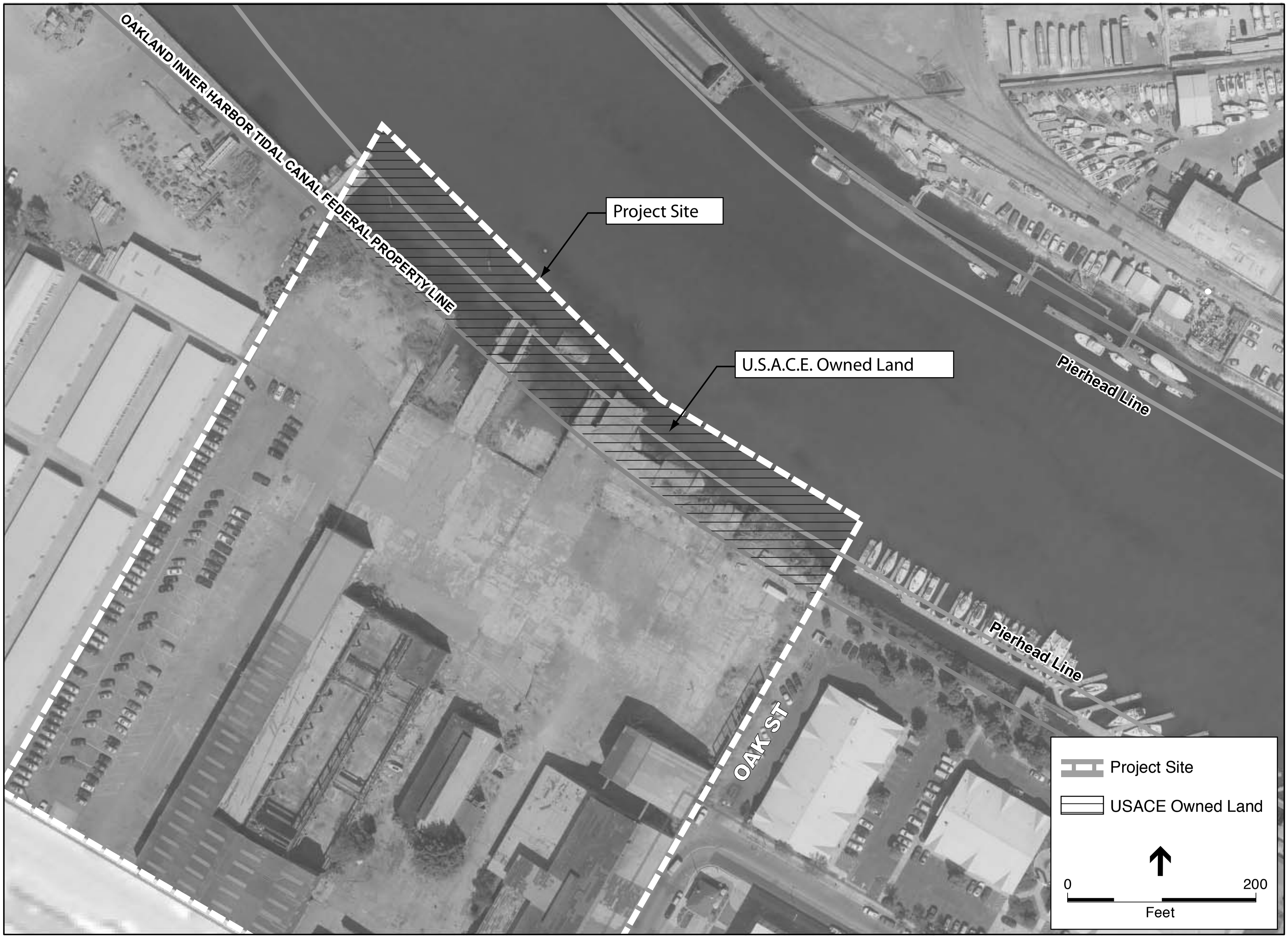
Site History

The project site has a history of water-dependent and -related industrial uses. The USACE completed the dredging of a Tidal Canal separating Alameda from the mainland of Oakland in 1902. With this and subsequent improvements to its waterfront, including the project site, Alameda became an important shipping port and the location of numerous industrial enterprises in the early twentieth century. The George A. Dow Pumping Engine Company operated on the project site from c. 1910 until 1941, building mining and irrigation pumps, and pumps for steamship and railroad lines. The company built the first diesel engines for a marine vessel on the Pacific Coast, and it was a major manufacturer of diesel engines for the Navy in World War I and for commercial operations.



Boatworks Residential Project . 208559

Figure 3-1
Project Location



SOURCE: USACE

Boatworks Residential Project . 208559
Figure 3-2
Project Site Ownership

SOURCE: Microsoft Corp, 2009; NAVTEQ, 2009; Picometry Birds Eye, 2009

Boatworks Residential Project . 208559

Figure 3-3
Birds Eye View

In 1941, the Pacific Coast Engineering Company (PACECO) moved its operations from Oakland and took over the Dow plant. The company specialized in the design and manufacture of hydraulic dredging equipment and other machinery for marine industries, and it did some structural steel fabrication and machine work. When the company moved to Alameda in 1941, it shifted its operations toward shipbuilding. During World War II, the company built harbor tugs for the Navy and ship sections for the main Kaiser Shipyards in Richmond. After the war, it again built ships and dredges, and expanded its facilities for large scale precision engineering equipment such as cranes and equipment for dams and public utilities. For further detail, please see Section 4.E, *Cultural Resources*.

In 1958, PACECO designed and built, at this plant, the world's first high speed, dockside, container handling crane, making possible implementation of the container shipping system for the first time on the west coast. The plant expanded in 1966 and grew to occupy the adjacent land to the east along the estuary. The machine shop was expanded along its west side and south end, so that it fronted on Clement Avenue. The expanded plant included two ship-building facilities, which reached into the Tidal Canal. In 1981, PACECO moved to Gulfport, Mississippi and the plant was taken over by Reliance Steel Co., a steel distributor from Berkeley, and other tenants.

Until 2008, a variety of other businesses were located on the project site, including a steel manufacturing company, a boat repair facility, an automobile storage site, and light industrial companies.

Existing Site Conditions

All of the buildings on the project site are vacant, and access is restricted by gates and chain-link fences. The site is comprised of two adjacent lots and the strip owned by USACE. APN 071 289-5 (2229 Clement Avenue) is 2.59 acres and is paved as a surface parking lot. APN 71-290-1 (2235 and 2241 Clement Avenue) is 6.82 acres and is a hardscape area on the northern half of the property. The strip owned by USACE. The southern portion of the property contains hardscape area and the following five industrial buildings:

- a two-story shop and warehouse with an approximately one-acre footprint;
- a two-story, fire-damaged machine shop and addition, also with an approximately one-acre footprint;
- a two-story storage building and former compressor room with an approximately 6,000 square-foot footprint;
- a two-story machine shop addition, attached to the warehouse via two massive steel beams at the second floor; the building has an approximately 5,200 square-foot footprint; and
- a one-story office building, approximately 90 feet long by 40 feet wide, facing Clement Avenue.

All of the buildings are clad in corrugated metal, except for the office building, which is clad in painted fiberglass. The buildings are in a general state of disrepair, and the hardscape area is substantially deteriorated. Grasses and other plants grow between cracks in the concrete, adjacent to buildings, and along dirt piles on the site. Piles of deteriorated concrete, tires, bits of glass, wire cable, and lumber scrap are also strewn throughout the site. The concrete hardscape area extends into the estuary on piers and platforms, which are also in a dilapidated condition. Some of these piers and platforms have collapsed over the banks of the estuary. In the areas where the hardscape piers do not extend into the water, the shoreline of the estuary is exposed, revealing grasses and mud.

The project site General Plan land use designations are Specified Mixed Use and Parks and Open Space. The project site Zoning Ordinance designations are Two Family Planned Development (R-2-PD) and General Industrial (M-2).

The proposed project would require both a General Plan amendment and rezoning to allow for residential development in all portions of the site.

Project Components

The proposed project consists of demolition of all existing structures and construction of approximately 242 housing units on the site, 20 percent of which would be affordable to low- and very low-income households, as well as public open space along the waterfront and a 36-berth small boat marina. The project site plan is shown in **Figure 3-4** and described below.

Housing

The project would include single-family homes and duplexes. All buildings would be three stories tall and 37.25 feet in height, with rectangular floor plans (see Figure 3-4). The project would include 137 three-bedroom units located inside the interior circulation roadway and along the waterfront, 73 two-bedroom units located along the eastern and western sides of the site, and 32 one-bedroom units located along the southern and western sides of the site.

The proposed residential development represents a contemporary design with architectural references to modern building design (i.e., simplification of form and the elimination of ornament). References include use of horizontal lines, streamlined windows, and urban loft design elements. Most units would face onto common open space and pedestrian lawns, with vehicular access via alleys in the rear of the buildings.

Low- and very low-income units would be primarily interspersed among market-rate units in the area between the internal circulation roadway and the project site border.

The project is subject to Government Code Section 65915 “State Density Bonus” regulations which allows the project to request 242 residential units. By providing 20 percent of the unit to lower income households, the project qualifies as an affordable project pursuant to Government Code Section 65589.5.

Boatworks Residential Project . 208559

SOURCE: Philip Banta & Associates

Figure 3-4
Project Site Plan

Marina

The project includes a small boat marina with approximately 36 berths. The berths would be located along the entire waterfront of the project site. The slip sizes would range from 30 to 50 feet in width and the average slip length would be 35 feet. There would be no vehicle access to the boat marina or new boat launch location. Access to the slips would only be via the Oakland Estuary. The nearest land-based access point would be from the Alameda Marina located at 1815 Clement Avenue. The proposed marina would not interfere with the San Francisco Water Trail access points or network.

The new marina layout would be in conformance with the California Department of Boating and Waterways Guidelines. The assumed depths of the basins based on dredging and reconfiguration would be -10 ft. MLLW datum.[1] Dredging impacts that could result from construction of the reconfigured marina are discussed in Section 4.F, *Biological Resources*.

The excavated and dredged material from the marina and site reconfiguration would need to be reused or disposed. Some of these materials may be suitable as fill onsite, but most of it would need to be transported off site, with suitable replacement materials returned to the site. The cut/fill material could either be trucked or barged to or from the site. Trucking would result in more substantial, though temporary, traffic, air quality, and noise effects than barging. This concerted dredge and excavation material transport would be related to construction only and would not be a part of the operation of the small boat marina, although normal operation of the marina would require periodic maintenance dredging[2] to provide an adequate water depth. It is anticipated that maintenance dredging would be done and materials disposed by barge.

Vehicular Access and Parking

Vehicle access through the site would be provided through an internal roadway system that would include a network of private roadways. Access points would connect at Clement Avenue and Oak Street (see Figure 3-4). The Oak Street connection would include a full access intersection, aligning with Blanding Avenue.

The internal roadways system, as illustrated in the site plan in Figure 3-4, would be made up of one two-way roadway running primarily parallel to the project site boundaries, forming a vehicular circulation ring within the site (for a more detailed description, please see Section 4.B, *Transportation and Circulation*). Two north-south, two-way private drives would run inside this ring, providing vehicular access to units in the interior. In addition, 11 short roadways would radiate eastward and westward from the ring toward the project site boundary, providing vehicular access to clusters of 8 units each. Two of these roadways, at the northernmost portion of the site, would extend all the way to the property line. The roadway on the eastern side of the site

1 For the purposes of nautical charting in U.S. tidal waters, depth is relative to mean lower low water (MLLW) or the average of the lower of the two low tides each lunar day.

2 This analysis does not consider the environmental effects of maintenance dredging which would discussed in a separate environmental review prior to obtaining dredging and disposal permits.

would connect to the Park Street Landing parking lot, and the driveway on the western side of the site would be available for future connection to potential development to the west of the site.

The proposed internal roadways would be constructed in a 24 foot right-of-way**.** The development intersections with Clement Avenue and Oak Street would be stop-sign controlled.

As shown above in **Table 3-1**, 210 of the proposed units would have two-car garages, and 32 units would have one-car garages—providing a total of 452 covered parking spaces. In addition, 52 surface parking spaces would be available either on the internal roadway system or in the parking lot of the Park Street Landing development to the east (the project applicant would obtain an easement for right of passage through the Park Street Landing parking lot). The surface parking near the waterfront would be available for public access to the waterfront.

TABLE 3-1
PROPOSED PROJECT HOUSING UNITS

	Unit Characteristics				Number of Units		
Unit Type	**Bedrooms**	**Parking Spaces**	**Gross Unit Area (sq. ft)**	**Net Unit Area (sq. ft)**	**Market Rate**	**Low Income**	**Very Low Income**
A	3	2	2,665	2,230	14	1	0
B	3	2	2,470	2,090	23	0	0
C	3	2	1,985	1,565	98	1	0
D	2	2	1,460	1,130	16	4	2
E	2	2	1,475	1,055	22	13	8
F	2	2	1,225	900	8	0	0
G	1	1	950	765	1	3	4
H	1	1	860	695	11	7	6
Entire Project	**589**	**604[a]**	**426,885**	**336,680**	**193**	**29**	**20**

[a] In addition to the 452 garage parking spaces, the project would include 52 surface parking spaces.

Pedestrian Circulation and Open Space

A sidewalk would run on the outside of the primary roadway within the site. In addition, the proposed project would add a sidewalk on the western side of Oak Street, where no sidewalk currently exists.

Inside the ring of the primary roadway, pedestrian paths would traverse the common open space between the units. Some units would face this open space and these paths, and these would be considered the primary meeting and circulation areas of the site. The paths and open space would be maintained by the project homeowner’s association.

Units outside of the primary circulation roadway, on the south side of the site, would have sidewalk access and face Clement Avenue. Some units on the east and west sides of the site would not have direct sidewalk access—pedestrians would instead traverse the driveways for access.

In the northern area of the site, a public plaza would extend toward the estuary waterfront and marina, and a publicly accessible waterfront esplanade would run the length of the shoreline, east-to-west. Concrete piers, a boardwalk, a sea wall, and viewing areas would be constructed at the water's edge to provide passive recreational opportunities for site residents and the City of Alameda. Pedestrian access to the marina would also be available from the boardwalk. These improvements would require coordination with, and approval, of USACE and the Bay Conservation and Development Commission (BCDC).

Project Schedule and Construction

As part of the project site preparation, during construction, the project applicant would need to clean-up the waterfront. This would include removing dilapidated piers and debris from the shoreline and estuary, reinforcing riprap, constructing a seawall, filling wetland areas behind the seawall, and general stabilization of the shoreline. This work would require permits from several responsible agencies, including Federal and State agencies, such as USACE, BCDC, San Francisco Bay Regional Water Quality Control Board, and California Department of Fish and Game. These permits are discussed further in 4.F, *Biological Resources*.

Project construction is anticipated to begin in spring 2011, contingent on approval of the project by the City Council. The project applicant anticipates a 36- to 42-month timeline from start of construction to completion of the project, with work broken into three phases and completed in 2013. Construction staging would occur primarily on the site and is anticipated to include a storage container, mobile office, parking, materials area and other construction equipment. Each construction phase would require an average of 15 workers on site, with a maximum of 30 workers at any one time.

An average of 3 truck trips would occur per day, with a maximum of 15 daily trips during Phase 1 and 10 daily trips during Phases 2 and 3. Trucks would travel to the site via Interstate 880, taking the Park Street exit, and then turn onto Blanding Avenue and Clement Avenue in the City of Alameda.

Construction activity would occur Monday through Friday from 7:00 a.m. to 7:00 p.m., and on Saturdays between 8:00 a.m. to 5:00 p.m.

D. Intended Uses of This EIR

A number of public agencies are expected to use this EIR in their decision-making, and a number of permits and other approvals would be required to implement the approved project or alternative. **Table 3-2** summarizes these required permits and approvals to the extent that they are known to the City of Alameda. The table lists permits and approvals required by the Lead Agency, responsible agencies, trustee agencies, and other entities, such as utility and telecommunications companies. The table also lists federal agencies that may have jurisdiction over certain portions of the project, if the project affects resources within the jurisdiction of these agencies.

TABLE 3-2
REQUIRED PERMITS AND APPROVALS

Lead Agency	
City of Alameda	• General Plan Amendment • Rezoning • Development Agreement (DA) Amendment • Disposition and Development Agreement (DDA) Amendment • Tentative and Final Subdivision Maps, Parcel Maps • Improvement Plans and Subdivision Agreements • Development Plans/Design Review • Demolition Permits • Grading and Building Permits • Power and Electricity (A.M.P.) • Approval of improvement to facilities for distribution of electricity and connection permits (and possibly cable connection)
Responsible Agencies	
San Francisco Bay Conservation and Development Commission (BCDC)	• Approval of any development located within 100 feet of the shoreline, if any
East Bay Municipal Utility District (EBMUD)	• Approval of water line, water hookups and review of water needs • Approval for sewer treatment capacity
California Department of Transportation (Caltrans)	• Approval of plans and encroachment permit for improvements located within the Caltrans right-of-way
California Regional Water Quality Control Board (RWQCB)	• National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharge • Approval and oversight of remediation of petroleum contamination • Clean Water Act Section 401 Certification, if needed
California Department of Toxic Substances Control (DTSC)	• Approval and oversight of hazardous material remediation
Bay Area Quality Management District (BAAQMD)	• Permitting of asbestos abatement activities
Trustee Agencies	
California Department of Fish and Game (CDFG)	• Designation of rare or endangered plants, wildlife, or other resources overseen by this agency, if any
Federal Agencies	
US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service	• Designation of rare or endangered plants, wildlife, or other resources overseen by these agencies, if any
US Army Corps of Engineers	• Clean Water Act Section 404 Authorization, if needed
US Coast Guard	• Rivers and Harbors Act Section 10 approval, if needed
Other Entities	
SBC and AT&T	• Approval of communication line improvements and connection permits
Pacific Gas & Electric (PG&E)	• Approval of natural gas improvements and connection permits

CHAPTER 4
Environmental Setting, Impacts and Mitigation Measures

A. Land Use Consistency and Compatibility

Introduction

This section describes the existing and planned land uses in the project area, identifies adopted plans that provide the framework for the City's land use and planning decisions, and evaluates land use impacts resulting from implementation of the proposed Boatworks Residential Project.

Environmental Setting

Regional and Local Setting

The City of Alameda is located in western Alameda County, adjacent to the City of Oakland and the San Francisco Bay (see **Figure 3-1**). Alameda County encompasses approximately 738 square miles and is one of the nine Bay Area counties. The county is well known for its housing and recreational resources for Bay Area residents, and has a population of approximately 1.5 million people (U.S. Census Bureau, 2009). The county contains more than 7,300 acres of urban park land and more than 53,000 acres of state and regional park land (ACCDA, 2003).

The City of Alameda spans 12.4 square miles and extends over two islands (Alameda Island and Coast Guard Island) and a portion of a peninsula connected to the mainland (Bay Farm Island). Alameda Island consists of the original City, with the former Naval Air Station Alameda (Alameda Point) at the west end. Coast Guard Island, located in the Oakland Estuary between Alameda Island and the City of Oakland, is home to the U.S. Coast Guard's Integrated Support Command. Bay Farm Island is adjacent to Oakland International Airport. The topography of the City is predominantly flat.

The 9.48-acre project site is on the northern shore of Alameda Island adjacent to the Oakland Estuary, one block west of the Park Street Bridge. The project site consists of two parcels (APNs 71-289-5 and 71-290-1), as well as a strip of partially underwater land between those parcels and the pierhead line of the estuary controlled by the Army Corps of Engineers (USACE).

Existing Land Uses

The project site has abandoned warehouse and manufacturing buildings abutting Clement Avenue and Oak Street, vacant hardscape and parking areas, and decayed piers extending into the estuary. These on-site buildings formerly housed boat construction and repair facilities and other uses.

Buildings on the Project Site

Five industrial buildings constructed between circa 1910 and circa 1970 (see **Figure 3-3**) are located on the project site. Each of these is described below. For further detail, see Section 4.E, *Cultural Resources*. Due to historic site uses, the project site had elevated levels of hazardous materials. In 2007, the substances detected above site cleanup goals were removed from the site. In a letter dated March 15, 2007, the Department of Toxic Substance Control (DTSC) certified that the site was remediated to unrestricted standards for ultimate use as multi-unit residential development. For further detail, see section 4.i, *Hazardous Materials*.

Steel Fabrication Shop and Warehouse

The steel fabrication shop and warehouse, located at the southeast corner of Clement Avenue and Oak Street, is an approximately 320 feet long by 130 feet wide two-story industrial building built circa (c.) 1910. The building is a typical shop in form, with a gabled roof and a glazed monitor above the central bay, and is a wood frame, post-and-beam structure on a concrete foundation. An approximately 130 feet wide by about 110 feet long wood frame annex is on the southern end of the building abutting Clement Avenue. The building served most recently as a boat repair shop for Nelson Marine, and is currently vacant.

Machine Shop

The machine shop was built in c. 1910 and was nearly identical in style, size, and materials to the steel fabrication shop and warehouse located to the south. The building is about 365 feet long by about 165 feet wide. It also is a typical shop in form, with a high glazed monitor between lower aisles. It is a wood frame post and beam structure with a concrete foundation and is clad in corrugated metal. This building has been badly damaged by fire, and the roof and most of the siding is no longer extant. A large, two-story, steel fabricating annex with an L-shaped plan and corrugated siding and roofing adjoins the western and southern elevations of this building. The annex was constructed in c. 1966. The building served most recently as a boat repair shop for Fred Anderson Boat & Woodworks, and is currently vacant.

Compressor Room/Storage Building & First Aid Office

Located between the Steel Fabrication Shop and Warehouse and the Machine Shop is the Compressor Room/Storage Building, which was constructed c. 1910. The two-story building is about 120 feet long by about 50 feet wide. Similar in style to these adjacent buildings although substantially smaller, the building is also composed of wood frame post-and-beam construction on a concrete foundation, with a gable roof and ventilating monitor, and corrugated metal cladding. A wood frame annex, built c. 1940 as a first aid office, is adjacent to it. Behind the First Aid Office is a deteriorating brick tank. The building is currently vacant.

Machine Shop Addition

Located immediately adjacent to the north of the Steel Fabrication Shop and Warehouse is a two-story machine shop addition, built in 1966. It consists of a steel frame structure on a concrete foundation, an asymmetrical ‘saltbox’ gable roof form, and corrugated steel cladding and roofing. The building is about 95 feet long by 55 feet wide, and is connected to the Steel Fabrication Shop and Warehouse via two massive steel beams which once held a gantry crane. It is currently vacant.

Office

Located along Clement Avenue is a single-story office structure comprised of steel frame modular construction on a raised foundation, a shallow-pitch gable roof form, and painted fiberglass cladding. The building is about 90 feet long by about 40 feet wide, and was built in 1966.

Land Uses in the Vicinity

West of the project site is a mix of uses, including a self-storage facility, a Naval and Marine Reserve Training Center, and McKinley Park and Thompson Field (home field for Alameda High School Hornets sporting events).[1] South of the project site is an industrial building housing a glass manufacturing business. Detached, single-family houses line Elm Street, which runs southward from Clement Avenue south of the site. Additional residential uses line the south side of Clement Avenue. East of the project site, the formerly industrial properties have been demolished. Other uses to the east include: 1) a café along Oak Street; 2) the Park Street Landing shopping center between Blanding Avenue and the Oakland Estuary (which includes a marina, a car rental facility, tax-preparation services, and retail spaces); 3) new office buildings between Blanding Avenue and Clement Avenue; and 4) a community center and automobile painting, upholstery, and repair facilities along Clement Avenue. Directly north of the project site is the Oakland Estuary. Heavy industrial uses in the City of Oakland, including a sand and gravel processing plant, line the opposite shore of the Oakland Estuary north of the site.

Regulatory Framework

Applicable plans and major policies and regulations that pertain to the project site are presented below, followed by a discussion of the project’s overall consistency (or inconsistency) with each plan. Several land use plans, policies, and regulations apply to the project site. Consistent with CEQA, not every City of Alameda General Plan policy that *could* apply to the project is included here.

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1 Alameda High School is located six blocks south of the project site, between Central Avenue, Oak Street, Encinal Avenue, and Walnut Street.

U.S. Army Corp of Engineers

Section 404 of the Clean Water Act regulates activities that involve a discharge of dredged or fill material into waters of the United States. USACE is responsible for issuing permits for discharges covered by Section 404, including, most notably, the filling of wetlands. USACE requires avoiding and minimizing impacts to wetlands where feasible. When impacts to wetlands cannot be avoided, compensatory mitigation is generally required as part of the Section 404 permit process to ensure there is no net loss of wetlands values and functions. USACE owns and controls the partially underwater strip of land at the edge of the estuary within the site boundary.

California Government Code

California Government Code Section 65915 states that local governments shall adopt an ordinance that grants a density bonus or other incentives or concessions when the applicant for the housing development seeks and agrees to construct one or more of the following: 10 percent of the total units for lower-income households, 5 percent of the total units for very low-income households, or a senior citizen housing development. The code states that the density bonus provided by the local government varies depending on the concessions offered by the applicant, including affordability of units and land donation to the local government. In 2009, the City of Alameda adopted a Density Bonus Ordinance implementing Section 65915.

California Government Code Section 65589.5 states that local governments may not disapprove a housing development project for very-low, low-, or moderate-income households or condition approval, including through the use of design review standards, in a manner that renders the project infeasible for development of affordable units unless it makes specific written findings based upon substantial evidence in the record.

Regional Plans

San Francisco Bay Conservation and Development Commission, San Francisco Bay Plan

The Bay Conservation and Development Commission (BCDC) was established in 1965 to prevent the unnecessary filling of San Francisco Bay and to increase public access to and along the Bay shoreline. BCDC has jurisdiction over development in shoreline areas within 100 feet of mean high tide landward of and parallel to the shoreline of the Bay, including the Oakland Estuary.

Filling, dredging, new construction, major remodeling, changes in land use, and subdivisions within this area are subject to review and approval by BCDC. BCDC implements the San Francisco Bay Plan, originally adopted in 1968 and periodically updated, as its policy framework. The plan focuses on water quality, size of the Bay, marshes and mudflats, and related uses. The plan designates specific waterfront sites for both water-related industry and port uses. The project site is not designated for any such priority uses under the Bay Plan.

The proposed project requires a permit from BCDC for fill, excavation, pier removal and construction along the water's edge, as discussed below.

Dredging and Filling. A permit from BCDC is required for any Bay filling or dredging within BCDC jurisdiction. A permit must be obtained prior to placing fill or dredging. For purposes of the Bay Plan, fill is defined to include earth or any other substance or material placed in the Bay, including piers, pilings, and floating structures moored in the Bay for extended periods. Public hearings must be held on all permit applications except those of a minor nature. BCDC allows some Bay filling for purposes providing substantial public benefits, when these same benefits could not be achieved equally well without filling. Some of these public benefits include shoreline parks, marinas, fishing piers, and developing new public access.

Shoreline Development. A permit from BCDC is required before proceeding with shoreline development. Permits may be granted or denied only after public hearings and after the process for review and comment by the City or county has been completed. BCDC generally approves a permit for shoreline development if the agency specifically determines that the proposed project is in accordance with defined standards for use of the shoreline, provision of public access, and advisory review of appearance. The proposed project is not located in a BCDC designated priority land use area and, therefore, the shoreline area should be used in any manner that would not adversely affect enjoyment of the Bay and shoreline by residents, employees, and visitors within the area itself or within adjacent areas of the Bay and shoreline. The McAteer-Petris Act specifies that for areas outside the priority use boundaries, the BCDC Commission may deny a permit application for a proposed project only on the grounds that the project fails to provide maximum feasible public access to the Bay and shoreline consistent with the project. Shoreline development should increase public access to the Bay to the maximum extent feasible. BCDC requires design review through its permitting process to control the quality of views along the Bay. View corridors from the nearest public right-of-way would be required to encourage public viewing and access to the waterfront. The following policies related to *Other Uses of the Bay and Shoreline*, *Public Access to the Bay*, and *Appearance, Design, and Scenic Views* would be applicable to shoreline development on the project site.

Other Uses of the Bay and Shoreline

> *Policy 1*: Shore areas not proposed to be reserved for a priority use should be used for any purpose (acceptable to the local government having jurisdiction) that uses the Bay as an asset and in no way affects the Bay adversely. This means any use that does not adversely affect enjoyment of the Bay and its shoreline by residents, employees, and visitors within the site area itself or within adjacent areas of the Bay or shoreline.
>
> *Policy 2*: Accessory structures such as boat docks and portions of a principal structure may extend on piles over the water when such extension is necessary to enable actual use of the water, e.g., for mooring boats, or to use the Bay as an asset in the design of the structure.
>
> *Policy 3*: Wherever waterfront areas are used for housing, whenever feasible, high densities should be encouraged to provide the advantages of waterfront housing to larger numbers of people. (BCDC, 2003)

Local Plans

City Charter Article 26

In 1973, in response to development pressures, demolition of single-family homes, and concerns about traffic congestion, Alameda voters approved Measure A, which amended the City's charter, and appears today on the charter as Article XXVI. The charter amendment prohibited the construction of multiple-unit dwellings in the City of Alameda, allowing only single-family houses and duplexes. In 1991 voters approved an amendment to Measure A, limiting the maximum density for any residential development within the City of Alameda to no more than one unit per 2,000 square feet of land.

City of Alameda General Plan

The City of Alameda General Plan is the principal policy document for guiding future conservation and development within the City. It represents the framework on which the City must base decisions regarding growth, public services and facilities, and protection and enhancement of the community).

The General Plan, by its comprehensive nature, contains policies that could be in competition, depending on the nature of a project. City decision-makers must determine whether, on balance, the project is consistent (i.e., in general harmony) with the General Plan. The fact that a specific project does not meet all General Plan goals, policies, and objectives does not inherently result in a significant effect on the environment. To the extent that a General Plan policy is also used as a significance criterion or contains a regulatory threshold that the project must meet, the project's consistency with such policies is addressed within the relevant impact analysis discussions throughout Chapter 4.

The *Alameda General Plan* establishes comprehensive, long-term land use policies for the City. Consistent with state law, the General Plan includes the Land Use Element; City Design Element; Transportation Element; Open Space and Conservation Element; Parks and Recreation, Shoreline Access, and Cultural Facilities Element; Airport Environs Element; Health and Safety Element; Housing Element; and Alameda Point Element. Each of the *Alameda General Plan* elements is discussed below, except for the Airport Environs Element and Alameda Point Element, because the project site is not located in those planning areas.

Site-Specific General Plan Policies

As shown in **Figure 4.A-1**, the project site is designated MU-5 (Specified Mixed Use Area #5) on the General Plan Diagram. The MU-5 area encompasses approximately 27 acres of property generally located between Willow Street and Oak Street, including the project site. The General Plan calls for 27 acres to be developed with between 250 and 350 housing units, 40,000 square feet of office, and up to 10 acres of park.

SOURCE: Microsoft Corp, 2009; NAVTEQ, 2009; Picometry Birds Eye, 2009

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Figure 4.A-1
Project Site General Plan Land Use Designations

The General Plan describes the MU-5 area as follows:

> **"MU5 Northern Waterfront, Willow Street to Oak Street:** The change anticipated in this segment provides an opportunity for Alameda to add highly desirable housing, stimulate improvement of housing east of Oak Street that is currently zoned for commercial-industrial use, and to provide an Estuary Park. Half of the north frontage of Clement is occupied by the Naval Reserve Training Center, which will remain. Other uses are steel fabricating, mini-storage, and dredging equipment yard, and a boatyard. The four blocks on the south side of Clement Avenue are occupied by a boat storage building/yard, Thompson Field (Alameda High School athletic field adjoining McKinley Park) a full block of housing, and a 5-acre site occupied by a die-casting plant and an automobile service establishment."

Policy 2.6.e states:

> "2.6.e **Willow Street to Oak Street (Northern Waterfront):** Provide for redevelopment of existing industrial sites for 250 to 350 two-family residential units, treating the area north of Clement Avenue as an extension of the residential neighborhood to the south.
>
> *The proposed Business and Waterfront Improvement project would provide public actions to stimulate development of the site."*

Policy 2.6.f states:

> "2.6.f **Willow Street to Oak Street (Northern Waterfront):** Create a continuous 300-foot-wide "marina green" park along the Estuary.
>
> *See Policy 3.2.i in the City Design Element and Policy 6.1.e in the Parks and Recreation Element. Currently, no housing has been built in the MU-5 area."*

Policy 3.2.i in the City Design Element states:

> "3.2.i Ensure that sections of the Estuary waterfront remain visually unobstructed.
>
> *Most of the Estuary waterfront not devoted to industrial use is developed as marinas which block vistas. The proposed Estuary Park will be on the most prominent viewpoint."*

Policy 6.1.e of the Parks and Recreation Element states:

> "6.1.e Acquire and develop an Estuary Park of 10 or more acres."
>
> The General Plan Diagram illustrates a park along 1,400 feet of Estuary frontage west of Oak Street in Specified Mixed Use Area 5. This park would require a major funding commitment by the City. The vision of the linear park would be to have the character of San Francisco's Marina Green, attracting all age groups to enjoy large and small boats on the Estuary, views of the Oakland skyline and hills, and active sports. The park would serve a sector of the City that is short of park space, and would guarantee the high quality of housing proposed for the area.

Finally, policy 2.6.j in the Land Use Element states:

> "2.6.j **Willow Street to Oak Street (Northern Waterfront);** Seek BCDC cooperation and Coastal Conservancy funding for the Estuary Park and make an early commitment to construction.
>
> *The park would serve the city sector with the greatest current shortage of parkland. Construction would be convincing evidence that the City is committed to implementation of the General Plan. The proposed Business and Waterfront Improvement Project would provide public actions and financing to facilitate the provision of this park.*
>
> *Local funding sources could include income from leases of public property to adjacent private property owners. Where provision of public access to the shoreline is infeasible, lease payments could include an amount to be used to provide shoreline access at another location."*

All of the policies highlighted above were adopted in 1991. Since the adoption of these policies, the City's efforts to raise funds to acquire land for the 10-acre park were not successful; the U.S. Navy and the Alameda Beltline Rail was terminated their operations in the City of Alameda, leaving behind significant opportunities to add up to 160 acres of new recreational open space in western and central Alameda; no new housing has been built in the MU-5 area; and almost all of the existing uses that were envisioned to be replaced in the MU-5 area remain.

Relevant General Plan Policies

Land Use Element

The Land Use Element is the core of the General Plan. It creates land use classifications with a range of population densities and building intensities for each type of land use designated on the *General Plan Diagram*. Land Use Element objectives and/or policies that apply to the project are listed and discussed below

- Maintain and enhance the residential environment of Alameda's Neighborhoods. *(Policy 2.4a)*
- Where a suitable residential environment can be created, give priority to housing on land to be developed or redeveloped in order to meet the qualified objectives of the Housing Element *(Policy 2.4c)*
- Expand housing opportunities for households in all income groups. *(Policy 2.4.e)*
- Include a specified minimum number of residential units in appropriate Specified Mixed Use areas. *(Policy 2.4.j)*
- Give priority for public open space and other public improvements to neighborhoods determined to have a shortage relative to the rest of the City. *(Policy 2.4.m)*

City Design Element

The City Design Element addresses visual issues at a citywide scale. The quality of the architectural and landscape design for individual sites and projects is included in this section of the General Plan. City Design Element objectives and/or policies that apply to the project are listed below:

- Maximize views and access to the shoreline. *(Policy 3.2.a)*
- Maintain views and access to the water along streets and other public rights-of-way that extend to the bulkhead line. Construct benches, ramps, rails, and seating appropriate for viewing and access, and provide walls or other screening where needed to protect adjoining property *(Policy 3.2d)*
- Ensure that sections of the Estuary waterfront remain visually unobstructed. *(Policy 3.2.i)*
- New construction, redevelopment and alterations should be compatible with historic resources in the immediate area. *(Policy 3.3.d)*

Transportation Element

The Transportation Element seeks to develop and maintain a safe and efficient transportation system, balancing the needs of the community with the desire to create a livable human environment, and to reduce the impact of automobile trips on the quality of life of City residents. An update to the Element was approved in March 2009. Transportation Element objectives that apply to the project are listed below:

- Ensure that new development implement approved transportation plans, including the goals, objectives, and policies of the Transportation Element of the General Plan and provides the transportation improvements needed to accommodate that development and cumulative development *(Objective 4.4.2)*
- Require developers to contribute toward the implementation of appropriate TSM/TDM measures to mitigate the impacts of their projects on the bridges, tubes, specific intersections, and corridors *(Objective 4.4.7)*

Open Space Element and Conservation Element

In function and content, the Open Space Element and Conservation Element often overlap. The Conservation Element is oriented toward the management of natural resources to prevent waste, destruction or neglect. The Open Space Element, in comparison, emphasizes open space as a land use and requires that preservation and management of natural resources be considered in land use planning and decision-making. Open Space and Conservation Element objectives and/or policies that apply to the project are listed below:

- Encourage the use of drought-resistant landscaping. *(Policy 5.1.i)*
- Use the City of Alameda Street Tree Management Plan as the guiding reference when considering action which would affect the trees contained in the urban forest *(Policy 5.1.j)*

- Prevent migration of runoff off-site or into wetlands areas and water-related habitat by requiring that proposed projects include design features ensuring detention of sediment and contaminants *(Policy 5.1.x)*

- Review proposed development projects for both water and energy efficiency, and integrate plans for the use of reclaimed wastewater for landscaping as a condition of approval. *(Policy 5.1.aa)*

Parks and Recreation, Shoreline Access, Schools and Cultural Facilities Element

This element established policies for facilities that deserve more attention than they would receive under the Open Space or Land Use Elements. Given that opportunities to expand the park system are few, this element guides the development and acquisition of those properties to take advantage of the City's island setting. Element objectives and/or policies that apply to the project are listed below:

- Expand Alameda's park system. *(Policy 6.1.a)*

- Promote the development and retention of private open space to compensate for the shortage of public open space. *(Policy 6.1.d)*

- Maximize visual and physical access to the shoreline and to open water. *(Policy 6.2.a)*

- Through design review of shoreline property, give consideration to views from the water. *(Policy 6.2.d)*

- Remove impediments to enjoyment of shoreline access where legal access exists. *(Policy 6.2.e)*

- Cooperate with property owners adjoining shoreline access points to ensure that public use does not cause unnecessary loss of privacy or unwarranted nuisance. *(Policy 6.2.f)*

- Require shoreline access where appropriate as a condition of development approval regardless of whether development occurs within the area of BCDC regulation. *(Policy 6.2.h)*

Health and Safety Element

State law requires a safety element to outline policies that will protect the community from both natural and human-induced disasters. This Health and Safety Element considers seismic, geologic, and soils hazards, fire hazards, flooding, hazardous materials release, waste management, magnetic fields, emergency management, and noise. Due to the City's relatively flat topography, its built-up character, and its location, slope failure, wildland fires, and dam failure are not considered threats to Alameda. Health and Safety Element objectives and/or policies that apply to the project are listed below:

- A soils and geologic report will be submitted if required by the Director of Public Works prior to the issues of all grading and building permits and submission of final maps, in accordance with the Subdivision Ordinance, to evaluate the potential for lateral spreading, liquefaction, differential settlement, and other types of ground failures. *(Policy 8.1.a)*

- Require the design of new buildings to resist the lateral effects and other potential forces of a large earthquake on any of the nearby faults, as required by the Uniform Building code. *(Policy 8.1.b)*

- Require building design to incorporate recommendations contained in the soils and geologic report. *(Policy 8.1.c)*

- Design building entrances, exits, and other vital features to accommodate expected settlement. *(Policy 8.1.g)*

- Assure the compliance of new structures with the City's Fire, Seismic, and Sprinkler Codes. Existing structures shall be required to comply with the intent of the Codes in a cost-effective manner. *(Policy 8.2.d)*

- Require new development to plan underground utilities so disruption by earthshaking or other natural disasters is diminished. *(Policy 8.2.e)*

- Reduce the effects of surface runoff by the use of extensive landscaping, minimizing impervious surface and drainage easements. *(Policy 8.3.i)*

- Require site and building design to achieve noise compatibility to the extent feasible. *(Policy 8.7.b)*

- Require acoustical analysis for new or replacement dwellings, hotels, motels, and schools within the projected 60 dB contour. Single-family dwellings not constructed as part of a subdivision requiring a final map require acoustical analysis only within the projected 65 dB contour. *(Policy 8.7.e)*

- Require new or replacement dwellings, hotels, motels, and schools within the noise impact areas described in Policy 8.7.e, above, to limit intruding noise to 45 dB CNEL in all habitable rooms. In new dwellings subject to a noise easement, noise is not to exceed 40 dB CNEL in habitable rooms. If this requirement is met by inoperable or closed windows, a mechanical ventilation system meeting Uniform Building Code requirements must be provided. *(Policy 8.7.f)*

- Minimize the impact of aircraft, railroad, and truck noise by requiring that noise levels caused by single events be controlled to 50 dB in bedrooms and 55 dB in living areas within the 60 dB contour. *(Policy 8.7.g)*

- In making a determination of impact under the California Environmental Quality Act (CEQA), consider the following impacts to be "significant"

- An increase of noise exposure of 4 or more dB if the resulting noise level would exceed that described as normally acceptable for the affected land use, as indicated in Table 8-1.

- Any increase of 6 dB or more, due to the potential for adverse community response.

Housing Element

The Housing Element is a blueprint of goals and policies for meeting the City's housing needs, including housing for low- and moderate-income families. It also includes an implementation strategy to meet the Association of Bay Area Governments (ABAG) fair share allocation. The

Draft 2007–2014 Housing Element is currently in draft form. Until it is finalized, the applicable Housing Element is the 2001–2006 Housing Element.

The 2001–2006 Housing Element lists the potential housing development sites throughout the City. Both the project site and the industrial property at the southeast corner of Clement Avenue and Oak Street are included in what is called the “MU-5 Site.” As stated in the Housing Element, the entire MU-5 Site is expected to eventually comprise 300 units, 45 of which would be affordable to very-low- or low-income families, as well as 10 acres of park land and 40,000 square feet of office space. The Housing Element notes that development applications for a portion of the property have been filed, and that a rezoning would be required to provide housing across the site.

Housing Element objectives and/or policies that apply to the project are listed below:

- Provide Housing to Meet the City’s Needs: Within the limits of available resources, seek to meet the City’s fair share housing needs, increase affordable housing opportunities, and provide for groups with special needs. (*Goal a*)
- Preserve and expand the City’s supply of affordable rental and ownership housing for low and moderate income households. (*Policy a, ii*)
- Ensure that new neighborhoods seamlessly integrate with older residential neighborhoods by designing new housing developments that complement the historic, architectural, aesthetic, and physical qualities of existing neighborhoods. (*Policy a, vi*)
- Support efforts to increase the homeownership rate in Alameda to 60 percent by promoting homeownership opportunities for Alameda residents and employees of all income groups, including lower income renters and newly formed households. (*Policy b, i*)
- Create rental and homeownership opportunities for people of all incomes, ethnic origins, cultures, gender, family structures, and special needs populations such as the elderly and physically and mentally challenged persons. (*Policy b, iii*)
- Designate an adequate amount of land for residential use to encourage housing development that will meet the needs of all income groups. (*Policy c, i*)
- Encourage development that offers residents easy access to goods, services, jobs, transportation, education and recreation. (*Policy c, iii*)
- Encourage development of homeownership units priced to meet the needs of families with incomes between 80 percent and 120 percent of area median income. (*Policy c, vi*)
- Promote residential opportunities in the City’s redevelopment areas and expand the supply of low and moderate income housing in those areas. (*Policy e, iv*)

City of Alameda Zoning Ordinance

The Zoning Ordinance is a primary tool for implementing the policies of the General Plan, and addresses the physical development standards and criteria for the City. One of the purposes of zoning is to implement the land use designations set forth in the General Plan. Existing zoning in the City of Alameda includes 22 zoning designations. As shown in **Figure 4.A-2**, the project site is currently subject to two separate zoning designations: General Industrial (Manufacturing) District (M-2) and Two-Family Residence District with a Special Planned Development District overlay (R-2-PD). The proposed project would require a rezoning to maintain consistency with the City of Alameda Zoning Ordinance.

The M-2 Manufacturing District is intended for land that is “suitable for the least restricted use of land within the City and that the restrictions applied shall be those necessary for the public health, safety and general welfare.” Given the heavy industrial nature of the M-2 district, the M-2 zoning designation does not permit residential use.

The R-2 Two Family Residential district is described in the Municipal Code as a zoning designation for land “where two-family dwellings are or are intended to be the dominant use, as developed from density standards of the General Plan.” The R-2 allows a variety of residential uses and parks and open space uses.

The PD Planned Development district is intended to “provide more flexibility in site design, development standards and types of land uses than would otherwise be allowed in the underlying zoning district; to ensure project compatibility with surrounding uses; and to ensure that adverse environmental effects are reduced or avoided to the maximum extent feasible.”

Surrounding properties have a mix of zoning designations. Directly to the east, the Park Street Landing Shopping Center is designated as a Commercial-Manufacturing Zone within a Planned Development Overlay (C-M-PD), and the block between Blanding Avenue and Clement Avenue is designated M-2. Properties to the southeast are designated Intermediate Industrial (M-1) and General Residential (R-5). South of the project site, properties are designated M-2 and Neighborhood Residential (R-4). East of the project site, properties are designated M-2 and, farther west, General Industrial and Government Combining Zone (M-2-G). Thompson Field and McKinley Park are designated as Open Space (O).

Density Bonus Ordinance

Pursuant to California Government Code Section 65915, the City of Alameda adopted a Density Bonus Ordinance in December 2009, which would allow applicants to seek an increase in the residential density of a project and development incentives and concessions if the project includes a specific percentage of qualifying housing units, such as affordable or senior housing units. The proposed project qualifies for a density bonus per the City’s ordinance.

Bicycle Master Plan

The City Council first approved the Bicycle Master Plan in 1999 with the goals of improving safety, quality of life, access of bicyclists, and creating an effective implementation strategy. The bicycle facilities map was later incorporated into the General Plan. The City is currently updating the Master Plan to help make Alameda a more bike-friendly city. The proposed project would not appear to interfere with any Bicycle Master Plan policies, as no specific bicycle facilities are identified in this master plan for the project site.

SOURCE: Microsoft Corp, 2009; NAVTEQ, 2009; Picometry Birds Eye, 2009

Boatworks Residential Project . 208559

Figure 4.A-2
Project Site Zoning Districts

Impacts and Mitigation Measures

Significance Criteria

This analysis evaluates the proposed project's impacts on land uses based on the criteria identified in the State CEQA Guidelines, Appendix G. A land use impact is considered significant if implementation of the project would result in any of the following:

1. Physically divide an established community.

2. Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the General Plan, specific plans, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

3. Conflict with any applicable habitat conservation plan or natural community conservation plan.

The evaluation of land use impacts resulting from implementation of the proposed project is based on: 1) a review of planning documents pertaining to the project site, including the City of Alameda General Plan and City of Alameda Zoning Ordinance; 2) a field review of the project site; 3) a review of planning documents pertaining to lands adjacent to the proposed project site; and 4) consultation with appropriate agencies. Changes in land use are not, in and of themselves, environmental impacts. Land use changes are impacts only relative to the prior use of the site (e.g., conversion of open space, an irreplaceable resource) or the surrounding usage and character (e.g., compatibility between housing and industrial uses, or between different intensities of development).

Impact Analysis

This following impact analysis focuses on potential impacts of the proposed project related to land use changes and policy conflicts. The following Appendix G criteria are not considered relevant to the project based upon the proposed project plans and data research; therefore, they will not be evaluated further in this EIR:

> ***Habitat Conservation Plans:*** As stated in Section 4.F, *Biological Resources*, there are no local, regional, or State habitat conservation plans that apply to the project site; therefore, no conflicts with such plans would occur.

Impact 4.A-1: The proposed Boatworks Residential Project would not physically divide an established community within the City of Alameda. (Less than Significant)

For the purpose of this impact analysis, physically dividing an established community means the creation of barriers that prevent or hinder the existing flow of people or goods through an established community, or the placement of a development in such a manner that it physically separates one portion of an established community from the remainder of that community.

The project site is physically separated from nearby properties by fences, roads, water, and other physical barriers. Uses adjacent to the project site, and across intervening streets, include light industrial, residential, commercial office, retail, and self-storage spaces. The proposed project would not interfere with those uses, nor would it create a physical barrier among them. It would extend current residential uses from south of the site northward to the estuary, and it would provide public access to the waterfront where none currently exists. This public access would enhance the project site's connection to the Park Street Landing shopping center to the east, which also provides waterfront access, as well as create a connection for workers and residents of properties to the south and west.

The proposed project would be incorporated into the established network of major streets in the area, and it would create no impediment to the passage of people or vehicles. It would not displace or directly alter off-site uses.

Therefore, the proposed project would not physically divide an established community.

Mitigation: None required.

Impact 4.A-2: The proposed Boatworks Residential Project would not conflict with an applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the General Plan and zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect. (Less than Significant)

According to *The General Plan Guidelines* published by the State Office of Planning and Research (OPR), a general rule for consistency determinations can be stated as follows: "An action, program, or project is consistent with the general plan if, considering all its aspects, it will further the objectives and policies of the general plan and not obstruct their attainment."

The City Council, as the legislative body of the City of Alameda, is ultimately responsible for determining whether an activity is consistent with the General Plan. Perfect conformity with a general plan is not required; instead, the City Council must balance various competing considerations and may find overall consistency with the plan despite minor inconsistencies with specific provisions. The potential inconsistencies with General Plan goals, objectives, and policies do not themselves create a significant environmental impact under the thresholds established in *CEQA Guidelines* Appendix G. The land use goals and policies at issue are not necessarily "adopted for the purpose of avoiding or mitigating an environmental effect." These policies are, instead, expressions of community planning and organization preferences, and the City of Alameda may modify these preferences without necessarily creating a significant adverse impact on the environment. However, project policy consistency is discussed below.

Project Consistency with Land Use Element Policies

The policies from the Land Use Element listed above restrict the number and location of residential units on the property by proposing that the City purchase approximately 4.5 acres of land within 300 feet of the Oakland Estuary for a park. As stated in Chapter 3, *Project Description*¸ the proposed project would require a General Plan amendment, which would change the land use policies for the site and ensure consistency with the Land Use Element.

Project Consistency with City Design Element Policies

The policies from the City Design Element listed above seek to maximize public enjoyment of the waterfront, including the Oakland Estuary, as well as ensure that development is compatible with its surroundings. Implementation of the proposed project would result in public access to the waterfront where none currently exists. The project would include a publicly accessible waterfront esplanade. In addition, the proposed project would require design review by the Planning Board pursuant to the Planned Development Overlay Combining District guidelines. Therefore, the proposed project would appear to be consistent with the City Design Element.

Project Consistency with Transportation Element Policies

The proposed project would appear to be consistent with the policies from the Transportation Element, listed above. The proposed project's potential impacts to vehicular traffic, bicycle, and pedestrian circulation and safety are discussed in Section 4.B, *Transportation and Circulation*.

Project Consistency with Open Space and Conservation Element Policies

The proposed project site is not located in a protected natural area. However, it is adjacent to the Oakland Estuary. On-site vegetation and stormwater best-management practices would be included in the project, and the proposed project would appear to be consistent with the Open Space and Conservation Element policies, listed above. Please see Section 4.H, *Hydrology and Water Quality*, for further discussion of these measures.

Project Consistency with Parks and Recreation, Shoreline Access, Schools and Cultural Facilities Element Policies

The proposed project would expand access to the shoreline and provide publicly accessible private open space. However, development of a private open space on the waterfront would directly contradict *Policy 6.1.e* regarding the City acquiring and developing an Estuary Park at the site. As stated in Chapter 3, *Project Description*¸ the proposed project includes a request for a General Plan amendment, which would change the land use designation of the site. The proposed project would therefore appear to be consistent with the Parks and Recreation, Shoreline Access, Schools and Facilities Element.

Project Consistency with Health and Safety Element Policies

The proposed project would be required, through existing regulations, to comply with the Health and Safety Element policies, listed above. The proposed project would therefore appear to be consistent with the Health and Safety Element. Noise impacts are addressed in Section 4.D.

Project Consistency with Housing Element Policies

The proposed project would provide new housing on a vacant site located near commercial and public services. The project would make 20 percent units available to low- or very-low-income families. The project is therefore consistent with the Housing Element.

As stated in the Project Description, the proposed project would include a General Plan Amendment and rezoning to allow its development. Therefore, if approved, the proposed project would not conflict with the General Plan or the zoning ordinance. As also stated above, the proposed project appears consistent with the *San Francisco Bay Plan*, especially as related to public access to the waterfront. However, BCDC will ultimately determine plan consistency.

Project Consistency with Site-Specific General Plan Policies

The proposed project is consistent with the following site-specific policies:

> **"MU5 Northern Waterfront, Willow Street to Oak Street:** The change anticipated in this segment provides an opportunity for Alameda to add highly desirable housing, stimulate improvement of housing east of Oak Street that is currently zoned for commercial-industrial use, and to provide an Estuary Park. Half of the north frontage of Clement is occupied by the Naval Reserve Training Center, which will remain. Other uses are steel fabricating, mini-storage, and dredging equipment yard, and a boatyard. The four blocks on the south side of Clement Avenue are occupied by a boat storage building/yard, Thompson Field (Alameda High School athletic field adjoining McKinley Park) a full block of housing, and a 5-acre site occupied by a die-casting plant and an automobile service establishment."

2.6.e **Willow Street to Oak Street (Northern Waterfront):** Provide for redevelopment of existing industrial sites for 250 to 350 two-family residential units, treating the area north of Clement Avenue as an extension of the residential neighborhood to the south.

The proposed Business and Waterfront Improvement project would provide public actions to stimulate development of the site.

3.2.i Ensure that sections of the Estuary waterfront remain visually unobstructed.

Most of the Estuary waterfront not devoted to industrial use is developed as marinas which block vistas. The proposed Estuary Park will be on the most prominent viewpoint.

The proposed project would not be consistent with the following policies:

2.6.f **Willow Street to Oak Street (Northern Waterfront):** Create a continuous 300-foot-wide "marina green" park along the Estuary.

2.6.j **Willow Street to Oak Street (Northern Waterfront);** Seek BCDC cooperation and Coastal Conservancy funding for the Estuary Park and make an early commitment to construction.

The park would serve the city sector with the greatest current shortage of parkland. Construction would be convincing evidence that the City is committed to implementation of the General Plan. The proposed Business and Waterfront

Improvement Project would provide public actions and financing to facilitate the provision of this park.

Local funding sources could include income from leases of public property to adjacent private property owners. Where provision of public access to the shoreline is infeasible, lease payments could include an amount to be used to provide shoreline access at another location.

6.1.e Acquire and develop an Estuary Park of 10 or more acres.

The General Plan Diagram indicates a park along 1,400 feet of Estuary frontage west of Oak Street in Specified Mixed Use Area 5. This park will require a major funding commitment by the City, but will probably do more than any other single project to ensure Alameda's long-term quality. It could have the character of San Francisco's Marina Green and would attract all age groups to enjoy large and small boats on the Estuary, views of the Oakland skyline and hills, and active sports. The new park would serve a sector of the City that is short of park space, and would guarantee the high quality of housing proposed for the area.

Project Consistency with the San Francisco Bay Plan

Because a portion of the project site lies within BCDC jurisdiction, development would be subject to the San Francisco Bay Plan.[2] The project applicant would need to obtain permits for dredging and filling and development on the shoreline from BCDC prior to any construction activities. Physical impacts related to dredging and filling are discussed in Sections 4.I, *Hazards and Hazardous Materials*, 4.H, *Hydrology and Water Quality*, and 4.F, *Biological Resources*.

The project would be subject to additional review by the BCDC to ensure that adequate public access to and along the shoreline has been incorporated into project. These review processes are not conducted as part of the environmental review of the project.

A permit from BCDC would be required for all dredging and filling (including placement of piers and pilings) associated with the proposed small boat marina and construction of the boardwalk and other site improvements. The new marina would have to be consistent with Bay Plan *Dredging* Policy 2. The dredging would result in a new marina that would be a water-oriented use according to the Bay Plan. In accordance with "Policy 1" *Fills in Accord with the Bay Plan*, new fill would be placed to improve shoreline appearance and public access. Additionally, in accordance with Policy 1, *Bay-Oriented Commercial Recreation and Bay-Oriented Public Assembly on Privately-owned Property*, the new fill would be for Bay-oriented commercial recreation and public assembly purposes and it would provide for improved shoreline appearance and public access to the Bay. Also, consistent with Policy 2, *Other Uses of the Bay and Shoreline*, most of the fill that would comprise the marina would be the docks on piles over water that would provide boat slips.

The ultimate design of the proposed project would need to be altered to adhere to polices related to public view corridors and waterfront access, which would happen during the BCDC permitting

2 BCDC has jurisdiction over development in shoreline areas within 100 feet of mean high tide landward of and parallel to the shoreline of the Bay, including the Oakland Estuary.

phase. However, the proposed project appears mostly consistent with the *San Francisco Bay Plan* in that it would provide recreational access to the Bay. BCDC will determine the proposed project's ultimate consistency with the Plan.

Conclusion

Conflicts with a General Plan or other relevant plans do not inherently result in a significant effect on the environment within the context of CEQA. Section 15358(b) of the CEQA Guidelines states that "effects analyzed under CEQA must be related to a physical change." Appendix G of the CEQA Guidelines makes explicit the focus on physical environmental policies and plans, asking if that the project would "conflict with any applicable land use plan, policy, or regulation….*adopted for the purpose of avoiding or mitigating an environmental effect*" (emphasis added). As such, the project's conflict or inconsistency with the policy could indicate that an environmental threshold has been exceeded. To the extent that the project exceeds an environmental threshold and significant physical impacts may result from a policy conflict or inconsistency, such physical impacts have been identified and fully analyzed in the relevant topical sections of this EIR.

The physical environmental effects of the proposed General Plan amendment and rezoning, and associated increases in development, such as increased traffic, noise, air emissions, habitat degradation, visual resources effects and hydrologic impacts, are discussed in their respective sections in this EIR. Assuming approval and adoption of the General Plan Amendment and Zoning designation described above, the project would be consistent with the applicable land use plans and policies and there would be a less-than-significant land use impact.

Mitigation: None required.

Cumulative Impact

Impact 4.A-3: The proposed project, combined with cumulative development in the defined geographic area, including past, present, reasonably foreseeable future development, would not have any significant adverse cumulative impacts in the area. (Less than Significant)

The geographic context considered for the cumulative land use, plans, and policy impacts includes the surrounding area that, when combined with the proposed project, could result in cumulative land use, plans, and policy impacts. Past projects are included in the existing setting described in this section and in the introduction for this chapter. Present projects would include any projects currently under construction. The Perforce Expansion at Oak Street and Blanding Avenue, which will result in 26,700 additional square feet of professional office uses, is the only present project in the site area.

Reasonably foreseeable future projects are those that could be developed or occur in the project site area by 2030, of which there are two:

- The Park Street Gateway District Strategic Plan. This would apply to northern Park Street between Downtown Alameda and the Oakland Estuary. It would be bounded by Lincoln Avenue and Tilden Way to the south, Everett Street to the east, the Oakland Estuary to the north, and Oak Street to the west. It would seek to replace existing auto-oriented and -service uses with pedestrian-oriented retail and housing. The strategic plan was published in 2008. Changes to the zoning ordinance and other land use regulations are currently under consideration.

- The Northern Waterfront General Plan Amendment Area: Bounded by the Alameda Beltline property at Constitution Way, Minturn Street at Eagle Avenue, and the Oakland Estuary, the Northern Waterfront encompasses an area of Alameda that was historically a working waterfront containing light and heavy industrial uses. New office buildings and housing have been constructed in this area. The goals of the amendment are to reduce or eliminate blight, incompatible land uses, and obsolete development or underutilized parcels. The Amendment seeks to increase public open space and public waterfront access and reduce incompatibilities between industrial and residential uses. The redevelopment process would occur over approximately 10 years. The amendment is under review.

As concluded in this section, the proposed project would not result in any significant impacts resulting from physically dividing an established community or conflicting with any land use plan, policy or regulation adopted for purposes of avoiding or mitigating an environmental effect. The proposed project site is primarily self-contained, bounded by roadways on two sides, the Oakland Estuary on one side, and a storage facility on one side.

Land use impacts from the proposed project are local and limited to the project site. Future development within the project vicinity is guided by the City's General Plan and associated documents. The area immediately south of the project site is generally built out pursuant to the General Plan with a mix of residential, industrial and commercial land uses. The project would make a less-than-significant contribution to cumulative land use impacts.

Similar to the proposed project, the Park Street Gateway District Strategic Plan and the Northern Waterfront General Plan Amendment would gradually replace existing auto-oriented uses, industrial uses, or vacant or underutilized land with additional residential and commercial uses, as well as open space. Such changes would alter the land use character of this area of the island, but not in an adverse manner. Compatibility of future land uses would likely be improved.

In addition, cumulative projects would be subject to development guidance contained within the General Plan, Specific Plan (if applicable) and/or the Zoning Ordinance to ensure land use compatibility. Therefore, it is not anticipated that the proposed project, when considered with other past, present or reasonably foreseeable future development in the area, would result in a cumulative impact with respect to land use, plans and policies. Thus, the proposed project would not result in a significant cumulative land use impact.

Mitigation: None required.

References – Land Use Consistency and Compatibility

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B. Transportation and Circulation

Introduction

This section describes transportation and circulation conditions in the project area, and assesses the proposed project in terms of whether it would (1) conflict with adopted policies or programs supporting alternative transportation (e.g., pedestrian, bicycles, and public transit travel modes), (2) cause an increase in traffic that is substantial in relation to background traffic load and capacity (i.e., increase congestion and delay at intersections), (3) exceed level of service standards established by the City of Alameda and by the Alameda County Congestion Management Agency, (4) substantially increase traffic safety hazards, or (5) result in inadequate emergency access. Both short-term and long-term project effects are analyzed to determine their significance under CEQA. For project impacts that are determined to be significant, mitigation measures have been identified to avoid or reduce those impacts.

Environmental Setting

Regional Setting

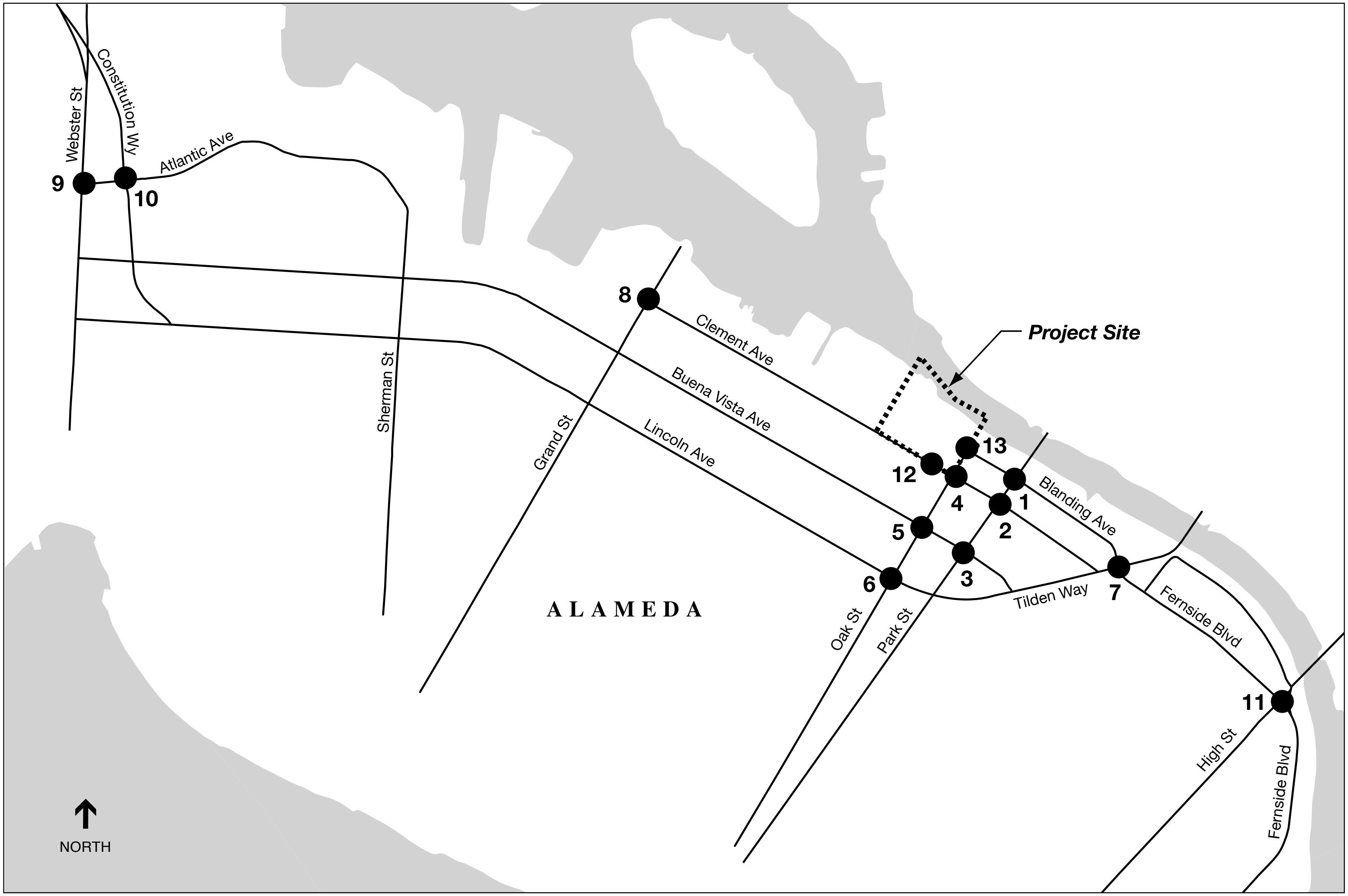
The City of Alameda is an island separated from the City of Oakland by the Oakland Estuary. Access to the City of Alameda across the Oakland-Alameda Estuary is provided by a one-way couplet of under-Estuary tubes at Webster and Posey Streets (State Route 260), and draw bridges at Park Street / 29th Avenue, Tilden Way / Fruitvale Avenue, and High Street. Doolittle Drive / Otis Drive (State Route 61) crosses San Leandro Channel, providing access from Bay Farm Island.

Interstate 880 (I-880) is a north-south eight-lane freeway (though oriented east-west in the study area) between I-80 near the Bay Bridge and San Jose. Traffic generated by this project could use I-880 to travel to/from eastern Alameda and Contra Costa County, San Francisco (via the Bay Bridge), the Tri-Valley (via State Route 238 and I-580), and the South Bay. The closest access to/from the project site is provided via circuitous routes to/from the 23rd Avenue and 29th Avenue / Fruitvale Avenue interchanges.

Local Setting

The proposed Boatworks Residential Project is located northwest of the intersection of Oak Street and Clement Avenue. One project access point is proposed to be located such that it would become a leg of the Oak Street / Blanding Avenue intersection. The second access point would form a T-intersection with Clement Avenue. Key local roadways that provide access to the project site are described below, and shown in **Figure 4.B-1**.

Park Street is the street that carries the most traffic near the project site. It consists of four travel lanes. One end is located at the Park Street Bridge (providing access to Oakland and I-880), while the other is located at Shoreline Drive, where it meets San Francisco Bay. Park Street is one of two major shopping streets in the City of Alameda.



SOURCE: Dowling Associates, Inc.

Boatworks Residential Project . 208559

Figure 4.B-1
Roadway Network

Oak Street lies parallel to Park Street, and serves as a bypass to avoid congestion on Park Street. Oak Street is a two-lane street and is fronted by a mix of residential and commercial uses.

Lincoln Avenue is a major street in Alameda (with two travel lanes in each direction), connecting with Tilden Way on its eastern end, which curves around to cross the Oakland Estuary via the Miller-Sweeney Bridge. It is fronted primarily by residential uses.

Buena Vista Avenue runs parallel to Lincoln Avenue, but consists only of a single travel lane in each direction with parking on both sides. It is fronted primarily by residential development. The San Francisco Bay Trail runs on Buena Vista Avenue in the project vicinity.

Clement Avenue is currently a two-lane street that runs from Grand Street to Broadway, and serves primarily industrial land uses. Parking is permitted on both sides of the street. This street is planned to be extended from Grand Street to Sherman Street / Atlantic Avenue, and from Broadway to Tilden Way, in the future. When those extensions are completed, the connection from Tilden Way to Sherman Street / Atlantic Avenue will tend to draw cross-town traffic from Lincoln Avenue and Buena Vista Avenue.

Blanding Avenue is a two-lane street that runs parallel to Clement Avenue and connects Oak Street on the west to Tilden Way on the east. It is fronted primarily by a mix of industrial and commercial uses.

Pedestrian / Bicycle / Transit Travel Modes

Pedestrian Travel

Currently, there is no sidewalk along the west side of Oak Street along the border of the project. These conditions are consistent with the historical usage of the project site as an industrial facility. Sidewalks exist along the east side of Oak Street north of Clement Avenue, on both sides of Oak Street south of Clement Avenue and on both sides of Clement Avenue to the east and west of Oak Street. There are numerous locations on these sidewalks where pedestrian access is partly obstructed by utility poles and other structures. The nearest crosswalks are at the intersection of Park Street / Clement Avenue. The waterfront Class I (a bicycle facility separated from vehicular facilities) path at Park Street Landing is a shared-use path accessible to pedestrians.

Bicycle Travel

There are currently no existing striped bike lanes or signed bike routes bordering the project site. The nearest north-south bike facility is a bike lane located on Broadway, approximately three blocks from the project site. The nearest east-west bike facility is a bike lane located on Central Avenue, about five blocks from the project site.

There are proposed bicycle facilities shown in the City's Bicycle Master Plan, which was re-adopted by the City in 2008. The plan shows a proposed Class I path along the waterfront, as well as bike lanes (Class II) along Clement Avenue, Oak Street, and Blanding Avenue. A portion of the waterfront Class I facility has been completed at the Park Street Landing shopping center, adjacent to the project site.

Although there are no bicycle improvements, the San Francisco Bay Trail runs along Buena Vista Avenue in the project vicinity.

Transit Travel

There are three AC Transit bus routes within about one-quarter mile (walking distance) of the proposed project, as well as three other AC Transit bus routes that stop within about 0.4 to 0.7 mile of the project site (AC Transit, 2010).

- Route 19 travels between the Fruitvale BART station and the North Berkeley BART station, passing through downtown Oakland. It runs along Buena Vista Avenue on half-hour headways seven days a week from approximately 6:00 a.m. to 10:00 p.m. The nearest bus stop to the project site on this route is at the intersection of Oak Street and Buena Vista Avenue. The future status of this route is unclear, as is has been proposed for elimination in 2010 by AC Transit.

- Route 50 travels between the Fruitvale BART station and Bayfair BART station, running along Park Street in the project site vicinity. It operates on 15-minute headways from approximately 5:00 a.m. to midnight on weekdays and on 30-minute headways from approximately 6:00 a.m. to midnight on weekends and holidays. The nearest bus stop to the project on this route is at the intersection of Park Street and Clement Avenue.

- Route OX is an express transbay route that travels between both downtown Alameda and Bay Farm Island and downtown San Francisco, running along Park Street in the project site vicinity. It operates on 10-minute headways during peak periods on weekdays only. The nearest bus stop to the project site on this route is at the intersection of Park Street and Clement Avenue.

- Route 51 travels from the Berkeley Amtrak station and the Berkeley BART station to the Alameda Bridgeside Center at the intersection of Blanding Avenue and Broadway. The line runs along Santa Clara Avenue and Broadway in the City of Alameda from approximately 5:00 a.m. to midnight on weekdays (on 10-minute headways) and on weekends and holidays (on 15-minute headways). The nearest bus stops to the project site are at the intersection of Broadway and Blanding Avenue (about 0.4 miles from project site), and the intersection of Santa Clara Avenue and Park Street (about 0.5 miles from project site).

- Route 851 is the all-nighter bus running a similar route to Route 51, except service is shortened, extending only from the Berkeley BART station to the intersection of Park Street and Santa Clara Avenue. Service is hourly from approximately midnight to 5:00 a.m. The nearest stop to the project site is at the intersection of Park Street and Santa Clara Avenue (about 0.5 miles from project site).

- Route O is a transbay route that travels between downtown Alameda and downtown San Francisco, running along Santa Clara Avenue in the project site vicinity. Some buses run an extended route to High Street and Fernside Boulevard. The bus operates on approximately half-hour headways from 6:30 a.m. to midnight on weekdays, with shorter headways during peak periods. The bus operates on 1-hour headways on weekends from 6:00 a.m. to midnight. The nearest bus stop to the project site on this route is at the intersection of Park Street and Encinal Avenue (about 0.7 miles from project site).

Vehicular Travel

Traffic conditions in urban areas are affected more by the operations of intersections than by the capacities of local streets because traffic control devices (signals and stop signs) at intersections control the capacity of the street segments. The operations are measured in terms of a grading system called Level of Service (LOS), which is based on "control delay" experienced at the intersections. That delay is a function of the signal timing, intersection lane configuration, hourly traffic volumes, pedestrian volumes, and parking and bus conflicts. Recent a.m. and p.m. peak-hour traffic counts conducted within the last two years were used for the analysis of existing conditions. Data concerning the existing intersection configurations and control were collected in the field. Existing traffic signal timing data was collected for all of the signalized study intersections from the City of Alameda Public Works Agency and other agencies, and then compared against the actual conditions at each study intersection to verify accuracy.

Analysis of peak-hour traffic conditions was conducted at the following 11 existing intersections in the project vicinity (all are signalized, except for #4 Oak Street / Clement Avenue (all-way stop-controlled) and #8 Grand Street / Clement Avenue (side-street stop-controlled).

1. Park Street and Blanding Avenue
2. Park Street and Clement Avenue
3. Park Street and Buena Vista Avenue
4. Oak Street and Clement Avenue
5. Oak Street and Buena Vista Avenue
6. Oak Street and Lincoln Avenue
7. Tilden Way and Blanding Avenue
8. Grand Street and Clement Avenue
9. Atlantic Avenue and Webster Avenue
10. Atlantic Avenue and Constitution Way
11. High Street and Fernside Boulevard
12. Clement Avenue and Project Access (*Future*)
13. Oak Street / Blanding Avenue and Project Access (*Future*)

They were selected because they represent locations along major traffic routes to and from the project site. Intersections #12 and #13 do not currently exist, but they would be created by the proposed project access drives. They are analyzed under future scenarios with the proposed project (i.e., Baseline Plus Project and Cumulative Plus Project).

Level of Service Analysis Methodologies

The operation of a local roadway network is commonly measured and described using an LOS grading system, which qualitatively characterizes traffic conditions associated with varying levels of vehicle traffic, ranging from LOS A (indicating free-flow traffic conditions with little or no delay experienced by motorists) to LOS F (indicating congested conditions where traffic flows exceed design capacity and result in long queues and delays). This LOS grading system applies to both signalized and unsignalized intersections (see **Table 4.B-1**).

Signalized Intersections. At the signalized study intersections, traffic conditions were evaluated applying the 2000 *Highway Capacity Manual* (HCM) operations methodology, using the Synchro computer software program (TRB, 2000). The operation analysis uses various intersection characteristics (e.g., traffic volumes, lane geometry, and signal phasing/timing) to estimate the average control delay experienced by motorists traveling through an intersection.

TABLE 4.B-1
DEFINITIONS FOR INTERSECTION LEVEL OF SERVICE

Unsignalized Intersections		Level of Service Grade	Signalized Intersections	
Description	**Average Total Vehicle Delay (Seconds)**		**Average Control Vehicle Delay (Seconds)**	**Description**
No delay for stop-controlled approaches.	≤10.0	A	≤10.0	Free Flow or Insignificant Delays: Operations with very low delay, when signal progression is extremely favorable and most vehicles arrive during the green light phase. Most vehicles do not stop at all.
Operations with minor delay.	>10.0 and ≤15.0	B	>10.0 and ≤20.0	Stable Operation or Minimal Delays: Generally occurs with good signal progression and/or short cycle lengths. More vehicles stop than with LOS A, causing higher levels of average delay. An occasional approach phase is fully utilized.
Operations with moderate delays.	>15.0 and ≤25.0	C	>20.0 and ≤35.0	Stable Operation or Acceptable Delays: Higher delays resulting from fair signal progression and/or longer cycle lengths. Drivers begin having to wait through more than one red light. Most drivers feel somewhat restricted.
Operations with increasingly unacceptable delays.	>25.0 and ≤35.0	D	>35.0 and ≤55.0	Approaching Unstable or Tolerable Delays: Influence of congestion becomes more noticeable. Longer delays result from unfavorable signal progression, long cycle lengths, or high volume to capacity ratios. Many vehicles stop. Drivers may have to wait through more than one red light. Queues may develop, but dissipate rapidly, without excessive delays.
Operations with high delays, and long queues.	>35.0 and ≤50.0	E	>55.0 and ≤80.0	Unstable Operation or Significant Delays: Considered to be the limit of acceptable delay. High delays indicate poor signal progression, long cycle lengths and high volume to capacity ratios. Individual cycle failures are frequent occurrences. Vehicles may wait through several signal cycles. Long queues form upstream from intersection.
Operations with extreme congestion, and with very high delays and long queues unacceptable to most drivers.	>50.0	F	>80.0	Forced Flow or Excessive Delays: Occurs with oversaturation when flows exceed the intersection capacity. Represents jammed conditions. Many cycle failures. Queues may block upstream intersections.

SOURCE: Transportation Research Board, Special Report 209, *Highway Capacity Manual*, 2000.

Unsignalized Intersections. For the unsignalized (all-way stop-controlled and side-street stop-controlled) study intersections, traffic conditions were evaluated applying the 2000 HCM operations methodology, using the Synchro computer software program. With this methodology, the LOS is related to the total delay per vehicle for the intersection as a whole (for all-way stop-controlled intersections), and for each stop-controlled movement or approach (for side-street stop-controlled intersections). Total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs the stop line. This time includes the time required for a vehicle to travel from the last-in-queue position to the first-in-queue position.

Figure 4.B-2 shows lane geometry and peak-hour volumes at the 11 existing intersections. The eleven existing intersections were evaluated using existing traffic volumes. Traffic counts were conducted at the intersection of Clement Avenue and Grand Street in December 2008. Traffic counts conducted by the City in 2007 as part of the General Plan Amendment work were used at the other ten intersections. **Table 4.B-2** shows the results of the existing intersection level of service. LOS calculation reports are provided in **Appendix D**.

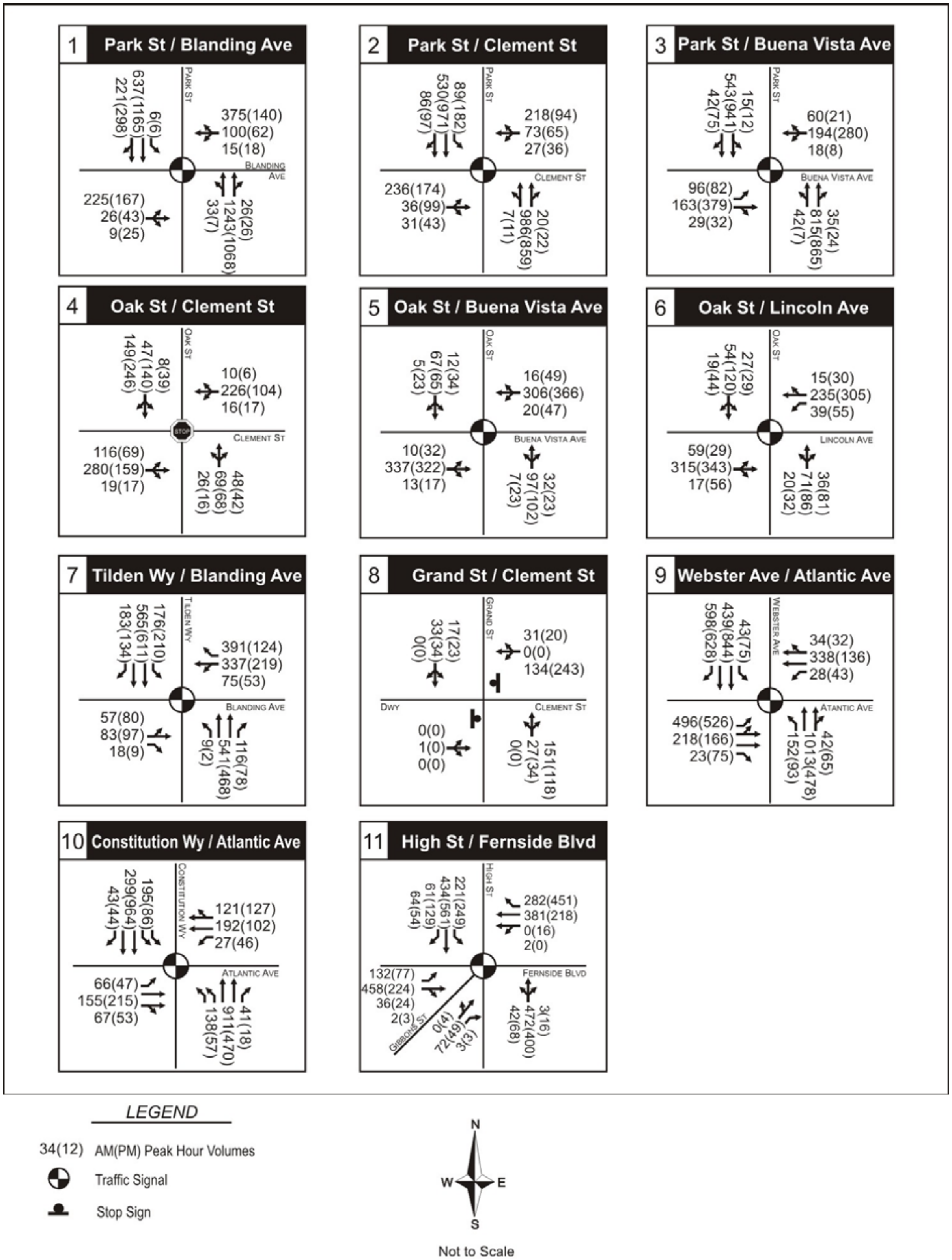
The intersection of Park Street / Blanding Avenue currently operates at an unacceptable LOS F during the a.m. peak hour, due to the heavy northbound volumes on Park Street (which dictates that the traffic light stays green a high proportion of available time to accommodate that traffic). Because the eastbound and westbound approaches are single-lane approaches, and right turns on red are prohibited on the westbound approach, the moderate-volume eastbound left turn and westbound right turn become critical movements and experience excessive delay during the a.m. peak hour. All other existing study intersections currently operate at an acceptable LOS D or better.

TABLE 4.B-2
EXISTING INTERSECTION LEVEL OF SERVICE (LOS) AND DELAY (seconds/vehicle)

No.	Intersection	Traffic Control	AM Peak Hour		PM Peak Hour	
			LOS	Delay	LOS	Delay
#1	Park Street and Blanding Avenue	Signal	F	91.5	C	22.2
#2	Park Street and Clement Avenue	Signal	D	37.8	C	24.7
#3	Park Street and Buena Vista Avenue	Signal	A	9.0	B	13.5
#4	Oak Street and Clement Avenue	AWSC	C	16.4	B	14.3
#5	Oak Street and Buena Vista Avenue	Signal	A	7.7	A	8.9
#6	Oak Street and Lincoln Avenue	Signal	B	11.5	A	8.7
#7	Tilden Way and Blanding Avenue	Signal	B	15.1	B	12.1
#8	Grand Street and Clement Avenue	SSSC	B	10.8	B	12.4
#9	Atlantic Avenue and Webster Avenue	Signal	D	53.4	D	41.7
#10	Atlantic Avenue and Constitution Way	Signal	D	43.1	C	34.2
#11	High Street and Fernside Boulevard	Signal	D	41.3	C	23.8

NOTE: The LOS/Delay for Side-Street Stop-Control (SSSC) intersections represent the worst movement or approach; for Signalized and All-Way Stop-Control (AWSC) the LOS/Delay represent overall intersection.

SOURCE: Dowling Associates, Inc.



SOURCE: Dowling Associates, Inc

Boatworks Residential Project . 208559

Figure 4.B-2
Existing Peak-Hour Volumes
and Lane Configurations

Truck Travel

Clement Avenue is one of two east-west truck routes in the City. Park Street and Broadway, which are within a few blocks of the project site, serve north-south truck travel at that end of the City. Tilden Way is also a truck route. A heavy vehicle percentage of 5 percent was used for truck routes in the intersection analysis (consistent with other City analyses).

Buena Vista Avenue formerly was a truck route, but the City removed the designation, except for the short distance between Sherman Street and Grand Street which will be taken off the truck route system when the extension of Clement Avenue from Grand Street to Sherman Street / Atlantic Avenue is constructed. It is relevant to note this situation because the Park Street / Buena Vista Avenue intersection was designed for trucks, especially the southbound-to-westbound right turn where the northwest corner has a large radius to accommodate turning paths of trucks. The intersection of Park Street / Clement Avenue has geometry more suitable for passenger vehicles, so is more limited in potential modifications involving re-striping. Specifically, the west leg of this intersection has a wide westbound receiving lane to enable trucks to make the southbound-to-westbound right turn onto Clement Avenue.

Research has shown that truck drivers appear to be better drivers than those of other vehicles, but truck crashes are more likely to result in fatality because of the vehicle’s size, weight, and stiffness (TRB, 2004). That research recommends several strategies to reduce the number of heavy truck fatality crashes, including the following:

- Reducing the number of tired truck drivers (e.g., increasing the efficiency of existing parking spaces, creating additional parking spaces, and incorporating rumble strips into new or existing roadways to alert fatigued drivers who wander out of traffic lane).
- Increasing the public’s awareness of how to share the road with trucks (e.g., incorporating Share the Road information into driver materials and promulgating Share the Road information through print and electronic media).
- Identifying and correcting unsafe roadway infrastructure and operational characteristics (e.g., identifying and correcting unsafe roadway configurations, installing interactive truck rollover signing, and modifying speed limits and increasing enforcement to reduce speeds).

Regulatory Framework

State

The California Department of Transportation (Caltrans) is responsible for operations and maintenance of the state highway system, and serves as a reviewing agency for Environmental Impact Reports (EIRs) to ensure that proposed projects would not have a significant impact on state highway facilities.

Regional

The Alameda County Congestion Management Agency (ACCMA), through its Congestion Management Program (CMP), oversees how roads of regional significance function, and requires local jurisdictions to evaluate the impact of proposed land use changes (i.e., General Plan amendments, and developments with trip-generating potential of more than 100 new peak-hour vehicle trips) on the regional transportation systems.

Local

The City of Alameda General Plan Transportation Element sets forth goals, objectives and policies that provide guidance for residents, businesses, policymakers and elected officials in making choices that shape the City's environment. In addition to the other General Plan policies discussed in Section 4A Land Use, the following are relevant to the proposed project and this analysis:

> *Objective 4.4.2*: Ensure that new developments implement approved transportation plans, including the goals, objectives, and policies of the Transportation Element of the General Plan and provides the transportation improvements needed to accommodate that development and cumulative development.
>
> *Policies*:
>
> 4.4.2.a Roadways will not be widened to create additional automobile travel lanes to accommodate additional automobile traffic volume, with the exception of increasing transit exclusive lanes or non-motorized vehicle lanes.
>
> 4.4.2.b Intersections will not be widened beyond the width of the approaching roadway with the exception of a single exclusive left turn lane when necessary, with the exception of increasing transit exclusive lanes or non-motorized vehicle lanes.
>
> 4.4.2.c Speed limits on Alameda's new roads should be consistent with existing roadways and be designed and implemented as 25 mph roadways.
>
> 4.4.2.d All EIRs must include analysis of the effects of the project on the city's transit, pedestrian and bicycling environment, including adjacent neighborhoods and the overall City network.
>
> 4.4.2.e EIRs will not propose mitigations that significantly degrade the bicycle and pedestrian environment, which are bellwethers for quality of life issues, and staff should identify "Levels of Service" or other such measurements to ensure that the pedestrian and bicycling environment will not be significantly degraded as development takes place.
>
> 4.4.2.f Transportation-related mitigations for future development should first implement TDM measures with appropriate regular monitoring; transit, bicycle and pedestrian capital projects; and more efficient use of existing infrastructure such as traffic signal re-timing in order to reduce the negative environmental effects of development, rather than attempting to accommodate them. Should appropriate regular monitoring indicate that these mitigations are unable to provide the predicted peak-hour vehicle trip reductions, additional TDM measures,

development specific traffic caps, or mitigations through physical improvements of streets and intersections, consistent with policy 4.4.2.a and policy 4.4.2.b, may be implemented.

4.4.2.g After the implementation of quantifiable/verifiable TDM measures (verified through appropriate regular monitoring), and mitigation measures consistent with 4.4.2.f and identification of how multimodal infrastructure relates to congestion concerns, some congestion may be identified in an EIR process as not possible to mitigate. This unmitigated congestion should be evaluated and disclosed (including intersection delay length of time) during the EIR process, and acknowledged as a by-product of the development and accepted with the on-going funding of TDM measures.

Impacts and Mitigation Measures

Significance Criteria [1]

According to Appendix G of the CEQA Guidelines, a project would have a significant impact on the environment if it would:

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

b. Conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the congestion management agency for designated roads or highways.

c. 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.

d. Substantially increase hazards due to a design feature. (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

e. Result in inadequate emergency access.

f. Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

For the purpose of this EIR[2], the project or a proposed mitigation measure would be a significant transportation impact if the project has one or more of the following effects:

- <u>Pedestrian</u> – Causes the Pedestrian LOS to degrade below LOS B at a signalized intersection. If the intersection were already below LOS B, an impact would be considered

1 Significance criteria used for the required Congestion Management Program evaluation (pages 4.B-39 to 4.B-42) are presented on page 4.B-39.

2 The significance criteria used for this analysis are the transportation threshold of significance recommended by the City of Alameda Transportation Commission on April 22, 2009 to implement General Plan Policy 4.4.2d.

significant if the delay for a crosswalk increases by 10 percent. (Pedestrian LOS would be determined using the Highway Capacity Manual methodology for determining the average delay for pedestrians at a signalized intersection.)

- Bicycle – Causes the Bicycle segment LOS to degrade below LOS B. If a street segment were already below LOS B, an impact would be considered significant if the LOS score increases by 10 percent or more in value. If a segment has an existing adjacent Class I facility, and has not been recommended for a future bicycle lane, the degradation of the Bicycle LOS to E would not be considered a significant impact. (Florida Department of Transportation methodology for street segments will be used for the LOS analysis).

- Transit – If travel speed degrades by 10 percent or more along a street segment. A segment would be defined as the impacted bus stop location, plus the two previous stops and the two subsequent stops. A segment that crosses a City boundary shall also include five bus stops, but the last stop shall be the first bus stop outside the City of Alameda (Transit LOS for an arterial segment would be calculated using the Highway Capacity Manual's methodology for Urban Street (arterial) Level of Service, or LOS).

- Automobile – Causes an intersection to degrade below LOS D. If an intersection were already at LOS E or worse, an impact would be considered significant if there is a 3 percent or greater increase in the traffic volume. (Automobile LOS at intersections would be calculated using the Highway Capacity Manual's methodology for determining the average vehicle delay at an intersection.)

Other thresholds of significance.

- Planned Alternative Transportation Services and Facilities – Conflicts with, disrupts or interferes with planned transit, bicycle, or pedestrian services and facilities.

- Short Term Construction – Causes short-term construction related traffic impacts on pedestrian circulation, bicycle access, transit or automobile circulation.

- Safety – Results in an unsafe on-site circulation system, creates or contributes to an existing unsafe transportation condition or facility, or results in inadequate emergency access due to limited or circuitous access routes to the project site or lack of sufficient clear width on streets to provide emergency vehicle access.

- Crosswalks – The removal of a marked or unmarked crosswalk to address project impacts will be considered a significant impact.

Procedures for Ranking Modes at Locations Where the Transportation Element Designates Multiple Modal Priorities

If an acceptable level of service can not be achieved for all modes, then the modes shall be prioritized based upon the General Plan street functional classification system. Priority shall be given to maintaining acceptable level of service for the higher priority mode. Mitigations should be adopted to improve the level of service for the lower priority mode, but those mitigations shall be designed to ensure that they do not impact the level of service for a higher priority mode.

The street functional classification system adopted as part of the City's Transportation Element includes a street type layer, a modal layer, and a land use layer. The modal hierarchy is based primarily on the street type layer, as follows:

Regional and Island Arterials

- Exclusive Right of Way Transit
- Primary Transit
- Secondary Transit
- Pedestrian
- Bicycle
- Automobiles

Collectors

- Bicycle
- Pedestrian
- Transit
- Automobile

Local

- Pedestrian
- Bicycle
- Transit
- Automobile

For all street types, if the LOS thresholds are not being achieved, the LOS for automobiles is reduced first. To determine which mode would be impacted next, the modal overlay is used to modify the hierarchy. Note that there are no pedestrian priorities designated in the modal layer, so the Commercial/Main and School/Recreation designations in the land use layer are used to identify the pedestrian priority areas.

Here is an illustration of how this method would apply. For a regional arterial, transit would be the highest priority and the last mode to be impacted. In the absence of any priority designations for bicycles or pedestrians (or if both modes are designated priorities), the pedestrian mode would be given a higher priority than the bicycle mode. If a street segment were identified as a bicycle priority, but not as a pedestrian priority, then the bicycle mode would be given a higher priority than the pedestrian mode.

Below is a list of the types of potential conflicts that were identified and how they would be resolved using the method described above.

a. On Regional Arterials with Commercial/Main or School/Recreation land use designation, modal preference would be in the following order: transit, pedestrian, bicycles, automobiles. Since transit is the highest preference, if necessary, a queue jump lane may share space with a Class II bicycle facility.

b. On Regional Arterials with land use designations other than Commercial/Main or School/Recreation, modal preference would be in the following order: transit, bicycle, pedestrian, automobiles. Since transit is the highest preference, if necessary, a queue jump lane may share space with a Class II bicycle facility.

c. On Island Arterials with Primary Transit or Exclusive Transit Right of Way, modal preference will be prioritized in the following order: transit, pedestrians, bicycles, automobiles.

d. On Island Arterials with Primary Transit or Exclusive Transit Right of Way and bicycle preference, modal preference will be in the following order: transit, bicycles, pedestrians, automobiles.

e. On Island Arterials with Primary Transit or Exclusive Transit Right of Way, and bicycle preference, and a Commercial/Main or School/Recreational Zone, modal preference will be in the following order: transit, pedestrians, bicycles, automobiles.

f. On Island Arterials with bicycle preference and Commercial/Main or School/Recreational Zone, modal preference will be in the following order: bicycles, pedestrians, transit, and automobiles.

g. On Island Arterials with Primary Transit or Transit Exclusive Right-of-Way and Commercial/Main or School/Recreation Zone, modal preference will be in the following order: transit, pedestrians, bicycles, automobiles.

h. On Island Collectors, modal preference will be in the following order: bicycles, pedestrians, transit, and automobiles.

i. On Local Streets, modal preference will be in the following order: pedestrians, bicycles, transit, and automobiles.

Impact Analysis

This following impact analysis focuses on potential impacts of the proposed project related to transportation and circulation. The evaluation considered the City's new Transportation Element policies, current Appendix G significance conditions at the project site, and applicable regulations and guidelines. The discussion of potential impacts generally follows the travel mode preferences set forth in the City's new Transportation Element policies and Street Classifications. Those impacts are described first for the direct project impacts, second for any secondary impacts, and third the project's contribution to cumulative impacts.

Analysis Methodology

The transportation analysis was conducted for typical weekday a.m. and p.m. peak commute hour conditions at local intersections and on the regional arterials. Those time periods are the most relevant for this analysis because traffic volumes (both background and project-generated) are generally the highest during those periods; therefore, evaluation of potentially significant impacts is most complete. In addition, standard traffic analytical tools focus on the weekday peak hours.

This analysis assumes full project buildout in three years. Conditions in 2013 with and without the proposed project were used to analyze direct project impacts. Cumulative traffic operating conditions, and the project's contribution to those cumulative conditions, were analyzed on the basis of forecasts of 2030 conditions.

Baseline Conditions

The purpose of this scenario is to characterize traffic conditions that are expected to occur in the future when the Boatworks Residential Project would receive occupancy approval in 2013, based on adding traffic generated by the following approved projects to existing traffic volumes at the study intersections:

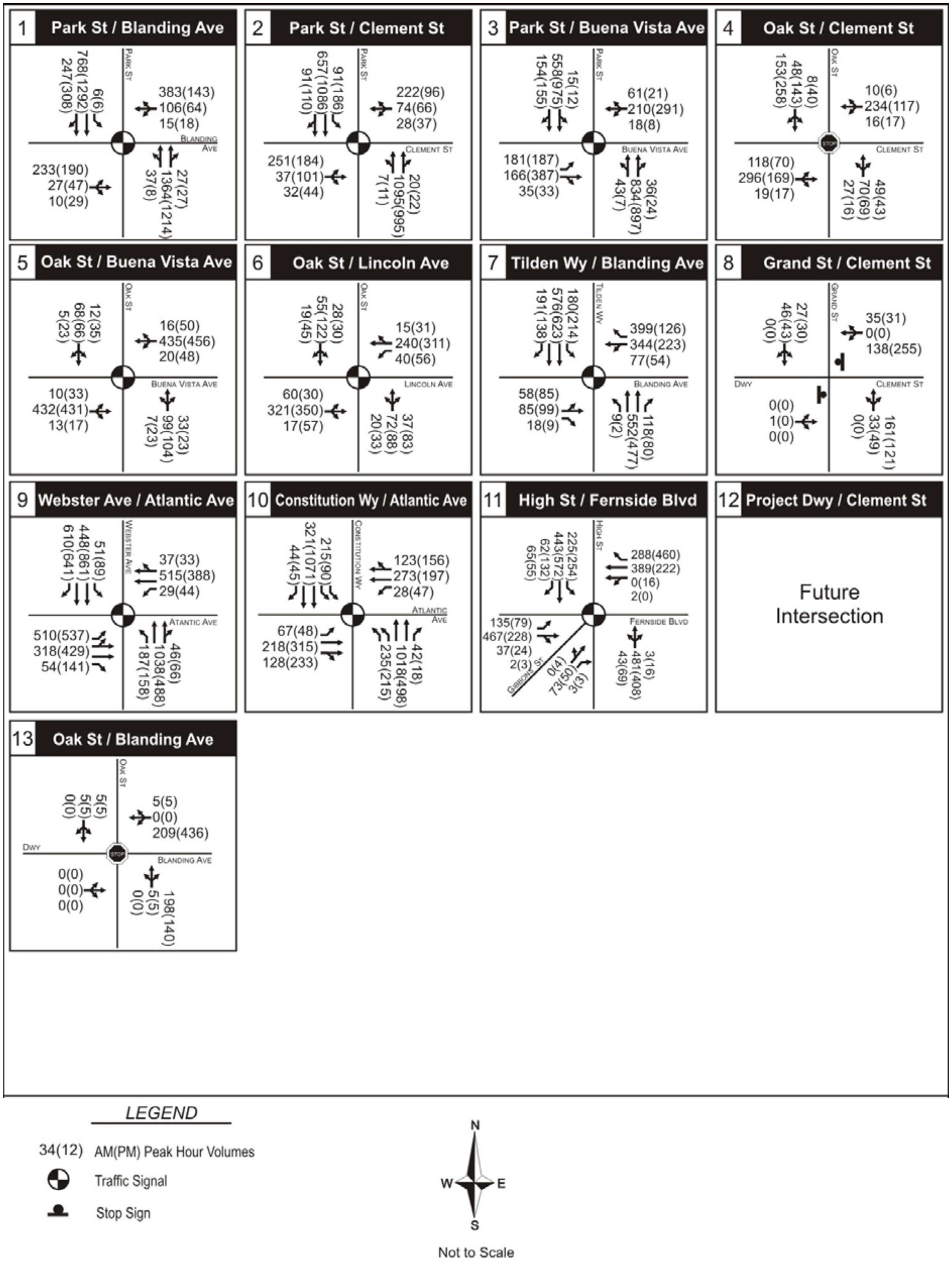
- **Grand Marina** – The project consists of 40 Single-Family units. Trip distribution assumptions were obtained from the project's Initial Study / Mitigated Negative Declaration, April 2006.
- **Del Monte Rehabilitation –** The project description and trip assignment were obtained from the *Alameda Northern Waterfront General Plan Amendment EIR*, approved 2008. The Del Monte project trip generation was compared to the Northern Waterfront project trip generation. Based on this comparison, trips from the Del Monte project were obtained by applying a factor of 30 percent to the trips from the Northern Waterfront project.
- **Alameda Landing –** The trip assignment for this mixed-use development was obtained from the project's Supplemental EIR, certified May 2006.
- **Alameda Town Center Expansion –** The trip assignment for this 100,000 square-foot retail expansion project was obtained from the project's EIR, approved May 2008.
- **Perforce Expansion –** This project consists of 110,000 square feet of office space and is located at the northeast corner of the intersection of Oak Street and Blanding Avenue. Because the Perforce Expansion project is located in the vicinity of the proposed Boatworks Residential Project, it was assumed that the trip distribution for this project is similar to the trip distribution presented on page 4.B-17 below.

The 2013 Baseline volumes were derived by applying a growth factor of 1.5 percent (i.e., 0.25 percent per year from 2007 to 2013) to the existing counts. The trips from the above-described approved projects were then added to these factored counts to obtain the 2013 Baseline volumes. Some of the study intersections were not included in the study areas for the approved projects, and in those cases, the approved project volumes at these study intersections were derived using arriving and departing volumes from adjacent intersections. **Figure 4.B-3** shows the Baseline peak-hour volumes at the study intersections.

Baseline Plus Project Conditions

Project Vehicle Trip Generation

Project trip generation was estimated on the basis of information published by the Institute of Transportation Engineers (ITE, 2008). The proposed project consists of duplexes and detached houses. While this suggests using trip generation for multi-family residential units, it is believed that the trip-making characteristics of the project would be more conservatively estimated using the single-family detached data from ITE. **Table 4.B-3** shows the trip generation rates and vehicle trips for the proposed project. The project would generate about 2,316 daily trips, of which about 182 and 245 trips would occur during the a.m. and p.m. peak hours, respectively.



SOURCE: Dowling Associates, Inc

Boatworks Residential Project . 208559

Figure 4.B-3
Baseline (2010) Peak-Hour Volumes

TABLE 4.B-3
VEHICLE TRIP GENERATION FOR PROPOSED PROJECT[a]

Land Use	Size [b]	Daily	AM Peak Hour			PM Peak Hour		
			Total	In	Out	Total	In	Out
Proposed Project	242 du							
• *Trip Rates*		*9.57*	*0.75*	*25%*	*75%*	*1.01*	*63%*	*37%*
• Vehicle Trips		2,316	182	46	136	245	155	90

[a] The proposed project consists of a 50/50 split of duplexes and detached homes. While this suggests using trip generation for multi-family residential units, it is believed that the trip-making characteristics of the project would be more accurately estimated using trip rates for single family detached houses, which also provides a degree of conservatism to the analysis.
[b] DU = Dwelling units

SOURCE: Dowling Associates, Inc., using data from ITE, *Trip Generation*, 8th Edition, 2008

Project Vehicle Trip Distribution and Assignment

The trip distribution percentages were derived from the Alameda citywide model that was developed and used for the General Plan Amendment (GPA) for the Transportation Element:

- Park Street Bridge: 56%
- Fruitvale Avenue Bridge: 10%
- Park Street South: 13%
- Webster/Posey Tubes (north): 3%
- Alameda Point Area (west of Webster Avenue): 4%
- Webster Street (south of Buena Vista Avenue): 14%

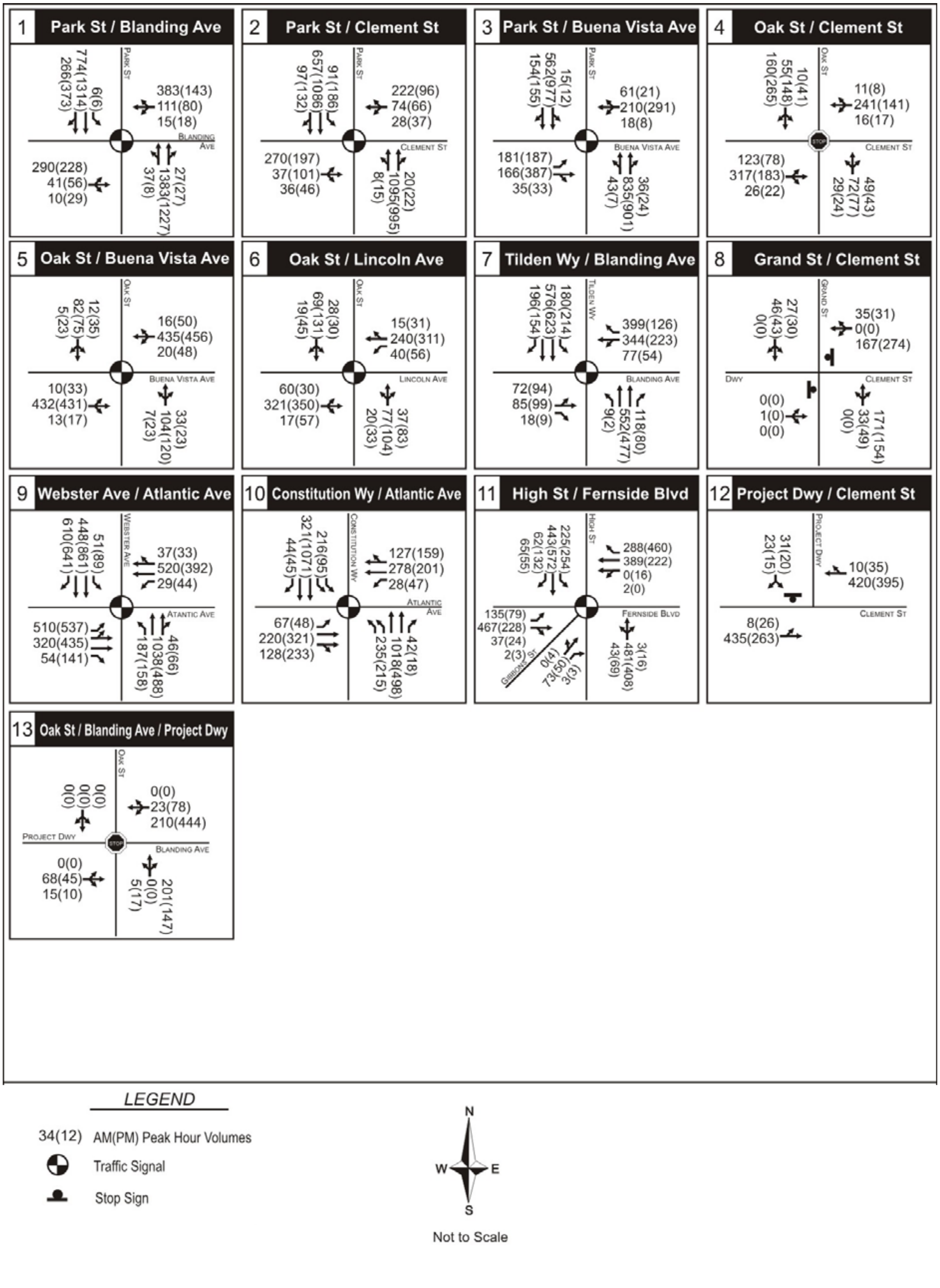
Trips were assigned to the roadway network based on logical paths to and from the various areas. **Figure 4.B-4** shows the Baseline plus project peak-hour volumes at the study intersections.

Multimodal Analysis

Because traffic operations at key intersections do not fully cover the effects of new development on transportation, a multimodal analysis covering the effects on pedestrians, bicyclists, and transit service was conducted.

Because of the flat terrain of Alameda, the bicycle and pedestrian travel modes are particularly feasible for able-bodied travelers. The Park Street and Miller-Sweeney Bridges provide good connections for cyclists traveling to Oakland and/or to the Fruitvale BART station. The nearby AC Transit routes offer reasonable travel opportunities for future residents of the proposed project. Sidewalks should be provided along the project frontages along Oak Street and Clement Avenue to improve pedestrian access and circulation in the vicinity of the project.

Procedures for prioritizing improvements to different (potentially competing) modes of travel were recommended to the City’s Transportation Commission in April 2009. Travel modes were given different rankings for different road classifications (i.e., Regional Arterials, Island Arterials, Island Collectors, and Local Streets), with variations in the ranking based on subheadings of the



SOURCE: Dowling Associates, Inc

Boatworks Residential Project . 208559

Figure 4.B-4
Baseline (2010) Plus Project Peak-Hour Volumes

road classifications (i.e., a modal layer and a land use layer). The recommended procedures apply to situations when acceptable levels of service cannot be achieved for all travel modes, and when a mitigation for an impact to a travel mode would cause an impact to a different travel mode, making it necessary to determine which mode receives priority.

Pedestrian Travel. The 2000 *Highway Capacity Manual* method was used to compute pedestrian delay and level of service at the signalized study intersections (TRB, 2000). Pedestrian LOS is based on the average delay, in seconds per person, that pedestrians will encounter as they wait to cross a signalized intersection. Delay (tied to a LOS letter grade, as shown in **Table 4.B-4**) is computed using the following two data requirements:

1. Effective green time for pedestrians for each crossing "leg"; and
2. The actuated cycle length of the signal.

TABLE 4.B-4
LEVEL OF SERVICE (LOS) CRITERIA FOR PEDESTRIANS AT SIGNALIZED INTERSECTIONS

LOS	Pedestrian Delay
A	< 10
B	≥ 10 and ≤ 20
C	> 20 and ≤ 30
D	> 30 and ≤ 40
E	> 40 and ≤60
F	> 60

SOURCE: Transportation Research Board, *2000 Highway Capacity Manual*, 2000

Impact 4.B-1: Operation of the proposed project would increase pedestrian traffic in the project area. (Less than Significant)

Table 4.B-5 shows the existing pedestrian delay and LOS conditions at signalized study intersections. The pedestrian crosswalks currently operate at an acceptable LOS B or better during both the a.m. and p.m. peak hours at six of the nine signalized study intersections. All of the crosswalks at the intersections of Atlantic Avenue / Webster Street and Atlantic Avenue / Constitution Way operate at an unacceptable LOS C or worse during both the a.m. and p.m. peak hours. The east crosswalk (carrying north-south pedestrian flow) across Fernside Boulevard at High Street operates at an unacceptable LOS C during the a.m. peak hour, and the north crosswalk (carrying east-west pedestrian flow) across High Street at Fernside Boulevard operates at an unacceptable LOS C during the p.m. peak hour.

The proposed project would increase vehicular and pedestrian traffic in the project area, but would not change the signal phasing and timing configurations at area intersections. As shown in

TABLE 4.B-5
EXISTING PEDESTRIAN LEVEL OF SERVICE (LOS) AND DELAY (seconds/person) BY CROSSWALK

No.	Intersection	Peak Hour	South[a] LOS	South[a] Delay	North[a] LOS	North[a] Delay	East[a] LOS	East[a] Delay	West[a] LOS	West[a] Delay
#1	Park Street and Blanding Avenue	AM PM	B B	16 16	B B	16 16	A A	8 8	A A	8 8
#2	Park Street and Clement Avenue	AM PM	B B	15 16	B B	15 16	B B	10 10	A A	6 5
#3	Park Street and Buena Vista Avenue	AM PM	B B	12 12	B B	12 12	A A	8 8	A A	8 8
#5	Oak Street and Buena Vista Avenue	AM PM	A A	4 4	A A	4 4	B B	17 17	B B	17 17
#6	Oak Street and Lincoln Avenue	AM PM	A A	6 6	A A	6 6	B B	14 14	B B	14 14
#7	Tilden Way and Blanding Avenue	AM PM	B B	11 13	B B	11 13	B B	12 10	A A	7 5
#9	Atlantic Avenue and Webster Avenue	AM PM	D D	32 33	D D	36 39	C C	24 24	C C	29 26
#10	Atlantic Avenue and Constitution Way	AM PM	C C	30 27	C C	27 25	C C	24 22	C C	21 21
#11	High Street and Fernside Boulevard	AM PM	A A	6 6	B C	20 22	B B	22 16	B A	13 7

[a] The crosswalk name signifies its location relative the intersection (e.g., the South Crosswalk is located on the south side of the intersection, and is used by pedestrians crossing eastbound or westbound).

SOURCE: Dowling Associates, Inc. 2009

Table 4.B-6, the pedestrian delay and LOS conditions at signalized study intersections would remain the same under baseline and baseline-plus-project conditions, and the project would have a less-than-significant pedestrian impact.

The project would not cause a marked or unmarked crosswalk to be removed, and would add a sidewalk on the western side of Oak Street from Clement Avenue to the Estuary, and would provide pedestrian access along the waterfront where none currently exists.

Mitigation: None required.

Bicycle Travel

The Florida Department of Transportation (DOT) method for computing bicycle levels of service was used to calculate the LOS for the following three segments (FDOT, 2002).

- Clement Avenue between Grand Avenue and Park Street
- Oak Street between Blanding Avenue and Buena Vista Avenue
- Blanding Avenue between Oak Street and Park Street

TABLE 4.B-6
BASELINE AND BASE PLUS PROJECT PEDESTRIAN LEVELS OF SERVICE (LOS) BY CROSSWALK

Intersection	Crosswalk[a]	AM Peak Hour				PM Peak Hour			
		Baseline		Base Plus Project		Baseline		Base Plus Project	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Park St. and Blanding Ave.	South	22	C	22	C	16	B	16	B
	North	22	C	22	C	16	B	16	B
	East	17	B	17	B	8	A	8	A
	West	17	B	17	B	8	A	8	A
Park St. and Clement Ave.	South	15	B	15	B	15	B	15	B
	North	15	B	15	B	15	B	15	B
	East	10	B	10	B	11	B	11	B
	West	6	A	6	A	5	A	5	A
Park St. and Buena Vista Ave.	South	12	B	12	B	12	B	12	B
	North	12	B	12	B	12	B	12	B
	East	8	A	8	A	8	A	8	A
	West	8	A	8	A	8	A	8	A
Oak St. and Buena Vista Ave.	South	4	A	4	A	4	A	4	A
	North	4	A	4	A	4	A	4	A
	East	17	B	17	B	17	B	17	B
	West	17	B	17	B	17	B	17	B
Oak St. and Lincoln Ave.	South	6	A	6	A	6	A	6	A
	North	6	A	6	A	6	A	6	A
	East	14	B	14	B	14	B	14	B
	West	14	B	14	B	14	B	14	B
Tilden Way and Blanding Ave.	South	11	B	11	B	13	B	13	B
	North	11	B	11	B	13	B	13	B
	East	13	B	13	B	10	B	10	B
	West	8	A	8	A	5	A	5	A
Atlantic Ave. and Webster Ave.	South	37	D	37	D	34	D	34	D
	North	41	E	41	E	43	E	43	E
	East	22	C	22	C	29	C	29	C
	West	30	C	30	C	30	C	30	C
Atlantic Ave. and Constitution Way	South	31	D	31	D	32	D	32	D
	North	33	D	33	D	36	D	36	D
	East	26	C	26	C	26	C	26	C
	West	25	C	25	C	23	C	23	C
High St. and Fernside Blvd.	South	6	A	6	A	6	A	6	A
	North	22	C	22	C	22	C	22	C
	East	19	B	19	B	16	B	16	B
	West	11	B	11	B	8	A	8	A

[a] The crosswalk name signifies its location relative the intersection (e.g., the South Crosswalk is located on the south side of the intersection, and is used by pedestrians crossing eastbound or westbound).

SOURCE: Dowling Associates, Inc., 2009.

The Florida DOT method for bicycle LOS is based on bicyclists' perceptions of their level of comfort along a roadway segment (not at intersections). A numerical score (tied to a LOS letter grade, as shown in **Table 4.B-7**), is computed using the following five variables:

1. Average effective width of the outside through lane (and presence of a bike lane),
2. Motorized vehicle volumes,
3. Motorized vehicle speeds,
4. Heavy vehicle (truck) volumes, and
5. Pavement condition.

TABLE 4.B-7
LEVEL OF SERVICE (LOS) CRITERIA FOR BICYCLES ON ROADWAY SEGMENTS

LOS	Bicycle LOS Score
A	≤ 1.5
B	> 1.5 and ≤ 2.5
C	> 2.5 and ≤ 3.5
D	> 3.5 and ≤ 4.5
E	> 4.5 and ≤5.5
F	> 5.5

SOURCE: Florida Department of Transportation, *2002 Quality/Level of Service Handbook*, 2002

Impact 4.B-2: The addition of project-generated traffic would affect bicycle level of service on area road segments. (Less than Significant)

As shown in **Table 4.B-8**, changes to bicycle score caused by addition of project-generated traffic would be less than the 10-percent threshold of significance. Thus, the project would have a less-than-significant affect on bicycle level of service.

Mitigation: None required.

Transit Travel

The 2000 *Highway Capacity Manual* arterial level-of-service analysis method (based on the average speed for the segment under consideration, computed from the running times on the street segment and the control delay of through movements at signalized intersections) was used to calculate the level of service along the following two transit corridors (TRB, 2000).

- Park Street between Blanding Avenue and Buena Vista Avenue
- Buena Vista Avenue between Grand Street and Tilden Way

TABLE 4.B-8
BASELINE AND BASE PLUS PROJECT BICYCLE LEVEL OF SERVICE (LOS)

Scenario	Corridor	AM Peak Hour LOS	AM Peak Hour Score	PM Peak Hour LOS	PM Peak Hour Score
Existing	Clement Avenue: Grand Street – Park Street	D	3.9	D	3.8
	Oak Street: Blanding Avenue – Buena Vista Avenue	C	3.3	D	3.6
	Blanding Avenue: Oak Street – Park Street	D	3.7	D	3.7
Baseline	Clement Avenue: Grand Street – Park Street	D	4.0	D	3.8
	Oak Street: Blanding Avenue – Buena Vista Avenue	C	3.4	D	3.6
	Blanding Avenue: Oak Street – Park Street	D	3.7	D	3.8
Baseline Plus Project	Clement Avenue: Grand Street – Park Street	D	4.0	D	3.8
	Oak Street: Blanding Avenue – Buena Vista Avenue	C	3.4	D	3.7
	Blanding Avenue: Oak Street – Park Street	D	3.8	D	3.9

SOURCE: Dowling Associates, Inc.

Table 4.B-9 shows the results of the transit level of service analysis. All but one change to travel speeds caused by addition of project-generated traffic would be less than the 10-percent threshold of significance.

TABLE 4.B-9
BASELINE AND BASE PLUS PROJECT TRANSIT LEVEL OF SERVICE (LOS)

Scenario	Corridor	Direction	AM Peak Hour LOS	AM Peak Hour Arterial Speed	PM Peak Hour LOS	PM Peak Hour Arterial Speed
Existing	Park Street: Blanding Ave. – Buena Vista Ave.	NB	D	9.5	D	11.0
		SB	C	14.2	D	12.6
	Buena Vista Ave: Grand St. – Tilden Way	EB	C	18.7	C	18.7
		WB	C	18.4	B	19.3
Baseline	Park Street: Blanding Ave. – Buena Vista Ave.	NB	F	4.7	E	8.7
		SB	C	14.8	C	15.6
	Buena Vista Ave: Grand St. – Tilden Way	EB	C	18.6	C	18.6
		WB	C	17.8	B	19.0
Baseline Plus Project	Park Street: Blanding Ave. – Buena Vista Ave.	NB	F	4.4	***E***	***7.5***
		SB	C	14.7	C	15.7
	Buena Vista Ave: Grand St. – Tilden Way	EB	C	18.6	C	18.6
		WB	C	17.8	B	19.0

Bold signifies significant impacts

SOURCE: Dowling Associates, Inc.

Impact 4.B-3: The addition of project-generated traffic would cause the p.m. peak-hour arterial speed on northbound Park Street between Buena Vista Avenue and Blanding Avenue to degrade by about 1.2 mph, a 14 percent decrease, from Baseline conditions. (Significant)

Mitigation Measure 4.B-3a (TDM): Prior to project occupancy, the project applicant shall put into place a City-approved Transportation Demand Management program with the goal of reducing the number of peak hour trips by 10 percent. This will include the following measures:

- Establish a Boatworks Home Owners Association (HOA) and CCRs for the project;
- Assess the HOA an annual fee in an amount necessary to provide the following on-going programs:
  - EasyPass program (unlimited transit pass, usable on AC Transit buses), two passes per unit, additional passes per unit for residents may be purchased at cost;
  - Bicycle facilities in each unit;
  - One car-share membership per residential unit; and
  - Provide annual funding for transportation coordination services including, but not limited to, promotional information packages and planning services regarding available transportation options, and annual monitoring reports to City regarding effectiveness of programs and recommended enhancements to meet 10% reduction goal.

Mitigation Measure 4.B-3b: Where feasible, restripe the Park Street intersection approaches between Buena Vista Avenue and Blanding Avenue to provide transit queue jump lanes during the p.m. peak period (southbound) and a.m. peak period (northbound). Regardless of the feasibility of queue jump lanes, modify the traffic signals, controllers, signage, and signal timing at the Park Street intersections at Blanding, Clement, and Buena Vista Avenues to allow for transit signal priority to improve transit flow. Restriping would require the prohibition of on-street parking on the northbound side of the street during the a.m. peak period, and on the southbound side during the p.m. peak period to accommodate the transit queue jump lanes.

Implementation of Mitigation Measure 4.B-3b would increase peak-hour arterial speed on Park Street, mitigating the project transit impact. Implementation of this measure would have a less-than-significant secondary impact on bicycle travel LOS, but would have a significant secondary impact on pedestrian travel LOS on the south and north crosswalks (carrying east-west pedestrian flow) across Park Street at the intersections of Blanding, Clement, and Buena Vista Avenues. However, as discussed above, procedures for prioritizing improvements to the different (potentially competing) travel modes were recommended to the City's Transportation Commission, and for Park Street (Regional Arterial), the modal preference would be in the following order: transit, pedestrians, bicycles and automobiles. Because Mitigation Measure 4.B-3b would mitigate the highest priority mode (transit), its implementation would outrank the pedestrian travel mode, and therefore the transit impact would be mitigated to a less-than-significant level, and the secondary pedestrian impact would be significant and unavoidable. The proposed signal timing and transit priority signals would also increase congestion for automobiles traveling on the cross streets.

Transit Travel Impact Significance after Mitigation: Less than Significant.

Pedestrian Travel Secondary Impact after Transit Mitigation: Significant and Unavoidable.

Bicycle Travel Secondary Impact after Transit Mitigation: Less than Significant.

Vehicular Travel Secondary Impact after Transit Mitigation: Significant and Unavoidable.

Vehicular Travel

As shown in **Table 4.B-10**, all except one of the study intersections would operate at acceptable levels of service during both the a.m. and p.m. peak hours. The peak-hour service levels at the Park Street / Blanding Avenue intersection would worsen significantly with the addition of project-generated traffic (as described below). LOS calculation reports are provided in **Appendix D**.

Impact 4.B-4: The addition of project-generated traffic would cause level of service at the signalized intersection of Park Street and Blanding Avenue (#1) to degrade from LOS E to LOS F during the a.m. peak hour, and from LOS D to LOS E during the p.m. peak hour. (Significant)

> **Mitigation Measure 4.B-4:** The project applicant shall provide full funding to restripe the Blanding Avenue approaches (eastbound and westbound) at Park Street to provide left turn pockets, modify the traffic signal to be fully actuated, provide protected left-turn phasing, modify the traffic control at the private driveway of the Waters Edge Nursing Home to stop-sign control, include audible pedestrian push buttons and pedestrian count down heads, and optimize the signal timing to improve the flow of traffic without causing a significant impact to pedestrian or transit level of service. The restriping would require the removal of 12 on-street parking spaces.

Implementation of Mitigation Measure 4.B-4 would improve vehicular operating conditions at the intersection of Park Street and Blanding Avenue by reducing average delay at the intersection by about 28 percent in the a.m. peak hour and by about 45 percent in the p.m. peak hour (improving the service level in each case from LOS F to LOS E). However, as discussed above, procedures for prioritizing improvements to the different (potentially competing) travel modes were recommended by the City's Transportation Commission, and for Park Street (Regional Arterial), the modal preference would be in the following order: transit, pedestrians, bicycles and automobiles. Therefore, the suitability of implementing Mitigation Measure 4.B-4 was judged in the context of impacts to travel modes ranked higher than automobiles.

TABLE 4.B-10
BASELINE AND BASE PLUS PROJECT PEAK-HOUR INTERSECTION LEVELS OF SERVICE (LOS)

Intersection	Traffic Control	AM Peak Hour				PM Peak Hour			
		Baseline		Base Plus Project		Baseline		Base Plus Project	
		Delay[a]	LOS	Delay[a]	LOS	Delay[a]	LOS	Delay[a]	LOS
1. Park Street and Blanding Avenue	Signal	70.4	E	***91.8***	***F***	35.1	D	***56.7***	***E***
2. Park Street and Clement Avenue	Signal	42.2	D	49.6	D	17.6	B	18.1	B
3. Park Street and Buena Vista Avenue	Signal	9.2	A	9.3	B	11.2	B	11.2	B
4. Oak Street and Clement Avenue	AWSC	17.9	C	22.0	C	15.4	C	18.4	C
5. Oak Street and Buena Vista Avenue	Signal	8.3	A	8.5	A	9.6	A	10.1	B
6. Oak Street and Lincoln Avenue	Signal	10.9	B	10.9	B	9.1	A	9.4	A
7. Tilden Way and Blanding Avenue	Signal	15.4	B	15.4	B	12.4	B	12.5	B
8. Grand Street and Clement Avenue	SSSC	11.5	B	12.0	B	13.5	B	14.5	B
9. Atlantic Avenue and Webster Avenue	Signal	52.2	D	52.5	D	47.3	D	47.5	D
10. Atlantic Avenue and Constitution Way	Signal	48.8	D	49.3	D	41.2	D	41.4	D
11. High Street and Fernside Boulevard	Signal	42.0	D	42.0	D	25.2	C	25.2	D
12. Clement Avenue and Project Access	SSSC	N/A	N/A	16.6	C	N/A	N/A	14.2	B
13. Oak Street – Blanding Avenue and Project Access	SSSC	N/A	N/A	13.3	B	N/A	N/A	16.5	C

[a] The LOS/Delay for Side-Street Stop-Control (SSSC) intersections represents the worst movement or approach; for Signalized intersections, the LOS/Delay represents the overall intersection.

Bold signifies significant impacts

SOURCE: Dowling Associates, Inc., 2009.

As described above, Mitigation Measure 4.B-4 is recommended to mitigate impacts to the vehicular transportation mode. To reduce delays to pedestrians or transit, in accordance with the Transportation Commission's priority order for thresholds of significance, the mitigation also proposes to modify the traffic control at the private driveway of the Waters Edge Nursing Home. While the transportation impacts for all transportation modes at the intersection of Park Street and Blanding Avenue would be lessened (in priority order), they might not all be reduced to a less-than-significant level. Transportation Policy 4.4.2.g recognizes this possibility and states "some congestion may be identified in an EIR process as not possible to mitigate. This unmitigated congestion should be evaluated and disclosed (including intersection delay length of time) during the EIR process, and acknowledged as a by-product of the development and accepted with the on-going funding of TDM measures."

Vehicular Travel Impact Significance after Mitigation: Significant and Unavoidable.

Pedestrian Travel Secondary Impact after Automobile Mitigation: Less than Significant

Bicycle Travel Secondary Impact after Automobile Mitigation: Less than Significant.

Transit Travel Secondary Impact after Automobile Mitigation Less than Significant.

Project Construction Impacts

Impact 4.B-5: The construction of the proposed project would generate temporary increases in traffic volumes on area roadways. (Potentially Significant)

Project construction activities would generate off-site traffic that would include the initial delivery of construction vehicles and equipment to the project site, the daily arrival and departure of construction workers, and the delivery of materials throughout the construction period and removal of construction debris. Deliveries would include shipments of concrete, lumber, and other building materials for on-site structures, utilities (e.g., plumbing equipment and electrical supplies), and paving and landscaping materials.

Construction-generated traffic would be temporary and therefore would not result in any long-term degradation in operating conditions on roadways in the project site vicinity. The impact of construction-related traffic would be a temporary and intermittent lessening of the capacities of streets in the project site vicinity because of the slower movements and larger turning radii of construction trucks compared to passenger vehicles. Most construction traffic would be dispersed throughout the day. Thus, the temporary increase would not significantly disrupt daily traffic flow on roadways in the project site vicinity in the long term.

Although the impact would be temporary, truck movements could have an adverse effect on traffic flow in the project site vicinity. As such, the impact is considered to be potentially significant.

Mitigation Measure 4.B-5: The project applicant and construction contractor(s) shall develop a construction management plan for review and approval by the Public Works Department prior to issuance of any permits. The plan shall include at least the following items and requirements to reduce traffic congestion during construction:

1. A set of comprehensive traffic control measures shall be developed, including scheduling of major truck trips and deliveries to avoid peak traffic hours, detour signs if required, lane closure procedures, signs, cones for drivers, and designated construction access routes.

2. The Construction Management Plan shall identify haul routes for movement of construction vehicles that would minimize impacts on motor vehicle, bicycle, and pedestrian traffic, circulation, and safety, and specifically to minimize impacts to the greatest extent possible on streets in the project area. The haul routes shall be approved by the City.

3. The Construction Management Plan shall provide for notification procedures for adjacent property owners and public safety personnel regarding when major deliveries, detours, and lane closures would occur.

4. The Construction Management Plan shall provide for monitoring surface streets used for haul routes so that any damage and debris attributable to the haul trucks can be identified and corrected by the project applicant.

Significance after Mitigation: Less than Significant.

Access and Circulation

Access to and from the proposed project would be located at two intersections, one new and one modified. The new intersection would be on Clement Avenue about halfway between Oak Street and Elm Street. Traffic leaving the project site at this intersection would be controlled by a stop sign; traffic on Clement Avenue would be uncontrolled. The modified intersection would be at the existing intersection of Oak Street and Blanding Avenue. This “intersection” is essentially a right angle turn on a continuous roadway, with a driveway that serves the back of a commercial center aligned with Oak Street. Under project conditions, the project access driveway would form a fourth leg of the intersection, and it is assumed that traffic leaving the project site at this intersection would be controlled by a stop signs; traffic on Oak Street would be uncontrolled.

Providing two access points is a favorable access configuration because it provides route alternatives for users. Based on the assignment of project vehicle trips, neither access point would experience a high enough traffic volume during peak periods to require an additional access point.

Based on the preliminary layout of the proposed project, no significant impacts are evident with respect to the onsite circulation. Using truck and bus turning templates, it appears that large vehicles would be able to maneuver sufficiently within the site, although by using the full widths of the circulation roadways as is typical for a development of this size. The detailed plans that are provided during later phases of project development will be reviewed for compatibility with large vehicles.

Cumulative Impacts (Year 2030)

Traffic Forecasts and Assumptions

This scenario is often called the "cumulative" scenario, as it is intended to incorporate all reasonably foreseeable future growth, even if specific projects are not known at this time. Cumulative scenario forecasts (and specifically cumulative volumes at the study intersections) were obtained from the 2030 Cumulative City of Alameda travel demand model developed during the update of the Transportation Element. The cumulative volumes at the unsignalized study intersections (not analyzed in the GPA work) were estimated using a combination of volumes obtained from the adjacent signalized intersections and the link volume model forecasts from the GPA work. For the Cumulative conditions analysis without and with the project, it is assumed that Clement Avenue will be extended from Grand Street to the intersection of Sherman Street / Atlantic Avenue, and from Broadway to Tilden Way. **Figures 4.B-5** and **4.B-6** show the Cumulative Baseline (2030) and the Cumulative Baseline Plus Project peak-hour volumes at the study intersections, respectively.

Multimodal Analysis

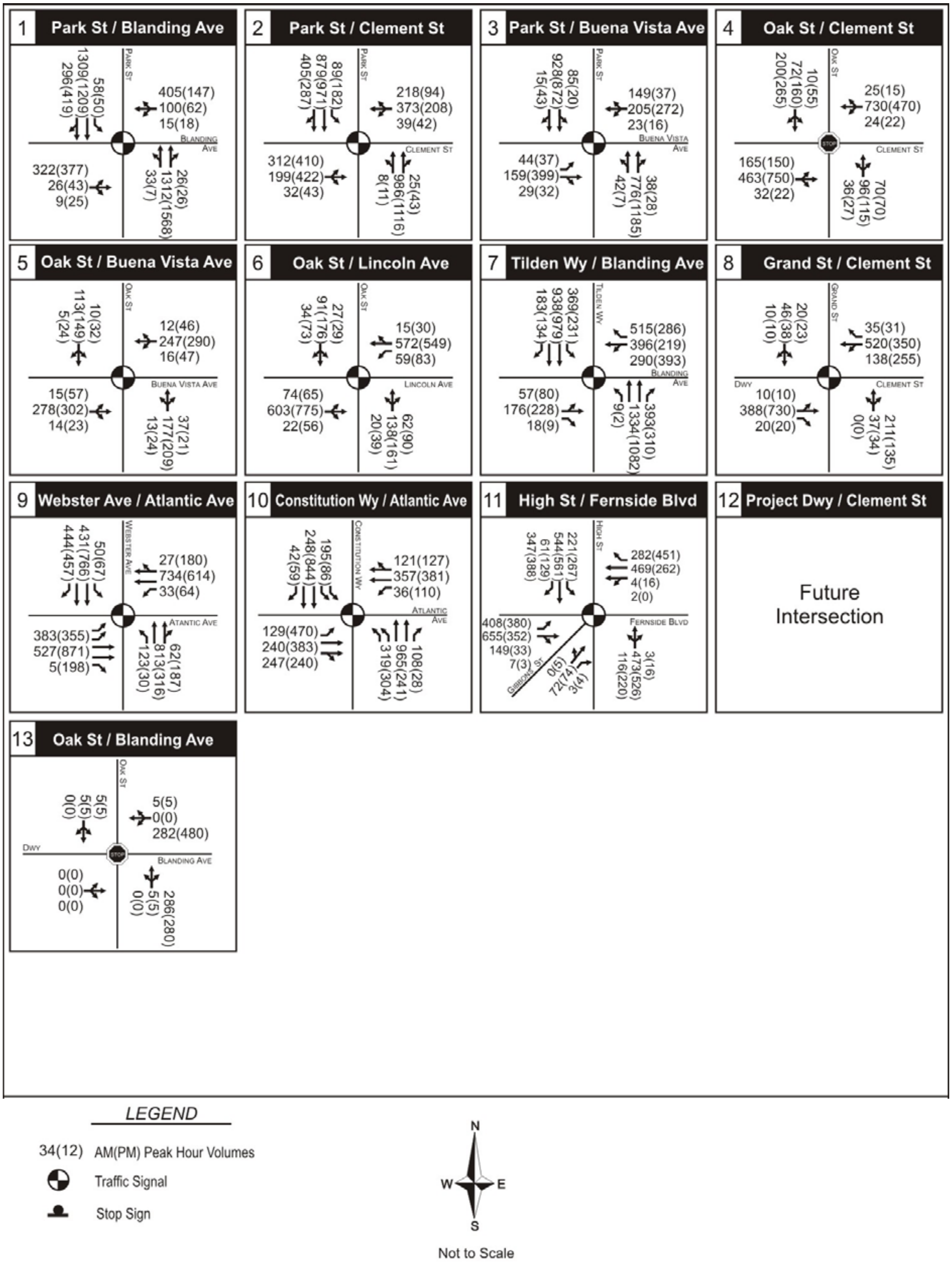
As described above, traffic operations at key intersections do not fully cover the effects of new development on transportation. The following discussion presents multimodal analyses of the cumulative effects on transit service, bicyclists, and pedestrians.

Pedestrian Travel

The same analysis method described on page 4.B-19 for Baseline conditions was used for cumulative analysis of the signalized study intersections. **Table 4.B-11** shows the Cumulative (2030) Baseline and Base Plus Project pedestrian delay and LOS conditions.

Impact 4.B-6: Operation of the proposed project would contribute to increased pedestrian traffic in the project area under cumulative conditions. (Less than Significant)

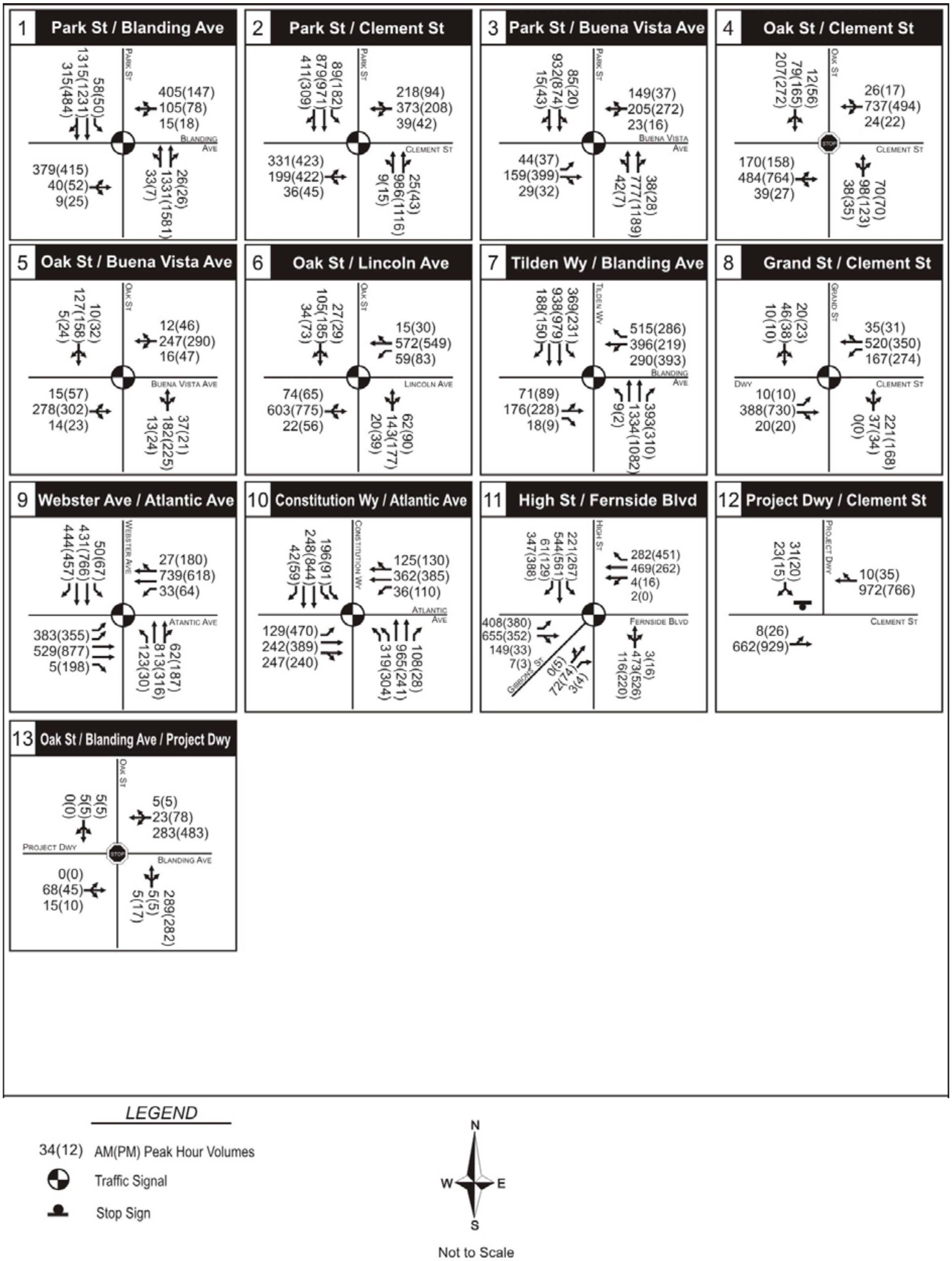
The pedestrian crosswalks are projected to operate at an acceptable LOS B or better during both the a.m. and p.m. peak hours at three of the nine signalized study intersections under Cumulative Baseline conditions. All of the crosswalks at the intersections of Atlantic Avenue / Webster Street and Atlantic Avenue / Constitution Way would operate at an unacceptable LOS C or worse during both the a.m. and p.m. peak hours. The crosswalks at the other four signalized study intersections generally would operate at an acceptable LOS B during both the a.m. and p.m. peak hours, but individual crosswalks would operate at an unacceptable LOS C or worse. The proposed project would increase pedestrian traffic in the project area, but would not change the signal phasing and timing configurations at area intersections. As shown in Table 4.B-11, the pedestrian



SOURCE: Dowling Associates, Inc

Boatworks Residential Project . 208559

Figure 4.B-5
Cumulative Baseline (2030) Peak-Hour Volumes



SOURCE: Dowling Associates, Inc

Boatworks Residential Project . 208559

Figure 4.B-6
Cumulative Baseline (2030) Plus Project Peak-Hour Volumes

TABLE 4.B-11
CUMULATIVE (2030) BASE PLUS PROJECT PEDESTRIAN LEVELS OF SERVICE (LOS) BY CROSSWALK

Intersection	Crosswalk[a]	AM Peak Hour				PM Peak Hour			
		Cumulative (2030) Baseline		Cumulative Base Plus Project		Cumulative (2030) Baseline		Cumulative Base Plus Project	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Park St. and Blanding Ave.	South	21	C	21	C	23	C	23	C
	North	21	C	21	C	23	C	23	C
	East	18	B	18	B	16	B	16	B
	West	18	B	18	B	16	B	16	B
Park St. and Clement Ave.	South	14	B	14	B	15	B	15	B
	North	14	B	14	B	15	B	15	B
	East	26	C	26	C	27	C	27	C
	West	20	B	20	B	20	B	20	B
Park St. and Buena Vista Ave.	South	12	B	12	B	12	B	12	B
	North	12	B	12	B	12	B	12	B
	East	8	A	8	A	8	A	8	A
	West	8	A	8	A	8	A	8	A
Oak St. and Buena Vista Ave.	South	4	A	4	A	4	A	4	A
	North	4	A	4	A	4	A	4	A
	East	17	B	17	B	17	B	17	B
	West	17	B	17	B	17	B	17	B
Oak St. and Lincoln Ave.	South	6	A	6	A	6	A	6	A
	North	6	A	6	A	6	A	6	A
	East	14	B	14	B	14	B	14	B
	West	14	B	14	B	14	B	14	B
Tilden Way and Blanding Ave.	South	18	B	18	B	11	B	11	B
	North	18	B	18	B	11	B	11	B
	East	27	C	27	C	20	B	20	B
	West	15	B	15	B	14	B	14	B
Atlantic Ave. and Webster Ave.	South	26	C	26	C	23	C	23	C
	North	29	C	29	C	25	C	25	C
	East	27	C	27	C	31	D	31	D
	West	34	D	34	D	29	C	29	C
Atlantic Ave. and Constitution Way	South	31	D	31	D	29	C	29	C
	North	33	D	33	D	37	D	37	D
	East	24	C	24	C	27	C	27	C
	West	27	C	27	C	31	D	31	D
High St. and Fernside Blvd.	South	6	A	6	A	4	A	4	A
	North	19	B	19	B	31	D	31	D
	East	23	C	23	C	17	B	17	B
	West	13	B	13	B	11	B	11	D

[a] The crosswalk name signifies its location relative the intersection (e.g., the South Crosswalk is located on the south side of the intersection, and is used by pedestrians crossing eastbound or westbound).

SOURCE: Dowling Associates, Inc., 2009.

delay and LOS conditions at signalized study intersections would remain the same under Cumulative Base Plus Project conditions as under Cumulative Baseline conditions, and the project would have a less-than-significant cumulative pedestrian impact. In addition, the project would not cause a marked or unmarked crosswalk to be removed. To ensure pedestrian facilities are provided consistent with the Pedestrian Plan, all sidewalks shall be five feet wide without reducing existing curb-to-curb width of Clement Avenue and providing 36-foot curb-to-curb width for Oak Street.

Mitigation: None required.

Bicycle Travel

The same analysis method described on page 4.B-20 for Baseline conditions was used for cumulative analysis of the same three segments.

Impact 4.B-7: The addition of project-generated traffic would contribute to cumulative effects on bicycle level of service on area road segments. (Less than Significant)

As shown in **Table 4.B-12**, changes to bicycle score caused by the addition of project-generated traffic under cumulative conditions would be less than the 10-percent threshold of significance. To ensure bicycle facilities can be provided consistent with the Bicycle Plan, Oak Street shall be maintained with a 36-foot curb-to-curb width

Mitigation: None required.

Transit Travel

The same analysis method described on page 4.B-12 for Baseline conditions was used for cumulative analysis of project impacts on transit travel. **Table 4.B-13** shows the results of the transit level of service analysis. All but one change to travel speeds caused by the addition of project-generated traffic would be less than the 10-percent threshold of significance.

Impact 4.B-8: The addition of project-generated traffic would cause the p.m. peak-hour arterial speed on northbound Park Street between Buena Vista Avenue and Blanding Avenue to degrade by about 0.3 mph, which is a 14 percent decrease from Cumulative Baseline conditions. (Significant)

> **Mitigation Measure 4.B-8a:** Implement Mitigation Measure 4.B-3a (TDM)
>
> **Mitigation Measure 4.B-8b:** Implement Mitigation Measure 4.B-3b (restripe Park Street between Buena Vista and Blanding Avenues to accommodate transit queue jump lanes, and modify the traffic signals and signal timing at the Park Street intersections at Blanding, Clement, and Buena Vista Avenues).

TABLE 4.B-12
CUMULATIVE (2030) BASE PLUS PROJECT BICYCLE LEVEL OF SERVICE (LOS)

Scenario	Corridor	AM Peak Hour		PM Peak Hour	
		LOS	Score	LOS	Score
Existing	Clement Avenue: Grand Street – Park Street	D	3.9	D	3.8
	Oak Street: Blanding Avenue – Buena Vista Avenue	C	3.3	D	3.6
	Blanding Avenue: Oak Street – Park Street	D	3.7	D	3.7
Cumulative (2030)	Clement Avenue: Grand Street – Park Street	D	4.1	D	4.2
	Oak Street: Blanding Avenue – Buena Vista Avenue	D	3.6	D	3.7
	Blanding Avenue: Oak Street – Park Street	D	3.8	D	3.8
Cumulative (2030) Plus Project	Clement Avenue: Grand Street – Park Street	D	4.2	D	4.2
	Oak Street: Blanding Avenue – Buena Vista Avenue	D	3.6	D	3.8
	Blanding Avenue: Oak Street – Park Street	D	3.8	D	3.9

SOURCE: Dowling Associates, Inc.

TABLE 4.B-13
CUMULATIVE (2030) BASE PLUS PROJECT TRANSIT LEVEL OF SERVICE (LOS)

Scenario	Corridor	Direction	AM Peak Hour		PM Peak Hour	
			LOS	Arterial Speed	LOS	Arterial Speed
Existing	Park Street: Blanding Ave. – Buena Vista Ave.	NB SB	D C	9.5 14.2	D D	11.0 12.6
	Buena Vista Ave: Grand St. – Tilden Way	EB WB	C C	18.7 18.4	C B	18.7 19.3
Cumulative (2030)	Park Street: Blanding Ave. – Buena Vista Ave.	NB SB	F D	1.7 9.5	F E	2.2 7.7
	Buena Vista Ave: Grand St. – Tilden Way	EB WB	C C	18.3 18.8	C B	18.4 19.4
Cumulative (2030) Plus Project	Park Street: Blanding Ave. – Buena Vista Ave.	NB SB	F D	1.7 9.4	***F*** E	***1.9*** 7.6
	Buena Vista Ave: Grand St. – Tilden Way	EB WB	C C	18.3 18.8	C B	18.4 19.4

Bold signifies significant impacts

SOURCE: Dowling Associates, Inc.

As described under Impact 4-B-3b, this mitigation measure would result in the following impacts:

Transit Travel Impact Significance after Mitigation: Less than Significant.

Pedestrian Travel Secondary Impact after Transit Mitigation: Significant and Unavoidable.

Bicycle Travel Secondary Impact after Transit Mitigation: Less than Significant.

Vehicular Travel Secondary Impact after Transit Mitigation: Significant and Unavoidable.

Vehicular Travel

As shown in **Table 4.B-14**, six of the 13 study intersections would operate at unacceptable levels of service during both the a.m. and p.m. peak hours as a result of assumed local and regional growth over the next 20 years. The peak-hour service levels at the intersections of Park Street / Blanding Avenue, Park Street / Clement Avenue, and Oak Street / Clement Avenue would worsen significantly with the addition of project-generated traffic (as described in Impact statements 4.B-9 through 4.B-11).

Also, the stop-controlled side-street approach at the unsignalized Clement Avenue / Project Access intersection (created as part of the project) would operate unacceptably (as described in Impact statement 4.B-12). The signalized intersection of High Street / Fernside Boulevard would operate at an unacceptable LOS F under both Cumulative Baseline and Cumulative Base-plus-Project conditions during both peak hours, but project traffic would contribute less than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions (i.e., a less-than-significant impact). LOS calculation reports are provided in **Appendix D**.

Impact 4.B-9: The signalized intersection of Park Street and Blanding Avenue (#1) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during both peak hours. (Significant)

Mitigation Measure 4.B-9: Implement Mitigation Measure 4.B-4.

As described above, Mitigation Measure 4.B-4 is recommended to mitigate the vehicular transportation mode. To reduce delays to pedestrians or transit, in accordance with the Transportation Commission's priority order for thresholds of significance, the mitigation also proposes to modify the traffic control at the private driveway of the Waters Edge Nursing Home. While the transportation impacts for all transportation modes at the intersection of Park Street and Blanding Avenue would be lessened (in priority order), they might not all be reduced to a less-than-significant level. Transportation Policy 4.4.2.g recognizes this possibility and states, "some congestion may be identified in an EIR process as not possible to mitigate. This

TABLE 4.B-14
CUMULATIVE (2030) BASE PLUS PROJECT PEAK-HOUR INTERSECTION LEVELS OF SERVICE (LOS)

Intersection	Traffic Control	AM Peak Hour				PM Peak Hour			
		Cumulative (2030) Baseline		Cumulative Base Plus Project		Cumulative (2030) Baseline		Cumulative Base Plus Project	
		Delay[a]	LOS	Delay[a]	LOS	Delay[a]	LOS	Delay[a]	LOS
1. Park Street and Blanding Avenue	Signal	>120.0	F	***>120.0***	***F***	101.6	F	***>120.0***	***F***
2. Park Street and Clement Avenue	Signal	100.0	F	***109.1***	***F***	>120.0	F	***>120.0***	***F***
3. Park Street and Buena Vista Avenue	Signal	13.0	B	13.0	B	19.3	B	19.3	B
4. Oak Street and Clement Avenue	AWSC	>80	F	***>80***	***F***	>80	F	***>80***	***F***
5. Oak Street and Buena Vista Avenue	Signal	10.6	B	10.9	B	12.7	B	13.5	B
6. Oak Street and Lincoln Avenue	Signal	14.2	B	14.2	B	163.7	B	16.9	B
7. Tilden Way and Blanding Avenue	Signal	119.5	F	>120.0	F	80.3	F	81.9	F
8. Grand Street and Clement Avenue	SSSC	12.5	B	13.3	B	32.5	C	34.3	C
9. Atlantic Avenue and Webster Avenue	Signal	45.9	D	46.1	D	41.1	D	41.2	D
10. Atlantic Avenue and Constitution Way	Signal	41.5	D	41.6	D	53.7	D	54.0	D
11. High Street and Fernside Boulevard	Signal	>120.0	F	>120.0	F	>120.0	F	>120.0	F
12. Clement Avenue and Project Access	SSSC	N/A	N/A	***59.1***	***F***	N/A	N/A	***55.0***	***F***
13. Oak Street – Blanding Avenue and Project Access	SSSC	N/A	N/A	16.1	C	N/A	N/A	20.7	C

[a] The LOS/Delay for Side-Street Stop-Control (SSSC) intersections represents the worst movement or approach; for Signalized intersections, the LOS/Delay represents the overall intersection.

Bold signifies significant impacts

SOURCE: Dowling Associates, Inc., 2009.

unmitigated congestion should be evaluated and disclosed (including intersection delay length of time) during the EIR process, and acknowledged as a by-product of the development and accepted with the on-going funding of TDM measures." As proposed, implementation of Mitigation Measure 4.B-4 would improve vehicular operating conditions at the intersection of Park Street and Blanding Avenue under cumulative conditions by reducing average delay at the intersection by about 21 percent in the a.m. peak hour and by about 46 percent in the p.m. peak hour (improving the service level in each case from LOS F to LOS E).

Vehicular Travel Impact Significance after Mitigation: Significant and Unavoidable.

Pedestrian Travel Secondary Impact after Automobile Mitigation: Less than Significant

Bicycle Travel Secondary Impact after Automobile Mitigation: Less than Significant.

Transit Travel Secondary Impact after Automobile Mitigation Less than Significant.

Impact 4.B-10: The signalized intersection of Park Street and Clement Avenue (#2) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during the p.m. peak hour. (Significant)

> **Mitigation Measure 4.B-10:** The project applicant shall fund a fair share contribution to reconfigure and restripe the intersection of Park Street and Clement Avenue to add dedicated left turn lanes on the eastbound and westbound approaches of Clement Avenue, and a northbound dedicated left turn lane on Park Street, and to modify the traffic signals to include protected left turn phasing for all approaches, fully actuated traffic signal, and audible pedestrian push buttons and pedestrian count down heads. The reconfiguration would require acquisition of property from the northeast and southwest corners and the removal of approximately eight parking spaces.

This mitigation measure would reduce the average vehicle delay by about 10 percent during the a.m. peak hour and about 41 percent during the p.m. peak hour. The overall intersection level of service would remain at an unacceptable LOS F. Because the General Plan identifies Clement Avenue as an exclusive transit corridor, improvements made to these approaches would provide significant benefits to transit service levels in the cumulative condition, the City's highest transportation mode priority. Furthermore, to reduce the project's contribution to the cumulative growth of intersection traffic volumes, Mitigation Measure 4-B-3a would require the project to reduce the number of peak-hour vehicle trips generated by the project by 10 percent; however, the level of that reduction cannot be guaranteed. Therefore, with implementation of the proposed mitigation measures, the project traffic volume would exceed the three-percent threshold of significance, and the traffic impact would be significant and unavoidable. Transportation Policy 4.4.2.g recognizes this possibility and states, "some congestion may be identified in an EIR process as not possible to mitigate. This unmitigated congestion should be evaluated and disclosed (including intersection delay length of time) during the EIR process, and acknowledged as a by-product of the development and accepted with the on-going funding of TDM measures."

Although implementation of Mitigation Measure 4.B-3a (TDM) is expected to reduce the number of vehicle trips generated by the project, the level of that reduction can not be guaranteed, and the impact is considered to remain significant and unavoidable.

Vehicular Travel Impact Significance after Mitigation: Significant and Unavoidable.

Pedestrian Travel Secondary Impact after Automobile Mitigation: Less than Significant.

Impact 4.B-11: The all-way stop-control unsignalized intersection of Oak Street and Clement Avenue (#4) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during both peak hours. (Significant)

> **Mitigation Measure 4.B-11:** The project applicant shall fund a fair share contribution to the installation of traffic signals at the intersection of Oak Street and Clement Avenue, and the restriping of the eastbound Clement Avenue approach to provide an exclusive left-turn lane and a shared through/right-turn lane. Because of potential safety concerns with vehicles and bicyclists in the left turn lane driving/riding parallel to the existing railroad tracks, this mitigation also would require that the railroad tracks within the left-turn lane be removed. This mitigation also would require acquisition of the necessary right-of-way from the project at the northwest corner of Park Street and Clement Avenue to install the traffic signal poles, while maintaining ADA access.

The intersection would satisfy the Caltrans peak-hour signal warrants under Cumulative conditions without and with the proposed project.

Implementation of Mitigation Measure 4.B-11 would improve the peak-hour levels of service to an acceptable LOS C during both a.m. and p.m. peak hours.

Significance after Mitigation: Less than Significant.

Impact 4.B-12: The Clement Avenue Project Driveway (#12), created as part of the project, would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Base Plus Project conditions. (Significant)

> **Mitigation Measure 4.B-12:** The project applicant shall fund a fair share contribution to the reconfiguration and restriping of Clement Avenue in front of the project site to include an eastbound left turn lane (into the project) and an eastbound center refuge/merge lane (for traffic exiting the project). Because of potential safety concerns with vehicles and bicyclists

in the lanes driving/riding parallel to the existing railroad tracks, this mitigation also would require that the railroad tracks within the left-turn lane be removed.

As described on pages 4.B-3 and 4.B-29, the City plans to extend Clement Avenue from Sherman Street to Tilden Way. Mitigation Measure 4.B-12 would be required when the Clement Avenue extension is being constructed.

Significance after Mitigation: Less than Significant.

Congestion Management Program Evaluation

The proposed project would generate more than 100 p.m. peak hour trips (see Table 4.B-3, page 4.B-17). Pursuant to the request of the ACCMA in a letter dated April 1, 2009 in response to the Notice of Preparation (NOP), a CMP analysis was conducted for this project. The impacts of the project on the regional transportation system were assessed using the latest version of the ACCMA Countywide Travel Demand Model (ACCMA Model), which uses Association of Bay Area Government's (ABAG) *Projections 2007* socio-economic forecasts. For the roadway analysis, the 2015 No Project and 2035 No Project forecasts were obtained from the ACCMA Model. The "with project" forecasts at the roadway segments were obtained by manually adding the proposed project trips to the "No Project" forecasts.

The land use for the project was added into the ACCMA Model in the form of socio-demographic data for the 2015 and 2035 forecasts for the purpose of analyzing transit impacts for AC Transit and BART. For the transit analysis, the "with project" forecasts were compared to the baseline "No-Project" forecasts for transit to determine impacts. The impact analysis for roadways includes all Metropolitan Transportation System (MTS) roadways and CMP designated roadways, plus several local MTS roadways and transit corridors in the project vicinity. Detailed tables are on-file and available for review at the City of Alameda Planning and Building Department and include all data for 2015 and 2035 forecast years.

Significance Criteria

Transit Segments

Transit frequency-of-service standards for the CMP are 15- to 30-minute headways for bus service and 3.75- to 15-minute headways for BART during peak hours. The transit impacts of the project were considered significant if the addition of project-related trips would result in a level of service worse than capacity of the transit system, except where the transit system was already operating at capacity under no project conditions. For those locations where this no-project condition is at capacity, the impacts of the project were considered significant if the contribution of project-related trips is three percent or more of the total trips. Capacity of the transit system is measured by the load factor for the transit segments in the study area. This criterion has been included to address impacts along transit segments currently operating under unacceptable levels and was developed based on professional judgment using a “reasonableness test” of daily fluctuations of transit ridership.

Roadway Segments

As described above, level of service is a qualitative measure of the traffic flow under different traffic conditions. The roadway impacts of the project were considered significant if the addition of project-related traffic would result in a service level worse than LOS E, except where the roadway link was already at LOS F under no project conditions. For those locations where this no-project condition is LOS F, the impacts of the project were considered significant if the contribution of project-related traffic is three percent or more of the total traffic. This criterion has been included to address impacts along roadway segments currently operating under unacceptable levels and was developed based on professional judgment using a “reasonableness test” of daily fluctuations of traffic. Also a change of volume-to-capacity (V/C) ratio of 0.03 has been found to be the threshold for which a perceived change in congestion is observed. The V/C ratio is calculated by comparing the peak-hour link volume to the peak-hour capacity of the road link. That change is equivalent to about one-half of the change from one level of service to the next.

Congestion Management Program Land Use Analysis

The traffic forecasts were based on the updated ACCMA Model for Projection 2007 for base years 2015 and 2035. The land use changes for the proposed project were added into the model for the 2015 and 2030 forecasts for traffic analysis zone “528” within the project area. Because the project includes housing, the land use changes were made to the number of residential units. See **Table D-1** in **Appendix D**, which summarizes the project land uses in terms of housing that were added to the Countywide model for the 2015 and 2035 project analysis for the transit impacts.

Transit impacts were addressed for AC Transit bus routes servicing the study area and Bay Area Rapid Transit (BART) at the Fruitvale BART station. Highway impacts were summarized for the designated link locations based on the ACCMA’s comments on the NOP for the project. The roadway links include selected segments of I-880, Park Street, 29th Avenue, 23rd Avenue (I-880 freeway entrance), Fruitvale Avenue, Encinal Avenue and International Boulevard.

MTS Transit Corridors

The proposed project is located within the service area of the AC Transit and the Bay Area Rapid Transit (BART) systems. The impact of the proposed project on these transit systems was assessed using the latest version of the ACCMA Model, which predicts transit ridership for all transit operators. The transit ridership for AC Transit for current and future conditions is summarized in tables in **Appendix D**. The model generates daily home-based work and non-work transit trips, but does not split these into peak hour transit trips. Therefore, to estimate the number of transit trips occurring during the peak period, a review of existing transit ridership data within the study area indicated peak hour transit trips can be conservatively assumed as 25 percent of daily transit trips.

Transit Ridership on AC Transit Buses

Future growth and development within the project area would increase ridership on AC Transit buses. The impact of the project on the AC Transit bus system was assessed based on the ridership derived from the ACCMA Model. AC transit routes 19, 50, OX, 51 and O were analyzed as they directly serve the project area. Some project residents would be expected to use the transit system to travel to work. The model was used to quantify the change in transit trips associated with the project on the AC Transit routes, and impacts are assessed based on an assumed existing load factor of 25 passengers per bus for all AC transit routes (see tables in **Appendix D**). Capacity is reached at a load factor of 40 passengers per bus.

Baseline Plus Project Conditions

Impact 4.B-13: The addition of project-generated traffic would increase ridership on AC Transit buses above that under Baseline conditions. (Less than Significant)

With the addition of the project on the AC transit buses in the study area, no bus route would operate over capacity. As a result, the project impact to peak-hour bus service in terms of the 15-30 minute headway standard would be less than significant.

Mitigation: None required.

Cumulative Base Plus Project Conditions

Impact 4.B-14: The addition of project-generated traffic would increase ridership on AC Transit buses above that under Cumulative Baseline conditions. (Less than Significant)

With the addition of the project on the AC transit buses in the study area, no bus route would operate over capacity. As a result, the project impact the peak-hour bus service in terms of the 15-30 minute headway standard would be less than significant.

Mitigation: None required.

Transit Ridership on BART

Future growth and development within the project area would increase ridership on BART trains. The impact of the project on the BART system were assessed based on the ridership derived from the ACCMA Model. The project site is served by BART via the Fruitvale BART station, which can be accessed by walking, bicycle or AC Transit bus lines. BART has three lines that stop at the Fruitvale station (Fremont-to–San Francisco, Fremont-to–Richmond and Dublin/Pleasanton-to–San Francisco), and in 2030 some lines may be extended to serve that station. The ACCMA Model was used to quantify the change in transit trips associated with the project on these BART routes at the Fruitvale station, and impacts are assessed based on an assumed existing load factor of 100 percent occupied seats (see table in **Appendix D**).

Baseline Plus Project Conditions

Impact 4.B-15: The addition of project-generated traffic would increase ridership on BART above that under Baseline conditions. (Less than Significant)

Under Baseline Plus Project conditions, the project has the potential to generate an increase in overall daily BART ridership at the Fruitvale station of 78 daily trips, or 20 peak-hour trips. The existing BART frequency of 15 minutes on the three lines equates to 24 trains per hour (both directions); therefore, the project-generated increase would average about one new rider per train. Conservatively assuming a 100 percent load factor, the 0.1 percent increase in trips per train would not be a significant impact on BART service, because there would be no exceedance of the 3.75- to 15-minute peak headway standard. Therefore, this impact is considered less than significant.

Mitigation: None required.

Cumulative Plus Project Conditions

Impact 4.B-16: The addition of project-generated traffic would increase ridership on BART above that under Cumulative Baseline conditions. (Less than Significant)

Under Cumulative Base Plus Project conditions, the project has the potential to generate an increase in overall daily BART ridership at the Fruitvale station of 103 daily trips, or 26 peak-hour trips. The existing BART frequency of 15 minutes on the three lines equates to 24 trains per hour (both directions); therefore, the project-generated increase would average about one new rider per train. Conservatively assuming a load factor approaching capacity, the 0.2 percent increase in trips per train would not be a significant cumulative impact on BART service, because there would be no exceedance of the 3.75- to 15-minute peak headway standard. Therefore, this impact is considered less than significant.

Mitigation: None required.

CMP and MTS Highway Segments

The LOS for the designated links were analyzed in a spreadsheet using the Florida Department of Transportation LOS methodology, which provides a planning level analysis based on 1985 *Highway Capacity Manual* methods. As a planning level analysis, the level of service is based on forecasts of traffic and assumptions for roadway and signalization control conditions, such as facility type (freeway, expressway, and arterial classification), speeds, capacity and number of lanes. The assumption for the number of lanes at each link location was extracted from the ACCMA Model, and also confirmed through aerial and field observations.

The traffic baseline forecasts for 2015 and 2035 were extracted at the required CMP and MTS highway segments from the ACCMA Model for both the a.m. and p.m. peak hours. The “With

Project" forecasts at the roadway segments for the proposed project were obtained by manually adding the proposed project trips to the "No Project" forecasts.

The peak hour operations were evaluated in compliance with ACCMA requirements. The tables compare the no-project results to the with-project results for each model horizon year. The peak hour volumes, V/C ratios and the level of service for with and without project conditions represent both directions of flow.

Baseline Plus Project Conditions

Impact 4.B-17: The addition of project-generated traffic would increase traffic volumes on Park Street (regional arterial) at the Park Street bridge above that under Baseline Conditions. (Significant)

With the addition of the project, most of the MTS roadways would experience increases in volume from baseline conditions, but no change in the level of service (see tables in **Appendix D**). The following MTS roadways would result in significant impacts:

- At the Park Street bridge, the a.m. peak-hour service level in northbound direction would be LOS F under Baseline No-Project conditions, and the project-generated increase in traffic volume would be about 3.6 percent. This would be considered a significant impact.
- At the Park Street bridge, the p.m. peak-hour service level in southbound direction would be LOS F under Baseline No-Project conditions, and the project-generated increase in traffic volume would be about 4.2 percent. This would be considered a significant impact.

Mitigation Measure 4.B-17a: Widen Park Street bridge to add an additional lane in each direction.

Implementation of Mitigation Measure 4.B-17a would mitigate the project impacts to less than significant levels. However, this measure is considered infeasible due to cost and inconsistency with Alameda General Plan Amendment policy EIR-1, which states: "*Roadways will not be widened to create additional automobile travel lanes to accommodate additional automobile traffic volume with the exception of increasing transit exclusive lanes or non-motorized vehicle lanes*".

Mitigation Measure 4.B-17b: Implement Mitigation Measures 4.B-3a (TDM Program) and 4.B-3b (Park Street Transit Signal Prioritization).

Although implementation of Mitigation Measure 4.B-3a is expected to reduce the number of vehicle trips generated by the project, the level of that reduction cannot be guaranteed, and the impact is considered to remain significant and unavoidable.

Significance after Mitigation: Significant and Unavoidable.

Cumulative Plus Project Conditions

Impact 4.B-18: The addition of project-generated traffic would increase traffic volumes in the southbound direction on Park Street (regional arterial) at the Park Street bridge above that under Cumulative Baseline Conditions. (Significant)

With the addition of the project, most of the MTS roadways would experience increases in volume from cumulative baseline conditions, but no change in the level of service (see tables in **Appendix D**). The following MTS roadway would result in a significant impact:

- At the Park Street bridge, the p.m. peak-hour service level in southbound direction would be LOS F under Baseline No-Project conditions, and the project-generated increase in traffic volume would be about 3.4 percent. This would be considered a significant impact.

  Mitigation Measure 4.B-18a: Widen Park Street bridge to add an additional lane in the southbound direction.

Implementation of Mitigation Measure 4.B-18a would mitigate the project impact to a less than significant level. However, this measure is considered infeasible due to cost and inconsistency with Alameda General Plan Amendment policy EIR-1, which states: "*Roadways will not be widened to create additional automobile travel lanes to accommodate additional automobile traffic volume with the exception of increasing transit exclusive lanes or non-motorized vehicle lanes*".

> **Mitigation Measure 4.B-18b:** Implement Mitigation Measures 4.B-3a (TDM Program) and 4.B-3b (Park Street Transit Signal Prioritization).

Although implementation of Mitigation Measure 4.B-3a is expected to reduce the number of vehicle trips generated by the project, the level of that reduction cannot be guaranteed, and the impact is considered to remain significant and unavoidable.

Significance after Mitigation: Significant and Unavoidable.

References – Transportation and Circulation

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Transportation Research Board. 2004. National Cooperative Highway Research Program, NCHRP Report 500, Volume 13, *A Guide for Reducing Collisions Involving Heavy Trucks*.

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C. Air Quality and Climate Change

Introduction

This section addresses the impacts of the proposed Boatworks Residential Project on ambient air quality and the exposure of people, especially sensitive individuals, to unhealthful pollutant concentrations, including the type and quantity of emissions that would be generated by construction and occupancy of the residential units. The analysis of emissions focuses on whether the proposed project would cause an exceedance of a State or national ambient air quality standard, a health based standard for exposure to toxic air contaminants, or a CEQA threshold recommended by the Bay Area Air Quality Management District (BAAQMD) and whether it would conflict with regulatory goals associated with greenhouse gas emissions that contribute to climate change.

Environmental Setting

Physical Setting

Climate and Meteorology

Atmospheric conditions such as wind speed, wind direction, and air temperature gradients interact with the physical features of the landscape to determine the movement and dispersal of air pollutants. The project site is located in the City of Alameda and is within the boundaries of the San Francisco Bay Area Air Basin. The Bay Area Air Basin encompasses the nine-county region, which is all of Alameda, Contra Costa, Santa Clara, San Francisco, San Mateo, Marin and Napa counties, and the southern portions of Solano and Sonoma counties. The climate of the Bay Area Air Basin is determined largely by a high-pressure system that is almost always present over the eastern Pacific Ocean off the West Coast of North America. During winter, the Pacific high-pressure system shifts southward, allowing more storms to pass through the region. During summer and early fall, when few storms pass through the region, emissions generated within the Bay Area can combine with abundant sunshine under the restraining influences of topography and subsidence inversions to create conditions that are conducive to the formation of photochemical pollutants, such as ozone, and secondary particulates, such as nitrates and sulfates.

The site lies approximately one mile east of San Francisco Bay in the Northern Alameda and Western Contra Costa Counties climatological subregion. This subregion stretches from Richmond to San Leandro with San Francisco Bay as its western boundary, and its eastern boundary is defined by the Oakland-Berkeley Hills. In this area, marine air traveling through the Golden Gate, as well as across San Francisco and the San Bruno Gap, is a dominant weather factor. The Oakland-Berkeley Hills cause the westerly flow of air to split off to the north and south of Oakland, which causes diminished wind speeds. The air pollution potential in this subregion is relatively low for portions close to the Bay, due to the relatively good ventilation and limited influx of pollutants from upwind sources (BAAQMD, 1999).

Wind measurements taken at the Alameda Naval Air Station indicate that the predominant wind flow is from the west and northwest. Northwest winds occur approximately 40 percent of the time.

Average wind speeds vary from season to season with the strongest average winds occurring during summer and the lightest average winds during winter. Average wind speeds are 10.8 miles per hour (mph) during summer and 7.3 mph during winter. Temperatures in Alameda/Oakland average 58 °Fahrenheit (F) annually, ranging from an average of 40°F on winter mornings to an average of mid-70s in the late summer afternoons. Daily and seasonal oscillations of temperature are small because of the moderating effects of the nearby ocean. In contrast to the steady temperature regime, rainfall is highly variable and confined almost exclusively to the "rainy" period from early November to mid-April. Alameda/Oakland averages 18 inches of precipitation annually, but because much of the area's rainfall is derived from the fringes of mid-latitude storms, a shift in the annual storm track of a few hundred miles can mean the difference between a very wet year and near drought conditions.

Existing Air Quality

Criteria Air Pollutants

The BAAQMD and California Air Resources Board (CARB) operate a regional air quality monitoring network that measures the ambient concentrations of the seven criteria air pollutants. Existing and probable future levels of air quality in the project area can generally be inferred from ambient air quality measurements conducted by the BAAQMD at its nearest monitoring stations. The closest monitoring stations are both located in Oakland. The station on Alice Street monitored ozone and carbon monoxide only and was closed at the end of 2005, and the International Boulevard station commenced operation in November of 2007.

Table 4.C-1 shows a five-year (2004 through 2008) summary of monitoring data for ozone, CO, PM_{10}, and $PM_{2.5}$ recorded at the nearest stations. The data presented also include San Leandro for ozone in 2006 and Fremont for $PM_{2.5}$, nitrogen dioxide and PM_{10} for all years. The table compares the measured concentrations with State and federal ambient air quality standards. As indicated in the table, there were no violations of the State or federal one-hour and eight-hour ozone standards during the period and three violations of the 24-hour State PM_{10} standard were recorded during the five-year summary period. While there were no violations of the state or federal $PM_{2.5}$ standards recorded at the time of the five-year monitoring period, there were three readings that would have exceeded the newly adopted (December 17, 2006) federal 24-hour standard of 35 micrograms per cubic meter. No annual average concentration exceeded the state standard of 12 micrograms per cubic meter that was adopted in 2003.

Toxic Air Contaminants (TACs)

The ambient background of Toxic Air Contaminants (TACs) is the combined result of many diverse human activities, including gasoline stations, automobiles, dry cleaners, industrial operations, hospital sterilizers, and painting operations. In general, mobile sources contribute more significantly to health risks than do stationary sources. The BAAQMD operates a network of monitoring stations that measure ambient concentrations of certain TACs that are associated with strong health-related effects and are present in appreciable concentrations in the Bay Area, as in all urban areas. The San Leandro TAC monitoring station located at 15400 Foothill Boulevard is the closest station, located approximately eight miles southeast of the project site. **Table 4.C-2** presents the measured concentrations and associated cancer risks at the San Leandro station.

TABLE 4.C-1
AIR QUALITY DATA SUMMARY (2004–2008) FOR THE AREA AROUND THE PROJECT SITE

Pollutant	Standard[a]	Monitoring Data by Year				
		2004	2005	2006	2007	2008
Ozone[b]						
Highest 1 Hour Average (ppm)	0.09	0.080	0.068	0.88[g]	0.040[h]	0.086[h]
Days over State Standard		0	0	0	0	0
Days over National Standard	NA	0	0	0	0	0
Highest 8 Hour Average (ppm)	0.07	0.057	0.045	0.066[g]	0.036[h]	0.064[h]
Days over State Standard	**0.075**	0	0	0	0	0
Days over National Standard		0	0	0	0	0
Carbon Monoxide[b]						
Highest 1 Hour Average (ppm)	20	3.5	3.4	2.9[c]	1.4[h]	1.6[h]
Days over State Standard		0	0	0	0	0
Highest 8 Hour Average (ppm)	9.0	2.6	2.4	1.8[c]	ND	ND
Days over State Standard		0	0	0	0	0
Nitrogen Dioxide[c]						
Highest 1 Hour Average (ppm)	0.25[d]	0.060	0.069	0.063	0.059[h]	0.070[h]
Days over State Standard			0	0	0	0
Annual Average (ppm)	0.0530	0.015	0.015	0.015	ND	0.015[h]
Particulate Matter (PM10)[c]						
Highest 24 Hour Average ($\mu g/m^3$)	50[e]	48.9	**54.1**	**56.6**	**60.6**	38.7
Days over State Standard		0	1	1	1	0
Annual Average ($\mu g/m^3$)	20	18.6	17.8	20	19.6	ND
Particulate Matter (PM2.5)[c]						
Highest 24 Hour Average ($\mu g/m^3$)	65/35[f]	39.9	33.4	43.9	22.8[h]	30.1[h]
Days over federal Standard		0/1	0	0/2	0	0
Annual Average ($\mu g/m^3$)	12	9.4	9.0	10.3	8.7	9.4

a Generally, state standards are not to be exceeded and national standards are not to be exceeded more than once per year.
b Oakland - Alice Street monitoring station closed at the end of 2005.
c Fremont – Chapel Way.
d State NO2 standard reduced to 0.18 ppm as of 2/23/07.
e Federal mean PM-10 standard revoked as of 12/17/06.
f Federal PM 2.5 standard reduced to 35 micrograms per cubic meter as of 12/17/06.
g San Leandro – County Hospital.
h Oakland International Boulevard Station started operation in November of 2007.

ppm = parts per million; $\mu g/m3$ = micrograms per cubic meter; ND: data not available or insufficient to determine annual average.

NOTE: Values in **bold** are in excess of applicable standard.

SOURCE: California Air Resources Board, Summaries of Air Quality Data, 2004-2008 (http://www.arb.ca.gov/aqd/aqdcd/aqdcd.htm).

Regionally, ambient concentrations of TACs are similar throughout the urbanized areas of the Bay Area Air Basin. Of the pollutants for which monitoring data are available, benzene and 1,3-butadiene[1] (which are emitted primarily from motor vehicles) account for over one half of the average calculated cancer risk (BAAQMD, 2004). Benzene levels have declined dramatically since 1996 with the advent of Phase 2 reformulated gasoline. The use of reformulated gasoline also appears to have led to significant decreases in 1,3-butadiene. Due largely to these observed reductions in ambient benzene and 1,3-butadiene levels, the calculated network average cancer risk has been

1 1,3-Butadiene is an important industrial chemical used as a monomer in the production of synthetic rubber.

TABLE 4.C-2
AVERAGE AMBIENT CONCENTRATIONS OF CARCINOGENIC TACS MEASURED AT BAAQMD MONITORING STATION, 15400 FOOTHILL BLVD., SAN LEANDRO, CA 94806

Compound	Concentration (ppb)[b]	Concentration ($\mu g/m^3$)[b]	Unit Risk[a] $(\mu g/m^3)^{-1}$	Cancer Risk (per million)
Gaseous TACs[c]				
1,3-Butadiene	0.09	0.20	1.7×10^{-4}	34.0
Carbon Tetrachloride	0.11	0.69	4.2×10^{-5}	29.0
Benzene	0.28	0.90	2.9×10^{-5}	26.1
Perchloroethylene	0.02	0.14	5.9×10^{-6}	8.3
Ethylene dibromide	0.01	0.08	7.1×10^{-5}	5.5
Ethylene dichloride	0.05	0.20	2.1×10^{-5}	4.2
Chloroform	0.08	0.40	5.3×10^{-6}	2.1
Methylene Chloride	0.28	0.97	1.0×10^{-6}	1.0
MTBE	0.32	1.15	2.6×10^{-7}	0.3
Trichloroethylene	0.03	0.16	2.0×10^{-6}	0.3
Total Risk for All TACs				**110.8**[d]

[a] Unit Risk is the probability of contracting cancer if one is constantly exposed to an average concentration of one microgram per cubic meter of the specific substance. Multiplying the Unit Risk of a compound by its concentration in micrograms per cubic meter gives its cancer risk per million. These Unit Risk values are from the California Office of Environmental Health Hazard Assessment (OEHHA).
[b] ppb is part per billion; ($\mu g/m^3$) is microgram per cubic meter or millionth of a gram per cubic meter.
[c] All values are from BAAQMD 2003 monitoring data for the San Leandro station (BAAQMD, 2007).
d This risk value is for the San Leandro station and is less than the 162 in a million risk for the urbanized portions of the Bay Area Basin region-wide.

significantly reduced in recent years. Based on 2003 ambient monitoring data, the calculated inhalation cancer risk is 162 in one million, which is 46 percent less than what was observed in 1995 (BAAQMD, 2004).

However, the risks described above do not include the entire cancer risk from exposure to airborne TACs, mainly because an important TAC, diesel particulate matter (DPM), is not included in the monitoring data. DPM is a mixture of over 30 different toxic chemicals, most of which are not part of the TAC measurement system. CARB has estimated statewide levels of DPM by relying on measurements of surrogate substances related to diesel exhaust, such as carbon black. From these statewide measurements, CARB has determined that risks from exposure to DPM make up about 70 percent of the total risks from TACs (CARB, 2006). Applying this factor to the Bay Area Air Basin value of 162 in a million (above) yields a combined cancer risk estimate of approximately 540 in a million.

Sensitive Land Uses

Some persons are considered more sensitive than others to air pollutants. The reasons for heightened sensitivity may include health problems, age, proximity to the emissions source, and duration of exposure to air pollutants. Land uses such as schools, hospitals, and convalescent homes are considered to be relatively sensitive to poor air quality because the very young, the old, and the infirm are more susceptible to respiratory infections and other air-quality-related health problems than the general public. Residential areas are considered sensitive to poor air quality because people are often at home for extended periods. Recreational land uses are moderately sensitive to air pollution, because vigorous exercise associated with recreation places a high demand on the human respiratory system.

The nearest sensitive land uses to the project site are single family residential dwellings along the south side of Clement Street and down Elm Street southwest of the project site. Additional residential uses exist along Eagle Avenue and Buena Vista Avenue also southwest of the project site. The future residents of the proposed project would also be considered sensitive receptors with respect to air pollutant and air toxic emissions.

Sources of Air Pollutant and Air Toxic Emissions

There are no major toxic air contaminant-emitting facilities located within a half-mile radius of the project site, nor are there any facilities with reportable toxic air contaminant emissions within a half-mile radius of the project site. While there are a Cemex concrete plant and a Con Agra food processing plant across the estuary in Oakland, these facilities are not listed with BAAQMD as either major facilities or a sources of reportable toxic air contaminant emissions in its latest TAC annual report (BAAQMD, 2007).

Regulatory Framework

Established federal, state, and regional regulations provide the framework for analyzing and controlling air pollutant emissions and thus general air quality.

Regulatory Setting for Criteria Pollutants

The United States Environmental Protection Agency (EPA) is responsible for implementing the programs established under the federal Clean Air Act, such as establishing and reviewing the federal ambient air quality standards and judging the adequacy of State Implementation Plans (SIPs). However, the EPA has delegated the authority to implement many of the federal programs to the states while retaining an oversight role to ensure that the programs continue to be implemented. In California, the CARB is responsible for establishing and reviewing the State ambient air quality standards, developing and managing the California SIP, securing approval of this plan from EPA, identifying toxic air contaminates (TAC), regulating mobile emissions sources in California, and overseeing the activities of air quality management districts, which are organized at the county or regional level. Air quality management districts, such as the BAAQMD, are primarily responsible for regulating stationary emissions sources at facilities within their geographic areas and for preparing the air quality plans that are required under the federal and State Clean Air Acts.

Criteria Air Pollutants

As required by the federal Clean Air Act passed in 1970, the EPA has identified seven criteria air pollutants that are pervasive in urban environments, and for which State and national health-based ambient air quality standards have been established. EPA calls these pollutants criteria air pollutants because the agency has regulated them by developing specific public health- and welfare-based criteria as the basis for setting permissible levels. Ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), and lead are the seven criteria air pollutants.

Ozone

Ozone is a respiratory irritant and an oxidant that increases susceptibility to respiratory infections and that can cause substantial damage to vegetation and other materials. Ozone is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic gases (ROG) and nitrogen oxides (NOx). ROG and NOx are known as precursor compounds for ozone formation. Significant ozone production generally requires ozone precursors to be present in a stable atmosphere with strong sunlight for approximately three hours. Ozone is a regional air pollutant because it is not emitted directly by sources, but is formed downwind of sources of ROG and NOx under the influence of wind and sunlight. Ozone concentrations tend to be higher in the late spring, summer, and fall, when the long sunny days combine with regional subsidence inversions to create conditions conducive to the formation and accumulation of secondary photochemical compounds, like ozone. Ground level ozone in conjunction with suspended particulate matter in the atmosphere leads to hazy conditions generally termed as “smog.”

Carbon Monoxide

CO, a colorless and odorless gas, is a non-reactive pollutant that is a product of incomplete combustion and is mostly associated with motor vehicles. High CO concentrations develop primarily during winter when periods of light wind combine with the formation of ground level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures. When inhaled at high concentrations, CO combines with hemoglobin in the blood and reduces the oxygen-carrying capacity of the blood. This results in reduced oxygen reaching the brain, heart, and other body tissues. This condition is especially critical for people with cardiovascular diseases, chronic lung disease or anemia.

Nitrogen Dioxide

NO_2 is an air quality concern because it acts as a respiratory irritant and is a precursor of ozone. NO_2 is produced by fuel combustion in motor vehicles, industrial stationary sources (such as industrial activities), ships, aircraft, and rail transit.

Sulfur Dioxide

SO_2 is a combustion product of sulfur or sulfur-containing fuels such as coal and oil, which are restricted in the Bay Area. Its health effects include breathing problems and may cause permanent damage to lungs. SO_2 is an ingredient in acid rain (acid aerosols), which can damage trees, lakes and property. Acid aerosols can also reduce visibility.

Particulate Matter

PM_{10} and $PM_{2.5}$ consist of particulate matter that is 10 microns or less in diameter and 2.5 microns or less in diameter, respectively. A micron is one-millionth of a meter, or less than one-25,000th of an inch. For comparison, a strand of human hair is 50 microns or larger in diameter. PM_{10} and $PM_{2.5}$ represent particulate matter of sizes that can be inhaled into the air passages and the lungs and can cause adverse health effects. Particulate matter in the atmosphere results from many kinds of aerosol-producing industrial and agricultural operations, fuel combustion, and atmospheric photochemical reactions. Some sources of particulate matter, such as demolition and construction activities, are more local in nature, while others, such as vehicular traffic, have a more regional effect. Very small particles ($PM_{2.5}$) of certain substances (e.g., sulfates and nitrates) can cause lung damage directly, or can contain adsorbed gases (e.g., chlorides or ammonium) that may be injurious to health. Particulates also can damage materials and reduce visibility.

PM_{10} emissions in the project area are mainly from urban sources, dust suspended by vehicle traffic, and secondary aerosols formed by reactions in the atmosphere. Particulate concentrations near residential sources generally are higher during the winter, when more fireplaces are in use and meteorological conditions prevent the dispersion of directly emitted contaminants.

Lead

Leaded gasoline (currently phased out), paint (houses, cars), smelters (metal refineries), and manufacture of lead storage batteries have been the primary sources of lead released into the atmosphere. Lead has a range of adverse neurotoxic health effects, with children at special risk. Some lead-containing chemicals have been found to cause cancer in animals.

Ambient Air Quality Standards

Regulation of criteria air pollutants is achieved through both national and State ambient air quality standards and emissions limits for individual sources. Regulations implementing the federal Clean Air Act and its subsequent amendments established national ambient air quality standards (national standards) for the seven criteria pollutants. California has adopted more stringent State ambient air quality standards for most of the criteria air pollutants. In addition, California has established State ambient air quality standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. Because of the unique meteorological problems in the State, there is a considerable difference between State and federal standards currently in effect in California, as shown in **Table 4.C-3**.

The ambient air quality standards are intended to protect the public health and welfare, and they incorporate an adequate margin of safety. They are designed to protect those segments of the public most susceptible to respiratory distress, known as sensitive receptors, including asthmatics, the very young, the elderly, people weak from other illness or disease, or persons engaged in strenuous work or exercise. Healthy adults can tolerate occasional exposure to air pollution levels somewhat above the ambient air quality standards before adverse health effects are observed.

TABLE 4.C-3
STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	CAAQS[a]	NAAQS[b]
O3	1 hour 8 hour	0.09 ppm 0.070	NS 0.075 ppm
CO	1 hour 8 hour	20 ppm 9.0 ppm	35 ppm 9 ppm
NO2	1 hour Annual	0.18 ppm 0.030	NA 0.053 ppm
SO2	1 hour 24 hour Annual	0.25 ppm 0.04 ppm NS	NS 0.14 ppm 0.03 ppm
PM10	24 hour Annual[c]	50 µg/m3 20 µg/m3	150 µg/m3 NS
PM2.5	24 hour Annual	NS 12 µg/m3[d]	35 µg/m3 15 µg/m3
Sulfates	24 hour	25 µg/m3	NS
Lead	30 day[d] Quarter	1.5 µg/m3 NS	0.15 µg/m3 1.5 µg/m3
Hydrogen Sulfide	1 hour	0.03 ppm	NS
Visibility-Reducing Particles	8 hour	see note e	NS

NOTES: NS = no standard; ppm = parts per million; µg/m^3 = micrograms per cubic meter.

[a] CAAQS = state ambient air quality standards (California). CAAQS for ozone, carbon monoxide (except Lake Tahoe), sulfur dioxide (1 hour and 24 hour), nitrogen dioxide, particulate matter, and visibility-reducing particles are values that are not to be exceeded. All other state standards shown are values not to be equaled or exceeded.

[b] NAAQS = national ambient air quality standards. NAAQS, other than ozone and particulates, and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The one-hour ozone standard is attained if, during the most recent three-year period, the average number of days per year with maximum hourly concentrations above the standard is equal to or less than one. The 8-hour ozone standard is attained when the three-year average of the fourth-highest daily concentration is 0.08 ppm or less. The 24-hour PM_{10} standard is attained when the three-year average of the 99th percentile of monitored concentrations is less than the standard. The 24-hour $PM_{2.5}$ standard is attained when the three-year average of the 98th percentile is less than the standard.

[c] State standard = annual geometric mean; national standard = annual arithmetic mean.

[d] 30-day federal standard was promulgated in October of 2008. USEPA changed the calculation method for the averaging time to use to 'rolling' three month period with a maximum (not-to-be-exceeded) form, evaluated over a three-year period. This replaces the current approach of using calendar quarters. A rolling three month average considers each of the 12 three-month periods associated with a given year, not just the four calendar quarters within that year.

[e] Statewide visibility-reducing particle standard (except Lake Tahoe Air Basin): Particles in sufficient amount to produce an extinction coefficient of 0.23 per kilometer when the relative humidity is less than 70 percent. This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a ten-mile nominal visual range.

SOURCE: CARB, 2008.

Attainment Status

Under amendments to the federal Clean Air Act, EPA has classified air basins or portions thereof, as either in "attainment" or "nonattainment" for each criteria air pollutant, based on whether or not the national standards have been achieved. The California Clean Air Act, which is patterned after the federal Clean Air Act, also requires areas to be designated as "attainment" or "nonattainment" for the State standards. Thus, areas in California have two sets of attainment/nonattainment designations: one set with respect to the federal standards and one set with respect to the State standards.

The Bay Area is currently designated "nonattainment" for State 1-hour and state and national 8-hour ozone standards and for the State PM_{10} and $PM_{2.5}$ standards and the federal $PM_{2.5}$

standard. The Bay Area is "attainment" or "unclassified" with respect to the other ambient air quality standards (CARB, 2008).

Air Quality Plans

As required by the federal and State Clean Air Acts, nonattainment areas are required to prepare air quality plans (referred to as State Implementation Plans or SIPs) that include strategies for achieving attainment. Plans are also required under federal law for areas designated as "maintenance" for national standards that have been achieved. Areas designated as non-attainment for federal standards must prepare a SIP that is approved by EPA, while state designated non-attainment areas need to be addressed by a plan approved only by the State. Currently, there are two plans applicable to the Bay Area:

- The Carbon Monoxide Maintenance Plan (ABAG, 1994) developed to ensure continued attainment of the national CO standard; and
- The Bay Area 2005 Ozone Strategy (BAAQMD, 2006), which was adopted by the BAAQMD Board of Directors on January 4, 2006, reviews the region's progress over the years in reducing ozone levels, describes current conditions, and charts a course for future actions to further reduce ozone and ozone precursor levels in the Bay Area. The control strategy is a central element of the Bay Area 2005 Ozone Strategy. The control strategy outlines a set of control measures to further reduce ozone precursor emissions in order to reduce ozone levels in the Bay Area and to reduce transport of pollution to downwind regions. The control strategy includes stationary source measures, mobile source measures and transportation control measures.

The SIP for the newly adopted federal 8-hour ozone (May 27, 2008) and $PM_{2.5}$ (December 17, 2006) standards was still in development at the time of this analysis. While certain elements of Phase 1 of the 8-hour implementation rule are still undergoing legal challenge, EPA signed Phase 2 of the 8-hour implementation rule on November 9, 2005. On March 12, 2009, CARB submitted its recommendations for area designations for the revised federal 8-hour ozone standard. These recommendations are based on ozone air quality data collected during 2006 through 2008. As recommended, there are 21 nonattainment areas including the San Francisco Bay Area Air Basin. The BAAQMD plans to address all requirements of the federal 8-hour standard in subsequent documents.

With respect to the revised $PM_{2.5}$ standards, EPA responded to CARB's recommended designations on August 18, 2008 and posted them on the EPA website. CARB conducted additional analysis in support of its earlier recommendations. This analysis, signed October 15, 2008, has been transmitted to EPA. EPA final recommendations are still pending, as of October 2009.

In 2003, the California Legislature enacted Senate Bill 656 (SB 656) to reduce public exposure to PM_{10} and $PM_{2.5}$. SB 656 requires CARB, in consultation with local air districts, to develop and adopt, by January 1, 2005, a list of the most readily available, feasible, and cost-effective control measures that could be used by CARB and the air districts to reduce PM_{10} and $PM_{2.5}$. BAAQMD implemented its PM Implementation Schedule in November of 2005.

This PM implementation schedule identifies the PM control measures most appropriate for the region and prioritizes the appropriate measures based on cost effectiveness and their effects on public health, air quality, and emissions reductions. The schedule identifies four specific measures that address PM emissions from stationary and portable internal combustion engines, broiling operations and residential wood burning.

Siting of Sensitive Land Uses Near Ports and Freeways

In April 2005, the CARB published *Air Quality and Land Use Handbook: a Community Health Perspective*. This handbook is intended to give guidance to local governments in the siting of sensitive land uses near sources of air pollution. Recent studies have shown that public exposure to air pollution can be substantially elevated near freeways and certain other facilities such as ports, rail yards and distribution centers. Specifically, the document focuses on risks from emissions of diesel particulate matter, a known carcinogen, and establishes recommended siting distances of sensitive receptors. With respect to Port facilities, the recommendations of the report are: “Avoid siting new sensitive land uses immediately downwind of ports in the most heavily impacted zones.” With respect to freeways, the recommendations of the report are: “Avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with more than 100,000 vehicles per day or rural roads with 50,000 vehicles/day”. The proposed project is located approximately three miles from the Port of Oakland and 1,700 feet from Interstate 880, the nearest freeway.

Local Standards

BAAQMD Rules and Regulations

The BAAQMD is the regional agency responsible for rulemaking, permitting, and enforcement activities affecting stationary sources in the Bay Area. Specific rules and regulations adopted by the BAAQMD limit the emissions that can be generated by various uses and/or activities, and identify specific pollution reduction measures that must be implemented in association with various uses and activities. These rules regulate not only emissions of the seven criteria air pollutants, but also toxic emissions and acutely hazardous non-radioactive materials emissions.

Emissions sources subject to these rules are regulated through the BAAQMD’s permitting process and standards of operation. Through this permitting process, including an annual permit review, the BAAQMD monitors generation of stationary emissions and uses this information in developing its air quality plans. Any sources of stationary emissions constructed as part of proposed projects would be subject to the BAAQMD *Rules and Regulations*. Both federal and State ozone plans rely heavily upon stationary source control measures set forth in BAAQMD’s *Rules and Regulations*.

With respect to construction activities that would result under the project, applicable BAAQMD regulations would relate to portable equipment (e.g., gasoline- or diesel-powered engines used for power generation, pumps, compressors, pile drivers, and cranes), architectural coatings, and paving materials. Equipment used during construction would be subject to the requirements of BAAQMD Regulation 2 (Permits), Rule 1 (General Requirements) with respect to portable equipment unless exempt under Rule 2-1-105 (Exemption, Registered Statewide Portable

Equipment); BAAQMD Regulation 8 (Organic Compounds), Rule 3 (Architectural Coatings); and BAAQMD Regulation 8 (Organic Compounds), Rule 15 (Emulsified and Liquid Asphalts).

Alameda General Plan

The Open Space and Conservation Element of the Alameda General Plan contains the following Air Quality implementing policies that would apply to the proposed project:

- *Policy 5.5.c*: Encourage use of public transit for all types of trips;
- *Policy 5.5.d*: Encourage development and implementation of Transportation System Management (TSM) programs;
- *Policy 5.5.e*: Minimize commuting by balancing jobs and nearby housing opportunities. Buildout of Alameda will create four jobs for every three employed residents, minimizing out-commuting. A surplus of jobs in Alameda is likely to result in less travel than if these office/business park jobs were at alternative outlying locations.

Toxic Air Contaminants

The California Health and Safety Code defines Toxic Air *C*ontaminants (TACs) as air pollutants "which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health" (Health and Safety Code Section 39655(a)). By definition, TACs include substances listed in the federal Clean Air Act as "hazardous air pollutants." TACs are less pervasive in the urban atmosphere than criteria air pollutants, but are linked to short-term (acute) or long-term (chronic and/or carcinogenic) adverse human health effects. There are hundreds of different types of TACs, with varying degrees of toxicity. Sources of TACs include industrial processes, commercial operations (e.g., gasoline stations and dry cleaners), and motor vehicle exhaust. Unlike regulations concerning criteria air pollutants, there are no ambient air quality standards for evaluation of TACs based on the amount of emissions. Instead, emissions of TACs are evaluated based on the degree of health risk that could result from exposure to these pollutants.

As noted above, the federal Clean Air Act refers to the term "hazardous air pollutants" while California regulations use the term "toxic air contaminants." "Toxic air contaminants" will be the term used in this document.

Regulation of toxic emissions, or TACs, under California State law and hazardous air pollutants (HAPs) under federal regulations, is achieved through federal and State controls on individual sources. The 1977, the Clean Air Act (CAA) Amendments required the EPA to identify National Emission Standards for Hazardous Air Pollutants to protect public health and welfare. These substances include certain volatile organic compounds (VOCs), pesticides, herbicides, and radionuclides that present a tangible hazard, based on scientific studies of exposure to humans and other mammals. The 1990 CAA Amendments offer a technology-based and performance-based approach to reducing air toxics from major sources of air pollution, followed by a risk-based approach to address any remaining, or residual risks. Under the 1990 CAA Amendments, designated HAPs are regulated under a two-phase strategy. Under the technology-based-approach, the EPA develops standards for controlling routine emissions of air toxics from each major type of facility within an industry group (or source category). These standards require facilities to install controls, known as Maximum Achievable Control Technology (MACT), based on emissions levels that are already being achieved by better-controlled and lower-emitting sources in an industry. MACT includes measures, methods and techniques, such as material substitutions, work practices, and operational improvements, aimed at reducing toxic air emissions. EPA has issued MACT standards covering over 100 categories of major industrial sources, such as chemical plants, oil refineries, and steel mills, as well as categories of smaller sources, such as dry cleaners, commercial sterilizers, and chromium electroplating facilities.

California State law defines TACs as air pollutants having carcinogenic or non-carcinogenic health effects. The State Air Toxics Program was established in 1983 under AB 1807. A total of 243 substances have been designated TACs under California law; they include the 189 (federal) HAPs adopted in accordance with AB 2728, including benzene and DPM. The Air Toxics “Hot Spots” Information and Assessment Act of 1987 (AB 2588) seeks to identify and evaluate risk from air toxics sources. TAC emissions from individual facilities are quantified and prioritized. “High-priority” facilities are required to perform a health risk assessment and, if specific thresholds are exceeded, are required to communicate the results to the public in the form of notices and public meetings. Depending on the risk levels, emitting facilities are required to implement varying levels of risk reduction measures. BAAQMD implements AB 2588, and is responsible for prioritizing facilities that emit air toxics, reviewing health risk assessments, and implementing risk reduction procedure.

Greenhouse Gases and Climate Change

Gases that trap heat in the atmosphere are called greenhouse gases. The major concern with greenhouse gases is that increases in their concentrations are causing global climate change. Global climate change is a change in the average weather on earth that can be measured by wind patterns, storms, precipitation and temperature. Although there is disagreement as to the speed of global warming and the extent of the impacts attributable to human activities, most agree that there is a direct link between increased emissions of greenhouse gases and long term global temperature. What greenhouse gases have in common is that they allow sunlight to enter the atmosphere, but trap a portion of the outward-bound infrared radiation which warms the air. The process is similar to the effect greenhouses have in raising the internal temperature, hence the name greenhouse gases. Both natural processes and human activities emit greenhouse gases. The accumulation of greenhouse gases in the atmosphere regulates the earth’s temperature; however, emissions from human activities such as electricity production and the use of motor vehicles have elevated the concentration of greenhouse gases in the atmosphere. This accumulation of greenhouse gases has contributed to an increase in the temperature of the earth’s atmosphere and has contributed to global climate change.

The principal greenhouse gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), and water vapor (H_2O). CO_2 is the most common reference gas for climate change. To account for the warming potential of greenhouse gases, greenhouse gas emissions are often quantified and reported as CO_2 equivalents (CO_2e). Large emission sources are reported in million metric tons of CO_2e ($MMTCO_2e$).

Federal

GHG emissions are not currently regulated under the federal CAA. However, on April 24, 2009, the EPA proposed to make findings under the CAA that GHGs in the atmosphere endanger the public health and welfare of current and future generations, and that emissions from motor vehicles are causing and contributing to GHGs in the atmosphere (see 74 Fed. Reg. 18886 [Apr. 24, 2009]). If adopted, these findings would likely lead to the adoption of federal GHG standards, which have not yet been developed.

State

Various statewide and local initiatives to reduce California's contribution to GHG emissions have raised awareness that, even though the various contributors to and consequences of global climate change are not yet fully understood, global climate change is occurring, and that there is a real potential for severe adverse environmental, social, and economic effects in the long term. Every nation emits GHGs and, therefore, makes an incremental cumulative contribution to global climate change. Hence, global cooperation will be required to reduce the rate of GHG emissions enough to slow or stop the human-caused increase in average global temperatures and associated changes in climatic conditions.

There are currently no state regulations in California that establish ambient air quality standards for GHGs. However, California has passed laws directing CARB and the Natural Resources Agency to develop actions to reduce GHG emissions, and several state legislative actions related to climate change and GHG emissions have come into play in the past decade.

Executive Order S-3-05

Governor Schwarzenegger signed Executive Order S-3-05 in 2005, in recognition of California's vulnerability to the effects of climate change. Executive Order S-3-05 set forth target dates by which statewide emissions of greenhouse gases shall be progressively reduced, as follows:

- By 2010, reduce greenhouse gas emissions to 2000 levels;
- By 2020, reduce greenhouse gas emissions to 1990 levels; and
- By 2050, reduce greenhouse gas emissions to 80 percent below 1990 levels.

The executive order directs the Secretary of the California Environmental Protection Agency (Cal/EPA) to coordinate a multi-agency effort to reduce GHG emissions to the target levels. The Secretary will also submit biannual reports to the Governor and California Legislature describing the progress made toward the emissions targets, the impacts of global climate change on California's resources, and mitigation and adaptation plans to combat these impacts. To comply with the executive order, the Secretary of Cal/EPA created the California Climate Action Team, made up of members from various state agencies and commissions. The team released its first report in March 2006. The report proposed to achieve the targets by building on the voluntary actions of California businesses, local governments, and communities and through state incentive and regulatory programs.

Assembly Bill 32 (California Global Warming Solutions Act of 2006)

Shortly after the issuance of Executive Order S-3-05, the California Legislature adopted Assembly Bill 32 (AB 32), the Global Warming Solutions Act of 2006. AB 32 recognizes that California is the source of substantial amounts of greenhouse gas emissions. In the Findings and Declarations for AB 32, the Legislature found:

> *The potential adverse impacts of global warming include the exacerbation of air quality problems, a reduction in quality and supply of water to the state from the Sierra snowpack, a rise in sea levels resulting in the displacement of thousands of coastal businesses and residences, damage to the marine ecosystems and that natural environment, and an increase in the incidences of infectious diseases, asthma, and other health-related problems.*

In order to avert these consequences, AB 32 requires CARB, the state agency charged with regulating statewide air quality, to create a plan and implement rules to achieve "real, quantifiable, cost-effective reductions of greenhouse gases." AB 32 requires CARB to design and implement emission limits, regulations, and other measures to reduce statewide greenhouse gas emissions by 2020 to 1990 levels (which is the same target in Executive Order S-3-05). AB 32 directs CARB to begin developing early actions to reduce greenhouse gas emissions while also preparing a Scoping Plan to identify how best to reach the 2020 limit. The measures and regulations to meet the 2020 target are to be in effect by 2012.

CARB has identified 44 Early Action measures that could be enforceable on or before 2010. These measure include potential regulations affecting landfills, motor vehicle fuels, refrigerant in cars, port operations, and many other sources. CARB has approved a Discrete Early Action measure to require electrification at ports. Regulatory development for the remaining measures is on-going.

In December 2007, CARB approved the 2020 emission limit of 427 million metric tons of CO_2 equivalents of greenhouse gases. CARB has also adopted a regulation, which took effect in December 2008, requiring the largest industrial sources to report and verify their greenhouse gas emissions.

In June 2008, CARB published its Climate Change Draft Scoping Plan (CARB, 2008b). The Draft Scoping Plan reported that CARB met the first milestones set by AB 32 in 2007: developing a list of early actions to begin sharply reducing greenhouse gas emissions; assembling an inventory of historic emissions; and establishing the 2020 emissions limit. After consideration of public comment and further analysis, CARB released the Climate Change Proposed Scoping Plan in October 2008. CARB approved the Scoping Plan in December 2008.

The Scoping Plan identifies a comprehensive set of actions designed to reduce overall carbon emissions in California. Key elements of the Scoping Plan include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a statewide renewables energy mix of 33 percent;

- Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;
- Establishing targets for transportation-related greenhouse gas emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;
- Adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel Standard; and
- Creating 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.

The Scoping Plan notes that "[a]fter Board approval of this plan, the measures in it will be developed and adopted through the normal rulemaking process, with public input." The Scoping Plan explains that local governments are "essential partners" in the effort to reduce greenhouse gas emissions, and that they have "broad influence and, in some cases, exclusive jurisdiction" over activities that contribute to greenhouse gas emissions. The Plan encourages local governments to reduce greenhouse gas emissions by approximately 15 percent from current levels by 2020. The Plan also explains that "local governments will play a significant role in the regional planning process to reach passenger vehicle greenhouse gas emissions reduction targets." With respect to this regional planning process, the Scoping Plan states that "[i]ncreasing low-carbon travel choices (public transit, carpooling, walking and biking) combined with land use patterns and infrastructure that support these low-carbon modes of travel, can decrease average vehicle trip lengths by bringing more people closer to more destinations." It also notes that regional targets will be set and achieved on a regional basis, which will help to maintain regional flexibility.

Senate Bill 97

SB 97, signed August 2007 (Chapter 185, Statutes of 2007; Public Resources Code Sections 21083.05 and 21097), acknowledges that climate change is a prominent environmental issue that requires analysis under CEQA. This bill directs the Governor's Office of Planning and Research (OPR), which is part of the state Natural Resources Agency, to prepare, develop, and transmit to CARB guidelines for the feasible mitigation of GHG emissions (or the effects of GHG emissions), as required by CEQA, by July 1, 2009. The Resources Agency is required to certify and adopt those guidelines by January 1, 2010.

Revisions to CEQA Guidelines

April 13, 2009, OPR submitted its proposed amendments to the state CEQA Guidelines for GHG emissions to the Secretary for Natural Resources, as required by Senate Bill 97 (Chapter 185, 2007). The Natural Resources Agency began a formal rulemaking in July 2009, and on October 23, 2009, the Agency reissued the proposed Guidelines amendments in revised form. The Natural Resources Agency accepted additional public comment. On December 31, 2009, the Natural Resources Agency delivered its rulemaking package to the Office of Administrative Law for review pursuant to the Administrative Procedure Act. On February 16, 2010, the Office of

Administrative Law filed the Amendments with the Secretary of State. The Amendments will become effective on March 18, 2010.

The CEQA Guidelines provide the following considerations for determining the significance of GHG emissions under draft section 15064.4:

A lead agency "should make a good-faith effort, based to the extent possible on scientific and factual data, to describe, calculate or estimate the amount of greenhouse gas emissions associated with a project." The agency has discretion as to whether to use a model or other means to quantify GHG emissions or to "rely on a qualitative analysis or performance standards" (Proposed Guidelines Section 15064.4(a)). Further, a lead agency should consider the following:

1. The extent to which the project may increase or reduce greenhouse gas emissions, compared to existing conditions;

2. Whether project emissions exceed a threshold of significance determined applicable by the lead agency; and

3. The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of greenhouse gas emissions. (Proposed Guidelines Section 15064.4(b)).

CAPCOA January 2008 CEQA and Climate Change White Paper

In January 2008, the California Air Pollution Control Officers Association (CAPCOA) issued a "white paper" on evaluating GHG emissions under CEQA. The CAPCOA white paper strategies are not guidelines and have not been adopted by any regulatory agency. Rather, the paper is a resource to assist lead agencies in considering climate change in environmental documents.

The CAPCOA white paper addresses what constitutes new emissions, how baseline emissions should be established, what should be considered cumulatively considerable under CEQA, what a "business as usual" scenario means, and whether an analysis should include life-cycle emissions.

The CAPCOA white paper contains a Climate Change Significance Criteria Flow Chart that proposes a tiered approach to determining significance under CEQA. The flow chart would consider a proposed plan's impact to be significant unless a General Plan for the project area exists that is in compliance with AB 32 (showing that GHG emissions for 2020 would be less than 1990 emissions for the plan area). The flow chart would consider a proposed project's impact to be significant unless one of the following can be demonstrated:

- The project is exempt under SB 97;
- The project is on the "Green List" of projects that are deemed a positive contribution to California efforts to reduce GHG emissions;[2]

[2] CAPCOA does not state what entity would have ultimate responsibility for Green List formulation or maintenance, but CAPCOA suggest that CARB and the Attorney General be consulted before any project is added to the list, and that the list be updated every six months.

- A General Plan for the project area exists that is in compliance with AB 32; and/or
- GHG emissions are analyzed and mitigated to less-than-significant.

The CAPCOA white paper considers GHG impacts to be exclusively cumulative impacts.

CARB Preliminary Draft Staff Proposal, October 2008

Separate from its Scoping Plan approved in December of 2008, CARB issued a Staff Proposal in October 2008, as its first step toward developing recommended statewide interim thresholds of significance for GHGs that may be adopted by local agencies for their own use. The proposal does not attempt to address every type of project that may be subject to CEQA, but instead focuses on common project types that, collectively, are responsible for substantial GHG emissions – specifically, industrial, residential, and commercial projects. CARB attempted to develop thresholds in these sectors to advance climate objectives, streamline project review, and encourage consistency and uniformity in the CEQA analysis of GHG emissions throughout the state. These draft thresholds are on currently on hold. CARB staff members have indicated that they will not continue this effort.

Other State Regulatory Programs

Senate Bill 375

SB 375, signed in September 2008 (Chapter 728, Statutes of 2008), aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation. SB 375 requires metropolitan planning organizations (MPOs) to adopt a sustainable communities strategy (SCS) or alternative planning strategy (APS) that will prescribe land use allocation in that MPO's regional transportation plan. CARB, in consultation with MPOs, will provide each affected region with reduction targets for GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets will be updated every 8 years, but can be updated every 4 years if advancements in emissions technologies affect the reduction strategies to achieve the targets. CARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG reduction targets, transportation projects will not be eligible for funding programmed after January 1, 2012.

Assembly Bill 1493 (Pavley)

AB 1493, enacted in 2002, required CARB to develop and adopt regulations to reduce GHGs emissions from new motor vehicles. To implement AB 1493, CARB adopted rules in 2004 to regulate GHG emissions from new passenger vehicles and light duty trucks, but the rules were stalled by automaker lawsuits and by the EPA's refusal to grant California a waiver under the CAA that would allow the State to enforce the rules. On January 21, 2009, CARB submitted a letter to EPA Administrator Jackson regarding California's request to reconsider the waiver denial. The EPA approved the waiver on June 30, 2009. Additionally, on May 19, 2009, President Obama announced a federal policy to adopt fuel economy standards that would reduce GHG emissions from motor vehicles. The federal standards that are being considered are similar to the rules that California has adopted.

Bay Area Air Quality Management District (BAAQMD)

In December 2009, the BAAQMD issued a draft update to its CEQA Air Quality Guidelines and thresholds of significance as part of a planned update of BAAQMD's CEQA Guidelines, which were last updated in 1999. The existing BAAQMD CEQA Guidelines contain no thresholds of significance for GHGs. The Draft Guidelines identify a project specific threshold of 1,100 metric tons per year as resulting in a cumulatively considerable contribution of GHG emissions and a cumulatively significant impact to global climate change. Alternatively, a project that is found to be consistent with a Qualified Climate Action Plan would have a less than significant impact to global climate change.

City of Alameda GHG Emissions and Local Action Plan for Climate Protection

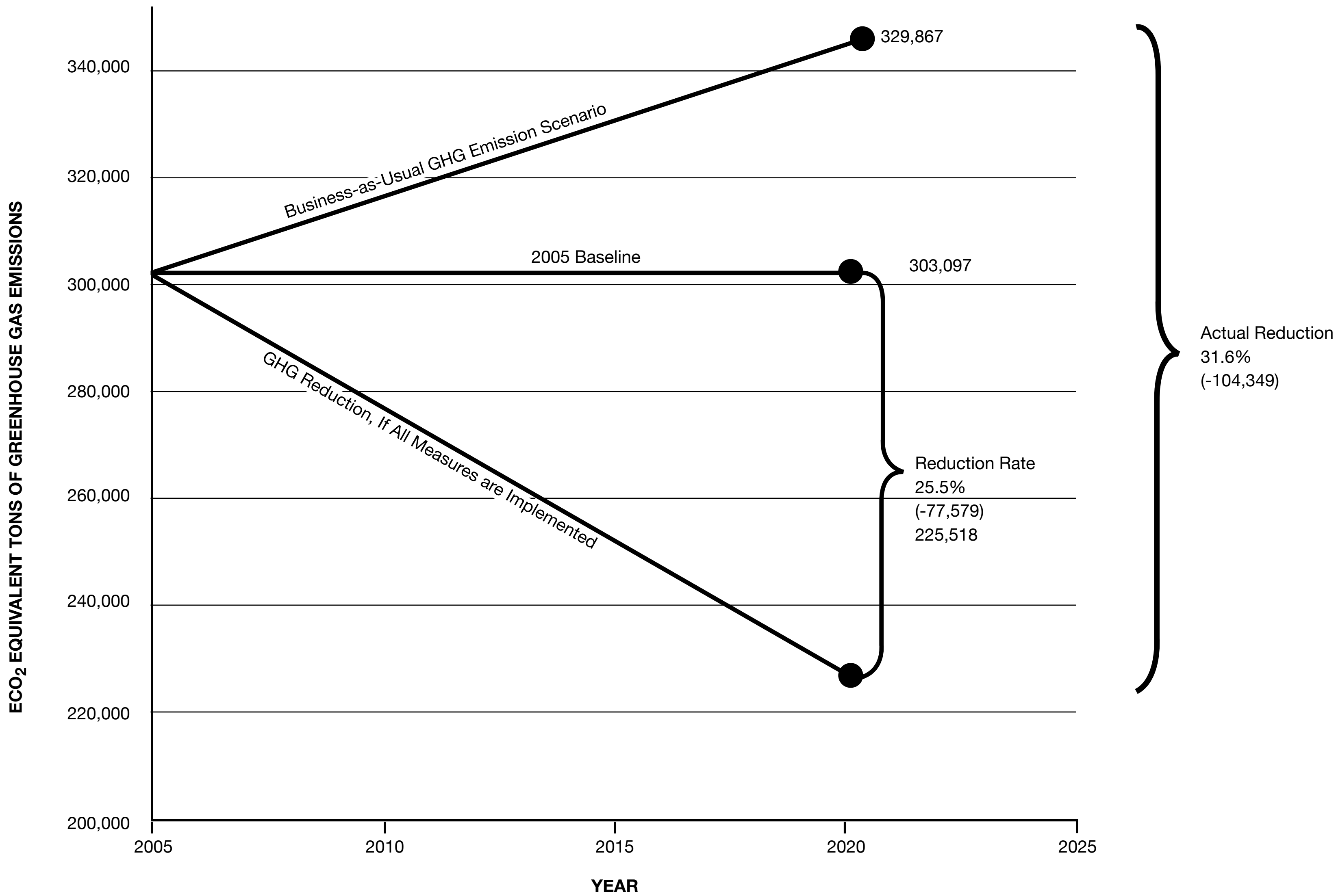
On February 5, 2008, the City of Alameda's City Council adopted the City of Alameda's Local Action Plan for Climate Protection (LAPCP) (City of Alameda, 2008), which outlines a greenhouse gas emission reduction goal and initiatives that would help achieve this reduction goal (see **Figure 4.C-1**). Important findings of the Plan include the following:

- The City of Alameda's greenhouse gas emissions baseline inventory reveals that Alameda generated approximately 303,097 tons of CO_2e in 2005;
- The City of Alameda is expected to increase its annual GHG emissions to 329,867 tons of CO_2e by 2020 based on a 0.65 percent annual population growth rate;
- Transportation based GHG emissions account for 54 percent of the City's GHG emissions, while 29 percent is from energy and heating demands of residential uses and 17 percent from commercial uses.
- Although the City sent approximately 59,024 tons of solid waste to landfills in 2005, because of the aggressive recycling efforts and efficient methane recovery capture of landfills which serve the City, the net GHG emissions from solid waste disposal are less than zero, and are therefore not considered as a contributor to the GHG emission baseline and are zeroed out for inventory purposes.

Additionally, the LAPCP identified the following initiatives that may apply to the proposed project:

> *Transportation Initiative 1*: Require that all new major developments' short and long-term transportation emissions are reduced by 10 percent. Examples of strategies to achieve this reduction include transportation demand management strategies and implementation of a Bike Plan, or bicycle facilities.

> *Energy Initiative 4*: Amend the Alameda Municipal Code to include sustainable design and green building standards for all new, substantially expanded and remodeled buildings. Although this Initiative directs the City to adopt green building standards, it provides examples of recent projects of varying sizes which have achieved a Leadership in Energy and Environmental Design (LEED) rating of silver or higher.



SOURCE: City of Alameda, 2008

Boatworks Residential Project . 208559

Figure 4.C-1

City of Alameda Greenhouse Gas Emissions Reductions Targets

<u>*Energy Initiative 6*</u>: Develop a wood-burning prohibition ordinance to reduce air pollution for new residential construction. Again, while this Initiative directs the City to adopt an ordinance, its intent is to discourage new development from installing wood-burning fireplaces.

<u>*Waste and Recycling Initiative 1*</u>: Adopt “Zero Waste Strategy” Programs and Ordinances. This Initiative identifies increased sorting and recycling of construction and demolition materials as an element of GHG reduction.

Impacts and Mitigation Measures

This analysis evaluates the proposed project’s impacts related to air quality and greenhouse gases. The evaluation considered project plans, current Appendix G significance conditions at the project site, and applicable regulations and guidelines.

Significance Criteria

In accordance with Appendix G of the state CEQA Guidelines, the impact of the proposed project on air quality or climate change would be considered significant if it 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 significant net increase of any nonattainment pollutant;
- Expose sensitive receptors to substantial pollutant concentrations;
- Create objectionable odors affecting a substantial number of people;
- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment; or
- Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases.

The following Appendix G criteria are not considered relevant to the project based upon the proposed project plans and data research; therefore, they will not be evaluated further in this EIR:

Creation of objectionable odors: The project would not involve the development of the types of land uses typically associated with odor issues, such as wastewater treatment plants, landfills, composting facilities, refineries, or chemical plants. Nor would the project locate sensitive receptors within proximity of these types of odor-producing sources. Therefore the following analysis relates to the project’s potential to result in a significant air quality impact based on the other six significance criteria.

Assessment Methodology

Approach to Analysis

When a project is proposed in a city with a general plan that is consistent with the most recently adopted Clean Air Plan (CAP), and if the project is consistent with the land use designation of the general plan, then the project is considered consistent with applicable air quality plans and policies. However, as discussed in the Project Description, the proposed project would require a General Plan amendment. BAAQMD Guidelines require that general plan amendments, redevelopment plans, specific area plans and similar planning activities should receive the same level of scrutiny as general plans with respect to consistency with regional air quality plans. Consistency with the CAP is assessed based on whether increases in population and vehicle miles travelled which may occur as a result of the proposed project are consistent with the underlying assumptions of the CAP.

BAAQMD has published the *BAAQMD CEQA Guidelines, Assessing the Air Quality Impacts of Projects and Plans,* which are a set of recommendations that provide specific guidance on evaluating projects relative to the above general criteria (BAAQMD, 1999). For temporary construction-phase impacts, BAAQMD recommends a qualitative approach that focuses on the dust control measures that would be implemented. If appropriate mitigation measures are implemented to control PM_{10} emissions, then the impact from construction would be less than significant. For evaluating operational-phase emissions, BAAQMD recommends that local agencies use criteria of 80 pounds per day or 15 tons per year to identify significant increases in emissions of ROG, NO_X, and PM_{10} from individual development projects; an exceedance of the criteria would be considered a significant impact.

For CO, an increase of 550 pounds per day would be considered significant if it leads to or contributes to CO concentrations exceeding the State Ambient Air Quality Standard of 9 parts per million (ppm) averaged over 8 hours or 20 ppm for 1 hour (i.e., if it creates a "hot spot").

Generally, if a project results in an increase in ROG, NOx, or PM_{10} of more than 80 pounds per day, then it would also be considered to contribute considerably to a significant cumulative effect. The daily emissions rates were then compared proposed mass emission thresholds to determine significance. For projects that would not lead to a significant increase of ROG, NO_x, or PM_{10} emissions, the cumulative effect is evaluated based on a determination of the consistency of the project with the regional clean air plan. This is accomplished is a stepwise manner as prescribed in BAAQMDs CEQA Guidelines. Specifically, if a project is proposed in a city or county with a general plan that is consistent with the Clean Air Plan *and* the project is consistent with that general plan (i.e., it does not require a general plan amendment), then the project will not have a significant cumulative impact (provided the project does not individually have any significant impacts)." If the general plan is not consistent with the Clean Air Plan then a project would be deemed to have a significant cumulative impact if the project, in combination with past, present and reasonably anticipated future projects, would exceed BAAQMD's numerical thresholds.

Air quality assessment methodologies in this section generally conform to those identified by BAAQMD in its *CEQA Guidelines* from 1999. However, because BAAQMD recently released a

Draft versions of an updated CEQA Air Quality Guidelines, additional methodologies from this Draft document were also included in the following analysis.

For construction phase-related impacts existing BAAQMD Guidelines do not require quantification of construction emissions, but recommends that significance be based on a consideration of the control measures to be implemented (BAAQMD, 1999). However, BAAQMD's Draft CEQA Air Quality Guidelines released in December 2009 do establish thresholds and in anticipation of this Draft Guidance, construction emissions are calculated and compared to the proposed significance thresholds. Construction emissions were estimated using the Urban Emissions Model, URBEMIS2007.

For operational impacts, proposed BAAQMD Guidelines identify that a project would have a significant operational impact with regard to criteria pollutant emissions if it results in an increase in ROG, NOx, or $PM_{2.5}$ of more than 54 pounds per day or of PM_{10} more than 82 pounds per day.

For impacts related to TAC's, BAAQMD Guidelines identify that a project would result in potential to expose persons to substantial levels of Toxic Air Contaminants (TAC) if the probability of contracting cancer for the Maximally Exposed Individual (MEI) exceeds 10 in one million.

Greenhouse Gas Assessment

The 2009 amendments to CEQA have been filed with the Secretary of State and will become affective on March 18, 2010. These amendments contain all new significance criteria to Appendix G that address GHG. While neither of these two new criteria specifies quantitative threshold for GHG emissions, interim guidance from the Governors Office of Planning and Research and the California Air Pollution Control Officers Association both suggest that quantification of emissions is a necessary element to an adequate evaluation of GHG impacts.

Currently, neither CARB, nor BAAQMD have adopted their proposed quantitative thresholds for determining the significance of a project's contribution to global climate change. As noted above, OPR's proposed CEQA Guidelines state that a lead agency should use its judgment and may consider a number of different factors when assessing the significance of impacts from GHG emissions. As also noted above, CARB's staff has stopped pursing development of a statewide threshold initially proposed in October 2008.

In December 2009, the BAAQMD issued a third draft update to its CEQA Air Quality Guidelines and thresholds of significance, as part of a planned update of BAAQMD's CEQA Guidelines, which were last updated in 1999. The December 2009 Draft Guidelines identify a project specific threshold of either 1,100 metric tons per year or 4.6 metric tons per year per service population as resulting in a cumulatively considerable contribution of GHG emissions and a cumulatively significant impact to global climate change. Alternatively, a project that is found to be consistent with a Qualified Climate Action Plan would have a less than significant impact to global climate change.

In assessing significance for this project, this analysis quantifies the project's GHG emissions and considers the regulatory approaches that have been proposed by OPR and BAAQMD. Additionally, the proposed project will be assessed for consistency with the City of Alameda's Local Action Plan for Climate Protection.

Impact Analysis

Impact 4.C-1: The proposed project would result in an increase in vehicle miles traveled (VMT) that would be greater than the rate of increase in population. Therefore, the proposed project would not be consistent with the ABAG Clean Air Plan. It would not conflict with other regional air quality management plans. (Significant)

For a local plan to be consistent with the regional air quality plan, it must be consistent with the most recently adopted CAP. While BAAQMD is in the process of preparing its 2009 CAP, the existing CAP is the *Bay Area 2005 Ozone Strategy*. General Plans of cities and counties must show consistency with regional plans and policies affecting air quality to support a determination of a less than significant impact on air quality.

BAAQMD identifies three criteria for CAP consistency determinations:

1. Demonstrate that the population growth for the jurisdiction under the proposed local plan will not exceed the values included in the current CAP.

2. Demonstrate that the rate of increase in vehicle miles traveled (VMT) for the jurisdiction under the proposed local plan will not exceed the rate of increase in population.

3. Demonstrate that transportation control measures (TCM's) identified in the CAP for implementation by the local jurisdiction are included in the project design.

Criterion 1: Population growth consistency

The population estimates assumed in the current CAP are from the Association of Bay Area Government's (ABAG) *Projections 2003* (although there are later iterations of projections). ABAG cites a year 2000 population of 72,259 for the City of Alameda and projects a year 2010 population of 77,000. Based on the latest available (2007) ABAG Projections, the City of Alameda has a average of 2.40 persons per household. Given that the proposed project would add 242 dwelling units to the City's inventory, the proposed project would result in a population increase of approximately 581 within the City.

The most recent update of ABAG's projections was completed in 2007 and indicates a City population of 77,100 persons in 2010. A population increase of 581 from the proposed project would result in a 2010 population of 77,681, less than the population of 77,700 assumed in the CAP. Therefore, population increases resulting from project development would be considered consistent with those assumed in the latest CAP.

Criterion 2: VMT increase consistency

The Metropolitan Transportation Commission (MTC) maintains an inventory of VMT and population for the region and by county. The rate of increase in VMT for Alameda County (City-specific data are not available) between 2015 and the base year of 2007 is 9.36 percent while the rate of increase in population for the same period is 6.04 percent. Consequently, even without the project, the rate of increase in VMT exceeds the rate of increase in VMT for the County.

As discussed in 4.B, *Transportation*, the proposed development would result in a net new vehicle trip generation of approximately 2,316 daily trips. Using the URBEMIS2007 default trip length assumption of 9.5 miles for year 2011 for Alameda County, the resulting increase in VMT would be 19,800 miles.

For year 2007, MTC data shows VMT for Alameda County of 36,402,500 miles. The proposed project VMT of 19,800 miles represents a rate of increase of VMT of 0.050 percent compared to a base year of 2007.

MTC's population estimates for Alameda County are 1,558,600 in 2007. The proposed project population increase of 581 represents a rate of increase of population of 0.035 percent compared to a base year of 2007. Consequently, the rate of increase in VMT (0.050%) would be greater than the rate of increase in population (0.035%) and the project would be considered not to be consistent with the CAP.

Criterion 3: Plan consistency with TCMs contained in the CAP

Air pollutant emissions are a function of human activity. The 1988 California Clean Air Act, Section 40919(d) requires regions to implement "transportation control measures to substantially reduce the rate of increase in passenger vehicle trips and miles traveled." Consistent with this requirement, one of the goals of the *Bay Area 2005 Ozone Strategy* is to reduce the number of trips and vehicle miles Bay Area residents travel in single-occupant vehicles through the implementation of twenty TCMs. **Table 4.C-4** identifies those TCMs that local governments should implement through local plans to be considered in conformance with the *2005 Ozone Strategy*. The BAAQMD recommends that local plans that do not demonstrate reasonable efforts to implement these TCMs be considered inconsistent with the regional air quality plan and to have a significant impact. Policy 5.5.d of the existing Alameda General Plan Open Space and Conservation Element calls for encouragement of development and implementation of Transportation System Management (TSM) programs and refers to Policies 4.2.4a and 4.2.4b of the Transportation Element. These transportation policies in turn provide for development patterns and land uses that promote the use of alternate modes and reduce the rate of growth in region-wide vehicle miles traveled (Policy 4.2.4a) and integrate planning for Environmentally Friendly Modes, including transit, bicycling and walking, into the City's development review process (Policy 4.2.4b).

In order to reduce the percentage growth of VMT to that of the population, it would be necessary to reduce project-related VMT by 7,059 miles, or about 36 percent.

TABLE 4.C-4
CLEAN AIR PLAN TRANSPORTATION CONTROL MEASURES (TCMS)
TO BE IMPLEMENTED BY LOCAL GOVERNMENTS

TCM in the 2005 Ozone Strategy	Policies in the Existing General Plan Consistent with the TCM
1. Support Voluntary Employer-Based Trip Reduction Programs (TCM #1)	Policy 4.3.4.a of the existing General Plan guides the City to "Work with major employers to accommodate and promote alternative transportation modes, flexible work hours, and other travel demand management techniques and require that appropriate mitigation be funded through new development if a nexus exists." The proposed General Plan amendment will not change this policy or interfere with its continued implementation. Therefore the proposed General Plan Amendment is consistent with the goals and implementation of TCM #1 of the CAP.
2. Improve Bicycle Access and Facilities (TCM #9)	Policies 4.1.1.d, 4.1.6.d, 4.1.7.d and 4.3.3.a of the existing General Plan address the need for improved bicycle facilities within the City. Additionally, the City has adopted a Bicycle Master Plan. The proposed General Plan amendment will not change these policies or Bicycle Master Plan or interfere with their continued implementation. Therefore the proposed General Plan Amendment is consistent with the goals and implementation of TCM #9 of the CAP.
3. Improve Arterial Traffic Management (TCM #12)	Objectives 4.1.2 and 4.1.6 of the existing general Plan address enhancement of roadway levels of service and implementation of Transportation demand Management (*TDM) techniques, respectively. Each of these objectives are facilitated by implementation of numerous policies that strive to improve the efficiency of the Citywide transportation system, including arterial roadways. The proposed General Plan amendment will not change this policy or interfere with its continued implementation. Therefore the proposed General Plan Amendment is consistent with the goals and implementation of TCM #12 of the CAP.
4. Local Clean Air Plans, Policies and Programs (TCM #15) Cities are to encourage parking strategies to reduce use of automobiles and promote use of transit	Policy 4.2.5.b of the existing General Plan calls for the City to "support use of parking in-lieu fees where feasible to increase and encourage public transit options and evaluate the use of shared parking strategies in mixed use areas". The proposed General Plan amendment will not change this policy or interfere with its continued implementation. Therefore the proposed General Plan Amendment is consistent with the goals and implementation of TCM #15 of the CAP.
5. Improve Pedestrian Access and Facilities (TCM #19)	Policies 4.1.1.a and 4.1.1.b, of the existing General Plan address the need for enhancement of pedestrian mobility withinthe City. The proposed General Plan amendment will not change these policies or interfere with their continued implementation. Therefore the proposed General Plan Amendment is consistent with the goals and implementation of TCM #19 of the CAP.
6. Promote Traffic Calming Measures (TCM #20)	Policy 4.2.2.b of the existing General Plan directs the City to maintain a "toolbox" of traffic calming measures. These measures are included in the Street Classification system and identify such measures as "bulb-outs" to be used to encourage traffic from using local access streets in favor of to arterials. The proposed General Plan amendment will not change this policy or interfere with its continued implementation. Therefore the proposed General Plan Amendment is consistent with the goals and implementation of TCM #20 of the CAP

SOURCE: Environmental Science Associates, 2010.

Mitigation Measure 4.C-1: Prior to project occupancy, the project applicant shall put into place a City-approved Transportation Demand Management program with the goal of reducing the number of peak hour trips by 10 percent. This will include the following measures:

- Establish a Boatworks Home Owners Association (HOA) and CCRs for the project;
- Assess the HOA an annual fee in an amount necessary to provide the following on-going programs:

- EasyPass program (unlimited transit pass, usable on AC Transit buses), two passes per unit, additional passes per unit for residents may be purchased at cost;
- Bicycle facilities in each unit;
- One car-share membership per residential unit; and
- Provide annual funding for transportation coordination services including, but not limited to, promotional information packages and planning services regarding available transportation options, and annual monitoring reports to City regarding effectiveness of programs and recommended enhancements to meet 10% reduction goal.

While the above measures would reduce VMT resulting from the proposed project, it is unlikely that they would result in a reduction of 36 percent or more that would be needed to reduce this impact to a less-than-significant level. Consequently this impact is considered significant and unavoidable.

Significance after Mitigation: Significant and Unavoidable.

Impact 4.C-2: Construction of the proposed project would generate short-term emissions of criteria pollutants, including suspended and inhalable particulate matter and equipment exhaust emissions. (Significant)

Construction of the proposed project would have the potential to create air quality impacts through the use of heavy-duty construction equipment, haul truck trips, and vehicle trips generated from construction workers traveling to and from the site. In addition, fugitive dust or PM_{10} emissions would result from excavation, trenching, and other construction activities. Mobile source emissions would result from the use of construction equipment such as bulldozers, graders, and excavators. Construction emission concentrations can vary substantially from day to day, depending on the level of activity, the specific type of operation, and the prevailing weather conditions.

Construction activities such as site preparation may generate significant quantities of dust on a temporary and intermittent basis. The BAAQMD's existing approach to analysis of construction impacts is to emphasize implementation of effective and comprehensive dust control measures rather than detailed quantification of emissions (BAAQMD, 1999). The BAAQMD considers construction related impacts of proposed projects to be less than significant if required dust-control measures are implemented.

Construction activities would also generate pollutant emissions from equipment exhaust related to construction-vehicle activity and construction worker automobile trips. Criteria pollutant emissions of ROG and NO_x from these emission sources would incrementally add to the regional atmospheric loading of ozone precursors. The BAAQMD recognizes that construction equipment emits ozone precursor emissions, but indicates that such emissions are included in the emission inventory that serves as the basis for regional air quality plans. Therefore, construction equipment exhaust emissions are not expected to impede attainment or maintenance of ozone standards in the Bay Area.

BAAQMD has proposed new daily mass significance thresholds for construction-related activities in its *Draft Air Quality Guidelines*. These thresholds are 54 pounds per day of either ROG, NOx or $PM_{2.5}$ and 82 pounds per day for PM_{10}. As can be seen from the data in **Table 4.C-5**, construction- related exhaust emissions would be less than the thresholds proposed by BAAQMD in their Draft CEQA Air Quality Guidelines for all pollutants except ROG. ROG emissions from construction would primarily be the result of architectural coating applications which were assumed to occur over a 5-month period. ROG emissions from architectural coating applications may be reduced by either extending the application period or by use of prefinished materials.

TABLE 4.C-5
PEAK DAY CONSTRUCTION-RELATED POLLUTANT EMISSIONS (POUNDS PER DAY)

Year	ROG	NO_x	CO	SO2	Exhaust PM10[a]	Exhaust PM2.5[a]	CO_2
2010	**121**	41	69	0.05	2.87	2.63	8,022
Proposed BAAQMD Construction Threshold	54	54	None	None	82	54	None
Significant Impact?	Yes	No	No	No	No	No	No

[a] BAAQMD's proposed construction-related significance thresholds for PM10 and PM 2.5 apply to exhaust emissions only and not to fugitive dust.

SOURCE: URBEIS2007

Mitigation Measure 4.C-2: During construction, the project applicant shall implement both BAAQMD's basic and enhanced dust control procedures listed below (BAAQMD CEQA Guidelines, 1999).

The "basic" dust control program shall include, but not necessarily be limited to, the following:

- Water all active construction areas at least twice daily. Watering should be sufficient to prevent airborne dust from leaving the site. Increased watering frequency may be necessary whenever wind speeds exceed 15 miles per hour. Reclaimed water should be used whenever possible.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard (i.e., the minimum required space between the top of the load and the top of the trailer).
- Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites.

- Sweep streets (with water sweepers using reclaimed water if possible) at the end of each day if visible soil material is carried onto adjacent paved roads.
- Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites.

The “enhanced” dust control measures shall include the following:

- Hydroseed or apply non-toxic soil stabilizers to construction areas and previously graded areas inactive for ten days or more
- Enclose, cover, water twice daily or apply non-toxic soil binders to exposed stockpiles of dirt, sand, etc.
- Limit traffic speeds on unpaved roads to 15 miles per hour (mph)
- Install sandbags or other erosion control measures to prevent silt runoff to public roadways
- Replant vegetation in disturbed areas as quickly as possible

Significance after Mitigation: Less than Significant.

Impact 4.C-3: Operations of the proposed project would result in an increase in operational emissions of criteria air pollutants (ROG, NO_x, CO, PM_{10}, and $PM_{2.5}$) from on-road motor vehicle traffic traveling to and from site and onsite area sources. (Less than Significant)

Mobile source emissions would be the largest source of pollutants resulting from proposed project operation and were estimated using the URBEMIS2007 version 9.2.4 emissions inventory model and the traffic impact analysis. Once construction is complete, the proposed project would generate about 2,316 daily vehicle trips as described in the Transportation analysis. An average trip length of 9.5 miles for Alameda County was also taken from the URBEMIS2007. Emissions of $PM._{10}$ and $PM_{2.5}$ include entrained road dust as well as exhaust emissions.

Table 4.C-6 presents the emissions associated with the proposed project. For the emissions estimates, all residential units were assumed to have gas fireplaces, because wood new burning fireplaces are prohibited by BAAQMD, unless fitted with EPA-approved inserts.

As shown in Table 4.C-6, the air quality impact from operation of the proposed project would not exceed existing or proposed BAAQMD significance thresholds for ROG, NOx, CO, PM_{10} or $PM_{2.5}$. Consequently the operational air quality impact of the proposed project would be considered less than significant and no mitigation measures are required.

Mitigation: None required.

TABLE 4.C-6
UNMITIGATED OPERATIONAL CRITERIA POLLUTANT EMISSIONS

	Estimated Emissions (lbs/day)				
Air Pollutant	**ROG**	**NO_X**	**CO**	**PM_{10}**	**$PM_{2.5}$**
Mobile Sources	17.4	22.5	222	34.1	6.59
Landscape maintenance	1.95	0.12	33.6	0.03	0.03
Natural gas combustion	0.23	3.03	2.63	0.01	0.01
Hearth (gas fireplaces)	0.12	2.01	0.85	0.16	0.16
Consumer products	11.8				
Architectural coatings	3.4	--	--	--	--
Total	34.9	27.7	259	34.3	6.79
Regional Significance Threshold	80	80	550	80	None
Significant Impact?	No	No	No (a)	No	No
Proposed BAAQMD Threshold	54	54	none	82	54
Significant?	No	No	No	No	No

[a] Exceeding the 550 pound per day CO threshold does not necessarily reflect a significant CO impact but rather, triggers a modeling assessment of localized CO concentrations for impact determination.

SOURCE: ESA, 2008 (see Appendix F).

Impact 4.C-4: Development of the proposed project would not expose sensitive receptors to substantial concentrations of toxic air contaminants. (Less than Significant)

The proposed residential development would not be considered a potential source of significantly new stationary emissions, because stationary source emissions on site would be limited to natural gas combustion for space and water heating similar to any residential area. The proposed project would be located within a mix of uses. South of the project site is a light industrial building housing a glass manufacturing business. North of the project site across the estuary in Oakland are the Cemex concrete plant and the Con Agra food processing plant, approximately 700 feet from the project site. Neither of these facilities is listed with BAAQMD as either a major facility or a source of reportable toxic air contaminant emissions in its latest TAC annual report (BAAQMD, 2007). Consequently, emissions from these facilities are not considered substantial by BAAQMD and as such would not be expected to result in exposure of project residents to substantial pollutant concentrations.

The California Air Resources Board (ARB) published *Air Quality and Land Use Handbook: a Community Health Perspective*, which is intended to give guidance to local governments in the siting of sensitive land uses near sources of air pollution. With respect to Port facilities, the recommendations of the report are: “Avoid siting new sensitive land uses immediately downwind of ports in the most heavily impacted zones.” With respect to freeways, the recommendations of the report are: “Avoid siting new sensitive land uses within 500 feet of a freeway, urban roads with more than 100,000 vehicle per day or rural roads with 50,000 vehicles/day". The proposed project is located approximately 3 miles from the Port of Oakland and 1,700 feet from Interstate 880. Therefore the proposed project is consistent with CARB recommendations regarding locating sensitive receptors with respect to emissions from ports and freeways. Because the proposed project would not locate sensitive receptors near significant stationary sources of toxic air contaminants or near freeways or ports, the project would have a less than significant impact with respect to exposure of sensitive receptors.

Mitigation: None required.

Cumulative Impacts

Impact 4.C-5: Development proposed as part of the project, when combined with past, present and other reasonably foreseeable development in the vicinity, would result in cumulative air quality impacts. (Significant)

According to the BAAQMD CEQA Guidelines, any proposed project that would individually have a significant air quality impact would also be considered to have a significant cumulative air quality impact. As shown in Table 4.C-5, the operational emissions of NOx, ROG, CO and PM_{10}, due to the implementation of the proposed project, would result in a less than significant impact.

For projects that individually have a less-than-significant impact on regional air quality, the BAAQMD Guidelines state that the cumulative impact should be determined based on the project's consistency with the applicable local Clean Air Plan, in this case, the 2005 Bay Area Ozone Strategy and with the local general plan. Consistency with the 2005 Bay Area Ozone Strategy was addressed in Impact 4.C-1 of this analysis, which was determined to be significant and unavoidable. Consequently, while the proposed project by itself would be considered to have a less than significant impact with regard to air quality and criteria air pollutants, it is considered to have a significant and unavoidable cumulative air quality impact.

> **Mitigation Measure 4.C-5: Trip Reduction / TDM:** Identified above relative to Impact 4.C-1.

Significance after Mitigation: Significant and Unavoidable.

Impact 4.C-6: Implementation of the proposed project would make a significant contribution to cumulative global climate change. (Significant)

Operation of the proposed project would result in emissions of greenhouse gases that contribute to global climate change. Greenhouse gas emissions would result from increases in motor vehicle trips, as well as from natural gas combustion, landscape maintenance activities, and other sources.

As of the date of this analysis, neither BAAQMD, CARB, nor any federal agency has formally implemented an emission rate criterion for GHG emissions for purposes of identifying a significant contribution to global climate change. Nor are there rules or regulations in place from CARB, BAAQMD, OPR or other resource agency applicable to the proposed project that define what is a "significant" source of greenhouse gas emissions, and there are no applicable facility-specific greenhouse gas emission limits or caps. Pursuant to Senate Bill 97, the Natural Resources Agency has submitted amendments to the CEQA Guidelines "for the mitigation of greenhouse gas emissions or the effects of greenhouse gas emissions." The amendments become effective March 18, 2010. However these amendments leave the determination of what constitutes a threshold of significance relative to GHG emissions and climate change up to the lead agency.

The proposed project would generate GHG emissions from a variety of sources. First, GHG emissions would be generated during construction of the proposed project. Once fully operational, proposed project operations would generate GHG emissions from both stationary sources and mobile sources. Indirect source emissions include electrical consumption and landscape maintenance. Mobile sources of air pollutants associated with the proposed project would consist of motor vehicles trips generated by residents and truck trips generated by the proposed project (e.g., delivery vehicles to/from residences).

Building Construction Emissions

Construction emissions from the proposed project were estimated using the URBEMIS2007 emissions inventory model developed by the CARB.

The URBEMIS2007 model separates the construction process into four default stages: fine grading, asphalt work, structural building, and architectural coating. The fine grading phase is separated into emissions from fugitive dust, emissions from off-road equipment, and emissions from on-road trucks off-hauling soil and worker vehicle trips. The asphalt application phase estimates emissions from off-road equipment, on-road trucks and worker vehicle trips. Emissions from the structural building phase consist of off-road equipment emissions, worker vehicle trips, and vendor vehicle trips. Peak annual construction-related GHG emissions for the proposed project are presented in **Table 4.C-7**. Because they are short-term emissions, construction-related emissions may be amortized over the lifetime of a project to estimate an annual contribution of these emissions.

Operational Emissions

Total annual operational greenhouse gas emissions from the proposed project are also present in Table 4.C-7.

Area and Indirect Sources

Area and indirect sources associated with the proposed project would primarily be related to electrical usage, natural gas combustion for space and water heating, and landscape maintenance. GHG emissions from electrical usage are generated when energy consumed on the site is generated by fuel combustion. GHG emissions from electrical usage were estimated using the protocol of the

TABLE 4.C-7
ESTIMATED ANNUAL EMISSIONS OF GREENHOUSE GASES

	Emissions (metric tons CO_2e per year)			
Emission Source	**CO_2**	**CH_4**	**N_2O**	**Total CO_2e**
Construction Emissions				
Construction Emissions (during construction period)	723.3	1.11	5.74	730.1
Construction (amortized over 30 year project lifetime)	24.11	0.04	0.19	24.3
Operational Emissions				
Motor vehicle trips	3,249	9.09	156.5	3,414
Electricity	691.9	0.11	0.90	693.0
Area Source (natural gas and landscape maintenance)	641.2	1.50	0.37	643.1
Total Operational Greenhouse Gas Emissions	789.7	0.84	6.11	**4,774.4**

NOTES: Project CO_2 emissions estimates were made using URBEMIS 2007 v.9.2.4 with trip generation data from the traffic report and other information from the project description. CO_2e emissions were estimated using emission factors of the California Climate Action Registry Protocol (URMEMIS2007, CCAR, 2009)

California Climate Action Registry. Natural gas and landscape maintenance emissions were estimated using CARB's URBEMIS20007 model. URBEMIS2007 calculates landscape maintenance emissions (e.g., from powered mowers and blowers)based on the acreage of the land use site.

Mobile Emission Sources

GHG emissions from mobile sources were calculated using the methodology and assumptions described for criteria pollutant emissions in Impact 4.C-2. Vehicle trip emissions of CO_2 were generated using CARB's URBEMIS2007 model. Emission factors for N_2O and CH_4 were taken from the CCAR Protocol for motor vehicles. (CCAR, 2009)

Table 4.C-7 presents the mobile source GHG emissions associated with full build-out of the project. As can be seen from this table, mobile source GHG emissions from the proposed project within California are estimated to be 4,774 MT/year of CO_2e. Assuming a project population increase of 600 residents, the project emissions in terms of service population would be 8.0 MT/year/service population.

Significance Assessment of Project GHG Emissions

The GHG emissions resulting from this project do not represent a significant contribution to global climate change based on any existing, adopted significance threshold. First, project emissions do not exceed any established air quality significance thresholds that apply to the construction or operation of the project. With respect to construction, GHG emissions are minor (only 145.2 total metric tons of CO_2e) and of temporary duration. While operational emissions would exceed both the proposed 1,100 metric ton per year threshold and the proposed 4.6 metric ton per year per service population threshold of the BAAQMD, these thresholds are currently in draft form at the time of this analysis. Although these thresholds are only proposals at the time of this analysis, they are relevant to this analysis because they are the only quantitative thresholds currently in existence proposed by a regulatory agency with jurisdiction over the proposed project. In light of the foregoing, and given that total operational GHG emissions from the project are 4,774 metric tons of CO_2e per year, this analysis finds there are significant impacts with respect to quantifiable GHG emissions resulting from the project.

Consistency with the Local Action Plan for Climate Protection

In addition to an evaluation of the magnitude of GHG emissions resulting from the proposed project, the project may also be assessed for consistency with the goals and initiatives of the City of Alameda's Local Action Plan for Climate Protection (LAPCP). Specifically, this Plan contains several initiatives related to transportation, energy and waste that should be a consideration to a residential project within the City. Each of these applicable initiatives are discussed below:

Transportation Initiative 1: Require that all new major developments' short and long-term transportation emissions are reduced by 10 percent. Examples of strategies to achieve this reduction include transportation demand management strategies and implementation of a Bike Plan, or bicycle facilities. These type of strategies have been identified and included as Mitigation Measure 4.C-1 of this document.

Energy Initiative 4: Amend the Alameda Municipal Code to include sustainable design and green building standards for all new, substantially expanded and remodeled buildings. Although this Initiative directs the City to adopt green building standards, it provides examples of recent projects of varying sizes which have achieved a LEED rating of silver or higher.

There are no project specific details within the project description to indicate any level of effort to address any energy savings through building design. While the City has yet to adopt sustainable design and green building standards, to be consistent with the intent of the LAPCP, the proposed project should include mitigation measures to address the goals and initiatives of the LAPCP. Consequently, mitigation measures addressing building efficiency would be would be necessary for the project to be consistent with LAPCP.

Energy Initiative 6: Develop a wood-burning prohibition ordinance to reduce air pollution for new residential construction. Again, while this Initiative directs the City to adopt an ordinance, its intent is to discourage new development from installing wood-burning fireplaces. Because there is no specific information with regard to wood-burning fireplaces, a mitigation measure is needed to ensure that wood-burning fireplaces or stoves are not installed as a part of the proposed project.

Waste and Recycling Initiative 1: Adopt "Zero Waste Strategy" Programs and Ordinances. This Initiative identifies increased sorting and recycling of construction and demolition materials as an element of GHG reduction. Because there is no specific information with regard to how demolition material would be discarded, a mitigation measure is needed to ensure that construction and demolition wastes are recycled or diverted from the land fill to the greatest degree feasible.

Mitigation Measure 4.C-1: Identified above relative to Impact 4.C-1.

Mitigation Measure 4.C-6a: In order to reduce GHG emissions from energy consumption and to maintain project operations consistent with the initiatives of the LAPCP, the project applicant shall pursue energy conserving building design and alternative energy conservation strategies to meet or exceed the most current Uniform Building Code requirements and State energy criteria.

Mitigation Measure 4.C-6b: In order to maintain project operations consistent with Energy Initiative 6 of the LAPCP, no fireplaces or stoves installed as part of the proposed project may be wood-burning.

Mitigation Measure 4.C-6c: In order to maintain project operations consistent with Waste and Recycling Initiative 1 of the LAPCP, demolition and construction wastes shall be sorted and recycled to the extent feasible. A demolition recycling plan shall be developed prior to issuance of demolition permits and approved by City Building Department staff.

Significance after Mitigation: Significant and Unavoidable.

The above identified mitigation would reduce GHG emissions associated with energy use of the proposed project. However, mobile GHG emissions alone represent approximately 72 percent of the total project emissions and would, of themselves, exceed proposed BAAQMD GHG significance thresholds. For project emissions to fall below the less stringent service population threshold of 4.6 MT/year/service population, it would be necessary to reduce mobile emissions by approximately 59 percent. This level of trip reduction would be unlikely to be achieved even with the most aggressive transportation demand management measures. Consequently, the proposed project would have a significant and unavoidable impact with regard to emission of GHG emissions that may have a significant impact on the environment.

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D. Noise

Introduction

This section provides an overview of the existing noise environment at the proposed project site and surrounding area, the regulatory framework, an analysis of potential noise impacts that would result from implementation of the proposed project, and mitigation measures where appropriate.

Environmental Setting

Technical Background

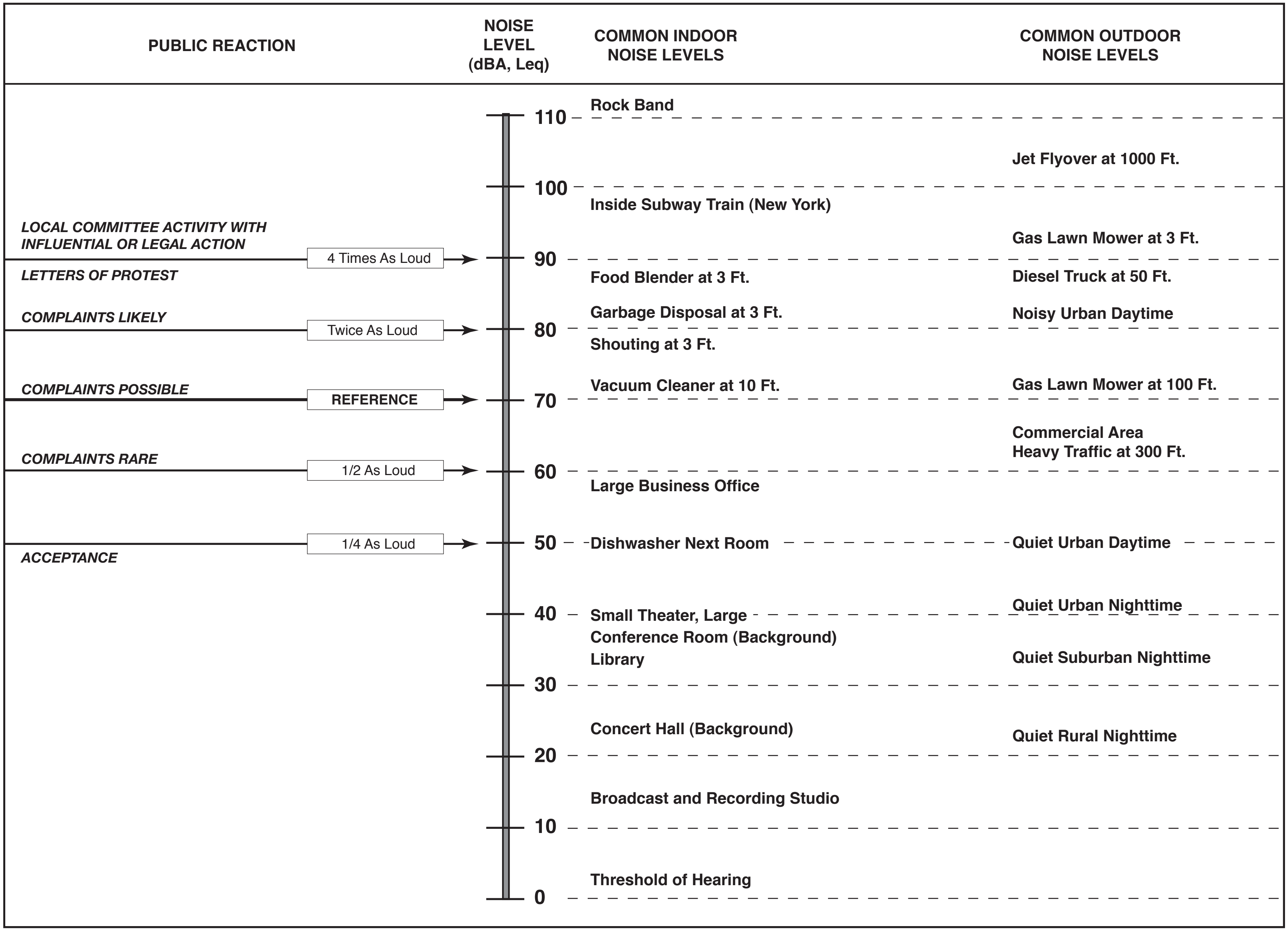
Noise can be generally defined as unwanted sound. Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) which is measured in decibels (dB), with zero dB corresponding roughly to the threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (sound power). The sound pressure level, therefore, constitutes the additive force exerted by a sound corresponding to the frequency/sound power level spectrum.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts, sound is measured using an electronic filter that de-emphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear’s decreased sensitivity to low and extremely high frequencies instead of the frequency mid-range. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA). Frequency A-weighting follows an international standard methodology of frequency de-emphasis and is typically applied to community noise measurements. Some representative noise sources and their corresponding A-weighted noise levels are shown in **Figure 4.D-1**.

Noise Exposure and Community Noise

Noise exposure is a measure of noise over a period of time. A noise level is a measure of noise at a given instant in time. Community noise varies continuously over a period of time with respect to the contributing sound sources of the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens), which are readily identifiable to the individual receptor.



SOURCE: Caltrans Transportation Laboratory Noise Manual, 1982; and modification by ESA

Boatworks Residential Project . 208559

Figure 4.D-1
Effects of Noise on People

These successive additions of sound to the community noise environment vary the community noise level from instant to instant, requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

Leq: the energy-equivalent sound level is used to describe noise over a specified period of time, typically one hour, in terms of a single numerical value. The Leq is the constant sound level which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

Lmax: the instantaneous maximum noise level for a specified period of time.

L_{50}: the noise level that is equaled or exceeded 50 percent of the specified time period. The L_{50} represents the median sound level.

L_{90}: the noise level that is equaled or exceeded 90 percent of the specific time period. This is considered the background noise level during a given time period.

DNL: Also abbreviated Ldn, it is a 24-hour day and night A-weighted noise exposure level which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night (“penalizing” nighttime noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (penalized) by adding 10 dBA to take into account the greater annoyance of nighttime noises.

CNEL: similar to DNL, the Community Noise Equivalent Level (CNEL) adds a 5-dBA “penalty” for the evening hours between 7:00 p.m. and 10:00 p.m. in addition to a 10-dBA penalty between the hours of 10:00 p.m. and 7:00 a.m.

As a general rule, in areas where the noise environment is dominated by traffic, the Leq during the peak-hour is generally within one to two decibels of the Ldn at that location.

Effects of Noise on People

When a new noise is introduced to an environment, human reaction can be predicted by comparing the new noise to the existing “ambient noise” level. In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:

- except in carefully controlled laboratory experiments, a change of 1-dBA cannot be perceived;
- outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- a change in level of at least 5-dBA is required before any noticeable change in human response would be expected; and
- a 10-dBA change is subjectively heard as approximately a doubling in loudness, and can cause adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion, hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, rather logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA.

Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (lessen) at a rate between 6 dBA for hard sites and 7.5 dBA for soft sites for each doubling of distance from the reference measurement. Hard sites are those with a reflective surface between the source and the receiver such as parking lots or smooth bodies of water. No excess ground attenuation is assumed for hard sites and the changes in noise levels with distance (drop-off rate) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface such as soft dirt, grass or scattered bushes and trees. In addition to geometric spreading, an excess ground attenuation value of 1.5 dBA (per doubling distance) is normally assumed for soft sites. Line sources (such at traffic noise from vehicles) attenuate at a rate between 3 dBA for hard sites and 4.5 dBA for soft sites for each doubling of distance from the reference measurement (Caltrans, 1998).

Fundamentals of Vibration

As described in the Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment (FTA, 2006), ground-borne vibration can be a serious concern for nearby neighbors, causing buildings to shake and rumbling sounds to be heard. In contrast to airborne noise, ground-borne vibration is not a common environmental problem. It is unusual for vibration from sources such as buses and trucks to be perceptible, even in locations close to major roads. Some common sources of ground-borne vibration are trains, buses on rough roads, and construction activities such as blasting, sheet pile-driving and operating heavy earth-moving equipment.

There are several different methods that are used to quantify vibration. The peak particle velocity (PPV) is defined as the maximum instantaneous peak of the vibration signal. The PPV is most frequently used to describe vibration impacts to buildings. The root mean square (RMS) amplitude is most frequently used to describe the affect of vibration on the human body. The RMS amplitude is defined as the average of the squared amplitude of the signal. Decibel notation (Vdb) is commonly used to measure RMS. The decibel notation acts to compress the range of numbers required to describe vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors for vibration include structures (especially older masonry structures), people (especially residents, students, the elderly and sick), and vibration sensitive equipment.

The effects of ground-borne vibration include movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. In extreme cases, the vibration can cause damage to buildings. Building damage is not a factor for most projects, with the occasional exception of blasting and sheet pile-driving during construction.

Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by only a small margin. A vibration level that causes annoyance will be well below the damage threshold for normal buildings. The FTA measure of the threshold of architectural damage for conventional sensitive structures is 0.2 in/sec PPV and the FTA threshold of human annoyance to ground-borne vibration is 80 RMS (FTA, 2006).[1]

Existing Noise Setting

The noise environment surrounding the site is influenced primarily by truck and automobile traffic on local streets. To quantify the existing noise environment, four short-term (ST) 5-minute noise level measurements were taken around the site. All noise measurements were collected using calibrated Metrosonics dB3080 sound level meters. The location of the noise measurements are shown in **Figure 4.D-2**.Results of the short-term noise measurements are presented in **Table 4.D-1**.

TABLE 4.D-1
EXISTING NOISE ENVIRONMENTS AT PROPOSED PROJECT LOCATION

Location	Time Period	Noise Levels (dBA)	Noise Sources
ST-1: Corner of Clement and Oak	Monday 07/13/09 2:35 – 2:40 PM	Leq : 66 L50 : 61 L25 : 65	Traffic on Clement Avenue
ST-2: Waterfront at eastern project site corner	Monday 07/13/09 2:42 – 2:47 PM	Leq : 65 L50 : 64 L25 : 65	Ventilation noise from grain elevators and concrete batch plant across the estuary.
ST-3: Clement at project site Center	Monday 07/13/09 2:51 – 2:56 PM	Leq : 67 L50 : 63 L25 : 66	Traffic on Clement Avenue
ST-4: Corner of Clement and Elm	Monday 07/13/09 2:59 – 3:04 PM	Leq : 64 L50 : 62 L25 : 65	Traffic on Clement Avenue

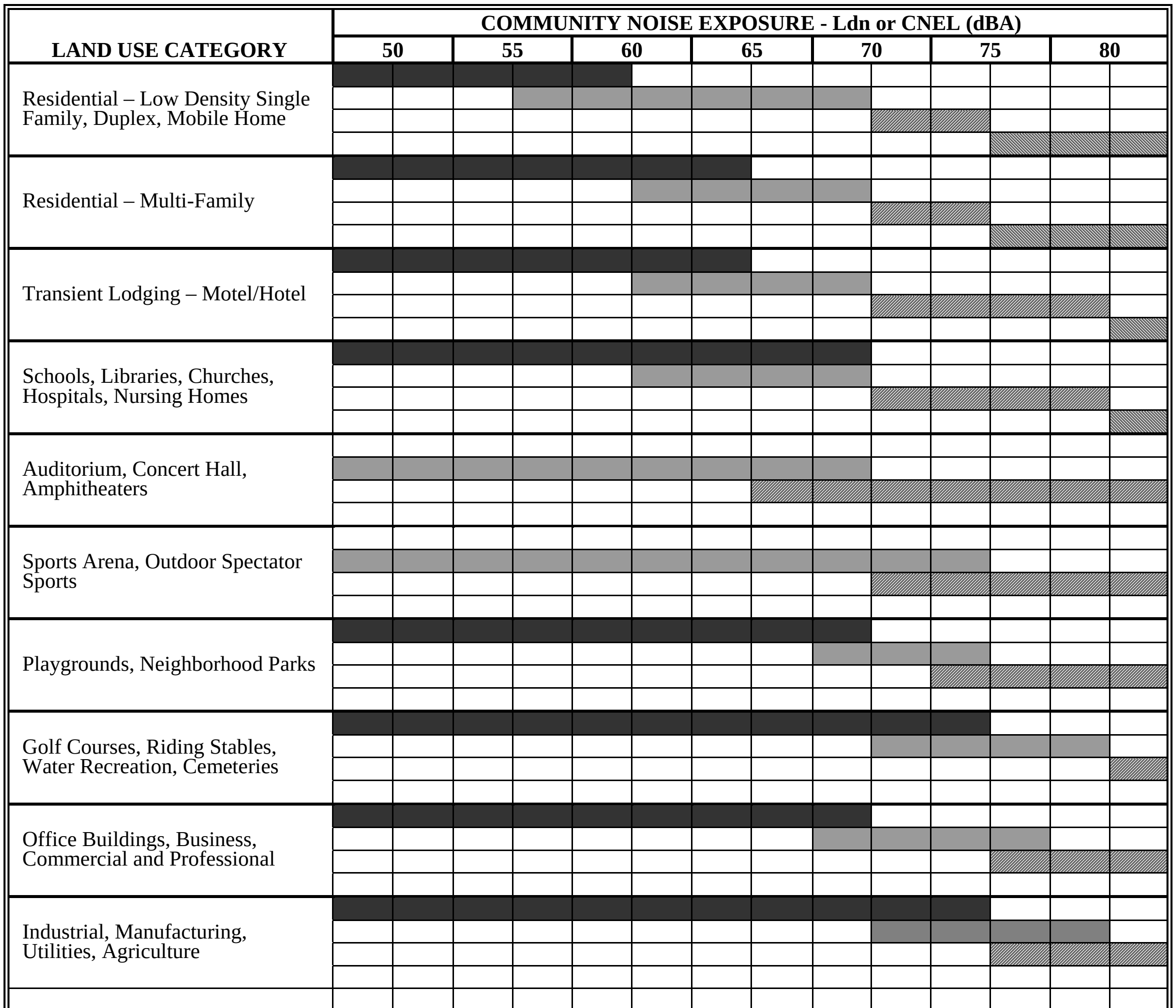
SOURCE: ESA, 2009.

Sensitive Receptors

Some land uses are considered more sensitive to ambient noise levels than others, due to the amount of noise exposure (in terms of both exposure duration and insulation from noise) and the types of activities typically involved. Residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, and parks and other outdoor recreation areas generally are more sensitive to noise than are commercial (other than lodging facilities) and industrial land uses. The nearest sensitive receptor to the proposed project is approximately 280 feet away, across Clement Ave.

1 The ratio of PPV to maximum RMS amplitude is defined as the “crest factor” for the signal (FTA, 2006). It is always greater than 1.71. A crest factor of 8 or more is not unusual for impulsive signals.

FIGURE 4.D-2
LAND USE COMPATIBILITY FOR COMMUNITY NOISE ENVIRONMENT



	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 are included in the design. Conventional construction, but 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 requirement must be made and needed noise insulation features included in the design.
	Clearly Unacceptable	New construction or development generally should not be undertaken.

SOURCE: State of California, Governor's Office of Planning and Research, 1998. *General Plan Guidelines*.

Regulatory Framework

Federal

Federal regulations establish noise limits for medium and heavy trucks (more than 4.5 tons, gross vehicle weight rating) under 40 Code of Federal Regulations (CFR), Part 205, Subpart B. The federal truck pass-by noise standard is 80 dBA at 15 meters from the vehicle pathway centerline. These controls are implemented through regulatory controls on truck manufacturers.

State

California Code of Regulations has guidelines for evaluating the compatibility of various land uses as a function of community noise exposure, as shown in **Figure 4.D-2**. The State of California also establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the State pass-by standard is consistent with the federal limit of 80 dB. The State pass-by standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dBA at 15 meters from the centerline. These standards are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials.

The State has also established noise insulation standards for new multi-family residential units, hotels, and motels that would be subject to relatively high levels of transportation-related noise. These requirements are collectively known as the California Noise Insulation Standards (Title 24, California Code of Regulations). The noise insulation standards set forth an interior standard of DNL 45 dBA in any habitable room. They require an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard where such units are proposed in areas subject to noise levels greater than DNL 60 dBA. Title 24 standards are typically enforced by local jurisdictions through the building permit application process.

Local

City of Alameda Municipal Code

The following sections of the City of Alameda Municipal Code are relevant to the project.

- In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standards shall be adjusted so as to equal said ambient noise level (Section 4.10-4(c)).

- Each of the noise level standards specified above shall be reduced by five (5) dB(A) for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises (Section 4.10-4(d)).

- If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the applicable noise level standards in **Table 4.D-2** (Ord. No. 2177 N.S.) (Section 4.10-4(e)).

- Construction noise is exempted from the noise standards provided it is limited to between the hours of 7:00 am and 7:00 pm Monday through Friday and 8:00 am to 5:00 pm on Saturdays. (Section 4-10.5(b)10)

TABLE 4.D-2
EXTERIOR NOISE STANDARDS

Location	Cumulative Number of Minutes in Any One Hour Time Period	7:00 am to 10:00 pm (dBA)	10:00 pm to 7:00 am (dBA)
Single or Multiple Family Residential, School, Hospital, Church, or Public Library Properties	30	55	50
	15	60	55
	5	65	60
	1	70	65
	0	75	70
Commercial Properties	30	65	60
	15	70	65
	5	75	70
	1	80	75
	0	85	80

SOURCE: Alameda Municipal Code, 2006

Impacts and Mitigation Measures

Approach to Analysis

Noise impacts are assessed based on a comparative analysis of the noise levels resulting from the project and the noise levels under existing conditions. Analysis of temporary construction noise effects is based on typical construction phases and equipment noise levels and attenuation of those noise levels due to distances, and any barriers between the construction activity and the sensitive receptors near the sources of construction noise. Operational impacts will be analyzed using reference noise levels and attenuation for operational equipment.

Significance Criteria

Based on the *CEQA Guidelines*, a project would have a significant effect on the environment with respect to noise and/or ground-borne vibration if it would result in:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan, noise ordinance, or applicable standards of other agencies;
- A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

- Exposure of people residing or working in the area around the project site to excessive noise levels (for a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport);

- Exposure of people residing or working in the area around the project site to excessive noise levels (for a project within the vicinity of a private airstrip); or

- Exposure of persons to or generation of excessive ground-borne vibration or ground-borne noise levels.

The following analysis discusses the first three criteria; the fourth and fifth are not discussed because the site lies outside a two-mile radius of a public airport or private airstrip.

Construction Noise. Noise impacts from short-term construction activities could exceed noise thresholds and could result in a significant construction impact if short-term construction activity occurred outside of the daytime hours permitted by the respective City's noise ordinance.

Vibration. The project would result in a significant vibration impact if buildings would be exposed to the FTA building damage ground-borne vibration threshold level of 0.2 PPV or if sensitive individuals would be exposed to the FTA human annoyance response ground-borne vibration threshold level of 80 RMS.

Stationary Noise. A resulting off-site noise level at residences from stationary non-transportation sources that exceed 55 dBA for 30 minutes between the hours of 7:00 am to 10:00 pm or 50 dBA for 30 minutes between the hours of 10:00 pm and 7:00 am at a residential area would result in a significant noise impact.

Traffic Noise. The project would result in significant traffic noise impacts if it would increase noise levels in excess of the thresholds shown in **Table 4.D-3**.

TABLE 4.D-3
THRESHOLDS OF SIGNIFICANCE FOR NOISE EXPOSURE

Ambient Noise Level Without Project (Ldn)	Significant Impact Assumed to Occur if the Project Increases Ambient Noise Levels By:
<60 dB	+ 5.0 dB or more
60-65 dB	+ 3.0 dB or more
>65 dB	+ 1.5 dB or more

SOURCE: Federal Interagency Committee on Noise (FICON), 1992.

Impact Analysis

This following impact analysis focuses on potential impacts of the proposed project related to noise.

Impact 4.D-1: Project construction would expose persons to or generate noise levels in excess of the City noise standards. (Significant)

Construction activity noise levels at and near the construction areas would fluctuate depending on the particular type, number, and duration of uses of various pieces of construction equipment. Construction-related material haul trips would raise ambient noise levels along haul routes, depending on the number of haul trips made and types of vehicles used. In addition, certain types of construction equipment generate impulsive noises (such as pile driving), which can be particularly disruptive. Pile driving, however, is not proposed during project construction. **Table 4.D-4** shows typical noise levels during different construction stages. **Table 4.D-5** shows typical noise levels produced by various types of construction equipment.

TABLE 4.D-4
TYPICAL CONSTRUCTION NOISE LEVELS

Construction Phase	Noise Level (dBA, Leq)[a]
Ground Clearing	84
Excavation	89
Foundations	78
Erection	85
Finishing	89

[a] Average noise levels correspond to a distance of 50 feet from the noisiest piece of equipment associated with a given phase of construction and 200 feet from the rest of the equipment associated with that phase.

SOURCE: U.S. Environmental Protection Agency, Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, 1971.

TABLE 4.D-5
TYPICAL NOISE LEVELS FROM CONSTRUCTION EQUIPMENT

Construction Equipment	Noise Level (dBA, Leq at 50 feet)
Dump Truck	88
Portable Air Compressor	81
Concrete Mixer (Truck)	85
Scraper	88
Jack Hammer	88
Dozer	87
Paver	89
Generator	76
Pile Driver	101
Backhoe	85

SOURCE: Cunniff, Environnemental Noise Pollution, 1977.

Noise from construction activities generally attenuates at a rate of 6 to 7.5 dBA per doubling distance. Based on the proposed project site layout and terrain, an attenuation of 6 dBA will be assumed.

The nearest sensitive receptor to project construction is approximately 280 feet away. Table 4.D-4 states that excavation is 89 dBA at 50 feet. At a distance 280 feet, these residences would experience attenuated noise levels of about 74 dBA Leq during finishing and excavation, the loudest of construction activities that would occur. Construction noise at these levels would be above the City of Alameda exterior noise standards depicted in Table 4.D-2.

> **Mitigation Measure 4.D-1:** The project applicant shall incorporate the following requirements into the construction contract specifications:
>
> - Construction activities will be limited to the hours between of 7:00 am and 7:00 pm Monday through Friday and 8:00 am to 5:00 pm on Saturdays
> - Equipment and trucks used for construction will use the industry standard noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically-attenuating shields or shrouds, wherever feasible).
> - Stationary noise sources will be located as far from adjacent receptors, whenever feasible, and they will be muffled and enclosed within temporary sheds. Insulation barriers and other measures will be used to the extent feasible.

Significance after Mitigation: Less than Significant.

Impact 4.D-2: Construction of the project would not result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels. (Less than Significant)

Ground-borne vibration from pile driving activities at the proposed marina could produce substantial vibration at nearby sensitive receptors. Vibration levels for pile drivers are typically 0.734 inches/second PPV and 101 RMS at 25 feet (FTA, 2006). Under normal propagation conditions, vibration levels at residences approximately 800 feet from the construction would be 0.004 in/sec PPV and 56 RMS, which is well below the FTA threshold of 0.20 in/sec and the annoyance threshold of 80 RMS; resulting in a less than significant.

Mitigation: None required.

Impact 4.D-3: Traffic associated with operation of the project would result in a significant increase in ambient noise levels on nearby roadways. (Less than Significant)

Most of the noise generated by the implementation of the project would primarily be traffic-generated noise. The proposed project would contribute to an increase in local traffic volumes, resulting in higher noise levels along local roadways. Using a spreadsheet based upon algorithms from the Federal Highway Administration's Highway Traffic Noise Prediction Model (FHWA-RD-77-108) and the project traffic study provided by Dowling Associates Inc., traffic noise levels were analyzed for 20 roadway segments. The segments analyzed and results of the modeling are shown in **Table 4.D-6**.

As depicted in Table 4.D-6, vehicle traffic on twenty roadway segments would not result in a significant increase in noise on any roadway segments. Therefore, traffic associated with the project is less than significant.

Mitigation: None required.

Impact 4.D-4: The project would place noise-sensitive multifamily residential uses in a noise environment that would exceed the City's goal for indoor noise exposure. (Significant)

As Table 4.D-1 shows, the area surrounding the project site has a greater than 60 dBA Leq, therefore these noise levels would exceed the City's goal for indoor noise exposure. The residences would be subject to Title 24 of the *California Code of Regulations*, which requires an interior noise standard of DNL 45 dBA in any habitable room and requires an acoustical analysis demonstrating how dwelling units have been designed to meet this interior standard. To allow the project to meet the City and state interior noise requirement of DNL 45 dBA, in habitable rooms of residential dwellings, sound-rated assemblies would be required at the exterior facades of project buildings. The project shall implement the following standard condition to reduce indoor noise exposure to within City and State standards. Implementation would ensure that interior noise levels are reduced to 45 dB and are less than significant.

> **Mitigation Measure 4.D-4:** If necessary to comply with the interior noise requirements of the State and achieve an acceptable interior noise level, noise reduction in the form of sound-rated assemblies (i.e., windows, exterior doors, and walls) shall be incorporated into project building design, based upon recommendations of a qualified acoustical engineer. Final recommendations for sound-rated assemblies will depend on the specific building designs and layout of buildings on the site and shall be determined by the acoustical engineer during the design phase. Specific consideration shall be given to window size: degree of sound insulation of exterior walls, which can be increased through staggered- or double-studs; multiple layers of gypsum board; and incorporation of resilient channels.

Significance after Mitigation: Less than Significant.

TABLE 4.D-6
EXISTING AND FUTURE PEAK-HOUR NOISE LEVELS ALONG SELECTED ROADWAYS

	Peak Hour Noise Levels (Leq)[a]							
Modeled Roadway Segment	**Baseline**	**Baseline Plus Project**	**Difference Between Baseline Plus Project and Baseline**	**Baseline Plus Reduced Density Alternative**	**Difference Between Baseline Plus Reduced Density and Baseline**	**Baseline Plus City Park Alternative**	**Difference Between Baseline Plus City Park Alternative**	**Significant (Yes/No)[c]**
Oak St North of Buena Vista Ave	61	62	1	61	0	62	1	No
Oak St South of Buena Vista Ave	61	61	0	61	0	61	0	No
Buena Vista Ave East of Oak St	67	67	0	67	0	67	0	No
Buena Vista Ave West of Oak St	66	66	0	66	0	66	0	No
Tilden Way North of Blanding Ave	69	69	0	69	0	69	0	No
Tilden Way South of Blanding Ave	67	67	0	67	0	67	0	No
Blanding Ave East of Tilden Way	65	65	0	65	0	65	0	No
Blanding Ave West of Tilden Way	64	64	0	64	0	64	0	No
Webster Ave North of Atlantic Ave	71	71	0	71	0	71	0	No
Webster Ave South of Atlantic Ave	69	69	0	69	0	69	0	No
Atlantic Ave East of Webster Ave	67	67	0	67	0	67	0	No
Atlantic Ave West of Webster Ave	70	70	0	70	0	70	0	No
Constitution Way North of Atlantic Ave	69	69	0	69	0	69	0	No
Constitution Way South of Atlantic Ave	70	70	0	70	0	70	0	No
Atlantic Ave East of Webster Ave	66	66	0	66	0	66	0	No
Atlantic Avenue West of Webster Ave	67	67	0	67	0	67	0	No
High St North of Fernside Blvd	69	69	0	69	0	69	0	No
High St South of Fernside Blvd	67	67	0	67	0	67	0	No
Fernside Blvd East of High St	67	67	0	67	0	67	0	No
Fernside Blvd West of High St	66	66	0	66	0	66	0	No

[a] Noise levels are estimated at a distance of 50 feet from roadway centerline. Data based on PM Peak Hour. Ldn is approximately equal to the Leq peak hour under normal traffic conditions (Caltrans, 1998).
[b] The numbers from Baseline were subtracted from Project Plus Baseline to show the incremental increase.
[c] Considered significant if the incremental increase in noise is greater than 5 dBA Leq in a noise environment of 60 dBA Ldn or less, an increase of 3 dBA Leq in a noise environment greater than 60 dBA and 65 dBA Ldn, or an increase of 1.5 dBA Leq in a noise environment greater than 65 dBA Ldn, FICON 1992.

NOTE: The project alternatives, discussed in Chapter 5 of this EIR, are also presented in Tables 4.D-6 and 4.D-7, in order to compare vehicle noise levels between the proposed project and the alternatives.

SOURCE: Dowling Associates, Inc 2009, ESA 2009.

Cumulative Impact

Impact 4.D-5: Increases in traffic from the project in combination with other development would not result in cumulatively considerable noise increases. (Less than Significant)

A cumulative impact arises when two or more individual projects, when considered together, are considerable or compound or increase other environmental impacts. Cumulative impacts can result from individually minor but collectively significant impacts, meaning that the project's incremental effects must be viewed in connection with the effects of past, current, and probable future projects.

The proposed project would generate noise by adding more traffic to the area. Many of the other anticipated projects also would contribute to noise in the area due to increased traffic volumes. **Table 4.D-7** shows the 2035 cumulative traffic without the project, the future cumulative traffic with the project, and the difference between the two. As depicted in Table 4.D-7, cumulative noise levels at seven locations would be significant without the project. As also shown in Table 4.D-7, adding project traffic to cumulative noise sources would result in no change in cumulative noise levels at these locations. Therefore, the contribution of the proposed project to future cumulative noise levels would not be cumulatively considerable, based on the identified significance criteria (see Table 4.D-3), and this impact would be considered less than significant.[2]

Mitigation: None required.

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U.S. Environmental Protection Agency, Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances, 1971.

[2] The project alternatives, discussed in Chapter 5 of this EIR, are also presented in Tables 4. D-6 and 4.D-7 in order to compare vehicle noise levels between the proposed project and the alternatives.

TABLE 4.D-7
2030 CUMULATIVE PEAK-HOUR NOISE LEVELS ALONG SELECTED ROADWAYS

	Peak Hour Noise Levels (Leq)[a]									
Modeled Roadway Segment	**Baseline**	**Cumulative**	**Difference Between Cumulative and Baseline**	**Cumulative Plus Project**	**Difference Between Cumulative Plus Project and Cumulative**	**Cumulative Plus Reduced Density Alternative**	**Difference Between Cum Plus Reduced Density Alt and Cumulative**	**Cumulative Plus City Park Alternative**	**Difference Between Cum Plus City Park Alt and Cumulative**	**Significant (Yes/No)[c]**
Oak St North of Buena Vista Ave	61	63	2	64	1	64	1	64	1	No
Oak St South of Buena Vista Ave	61	63	2	63	0	63	0	63	0	No
Buena Vista Ave East of Oak St	67	65	**2**	65	0	65	0	65	0	No
Buena Vista Ave West of Oak St	66	65	1	65	0	65	0	65	0	No
Tilden Way North of Blanding Ave	69	71	**2**	71	0	71	0	71	0	No
Tilden Way South of Blanding Ave	67	71	**4**	71	0	71	0	71	0	No
Blanding Ave East of Tilden Way	65	69	**4**	69	0	69	0	69	0	No
Blanding Ave West of Tilden Way	64	65	1	65	0	65	0	65	0	No
Webster Ave North of Atlantic Ave	71	70	-1	70	0	70	0	70	0	No
Webster Ave South of Atlantic Ave	69	68	-1	68	0	68	0	68	0	No
Atlantic Ave East of Webster Ave	67	69	2	69	0	69	0	69	0	No
Atlantic Ave West of Webster Ave	70	70	0	70	0	70	0	70	0	No
Constitution Way North of Atlantic Ave	69	69	0	69	0	69	0	69	0	No
Constitution Way South of Atlantic Ave	70	69	-1	69	0	69	0	69	0	No
Atlantic Ave East of Webster Ave	66	69	**3**	69	0	67	0	67	0	No
Atlantic Avenue West of Webster Ave	67	69	**2**	69	0	69	0	69	0	No
High St North of Fernside Blvd	69	71	**2**	71	0	71	0	71	0	No
High St South of Fernside Blvd	67	68	1	68	0	68	0	68	0	No
Fernside Blvd East of High St	67	68	1	68	0	68	0	68	0	No
Fernside Blvd West of High St	66	69		69	0	68	0	68	0	No

[a] Noise levels are estimated at a distance of 50 feet from roadway centerline. Data based on PM Peak Hour. Ldn is approximately equal to the Leq peak hour under normal traffic conditions (Caltrans, 1998).
[b] The numbers from Cumulative were subtracted from Project Plus Cumulative to show the incremental increase.
[c] Considered significant if the incremental increase in noise is greater than 5 dBA Leq in a noise environment of 60 dBA Ldn or less, an increase of 3 dBA Leq in a noise environment greater than 60 dBA and less than 65 dBA Ldn, or an increase of 1.5 dBA Leq in a noise environment greater than 65 dBA Ldn, FICON 1992.
[D] **Bold** numbers indicate significant increase.

NOTE: The project alternatives, discussed in Chapter 5 of this EIR, are also presented in Tables 4.D-6 and 4.D-7, in order to compare vehicle noise levels between the proposed project and the alternatives.

SOURCE: Dowling Associates, Inc 2009, ESA 2009.

E. Cultural Resources

Introduction

This section examines the potential impacts on cultural resources (archaeological, historic architectural, and paleontological) of the Boatworks Residential Project. Research for this section includes an historical resources survey and evaluation of affected buildings on the project site in March 2009 by ESA, and archival research at the California Historical Resources Information System's Northwest Information Center (NWIC) completed on February 13, 2009 (File No. 08-0943). Potential impacts are discussed and evaluated, and appropriate mitigation measures are identified, as necessary.

Environmental Setting

Paleontological Resources

Paleontological resources are the fossilized remains of plants and animals, including vertebrates (animals with backbones), invertebrates (e.g., starfish, clams, ammonites, and coral marine), and fossils of microscopic plants and animals (microfossils). Paleontological resources are distinct from archeological resources in that they are records of past plant and animal life, and not human history. Fossil discoveries provide paleontologists with valuable evidence to help them reconstruct biological and geological histories. In order for an organism to be preserved, it must be buried and mineralized, which requires a specific set of favorable geologic conditions and a significant amount of time. When fossils are discovered at the earth's surface, it is because the material in which the organism was fossilized has been eroded away by natural processes or exhumed by humans.

On a regional scale, fossilized plants, animals and microorganisms are prevalent throughout the East Bay. Many of the hills in the East Bay are made up of sedimentary bedrock that is known to contain a wide range of fossils, including radiolarians, mullusks, diatoms, foraminifers and non-marine vertebrates. In addition, Pleistocene-age (1.8 million to 10,000 years ago) alluvial fan and fluvial deposits have been known to yield fresh water mullusks and extinct late Pleistocene vertebrate fossils (Graymer, 1996). Thus, the East Bay as a whole is rich in potentially fossil-yielding rock formations.

However, the proposed project overlies geologic units that have low paleontological potential[1]. As discussed in *Section 4.G – Geology and Seismicity*, and shown in Figure 4.G-1, the surface geology of the site is composed of artificial fills and dune sands. Beneath the surface units lie deposits of mud and silt associated with the present-day Oakland Estuary (Bay Mud). All of these geologic units represent either historic (in the last 200 years) or Holocene-age (last 10,000 years) geologic units. Such recent deposits are unlikely to preserve the remains of organisms due to the

1 Paleontological potential refers to the likelihood a particular rock unit or formation would yield significant fossils, based on its geologic history and records of previous fossil discoveries within the same unit.

lack of time and burial needed for the organisms to be fossilized. In addition, artificial fills are man made, and have been mixed and reworked from native geologic materials, and therefore are not fossil-yielding.

The University of California Museum of Paleontology maintains the world's largest database of fossil discoveries and collections, with thousands of records for the East Bay. A search of the database by both sediment age and location revealed few invertebrate fossils and no vertebrate fossils in similar geologic environments in Alameda County. Fourteen marine invertebrate fossils of Quaternary age (within the last 1.8 million years) were found in Oakland, three of which were found in or around Lake Merritt, which has similar geologic conditions as the project site (UCMP, 2009). However, recent marine invertebrate fossils are not considered significant fossil resources because they are typically abundant in similar geologic deposits and do not represent unique specimens that contribute substantially to scientific knowledge. Overall, there is a very low, if any, potential to encounter fossil resources at the project site.

Prehistoric and Ethnographic Overview

A framework for the interpretation of the San Francisco Bay Area, including Alameda County, is provided by Milliken et al. (2007), who have divided human history in California into three broad periods: the Early Period, the Middle Period, and the Late Period. Economic patterns, stylistic aspects, and regional phases further subdivide cultural patterns into shorter phases. This scheme uses economic and technological types, socio-politics, trade networks, population density, and variations of artifact types to differentiate between cultural periods.

The Paleoindian period (11,500 to 8000 B.C.) was characterized by big-game hunters occupying broad geographic areas – evidence for this period has not yet been discovered in the San Francisco Bay or Sonoma County vicinity. During the Early period, consisting of the *Early Holocene* (8000 to 3500 B.C.) and *Early Period* (3500 B.C. to 500 B.C.), geographic mobility continued and is characterized by the millingslab and handstone as well as large wide-stemmed and leaf-shaped projectile points. The first cut shell beads and the mortar and pestle are first documented in burials during this period, indicating the beginning of a shift to sedentism. During the Middle period, which includes the *Lower Middle Period* (500 B.C. to A.D. 430), and *Upper Middle Period* (A.D. 430 to 1050), geographic mobility may have continued, although groups began to establish longer-term base camps in localities from which a more diverse range of resources could be exploited. The first rich black middens are recorded from this period. The addition of milling tools, obsidian and chert concave-base points, and the occurrence of sites in a wider range of environments suggest that the economic base was more diverse. By the Upper Middle Period, mobility was being replaced by the development of numerous small villages. Around A.D. 430 a "dramatic cultural disruption" occurred evidenced by the sudden collapse of the *Olivella* saucer bead trade network. During the Initial Late period (A.D. 1050 to 1550), social complexity developed toward lifeways of large, central villages with resident political leaders and specialized activity sites. Artifacts associated with the period include the bow and arrow, small corner-notched points, and a diversity of beads and ornaments.

The project site is within the traditional territory of the Costanoan or Ohlone people (Levy, 1978:485–495). These people were collectively referred to by ethnographers as Costanoan, but were actually distinct sociopolitical groups that spoke at least eight languages of the same Penutian language group. The Costanoan occupied a large territory from San Francisco Bay in the north to the Big Sur and Salinas Rivers in the south. The primary sociopolitical unit was the tribelet, or village community, which was overseen by one or more chiefs. The project site is in the greater *Chochenyo* tribal area occupied by the San Antonio tribelet (Spanish designation; Levy, 1978:485).

Economically, the Costanoan engaged in hunting and gathering. Their territory encompassed both coastal and open valley environments that contained a wide variety of resources, including grass seeds, acorns, bulbs and tubers, bear, deer, elk, antelope, a variety of bird species, and rabbit and other small mammals. The Costanoan acknowledged private ownership of goods and songs, and village ownership of rights to land and/or natural resources; they appear to have aggressively protected their village territories, requiring monetary payment for access rights in the form of clamshell beads, and even shooting trespassers if caught. After European contact, Costanoan society was severely disrupted by missionization, disease, and displacement.

Native American Consultation

On February 10, 2009, a sacred lands search request was submitted to the Native American Heritage Commission (NAHC) on for the project site. A response from the NAHC was received on April 25, 2008. The records search of the sacred lands file failed to indicate the presence of Native American cultural resources in the project site or surrounding area. The NAHC provided a list of Native American contacts that might have further knowledge of the vicinity with respect to cultural resources. Each person or organization identified by the NAHC was contacted by letter on February 10, 2009. Correspondence is provided in **Appendix E**.

Prehistoric Archaeological Resources

A records search was conducted at the Northwest Information Center of the California Historical Resources Information System at Sonoma State University on February 13, 2009 (File No. 08-0943). The records were accessed by utilizing the Oakland East, California, U.S. Geological Survey 7.5-minute quadrangle base maps. The records search, which encompassed a one-half-mile radius around the project site, was conducted to: (1) determine whether known cultural resources had been recorded within or adjacent to the project site; (2) assess the likelihood of unrecorded cultural resources based on historical references and the distribution of nearby sites; and (3) develop a context for the identification and preliminary evaluation of cultural resources.

During the records search, the following sources were reviewed: the *California Inventory of Historical Resources* (DPR, 1976), *California Historical Landmarks* (DPR, 1990), *California Points of Historical Interest* (DPR, 1992), and *Historic Properties Directory Listing* (OHP, 2009). The Historic Properties Directory includes listings of the National Register of Historic Places and the California Register of Historical Resources, and the most recent listings of California Historical Landmarks and California Points of Historical Interest. Historic maps, including Thompson and West (1878) and Sanborn Insurance Company maps (1897, 1948) were reviewed to assess historic-era archaeological potential.

Three prehistoric archaeological sites have been recorded in the eastern portion of Alameda within a 0.5-mile radius of the project site. Site CA-ALA-11 is a very extensive shell midden with numerous burials that was originally recorded as Nelson’s 440 (Nelson, 1909). Burials have been accidentally discovered at the location several times. One burial recovered in 2001 was found with more than 500 shell beads and pendants. The site is located approximately 0.5 miles west of the project site on land that was historically bordering the Oakland marshland. Two additional prehistoric sites are located to the south and southeast of the project site: CA-ALA-316 is a large shellmound and burial site approximately 1 mile from the project site; CA-ALA-54 is a recovered burial noted in the 1928 newspaper clipping located about 0.5 mile south of the project site.

The project site is entirely paved and/or built upon therefore no comprehensive archaeological surface survey was completed. The project site was once adjacent to marshland that was both filled in and excavated during construction of the Oakland tidal canal. There is precedent for archaeological sites to be located in this environment as with site CA-ALA-11 above, however the project site is highly disturbed due to the extensive activities associated with both the construction of the tidal canal and the Pacific Coast Engineering Company buildings. The project site therefore has a low to moderate potential for containing prehistoric archaeological resources.

Historic Overview

Brief History of Alameda

European settlement began in the late 1700s with the arrival of the Spanish, initiating a period of land appropriation and subdivision which ultimately displaced Alameda's earliest inhabitants. By the late 1800s, settlement existed at three disparate locations on the peninsula which formed today’s Alameda Island, with a main road (now Central Avenue) and a railroad line linking the settlements. The area known today as the City of Alameda (a Spanish name chosen by popular vote in 1853, meaning "grove of poplar trees") is part of a former Spanish land grant stretching from San Leandro to Berkeley, and given to Luis Peralta in 1818, by the Governor of California. Subsequently, Peralta gave this land to his son, Antonio Peralta. The first American settlers to arrive in Alameda were WW Chipman and Gideon Aughinbaugh. They established a large peach orchard signaling the beginning of the area's agricultural development. Subsequently, Chipman and Aughinbaugh purchased the Alameda land (then a peninsula as described above) for $14,000 (www.ci.alameda.ca.us, 2009).

The California Gold Rush brought a huge influx of population to the Bay Area in the mid-1800s. Among these settlers were several entrepreneurs who would subdivide the Alameda peninsula and sell tracts for residences and orchards. The pace of settlement within Alameda remained steady during the last three decades of the century as rail and ferry projects connected Alameda to the rest of the Bay Area. The corner of Lincoln and Webster streets is noted for being the location of the terminus of the first transcontinental railroad; a Central Pacific train completed a cross-continental journey for the first time in 1869. On December 27, 1884, the City of Alameda was formally organized (City of Alameda, 1991).

By this time a large-scale transformation of the landscape was already taking place, with some wetlands being diked and filled, and the initiation of a federal government project which would take nearly 30 years to complete: the dredging of a Tidal Canal separating Alameda from the mainland of Oakland by the US Army Corps of Engineers. Completed in 1902, this project joined Oakland's harbor with the San Leandro Bay between the peninsula and the mainland, severing Alameda from the shore and creating the Island of Alameda. With this and subsequent improvements to its waterfront, Alameda became an important shipping port and the location of numerous industrial enterprises in the early twentieth century (see discussion below of Alameda’s Northern Waterfront). The late 1800s and early 1900s also left their mark within the City in the form of Victorian-period homes which may be seen throughout Alameda (City of Alameda, 1991).

Alameda’s Northern Waterfront

Since its initial development in the mid-1800s, land uses and economic activities in the Northern Waterfront area have been characterized by continual change. Prior to 1852, the area consisted primarily of marshland. Boatyards, shipping facilities, warehouses, and residences were among the first buildings constructed at the Northern Waterfront. Residential tracts were subdivided for development in the 1870s, resulting in development of the first neighborhoods in the area. In the 1880s and 1890s, the shipping and commercial marine activities at the Northern Waterfront were considered to be the best in the Bay Area. The Alaska Packers Association (the world's largest salmon-packing company and subsidiary of the California Packing Corporation - now Del Monte) started berthing its vessels in the area currently run by the Grand Marina around 1890 (City of Alameda, 2006).

During the two world wars and the Vietnam War, large industrial, shipbuilding, and commercial uses such as Encinal Terminals, Del Monte Warehouse, Weyerhaeuser, Pennzoil, and Listo Pencil Company emerged as leading economic activities at the Northern Waterfront. During the 1970s, the Northern Waterfront area experienced a decline in activity when many of the commercial shipyards closed. The area Northern Waterfront currently consists of a patchwork of land uses; many former thriving industrial properties are now vacant and underutilized (City of Alameda, 2006).

Historic Overview of the Project Site

The George A. Dow Pumping Engine Company operated on the project site from c. 1910 until 1941. Prior to its location in Alameda, the company was established at 179 First Street in San Francisco in 1880 by George A. Dow Sr. of San Francisco. In 1895, George Dow Jr. (1874 – 1941) entered his father’s pump manufacturing company as an apprentice, and later became the company vice president when it incorporated in 1905 (International News Service, 1915).

By this time the company called itself “the largest pump and manufacturing plant in the west,” building mining and irrigation pumps, and pumps for steamship and railroad lines. The company sold its products in the United States, Mexico, Hawaii, and elsewhere and supplied many of the largest mining and irrigation operations in those places. The company built the first diesel engines for a marine vessel on the Pacific Coast and was a major manufacturer of diesel engines for the Navy in World War I and for commercial operations, notably in Java for the copper industry afterwards. In 1919, 600 workers were at the plant which was "the largest incorporation in Alameda" (Corbett & Hardy, 1988).

According to a 1915 biography of George A. Dow, "In 1907 he closed a deal for the largest pumping contract that was ever let in the world and which called for a pipe line for the Southern Pacific Company extending from Bakersfield to Port Costa, at a cost of more than a million and a half dollars" (International News Service, 1915). It is likely that this contract enabled Dow to construct the manufacturing plant at the project site.

The Sanborn maps of 1910 show most of the current complex of buildings substantially in place. At that time the plant consisted of a foundry with a brass foundry and coke oven, a machine shop, and a storage house/compressor room, all of which are still standing. The plant also contained two pattern shops and one office building, all of which were demolished after 1948. A 1927 photograph of the plant shows it to be slightly expanded since 1910, including the foundry annex and three small sheds at the north end of the property (see **Figure 4.E-1**). In 1932, the Sanborn maps show that the coke ovens in the foundry have been moved, that a wood frame annex had been constructed on the southern end of the building, and that the foundry has been leased by the Van Niel Brass Casting Company. The Van Niel Company was established in 1926 and its officers were George Dow and Karel Van Niel, indicating that there was some connected function between the two companies (Corbett & Hardy, 1988).

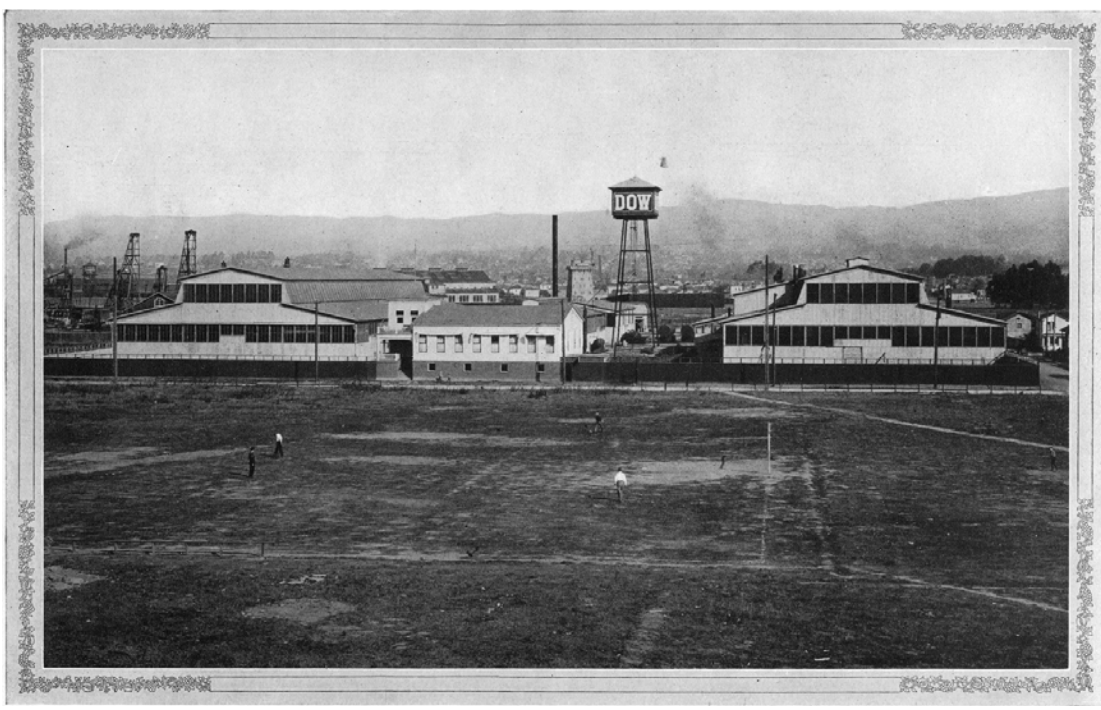

Figure 4.E-1
Circa 1927 Photograph of the George E. Dow Pumping Engine Company.
Original Machine Shop (left) and Steel Fabrication Shop and Warehouse (right)

In 1941 the Pacific Coast Engineering Company (PACECO) moved its operations from Oakland where it was established in 1923 by H.G. Plummer and J.H. Coney and took over the Dow plant. The company specialized in the design and manufacturer of hydraulic dredging equipment and other machinery for marine industries and did some structural steel fabrication and machine work. The company's products were sold in the United States, Hawaii and South America. When the company moved to Alameda in 1941, it was sold to C.H. Ramsden and shifted its operations toward shipbuilding. During the war the company built harbor tugs for the Navy and ship sections for the main Kaiser Shipyards in Richmond. After the war, it again built ships and dredges and expanded its facilities for large scale precision engineering equipment such as cranes and equipment for dams and public utilities (Corbett & Hardy, 1988).

By 1948 and presumably during the war, one of the original pattern shops had been converted to a mold loft, the foundry had been enlarged and converted to a steel warehouse and fabricating shop, and other changes were made so that the plant could function primarily as a shipyard. In 1958, PACECO designed and built, at this plant, the world's first high speed, dockside, container handling crane for the use of Matson Lines at Encinal Terminals, also in Alameda. This crane made possible implementation of the container shipping system for the first time on the west coast (a slightly different system was just beginning operation in New Jersey). The container shipping system is the most far-reaching change in the way of handling ships cargo in modern times. The system reduced the time needed to unload a ship from up to three weeks to a day and a half. This greatly reduced labor needs and changed the kinds of port facilities and ports that were needed. Before the plant closed the company had built giant container cranes for over 50 countries around the world and had licensed additional plants in Canada, Australia, Europe and Japan (Corbett & Hardy, 1988).

This first container crane went into use on January 7, 1959 at Encinal Terminals in Alameda, and was recognized as an historical landmark in 1983 by the American Society of Mechanical Engineers. The crane was purchased in 1987 by the Port of Nanjing, China, where it is now located. Crane #85 PACECO Crane was redesignated as an engineering landmark in 1988 in conjunction with the Chinese Mechanical Engineering Society (www. asme.org, 2009)

The plant expanded in 1966 and grew to occupy the adjacent land to the east along the estuary. The machine shop was expanded along its west side and south end, so that it fronted on Clement Avenue. The expanded plant included two ship-building ways which reached into the Tidal Canal. In 1981, PACECO moved to Gulfport, Mississippi and the plant was taken over by Reliance Steel Co., a steel distributor from Berkeley, and other tenants.

According to a survey and evaluation of the site in 1988, "As a physical plant, this is a typical example of an early 20th century machine factory with its complex of large shops and small support buildings oriented toward the water. As such it is representative of one of the major manufacturing activities of the Bay Area since the Gold Rush production of mining machinery. Although once common, such plants are now unusual. In assessing eligibility to the National Register of Historic Places (National Register), as an early 20th century machine factory it should qualify under criterion C. In addition, the production of the first container cranes here is of such world-wide importance that, although this activity is less than 50 years old, an exception could be justified to the 50 year rule, if it were necessary.” (Corbett & Hardy, 1988).

As part of the survey and evaluation of the site by ESA in March 2009, this statement has been updated to specify that only c. 1910 Steel Fabrication Shop and Warehouse and Compressor Room/Storage Building from the former George A. Dow Pumping Engine Company appear eligible for listing under National Register/California Register Criterion A/1 (events), and C/3 (architecture). Provided below are an updated description and evaluation of all standing structures on the project site.

Historic-era Architectural/Structural Resources

The project site consists of five industrial buildings constructed between circa 1910 and circa 1970. Each of these is described below, along with a discussion of physical integrity and architectural and/or historical significance.

Steel Fabrication Shop and Warehouse (c. 1910, addition pre-1932)

The steel fabrication shop and warehouse, located at the southeast corner of Clement Avenue and Oak Street, is a large (approximately 320 feet long by about 130 feet wide) two-story industrial building built circa 1910 for the Gorge A (see **Figure 4.E-2**). Dow Pumping Engine Co. The building is a typical shop in form, with a gabled roof and a glazed monitor above the central bay, and constructed of a wood frame post and beam structure on a concrete foundation.


Figure 4.E-2
Steel Fabrication Shop and Warehouse. (left - rear) and (right - front & side)

The building is clad in corrugated metal and with fiberglass panels covering the original bands of industrial windows. Steel coved cornices decorate the eaves of the building. The interior space consists of a high (two-story) central aisle with steel frame gantry crane, and two lower (one-story) side aisles.

The building originally incorporated a coke oven and carpenter shop, and there was a small shed outside the main building which served as a brass foundry, which are no longer extant. Between 1927 and 1932, a large (approximately 130 feet wide by about 110 feet long) wood frame annex had been constructed on the southern end of the building abutting Clement Avenue, similar in style, shape, and materials as the original c. 1910 building. By 1948 the original c. 1910 building was used as a steel warehouse and fabricating shop, and the annex served as a warehouse. The building served most recently as a boat repair shop for Nelson Marine, and is currently vacant. Although currently in dilapidated condition, the building retains sufficient physical integrity to convey its former uses as an early twentieth century steel fabrication shop and warehouse. This building was assigned a National Register rating of “4D” as part of the 1988 survey, indicating that it may become eligible for the National Register as a contributing property. As this rating no longer exists, this building would be assigned a National Register rating of “5D2” today, indicating that it is a contributor to a district that is eligible for local listing or designation.

Machine Shop (c. 1910, addition c. 1966)

The machine shop was built in c. 1910 and was nearly identical style, size, and materials to the steel fabrication shop and warehouse located to the south (see **Figure 4.E-3**). Although expanded from its original size, the building is about 365 feet long by about 165 feet wide. It also was a typical shop in form, with a high glazed monitor between lower aisles. It is a wood frame post and beam structure with a concrete foundation and clad in corrugated metal. It is also decorated with coved cornices, and bands of industrial windows have been covered with translucent corrugated fiberglass. This building has been badly damaged by fire, and the roof and most of the siding is no longer extant. A large, two-story, steel fabricating annex with an L-shaped plan and corrugated siding and roofing was added to the western and southern elevations of this building, substantially altering its plan, massing, materials, and architectural appearance.

Figure 4.E-3
Machine Shop (left - rear) and Addition (right - front)

This building was constructed in c. 1966 during an expansion of the plant by PACECO. The building served most recently as a boat repair shop for Fred Anderson Boat & Woodworks, and is currently vacant.

The c. 1910 portion of the building was assigned a National Register rating of "4D" as part of the 1988 survey, indicating that it may become eligible for the National Register as a contributing property. Due to its fire-damaged condition and altered plan, however, the building no longer retains sufficient physical integrity to convey its former uses as an early twentieth century machine shop. Today this building would be assigned a National Register code of 6Z, indicating that it is ineligible for listing in the National Register or California Register.

Compressor Room/Storage Building and First Aid Office (c. 1910, c. 1940)

Located between the Steel Fabrication Shop and Warehouse and the Machine Shop is the Compressor Room/Storage Building, which was constructed c. 1910 (see **Figure 4.E-4**). The two-story building is about 120 feet long by about 50 feet wide. Similar in style to these adjacent buildings although substantially smaller, Compressor Room/Storage Building is also comprised of wood frame post and beam construction on a concrete foundation, with a gable roof and ventilating monitor, and corrugated metal cladding. This two-story building also has corrugated fiberglass cladding over the bands of industrial windows, and decorative coved cornices. In 1932, the building housed a boiler, two oil compressors, and an oil burning engine. A wood frame annex, built between 1932 and 1948 (c. 1940) was a first aid office. Behind the First Aid Office is a deteriorating brick tank. The ground floor was subdivided into smaller rooms and leased to various industrial tenants in the recent past, although the second floor is still one large, open-plan space. The building is currently vacant. Although currently in dilapidated condition, the building retains sufficient physical integrity to convey its former uses as an early twentieth century industrial building.

Figure 4.E-4
Compressor Room/Storage Building (left - rear & side) and
First Aid Office (right - front & side)

The c. 1910 portion of this building was assigned a National Register rating of "4D" as part of the 1988 survey, indicating that it may become eligible for the National Register as a contributing property. As this rating no longer exists, today this building would be assigned a National Register rating of "5D2," indicating that it is a contributor to a district that is eligible for local listing or designation. The wood frame first aid office was assigned a National Register rating of "6" as part of the 1988 survey, indicating that it is ineligible for listing in the National Register.

Today this building would have a rating of "6Z," indicating that it was found ineligible for the National Register, California Register or local designation through a survey evaluation.

Machine Shop Addition (c. 1966)

Located immediately adjacent and to, and the north of, the Steel Fabrication Shop and Warehouse is a two-story machine shop addition, consisting of a steel frame structure on a concrete foundation, an asymmetrical 'saltbox' gable roof form, and corrugated steel cladding and roofing (see **Figure 4.E-5**). The building is about 95 feet long by 55 feet wide, and is connected to the Steel Fabrication Shop and Warehouse via two massive steel beams which once held a gantry crane. This building was constructed in 1966 during an expansion of the plant by PACECO. Due to its dilapidated condition, more recent construction and lack of architectural or historical significance, the machine shop addition does not appear to substantially contribute to the early twentieth century industrial setting. The Machine Shop Addition was assigned a National Register rating of "6" as part of the 1988 survey, indicating that it is ineligible for listing in the National Register. Today this building would have a rating of 6Z, indicating that it is ineligible for the National Register, California Register or local designation through a survey evaluation.

Figure 4.E-5
Machine Shop Addition (rear - left) (front & side - right)

Office (c. 1966)

Located along Clement Street is a single-story office structure comprised of steel frame modular construction on a raised foundation, a shallow-pitch gable roof form, and painted fiberglass cladding (see **Figure 4.E-6**). The building is about 90 feet long by about 40 feet wide, and it is one story tall. This building was constructed in 1966 during an expansion of the plant by PACECO. Due to its lack of architectural or historical significance, the office building addition does not appear to

Figure 4.E-6
Office

substantially contribute to the early twentieth century industrial setting. The office structure was assigned a National Register rating of "6" as part of the 1988 survey, indicating that it is ineligible for listing in the National Register. Today this building would have a rating of 6Z, indicating that it was found ineligible for the National Register, California Register or local designation through a survey evaluation.

Historic-era Archaeological Resources

Archaeology undertaken for various projects in an urban environment (Meyer, 2002; Praetzellis, 2001, 2004) has demonstrated that historic-era archaeological features often survive within two feet of the modern ground surface. According to National Park Service guidelines, archaeological sites in urban areas "are likely to be more or less invisible, buried under modern created land surfaces." Here, "the reconnaissance consists of field checking predictions made on the basis of archival research" (National Park Service 1985:36). These features include pits, privies, wells, and sheet refuse associated with buildings shown on early Sanborn and other maps. Urban archaeological experience has also shown that pits and privies are most often located near the back of house lots, while wells tend to be closer to the rear of the building and can sometimes be located within the footprint of the house itself, typically at a rear or side addition. The significance of these features has been illuminated in numerous urban historical archaeology projects in (McIlroy, Meter, Solari, and Koenig, 2002; Praetzellis, 1994), San Francisco (ArcheoTec Inc., 2000; Praetzellis and Praetzellis, 1993), San Jose (Basin, 1999), and Sacramento (Praetzellis and Praetzellis, 1997) over the past decade.

One historic-era archaeological site has been recorded within a 0.5-mile radius of the project site. Fourteen small trash pits were uncovered during archaeological monitoring at a construction site. The pits, averaging 2 feet in diameter and 1 to 2 feet deep, contained fragments of ceramic, glass, metal, bricks, ash, charcoal, bottles, and food remains. The pits were located approximately 2 feet below the present-day ground surface.

Based on a review of available historical maps and additional research, it appears that the project site was not built upon until about 1908. Therefore, there is a low possibility for historic-era features to be located within the project site which predate the George A. Dow Pumping Engine Company use.

Regulatory Framework

State Regulations

The State of California implements the NHPA through its statewide comprehensive cultural resource surveys and preservation programs. The California Office of Historic Preservation (OHP), as an office of the California Department of Parks and Recreation, implements the policies of the NHPA on a statewide level. The OHP also maintains the California Historic Resources Inventory. The State Historic Preservation Officer is an appointed official who implements historic preservation programs within the state's jurisdictions.

California Environmental Quality Act

CEQA, as codified at California Public Resources Code [PRC] Sections 21000 et seq., is the principal statute governing the environmental review of projects in the state. CEQA requires lead agencies to determine if a proposed project would have a significant effect on historical resources.

The CEQA Guidelines define a historical resource as: (1) a resource in the California Register of Historical Resources (California Register); (2) a resource included in a local register of historical resources, as defined in PRC Section 5020.1(k) or identified as significant in a historical resource survey meeting the requirements of PRC Section 5024.1(g); or (3) any object, building, structure, site, area, place, record, or manuscript that 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, provided the lead agency's determination is supported by substantial evidence in light of the whole record.

If a lead agency determines that an archaeological site is a historical resource, the provisions of PRC Section 21084.1 and CEQA Guidelines Section 15064.5 would apply. If an archaeological site does not meet the CEQA Guidelines criteria for a historical resource, then the site may meet the threshold of PRC Section 21083 regarding unique archaeological resources. A unique archaeological resource is "an archaeological artifact, object, or site about 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 research questions, and there is a demonstrable public interest in that information;
- Has a special and particular quality, such as being the oldest of its type or the best available example of its type; and/or
- Is directly associated with a scientifically recognized important prehistoric or historic event or person.

The CEQA Guidelines note that if a resource is neither a unique archaeological resource nor a historical resource, the effects of the project on that resource shall not be considered a significant effect on the environment (CEQA Guidelines Section 15064[c][4]).

California Register of Historical Resources

The California Register is "an authoritative listing and guide to be used by state and local agencies, private groups, and citizens in identifying the existing historical resources of the state and to indicate which resources deserve to be protected, to the extent prudent and feasible, from substantial adverse change" (PRC Section 5024.1[a]). The criteria for eligibility to the California Register are based on National Register criteria (PRC Section 5024.1[b]). Certain resources are determined by the statute to be automatically included in the California Register, including California properties formally eligible for or listed in the National Register.

To be eligible for the California Register as a historical resource, a prehistoric or historic-period resource must be significant at the local, state, and/or federal level under one or more of the following criteria:

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

2) Is associated with the lives of persons important in our past;

3) 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; or,

4) Has yielded, or may be likely to yield, information important in prehistory or history [14 CCR Section 4852(b)].

For a resource to be eligible for the California Register, it must also retain enough integrity to be recognizable as a historical resource and to convey its significance. A resource that does not retain sufficient integrity to meet the National Register criteria may still be eligible for listing in the California Register.

Local

The City Design Element and the Open Space and Conservation Element of the City of Alameda General Plan (1991) contain numerous goals and policies related to the protection and enhancement of Alameda's cultural resources. Goals and policies applicable to the proposed project are provided below.

City Design Element. Implementing Policies to Preserve Architectural Resources

3.3.a Continue to identify quality architecture of all periods in Alameda's history and participate in programs to increase owners' and buyers' awareness of the importance of preservation.

3.3.b Consider formation of Historic Districts within which alterations to existing structures would be regulated to maintain neighborhood scale and historic character.

3.3.c Maintain strong demolition control for historic properties.

3.3.d New construction, redevelopment and alterations should be compatible with historic resources in the immediate area.

3.3.e Develop detailed design guidelines to ensure protection of Alameda's historic, neighborhood, and small-town character. Encourage preservation of all buildings, structures, areas and other physical environment elements having architectural, historic or aesthetic merit, including restoration of such elements where they have been insensitively altered. Include special guidelines for older buildings of existing or potential architectural, historical or aesthetic merit which encourage retention of original architectural elements and restoration of any missing elements. The design guidelines include detailed design standards for commercial districts.

3.3.f Regulate development in neighborhood business districts to maintain a street-wall, with most structures built to the property lines, entrances directly facing the sidewalk, and parking at the rear.

3.3.k Require that any exterior changes to existing buildings receiving City rehabilitation assistance or related to Use Permits, Variances or Design Review, or other discretionary City approvals be consistent with the building's existing or original architectural design unless the City determines either (a) that the building has insufficient existing or original design merit of historical interest to justify application of this policy or (b) that application of this policy would cause undue economic or operational hardship to the applicant, owner or tenant.

Open Space and Conservation Element. Policies for the Protection of Historic and Archaeological Resources

5.6.a Protect historic sites and archaeologic resources for their aesthetic, scientific, educational, and cultural values.

5.6.b Working in conjunction with the California Archaeological Inventory, review proposed development projects to determine whether the site contains known prehistoric or historic cultural resources and/or to determine the potential for discovery of additional cultural resources.

5.6.c Require that areas found to contain significant historic or prehistoric archaeological artifacts be examined by a qualified consulting archaeologist or historian for appropriate protection and preservation.

The California Environmental Quality Act (CEQA) requires evaluation of any archaeological resource on the site of a development project. Unique resources, as defined by State law, should be protected, either by physical measures or by locating development away from the site. A preferred preservation method involves covering a site with earth fill for potential future, leisurely excavation; immediate excavation by qualified archaeologists should be undertaken only if such protection is infeasible.

In addition, the Historic Preservation Element, adopted in 1980 by the City of Alameda, identified nearly 4,000 properties as having architectural and historical importance. Recommendations for preservation include designation of Heritage Areas, and Historic Districts. Historic preservation district boundaries were not proposed, but three Heritage Areas have been studied under the Certified Local Government Program, and designated by the City Council: Bay Station (1986), Park Avenue (1988), and Burbank-Portola (1989). Since the adoption of the Historic Preservation Element, the City completed detailed surveys of unreinforced buildings, commercial buildings on Webster Street, and buildings and sites in the northern waterfront.

Impacts and Mitigation Measures

Significance Criteria

A cultural resource impact would be considered significant if the project would result in any of the following:

- Cause a substantial adverse change in the significance of a historical resource, as defined in Section 15064.5;
- Cause a substantial adverse change in the significance of a unique archaeological resource, pursuant to Section 15064.5;
- Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature; or
- Disturb any human remains, including those interred outside of formal cemeteries.

CEQA Section 21084.1 states that "a project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment." A "substantial adverse change" is defined in Section 15064.5(b)(1) of the CEQA Guidelines as "physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired." The significance of a historical resource is "materially impaired," according to Guidelines Section 15064(b)(2), when a project demolishes or materially alters, in an adverse manner, those physical characteristics of the resource that:

- convey its historic significance and that justify its inclusion in, or eligibility for inclusion in, the California Register (including a determination by the lead agency that the resource is eligible for inclusion in the California Register);
- account for its inclusion in a local register of historical resources adopted by local agency ordinance or resolution (in accordance with Public Resources Code Sec. 5020.1(k)); or
- account for its identification in a historical resources survey that meets the requirement of Public Resources Code Sec. 5024.1(g), including, among other things, that "the resource is evaluated and determined by the [State Office of Historic Preservation] to have a significance rating of Category 1 to 5 on DPR Form 523," unless the lead agency "establishes by a preponderance of evidence that the resource is not historically or culturally significant."

The state CEQA Guidelines indicate that projects that are consistent with the *Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings* generally "shall be considered as mitigated to a level of less than a significant impact on the historical resource" (Section 15064.5(b)(3)).

When a project would adversely affect an archaeological site, a lead agency shall first determine whether the site is a historical resource, as defined above. If it is determined that the archaeological site is a historical resource, the provisions of Public Resources Code

Section 21084.1 (Historical Resources) apply. If an archaeological site does not meet the criteria, but does meet the definition of a “unique archaeological resource” in Public Resources Code Section 21083.2 (Archaeological Resources), the site must be treated in accordance with the provisions of Section 21083.2. Public Resources Code section 21083.2, subdivision (g), states that “unique archaeological resource” means an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

1. Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

2. Has a special and particular quality such as being the oldest of its type or the best available example of its type.

3. Is directly associated with a scientifically recognized important prehistoric or historic event or person.

Impact Analysis

This following impact analysis focuses on potential impacts of the proposed project related to cultural resources.

Historic Architectural Resources

Impact 4.E-1: Construction of the proposed project would have a significant, adverse impact on significant historic resources through demolition of the circa 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building. (Significant)

The proposed project would demolish all buildings on the project site and replace them with the proposed residential development. Of the five primary structures which exist on the project site, only the circa 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building have sufficient physical integrity to be considered historical resources for CEQA purposes. These two buildings appear to be contributors to a potential historic industrial district that is eligible for local listing. Demolition of these structures would materially alter in an adverse manner those characteristics which would qualify them for listing in the federal, state, and local registers. Construction of the proposed project would also materially alter in an adverse manner the setting of a potential historic district that is eligible for local listing. The proposed project also would involve demolishing three non-historical buildings on the project site (the Foundry, Machine Shop Addition, and the Office), as well as the First Aid Office Annex of the Compressor Room/Storage Building, and all dilapidated docks, ways, and concrete ramps and laydown pads along the waterfront. Because none of these structures has been identified as historic resources, their proposed removal and replacement with the proposed project would have no significant impacts.

Therefore, the proposed project would have a significant impact on historical resources because it would require demolition of the Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building. Mitigation Measure 4.E-1, below, would reduce the impacts of demolition.

Mitigation Measure 4.E-1: The project applicant shall document the circa 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building in accordance with the Historic American Building Survey (HABS) Level II documentation standards of the National Park Service. Level II standards include the following:

1. Photographs. Large-format (4 x 5-inch negatives or greater), black and white photographs should be taken of all elevations of the two buildings, plus limited context and detail shots. A limited number of historical photos of the project site buildings, if available, should also be photographically reproduced. All photographs should be printed on acid-free archival bond paper.

2. Written History. Prepare a written history of the project site and buildings using the HABS standard outline format.

3. Drawings. If available, reproduce original building drawings on mylar or through photographic means.

4. Archiving. The completed HABS documentation package (photos, report, and drawings) shall be archived at the City of Alameda, the City of Alameda Public Library, and the Northwest Information Center of Sonoma State University.

The project applicant shall also provide an interpretive history exhibit in the form of a plaque or panel to describe the historical importance of the former Dow Company buildings to the general public. Information generated from the documentation effort, such as photographs and historical text, described above, can be utilized for this effort as well. The interpretive exhibit can either be placed along the proposed waterfront trail/openspace, or at the corner of Clement Avenue and Oak Street. The interpretive exhibit should be designed by a professional architectural historian meeting the qualifications of the Secretary of the Interior's Standards.

These mitigation strategies would not fully reduce the significant adverse impact on the 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building to a less-than-significant level. CEQA Section 15126.4 (b) (2) states that 'In some circumstances, documentation of a historical resource, by way of historic narrative, photographs and/or architectural drawings, as a mitigation for the effects of demolition of the resource will not mitigate the effects to a point where clearly no significant effect on the environment would occur.' Therefore, even with implementation of the Mitigation Measures 4.E-1, demolition of the circa 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building would be considered a significant unavoidable impact. Chapter 5, *Alternatives*, describes a preservation/adaptive reuse alternative that would avoid the significant impacts of the proposed project.

Significance after Mitigation: Significant and Unavoidable.

Archaeological Resources

Impact 4.E-2: Construction of the proposed project could result in the inadvertent discovery of archaeological resources. (Significant)

No archaeological resources have been recorded in the project site. The project site has a low to moderate potential to contain buried prehistoric or historic-era sites. The possibility of encountering archaeological resources cannot be entirely discounted. To facilitate compliance with legal requirements, project personnel should be alerted to the possibility of encountering cultural materials during project implementation, and apprised of the proper procedures to follow in the event that such materials are found. Implementation of the following mitigation measure would reduce potential impacts to a less-than-significant level.

> **Mitigation Measure 4.E-2:** If cultural resources are encountered, all activity in the vicinity of the find shall cease until it can be evaluated by a qualified archaeologist and a Native American representative. Prehistoric archaeological materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil ("midden") containing heat-affected rocks, artifacts, or shellfish remains; and stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs); and battered stone tools, such as hammerstones and pitted stones. Historic-era materials might include stone, concrete, or adobe footings and walls; filled wells or privies; and deposits of metal, glass, and/or ceramic refuse. If the archaeologist and Native American representative determine that the resources may be significant, they shall notify the project applicant and the City of Alameda and shall develop an appropriate treatment plan for the resources. The archaeologist shall consult with Native American monitors or other appropriate Native American representatives in determining appropriate treatment for unearthed cultural resources if the resources are prehistoric or Native American in nature.
>
> In considering any suggested mitigation proposed by the archaeologist and Native American representative in order to mitigate impacts to cultural resources, the project applicant shall determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) shall be instituted. Work may proceed on other parts of the project site while mitigation for cultural resources is being carried out.

Significance after Mitigation: Less than Significant.

Paleontological Resources

Impact 4.E-3: Construction of the proposed project could result in the discovery of unidentified paleontological resources. (Significant)

As discussed in the setting portion of this Section 4.E, there are no known fossil sites in the project site, and the geologic units underlying the site have very low potential to yield significant paleontological resources. Excavations for the project would involve site preparation for housing unit foundations, roads and utilities. Such activities would likely excavate or otherwise disturb previous fills, relict dune sands, and Bay Mud deposits – all of which are unlikely to yield fossil resources. However, because it has not been proven that fossil resources do not occur within the subsurface geology of the site, disturbance or destruction of a paleontological resource is a *potentially significant* impact of the proposed project. Implementation of Mitigation Measure 4.E-3, described below, would avoid disturbance or destruction of accidentally discovered fossil resources by halting work and salvaging the find, if appropriate.

> **Mitigation Measure 4.E-3:** If paleontological resources, such as fossilized bone, teeth, shell, tracks, trails, casts, molds, or impressions are discovered during ground-disturbing construction activities, all such activities within 100 feet of the find shall be halted until a qualified paleontologist can assess the significance of the find and, if necessary, develop appropriate salvage measures in consultation with the City of Alameda and in conformance with Society of Vertebrate Paleontology Guidelines (SVP, 1995; SVP, 1996).

Significance after Mitigation: Less than Significant.

Human Remains

Impact 4.E-4: Construction of the proposed project could result in the inadvertent discovery of human remains. (Significant)

There is no indication at the project site that the location has been used for burial purposes in the recent or distant past. It is unlikely that human remains would be encountered in the project site. However, in the event of the discovery of any human remains during project construction activities, work would be halted. Damage to human remains would be a significant impact. Implementation of the following mitigation measure would reduce potential impacts to a less-than-significant level.

> **Mitigation Measure 4.E-4:** If human skeletal remains are uncovered during project construction, the project applicant shall immediately halt work, contact the Alameda County coroner to evaluate the remains, and follow the procedures and protocols set forth in Section 15064.5 (e)(1) of the CEQA Guidelines. If the County coroner determines that the remains are Native American, the project applicant shall contact the Native American Heritage Commission, in accordance with Health and Safety Code Section 7050.5, subdivision (c), and Public Resources Code 5097.98 (as amended by AB 2641). Per Public Resources Code 5097.98, the landowner shall ensure that the immediate vicinity, according to generally accepted cultural or archaeological standards or practices, where the Native American human remains are located, is not damaged or disturbed by further development activity until the landowner has discussed and conferred, as prescribed in this section (PRC 5097.98), with the most likely descendents regarding their recommendations, if applicable, taking into account the possibility of multiple human remains.

Significance after Mitigation: Less than Significant.

Cumulative Impact

Impact 4.E-5: The proposed project, in conjunction with cumulative development, could adversely affect historic resources in the project vicinity. (Significant)

Impacts to cultural resources from other reasonably foreseeable projects in the vicinity could combine with those of the proposed project to form a cumulatively considerable impact.

The larger Northern Waterfront area contains numerous examples of primarily commercial and maritime-industrial uses which date to the late 1800s and early 1900s. While some buildings in these areas have been previously surveyed and evaluated for their potential historical significance, comprehensive surveys have not been completed for the entire area. Hence, it is unknown whether historically significant resources would be threatened by the proposed reuse efforts in these areas. Similar to the proposed project, implementation of these plans could also substantially damage or destroy historically significant resources. As such, the significant and unavoidable impacts of the proposed project could combine with potentially significant and unavoidable impacts resulting from redevelopment elsewhere in the Northern Waterfront area to contribute to a significant cumulative impact to historic resources. Although the individual projects implemented pursuant to these plans would require their own CEQA review prior to approval, and CEQA requires that projects avoid direct impacts to resources listed in or eligible for listing in federal, state, and local registers (or reduce impacts to a less-than-significant level through the application of the Secretary of the Interior's Standards whenever it is feasible to do so), the proposed project may still result in a significant cumulative impact to historic resources. Implementation of Mitigation Measure 4.E-1, described above, would also reduce the contribution of the proposed project to cumulative impacts, but not to a less-than-cumulatively considerable level. Therefore, the cumulative impacts of the project would remain significant and unavoidable.

> **Mitigation:** Implement Mitigation Measures 4.E-1, -2, -3, and -4.
>
> **Significance after Mitigation:** Significant and Unavoidable.

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F. Biological Resources

Introduction

This section identifies the existing biological resources at the Boatworks Residential Project site (the "project site"); identifies the federal, state, and local regulations pertaining to biological resources within the region; and describes project impacts on those biological resources as well as mitigation measures to reduce project-related potentially significant impacts. Information used in the preparation of this section was obtained from the California Natural Diversity Database (CNDDB) (CDFG, 2009), California Native Plant Society Electronic Inventory (CNPS, 2009), U.S. Fish and Wildlife Service (USFWS, 2009), and standard biological literature.

Environmental Setting

Regional Setting

The project site is located in the Bay Area-Delta Bioregion, as defined by the State's Natural Communities Conservation Program. This bioregion consists of a variety of natural communities that range from the open waters of the Bay and Delta, to salt and brackish marshes, to chaparral and oak woodlands. The temperate climate is Mediterranean in nature, with relatively mild, generally wet winters and warm, dry summers. The high diversity of vegetation and wildlife found in Alameda County, which reflects that of the region as a whole, is a result of soils, topography, and micro-climate diversity that combine to promote relatively high levels of endemism.[1] This, in combination with the rapid pace of development in the region, has resulted in a relatively high degree of endangerment for local flora and fauna.

The project site is located on the north shore of Alameda Island, along the Oakland Estuary, which is part of the San Francisco Bay Estuary. The San Francisco Estuary is designated as a Western Hemisphere Shorebird Reserve Network of international importance, with more than one million shorebirds using regional wetlands each winter. Between 300,000 and 900,000 shorebirds pass through San Francisco Bay during spring and fall migration periods, more than 50 percent of the diving ducks in the Pacific Flyway winter in the shallow wetlands of the Bay, and several species breed in regional wetlands during the summer (Goals Project, 1999).

Alameda Island

Although Alameda has lost most of its historic wetlands, some remain on the South Shore of the Main Island at the Elsie D. Roemer Bird Sanctuary. Common birds found in the Oakland Estuary include Canada geese (*Branta canadensis*), American coot (*Fulica americana*), northern shoveler (*Anas clypeata*), common goldeneye (*Bucephala clangula*), gulls (*Larus* spp.). Other birds such as the snowy plover *(Gavia immer),* California brown pelican *(Pelicanus occidentalis),* double-crested cormorant *(Phalacrocorax auritus),* Barrow's goldeneye (*Bucephela islandica*), northern harrier *(Circus cyaneus),* California gull (*Larus californicus*), salt marsh yellowthroat

1 *Endemism* refers to the degree to which organisms or taxa are restricted to a geographical region or locality and are thus individually characterized as endemic to that area.

(*Geothlypis trichas sinuosa*), and elegant tern *(Sterna elegans)*, California least tern (*Sternula antillarum browni*), black skimmer (*Rhynchops niger*), black-crowned night heron (*Nycticorax nycticorax*), cackling goose (*Branta hutchinii leucopareia*), Caspian tern (*Hydroprogne caspia*), great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), and Cooper's hawk (*Accipiter cooperii*), may forage in and around Alameda (National Audubon Society, 2009; CDFG, 2009).

Project Setting

The proposed Boatworks Residential Project would involve the construction of approximately 242 housing units on the project site. The approximately 9.5-acre project site is located on the northern shore of Alameda Island adjacent to the Oakland Estuary, one block west of the Park Street Bridge. The project site is currently developed with several abandoned buildings, and has some ruderal vegetation. Surrounding land-use includes warehouses, commercial center, cafe and residential units to the west, east, and south, and the Oakland Estuary to the north.

Terrestrial and Aquatic Habitat

The project site contains urban and aquatic habitat. While these two habitats are largely devoid of plant communities, both can provide wildlife habitat.

Urban

The project site is predominantly developed and occurs in a highly urbanized context. As discussed above, the project site is bordered on the west, south, and east by development; the area on the north side of the Alameda Estuary is also developed. Urban, developed areas, dominated by roads, structures, concrete, and asphalt, provide little wildlife habitat and essentially no habitat for plants other than opportunistic weedy species adapted to harsh conditions or the horticultural plants used in landscaped areas. Vegetation onsite is made up of limited, ruderal grasses, shrubs, and trees, such as pampas grass (*Cortaderia selloana*) and the non-native shrub Indian princess hawthorn (*Raphiolepis indica*).

Wildlife species utilizing urban areas must be able to tolerate the presence of humans and their activities and are typically generalists, capable of utilizing the limited food sources available, such as garbage and horticultural plants and their fruit. Urban wildlife species in the Alameda area include common raven (*Corvus corax*), northern mockingbird (*Mimus polyglottos*), raccoon (*Procyon lotor*), Norway rat (*Rattus norvegicus*), Virginia opossum (*Didelphis virginiana*), and feral cats. Several exceptions to the generalist rule are red-tailed hawks (*Buteo jamaicensis*), which prey on rodents and birds often found in urban parks, and Cooper's hawks (*Accipiter cooperii*) and peregrine falcons (*Falco peregrinus anatum*), which prey almost exclusively on small to medium sized birds. Birds observed during ESA's site visit on February 18, 2009 include Anna's hummingbird (*Calypte anna*), rock dove (*Columba livia*), mourning dove (*Zenaida macroura*), white-crowned sparrow (*Zonotrichia leucophrys*), European starling (*Sturnus vulgaris*), as well as water and shore birds including mallard (*Anas platyrhynchos*), Canada goose, gulls (*Larus* spp.), and greater scaup (*Aythya marila*).

Aquatic

Along the northern boundary of the project site is a tidal canal, which is connected to the Oakland Inner Harbor to the north, and which is part of the Oakland Estuary. The Oakland Estuary was originally a tidal slough, but it was dredged at the turn of the century. The estuary is influenced by both freshwater and marine water. It receives freshwater inflow from a combination of natural creeks, human-made stormwater drainage facilities, and direct surface runoff. The estuary is also influenced by the marine waters of the Bay and is subject to tidal currents. Sediment from Oakland's shoreline and creeks is carried by the tidal current to shoals and sandbars, causing siltation of the nearby shipping channels.

The shoreline of the Oakland Estuary is currently owned by the Army Corps of Engineers (Corps), but is expected to be transferred to the City of Alameda as early as 2011. The estuary shoreline at the site is primarily composed of large slabs of cement, with a derelict pier and two boat ramps. An approximately five feet by five feet patch of pickleweed (*Sarcocornia pacifica* [=*Salicornia virginica*]) is present along the northern boundary of the project site, along the Oakland Estuary shoreline.

Oakland Estuary waters and adjacent upland habitat provides foraging, resting, and wintering habitat for waterfowl and shorebirds, including ducks, grebes, gulls, terns, geese, and cormorants. Many of these species are migratory and stay predominantly in the Oakland Estuary waters, although they may occasionally use the adjacent upland habitat in the project site for loafing.

The San Francisco Bay and adjacent estuaries, including the Oakland Estuary, support a wide variety of fishes, including special-status species such as steelhead (*Oncorhynchus mykiss irideus)*, Chinook salmon (*Oncorhynchus tshawytscha*), and green sturgeon (*Acipenser transmontanus*). In addition, although it is not listed as a special-status species, the San Francisco Bay Pacific herring (*Culpea harengus pallasi*) fishery is one of the last remaining fisheries in the San Francisco Bay, and is currently suffering significant declines. Because of its commercial importance, the fishery is regulated by the California Department of Fish and Game (CDFG), and the Pacific herring population and spawning success within the San Francisco Bay are closely monitored. Marine vegetation, such as eelgrass and algae, are the preferred substrate for herring spawning. However, pier pilings, riprap, and other rigid, smooth structures within Bay waters also serve as spawning substrate (Goals Project, 2000).

Marine mammals known to occur in San Francisco Bay that may be found in the project vicinity include California sea lion (*Zalophus californianus*) and harbor seal (*Phoca vitulina*).

Sensitive Natural Communities

Sensitive natural communities are designated as such by various state or local resource agencies, and are generally considered to have important value for wildlife, and/or are threatened enough in extent to warrant some sort of protection. For example, many local agencies in California consider protection of oak woodlands important and federal, state, and most local agencies also consider wetlands and riparian habitat as sensitive natural communities. The CDFG's CNDDB tracks communities it believes to be of conservation concern and these communities are typically considered sensitive for the purposes of CEQA analysis (see *Regulatory Framework*, below). The CNDDB lists three sensitive natural communities as occurring in the vicinity of the project site: northern coastal salt marsh, northern maritime chaparral, and serpentine bunchgrass grasslands. None of these communities are present in the project site.

Special-Status Species

A number of species known to occur in the project site vicinity are protected pursuant to federal and/or State of California endangered species laws, or have been designated Species of Special Concern by CDFG. In addition, Section 15380(b) of the California Environmental Quality Act (CEQA) Guidelines provides a definition of rare, endangered, or threatened species that are not included in any listing, provided they meet certain criteria (e.g., it can be shown that the species' survival in the wild is in jeopardy or the species is at risk of becoming endangered in the near future).[2] Species recognized under these terms are collectively referred to as "special-status species." For the purposes of this EIR, special-status species include:

- Plant and wildlife species listed as rare, threatened or endangered under the federal or state endangered species acts.
- Species that are candidates for listing under either federal or state law.
- Species formerly designated by the USFWS as Species of Concern or designated by CDFG as Species of Special Concern.
- Raptors (birds of prey), which are specifically protected by California Fish & Game Code Section 3503.5, which prohibits the take, possession, or killing of raptors and owls, their nests, and their eggs;[3] and
- Species such as candidate species that may be considered rare or endangered pursuant to Section 15380(b) of the CEQA Guidelines.

Appendix G of this document provides comprehensive lists of 105 special-status species that have been documented from, or have potential to occur in suitable habitat within, the vicinity of the project. These lists include occurrences documented by the California Natural Diversity Database (CNDDB) (CDFG, 2009), California Native Plant Society Electronic Inventory (CNPS, 2009), and the U.S. Fish and Wildlife Service (USFWS, 2009). Based on review of the biological literature of the region, information presented in previous environmental documentation, and an evaluation of the habitat conditions of the project site, ESA biologists designated a species as

2 These criteria have been modeled after the definition in the FESA and the section of the California Fish and Game Code dealing with rare or endangered plants or animals. This section was included in the CEQA Guidelines primarily to deal with situations in which a public agency is reviewing a project that may have a significant effect on, for example, a "species of concern" that has not yet been listed by either the USFWS or CDFG. Additionally, for example, vascular plants listed as rare or endangered or as List 1 or 2 by the California Native Plant Society (CNPS) are considered subject to Section 15380(b).

3 The inclusion of birds protected by Fish & Game Code Section 3503.5 is in recognition of the fact that these birds are substantially less common in California than most other birds, having lost much of their habitat to development, and the recognition that the populations of these species are therefore substantially more vulnerable to further loss of habitat and to interference with nesting and breeding than are most other birds. It is noted that a number of raptors and owls are already specifically listed as threatened or endangered by state and federal wildlife authorities.

having a “low potential” for occurrence if: (1) its known current distribution or range is outside of the project area, (2) only limited or marginally suitable habitat is present within the project area, (3) the species’ specific habitat requirements (e.g., serpentine grasslands, as opposed to grasslands occurring on other soils) are not present, or (4) the species is presumed, based on the best scientific information available, to be extirpated from the project area or region. A species was designated as having a “moderate potential” for occurrence if there is low to moderate quality habitat within the project area or immediately adjacent areas, even though the species was not observed during biological surveys. A species was designated as having a “high potential” for occurrence if: (1) moderate to high quality habitat is present within the project area, and (2) the project area is within the known range of the species. Most of the species listed in Appendix G have only a low potential for occurrence or are absent from the project site and were eliminated from further evaluation, primarily because the site’s developed environment does not provide suitable habitat for many species. Species with a moderate or high potential to occur in the project site or immediate vicinity are discussed in further detail, below.

Special-Status Plants

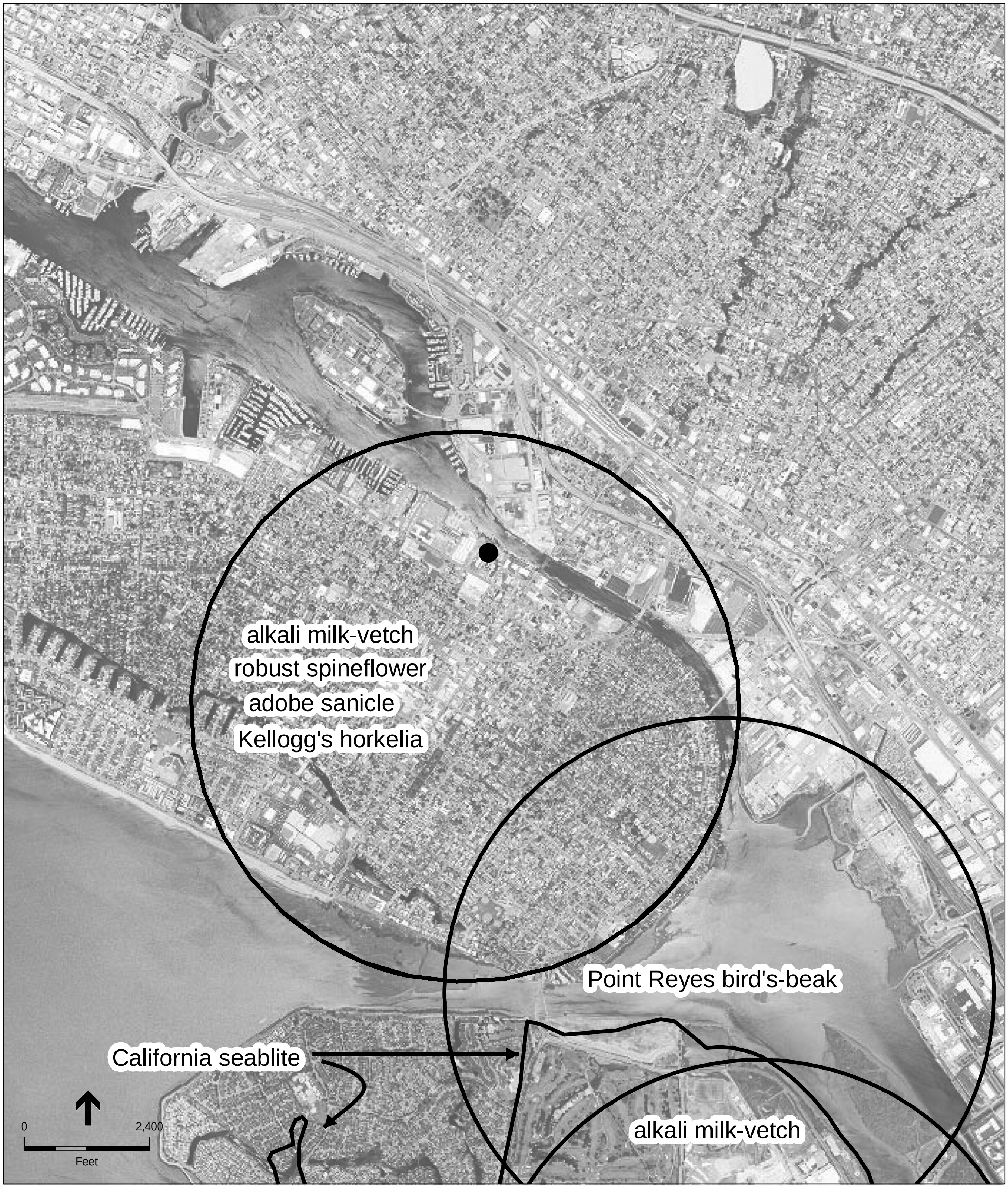
No special-status plant species are expected to occur on the proposed project site. Although a number of special-status plant species historically occurred within the project site vicinity, these plants are not expected to occur in the project site because: (1) there are no intact native communities remaining within the project site; and (2) distribution of many of these species is restricted to specific habitat types or soils that are not, and/or never were, present within the project site, such as vernal pools or serpentine soils. **Figure 4.F-1** shows the plant species occurrences in the project vicinity, and Appendix G lists the plants that have historically occurred in the project vicinity, and their potential to currently occur in the project site.

Special-Status Animals

There are 53 special-status wildlife species records with current or historic occurrences in the vicinity of the project. None of these species have a high potential to occur onsite, but native birds and bats may nest/roost onsite; these animals are protected under federal and state law as described below. **Figure 4.F-2** shows animal species occurrences in the project vicinity, and Appendix G lists animals that have historically occurred in the project vicinity, and their potential to currently occur in the project site.

Special-Status Birds. Bird species may nest within the abandoned warehouses or trees on the project site, or along the Estuary’s edge. ESA observed one bird nest in the warehouse on the east side of the project site during the February 18, 2009 visit. The federal Migratory Bird Treaty Act protects most native birds in California, and the California Fish and Game Code protects native, nongame, breeding birds under Section 3503, and raptors (eagles, hawks, and owls) under Section 3503.5 (see *Regulatory Framework*, below).

Special-Status Bats. The project site may support roosting bats that are either former federal species of concern and/or California Species of Special Concern, including the pallid bat, Townsend’s big-eared bat, fringed myotis, and Yuma myotis. These bats could roost in any of the abandoned warehouses or trees onsite. Bats and non-game mammals are protected under

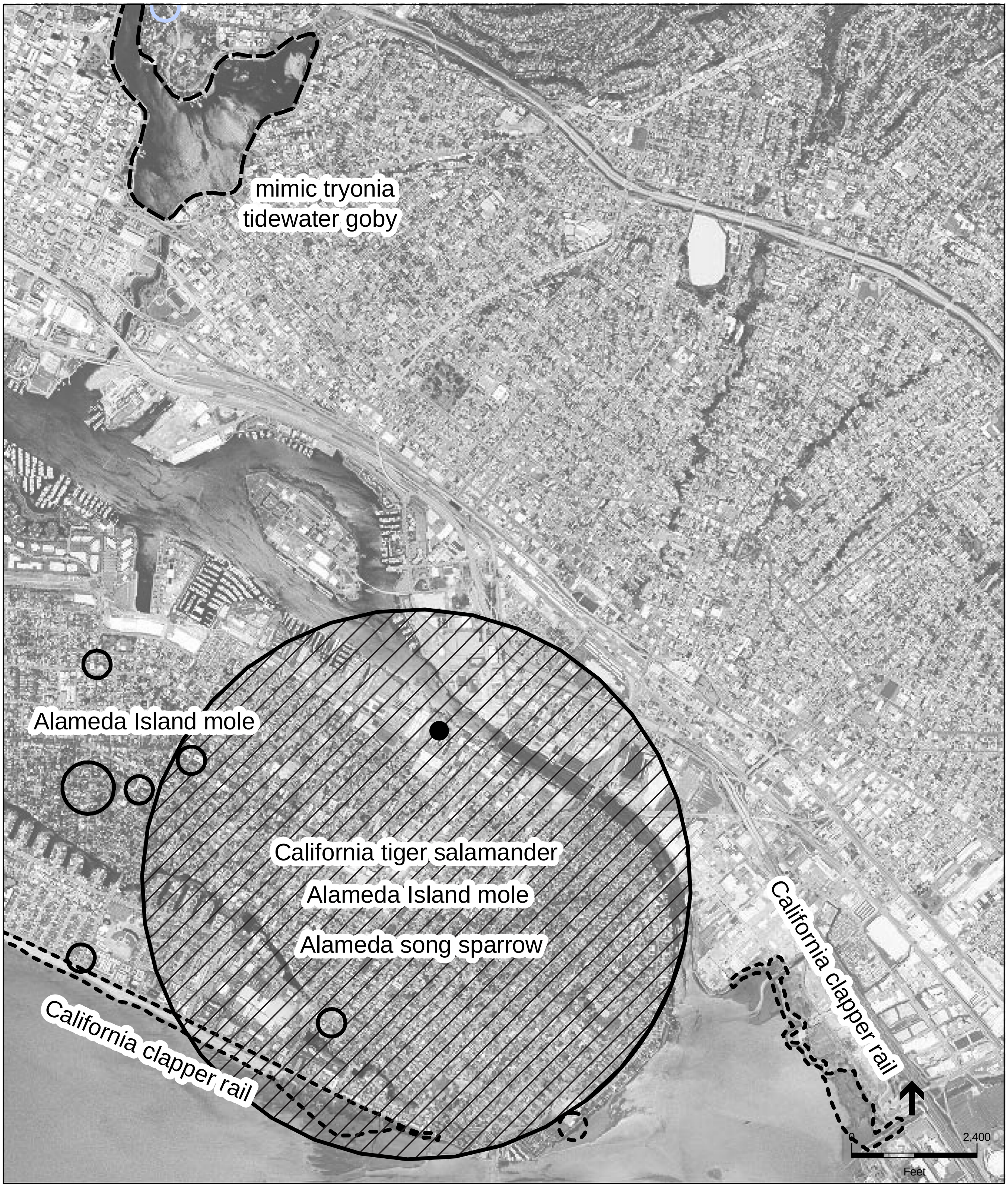


Alameda Boatworks

SOURCE: CDFG, 2009; NAIP, 2005

Boatworks Residential Project . 208559

Figure 4.F-1
Records of Special-Status Plants Within 1.5 Miles of the Project Site



Alameda Boatworks | Alameda Island mole | California clapper rail | California tiger salamander, Alameda Island mole, Alameda song sparrow | mimic tryonia, tidewater goby

SOURCE: CDFG, 2009; NAIP, 2005

Boatworks Residential Project . 208559

Figure 4.F-2

Records of Special-Status Animals Within 1.5 Miles of Project Site

California Fish and Game Code Section 4150, and destruction of a maternity colony of even a relatively common species such as the Mexican free-tailed bat, would be considered significant in this EIR.

Special-Status Fish. Four special-status fish have the potential to occur in or near the project site: steelhead (Central California Coast distinct population segment [DPS][4] and Central Valley DPS), Chinook salmon (Central Valley winter-run evolutionarily significant unit [ESU], Central Valley spring-run ESU, and Central Valley fall and late fall-run ESU), green sturgeon, and Pacific herring. A general description of their status, ecology, and distribution are given in the paragraphs that follow.

Steelhead: The steelhead Central California Coast DPS and California Central Valley DPS are both listed as threatened under the Federal Endangered Species Act (FESA). Anadromous rainbow trout, or steelhead, occur in California from the Smith River south along the coast to San Mateo Creek, San Diego County, and in streams of the San Francisco Estuary and Central Valley (Moyle, 2002). These fish possess the ability to spawn repeatedly and maintain the mechanisms to return to the Pacific Ocean after spawning in freshwater. Juvenile steelhead may spend up to four years residing in fresh water prior to migrating to the ocean as smolts. Tributaries to the San Francisco Estuary support the ocean-maturing steelhead ecotype, as well as non-anadromous, or resident, forms of rainbow trout (Leidy et al., 2005). Individuals migrating between the ocean and spawning habitat could be present in the Oakland Estuary, although their presence would be sporadic.

Chinook Salmon: The population of Chinook salmon in San Francisco Bay consists of three distinct evolutionarily significant units (ESUs): winter-run, spring-run, and fall/late fall-run. These races are distinguished by the seasonal differences in adult upstream migration, spawning, and juvenile downstream migration. Chinook salmon are anadromous fish, spending three to five years at sea before returning to fresh water to spawn. These fish pass through San Francisco Bay waters to reach their upstream spawning grounds. In addition, juvenile salmon migrate through the Bay on their way to the Pacific Ocean.

Sacramento River winter-run Chinook salmon, listed as endangered by both the state and the federal government, migrate through San Francisco Bay from December through July with a peak in March (Moyle, 2002). Spawning is confined to the mainstem Sacramento River and occurs from mid-April through August. Juveniles emerge between July and October and are resident in their natal stream for 5 to 10 months, followed by an indeterminate residency period in estuarine habitats (Moyle, 2002).

The state and federal-listed threatened Central Valley spring-run Chinook salmon migrates to the Sacramento River from March to September with a peak spawning period between late August and October (Moyle, 2002). Juvenile salmon emerge between November and March and are resident in streams for a period of 3 to 15 months before migrating to downstream habitats (Moyle, 2002).

4 DPS: Distinct population segment: A population segment markedly separate from other populations of the same taxon due to physical, physiological, ecological, or behavioral factors and significant to the conservation of the entire taxon.

The Central Valley fall/late fall-run Chinook salmon is a California Species of Special Concern. These salmon enter the Sacramento and San Joaquin rivers from June through December and spawn from October through December, with a peak in November.

All three Chinook salmon ESUs travel through the San Francisco Bay, and use it for rearing habitat These ESUs could be present in the Oakland Estuary.

Green Sturgeon: The green sturgeon is a federally threatened species. This anadromous fish is the most widely distributed member of the sturgeon family and the most marine-oriented of the sturgeon species. Green sturgeons reside in nearshore waters from Mexico to the Bering Sea and are common occupants of bays and estuaries along the western coast of the United States (Moyle et al., 1995). Adults in the San Joaquin Delta are reported to feed on benthic invertebrates including shrimp, amphipods and occasionally small fish (Moyle et al., 1995), while juveniles reportedly feed on opossum shrimp and amphipods. Adult green sturgeons migrate into freshwater beginning in late February with spawning occurring March through July, and peak activity in April and June. After spawning, juveniles remain in fresh and estuarine waters for 1-4 years and then begin to migrate out to the sea (Moyle et al., 1995). The upper Sacramento River has been identified as the only known spawning habitat for green sturgeon in the southern DPS. Although they are not expected to spawn in the Oakland Estuary, they could occasionally travel through.

Pacific Herring: Pacific herring is protected under the Magnuson-Stevens Fishery Conservation and Management Act. It is a marine fish that migrates from offshore habitats into coastal estuaries to spawn. San Francisco is a major spawning ground for herring, and they are present in San Francisco Bay from November through March. Adult fish mobilize in deep channels within the Bay until they move into shallower areas where suitable spawning microhabitat is present (Goals, 1999). Herring spawning occurs in waves separated by one to several weeks, and eggs are typically attached to aquatic vegetation, rocks, structures in the water, or other solid substrates (Lassuy, 1989). Eelgrass beds are especially good habitat for spawning adult herring.

Both the Pacific herring and its eggs belong to an important San Francisco Bay commercial fishery, and populations have been monitored for the past 36 years by the California Fish and Game Commission. The 2008-2009 season spawning biomass estimate for the San Francisco stock was 4,844 tons, well below the historical average (1978-1979 season to present) of 49,428 tons. The 2008-2009 season was the third consecutive season of historically low biomass estimates during the 36 years of monitoring (California Fish and Game Commission, 2009). The 2009-2010 Pacific herring fishing season is closed as a result of these low numbers.

Pacific herring are known to occur within the Oakland Estuary, and it is presumed that they are seasonally present in the area of the project site. Although eelgrass habitat does not exist in the vicinity of the project site, there are structures in the water (e.g., old boats and dock pilings) that could provide suitable substrates on which egg masses could be attached.

Designated Critical Habitat

The National Marine Fisheries Services (NMFS) designated critical habitat for Sacramento winter-run Chinook salmon on June 16, 1993 (NMFS, 1993) and for central California coast steelhead DPS, Central Valley steelhead DPS, and Central Valley spring-run Chinook salmon ESU on September 2, 2005 (NMFS, 2005). The area adjacent to the project site is within designated critical habitat for the central California coast steelhead DPS.

Regulatory Framework

This subsection briefly describes federal, state, and local regulations, permits, and policies pertaining to biological resources and wetlands as they apply to the proposed project.

Special-Status Species

Federal Endangered Species Act

The USFWS, which has jurisdiction over plants, wildlife, and most freshwater fish, and the National Marine Fisheries Service (NMFS), which has jurisdiction over anadromous fish, marine fish, and mammals, oversee implementation of the Federal Endangered Species Act (FESA). Section 7 of the FESA mandates that all federal agencies consult with the USFWS and NMFS to ensure that federal agency actions do not jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat for listed species. A federal agency is required to consult with USFWS and NMFS if it determines that the construction or operation of the proposed project "may affect" federally listed species or designated critical habitat. The FESA prohibits the "take"[5] of any fish or wildlife species listed as threatened or endangered, including the destruction of habitat that could hinder species recovery.

Under Section 9 of the FESA, the take prohibition applies only to wildlife and fish species. However, Section 9 does prohibit the removal, possession, damage, or destruction of any endangered plant from federal land. Section 9 also prohibits acts to remove, cut, dig up, damage, or destroy an endangered plant species in non-federal areas in knowing violation of any state law or in the course of criminal trespass. Candidate species and species that are proposed or under petition for listing receive no protection under Section 9 of the FESA.

Section 10 of the FESA requires the issuance of an "incidental take" permit before any public or private action may be taken that would potentially harm, harass, injure, kill, capture, collect, or otherwise hurt (i.e., take) any individual of an endangered or threatened species. To offset the take of individuals that may occur incidental to implementation of the project, the permit requires preparation and implementation of a habitat conservation plan that provides for the overall preservation of the affected species through specific mitigation measures.

5 "Take," as defined in Section 9 of the FESA, is broadly defined to include intentional or accidental "harassment" or "harm" to wildlife. "Harass" is further defined by the U.S. Fish and Wildlife Service as an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns that include, but are not limited to, breeding, feeding, and sheltering. "Harm" is defined as an act that actually kills or injures wildlife. This may include significant habitat modification or degradation that actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

Federal Migratory Bird Treaty Act

The federal Migratory Bird Treaty Act (16 USC, Section 703, Supplement 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, and bird nests and egg.

Federal Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) is the principal Federal legislation that guides marine mammal species protection and conservation policy. The MMPA delegates authority for oceanic marine mammals to the Secretary of Commerce, the parent agency of the National Oceanic and Atmospheric Administration (NOAA). Species of the order Cetacea (whales and dolphins) and species, other than walrus, of the order Carnivora, suborder Pinnipedia (seals and sea lions), are the responsibility of NOAA Fisheries (or the Service). The Department of the Interior's Fish and Wildlife Service is responsible for the dugong, manatee, polar bear, sea otter, and walrus. Marine mammals that are already managed under international agreements are exempt as along as the agreements further the purposes of the MMPA.

The MMPA prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.

Magnuson-Stevens Fishery Conservation and Management Act and Federal Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) of 1976 applies to fisheries resources and fishing activities in federal waters that extend to 200 miles offshore. Conservation and management of U.S. fisheries, development of domestic fisheries, and phasing out of foreign fishing activities are the main objectives of the legislation. When the MSFCMA was amended in 1996 to include habitat conservation issues, the designation of "Essential Fish Habitat" (EFH) was created. EFH is broadly defined by the MSFCMA as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

The Sustainable Fisheries Act of 1996 (Public Law 104-297), amended the MSFCMA to establish new requirements for Essential Fish Habitat (EFH) descriptions in federal Fisheries Management Plans (FMPs) and to require federal agencies to consult with the National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. The Magnuson-Stevens Act requires all fishery management councils to amend their FMPs to describe and identify EFH for each managed fishery. The act also requires consultation for all federal agency actions that may adversely affect EFH (i.e., direct versus indirect effects); it does not distinguish between actions in EFH and actions outside EFH. Any reasonable attempt to encourage the conservation of EFH must take into account actions that occur outside of EFH, such as upstream and upslope activities that may have an adverse effect on EFH. Therefore, EFH consultation with NMFS is required by federal agencies undertaking, permitting, or funding activities that may adversely affect EFH, regardless of the activity's location. Under section 305(b)(4) of the MSFCMA, NMFS is required to provide EFH conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH. However, state agencies and private parties are not required to consult with NMFS unless state or private actions require a federal permit or receive federal funding. Although the concept of EFH is similar to that of critical habitat under the FESA, measures recommended to protect EFH by NMFS are advisory, not proscriptive.

California Endangered Species Act

Under the California Endangered Species Act (CESA), CDFG has the responsibility for maintaining a list of threatened and endangered species (California Fish and Game Code Section 2070). CDFG also maintains a list of "candidate species," which are species formally noticed as being under review for addition to either the list of endangered species or the list of threatened species. In addition, CDFG maintains lists of "species of special concern," which serve as "watch lists." Pursuant to the requirements of the CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species could be present on the project site and determine whether the proposed project could have a potentially significant impact on such species. In addition, CDFG encourages informal consultation on any proposed project that may affect a candidate species.

California Native Plant Protection Act

State listing of plant species began in 1977 with the passage of the California Native Plant Protection Act (NPPA), which directed CDFG to carry out the legislature's intent to "preserve, protect, and enhance endangered plants in this state." The NPPA gave the California Fish and Game Commission the power to designate native plants as endangered or rare and to require permits for collecting, transporting, or selling such plants. The California Endangered Species Act expanded upon the original NPPA and enhanced legal protection for plants. The CESA established threatened and endangered species categories, and grandfathered all rare animals—but not rare plants—into the act as threatened species. Thus, there are three listing categories for plants in California: rare, threatened, and endangered.

California Fish and Game Code

Under Section 3503 of the California Fish and Game Code, 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. Section 3503.3 of the California Fish and Game Code prohibits take, possession, or destruction of any birds in the orders Falconiformes (hawks) or Strigiformes (owls), or of their nests and eggs.

The State Fish and Game Code Section 4150 states that all non-game mammals or parts thereof may not be taken or possessed except as otherwise provided in the code or in accordance with regulations adopted by the commission. This Section applies to all bat species.

The California Fish and Game Code (Sections 3511-birds, 4700-mammals, 5050-reptiles and amphibians, and 5515-fish) also allows the designation of a species as Fully Protected. This designation provides a greater level of protection than is afforded by the California Endangered Species Act, since it means the designated species cannot be taken at any time.

Sensitive Natural Communities

Sensitive natural communities are identified as such by CDFG's Natural Heritage Division and include those that are naturally rare and those whose extent has been greatly diminished through changes in land use. The California Natural Diversity Database (CNDDB) tracks 135 such natural communities in the same way that it tracks occurrences of special-status species: information is maintained on each site's location, extent, habitat quality, level of disturbance, and current protection measures. CDFG is mandated to seek the long-term perpetuation of the areas in which these communities occur. While there is no statewide law that requires protection of all special-status natural communities, CEQA requires consideration of a project's potential impacts on biological resources of statewide or regional significance.

Jurisdictional Waters (Including Wetlands)

Rivers and Harbors Act. The objective of the Rivers and Harbors Act of 1899 is to prevent interferences with navigation, by barring unpermitted discharges of refuse into navigable waters.

Section 10 of the Rivers and Harbors Act appoints the Corps to regulate the construction of structures in, over, or under, excavation of material from, or deposition of material into "navigable waters." In tidal areas, the limit of navigable water is the mean high tide line; in non-tidal waters it is the ordinary high water mark (OHWM). Larger streams, rivers, lakes, bays, and oceans are examples of navigable waters regulated under Section 10 of the Rivers and Harbors Act. Historically, navigable waters are those areas that are no longer navigable as a result of artificial modifications, such as levees, dikes and dams.

Federal Clean Water Act. The objective of the Clean Water Act (CWA) (33 U.S.C. §§ 1251 et seq) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters.

Section 404 of the CWA regulates activities that involve a discharge of dredged or fill material into waters of the United States. The Corps is responsible for issuing permits for discharges covered by Section 404, including most notably the filling of wetlands. The Corps emphasizes avoiding and minimizing impacts to wetlands where feasible. When impacts to wetlands cannot be avoided, compensatory mitigation is generally required as part of the Section 404 permit process to ensure there is no net loss of wetlands values and functions.

Section 401 of the CWA is administered by the State Water Resources Control Board (SWRCB) and the nine Regional Water Quality Control Boards. Under Section 401, an applicant for a federal permit, such as a Section 404 permit to discharge dredged or fill material into waters of the United States, must obtain a "water quality certification" from the appropriate state agency stating that the permitted activity is consistent with the state's water quality standards. The San Francisco Bay Regional Water Quality Control Board (SFRWQCB) is the appointed authority for Section 401 compliance in the Bay Area.

State Policies and Regulations

State regulation of activities in waters and wetlands resides primarily with CDFG and the State Water Resources Control Board (SWRCB). In addition, the California Coastal Commission has review authority for wetland permits within its planning jurisdiction. CDFG provides comment on Corps permit actions under the Fish and Wildlife Coordination Act. CDFG is also authorized under the California Fish and Game Code, Sections 1600-1616, to enter into a Streambed Alteration Agreement with applicants and to develop mitigation measures when a proposed project would obstruct the flow or alter the bed, channel, or bank of a river or stream in which there is a fish or wildlife resource, including intermittent and ephemeral streams. The SWRCB, acting through the nine Regional Water Quality Control Boards, must certify that a Corps permit action meets state water quality objectives (Section 401, Clean Water Act).

Bay Conservation and Development Commission Regulations

The Bay Conservation and Development Commission (BCDC) is authorized by the McAteer Petris Act to analyze, plan, and regulate San Francisco Bay and its shoreline. BCDC implements the San Francisco Bay Plan and regulates filling and dredging in the bay, its sloughs and marshes, and certain creeks and their tributaries. BCDC jurisdiction includes the waters of San Francisco Bay as well as a shoreline band that extends inland 100 feet from the high tide line. Any fill, excavation of material, or substantial change in use within BCDC jurisdiction requires a permit from BCDC. The project site lies within the jurisdiction of BCDC, as discussed in more detail in the Land Use Consistency and Compatibility section (4.A).

Local

City of Alameda General Plan

The City of Alameda General Plan identifies ten Guiding Policies that pertain to Open Space for the Preservation of Natural Resources. In relation to the proposed project, it is important to consider the following Guiding Policies:

- *Policy 5.1.a*: Preserve and enhance all wetlands and water-related habitat.
- *Policy 5.1.e*: Continue to preserve and maintain all lagoons as habitat as well as visual and compatible-use recreational resources.
- *Policy 5.2.a*: Protect and preserve Bay waters and vegetation as nurseries and spawning grounds for fish and other aquatic species, both as part of habitat preservation and to encourage continued use of the Bay for commercial fishing production.

City of Alameda Tree Ordinance

Ordinances for the City of Alameda protect palm trees within the public right-of-way on Burbank Street and Portola Avenue, any street tree on Thompson and Central Avenues, and any coast live oak greater than 10 inches diameter at breast height (DBH).

Impacts and Mitigation Measures

Significance Criteria

Significant impacts would occur if the proposed Boatworks Residential Project results in:

- Reductions in threatened, endangered, or other special-status species populations.
- A substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or US Fish and Wildlife Service.
- Substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption, or other means.
- Interference 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 policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- Conflict with any local, regional, or State Habitat Conservation Plan.

CEQA Section 15380 further provides that a plant or animal species may be treated as “rare or endangered” even if not on one of the official lists if, for example, it is likely to become endangered in the foreseeable future.

For purposes of this EIR, three principal components of the guidelines outlined above were considered:

- Magnitude of the impact (e.g., substantial/not substantial),
- Uniqueness of the affected resource (rarity), and
- Susceptibility of the affected resource to perturbation (sensitivity).

The evaluation of significance must consider the interrelationship of these three components. For example, a relatively small magnitude impact to a state or federally listed species would be considered significant because the species is very rare and is believed to be very susceptible to disturbance. Conversely, a plant community such as California annual grassland is not necessarily rare or sensitive to disturbance. Therefore, a much larger magnitude of impact would be required to result in a significant impact. Impacts are generally considered less than significant if the habitats and species affected are common and widespread in the region and the state. Impacts are considered beneficial if the action causes no detrimental impacts and results in an increase of habitat quantity and quality. *CEQA Guidelines* (Appendix G) specify that a project will normally have a significant impact on the environment if it will physically impact communities or species protected by adopted environmental plans and goals of the communities where it is located.

Impact Analysis

This following impact analysis focuses on potential impacts of the proposed project related to biological resources. The following Appendix G criteria are not considered relevant to the project based upon the proposed project plans and data research; therefore, they will not be evaluated further in this EIR:

> *Sensitive Natural Communities:* No riparian habitat or other sensitive natural communities, as defined in the *Setting* section above, are present on the project site, and none would be impacted by proposed Boatworks Residential Project activities.
>
> *Protected Trees:* Tree ordinances for the City of Alameda protect palm trees within the public right-of-way on Burbank Street and Portola Avenue, any street tree on Thompson and Central Avenues, and any coast live oak greater than 10 inches diameter at breast height (dbh). The only tree present at the project site is not a native species, and thus it is not protected by this ordinance. **Mitigation Measures 4.F-1 and 4.F-3,** below, would ensure no significant impacts occur to protected species that may inhabit the tree.
>
> *Habitat Conservation Plans:* There are no local, regional, or State habitat conservation plans for the project site: thus, no conflicts with such plans would occur.

Special-Status Bird Species

Impact 4.F-1: The proposed project could result in the take of protected birds or their nests. (Significant)

The project site is located on the shore of the Oakland Estuary, part of the San Francisco Bay Estuary. The San Francisco Estuary is designated as a Western Hemisphere Shorebird Reserve Network of international importance because more than one million shorebirds use San Francisco Bay wetlands each winter; between 300,000 and 900,000 shorebirds pass through San Francisco Bay during spring and fall migration periods; more than 50 percent of the diving ducks in the Pacific Flyway winter in the shallow wetlands of the Bay; and several species breed in the wetlands during the summer (Goals Project, 1999).

Increased noise and activity resulting from construction activities, were it to exceed ambient levels, could cause nest abandonment and death of young or loss of reproductive potential at active nests of special-status bird species located within the project site. In addition, grading and removal of vegetation and building structures could result in direct losses of nests, eggs, or nestlings. Although this is an urbanized, developed area, there is the possibility that special-status bird species use the site for nesting. The loss of active nests of special-status bird species would be considered a significant impact. Implementation of Mitigation Measure BIO-1 would reduce impacts to less than significant.

In addition to impacts under CEQA, the nests, eggs, and nestlings of all birds are protected under the California Fish and Game Code.[6] All migratory birds are protected under the Migratory Bird Treaty Act.

> **Mitigation Measure 4.F-1:** No more than two weeks in advance of any tree or shrub removal, or alteration to structures that would commence during the breeding season (February 1 through August 31), a qualified wildlife biologist shall conduct pre-construction surveys of all potential special-status bird nesting habitat in the vicinity of the planned activity. Pre-construction surveys are not required for construction activities scheduled to occur during the non-breeding season (August 31 through January 31). Construction activities commencing during the non-breeding season and continuing into the breeding season do not require surveys (as it is assumed that any breeding birds taking up nests would be acclimated to project-related activities already under way). Nests initiated during construction activities would be presumed to be unaffected by project activities, and a buffer zone around such nests would not be necessary. However, a nest initiated during construction cannot be moved or altered.
>
> If no active nests are found during pre-construction avian surveys, then no further mitigation is required.
>
> If active nests are found during pre-construction avian surveys, the results of the surveys shall be discussed with the appropriate resource agency and avoidance procedures shall be adopted, if necessary, on a case-by-case basis. Avoidance measures would most likely include a no-disturbance buffer around the nest, which will be maintained until a qualified biologist determines that the young have fledged or otherwise abandoned the nest. The size of the buffer zones and types of construction activities restricted within them shall be determined through consultation with resource agencies, taking into account factors such as: (1) noise and human disturbance levels at the project site and the nesting site at the time of the survey and the noise and disturbance expected during the construction activity; (2) distance and amount of vegetation or other screening between the project site and the nest; and (3) sensitivity of individual nesting species and behaviors of the nesting birds.

Significance after Mitigation: Less than Significant.

Impact 4.F-2: The proposed project could result in impacts to migratory or breeding birds and other special-status species due to building configurations and lighting conditions. (Significant)

It is estimated that in North America alone, millions of songbirds are killed due to collisions with buildings and other structures each year (Lochhead, 2008). Collisions are currently recognized as one of the leading causes of bird population declines worldwide (Brown et al., 2007). Daytime collisions occur most often when birds fail to recognize window glass as a barrier. In addition, many nighttime collisions are induced by artificial night lighting, particularly from buildings,

[6] The nests, eggs, and nestlings of all birds are protected, with the exception of English sparrow, European starling, and rock dove (pigeon),

which can be especially problematic for migrating songbirds since many species are nocturnal migrants (Ogden, 1996).

The tendency of birds to move towards lights at night when migrating, and their reluctance to leave the sphere of light influence for hours or days once encountered, has been well documented. It has been suggested that structures located at key points along migratory routes may present a greater hazard than those at other locations (Ogden, 1996). Other research suggests that fatal bird collisions increase as light emissions increase, that weather often plays an important part in increasing the risk of collisions, and that nights with heavy cloud cover and/or precipitation present the conditions most likely to result in high numbers of collisions (Ogden, 2002). Direct effects include death or injury as the birds collide with lighted structures and other birds that are attracted to the light, as well as collisions with glass during the daytime. Indirect effects include delayed arrival at breeding or wintering grounds, and reduced energy stores necessary for migration, winter survival, or subsequent reproduction (Gauthreaux and Belser, 2006). The type of light used may affect its influence on the birds; for example, studies have indicated that blinking lights or strobe lights affect birds significantly less than non-blinking lights (Gauthreaux and Belser, 2006).

The project site and surrounding vicinity currently contain street lights and building lights in an urban setting, surrounded by other light sources. Proposed project lighting would be consistent with existing illumination of the area, which has not been demonstrated to pose a significant impact on flying birds. Nevertheless, the project site is located on the Oakland Estuary, part of the Western Hemisphere Shorebird Reserve Network, and is used by waterfowl and songbirds. Although the height of the proposed buildings will be three stories or less, the New York City (NYC) Audubon Society identifies the shortest buildings as being the most hazardous to birds (Brown et al., 2007). Regardless of overall height, the first few stories are where birds are the most likely to fly into windows, as they reflect surrounding vegetation, sky, and other habitat features.

A growing recognition of the severity of this worldwide impact on migratory birds suggests that, whenever feasible, measures to reduce the risk of avian collisions should be incorporated in the construction and operations of buildings, particularly when they are to be located in areas where the risk of collision may be heightened due to a number of risk factors, including location along a known migratory route, proximity to migratory stopover locations, proximity to open space and areas of natural habitat, and areas where low cloud ceilings are frequent (Brown et al., 2007).

The following measures are based on the Bird-Safe Building Guidelines developed by the New York Audubon Society (Brown et al., 2007) and the Bird Friendly Building Program developed by the Fatal Light Awareness Program (www.flap.org) in order to help to minimize the potential impacts to migrating birds in the area of the project site:

Mitigation Measure 4.F-2: The applicant and project designer shall reduce building lighting from exterior sources by the following measures:

1. Minimize amount and visual impact of perimeter lighting, through measures such as downward-pointing lights, side shields, visors, and motion-sensor lighting.

2. Utilize minimum wattage fixtures to achieve required lighting levels.

3. Use minimum wattage fixtures to achieve required lighting levels.

4. Avoid placing water features in close proximity to glazed facades.

5. Design to avoid monolithic, undistinguishable expanses of glazing by maximizing "visual noise" both on the building scale and individual glass units.

Significance after Mitigation: Less than Significant.

Special-Status Bat Species

Impact 4.F-3: The proposed project could result in the take of special-status bat species. (Significant)

Bats have the potential to roost in existing man-made structures and trees within or near the project site. In addition to protections afforded special-status bat species by the Federal and California Endangered Species Act, other bats and non-game mammals are protected in California, under the State Fish and Game Code (described above under *Regulatory Framework*).

Maternity roosts are those that are occupied by pregnant females or females with non-flying young. Non-breeding roosts are day roosts without pregnant females or non-flying young. Destruction of an occupied, non-breeding bat roost, resulting in the death of bats; disturbance that causes the loss of a maternity colony of bats (resulting in the death of young); or destruction of hibernacula[7] are prohibited and would be considered a significant impact (although hibernacula are generally not formed by bat species in the Bay Area due to sufficiently high temperatures year round). This may occur due to direct or indirect disturbances. Direct disturbance includes tree removal, building removal, or roost destruction by any other means. Indirect disturbance to bat species includes behavioral alterations due to noise or increased human activity in area. The proposed project would involve tree removal and building removal through demolition of existing structures and site grading prior to construction.

Mitigation Measure 4.F-3a: Potential direct and indirect disturbances to bats shall be identified by locating colonies, and instituting protective measures prior to construction. No more than two weeks in advance of tree removal or demolition of buildings onsite, a qualified bat biologist (e.g., a biologist holding a CDFG collection permit and a Memorandum of Understanding with CDFG allowing the biologist to handle and collect bats) shall conduct pre-construction surveys for bat roosts. No activities that could disturb active roosts shall proceed prior to the completed surveys.

Mitigation Measure 4.F-3b: If a bat colony is located within the project site during pre-construction surveys, the project shall be redesigned to avoid impacts, and a no-disturbance buffer acceptable in size to the CDFG shall be created around any roosts in the project vicinity, if possible. Bat roosts initiated during construction are presumed to be unaffected, and no buffer is necessary. However, the "take" of individuals is prohibited.

7 Hibernacula refers to the winter quarters of a hibernating animal.

> If there is a maternity colony present and the project cannot be redesigned to avoid removal of the tree or structure inhabited by the bats, demolition of that tree or structure shall not commence until after young are flying (i.e., after July 31, confirmed by a qualified bat biologist) or before maternity colonies form the following year (i.e. prior to March 1).
>
> If a non-maternity roost must be removed as part of the project, the non-maternity roost shall be evicted prior to building/tree removal by a qualified biologist, using methods such as making holes in the roost to alter the air-flow, or creating one-way funnel exits for the bats.
>
> **Mitigation Measure 4.F-3c:** If known bat roosting habitat is destroyed during building/tree removal, artificial bat roosts shall be constructed in an undisturbed area in the project site vicinity away from human activity and at least 200 feet from project demolition/construction activities. The design and location of the artificial bat roost(s) shall be determined by a qualified bat biologist.

Significance after Mitigation: Less than Significant.

Special-Status Fish

Impact 4.F-4: The proposed project could impact special-status fish species. (Significant)

Project activities that occur in the Oakland Estuary, such as removing the existing boat ramps, pier, or sunken tugboat, or constructing a marina, could adversely affect Pacific herring spawning habitat through direct removal of spawning substrate. Special-status fish such as Pacific herring or salmonid species could be directly impacted by construction equipment. Indirect impacts on these species could occur if increased sedimentation or pollutants reduce water quality. Permits required from the Corps, BCDC, and RWQCB would require measures to reduce impacts on these species.

In addition, a marina constructed on the north shore of the project would increase the number of vessels and vessel trips per day, thereby resulting in water quality impacts from raw sewage, spilled hydrocarbons (fuels and oils), organic and inorganic contaminants from antifouling paint, and trash from marine vessels. Raw sewage introduced into marine and estuarine waters may adversely impact the aquatic environment by potentially lowering dissolved oxygen concentrations, potentially leading to eutrophication or anoxia.[8] Accidental or deliberate discharge of hydrocarbons and the release of organic and inorganic compounds and sediments into the Oakland Estuary would result in impacts to benthos, plankton, fish, and the entire ecosystem.

Additionally, development often increases the load of pollutants of concern associated with activities accompanying development, such as pesticides associated with home maintenance and lawn care, oil associated with vehicle usage and maintenance, and bacteria associated with

8 Anoxia refers to near absence of oxygen.

municipal sewage and pet waste. Discharge of these pollutants would adversely affect fisheries and other aquatic biota.

The project applicant would be required to prepare and execute a Storm Water Pollution Prevention Plan (SWPPP), as described in 4.H,*Hydrology*, and implement Mitigation Measure 4.H-3, Integrated Pest Management Plan. The following additional mitigation measure would reduce potential impacts of pile driving or dredging on aquatic special-status species to a less-than-significant level.

> **Mitigation Measure 4.F-4:** If dredging or pile-driving occurs as part of the project, the project applicant shall implement Best Management Practices (BMPs) for protection of salmonids and Pacific herring, that are identified in the *Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region* (LTMS) (Corps, 2001).[9] BMPs listed in the LTMS include the following:
>
> - installation of silt curtains and gunderbooms for filtering sediment;
> - mechanical dredge operations controls, including increased cycle time, elimination of multiple bucket bites, and elimination of bottom stockpiling;
> - hydraulic dredge operations controls, including reduction of cutterhead rotation speed, reduction of swing speed, and elimination of bank undercutting;
> - hopper dredges and barges operational controls, including reduction of hopper overflow, lower hopper fill levels, and use of a water recirculation system; and
> - use of specialty equipment, including pneuma pumps, closed or environmental buckets, large-capacity dredges, and specialized tools for precision dredging.
>
> In addition, dredging or pile-driving in the Oakland Estuary shall minimize impacts on special-status fish through one or more of the following methods: (1) dredging or pile-driving shall only be conducted within work windows designated to cause the least impact on Pacific herring and salmonids (i.e., June through November, see **Table 4.F-1**); (2) dredging or pile-driving shall only produce noise levels below 150 decibels at 30 feet[10]; and/or (3) dredging or pile-driving shall only be conducted in accordance with NMFS directives and Corps permits to reduce potential impacts on fish species.

Significance after Mitigation: Less than Significant.

9 The LTMS was developed during formal consultation among the NMFS, USFWS, and CDFG to address impacts on sensitive fisheries and designated critical habitats under their respective jurisdictions and to standardize mitigation for dredging projects. The Biological Opinion (BO) resulting from the LTMS presents specific restrictions on the timing and design of dredging and disposal projects. As the LTMS states, if the dredging project can be accomplished during the identified work windows, the project is authorized for incidental take under the federal Endangered Species Act of 1973, as amended. The LTMS serves as the federal and state pathway for determining potential impacts of dredging and dredge disposal projects on fish species, with timing of construction as the single significance criterion.

10 As shown in Table 4.D-5 in 4.D,*Noise*, pile driving creates a typical noise level of 101 decibels (dbA) at 50 feet.

TABLE 4.F-1
CONSTRUCTION WORK WINDOWS FOR IN-WATER PILE-DRIVING AND OTHER IN-WATER ACTIVITIES

Fish Species	Work Activity	Construction Work Windows for Project Activities, by Month											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Pacific herring	Pile-driving						W	W	W	W	W	(W)	
	Other In-Water Activities			W	W	W	W	W	W	W	W	W	
Chinook salmon	Pile-driving						W	W	W	W	W	(W)	
	Other In-Water Activities						W	W	W	W	W	W	
Steelhead	Pile-driving						W	W	W	W	W	(W)	
	Other In-Water Activities						W	W	W	W	W	W	

"W" indicates work window when the identified construction activities would minimize impacts to fisheries, in accordance with specific guidance provided by the LTMS (Corps, 2001) for dredging and dredge disposal related activities.

"(W)" indicates possible work window. Frank Filice with the San Francisco Department of Public Works indicated that a letter from NMFS (on another project) established a June 1 to November 30 work window for pile-driving activities (Filice, personal communication). The actual project construction work window will be determined by the Corps in consultation with NMFS during the permitting phase of the project.

Wetlands

Impact 4.F-5: Proposed project activities could have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption, or other means. (Significant)

The Oakland Estuary is a "navigable water" that is under the jurisdiction of the U.S. Army Corps of Engineers (Corps) under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. The shoreline of the Oakland Estuary is currently owned by the Corps; however, the shoreline is expected to be deeded over to the City of Alameda, possibly as soon as 2011. The proposed project includes several components that would impact the Oakland Estuary or its shoreline: creating a publicly accessible waterfront esplanade along the length of the shoreline; creating passive recreational access to the Oakland Estuary through concrete piers, a boardwalk, and viewing areas; removing a derelict dock and boat ramps that extend into the Estuary; removing a sunken boat; and potentially constructing a marina and/or seawall along the shoreline.

The creation of a public plaza that extends toward the Estuary waterfront could also potentially impact the Estuary or its shoreline. Potential effects of these activities on the Oakland Estuary include: (1) impacts on water quality from dredging or pile-driving activities to install a new marina or remove docks, boat ramps, or the old boat; (2) sedimentation of the Oakland Estuary during demolition of existing structures; and (3) sedimentation in the Oakland Estuary resulting from grading and land-clearing activities related to the construction of new housing units, the boardwalk, esplanade, or plaza.

Placement of fill and excavation within and along the Oakland Estuary as a result of activities described in the previous two paragraphs would require a wetland delineation and Section 404 permit from the Corps, a Section 401 Water Quality Waiver or Certification from the SFRWQCB, and a BCDC permit. Specifically, the Corps and RWQCB would require permits for construction along the Oakland Estuary edge below mean high water (MHW) elevation. The Corps must consult with the USFWS, NMFS, and CDFG in the Section 10 permitting processes as to the likelihood of project activities, including shoreline development affecting state or federally listed species or their habitat. In addition, BCDC permits are specifically required for activities such as placing solid material, building or repairing docks, placing pile-supported or cantilevered structures, mooring a vessel for a long period, extracting material from the Bay bottom, or substantially change the use of an area within the 100-foot shoreline band inland from mean high tide line. These permits are issued only under strict guidelines that require specific mitigation for impacts to jurisdictional waters.

Additional indirect impacts to the Oakland Estuary waters would occur if a marina is constructed on the north shore of the project, which would increase the number of vessels and vessel trips per day, thereby resulting in water quality impacts from raw sewage, spilled hydrocarbons (fuels and oils), organic and inorganic contaminants from antifouling paint, and trash from marine vessels. Raw sewage introduced into marine and estuarine waters may adversely impact the aquatic environment by potentially lowering dissolved oxygen concentrations, potentially leading to eutrophication or anoxia. Accidental or deliberate discharge of hydrocarbons and the release of organic and inorganic compounds and sediments into the Oakland Estuary would result in impacts to benthos, plankton, fish and the entire ecosystem.

Additionally, the proposed residential units could increase the load of pollutants of concern that would run off into the Oakland Estuary, such as pesticides associated with home maintenance and lawn care, oil inputs associated with vehicle usage and maintenance, and bacteria associated with municipal sewage and pet waste. Discharge of these pollutants into the Oakland Estuary would adversely affect these jurisdictional waters.

In order to reduce impacts to water resources, the project applicant would be required to prepare and execute a Storm Water Pollution Prevention Plan (SWPPP), as described in 4.H, *Hydrology*, and implement Mitigation Measure 4.H-3, Integrated Pest Management Plan. **Mitigation Measures 4.F-5a** and **4.F-5b**, below, would reduce impacts to the Oakland Estuary to a less than significant level.

Mitigation Measure 4.F-5a: The project applicant shall implement the following Best Management Practices (BMPs) during construction:

(1) Install silt fencing, straw wattles or other appropriate erosion and sediment control methods or devices to prevent sediment from the upland portion of the site from entering the Estuary as a result of project activities.

(2) Operate equipment (e.g., backhoes and cranes) that is used for removal or installation of fill and rip-rap along the Estuary shoreline from dry land, where possible. Construction operations within the Oakland Estuary can also be barge-mounted or utilize other water-based equipment such as scows, derrick barges and tugs.

(3) Prevent any fueling activity from occurring within 50 feet of the Oakland Estuary.

(4) Where applicable, implement BMPs listed under Mitigation Measure 4.F-4 to avoid impacts to water quality resulting from dredging or other activities within open waters, as identified in the *Long-term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region* (LTMS) (Corps, 2001).

(5) Test all materials proposed for excavation and dredging for the possible presence of contaminants. Construction practices shall be designed in coordination with the Corps, RWQCB, and other applicable agencies, to minimize the dispersion of contaminants into the water column and ensure proper disposal of contaminated materials.

Mitigation Measure 4.F-5b: The project applicant shall provide compensatory mitigation (i.e., "no net loss") for any temporary and permanent impacts to wetlands as defined by Section 404 of the Clean Water Act, as required by regulatory permits issued by the Corps, RWQCB, and BCDC. Measures may include but would not be limited to (1) onsite or offsite mitigation through wetland creation or restoration; and (2) development of a Mitigation and Monitoring Plan.

Onsite or Offisite Wetland Creation or Restoration. To the extent practicable, the project applicant shall restore the tidal marsh to the Oakland Estuary shoreline at a minimum 1:1 impact-to-restoration ratio, through activities such as removal of debris and concrete riprap, and revegetating with native tidal marsh species.

If onsite restoration is not feasible, the project applicant shall negotiate compensatory offsite mitigation for wetland losses with applicable regulatory agencies, at a 3:1 impact-to-restoration ratio, or other ratio determined by the agencies.

Mitigation and Monitoring Program. Prior to the start of construction or in coordination with regulatory permit conditions, the project applicant shall prepare and submit for approval to the Corps, RWQCB, and BCDC a mitigation and monitoring program that outlines the mitigation obligations for temporary and permanent impacts to waters of the U.S., including wetlands. The program shall include baseline information from existing conditions, anticipated habitat to be enhanced, thresholds of success, monitoring and reporting requirements, and site-specific plans to compensate for wetland losses resulting from the project. The Boatworks Residential Project Mitigation and Monitoring Plan shall include, but not be limited to, the following:

- Clearly stated objectives and goals consistent with regional habitat goals.
- Location, size, and type of mitigation wetlands proposed.
- A functional assessment of affected jurisdictional waters to ensure that the EPA's "no net loss of wetland value" standard is met. The functional assessment shall also ensure that the mitigation provided is commensurate with the adverse impacts on Bay

resources in accordance with BCDC mitigation policies. The assessment shall provide sufficient technical detail in the project design including, at a minimum, an engineered grading plan and water control structures, methods for conserving or stockpiling topsoil, a planting program including removal of exotic species, a list of all species to be planted, sources of seeds and/or plants, timing of planting, plant locations and elevations on the mitigation site base map, and maintenance techniques.

- Documentation of performance, monitoring, and adaptive management standards that provide a mechanism for making adjustments to the mitigation site. Performance and monitoring standards shall indicate success criteria to be met within 5 years for vegetation, animal use, removal of exotic species, and hydrology. Adaptive management standards shall include contingency measures that outline clear steps to be taken if and when it is determined, through monitoring or other means, that the enhancement or restoration techniques are not meeting success criteria.

Significance after Mitigation: Less than Significant.

Cumulative Impacts

This analysis evaluates whether the impacts of the proposed project, together with the impacts of cumulative development, would result in a cumulatively significant impact on special-status species, wetlands and other waters of the U.S., or other biological resources protected by federal, state, or local regulations or policies (based on the significance criteria and thresholds presented earlier). This analysis then considers whether the incremental contribution of the proposed project to this cumulative impact would be considerable. Both conditions must apply in order for a project's cumulative effects to rise to the level of significance.

The geographic context for analysis of cumulative impacts to biological resources in this EIR is the Island of Alameda and the adjacent stretch of the Oakland Estuary. Specific projects considered in this analysis are the Grand Marina, Del Monte Rehabilitation, Alameda Landing, Alameda Town Center Expansion, and Perforce Expansion.

Impact 4.F-6: Project construction activity and operations, in conjunction with other past, current, or foreseeable development in Alameda, could result in impacts on special-status species, habitats, wetlands, and other waters of the U.S. (Less than Significant)

Past projects (i.e., the principle determinant of existing conditions on Alameda) have already developed or altered the entire island. Natural communities on the island are rare—even where open space persists. Therefore, due to past projects, there has already been an adverse cumulative effect on biological resources. With the addition of current and other proposed projects, there is an existing cumulative impact *without* the project, which could be considered to combine with the proposed project to increase the aggregate effect and be cumulatively significant, though the contribution of the proposed project is not considerable.

However, relative to the CEQA baseline, the impacts of the proposed project *do not* aggregate to breach the CEQA significance thresholds described elsewhere in this EIR. The results would be the displacement of a few potential scattered pockets of wildlife (i.e., bats in abandoned buildings; birds nesting in street trees and buildings). These outcomes are essentially similar to those anticipated for the proposed project and generally represent a less-than-significant effect on disturbance-tolerant plants and animals.

Environmentally protective laws and regulations have been applied with increasing rigor since the early 1970s, including the California Endangered Species Act, Federal Endangered Species Act, and the Clean Water Act as described in the *Regulatory Setting* earlier in this EIR chapter. The proposed project and other future projects within the cumulative geographic context are and would be required to comply with local, state, and federal laws and policies and all applicable permitting requirements of the regulatory and oversight agencies intended to address potential impacts on biological resources, including wetlands, other waters of the U.S., and special-status species. Additionally, new projects would be required to demonstrate that they would not have significant effects on these biological resources, although it is possible that some projects may be approved even though they would have significant, unavoidable impacts on biological resources.

The current impact analysis has shown that the Boatworks Residential Project has the potential for relatively minor impacts on biological resources and that these impacts can be reduced to less-than-significant levels through the proposed mitigation measures. When considered relative to all past, present, and reasonably foreseeable similar projects within the geographic context for this analysis, the minor incremental contribution of the proposed project to an already existing cumulative impact is not considerable. Therefore, the cumulative effect of the proposed project on biological resources would be less than significant.

Mitigation: None required.

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G. Geology and Seismicity

Introduction

This section describes the geologic and seismic conditions in the project site, their associated hazards, and assesses the proposed project in terms of whether it would (1) place additional people or structures at risk to existing geologic or seismic hazards, (2) create a new or worsen an existing hazard, or (3) cause the loss of a geologic resource. Both short term and long term project effects are analyzed in the context of applicable laws and regulations to determine their significance under CEQA. When project impacts are determined to be significant or potentially significant, mitigation measures to avoid or reduce those impacts are identified.

Environmental Setting

Regional Physiography

The project site is located adjacent to the Oakland Estuary on the eastern San Francisco Bay plain. This area is part of the Coast Range Geomorphic Province[1] (Coast Range), characterized by northwest-southeast-trending mountain ridges and intervening valleys that have formed over millions of years due to movements along major regional faults. The bedrock of the Coast Ranges is primarily composed of ancient seafloor sediments and volcanic rocks. In most areas, these rocks have been significantly hardened, mineralized, folded and fractured by heat and pressure deep within the earth. This bedrock – broadly known as the Franciscan Complex and Great Valley Sequence - forms most of the hills and mountains of the Bay Area.

The valleys, plains, estuaries, and bay floors of the region are filled by loose, geologically young deposits of mud, silt, sand and gravel. The character of these deposits varies significantly depending on their origin. For example, the Sacramento and San Joaquin Rivers deliver significant volumes of fine sediments (mud and silt), which slowly accumulate on the floors of the San Pablo and San Francisco Bays where currents are gentle. In contrast, peak winter flows from local creeks and streams often convey pulses of relatively coarse sediment (sand and gravel) to the region’s valleys and plains, occasionally reaching estuarine sloughs. Over geologic time scales and with fluctuating sea levels, dominant geologic processes in any one place are always competing, overlapping or changing. Thus, the character of flatland deposits changes significantly over short distances and depths, and such deposits often produce heterogeneous geologic conditions.

1 A geomorphic province is an area that possesses similar bedrock, structure, history, and age. California has 11 geomorphic provinces.

Geology, Soils and Geologic Hazards

The following discussion describes the general geology of the project site and identifies potential risks associated with such conditions. The primary sources of information for this section consist of publically available maps and reports prepared by United States Geological Survey (USGS), the California Geological Survey (formerly the California Division of Mines and Geology), and the Natural Resource Conservation Service (NRCS). Maps of topography, bedrock, soil and mineral resources provide the basic setting of the project site, and this information is used to describe the geologic hazards most likely to affect the project.

Site Topography

Elevations of the project site range from about 5 feet on the northern end of the project site to approximately 12 feet above mean sea level on the southern end (USGS, 1959). Thus, the site is flat to slightly sloped, and it lacks any distinct natural topography. Although adjacent to the Oakland Estuary, the project site does not directly abut the estuary. The Army Corps of Engineers currently owns the shoreline between the estuary and the project site. The shore rises abruptly approximately 5 feet above the water's edge, depending on tidal fluctuations. The banks currently comprise a combination of exposed soil (artificial fills), construction debris and abandoned piers.

Local Geology

The project site is underlain by a combination of dune sands, estuarine mud, and overlying artificial fills. The estuarine mud – also referred to as Bay Mud – is a silty clay that is rich in organic materials and is known to be soft and compressible. In many places, humans have placed poorly engineered fills over the Bay Mud in order to create buildable areas or dispose of materials excavated from elsewhere. At the turn of the twentieth century, engineers expanded Oakland's natural estuary by excavating a tidal canal inland of the Oakland Harbor, creating Alameda Island from the peninsula. A geologic map compiled by the USGS (2006) shows that the northern portion of the project site comprises artificial fill material overlying the Bay Mud. It is estimated that the thickness of fill that rings Alameda Island ranges from 5 to 25 feet (CGS, 2003). The southern portion of the project site is underlain by dune sands. It is commonly referred to as the Merrit Sand—a loose, well-sorted, fine- to medium-grained sand. The Merrit Sand makes up the core of Alameda Island and is likely to be underlain by Bay Mud at variable depths.

Soils

The project site is located on two developed properties, and the ground surface is entirely devoid of natural soils. The United States Department of Agriculture Natural Resource Conservation Service (NRCS) has characterized soils beneath the project site as "Urban Land" soils (NRCS, 2009). Urban land refers to areas that are so altered or obstructed by urbanization—such as buildings, pavement, and cut and fill operations—that identification of the native soils is not feasible. The physical properties of the site's underlying geology are crucial factors in assessing the site's susceptibility to geologic and seismic hazards, discussed below.

Mineral Resources

The California Division of Mines and Geology (CDMG) has classified lands within the San Francisco-Monterey Bay Region into Mineral Resource Zones (MRZs). The classification of MRZs is based on guidelines adopted by the California State Mining and Geology Board, as mandated by the Surface Mining and Reclamation Act (SMARA) of 1974 (Stinson et al., 1982). The project site is mapped by the CDMG as MRZ-1, an area where no significant mineral deposits are present (Stinson et al., 1982).

Geologic Hazards

The artificial fills and natural geology underlying the project site present potential hazards related to soil erosion, settlement, and expansive soil materials. These hazards are discussed briefly below and provide the initial context for further evaluation in the impact analysis. Because the site is nearly flat and does not directly abut the Oakland Estuary, slope-related ground failure is not expected to pose a hazard.

Expansive Soils

Expansive soils possess a "shrink-swell" behavior. Shrink-swell is the cyclic change in volume (expansion and contraction) that occurs in fine-grained clay sediments from the process of wetting and drying. Structural damage may occur over a long period of time, usually as a result of inadequate soil and foundation engineering or the placement of structures directly on expansive soils. Normally, soils that are expansive contain a significant clay fraction, and thus the Merrit Sand is not likely to exhibit shrink-swell behavior due to its primarily sandy composition. Because a project-specific geotechnical investigation has not been performed, it is unknown whether artificial fills underlying the site contain expansive clays, although typically fills have a low expansive potential due to their predominantly coarse-grained composition. However, the Bay Mud that presumably underlies the whole site could potentially be subject to shrink-swell behavior.

Soil Erosion

Erosion is the wearing away of soil and rock by processes, such as mechanical or chemical weathering, mass wasting, and the action of waves, wind and underground water. Excessive soil erosion can eventually lead to damage of building foundations and roadways. At the project site, areas that are susceptible to erosion are those that would be exposed during the construction phase. Typically, the soil erosion potential is reduced once the soil is graded and covered with concrete, structures, asphalt, or slope protection. The site is generally flat, and thus, accelerated erosion due to runoff is not anticipated.

Settlement

Settlement can occur from immediate settlement, consolidation, or shrinkage of expansive soil. Immediate settlement occurs when a load from a structure or placement of new fill material is applied, causing distortion in the underlying materials. This settlement occurs quickly and is typically complete after placement of the final load. Consolidation settlement occurs in saturated clay from the volume change caused by squeezing out water from the pore spaces. Consolidation occurs over a period of time and is followed by secondary compression, which is a continued change in void ratio under the continued application of the load. Rapid settlement can occur if soil is liquefied during an earthquake, an effect which is addressed later in the discussion of Seismic Hazards.

Soils tend to settle at different rates and by varying amounts depending on the load weight or changes in properties over an area, which is referred to as differential settlement. The northern portion of the project site is underlain by artificial fill, which varies in thickness and is known to experience consolidation settlement and secondary compression. On the other hand, the southern portion of the site is underlain primarily by Merrit Sand, which is unlikely to compress significantly over time. In addition, historic bay sloughs, old foundations, and former marsh areas may have been buried by fill material and the Merrit Sand, suggesting the site is subject to variable conditions and is likely to experience some degree of differential settlement.

Regional Faulting and Seismic Hazards

This section characterizes the region's existing faults, describes historic earthquakes, estimates the likelihood of future earthquakes, and describes probable ground-shaking effects. The primary sources of information for this section are publications prepared by United States Geological Survey (USGS), the California Geological Survey (CGS), and hazard mapping tools provided by the Association of Bay Area Governments (ABAG).

Earthquake Terminology and Concepts

Earthquake Mechanisms and Fault Activity

Faults are planar features within the earth's crust that have formed to release stresses caused by the dynamic movements of the earth's major tectonic plates. An earthquake on a fault is produced when these stresses overcome the inherent strength of the earth's crust, and the rock ruptures. The rupture causes seismic waves to propagate through the earth's crust, producing the ground-shaking effect known as an earthquake. The rupture also causes variable amounts of slip along the fault, which may or may not be visible at the earth's surface. It is important to note that faults are pervasive features in rocks, and occur even in areas of little-to-no earthquake activity. This is because over geologic time scales, the areas where tectonic stresses build up are always changing; thus, faults are more often evidence of past tectonic activity than indicators of a current earthquake hazard.

Geologists commonly use the age of offset rocks as evidence of fault activity—the younger the displaced rocks, the more recently earthquakes have occurred. To evaluate the likelihood that a fault will produce an earthquake, geologists examine the magnitude and frequency of recorded earthquakes and evidence of past displacement along a fault. An *active* fault is defined by the State of California as a fault that has had surface displacement within Holocene time (last 11,000 years). A *potentially active* fault is defined as a fault that has shown evidence of surface displacement during the Quaternary (last 1.6 million years) (Hart, 1997). *Blind* faults do not show surface evidence of past earthquakes, even if they occurred in the recent past. Faults that show no evidence of having generated earthquakes in the last 1.6 million years (Quaternary) are considered incapable of generating an earthquake.

Earthquake Magnitude

When an earthquake occurs along a fault, a characteristic way to measure its size is to measure the energy released during the event. When an earthquake occurs, a network of seismographs records the amplitude and frequency of the seismic waves it generates. The Richter Magnitude (M) for an earthquake represents the highest amplitude measured by the seismograph at a distance of 100 kilometers from the epicenter. Richter magnitudes vary logarithmically with each whole number step representing a ten-fold increase in the amplitude of the recorded seismic waves. While Richter Magnitude was historically the primary measure of earthquake magnitude, seismologists now use Moment Magnitude as the preferred way to measure earthquakes. The Moment Magnitude scale (Mw) is related to the physical characteristics of a fault, including the rigidity of the rock, the size of fault rupture, and the style of movement or displacement across the fault. Although the formulae of the scales are different, they both contain a similar continuum of magnitude values, except that Mw can reliably measure larger earthquakes and do so from greater distances.

Peak Ground Acceleration

A common measure of ground motion during an earthquake is the peak ground acceleration (PGA). The PGA for a given component of motion is the largest value of horizontal acceleration obtained from a seismograph. PGA is expressed as the percentage of the acceleration due to gravity (g), which is approximately 980 centimeters per second squared. In terms of automobile accelerations, one "g" of acceleration is equivalent to the motion of a car traveling 328 feet from rest in 4.5 seconds. For comparison purposes, the maximum peak acceleration value recorded during the Loma Prieta earthquake was in the vicinity of the epicenter, near Santa Cruz, at 0.64g (ABAG, 2003b). Unlike measures of magnitude, which provide a single measure of earthquake energy, PGA varies from place to place, and is dependent on the distance from the epicenter and the character of the underlying geology (e.g. hard bedrock, soft sediments or artificial fills).

The Modified Mercalli Intensity Scale

The Modified Mercalli Intensity Scale (**Table 4.G-1**) assigns an intensity value based on the observed effects of ground-shaking produced by an earthquake. Unlike measures of earthquake magnitude and PGA, the Modified Mercalli (MM) intensity scale is qualitative in nature (i.e. it is based on actual observed effects rather than measured values). Similar to PGA, MM intensity values for an earthquake at any one place can vary depending on its magnitude, the distance from its epicenter, the focus its energy, and the type of geologic material. The MM values for intensity range from I (earthquake not felt) to XII (damage nearly total), and intensities ranging from IV to X could cause moderate to significant structural damage. Because the MM is a measure of ground-shaking effects, intensity values can be related to a range of PGA values, also shown in Table 4.G-1.

TABLE 4.G-1
MODIFIED MERCALLI INTENSITY SCALE

Intensity Value	Intensity Description	Average Peak Ground Acceleration[a]
I	Not felt except by a very few persons under especially favorable circumstances.	< 0.0017 g
II	Felt only by a few persons at rest, especially on upper floors on buildings. Delicately suspended objects may swing.	0.0017-0.014 g
III	Felt noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly, vibration similar to a passing truck. Duration estimated.	0.0017-0.014 g
IV	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	0.014–0.039g
V	Felt by nearly everyone, many awakened. Some dishes and windows broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles may be noticed. Pendulum clocks may stop.	0.035 – 0.092 g
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; and fallen plaster or damaged chimneys. Damage slight.	0.092 – 0.18 g
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.	0.18 – 0.34 g
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.	0.34 – 0.65 g
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	0.65 – 1.24 g
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.	> 1.24 g
XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.	> 1.24 g
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	> 1.24 g

[a] Value is expressed as a fraction of the acceleration due to gravity (g). Gravity (g) is 9.8 meters per second squared. 1.0 g of acceleration is a rate of increase in speed equivalent to a car traveling 328 feet from rest in 4.5 seconds.

SOURCE: ABAG, 2003a

Seismic Context

The proposed project lies within a region of California that contains many active and potentially active faults and is considered an area of high seismic activity (**Figure 4.G-2**). The USGS along with the California Geological Survey and the Southern California Earthquake Center, formed the 2007 Working Group on California Earthquake Probabilities to summarize the probability of one or more earthquakes of magnitude 6.7 or higher occurring in the state of California over the next 30 years. Accounting for the wide range of possible earthquake sources, it is estimated that the Bay Area has a 63 percent chance of experiencing such an earthquake (Working Group on California Earthquake Probabilities, 2008). According to the working group, the individual faults posing the greatest threat to the Bay Area are the Hayward, the San Andreas, and the Calaveras faults. Other principal faults capable of producing significant earthquakes in the Bay Area include the Concord–Green Valley, Marsh Creek–Greenville, San Gregorio and Rodgers Creek faults (see Figure 4.G-2).

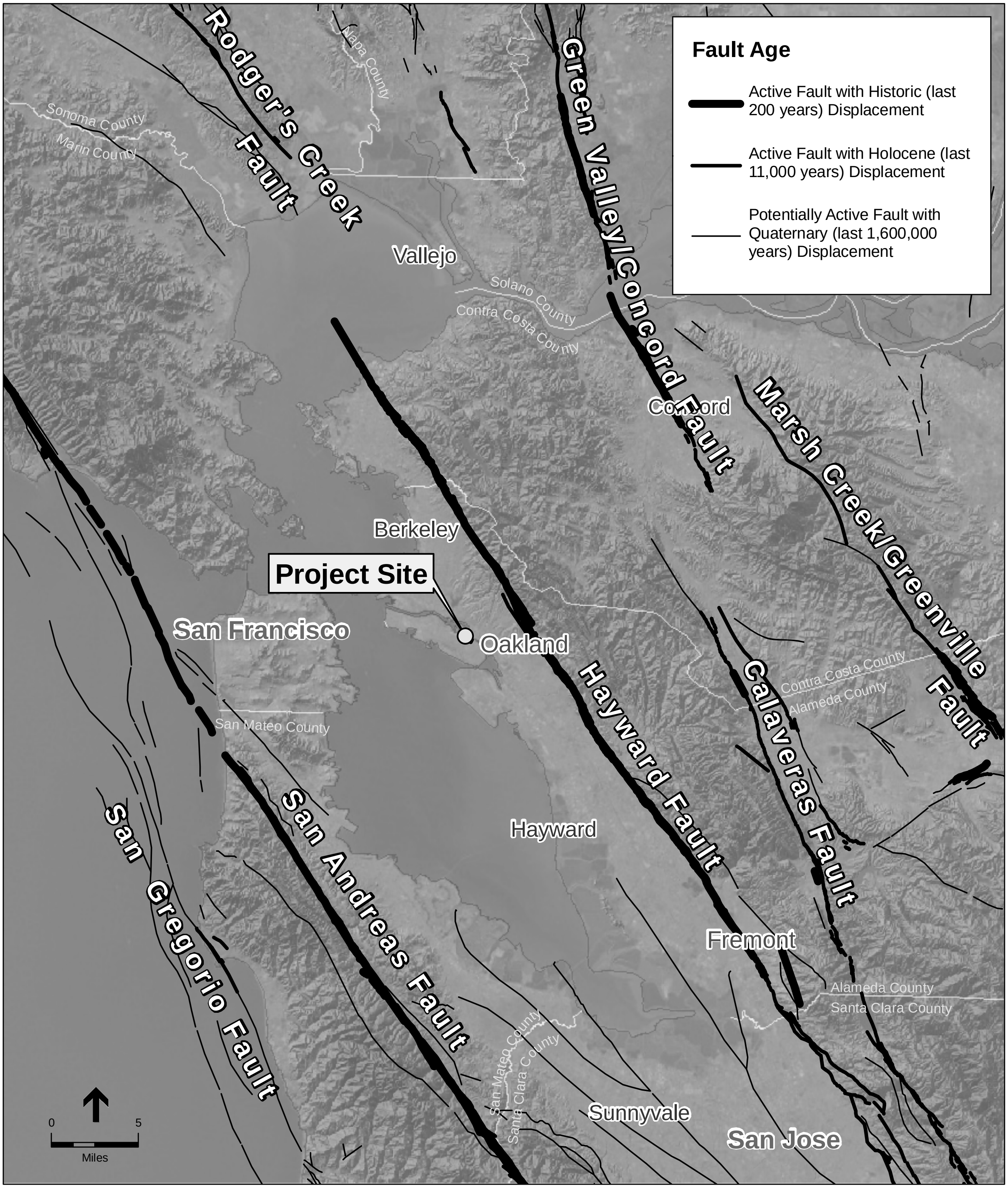
Table 4.G-2 lists the above mentioned faults, their distance and directions from the project site, and their maximum credible earthquake magnitude. Each of these faults is briefly described below.

TABLE 4.G-2
ACTIVE FAULTS IN THE PROJECT SITE VICINITY

Fault	Distance and Direction from Project	Recency of Movement[a]	Future Earthquake Probability[b]	Historical Seismicity	Maximum Moment Magnitude Earthquake (Mw)[c]
Hayward (Northern Section)	4.9 miles northeast	Historic	31% (combined with Rodgers Creek Fault)	M 6.8 in 1868 Many <M 4.5	7.1
Rodgers Creek	28 miles north	Historic		M 6.7 in 1898 M 5.6 and 5.7 in 1969	7.0
San Andreas (Peninsula Section)	13.9 miles southwest	Historic	21%	M 7.1 in 1989 M 8.25 in 1906 M 7.0 in 1838 Many <M 6	7.9
Calaveras (Northern Section)	16.5 miles east	Historic	7%	M 5.6–M 6.4 in 1861 M 6.2, 1911 in 1984	6.8
San Gregorio	22 miles southwest	Holocene	6%	n/a	7.3
Concord–Green Valley (Avon Section)	19 miles northeast	Historic	3%	Historic active creep	6.7
Marsh Creek–Greenville	28 miles East	Historic	3%	M 5.6 in 1980	6.9

a From Jenning (2004), historic refers to the post-colonial era (after 1775), the Holocene is from 11,000 years ago to present.
b Probability of one or more earthquakes of magnitude 6.7 or greater in the next 30 years from the Working Group on California Earthquake Probabilities (2008). The Working Group estimates the probability of a “background” earthquake not from one of the seven major faults studied to be 9%.
c The Maximum Moment Magnitude Earthquake is derived from the joint CDMG/USGS Probabilistic Seismic Hazard Assessment for the State of California (Peterson et al., 1996)

SOURCES: Hart, 1997; Jennings, 1994; Working Group on California Earthquake Probabilities (2008); Peterson et al., 1996.



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SOURCE: ESRI, 2008; Bryant, 2005

Figure 4.G-1
Regional Fault Map

Hayward Fault

The Hayward Fault Zone, located 4.9 miles southwest of the project site, extends for 60 miles from San Pablo Bay in Richmond south to the San Jose area. The Hayward fault has historically generated one sizable earthquake, in 1868, when a Richter magnitude 7 earthquake on its southern segment ruptured the ground for a distance of about 30 miles (Bryant, 2005). Lateral ground surface displacement during this event was at least 3 feet.

A characteristic feature of the Hayward fault is its well-expressed and relatively consistent fault creep. Although large earthquakes on the Hayward fault have been rare since 1868, slow fault creep has continued to occur and has caused measurable offset. Fault creep on the East Bay segment of the Hayward fault is estimated at 9 millimeters per year (mm/yr) (Peterson, et al., 1996). However, a large earthquake could occur on the Hayward fault with an estimated moment magnitude (Mw) of about Mw 7.1 (Table 4.G-2). The USGS Working Group on California Earthquake Probabilities (2008) identifies the Hayward–Rodgers Creek Fault Systems as having a 31 percent chance of generating one or more earthquakes of magnitude 6.7 or greater in the next 30 years.

San Andreas Fault

The San Andreas Fault Zone, located about 13.9 miles northeast of the project site, is a major structural feature that forms at the boundary between the North American and Pacific tectonic plates. It is a strike-slip[2] fault, extending from the Salton Sea in Southern California near the border with Mexico to north of Point Arena, where the fault trace continues out into the Pacific Ocean. The main trace of the San Andreas Fault through the Bay Area trends northwest from the Santa Cruz Mountains to the eastern side of the San Francisco Peninsula.

In the San Francisco Bay Area, the San Andreas Fault Zone was the source of the two major earthquakes in recent history that affected the San Francisco Bay region. The 1906 San Francisco earthquake was estimated at M 7.9 and resulted in approximately 290 miles of surface fault rupture, the longest of any known continental strike slip fault. Horizontal displacement along the fault approached 17 feet near the epicenter (Bryant, 2005). The 1989 Loma Prieta earthquake, with a magnitude of Mw 6.9, was centered in the Santa Cruz Mountains and resulted in widespread damage throughout the Bay Area. The USGS Working Group on California Earthquake Probabilities (2008) identifies the San Andreas Fault as having a 21 percent chance of generating one or more earthquakes of magnitude 6.7 or greater in the next 30 years.

Calaveras Fault

The Calaveras fault, located 16.5 miles east of the project site, is a major right-lateral strike-slip fault that has been active during the last 11,000 years. The Calaveras fault is located in the eastern San Francisco Bay region and generally trends from north to south along the eastern side of the Oakland Hills into the western Diablo Range, eventually joining the San Andreas Fault Zone south of Hollister. The northern extent of the fault zone is somewhat speculative and could be linked with the Concord fault.

2 Refers to relative motion on either side of a fault which is primarily horizontal (as opposed to vertical).

There is a distinct change in slip rate and fault behavior north and south of the vicinity of Calaveras Reservoir. North of Calaveras Reservoir, the fault is characterized by a relatively low slip rate of 5-6 mm/yr and sparse seismicity (Bryant, 2005). South of Calaveras Reservoir, the fault zone is characterized by a higher rate of surface fault creep that has been evidenced in historic times. The Calaveras fault has been the source of several moderate magnitude earthquakes, and the probability of a large earthquake (greater than M 6.7) is much lower than on the San Andreas or Hayward faults. The USGS Working Group on California Earthquake Probabilities (2008) identifies the Calaveras fault as having a 7 percent chance of generating one or more earthquakes of magnitude 6.7 or greater in the next 30 years.

Rodgers Creek Fault

The Rodgers Creek Fault Zone (RCFZ), located 28 miles north of the project site, is considered to be the northern extension of the Hayward Fault Zone. The most recent significant earthquakes on the RCFZ both occurred on October 1, 1969. On this date, two earthquakes of Richter magnitude 5.6 and 5.7 occurred within an 83-minute period. Buildings in Santa Rosa sustained serious damage during these quakes. Prior to these events, the last major earthquake (estimated Richter magnitude 6.7) was generated in 1898 with an epicenter near Mare Island at the north margin of San Pablo Bay. The combined Hayward–Rodgers Creek Fault System has a 31 percent chance of generating one or more earthquake of magnitude 6.7 or greater in the next 30 years (USGS Working Group on California Earthquake Probabilities, 2008).

Concord - Green Valley Fault

The Concord-Green Valley fault, located 19 miles northeast of the project site, extends from Walnut Creek north to Wooden Valley (east of Napa Valley). Historical record indicates that no large earthquakes have occurred on the Concord or Green Valley faults (Bryant, 2005). However, a moderate earthquake of magnitude M 5.4 occurred on the Concord fault segment in 1955. The Concord and Green Valley faults exhibit active fault creep and are considered to have a small probability of causing a significant earthquake. The USGS Working Group on California Earthquake Probabilities (2008) identifies the Concord-Green Valley fault as having a 3 percent chance of generating one or more earthquakes of magnitude 6.7 or greater in the next 30 years.

The San Gregorio Fault

The San Gregorio fault, located 22 miles southwest of the project site, is an active, structurally complex fault zone as much as 5 km wide. The fault zone is mainly located offshore, west of San Francisco Bay and Monterey Bay, with onshore locations at promontories, such as Moss Beach, Pillar Point, Pescadero Point, and Point Año Nuevo. While there is no record of historic seismicity, the most recent earthquake along the San Gregorio Fault Zone is thought to have occurred after 1270 AD to 1400 AD, but prior to the arrival of Spanish missionaries in 1775 AD (Bryant, 2005). The USGS Working Group on California Earthquake Probabilities (2008) identifies the San Gregorio fault as having a 6 percent chance of generating one or more earthquakes of magnitude 6.7 or greater in the next 30 years.

Seismic Hazards

The following discussion identifies the seismic hazards for the project site vicinity and provides the initial context for further evaluation in the impact analysis.

Surface Fault Rupture

Seismically-induced ground rupture is defined as the physical displacement of surface deposits in response to an earthquake's seismic waves. The magnitude, sense, and nature of fault rupture can vary for different faults or even along different strands of the same fault. Ground rupture is considered more likely along active faults, which are referenced in Figure 4.G-2 and Table 4.G-2. Because the site is not within an Alquist-Priolo Fault Rupture Hazard Zone, as designated by the Alquist-Priolo Earthquake Fault Zoning Act, and no active or potentially active faults are known to pass through the project site, the risk of ground rupture at the site is low.

Ground Shaking

As discussed above, a major earthquake is likely to affect the project site vicinity within the next 30 years, and would produce strong ground-shaking effects throughout the region. Earthquakes on active or potentially active faults, depending on magnitude and distance from the project site, could produce a range of ground-shaking intensities at the project site. Historically, earthquakes have caused strong ground-shaking and damage in the San Francisco Bay Area, the most recent being the M 6.9 Loma Prieta earthquake in October 1989. The epicenter was approximately 45 miles south of the project site, but this earthquake is estimated to have caused moderate (VI) to strong (VII) shaking intensities at the project site (ABAG, 2003b). The largest earthquake in Bay Area history was the San Francisco Earthquake of 1906, with an estimated moment magnitude of 7.9. This produced very strong (VIII) to violent (IX) shaking intensities at the project site (ABAG, 2003c).

A future worst-case scenario would be a large earthquake on the nearby Hayward fault, which could produce far more severe ground-shaking at the site than was observed during the Loma Prieta earthquake. It is estimated that a characteristic[3] earthquake along the entire Hayward Fault (both north and south segments) would produce ground-shaking of violent (IX) to very violent (X) intensity (ABAG, 2003d). These intensities can be expected to destroy some well built wood-frame structures, cause considerable ground deformation, and induce landslides. It is important to note that rupture along the entire fault is an extremely low probability event.

One useful tool that seismologists use to describe ground-shaking hazard is a probabilistic seismic hazard assessment (PSHA). The PSHA for the State of California takes into consideration the range of possible earthquake sources (including such worse-case scenarios as described above) and estimates their characteristic magnitudes to generate a probability map for ground-shaking. The PSHA maps depict values of peak ground acceleration (PGA) that have a 10% probability of being exceeded in 50 years. This probability level allows engineers to design buildings for ground motions that have a 90% chance of NOT occurring in the next 50-years,

[3] The concept of "characteristic" earthquakes means that we can anticipate, with reasonable certainty, the actual damaging earthquakes that will occur on a fault segment (Peterson et al., 1996)

making buildings safer than if they were simply designed for the most likely events. The PSHA indicates that at the project site, there is a 10 percent chance of exceeding PGA values of 0.655g over the next 50 years (Peterson et al., 1996). As indicated in Table 4.G-1, these PGAs could result in considerable damage even in specially designed structures, causing partial collapse of some buildings and damaging underground utilities. The potential hazards related to ground-shaking are discussed further in the Impacts and Mitigation Measures section of this chapter.

Liquefaction

Liquefaction is a transformation of soil from a solid to a liquefied state, during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soil susceptible to liquefaction includes loose- to medium-density sand and gravel, low-plasticity silt, and some low-plasticity clay deposits. Four kinds of ground failure commonly result from liquefaction: lateral spread, flow failure, ground oscillation, and loss of bearing strength. *Lateral spreading* is the horizontal displacement of surficial blocks of sediments resulting from liquefaction in a subsurface layer that occurs on slopes ranging between 0.3 and 3 percent and commonly displaces the surface by several meters to tens of meters. *Flow failures* occur on slopes greater than 3 degrees and are primarily liquefied soil or blocks of intact material riding on a liquefied subsurface zone. *Ground oscillation* occurs on gentle slopes when liquefaction occurs at depth and no lateral displacement takes place. Soil units that are not liquefied may pull apart from each other and oscillate on the liquefied zone. The *loss of bearing pressure* can occur beneath a structure when the underlying soil loses strength and liquefies. When this occurs, the structure can settle, tip, or even become buoyant and “float” upwards. Liquefaction and associated failures could damage foundations, roads, underground cables and pipelines, and disrupt utility service.

Of particular relevance to the project site is the fact that liquefaction can occur in unconsolidated or artificial fill sediments and other reclaimed areas along the margin of San Francisco Bay. The depth to groundwater influences the potential for liquefaction, in that sediments need to be saturated to have a potential for liquefaction. As a site immediately adjacent to a tidal canal, groundwater is shallow at all times. Witter et al. (2006) has classified the site as having a very high liquefaction potential over the artificial fill, and a moderate liquefaction potential over the dune sands. Moreover, the California Geological Survey (2003) places the whole area within a liquefaction hazard zone. The implications of this designation are discussed under the regulatory setting and impact analysis below.

Earthquake-Induced Settlement

Settlement of the ground surface can be accelerated and accentuated by earthquakes. During an earthquake, settlement can occur as a result of the relatively rapid compaction and settling of subsurface materials (particularly loose, uncompacted, and variable sandy sediments above the water table) due to the rearrangement of soil particles during prolonged ground-shaking. Settlement can occur both uniformly and differentially (i.e., where adjoining areas settle at different amounts). Areas underlain by artificial fill would be susceptible to this type of settlement. Given the geologic setting of the project site vicinity, this area could be subjected to earthquake-induced settlement, discussed further in the impact analysis to follow.

Regulatory Framework

Federal

There are no federal regulations that would apply to the proposed project related to geology, soils and seismicity.

State

Alquist-Priolo Earthquake Fault Zoning Act

Surface rupture is the most easily avoided seismic hazard. The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. In accordance with this act, the state geologist established regulatory zones, called "earthquake fault zones," around the surface traces of active faults and published maps showing these zones. Within these zones, buildings for human occupancy cannot be constructed across the surface trace of active faults. Each earthquake fault zone extends approximately 200 to 500 feet on either side of the mapped fault trace, because many active faults are complex and consist of more than one branch. There is the potential for ground surface rupture along any of the branches.

Title 14 of the California Code of Regulations, Section 3601(e), defines buildings intended for human occupancy as those that would be inhabited for more than 2,000 hours per year. This Act will not apply to the proposed project because the project site is not within an earthquake fault zone defined by the act.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 was developed to protect the public from the effects of strong ground-shaking, liquefaction, landslides, or other ground failure, and from other hazards caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit may be granted for a site within a Seismic Hazard Zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the project design. The project site is located within a Seismic Hazard Zone for liquefaction, as designated by the California Geological Survey. Therefore, evaluation and mitigation of potential liquefaction hazards must be conducted in accordance with the California Geological Survey, Special Publication 117, adopted March 13, 1997 by the State Mining and Geology Board pursuant to the Seismic Hazards Mapping Act, as discussed in the Impacts and Mitigations chapter below.

California Building Code

The California Building Code (CBC) has been codified in the California Code of Regulations (CCR) as Title 24, Part 2. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The purpose of the

CBC is to establish minimum standards to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all building and structures within its jurisdiction. The CBC is based on the International Building Code. The 2007 CBC is based on the 2006 International Building Code (IBC) published by the International Code Conference. In addition, the CBC contains necessary California amendments which are based on the American Society of Civil Engineers (ASCE) Minimum Design Standards 7-05. ASCE 7-05 provides requirements for general structural design and includes means for determining earthquake loads as well as other loads (flood, snow, wind, etc.) for inclusion into building codes. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California.

The earthquake design requirements take into account the occupancy category of the structure, site class, soil classifications, and various seismic coefficients which are used to determine a Seismic Design Category (SDC) for a project. The SDC is a classification system that combines the occupancy categories with the level of expected ground motions at the site and ranges from SDC A (very small seismic vulnerability) to SDC E/F (very high seismic vulnerability and near a major fault). Design specifications are then determined according to the SDC.

Local

Several City of Alameda policy documents contain general, citywide policies that apply to the project (see Section IV.A, *Land Use, Plans and Policies*). This section summarizes relevant policies contained within the General Plan (1991). This section also discusses applicable city ordinances.

City of Alameda General Plan Health and Safety Element

Relevant Guiding Policies

8.1.a A soils and geologic report will be submitted as required by the Director of Public Works prior to the issue of all grading and building permits and submission of final maps, in accordance with the Subdivision Ordinance, to evaluate the potential for lateral spreading, liquefaction, differential settlement, and other types of ground failures.

Parts of Bay Farm Island, the Oakland Airport, and the NAS were subjected to liquefaction and sand boils during the Loma Prieta earthquake.

8.1.b Require design of new buildings to resist the lateral effects and other potential forces of a large earthquake on any of the nearby faults, as required by the Uniform Building Code. The San Andreas, Hayward, Calaveras and San Gregorio faults are of primary concern in the evaluation of seismic activity that affects the San Francisco Bay Area and Alameda. Any of these four faults are capable of producing large, destructive earthquakes that could affect the entire region.

8.1.c Require building design to incorporate recommendations contained in the soils and geologic report.

8.1.d Require all structures of three or more stories to be supported on pile foundations that penetrate Bay Mud deposits to firm, non-compressible materials, unless geotechnical findings indicate a more appropriate design.

8.1.e Design underground utilities to minimize the effect of differential ground displacements.

Relevant Implementing Policies

8.1.g Design building entrances, exits, and other vital features to accommodate expected settlement.

Buildings should be sited so entrances, exits, and other vital structures continue to be accessible as settling occurs.

8.1.h Require owners of shoreline properties to inspect, maintain, and repair the perimeter slopes according to City standards as settlement occurs due to the consolidation of underlying Bay Mud and wave erosion.

Bay Mud (a silty clay rich in organic materials) and Merritt [sic] Sand (a loose, well-sorted fine-to-medium grained sand with silt) are the two base soils underlying Alameda. Development along the edges of the Main Island [Alameda Island] and on all of Bay Farm Island rests on fill overlying Bay Mud. Bay Mud is prone to consolidation, leading to surface settlement, and potentially increasing perimeter erosion.

Projects such as the proposed Ballena Isle Hotel could increase island erosion, and should be mitigated according to City specifications/standards.

8.1.j Amend the local Uniform Building Code, as frequently as may be prudent, to incorporate standards for new and modified construction pertaining to development on areas of fill or underlain by Bay Mud or Merritt [sic] Sand.

City of Alameda Municipal Code

The Alameda Municipal Code Section 13.2-1 adopts the California Building Code (discussed above), with minor revisions. Section 13-2.3 recognizes the following:

“a. The City of Alameda is an island community with access dependent upon bridges and underwater tubes and, in the event of a disaster, could be completely isolated from outside assistance.

b. The City of Alameda is adjacent to several earthquake faults, which make buildings and structures susceptible to structural ruptures and fires.

c. The entire municipal water supply for the City of Alameda is transported via three aqueducts, which are vulnerable to earthquake and tidal flooding.

d. Alameda is a low-lying island community with soil and groundwater conditions, which are corrosive to metals.

e. Alameda has very fine, sandy soil conditions.”

City of Alameda Department of Public Works

The City of Alameda Department of Public Works Engineering Department is responsible for reviewing and issuing grading permits for construction projects. The purpose of the grading permit is to ensure land stability and control erosion. The permit covers the removal, placement and movement of soil on private property.

Impacts and Mitigation Measures

Significance Criteria

The criteria used to determine the significance of an impact are based on Appendix G of the *CEQA Guidelines*. For this analysis, implementation of the proposed project could result in redevelopment in the project site that may result in significant impacts if it would:

1. Expose people or structures to potential substantial adverse effects, including risk of loss, injury or death involving:
   a) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;
   b) Strong seismic ground-shaking;
   c) Seismic-related ground failure, including liquefaction; and/or
   d) Landslides.
2. Result in substantial soil erosion or the loss of topsoil.
3. 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 landslide, lateral spreading, subsidence, liquefaction or collapse.
4. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code creating substantial risks to life or property.
5. Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.
6. Change substantially the topography or any unique geologic or physical features of the site.

Impact Analysis

This following impact analysis focuses on potential impacts of the proposed project related to seismicity and other geologic hazards. The following Appendix G criteria are not considered relevant to the project based upon the proposed project plans and data research; therefore, they will not be evaluated further in this EIR:

Rupture of a known earthquake fault: Ground rupture is considered most likely to occur along active faults, which are referenced in Table 4.G-2. As indicated previously, the project site is *not* within an Alquist-Priolo Fault Rupture Hazard Zone, and no mapped active faults are known to pass through the project site vicinity (Hart, 1997; Jennings, 1994). Therefore, the project would not expose persons or structures to risk of ground rupture along a fault line.

Slope Failure: The site contains level to nearly level slopes, and thus is not expected to experience landslides. Moreover, the site is not within a landslide hazard zone as designated by the California Geological Survey (2003). The shore of the Oakland Estuary contains some minor slopes, but if redeveloped as a Marina, the shoreline would receive improvements designed in accordance with California Building Code standards that would reduce the potential for slope failure. Thus, slope failures are not expected onsite.

Substantial Erosion or Loss of Topsoil: While soil may be exposed and potentially eroded by wind or water during the construction phases of the proposed project, the site is level, and thus substantial and accelerated erosion due to storm runoff is not anticipated. In addition, natural topsoil does not exist onsite, and thus any minor loss of onsite soils would not represent loss of a natural resource. Finally, the Storm Water Pollution and Prevention Plan (SWPPP) that would be required during the construction phases of this project (see Section 4.H, Hydrology and Water Quality) would control the minor soil erosion that could occur during storm events. Thus, substantial erosion and loss of topsoil would not occur.

Inadequate Support for Septic Tanks: As proposed, the project would not use septic tanks but would be served by the City of Alameda sanitary sewer collection system. Therefore, this issue is not applicable to the proposed project.

Substantial alteration to topography or unique geologic feature: The topography of the site would not be substantially altered from its current state (flat) due to the proposed project. In addition, there are no unique geologic features on the site or known mineral deposits. Therefore this CEQA significance criterion is not applicable to the proposed project.

Impact 4.G-1: In the event of a major earthquake in the region, seismic ground-shaking could potentially injure people and cause collapse of or structural damage to proposed structures and / or retaining walls. (Significant)

The project site will likely experience at least one major earthquake (Richter magnitude 6.7 or higher) within the next 30 years. The intensity of such an event would depend on the causative fault and the distance to the epicenter, the moment magnitude, and the duration of shaking. As discussed in the setting section above, in an unlikely event (10 percent probability), ground-shaking could reach PGA values of 0.655g in the next fifty years. This degree of ground-shaking corresponds to a Modified Mercalli intensity of IX (violent), and would be expected to cause considerable damage, even in modern, well designed structures. Substantial cracks could appear in the ground, and the shaking could cause other secondary damaging effects, such as the failure of underground pipes. This level of ground-shaking would likely also induce soil liquefaction and rapid settlement, which is addressed under Impact 4.G-2.

Due to the location of the project site in an area of high seismic risk, people could be harmed and structures may be damaged from strong ground-shaking; thus, Impact 4.G-1 is considered *potentially significant*. Several laws and policies exist that impose stringent seismic safety requirements on the design and construction of new structures. As stated under "Regulatory Framework," on page 4.G-15, all buildings in California are subject to the standards in the California Building Code, which contains specific design requirements for areas with very high seismic risk (Seismic Design Category E/F). The project applicant would be required to submit a geotechnical report pursuant to the Seismic Hazards Mapping Act of 1990 (discussed further under Impact 4.G-2) and Policies 8.1a and 8.1b of the City of Alameda General Plan (City of Alameda, 1991). Pursuant to Policy 8.1d, the City requires that pile foundations penetrate through Bay Mud deposits to firm, non-compressible materials, unless geotechnical findings indicate a more appropriate design.

Compliance with these laws and policies will greatly reduce the potential risk to people and structures caused by the project. However, because the site could experience violent ground-shaking in the next 50 years, is located on unfavorable materials that amplify ground-shaking, and is likely to experience a variety of secondary effects, Mitigation Measures 4.G-1a and 4.G-1b are identified to ensure proper compliance with laws and policies, and minimize harm to people and structures.

> **Mitigation Measure 4.G-1a:** A site-specific, design-level geotechnical investigation for the project shall be conducted as a condition of building permit. The investigation shall include detailed characterization of the distribution and compositions of subsurface materials and an assessment of their behavior during violent seismic ground-shaking. The analysis shall recommend design parameters that would be necessary to avoid or substantially reduce structural damage under peak ground accelerations of no less than 0.655g. The investigation and recommendations shall be in conformance with all applicable city ordinances and policies and consistent with the design requirements of Seismic Design Category E/F (very high vulnerability) of the California Building Code. The geotechnical report shall be prepared by a registered geotechnical engineer and approved by the City, and all recommendations shall be included in the final design of the project.

> **Mitigation Measure 4.G-1b:** Prior to issuance of occupancy permits, the project applicant shall prepare an earthquake hazards information document to the satisfaction of City staff. This document shall be made available to any potential occupant prior to purchase or rental of the housing units. The document shall describe the potential for strong ground-shaking at the site, potential effects of ground shaking, and earthquake preparedness procedures.

These mitigation measures ensure that the proposed project will be designed to withstand strong seismic ground-shaking, and that the occupants of the proposed development are informed of safety procedures to follow in the event of an earthquake.

Significance after Mitigation: Less than Significant.

Impact 4.G-2: In the event of a major earthquake in the region, people and property could be exposed to seismically-induced ground failure, including liquefaction, lateral spreading and earthquake-induced settlement. (Significant)

The CGS has designated the project and the entirety of Alameda Island as a Seismic Hazard Zone for liquefaction due to historic occurrences, the presence of unfavorable soils and shallow groundwater (CGS, 2003). Liquefaction at the site could result in loss of bearing pressure, lateral spreading, sand boils (liquefied soil exiting at the ground surface), and earthquake-induced settlement. During the Loma Prieta earthquake, for example, parts of Bay Farm Island, the Oakland Airport, and the NAS were subjected to liquefaction and sand boils (City of Alameda, 1991). Future earthquakes could potentially produce similar effects at the project site, especially on the northern portion of the site, which is underlain by artificial fills and Bay Mud.

Due to the location of the project site in an area of high liquefaction potential, people could be harmed and structures may be damaged from earthquake-induced liquefaction, rapid settlement or other earthquake-induced ground failures; thus, Impact 4.G-2 is considered *potentially significant*. Because the site is in a liquefaction hazard zone, pursuant to the Seismic Hazards Mapping Act of 1990, a geotechnical report must be prepared that evaluates and provides mitigation for potential liquefaction hazards. The investigation and mitigation recommendations must be made in accordance with the California Geological Survey, Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards.* Mitigation Measure 4.G-2 is identified to ensure that seismically-induced ground failure is a less than significant impact to the project.

> **Mitigation Measure 4.G-2:** Earthwork, foundation and structural design for the proposed project shall be conducted in accordance with all recommendations contained in the required geotechnical investigation (Mitigation Measure 4.G-1a). The investigation must include an assessment of all potentially foreseeable seismically-induced ground failures, including liquefaction, sand boils, lateral spreading and rapid settlement. Mitigation strategies must be designed for the site-specific conditions of the project and must be reviewed for compliance with the guidelines of CGS Special Publication 117 prior to incorporation into the project. Examples of possible strategies include edge containment structures (berms, diked sea walls, retaining structures, compacted soil zones), removal or treatment of liquefiable soils, soil modification, modification of site geometry, lowering the groundwater table, in-situ ground densification, deep foundations, reinforced shallow foundations, and structural design that can accommodate predicted displacements.

Significance after Mitigation: Less than Significant.

Impact 4.G-3: Continuing consolidation and land subsidence at the project site could result in damage to structures, utilities and pavements. (Significant)

As described earlier, the project site, especially the northern portion that is underlain by artificial fill and Bay Mud, is susceptible to settlement. Younger Bay Mud is highly compressible and has low strength. The weight of the overlying materials (which could include existing fill, proposed new fill, and structures) causes consolidation of the sediments over time. As the sediments consolidate at depth, the ground surface settles and structural damage can occur. Subsidence related to consolidation of Bay Mud beneath fill and foundation settlement directly related to site-specific structural building loads could affect structures proposed as part of the project. Underground utilities could also experience differential settlement along their alignments, possibly resulting in rupture or leakage, which could cause disruption of service or safety hazards. Construction of new shallow foundations and/or placement of new fill at the site would begin a new cycle of consolidation settlement in the Bay Mud. The amount and rate of consolidation settlement would depend on:

- the weight of any new fill or structural loads (i.e., footings),
- the thickness and character of the existing fill,
- the thickness of the Bay Mud deposit beneath the existing fill and Merrit Sand,
- the potential presence of sand lenses within the Bay Mud deposit,
- the amount of consolidation/settlement that has already occurred due to previous site activities, and
- the presence of existing foundations or other obstructions, particularly pile foundations.

Buried foundations or foundation elements may also act as “hard points” beneath new roads or utilities, resulting in the potential for abrupt differential settlement.

Soil consolidation and differential settlement presents a *potentially significant* impact to the proposed project.

> **Mitigation Measure 4.G-3:** The required geotechnical report for the project (Mitigation Measure 4.G-1a) shall determine the susceptibility of the project site to settlement and prescribe appropriate engineering techniques for reducing its effects. Where settlement and/or differential settlement is predicted, mitigation measures—such as lightweight fill, geofoam, surcharging, wick drains, deep foundations, structural slabs, hinged slabs, flexible utility connections, and utility hangers—could be used. These measures shall be evaluated and the most effective, feasible, and economical measures shall be recommended. Engineering recommendations shall be included in the project engineering and design plans, and be reviewed and approved by a registered geotechnical engineer. All construction activities and design criteria shall comply with applicable codes and requirements of the most recent California Building Code, and applicable City construction and grading ordinances.

Significance after Mitigation: Less than Significant.

Cumulative Impacts

Impact 4.G-4: Implementation of the proposed project, combined with past, present, and reasonably foreseeable probable projects, would not result in substantial adverse cumulative impacts to geology, soils, or seismic hazards. (Less than Significant)

The geographic area considered for the cumulative geology, soils, of seismic hazards effects is the – entire San Francisco Bay Area region. This region is considered seismically active and future development would expose additional people and structures to potentially adverse effects associated with earthquakes, including seismic ground shaking and seismic-related ground failure. However, site-specific geotechnical studies that future development projects would be required to prepare would determine how each development could be designed to minimize exposure of people to these effects. Future development would be constructed to standards that likely would exceed those of older structures within the region. The proposed project, as well as all other projects, would be constructed in accordance with the current version of the California Building Code seismic safety requirements and recommendations contained in each site-specific geotechnical report. Therefore, impacts to area geology and soils resulting from future development of the proposed project, combined with other past, present, or probable future projects, would not result in a cumulatively significant impact. The cumulative impact would be less than significant given mandatory compliance with existing state and local building codes and regulations.

Mitigation: None required.

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H. Hydrology and Water Quality

This section describes existing hydrologic conditions in the project vicinity and presents applicable regulations that pertain to hydrology, surface water, flooding, and water quality. This section also discusses the changes in hydrology and water quality that could result from construction and operation of the project and identifies potential project impacts and appropriate mitigation measures when necessary.

Setting

Hydrology

Regional

The project site lies in the Central Basin within the San Francisco Bay Hydrologic Region. San Francisco Bay marks a natural topographic separation between the northern and southern coastal mountain ranges. The San Francisco Bay estuarine system conveys the waters of the Sacramento and San Joaquin rivers into the Pacific Ocean. The rivers enter the bay through the delta at the eastern end of Suisun Bay (RWQCB, 2007). Within the San Francisco Bay Hydrologic Region, the project site vicinity is a part of the South Bay region in Alameda County. This unit is divided into a number of small watersheds that are defined by the natural topographic features of the region. A series of linear drainage basins trending northeast to southwest extend from the ridges of the Oakland hills across the alluvial plain[1] of the East Bay toward San Francisco Bay.

Local

The topography of the project site is generally flat. The site lies at an elevation of approximately 5 to 10 feet above mean sea level and gently slopes northerly to sea level toward the tidal canal that separates Alameda Island from Oakland (USGS, 1978). The tidal canal is the major receiving water body in the project site vicinity and abuts the project site. The Army Corps of Engineers owns and controls the land's edge, which has a slightly varied topography due to collapsed boat ramps and uneven fill.

Tidal Canal and Oakland Estuary

The Oakland Estuary was originally a tidal slough that originated in a vast marsh stretching from Lake Merritt to Brooklyn Basin. At the turn of the century (1902), the estuary and tidal canal were dredged, separating Oakland from Alameda and forming the estuary as it is today. Lake Merritt remains hydrologically connected to the estuary through tidal gates at the Seventh Street Pump Station.

1 Alluvial plain is an area formed by deposition of sediment by a stream.

The estuary is influenced by both freshwater and marine water. The estuary receives freshwater inflow from a combination of natural creeks, human-made stormwater drainage facilities, and direct surface runoff. The estuary is also influenced by the marine waters of the bay and is subject to tidal currents. Sediment from Oakland's shoreline and creeks is carried by the tidal current to shoals and sandbars, causing siltation of the shipping channels.

Water Quality

In addition to fresh and marine water, past and present urban uses in the area have contributed to industrial waste discharges and urban stormwater runoff that has influenced the water quality in the Oakland Estuary. Pollutant sources discharging into the estuary include both point and nonpoint discharges. A point source is any discernible, confined, and discrete conveyance (e.g., a pipe discharge) of pollutants to a water body from such sources as industrial facilities, stormwater conveyance infrastructure or wastewater treatment plants. Nonpoint source (NPS) pollution is the result of land runoff, rainfall, drainage or seepage from diffuse sources such as agricultural fields, urban streets, confined animal facilities, and streambank erosion. NPS pollution is one of the major impacts on the water quality of San Francisco Bay, its tributary streams, and the Region's coastal waters.

Groundwater Resources

The project site lies in the East Bay Plain of the San Francisco Bay Hydrologic Region (Department of Water Resources [DWR] Groundwater Basin[2] No. 2-9.04), a northwest-trending alluvial plain bounded on the north by San Pablo Bay, on the east by the contact with Franciscan Basement rock, and on the south by the Niles Cone Groundwater Basin (DWR, 2004). The East Bay Plain extends from Richmond to Hayward. The alluvial materials that extend westward from the East Bay Hills to the edge of San Francisco Bay constitute the deep water-bearing strata for this groundwater basin, which is identified as a potential water source for municipal, industrial, and agricultural use (RWQCB, 2007). Since the early 1950s, historic groundwater levels in the deep aquifer in the basin have varied between -10 and -140 feet mean sea level (DWR, 2004).

Flooding

Flooding is inundation of normally dry land as a result of rise in the level of surface waters or rapid accumulation of stormwater runoff. The Federal Emergency Management Agency (FEMA), through its Flood Insurance Rate Mapping (FIRM) program, designates areas where urban flooding could occur during 100-year and 500-year flood events.[3] The project site is located in an area designated as Flood Hazard Zone X, which is defined as an area outside of both the 500-year and 100-year flood zone (FEMA, 2009). Storm drain facilities on the existing project site convey runoff from the site into the tidal canal.

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2 A groundwater basin is defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers (RWQCB, 1995).

3 A 100-year flood event has a one percent probability of occurring in a single year. Although infrequent, 100-year floods can occur in consecutive years or periodically throughout a decade. A 500-year flood event has a 0.2 percent probability of occurring in a single year.

Flooding can also occur due to tsunamis, seiches, failure of dams, or sea level rise. Tsunamis are waves caused by an underwater earthquake, landslide, or volcanic eruption, while seiches are waves in an enclosed or semi-enclosed body of water such as a lake, reservoir, or harbor. Flooding from tsunamis would generally affect low-lying areas along San Francisco Bay. Areas along the inner harbor, Brooklyn Basin and the tidal canal would be sheltered by the island of Alameda. In addition, the tidal canal, with its connection to the bay on either end, is not characterized as an enclosed or semi-enclosed body of water and therefore is not susceptible to seiches.

Flooding can also occur due to dam failure. The California DWR, Division of Safety of Dams (DSOD) oversees the construction of dams that are more than 25 feet high and impound more than 15 acre-feet of water, or more than 6 feet high and impound more than 50 acre-feet of water. Due to DSOD regulatory oversight, monitoring, and design review, the potential is minimal for the catastrophic failure of a properly designed and constructed dam, whether caused by a seismic event, flood event, unstable slope conditions, or damage from corrosive or expansive soils. Although some areas in Oakland include dam failure inundation areas, the project site would be protected by the tidal canal and there are no dams located within Alameda.

Sea Level Rise

Global climate change will likely result in sea level rise and could expose shoreline areas to flooding as well as affect the timing and amount of precipitation. Climate change is expected to result in more extreme weather events; both heavier precipitation events that can lead to flooding as well as more extended drought periods. According to a report by the Intergovernmental Panel on Climate Change, the average global mean sea level increased by approximately 5.9 inches during the past 100 years (IPCC, 2007). The IPCC report (2007) projects global mean sea level could increase by 7 to 23 inches by 2099. Estimates of sea level rise vary between model runs and researchers, so trends and potential increases are typically reported in ranges. Another reported range of possible sea level rise increases by 2100 have been estimated at 40.2 inches (1.02 m) to 57.5 inches (1.46 m) (Pacific Institute, 2009).

Regulatory Setting

Federal

Clean Water Act

Under the Clean Water Act (CWA) of 1977, the U.S. Environmental Protection Agency (EPA) seeks to restore and maintain the chemical, physical, and biological integrity in the nation’s waters. The statute employs a variety of regulatory and nonregulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. The CWA authorizes the EPA to implement water quality regulations. The National Pollutant Discharge Elimination System (NPDES) permit program under section 402(p) of the CWA controls water pollution by regulating stormwater discharges into the waters of the U.S. California has an approved state NPDES program. The EPA has delegated authority for water permitting to the California State Water Resources Control Board (SWRCB), which has nine regional boards. The San Francisco Bay Regional Water Quality Control Board (RWQCB) regulates water quality in the project site vicinity.

Total Maximum Daily Load

Section 303(d) of the CWA requires that each state identify water bodies or segments of water bodies that are "impaired" (i.e., not meeting one or more of the water quality standards established by the state). These waters are identified in the Section 303(d) list as waters that are polluted and need further attention to support their beneficial uses. Once the water body or segment is listed, the state is required to establish Total Maximum Daily Load (TMDL) for the pollutant causing the conditions of impairment. TMDL is the maximum amount of a pollutant that a water body can receive and still meet water quality standards. Typically, TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources. The intent of the 303(d) list is to identify water bodies that require future development of a TMDL to maintain water quality.

In accordance with Section 303(d), the RWQCB has identified impaired water bodies within its jurisdiction, and the pollutant or stressor responsible for impairing the water quality. Within the project site vicinity, the RWQCB has designated the Central Basin of the San Francisco Bay as an impaired water body. Pollutants that contribute to this impairment are chlordane, DDT, diazinon, dieldrin, various dioxins, exotic species, furan compounds, mercury, polyaromatic hydrocarbons, polychlorinated biphenyls, and selenium. The potential sources of the pollutants listed are non-point sources, atmospheric deposition, ballast water, industrial point sources and resource extraction, urban runoff, agriculture, exotic species, and natural sources (RWQCB, 2003). The RWQCB does not list any specific water bodies at the project site, i.e., the tidal canal or Oakland Estuary, as impaired. The RWQCB is required to establish TMDLs for these pollutants in order to gradually eliminate impairment of the waters and attain water quality standards (ACCWP, 2003). Current TMDL projects include TMDLs for mercury and polychlorinated biphenyls in San Francisco Bay. The project applicant would be required to ensure that the proposed project would not conflict with the current TMDLs and comply with specific water quality control measures under the NPDES permit requirements (see below for details) to prevent project-related contaminants from entering into the estuary, which is connected to the Central Basin.

Waste Discharge Requirements: Section 401 of the CWA requires every applicant for a federal permit or license for an activity that may result in a discharge of pollutants to the waters of the U.S. (including permits under Section 404 of the CWA, see Section 4.F, Biological Resources). The purpose of the permit application is to obtain certification that the proposed activity will comply with the state water quality standards (RWQCB, 2003b). The proposed project would require 401 certification for any construction work in the Tidal Canal such as removal of debris or dredging and would be subject to Section 404 of the CWA (see Section IV.I, Biological Resources).

State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act allows the SWRCB to adopt statewide water quality control plans or basin plans. The purpose of the plans is to establish water quality objectives for specific water bodies. The RWQCB has prepared the *San Francisco Bay Basin Plan* that establishes water quality objectives and implementation programs to meet the stated objectives and to protect the beneficial uses of the bay waters (see regional regulatory discussion below). The act also authorizes the NPDES program under the CWA, which establishes effluent limitations and water quality requirements for discharges to waters of the state. Most of the implementation of SWRCB's responsibilities is delegated to the nine regional boards. Under the NPDES program, the RWQCB has established permit requirements for stormwater runoff for the project site vicinity (see Regional discussion below).

Regional

The RWQCB is responsible for the protection of beneficial uses and the water quality of water resources within the San Francisco Bay region. The RWQCB administers the NPDES stormwater permitting program and regulates stormwater in the San Francisco Bay region, which includes the project site. The City of Alameda is a permittee under the NPDES permit for the Alameda Countywide Clean Water Program (see below for detailed discussion). The RWQCB also issues 401 certifications for projects that require Section 404 permit from the U.S. Army Corps of Engineers (USACE). The regulatory requirements under the RWQCB are discussed below.

Basin Plan

The RWQCB prepared the *San Francisco Bay Water Quality Control Plan* (Basin Plan) (2007) for San Francisco Bay, which contains descriptions of the legal, technical, and programmatic bases of water quality regulation in the region. The Basin Plan describes beneficial uses of major surface waters and their tributaries. The following beneficial uses have been listed for San Francisco Bay in the Central Basin:

- Ocean, Commercial, and Sport Fishing
- Estuarine Habitat
- Industrial Service Supply
- Fish Migration
- Navigation
- Industrial Process Supply
- Preservation of Rare and Endangered Species
- Water Contact Recreation
- Noncontact Recreation
- Shellfish Harvesting
- Fish Spawning
- Wildlife Habitat

The RWQCB is responsible for permitting construction activities for development projects to ensure the protection of the above beneficial uses.

McAteer-Petris Act / San Francisco Bay Conservation and Development Commission (BCDC)

The McAteer-Petris Act is a provision under California law that preserves San Francisco Bay from indiscriminate filling. The act established the San Francisco Bay Conservation and Development Commission (BCDC) as the agency charged with preparing a plan for the long-term use of the bay and regulating development in and around the bay while the plan was being prepared. The San Francisco Bay Plan, completed in January 1969, includes policies on 18 issues critical to the wise use of the bay, ranging from ports and public access to design considerations and weather. The McAteer-Petris Act authorizes BCDC to incorporate the policies of the Bay Plan into state law. The Bay Plan has two features: policies to guide future uses of the bay and shoreline, and maps that apply these policies to the bay and shoreline. BCDC conducts the regulatory process in accord with the Bay Plan policies and maps, which guide the protection and development of the bay and its tributary waterways, marshes, managed wetlands, salt ponds, and shoreline (BCDC, 2003).

BCDC has jurisdictional over areas within “a shoreline band that consists of all territory located between the shoreline of the bay and a line 100 feet landward of and parallel with that line” (BCDC, 2003). The City and the project applicant would be required to comply with the BCDC requirements due to the project location.

Construction Permitting

Construction activities on one acre or more are regulated by the RWQCB and are subject to the requirements of the NPDES General Permit for Discharges of Stormwater Runoff Associated with Construction Activity (General Construction Permit). Effective July 1, 2010 all dischargers are required to obtain coverage under the Construction General Permit Order 2009-0009-DWQ adopted on September 2, 2009. The SWRCB established the General Construction Permit for the purpose of reducing impacts to surface waters that may occur due to construction activities. The project applicant would be required to apply for the General Construction Permit that requires the preparation and implementation of a stormwater pollution prevention plan (SWPPP). The SWPPP is prepared before project construction begins and, in certain cases, before demolition begins and includes specifications for best management practices (BMPs) that would be implemented during construction. BMPs are measures undertaken to control degradation of surface water by preventing soil erosion or the discharge of pollutants from the construction area. Additionally, the SWPPP describes measures to prevent or control runoff after construction is complete, and it identifies procedures for inspecting and maintaining facilities or other project elements. Required elements of a SWPPP (also found in Section A of the Construction General Permit) include:

1. A site map(s) which shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project.

2. A list of Best Management Practices (BMPs) the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP

3. Description of a visual monitoring program; a chemical monitoring program for “non-visible” pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

Examples of typical construction BMPs include scheduling or limiting activities to certain times of the year; installing sediment barriers, such as silt fence and fiber rolls; maintaining equipment and vehicles used for construction; tracking controls, such as stabilizing entrances to the construction sit;, and developing and implementing a spill prevention and cleanup plan. Non-stormwater management includes installing specific discharge controls during activities, such as paving operations, vehicle and equipment washing and fueling.

The RWQCB has identified BMPs in the *California Storm Water Best Management Practice Handbook* (2003) to effectively reduce degradation of surface waters to an acceptable level. The City of Alameda holds a NPDES permit under the Alameda County Clean Water Program and the project would be required to comply with the permit requirements to control stormwater discharges from the construction site (see Alameda County discussion below).

Construction activities, such as excavation and trenching in areas with shallow groundwater, would require dewatering, which would be subject to the RWQCB construction dewatering permit requirements. Dewatering operations are regulated under State requirements for stormwater pollution prevention and control. Discharge of non-stormwater from a trench or excavation that contains sediments or other pollutants to sanitary sewer, storm drain systems, creek bed (even if dry), or receiving waters is prohibited. Discharge of uncontaminated groundwater from dewatering is a conditionally exempted discharge by the RWQCB. However, the removed water could potentially be contaminated with chemicals released from construction equipment or sediments from excavation. Therefore, disposal of dewatering discharge would require permits from either the RWQCB for discharge to surface creeks and groundwater, or local agencies for discharge to storm or sanitary sewers. The RWQCB lists non-stormwater discharge controls specifically for dewatering operations. The control measures are described in the mitigation for impacts discussion. These control measures would be implemented by the project applicant during construction activities at the project site. Discharge of water resulting from dewatering operations would require an NPDES permit, or a waiver (exemption) from the RWQCB, which would establish discharge limitations for specific chemicals (if they occur in the dewatering flows).

San Francisco Estuary Project

The San Francisco Estuary Project was established pursuant to CWA Section 320 to protect and improve the water quality and natural resources of San Francisco Bay-Delta Estuary. The San Francisco Estuary Project, through its *2007 Comprehensive Conservation and Management Plan*, recommends actions in the several areas, such as aquatic resources, water use, pollution prevention and reduction, dredging and waterway modification, and research and monitoring. As stated earlier, the project site is located in the San Francisco Bay hydrologic region and drains eventually into the bay, which is a part of the Bay-Delta Estuary. Therefore, the following recommended actions that would apply to the project are:

- *Action PO-2.4*: Improve the management and control of urban runoff from public and private sources.
- *Action LU-3.2*: Develop and implement guidelines for site planning and BMPs.

Alameda County

The Alameda County Flood Control and Water Conservation District and the City of Oakland Public Works Agency share the responsibility for maintaining drainage facilities in Oakland. The project applicant would be required to comply with the requirements concerning drainage issues during construction and operation of the project as a condition of receiving a drainage permit.

Alameda Countywide Clean Water Program

The Alameda Countywide Clean Water Program (ACCWP) comprises 17 participating agencies, including the City of Alameda, that cooperatively comply with a municipal stormwater permit issued by the RWQCB. The permit contains requirements to prevent stormwater pollution and to protect and restore creek and wetland habitat. The member agencies have developed performance standards to clarify the requirements of the stormwater pollution prevention program, adopted stormwater management ordinances, conducted extensive education and training programs, and reduced stormwater pollutants from industrial areas and construction sites. In the project site vicinity, the ACCWP administers the stormwater program to meet the CWA requirements by controlling pollution in the local storm drain sewer systems.

The ACCWP prepared the *Stormwater Quality Management Plan* in 2001 that was effective through June 2008 and continues to be in use until replaced. This plan describes the ACCWP's approach to reducing stormwater pollution. In conjunction with the stormwater discharge permit adopted by the RWQCB, the plan is designed to enable the ACCWP member agencies to meet CWA requirements. The plan provides a framework for protection and restoration of creeks and watersheds in Alameda County in part through effective and efficient implementation of appropriate control measures for pollutants. The plan addresses the following major program areas: regulatory compliance, focused watershed management, public information/participation, municipal maintenance activities, new development and construction controls, illicit discharge controls, industrial and commercial discharge controls, monitoring and special studies, control of specific pollutants of concern, and performance standards. New development and construction controls in the plan would apply to the project. The plan recommends tasks to implement source, site design, post-construction stormwater treatment and hydromodification[4] controls (ACCWP, 2001).

Construction activities associated with the proposed project would be subject to the NPDES permit requirements for stormwater management and discharges. The ACCWP NPDES permit also incorporates updated state and federal requirements related to the quantity and quality of post-construction stormwater discharges from new development and redevelopment projects.

The RWQCB issued a NPDES permit (Permit No. CAS0029831) to ACCWP that includes the City of Alameda by Order 97-030 on February 19, 1997, and modified by Order No. 99-049 on July 21, 1999. The most recent Order R2-2003-021 was adopted on February 19, 2003 for waste discharge requirements. The City of Alameda has jurisdiction over and/or maintenance responsibility for its municipal separate storm drain systems and/or watercourses in Alameda County.

4 Hydromodification is alteration of the natural flow of water through a landscape.

NPDES permit provision C.3 governs storm drain systems and regulates post-construction stormwater runoff. The provision requires new development and redevelopment projects to incorporate treatment measures and other appropriate source control and site design features to reduce the pollutant load in stormwater discharges and to manage runoff flows. "Redevelopment" is defined as a project on a previously developed site that results in the addition or replacement of impervious surface. A redevelopment project that adds or replaces at least 10,000 square feet of impervious surface is required to adhere to the C.3 provisions. The proposed project would replace more than 10,000 square feet of impervious surface; therefore, the entire project would be required to implement treatment measures and appropriate source control and site design measures under the NPDES permit.

City of Alameda General Plan

The following Guiding Policies and Implementing Policies contained in the City of Alameda *General Plan* are relevant to the project:

> *Guiding Policy 8.3.b*: Ensure that structures proposed for sites located on floodplains subject to the 100-year flood are provided adequate protection from floods.
>
> *Guiding Policy 8.3.c*: Monitor EPA reports on sea level rise in order to anticipate impacts if sea level rise accelerates; coordinate with BCDC to design an appropriate response.
>
> *Guiding Policy 8.3.e*: Support a multi-use concept of roadways, including, where appropriate, uses for flood control, open space, nature study, habitat, pedestrian circulation, and outdoor sports and recreation.
>
> *Implementing Policy 8.3.f*: Use all possible means of reducing the potential for flood damage in Alameda. These include the requirement of flood-proofing, flood forecast and warning or evacuation programs, and stringent groundwater management programs to prevent subsidence.
>
> *Implementing Policy 8.3.i*: Reduce the effect of surface runoff by the use of extensive landscaping, minimizing impervious surface and drainage easements.
>
> *Implementing Policy 8.3.k*: Leave adequate setbacks along waterfront areas for the expansion of seawalls and levees.
>
> *Implementing Policy 5.1.x*: Prevent migration of runoff off-site or into wetland areas and water-related habitat by requiring that proposed projects include design features ensuring detention of sediment and contaminants.

Impacts and Mitigation Measures

Significance Criteria

A hydrology or water quality impact would be considered significant if the impact would result in any of the following, which are adapted from CEQA *Guidelines*, Appendix G CEQA Thresholds/Criteria of Significance Guidelines:

- Violate any water quality standards or waste discharge requirements or otherwise substantially degrade water quality;
- 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 patterns, currents, or the course of direction of water movements, in a manner which would result in substantial erosion of siltation on- or off-site, or substantially increase the rate or amount of surface water runoff in a manner which would result in flooding on- or off-site;
- Create or substantially contribute to runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Alter the course or flow of flood waters within the 100-year flood hazard area;
- Place housing or other improvements susceptible to flooding within a 100-year flood hazard zone as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard map; or
- Expose people or property to water-related hazards, such as flooding or inundation by seiche, tsunami, mud flows, or dam or levee failure.

Impact Analysis

This following impact analysis focuses on potential impacts of the proposed project related to hydrology and water quality. The following Appendix G criteria are not considered relevant to the project based upon the proposed project plans and data research; therefore, they will not be evaluated further in this EIR:

Groundwater Supplies: The project site is currently almost entirely covered in impervious surfaces and receives little to no recharge from precipitation. With construction of the proposed project and introduction of landscaped areas, there would be a net increase in groundwater recharge. The proposed project also would not require the extraction of any groundwater supplies, with the possible exception of temporary dewatering necessary for construction. Therefore, there would be no impact to local groundwater supplies or groundwater recharge.

Flooding: The proposed project site is not located in an area that is currently mapped as a flood hazard zone. The project site is also almost entirely covered by impervious surfaces and the project would include some landscaping that would reduce flows offsite; therefore, the project would not cause any flooding on or offsite. However, the potential for flooding as a result of potential sea level rise is discussed below.

Seiche, Tsunami, Mud Flows, Dam Failure: As discussed above in the setting section, the proposed project site is not located in an area susceptible to seiche, tsunami, mud flows, or dam failure. Therefore, there would be no impact related to these hazards.

Water Quality

Construction Impacts

Impact 4.H-1: Project construction would involve activities (excavation, soil stockpiling, boring and pile driving, grading, and dredging, etc.) that would generate loose, erodible soils that, if not properly managed, could violate water quality standards or waste discharge requirements; result in substantial erosion or siltation; create or constitute substantial polluted runoff; or otherwise substantially degrade water quality. (Less than Significant)

Construction of the project would involve excavation, soil stockpiling, and other ground-disturbing activities. The construction activities listed above would generate loose, erodible soils that, if not properly managed, could be washed into surface water by rain or by water used during grading operations. Soil erosion would cause excess sediment loads in waterways and could affect the water quality of the tidal canal and eventually San Francisco Bay. However, stormwater control measures, such as the installation of silt fences and hay bales, would be implemented to prevent uncontrolled stormwater runoff from being discharged from the site. Construction would involve the use of fuel and other chemicals that, if not managed properly, could get washed off into the stormwater. These construction impacts, while temporary, would be potentially significant, particularly due to the proximity of the project site to the tidal canal. Adherence to the RWQCB requirements as part of the General Construction NPDES permit requirements would include preparation and execution of a Storm Water Pollution Prevention Plan (SWPPP) that would outline construction stormwater quality management practices likely based on the ACCWP *Stormwater Quality Management Plan.* The SWPPP would describe erosion control measures similar to those recommended in the *California Stormwater Best Management Practice Handbook*, which are designed to reduce the potential for pollutants to contact stormwater and eliminate or reduce discharge of materials to stormwater. Implementation of the NPDES requirements would reduce soil erosion and release of hazardous materials into watercourses. Therefore, construction of the project would not cause degradation of water quality in the tidal canal or other waterways or violate any water quality standards. The impact would be less than significant after regulatory compliance.

In addition, as mentioned above, the proposed project includes improvements along the Estuary that are currently owned by the U.S. Army Corps of Engineers. Proposed improvements on this land would be undertaken by the project applicant, subject to the approval of the applicable property owner (Corps or City), in addition to regulatory approval by entities including, but not limited to, the Corps, the Regional Water Quality Control Board, the Bay Conservation and Development Commission, and the City of Alameda. This work may involve the removal of debris and placement of new fill for the construction of a new sea wall. All work would be required to obtain permits from the Corps, the RWQCB, and the City which will include measures to protect water quality during construction. Any construction work that takes place in the tidal canal would be required to adhere to Section 401 and 404 of the CWA with approvals from the Corps and the RWQCB. The impact would be less than significant after regulatory compliance.

Mitigation: None required.

Operational Impacts

Impact 4.H-2: Development of the project would alter existing drainage patterns, which could result in increased pollutant loading in stormwater runoff violating water quality standards of receiving waters. (Less than Significant)

The majority of the project site is currently covered with impervious surfaces. Stormwater from the existing site is discharged either overland or through the existing piped storm drain system directly into the tidal canal without treatment. Implementation of the project would increase the amount of landscaped open space areas and reduce impervious surface areas, which would facilitate infiltration and reduce storm water runoff. The water would infiltrate into the subsurface soils and eventually flow into the canal and the Bay through groundwater seepage. As part of the proposed project, selected post-construction stormwater BMPs—such as grass swales, pervious pavements, and infiltration basins required as part of the C.3 NPDES requirements—would be installed, where practicable, to treat runoff from impervious surface areas. Other administrative BMPs would include signage at inlets to prevent illicit discharge to storm drains, street sweeping, public education, and household hazardous waste disposal programs. Implementation of the BMPs would improve the water quality seeping into the subsurface soils and into the estuary. The project would also provide a grading and a storm drain system to limit direct storm runoff or discharge into the canal, connecting to the existing storm drain system. Also, with the addition of a marina, the project may require maintenance dredging beyond what is already occurring for the main canal by the Corps, and such dredging would be significant to regulations imposed for the purpose of protecting water quality. Therefore, with adherence to regulatory requirements, the long-term water quality impact resulting from the project would be less than significant.

Mitigation: None required.

Impact 4.H-3: Site development under the proposed project would involve new landscaping and open lawns. If not properly handled, chemicals used to establish and maintain landscaping and open lawn areas, such as pesticides and fertilizers, could flow into the waterways, and result in water quality impacts to the tidal canal and eventually San Francisco Bay. (Significant)

The project would redevelop an underutilized industrial area into a residential development that includes a shoreline park and landscaped areas surrounding the development. New pervious areas would replace areas that are currently impervious. The increase in pervious areas on the project site could increase the amount of pollutants in runoff associated with maintenance of landscaped areas, particularly nutrients from pesticides and fertilizers typically used in parks.

The City of Alameda is a participating agency in the ACCWP that protects water quality through implementation of various source control and monitoring measures outlined in the NPDES permit and the *Stormwater Quality Management Plan*. Under the ACCWP *Stormwater Quality Management Plan* (2001), new development is required to comply with existing stormwater runoff controls. These include hazardous materials storage requirements, elimination of illicit discharges and others. The project would be required to comply with these controls. The ACCWP NPDES permit requires the City of Alameda as a permittee, to address pesticides, which have been found by the RWQCB to have a reasonable potential to cause or contribute to exceedances of water quality standards. This pesticide program includes a proactive Diazinon Pollutant Reduction Plan (the "Pesticide Plan"). The goals of the Pesticide Plan and of its resulting implementing actions are to reduce or substitute pesticide use (especially diazinon use) with less toxic alternatives. In addition, compliance with the existing water quality protection requirements and ordinances implemented through the City, the RWQCB, and Alameda County, in addition to implementation of Mitigation Measure H-1, below, would effectively reduce surface water pollutants and ensure that potential project impacts to water quality would remain less-than-significant.

> **Mitigation Measure 4.H-3:** An Integrated Pest Management Plan (IPM) shall be prepared and implemented by the project applicant for all common landscaped areas. The IPM shall be prepared by a qualified professional and shall recommend methods of pest prevention and turf grass management that use pesticides as a last resort in pest control. Types and rates of fertilizer and pesticide application shall be specified. The IPM shall specify methods of avoiding runoff of pesticides and nitrates into receiving storm drains and surface waters or leaching into the shallow groundwater table. Pesticides shall be used only in response to a persistent pest problem that cannot be resolved by non-pesticide measures. Preventative chemical use shall not be employed. Cultural and biological approaches to pest control shall be fully integrated into the IPMs, with an emphasis toward reducing pesticide application.

Significance after Mitigation: Less than Significant.

Impact 4.H-4: Site development under the proposed project could be subjected to flooding as a result of sea level rise. (Less than Significant)

Quantifying potential sea level rise into the future is difficult to predict but it has been estimated as high as 57 inches by the year 2100. The proposed project includes improvements on a narrow strip of land along the Estuary that is currently owned by the U.S. Army Corps of Engineers. This land is anticipated to be transferred to the City of Alameda, possibly as early as 2011, as part of a larger plan by the Corps to relinquish its ownership of the entire Tidal Estuary. Any improvements on land owned by the Corps or the City of Alameda would be undertaken by the project applicant, subject to the approval of the applicable property owner (Corps or City), in addition to regulatory approval by entities including, but not limited to, the Corps, the Regional Water Quality Control Board, the Bay Conservation and Development Commission, and the City of Alameda. Shoreline improvements would likely include the construction of a sea wall, which would be constructed according to current standards and BCDC guidelines which address the latest data on sea level rise.

> **Mitigation Measure 4.H-4:** The project applicant shall design and construct the proposed seawall such that future adaptive management measures can be implemented to further protect upland areas from potential rising sea levels. Prior to construction, the final seawall design shall be reviewed by BCDC and in accordance with current guidelines regarding protection against sea level rise.

Significance after Mitigation: Less than Significant.

Cumulative Impacts

Hydrology and Water Quality

Impact 4.H-5: Increased construction activity and new development resulting from the proposed project, in conjunction with other reasonably foreseeable development in Alameda, would not result in cumulative impacts with respect to hydrology and water quality. (Less than Significant)

Implementation of the project, together with past present and other reasonably foreseeable future projects in the vicinity, would not result in adverse cumulative effects to hydrology and water quality. These effects could include increases in stormwater runoff and pollutant loading to the tidal canal and San Francisco Bay. The project and other future projects in the vicinity would be required to comply with drainage and grading ordinances intended to control runoff and regulate water quality at each development site. Additionally, new projects would be required to demonstrate that stormwater volumes could be managed by downstream conveyance facilities. New development projects in Alameda and Oakland also would be required to comply with Alameda County and City of Oakland ordinances regarding water quality, and ACCWP NPDES permitting requirements. All construction work and dredging activities within the Tidal Canal would require permits from the Corps and RWQCB which require all activities to be conducted in a fashion that minimizes adverse effects to water quality. Therefore, the effect of the project on water quality and hydrology, in combination with other cumulative projects, would not be significant. Additionally, the project itself would reduce impervious surfaces in the project, thereby decreasing runoff from the site.

Mitigation: None required.

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I. Hazardous Materials

Introduction

This section presents issues related to the existence of hazardous materials associated with the project site, project construction, and project operations. This section provides an overview of the regulatory setting that is applicable to human health and safety for the environment regarding hazardous materials at the project site and potential project impacts and appropriate mitigation measures, as necessary.

Environmental Setting

Definitions

Materials and waste may be considered hazardous if they are poisonous (toxicity), can be ignited by open flame (ignitability), corrode other materials (corrosivity), or react violently, explode or generate vapors when mixed with water (reactivity). The term “hazardous material” is defined in the State Health and Safety Code (Chapter 6.95, Section 25501[o]) as any material that, because of quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment.

A hazardous waste, for the purpose of this EIR, is any hazardous material that is abandoned, discarded, or recycled, as defined in the State Health and Safety Code (Chapter 6.95, Section 25125). The transportation, use, and disposal of hazardous materials, as well as the potential releases of hazardous materials to the environment, are closely regulated through many state and federal laws.

Potential Receptors/Exposure

The sensitivity of potential receptors in the areas of known or potential hazardous materials contamination is dependent on several factors, the primary factor being the potential pathway for human exposure. Exposure pathways include external exposure, inhalation, and ingestion of contaminated soil, air, water, or food. The magnitude, frequency, and duration of human exposure can cause a variety of health effects, from short term acute symptoms to long-term chronic effects. Potential health effects from exposure can be evaluated in a health risk assessment. The principle elements of exposure assessments typically include:

- Evaluation of the fate and transport processes for hazardous materials at a given site;
- Identification of potential exposure pathways;
- Identification of potential exposure scenarios;
- Calculation of representative chemical concentrations; and
- Estimation of potential chemical uptake.

Hazardous Building Materials Associated with Demolition

Because of the age of many buildings and structures in Alameda, the potential exists for the structures to contain hazardous building materials. Older buildings can contain building materials that consist of hazardous components such as lead-based paint, asbestos, mercury and polychlorinated biphenyls (PCBs). When these buildings or structures are demolished for the purpose of renovation or new development, these hazardous building materials can become exposed.

Prior to the EPA ban in 1978, lead-based paint was commonly used on interior and exterior surfaces of buildings. Old peeling paint has been found to contaminate near surface soil, and exposure to residual lead has resulted in illness in children.

Asbestos is a naturally occurring fibrous material that was extensively used as a fireproofing and insulating agent in building construction before such uses were banned by EPA in the 1970s. Asbestos can lead to lung disease by inhaling its tiny fibers.

Spent fluorescent light tubes commonly contain mercury vapors. In February 2004, regulations took effect in California that classified all fluorescent lamps and tubes as a hazardous waste. When these lamps or tubes are broken, mercury is released to the environment. Mercury can also be absorbed through the lungs into the bloodstream and can be washed by rain water into waterways.

PCBs are organic oils that were formerly used primarily as insulators in many types of electrical equipment such as transformers and capacitors. After PCBs were determined to be a carcinogen in the mid-to-late 1970s, the USEPA banned PCB use in most new equipment and began a program to phase out certain existing PCB-containing equipment. Fluorescent lighting ballasts manufactured after January 1, 1978, do not contain PCBs and are required to have a label clearly stating that PCBs are not present in the unit. Additional information about these materials is provided in the Regulatory Setting Section below.

Underground Fuel Storage Tanks

Underground storage tanks (USTs) are commonly used for fuel storage and have been for many years. UST design has changed over the years after it was discovered that single walled steel tanks can be relatively easily compromised, causing releases of petroleum hydrocarbons to the subsurface and soil and groundwater contamination. Current UST designs typically contain engineering controls, such as fiberglass construction that resists corrosion, double walled construction, and active monitoring controls that reduce the potential for inadvertent releases to the environment.

Project Site Historical Uses

The proposed project site is located within a light industrial and residential district of Alameda. Development at the project site began in 1897 with residential housing, although another account suggests it was originally used for agricultural purposes (Sequoia, 2007; DTSC, 2006). By 1905, the site was occupied by the Dow Pumping Engine Company. During World War I and until

1941, the site was used for several different industrial uses such as a manufacturer for diesel engines, a brass casting company, and a marine engineering firm that produced dredging equipment, marine machinery, habor tugs, and ship sections. Multiple tenants have occupied the site since 1981.

Soil and Groundwater Contamination

The proposed project site has been the subject of a number of soil and groundwater investigations; however, the investigations have focused on separate portions of the project site. The 2229 Clement Avenue site (APN 71-289-5), otherwise known as the Fox property, has been the subject of its own assessment work (see **Figure 3-1** in the Project Description). 2235 and 2241 Clement Avenue (APN 71-290-1) have also had environmental work done in the form of both assessment and remediation. A summary of these actions and present status is presented below.

2229 Clement Avenue – Fox Property

The Regional Water Quality Control Board (RWQCB) lists this site in its database for sites in the Spills, Leaks, Incidents, and Cleanup (SLIC) program, which covers sites that do not involve contamination from USTs. The database record indicates that the Alameda County Department of Environmental Health (ACDEH) sent a letter to the property owner in 1991 regarding a previous subsurface soil investigation that found polyaromatic compounds and metals in the soils at elevated concentrations, some of which are known to cause cancer (ACDEH, 1991). The letter requested that a corrective action plan be submitted to the RWQCB. No further records exist in the database, and the current status is listed as open but inactive.

2235 and 2241 Clement Avenue

Subsurface soil and groundwater investigations at these addresses were conducted between 1989 and 2002. The investigations concluded that the site soils and groundwater were impacted with metals, including arsenic, lead and total chromium; total petroleum hydrocarbons (TPHs), including benzene, toluene, ethylbenzene and xylenes; and semi volatile compounds (SVOCs), such as naphthalene, 2-methylnaphthalene, chrysene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and dibenzo(a,h)anthracene. Also, PCBs were detected in imported soil stockpiles on the site. As a result, various cleanup activities were conducted over this time period under the oversight of the Department of Toxic Substances Control (DTSC). In 2006, a Removal Action Workplan was developed for the site, and approved by DTSC, which evaluated different remediation methods for the site to meet the standards required for future residential use. The preferred alternative was determined to be excavation and offsite disposal of contaminated soils from three areas of the property. Samples were collected from the bottoms of the excavation areas to confirm that the contaminated material was sufficiently removed prior to backfilling with imported clean fill material.

Sequoia Environmental documented the results of the remediation work in a report titled *Removal Action Implementation Report*, dated February 13, 2007. The report concluded that hazardous substances detected above site cleanup goals were removed from the site. In a letter dated March 15, 2007, the DTSC certified that the site was remediated to cleanup standards for residential development, according to department requirements (DTSC, 2007).

Regulatory Framework

Federal

Hazardous Materials Management

The primary federal agencies with responsibility for hazardous materials management are the USEPA, U.S. Department of Labor Occupational Safety and Health Administration (Fed/OSHA), and the U.S. Department of Transportation (DOT). Federal laws, regulations, and responsible agencies are summarized in **Table 4.I-1** and are discussed in detail in this section.

TABLE 4.I-1
FEDERAL LAWS AND REGULATIONS RELATED TO HAZARDOUS MATERIALS MANAGEMENT

Classification	Law or Responsible Federal Agency	Description
Hazardous Materials Management	Community Right-to-Know Act of 1986 (also known as Title III of the Superfund Amendments and Reauthorization Act (SARA)	Imposes requirements to ensure that hazardous materials are properly handled, used, stored, and disposed of, and imposes requirements to prevent or mitigate injury to human health or the environment in the event that such materials are accidentally released.
Hazardous Waste Handling	Resource Conservation and Recovery Act of 1976 (RCRA)	Under RCRA, the EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous waste from "cradle to grave."
	Comprehensive Environmental Response Compensation Liability Act (CERCLA)	CERCLA, commonly known as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment
	Hazardous and Solid Waste Act	Amended RCRA in 1984, affirming and extending the "cradle to grave" system of regulating hazardous wastes. The amendments specifically prohibit the use of certain techniques for the disposal of some hazardous wastes.
Hazardous Materials Transportation	U.S. Department of Transportation (DOT)	Has the regulatory responsibility for the safe transportation of hazardous materials. The DOT regulations govern all means of transportation except packages shipped by mail (49 CRF).
	U.S. Postal Service (USPS)	USPS regulations govern the transportation of hazardous materials shipped by mail.
Occupational Safety	Occupational Safety and Health Act of 1970	Fed/OSHA sets standards for safe workplaces and work practices, including the reporting of accidents and occupational injuries (29 CFR).
Structural and Building Components (Lead-based paint, PCBs, and asbestos)	Toxic Substances Control Act (TSCA)	Regulates the use and management of PCBs in electrical equipment, and sets forth detailed safeguards to be followed during the disposal of such items.
	U.S. EPA	The EPA monitors and regulates hazardous materials used structural and building components and effects on human health.

State and local agencies often have either parallel or more stringent regulations than federal agencies. In most cases, state law mirrors or overlaps federal law, and enforcement of these laws is the responsibility of the state or of a local agency to which enforcement powers are delegated. For these reasons, the requirements of the law and its enforcement are discussed under either the state or local agency section.

State

In January 1996, the California Environmental Protection Agency (Cal EPA) adopted regulations implementing a Unified Hazardous Waste and Hazardous Materials Management Regulatory Program (Unified Program). The program has six elements: hazardous waste generators and hazardous waste on-site treatment; underground storage tanks; aboveground storage tanks; hazardous materials release response plans and inventories; risk management and prevention programs; and Unified Fire Code hazardous materials management plans and inventories. The plan is implemented at the local level. The Certified Unified Program Agency (CUPA) is the local agency that is responsible for the implementation of the Unified Program. In Alameda, the Alameda County Department of Environmental Health (ACDEH) is the designated CUPA for all businesses.

Hazardous Materials Management

The California 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 the following:

- Details, including floor plans, of the facility and business conducted at the site;
- An inventory of hazardous materials that are handled or stored on site;
- An emergency response plan; and
- A safety and emergency response training program for new employees with annual refresher courses

Hazardous Waste Handling

The Cal EPA Department of Toxic Substances Control (DTSC) regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. State and federal laws require detailed planning to ensure that hazardous materials are properly handled, used, stored, and disposed of, and, in the event that such materials are accidentally released, to prevent or to mitigate injury to health or the environment. Laws and regulations require hazardous materials users to store these materials appropriately and to train employees to manage them safely.

Under the federal Resource Conservation and Recovery Act of 1976 (RCRA), described in Table 4.I-1, individual states may implement their own hazardous waste programs in lieu of RCRA, as long as the state program is at least as stringent as federal RCRA requirements. In California, the DTSC regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. The hazardous waste regulations establish criteria for identifying, packaging, and labeling hazardous wastes; prescribe management of hazardous waste; establish permit requirements for hazardous waste treatment, storage, disposal, and transportation; and identify hazardous wastes that cannot be disposed of in landfills.

Hazardous Materials Transportation

The State of California has adopted DOT regulations for the intrastate movement of hazardous materials. State regulations are contained in Title 26 of the California Code of Regulations (CCR). In addition, the State of California regulates the transportation of hazardous waste originating in the state and passing through the state (26 CCR). Both regulatory programs apply in California. The two state agencies that have primary responsibility for enforcing federal and state regulations and responding to hazardous materials transportation emergencies are the California Highway Patrol (CHP) and the California Department of Transportation (Caltrans).

Occupational Safety

The California Occupational Safety and Health Administration (Cal/OSHA) assumes primary responsibility for developing and enforcing workplace safety regulations in California. Because California has a federally approved OSHA program, it is required to adopt regulations that are at least as stringent as those found in Title 29 of the Code of Federal Regulations (CFR). Cal/OSHA standards are generally more stringent than federal regulations.

Cal/OSHA regulations (8 CCR) concerning the use of hazardous materials in the workplace require employee safety training, safety equipment, accident and illness prevention programs, hazardous substance exposure warnings, and emergency action and fire prevention plan preparation. Cal/OSHA enforces hazard communication program regulations, which contain training and information requirements, including procedures for identifying and labeling hazardous substances, and communicating hazard information relating to hazardous substances and their handling. The hazard communication program also requires that Materials Safety Data Sheets (MSDS) be available to employees, and that employee information and training programs be documented. These regulations also require preparation of emergency action plans (escape and evacuation procedures, rescue and medical duties, alarm systems, and training in emergency evacuation).

State laws, like federal laws, include special provisions for hazard communication to employees in research laboratories, including training in chemical work practices. Specific, more detailed training and monitoring is required for the use of carcinogens, ethylene oxide, lead, asbestos, and certain other chemicals listed in 29 CFR. Emergency equipment and supplies, such as fire extinguishers, safety showers, and eye washes, must also be provided and maintained in accessible places.

Cal/OSHA (8 CCR), like Fed/OSHA (29 CFR) includes extensive, detailed requirements for worker protection applicable to any activity that could disturb asbestos-containing materials, including maintenance, renovation, and demolition. These regulations are also designed to ensure that persons working near the maintenance, renovation, or demolition activity are not exposed to asbestos.

Emergency Response

California has developed an emergency response plan to coordinate emergency services provided by federal, state, and local government and private agencies. Responding to hazardous materials incidents is one part of this plan. The plan is administered by the State Office of Emergency Services (OES), which coordinates the responses of other agencies, including Cal EPA, CHP, CDFG, the San Francisco Bay Regional Water Quality Control Board (RWQCB), and the Alameda County Fire Department (ACFD). The ACFD provides first response capabilities, if needed, for hazardous materials emergencies within the project site vicinity.

Structural and Building Components

Implementation of the project would include demolition of structures which, due to their age, may contain asbestos, polychlorinated biphenyls (PCBs), or lead and lead-based paint. In addition, removal of existing aboveground or underground storage tanks may be required.

Asbestos: State laws and regulations prohibit emissions of asbestos from asbestos-related manufacturing, demolition, or construction activities; require medical examinations and monitoring of employees engaged in activities that could disturb asbestos; specify precautions and safe work practices that must be followed to minimize the potential for release of asbestos fibers; and require notice to federal and local governmental agencies prior to beginning renovation or demolition that could disturb asbestos. Asbestos represents a human health risk when asbestos fibers become airborne (friable) and are inhaled into the lungs.

The BAAQMD is vested by the California legislature with authority to regulate airborne pollutants, including asbestos, through both inspection and law enforcement, and is to be notified ten days in advance of any proposed demolition or abatement work. Cal/OSHA regulates asbestos removal to ensure the health and safety of workers removing asbestos containing materials and also must be notified of asbestos abatement activities.

Polychlorinated Biphenyls (PCBs): As previously discussed, PCBs are organic oils that were formerly placed in many types of electrical equipment and in fluorescent lighting ballasts. PCBs are highly persistent in the environment and are toxic. In 1979, USEPA banned the use of PCBs in most new electrical equipment and began a program to phase out certain existing PCB-containing equipment. The use and management of PCBs in electrical equipment is regulated pursuant to the Toxic Substances Control Act (40 CFR). Fluorescent lighting ballasts that contain PCBs, regardless of size and quantity, are regulated as hazardous waste and must be transported and disposed of as hazardous waste.

Lead and Lead-Based Paint: The California Code of Regulations, Title 22, considers waste soil with concentrations of lead to be hazardous if it exceeds a total concentration of 1,000 parts per million (ppm) and a soluble[1] concentration of 5 ppm. Both the federal and California OSHAs regulate all worker exposure during construction activities that involve lead-based paint. The

1 Capable of being dissolved, especially in water.

Interim Final Rule found in 29 CFR Part 1926.62 covers construction work in which employees may be exposed to lead during such activities as demolition, removal, surface preparation for re-painting, renovation, clean up and routine maintenance. The OSHA-specified method of compliance includes respiratory protection, protective clothing, housekeeping, hygiene facilities, medical surveillance, and training.

Regional

Soil and Groundwater Contamination

In Alameda County, remediation of contaminated sites is performed under the oversight of the ACDEH, the DTSC, or the San Francisco Bay RWQCB. The ACDEH implements a local oversight program under contract with the SWRCB to provide regulatory oversight of the investigation and cleanup of soil and groundwater contamination from leaking petroleum USTs and aboveground storage tanks (ASTs). At sites where contamination is suspected or known to have occurred, the project applicant is required to perform a site investigation and prepare a remediation plan, if necessary. For typical development projects, actual site remediation is completed either before or during the construction phase of the project. Site remediation or development may be subject to regulation by other agencies. As noted above, several properties slated for acquisition have contaminated soil and groundwater, which is currently subject to oversight by ACDEH. Future investigation and remediation of soil or groundwater contamination that is known, or has not yet been identified, would be subject to oversight by ACDEH.

Alameda County Hazardous Waste Management Program

Assembly Bill (AB) 2948 requires counties and cities either to adopt a county hazardous waste management plan as part of their general plan, or to enact an ordinance requiring that all applicable zoning, subdivision, conditional use permit, and variance decisions be consistent with the county hazardous waste management plan. Once each County had its Hazardous Waste Management Program approved by the State, each city had 180 days to 1) adopt a City Hazardous Waste Management Plan containing specified elements consistent with the approved County Hazardous Waste Management Plan; 2) incorporate the applicable portions of the approved Plan, by reference, into the City's General Plan, or 3) enact an ordinance that requires all applicable zoning, subdivision, conditional use permits, and variance decisions be consistent with the specified portions of the plan. Alameda County has adopted a Hazardous Waste Management Program that addresses procedures for hazardous materials incidents.

Under the Unified Hazardous Waste and Hazardous Materials Management Regulatory Program, the ACDEH is certified by the DTSC to implement the following programs:

- Hazardous Materials Management Plan and Inventory (HMMP) and the Hazardous Materials Business Plan (HMBP)
- Risk Management program (RMP)
- UST program
- Spill Prevention, control and Countermeasure (SPCC) Plan for ASTs

- Hazardous waste generators
- On-site hazardous waste treatment (tiered permit).

Submittal of updated HMMP and HMBP to the ACDEH in accordance with changes to hazardous materials storage and disposal locations and volumes in association with implementation of the project and future operation of the hospital would be required. Potential removal or installation of USTs or ASTs under the project would also be subject to oversight by ACDEH.

Local Plans and Policies

The *City of Alameda General Plan* includes several Guiding Policies and Implementing Policies governing response to hazardous material incidents. These include, but are not limited to, clarifying responsibilities for resolving incidents of hazardous materials release (*Guiding Policy 8.4.*b) and requiring entities that store hazardous materials to have the training and capacity to respond to their own emergencies (*Implementing Policy 8.4.i*).

Impacts and Mitigation Measures

Significance Criteria

A project would generally be considered to have a significant adverse impact on the environment if it 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.
- Result in a safety hazard for people residing or working in the project site vicinity for a project within the vicinity of a private airstrip.
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan.

Impact Analysis

This following impact analysis focuses on potential impacts of the proposed project related to hazards and hazardous materials. The following Appendix G criteria are not considered relevant to the project based upon the proposed project plans and data research; therefore, they will not be evaluated further in this EIR:

> *Release of Hazardous Materials through Upset and Accidents*: The proposed project would not handle, store, transport, or dispose of significant quantities of hazardous materials. The volumes of hazardous materials that would be associated with the proposed uses, though not quantifiable, would not be significant compared to industrial or manufacturing uses where emissions are of a greater concern.
>
> *Hazardous Materials Emissions within One Quarter Mile of a School*: As stated above, the quantities of hazardous materials at the proposed site would be limited and therefore would not represent a potential impact to any schools in the area.
>
> *Vicinity of Airstrip*: The Development Plan Area is not located within two miles of any airport or private airstrip and therefore there would be no impact.
>
> *Emergency Response Plan or Evacuation Plan:* The proposed project would result in an increased resident, employee and visitor population in the project area. As stated in Section 4.B, Transportation and Circulation, the proposed project would not alter the existing street network and would comply with all emergency vehicle access requirements. Overall, the proposed project would not impede an emergency access route or emergency response requirements and would not result in permanent road closures, and therefore, would not physically interfere with emergency response or evacuation plans.

Construction-Related Impacts

Impact 4.I-1: Demolition of the existing structures that contain hazardous building materials—such as lead-based paint, asbestos, and PCBs—could expose workers, the public, or the environment to these hazardous materials and would generate hazardous waste. (Significant)

Demolition of existing structures on the project site may expose construction workers, the public, or the environment to hazardous materials such as lead-based paint, asbestos, and PCBs. The level of potential impact is dependent upon the age, construction, and building materials of each building. Based on the age of the existing structures, any of these hazardous building materials could be present at the site which, if disturbed, could expose workers and the public during demolition. Any remaining asbestos containing materials (ACMs) would need appropriate abatement of identified asbestos prior to demolition. ACMs are regulated both as a hazardous air pollutant under the Clean Air Act and as a potential worker safety hazard under the authority of Cal-OSHA. Potential exposure to these hazardous building materials can be reduced through appropriate abatement measures.

Both the federal OSHA and Cal-OSHA regulate worker exposure during construction activities that disturb lead-based paint. The Interim Final Rule found in 29 CFR 1926.62 covers construction work in which employees may be exposed to lead during such activities as demolition, removal, surface preparation for repainting, renovation, cleanup, and routine maintenance. The OSHA-specified compliance includes respiratory protection, protective clothing, housekeeping, special high-efficiency filtered vacuums, hygiene facilities, medical surveillance, and training. No minimum level of lead is specified to activate the provisions of this regulation.

Exposure to asbestos, and the resulting adverse health effects, is possible throughout the demolition and renovation phases if materials that contain asbestos are present. In structures slated for demolition under the project, any asbestos-containing materials would be abated in accordance with state and federal regulations prior to the start of demolition or renovation activities.

Section 19827.5 of the California Health and Safety Code requires that local agencies not issue demolition or alteration permits until an applicant has demonstrated compliance with notification requirements under applicable federal regulations regarding hazardous air pollutants, including asbestos. The BAAQMD is vested by the California legislature with authority to regulate airborne pollutants, including asbestos, through both inspection and law enforcement, and is to be notified 10 days in advance of any proposed demolition or abatement work. The provisions that cover these operations are found in District Regulation 11, Rule 2.

Notification includes the names and addresses of operations and persons responsible; description and location of the structure to be demolished/altered including size, age, and prior use, and the approximate amount of friable asbestos; scheduled starting and completion dates of demolition or abatement; nature of planned work and methods to be employed; procedures to be employed to meet BAAQMD requirements; and the name and location of the waste disposal site to be used. The BAAQMD randomly inspects asbestos removal operations and will inspect any removal operation about which a complaint has been received.

Asbestos abatement contractors must follow state regulations contained in 8 CCR 1529 and 8 CCR 341.6 through 341.14 where there is asbestos-related work involving 100 square feet or more of asbestos-containing material. Asbestos removal contractors must be certified as such by the Contractors Licensing Board of the State of California. The owner of the property where abatement is to occur must have a hazardous waste generator number assigned by and registered with the DTSC in Sacramento. The applicant and the transporter of the waste are required to file a hazardous waste manifest that details the transportation of the material from the site and its disposal.

Fluorescent lighting ballasts manufactured prior to 1978, and electrical transformers, capacitors, and generators manufactured prior to 1977, may contain PCBs. In accordance with the Toxic Substances Control Act and other federal and state regulations, the applicant would be required to properly handle and dispose of electrical equipment and lighting ballasts that contain PCBs, reducing potential impacts to a less-than-significant level.

Mitigation Measure 4.I-1a: Each structure proposed for demolition shall be assessed by qualified licensed contractors for the potential presence of lead-based paint or coatings, asbestos containing materials, and PCB-containing equipment prior to issuance of a demolition permit.

Mitigation Measure 4.I-1b: If the assessment required by Mitigation Measure 4I-1a finds presence of lead-based paint, asbestos, and/or PCBs, the project applicant shall create and implement a health and safety plan to protect workers from risks associated with hazardous materials during demolition or renovation of affected structures.

Mitigation Measure 4.I-1c: If the assessment required by Mitigation Measure 4I-1a finds presence of lead-based paint, the project applicant shall develop and implement a lead-based paint removal plan. The plan shall specify, but not be limited to, the following elements for implementation:

- Develop a removal specification approved by a Certified Lead Project Designer.
- Ensure that all removal workers are properly trained.
- Contain all work areas to prohibit off-site migration of paint chip debris.
- Remove all peeling and stratified lead-based paint on building and non-building surfaces to the degree necessary to safely and properly complete demolition activities according to recommendations of the survey. The demolition contractor shall be responsible for the proper containment and disposal of intact lead-based paint on all equipment to be cut and/or removed during the demolition.
- Provide on-site personnel and area air monitoring during all removal activities to ensure that workers and the environment are adequately protected by the control measures used.
- Clean up and/or vacuum paint chips with a high efficiency particulate air (HEPA) filter.
- Collect, segregate, and profile waste for disposal determination.
- Properly dispose of all waste.

Mitigation Measure 4.I-1d: If the assessment required by Mitigation Measure 4.I-a finds asbestos, the project applicant shall ensure that asbestos abatement shall be conducted by a licensed contractor prior to building demolition. Abatement of known or suspected ACMs shall occur prior to demolition or construction activities that would disturb those materials. Pursuant to an asbestos abatement plan developed by a state-certified asbestos consultant and approved by the City, all ACMs shall be removed and appropriately disposed of by a state certified asbestos contractor.

Mitigation Measure 4.I-1e: If the assessment required by Mitigation Measure 4I-1a finds PCBs, the project applicant shall ensure that PCB abatement shall be conducted prior to building demolition or renovation. PCBs shall be removed by a qualified contractor and transported in accordance with Caltrans requirements.

Implementation of **Mitigation Measures 4.I-1a** through **4.I-1e** would reduce impacts to less than significant levels.

Significance after Mitigation: Less than Significant.

Impact 4.I-2: Construction of the proposed project would disturb soil and groundwater impacted by historic hazardous material use, which could expose construction workers, the public, or the environment to adverse conditions related to hazardous materials handling. (Significant)

As discussed above, the soil and groundwater at the proposed project site has been contaminated from historical industrial uses. The contamination discovered at 2235 and 2241 Clement Avenue was remediated, and DTSC has certified the site for residential use. However, areas that may previously have been inaccessible due to the presence of existing structures could potentially contain pockets of previously unidentified contamination. Construction activities would include demolition of existing buildings, excavation and trenching, which could potentially intercept and/or disturb or uncover impacted soil and/or groundwater.

The project would involve excavation for installation of building substructures and subgrade utilities, and would involve grading that could be substantial in certain areas. Soil disturbance during construction could disperse existing contamination into the environment and expose construction workers and the public to contaminants. Significant undetected levels of contamination in soils could result in various short-term health effects such as nausea, vomiting, headache, dizziness, or burns. This would result in a potentially significant impact.

> **Mitigation Measure 4.I-2a:** The project applicant shall prepare a health and safety plan, based on the site conditions and past contaminant release history and remediation, by a licensed industrial hygienist. The health and safety plan shall identify potential contaminants that may be encountered, appropriate personal protective equipment, and worker safety procedures for spills and accidents.

> **Mitigation Measure 4.I-2b:** To reduce environmental risks associated with encountering contaminated soil discovered during grading and construction, the project applicant shall ensure that any suspected contaminated soil is stockpiled separately, sampled for hazardous material content, and disposed of in accordance with all applicable state, federal, and local laws and regulations. All contaminated soil determined to be hazardous or non-hazardous waste shall have received all laboratory analyses for acceptable disposal as required by the receiving facility before it can be removed from the site.

> **Mitigation Measure 4.I-2c:** Prior to issuance of any building or grading permits, any areas of identified contamination shall have completed all measures required by ACDEH, DTSC or RWQCB for site closure, and shall be certified for residential use. Where necessary, additional remediation to permit residential use and occupancy of the project shall be accomplished by the project applicant prior to issuance of any building or grading plans.

Implementation of **Mitigation Measures 4.I-2a** through **4.I-2c** would reduce impacts to less than significant levels.

Significance after Mitigation: Less than Significant.

Hazardous Materials Use, Storage, and Disposal

Impact 4.I-3: The project would involve the transportation, use, and storage of hazardous chemicals, which could present public health and/or safety risks to residents, visitors, and the surrounding area. (Less than Significant)

Hazardous materials associated with residential land use generally include various products associated with building maintenance, landscape management (i.e. pesticides and herbicides, etc.), and products related to automobile cleaning and maintenance. These uses would likely involve a wide range of chemical compounds and products that are considered hazardous. Exposure to hazardous chemicals could cause acute or chronic health effects to residents and visitors.

Hazardous materials for building and landscaping maintenance would typically be stored in their original containers in a centralized location prior to use. However, the volume of hazardous materials that would be associated with the proposed project would likely be limited to relatively small quantities. In addition, required compliance with applicable regulatory requirements would minimize hazards to residents, the public, and the environment from waste products.

Mitigation: None required.

Impact 4.I-4: Hazardous materials used onsite during construction activities (i.e. solvents) could be spilled through improper handling or storage, potentially increasing public health and/or safety risks to future residents, maintenance workers, visitors, and the surrounding area. (Less than Significant)

Construction activities would require the use of certain hazardous materials such as fuels, oils, solvents, and glues. Inadvertent release of large quantities of these materials into the environment could adversely impact soil, surface waters, or groundwater quality. The use of construction best management practices typically implemented as part of construction and as required by the Storm Water Pollution Prevention Plan (discussed further in the *Hydrology Section*) would minimize the potential adverse effects to groundwater and soils. These could include the following:

- Follow manufacturer’s recommendations on use, storage and disposal of chemical products used in construction;
- Avoid overtopping construction equipment fuel gas tanks;

- During routine maintenance of construction equipment, properly contain and remove grease and oils.
- Properly dispose of discarded containers of fuels and other chemicals.

Construction projects, such as the one that would be undertaken for the proposed project, would require certain hazardous materials (fuels, adhesives, solvents), that, if improperly used and inadvertently released, could result in a hazard to workers, the public, or the environment. However, the hazardous materials typically used on a construction site are brought onto the site packaged in consumer quantities and used in accordance with manufacturer recommendations. The overall quantities of these materials on the site at one time does not result in large bulk amounts that, if spilled, could cause a significant soil or groundwater contamination issue. Spills of hazardous materials on construction sites are typically localized and are cleaned up in a timely manner. Given the quantities of hazardous materials typically needed for construction projects such as the proposed project and the use of best management practices by the individual construction contractors, the threat of exposure to the public or contamination to soil and groundwater from construction-related hazardous materials is considered a less than significant impact.

Mitigation: None required.

Cumulative Impacts

Impact 4.I-5: Hazards at the project site could contribute to cumulative hazards in the vicinity of the project site. (Less than Significant)

Cumulative hazardous materials effects could occur if activities at the project site and other past, existing and proposed development, together, could significantly increase risks in the regional vicinity of the project site. However, most routine hazardous materials activities at the project site would likely involve relatively small quantities of hazardous materials both in interior and exterior settings. Any health or safety effects of routine hazardous materials use would be limited to the specific individuals using the materials and anyone in the immediate vicinity of the use. No interaction would occur between these routine activities and similar activities at different sites. In addition, based on the estimated slight increase in usage of hazardous materials due to construction and operation of the proposed project, there would not be a substantial change in the amount of hazardous materials handled on the proposed project site.

Cumulative health and safety impacts could occur if project-related outdoor or offsite hazards were to interact or combine with those of other existing and proposed development. This could only occur through the following mechanisms: air emissions; transport of hazardous materials and waste to or from the project site; inadvertent release of hazardous materials to the sanitary sewer, storm drain, or non-hazardous waste landfill; and potential accidents that require hazardous materials emergency response capabilities. Air emissions are addressed in Section IV.C, Air

Quality. The proposed project would not involve a significant increase in the quantities of hazardous materials, and hazardous materials use would be similar to the use in the surrounding residential area. Cumulative increases in the transportation of hazardous materials and wastes would cause a less than significant impact because the probability of such accidents is relatively low, and the use of legally required packaging minimizes the consequences of potential accidents. In addition, all projects in the area would be required to comply with the same laws and regulations as the project. This includes federal and state regulatory requirements for transporting (Cal EPA and Caltrans) hazardous materials or cargo (including fuel and other materials used in all motor vehicles) on public roads or disposing of hazardous materials (Cal EPA, DTSC, ACEHD).Therefore, this cumulative impact would be less than significant.

Mitigation: None required.

References – Hazardous Materials

Alameda County Department of Environmental Health (ACDEH), *Subsurface Investigation 2229 Clement Avenue, Alameda 94501*, December 18, 1991.

Department of Toxic Substances Control (DTSC), *Remedial Certification Letter for 2235 & 2241 Clement Avenue, Alameda California*, March 15, 2007.

Department of Toxic Substances Control (DTSC), *The Collins Property Removal Action Workplan Is Available For Review*, Fact Sheet, *February*, 2006.

Sequoia Environmental Corporation, *Removal Action Implementation Report, 2235 & 2241 Clement Avenue, Alameda California*, February 13, 2007.

CHAPTER 5
Alternatives

The purpose of this chapter is to describe and evaluate alternatives to the proposed project. Alternatives are developed to assist in identifying methods to substantially lessen or avoid any of the significant environmental effects of the proposed project, as identified in Chapter 4.

A. CEQA Requirements

CEQA requires that an EIR describe and evaluate a range of reasonable alternatives to the proposed project, or to the location of the proposed project, and evaluate the comparative merits of the alternatives (*CEQA Guidelines* Section 15126.6(a)). The "range of alternatives" is governed by the "rule of reason," which requires the EIR to set forth only those alternatives necessary to permit informed public participation and an informed and reasoned choice by the decision-making body (Section 15126.6(f)).

A reasonable range of alternatives must include alternatives that would feasibly attain most of the basic objectives of the project and would avoid or substantially lessen any of the significant effects of the project (*CEQA Guidelines* Section 15126.6(a)-(c)). CEQA generally defines "feasible" to mean an alternative that is capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, technological, and legal factors. In addition, the following may be taken into consideration when assessing the feasibility of alternatives: site suitability; economic viability; availability of infrastructure; general plan consistency; other plans or regulatory limitations; jurisdictional boundaries; and the ability of the proponent to attain site control (Section 15126.6(f)(1)). If the lead agency concludes that no feasible alternative locations exist, it must disclose the reasons for this conclusion, and should include the reasons in the EIR (Section 15126.6(f)(2)(B)).

The description or evaluation of alternatives does not need to be exhaustive, and an EIR need not consider alternatives for which the effects cannot be reasonably determined and for which implementation is remote or speculative. An EIR need not describe or evaluate the environmental effects of alternatives in the same level of detail as the proposed project, but must include enough information to allow meaningful evaluation, analysis, and comparison with the proposed project.

The "no project" alternative must be evaluated. This analysis shall discuss the existing conditions, as well as what could be reasonably expected to occur in the foreseeable future if the project were to be approved, based on current plans and consistent with available infrastructure and community services (*CEQA Guidelines* Section 15126.6(e)(2)).CEQA also requires that an environmentally superior alternative be selected from among the alternatives. In general, the environmentally superior alternative is the alternative with the fewest adverse impacts to the project area and its surrounding environment. When the "No-Project" alternative is the environmentally superior alternative, an EIR must also identify an environmentally superior alternative from among the other alternatives (*CEQA Guidelines* Section 15126.6(e)(2)).

B. Factors in the Selection of Alternatives

The *CEQA Guideline*s recommend that an EIR should briefly describe the rationale for selecting the alternatives to be discussed, identify any alternatives that were considered by the lead agency but were rejected as infeasible, and briefly explain the reasons underlying the lead agency's determination (*CEQA Guidelines* Section 15126.6(c)). The following factors were considered in identifying the reasonable range of alternatives to the project for this EIR:

- The extent to which the alternative would accomplish most of the basic objectives of the project;
- The extent to which the alternative would avoid or lessen any of the identified significant and unavoidable environmental impacts of the project;
- The feasibility of the alternative, taking into account site suitability, availability of infrastructure, general plan consistency, consistency with other applicable plans and regulatory limitations, and other factors;
- The extent to which an alternative contributes to a "reasonable range" of alternatives necessary to permit a reasoned choice; and
- The requirement of the *CEQA Guidelines* to consider a "No-Project" alternative and to identify an "environmentally superior" alternative in addition to the no-project alternative (*CEQA Guidelines* Section 15126.6(e)).

Project Objectives

As previously presented in Chapter 3, *Project Description*, the basic objectives of the proposed Boatworks Residential Project are the following:

- Eliminate blighting influences and correct environmental deficiencies in the area including, but not limited to, abandoned buildings, incompatible land uses, depreciated or stagnant land values, contamination, inadequate public improvements, facilities and utilities.
- Plan, redesign, and develop an underutilized site approximately 9.5 acres in size to complement the surrounding residential neighborhoods.
- Provide a variety of housing types consistent with City of Alameda Housing Element goals and objectives.
- Increase the supply of affordable housing in the City of Alameda.

- Reduce the impact of the automobile and energy consumption though site design and by facilitating public transit opportunities, providing for bicycle paths and pedestrian paths through the site and along the waterfront.
- Improve public access to and views of the waterfront by providing a waterfront promenade and views to through the site to the waterfront from Clement Avenue.

Significant Impacts

The proposed project would result in significant and unavoidable impacts to transportation (Impacts 4.B-3, 4.B-4, 4.B-8, 4.B-9, 4.B-10, 4.B-17, and 4.B-18), air quality (Impacts C-1, C-5, and C-6), and cultural resources (Impacts E-1 and E-5). The alternatives selected for evaluation are intended to avoid or reduce these significant and unavoidable impacts. The impact discussion of each alternative below also addresses each alternative's ability to avoid or reduce each of the significant but mitigable impacts identified for the project.

C. Alternatives Selected for Consideration

With consideration given to the factors for selecting a range of reasonable alternative as described in Section A and the project objectives listed in Section B, the Lead Agency, the City of Alameda ("City"), identified the following reasonable range of project alternatives to be addressed in this EIR:

- No Project Alternative
- Preservation Alternative
- Reduced Density Alternative
- City Park Alternative

D. Description and Analysis of Alternatives

The description of each alternative is followed by a discussion of its impacts and how they differ from the impacts of the proposed project. As permitted by CEQA, the significant effects of the alternatives are discussed in less detail than are the effects of the project (CEQA Guidelines, Section 15126.6(d)). However, the analysis is conducted at a sufficient level of detail to provide project decision-makers adequate information to fully evaluate the alternatives and to approve any of the alternatives without further environmental review.

The discussion of each alternative addresses the alternative's ability to avoid or reduce the significant impacts identified for the project. The impacts for the alternatives, in comparison to the proposed project's impacts, are summarized in **Table 5-1** at the end of this chapter. The ability of each alternative to meet the basic project objectives is discussed under each alternative analysis.

The manner in which each of the mitigation measures identified for the proposed project would apply to the analyzed alternatives is summarized **Table 5-2**, at the end of this chapter.

No Project Alternative

Consideration of a No Project Alternative is required under CEQA. This Alternative is analyzed consistent with the requirements of State *CEQA Guidelines* 15126.6(e)(3)(A), which states that when the project under evaluation is the revision of an existing land use or regulatory plan, the "no project" alternative will be the continuation of the existing plan.

Under the No Project Alternative, the project site would remain in its current condition for an unknown period of time. The existing buildings would not be demolished, and the hardscape and parking areas would remain. Access to the site would continue to be controlled with a chain-link fence and gate.

The No Project Alternative assumes no changes in the existing environment, and assumes continuation of the existing conditions on the site.

This alternative would not include a rezoning or General Plan amendment. The waterfront land between the project site and the Oakland Estuary could be rehabilitated in the future with a waterfront park, running from the Estuary in the north 300 feet southward across the project site. Multifamily housing could be developed south of that the waterfront park. Although it is reasonable to assume that the project site would eventually be developed, no other plans for the project site are currently under consideration. None of the mitigation measures identified for the proposed project would be applicable to the No Project Alternative. Therefore, should the proposed project be rejected, the No Project Alternative assumes no change in the existing environment, and assumes continuation of the existing conditions on the site.

Impacts

Land Use

Under this alternative the existing conditions on the site would remain. Without an approved development plan for the site, there would be no financial incentive or resources to fund improvements to the property. Public access to the waterfront would continue to be prohibited, and the existing structures on the site would continue to deteriorate.

Transportation and Circulation

The No Project Alternative would not generate any trips, and this alternative would not result in any of the transportation improvements proposed as part of the project, such as the bicycle and pedestrian access along the waterfront and the new sidewalks on Oak Street, where no sidewalks currently exist. Because the majority of the significant impacts associated with the project are cumulative traffic impacts, it should be expected that those intersections and roadways will continue to be impacted under the no project alternative.

Air Quality

Because no construction would occur on the site, there would be no impacts due to construction activities on air quality under this scenario, and no operation-related air quality impacts would occur.

Noise

Because no construction would occur on the site, there would be no construction-related or operational noise impacts caused by the No Project Alternative.

Cultural and Historic Resources

This alternative would preserve the fundamental structure of the two historic buildings on the site, including the exterior facades of both buildings. Therefore, the existing architectural character of the project site would be substantially preserved. This alternative would have, at least in the short term, a less-than-significant impact on cultural resources, as compared to the significant impact of the proposed project. However, it should be recognized that under the No Project Alternative, the condition of the existing buildings would continue to deteriorate.

Biological Resources

Under this scenario, the clean up of the dilapidated piers and construction of a small boat marina would not occur. Existing water quality issues associated with the current conditions would continue.

Geology and Seismicity

With no change to the existing conditions on the site, there would be no impacts related to geology and seismicity. Given the current conditions of the structures on the site, it would be necessary to ensure that people are not allowed inside the buildings, which are currently unsafe to occupy.

Hydrology and Water Quality

Under this scenario, existing water quality issues associated with the current conditions would continue. Runoff from the site to the Estuary would continue, and no landscaping or reduction in impermeable surfaces associated with the project would occur.

Hazardous Materials

The interior areas of the buildings may require additional remediation, which would not occur, and existing hazardous material conditions in the buildings would remain.

Conclusion

The No Project Alternative would eliminate or substantially reduce all project-related impacts. If the No Project Alternative were implemented, no components of the project would be built, and the existing five vacant buildings, parking lot, and hardscape area would remain on the project site. No change in land use would occur, and there would be no significant impact to cultural resources, although the existing buildings would continue to deteriorate over time. The strip of land between the project site and the waterfront would continue to have dilapidated and deteriorating piers, as there are no proposals to remove them under the No Project Alternative.

The No Project Alternative would not meet any of the objectives of the proposed project, in particular to eliminate blighting influences and correct environmental deficiencies in the area. Furthermore, the No Project Alternative would not support the City's affordable housing goals.

Preservation Alternative

The Preservation Alternative would retain and rehabilitate the circa 1910 Steel Fabrication Shop and Warehouse, and the circa 1910 Compressor Room/Storage Building (see **Figure 5-1**). This alternative would construct new in-fill residential uses elsewhere on the project site in a manner similar to the proposed project, yet at a reduced size and density; approximately 171 residential units would be developed, compared to 242 units with the proposed project. The circulation pattern would also be revised to accommodate the existing historic buildings.

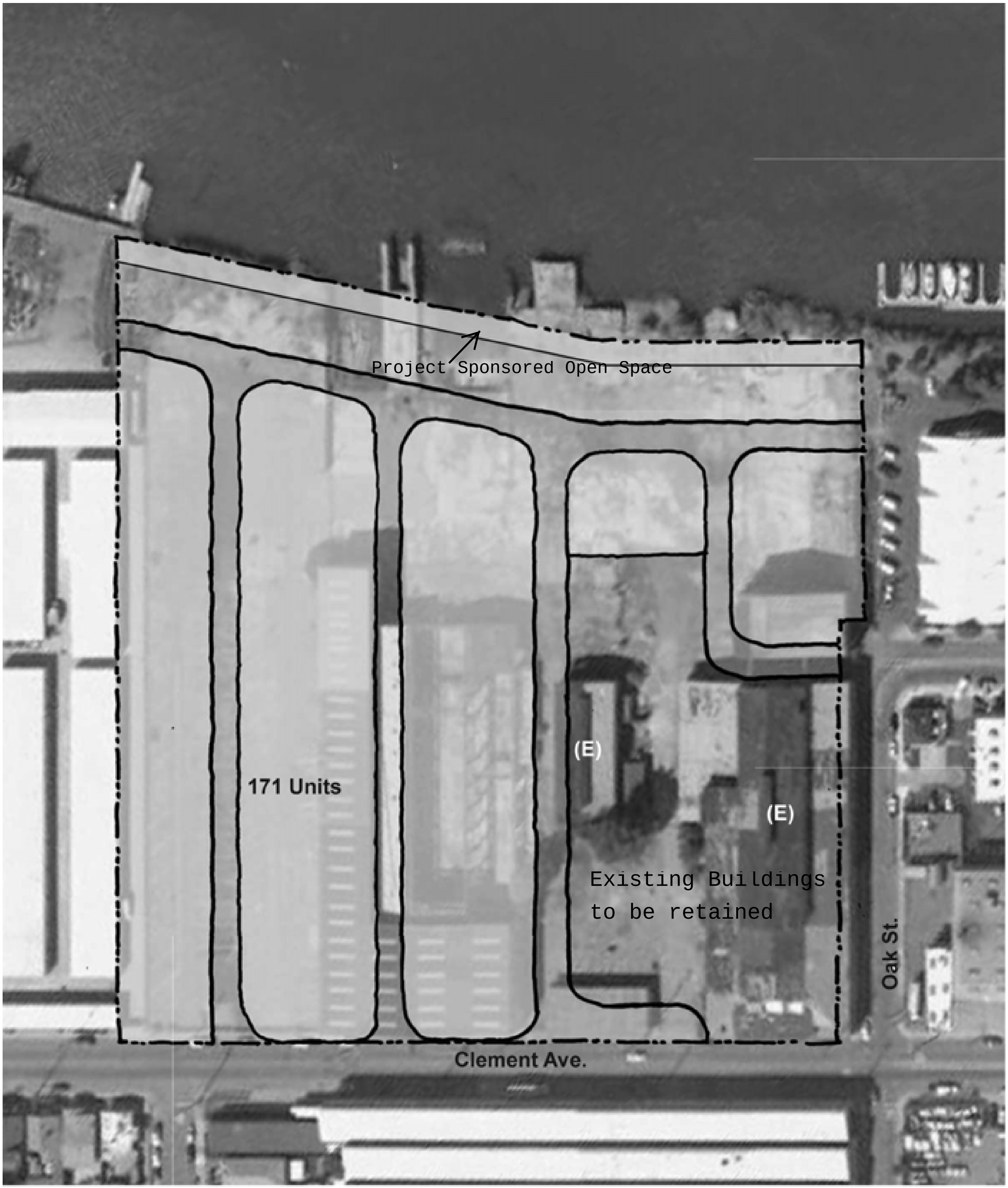
It is assumed that the Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building would be upgraded for ADA and seismic code compliance, and all rehabilitation efforts would be consistent with the guidance provided by the *Secretary of the Interior's Standards for Rehabilitation* ("*Secretary's Standards*"). The Secretary of the Interior defines rehabilitation as "the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values." The full set of ten principles which guide the *Secretary's Standards* are provided in **Appendix H**.

The Compressor Room/Storage Building, specifically, would be retained and rehabilitated for use as a community center. The Steel Fabrication Shop and Warehouse would be retained and rehabilitated for use as a recreation center or commercial space that is compatible with the proposed residential uses immediately adjacent to this building. While not all of the large interior spaces of the industrial building must be retained to comply with the *Secretary's Standards*, at least some portions of the interior, high-bay form and exposed wood roof trusses and posts would be retained to convey the building's former industrial use.

Impacts

Land Use

This alternative, like the proposed project, would require rezoning and a *General Plan* amendment to allow for the residential land uses on the site. The new residential buildings would be similar in design and scale to those of the proposed project, while the retained buildings' design and scale would remain the same. This alternative would retain two existing buildings,



SOURCE: Philip Banta & Associates

Boatworks Residential Project . 208559

Figure 5-1
Preservation Alternative Site Plan

which would be converted to commercial or recreational uses. These uses would be different from those included in the proposed project, but they would not create a substantial change in land use compared to the proposed project.

Transportation and Circulation

The Preservation Alternative would generate fewer trips than the proposed project, as it would involve developing approximately 171 residential units and would include reuse of the Shop and Warehouse for recreation or commercial uses. The Preservation Alterative would have many of the same significant and unavoidable impacts identified for the proposed project related to traffic and circulation. The a.m. peak hour impact to the intersection of Park Avenue and Blanding would still be significant and unavoidable, as well as, the cumulative transit impact, the cumulative impact to the Park Street and Clement Avenue intersection, and the cumulative regional arterial impact on Park Street. As show in Table 5-2, Mitigation Measures B-3, B-4, B-5, B-8, B-9, B-10, B-11, B-12, and B-17 associated with roadway and intersection impacts under the proposed project would apply. Mitigation Measure B-18 would not apply.

Air Quality

Because construction, including rehabilitation, would occur under the Preservation Alternative, construction impacts on air quality would be similar to the proposed project. Operation-related air quality impacts would be similar to the proposed project and would be less than significant. Mitigation Measures C-1, C-2, and C-6 would be implemented.

Noise

Construction and rehabilitation under the Preservation Alternative would involve essentially the same construction activities as the proposed project, but demolition activities would be slightly reduced. Overall, the impacts would be the same as identified for the project, and Mitigation Measures D-1 and D-4 would be implemented under this alternative.

Cultural and Historic Resources

This alternative would preserve the fundamental structure of the two historic buildings on the site, including the exterior facades of both buildings. Therefore, the character of the project site would be substantially preserved, though the surrounding onsite context would be altered. Mitigation Measures E-2, E-3, and E-4 would be implemented under this alternative. Mitigation Measure E-1 would not be implemented because the subject buildings would be preserved. This alternative would have a less-than-significant impact on cultural resources compared to the significant impact of the proposed project.

Biological Resources

Similar to the proposed project, this alternative would require redevelopment of the entire site and would include clean up of the dilapidated piers and construction of a small boat marina. The Preservation Alternative, with implementation of project-identified Mitigation Measures F-1, F-2, F-3, F-4, and F-5, would also have a less-than-significant impact on biological resources.

Geology and Seismicity

Similar to the proposed project, this alternative would involve redevelopment of the entire site, even with the retention of the two historic buildings on site. This is because the retained buildings would need to be seismically retrofitted to meet current California Building Code standards. With implementation of project-identified Mitigation Measures G-1, G-2, and G-3, this alternative would also have a less-than-significant impact related to geology and seismicity.

Hydrology and Water Quality

Similar to the proposed project, this alternative would involve redevelopment of the entire site. Mitigation Measures H-3 and H-4 would be implemented under this alternative. The less-than-significant impacts to hydrology and water quality would therefore be similar to those of the proposed project.

Hazardous Materials

Similar to the proposed project, this alternative would involve redevelopment of the entire site. The interior areas of the two historic buildings would require remediation to function as commercial or recreation spaces. Mitigation Measures I-1 and I-2 would be implemented. The less-than-significant impacts related to hazards and hazardous materials would be similar to the proposed project.

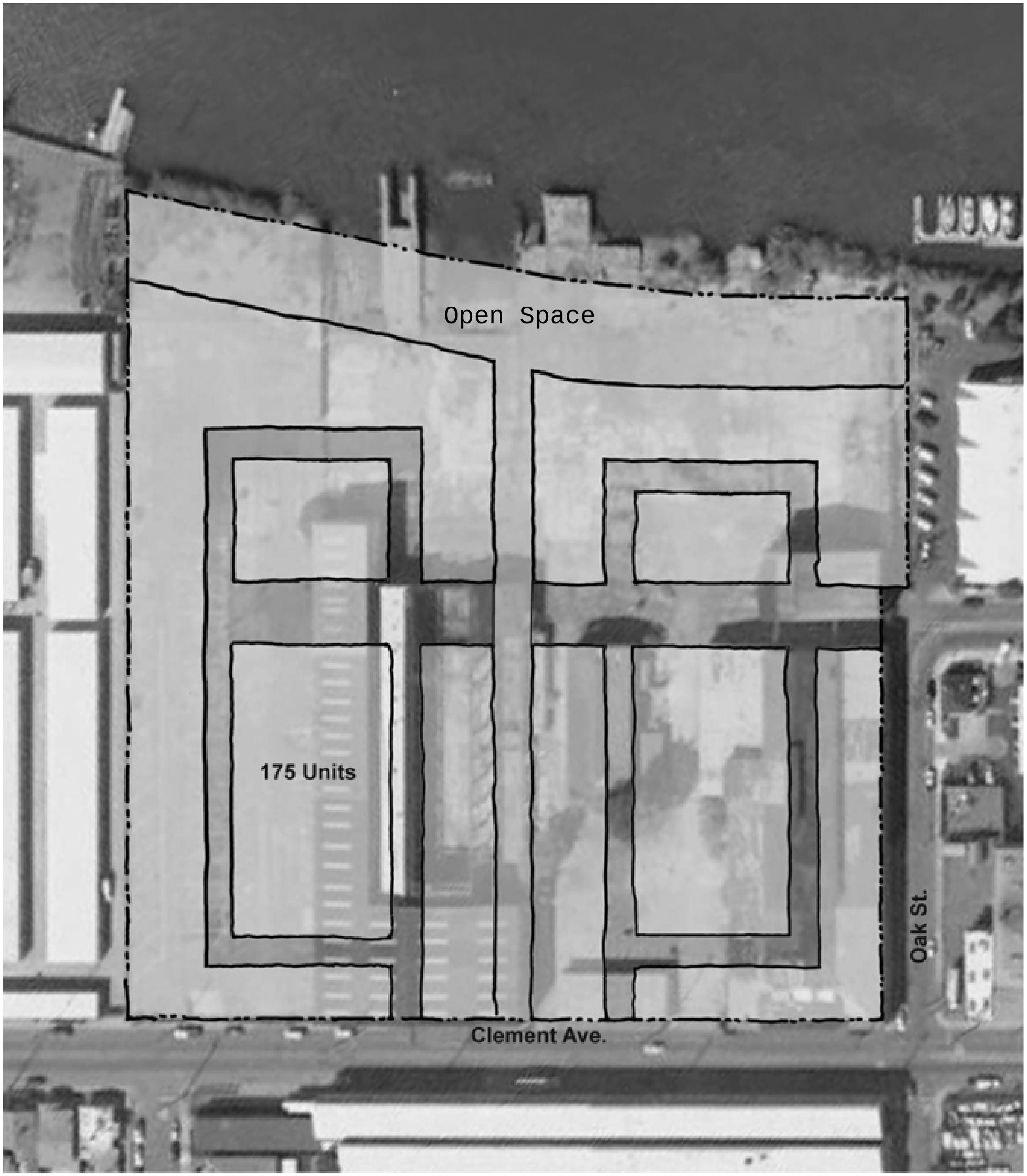
Conclusion

The Preservation Alternative would meet the basic objectives of the proposed project, in particular to eliminate blighting influences and correct environmental deficiencies in the area and redeveloping the underutilized site. In addition, the Preservation Alternative would support the City's affordable housing goals and improve public access to and views of the waterfront.

Reduced Density Alternative

Under the Reduced Density Alternative, the existing buildings would be demolished, and the hardscape and parking areas would be removed, similar to the proposed project. However, the Reduced Project Alternative would involve construction of 175 housing units rather than 242 housing units. The Reduced Project Alternative would include internal circulation roadways and pedestrian paths, a small boat marina, and a wider waterfront esplanade in comparison to the proposed project (see **Figure 5-2** at the end of this chapter).

The waterfront land between the project site and the Oakland Estuary would be rehabilitated under this alterative, similar to the Proposed Project, but the Reduced Density Alternative would allow for a larger publicly accessible waterfront open space to be provided by the project.



SOURCE: Philip Banta & Associates

Boatworks Residential Project . 208559

Figure 5-2
Reduced Density Alternative Site Plan

Land Use

This alternative would require rezoning and a *General Plan* amendment, similar to the proposed project. The new buildings would have similar height and footprints to those included in the proposed project. This alternative would generally involve a less intense residential use of the project site, with increased open space and recreational use. The Reduced Density Alterative, like the proposed project, would have less than significant impacts on land use. However, this alternative would adhere to BCDC policies related to public access better than the proposed project as it would provide much land for recreational enjoyment along the waterfront.

Transportation and Circulation

This alternative would reduce the total number of units on the project site, thereby decreasing trip generation associated with residential units. Although the increased park space could draw some additional visitors to the site, the Reduced Project Alternative would generate fewer vehicle and transit trips than the proposed project. Under this alternative, many of the significant and unavoidable traffic impacts would still occur, but the severity of the impacts would be lessened compared to the proposed project. The a.m. peak hour impact to the intersection of Park Avenue and Blanding would still be significant and unavoidable, as well as, the cumulative transit impact, the cumulative impact to the Park Street and Clement Avenue intersection, and the cumulative regional arterial impact on Park Street. Mitigation Measures B-3, B-4, B-5, B-8, B-9, B-10, B-11, B-12, and B-17 would apply. Mitigation Measures B-18 would not apply. The project’s contribution to cumulative impacts would be lessened.

Air Quality

This alternative would reduce the total number of units on the project site, thereby decreasing total trip generation and associated air quality emissions. Although recreation use would draw some additional visitors to the site, this alternative would generate fewer mobile air quality emissions and have fewer air quality impacts than the proposed project. Mitigation Measures C-1, C-2, and C-6 would be implemented. Construction-related emissions would be slightly reduced from those of the proposed project.

Noise

This alternative would reduce the total number of units on the project site, thereby decreasing total trip generation and associated noise generation. Although recreation use would draw some additional visitors to the site, this alternative would have fewer noise impacts than the proposed project. The impacts would be less than significant. Construction-related noise impacts would be similar to those of the proposed project. Mitigation Measures D-1 and D-4 would be implemented under this alternative. See **Tables 4.D-6** and **4.D-7** in Section 4.D, Noise, for further comparison of noise between this alternative and the proposed project.

Cultural and Historic Resources

This alternative would include demolition of all structures on site, including the Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building, which have been identified as historic resources under CEQA. Mitigation Measures E-1, E-2, E-3, and E-4 would be implemented under this alternative, but they would not mitigate the impact to historic resources to a less-than-significant level. Therefore, like the proposed project, this alternative would have a significant and unavoidable impact on cultural resources.

Biological Resources

Like the proposed project, this alternative would involve redevelopment of the entire site, including the construction of the small boat marina. This alternative would, therefore, also have less-than-significant impacts on biological resources because of regulatory requirements and due to implementation of Mitigation Measures F-1, F-2, F-3, F-4, and F-5 identified for the proposed project. With an increase of open space area adjacent to the Estuary, development-related impacts on birds and operational water quality impacts on aquatic species may be slightly reduced in comparison to the proposed project.

Geology and Seismicity

Similar to the proposed project, this alternative would involve redevelopment of the entire site. The buildings constructed under this alternative would be required to meet the same California Building Code requirements as the units that would be constructed under the proposed project. With project-identified Mitigation Measures G-1, G-2, and G-3, the Reduced Density Alternative would therefore also have a less-than-significant impact related to geology and seismicity.

Hydrology and Water Quality

Similar to the proposed project, this alternative would require redevelopment of the entire site. Mitigation Measures H-3 and H-4 would be implemented under this alternative. The less-than-significant impacts to hydrology and water quality would be similar to those of the proposed project. Water quality impacts may be slightly reduced due to the increased area devoted to open space, which would result in more permeable surface area than the proposed project. This permeable surface could absorb rainwater and reduce the amount of stormwater runoff from the project site.

Hazardous Materials

Similar to the proposed project, this alternative would involve redevelopment of the entire site. Mitigation Measures I-1 and I-2 would be implemented. The less-than-significant impacts related to hazards and hazardous materials would be similar to the proposed project.

Conclusion

The Reduced Density Alternative would meet the basic objectives of the proposed project, in particular to eliminate blighting influences and correct environmental deficiencies in the area and redeveloping the underutilized site. In addition, the Reduced Density Alternative would support the City's affordable housing goals and improve public access to and views of the waterfront.

City Park Alternative

Under this alternative, the City of Alameda would purchase approximately 4.5 acres of the property adjacent to the Oakland/Alameda Estuary for the proposed 10 acre Estuary Park (the remaining 5.5 acres would be purchased as adjacent properties were redevelopment). As described in the General Plan, the City would purchase the 4.5 acres, make the improvements to the property for a public park, and maintain the park in perpetuity. The remaining five (5) acres of the property between the City Park and Clement Street would be redeveloped by the property owner with residential units consistent with the General Plan and zoning for the five acres. The existing buildings would be demolished, and the hardscape and parking areas would be removed. The project would include approximately 125 housing units, internal circulation roadways and pedestrian paths (see **Figure 5-3**). The City owned waterfront land between the project site and the Oakland Estuary would be rehabilitated, improved, and maintained by the City for a City park. The waterfront esplanade would be located within a waterfront park, running from the Estuary in the north 300 feet southward across the project site.

Land Use

The project would include development of approximately one half of the site, along the Clement Avenue and Oak Street frontage, at a similar density as the proposed project. The new buildings would have heights and footprints similar to those of the proposed project. This alternative would result in less than significant impacts on land use, similar to the proposed project. However, this alternative would adhere to BCDC policies related to public access better than the proposed project as it would provide more space for recreational waterfront opportunities.

Transportation and Circulation

This alternative would reduce the total number of units on the project site, thereby decreasing trip generation associated with residential units. Although the City Park would be expected to draw some additional visitors to the site, those visitors would generally not occur during peak commute hours. Therefore, this alternative would have less severe traffic and transit impacts than the proposed project. The City Park Alternative would have two of the significant and unavoidable impacts identified for the proposed project related to traffic and circulation, including the a.m. peak hour impact to the intersection of Park Avenue and Blanding and the cumulative impact to the Park Street and Clement Avenue intersection. This alternative would be required to implement Mitigation Measures B-4, B-5, B-8, B-9, B-10, and B-12 (see **Table 5-2**). Mitigation Measures B-3, B-11, B-17, and B-18 would not be required to be implemented.

Air Quality

This alternative would reduce the total number of units on the project site, thereby decreasing total trip generation. Although increased park space could draw some additional visitors to the site, this alternative would generate fewer mobile air quality emissions and have fewer air quality impacts than the proposed project. Mitigation Measures C-1, C-2, and C-6 would be implemented. Impacts related to construction would be incrementally less, as less construction would be completed.

SOURCE: Philip Banta & Associates

Boatworks Residential Project . 208559

Figure 5-3
City Park Alternative Site Plan

Noise

This alternative would reduce the number of units on the project site, thereby decreasing total trip generation compared to the proposed project. Although increased park space could draw additional visitors to the site, this alternative would have fewer construction- and operation-related noise impacts than the proposed project. None of the impacts would be significant. Impacts related to the reduced amount of residential construction would be incrementally less than the proposed project. None of the impacts would be significant. Mitigation Measures D-1 and D-4 would be implemented under this alternative. See **Tables 4.D-6** and **4.D-7** in Section 4.D, Noise, for further comparison of noise between this alternative and the proposed project.

Cultural and Historic Resources

This alternative would include demolition of all structures onsite, including the Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building, which have been identified as historic resources under CEQA. Mitigation Measures E-1, E-2, E-3, and E-4 would be implemented under this alternative, but they would not mitigate the impact to historic resources to a less-than-significant level. Therefore, like the proposed project, The City Park Alternative would have a significant and unavoidable impact on cultural resources.

Biological Resources

Like the proposed project, this alternative would involve alteration to the entire site, including the waterfront where park users would occur. However, the City Park Alterative would have less impermeable surface than the proposed project, because it would have a large park and would not have a small boat marina (with associated development). This alternative would therefore also have fewer significant impacts on biological resources than the proposed project because impacts to the water quality of the Estuary would be reduced. This alternative would involve implementation of project-identified Mitigation Measures F-1, F-2, F-3, F-4, and F-5 and comply with regulatory requirements.

Geology and Seismicity

Like the proposed project, this alternative would involve redevelopment of the entire site; however, it would have fewer building-related seismic hazards because half of the project site would be developed as a park. The buildings constructed under this alternative would meet the same California Building Code requirements as the units that would be constructed under the proposed project. This alternative would therefore also have less-than-significant impacts related to geology and seismicity, and would require the same Mitigation Measures G-1, G-2, and G-3 as the proposed project related to buildings and construction.

Hydrology and Water Quality

Similar to the proposed project, this alternative would involve alteration of the entire site. However, this alterative would a smaller area of impermeable surfaces because it would have a large park, which would create less runoff during storm events than the proposed project. Mitigation Measures

H-3 and H-4 would be implemented under this alternative. The less-than-significant impacts to hydrology and water quality would be reduced compared to the proposed project.

Hazardous Materials

Similar to the proposed project, this alternative would involve redevelopment of the entire site. Mitigation Measures I-1 and I-2 would be implemented. The less-than-significant impacts related to hazards and hazardous materials would be similar to those of the proposed project.

Conclusion

The City Park Alternative would meet the basic objectives of the proposed project, in particular to eliminate blighting influences and correct environmental deficiencies in the area and redeveloping the underutilized site. In addition, the City Park Alternative would support the City's affordable housing goals, but to a lesser extent than the Preservation and Reduced Density Alternatives. However, the City Park Alternative would provide a more opportunities for public access to and views of the waterfront.

E. Environmentally Superior Alternative

Based on the evaluation described in this section, the No Project Alternative, the Preservation Alternative, the Reduced Density Alternative, and the City Park Alternative would all be environmentally superior to the proposed project.

The "No Project" alternative would be as the most environmentally superior alternative with the fewest environmental impacts. However, the No Project Alternative does not meet some of the key objectives and goals of the project, namely eliminating blight and improving public access to the waterfront.

CEQA requires that that a second alternative be identified when the "No Project" alternative is the environmentally superior alternative (CEQA Guidelines, Section 15126.6(e)). Therefore, Preservation Alternative would be the Environmentally Superior Alternative for the purpose of this analysis, because it would avoid the proposed project's significant impact on cultural resources, and by rehabilitating the cultural resources, it would eliminate blighting influences in the area. However, as stated above, the Preservation Alternative would, like the proposed project, have significant and unavoidable impacts related to transportation and air quality. The Preservation Alterative would meet the project objectives while eliminating one of the significant effects of the proposed project.

The Reduced Density and City Park Alternatives would have less severe traffic and transit impacts than the proposed project and the Preservation Alternative, because both the Reduced Density and City Park Alternative would generate less peak hour trips, than both the Preservation Alternative and the Proposed Project.

TABLE 5-1
SUMMARY OF IMPACTS: PROJECT AND ALTERNATIVES

	Proposed Project	No Project	Preservation	Reduced Density	City Park
A. Land Use Consistency and Compatibility					
A-1: Physically divide an established community within the City of Alameda?	LSM	N	LSM	LSM	LSM
A-2: Conflict with an applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the General Plan and zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.	LSM	N	LSM	LSM⇩	LSM⇩
A-3: Combined with cumulative development in the defined geographic area, including past, present, reasonably foreseeable future development, have any significant adverse cumulative impacts in the area?	LSM	N	LSM	LSM	LSM
B. Transportation and Circulation					
B-1: Operation of the proposed project would increase pedestrian traffic in the project area.	LS	N	LS	LS	LS
B-2: The addition of project-generated traffic would affect bicycle level of service on area road segments.	LS	N	LS	LS	LS
B-3: The addition of project-generated traffic would cause the p.m. peak-hour arterial speed on northbound Park Street between Buena Vista Avenue and Blanding Avenue to degrade by about 1.2 mph, a 14 percent decrease, from Baseline conditions.	LSM (SU)	N	LSM (SU)	LSM (SU)	LS
B-4: The addition of project-generated traffic would cause level of service at the signalized intersection of Park Street and Blanding Avenue (#1) to degrade from LOS E to LOS F during the a.m. peak hour, and from LOS D to LOS E during the p.m. peak hour.	SU	N	LSM (SU)	LSM (SU)	LSM (SU)
B-5: The construction of the proposed project would generate temporary increases in traffic volumes on area roadways.	LSM	N	LSM	LSM	LSM
B-6: Operation of the proposed project would contribute to increased pedestrian traffic in the project area under cumulative conditions.	LS	N	LS	LS	LS
B-7: The addition of project-generated traffic would contribute to cumulative effects on bicycle level of service on area road segments.	LS	N	LS	LS	LS

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TABLE 5-1 (Continued)
SUMMARY OF IMPACTS: PROJECT AND ALTERNATIVES

	Proposed Project	No Project	Preservation	Reduced Density	City Park
B. Transportation and Circulation (cont.)					
B-8: The addition of project-generated traffic would cause the p.m. peak-hour arterial speed on northbound Park Street between Buena Vista Avenue and Blanding Avenue to degrade by about 0.3 mph, which is a 14 percent decrease from Cumulative Baseline conditions.	LSM (SU)	N	LS	LS	LS
B-9: The signalized intersection of Park Street and Blanding Avenue (#1) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during both peak hours.	SU	N	LSM	LSM	LSM
B-10: The signalized intersection of Park Street and Clement Avenue (#2) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during the p.m. peak hour.	SU	N	LS	LS	LS
B-11: The all-way stop-control unsignalized intersection of Oak Street and Clement Avenue (#4) would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Baseline conditions. The project-generated traffic would contribute more than three percent to the growth of intersection traffic volume from Existing to Cumulative Plus Project conditions during both peak hours.	LSM	N	LSM	LSM	LS
B-12: The Clement Avenue Project Driveway (#12), created as part of the project, would operate at an unacceptable LOS F during both the a.m. and p.m. peak hours under Cumulative Base Plus Project conditions.	LSM	N	LSM	LSM	LSM
B-13: The addition of project-generated traffic would increase ridership on AC Transit buses above that under Baseline conditions.	LS	N	LS	LS	LS
B-14: The addition of project-generated traffic would increase ridership on AC Transit buses above that under Cumulative Baseline conditions.	LS	N	LS	LS	LS
B-15: The addition of project-generated traffic would increase ridership on BART above that under Baseline conditions.	LS	N	LS	LS	LS

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TABLE 5-1 (Continued)
SUMMARY OF IMPACTS: PROJECT AND ALTERNATIVES

	Proposed Project	No Project	Preservation	Reduced Density	City Park
B. Transportation and Circulation (cont.)					
B-16: The addition of project-generated traffic would increase ridership on BART above that under Cumulative Baseline conditions.	LS	N	LS	LS	LS
B-17: The addition of project-generated traffic would increase traffic volumes on Park Street (regional arterial) at the Park Street bridge above that under Baseline Conditions.	SU	N	SU	SU	LS
B-18: The addition of project-generated traffic would increase traffic volumes in the southbound direction on Park Street (regional arterial) at the Park Street bridge above that under Cumulative Baseline Conditions.	SU	N	LS	LS	LS
C. Air Quality and Climate Change					
C-1: Result in an increase in vehicle miles traveled (VMT) that would be greater than the rate of increase in population, and therefore not be consistent with the ABAG Clean Air Plan.	SU	N	SU⇩	SU⇩	LSM⇩
C-2: Generate short-term emissions of criteria pollutants, including suspended and inhalable particulate matter and equipment exhaust emissions.	LSM	N	LSM	LSM	LSM⇩
C-3: Result in an increase in operational emissions of criteria air pollutants (ROG, NO_x, CO, PM_{10}, and $PM_{2.5}$) from on-road motor vehicle traffic traveling to and from site and onsite area sources.	LSM	N	LSM	LSM	LSM⇩
C-4: Expose sensitive receptors to substantial concentrations of toxic air contaminants	LSM	N	LSM	LSM	LSM⇩
C-5: Combined with past, present, and reasonably foreseeable development in the vicinity, result in cumulative toxic air contaminant air quality impacts.	SU	N	LSM	LSM	LSM⇩
C-6: Make a significant contribution to cumulative global climate change.	SU	N	SU⇩	SU⇩	SU⇩
D. Noise					
D-1: Construction would expose persons to or generate noise levels in excess of the City noise standards.	LSM	N	LSM	LSM	LSM⇩
D-2: Construction would result in exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.	LSM	N	LSM	LSM	LSM⇩

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TABLE 5-1 (Continued)
SUMMARY OF IMPACTS: PROJECT AND ALTERNATIVES

	Proposed Project	No Project	Preservation	Reduced Density	City Park
D. Noise (cont.)					
D-3: Generate operational traffic resulting in a significant increase in ambient noise levels on nearby roadways	LSM	N	LSM	LSM	LSM⇩
D-4: Place noise-sensitive multifamily residential uses in a noise environment that would exceed the City's goal for indoor noise exposure.	LSM	N	LSM	LSM	LSM⇩
E. Cultural Resources					
E-1: Construction of the proposed project would have a significant, adverse impact on significant historic resources through demolition of the circa 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building.	SU	N	LSM	SU	SU
E-2: Result in the inadvertent discovery of archaeological resources.	LSM	N	LSM	LSM	LSM
E-3: Result in the discovery of unidentified paleontological resources.	LSM	N	LSM	LSM	LSM
E-4: Result in the inadvertent discovery of human remains.	LSM	N	LSM	LSM	LSM
E-5: In conjunction with cumulative development, adversely affect historic resources in the project vicinity.	SU	N	LSM⇩	SU	SU
F. Biological Resources					
F-1: Result in the take of protected birds or their nests.	LSM	N	LSM	LSM⇩	LSM⇩
F-2: Result in impacts to migratory or breeding birds and other special-status species due to building configurations and lighting conditions.	LSM	N	LSM	LSM⇩	LSM⇩
F-3: Result in the take of special-status bat species.	LSM	N	LSM	LSM	LSM
F-4: Impact special-status fish species.	LSM	N	LSM	LSM	LSM⇩
F-5: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption, or other means.	LSM	N	LSM	LSM	LSM⇩
F-6: Construction activity and operations, in conjunction with other past, current, or foreseeable development in Alameda, result in impacts on special-status species, habitats, wetlands, and other waters of the U.S.	LSM	N	LSM	LSM	LSM⇩

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TABLE 5-1 (Continued)
SUMMARY OF IMPACTS: PROJECT AND ALTERNATIVES

	Proposed Project	No Project	Preservation	Reduced Density	City Park
G. Geology and Seismicity					
G-1: In the event of a major earthquake in the region, would seismic ground-shaking potentially injure people and cause collapse of or structural damage to proposed structures and / or retaining walls?	LSM	N	LSM	LSM⇩	LSM⇩
G-2: In the event of a major earthquake in the region, would people and property be exposed to seismically-induced ground failure, including liquefaction, lateral spreading and earthquake-induced settlement?	LSM	N	LSM	LSM	LSM⇩
G-3: Would continuing consolidation and land subsidence at the project site result in damage to structures, utilities and pavements?	LSM	N	LSM	LSM	LSM⇩
G-4: Combined with past, present, and reasonably foreseeable probable projects, result in substantial adverse cumulative impacts to geology, soils, or seismic hazards.	LSM	N	LSM	LSM	LSM⇩
H. Hydrology					
H-1: Would construction involve activities (excavation, soil stockpiling, boring and pile driving, grading, and dredging, etc.) that would generate loose, erodible soils that, if not properly managed, could violate water quality standards or waste discharge requirements; result in substantial erosion or siltation; create or constitute substantial polluted runoff; or otherwise substantially degrade water quality?	LSM	N	LSM	LSM	LSM
H-2: Alter existing drainage patterns, which could result in increased pollutant loading in stormwater runoff violating water quality standards of receiving waters.	LSM	N	LSM	LSM	LSM⇩
H-3: Involve new landscaping and open lawns. If not properly handled, chemicals used to establish and maintain landscaping and open lawn areas, such as pesticides and fertilizers, could flow into the waterways, and result in water quality impacts to the tidal canal and eventually San Francisco Bay.	LSM	N	LSM⇧	LSM⇧	LSM⇧
H-4: Site development could be subject to flooding as a result of sea level rise.	LSM	N	LSM	LSM	LSM
H-5: In conjunction with other reasonably foreseeable development in Alameda, would not result in cumulative impacts with respect to hydrology and water quality.	LSM	N	LSM	LSM	LSM⇩

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TABLE 5-1 (Continued)
SUMMARY OF IMPACTS: PROJECT AND ALTERNATIVES

	Proposed Project	No Project	Preservation	Reduced Density	City Park
I. Hazardous Materials					
I-1: Demolition of the existing structures that contain hazardous building materials—such as lead-based paint, asbestos, and PCBs—could expose workers, the public, or the environment to these hazardous materials and would generate hazardous waste.	LSM	N	LSM	LSM	LSM
I-2: Construction would disturb soil and groundwater impacted by historic hazardous material use, which could expose construction workers, the public, or the environment to adverse conditions related to hazardous materials handling.	LSM	N	LSM	LSM	LSM
I-3: Operations would involve the transportation, use, and storage of hazardous chemicals, which could present public health and/or safety risks to residents, visitors, and the surrounding area.	LSM	N	LSM	LSM	LSM
I-4: Hazardous materials used onsite during construction activities (i.e. solvents) could be spilled through improper handling or storage, potentially increasing public health and/or safety risks to future residents, maintenance workers, visitors, and the surrounding area.	LSM	N	LSM	LSM	LSM
I-5: Hazards at the project site could contribute to cumulative hazards in the vicinity of the project site.	LSM	N	LSM	LSM	LSM

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TABLE 5-2
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
B. Transportation and Circulation				
MM B-3a (TDM): Prior to project occupancy, the project applicant shall put into place a City-approved Transportation Demand Management program with the goal of reducing the number of peak hour trips by 10 percent. This will include the following measures: • Establish a Boatworks Home Owners Association (HOA) and CCRs for the project; • Assess the HOA an annual fee in an amount necessary to provide the following strategies: - EasyPass program (unlimited transit pass, usable on AC Transit buses), two passes per unit, additional passes per unit for residents may be purchased at cost; - Bicycle facilities in each unit; - One car-share membership per residential unit; and - Provide annual funding for transportation coordination services including, but not limited to, promotional information packages and planning services regarding available transportation options, and annual monitoring reports to City regarding effectiveness of programs and recommended enhancements to meet 10% reduction goal. **MM B-3b:** Where feasible, restripe the Park Street intersection approaches between Buena Vista Avenue and Blanding Avenue to provide transit queue jump lanes during the p.m. peak period (southbound) and a.m. peak period (northbound). Regardless of the feasibility of queue jump lanes, modify the traffic signals, controllers, signage, and signal timing at the Park Street intersections at Blanding, Clement, and Buena Vista Avenues to allow for transit signal priority to improve transit flow. Restriping would require the prohibition of on-street parking on the northbound side of the street during the a.m. peak period, and on the southbound side during the p.m. peak period to accommodate the transit queue jump lanes.	—	X	X	—
MM B-4: The project applicant shall provide full funding to restripe the Blanding Avenue approaches (eastbound and westbound) at Park Street to provide left turn pockets, modify the traffic signal to be fully actuated, provide protected left-turn phasing, modify the traffic control at the private driveway of the Waters Edge Nursing Home to stop-sign control, include audible pedestrian push buttons and pedestrian count down heads, and optimize the signal timing to improve the flow of traffic without causing a significant impact to pedestrian or transit level of service. The restriping would require the removal of 12 on-street parking spaces.	—	X	X	X
MM B-5: The project applicant and construction contractor(s) shall develop a construction management plan for review and approval by the Public Works Department prior to issuance of any permits. The plan shall include at least the following items and requirements to reduce traffic congestion during construction: • A set of comprehensive traffic control measures shall be developed, including scheduling of major truck trips and deliveries to avoid peak traffic hours, detour signs if required, lane closure procedures, signs, cones for drivers, and designated construction access routes. • The Construction Management Plan shall identify haul routes for movement of construction vehicles that would minimize	—	X	X	X

X = Mitigation Measure would be applicable to the alternative
— = Mitigation Measure would NOT be applicable to the alternative

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
B. Transportation and Circulation (cont.)				
impacts on motor vehicle, bicycle, and pedestrian traffic, circulation, and safety, and specifically to minimize impacts to the greatest extent possible on streets in the project area. The haul routes shall be approved by the City. • The Construction Management Plan shall provide for notification procedures for adjacent property owners and public safety personnel regarding when major deliveries, detours, and lane closures would occur. • The Construction Management Plan shall provide for monitoring surface streets used for haul routes so that any damage and debris attributable to the haul trucks can be identified and corrected by the project applicant.				
MM B-8a: Implement Mitigation Measure 4.B-3a (TDM) **MM B-8b:** Implement Mitigation Measure 4.B-3b (restripe Park Street between Buena Vista and Blanding Avenues to accommodate transit queue jump lanes, and modify the traffic signals and signal timing at the Park Street intersections at Blanding, Clement, and Buena Vista Avenues).	—	X	X	X
MM B-9: Implement Mitigation Measure 4.B-4 (restriping the eastbound Blanding Avenue approach at Park Street Blanding Avenue, and, as needed, optimize the signal timing at the intersection of Park Street and Blanding Avenue).	—	X	X	X
MM B-10: The project applicant shall fund a fair share contribution to reconfigure and restripe the intersection of Park Street and Clement Avenue to add dedicated left turn lanes on the eastbound and westbound approaches of Clement Avenue, and a northbound dedicated left turn lane on Park Street, and to modify the traffic signals to include protected left turn phasing for all approaches, fully actuated traffic signal, and audible pedestrian push buttons and pedestrian count down heads. The reconfiguration would require acquisition of property from the northeast and southwest corners and the removal of approximately eight parking spaces.	—	X	X	X
MM B-11: The project applicant shall fund a fair share contribution to the installation of traffic signals at the intersection of Oak Street and Clement Avenue, and the restriping of the eastbound Clement Avenue approach to provide an exclusive left-turn lane and a shared through/right-turn lane. Because of potential safety concerns with vehicles and bicyclists in the left turn lane driving/riding parallel to the existing railroad tracks, this mitigation also would require that the railroad tracks within the left-turn lane be removed. This mitigation also would require acquisition of the necessary right-of-way from the project at the northwest corner of Park Street and Clement Avenue to install the traffic signal poles, while maintaining ADA access.	—	X	X	—
MM B-12: The project applicant shall fund a fair share contribution to the reconfiguration and restriping of Clement Avenue in front of the project site to include an eastbound left turn lane (into the project) and an eastbound center refuge/merge lane (for traffic exiting the project). Because of potential safety concerns with vehicles and bicyclists in the lanes driving/riding parallel to the existing railroad tracks, this mitigation also would require that the railroad tracks within the left-turn lane be removed.	—	X	X	X

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
B. Transportation and Circulation (cont.)				
MM B-17a: Widen Park Street bridge to add an additional lane in each direction. **MM B-17b:** Implement Mitigation Measure 4.B-3a (TDM Program) and 4.B-3b (Park Street Transit Signal Prioritization).	—	X	X	—
MM B-18a: Widen Park Street bridge to add an additional lane in the southbound direction. **MM B-18b:** Implement Mitigation Measure 4.B-3a (TDM Program) and 4.B-3b (Park Street Transit Signal Prioritization).	—	—	—	—
C. Air Quality				
MM C-1: Prior to project occupancy, the project applicant shall put into place the following measures: • Establish a Boatworks Home Owners Association (HOA) and CCRs for the project; • Assess the HOA an annual fee in an amount necessary to provide the following strategies: - EcoPass program (unlimited transit pass, usable on AC Transit buses), two passes per unit; - Bicycle facilities in each unit; - One car-share membership per residential unit; and - Promotional and planning services that include transportation options, and information packages.	—	X	X	X
MM C-2: During construction, the project applicant shall implement both BAAQMD's basic and enhanced dust control procedures listed below (BAAQMD CEQA Guidelines, 1999). The "basic" dust control program shall include, but not necessarily be limited to, the following: • Water all active construction areas at least twice daily. Watering should be sufficient to prevent airborne dust from leaving the site. Increased watering frequency may be necessary whenever wind speeds exceed 15 miles per hour. Reclaimed water should be used whenever possible. • Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard (i.e., the minimum required space between the top of the load and the top of the trailer). • Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas and staging areas at construction sites. • Sweep streets (with water sweepers using reclaimed water if possible) at the end of each day if visible soil material is carried onto adjacent paved roads. • Sweep daily (with water sweepers) all paved access roads, parking areas and staging areas at construction sites. The "enhanced" dust control measures shall include the following: • Hydroseed or apply non-toxic soil stabilizers to construction areas and previously graded areas inactive for ten days or more	—	X	X	X

X = Mitigation Measure would be applicable to the alternative
— = Mitigation Measure would NOT be applicable to the alternative

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
B. Transportation and Circulation (cont.)				
• Enclose, cover, water twice daily or apply non-toxic soil binders to exposed stockpiles of dirt, sand, etc. • Limit traffic speeds on unpaved roads to 15 miles per hour (mph) • Install sandbags or other erosion control measures to prevent silt runoff to public roadways • Replant vegetation in disturbed areas as quickly as possible				
MM C-6a: In order to reduce GHG emissions from energy consumption and to maintain project operations consistent with the initiatives of the LAPCP, the project applicant shall pursue energy conserving building design and alternative energy conservation strategies to meet or exceed the most current Uniform Building Code requirements and State energy criteria. **MM C-6b:** In order to maintain project operations consistent with Energy Initiative 6 of the LAPCP, any fireplaces or stoves installed as part of the proposed project shall not be wood-burning. **MM C-6c:** In order to maintain project operations consistent with Waste and Recycling Initiative 1 of the LAPCP, demolition and construction wastes shall be sorted and recycled to the extent feasible.	—	X	X	X
D. Noise				
MM D-1: The project applicant shall incorporate the following requirements into the construction contract specifications: • Construction activities will be limited to between the hours of 7:00 am and 7:00 pm Monday through Friday and 8:00 am to 5:00 pm on Saturdays • Equipment and trucks used for construction will use the industry standard noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures, and acoustically-attenuating shields or shrouds, wherever feasible). • Stationary noise sources will be located as far from adjacent receptors, whenever feasible, and they will be muffled and enclosed within temporary sheds, incorporate insulation barriers, or other measures to the extent feasible.	—	X	X	X
MM D-4: If necessary to comply with the interior noise requirements of the State and achieve an acceptable interior noise level, noise reduction in the form of sound-rated assemblies (i.e., windows, exterior doors, and walls) shall be incorporated into project building design, based upon recommendations of a qualified acoustical engineer. Final recommendations for sound-rated assemblies will depend on the specific building designs and layout of buildings on the site and shall be determined by the acoustical engineer during the design phase. Specific consideration shall be given to window size, degree of sound insulation of exterior walls, which can be increased through staggered- or double-studs, multiple layers of gypsum board, and incorporation of resilient channels.	—	X	X	X

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
E. Cultural Resources				
MM E-1: Documentation and Interpretation The project applicant shall document the circa 1910 Steel Fabrication Shop/Warehouse and Compressor Room/Storage Building in accordance with the Historic American Building Survey (HABS) Level II documentation standards of the National Park Service. Level II standards include the following: 1. Photographs. Large-format (4 x 5-inch negatives or greater), black and white photographs should be taken of all elevations of the two buildings, plus limited context and detail shots. A limited number of historical photos of the project site buildings, if available, should also be photographically reproduced. All photographs should be printed on acid-free archival bond paper. 2. Written History. Prepare a written history of the project site and buildings using the HABS standard outline format. 3. Drawings. If available, reproduce original building drawings on mylar or through photographic means. 4. Archiving. The completed HABS documentation package (photos, report, and drawings) shall be archived at the City of Alameda, the City of Alameda Public Library, and the Northwest Information Center of Sonoma State University. The project applicant shall also provide an interpretive history exhibit in the form of a plaque or panel to describe the historical importance of the former Dow Company buildings to the general public. Information generated from the documentation effort, such as photographs and historical text, described above, can be utilized for this effort as well. The interpretive exhibit can either be placed along the proposed waterfront trail/open space, or at the corner of Clement Avenue and Oak Street. The interpretive exhibit should be designed by a professional architectural historian meeting the qualifications of the Secretary of the Interior's Standards.	—	—	X	X
MM E-2: Cease Work if Prehistoric, Historic-era or Subsurface Cultural Resources are Discovered During Ground-Disturbing Activities. If cultural resources are encountered, all activity in the vicinity of the find shall cease until it can be evaluated by a qualified archaeologist and a Native American representative. Prehistoric archaeological materials might include obsidian and chert flaked-stone tools (e.g., projectile points, knives, scrapers) or toolmaking debris; culturally darkened soil ("midden") containing heat-affected rocks, artifacts, or shellfish remains; and stone milling equipment (e.g., mortars, pestles, handstones, or milling slabs); and battered stone tools, such as hammerstones and pitted stones. Historic-era materials might include stone, concrete, or adobe footings and walls; filled wells or privies; and deposits of metal, glass, and/or ceramic refuse. If the archaeologist and Native American representative determine that the resources may be significant, they will notify the project applicant and the City of Alameda and will develop an appropriate treatment plan for the resources. The archaeologist shall consult with Native American monitors or other appropriate Native American representatives in determining appropriate treatment for unearthed cultural resources if the resources are prehistoric or Native American in nature.	—	X	X	X

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TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
E. Cultural Resources (cont.)				
In considering any suggested mitigation proposed by the archaeologist and Native American representative in order to mitigate impacts to cultural resources, the project applicant will determine whether avoidance is necessary and feasible in light of factors such as the nature of the find, project design, costs, and other considerations. If avoidance is infeasible, other appropriate measures (e.g., data recovery) will be instituted. Work may proceed on other parts of the project site while mitigation for cultural resources is being carried out.				
MM E-3: Halt Work if Paleontological Resources are Identified During Construction. If paleontological resources, such as fossilized bone, teeth, shell, tracks, trails, casts, molds, or impressions are discovered during ground-disturbing construction activities, all such activities within 100 feet of the find shall be halted until a qualified paleontologist can assess the significance of the find and, if necessary, develop appropriate salvage measures in consultation with the City of Alameda and in conformance with Society of Vertebrate Paleontology Guidelines	—	X	X	X
MM E-4: Halt Work if Human Skeletal Remains are Identified During Construction. If human skeletal remains are uncovered during project construction, the project applicant shall immediately halt work, contact the Alameda County coroner to evaluate the remains, and follow the procedures and protocols set forth in Section 15064.5 (e)(1) of the CEQA Guidelines. If the County coroner determines that the remains are Native American, the project applicant shall contact the Native American Heritage	—	X	X	X
Commission, in accordance with Health and Safety Code Section 7050.5, subdivision (c), and Public Resources Code 5097.98 (as amended by AB 2641). Per Public Resources Code 5097.98, the landowner shall ensure that the immediate vicinity, according to generally accepted cultural or archaeological standards or practices, where the Native American human remains are located, is not damaged or disturbed by further development activity until the landowner has discussed and conferred, as prescribed in this section (PRC 5097.98), with the most likely descendents regarding their recommendations, if applicable, taking into account the possibility of multiple human remains.				
F. Biological Resources				
MM F-1: Avian surveys and avoidance. No more than two weeks in advance of any tree or shrub removal, or alteration to structures that will commence during the breeding season (February 1 through August 31), a qualified wildlife biologist will conduct pre-construction surveys of all potential special-status bird nesting habitat in the vicinity of the planned activity. Pre-construction surveys are not required for construction activities scheduled to occur during the non-breeding season (August 31 through January 31). Construction activities commencing during the non-breeding season and continuing into the breeding season do not require surveys (as it is assumed that any breeding birds taking up nests would be acclimated to project-related activities already under way). Nests initiated during construction activities would be presumed to be unaffected by project activities, and a buffer zone around such	—	X	X	X

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
F. Biological Resources (cont.)				
nests would not be necessary. However, a nest initiated during construction cannot be moved or altered. If no active nests are found during pre-construction avian surveys, then no further mitigation is required. If active nests are found during pre-construction avian surveys, the results of the surveys will be discussed with the appropriate resource agency and avoidance procedures will be adopted, if necessary, on a case-by-case basis. Avoidance measures will most likely include a no-disturbance buffer around the nest, which will be maintained until a qualified biologist determines that the young have fledged or otherwise abandoned the nest. The size of the buffer zones and types of construction activities restricted within them will be determined through consultation with resource agencies, taking into account factors such as: (1) noise and human disturbance levels at the project site and the nesting site at the time of the survey and the noise and disturbance expected during the construction activity; (2) distance and amount of vegetation or other screening between the project site and the nest; and (3) sensitivity of individual nesting species and behaviors of the nesting birds.				
MM F-2: Follow bird-safe building guidelines. The applicant and project designer shall reduce building lighting from exterior sources by the following measures: 1. Minimize amount and visual impact of perimeter lighting, through measures such as downward-pointing lights, side shields, visors, and mition-sensor lighting. 2. Utilize minimum wattage fixtures to achieve required lighting levels.	—	X	X	X
MM F-3a: Pre-construction surveys for bats. Potential direct and indirect disturbances to bats will be identified by locating colonies, and instituting protective measures prior to construction. No more than two weeks in advance of tree removal or demolition of buildings onsite, a qualified bat biologist (e.g., a biologist holding a CDFG collection permit and a Memorandum of Understanding with CDFG allowing the biologist to handle and collect bats) will conduct pre-construction surveys for bat roosts. No activities that could disturb active roosts will proceed prior to the completed surveys. **MM F-3b:** Avoidance or relocation of bats. If a bat colony is located within or near the project site during pre-construction surveys, the project will be redesigned to avoid impacts, and a no-disturbance buffer acceptable in size to the CDFG will be created around any roosts in the project vicinity, if possible. Bat roosts initiated during construction are presumed to be unaffected, and no buffer is necessary. However, the "take" of individuals is prohibited. If there is a maternity colony present and the project cannot be redesigned to avoid removal of the tree or structure inhabited by the bats, demolition of that tree or structure will not commence until after young are flying (i.e., after July 31, confirmed by a qualified bat biologist) or before maternity colonies form the following year (i.e. prior to March 1).	—	X	X	X

X = Mitigation Measure would be applicable to the alternative
— = Mitigation Measure would NOT be applicable to the alternative

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
F. Biological Resources (cont.)				
If a non-maternity roost must be removed as part of the project, the non-maternity roost will be evicted prior to building/tree removal by a qualified biologist, using methods such as making holes in the roost to alter the air-flow, or creating one-way funnel exists for the bats. **MM F-3c:** Creating compensatory bat roosts. If known bat roosting habitat is destroyed during building/tree removal, artificial bat roosts shall be constructed in an undisturbed area in the project site vicinity away from human activity and at least 200 feet from project demolition/construction activities. The design and location of the artificial bat roost(s) shall be determined by a qualified bat biologist.				
MM F-4: Reduce impacts of dredging and pile-driving on special-status fish. If dredging or pile-driving occurs as part of the project, the project applicant shall implement work windows and Best Management Practices (BMPs) for protection of salmonids and Pacific herring, that are identified in the *Long-Term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region*. BMPS listed there include the following: • installation of silt curtains and gunderbooms for filtering sediment; • mechanical dredge operations controls, including increased cycle time, elimination of multiple bucket bites, and elimination of bottom stockpiling; • hydraulic dredge operations controls, including reduction of cutterhead rotation speed, reduction of swing speed, and elimination of bank undercutting; • hopper dredges and barges operational controls, including reduction of hopper overflow, lower hopper fill levels, and use of a water recirculation system; and • use of specialty equipment, including pneuma pumps, closed or environmental buckets, large-capacity dredges, and specialized tools for precision dredging. In addition, dredging or pile-driving in the Oakland Estuary shall minimize impacts on special-status fish through one or more of the following methods: (1) dredging or pile-driving shall only be conducted within work windows designated to cause the least impact on Pacific herring and salmonids (i.e., June through November, see **Table 4.F-1**); (2) dredging or pile-driving shall only produce noise levels below 150 decibels at 30 feet[1]; and/or (3) dredging or pile-driving shall only be conducted in accordance with NMFS directives and Corps permits to reduce potential impacts on fish species.	—	X	X	X
MM F-5a: Minimize impacts to wetlands. The project applicant shall implement the following Best Management Practices (BMPs) during construction: 1. Install silt fencing, straw wattles or other appropriate erosion and sediment control methods or devices to prevent sediment from the upland portion of the site from entering the Estuary as a result of project activities.	—	X	X	X

1 As shown in Table 4.D-5 in 4.D,*Noise*, pile driving creates a typical noise level of 101 decibels (dbA) at 50 feet.

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
F. Biological Resources (cont.)				
2. Operate equipment (e.g., backhoes and cranes) that is used for removal or installation of fill and rip-rap along the Estuary shoreline from dry land, where possible. Construction operations within the Oakland Estuary can also be barge-mounted or utilize other water-based equipment such as scows, derrick barges and tugs. 3. Prevent any fueling activity from occurring within 50 feet of the Oakland Estuary. 4. Where applicable, implement BMPs listed under Mitigation Measure 4.F-4 to avoid impacts to water quality resulting from dredging or other activities within open waters, as identified in the *Long-term Management Strategy for the Placement of Dredged Material in the San Francisco Bay Region* (LTMS) (Corps, 2001). 5. Test all materials proposed for excavation and dredging for the possible presence of contaminants. Construction practices shall be designed in coordination with the Corps, RWQCB, and other applicable agencies, to minimize the dispersion of contaminants into the water column and ensure proper disposal of contaminated materials.				
MM F-5b: The project applicant shall provide compensatory mitigation (i.e., “no net loss”) for any temporary and permanent impacts to wetlands as defined by Section 404 of the Clean Water Act, as required by regulatory permits issued by the Corps, RWQCB, and BCDC. Measures may include but would not be limited to (1) onsite or offsite mitigation through wetland creation or restoration; and (2) development of a Mitigation and Monitoring Plan. ***Onsite or Offsite Wetland Creation or Restoration.*** To the extent practicable, the project applicant shall restore the tidal marsh to the Oakland Estuary shoreline at a minimum 1:1 impact-to-restoration ratio, through activities such as removal of debris and concrete riprap, and revegetating with native tidal marsh species. If onsite restoration is not feasible, the project applicant shall negotiate compensatory offsite mitigation for wetland losses with applicable regulatory agencies, at a 3:1 impact-to-restoration ratio, or other ratio determined by the agencies. ***Mitigation and Monitoring Program.*** Prior to the start of construction or in coordination with regulatory permit conditions, the project applicant shall prepare and submit for approval to the Corps, RWQCB, and BCDC a mitigation and monitoring program that outlines the mitigation obligations for temporary and permanent impacts to waters of the U.S., including wetlands. The program shall include baseline information from existing conditions, anticipated habitat to be enhanced, thresholds of success, monitoring and reporting requirements, and site-specific plans to compensate for wetland losses resulting from the project. The Boatworks Residential Project Mitigation and Monitoring Plan shall include, but not be limited to, the following: • Clearly stated objectives and goals consistent with regional habitat goals. • Location, size, and type of mitigation wetlands proposed.	—	X	X	X

X = Mitigation Measure would be applicable to the alternative
— = Mitigation Measure would NOT be applicable to the alternative

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
F. Biological Resources (cont.)				
• A functional assessment of affected jurisdictional waters to ensure that the EPA's "no net loss of wetland value" standard is met. The functional assessment will also ensure that the mitigation provided is commensurate with the adverse impacts on Bay resources in accordance with BCDC mitigation policies. The assessment will provide sufficient technical detail in the project design including, at a minimum, an engineered grading plan and water control structures, methods for conserving or stockpiling topsoil, a planting program including removal of exotic species, a list of all species to be planted, sources of seeds and/or plants, timing of planting, plant locations and elevations on the mitigation site base map, and maintenance techniques. • Documentation of performance, monitoring, and adaptive management standards that provide a mechanism for making adjustments to the mitigation site. Performance and monitoring standards will indicate success criteria to be met within 5 years for vegetation, animal use, removal of exotic species, and hydrology. Adaptive management standards will include contingency measures that will outline clear steps to be taken if and when it is determined, through monitoring or other means, that the enhancement or restoration techniques are not meeting success criteria. Documentation of the necessary long-term management and maintenance requirements, and provisions for sufficient funding.				
G. Geology, Soils, and Seismicity				
MM G-1a: A site-specific, design-level geotechnical investigation for the project shall be conducted as a condition of building permit. The investigation shall include detailed characterization of the distribution and compositions of subsurface materials and an assessment of their behavior during violent seismic ground-shaking. The analysis shall recommend design parameters that would be necessary to avoid or substantially reduce structural damage under peak ground accelerations of no less than 0.655g. The investigation and recommendations shall be in conformance with all applicable city ordinances and policies and consistent with the design requirements of Seismic Design Category E/F (very high vulnerability) of the California Building Code. The geotechnical report shall be prepared by a registered geotechnical engineer and approved by the City, and all recommendations shall be included in the final design of the project. **MM G-1b:** Prior to issuance of occupancy permits, the project applicant shall prepare an earthquake hazards information document to the satisfaction of City staff. This document shall be made available to any potential occupant prior to purchase or rental of the housing units. The document shall describe the potential for strong ground-shaking at the site, potential effects of ground shaking, and earthquake preparedness procedures.	—	X	X	X
MM G-2: Earthwork, foundation and structural design for proposed project shall be conducted in accordance with all recommendations contained in the required geotechnical investigation (MM G-1a). The investigation must include an assessment of all potentially foreseeable seismically induced ground failures, including liquefaction, sand boils, lateral spreading and rapid settlement. Mitigation strategies must be designed for the site-specific conditions of the project and must	—	X	X	X

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
G. Geology, Soils, and Seismicity (cont.)				
be reviewed for compliance with the guidelines of CGS Special Publication 117 prior to incorporation into the project. Example of possible strategies include edge containment structures (berms, dikes sea walls, retaining structures, compacted soil zones), removal or treatment of liquefiable soils, soil modification, modification of site geometry, lowering the groundwater table, in-situ ground densification, deep foundations, reinforced shallow foundations, and structural design that can accommodate predicted displacements.				
MM G-3: The required geotechnical report (MM G-1a)for the project shall determine the susceptibility of the project site to settlement and prescribe appropriate engineering techniques for reducing its effects. Where settlement and/or differential settlement is predicted, mitigation measures—such as lightweight fill, geofoam, surcharging, wick drains, deep foundations, structural slabs, hinged slabs, flexible utility connections, and utility hangers—could be used. These measures shall be evaluated and the most effective, feasible, and economical measures shall be recommended. Engineering recommendations shall be included in the project engineering and design plans, and be reviewed and approved by a registered geotechnical engineer. All construction activities and design criteria shall comply with applicable codes and requirements of the 1997 UBC with California additions (Title 22), and applicable City construction and grading ordinances.	—	X	X	X
H. Hydrology and Water Quality				
MM H-3: Integrated Pest Management Plan. An Integrated Pest Management Plan (IPM) shall be prepared and implemented by the project applicant for all common landscaped areas. The IPM shall be prepared by a qualified professional and address and recommend methods of pest prevention and turf grass management that use pesticides as a last resort in pest control. Types and rates of fertilizer and pesticide application shall be specified. The IPMs shall specify methods of avoiding runoff of pesticides and nitrates into storm drains and surface waters or leaching into the shallow groundwater table. Pesticides shall be used only in response to a persistent pest problem. Preventative chemical use shall not be employed. Cultural and biological approaches to pest control shall be fully integrated into the IPMs, with an emphasis toward reducing pesticide application.	—	X	X	X
MM H-4: The project applicant shall design and construct the proposed seawall such that future adaptive management measures can be implemented to further protect upland areas from potential rising sea levels. Prior to construction, the final seawall design shall be reviewed by BCDC and in accordance with current guidelines regarding protection against sea level rise.	—	X	X	X
I. Hazards and Hazardous Materials				
MM I-1a: Each structure proposed for demolition shall be assessed by licensed contractors for the potential presence of lead-based paint or coatings, asbestos containing materials, and PCB-containing equipment prior to issuance of a demolition permit.	—	X	X	X

X = Mitigation Measure would be applicable to the alternative
— = Mitigation Measure would NOT be applicable to the alternative

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
I. Hazards and Hazardous Materials (cont.)				
MM I-1b: If the assessment required by Mitigation Measure 4I.1a finds presence of lead-based paint, asbestos, and/or PCBs, the project applicant shall create and implement a health and safety plan to protect workers from risks associated with hazardous materials during demolition or renovation of affected structures. **MM I-1c:** If the assessment required by Mitigation Measure 4I.1a finds presence of lead-based paint, the project applicant shall develop and implement a lead-based paint removal plan. The plan shall specify, but not be limited to, the following elements for implementation: • Develop a removal specification approved by a Certified Lead Project Designer. • Ensure that all removal workers are properly trained. • Contain all work areas to prohibit off-site migration of paint chip debris. • Remove all peeling and stratified lead-based paint on building and non-building surfaces to the degree necessary to safely and properly complete demolition activities according to recommendations of the survey. The demolition contractor shall be responsible for the proper containment and disposal of intact lead-based paint on all equipment to be cut and/or removed during the demolition. • Provide on-site personnel and area air monitoring during all removal activities to ensure that workers and the environment are adequately protected by the control measures used. • Clean up and/or vacuum paint chips with a high efficiency particulate air (HEPA) filter. • Collect, segregate, and profile waste for disposal determination. • Properly dispose of all waste. **MM I-1d:** If the assessment required by Mitigation Measure H.1a finds presence of asbestos, the project applicant shall ensure that asbestos abatement shall be conducted by a licensed contractor prior to building demolition. Abatement of known or suspected ACMs shall occur prior to demolition or construction activities that would disturb those materials. Pursuant to an asbestos abatement plan developed by a state-certified asbestos consultant and approved by the City, all ACMs shall be removed and appropriately disposed of by a state certified asbestos contractor. **MM I-1e:** If the assessment required by Mitigation Measure 4I.1a finds presence of PCBs, the project applicant shall ensure that PCB abatement shall be conducted prior to building demolition or renovation. PCBs shall be removed by a qualified contractor and transported in accordance with Caltrans requirements.	—	X	X	X
MM I-2a: The project applicant shall prepare a health and safety plan, based on the site conditions and past contaminant release history and remediation, by a licensed industrial hygienist. The health and safety plan shall identify potential contaminants that may be encountered, appropriate personal protective equipment, and worker safety procedures for spills and accidents.	—	X	X	X

TABLE 5-2 (Continued)
SUMMARY OF MITIGATION FOR THE ALTERNATIVES

Mitigation Measure	No Project	Preservation	Reduced Density	City Park
I. Hazards and Hazardous Materials (cont.)				
MM I-2b: To reduce environmental risks associated with encountering contaminated soil that is discovered during grading and construction, the project applicant shall ensure that any suspected contaminated soil is stockpiled separately, sampled for hazardous material content and disposed of in accordance with all applicable state and federal and local laws and regulations. All contaminated soil determined to be hazardous or non-hazardous waste shall have received all laboratory analyses for acceptable disposal as required by the receiving facility before it can be removed from the site. **MM I-2c:** Prior to issuance of any building or grading permits, any areas of identified contamination shall have completed all measures required by ACDEH, DTSC or RWQCB for site closure, and shall be certified for residential use. Where necessary, additional remediation to permit use and occupancy of the project shall be accomplished by the project applicant prior to issuance of any building or grading plans.	—	X	X	X

X = Mitigation Measure would be applicable to the alternative
— = Mitigation Measure would NOT be applicable to the alternative

CHAPTER 6
Other Statutory Sections

Consistent with CEQA Guidelines Section 15126.2, this section addresses growth-inducing effects, significant irreversible environmental changes, cumulative impacts (when considered with other projects), significant unavoidable environmental, and effects found to be less than significant.

A. Growth-Inducing Effects

The CEQA Guidelines require that an EIR evaluate the growth-inducing impacts of a proposed action (Section 15126.2[d]). A growth-inducing impact is defined by the CEQA Guidelines as:

> *[T]he ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth.... It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.*

A project can have direct and/or indirect growth-inducement potential. Direct growth inducement would result if a project involved construction of new housing. A project can have indirect growth-inducement potential if it would establish substantial new permanent employment opportunities (e.g., commercial, industrial or governmental enterprises) or if it would involve a substantial construction effort with substantial short-term employment opportunities and indirectly stimulate the need for additional housing and services to support the new employment demand. Similarly, under CEQA, a project would indirectly induce growth if it would remove an obstacle to additional growth and development, such as removing a constraint on a required public service. Increases in population could tax existing community service facilities, requiring construction of new facilities that could cause significant environmental effects. The CEQA Guidelines also require analysis of the characteristics of projects that may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively.

The timing, magnitude, and location of land development and population growth is based on various interrelated land use and economic variables. Key variables include regional economic trends, market demand for residential and non-residential uses, land availability and cost, the availability and quality of transportation facilities and public services, proximity to employment centers, the supply and cost of housing, and regulatory policies or conditions. Because general plans define the location, type and intensity of growth, they are the primary means of regulating development and growth in California.

The growth inducing impacts analysis addresses the potential of the project for growth inducement in the project vicinity or broader area. Under CEQA, a project is generally considered to be growth-inducing if it results in any one of the following:

1. Extension of urban services or infrastructure into a previously unserved area;

2. Extension of a transportation corridor into an area that may be subsequently developed; or

3. Removal of obstacles to population growth (such as provision of major new public services to an area where those services are not currently available).

1. Extension of urban services or infrastructure

Although on-site infrastructure improvements would occur as part of the proposed project, the site is within an urban setting, and the project infrastructure would connect to existing city infrastructure and not require any major expansions of infrastructure. The project would not extend infrastructure to any undeveloped areas. The project site, although occupied by buildings, is currently vacant and located in an urban area. Hence, the proposed project would be infill development rather than a growth-inducing development.

2. Extension of transportation corridor

The project would include an extension of Blanding Street to serve the project site. The project site is surrounded by urban development. As an infill development, the project would not extend transportation corridors into undeveloped areas resulting in growth inducing impacts. In fact, the project site's proximity to a major transportation corridor through the City of Alameda (Park Street) and its location near Interstate 880 and regional alternative transportation systems could result in less impact on regional transportation systems and air quality than would comparable development in a more outlying area, or an area with a lower concentration of population within the county.

3. Removal of obstacles to population growth

The project involves a General Plan amendment for the subject property to facilitate the proposed project. The General Plan amendment would remove 'obstacles to population growth ***only*** for the proposed residential project. The General Plan amendment would not facilitate population growth on any other property.

The project would result in the construction of 242 multi-family residential dwelling units. The project would increase the onsite population by approximately 600 new residents. This represents approximately 0.8 percent of the City's 2008 population (75,823 residents) and about 0.7 percent of the projected 2020 population (82,200 projected residents). The population growth due to the proposed project would not be a substantial percentage of Alameda's existing or projected population/population growth.

B. Significant Irreversible Changes

Pursuant to Section 15126.2(c) of the State CEQA Guidelines, an EIR must consider any significant irreversible environmental changes that would be caused by the proposed Project should it be implemented. 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."*

Resources that would be permanently and continually consumed by implementation of the proposed project include water, electricity, natural gas, and fossil fuels; however, the amount and rate of consumption of these resources would not result in significant environmental impacts or the unnecessary, inefficient, or wasteful use of resources. Construction activities related to the proposed project, though previously analyzed, 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. With respect to the operational activities of the proposed project, compliance with all applicable building codes, as well as EIR mitigation measures, would ensure that all natural resources are conserved to the maximum extent practicable. It is also possible that new technologies or systems would emerge, or would become more cost-effective or user-friendly, and would further reduce the project reliance upon nonrenewable energy resources.

The CEQA Guidelines also require a discussion of the potential for irreversible environmental damage caused by an accident associated with the proposed project. Completion of the proposed project with residential and waterfront land uses would not involve the routine use, transport, storage, or disposal of hazardous wastes other than small amounts of construction chemicals and household cleaners by residents of the site. Therefore, the potential for the completed project to cause significant irreversible environmental damage from an accident or upset of hazardous materials would be less-than-significant.

C. Cumulative Impacts

CEQA defines cumulative impacts as two or more individual impacts which, when considered together, are substantial or which compound or increase other environmental impacts. The cumulative analysis is intended to describe the "incremental impact of the project when added to other, closely related past, present, or reasonably foreseeable future projects" that can result from "individually minor but collectively significant projects taking place over a period of time." (CEQA Guidelines Section 15355) The analysis of cumulative impacts is a two-phase process that first involves the determination of whether the project, together with existing and reasonably foreseeable projects, would result in a significant impact. If there would be a significant cumulative impact of all such projects, the EIR must determine whether the project's incremental "contribution" is cumulatively considerable, in which case, the cumulative impact would be significant. (CEQA Guidelines Section 15130)

The analysis of each environmental topic included in Chapter 4, *Environmental Setting, Impacts, and Mitigation Measures*, of this EIR considers possible cumulative impacts and identifies circumstances in which the project would contribute to significant cumulative impacts.

Projects identified in the *General Plan, Northern Waterfront Plan* and reasonably foreseeable projects were considered in the cumulative analysis. Cumulative development was analyzed by adding a regional growth rate and adding the project and foreseeable projects to assess cumulative traffic impacts, as well as air quality and noise. Cumulative analysis for population, employment, housing, water demand, wastewater generation, and solid waste generation were based on evaluating the project and the identified reasonably foreseeable projects in the context of the Alameda General Plan and master plans prepared by service providers.

Cumulative traffic, noise, and air quality impacts were identified for the year 2030. These cumulative analyses assumed that the project-required mitigation transportation system improvements identified in this EIR would be implemented. Nonetheless, transportation and air quality impacts would be cumulatively considerable and not fully mitigable. No other cumulative impacts were determined to be significant.

D. Significant and Unavoidable Environmental Impacts

In accordance with CEQA Section 21083, and with CEQA Guidelines Sections 15064 and 15065, an EIR must also identify impacts that cannot be eliminated or reduced to an insignificant level by mitigation measures included as part of the implementation of the proposed project, or by other mitigation measures that could be implemented, as described in Chapter 4, *Environmental Setting, Impacts, and Mitigation Measures*.

The proposed project would result in significant and unavoidable impacts to transportation (Impacts 4.B-3, 4.B-4, 4.B-8, 4.B-9, 4.B-10, 4.B-17, and 4.B-18), air quality (Impacts C-1, C-5, and C-6), and cultural resources (Impacts E-1 and E-5).

References – Other Statutory Sections

California Environmental Quality Act (CEQA) Statutes and Guidelines; Public Resources Code 21000-21177) and California Code of Federal Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387. 2008.

CHAPTER 7
Report Preparers

EIR Preparers

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APPENDIX A

Notice of Preparation (NOP)

Notice of Preparation

To: State Clearinghouse
(Agency)
1400 Tenth Street, Suite 212
(Address)
Sacramento, CA 95814

Subject: Notice of Preparation of a Draft Environmental Impact Report

Lead Agency:

Agency Name City of Alameda, Planning & Building Department

Street Address 2263 Santa Clara Avenue, Room 190

City/State/Zip Alameda, CA 94501

Contact Andrew Thomas

Consulting Firm (If applicable):

Firm Name ESA

Street Address 225 Bush Street, Suite 1700

City/State/Zip San Francisco, CA 94104

Contact Karl Heisler

The City of Alameda will be Lead Agency and will prepare an environmental impact report for the project identified below. We need to know the views of your agency as to the scope and content of the environmental information which is germane to your agency's statutory responsibilities in connection with the proposed project. Your agency may need to use the EIR prepared by our agency when considering your permit or other approval for the project.

The project description and location are contained in the attached materials. An Initial Study is **not** attached.

Due to the time limits mandated by State law, your response must be sent at the earliest possible date but **not later than 30 days** after receipt of this notice.

Please send your response to Andrew Thomas at the address shown above. Please include the name of a contact person in your agency.

Project Title: Boatworks Residential Project

Project Location: 2229 Clement Avenue Alameda (City (nearest)) Alameda (County)

Project Description: (brief)

The proposed project would entail the construction of 242 housing units at 2229 Clement Street in Alameda, California. The project site is approximately 9.5 acres and the project would include a mix of single-family homes and duplexes. Public access would be provided along the waterfront side of the project site. The project proposes to build a small boat marina with approximately 36 berths. The berths would be located along the entire waterfront of the project site. There would be no vehicle access to the boat marina or new boat launch location.

Date

Signature

Title Planning Service Manager

Telephone 510.747.6881
email athomas@ci.alameda.ca.us

Project Location and Site Description: The City of Alameda is located on a small island and a portion of an adjacent peninsula (Bay Farm Island) in the San Francisco Bay within a county of the same name, adjacent to the City of Oakland.

The project site is located on the northern shore of Alameda Island adjacent to the Oakland Alameda Estuary, one block west of the Park Street Bridge, directly abutting the Estuary. The project site is bounded by Clement Avenue to the south, Oak Street to the east and the estuary to the north, and it extends westward to approximately Elm Street. The Project Applicant, Francis Collins, owns and controls Assessor Parcel Numbers (APNs) 029-000-100 and 028-900-500, which compose most of the project site.

The U.S. Army Corps of Engineers (USACE) owns and controls a strip of land between those parcels and the water's edge. This land is anticipated to be transferred to the City of Alameda, possibly as early as 2011, as part of a larger plan by the USACE to relinquish its ownership of the entire Estuary. Any improvements on land owned by the USACE or the City of Alameda would be undertaken by the Project Applicant, subject to the approval of the applicable property owner (USACE or City), in addition to regulatory approval by entities including, but not limited to, the USACE, the Regional Water Quality Control Board, the Bay Conservation and Development Commission, and the City of Alameda.

The project site is located in an area known as the Northern Waterfront, which currently comprises a patchwork of land uses; many former thriving industrial properties are now vacant and underutilized. Directly west of the project site is a modular storage center. South of the project site are commercial, industrial, and residential uses. East of the project site, properties have been redeveloped, including the Park Street Landing commercial development and marina, as well as new low-rise commercial office buildings. The project site is currently occupied by a number of vacant warehouses and industrial buildings.

Project Characteristics: The proposed project would demolish all existing structures and construct approximately 242 housing units on the site, 25 percent of which would be affordable to low- and very low-income households, as well as public open space along the waterfront. The project is illustrated in the attached figures and described below.

The project would include single-family homes and duplexes. All buildings would be three stories tall, with rectangular floor plans, and buildings would range from 860 square feet to 2,665 square feet of floor area.

The development of the site would provide vehicle access through the site through its internal roadway system that would include a network of private roadways. Access points would connect at Clement Avenue and Oak Street. The Oak Street connection would include a full access intersection, aligning with Blanding Avenue.

The project proposes to build a small boat marina with approximately 36 berths. The berths would be located along the entire waterfront of the project site. The slip sizes would range from 30 to 50, feet and the average slip length would be 35 feet.

The proposed project would require both zoning and general plan amendments.

Probable Environmental Affects to be Discussed in the EIR: Air Quality; Biology; Geology, Soils and Seismicity; Hazards, Hydrology and Water Quality, Land Use and Planning, Noise; Historic Resources; and Transportation.

Public Review Period: The required 30-day public comment period shall begin on October 12, 2009 and end at 5:00 p.m. on November 10, 2009. All comments regarding the Notice of Preparation must be received by this ending date/time.

You are encouraged to submit written comments and recommendations. Comments and recommendations may be directed to Andrew Thomas, Planning Services Manager, City of Alameda, 2263 Santa Clara Avenue, Room 190, Alameda, CA 94501, telephone 510.747.6881, fax 510.747.6853, or e-mail: athomas@ci.alameda.ca.us by specifying "Boatworks Residential" in the subject line.

City of Alameda • California

Notice of Preparation of a Draft Environmental Impact Report (EIR) For the Boatworks Residential Project

Notice is hereby given that the City of Alameda will be the Lead Agency and will prepare an Environmental Impact Report (EIR) for the Boatworks Residential Project described below. The EIR will address the potential physical and environmental effects for each of the topics outlined in the California Environmental Quality Act (CEQA).

The City of Alameda is the Lead Agency for the Project and is the public agency with the greatest responsibility for reviewing the project. This notice is being sent to responsible agencies and other interested parties. Responsible Agencies are those public agencies, besides the City of Alameda, that also have a role in the review of the project.

We need to know the views of your agency as to the scope and content of the environmental information that should be included in the environmental analysis. The City of Alameda Planning Board will hold a scoping meeting to receive comments on the scope of the EIR on **January 26, 2009** at 7:00 PM at 2263 Santa Clara Avenue, City Hall Council Chambers, 3rd Floor. No action will be taken at the meeting. Comments on the scope of the EIR may also be submitted in writing to the City of Alameda Planning and Building Department **by 5:00 PM on Monday, February 16, 2009.** Please send your response to Andrew Thomas, Planning Services Manager, at the address shown below. The project description, location, and probable environmental effects are contained in this notice.

Project Title and Location:
Boatworks Residential Project
2229 Clement Street
Alameda, California 94501

Project Applicant:
Mr. Francis Collins
6050 Hollis Street
Emeryville, California 94608

Lead Agency
City of Alameda
Planning and Building Department
2263 Santa Clara Avenue, Room 190
Alameda, CA 94501

Lead Agency Contact Person
Andrew Thomas
Planning Services Manager
Telephone: (510) 747-6881
E-mail: athomas@ci.alameda.ca.us
Fax: (510) 747-6853

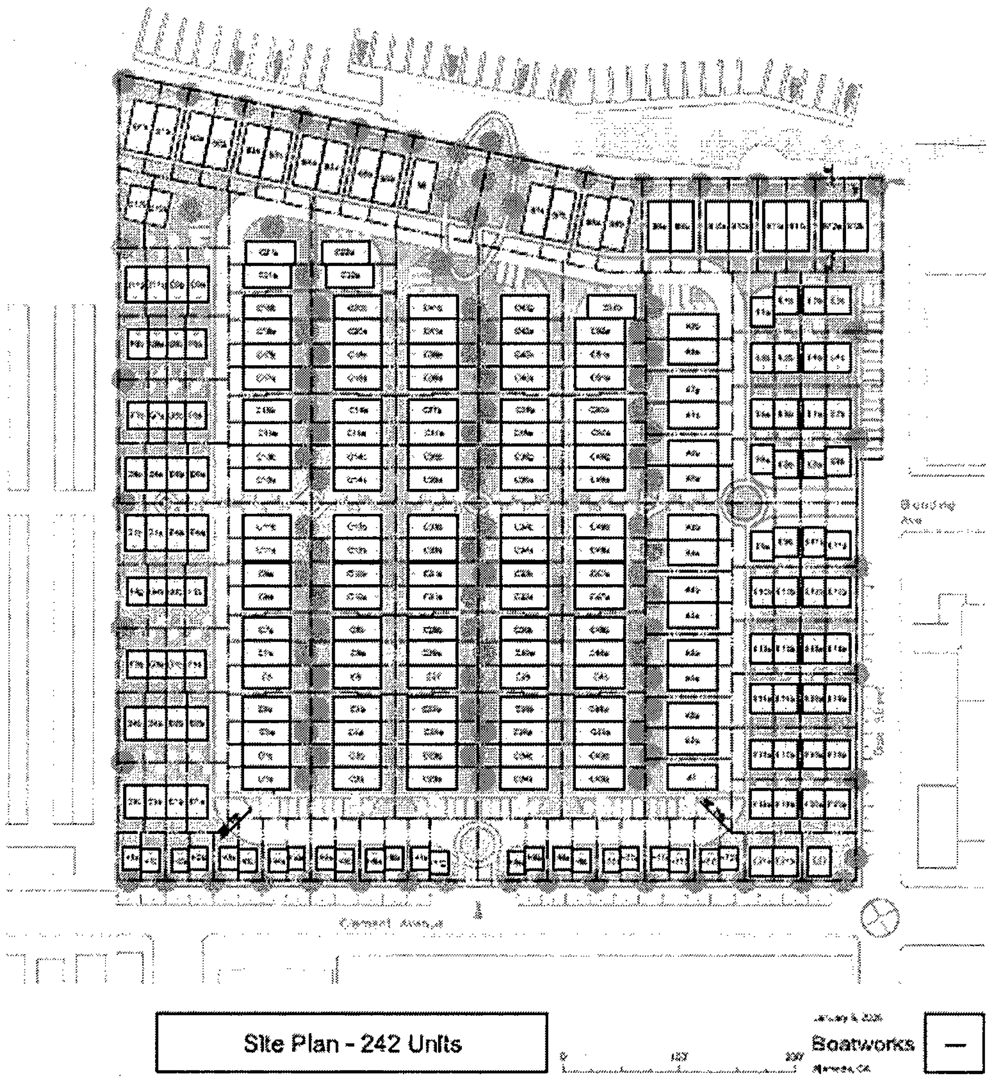
PROJECT LOCATION:

The proposed Boatworks Project is located on the northern shore of Alameda Island adjacent to the Oakland Estuary at 2229 Clement Street at the intersection of Clement and Oak Streets, one block from the Park Street Bridge.

PROJECT DESCRIPTION:

The project applicant, Mr. Francis Collins, has submitted a development application for permits to construct 242 housing units on the site, which is approximately 9.5 acres in size. The project includes single-family homes and duplexes. Forty-nine of the units would be made affordable to low and very low-income households. The project applicant is proposing to clear the site of all existing structures to make room for the proposed new homes. Public access would be provided along the waterfront side of the project site. (See site plan below.)

PROJECT SITE PLAN:



ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The EIR will evaluate each of the environmental topics that were developed according to recommendations in the CEQA Guidelines, feedback from the consultant team, and input from community meetings and scoping sessions. The topics to be evaluated in the EIR include: land use, public policy, population, employment and housing, municipal services, utilities and infrastructure, transportation and circulation, biological resources, historic resources, noise, geology, soils and seismicity, hydrology and water quality, air quality, hazardous materials, visual resources, and parks, open space and recreation. The property is on the Cortese List. The draft EIR will also consider a reasonable range of alternatives to the proposed project, including the CEQA mandated No Project Alternative and other potential alternatives that may be capable of reducing or avoiding potential environmental effects.

APPENDIX B
Comments Received in Response to the NOP

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT

ARNOLD SCHWARZENEGGER
GOVERNOR

CYNTHIA BRYANT
DIRECTOR

Notice of Preparation

October 12, 2009

RECEIVED
OCT 15 2009
PERMIT CENTER
ALAMEDA, CA 94501

To: Reviewing Agencies

Re: Boatworks Residential
SCH# 2009102040

Attached for your review and comment is the Notice of Preparation (NOP) for the Boatworks Residential draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Andrew Thomas
City of Alameda
2263 Santa Clara Avenue, Rm 190
Alameda, CA 94501

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Acting Director

Attachments
cc: Lead Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT

ARNOLD SCHWARZENEGGER
GOVERNOR

CYNTHIA BRYANT
DIRECTOR

Notice of Preparation

October 12, 2009

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ALAMEDA, CA 94501

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Re: Boatworks Residential
SCH# 2009102040

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Please direct your comments to:

Andrew Thomas
City of Alameda
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Sincerely,

Scott Morgan
Acting Director

Attachments
cc: Lead Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# **2009102040**
Project Title Boatworks Residential
Lead Agency Alameda, City of

Type **NOP** Notice of Preparation

Description Project characteristics: The proposed project would demolish all existing structures and construct approximately 242 housing units on the site, 25 percent of which would be affordable to low-and very low-income households, as well as public open space along the waterfront. The project would include single-family homes and duplexes. All buildings would be three stories tall, with rectangular floor plans and building footprints would range from 860 square feet to 2,665 sf of floor area. The development of the site would provide vehicle access through the site through its internal roadway system that would include a network of private roadways. Access points would connect at Clement Avenue and Oak Street. The Oak Street connection would include a full access intersection, aligning with Blanding Avenue. The project proposes to build a small boat marina with ~ 36 berths. The berths would be located along the entire waterfront of the project site. The slip sizes would range from 30 to 50 feet and the average slip length would be 35 feet. There would be no vehicle access to the boat marina or new boat launch location.

Lead Agency Contact

Name Andrew Thomas
Agency City of Alameda
Phone 510 747-6881 ***Fax***
email
Address 2263 Santa Clara Avenue, Rm 190
City Alameda ***State*** CA ***Zip*** 94501

Project Location

County Alameda
City
Region
Cross Streets Clement and Oak
Lat / Long
Parcel No. 029-000-100 and 028-900-500
Township ***Range*** ***Section*** ***Base***

Proximity to:

Highways SR 261, SR 61
Airports Oakland Intl
Railways UP
Waterways Oakland Estuary
Schools
Land Use GP: Parks & Public Open Space/Specified Mixed Use (MU5)

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Forest Land/Fire Hazard; Flood Plain/Flooding; Drainage/Absorption; Geologic/Seismic; Job Generation; Housing; Minerals; Noise; Public Services; Schools/Universities; Sewer Capacity; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Wildlife; Growth Inducing; Landuse; Cumulative Effects

Reviewing Agencies Resources Agency; Department of Boating and Waterways; Department of Parks and Recreation; San Francisco Bay Conservation and Development Commission; Department of Water Resources; Department of Fish and Game, Region 3; Native American Heritage Commission; State Lands Commission; Department of Housing and Community Development; Caltrans, District 4; Integrated Waste Management Board; Department of Toxic Substances Control; Regional Water Quality Control Board, Region 2

Note: Blanks in data fields result from insufficient information provided by lead agency.

NOP Distribution List   SL   County: Alameda   SCH# 2009102040

Resources Agency

- [x] **Resources Agency**
  Nadell Gayou
- [x] **Dept. of Boating & Waterways**
  Mike Sotelo
- [ ] **California Coastal Commission**
  Elizabeth A. Fuchs
- [ ] **Colorado River Board**
  Gerald R. Zimmerman
- [ ] **Dept. of Conservation**
  Rebecca Salazar
- [ ] **California Energy Commission**
  Dale Edwards
- [ ] **Cal Fire**
  Allen Robertson
- [ ] **Office of Historic Preservation**
  Wayne Donaldson
- [x] **Dept of Parks & Recreation**
  Environmental Stewardship Section
- [ ] **Central Valley Flood Protection Board**
  Jon Yego
- [x] **S.F. Bay Conservation & Dev't. Comm.**
  Steve McAdam
- [x] **Dept. of Water Resources**
  Resources Agency
  Nadell Gayou
- [ ] ____________________
  Conservancy

B-4

Fish and Game

- [ ] **Depart. of Fish & Game**
  Scott Flint
  Environmental Services Division
- [ ] **Fish & Game Region 1**
  Donald Koch
- [ ] **Fish & Game Region 1E**
  Laurie Harnsberger
- [ ] **Fish & Game Region 2**
  Jeff Drongesen
- [x] **Fish & Game Region 3**
  Robert Floerke
- [ ] **Fish & Game Region 4**
  Julie Vance
- [ ] **Fish & Game Region 5**
  Don Chadwick
  Habitat Conservation Program
- [ ] **Fish & Game Region 6**
  Gabrina Gatchel
  Habitat Conservation Program
- [ ] **Fish & Game Region 6 I/M**
  Gabrina Getchel
  Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Game M**
  George Isaac
  Marine Region

Other Departments

- [ ] **Food & Agriculture**
  Steve Shaffer
  Dept. of Food and Agriculture
- [ ] **Depart. of General Services**
  Public School Construction
- [ ] **Dept. of General Services**
  Anna Garbeff
  Environmental Services Section
- [ ] **Dept. of Public Health**
  Bridgette Binning
  Dept. of Health/Drinking Water

Independent Commissions,Boards

- [ ] **Delta Protection Commission**
  Linda Flack
- [ ] **Office of Emergency Services**
  Dennis Castrillo
- [ ] **Governor's Office of Planning & Research**
  State Clearinghouse
- [x] **Native American Heritage Comm.**
  Debbie Treadway
- [ ] **Public Utilities Commission**
  Leo Wong
- [ ] **Santa Monica Bay Restoration**
  Guangyu Wang
- [x] **State Lands Commission**
  Marina Brand
- [ ] **Tahoe Regional Planning Agency (TRPA)**
  Cherry Jacques

Business, Trans & Housing

- [ ] **Caltrans - Division of Aeronautics**
  Sandy Hesnard
- [ ] **Caltrans - Planning**
  Terri Pencovic
- [ ] **California Highway Patrol**
  Scott Loetscher
  Office of Special Projects
- [x] **Housing & Community Development**
  CEQA Coordinator
  Housing Policy Division

Dept. of Transportation

- [ ] **Caltrans, District 1**
  Rex Jackman
- [ ] **Caltrans, District 2**
  Marcelino Gonzalez
- [ ] **Caltrans, District 3**
  Bruce de Terra
- [x] **Caltrans, District 4**
  Lisa Carboni
- [ ] **Caltrans, District 5**
  David Murray
- [ ] **Caltrans, District 6**
  Michael Navarro
- [ ] **Caltrans, District 7**
  Elmer Alvarez
- [ ] **Caltrans, District 8**
  Dan Kopulsky
- [ ] **Caltrans, District 9**
  Gayle Rosander
- [ ] **Caltrans, District 10**
  Tom Dumas
- [ ] **Caltrans, District 11**
  Jacob Armstrong
- [ ] **Caltrans, District 12**
  Chris Herre

Cal EPA

Air Resources Board

- [ ] Airport Projects
  Jim Lerner
  - [ ] Transportation Projects
    Douglas Ito
  - [ ] Industrial Projects
    Mike Tollstrup
- [x] **California Integrated Waste Management Board**
  Sue O'Leary
- [ ] **State Water Resources Control Board**
  Regional Programs Unit
  Division of Financial Assistance
- [ ] **State Water Resources Control Board**
  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- [ ] **State Water Resouces Control Board**
  Steven Herrera
  Division of Water Rights
- [x] **Dept. of Toxic Substances Control**
  CEQA Tracking Center
- [ ] **Department of Pesticide Regulation**
  CEQA Coordinator

Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1**
  Cathleen Hudson
  North Coast Region (1)
- [x] **RWQCB 2**
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] **RWQCB 3**
  Central Coast Region (3)
- [ ] **RWQCB 4**
  Teresa Rodgers
  Los Angeles Region (4)
- [ ] **RWQCB 5S**
  Central Valley Region (5)
  - [ ] **RWQCB 5F**
    Central Valley Region (5)
    Fresno Branch Office
  - [ ] **RWQCB 5R**
    Central Valley Region (5)
    Redding Branch Office
- [ ] **RWQCB 6**
  Lahontan Region (6)
  - [ ] **RWQCB 6V**
    Lahontan Region (6)
    Victorville Branch Office
- [ ] **RWQCB 7**
  Colorado River Basin Region (7)
- [ ] **RWQCB 8**
  Santa Ana Region (8)
- [ ] **RWQCB 9**
  San Diego Region (9)
- [ ] Other ____________________

Last Updated on 03/24/2009

STATE OF CALIFORNIA ARNOLD SCHWARZENEGGER, *Governor*

CALIFORNIA STATE LANDS COMMISSION
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

PAUL D. THAYER, *Executive Officer*
(916) 574-1800 FAX (916) 574-1810
Relay Service From TDD Phone **1-800-735-2929**
from Voice Phone **1-800-735-2922**

Contact Phone: **(916) 574-1900**
Contact FAX: **(916) 574-1885**

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NOV 12 2009
PERMIT CENTER
ALAMEDA, CA

November 9, 2009

File Ref: SCH 2009102040

Andrew Thomas
City of Alameda
2263 Santa Clara Avenue, Rm 190
Alameda, CA 94501

Subject: Notice of Preparation (NOP) for the Boatworks Residential Environmental Impact Report (EIR)

Dear: Mr. Thomas,

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. The boundaries of these State-owned lands generally are based upon the last naturally occurring location of the ordinary high or low water marks prior to artificial influences that may have altered or modified the river or shoreline characteristics. On tidal waterways, the State's sovereign fee ownership extends landward to the ordinary high water mark as it last naturally existed. On navigable non-tidal waterways, the State holds fee ownership of the bed landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, as they last naturally existed. Such boundaries may not be readily apparent from present day site inspections. The State's sovereign interests are under the jurisdiction of the CSLC.

Based on staff's review of our in-house records and maps, it appears that the proposed project will be located within Rancho San Antonio. This Rancho was confirmed into private ownership and patented by the Federal Government in 1857. The State is precluded from asserting that it acquired sovereign title interests by virtue of its admission to the United States in 1850 pursuant to the holdings in Summa Corporation v. California 466 U.S. 198 (1984). All remaining State interest has been granted to the city of Alameda (City), pursuant to Chapter 348, Statutes of 1913, and as amended. As day to day administration of these lands has been granted, in trust, to the City, the City need not obtain authorization from the CSLC to proceed with this project.

However, the City should contact any additional regulatory agencies with permitting authority for this project.

For these reasons, we have no comment on the NOP at this time.

Sincerely,

Marina R. Brand

Marina R. Brand, Assistant Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
G. Kato, CSLC
M. Hadden, CSLC

ALAMEDA COUNTY
CONGESTION MANAGEMENT AGENCY

1333 BROADWAY, SUITE 220 • OAKLAND, CA 94612 • PHONE: (510) 836-2560 • FAX: (510) 836-2185
E-MAIL: mail@accma.ca.gov • WEB SITE: accma.ca.gov

April 1, 2009

Mr. Andrew Thomas
Planning and Building Department
City of Alameda
Planning Department
City Hall
2263 Santa Clara Avenue, Room 190
Alameda, CA 94501

SUBJECT: Comments on the Notice of Preparation of a Draft Environmental Impact Report for the Boatworks Residential Project in the City of Alameda

Dear Mr. Thomas:

Thank you for the opportunity to comment on the City of Alameda's Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) for the Boatworks Residential Project in the City of Alameda. The proposed project would allow development of 242 housing units on a 9.5 acre site. Existing structures would be removed for the new homes. The project is located on the northern shore of Alameda Island adjacent to the Oakland Estuary at 2229 Clement Street at the intersection of Clement and Oak Streets, one block from the Park Street Bridge.

The ACCMA respectfully submits the following comments:

- The City of Alameda adopted Resolution 12308 on August 18, 1992 establishing guidelines for reviewing the impacts of local land use decisions consistent with the Alameda County Congestion Management Program (CMP). Based on our review of the NOP and the land uses that are being considered, the proposed project appears to generate at least 100 p.m. peak hour trips over existing conditions. If this is the case, the CMP Land Use Analysis Program requires the City to conduct a traffic analysis of the project using the Countywide Transportation Demand Model for Year 2007 conditions. Please note the following paragraph as it discusses the responsibility for modeling.
    - The CMA Board amended the CMP on March 26th, 1998 so that local jurisdictions are responsible for conducting the model runs themselves or through a consultant. The Countywide model is available to the local jurisdictions for this purpose. The Countywide Model has been updated to Projections 2007 for base years 2015 and 2035. The City of Alameda has a signed Countywide Model Agreement with the ACCMA dated April 1, 2008. The Congestion Management Program (CMP) Land Use Analysis Program requires that the City of Alameda conduct a traffic analysis of the project using the Countywide Transportation Demand Model for projection years 2015 and 2030 conditions. Before the model can be used for this

project, a letter must be submitted to the ACCMA requesting use of the model and describing the project. A copy of a sample letter agreement is available upon request.

- Potential impacts of the project on the Metropolitan Transportation System (MTS) need to be addressed. (See 2007 CMP Figures E-2 and E-3 and Figure 2). The analysis should address all potential impacts of the project on the MTS roadway and transit systems. These include I-880, Park Street (Alameda and Oakland), Fruitvale Avenue (Alameda and Oakland), Encinal Avenue, International Boulevard (Oakland), as well as BART and AC Transit. Potential impacts or the project must be addressed for 2015 and 2035 conditions. Please note that the ACCMA does *not* have a policy for determining a threshold of significance. Rather, it is expected that professional judgment will be applied to determine project level impacts.

- The CMA requests that there be a discussion on the proposed funding sources of the transportation mitigation measures identified in the environmental documentation. The CMP establishes a Capital Improvement Program (See 2007 CMP, Chapter 7) that assigns priorities for funding roadway and transit projects throughout Alameda County. The improvements called for in the analysis should be consistent with the CMP CIP. Given the limited resources at the state and federal levels, it would be speculative to assume funding of an improvement unless it is consistent with the project funding priorities established in the Capital Improvement Program (CIP) of the CMP, the federal Transportation Improvement Program (TIP), or the adopted Regional Transportation Plan (RTP). Therefore, we are requesting that the environmental documentation include a financial program for all roadway and transit improvements.

- The adequacy of any project mitigation measures should be discussed. On February 25, 1993 the CMA Board adopted three criteria for evaluating the adequacy of DEIR project mitigation measures:

    - Project mitigation measures must be adequate to sustain CMP service standards for roadways and transit;
    - Project mitigation measures must be fully funded to be considered adequate;
    - Project mitigation measures that rely on state or federal funds directed by or influenced by the CMA must be consistent with the project funding priorities established in the Capital Improvement Program (CIP) section of the CMP or the Regional Transportation Plan (RTP).

    It would be helpful to indicate in the analysis the adequacy of proposed mitigation measures relative to these criteria. In particular, the analysis should detail when proposed roadway or transit route improvements are expected to be completed, how they will be funded, and what would be the effect on LOS if only the funded portions of these projects were assumed to be built prior to project completion.

- Potential impacts of the project on CMP transit levels of service must be analyzed. (See 2007 CMP, Chapter 4). Transit service standards are 15-30 minute headways for bus service and 3.75-15 minute headways for BART during peak hours. The analysis should address the issue of transit funding as a mitigation measure in the context of the CMA's policies as discussed above.

- The analysis should consider demand-related strategies that are designed to reduce the need for new roadway facilities over the long term and to make the most efficient use of existing facilities (see 2007 CMP, Chapter 5). The analysis could consider the use of TDM measures, in conjunction with roadway and transit improvements, as a means of attaining acceptable levels of service. Whenever possible, mechanisms that encourage ridesharing, flextime, transit, bicycling, telecommuting and other means of reducing peak hour traffic trips should be considered. Street layout and design strategies would foster pedestrian and bicycle connections and transit-friendly site design should also be considered. The Site Design Guidelines Checklist may be useful during the review of the development proposal. A copy of the checklist is enclosed.

- The Alameda Countywide Bicycle Plan was approved by the ACCMA Board on October 26, 2006. The EIR should consider opportunities to promote countywide bicycle routes identified in the Plan through the project development review process. The approved Countywide Bike Plan is available at http://www.accma.ca.gov/pages/HomeBicyclePlan.aspx

- The Alameda County Pedestrian Plan, developed by ACTIA, was adopted by both the ACTIA and ACCMA Boards in September 2006 and October 2006, respectively. The EIR should consider opportunities to promote pedestrian improvements identified in the Plan through the project development review process. The approved Countywide Pedestrian Plan is available at http://www.acta2002.com/

Once again, thank you for the opportunity to comment on this NOP for a DEIR. Please do not hesitate to contact me at 510/836-2560 if you require additional information.

Sincerely,

Diane Stark

Diane Stark
Senior Transportation Planner

cc: Beth Walukas, Manager of Planning
Chron
file: CMP - Environmental Review Opinions - Responses - 2009

Attachment

Design Strategies Checklist
for the
Transportation Demand Management Element
of the
Alameda County CMP

The Transportation Demand Management Element included in the Congestion Management Program requires each jurisdiction to comply with the "" Required Program". This requirement can be satisfied in three ways: 1) adoption of "Design Strategies for encouraging alternatives to auto use through local development review" prepared by ABAG and the Bay Area Quality Management District; 2) adoption of new design guidelines that meet the individual needs of the local jurisdictions and the intent of the goals of the TDM Element or 3) evidence that existing policies and programs meet the intent of the goals of the TDM Element.

For those jurisdictions who have chosen to satisfy this requirement by Option 2 or 3 the following checklist has been prepared. In order to insure consistency and equity throughout the County, this checklist identifies the components of a design strategy that should be included in a local program to meet the minimum CMP conformity requirements. The required components are highlighted in bold type and are shown at the beginning of each section. A jurisdiction must answer Yes to each of the required components to be considered consistent with the CMP. Each jurisdiction will be asked to annually certify that it is complying with the TDM Element. Local jurisdictions will not be asked to submit the back-up information to the CMA justifying its response; however it should be available at the request of the public or neighboring jurisdictions.

Questions regarding optional program components are also included. You are encouraged but not required to answer these questions. ACTAC and the TDM Task Force felt that it might be useful to include additional strategies that could be considered for implementation by each jurisdiction.

CHECKLIST

Bicycle Facilities

Goal: To develop and implement design strategies that foster the development of a countywide bicycle program that incorporates a wide range of bicycle facilities to reduce vehicle trips and promote bicycle use for commuting, shopping and school activities. (Note: an example of facilities are bike paths, lanes or racks.)

Note: Bold type face indicates those components that must be included the "Required Program" in order to be found in compliance with the Congestion Management Program.

Local Responsibilities:

1a. In order to achieve the above goal, does your jurisdiction have design strategies or adopted policies that include the following:

1a.1 provides a system of bicycle facilities that connect residential and/or non-residential development to other major activity centers?

Yes No

1a.2 bicycle facilities that provide access to transit?

Yes No

1a.3 that provide for construction of bicycle facilities needed to fill gaps, (i.e. gap clure), not provided through the development review process?

Yes No

1a.4 that consider bicycle safety such as safe crossing of busy arterials or along bike trails?

Yes No

1a.5 that provide for bicycle storage and bicycle parking for (A) multi-family residential and/or (B) non-residential developments?

Yes No

1b. How does your jurisdiction implement these strategies? Please identify.

Zoning ordinance
Design Review
Standard Conditions of Approval
Capital Improvement Program
Specific Plan
Other

Pedestrian Facilities

Goal: To develop and implement design strategies that reduce vehicle trips and foster walking for commuting, shopping and school activities.

Local Responsibilities

2a. In order to achieve the above goal, does your jurisdiction have design strategies or adopted policies that incorporate the following:

2a.1 that provides reasonably direct, convenient, accessible and safe pedestrian connections to major activity centers, transit stops or hubs parks/open space and other pedestrian facilities?

Yes No

Note: Bold type face indicates those components that must be included the "Required Program" in order to be found in compliance with the Congestion Management Program.

2a.2 that provide for construction of pedestrian paths needed to fill gaps, (i.e. gap closure), not provided through the development process?

Yes No

2a.3 that include safety elements such as convenient crossing at arterials?

Yes No

2a.4 that provide for amenities such as lighting, street trees, trash receptacles that promote walking?

Yes No

2a.5 that encourage uses on the first floor that are pedestrian oriented, entrances that are conveniently accessible from the sidewalk or transit stops or other strategies that promote pedestrian activities in commercial areas?

Yes No

2b. How does your jurisdiction implement these strategies? Please identify.

Zoning ordinance
Design Review, such as ADA Accessibility Design Standards
Standard Conditions of Approval
Capital Improvement Program
Specific Plan
Other

Transit

Goal: To develop and implement design strategies in cooperation with the appropriate transit agencies that reduce vehicle trips and foster the use of transit for commuting, shopping and school activities.

Local Responsibilities

3a. In order to achieve the above goal, does your jurisdiction have design strategies or adopted policies that include the following:

3a.1 provide for the location of transit stops that minimize access time, facilitate intermodal transfers, and promote reasonably direct, accessible, convenient and safe connections to residential uses and major activity centers?

Yes No

Note: Bold type face indicates those components that must be included the "Required Program" in order to be found in compliance with the Congestion Management Program.

3a.2 provide for transit stops that have shelters or benches, trash receptacles, street trees or other street furniture that promote transit use?

Yes No

3a.3 that includes a process for including transit operators in development review?

Yes No

3a.4 provide for directional signage for transit stations and/or stops?

Yes No

3a.5 that include specifications for pavement width, bus pads or pavement structure, length of bus stops, and turning radii that accommodates bus transit?

Yes No

3.b How does your jurisdiction implement these strategies? Please identify.
- Zoning ordinance
- Design Review
- Standard Conditions of Approval
- Capital Improvement Program
- Specific Plan
- Other

Carpools and Vanpools

Goal: To develop and implement design strategies that reduce the overall number of vehicle trips and foster carpool and vanpool use.

Local Responsibilities:

4a. In order to achieve the above goal, does your jurisdiction have design strategies or adopted policies that include the following:

4a.1 For publicly owned parking garages or lots, are there preferential parking spaces and/or charges for carpools or vanpools?

Yes No

4a.2 that provide for convenient or preferential parking for carpools and vanpools in non-residential developments?

Yes No

Note: Bold type face indicates those components that must be included the "Required Program" in order to be found in compliance with the Congestion Management Program.

4.b How does your jurisdiction implement these strategies? Please identify.

- Zoning ordinance
- Design Review
- Standard Conditions of Approval
- Capital Improvement Program
- Specific Plan
- Other

Park and Ride

Goal: To develop design strategies that reduce the overall number of vehicle trips and provide park and ride lots at strategic locations.

Local Responsibilities:
5a. In order to achieve the above goal, does your jurisdiction have design strategies or adopted policies that include the following:

5a.1 promote park and ride lots that are located near freeways or major transit hubs?

Yes No

5a.2 a process that provides input to Caltrans to insure HOV by-pass at metered freeway ramps?

Yes No

5b. How does your jurisdiction implement these strategies? Please identify.

- Zoning ordinance
- Design Review
- Standard Conditions of Approval
- Capital Improvement Program
- Specific Plan
- Other

Note: Bold type face indicates those components that must be included the "Required Program" in order to be found in compliance with the Congestion Management Program.

EAST BAY
MUNICIPAL UTILITY DISTRICT

February 4, 2009

Andrew Thomas, Planning Services Manager
City of Alameda
Planning and Building Department
2263 Santa Clara Avenue, Room 190
Alameda, CA 94501

Re: Notice of Preparation of a Draft Environmental Impact Report – Boatworks Residential Project, Alameda

Dear Mr. Thomas:

East Bay Municipal Utility District (EBMUD) appreciates the opportunity to comment on the Notice of Preparation of a Draft Environmental Impact Report (EIR) for the Boatworks Residential Project located in the City of Alameda. EBMUD has the following comments.

WATER SERVICE

EBMUD's Central Pressure Zone, with a service elevation between 0 and 100 feet, will serve the proposed development. A main extension, at the project sponsor's expense, will be required to serve the proposed development. When the development plans are finalized, the project sponsor should contact EBMUD's New Business Office and request a water service estimate to determine costs and conditions for providing water service to the proposed development. Engineering and installation of water mains and services requires substantial lead-time, which should be provided for in the project sponsor's development schedule.

EBMUD will not inspect, install or maintain pipeline in contaminated soil or groundwater (if groundwater is present at any time during the year at the depth piping is to be installed) that must be handled as a hazardous waste or that may pose a health and safety risk to construction or maintenance personnel wearing Level D personal protective equipment. Nor will EBMUD install piping in areas where groundwater contaminant concentrations exceed specified limits for discharge to sanitary sewer systems or sewage treatment plants.

Applicants for EBMUD services requiring excavation in contaminated areas must submit copies of existing information regarding soil and groundwater quality within or adjacent to the project boundary. In addition, the applicant must provide a legally sufficient, complete and specific written remedial plan establishing the methodology, planning and

375 ELEVENTH STREET • OAKLAND • CA 94607-4240 • TOLL FREE 1-866-40 -EBMUD

design of all necessary systems for the removal, treatment, and disposal of all identified contaminated soil and/or groundwater. EBMUD will not design the installation of pipelines until such time as soil and groundwater quality data and remediation plans are received and reviewed and will not install pipelines until remediation has been carried out and documentation of the effectiveness of the remediation has been received and reviewed. If no soil or groundwater quality data exists or the information supplied by the applicant is insufficient EBMUD may require the applicant to perform sampling and analysis to characterize the soil being excavated and groundwater that may be encountered during excavation or perform such sampling and analysis itself at the applicant's expense.

WASTEWATER PLANNING

EBMUD Main Wastewater Treatment Plant is anticipated to have adequate dry-weather capacity to treat the proposed wastewater flow from this project, provided this wastewater meets the standards of EBMUD's Environmental Services Division. The City of Alameda has set a maximum allowable peak wastewater flow limit for each subbasin within the City, and EBMUD agreed to design and construct its wet-weather conveyance and treatment facilities to accommodate these flows. Flows above the agreed-upon flow limits may adversely impact EBMUD's wet-weather conveyance and treatment facilities; therefore, EBMUD prohibits any subbasin from discharging wastewater flows above its allocated peak flow.

The project applicant must confirm with the City of Alameda Public Works Department that there is available capacity within the subbasin flow allocation and that it has not been allocated to other developments. The projected peak wet-weather wastewater flows from this project need to be determined to assess the available capacity within the subbasin and confirmation included in the EIR. Suggested language to include in the EIR is as follows: "The City of Alameda Public Works Department has confirmed that there is available wastewater capacity within Subbasin (*insert subbasin number here*) for this project."

In general, the project should address the replacement or rehabilitation of the existing sanitary sewer collection system to prevent an increase in I/I. Please include a provision to control or reduce the amount of I/I in the EIR for this project. The main concern is the increase in total wet-weather flow, which could have an adverse impact if the flow is greater than the maximum allowable flow from this subbasin.

WATER RECYCLING

The proposed project is not a likely candidate for recycled water due to minimal irrigation demands and the cost to provide recycled water to the project site may be cost prohibitive due to the long length of pipeline required to get to the site. However, EBMUD requests that the project applicant contact and coordinate with EBMUD during the planning of the project to confirm the feasibility of using recycled water at the project site.

WATER CONSERVATION

The proposed project presents an opportunity to incorporate water conservation measures. EBMUD would request that the City of Alameda include in its conditions of approval a requirement that the project sponsor comply with Assembly Bill 325, Model Water Efficient Landscape Ordinance (Division 2, Title 23, California Code of Regulations, Chapter 2.7, Sections 490 through 495). EBMUD staff would appreciate the opportunity to meet with the project sponsor to discuss water conservation programs and best management practices applicable to the integrated projects. A key objective of this discussion will be to explore timely opportunities to expand water conservation via early consideration of EBMUD's conservation programs and best management practices applicable to the project.

If you have any questions concerning this response, please contact David J. Rehnstrom, Senior Civil Engineer, Water Service Planning at (510) 287-1365.

Sincerely,

William R. Kirkpatrick
Manager of Water Distribution Planning

WRK:AMW:sb
sb09_020.doc

cc: Mr. Francis Collins
6050 Hollis Street
Emeryville, California 94608

Alameda Unified School District
Excellence & Equity For All Students
Maintenance, Operations & Facilities
2200 Central Avenue, Alameda, CA 94501
Phone 510/337-7090; Fax 510/337-7083

February 12, 2009

Andrew Thomas
Planning Services Manager
Planning and Building Department
2263 Santa Clara Avenue, Room 190
Alameda, CA 94501

Re: Draft EIR Boatworks Residential Property

Dear Mr. Thomas:

Alameda Unified School District will be impacted by the addition of 242 housing units within the boundaries of the school district. Student Generation Rates (SGR) based on types of housing should be calculated with a focus on addressing the need for additional capacity at the neighborhood Elementary and both Secondary Schools. In the Scope of the EIR the study should be specific to SGR calculated from local developments (i.e. Bayport) as the basis for both total number and distribution of student populations.

The school district is keenly aware of its responsibility as it is often required to support communities by providing facilities for physical activities, meeting rooms and community activities. The EIR should address in terms of official recognition the additional impact of adding the needs of the occupants of this new development on the facilities of Alameda Unified School District. Over the years the sports facilities, including gyms and fields are increasingly used by our communities without increasing capacity. Existing sites can be improved to accommodate year round all-weather use by our community and should be considered with this and all future projects within the boundaries of the district.

Sincerely,

Leland C. Noll
Administrative Director
Maintenance, Operations and
Facilities

LN:ct

Cc: Mr. Francis Collins, Boatworks Residential Project

The
ALAMEDA
ARCHITECTURAL
Preservation
Society

January 26, 2009

Mr. Andrew Thomas, Planning Manager
City of Alameda
2263 Santa Clara Avenue
Alameda, CA. 94501

Subject: Scoping Session for Boatworks Draft EIR - - -(2229 Clement Avenue - - Northwest Corner Oak Street and Clement Avenue)

Dear Andrew:

The Alameda Architectural Preservation Society (AAPS) requests that the following project impact and project alternatives be evaluated in the subject EIR:

1. **<u>Project Impact</u>: Removal of the Dow Pump and Engine Company Plant at the Northwest Corner of Oak Street and Clement Avenue.** The building at the northwest corner of Oak and Clement within the plant complex appears to be a "historic resource" as defined by the California Environmental Quality Act (CEQA).

   According to local architectural historian Woodruff Minor, the structure is probably the oldest major industrial building in Alameda (small metal sheds aside), with the Southern Pacific Maintenance Shop (Rosenblum's Winery) a close second. He also believes that that this is the largest wood-frame structure in the city (unless some of the FISC buildings still stand), measuring about 100 feet wide by about 300 feet long, with a 50-ft. clear span down the center. He describes it as "a magnificent space of the classic industrial 'cathedral' genre, a la nave and aisles". Mr. Minor advises that the plant was built in 1909.

   Established ca. 1880 in San Francisco, with a large plant south of Market near the waterfront, the Dow Pump and Engine Co. was the largest manufacturer of pumps in the western United States; their clients were primarily mine operators. The company moved to Alameda after the 1906 earthquake, shortly after harbor improvements that provided deepened shipping channels in the Estuary.

   The plant was acquired in 1941 by the Pacific Coast Engineering Company (later, PACECO), which remained here until 1981. Founded in 1923, this company started out on Oakland's western waterfront, but was evicted by the Army when the Oakland Army Base went in. It was at the Alameda plant that PACECO designed and built the world's first dockside container crane, for Matson, in 1958,

P.O. Box 1677
Alameda, CA 94501
510-986-9232

helping inaugurate the modern era of container shipping; so the building has layers of significance.

Attached is a photograph of the Dow Pump and Engine Company complex, as it appeared ca. 1910. The image is from a brochure ("Alameda, California") published by the Southern Pacific and Sunset Magazine in 1911 from Mr. Minor's private collection. Please note that the left-hand building in the picture was later altered with modern additions at the front and side; the old building survived intact behind these accretions, but has been damaged by fire. The rearmost of the two smaller buildings at the center of the group survives more or less intact.

The right-hand building is the extant structure at the corner of Oak and Clement, and is largely intact. The building is of heavy timber construction, and the window banding was probably originally wood sash, but is now covered with what appears to be translucent panels.

It is not clear, based on this photograph, whether the large monitor features in the two large buildings were both originally glazed; the left-hand building in this photo seems to have metal roofing (not glass) on the slanted sides of the monitor; since the right-hand building is seen face-on, the treatment of the monitor sides is not visible. Viewed from inside, however, it is clear that the monitor is open along the sides (but currently enclosed with translucent fiberglass panels).

Although the building is currently in very poor condition and an eyesore, the photo shows that it was once a very attractive structure and the heavy timbered structural frame (probably old growth redwood or fir) appears intact. The unsightly window coverings could be removed and replaced with the original glazing and deteriorated portions of the corrugated metal siding could be replaced as needed.

The building was included in a 1989 survey of the Northern Waterfront conducted for the City by the historic preservation consulting firm Corbett and Hardy. Mr. Minor advises that the Planning Department has the research file for the Corbett and Hardy survey but he cannot locate the State Historic Resources Inventory Form (Form DPR 523) that they produced.

2. **Project Alternatives: Include retention, rehabilitation and adaptive reuse of all or a significant portion of the Dow Building.** Possible new uses may include a large format retail store, such as the Borders Book Store in Emeryville, which is located within an historic warehouse. This alternative would mesh well with the Park Street North of Lincoln Strategic Plan. AAPS had previously recommended that the west side of Oak Street, including the subject site, be included within the Plan's study area. It is unfortunate that these areas were not included.

Although probably outside the scope of the EIR, the Boatworks Project should consider a possible truck route connector extending behind the building from the western terminus of Blanding Avenue (at Oak Street) to the existing Clement Avenue truck route. The connecter would extend Blanding Avenue to the west behind the Dow Building and the connecter would then bend diagonally to the southwest to connect with Clement west of the Dow Building (see Attachment 2 map). A newer building to the north of the Dow Building could be removed to accommodate the truck route extension.

East of Oak and especially east of Park, Blanding is probably a more logical truck route than Clement, since access to the Bridgeside Shopping Center is from Blanding and Blanding has more solid industrial type uses than Clement east of Park. Running the truck route along Blanding would also reduce impacts on historic residences along Clement east of Everett and provide a more direct truck route connection to the Fruitvale Bridge.

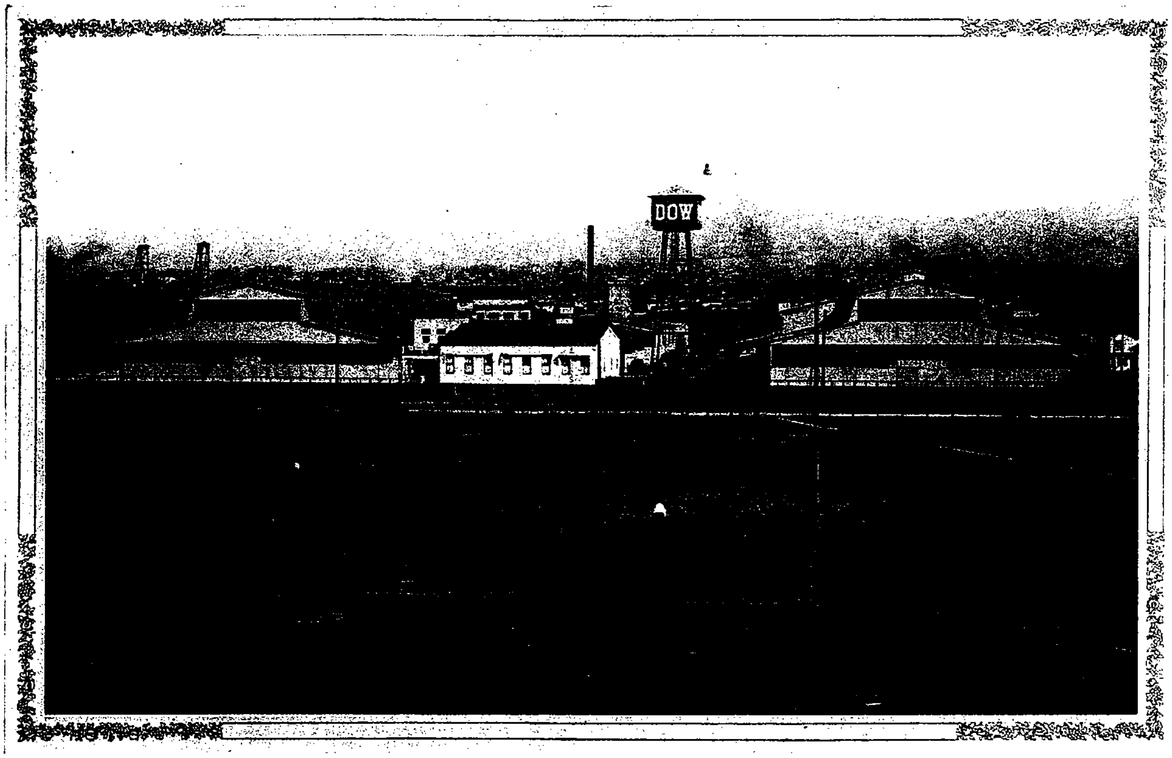
Please contact me at 510-523-0411 or cbuckley@alamedanet.net if you would like to discuss these comments.

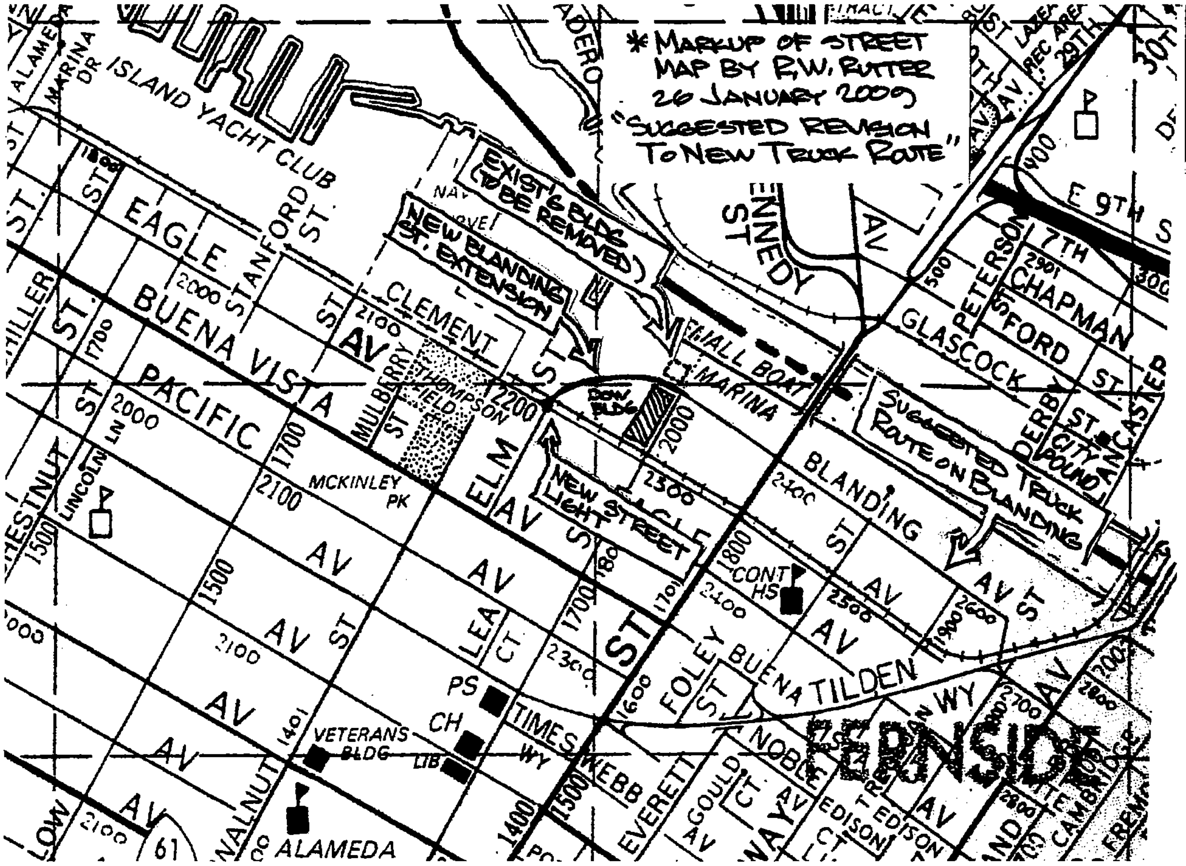
Sincerely,

Christopher Buckley, Chair
Preservation Action Committee AAPS

Attachments: (1) Photo of Dow Pump and Engine Co. complex. ca. 1910
(2) Map of possible truck route connector between Blanding and Clement Avenues.

cc: City of Alameda Planning Board
Cathy Woodbury and Jon Biggs, Planning and Building Department
AAPS Board and Preservation Action Committee members


DOW


* MARKUP OF STREET MAP BY R.W. RUTTER 26 JANUARY 2009
"SUGGESTED REVISION TO NEW TRUCK ROUTE"
EXIST'G BLDG (TO BE REMOVED)
NEW BLANDING ST. EXTENSION
NEW STREET LIGHT
SUGGESTED TRUCK ROUTE ON BLANDING
ISLAND YACHT CLUB
EAGLE
STANFORD ST
CLEMENT AV
BUENA VISTA
PACIFIC
MULBERRY ST
THOMPSON FIELD
MCKINLEY PK
ELM ST
MARINA
BLANDING
GLASCOCK
CHAPMAN
FORD
PETERSON
E 9TH
7TH
TILDEN WY
FERNSIDE
FOLEY ST
EVERETT
WEBB
TIMES WY
LEA CT
VETERANS BLDG
PS
CH
LIB
ALAMEDA
LINCOLN LN
CHESTNUT
CONT HS
EDISON CT
CITY POUND
LANCASTER
DERBY ST

February 12th, 2009

RECEIVED

FEB 1 2 2009

PERMIT CENTER
ALAMEDA, CA 94501

Mr. Andrew Thomas
Planning Services Manager
2263 Santa Clara Avenue
Room 190
Alameda, CA 94501

Dear Mr. Thomas;

This is regarding the "Boatworks Residential Project" located on the northern shore of Alameda Island adjacent to the Oakland Estuary at 2229 Clement Street at the intersection of Clement and Oak Streets, one block from the Park Street Bridge.

I wish to object to the size of this project on the following grounds:

#1 Mr. Collins wants to construct 242 "housing units". The letter sent by you is vague as to the number of single-family homes and duplexes. The height of the duplexes is not mentioned nor is the footprint for each "unit".

#2 I believe the proposal to build these units is in direct violation of Measure A. The city of Alameda has been dealing with Mr. Collins since October of 2006. Why are we yet again wasting money on consultants and EIR's?

#3 You fail to note the impact of so many more children living in that area. Some of the considerations not mentioned as to your cope would include: the total lack of facilities at the elementary schools and high schools. Recent failures of previous EIR evaluations as to this problem have led to overcrowding at all of the current schools in Alameda, most notably Lincoln Middle School and Alameda High School. In addition to the actual limitations of space would be the requirement of many of the parents to drive their children to school. This would create even more crowed and dangerous conditions on the streets. We currently have crossing guards for just that reason, to safeguard our children as the walk to school. Clement Street is currently a truck route. Will the truck route be changed, if so, how?

#4 You have not mentioned the additional traffic crowding at the rush hours for not only the people traveling to and from work but also the crowed traffic on the the streets should there be additional "units" built in that area.

#5 You have not defined what is considered a "unit". Single family dwellings can contain anywhere from one to four bedrooms. This lack of information makes a considerable difference. How are we to know just how many people could be living in the "units"?

#6 You have not defined the size as to the duplexes. Again, one, two, three, four bedrooms?

#7 The total amount of additional vehicles in that area is not mentioned. Even if each "unit" has just two occupants, there is the possibility that each occupant would own and drive a car. Where are all of these cars going to be parked? Not to mention the fumes that will be coming form those vehicles will decrease air quality.

#8 I believe the building of these "units" also violates the vision of the "General Plan" of the city of Alameda.

#9 The idea that 49 of the "units" will be made affordable to low and very low-income households lacks clarity. Please come up with a price range.

#10 Also, is this project the "highest and best use" of such a prime piece of land? I think not.

Thanks for your consideration of my concerns in this matter.

Gayle and Carl Winterbauer
Property Owners

From: Pat M Gannon <pmgannon@juno.com>
To: <athomas@ci.alameda.ca.us>
Date: 1/25/2009 10:49 AM
Subject: Boatworks Project

January 25, 2009

Dear Mr. Thomas:

RE; Boatworks Project

On Monday, January 26, 2009, the Planning Department will decide what environmental impacts should be included in the EIS for this project. Of paramount concern is the cleanup of the ground contamination to the highest possible level for the safety of future residents in the planned homes. It is imperative that the Planning Board hold Mr. Collins accountable for toxic cleanup and ensure that it is done responsiubly, thoroughly, and safely.

In 1991 the city approved the concept of an Estuary Park on a portion of this parcel of land. Parks are sadly lacking in this part of Alameda and would significantly upgrade the quality of life in this neighborhood. A park would also require less intense cleanup since citizens would be visiting it rather than living on it and would require no expensive intrastructure and maintenance.

The increased traffic generated by 242 units is also a consideration.

I am unable to attend next Monday' meeting due to a prior commitment. I urge the Planning Board to do the right thing and hold Mr. Collins accountable for cleanup, including the park as approved in 1991 and measure to reduce the impact of increased traffic congention in this area. Thank you for your consideration.

Sincerely,

Patricia M. Gannon

1019 Tobago Lane

Alameda, CA 94502

pmgannon@juno.com

From: <Leslie.Milosevich@kp.org>
To: <AThomas@ci.alameda.ca.us>
Date: 1/25/2009 5:56 PM
Subject: High Denisty Housing Project

Hi. I live on Buena Vista, just a few blocks from the proposed Housing site and I'm kind of horrified at this idea. We are already drowning in traffic on Buena Vista and the noise is awful. I installed dual pane windows just to be able to hear myself think in the living room. There have been improvements made recently that are improving the neighborhood, like the Marketplace and Nob Hill shopping center for example, and the library. This development would seem to be a huge step in the oposite direction. Is there a petition to sign or some way I could offer help to fight the proposal. I'm really interested.

Thanks,
Leslie

510-521-7688
2212 Buena Vista Avenue

APPENDIX C
Initial Study Checklist

CITY OF ALAMEDA
ENVIRONMENTAL IMPACT INITIAL STUDY

1. PROJECT TITLE: BOATWORKS RESIDENTIAL PROJECT

2. LEAD AGENCY NAME AND ADDRESS: CITY OF ALAMEDA, 2263 SANTA CLARA, ALAMEDA, CA 94501

3. LEAD AGENCY CONTACT PERSON AND PHONE NUMBER: ANDREW THOMAS, PLANNING SERVICES MANAGER 510-747-6881

4. PROJECT LOCATION: 2229 CLEMENT STREET, ALAMEDA, CA.

5. PROJECT SPONSOR'S NAME AND ADDRESS: FRANCIS COLLINS 6050 HOLLIS STREET, EMERYVILLE, CA 94608

6. GENERAL PLAN DESIGNATION: Specified Mixed use (MU-5)

7. ZONING: M-2 AND R-2 PD

8. DESCRIPTION OF THE PROJECT: The proposed project would construct 242 new housing units on a 9.5 acre site currently occupied by vacant industrial buildings and warehouses. The proposed project would include affordable housing and public open space adjacent to the Oakland Alameda Estuary.

9. SURROUNDING LAND USES AND SETTING: The proposed project site is located in at the corner of Oak and Clement Streets. The site is surrounded by a self storage facility (5A Storage) and a maritime industrial use (Dutra property). Across Oak Street, the site faces the Perforce company office building, a coffee house, and the Park Street Landing commercial center. Across Clement Street, the site faces a large glass manufacturing business. To the north, the site is adjacent to the Oakland Alameda Estuary. Across the estuary, the site faces a large sand and gravel processing plant. The Army Corps of Engineers owns and controls the land's edge, and the project sponsor does not propose to acquire this strip.

10. OTHER PUBLIC AGENCIES WHO'S APPROVAL IS REQUIRED (E.G. PERMITS, FINANCING APPROVAL, OR PARTICIPATION AGREEMENT).

The proposed project would require permits from the Bay Conservation and Development Commission (BCDC), the Department of Toxic Substances Control (DTSC), and the regional water quality board.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED

The environmental factors checked ✓ below would be potentially affected by this project, involving at least one impact that is a “Potentially Significant Impact” as indicated by the checklist on the following pages.

	Aesthetics	✓	Hazards & Hazardous Materials		Public Services (Police, Fire, Schools)
	Agricultural Resources	✓	Hydrology/Water Quality		Recreation
✓	Air Quality	✓	Land Use/Planning	✓	Transportation/Traffic
✓	Biological Resources		Mineral Resources		Utilities/Service Systems
✓	Cultural Resources	✓	Noise	✓	Mandatory Findings of Significance
✓	Geology/Soils		Population/Housing		

DETERMINATION: On the basis of this initial evaluation, I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

By: Andrew Thomas, Planning Services Manger

Date: January 15, 2009

1. AESTHETICS

A. Would the project have a substantial adverse effect on an identified scenic vista?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

B. Would the project substantially damage scenic resources, including, but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
			✓	

C. Would the project substantially degrade the existing visual character or quality of the site and its surroundings?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

D. Would the project create a new source of substantial light or glare that would adversely affect day or nighttime views in the area?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

DISCUSSION -

The project site does not include any designated scenic vistas, resources or state scenic highways. Underutilized, under-maintained, and vacant former industrial buildings and facilities have substantially degraded the existing visual character and quality at the property. Currently, there is no public access provided along the estuary on the project site, and views of the estuary and the Oakland hills are completely blocked on most of the property. A paved, fenced parking lot on the western edge of the property provides visual access from Clement Street to the north toward the Oakland hills.

The proposed project is subject to the City of Alameda Municipal Code requirements for Design Review and City of Alameda standard conditions and requirements regarding lighting placement and design. Through the required Design Review permitting process, a high quality architectural and landscape design, public access along the waterfront, and open space view corridors from the public streets through the property, and appropriate lighting would be required. Redevelopment of the site would improve the visual quality and character of the site.

SOURCES –

Observations, City of Alameda General Plan, and City of Alameda Municipal Code.

2. AIR QUALITY (Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations.)

A. Would the project conflict with or obstruct implementation of the applicable air quality plan?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

B. Would the project violate any air quality standard or contribute substantially to an existing or projected air quality violation.

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

C. Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions that exceed quantitative thresholds for ozone precursors)?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

D. Would the project expose sensitive receptors substantial to pollutant concentrations?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

E. Would the project create objectionable odors affecting a substantial number of people?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

DISCUSSION –

The proposed project has the potential to generate a significant number of automobile trips and automobile emissions, which could result in potentially significant air quality impacts. The release of diesel emissions and soil particulates during construction could also result in short term air quality impacts. The project EIR will analyze the impacts of the proposed project on air quality during project construction and operation.

SOURCES –

Initial project review, BAAQMD Guidelines, City of Alameda General Plan, and City of Alameda Municipal Code.

3. BIOLOGICAL RESOURCES

A. WOULD THE PROJECT HAVE A SUBSTANTIAL ADVERSE EFFECT, EITHER DIRECTLY OR THROUGH HABITAT MODIFICATIONS, ON ANY SPECIES IDENTIFIED AS A CANDIDATE, SENSITIVE, OR SPECIAL STATUS SPECIES IN LOCAL OR REGIONAL PLANS, POLICIES, OR REGULATIONS, OR BY THE CALIFORNIA DEPARTMENT OF FISH AND GAME OR U. S. FISH AND WILDLIFE SERVICE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

B. WOULD THE PROJECT HAVE A SUBSTANTIALLY ADVERSE EFFECT ON ANY RIPARIAN HABITAT OR OTHER SENSITIVE NATURAL COMMUNITY IDENTIFIED IN LOCAL OR REGIONAL PLANS, POLICIES, AND REGULATIONS OR BY THE CALIFORNIA DEPARTMENT OF FISH AND GAME OR U. S. WILDLIFE SERVICE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

C. WOULD THE PROJECT HAVE A SUBSTANTIAL ADVERSE EFFECT ON FEDERALLY PROTECTED WETLANDS AS DEFINED BY SECTION 404 OF THE CLEAN WATER ACT (INCLUDING, BUT NOT LIMITED TO, MARSH, VERNAL POOL, COASTAL, ETC.) THROUGH DIRECT REMOVAL, FILLING, HYDROLOGICAL INTERRUPTION, OR OTHER MEANS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

D. WOULD THE PROJECT INTERFERE SUBSTANTIALLY WITH THE MOVEMENT OF ANY RESIDENT OR MIGRATORY FISH OR WILDLIFE SPECIES OR WITH ESTABLISHED NATIVE RESIDENT MIGRATORY WILDLIFE CORRIDORS, OR IMPEDE THE USE OF NATIVE WILDLIFE NURSERY SITES?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

E. WOULD THE PROJECT CONFLICT WITH ANY LOCAL POLICIES OR ORDINANCES PROTECTING BIOLOGICAL RESOURCES, SUCH AS A TREE PRESERVATION POLICY OR ORDINANCE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

F. WOULD THE PROJECT CONFLICT WITH THE PROVISIONS OF AN ADOPTED HABITAT CONSERVATION PLAN, NATURAL CONSERVATION COMMUNITY PLAN, OTHER APPROVED LOCAL, REGIONAL, OR STATE HABITAT CONSERVATION PLAN?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

DISCUSSION –

The proposed project includes improvements adjacent to the Oakland Alameda Estuary, and the project proposes demolition of existing vacant warehouses which may provide habitat for endanger species of bats. These issues will be discussed further in the project EIR.

SOURCES –

Observations, City of Alameda General Plan, and City of Alameda Municipal Code.

4. CULTURAL RESOURCES

A. WOULD THE PROJECT CAUSE A SUBSTANTIAL ADVERSE CHANGE IN THE SIGNIFICANCE OF A HISTORICAL RESOURCE AS DEFINED IN SECTION 15064.5?

	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
IMPACT		✓		

B. WOULD THE PROJECT CAUSE A SUBSTANTIAL ADVERSE CHANGE IN THE SIGNIFICANCE OF AN ARCHAEOLOGICAL RESOURCE PURSUANT TO SECTION 15064.5?

	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
IMPACT		✓		

C. WOULD THE PROJECT DIRECTLY OR INDIRECTLY DESTROY A UNIQUE PALEONTOLOGICAL RESOURCE OR SITE OR UNIQUE GEOLOGIC FEATURE?

	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
IMPACT		✓		

D. WOULD THE PROJECT DISTURB ANY HUMAN REMAINS, INCLUDING THOSE INTERRED OUTSIDE OF FORMAL CEMETERIES?

	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
IMPACT		✓		

DISCUSSION –

The proposed project includes demolition of existing structures on the site and new construction, which would include significant site alterations and disturbances. The existing buildings are over 50 years old and are potentially historically significant. The site itself is located in an area that is generally located within areas inhabited by Native American tribes. These issues will be discussed further in the project EIR.

SOURCES –

Observations, Letter submitted by Alameda Architectural Preservation Society, City of Alameda General Plan, and City of Alameda Municipal Code.

5. GEOLOGY AND SOILS

A. WOULD THE PROJECT EXPOSE PEOPLE OR STRUCTURES TO POTENTIAL SUBSTANTIAL ADVERSE EFFECTS, INCLUDING THE RISK OF LOSS, INJURY, OR DEATH INVOLVING:

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

B. WOULD THE PROJECT RESULT IN SUBSTANTIAL SOIL EROSION OR THE LOSS OF TOPSOIL?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

C. WOULD THE PROJECT 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 LANDSLIDE, LATERAL SPREADING, SUBSIDENCE, LIQUEFACTION OR COLLAPSE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

D. WOULD THE PROJECT BE LOCATED ON EXPANSIVE SOIL, AS DEFINED IN TABLE 18-I-B OF THE UNIFORM BUILDING CODE (1997), CREATING SUBSTANTIAL RISKS TO LIFE OR PROPERTY?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

E. WOULD THE PROJECT HAVE SOILS INCAPABLE OF ADEQUATELY SUPPORTING THE USE OF SEPTIC TANKS OR ALTERNATIVE WASTEWATER DISPOSAL SYSTEMS WHERE SEWERS ARE NOT AVAILABLE FOR THE DISPOSAL OF WASTEWATER?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

DISCUSSION –

The proposed project site is located in an area that is subject to significant ground shaking and earthquakes. These issues will be discussed further in the project EIR. The project would not require septic tanks.

SOURCES –

Observations, City of Alameda General Plan, and City of Alameda Municipal Code.

6. HAZARDS AND HAZARDOUS MATERIALS

A. WOULD THE PROJECT CREATE A SIGNIFICANT HAZARD TO THE PUBLIC OR THE ENVIRONMENT THROUGH THE ROUTINE TRANSPORT, USE, OR DISPOSAL OF HAZARDOUS MATERIALS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

B. WOULD THE PROJECT CREATE A SIGNIFICANT HAZARD TO THE PUBLIC OR THE ENVIRONMENT THROUGH REASONABLY FORESEEABLE UPSET AND ACCIDENT CONDITIONS INVOLVING THE LIKELY RELEASE OF HAZARDOUS MATERIALS INTO THE ENVIRONMENT?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

C. WOULD THE PROJECT EMIT HAZARDOUS EMISSIONS OR HANDLE HAZARDOUS OR ACUTELY HAZARDOUS MATERIALS, SUBSTANCES, OR WASTE WITHIN ONE-QUARTER MILE OF AN EXISTING OR PROPOSED SCHOOL?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

D. WOULD THE PROJECT BE LOCATED ON A SITE WHICH IS INCLUDED ON A LIST OF HAZARDOUS MATERIALS SITES COMPILED PURSUANT TO GOVERNMENT CODE SECTION 65962.5 AND, AS A RESULT WOULD IT CREATE A SIGNIFICANT HAZARD TO THE PUBLIC OR THE ENVIRONMENT?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

E. WOULD THE PROJECT IMPAIR IMPLEMENTATION OF, OR PHYSICALLY INTERFERE WITH AN ADOPTED EMERGENCY RESPONSE PLAN OR EMERGENCY EVACUATION PLAN?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
			✓	

F. WOULD THE PROJECT 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?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

DISCUSSION –

The site is located on the City of Alameda list of properties containing hazardous materials. Grading and construction may release hazardous materials into the environment when materials in the soil become airborne and when exposed soils are washed into the estuary. These issues will be discussed further in the project EIR.

SOURCES –

DTSC, City of Alameda General Plan, and City of Alameda Municipal Code.

7. HYDROLOGY AND WATER QUALITY

A. WOULD THE PROJECT VIOLATE ANY WATER QUALITY STANDARDS OR WASTE DISCHARGE REQUIREMENTS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

B. WOULD THE PROJECT SUBSTANTIALLY DEGRADE 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 (E.G., THE PRODUCTION RATE OF PRE-EXISTING NEARBY WELLS WOULD DROP TO A LEVEL WHICH WOULD NOT SUPPORT EXISTING LAND USES OR PLANNED USES FOR WHICH PERMITS HAVE BEEN GRANTED)?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

C. WOULD THE PROJECT 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- OR OFF-SITE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

D. WOULD THE PROJECT 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 SURFACE RUNOFF IN A MANNER THAT WOULD RESULT IN FLOODING ON-OR OFF SITE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

E. WOULD THE PROJECT CREATE OR CONTRIBUTE RUNOFF WHICH WOULD EXCEED THE CAPACITY OF EXISTING OR PLANNED STORMWATER DRAINAGE SYSTEMS OR PROVIDE SUBSTANTIAL ADDITIONAL SOURCES OF POLLUTED RUNOFF?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

F. WOULD THE PROJECT OTHERWISE SUBSTANTIALLY DEGRADE WATER QUALITY?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

G. WOULD THE PROJECT PLACE HOUSING WITHIN A 100-YEAR FLOOD PLAIN, AS MAPPED ON A FEDERAL FLOOD HAZARD BOUNDARY OR FLOOD INSURANCE RATE MAP OR OTHER FLOOD HAZARD DELINEATION MAP?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

H. WOULD THE PROJECT PLACE WITHIN A 100-YEAR FLOOD HAZARD AREA STRUCTURES THAT WOULD IMPEDE OR REDIRECT FLOOD FLOWS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

I. WOULD THE PROJECT 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?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
			✓	

J. WOULD THE PROJECT BE SUBJECT TO INUNDATION BY SEICHE, TSUNAMI, OR MUD FLOW?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

DISCUSSION –
The proposed residential project could be affected by flooding as a result of global warming induced sea level rise. The construction process may expose pollutants in the soil to runoff into the Bay. These issues will be discussed further in the project EIR.

SOURCES –
Observations, City of Alameda General Plan, City of Alameda Municipal Code, Local Action Plan for Greenhouse Gas Emission Reduction, and Bay Conservation and Development Commission policy papers on sea level rise.

8. LAND USE AND PLANNING

A. WOULD THE PROJECT PHYSICALLY DIVIDE AN ESTABLISHED COMMUNITY?

	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.

IMPACT			✓	

B. WOULD THE PROJECT CONFLICT WITH AN APPLICABLE LAND USE PLAN, POLICY OR REGULATION OF AN AGENCY WITH JURISDICTION OVER THE PROJECT (INCLUDING, BUT NOT LIMITED TO THE GENERAL PLAN, SPECIFIC PLAN, LOCAL COASTAL PROGRAM, OR ZONING ORDINANCE) ADOPTED FOR THE PURPOSE OF AVOIDING OR MITIGATING AN ENVIRONMENTAL EFFECT?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

C. WOULD THE PROJECT CONFLICT WITH ANY APPLICABLE HABITAT CONSERVATION PLAN OR NATURAL COMMUNITY'S CONSERVATION PLAN?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
			✓	

DISCUSSION –
The proposed project is not consistent with the General Plan and Zoning Designations on the property and would require amendments to the General Plan and zoning ordinance designations. The project is also within the jurisdiction of the Bay Conservation and Development Commission and may not be consistent with BCDC conservation policies. These issues will be discussed further in the project EIR.

SOURCES –
City of Alameda General Plan, and City of Alameda Municipal Code.

9. NOISE

A. WOULD THE PROJECT RESULT IN 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?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
		✓		

B. WOULD THE PROJECT RESULT IN EXPOSURE OF PERSONS TO OR GENERATION OF EXCESSIVE GROUNDBORNE VIBRATION OR GROUNDBORNE NOISE LEVELS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

C. WOULD THE PROJECT RESULT IN A SUBSTANTIAL PERMANENT INCREASE IN AMBIENT NOISE LEVELS IN THE PROJECT VICINITY ABOVE LEVELS EXISTING WITHOUT THE PROJECT?

	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.

IMPACT		✓		

D. WOULD THE PROJECT RESULT IN A SUBSTANTIALLY TEMPORARY OR PERIODIC INCREASE IN AMBIENT NOISE LEVELS IN THE PROJECT VICINITY ABOVE LEVELS EXISTING WITHOUT THE PROJECT?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

DISCUSSION –
The proposed residential development would be located across the estuary from a cement factory that produces noise levels that may not be compatible with residential uses. Similarly, Clement Street is a truck route and major east-west automobile corridor through Alameda. The project proposes residential uses adjacent to Clement Street, which may expose future residents to unacceptable noise levels. Construction activities could also result in short term noise impacts. These issues will be discussed further in the project EIR.

SOURCES –
Observations, City of Alameda General Plan, and City of Alameda Municipal Code.

10. POPULATION AND HOUSING.

A. WOULD THE PROJECT INDUCE SUBSTANTIAL POPULATION GROWTH IN AN AREA, EITHER DIRECTLY (FOR EXAMPLE, BY PROPOSING NEW HOMES AND BUSINESSES) OR INDIRECTLY (FOR EXAMPLE, THROUGH EXTENSION OF ROADS OR OTHER INFRASTRUCTURE)?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

B. WOULD THE PROJECT DISPLACE SUBSTANTIAL NUMBERS OF EXISTING HOUSING, NECESSITATING THE CONSTRUCTION OF REPLACEMENT HOUSING ELSEWHERE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
			✓	

C. WOULD THE PROJECT DISPLACE SUBSTANTIAL NUMBERS OF PEOPLE, NECESSITATING THE CONSTRUCTION OF REPLACEMENT HOUSING ELSEWHERE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

DISCUSSION -
The population growth anticipated as a result of the proposed project is consistent with the population growth projections in the City of Alameda General Plan, the Association of Bay Area Government's and Alameda County Congestion Management Agency's projections, and the State of California's and

ABAG's Regional Housing Needs Determinations for the City of Alameda. The site is located in the MU-5 Specified Mixed Use Designation in the City of Alameda General Plan and Housing Element, which establishes a goal of 300 housing units in the MU-5 area. Currently there are no housing units in the MU-5 area. Additionally, the proposed project includes housing for low income families which is an identified need in Alameda and the region. A medium to high density housing development on this site, located in the center of the Bay Area, within one block of AC Transit Lines on Buena Vista and Park Street is consistent with population, housing, transportation, and greenhouse gas reduction (global warming) policies established by the State of California (most recently by SB 375 and AB 32), the Metropolitan Transportation Commission, and ABAG. The site does not currently provide any housing or jobs, so redevelopment of the site would not displace existing residents or businesses.

SOURCES –
City of Alameda General Plan, and City of Alameda Housing Element (2003), SB 375, AB 32, ABAG/HCD Regional Housing Needs Determination 2008.

11. PUBLIC SERVICES

Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered government 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 following public services:

A. FIRE PROTECTION?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

B. POLICE PROTECTION?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

C. SCHOOLS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

D. PARKS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant	No. Less than significant.	No impact.
			✓	

E. OTHER PUBLIC FACILITIES?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

DISCUSSION -
The project site is designated for residential redevelopment in the City of Alameda's General Plan and Housing Element. The General Plan and Housing Element ensure that land use policy is consistent with the City's ability to serve the land uses with transportation, utilities, and other services.

The proposed 242 dwellings would result in an increase in calls for police and fire service, but the increase would not be sufficient to require construction of new fire and police stations in order to maintain adequate response times. Redevelopment of the site would result in increased tax revenues to pay for police and fire services, and the project would be required to pay police and fire impact fees to mitigate its impacts on police and fire services.

Pursuant to State of California government code, payment of school impact fees mitigates the impacts of new residential development on schools. The proposed project is subject to Alameda Unified School District impact fees.

The proposed project would result in an increased demand on City parks, but this increased demand would not result in the need to construct new parks. The project would also pay park impact fees which are used to mitigate the impacts of new development on existing city parks. Finally, the project would provide onsite open space opportunities. The provision of open space would be carefully considered through the site design process, but the project as proposed would not result in a significant environmental impact on park resources.

SOURCES –
City of Alameda General Plan, City of Alameda Municipal Code, City of Alameda Citywide Development Impact Fees Nexus Study, AUSD Impact Fee Schedule.

13. TRANSPORTATION / TRAFFIC

A. WOULD THE PROJECT CAUSE AN INCREASE IN TRAFFIC THAT IS SUBSTANTIAL IN RELATION TO THE EXISTING TRAFFIC LOAD AND CAPACITY OF THE STREET SYSTEM (I.E., RESULT IN A SUBSTANTIAL INCREASE IN EITHER THE NUMBER OF VEHICLE TRIPS, THE VOLUME TO CAPACITY RATIO ON ROADS, OR CONGESTION AT INTERSECTIONS)?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

B. WOULD THE PROJECT EXCEED, EITHER INDIVIDUALLY OR CUMULATIVELY, A LEVEL OF SERVICE STANDARD ESTABLISHED BY THE COUNTY CONGESTION MANAGEMENT AGENCY FOR DESIGNATED ROADS OR HIGHWAYS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant..	No. Less than significant.	No impact.
		✓		

C. WOULD 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?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

D. WOULD THE PROJECT SUBSTANTIALLY INCREASE HAZARDS TO A DESIGN FEATURE (E.G., SHARP CURVES OR DANGEROUS INTERSECTIONS) OR INCOMPATIBLE USES (E.G. FARM EQUIPMENT)?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant..	No. Less than significant.	No impact.
		✓		

E. WOULD THE PROJECT RESULT IN INADEQUATE EMERGENCY ACCESS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant..	No. Less than significant.	No impact.
		✓		

F. WOULD THE PROJECT CONFLICT WITH ADOPTED POLICIES OR PROGRAMS SUPPORTING ALTERNATIVE TRANSPORTATION (E.G., BUS TURNOUTS, BICYCLE RACKS)?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
		✓		

DISCUSSION –
The proposed project would result in an increase in traffic in the area which may exceed local and regional thresholds of significance. The increase in traffic could also result in impacts to bicyclists, pedestrians, and transit. Redevelopment of the site would not result in a change in air traffic patterns. These issues will be discussed further in the project EIR. The site is not located in an Airport safety zone.

SOURCES –
Preliminary Project Review, City of Alameda General Plan, City of Alameda Transportation Element EIR (2008), and City of Alameda Municipal Code.

14. UTILITIES AND SERVICE SYSTEMS

A. WOULD THE PROJECT EXCEED WASTEWATER TREATMENT REQUIREMENTS OF THE APPLICABLE REGIONAL WATER QUALITY CONTROL BOARD?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

B. WOULD THE PROJECT REQUIRE OR RESULT IN CONSTRUCTION OF NEW WATER OR WASTEWATER TREATMENT FACILITIES OR EXPANSION OF EXISTING FACILITIES, THE CONSTRUCTION OF WHICH COULD CAUSE SIGNIFICANT ENVIRONMENTAL EFFECTS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

C. WOULD THE PROJECT REQUIRE OR RESULT IN THE CONSTRUCTION OF NEW STORM WATER DRAINAGE FACILITIES OR EXPANSION OF EXISTING FACILITIES, THE CONSTRUCTION OF WHICH COULD CAUSE SIGNIFICANT ENVIRONMENTAL EFFECTS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

D. WOULD THE PROJECT HAVE SUFFICIENT WATER SUPPLIES AVAILABLE TO SERVE THE PROJECT FROM EXISTING ENTITLEMENTS AND RESOURCES, OR ARE NEW OR EXPANDED ENTITLEMENTS NEEDED?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

E. WOULD THE PROJECT RESULT IN A DETERMINATION BY THE WASTEWATER TREATMENT PROVIDER THAT SERVICES THE PROJECT THAT IT HAS ADEQUATE CAPACITY TO SERVE THE PROJECT'S PROJECTED DEMAND IN ADDITION TO THE PROVIDER'S EXISTING COMMITMENTS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

F. WOULD THE PROJECT BE SERVED BY A LANDFILL WITH SUFFICIENT PERMITTED CAPACITY TO ACCOMMODATE THE PROJECT'S SOLID WASTE DISPOSAL NEEDS?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant..	No. Less than significant.	No impact.
			✓	

G. WOULD THE PROJECT COMPLY WITH FEDERAL, STATE, AND LOCAL STATUES AND REGULATIONS RELATED TO SOLID WASTE?

IMPACT	Yes. Significant unavoidable impact.	Yes, potentially significant.	No. Less than significant.	No impact.
			✓	

DISCUSSION -

The project site is an urban infill site that has been in use for over 50 years and is currently served by sewer, storm drain, water, and power infrastructure. As a standard condition of redevelopment and pursuant to existing local and regional permitting requirements, the proposed project would be required to replace all of the onsite utility systems, including storm drain, sewer, water, and other utilities. he new utility systems would be required to meet current building code and regional storm water and waste water standards for new development.

SOURCES –
City of Alameda General Plan, and City of Alameda Municipal Code.

15. MANDATORY FINDINGS OF SIGNIFICANCE

A. DOES THE PROJECT HAVE THE POTENTIAL TO DEGRADE THE QUALITY OF THE ENVIRONMENT, SUBSTANTIALLY REDUCE THE HABITAT OF A FISH OR WILDLIFE SPECIES, CAUSE A FISH OR WILDLIFE POPULATION TO DROP BELOW SELF-SUSTAINING LEVELS, THREATEN TO ELIMINATE A PLANT OR ANIMAL COMMUNITY, REDUCE THE NUMBER OR RESTRICT THE RANGE OF A RARE OR ENDANGERED PLANT OR ANIMAL, OR ELIMINATE IMPORTANT EXAMPLES OF THE MAJOR PERIODS OF CALIFORNIA HISTORY OR PREHISTORY?

IMPACT	Yes. Significant unavoidable impact.	Yes	No. Less than significant.	No impact.
		✓		

DISCUSSION –
See Biological discussion above.

B. DOES THE PROJECT HAVE IMPACTS THAT ARE INDIVIDUALLY LIMITED, BUT CUMULATIVELY CONSIDERABLE? ("CUMULATIVELY CONSIDERABLE" MEANS THAT THE INCREMENTAL EFFECTS OF A PROJECT ARE CONSIDERABLE WHEN VIEWED IN CONNECTION WITH THE EFFECTS OF THE PAST PROJECTS, THE EFFECTS OF OTHER CURRENT PROJECTS, AND THE EFFECTS OF PROBABLE FUTURE PROJECTS)?

IMPACT	Yes. Significant unavoidable impact.	Yes	No. Less than significant.	No impact.
		✓		

DISCUSSION –
See Transportation discussion above.

C. DOES THE PROJECT HAVE ENVIRONMENTAL EFFECTS THAT WILL CAUSE SUBSTANTIAL ADVERSE EFFECTS ON HUMAN BEINGS, EITHER DIRECTLY OR INDIRECTLY?

IMPACT	Yes. Significant unavoidable impact.	Yes	No. Less than significant.	No impact.
		✓		

DISCUSSION –
See Air Quality and Noise discussions above.

APPENDIX D

Supporting Traffic Tables for CMP/MTS Analysis

<u>APPENDIX D:</u>

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS (EXISTING CONDITIONS)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	225	26	9	15	100	375	33	1243	26	6	637	221
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.90			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1772			1602			3421		1719	3290	
Flt Permitted		0.23			0.99			0.92		0.95	1.00	
Satd. Flow (perm)		432			1583			3138		1719	3290	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	237	27	9	16	105	395	35	1308	27	6	671	233
RTOR Reduction (vph)	0	2	0	0	0	0	0	2	0	0	56	0
Lane Group Flow (vph)	0	271	0	0	516	0	0	1368	0	6	848	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		16.5			16.5			29.5		4.0	29.5	
Effective Green, g (s)		16.0			16.0			29.0		3.0	29.0	
Actuated g/C Ratio		0.27			0.27			0.48		0.05	0.48	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		115			422			1517		86	1590	
v/s Ratio Prot										c0.00	0.26	
v/s Ratio Perm		c0.63			0.33			c0.44				
v/c Ratio		2.35			1.22			0.90		0.07	0.53	
Uniform Delay, d1		22.0			22.0			14.2		27.2	10.8	
Progression Factor		1.00			1.00			0.49		1.00	1.00	
Incremental Delay, d2		635.7			119.8			5.4		0.1	1.3	
Delay (s)		657.7			141.8			12.4		27.3	12.1	
Level of Service		F			F			B		C	B	
Approach Delay (s)		657.7			141.8			12.4			12.2	
Approach LOS		F			F			B			B	

Intersection Summary			
HCM Average Control Delay	91.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	113.5%	ICU Level of Service	H
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)	236	36	31	27	73	218	7	986	20	89	530	86
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.98	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1708			1613			3425		1719	3346	
Flt Permitted		0.46			0.96			0.95		0.95	1.00	
Satd. Flow (perm)		808			1558			3260		1719	3346	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	248	38	33	28	77	229	7	1038	21	94	558	91
RTOR Reduction (vph)	0	7	0	0	131	0	0	2	0	0	22	0
Lane Group Flow (vph)	0	312	0	0	203	0	0	1064	0	94	627	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		18.5			18.5			26.5		5.0	34.5	
Effective Green, g (s)		18.0			18.0			26.0		4.0	34.0	
Actuated g/C Ratio		0.30			0.30			0.43		0.07	0.57	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		242			467			1413		115	1896	
v/s Ratio Prot										c0.05	0.19	
v/s Ratio Perm		c0.39			0.13			c0.33				
v/c Ratio		1.29			0.43			0.75		0.82	0.33	
Uniform Delay, d1		21.0			16.9			14.3		27.6	6.9	
Progression Factor		1.00			1.00			1.29		1.15	0.68	
Incremental Delay, d2		157.6			0.2			1.8		28.8	0.0	
Delay (s)		178.6			17.1			20.2		60.5	4.8	
Level of Service		F			B			C		E	A	
Approach Delay (s)		178.6			17.1			20.2			11.8	
Approach LOS		F			B			C			B	

Intersection Summary			
HCM Average Control Delay	37.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
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)	96	163	29	18	194	60	42	815	35	15	543	42
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.98			0.97			0.99			0.99	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1766	1811			1794			3412			3394	
Flt Permitted	0.52	1.00			0.98			0.91			0.93	
Satd. Flow (perm)	971	1811			1759			3096			3155	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	101	172	31	19	204	63	44	858	37	16	572	44
RTOR Reduction (vph)	0	11	0	0	17	0	0	5	0	0	9	0
Lane Group Flow (vph)	101	192	0	0	269	0	0	934	0	0	623	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	356	664			645			1548			1578	
v/s Ratio Prot		0.11										
v/s Ratio Perm	0.10				c0.15			c0.30			0.20	
v/c Ratio	0.28	0.29			0.42			0.60			0.39	
Uniform Delay, d1	13.4	13.5			14.2			10.7			9.3	
Progression Factor	0.98	0.99			1.47			0.39			0.46	
Incremental Delay, d2	1.9	1.1			1.8			1.6			0.7	
Delay (s)	15.0	14.3			22.7			5.7			5.0	
Level of Service	B	B			C			A			A	
Approach Delay (s)		14.6			22.7			5.7			5.0	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	116	280	19	16	226	10	26	69	48	8	47	149
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)	126	304	21	17	246	11	28	75	52	9	51	162

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	451	274	155	222
Volume Left (vph)	126	17	28	9
Volume Right (vph)	21	11	52	162
Hadj (s)	0.06	0.02	-0.13	-0.40
Departure Headway (s)	5.7	6.0	6.4	6.0
Degree Utilization, x	0.71	0.45	0.28	0.37
Capacity (veh/h)	610	549	477	519
Control Delay (s)	21.5	13.8	11.8	12.4
Approach Delay (s)	21.5	13.8	11.8	12.4
Approach LOS	C	B	B	B

Intersection Summary			
Delay	16.4		
HCM Level of Service	C		
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	337	13	20	306	16	7	97	32	12	67	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			0.99			0.97			0.99	
Flt Protected		1.00			1.00			1.00			0.99	
Satd. Flow (prot)		1846			1839			1776			1824	
Flt Permitted		0.99			0.97			0.99			0.96	
Satd. Flow (perm)		1830			1796			1761			1760	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	355	14	21	322	17	7	102	34	13	71	5
RTOR Reduction (vph)	0	2	0	0	3	0	0	19	0	0	4	0
Lane Group Flow (vph)	0	378	0	0	357	0	0	124	0	0	85	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1129			1108			440			440	
v/s Ratio Prot												
v/s Ratio Perm		c0.21			0.20			c0.07			0.05	
v/c Ratio		0.33			0.32			0.28			0.19	
Uniform Delay, d1		5.6			5.5			18.2			17.7	
Progression Factor		0.74			0.47			1.00			1.00	
Incremental Delay, d2		0.7			0.7			1.5			1.0	
Delay (s)		4.8			3.3			19.7			18.7	
Level of Service		A			A			B			B	
Approach Delay (s)		4.8			3.3			19.7			18.7	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	45.6%	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)	59	315	17	39	235	15	20	71	36	27	54	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	
Lane Util. Factor		1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes		0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes		1.00		0.95	1.00			1.00			1.00	
Frt		0.99		1.00	0.99			0.96			0.97	
Flt Protected		0.99		0.95	1.00			0.99			0.99	
Satd. Flow (prot)		1826		1685	1842			1765			1781	
Flt Permitted		0.92		0.51	1.00			0.96			0.92	
Satd. Flow (perm)		1700		900	1842			1703			1657	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	62	332	18	41	247	16	21	75	38	28	57	20
RTOR Reduction (vph)	0	3	0	0	4	0	0	24	0	0	14	0
Lane Group Flow (vph)	0	409	0	41	259	0	0	110	0	0	91	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		33.5		33.5	33.5			19.5			19.5	
Effective Green, g (s)		33.0		33.0	33.0			19.0			19.0	
Actuated g/C Ratio		0.55		0.55	0.55			0.32			0.32	
Clearance Time (s)		3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)		935		495	1013			539			525	
v/s Ratio Prot					0.14							
v/s Ratio Perm		c0.24		0.05				c0.06			0.06	
v/c Ratio		0.44		0.08	0.26			0.20			0.17	
Uniform Delay, d1		8.0		6.4	7.1			15.0			14.8	
Progression Factor		0.61		2.23	2.36			1.13			0.50	
Incremental Delay, d2		1.5		0.3	0.6			0.8			0.7	
Delay (s)		6.4		14.5	17.3			17.7			8.1	
Level of Service		A		B	B			B			A	
Approach Delay (s)		6.4			16.9			17.7			8.1	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
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	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	83	18	75	337	391	9	541	116	176	565	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1804	1538		1846	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.67	1.00		0.92	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1242	1538		1719	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	87	19	79	355	412	9	569	122	185	595	193
RTOR Reduction (vph)	0	0	12	0	0	213	0	0	84	0	0	103
Lane Group Flow (vph)	0	147	7	0	434	199	9	569	38	185	595	90
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		18.4	18.4		18.4	18.4	0.7	16.6	16.6	7.9	24.8	24.8
Effective Green, g (s)		18.4	18.4		18.4	18.4	0.7	16.6	16.6	7.9	24.8	24.8
Actuated g/C Ratio		0.35	0.35		0.35	0.35	0.01	0.31	0.31	0.15	0.47	0.47
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		432	535		598	551	23	1079	483	257	1612	742
v/s Ratio Prot							0.01	c0.17		c0.11	0.17	
v/s Ratio Perm		0.12	0.00		c0.25	0.13			0.02			0.06
v/c Ratio		0.34	0.01		0.73	0.36	0.39	0.53	0.08	0.72	0.37	0.12
Uniform Delay, d1		12.8	11.3		15.0	12.9	25.9	14.9	12.8	21.4	9.0	7.9
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	0.0		4.4	0.4	10.7	1.8	0.3	9.3	0.7	0.3
Delay (s)		13.2	11.3		19.4	13.3	36.5	16.8	13.1	30.7	9.7	8.3
Level of Service		B	B		B	B	D	B	B	C	A	A
Approach Delay (s)		13.0			16.4			16.4			13.4	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	52.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	67.4%	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 (veh/h)	0	1	0	134	0	31	0	27	151	17	33	0
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)	0	1	0	146	0	34	0	29	164	18	36	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	218	266	36	185	184	111	36			193		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	218	266	36	185	184	111	36			193		
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 %	100	100	100	81	100	96	100			99		
cM capacity (veh/h)	705	631	1037	767	701	942	1575			1380		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	1	179	193	54
Volume Left	0	146	0	18
Volume Right	0	34	164	0
cSH	631	795	1575	1380
Volume to Capacity	0.00	0.23	0.00	0.01
Queue Length 95th (ft)	0	22	0	1
Control Delay (s)	10.7	10.8	0.0	2.7
Lane LOS	B	B		A
Approach Delay (s)	10.7	10.8	0.0	2.7
Approach LOS	B	B		

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	39.4%	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)	496	218	23	28	338	34	152	1013	42	43	439	598
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
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	0.91	0.91	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	0.99		1.00	1.00		1.00	1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	0.97	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1314	2791	1276	1496	2929		1547	3066		1547	3094	1276
Flt Permitted	0.95	0.97	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1314	2791	1276	1496	2929		1547	3066		1547	3094	1276
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	522	229	24	29	356	36	160	1066	44	45	462	629
RTOR Reduction (vph)	0	0	18	0	6	0	0	2	0	0	0	386
Lane Group Flow (vph)	261	490	6	29	386	0	160	1108	0	45	462	243
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)	27.6	27.6	27.6	22.4	22.4		15.1	37.9		7.2	30.0	30.0
Effective Green, g (s)	27.6	27.6	27.6	22.4	22.4		15.1	38.9		7.2	31.0	31.0
Actuated g/C Ratio	0.25	0.25	0.25	0.20	0.20		0.13	0.35		0.06	0.28	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	5.0
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)	324	687	314	299	585		208	1064		99	856	353
v/s Ratio Prot	c0.20	0.18		0.02	c0.13		c0.10	c0.36		0.03	0.15	
v/s Ratio Perm			0.00									0.19
v/c Ratio	0.81	0.71	0.02	0.10	0.66		0.77	1.04		0.45	0.54	0.69
Uniform Delay, d1	39.7	38.6	32.0	36.6	41.3		46.8	36.6		50.6	34.5	36.2
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	13.6	3.5	0.0	0.1	2.8		15.6	39.0		3.3	0.7	5.5
Delay (s)	53.3	42.1	32.0	36.7	44.1		62.5	75.6		53.8	35.1	41.7
Level of Service	D	D	C	D	D		E	E		D	D	D
Approach Delay (s)		45.6			43.6			73.9			39.5	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM Average Control Delay	53.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	112.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
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)	66	155	67	27	192	121	138	911	41	195	299	43
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.95		1.00	0.94		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3256		1770	3161		3433	3539	1493	3335	3539	1454
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3256		1770	3161		3433	3539	1493	3335	3539	1454
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	69	163	71	28	202	127	145	959	43	205	315	45
RTOR Reduction (vph)	0	54	0	0	98	0	0	0	30	0	0	30
Lane Group Flow (vph)	69	180	0	28	231	0	145	959	13	205	315	15
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	19.3	19.3		22.1	22.1		6.7	24.9	24.9	11.8	30.0	30.0
Effective Green, g (s)	18.4	18.4		21.2	21.2		6.4	25.1	25.1	11.5	30.2	30.2
Actuated g/C Ratio	0.20	0.20		0.23	0.23		0.07	0.27	0.27	0.12	0.33	0.33
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	343	650		407	727		238	963	406	416	1159	476
v/s Ratio Prot	0.04	c0.06		0.02	c0.07		0.04	c0.27		c0.06	0.09	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.20	0.28		0.07	0.32		0.61	1.00	0.03	0.49	0.27	0.03
Uniform Delay, d1	30.8	31.3		27.8	29.5		41.7	33.5	24.6	37.6	22.9	21.1
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	0.1	0.1		0.0	0.1		3.0	27.8	0.0	0.3	0.0	0.0
Delay (s)	30.9	31.4		27.8	29.6		44.7	61.3	24.6	38.0	22.9	21.1
Level of Service	C	C		C	C		D	E	C	D	C	C
Approach Delay (s)		31.2			29.4			57.8			28.2	
Approach LOS		C			C			E			C	

Intersection Summary			
HCM Average Control Delay	43.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	92.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

11: Fernside Blvd & High St

Movement	EBL	EBT	EBR	EBR2	WBL2	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	132	458	36	2	2	381	282	42	472	3	221	434
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		1.00		0.95	1.00
Satd. Flow (prot)	1770	1841				3538	1583		1854		1770	1863
Flt Permitted	0.44	1.00				0.95	1.00		0.93		0.95	1.00
Satd. Flow (perm)	813	1841				3375	1583		1739		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	139	482	38	2	2	401	297	44	497	3	233	457
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	139	522	0	0	0	403	297	0	544	0	233	457
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	2
Permitted Phases	3				3		Free	6				
Actuated Green, G (s)	28.8	28.8				28.8	87.8		25.6		12.1	40.7
Effective Green, g (s)	28.8	28.8				28.8	87.8		25.6		12.1	40.7
Actuated g/C Ratio	0.33	0.33				0.33	1.00		0.29		0.14	0.46
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	267	604				1107	1583		507		244	864
v/s Ratio Prot		c0.28									c0.13	0.25
v/s Ratio Perm	0.17					0.12	0.19		c0.31			
v/c Ratio	0.52	0.86				0.36	0.19		1.07		0.95	0.53
Uniform Delay, d1	23.9	27.7				22.5	0.0		31.1		37.6	16.7
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	1.8	12.3				0.2	0.3		61.0		44.8	0.6
Delay (s)	25.7	39.9				22.7	0.3		92.1		82.4	17.3
Level of Service	C	D				C	A		F		F	B
Approach Delay (s)		36.9				13.2			92.1			35.2
Approach LOS		D				B			F			D

Intersection Summary			
HCM Average Control Delay	41.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	87.8	Sum of lost time (s)	14.4
Intersection Capacity Utilization	107.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL	NER
Lane Configurations				
Volume (vph)	61	64	72	3
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	3.8		4.1	4.1
Lane Util. Factor	1.00		1.00	1.00
Frt	0.85		1.00	0.85
Flt Protected	1.00		0.95	1.00
Satd. Flow (prot)	1583		1770	1583
Flt Permitted	1.00		0.95	1.00
Satd. Flow (perm)	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	64	67	76	3
RTOR Reduction (vph)	35	0	0	0
Lane Group Flow (vph)	96	0	76	3
Turn Type	Perm			Perm
Protected Phases			4	
Permitted Phases	2			4
Actuated Green, G (s)	40.7		6.9	6.9
Effective Green, g (s)	40.7		6.9	6.9
Actuated g/C Ratio	0.46		0.08	0.08
Clearance Time (s)	3.8		4.1	4.1
Vehicle Extension (s)	3.0		2.0	2.0
Lane Grp Cap (vph)	734		139	124
v/s Ratio Prot			c0.04	
v/s Ratio Perm	0.06			0.00
v/c Ratio	0.13		0.55	0.02
Uniform Delay, d1	13.4		38.9	37.3
Progression Factor	1.00		1.00	1.00
Incremental Delay, d2	0.1		2.3	0.0
Delay (s)	13.5		41.3	37.4
Level of Service	B		D	D
Approach Delay (s)			41.1	
Approach LOS			D	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	167	43	25	18	62	140	7	1068	26	6	1165	298
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.97	
Flt Protected		0.97			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1763			1638			3421		1719	3324	
Flt Permitted		0.58			0.97			0.93		0.95	1.00	
Satd. Flow (perm)		1052			1589			3171		1719	3324	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	176	45	26	19	65	147	7	1124	27	6	1226	314
RTOR Reduction (vph)	0	7	0	0	0	0	0	3	0	0	37	0
Lane Group Flow (vph)	0	240	0	0	231	0	0	1155	0	6	1503	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		16.6			16.6			29.4		4.0	29.4	
Effective Green, g (s)		16.1			16.1			28.9		3.0	28.9	
Actuated g/C Ratio		0.27			0.27			0.48		0.05	0.48	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		282			426			1527		86	1601	
v/s Ratio Prot										c0.00	c0.45	
v/s Ratio Perm		c0.23			0.15			0.36				
v/c Ratio		0.85			0.54			0.76		0.07	0.94	
Uniform Delay, d1		20.8			18.8			12.7		27.2	14.7	
Progression Factor		1.00			1.00			0.77		1.00	1.00	
Incremental Delay, d2		20.6			1.4			2.6		0.1	12.0	
Delay (s)		41.4			20.2			12.3		27.3	26.7	
Level of Service		D			C			B		C	C	
Approach Delay (s)		41.4			20.2			12.3			26.7	
Approach LOS		D			C			B			C	

Intersection Summary			
HCM Average Control Delay	22.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.9%	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)	174	99	43	36	65	94	11	859	22	182	971	97
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.98			0.93			1.00		1.00	0.99	
Flt Protected		0.97			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1718			1658			3421		1719	3379	
Flt Permitted		0.69			0.91			0.94		0.95	1.00	
Satd. Flow (perm)		1215			1528			3212		1719	3379	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	183	104	45	38	68	99	12	904	23	192	1022	102
RTOR Reduction (vph)	0	9	0	0	58	0	0	3	0	0	12	0
Lane Group Flow (vph)	0	323	0	0	147	0	0	936	0	192	1112	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		17.1			17.1			26.5		6.4	35.9	
Effective Green, g (s)		16.6			16.6			26.0		5.4	35.4	
Actuated g/C Ratio		0.28			0.28			0.43		0.09	0.59	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		336			423			1392		155	1994	
v/s Ratio Prot										c0.11	0.33	
v/s Ratio Perm		c0.27			0.10			c0.29				
v/c Ratio		0.96			0.35			0.67		1.24	0.56	
Uniform Delay, d1		21.4			17.4			13.6		27.3	7.5	
Progression Factor		1.00			1.00			0.71		1.31	0.48	
Incremental Delay, d2		38.2			0.2			0.9		128.4	0.1	
Delay (s)		59.6			17.5			10.6		164.1	3.7	
Level of Service		E			B			B		F	A	
Approach Delay (s)		59.6			17.5			10.6			27.1	
Approach LOS		E			B			B			C	

Intersection Summary			
HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
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)	82	379	32	8	280	21	7	865	24	12	941	75
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.99			1.00			0.99	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1836			1841			3423			3393	
Flt Permitted	0.48	1.00			0.99			0.95			0.94	
Satd. Flow (perm)	888	1836			1824			3247			3201	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	86	399	34	8	295	22	7	911	25	13	991	79
RTOR Reduction (vph)	0	5	0	0	4	0	0	3	0	0	10	0
Lane Group Flow (vph)	86	428	0	0	321	0	0	940	0	0	1074	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	326	673			669			1624			1601	
v/s Ratio Prot		c0.23										
v/s Ratio Perm	0.10				0.18			0.29			c0.34	
v/c Ratio	0.26	0.64			0.48			0.58			0.67	
Uniform Delay, d1	13.3	15.7			14.6			10.6			11.3	
Progression Factor	1.00	1.06			0.78			0.95			0.90	
Incremental Delay, d2	1.9	4.4			2.4			1.5			1.9	
Delay (s)	15.3	21.0			13.8			11.6			12.1	
Level of Service	B	C			B			B			B	
Approach Delay (s)		20.0			13.8			11.6			12.1	
Approach LOS		C			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	69	159	17	17	104	6	16	68	42	39	140	246
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)	75	173	18	18	113	7	17	74	46	42	152	267

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	266	138	137	462
Volume Left (vph)	75	18	17	42
Volume Right (vph)	18	7	46	267
Hadj (s)	0.05	0.03	-0.14	-0.29
Departure Headway (s)	5.8	6.1	5.8	5.1
Degree Utilization, x	0.43	0.23	0.22	0.65
Capacity (veh/h)	557	506	547	678
Control Delay (s)	13.2	10.9	10.4	17.0
Approach Delay (s)	13.2	10.9	10.4	17.0
Approach LOS	B	B	B	C

Intersection Summary			
Delay	14.3		
HCM Level of Service	B		
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	322	17	47	366	49	23	102	23	34	65	23
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			0.99			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			0.99	
Frt		0.99			0.99			0.98			0.97	
Flt Protected		1.00			0.99			0.99			0.99	
Satd. Flow (prot)		1836			1813			1789			1762	
Flt Permitted		0.95			0.94			0.95			0.89	
Satd. Flow (perm)		1743			1710			1710			1597	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	34	339	18	49	385	52	24	107	24	36	68	24
RTOR Reduction (vph)	0	3	0	0	7	0	0	11	0	0	14	0
Lane Group Flow (vph)	0	388	0	0	479	0	0	144	0	0	115	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1075			1055			428			399	
v/s Ratio Prot												
v/s Ratio Perm		0.22			c0.28			c0.08			0.07	
v/c Ratio		0.36			0.45			0.34			0.29	
Uniform Delay, d1		5.7			6.1			18.4			18.2	
Progression Factor		0.51			0.54			1.34			1.00	
Incremental Delay, d2		0.7			1.3			2.0			1.8	
Delay (s)		3.6			4.6			26.7			20.0	
Level of Service		A			A			C			B	
Approach Delay (s)		3.6			4.6			26.7			20.0	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.5%	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)	29	343	56	55	305	30	32	86	81	29	120	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	
Lane Util. Factor		1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes		0.98		1.00	1.00			0.99			1.00	
Flpb, ped/bikes		1.00		0.96	1.00			1.00			1.00	
Frt		0.98		1.00	0.99			0.95			0.97	
Flt Protected		1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)		1793		1692	1833			1730			1783	
Flt Permitted		0.97		0.48	1.00			0.93			0.94	
Satd. Flow (perm)		1737		851	1833			1629			1685	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	31	361	59	58	321	32	34	91	85	31	126	46
RTOR Reduction (vph)	0	9	0	0	6	0	0	41	0	0	18	0
Lane Group Flow (vph)	0	442	0	58	347	0	0	169	0	0	185	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		33.5		33.5	33.5			19.5			19.5	
Effective Green, g (s)		33.0		33.0	33.0			19.0			19.0	
Actuated g/C Ratio		0.55		0.55	0.55			0.32			0.32	
Clearance Time (s)		3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)		955		468	1008			516			534	
v/s Ratio Prot					0.19							
v/s Ratio Perm		c0.25		0.07				0.10			c0.11	
v/c Ratio		0.46		0.12	0.34			0.33			0.35	
Uniform Delay, d1		8.1		6.5	7.5			15.6			15.7	
Progression Factor		0.40		0.82	0.72			0.57			1.20	
Incremental Delay, d2		1.6		0.5	0.9			1.3			1.7	
Delay (s)		4.8		5.9	6.3			10.2			20.6	
Level of Service		A		A	A			B			C	
Approach Delay (s)		4.8			6.2			10.2			20.6	
Approach LOS		A			A			B			C	

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.3%	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)	80	97	9	53	219	124	2	468	78	210	611	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1798	1538		1845	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.68	1.00		0.91	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1247	1538		1701	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	84	102	9	56	231	131	2	493	82	221	643	141
RTOR Reduction (vph)	0	0	7	0	0	0	0	0	53	0	0	0
Lane Group Flow (vph)	0	186	2	0	287	131	2	493	29	221	643	141
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		12.6	12.6		12.6	47.3	0.7	16.6	16.6	8.1	25.0	47.3
Effective Green, g (s)		12.6	12.6		12.6	47.3	0.7	16.6	16.6	8.1	25.0	47.3
Actuated g/C Ratio		0.27	0.27		0.27	1.00	0.01	0.35	0.35	0.17	0.53	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		332	410		453	1583	26	1207	540	294	1817	1583
v/s Ratio Prot							0.00	c0.14		c0.13	0.19	
v/s Ratio Perm		0.15	0.00		c0.17	0.08			0.02			0.09
v/c Ratio		0.56	0.01		0.63	0.08	0.08	0.41	0.05	0.75	0.35	0.09
Uniform Delay, d1		15.0	12.7		15.3	0.0	23.0	11.6	10.2	18.6	6.5	0.0
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		2.2	0.0		2.9	0.1	1.3	1.0	0.2	10.3	0.5	0.1
Delay (s)		17.1	12.8		18.2	0.1	24.2	12.7	10.3	29.0	7.0	0.1
Level of Service		B	B		B	A	C	B	B	C	A	A
Approach Delay (s)		16.9			12.5			12.4			10.9	
Approach LOS		B			B			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)	47.3	Sum of lost time (s)	10.0
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 (veh/h)	0	0	0	243	0	20	0	34	118	23	34	0
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)	0	0	0	264	0	22	0	37	128	25	37	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	210	252	37	188	188	101	37			165		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	210	252	37	188	188	101	37			165		
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 %	100	100	100	65	100	98	100			98		
cM capacity (veh/h)	721	640	1035	762	694	954	1574			1413		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	286	165	62
Volume Left	0	264	0	25
Volume Right	0	22	128	0
cSH	1700	774	1574	1413
Volume to Capacity	0.00	0.37	0.00	0.02
Queue Length 95th (ft)	0	43	0	1
Control Delay (s)	0.0	12.4	0.0	3.1
Lane LOS	A	B		A
Approach Delay (s)	0.0	12.4	0.0	3.1
Approach LOS	A	B		

Intersection Summary			
Average Delay	7.3		
Intersection Capacity Utilization	37.1%	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)	526	166	75	43	136	32	93	478	65	75	844	628
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
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	0.91	0.91	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	0.98		1.00	0.99		1.00	1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	0.97	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1314	2780	1273	1496	2860		1547	3010		1547	3094	1273
Flt Permitted	0.95	0.97	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1314	2780	1273	1496	2860		1547	3010		1547	3094	1273
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	554	175	79	45	143	34	98	503	68	79	888	661
RTOR Reduction (vph)	0	0	59	0	16	0	0	7	0	0	0	401
Lane Group Flow (vph)	277	452	20	45	161	0	98	564	0	79	888	260
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)	29.0	29.0	29.0	20.8	20.8		12.3	39.9		9.4	37.0	37.0
Effective Green, g (s)	29.0	29.0	29.0	20.8	20.8		12.3	40.9		9.4	38.0	38.0
Actuated g/C Ratio	0.25	0.25	0.25	0.18	0.18		0.11	0.35		0.08	0.33	0.33
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	5.0
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)	328	694	318	268	512		164	1060		125	1013	417
v/s Ratio Prot	c0.21	0.16		0.03	c0.06		c0.06	c0.19		0.05	c0.29	
v/s Ratio Perm			0.02									0.20
v/c Ratio	0.84	0.65	0.06	0.17	0.31		0.60	0.53		0.63	0.88	0.62
Uniform Delay, d1	41.4	39.0	33.2	40.3	41.4		49.5	30.0		51.7	36.8	33.0
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	17.7	2.2	0.1	0.3	0.4		5.7	0.5		10.0	8.7	2.9
Delay (s)	59.1	41.2	33.3	40.6	41.8		55.3	30.5		61.7	45.5	35.9
Level of Service	E	D	C	D	D		E	C		E	D	D
Approach Delay (s)		46.6			41.6			34.1			42.4	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM Average Control Delay	41.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	116.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
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	215	53	46	102	127	57	470	18	86	964	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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.99		1.00	0.97		1.00	1.00	0.95	1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3320		1770	3047		3433	3539	1496	3335	3539	1458
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3320		1770	3047		3433	3539	1496	3335	3539	1458
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	49	226	56	48	107	134	60	495	19	91	1015	46
RTOR Reduction (vph)	0	23	0	0	102	0	0	0	13	0	0	28
Lane Group Flow (vph)	49	259	0	48	139	0	60	495	6	91	1015	18
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	20.0	20.0		21.8	21.8		4.8	25.4	25.4	6.3	26.9	26.9
Effective Green, g (s)	19.1	19.1		20.9	20.9		4.5	25.6	25.6	6.0	27.1	27.1
Actuated g/C Ratio	0.22	0.22		0.24	0.24		0.05	0.29	0.29	0.07	0.31	0.31
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	375	724		422	727		176	1034	437	228	1095	451
v/s Ratio Prot	0.03	c0.08		0.03	c0.05		0.02	c0.14		0.03	c0.29	
v/s Ratio Perm									0.00			0.01
v/c Ratio	0.13	0.36		0.11	0.19		0.34	0.48	0.01	0.40	0.93	0.04
Uniform Delay, d1	27.6	29.0		26.1	26.6		40.1	25.5	22.0	39.1	29.3	21.1
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	0.1	0.1		0.0	0.0		0.4	0.1	0.0	0.4	12.8	0.0
Delay (s)	27.6	29.2		26.1	26.7		40.5	25.6	22.0	39.5	42.1	21.2
Level of Service	C	C		C	C		D	C	C	D	D	C
Approach Delay (s)		28.9			26.6			27.1			41.1	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	34.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	87.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	77	224	24	3	16	218	451	68	400	16	249	561
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.98				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1833				3527	1583		1841		1770	1863
Flt Permitted	0.57	1.00				0.93	1.00		0.86		0.95	1.00
Satd. Flow (perm)	1057	1833				3283	1583		1588		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	81	236	25	3	17	229	475	72	421	17	262	591
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	81	263	0	0	0	246	475	0	509	0	262	591
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	17.5	17.5				17.5	74.6		26.0		12.3	41.3
Effective Green, g (s)	17.5	17.5				17.5	74.6		26.0		12.3	41.3
Actuated g/C Ratio	0.23	0.23				0.23	1.00		0.35		0.16	0.55
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	248	430				770	1583		553		292	1031
v/s Ratio Prot		c0.14									c0.15	
v/s Ratio Perm	0.08					0.07	c0.30		c0.32			0.32
v/c Ratio	0.33	0.61				0.32	0.30		0.92		0.90	0.57
Uniform Delay, d1	23.7	25.5				23.6	0.0		23.3		30.5	10.9
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.8	2.6				0.2	0.5		20.4		27.7	0.8
Delay (s)	24.4	28.1				23.9	0.5		43.7		58.3	11.7
Level of Service	C	C				C	A		D		E	B
Approach Delay (s)		27.2				8.5			43.7			22.8
Approach LOS		C				A			D			C

Intersection Summary			
HCM Average Control Delay	23.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	74.6	Sum of lost time (s)	10.3
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	129	54	4	49	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	57	4	52	3
RTOR Reduction (vph)	12	0	0	0	0
Lane Group Flow (vph)	181	0	0	56	3
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	41.3			4.4	4.4
Effective Green, g (s)	41.3			4.4	4.4
Actuated g/C Ratio	0.55			0.06	0.06
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	876			104	93
v/s Ratio Prot				0.03	
v/s Ratio Perm	0.11				0.00
v/c Ratio	0.21			0.54	0.03
Uniform Delay, d1	8.4			34.1	33.1
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.1			2.7	0.1
Delay (s)	8.5			36.8	33.1
Level of Service	A			D	C
Approach Delay (s)				36.6	
Approach LOS				D	

Intersection Summary

APPENDIX D:

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS (BASELINE 2013 CONDITIONS)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	233	27	10	15	106	383	37	1364	27	6	768	247
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.98	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.90			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1774			1592			3420		1719	3278	
Flt Permitted		0.31			0.99			0.82		0.95	1.00	
Satd. Flow (perm)		567			1574			2808		1719	3278	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	245	28	11	16	112	403	39	1436	28	6	808	260
RTOR Reduction (vph)	0	1	0	0	0	0	0	1	0	0	25	0
Lane Group Flow (vph)	0	283	0	0	531	0	0	1502	0	6	1043	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		48.5			48.5			57.4		4.1	57.4	
Effective Green, g (s)		48.0			48.0			56.9		3.1	56.9	
Actuated g/C Ratio		0.40			0.40			0.47		0.03	0.47	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		227			630			1331		44	1554	
v/s Ratio Prot										c0.00	0.32	
v/s Ratio Perm		c0.50			0.34			c0.53				
v/c Ratio		1.25			0.84			1.13		0.14	0.67	
Uniform Delay, d1		36.0			32.6			31.6		57.1	24.3	
Progression Factor		1.00			1.00			0.90		1.00	1.00	
Incremental Delay, d2		141.9			10.0			62.6		0.5	2.3	
Delay (s)		177.9			42.6			91.1		57.7	26.7	
Level of Service		F			D			F		E	C	
Approach Delay (s)		177.9			42.6			91.1			26.8	
Approach LOS		F			D			F			C	

Intersection Summary			
HCM Average Control Delay	70.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	121.0%	ICU Level of Service	H
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)	251	37	32	28	74	222	7	1095	20	91	657	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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.98	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1709			1612			3426		1719	3358	
Flt Permitted		0.45			0.96			0.95		0.95	1.00	
Satd. Flow (perm)		793			1556			3259		1719	3358	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	264	39	34	29	78	234	7	1153	21	96	692	96
RTOR Reduction (vph)	0	7	0	0	131	0	0	2	0	0	18	0
Lane Group Flow (vph)	0	330	0	0	210	0	0	1179	0	96	770	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		18.5			18.5			26.5		5.0	34.5	
Effective Green, g (s)		18.0			18.0			26.0		4.0	34.0	
Actuated g/C Ratio		0.30			0.30			0.43		0.07	0.57	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		238			467			1412		115	1903	
v/s Ratio Prot										c0.06	0.23	
v/s Ratio Perm		c0.42			0.14			c0.36				
v/c Ratio		1.39			0.45			0.83		0.83	0.40	
Uniform Delay, d1		21.0			17.0			15.1		27.7	7.3	
Progression Factor		1.00			1.00			1.20		1.73	0.55	
Incremental Delay, d2		197.8			0.3			3.5		29.7	0.0	
Delay (s)		218.8			17.2			21.6		77.7	4.1	
Level of Service		F			B			C		E	A	
Approach Delay (s)		218.8			17.2			21.6			12.1	
Approach LOS		F			B			C			B	

Intersection Summary			
HCM Average Control Delay	42.2	HCM Level of Service	D
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.3%	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)	181	166	35	18	210	61	43	834	36	15	558	154
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	0.99			1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.97			0.97			0.99			0.97	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1766	1804			1797			3412			3309	
Flt Permitted	0.50	1.00			0.98			0.89			0.93	
Satd. Flow (perm)	935	1804			1763			3058			3087	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	191	175	37	19	221	64	45	878	38	16	587	162
RTOR Reduction (vph)	0	13	0	0	16	0	0	5	0	0	41	0
Lane Group Flow (vph)	191	199	0	0	288	0	0	956	0	0	725	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	343	661			646			1529			1544	
v/s Ratio Prot		0.11										
v/s Ratio Perm	c0.20				0.16			c0.31			0.23	
v/c Ratio	0.56	0.30			0.45			0.63			0.47	
Uniform Delay, d1	15.1	13.5			14.4			10.9			9.8	
Progression Factor	0.90	0.96			1.46			0.40			0.29	
Incremental Delay, d2	5.9	1.1			2.0			1.8			0.9	
Delay (s)	19.6	14.0			23.1			6.2			3.8	
Level of Service	B	B			C			A			A	
Approach Delay (s)		16.6			23.1			6.2			3.8	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	118	296	19	16	234	10	27	70	49	8	48	153
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)	128	322	21	17	254	11	29	76	53	9	52	166

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	471	283	159	227
Volume Left (vph)	128	17	29	9
Volume Right (vph)	21	11	53	166
Hadj (s)	0.06	0.02	-0.13	-0.40
Departure Headway (s)	5.8	6.1	6.6	6.1
Degree Utilization, x	0.76	0.48	0.29	0.39
Capacity (veh/h)	471	546	471	509
Control Delay (s)	24.4	14.5	12.2	12.9
Approach Delay (s)	24.4	14.5	12.2	12.9
Approach LOS	C	B	B	B

Intersection Summary			
Delay	17.9		
HCM Level of Service	C		
Intersection Capacity Utilization	66.1%	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 (vph)	10	432	13	20	435	16	7	99	33	12	68	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			1.00			0.97			0.99	
Flt Protected		1.00			1.00			1.00			0.99	
Satd. Flow (prot)		1850			1846			1775			1824	
Flt Permitted		0.99			0.98			0.99			0.96	
Satd. Flow (perm)		1833			1807			1761			1760	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	455	14	21	458	17	7	104	35	13	72	5
RTOR Reduction (vph)	0	2	0	0	2	0	0	19	0	0	4	0
Lane Group Flow (vph)	0	478	0	0	494	0	0	127	0	0	86	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1130			1114			440			440	
v/s Ratio Prot												
v/s Ratio Perm		0.26			c0.27			c0.07			0.05	
v/c Ratio		0.42			0.44			0.29			0.20	
Uniform Delay, d1		6.0			6.1			18.2			17.7	
Progression Factor		0.77			0.72			1.07			1.00	
Incremental Delay, d2		1.1			1.2			1.6			1.0	
Delay (s)		5.7			5.5			21.1			18.7	
Level of Service		A			A			C			B	
Approach Delay (s)		5.7			5.5			21.1			18.7	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.1%	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)	60	321	17	40	240	15	20	72	37	28	55	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	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	0.99	1.00		0.94	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	0.99			0.96			0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1759	1837		1670	1843			1764			1782	
Flt Permitted	0.57	1.00		0.49	1.00			0.96			0.92	
Satd. Flow (perm)	1053	1837		855	1843			1706			1660	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	338	18	42	253	16	21	76	39	29	58	20
RTOR Reduction (vph)	0	3	0	0	4	0	0	24	0	0	13	0
Lane Group Flow (vph)	63	353	0	42	265	0	0	112	0	0	94	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	30.5	30.5		30.5	30.5			22.5			22.5	
Effective Green, g (s)	30.0	30.0		30.0	30.0			22.0			22.0	
Actuated g/C Ratio	0.50	0.50		0.50	0.50			0.37			0.37	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	527	919		428	922			626			609	
v/s Ratio Prot		c0.19			0.14							
v/s Ratio Perm	0.06			0.05				c0.07			0.06	
v/c Ratio	0.12	0.38		0.10	0.29			0.18			0.15	
Uniform Delay, d1	8.0	9.3		7.9	8.8			12.9			12.8	
Progression Factor	0.49	0.55		1.82	1.92			1.14			0.48	
Incremental Delay, d2	0.5	1.2		0.4	0.8			0.6			0.5	
Delay (s)	4.4	6.3		14.8	17.6			15.2			6.7	
Level of Service	A	A		B	B			B			A	
Approach Delay (s)		6.0			17.2			15.2			6.7	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	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)	58	85	18	77	344	399	9	552	118	180	576	191
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1804	1538		1846	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.66	1.00		0.92	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1219	1538		1717	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	61	89	19	81	362	420	9	581	124	189	606	201
RTOR Reduction (vph)	0	0	12	0	0	211	0	0	85	0	0	107
Lane Group Flow (vph)	0	150	7	0	443	209	9	581	39	189	606	94
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		18.6	18.6		18.6	18.6	0.7	16.6	16.6	7.9	24.8	24.8
Effective Green, g (s)		18.6	18.6		18.6	18.6	0.7	16.6	16.6	7.9	24.8	24.8
Actuated g/C Ratio		0.35	0.35		0.35	0.35	0.01	0.31	0.31	0.15	0.47	0.47
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		427	539		601	554	23	1075	481	256	1606	739
v/s Ratio Prot							0.01	c0.17		c0.11	0.18	
v/s Ratio Perm		0.12	0.00		c0.26	0.13			0.03			0.06
v/c Ratio		0.35	0.01		0.74	0.38	0.39	0.54	0.08	0.74	0.38	0.13
Uniform Delay, d1		12.8	11.3		15.1	12.9	26.0	15.1	12.9	21.6	9.2	8.0
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	0.0		4.7	0.4	10.7	2.0	0.3	10.6	0.7	0.4
Delay (s)		13.3	11.3		19.8	13.3	36.6	17.0	13.2	32.2	9.8	8.4
Level of Service		B	B		B	B	D	B	B	C	A	A
Approach Delay (s)		13.1			16.7			16.6			13.8	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	53.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	68.6%	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 (veh/h)	0	1	0	138	0	35	0	33	161	27	46	0
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)	0	1	0	150	0	38	0	36	175	29	50	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	270	320	50	233	232	123	50			211		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	270	320	50	233	232	123	50			211		
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 %	100	100	100	79	100	96	100			98		
cM capacity (veh/h)	644	584	1018	709	654	927	1557			1360		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	1	188	211	79
Volume Left	0	150	0	29
Volume Right	0	38	175	0
cSH	584	745	1557	1360
Volume to Capacity	0.00	0.25	0.00	0.02
Queue Length 95th (ft)	0	25	0	2
Control Delay (s)	11.2	11.5	0.0	3.0
Lane LOS	B	B		A
Approach Delay (s)	11.2	11.5	0.0	3.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	42.0%	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)	510	318	54	29	515	37	187	1038	46	51	448	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	0.99		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1265	1496	2944		1547	3064		1547	3094	1321
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1265	1496	2944		1547	3064		1547	3094	1321
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	537	335	57	31	542	39	197	1093	48	54	472	642
RTOR Reduction (vph)	0	0	41	0	4	0	0	2	0	0	0	38
Lane Group Flow (vph)	537	335	16	31	577	0	197	1139	0	54	472	604
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	29.3	35.9	35.9	19.4	26.0		20.5	49.0		5.0	33.5	62.8
Effective Green, g (s)	29.3	35.9	35.9	19.4	26.0		20.5	50.0		5.0	34.5	64.8
Actuated g/C Ratio	0.23	0.28	0.28	0.15	0.21		0.16	0.40		0.04	0.27	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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	850	360	230	606		251	1213		61	845	678
v/s Ratio Prot	0.19	0.11		0.02	c0.20		c0.13	c0.37		0.03	0.15	c0.21
v/s Ratio Perm			0.01									0.24
v/c Ratio	0.83	0.39	0.05	0.13	0.95		0.78	0.94		0.89	0.56	0.89
Uniform Delay, d1	46.1	36.4	32.8	46.2	49.5		50.8	36.7		60.4	39.4	27.6
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	8.5	0.3	0.1	0.3	25.1		14.8	13.5		75.0	0.8	13.9
Delay (s)	54.5	36.7	32.8	46.5	74.6		65.6	50.2		135.4	40.2	41.5
Level of Service	D	D	C	D	E		E	D		F	D	D
Approach Delay (s)		46.8			73.2			52.5			45.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	126.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
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)	67	218	128	28	273	123	235	1018	42	215	321	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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3208		1770	3207		3433	3539	1482	3335	3539	1445
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3208		1770	3207		3433	3539	1482	3335	3539	1445
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	71	229	135	29	287	129	247	1072	44	226	338	46
RTOR Reduction (vph)	0	83	0	0	49	0	0	0	27	0	0	32
Lane Group Flow (vph)	71	281	0	29	367	0	247	1072	17	226	338	14
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	25.6	25.6		22.5	22.5		10.5	31.5	31.5	12.0	33.0	33.0
Effective Green, g (s)	24.7	24.7		21.6	21.6		10.2	31.7	31.7	11.7	33.2	33.2
Actuated g/C Ratio	0.23	0.23		0.20	0.20		0.10	0.30	0.30	0.11	0.31	0.31
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	402	750		362	655		331	1061	444	369	1112	454
v/s Ratio Prot	0.04	c0.09		0.02	c0.11		0.07	c0.30		c0.07	0.10	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.18	0.37		0.08	0.56		0.75	1.01	0.04	0.61	0.30	0.03
Uniform Delay, d1	32.4	34.0		34.0	37.8		46.5	37.0	26.2	44.8	27.5	25.1
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	0.1	0.1		0.0	0.6		7.8	30.2	0.0	2.1	0.1	0.0
Delay (s)	32.4	34.1		34.0	38.4		54.3	67.2	26.2	47.0	27.5	25.1
Level of Service	C	C		C	D		D	E	C	D	C	C
Approach Delay (s)		33.9			38.1			63.5			34.6	
Approach LOS		C			D			E			C	

Intersection Summary			
HCM Average Control Delay	48.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	105.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL2	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	135	467	37	2	2	389	288	43	481	3	225	443
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		1.00		0.95	1.00
Satd. Flow (prot)	1770	1841				3538	1583		1854		1770	1863
Flt Permitted	0.41	1.00				0.90	1.00		0.93		0.95	1.00
Satd. Flow (perm)	765	1841				3176	1583		1739		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	142	492	39	2	2	409	303	45	506	3	237	466
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	142	533	0	0	0	411	303	0	554	0	237	466
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	2
Permitted Phases	3				3		Free	6				
Actuated Green, G (s)	26.2	26.2				26.2	89.5		30.7		11.0	44.7
Effective Green, g (s)	26.2	26.2				26.2	89.5		30.7		11.0	44.7
Actuated g/C Ratio	0.29	0.29				0.29	1.00		0.34		0.12	0.50
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	224	539				930	1583		597		218	930
v/s Ratio Prot		c0.29									c0.13	0.25
v/s Ratio Perm	0.19					0.13	0.19		c0.32			
v/c Ratio	0.63	0.99				0.44	0.19		0.93		1.09	0.50
Uniform Delay, d1	27.5	31.5				25.7	0.0		28.3		39.2	15.0
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	5.8	35.5				0.3	0.3		20.7		86.1	0.4
Delay (s)	33.2	67.0				26.0	0.3		49.0		125.4	15.4
Level of Service	C	E				C	A		D		F	B
Approach Delay (s)		59.9				15.1			49.0			46.0
Approach LOS		E				B			D			D

Intersection Summary			
HCM Average Control Delay	42.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.4
Intersection Capacity Utilization	109.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL	NER
Lane Configurations				
Volume (vph)	62	65	73	3
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	3.8		4.1	4.1
Lane Util. Factor	1.00		1.00	1.00
Frt	0.85		1.00	0.85
Flt Protected	1.00		0.95	1.00
Satd. Flow (prot)	1583		1770	1583
Flt Permitted	1.00		0.95	1.00
Satd. Flow (perm)	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	65	68	77	3
RTOR Reduction (vph)	34	0	0	0
Lane Group Flow (vph)	99	0	77	3
Turn Type	Perm			Perm
Protected Phases			4	
Permitted Phases	2			4
Actuated Green, G (s)	44.7		7.2	7.2
Effective Green, g (s)	44.7		7.2	7.2
Actuated g/C Ratio	0.50		0.08	0.08
Clearance Time (s)	3.8		4.1	4.1
Vehicle Extension (s)	3.0		2.0	2.0
Lane Grp Cap (vph)	791		142	127
v/s Ratio Prot			c0.04	
v/s Ratio Perm	0.06			0.00
v/c Ratio	0.13		0.54	0.02
Uniform Delay, d1	12.0		39.6	37.9
Progression Factor	1.00		1.00	1.00
Incremental Delay, d2	0.1		2.3	0.0
Delay (s)	12.0		41.8	37.9
Level of Service	B		D	D
Approach Delay (s)			41.7	
Approach LOS			D	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	47	29	18	64	143	8	1214	27	6	1292	308
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.97	
Flt Protected		0.97			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1761			1639			3423		1719	3330	
Flt Permitted		0.57			0.97			0.85		0.95	1.00	
Satd. Flow (perm)		1032			1593			2895		1719	3330	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	200	49	31	19	67	151	8	1278	28	6	1360	324
RTOR Reduction (vph)	0	7	0	0	0	0	0	3	0	0	35	0
Lane Group Flow (vph)	0	273	0	0	237	0	0	1311	0	6	1649	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		16.5			16.5			29.5		4.0	29.5	
Effective Green, g (s)		16.0			16.0			29.0		3.0	29.0	
Actuated g/C Ratio		0.27			0.27			0.48		0.05	0.48	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		275			425			1399		86	1610	
v/s Ratio Prot										c0.00	c0.50	
v/s Ratio Perm		c0.26			0.15			0.45				
v/c Ratio		0.99			0.56			0.94		0.07	1.02	
Uniform Delay, d1		21.9			19.0			14.6		27.2	15.5	
Progression Factor		1.00			1.00			0.60		1.00	1.00	
Incremental Delay, d2		51.7			1.6			9.0		0.1	28.9	
Delay (s)		73.7			20.5			17.7		27.3	44.4	
Level of Service		E			C			B		C	D	
Approach Delay (s)		73.7			20.5			17.7			44.3	
Approach LOS		E			C			B			D	

Intersection Summary			
HCM Average Control Delay	35.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	60.0	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	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	184	101	44	37	66	96	11	995	22	186	1086	110
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.98			0.93			1.00		1.00	0.99	
Flt Protected		0.97			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1718			1658			3423		1719	3378	
Flt Permitted		0.68			0.91			0.94		0.95	1.00	
Satd. Flow (perm)		1208			1525			3210		1719	3378	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	194	106	46	39	69	101	12	1047	23	196	1143	116
RTOR Reduction (vph)	0	9	0	0	57	0	0	2	0	0	12	0
Lane Group Flow (vph)	0	337	0	0	152	0	0	1080	0	196	1247	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		17.7			17.7			23.9		8.4	35.8	
Effective Green, g (s)		17.2			17.2			23.4		7.4	35.3	
Actuated g/C Ratio		0.29			0.29			0.39		0.12	0.59	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		346			437			1252		212	1987	
v/s Ratio Prot										c0.11	0.37	
v/s Ratio Perm		c0.28			0.10			c0.34				
v/c Ratio		0.97			0.35			0.86		0.92	0.63	
Uniform Delay, d1		21.2			17.0			16.8		26.0	8.1	
Progression Factor		1.00			1.00			0.97		0.50	0.07	
Incremental Delay, d2		40.8			0.2			5.0		15.5	0.1	
Delay (s)		62.0			17.1			21.3		28.4	0.7	
Level of Service		E			B			C		C	A	
Approach Delay (s)		62.0			17.1			21.3			4.4	
Approach LOS		E			B			C			A	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.6%	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)	187	387	33	8	291	21	7	897	24	12	975	155
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.99			1.00			0.98	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1836			1842			3424			3356	
Flt Permitted	0.47	1.00			0.99			0.95			0.94	
Satd. Flow (perm)	868	1836			1825			3244			3167	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	197	407	35	8	306	22	7	944	25	13	1026	163
RTOR Reduction (vph)	0	5	0	0	4	0	0	3	0	0	21	0
Lane Group Flow (vph)	197	437	0	0	332	0	0	973	0	0	1181	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	318	673			669			1622			1584	
v/s Ratio Prot		c0.24										
v/s Ratio Perm	0.23				0.18			0.30			c0.37	
v/c Ratio	0.62	0.65			0.50			0.60			0.75	
Uniform Delay, d1	15.6	15.8			14.7			10.7			12.0	
Progression Factor	1.05	1.06			0.78			0.94			0.14	
Incremental Delay, d2	8.3	4.6			2.6			1.6			2.5	
Delay (s)	24.8	21.4			14.0			11.7			4.2	
Level of Service	C	C			B			B			A	
Approach Delay (s)		22.4			14.0			11.7			4.2	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	70	169	17	17	117	6	16	69	43	40	143	258
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)	76	184	18	18	127	7	17	75	47	43	155	280

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	278	152	139	479
Volume Left (vph)	76	18	17	43
Volume Right (vph)	18	7	47	280
Hadj (s)	0.05	0.03	-0.14	-0.30
Departure Headway (s)	6.0	6.2	5.9	5.2
Degree Utilization, x	0.46	0.26	0.23	0.69
Capacity (veh/h)	546	495	525	664
Control Delay (s)	14.0	11.4	10.7	19.0
Approach Delay (s)	14.0	11.4	10.7	19.0
Approach LOS	B	B	B	C

Intersection Summary			
Delay	15.4		
HCM Level of Service	C		
Intersection Capacity Utilization	62.7%	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 (vph)	33	431	17	48	456	50	23	104	23	35	66	23
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			0.99	
Frt		1.00			0.99			0.98			0.98	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		1842			1821			1790			1763	
Flt Permitted		0.95			0.93			0.95			0.89	
Satd. Flow (perm)		1752			1708			1711			1594	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	454	18	51	480	53	24	109	24	37	69	24
RTOR Reduction (vph)	0	2	0	0	6	0	0	11	0	0	14	0
Lane Group Flow (vph)	0	505	0	0	578	0	0	147	0	0	117	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1080			1053			428			399	
v/s Ratio Prot												
v/s Ratio Perm		0.29			c0.34			c0.09			0.07	
v/c Ratio		0.47			0.55			0.34			0.29	
Uniform Delay, d1		6.2			6.7			18.5			18.2	
Progression Factor		0.50			0.82			1.16			1.00	
Incremental Delay, d2		1.1			1.8			2.1			1.8	
Delay (s)		4.2			7.3			23.4			20.1	
Level of Service		A			A			C			C	
Approach Delay (s)		4.2			7.3			23.4			20.1	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	9.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.3%	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)	30	350	57	56	311	31	33	88	83	30	122	45
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	
Frpb, ped/bikes	1.00	0.98		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		0.95	1.00			1.00			1.00	
Frt	1.00	0.98		1.00	0.99			0.95			0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1761	1792		1686	1832			1730			1783	
Flt Permitted	0.49	1.00		0.43	1.00			0.93			0.94	
Satd. Flow (perm)	906	1792		762	1832			1629			1685	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	368	60	59	327	33	35	93	87	32	128	47
RTOR Reduction (vph)	0	10	0	0	6	0	0	41	0	0	18	0
Lane Group Flow (vph)	32	418	0	59	354	0	0	174	0	0	189	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	31.5	31.5		31.5	31.5			21.5			21.5	
Effective Green, g (s)	31.0	31.0		31.0	31.0			21.0			21.0	
Actuated g/C Ratio	0.52	0.52		0.52	0.52			0.35			0.35	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	468	926		394	947			570			590	
v/s Ratio Prot		c0.23			0.19							
v/s Ratio Perm	0.04			0.08				0.11			c0.11	
v/c Ratio	0.07	0.45		0.15	0.37			0.31			0.32	
Uniform Delay, d1	7.3	9.1		7.6	8.7			14.2			14.3	
Progression Factor	0.38	0.37		1.09	0.94			0.57			1.19	
Incremental Delay, d2	0.3	1.6		0.7	1.0			1.1			1.4	
Delay (s)	3.1	5.0		9.0	9.2			9.2			18.4	
Level of Service	A	A		A	A			A			B	
Approach Delay (s)		4.8			9.2			9.2			18.4	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.9%	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 (vph)	85	99	9	54	223	126	2	477	80	214	623	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1796	1538		1845	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.66	1.00		0.91	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1211	1538		1698	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	89	104	9	57	235	133	2	502	84	225	656	145
RTOR Reduction (vph)	0	0	7	0	0	0	0	0	55	0	0	0
Lane Group Flow (vph)	0	193	2	0	292	133	2	502	29	225	656	145
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		12.8	12.8		12.8	47.5	0.7	16.6	16.6	8.1	25.0	47.5
Effective Green, g (s)		12.8	12.8		12.8	47.5	0.7	16.6	16.6	8.1	25.0	47.5
Actuated g/C Ratio		0.27	0.27		0.27	1.00	0.01	0.35	0.35	0.17	0.53	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		326	414		458	1583	26	1201	537	293	1809	1583
v/s Ratio Prot							0.00	c0.15		c0.13	0.19	
v/s Ratio Perm		0.16	0.00		c0.17	0.08			0.02			0.09
v/c Ratio		0.59	0.01		0.64	0.08	0.08	0.42	0.05	0.77	0.36	0.09
Uniform Delay, d1		15.1	12.7		15.3	0.0	23.1	11.8	10.2	18.8	6.6	0.0
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		2.9	0.0		2.9	0.1	1.3	1.1	0.2	11.4	0.6	0.1
Delay (s)		18.0	12.7		18.2	0.1	24.3	12.8	10.4	30.2	7.2	0.1
Level of Service		B	B		B	A	C	B	B	C	A	A
Approach Delay (s)		17.7			12.5			12.5			11.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	47.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	63.0%	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 (veh/h)	0	0	0	255	0	31	0	49	121	30	43	0
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)	0	0	0	277	0	34	0	53	132	33	47	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	265	297	47	231	231	119	47			185		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	265	297	47	231	231	119	47			185		
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 %	100	100	100	61	100	96	100			98		
cM capacity (veh/h)	651	601	1023	711	653	933	1561			1390		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	311	185	79
Volume Left	0	277	0	33
Volume Right	0	34	132	0
cSH	1700	730	1561	1390
Volume to Capacity	0.00	0.43	0.00	0.02
Queue Length 95th (ft)	0	53	0	2
Control Delay (s)	0.0	13.5	0.0	3.3
Lane LOS	A	B		A
Approach Delay (s)	0.0	13.5	0.0	3.3
Approach LOS	A	B		

Intersection Summary			
Average Delay	7.8		
Intersection Capacity Utilization	40.0%	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)	537	429	141	44	388	33	158	488	66	89	861	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	0.99		1.00	0.99		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1266	1496	2936		1547	3009		1547	3094	1316
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1266	1496	2936		1547	3009		1547	3094	1316
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	565	452	148	46	408	35	166	514	69	94	906	675
RTOR Reduction (vph)	0	0	82	0	5	0	0	8	0	0	0	18
Lane Group Flow (vph)	565	452	66	46	438	0	166	575	0	94	906	657
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	28.6	33.6	33.6	19.1	24.1		15.4	42.7		12.2	39.5	68.1
Effective Green, g (s)	28.6	33.6	33.6	19.1	24.1		15.4	43.7		12.2	40.5	70.1
Actuated g/C Ratio	0.23	0.27	0.27	0.15	0.19		0.12	0.35		0.10	0.33	0.56
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	643	807	341	229	568		191	1055		151	1006	740
v/s Ratio Prot	0.20	0.15		0.03	c0.15		c0.11	c0.19		0.06	c0.29	c0.21
v/s Ratio Perm			0.05									0.29
v/c Ratio	0.88	0.56	0.19	0.20	0.77		0.87	0.55		0.62	0.90	0.89
Uniform Delay, d1	46.3	39.1	35.1	46.1	47.6		53.6	32.5		54.0	40.1	23.8
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	13.0	0.9	0.3	0.4	6.4		31.6	0.6		7.7	10.9	12.4
Delay (s)	59.3	40.0	35.3	46.5	54.1		85.2	33.1		61.7	51.1	36.2
Level of Service	E	D	D	D	D		F	C		E	D	D
Approach Delay (s)		48.8			53.4			44.6			45.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	47.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	124.6	Sum of lost time (s)	19.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
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)	48	315	233	47	197	156	215	498	18	90	1071	45
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.97		1.00	1.00	0.93	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3172		1770	3107		3433	3539	1478	3335	3539	1441
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3172		1770	3107		3433	3539	1478	3335	3539	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	51	332	245	49	207	164	226	524	19	95	1127	47
RTOR Reduction (vph)	0	115	0	0	124	0	0	0	13	0	0	25
Lane Group Flow (vph)	51	462	0	49	247	0	226	524	6	95	1127	22
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	27.0	27.0		21.9	21.9		9.2	35.4	35.4	12.4	38.6	38.6
Effective Green, g (s)	26.1	26.1		21.0	21.0		8.9	35.6	35.6	12.1	38.8	38.8
Actuated g/C Ratio	0.24	0.24		0.19	0.19		0.08	0.32	0.32	0.11	0.35	0.35
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	405	747		335	589		276	1137	475	364	1239	505
v/s Ratio Prot	0.03	c0.15		0.03	c0.08		c0.07	0.15		0.03	c0.32	
v/s Ratio Perm									0.00			0.02
v/c Ratio	0.13	0.62		0.15	0.42		0.82	0.46	0.01	0.26	0.91	0.04
Uniform Delay, d1	33.4	37.9		37.4	39.5		50.2	30.0	25.6	45.3	34.3	23.8
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	1.1		0.1	0.2		16.2	0.1	0.0	0.1	9.7	0.0
Delay (s)	33.4	39.0		37.5	39.7		66.3	30.1	25.6	45.4	44.0	23.8
Level of Service	C	D		D	D		E	C	C	D	D	C
Approach Delay (s)		38.5			39.5			40.6			43.4	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.8	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	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	79	228	24	3	16	222	460	69	408	16	254	572
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.98				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1834				3527	1583		1842		1770	1863
Flt Permitted	0.56	1.00				0.93	1.00		0.85		0.95	1.00
Satd. Flow (perm)	1046	1834				3284	1583		1584		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	240	25	3	17	234	484	73	429	17	267	602
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	83	267	0	0	0	251	484	0	518	0	267	602
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	17.7	17.7				17.7	74.9		26.0		12.3	41.3
Effective Green, g (s)	17.7	17.7				17.7	74.9		26.0		12.3	41.3
Actuated g/C Ratio	0.24	0.24				0.24	1.00		0.35		0.16	0.55
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	247	433				776	1583		550		291	1027
v/s Ratio Prot		c0.15									c0.15	
v/s Ratio Perm	0.08					0.08	c0.31		c0.33			0.32
v/c Ratio	0.34	0.62				0.32	0.31		0.94		0.92	0.59
Uniform Delay, d1	23.7	25.6				23.6	0.0		23.7		30.8	11.1
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.8	2.6				0.2	0.5		24.6		31.7	0.9
Delay (s)	24.5	28.2				23.9	0.5		48.3		62.5	12.0
Level of Service	C	C				C	A		D		E	B
Approach Delay (s)		27.3				8.5			48.3			24.0
Approach LOS		C				A			D			C

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	74.9	Sum of lost time (s)	10.3
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	132	55	4	50	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	139	58	4	53	3
RTOR Reduction (vph)	12	0	0	0	0
Lane Group Flow (vph)	185	0	0	57	3
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	41.3			4.5	4.5
Effective Green, g (s)	41.3			4.5	4.5
Actuated g/C Ratio	0.55			0.06	0.06
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	873			106	95
v/s Ratio Prot				0.03	
v/s Ratio Perm	0.12				0.00
v/c Ratio	0.21			0.54	0.03
Uniform Delay, d1	8.5			34.2	33.1
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.1			2.6	0.0
Delay (s)	8.7			36.8	33.2
Level of Service	A			D	C
Approach Delay (s)				36.6	
Approach LOS				D	

Intersection Summary

APPENDIX D:

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS (BASE 2013 PLUS PROJECT CONDITIONS)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	290	41	10	15	111	383	37	1383	27	6	774	266
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.98	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.90			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1778			1595			3420		1719	3270	
Flt Permitted		0.31			0.99			0.81		0.95	1.00	
Satd. Flow (perm)		567			1573			2777		1719	3270	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	305	43	11	16	117	403	39	1456	28	6	815	280
RTOR Reduction (vph)	0	1	0	0	0	0	0	1	0	0	28	0
Lane Group Flow (vph)	0	358	0	0	536	0	0	1522	0	6	1067	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		48.5			48.5			57.4		4.1	57.4	
Effective Green, g (s)		48.0			48.0			56.9		3.1	56.9	
Actuated g/C Ratio		0.40			0.40			0.47		0.03	0.47	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		227			629			1317		44	1551	
v/s Ratio Prot										c0.00	0.33	
v/s Ratio Perm		c0.63			0.34			c0.55				
v/c Ratio		1.58			0.85			1.16		0.14	0.69	
Uniform Delay, d1		36.0			32.8			31.6		57.1	24.6	
Progression Factor		1.00			1.00			0.91		1.00	1.00	
Incremental Delay, d2		279.4			10.8			73.9		0.5	2.5	
Delay (s)		315.4			43.6			102.7		57.7	27.1	
Level of Service		F			D			F		E	C	
Approach Delay (s)		315.4			43.6			102.7			27.3	
Approach LOS		F			D			F			C	

Intersection Summary			
HCM Average Control Delay	91.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	125.7%	ICU Level of Service	H
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)	270	37	36	28	74	222	8	1095	20	91	657	97
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.98	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1707			1612			3426		1719	3354	
Flt Permitted		0.45			0.96			0.95		0.95	1.00	
Satd. Flow (perm)		790			1556			3256		1719	3354	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	284	39	38	29	78	234	8	1153	21	96	692	102
RTOR Reduction (vph)	0	7	0	0	131	0	0	2	0	0	20	0
Lane Group Flow (vph)	0	354	0	0	210	0	0	1180	0	96	775	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		18.5			18.5			26.5		5.0	34.5	
Effective Green, g (s)		18.0			18.0			26.0		4.0	34.0	
Actuated g/C Ratio		0.30			0.30			0.43		0.07	0.57	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		237			467			1411		115	1901	
v/s Ratio Prot										c0.06	0.23	
v/s Ratio Perm		c0.45			0.14			c0.36				
v/c Ratio		1.49			0.45			0.84		0.83	0.41	
Uniform Delay, d1		21.0			17.0			15.1		27.7	7.3	
Progression Factor		1.00			1.00			1.20		1.73	0.58	
Incremental Delay, d2		243.1			0.3			3.5		29.0	0.0	
Delay (s)		264.1			17.2			21.6		76.9	4.3	
Level of Service		F			B			C		E	A	
Approach Delay (s)		264.1			17.2			21.6			12.1	
Approach LOS		F			B			C			B	

Intersection Summary			
HCM Average Control Delay	49.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.8%	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)	181	166	35	18	210	61	43	835	36	15	562	154
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	0.99			1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.97			0.97			0.99			0.97	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1766	1804			1797			3412			3310	
Flt Permitted	0.50	1.00			0.98			0.89			0.93	
Satd. Flow (perm)	935	1804			1763			3057			3088	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	191	175	37	19	221	64	45	879	38	16	592	162
RTOR Reduction (vph)	0	13	0	0	16	0	0	5	0	0	40	0
Lane Group Flow (vph)	191	199	0	0	288	0	0	957	0	0	730	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	343	661			646			1529			1544	
v/s Ratio Prot		0.11										
v/s Ratio Perm	c0.20				0.16			c0.31			0.24	
v/c Ratio	0.56	0.30			0.45			0.63			0.47	
Uniform Delay, d1	15.1	13.5			14.4			10.9			9.8	
Progression Factor	0.90	0.95			1.47			0.40			0.31	
Incremental Delay, d2	5.9	1.1			2.0			1.8			0.9	
Delay (s)	19.5	14.0			23.1			6.2			4.0	
Level of Service	B	B			C			A			A	
Approach Delay (s)		16.6			23.1			6.2			4.0	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	123	317	26	16	241	11	29	72	49	10	55	160
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)	134	345	28	17	262	12	32	78	53	11	60	174

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	507	291	163	245
Volume Left (vph)	134	17	32	11
Volume Right (vph)	28	12	53	174
Hadj (s)	0.05	0.02	-0.12	-0.38
Departure Headway (s)	6.0	6.3	6.9	6.4
Degree Utilization, x	0.84	0.51	0.31	0.43
Capacity (veh/h)	591	519	462	511
Control Delay (s)	32.2	15.8	13.0	14.2
Approach Delay (s)	32.2	15.8	13.0	14.2
Approach LOS	D	C	B	B

Intersection Summary			
Delay	22.0		
HCM Level of Service	C		
Intersection Capacity Utilization	68.4%	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 (vph)	10	432	13	20	435	16	7	104	33	12	82	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			1.00			0.97			0.99	
Flt Protected		1.00			1.00			1.00			0.99	
Satd. Flow (prot)		1850			1846			1778			1830	
Flt Permitted		0.99			0.98			0.99			0.96	
Satd. Flow (perm)		1833			1807			1763			1772	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	455	14	21	458	17	7	109	35	13	86	5
RTOR Reduction (vph)	0	2	0	0	2	0	0	18	0	0	3	0
Lane Group Flow (vph)	0	478	0	0	494	0	0	133	0	0	101	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1130			1114			441			443	
v/s Ratio Prot												
v/s Ratio Perm		0.26			c0.27			c0.08			0.06	
v/c Ratio		0.42			0.44			0.30			0.23	
Uniform Delay, d1		6.0			6.1			18.3			17.9	
Progression Factor		0.77			0.72			1.06			1.00	
Incremental Delay, d2		1.1			1.2			1.7			1.2	
Delay (s)		5.7			5.5			21.1			19.1	
Level of Service		A			A			C			B	
Approach Delay (s)		5.7			5.5			21.1			19.1	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.1%	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)	60	321	17	40	240	15	20	77	37	28	69	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	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	0.99	1.00		0.94	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	0.99			0.96			0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1759	1837		1670	1843			1768			1792	
Flt Permitted	0.57	1.00		0.49	1.00			0.96			0.93	
Satd. Flow (perm)	1053	1837		855	1843			1708			1680	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	338	18	42	253	16	21	81	39	29	73	20
RTOR Reduction (vph)	0	3	0	0	4	0	0	23	0	0	12	0
Lane Group Flow (vph)	63	353	0	42	265	0	0	118	0	0	110	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	30.5	30.5		30.5	30.5			22.5			22.5	
Effective Green, g (s)	30.0	30.0		30.0	30.0			22.0			22.0	
Actuated g/C Ratio	0.50	0.50		0.50	0.50			0.37			0.37	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	527	919		428	922			626			616	
v/s Ratio Prot		c0.19			0.14							
v/s Ratio Perm	0.06			0.05				c0.07			0.07	
v/c Ratio	0.12	0.38		0.10	0.29			0.19			0.18	
Uniform Delay, d1	8.0	9.3		7.9	8.8			12.9			12.9	
Progression Factor	0.49	0.55		1.82	1.92			1.14			0.44	
Incremental Delay, d2	0.5	1.2		0.4	0.8			0.6			0.6	
Delay (s)	4.4	6.3		14.8	17.6			15.3			6.2	
Level of Service	A	A		B	B			B			A	
Approach Delay (s)		6.0			17.2			15.3			6.2	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	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)	72	85	18	77	344	399	9	552	118	180	576	196
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1796	1538		1846	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.60	1.00		0.92	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1096	1538		1711	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	76	89	19	81	362	420	9	581	124	189	606	206
RTOR Reduction (vph)	0	0	12	0	0	211	0	0	85	0	0	110
Lane Group Flow (vph)	0	165	7	0	443	209	9	581	39	189	606	96
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		18.6	18.6		18.6	18.6	0.7	16.6	16.6	7.9	24.8	24.8
Effective Green, g (s)		18.6	18.6		18.6	18.6	0.7	16.6	16.6	7.9	24.8	24.8
Actuated g/C Ratio		0.35	0.35		0.35	0.35	0.01	0.31	0.31	0.15	0.47	0.47
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		384	539		599	554	23	1075	481	256	1606	739
v/s Ratio Prot							0.01	c0.17		c0.11	0.18	
v/s Ratio Perm		0.15	0.00		c0.26	0.13			0.03			0.06
v/c Ratio		0.43	0.01		0.74	0.38	0.39	0.54	0.08	0.74	0.38	0.13
Uniform Delay, d1		13.2	11.3		15.1	12.9	26.0	15.1	12.9	21.6	9.2	8.0
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		0.8	0.0		4.8	0.4	10.7	2.0	0.3	10.6	0.7	0.4
Delay (s)		14.0	11.3		19.9	13.3	36.6	17.0	13.2	32.2	9.8	8.4
Level of Service		B	B		B	B	D	B	B	C	A	A
Approach Delay (s)		13.7			16.7			16.6			13.8	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	53.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.4%	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 (veh/h)	0	1	0	167	0	35	0	33	171	27	46	0
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)	0	1	0	182	0	38	0	36	186	29	50	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	276	330	50	238	238	129	50			222		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	276	330	50	238	238	129	50			222		
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 %	100	100	100	74	100	96	100			98		
cM capacity (veh/h)	638	576	1018	703	649	921	1557			1347		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	1	220	222	79
Volume Left	0	182	0	29
Volume Right	0	38	186	0
cSH	576	733	1557	1347
Volume to Capacity	0.00	0.30	0.00	0.02
Queue Length 95th (ft)	0	31	0	2
Control Delay (s)	11.3	12.0	0.0	3.0
Lane LOS	B	B		A
Approach Delay (s)	11.3	12.0	0.0	3.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	5.5		
Intersection Capacity Utilization	44.2%	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)	510	320	54	29	520	37	187	1038	46	51	448	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	0.99		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1265	1496	2944		1547	3064		1547	3094	1321
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1265	1496	2944		1547	3064		1547	3094	1321
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	537	337	57	31	547	39	197	1093	48	54	472	642
RTOR Reduction (vph)	0	0	41	0	4	0	0	2	0	0	0	38
Lane Group Flow (vph)	537	337	16	31	582	0	197	1139	0	54	472	604
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	29.3	35.9	35.9	19.4	26.0		20.5	49.0		5.0	33.5	62.8
Effective Green, g (s)	29.3	35.9	35.9	19.4	26.0		20.5	50.0		5.0	34.5	64.8
Actuated g/C Ratio	0.23	0.28	0.28	0.15	0.21		0.16	0.40		0.04	0.27	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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	850	360	230	606		251	1213		61	845	678
v/s Ratio Prot	0.19	0.11		0.02	c0.20		c0.13	c0.37		0.03	0.15	c0.21
v/s Ratio Perm			0.01									0.24
v/c Ratio	0.83	0.40	0.05	0.13	0.96		0.78	0.94		0.89	0.56	0.89
Uniform Delay, d1	46.1	36.5	32.8	46.2	49.6		50.8	36.7		60.4	39.4	27.6
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	8.5	0.3	0.1	0.3	26.9		14.8	13.5		75.0	0.8	13.9
Delay (s)	54.5	36.8	32.8	46.5	76.5		65.6	50.2		135.4	40.2	41.5
Level of Service	D	D	C	D	E		E	D		F	D	D
Approach Delay (s)		46.8			75.0			52.5			45.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	126.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
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)	67	220	128	28	278	127	235	1018	42	216	321	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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3210		1770	3205		3433	3539	1482	3335	3539	1445
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3210		1770	3205		3433	3539	1482	3335	3539	1445
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	71	232	135	29	293	134	247	1072	44	227	338	46
RTOR Reduction (vph)	0	81	0	0	50	0	0	0	27	0	0	32
Lane Group Flow (vph)	71	286	0	29	377	0	247	1072	17	227	338	14
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	25.7	25.7		22.6	22.6		10.5	31.4	31.4	12.0	32.9	32.9
Effective Green, g (s)	24.8	24.8		21.7	21.7		10.2	31.6	31.6	11.7	33.1	33.1
Actuated g/C Ratio	0.23	0.23		0.21	0.21		0.10	0.30	0.30	0.11	0.31	0.31
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	403	752		363	657		331	1057	443	369	1107	452
v/s Ratio Prot	0.04	c0.09		0.02	c0.12		0.07	c0.30		c0.07	0.10	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.18	0.38		0.08	0.57		0.75	1.01	0.04	0.62	0.31	0.03
Uniform Delay, d1	32.3	34.0		34.0	37.9		46.5	37.1	26.3	44.9	27.6	25.2
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	0.1		0.0	0.8		7.8	31.3	0.0	2.1	0.1	0.0
Delay (s)	32.4	34.2		34.0	38.6		54.3	68.4	26.3	47.0	27.7	25.2
Level of Service	C	C		C	D		D	E	C	D	C	C
Approach Delay (s)		33.9			38.3			64.5			34.7	
Approach LOS		C			D			E			C	

Intersection Summary			
HCM Average Control Delay	49.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	105.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL2	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	135	467	37	2	2	389	288	43	481	3	225	443
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		1.00		0.95	1.00
Satd. Flow (prot)	1770	1841				3538	1583		1854		1770	1863
Flt Permitted	0.41	1.00				0.90	1.00		0.93		0.95	1.00
Satd. Flow (perm)	765	1841				3176	1583		1739		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	142	492	39	2	2	409	303	45	506	3	237	466
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	142	533	0	0	0	411	303	0	554	0	237	466
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	2
Permitted Phases	3				3		Free	6				
Actuated Green, G (s)	26.2	26.2				26.2	89.5		30.7		11.0	44.7
Effective Green, g (s)	26.2	26.2				26.2	89.5		30.7		11.0	44.7
Actuated g/C Ratio	0.29	0.29				0.29	1.00		0.34		0.12	0.50
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	224	539				930	1583		597		218	930
v/s Ratio Prot		c0.29									c0.13	0.25
v/s Ratio Perm	0.19					0.13	0.19		c0.32			
v/c Ratio	0.63	0.99				0.44	0.19		0.93		1.09	0.50
Uniform Delay, d1	27.5	31.5				25.7	0.0		28.3		39.2	15.0
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	5.8	35.5				0.3	0.3		20.7		86.1	0.4
Delay (s)	33.2	67.0				26.0	0.3		49.0		125.4	15.4
Level of Service	C	E				C	A		D		F	B
Approach Delay (s)		59.9				15.1			49.0			46.0
Approach LOS		E				B			D			D

Intersection Summary			
HCM Average Control Delay	42.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.4
Intersection Capacity Utilization	109.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL	NER
Lane Configurations				
Volume (vph)	62	65	73	3
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	3.8		4.1	4.1
Lane Util. Factor	1.00		1.00	1.00
Frt	0.85		1.00	0.85
Flt Protected	1.00		0.95	1.00
Satd. Flow (prot)	1583		1770	1583
Flt Permitted	1.00		0.95	1.00
Satd. Flow (perm)	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	65	68	77	3
RTOR Reduction (vph)	34	0	0	0
Lane Group Flow (vph)	99	0	77	3
Turn Type	Perm			Perm
Protected Phases			4	
Permitted Phases	2			4
Actuated Green, G (s)	44.7		7.2	7.2
Effective Green, g (s)	44.7		7.2	7.2
Actuated g/C Ratio	0.50		0.08	0.08
Clearance Time (s)	3.8		4.1	4.1
Vehicle Extension (s)	3.0		2.0	2.0
Lane Grp Cap (vph)	791		142	127
v/s Ratio Prot			c0.04	
v/s Ratio Perm	0.06			0.00
v/c Ratio	0.13		0.54	0.02
Uniform Delay, d1	12.0		39.6	37.9
Progression Factor	1.00		1.00	1.00
Incremental Delay, d2	0.1		2.3	0.0
Delay (s)	12.0		41.8	37.9
Level of Service	B		D	D
Approach Delay (s)			41.7	
Approach LOS			D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	8	435	420	10	31	23
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)	9	473	457	11	34	25
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	467				952	462
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	467				952	462
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				88	96
cM capacity (veh/h)	1094				285	600

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	482	467	59
Volume Left	9	0	34
Volume Right	0	11	25
cSH	1094	1700	368
Volume to Capacity	0.01	0.27	0.16
Queue Length 95th (ft)	1	0	14
Control Delay (s)	0.2	0.0	16.6
Lane LOS	A		C
Approach Delay (s)	0.2	0.0	16.6
Approach LOS			C

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	39.3%	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 (veh/h)	0	68	15	0	0	0	5	0	201	0	210	23
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)	0	74	16	0	0	0	5	0	218	0	228	25
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	361	470	241	414	373	109	253			218		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	361	470	241	414	373	109	253			218		
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 %	100	85	98	100	100	100	100			100		
cM capacity (veh/h)	593	489	798	474	555	944	1312			1351		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	90	0	224	253
Volume Left	0	0	5	0
Volume Right	16	0	218	25
cSH	526	1700	1312	1351
Volume to Capacity	0.17	0.00	0.00	0.00
Queue Length 95th (ft)	15	0	0	0
Control Delay (s)	13.3	0.0	0.2	0.0
Lane LOS	B	A	A	
Approach Delay (s)	13.3	0.0	0.2	0.0
Approach LOS	B	A		

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	28.3%	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)	228	56	29	18	80	143	8	1227	27	6	1314	373
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.92			1.00		1.00	0.97	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1765			1653			3423		1719	3314	
Flt Permitted		0.54			0.97			0.80		0.95	1.00	
Satd. Flow (perm)		981			1611			2736		1719	3314	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	240	59	31	19	84	151	8	1292	28	6	1383	393
RTOR Reduction (vph)	0	6	0	0	0	0	0	3	0	0	43	0
Lane Group Flow (vph)	0	324	0	0	254	0	0	1325	0	6	1733	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		16.5			16.5			29.5		4.0	29.5	
Effective Green, g (s)		16.0			16.0			29.0		3.0	29.0	
Actuated g/C Ratio		0.27			0.27			0.48		0.05	0.48	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		262			430			1322		86	1602	
v/s Ratio Prot										c0.00	c0.52	
v/s Ratio Perm		c0.33			0.16			0.48				
v/c Ratio		1.24			0.59			1.00		0.07	1.08	
Uniform Delay, d1		22.0			19.1			15.5		27.2	15.5	
Progression Factor		1.00			1.00			0.63		1.00	1.00	
Incremental Delay, d2		135.0			2.2			19.7		0.1	48.1	
Delay (s)		157.0			21.3			29.4		27.3	63.6	
Level of Service		F			C			C		C	E	
Approach Delay (s)		157.0			21.3			29.4			63.4	
Approach LOS		F			C			C			E	

Intersection Summary			
HCM Average Control Delay	56.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
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)	197	101	46	37	66	96	15	995	22	186	1086	132
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.98			0.93			1.00		1.00	0.98	
Flt Protected		0.97			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1717			1658			3422		1719	3367	
Flt Permitted		0.68			0.91			0.93		0.95	1.00	
Satd. Flow (perm)		1209			1523			3178		1719	3367	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	207	106	48	39	69	101	16	1047	23	196	1143	139
RTOR Reduction (vph)	0	9	0	0	56	0	0	2	0	0	15	0
Lane Group Flow (vph)	0	352	0	0	153	0	0	1084	0	196	1267	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		18.4			18.4			23.6		8.0	35.1	
Effective Green, g (s)		17.9			17.9			23.1		7.0	34.6	
Actuated g/C Ratio		0.30			0.30			0.39		0.12	0.58	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		361			454			1224		201	1942	
v/s Ratio Prot										c0.11	0.38	
v/s Ratio Perm		c0.29			0.10			c0.34				
v/c Ratio		0.97			0.34			0.89		0.98	0.65	
Uniform Delay, d1		20.8			16.4			17.2		26.4	8.6	
Progression Factor		1.00			1.00			0.98		0.50	0.07	
Incremental Delay, d2		40.2			0.2			6.3		13.5	0.1	
Delay (s)		61.0			16.6			23.2		26.7	0.7	
Level of Service		E			B			C		C	A	
Approach Delay (s)		61.0			16.6			23.2			4.1	
Approach LOS		E			B			C			A	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	108.3%	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)	187	387	33	8	291	21	7	901	24	12	977	155
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.99			1.00			0.98	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1836			1842			3424			3356	
Flt Permitted	0.47	1.00			0.99			0.95			0.94	
Satd. Flow (perm)	868	1836			1825			3244			3167	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	197	407	35	8	306	22	7	948	25	13	1028	163
RTOR Reduction (vph)	0	5	0	0	4	0	0	3	0	0	21	0
Lane Group Flow (vph)	197	437	0	0	332	0	0	977	0	0	1183	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	318	673			669			1622			1584	
v/s Ratio Prot		c0.24										
v/s Ratio Perm	0.23				0.18			0.30			c0.37	
v/c Ratio	0.62	0.65			0.50			0.60			0.75	
Uniform Delay, d1	15.6	15.8			14.7			10.7			12.0	
Progression Factor	1.05	1.06			0.78			0.94			0.15	
Incremental Delay, d2	8.3	4.6			2.6			1.7			2.4	
Delay (s)	24.7	21.3			14.0			11.7			4.2	
Level of Service	C	C			B			B			A	
Approach Delay (s)		22.4			14.0			11.7			4.2	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	78	183	22	17	141	8	24	77	43	41	148	265
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)	85	199	24	18	153	9	26	84	47	45	161	288

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	308	180	157	493
Volume Left (vph)	85	18	26	45
Volume Right (vph)	24	9	47	288
Hadj (s)	0.04	0.03	-0.11	-0.30
Departure Headway (s)	6.3	6.6	6.4	5.5
Degree Utilization, x	0.54	0.33	0.28	0.76
Capacity (veh/h)	529	471	484	493
Control Delay (s)	16.3	12.8	11.8	23.7
Approach Delay (s)	16.3	12.8	11.8	23.7
Approach LOS	C	B	B	C

Intersection Summary			
Delay	18.4		
HCM Level of Service	C		
Intersection Capacity Utilization	64.7%	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 (vph)	33	431	17	48	456	50	23	120	23	35	75	23
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			0.99			0.98			0.98	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		1842			1821			1797			1770	
Flt Permitted		0.95			0.93			0.95			0.89	
Satd. Flow (perm)		1752			1708			1723			1604	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	454	18	51	480	53	24	126	24	37	79	24
RTOR Reduction (vph)	0	2	0	0	6	0	0	10	0	0	13	0
Lane Group Flow (vph)	0	505	0	0	578	0	0	164	0	0	127	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1080			1053			431			401	
v/s Ratio Prot												
v/s Ratio Perm		0.29			c0.34			c0.10			0.08	
v/c Ratio		0.47			0.55			0.38			0.32	
Uniform Delay, d1		6.2			6.7			18.7			18.3	
Progression Factor		0.50			0.82			1.22			1.00	
Incremental Delay, d2		1.1			1.8			2.5			2.1	
Delay (s)		4.2			7.3			25.2			20.4	
Level of Service		A			A			C			C	
Approach Delay (s)		4.2			7.3			25.2			20.4	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	9.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.8%	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)	30	350	57	56	311	31	33	104	83	30	131	45
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	
Frpb, ped/bikes	1.00	0.98		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		0.95	1.00			1.00			1.00	
Frt	1.00	0.98		1.00	0.99			0.95			0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1761	1792		1686	1832			1739			1786	
Flt Permitted	0.49	1.00		0.43	1.00			0.94			0.94	
Satd. Flow (perm)	906	1792		762	1832			1642			1689	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	368	60	59	327	33	35	109	87	32	138	47
RTOR Reduction (vph)	0	10	0	0	6	0	0	36	0	0	17	0
Lane Group Flow (vph)	32	418	0	59	354	0	0	195	0	0	200	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	31.5	31.5		31.5	31.5			21.5			21.5	
Effective Green, g (s)	31.0	31.0		31.0	31.0			21.0			21.0	
Actuated g/C Ratio	0.52	0.52		0.52	0.52			0.35			0.35	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	468	926		394	947			575			591	
v/s Ratio Prot		c0.23			0.19							
v/s Ratio Perm	0.04			0.08				c0.12			0.12	
v/c Ratio	0.07	0.45		0.15	0.37			0.34			0.34	
Uniform Delay, d1	7.3	9.1		7.6	8.7			14.4			14.4	
Progression Factor	0.38	0.37		1.09	0.94			0.59			1.24	
Incremental Delay, d2	0.3	1.6		0.7	1.0			1.3			1.5	
Delay (s)	3.1	5.0		9.0	9.2			9.7			19.3	
Level of Service	A	A		A	A			A			B	
Approach Delay (s)		4.8			9.2			9.7			19.3	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	9.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.8%	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 (vph)	94	99	9	54	223	126	2	477	80	214	623	154
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1793	1538		1845	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.63	1.00		0.91	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1149	1538		1695	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	99	104	9	57	235	133	2	502	84	225	656	162
RTOR Reduction (vph)	0	0	7	0	0	0	0	0	55	0	0	0
Lane Group Flow (vph)	0	203	2	0	292	133	2	502	29	225	656	162
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		12.8	12.8		12.8	47.5	0.7	16.6	16.6	8.1	25.0	47.5
Effective Green, g (s)		12.8	12.8		12.8	47.5	0.7	16.6	16.6	8.1	25.0	47.5
Actuated g/C Ratio		0.27	0.27		0.27	1.00	0.01	0.35	0.35	0.17	0.53	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		310	414		457	1583	26	1201	537	293	1809	1583
v/s Ratio Prot							0.00	c0.15		c0.13	0.19	
v/s Ratio Perm		c0.18	0.00		0.17	0.08			0.02			0.10
v/c Ratio		0.65	0.01		0.64	0.08	0.08	0.42	0.05	0.77	0.36	0.10
Uniform Delay, d1		15.4	12.7		15.3	0.0	23.1	11.8	10.2	18.8	6.6	0.0
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		4.9	0.0		2.9	0.1	1.3	1.1	0.2	11.4	0.6	0.1
Delay (s)		20.3	12.7		18.2	0.1	24.3	12.8	10.4	30.2	7.2	0.1
Level of Service		C	B		B	A	C	B	B	C	A	A
Approach Delay (s)		20.0			12.6			12.5			11.0	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	47.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	63.5%	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 (veh/h)	0	0	0	274	0	31	0	49	154	30	43	0
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)	0	0	0	298	0	34	0	53	167	33	47	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	283	333	47	249	249	137	47			221		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	283	333	47	249	249	137	47			221		
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 %	100	100	100	57	100	96	100			98		
cM capacity (veh/h)	633	573	1023	692	638	912	1561			1349		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	332	221	79
Volume Left	0	298	0	33
Volume Right	0	34	167	0
cSH	1700	709	1561	1349
Volume to Capacity	0.00	0.47	0.00	0.02
Queue Length 95th (ft)	0	63	0	2
Control Delay (s)	0.0	14.5	0.0	3.3
Lane LOS	A	B		A
Approach Delay (s)	0.0	14.5	0.0	3.3
Approach LOS	A	B		

Intersection Summary			
Average Delay	8.0		
Intersection Capacity Utilization	43.0%	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)	537	435	141	44	392	33	158	488	66	89	861	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	0.99		1.00	0.99		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1266	1496	2936		1547	3009		1547	3094	1316
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1266	1496	2936		1547	3009		1547	3094	1316
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	565	458	148	46	413	35	166	514	69	94	906	675
RTOR Reduction (vph)	0	0	81	0	5	0	0	8	0	0	0	18
Lane Group Flow (vph)	565	458	67	46	443	0	166	575	0	94	906	657
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	28.6	33.7	33.7	19.1	24.2		15.4	42.7		12.2	39.5	68.1
Effective Green, g (s)	28.6	33.7	33.7	19.1	24.2		15.4	43.7		12.2	40.5	70.1
Actuated g/C Ratio	0.23	0.27	0.27	0.15	0.19		0.12	0.35		0.10	0.32	0.56
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	642	808	342	229	570		191	1054		151	1005	740
v/s Ratio Prot	0.20	0.15		0.03	c0.15		c0.11	c0.19		0.06	c0.29	c0.21
v/s Ratio Perm			0.05									0.29
v/c Ratio	0.88	0.57	0.20	0.20	0.78		0.87	0.55		0.62	0.90	0.89
Uniform Delay, d1	46.4	39.2	35.1	46.1	47.7		53.7	32.5		54.0	40.2	23.9
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	13.3	0.9	0.3	0.4	6.6		31.6	0.6		7.7	11.0	12.5
Delay (s)	59.7	40.1	35.3	46.6	54.3		85.3	33.1		61.8	51.2	36.3
Level of Service	E	D	D	D	D		F	C		E	D	D
Approach Delay (s)		49.0			53.6			44.7			45.8	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	47.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	124.7	Sum of lost time (s)	19.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
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)	48	321	233	47	201	159	215	498	18	95	1071	45
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.97		1.00	1.00	0.93	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3174		1770	3108		3433	3539	1478	3335	3539	1441
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3174		1770	3108		3433	3539	1478	3335	3539	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	51	338	245	49	212	167	226	524	19	100	1127	47
RTOR Reduction (vph)	0	113	0	0	123	0	0	0	13	0	0	25
Lane Group Flow (vph)	51	470	0	49	256	0	226	524	6	100	1127	22
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	27.0	27.0		22.0	22.0		9.2	35.4	35.4	12.4	38.6	38.6
Effective Green, g (s)	26.1	26.1		21.1	21.1		8.9	35.6	35.6	12.1	38.8	38.8
Actuated g/C Ratio	0.24	0.24		0.19	0.19		0.08	0.32	0.32	0.11	0.35	0.35
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	405	747		337	591		276	1136	474	364	1238	504
v/s Ratio Prot	0.03	c0.15		0.03	c0.08		c0.07	0.15		0.03	c0.32	
v/s Ratio Perm									0.00			0.02
v/c Ratio	0.13	0.63		0.15	0.43		0.82	0.46	0.01	0.27	0.91	0.04
Uniform Delay, d1	33.4	38.1		37.4	39.6		50.2	30.0	25.7	45.4	34.4	23.8
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	1.2		0.1	0.2		16.2	0.1	0.0	0.1	9.9	0.0
Delay (s)	33.5	39.3		37.5	39.8		66.4	30.1	25.7	45.5	44.3	23.8
Level of Service	C	D		D	D		E	C	C	D	D	C
Approach Delay (s)		38.8			39.5			40.7			43.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	110.9	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	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	79	228	24	3	16	222	460	69	408	16	254	572
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.98				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1834				3527	1583		1842		1770	1863
Flt Permitted	0.56	1.00				0.93	1.00		0.85		0.95	1.00
Satd. Flow (perm)	1046	1834				3284	1583		1584		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	240	25	3	17	234	484	73	429	17	267	602
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	83	267	0	0	0	251	484	0	518	0	267	602
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	17.7	17.7				17.7	74.9		26.0		12.3	41.3
Effective Green, g (s)	17.7	17.7				17.7	74.9		26.0		12.3	41.3
Actuated g/C Ratio	0.24	0.24				0.24	1.00		0.35		0.16	0.55
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	247	433				776	1583		550		291	1027
v/s Ratio Prot		c0.15									c0.15	
v/s Ratio Perm	0.08					0.08	c0.31		c0.33			0.32
v/c Ratio	0.34	0.62				0.32	0.31		0.94		0.92	0.59
Uniform Delay, d1	23.7	25.6				23.6	0.0		23.7		30.8	11.1
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.8	2.6				0.2	0.5		24.6		31.7	0.9
Delay (s)	24.5	28.2				23.9	0.5		48.3		62.5	12.0
Level of Service	C	C				C	A		D		E	B
Approach Delay (s)		27.3				8.5			48.3			24.0
Approach LOS		C				A			D			C

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	74.9	Sum of lost time (s)	10.3
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	132	55	4	50	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	139	58	4	53	3
RTOR Reduction (vph)	12	0	0	0	0
Lane Group Flow (vph)	185	0	0	57	3
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	41.3			4.5	4.5
Effective Green, g (s)	41.3			4.5	4.5
Actuated g/C Ratio	0.55			0.06	0.06
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	873			106	95
v/s Ratio Prot				0.03	
v/s Ratio Perm	0.12				0.00
v/c Ratio	0.21			0.54	0.03
Uniform Delay, d1	8.5			34.2	33.1
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.1			2.6	0.0
Delay (s)	8.7			36.8	33.2
Level of Service	A			D	C
Approach Delay (s)				36.6	
Approach LOS				D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	26	263	395	35	20	15
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)	28	286	429	38	22	16
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	467				791	448
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	467				791	448
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				94	97
cM capacity (veh/h)	1094				349	610

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	314	467	38
Volume Left	28	0	22
Volume Right	0	38	16
cSH	1094	1700	428
Volume to Capacity	0.03	0.27	0.09
Queue Length 95th (ft)	2	0	7
Control Delay (s)	1.0	0.0	14.2
Lane LOS	A		B
Approach Delay (s)	1.0	0.0	14.2
Approach LOS			B

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	45	10	0	0	0	17	0	147	0	444	78
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)	0	49	11	0	0	0	18	0	160	0	483	85
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	642	722	525	677	684	80	567			160		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	642	722	525	677	684	80	567			160		
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 %	100	86	98	100	100	100	98			100		
cM capacity (veh/h)	382	347	552	316	364	980	1005			1419		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	60	0	178	567
Volume Left	0	0	18	0
Volume Right	11	0	160	85
cSH	372	1700	1005	1419
Volume to Capacity	0.16	0.00	0.02	0.00
Queue Length 95th (ft)	14	0	1	0
Control Delay (s)	16.5	0.0	1.1	0.0
Lane LOS	C	A	A	
Approach Delay (s)	16.5	0.0	1.1	0.0
Approach LOS	C	A		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D:

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS (BASE 2013 PLUS ALTERNATIVE 1 CONDITIONS)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	257	33	10	15	108	383	37	1372	27	6	771	255
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.98	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.90			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1776			1593			3420		1719	3275	
Flt Permitted		0.31			0.99			0.82		0.95	1.00	
Satd. Flow (perm)		568			1573			2794		1719	3275	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	271	35	11	16	114	403	39	1444	28	6	812	268
RTOR Reduction (vph)	0	1	0	0	0	0	0	1	0	0	26	0
Lane Group Flow (vph)	0	316	0	0	533	0	0	1510	0	6	1054	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		48.5			48.5			57.4		4.1	57.4	
Effective Green, g (s)		48.0			48.0			56.9		3.1	56.9	
Actuated g/C Ratio		0.40			0.40			0.47		0.03	0.47	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		227			629			1325		44	1553	
v/s Ratio Prot										c0.00	0.32	
v/s Ratio Perm		c0.56			0.34			c0.54				
v/c Ratio		1.39			0.85			1.14		0.14	0.68	
Uniform Delay, d1		36.0			32.7			31.6		57.1	24.5	
Progression Factor		1.00			1.00			0.91		1.00	1.00	
Incremental Delay, d2		200.8			10.3			67.2		0.5	2.4	
Delay (s)		236.8			43.0			95.8		57.7	26.9	
Level of Service		F			D			F		E	C	
Approach Delay (s)		236.8			43.0			95.8			27.0	
Approach LOS		F			D			F			C	

Intersection Summary			
HCM Average Control Delay	78.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.22		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	123.0%	ICU Level of Service	H
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)	259	37	33	28	74	222	7	1095	20	91	657	94
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.98	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1708			1612			3426		1719	3356	
Flt Permitted		0.45			0.96			0.95		0.95	1.00	
Satd. Flow (perm)		791			1556			3259		1719	3356	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	273	39	35	29	78	234	7	1153	21	96	692	99
RTOR Reduction (vph)	0	7	0	0	131	0	0	2	0	0	19	0
Lane Group Flow (vph)	0	340	0	0	210	0	0	1179	0	96	772	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		18.5			18.5			26.5		5.0	34.5	
Effective Green, g (s)		18.0			18.0			26.0		4.0	34.0	
Actuated g/C Ratio		0.30			0.30			0.43		0.07	0.57	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		237			467			1412		115	1902	
v/s Ratio Prot										c0.06	0.23	
v/s Ratio Perm		c0.43			0.14			c0.36				
v/c Ratio		1.43			0.45			0.83		0.83	0.41	
Uniform Delay, d1		21.0			17.0			15.1		27.7	7.3	
Progression Factor		1.00			1.00			1.20		1.73	0.56	
Incremental Delay, d2		218.1			0.3			3.5		29.4	0.0	
Delay (s)		239.1			17.2			21.5		77.3	4.1	
Level of Service		F			B			C		E	A	
Approach Delay (s)		239.1			17.2			21.5			12.1	
Approach LOS		F			B			C			B	

Intersection Summary			
HCM Average Control Delay	45.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.9%	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)	181	166	35	18	210	61	43	834	36	15	559	154
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	0.99			1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.97			0.97			0.99			0.97	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1766	1804			1797			3412			3309	
Flt Permitted	0.50	1.00			0.98			0.89			0.93	
Satd. Flow (perm)	935	1804			1763			3058			3087	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	191	175	37	19	221	64	45	878	38	16	588	162
RTOR Reduction (vph)	0	13	0	0	16	0	0	5	0	0	41	0
Lane Group Flow (vph)	191	199	0	0	288	0	0	956	0	0	726	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	343	661			646			1529			1544	
v/s Ratio Prot		0.11										
v/s Ratio Perm	c0.20				0.16			c0.31			0.24	
v/c Ratio	0.56	0.30			0.45			0.63			0.47	
Uniform Delay, d1	15.1	13.5			14.4			10.9			9.8	
Progression Factor	0.90	0.96			1.46			0.40			0.30	
Incremental Delay, d2	5.9	1.1			2.0			1.8			0.9	
Delay (s)	19.5	14.0			23.1			6.2			3.9	
Level of Service	B	B			C			A			A	
Approach Delay (s)		16.6			23.1			6.2			3.9	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	120	305	22	16	237	10	28	71	49	9	51	156
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)	130	332	24	17	258	11	30	77	53	10	55	170

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	486	286	161	235
Volume Left (vph)	130	17	30	10
Volume Right (vph)	24	11	53	170
Hadj (s)	0.06	0.02	-0.13	-0.39
Departure Headway (s)	5.8	6.2	6.7	6.2
Degree Utilization, x	0.79	0.49	0.30	0.41
Capacity (veh/h)	486	536	467	514
Control Delay (s)	27.2	15.0	12.5	13.4
Approach Delay (s)	27.2	15.0	12.5	13.4
Approach LOS	D	C	B	B

Intersection Summary			
Delay	19.4		
HCM Level of Service	C		
Intersection Capacity Utilization	67.0%	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 (vph)	10	432	13	20	435	16	7	101	33	12	74	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			1.00			0.97			0.99	
Flt Protected		1.00			1.00			1.00			0.99	
Satd. Flow (prot)		1850			1846			1776			1827	
Flt Permitted		0.99			0.98			0.99			0.96	
Satd. Flow (perm)		1833			1807			1762			1766	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	455	14	21	458	17	7	106	35	13	78	5
RTOR Reduction (vph)	0	2	0	0	2	0	0	19	0	0	3	0
Lane Group Flow (vph)	0	478	0	0	494	0	0	129	0	0	93	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1130			1114			441			442	
v/s Ratio Prot												
v/s Ratio Perm		0.26			c0.27			c0.07			0.05	
v/c Ratio		0.42			0.44			0.29			0.21	
Uniform Delay, d1		6.0			6.1			18.2			17.8	
Progression Factor		0.77			0.72			1.07			1.00	
Incremental Delay, d2		1.1			1.2			1.7			1.1	
Delay (s)		5.7			5.5			21.1			18.9	
Level of Service		A			A			C			B	
Approach Delay (s)		5.7			5.5			21.1			18.9	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.1%	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)	60	321	17	40	240	15	20	74	37	28	61	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	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	0.99	1.00		0.94	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	0.99			0.96			0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1759	1837		1670	1843			1766			1786	
Flt Permitted	0.57	1.00		0.49	1.00			0.96			0.92	
Satd. Flow (perm)	1053	1837		855	1843			1707			1668	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	338	18	42	253	16	21	78	39	29	64	20
RTOR Reduction (vph)	0	3	0	0	4	0	0	23	0	0	13	0
Lane Group Flow (vph)	63	353	0	42	265	0	0	115	0	0	100	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	30.5	30.5		30.5	30.5			22.5			22.5	
Effective Green, g (s)	30.0	30.0		30.0	30.0			22.0			22.0	
Actuated g/C Ratio	0.50	0.50		0.50	0.50			0.37			0.37	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	527	919		428	922			626			612	
v/s Ratio Prot		c0.19			0.14							
v/s Ratio Perm	0.06			0.05				c0.07			0.06	
v/c Ratio	0.12	0.38		0.10	0.29			0.18			0.16	
Uniform Delay, d1	8.0	9.3		7.9	8.8			12.9			12.8	
Progression Factor	0.49	0.55		1.82	1.92			1.13			0.45	
Incremental Delay, d2	0.5	1.2		0.4	0.8			0.6			0.6	
Delay (s)	4.4	6.3		14.8	17.6			15.2			6.3	
Level of Service	A	A		B	B			B			A	
Approach Delay (s)		6.0			17.2			15.2			6.3	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	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)	64	85	18	77	344	399	9	552	118	180	576	193
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1801	1538		1846	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.63	1.00		0.92	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1167	1538		1714	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	67	89	19	81	362	420	9	581	124	189	606	203
RTOR Reduction (vph)	0	0	12	0	0	211	0	0	85	0	0	108
Lane Group Flow (vph)	0	156	7	0	443	209	9	581	39	189	606	95
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		18.6	18.6		18.6	18.6	0.7	16.6	16.6	7.9	24.8	24.8
Effective Green, g (s)		18.6	18.6		18.6	18.6	0.7	16.6	16.6	7.9	24.8	24.8
Actuated g/C Ratio		0.35	0.35		0.35	0.35	0.01	0.31	0.31	0.15	0.47	0.47
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		409	539		600	554	23	1075	481	256	1606	739
v/s Ratio Prot							0.01	c0.17		c0.11	0.18	
v/s Ratio Perm		0.13	0.00		c0.26	0.13			0.03			0.06
v/c Ratio		0.38	0.01		0.74	0.38	0.39	0.54	0.08	0.74	0.38	0.13
Uniform Delay, d1		12.9	11.3		15.1	12.9	26.0	15.1	12.9	21.6	9.2	8.0
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	0.0		4.7	0.4	10.7	2.0	0.3	10.6	0.7	0.4
Delay (s)		13.5	11.3		19.9	13.3	36.6	17.0	13.2	32.2	9.8	8.4
Level of Service		B	B		B	B	D	B	B	C	A	A
Approach Delay (s)		13.3			16.7			16.6			13.8	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	53.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	68.9%	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 (veh/h)	0	1	0	150	0	35	0	33	165	27	46	0
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)	0	1	0	163	0	38	0	36	179	29	50	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	272	324	50	235	234	126	50			215		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	272	324	50	235	234	126	50			215		
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 %	100	100	100	77	100	96	100			98		
cM capacity (veh/h)	641	581	1018	707	652	925	1557			1355		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	1	201	215	79
Volume Left	0	163	0	29
Volume Right	0	38	179	0
cSH	581	740	1557	1355
Volume to Capacity	0.00	0.27	0.00	0.02
Queue Length 95th (ft)	0	28	0	2
Control Delay (s)	11.2	11.7	0.0	3.0
Lane LOS	B	B		A
Approach Delay (s)	11.2	11.7	0.0	3.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	510	319	54	29	517	37	187	1038	46	51	448	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	0.99		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1265	1496	2944		1547	3064		1547	3094	1321
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1265	1496	2944		1547	3064		1547	3094	1321
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	537	336	57	31	544	39	197	1093	48	54	472	642
RTOR Reduction (vph)	0	0	41	0	4	0	0	2	0	0	0	38
Lane Group Flow (vph)	537	336	16	31	579	0	197	1139	0	54	472	604
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	29.3	35.9	35.9	19.4	26.0		20.5	49.0		5.0	33.5	62.8
Effective Green, g (s)	29.3	35.9	35.9	19.4	26.0		20.5	50.0		5.0	34.5	64.8
Actuated g/C Ratio	0.23	0.28	0.28	0.15	0.21		0.16	0.40		0.04	0.27	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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	850	360	230	606		251	1213		61	845	678
v/s Ratio Prot	0.19	0.11		0.02	c0.20		c0.13	c0.37		0.03	0.15	c0.21
v/s Ratio Perm			0.01									0.24
v/c Ratio	0.83	0.40	0.05	0.13	0.96		0.78	0.94		0.89	0.56	0.89
Uniform Delay, d1	46.1	36.4	32.8	46.2	49.6		50.8	36.7		60.4	39.4	27.6
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	8.5	0.3	0.1	0.3	25.7		14.8	13.5		75.0	0.8	13.9
Delay (s)	54.5	36.8	32.8	46.5	75.3		65.6	50.2		135.4	40.2	41.5
Level of Service	D	D	C	D	E		E	D		F	D	D
Approach Delay (s)		46.8			73.8			52.5			45.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	126.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
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)	67	219	128	28	275	125	235	1018	42	216	321	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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3209		1770	3205		3433	3539	1482	3335	3539	1445
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3209		1770	3205		3433	3539	1482	3335	3539	1445
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	71	231	135	29	289	132	247	1072	44	227	338	46
RTOR Reduction (vph)	0	81	0	0	50	0	0	0	27	0	0	32
Lane Group Flow (vph)	71	285	0	29	371	0	247	1072	17	227	338	14
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	25.6	25.6		22.6	22.6		10.5	31.5	31.5	12.0	33.0	33.0
Effective Green, g (s)	24.7	24.7		21.7	21.7		10.2	31.7	31.7	11.7	33.2	33.2
Actuated g/C Ratio	0.23	0.23		0.21	0.21		0.10	0.30	0.30	0.11	0.31	0.31
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	401	749		363	657		331	1060	444	369	1111	453
v/s Ratio Prot	0.04	c0.09		0.02	c0.12		0.07	c0.30		c0.07	0.10	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.18	0.38		0.08	0.56		0.75	1.01	0.04	0.62	0.30	0.03
Uniform Delay, d1	32.4	34.1		34.0	37.8		46.5	37.0	26.2	44.9	27.5	25.2
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	0.1		0.0	0.7		7.8	30.5	0.0	2.1	0.1	0.0
Delay (s)	32.5	34.2		34.0	38.5		54.3	67.5	26.3	47.0	27.6	25.2
Level of Service	C	C		C	D		D	E	C	D	C	C
Approach Delay (s)		33.9			38.2			63.8			34.6	
Approach LOS		C			D			E			C	

Intersection Summary			
HCM Average Control Delay	49.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	105.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL2	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	135	467	37	2	2	389	288	43	481	3	225	443
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		1.00		0.95	1.00
Satd. Flow (prot)	1770	1841				3538	1583		1854		1770	1863
Flt Permitted	0.41	1.00				0.90	1.00		0.93		0.95	1.00
Satd. Flow (perm)	765	1841				3176	1583		1739		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	142	492	39	2	2	409	303	45	506	3	237	466
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	142	533	0	0	0	411	303	0	554	0	237	466
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	2
Permitted Phases	3				3		Free	6				
Actuated Green, G (s)	26.2	26.2				26.2	89.5		30.7		11.0	44.7
Effective Green, g (s)	26.2	26.2				26.2	89.5		30.7		11.0	44.7
Actuated g/C Ratio	0.29	0.29				0.29	1.00		0.34		0.12	0.50
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	224	539				930	1583		597		218	930
v/s Ratio Prot		c0.29									c0.13	0.25
v/s Ratio Perm	0.19					0.13	0.19		c0.32			
v/c Ratio	0.63	0.99				0.44	0.19		0.93		1.09	0.50
Uniform Delay, d1	27.5	31.5				25.7	0.0		28.3		39.2	15.0
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	5.8	35.5				0.3	0.3		20.7		86.1	0.4
Delay (s)	33.2	67.0				26.0	0.3		49.0		125.4	15.4
Level of Service	C	E				C	A		D		F	B
Approach Delay (s)		59.9				15.1			49.0			46.0
Approach LOS		E				B			D			D

Intersection Summary			
HCM Average Control Delay	42.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.4
Intersection Capacity Utilization	109.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL	NER
Lane Configurations				
Volume (vph)	62	65	73	3
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	3.8		4.1	4.1
Lane Util. Factor	1.00		1.00	1.00
Frt	0.85		1.00	0.85
Flt Protected	1.00		0.95	1.00
Satd. Flow (prot)	1583		1770	1583
Flt Permitted	1.00		0.95	1.00
Satd. Flow (perm)	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	65	68	77	3
RTOR Reduction (vph)	34	0	0	0
Lane Group Flow (vph)	99	0	77	3
Turn Type	Perm			Perm
Protected Phases			4	
Permitted Phases	2			4
Actuated Green, G (s)	44.7		7.2	7.2
Effective Green, g (s)	44.7		7.2	7.2
Actuated g/C Ratio	0.50		0.08	0.08
Clearance Time (s)	3.8		4.1	4.1
Vehicle Extension (s)	3.0		2.0	2.0
Lane Grp Cap (vph)	791		142	127
v/s Ratio Prot			c0.04	
v/s Ratio Perm	0.06			0.00
v/c Ratio	0.13		0.54	0.02
Uniform Delay, d1	12.0		39.6	37.9
Progression Factor	1.00		1.00	1.00
Incremental Delay, d2	0.1		2.3	0.0
Delay (s)	12.0		41.8	37.9
Level of Service	B		D	D
Approach Delay (s)			41.7	
Approach LOS			D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	3	434	416	4	13	9
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)	3	472	452	4	14	10
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	457				933	454
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	457				933	454
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				95	98
cM capacity (veh/h)	1104				295	606

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	475	457	24
Volume Left	3	0	14
Volume Right	0	4	10
cSH	1104	1700	373
Volume to Capacity	0.00	0.27	0.06
Queue Length 95th (ft)	0	0	5
Control Delay (s)	0.1	0.0	15.3
Lane LOS	A		C
Approach Delay (s)	0.1	0.0	15.3
Approach LOS			C

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	35.2%	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 (veh/h)	0	28	6	0	0	0	2	5	199	5	209	10
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)	0	30	7	0	0	0	2	5	216	5	227	11
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	361	470	233	383	367	114	238			222		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	361	470	233	383	367	114	238			222		
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 %	100	94	99	100	100	100	100			100		
cM capacity (veh/h)	592	489	807	541	559	939	1329			1347		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	37	0	224	243
Volume Left	0	0	2	5
Volume Right	7	0	216	11
cSH	526	1700	1329	1347
Volume to Capacity	0.07	0.00	0.00	0.00
Queue Length 95th (ft)	6	0	0	0
Control Delay (s)	12.4	0.0	0.1	0.2
Lane LOS	B	A	A	A
Approach Delay (s)	12.4	0.0	0.1	0.2
Approach LOS	B	A		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	24.8%	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)	206	51	29	18	70	143	8	1219	27	6	1301	335
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.92			1.00		1.00	0.97	
Flt Protected		0.97			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1763			1645			3423		1719	3323	
Flt Permitted		0.55			0.97			0.82		0.95	1.00	
Satd. Flow (perm)		1011			1601			2820		1719	3323	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	217	54	31	19	74	151	8	1283	28	6	1369	353
RTOR Reduction (vph)	0	7	0	0	0	0	0	3	0	0	38	0
Lane Group Flow (vph)	0	295	0	0	244	0	0	1316	0	6	1684	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		16.5			16.5			29.5		4.0	29.5	
Effective Green, g (s)		16.0			16.0			29.0		3.0	29.0	
Actuated g/C Ratio		0.27			0.27			0.48		0.05	0.48	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		270			427			1363		86	1606	
v/s Ratio Prot										c0.00	c0.51	
v/s Ratio Perm		c0.29			0.15			0.47				
v/c Ratio		1.09			0.57			0.97		0.07	1.05	
Uniform Delay, d1		22.0			19.0			15.0		27.2	15.5	
Progression Factor		1.00			1.00			0.61		1.00	1.00	
Incremental Delay, d2		82.2			1.8			12.4		0.1	36.3	
Delay (s)		104.2			20.9			21.6		27.3	51.8	
Level of Service		F			C			C		C	D	
Approach Delay (s)		104.2			20.9			21.6			51.8	
Approach LOS		F			C			C			D	

Intersection Summary			
HCM Average Control Delay	43.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	60.0	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	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	189	101	45	37	66	96	13	995	22	186	1086	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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.98			0.93			1.00		1.00	0.99	
Flt Protected		0.97			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1718			1658			3423		1719	3374	
Flt Permitted		0.68			0.91			0.93		0.95	1.00	
Satd. Flow (perm)		1207			1524			3195		1719	3374	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	199	106	47	39	69	101	14	1047	23	196	1143	125
RTOR Reduction (vph)	0	9	0	0	57	0	0	2	0	0	13	0
Lane Group Flow (vph)	0	343	0	0	152	0	0	1082	0	196	1255	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		17.8			17.8			23.9		8.3	35.7	
Effective Green, g (s)		17.3			17.3			23.4		7.3	35.2	
Actuated g/C Ratio		0.29			0.29			0.39		0.12	0.59	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		348			439			1246		209	1979	
v/s Ratio Prot										c0.11	0.37	
v/s Ratio Perm		c0.28			0.10			c0.34				
v/c Ratio		0.98			0.35			0.87		0.94	0.63	
Uniform Delay, d1		21.2			16.9			16.9		26.1	8.2	
Progression Factor		1.00			1.00			0.97		0.50	0.07	
Incremental Delay, d2		43.7			0.2			5.2		8.0	0.0	
Delay (s)		65.0			17.1			21.6		20.9	0.6	
Level of Service		E			B			C		C	A	
Approach Delay (s)		65.0			17.1			21.6			3.3	
Approach LOS		E			B			C			A	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	107.3%	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)	187	387	33	8	291	21	7	899	24	12	976	155
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.99			1.00			0.98	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1836			1842			3424			3356	
Flt Permitted	0.47	1.00			0.99			0.95			0.94	
Satd. Flow (perm)	868	1836			1825			3244			3167	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	197	407	35	8	306	22	7	946	25	13	1027	163
RTOR Reduction (vph)	0	5	0	0	4	0	0	3	0	0	21	0
Lane Group Flow (vph)	197	437	0	0	332	0	0	975	0	0	1182	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	318	673			669			1622			1584	
v/s Ratio Prot		c0.24										
v/s Ratio Perm	0.23				0.18			0.30			c0.37	
v/c Ratio	0.62	0.65			0.50			0.60			0.75	
Uniform Delay, d1	15.6	15.8			14.7			10.7			12.0	
Progression Factor	1.05	1.06			0.78			0.94			0.15	
Incremental Delay, d2	8.3	4.6			2.6			1.7			2.5	
Delay (s)	24.7	21.4			14.0			11.7			4.2	
Level of Service	C	C			B			B			A	
Approach Delay (s)		22.4			14.0			11.7			4.2	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	73	175	19	17	127	7	19	72	43	40	145	261
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)	79	190	21	18	138	8	21	78	47	43	158	284

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	290	164	146	485
Volume Left (vph)	79	18	21	43
Volume Right (vph)	21	8	47	284
Hadj (s)	0.05	0.03	-0.13	-0.30
Departure Headway (s)	6.1	6.4	6.1	5.3
Degree Utilization, x	0.49	0.29	0.25	0.72
Capacity (veh/h)	536	487	508	650
Control Delay (s)	14.9	12.0	11.1	20.7
Approach Delay (s)	14.9	12.0	11.1	20.7
Approach LOS	B	B	B	C

Intersection Summary			
Delay	16.6		
HCM Level of Service	C		
Intersection Capacity Utilization	63.4%	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 (vph)	33	431	17	48	456	50	23	111	23	35	70	23
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			0.99	
Frt		1.00			0.99			0.98			0.98	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		1842			1821			1793			1766	
Flt Permitted		0.95			0.93			0.95			0.89	
Satd. Flow (perm)		1752			1708			1717			1599	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	454	18	51	480	53	24	117	24	37	74	24
RTOR Reduction (vph)	0	2	0	0	6	0	0	11	0	0	13	0
Lane Group Flow (vph)	0	505	0	0	578	0	0	155	0	0	122	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1080			1053			429			400	
v/s Ratio Prot												
v/s Ratio Perm		0.29			c0.34			c0.09			0.08	
v/c Ratio		0.47			0.55			0.36			0.31	
Uniform Delay, d1		6.2			6.7			18.5			18.3	
Progression Factor		0.50			0.82			1.18			1.00	
Incremental Delay, d2		1.1			1.8			2.3			2.0	
Delay (s)		4.2			7.3			24.2			20.2	
Level of Service		A			A			C			C	
Approach Delay (s)		4.2			7.3			24.2			20.2	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	9.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.3%	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)	30	350	57	56	311	31	33	95	83	30	126	45
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	
Frpb, ped/bikes	1.00	0.98		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		0.95	1.00			1.00			1.00	
Frt	1.00	0.98		1.00	0.99			0.95			0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1761	1792		1686	1832			1734			1785	
Flt Permitted	0.49	1.00		0.43	1.00			0.94			0.94	
Satd. Flow (perm)	906	1792		762	1832			1635			1687	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	368	60	59	327	33	35	100	87	32	133	47
RTOR Reduction (vph)	0	10	0	0	6	0	0	38	0	0	17	0
Lane Group Flow (vph)	32	418	0	59	354	0	0	184	0	0	195	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	31.5	31.5		31.5	31.5			21.5			21.5	
Effective Green, g (s)	31.0	31.0		31.0	31.0			21.0			21.0	
Actuated g/C Ratio	0.52	0.52		0.52	0.52			0.35			0.35	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	468	926		394	947			572			590	
v/s Ratio Prot		c0.23			0.19							
v/s Ratio Perm	0.04			0.08				0.11			c0.12	
v/c Ratio	0.07	0.45		0.15	0.37			0.32			0.33	
Uniform Delay, d1	7.3	9.1		7.6	8.7			14.3			14.3	
Progression Factor	0.38	0.37		1.09	0.94			0.58			1.21	
Incremental Delay, d2	0.3	1.6		0.7	1.0			1.2			1.5	
Delay (s)	3.1	5.0		9.0	9.2			9.4			18.8	
Level of Service	A	A		A	A			A			B	
Approach Delay (s)		4.8			9.2			9.4			18.8	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.3%	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)	89	99	9	54	223	126	2	477	80	214	623	144
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1794	1538		1845	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.64	1.00		0.91	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1179	1538		1697	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	94	104	9	57	235	133	2	502	84	225	656	152
RTOR Reduction (vph)	0	0	7	0	0	0	0	0	55	0	0	0
Lane Group Flow (vph)	0	198	2	0	292	133	2	502	29	225	656	152
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		12.8	12.8		12.8	47.5	0.7	16.6	16.6	8.1	25.0	47.5
Effective Green, g (s)		12.8	12.8		12.8	47.5	0.7	16.6	16.6	8.1	25.0	47.5
Actuated g/C Ratio		0.27	0.27		0.27	1.00	0.01	0.35	0.35	0.17	0.53	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		318	414		457	1583	26	1201	537	293	1809	1583
v/s Ratio Prot							0.00	c0.15		c0.13	0.19	
v/s Ratio Perm		0.17	0.00		c0.17	0.08			0.02			0.10
v/c Ratio		0.62	0.01		0.64	0.08	0.08	0.42	0.05	0.77	0.36	0.10
Uniform Delay, d1		15.2	12.7		15.3	0.0	23.1	11.8	10.2	18.8	6.6	0.0
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		3.8	0.0		2.9	0.1	1.3	1.1	0.2	11.4	0.6	0.1
Delay (s)		19.0	12.7		18.2	0.1	24.3	12.8	10.4	30.2	7.2	0.1
Level of Service		B	B		B	A	C	B	B	C	A	A
Approach Delay (s)		18.7			12.6			12.5			11.1	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	47.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	63.2%	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 (veh/h)	0	0	0	263	0	31	0	49	134	30	43	0
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)	0	0	0	286	0	34	0	53	146	33	47	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	272	311	47	238	238	126	47			199		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	272	311	47	238	238	126	47			199		
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 %	100	100	100	59	100	96	100			98		
cM capacity (veh/h)	644	590	1023	703	647	924	1561			1373		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	320	199	79
Volume Left	0	286	0	33
Volume Right	0	34	146	0
cSH	1700	721	1561	1373
Volume to Capacity	0.00	0.44	0.00	0.02
Queue Length 95th (ft)	0	57	0	2
Control Delay (s)	0.0	13.9	0.0	3.3
Lane LOS	A	B		A
Approach Delay (s)	0.0	13.9	0.0	3.3
Approach LOS	A	B		

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	41.2%	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)	537	432	141	44	389	33	158	488	66	89	861	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	0.99		1.00	0.99		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1266	1496	2936		1547	3009		1547	3094	1316
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1266	1496	2936		1547	3009		1547	3094	1316
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	565	455	148	46	409	35	166	514	69	94	906	675
RTOR Reduction (vph)	0	0	81	0	5	0	0	8	0	0	0	18
Lane Group Flow (vph)	565	455	67	46	439	0	166	575	0	94	906	657
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	28.6	33.6	33.6	19.1	24.1		15.4	42.7		12.2	39.5	68.1
Effective Green, g (s)	28.6	33.6	33.6	19.1	24.1		15.4	43.7		12.2	40.5	70.1
Actuated g/C Ratio	0.23	0.27	0.27	0.15	0.19		0.12	0.35		0.10	0.33	0.56
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	643	807	341	229	568		191	1055		151	1006	740
v/s Ratio Prot	0.20	0.15		0.03	c0.15		c0.11	c0.19		0.06	c0.29	c0.21
v/s Ratio Perm			0.05									0.29
v/c Ratio	0.88	0.56	0.20	0.20	0.77		0.87	0.55		0.62	0.90	0.89
Uniform Delay, d1	46.3	39.2	35.1	46.1	47.7		53.6	32.5		54.0	40.1	23.8
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	13.0	0.9	0.3	0.4	6.5		31.6	0.6		7.7	10.9	12.4
Delay (s)	59.3	40.1	35.4	46.5	54.1		85.2	33.1		61.7	51.1	36.2
Level of Service	E	D	D	D	D		F	C		E	D	D
Approach Delay (s)		48.8			53.4			44.6			45.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	47.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	124.6	Sum of lost time (s)	19.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
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)	48	318	233	47	198	157	215	498	18	92	1071	45
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.97		1.00	1.00	0.93	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3173		1770	3107		3433	3539	1478	3335	3539	1441
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3173		1770	3107		3433	3539	1478	3335	3539	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	51	335	245	49	208	165	226	524	19	97	1127	47
RTOR Reduction (vph)	0	113	0	0	125	0	0	0	13	0	0	25
Lane Group Flow (vph)	51	467	0	49	248	0	226	524	6	97	1127	22
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	27.0	27.0		21.9	21.9		9.2	35.4	35.4	12.4	38.6	38.6
Effective Green, g (s)	26.1	26.1		21.0	21.0		8.9	35.6	35.6	12.1	38.8	38.8
Actuated g/C Ratio	0.24	0.24		0.19	0.19		0.08	0.32	0.32	0.11	0.35	0.35
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	405	747		335	589		276	1137	475	364	1239	505
v/s Ratio Prot	0.03	c0.15		0.03	c0.08		c0.07	0.15		0.03	c0.32	
v/s Ratio Perm									0.00			0.02
v/c Ratio	0.13	0.62		0.15	0.42		0.82	0.46	0.01	0.27	0.91	0.04
Uniform Delay, d1	33.4	38.0		37.4	39.5		50.2	30.0	25.6	45.3	34.3	23.8
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	1.2		0.1	0.2		16.2	0.1	0.0	0.1	9.7	0.0
Delay (s)	33.4	39.1		37.5	39.7		66.3	30.1	25.6	45.4	44.0	23.8
Level of Service	C	D		D	D		E	C	C	D	D	C
Approach Delay (s)		38.7			39.5			40.6			43.4	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.8	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	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	79	228	24	3	16	222	460	69	408	16	254	572
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.98				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1834				3527	1583		1842		1770	1863
Flt Permitted	0.56	1.00				0.93	1.00		0.85		0.95	1.00
Satd. Flow (perm)	1046	1834				3284	1583		1584		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	240	25	3	17	234	484	73	429	17	267	602
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	83	267	0	0	0	251	484	0	518	0	267	602
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	17.7	17.7				17.7	74.9		26.0		12.3	41.3
Effective Green, g (s)	17.7	17.7				17.7	74.9		26.0		12.3	41.3
Actuated g/C Ratio	0.24	0.24				0.24	1.00		0.35		0.16	0.55
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	247	433				776	1583		550		291	1027
v/s Ratio Prot		c0.15									c0.15	
v/s Ratio Perm	0.08					0.08	c0.31		c0.33			0.32
v/c Ratio	0.34	0.62				0.32	0.31		0.94		0.92	0.59
Uniform Delay, d1	23.7	25.6				23.6	0.0		23.7		30.8	11.1
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.8	2.6				0.2	0.5		24.6		31.7	0.9
Delay (s)	24.5	28.2				23.9	0.5		48.3		62.5	12.0
Level of Service	C	C				C	A		D		E	B
Approach Delay (s)		27.3				8.5			48.3			24.0
Approach LOS		C				A			D			C

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	74.9	Sum of lost time (s)	10.3
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	132	55	4	50	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	139	58	4	53	3
RTOR Reduction (vph)	12	0	0	0	0
Lane Group Flow (vph)	185	0	0	57	3
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	41.3			4.5	4.5
Effective Green, g (s)	41.3			4.5	4.5
Actuated g/C Ratio	0.55			0.06	0.06
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	873			106	95
v/s Ratio Prot				0.03	
v/s Ratio Perm	0.12				0.00
v/c Ratio	0.21			0.54	0.03
Uniform Delay, d1	8.5			34.2	33.1
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.1			2.6	0.0
Delay (s)	8.7			36.8	33.2
Level of Service	A			D	C
Approach Delay (s)				36.6	
Approach LOS				D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	11	259	393	14	8	6
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)	12	282	427	15	9	7
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	442				740	435
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	442				740	435
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	99
cM capacity (veh/h)	1118				380	621

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	293	442	15
Volume Left	12	0	9
Volume Right	0	15	7
cSH	1118	1700	456
Volume to Capacity	0.01	0.26	0.03
Queue Length 95th (ft)	1	0	3
Control Delay (s)	0.4	0.0	13.2
Lane LOS	A		B
Approach Delay (s)	0.4	0.0	13.2
Approach LOS			B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	32.6%	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 (veh/h)	0	19	4	0	0	0	7	5	146	5	442	32
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)	0	21	4	0	0	0	8	5	159	5	480	35
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	609	688	498	623	626	85	515			164		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	609	688	498	623	626	85	515			164		
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 %	100	94	99	100	100	100	99			100		
cM capacity (veh/h)	404	365	572	375	396	974	1050			1414		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	25	0	172	521
Volume Left	0	0	8	5
Volume Right	4	0	159	35
cSH	390	1700	1050	1414
Volume to Capacity	0.06	0.00	0.01	0.00
Queue Length 95th (ft)	5	0	1	0
Control Delay (s)	14.9	0.0	0.4	0.1
Lane LOS	B	A	A	A
Approach Delay (s)	14.9	0.0	0.4	0.1
Approach LOS	B	A		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D:

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS
(BASE 2013 PLUS ALTERNATIVE 2 CONDITIONS)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	280	38	10	15	110	383	37	1380	27	6	773	263
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.98	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.90			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1777			1594			3420		1719	3271	
Flt Permitted		0.31			0.99			0.81		0.95	1.00	
Satd. Flow (perm)		567			1573			2782		1719	3271	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	295	40	11	16	116	403	39	1453	28	6	814	277
RTOR Reduction (vph)	0	1	0	0	0	0	0	1	0	0	27	0
Lane Group Flow (vph)	0	345	0	0	535	0	0	1519	0	6	1064	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		48.5			48.5			57.4		4.1	57.4	
Effective Green, g (s)		48.0			48.0			56.9		3.1	56.9	
Actuated g/C Ratio		0.40			0.40			0.47		0.03	0.47	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		227			629			1319		44	1551	
v/s Ratio Prot										c0.00	0.33	
v/s Ratio Perm		c0.61			0.34			c0.55				
v/c Ratio		1.52			0.85			1.15		0.14	0.69	
Uniform Delay, d1		36.0			32.7			31.6		57.1	24.6	
Progression Factor		1.00			1.00			0.91		1.00	1.00	
Incremental Delay, d2		254.8			10.7			72.2		0.5	2.5	
Delay (s)		290.8			43.4			100.9		57.7	27.1	
Level of Service		F			D			F		E	C	
Approach Delay (s)		290.8			43.4			100.9			27.2	
Approach LOS		F			D			F			C	

Intersection Summary			
HCM Average Control Delay	87.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	124.8%	ICU Level of Service	H
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)	267	37	35	28	74	222	8	1095	20	91	657	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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.98	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1707			1612			3426		1719	3355	
Flt Permitted		0.45			0.96			0.95		0.95	1.00	
Satd. Flow (perm)		790			1556			3256		1719	3355	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	281	39	37	29	78	234	8	1153	21	96	692	101
RTOR Reduction (vph)	0	7	0	0	131	0	0	2	0	0	19	0
Lane Group Flow (vph)	0	350	0	0	210	0	0	1180	0	96	774	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		18.5			18.5			26.5		5.0	34.5	
Effective Green, g (s)		18.0			18.0			26.0		4.0	34.0	
Actuated g/C Ratio		0.30			0.30			0.43		0.07	0.57	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		237			467			1411		115	1901	
v/s Ratio Prot										c0.06	0.23	
v/s Ratio Perm		c0.44			0.14			c0.36				
v/c Ratio		1.48			0.45			0.84		0.83	0.41	
Uniform Delay, d1		21.0			17.0			15.1		27.7	7.3	
Progression Factor		1.00			1.00			1.20		1.73	0.57	
Incremental Delay, d2		235.9			0.3			3.5		29.1	0.0	
Delay (s)		256.9			17.2			21.6		77.0	4.2	
Level of Service		F			B			C		E	A	
Approach Delay (s)		256.9			17.2			21.6			12.1	
Approach LOS		F			B			C			B	

Intersection Summary			
HCM Average Control Delay	48.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.6%	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)	181	166	35	18	210	61	43	835	36	15	561	154
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	0.99			1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.97			0.97			0.99			0.97	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1766	1804			1797			3412			3310	
Flt Permitted	0.50	1.00			0.98			0.89			0.93	
Satd. Flow (perm)	935	1804			1763			3057			3088	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	191	175	37	19	221	64	45	879	38	16	591	162
RTOR Reduction (vph)	0	13	0	0	16	0	0	5	0	0	40	0
Lane Group Flow (vph)	191	199	0	0	288	0	0	957	0	0	729	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	343	661			646			1529			1544	
v/s Ratio Prot		0.11										
v/s Ratio Perm	c0.20				0.16			c0.31			0.24	
v/c Ratio	0.56	0.30			0.45			0.63			0.47	
Uniform Delay, d1	15.1	13.5			14.4			10.9			9.8	
Progression Factor	0.90	0.95			1.47			0.40			0.31	
Incremental Delay, d2	5.9	1.1			2.0			1.8			0.9	
Delay (s)	19.5	14.0			23.1			6.2			4.0	
Level of Service	B	B			C			A			A	
Approach Delay (s)		16.6			23.1			6.2			4.0	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	9.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	96.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	122	313	25	16	240	10	29	72	49	9	54	158
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)	133	340	27	17	261	11	32	78	53	10	59	172

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	500	289	163	240
Volume Left (vph)	133	17	32	10
Volume Right (vph)	27	11	53	172
Hadj (s)	0.05	0.02	-0.12	-0.39
Departure Headway (s)	5.9	6.3	6.8	6.3
Degree Utilization, x	0.82	0.50	0.31	0.42
Capacity (veh/h)	594	523	465	511
Control Delay (s)	30.4	15.5	12.8	13.9
Approach Delay (s)	30.4	15.5	12.8	13.9
Approach LOS	D	C	B	B

Intersection Summary			
Delay	21.0		
HCM Level of Service	C		
Intersection Capacity Utilization	68.6%	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 (vph)	10	432	13	20	435	16	7	103	33	12	80	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		1.00			1.00			0.97			0.99	
Flt Protected		1.00			1.00			1.00			0.99	
Satd. Flow (prot)		1850			1846			1777			1829	
Flt Permitted		0.99			0.98			0.99			0.96	
Satd. Flow (perm)		1833			1807			1763			1771	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	455	14	21	458	17	7	108	35	13	84	5
RTOR Reduction (vph)	0	2	0	0	2	0	0	18	0	0	3	0
Lane Group Flow (vph)	0	478	0	0	494	0	0	132	0	0	99	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1130			1114			441			443	
v/s Ratio Prot												
v/s Ratio Perm		0.26			c0.27			c0.07			0.06	
v/c Ratio		0.42			0.44			0.30			0.22	
Uniform Delay, d1		6.0			6.1			18.2			17.9	
Progression Factor		0.77			0.72			1.07			1.00	
Incremental Delay, d2		1.1			1.2			1.7			1.2	
Delay (s)		5.7			5.5			21.1			19.0	
Level of Service		A			A			C			B	
Approach Delay (s)		5.7			5.5			21.1			19.0	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.1%	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)	60	321	17	40	240	15	20	76	37	28	67	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	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	0.99	1.00		0.94	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	0.99			0.96			0.98	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1759	1837		1670	1843			1767			1790	
Flt Permitted	0.57	1.00		0.49	1.00			0.96			0.93	
Satd. Flow (perm)	1053	1837		855	1843			1708			1678	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	338	18	42	253	16	21	80	39	29	71	20
RTOR Reduction (vph)	0	3	0	0	4	0	0	23	0	0	12	0
Lane Group Flow (vph)	63	353	0	42	265	0	0	117	0	0	108	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	30.5	30.5		30.5	30.5			22.5			22.5	
Effective Green, g (s)	30.0	30.0		30.0	30.0			22.0			22.0	
Actuated g/C Ratio	0.50	0.50		0.50	0.50			0.37			0.37	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	527	919		428	922			626			615	
v/s Ratio Prot		c0.19			0.14							
v/s Ratio Perm	0.06			0.05				c0.07			0.06	
v/c Ratio	0.12	0.38		0.10	0.29			0.19			0.18	
Uniform Delay, d1	8.0	9.3		7.9	8.8			12.9			12.9	
Progression Factor	0.49	0.55		1.82	1.92			1.14			0.44	
Incremental Delay, d2	0.5	1.2		0.4	0.8			0.6			0.6	
Delay (s)	4.4	6.3		14.8	17.6			15.3			6.3	
Level of Service	A	A		B	B			B			A	
Approach Delay (s)		6.0			17.2			15.3			6.3	
Approach LOS		A			B			B			A	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.4%	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)	69	85	18	77	344	399	9	552	118	180	576	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1798	1538		1846	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.61	1.00		0.92	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1119	1538		1712	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	73	89	19	81	362	420	9	581	124	189	606	205
RTOR Reduction (vph)	0	0	12	0	0	211	0	0	85	0	0	109
Lane Group Flow (vph)	0	162	7	0	443	209	9	581	39	189	606	96
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		18.6	18.6		18.6	18.6	0.7	16.6	16.6	7.9	24.8	24.8
Effective Green, g (s)		18.6	18.6		18.6	18.6	0.7	16.6	16.6	7.9	24.8	24.8
Actuated g/C Ratio		0.35	0.35		0.35	0.35	0.01	0.31	0.31	0.15	0.47	0.47
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		392	539		600	554	23	1075	481	256	1606	739
v/s Ratio Prot							0.01	c0.17		c0.11	0.18	
v/s Ratio Perm		0.14	0.00		c0.26	0.13			0.03			0.06
v/c Ratio		0.41	0.01		0.74	0.38	0.39	0.54	0.08	0.74	0.38	0.13
Uniform Delay, d1		13.1	11.3		15.1	12.9	26.0	15.1	12.9	21.6	9.2	8.0
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		0.7	0.0		4.7	0.4	10.7	2.0	0.3	10.6	0.7	0.4
Delay (s)		13.8	11.3		19.9	13.3	36.6	17.0	13.2	32.2	9.8	8.4
Level of Service		B	B		B	B	D	B	B	C	A	A
Approach Delay (s)		13.5			16.7			16.6			13.8	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	53.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.2%	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 (veh/h)	0	1	0	162	0	35	0	33	169	27	46	0
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)	0	1	0	176	0	38	0	36	184	29	50	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	274	328	50	237	236	128	50			220		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	274	328	50	237	236	128	50			220		
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 %	100	100	100	75	100	96	100			98		
cM capacity (veh/h)	639	578	1018	705	650	922	1557			1350		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	1	214	220	79
Volume Left	0	176	0	29
Volume Right	0	38	184	0
cSH	578	735	1557	1350
Volume to Capacity	0.00	0.29	0.00	0.02
Queue Length 95th (ft)	0	30	0	2
Control Delay (s)	11.2	11.9	0.0	3.0
Lane LOS	B	B		A
Approach Delay (s)	11.2	11.9	0.0	3.0
Approach LOS	B	B		

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	43.8%	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)	510	320	54	29	519	37	187	1038	46	51	448	610
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	0.99		1.00	1.00		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1265	1496	2944		1547	3064		1547	3094	1321
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1265	1496	2944		1547	3064		1547	3094	1321
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	537	337	57	31	546	39	197	1093	48	54	472	642
RTOR Reduction (vph)	0	0	41	0	4	0	0	2	0	0	0	38
Lane Group Flow (vph)	537	337	16	31	581	0	197	1139	0	54	472	604
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	29.3	35.9	35.9	19.4	26.0		20.5	49.0		5.0	33.5	62.8
Effective Green, g (s)	29.3	35.9	35.9	19.4	26.0		20.5	50.0		5.0	34.5	64.8
Actuated g/C Ratio	0.23	0.28	0.28	0.15	0.21		0.16	0.40		0.04	0.27	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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	850	360	230	606		251	1213		61	845	678
v/s Ratio Prot	0.19	0.11		0.02	c0.20		c0.13	c0.37		0.03	0.15	c0.21
v/s Ratio Perm			0.01									0.24
v/c Ratio	0.83	0.40	0.05	0.13	0.96		0.78	0.94		0.89	0.56	0.89
Uniform Delay, d1	46.1	36.5	32.8	46.2	49.6		50.8	36.7		60.4	39.4	27.6
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	8.5	0.3	0.1	0.3	26.3		14.8	13.5		75.0	0.8	13.9
Delay (s)	54.5	36.8	32.8	46.5	75.9		65.6	50.2		135.4	40.2	41.5
Level of Service	D	D	C	D	E		E	D		F	D	D
Approach Delay (s)		46.8			74.4			52.5			45.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	52.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	126.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
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)	67	220	128	28	277	126	235	1018	42	216	321	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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.98		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3210		1770	3205		3433	3539	1482	3335	3539	1445
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3210		1770	3205		3433	3539	1482	3335	3539	1445
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	71	232	135	29	292	133	247	1072	44	227	338	46
RTOR Reduction (vph)	0	81	0	0	50	0	0	0	27	0	0	32
Lane Group Flow (vph)	71	286	0	29	375	0	247	1072	17	227	338	14
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	25.7	25.7		22.6	22.6		10.5	31.4	31.4	12.0	32.9	32.9
Effective Green, g (s)	24.8	24.8		21.7	21.7		10.2	31.6	31.6	11.7	33.1	33.1
Actuated g/C Ratio	0.23	0.23		0.21	0.21		0.10	0.30	0.30	0.11	0.31	0.31
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	403	752		363	657		331	1057	443	369	1107	452
v/s Ratio Prot	0.04	c0.09		0.02	c0.12		0.07	c0.30		c0.07	0.10	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.18	0.38		0.08	0.57		0.75	1.01	0.04	0.62	0.31	0.03
Uniform Delay, d1	32.3	34.0		34.0	37.9		46.5	37.1	26.3	44.9	27.6	25.2
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	0.1		0.0	0.7		7.8	31.3	0.0	2.1	0.1	0.0
Delay (s)	32.4	34.2		34.0	38.6		54.3	68.4	26.3	47.0	27.7	25.2
Level of Service	C	C		C	D		D	E	C	D	C	C
Approach Delay (s)		33.9			38.3			64.5			34.7	
Approach LOS		C			D			E			C	

Intersection Summary			
HCM Average Control Delay	49.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	105.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL2	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	135	467	37	2	2	389	288	43	481	3	225	443
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		1.00		0.95	1.00
Satd. Flow (prot)	1770	1841				3538	1583		1854		1770	1863
Flt Permitted	0.41	1.00				0.90	1.00		0.93		0.95	1.00
Satd. Flow (perm)	765	1841				3176	1583		1739		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	142	492	39	2	2	409	303	45	506	3	237	466
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	142	533	0	0	0	411	303	0	554	0	237	466
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	2
Permitted Phases	3				3		Free	6				
Actuated Green, G (s)	26.2	26.2				26.2	89.5		30.7		11.0	44.7
Effective Green, g (s)	26.2	26.2				26.2	89.5		30.7		11.0	44.7
Actuated g/C Ratio	0.29	0.29				0.29	1.00		0.34		0.12	0.50
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	224	539				930	1583		597		218	930
v/s Ratio Prot		c0.29									c0.13	0.25
v/s Ratio Perm	0.19					0.13	0.19		c0.32			
v/c Ratio	0.63	0.99				0.44	0.19		0.93		1.09	0.50
Uniform Delay, d1	27.5	31.5				25.7	0.0		28.3		39.2	15.0
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	5.8	35.5				0.3	0.3		20.7		86.1	0.4
Delay (s)	33.2	67.0				26.0	0.3		49.0		125.4	15.4
Level of Service	C	E				C	A		D		F	B
Approach Delay (s)		59.9				15.1			49.0			46.0
Approach LOS		E				B			D			D

Intersection Summary			
HCM Average Control Delay	42.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.4
Intersection Capacity Utilization	109.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL	NER
Lane Configurations				
Volume (vph)	62	65	73	3
Ideal Flow (vphpl)	1900	1900	1900	1900
Total Lost time (s)	3.8		4.1	4.1
Lane Util. Factor	1.00		1.00	1.00
Frt	0.85		1.00	0.85
Flt Protected	1.00		0.95	1.00
Satd. Flow (prot)	1583		1770	1583
Flt Permitted	1.00		0.95	1.00
Satd. Flow (perm)	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95
Adj. Flow (vph)	65	68	77	3
RTOR Reduction (vph)	34	0	0	0
Lane Group Flow (vph)	99	0	77	3
Turn Type	Perm			Perm
Protected Phases			4	
Permitted Phases	2			4
Actuated Green, G (s)	44.7		7.2	7.2
Effective Green, g (s)	44.7		7.2	7.2
Actuated g/C Ratio	0.50		0.08	0.08
Clearance Time (s)	3.8		4.1	4.1
Vehicle Extension (s)	3.0		2.0	2.0
Lane Grp Cap (vph)	791		142	127
v/s Ratio Prot			c0.04	
v/s Ratio Perm	0.06			0.00
v/c Ratio	0.13		0.54	0.02
Uniform Delay, d1	12.0		39.6	37.9
Progression Factor	1.00		1.00	1.00
Incremental Delay, d2	0.1		2.3	0.0
Delay (s)	12.0		41.8	37.9
Level of Service	B		D	D
Approach Delay (s)			41.7	
Approach LOS			D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	6	435	419	9	25	19
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)	7	473	455	10	27	21
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	465				946	460
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	465				946	460
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	97
cM capacity (veh/h)	1096				288	601

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	479	465	48
Volume Left	7	0	27
Volume Right	0	10	21
cSH	1096	1700	372
Volume to Capacity	0.01	0.27	0.13
Queue Length 95th (ft)	0	0	11
Control Delay (s)	0.2	0.0	16.1
Lane LOS	A		C
Approach Delay (s)	0.2	0.0	16.1
Approach LOS			C

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	37.7%	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 (veh/h)	0	56	12	0	0	0	4	5	200	5	210	19
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)	0	61	13	0	0	0	4	5	217	5	228	21
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	372	481	239	416	383	114	249			223		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	372	481	239	416	383	114	249			223		
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 %	100	87	98	100	100	100	100			100		
cM capacity (veh/h)	581	481	800	483	547	938	1317			1346		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	74	0	227	254
Volume Left	0	0	4	5
Volume Right	13	0	217	21
cSH	517	1700	1317	1346
Volume to Capacity	0.14	0.00	0.00	0.00
Queue Length 95th (ft)	12	0	0	0
Control Delay (s)	13.1	0.0	0.2	0.2
Lane LOS	B	A	A	A
Approach Delay (s)	13.1	0.0	0.2	0.2
Approach LOS	B	A		

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	25.2%	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)	221	54	29	18	77	143	8	1224	27	6	1310	362
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.92			1.00		1.00	0.97	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1764			1651			3423		1719	3317	
Flt Permitted		0.54			0.97			0.80		0.95	1.00	
Satd. Flow (perm)		989			1608			2743		1719	3317	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	233	57	31	19	81	151	8	1288	28	6	1379	381
RTOR Reduction (vph)	0	7	0	0	0	0	0	3	0	0	42	0
Lane Group Flow (vph)	0	314	0	0	251	0	0	1321	0	6	1718	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		16.5			16.5			29.5		4.0	29.5	
Effective Green, g (s)		16.0			16.0			29.0		3.0	29.0	
Actuated g/C Ratio		0.27			0.27			0.48		0.05	0.48	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		264			429			1326		86	1603	
v/s Ratio Prot										c0.00	c0.52	
v/s Ratio Perm		c0.32			0.16			0.48				
v/c Ratio		1.19			0.59			1.00		0.07	1.07	
Uniform Delay, d1		22.0			19.1			15.5		27.2	15.5	
Progression Factor		1.00			1.00			0.63		1.00	1.00	
Incremental Delay, d2		117.1			2.0			18.3		0.1	44.5	
Delay (s)		139.1			21.2			28.0		27.3	60.0	
Level of Service		F			C			C		C	E	
Approach Delay (s)		139.1			21.2			28.0			59.9	
Approach LOS		F			C			C			E	

Intersection Summary			
HCM Average Control Delay	52.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.5%	ICU Level of Service	E
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)	194	101	46	37	66	96	14	995	22	186	1086	128
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.98			0.93			1.00		1.00	0.98	
Flt Protected		0.97			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1717			1658			3423		1719	3369	
Flt Permitted		0.68			0.91			0.93		0.95	1.00	
Satd. Flow (perm)		1209			1524			3187		1719	3369	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	204	106	48	39	69	101	15	1047	23	196	1143	135
RTOR Reduction (vph)	0	9	0	0	56	0	0	2	0	0	15	0
Lane Group Flow (vph)	0	349	0	0	153	0	0	1083	0	196	1263	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2 5	
Permitted Phases	4			8			6					
Actuated Green, G (s)		18.2			18.2			23.7		8.1	35.3	
Effective Green, g (s)		17.7			17.7			23.2		7.1	34.8	
Actuated g/C Ratio		0.29			0.29			0.39		0.12	0.58	
Clearance Time (s)		3.5			3.5			3.5		3.0		
Vehicle Extension (s)		0.2			0.2			0.2		0.2		
Lane Grp Cap (vph)		357			450			1232		203	1954	
v/s Ratio Prot										c0.11	0.37	
v/s Ratio Perm		c0.29			0.10			c0.34				
v/c Ratio		0.98			0.34			0.88		0.97	0.65	
Uniform Delay, d1		20.9			16.6			17.1		26.3	8.5	
Progression Factor		1.00			1.00			0.98		0.50	0.07	
Incremental Delay, d2		40.9			0.2			5.9		11.8	0.1	
Delay (s)		61.9			16.7			22.5		24.9	0.6	
Level of Service		E			B			C		C	A	
Approach Delay (s)		61.9			16.7			22.5			3.9	
Approach LOS		E			B			C			A	

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	108.0%	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)	187	387	33	8	291	21	7	900	24	12	977	155
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			0.99	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.99			1.00			0.98	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1836			1842			3424			3356	
Flt Permitted	0.47	1.00			0.99			0.95			0.94	
Satd. Flow (perm)	868	1836			1825			3244			3167	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	197	407	35	8	306	22	7	947	25	13	1028	163
RTOR Reduction (vph)	0	5	0	0	4	0	0	3	0	0	21	0
Lane Group Flow (vph)	197	437	0	0	332	0	0	976	0	0	1183	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	318	673			669			1622			1584	
v/s Ratio Prot		c0.24										
v/s Ratio Perm	0.23				0.18			0.30			c0.37	
v/c Ratio	0.62	0.65			0.50			0.60			0.75	
Uniform Delay, d1	15.6	15.8			14.7			10.7			12.0	
Progression Factor	1.05	1.06			0.78			0.94			0.15	
Incremental Delay, d2	8.3	4.6			2.6			1.7			2.4	
Delay (s)	24.7	21.3			14.0			11.7			4.2	
Level of Service	C	C			B			B			A	
Approach Delay (s)		22.4			14.0			11.7			4.2	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	91.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	77	180	21	17	137	8	23	76	43	41	147	264
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)	84	196	23	18	149	9	25	83	47	45	160	287

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	302	176	154	491
Volume Left (vph)	84	18	25	45
Volume Right (vph)	23	9	47	287
Hadj (s)	0.04	0.03	-0.12	-0.30
Departure Headway (s)	6.2	6.5	6.3	5.5
Degree Utilization, x	0.52	0.32	0.27	0.75
Capacity (veh/h)	532	477	491	491
Control Delay (s)	15.9	12.5	11.6	22.9
Approach Delay (s)	15.9	12.5	11.6	22.9
Approach LOS	C	B	B	C

Intersection Summary			
Delay	17.8		
HCM Level of Service	C		
Intersection Capacity Utilization	64.3%	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 (vph)	33	431	17	48	456	50	23	117	23	35	74	23
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			0.99	
Frt		1.00			0.99			0.98			0.98	
Flt Protected		1.00			1.00			0.99			0.99	
Satd. Flow (prot)		1842			1821			1796			1769	
Flt Permitted		0.95			0.93			0.95			0.89	
Satd. Flow (perm)		1752			1708			1721			1603	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	35	454	18	51	480	53	24	123	24	37	78	24
RTOR Reduction (vph)	0	2	0	0	6	0	0	10	0	0	13	0
Lane Group Flow (vph)	0	505	0	0	578	0	0	161	0	0	126	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1080			1053			430			401	
v/s Ratio Prot												
v/s Ratio Perm		0.29			c0.34			c0.09			0.08	
v/c Ratio		0.47			0.55			0.38			0.31	
Uniform Delay, d1		6.2			6.7			18.6			18.3	
Progression Factor		0.50			0.82			1.21			1.00	
Incremental Delay, d2		1.1			1.8			2.4			2.0	
Delay (s)		4.2			7.3			24.9			20.4	
Level of Service		A			A			C			C	
Approach Delay (s)		4.2			7.3			24.9			20.4	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.7%	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)	30	350	57	56	311	31	33	101	83	30	130	45
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	
Frpb, ped/bikes	1.00	0.98		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		0.95	1.00			1.00			1.00	
Frt	1.00	0.98		1.00	0.99			0.95			0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1761	1792		1686	1832			1738			1786	
Flt Permitted	0.49	1.00		0.43	1.00			0.94			0.94	
Satd. Flow (perm)	906	1792		762	1832			1639			1689	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	368	60	59	327	33	35	106	87	32	137	47
RTOR Reduction (vph)	0	10	0	0	6	0	0	37	0	0	17	0
Lane Group Flow (vph)	32	418	0	59	354	0	0	191	0	0	199	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	31.5	31.5		31.5	31.5			21.5			21.5	
Effective Green, g (s)	31.0	31.0		31.0	31.0			21.0			21.0	
Actuated g/C Ratio	0.52	0.52		0.52	0.52			0.35			0.35	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	468	926		394	947			574			591	
v/s Ratio Prot		c0.23			0.19							
v/s Ratio Perm	0.04			0.08				0.12			c0.12	
v/c Ratio	0.07	0.45		0.15	0.37			0.33			0.34	
Uniform Delay, d1	7.3	9.1		7.6	8.7			14.3			14.4	
Progression Factor	0.38	0.37		1.09	0.94			0.58			1.23	
Incremental Delay, d2	0.3	1.6		0.7	1.0			1.2			1.5	
Delay (s)	3.1	5.0		9.0	9.2			9.6			19.2	
Level of Service	A	A		A	A			A			B	
Approach Delay (s)		4.8			9.2			9.6			19.2	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	9.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	52.7%	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)	92	99	9	54	223	126	2	477	80	214	623	151
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1793	1538		1845	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.63	1.00		0.91	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1161	1538		1695	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	97	104	9	57	235	133	2	502	84	225	656	159
RTOR Reduction (vph)	0	0	7	0	0	0	0	0	55	0	0	0
Lane Group Flow (vph)	0	201	2	0	292	133	2	502	29	225	656	159
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		12.8	12.8		12.8	47.5	0.7	16.6	16.6	8.1	25.0	47.5
Effective Green, g (s)		12.8	12.8		12.8	47.5	0.7	16.6	16.6	8.1	25.0	47.5
Actuated g/C Ratio		0.27	0.27		0.27	1.00	0.01	0.35	0.35	0.17	0.53	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		313	414		457	1583	26	1201	537	293	1809	1583
v/s Ratio Prot							0.00	c0.15		c0.13	0.19	
v/s Ratio Perm		c0.17	0.00		0.17	0.08			0.02			0.10
v/c Ratio		0.64	0.01		0.64	0.08	0.08	0.42	0.05	0.77	0.36	0.10
Uniform Delay, d1		15.3	12.7		15.3	0.0	23.1	11.8	10.2	18.8	6.6	0.0
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		4.5	0.0		2.9	0.1	1.3	1.1	0.2	11.4	0.6	0.1
Delay (s)		19.8	12.7		18.2	0.1	24.3	12.8	10.4	30.2	7.2	0.1
Level of Service		B	B		B	A	C	B	B	C	A	A
Approach Delay (s)		19.5			12.6			12.5			11.1	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	47.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	63.4%	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 (veh/h)	0	0	0	271	0	31	0	49	148	30	43	0
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)	0	0	0	295	0	34	0	53	161	33	47	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								572				
pX, platoon unblocked												
vC, conflicting volume	279	326	47	246	246	134	47			214		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	279	326	47	246	246	134	47			214		
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 %	100	100	100	58	100	96	100			98		
cM capacity (veh/h)	636	578	1023	695	641	915	1561			1356		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	0	328	214	79
Volume Left	0	295	0	33
Volume Right	0	34	161	0
cSH	1700	713	1561	1356
Volume to Capacity	0.00	0.46	0.00	0.02
Queue Length 95th (ft)	0	61	0	2
Control Delay (s)	0.0	14.3	0.0	3.3
Lane LOS	A	B		A
Approach Delay (s)	0.0	14.3	0.0	3.3
Approach LOS	A	B		

Intersection Summary			
Average Delay	8.0		
Intersection Capacity Utilization	42.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	537	434	141	44	391	33	158	488	66	89	861	641
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.91	1.00	0.99		1.00	0.99		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1266	1496	2936		1547	3009		1547	3094	1316
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1266	1496	2936		1547	3009		1547	3094	1316
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	565	457	148	46	412	35	166	514	69	94	906	675
RTOR Reduction (vph)	0	0	81	0	5	0	0	8	0	0	0	18
Lane Group Flow (vph)	565	457	67	46	442	0	166	575	0	94	906	657
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	28.6	33.7	33.7	19.1	24.2		15.4	42.8		12.2	39.6	68.2
Effective Green, g (s)	28.6	33.7	33.7	19.1	24.2		15.4	43.8		12.2	40.6	70.2
Actuated g/C Ratio	0.23	0.27	0.27	0.15	0.19		0.12	0.35		0.10	0.33	0.56
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	642	808	342	229	569		191	1056		151	1007	740
v/s Ratio Prot	0.20	0.15		0.03	c0.15		c0.11	c0.19		0.06	c0.29	c0.21
v/s Ratio Perm			0.05									0.29
v/c Ratio	0.88	0.57	0.20	0.20	0.78		0.87	0.54		0.62	0.90	0.89
Uniform Delay, d1	46.4	39.2	35.1	46.2	47.7		53.7	32.5		54.1	40.2	23.9
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	13.3	0.9	0.3	0.4	6.6		31.6	0.6		7.7	10.7	12.5
Delay (s)	59.8	40.2	35.4	46.6	54.3		85.3	33.1		61.8	50.8	36.3
Level of Service	E	D	D	D	D		F	C		E	D	D
Approach Delay (s)		49.0			53.6			44.7			45.6	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	47.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	124.8	Sum of lost time (s)	19.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
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)	48	320	233	47	200	158	215	498	18	94	1071	45
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.97		1.00	1.00	0.93	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3174		1770	3109		3433	3539	1478	3335	3539	1441
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3174		1770	3109		3433	3539	1478	3335	3539	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	51	337	245	49	211	166	226	524	19	99	1127	47
RTOR Reduction (vph)	0	113	0	0	123	0	0	0	13	0	0	25
Lane Group Flow (vph)	51	469	0	49	254	0	226	524	6	99	1127	22
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	27.0	27.0		22.0	22.0		9.2	35.4	35.4	12.4	38.6	38.6
Effective Green, g (s)	26.1	26.1		21.1	21.1		8.9	35.6	35.6	12.1	38.8	38.8
Actuated g/C Ratio	0.24	0.24		0.19	0.19		0.08	0.32	0.32	0.11	0.35	0.35
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	405	747		337	592		276	1136	474	364	1238	504
v/s Ratio Prot	0.03	c0.15		0.03	c0.08		c0.07	0.15		0.03	c0.32	
v/s Ratio Perm									0.00			0.02
v/c Ratio	0.13	0.63		0.15	0.43		0.82	0.46	0.01	0.27	0.91	0.04
Uniform Delay, d1	33.4	38.0		37.4	39.6		50.2	30.0	25.7	45.4	34.4	23.8
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	1.2		0.1	0.2		16.2	0.1	0.0	0.1	9.9	0.0
Delay (s)	33.5	39.2		37.5	39.8		66.4	30.1	25.7	45.5	44.3	23.8
Level of Service	C	D		D	D		E	C	C	D	D	C
Approach Delay (s)		38.8			39.5			40.7			43.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	110.9	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	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	79	228	24	3	16	222	460	69	408	16	254	572
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.98				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1834				3527	1583		1842		1770	1863
Flt Permitted	0.56	1.00				0.93	1.00		0.85		0.95	1.00
Satd. Flow (perm)	1046	1834				3284	1583		1584		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	83	240	25	3	17	234	484	73	429	17	267	602
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	83	267	0	0	0	251	484	0	518	0	267	602
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	17.7	17.7				17.7	74.9		26.0		12.3	41.3
Effective Green, g (s)	17.7	17.7				17.7	74.9		26.0		12.3	41.3
Actuated g/C Ratio	0.24	0.24				0.24	1.00		0.35		0.16	0.55
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	247	433				776	1583		550		291	1027
v/s Ratio Prot		c0.15									c0.15	
v/s Ratio Perm	0.08					0.08	c0.31		c0.33			0.32
v/c Ratio	0.34	0.62				0.32	0.31		0.94		0.92	0.59
Uniform Delay, d1	23.7	25.6				23.6	0.0		23.7		30.8	11.1
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.8	2.6				0.2	0.5		24.6		31.7	0.9
Delay (s)	24.5	28.2				23.9	0.5		48.3		62.5	12.0
Level of Service	C	C				C	A		D		E	B
Approach Delay (s)		27.3				8.5			48.3			24.0
Approach LOS		C				A			D			C

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	74.9	Sum of lost time (s)	10.3
Intersection Capacity Utilization	96.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	132	55	4	50	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	139	58	4	53	3
RTOR Reduction (vph)	12	0	0	0	0
Lane Group Flow (vph)	185	0	0	57	3
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	41.3			4.5	4.5
Effective Green, g (s)	41.3			4.5	4.5
Actuated g/C Ratio	0.55			0.06	0.06
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	873			106	95
v/s Ratio Prot				0.03	
v/s Ratio Perm	0.12				0.00
v/c Ratio	0.21			0.54	0.03
Uniform Delay, d1	8.5			34.2	33.1
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.1			2.6	0.0
Delay (s)	8.7			36.8	33.2
Level of Service	A			D	C
Approach Delay (s)				36.6	
Approach LOS				D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	22	261	394	29	17	12
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)	24	284	428	32	18	13
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	460				776	444
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	460				776	444
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				95	98
cM capacity (veh/h)	1101				358	614

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	308	460	32
Volume Left	24	0	18
Volume Right	0	32	13
cSH	1101	1700	433
Volume to Capacity	0.02	0.27	0.07
Queue Length 95th (ft)	2	0	6
Control Delay (s)	0.8	0.0	14.0
Lane LOS	A		B
Approach Delay (s)	0.8	0.0	14.0
Approach LOS			B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Volume (veh/h)	0	37	8	0	0	0	14	5	146	5	444	64
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)	0	40	9	0	0	0	15	5	159	5	483	70
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	643	723	517	672	678	85	552			164		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	643	723	517	672	678	85	552			164		
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 %	100	88	98	100	100	100	99			100		
cM capacity (veh/h)	381	346	558	327	367	974	1018			1414		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	49	0	179	558
Volume Left	0	0	15	5
Volume Right	9	0	159	70
cSH	371	1700	1018	1414
Volume to Capacity	0.13	0.00	0.01	0.00
Queue Length 95th (ft)	11	0	1	0
Control Delay (s)	16.2	0.0	0.9	0.1
Lane LOS	C	A	A	A
Approach Delay (s)	16.2	0.0	0.9	0.1
Approach LOS	C	A		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	38.4%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D:

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS (CUMULATIVE 2030 BASELINE CONDITIONS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	322	26	9	15	100	405	33	1312	26	58	1309	296
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.89			1.00		1.00	0.97	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1775			1586			3420		1719	3316	
Flt Permitted		0.30			0.98			0.61		0.95	1.00	
Satd. Flow (perm)		547			1564			2079		1719	3316	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	339	27	9	16	105	426	35	1381	27	61	1378	312
RTOR Reduction (vph)	0	1	0	0	0	0	0	1	0	0	16	0
Lane Group Flow (vph)	0	374	0	0	547	0	0	1442	0	61	1674	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		49.5			49.5			55.5		5.0	55.5	
Effective Green, g (s)		49.0			49.0			55.0		4.0	55.0	
Actuated g/C Ratio		0.41			0.41			0.46		0.03	0.46	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		223			639			953		57	1520	
v/s Ratio Prot										c0.04	0.50	
v/s Ratio Perm		c0.68			0.35			c0.69				
v/c Ratio		1.68			0.86			1.51		1.07	1.10	
Uniform Delay, d1		35.5			32.3			32.5		58.0	32.5	
Progression Factor		1.00			1.00			0.52		1.00	1.00	
Incremental Delay, d2		324.3			10.9			231.4		140.1	56.0	
Delay (s)		359.8			43.2			248.4		198.1	88.5	
Level of Service		F			D			F		F	F	
Approach Delay (s)		359.8			43.2			248.4			92.3	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	164.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.57		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	122.5%	ICU Level of Service	H
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)	312	199	32	39	373	218	8	986	25	89	879	405
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.98	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.95			1.00		1.00	0.95	
Flt Protected		0.97			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1741			1703			3421		1719	3211	
Flt Permitted		0.41			0.94			0.77		0.95	1.00	
Satd. Flow (perm)		732			1608			2621		1719	3211	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	328	209	34	41	393	229	8	1038	26	94	925	426
RTOR Reduction (vph)	0	2	0	0	16	0	0	1	0	0	45	0
Lane Group Flow (vph)	0	569	0	0	647	0	0	1071	0	94	1306	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2	
Permitted Phases	4			8			6					
Actuated Green, G (s)		62.5			62.5			41.5		6.0	50.5	
Effective Green, g (s)		62.0			62.0			41.0		5.0	50.0	
Actuated g/C Ratio		0.52			0.52			0.34		0.04	0.42	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		0.2			0.2			0.2		0.2	0.2	
Lane Grp Cap (vph)		378			831			896		72	1338	
v/s Ratio Prot										0.05	c0.41	
v/s Ratio Perm		c0.78			0.40			c0.41				
v/c Ratio		1.51			0.78			1.19		1.31	0.98	
Uniform Delay, d1		29.0			23.5			39.5		57.5	34.4	
Progression Factor		1.00			1.00			1.25		0.72	0.50	
Incremental Delay, d2		240.9			4.2			97.1		146.5	3.7	
Delay (s)		269.9			27.7			146.3		187.7	20.9	
Level of Service		F			C			F		F	C	
Approach Delay (s)		269.9			27.7			146.3			31.8	
Approach LOS		F			C			F			C	

Intersection Summary			
HCM Average Control Delay	100.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	144.5%	ICU Level of Service	H
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)	44	159	29	23	205	149	42	776	38	85	928	15
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			0.99			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.98			0.95			0.99			1.00	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1810			1746			3410			3422	
Flt Permitted	0.42	1.00			0.98			0.86			0.79	
Satd. Flow (perm)	775	1810			1712			2956			2710	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	46	167	31	24	216	157	44	817	40	89	977	16
RTOR Reduction (vph)	0	11	0	0	39	0	0	6	0	0	2	0
Lane Group Flow (vph)	46	187	0	0	358	0	0	896	0	0	1081	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	284	664			628			1478			1355	
v/s Ratio Prot		0.10										
v/s Ratio Perm	0.06				c0.21			0.30			c0.40	
v/c Ratio	0.16	0.28			0.57			0.61			0.80	
Uniform Delay, d1	12.8	13.4			15.2			10.8			12.5	
Progression Factor	0.98	0.96			1.47			0.40			1.00	
Incremental Delay, d2	1.2	1.0			2.7			1.4			2.0	
Delay (s)	13.7	13.9			25.1			5.7			14.5	
Level of Service	B	B			C			A			B	
Approach Delay (s)		13.8			25.1			5.7			14.5	
Approach LOS		B			C			A			B	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.6%	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		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	165	463	32	24	730	25	36	96	70	10	72	200
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)	179	503	35	26	793	27	39	104	76	11	78	217

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	717	847	220	307
Volume Left (vph)	179	26	39	11
Volume Right (vph)	35	27	76	217
Hadj (s)	0.05	0.02	-0.14	-0.38
Departure Headway (s)	7.6	7.6	8.6	7.9
Degree Utilization, x	1.52	1.78	0.52	0.68
Capacity (veh/h)	479	481	399	442
Control Delay (s)	263.2	378.5	20.6	26.0
Approach Delay (s)	263.2	378.5	20.6	26.0
Approach LOS	F	F	C	D

Intersection Summary			
Delay	249.7		
HCM Level of Service	F		
Intersection Capacity Utilization	113.1%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	278	14	16	247	12	13	177	37	10	113	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.98			0.99	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1840			1839			1799			1840	
Flt Permitted		0.98			0.98			0.98			0.97	
Satd. Flow (perm)		1813			1805			1773			1793	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	293	15	17	260	13	14	186	39	11	119	5
RTOR Reduction (vph)	0	3	0	0	3	0	0	12	0	0	2	0
Lane Group Flow (vph)	0	321	0	0	287	0	0	227	0	0	133	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1118			1113			443			448	
v/s Ratio Prot												
v/s Ratio Perm		c0.18			0.16			c0.13			0.07	
v/c Ratio		0.29			0.26			0.51			0.30	
Uniform Delay, d1		5.4			5.2			19.4			18.2	
Progression Factor		0.74			0.42			1.02			1.00	
Incremental Delay, d2		0.6			0.5			3.5			1.7	
Delay (s)		4.6			2.6			23.3			19.9	
Level of Service		A			A			C			B	
Approach Delay (s)		4.6			2.6			23.3			19.9	
Approach LOS		A			A			C			B	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.0%	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)	74	603	22	59	572	15	20	138	62	27	91	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	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.96			0.97	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1765	1845		1726	1854			1772			1781	
Flt Permitted	0.31	1.00		0.28	1.00			0.97			0.93	
Satd. Flow (perm)	574	1845		510	1854			1726			1667	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	635	23	62	602	16	21	145	65	28	96	36
RTOR Reduction (vph)	0	2	0	0	2	0	0	24	0	0	18	0
Lane Group Flow (vph)	78	656	0	62	616	0	0	207	0	0	143	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			18.5			18.5	
Effective Green, g (s)	34.0	34.0		34.0	34.0			18.0			18.0	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.30			0.30	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	325	1046		289	1051			518			500	
v/s Ratio Prot		c0.36			0.33							
v/s Ratio Perm	0.14			0.12				c0.12			0.09	
v/c Ratio	0.24	0.63		0.21	0.59			0.40			0.28	
Uniform Delay, d1	6.5	8.7		6.4	8.4			16.7			16.1	
Progression Factor	0.40	0.68		2.16	2.15			1.16			0.38	
Incremental Delay, d2	1.7	2.7		1.5	2.2			1.9			1.4	
Delay (s)	4.2	8.6		15.4	20.3			21.3			7.5	
Level of Service	A	A		B	C			C			A	
Approach Delay (s)		8.2			19.9			21.3			7.5	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.5%	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)	57	176	18	290	396	515	9	1334	393	369	938	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1827	1538		1824	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.33	1.00		0.64	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		609	1538		1193	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	185	19	305	417	542	9	1404	414	388	987	193
RTOR Reduction (vph)	0	0	11	0	0	217	0	0	197	0	0	43
Lane Group Flow (vph)	0	245	8	0	722	325	9	1404	217	388	987	150
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		48.0	48.0		48.0	48.0	0.8	34.4	34.4	20.0	54.6	54.6
Effective Green, g (s)		48.0	48.0		48.0	48.0	0.8	34.4	34.4	20.0	54.6	54.6
Actuated g/C Ratio		0.43	0.43		0.43	0.43	0.01	0.31	0.31	0.18	0.49	0.49
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		260	657		509	676	13	1052	471	306	1670	769
v/s Ratio Prot							0.01	c0.41		c0.23	0.29	
v/s Ratio Perm		0.40	0.01		c0.61	0.21			0.14			0.09
v/c Ratio		0.94	0.01		1.42	0.48	0.69	1.33	0.46	1.27	0.59	0.20
Uniform Delay, d1		30.9	18.5		32.2	23.2	55.7	39.0	31.5	46.2	20.8	16.4
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		40.1	0.0		199.6	0.5	96.3	157.1	3.2	143.9	1.5	0.6
Delay (s)		71.0	18.6		231.8	23.8	152.0	196.1	34.7	190.1	22.4	17.0
Level of Service		E	B		F	C	F	F	C	F	C	B
Approach Delay (s)		67.2			142.6			159.3			63.2	
Approach LOS		E			F			F			E	

Intersection Summary			
HCM Average Control Delay	119.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	120.0%	ICU Level of Service	H
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)	10	388	20	138	520	35	0	37	211	20	46	10
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	0.99			0.89			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1770	1849		1770	1845			1649			1805	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			0.79	
Satd. Flow (perm)	1770	1849		1770	1845			1649			1441	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	422	22	150	565	38	0	40	229	22	50	11
RTOR Reduction (vph)	0	3	0	0	4	0	0	186	0	0	9	0
Lane Group Flow (vph)	11	441	0	150	599	0	0	83	0	0	74	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	0.6	18.1		6.6	24.1			8.4			8.4	
Effective Green, g (s)	0.6	18.1		6.6	24.1			8.4			8.4	
Actuated g/C Ratio	0.01	0.40		0.15	0.53			0.19			0.19	
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)	24	742		259	986			307			268	
v/s Ratio Prot	0.01	0.24		c0.08	c0.32			0.05				
v/s Ratio Perm											c0.05	
v/c Ratio	0.46	0.59		0.58	0.61			0.27			0.28	
Uniform Delay, d1	22.1	10.6		18.0	7.2			15.7			15.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	13.2	1.3		3.1	1.1			0.5			0.6	
Delay (s)	35.3	11.9		21.1	8.3			16.2			16.3	
Level of Service	D	B		C	A			B			B	
Approach Delay (s)		12.5			10.9			16.2			16.3	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	45.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.7%	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)	383	527	5	33	734	27	123	813	62	50	431	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	1.00		1.00	0.99		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1269	1496	2967		1547	3043		1547	3094	1319
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1269	1496	2967		1547	3043		1547	3094	1319
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	403	555	5	35	773	28	129	856	65	53	454	467
RTOR Reduction (vph)	0	0	3	0	2	0	0	5	0	0	0	33
Lane Group Flow (vph)	403	555	2	35	799	0	129	916	0	53	454	434
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	23.0	41.5	41.5	18.5	37.0		15.1	40.3		4.4	29.6	52.6
Effective Green, g (s)	23.0	41.5	41.5	18.5	37.0		15.1	41.3		4.4	30.6	54.6
Actuated g/C Ratio	0.19	0.34	0.34	0.15	0.30		0.12	0.34		0.04	0.25	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	529	1020	433	227	902		192	1033		56	778	592
v/s Ratio Prot	c0.14	0.19		0.02	c0.27		0.08	c0.30		c0.03	0.15	c0.14
v/s Ratio Perm			0.00									0.18
v/c Ratio	0.76	0.54	0.00	0.15	0.89		0.67	0.89		0.95	0.58	0.73
Uniform Delay, d1	46.8	32.4	26.5	44.8	40.3		50.9	38.0		58.5	40.0	27.6
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	6.4	0.6	0.0	0.3	10.4		8.9	9.3		99.8	1.1	4.7
Delay (s)	53.2	33.0	26.5	45.1	50.7		59.8	47.3		158.4	41.1	32.3
Level of Service	D	C	C	D	D		E	D		F	D	C
Approach Delay (s)		41.4			50.5			48.9			43.2	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	45.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	121.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.9%	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)	129	240	247	36	357	121	319	965	108	195	248	42
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.92		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3123		1770	3249		3433	3539	1481	3335	3539	1444
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3123		1770	3249		3433	3539	1481	3335	3539	1444
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	253	260	38	376	127	336	1016	114	205	261	44
RTOR Reduction (vph)	0	162	0	0	28	0	0	0	70	0	0	31
Lane Group Flow (vph)	136	351	0	38	475	0	336	1016	44	205	261	13
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	26.0	26.0		23.5	23.5		13.1	34.7	34.7	9.0	30.6	30.6
Effective Green, g (s)	25.1	25.1		22.6	22.6		12.8	34.9	34.9	8.7	30.8	30.8
Actuated g/C Ratio	0.23	0.23		0.21	0.21		0.12	0.33	0.33	0.08	0.29	0.29
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	402	731		373	684		410	1151	482	270	1016	414
v/s Ratio Prot	0.08	c0.11		0.02	c0.15		0.10	c0.29		c0.06	0.07	
v/s Ratio Perm									0.03			0.01
v/c Ratio	0.34	0.48		0.10	0.69		0.82	0.88	0.09	0.76	0.26	0.03
Uniform Delay, d1	34.2	35.5		34.2	39.2		46.1	34.3	25.2	48.3	29.4	27.5
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	0.2	0.2		0.0	2.5		11.5	8.0	0.0	10.4	0.0	0.0
Delay (s)	34.4	35.7		34.2	41.6		57.6	42.3	25.2	58.6	29.5	27.5
Level of Service	C	D		C	D		E	D	C	E	C	C
Approach Delay (s)		35.4			41.1			44.5			41.0	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	107.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Volume (vph)	408	655	149	7	2	4	469	282	116	473	3	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5					3.5	4.0		3.8		3.0
Lane Util. Factor	1.00	1.00					0.95	1.00		1.00		1.00
Frt	1.00	0.97					1.00	0.85		1.00		1.00
Flt Protected	0.95	1.00					1.00	1.00		0.99		0.95
Satd. Flow (prot)	1770	1809					3537	1583		1843		1770
Flt Permitted	0.37	1.00					0.80	1.00		0.68		0.95
Satd. Flow (perm)	685	1809					2820	1583		1266		1770
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	429	689	157	7	2	4	494	297	122	498	3	233
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	429	853	0	0	0	0	500	297	0	623	0	233
Turn Type	Perm				Perm	Perm		Free	Perm			Prot
Protected Phases		3					3			6		5
Permitted Phases	3				3	3		Free	6			
Actuated Green, G (s)	30.6	30.6					30.6	89.5		25.3		12.1
Effective Green, g (s)	30.6	30.6					30.6	89.5		25.3		12.1
Actuated g/C Ratio	0.34	0.34					0.34	1.00		0.28		0.14
Clearance Time (s)	3.5	3.5					3.5			3.8		3.0
Vehicle Extension (s)	3.0	3.0					3.0			3.0		3.0
Lane Grp Cap (vph)	234	618					964	1583		358		239
v/s Ratio Prot		0.47										c0.13
v/s Ratio Perm	c0.63						0.18	0.19		c0.49		
v/c Ratio	1.83	1.38					0.52	0.19		1.74		0.97
Uniform Delay, d1	29.4	29.4					23.6	0.0		32.1		38.5
Progression Factor	1.00	1.00					1.00	1.00		1.00		1.00
Incremental Delay, d2	391.2	181.1					0.5	0.3		344.5		50.7
Delay (s)	420.7	210.6					24.0	0.3		376.6		89.3
Level of Service	F	F					C	A		F		F
Approach Delay (s)		280.9					15.2			376.6		
Approach LOS		F					B			F		

Intersection Summary			
HCM Average Control Delay	161.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.4
Intersection Capacity Utilization	138.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR	SBR2	NEL	NER
Lane Configurations					
Volume (vph)	544	61	347	72	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8	3.8		4.1	4.1
Lane Util. Factor	1.00	1.00		1.00	1.00
Frt	1.00	0.85		1.00	0.85
Flt Protected	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1863	1583		1770	1583
Flt Permitted	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1863	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	573	64	365	76	3
RTOR Reduction (vph)	0	195	0	0	0
Lane Group Flow (vph)	573	234	0	76	3
Turn Type		Perm			Perm
Protected Phases	2			4	
Permitted Phases		2			4
Actuated Green, G (s)	40.4	40.4		7.1	7.1
Effective Green, g (s)	40.4	40.4		7.1	7.1
Actuated g/C Ratio	0.45	0.45		0.08	0.08
Clearance Time (s)	3.8	3.8		4.1	4.1
Vehicle Extension (s)	3.0	3.0		2.0	2.0
Lane Grp Cap (vph)	841	715		140	126
v/s Ratio Prot	0.31			c0.04	
v/s Ratio Perm		0.15			0.00
v/c Ratio	0.68	0.33		0.54	0.02
Uniform Delay, d1	19.5	15.8		39.6	38.0
Progression Factor	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.3	0.3		2.3	0.0
Delay (s)	21.7	16.1		41.9	38.0
Level of Service	C	B		D	D
Approach Delay (s)	32.5			41.8	
Approach LOS	C			D	

Intersection Summary

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	377	43	25	18	62	147	7	1568	26	50	1209	419
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.98	
Flpb, ped/bikes		0.99			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1757			1626			3425		1719	3276	
Flt Permitted		0.53			0.95			0.80		0.95	1.00	
Satd. Flow (perm)		965			1552			2755		1719	3276	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	397	45	26	19	65	155	7	1651	27	53	1273	441
RTOR Reduction (vph)	0	2	0	0	0	0	0	1	0	0	28	0
Lane Group Flow (vph)	0	466	0	0	239	0	0	1684	0	53	1686	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		46.5			46.5			59.5		4.0	59.5	
Effective Green, g (s)		46.0			46.0			59.0		3.0	59.0	
Actuated g/C Ratio		0.38			0.38			0.49		0.02	0.49	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		370			595			1355		43	1611	
v/s Ratio Prot										c0.03	0.51	
v/s Ratio Perm		c0.48			0.15			c0.61				
v/c Ratio		1.26			0.40			1.24		1.23	1.05	
Uniform Delay, d1		37.0			27.0			30.5		58.5	30.5	
Progression Factor		1.00			1.00			0.42		1.00	1.00	
Incremental Delay, d2		137.1			0.4			109.9		213.4	35.6	
Delay (s)		174.1			27.4			122.8		271.9	66.1	
Level of Service		F			C			F		F	E	
Approach Delay (s)		174.1			27.4			122.8			72.3	
Approach LOS		F			C			F			E	

Intersection Summary			
HCM Average Control Delay	101.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
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)	410	422	43	42	208	94	11	1116	43	182	971	287
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.96			0.99		1.00	0.97	
Flt Protected		0.98			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1748			1719			3413		1719	3274	
Flt Permitted		0.63			0.85			0.86		0.95	1.00	
Satd. Flow (perm)		1119			1476			2926		1719	3274	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	432	444	45	44	219	99	12	1175	45	192	1022	302
RTOR Reduction (vph)	0	1	0	0	11	0	0	2	0	0	23	0
Lane Group Flow (vph)	0	920	0	0	351	0	0	1230	0	192	1301	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2	
Permitted Phases	4			8			6					
Actuated Green, G (s)		61.5			61.5			39.5		9.0	51.5	
Effective Green, g (s)		61.0			61.0			39.0		8.0	51.0	
Actuated g/C Ratio		0.51			0.51			0.32		0.07	0.42	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		0.2			0.2			0.2		0.2	0.2	
Lane Grp Cap (vph)		569			750			951		115	1391	
v/s Ratio Prot										c0.11	0.40	
v/s Ratio Perm		c0.82			0.24			c0.42				
v/c Ratio		1.62			0.47			1.29		1.67	0.94	
Uniform Delay, d1		29.5			19.0			40.5		56.0	32.9	
Progression Factor		1.00			1.00			0.86		1.38	0.74	
Incremental Delay, d2		285.3			0.2			137.1		316.4	6.2	
Delay (s)		314.8			19.2			172.0		393.4	30.6	
Level of Service		F			B			F		F	C	
Approach Delay (s)		314.8			19.2			172.0			76.5	
Approach LOS		F			B			F			E	

Intersection Summary			
HCM Average Control Delay	155.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.50		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	149.0%	ICU Level of Service	H
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)	37	399	32	16	272	37	7	1185	28	20	872	43
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.98			1.00			0.99	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1838			1826			3426			3409	
Flt Permitted	0.46	1.00			0.97			0.95			0.92	
Satd. Flow (perm)	863	1838			1780			3257			3124	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	39	420	34	17	286	39	7	1247	29	21	918	45
RTOR Reduction (vph)	0	5	0	0	8	0	0	3	0	0	6	0
Lane Group Flow (vph)	39	449	0	0	334	0	0	1281	0	0	979	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	316	674			653			1629			1562	
v/s Ratio Prot		c0.24										
v/s Ratio Perm	0.05				0.19			c0.39			0.31	
v/c Ratio	0.12	0.67			0.51			0.79			0.63	
Uniform Delay, d1	12.6	15.9			14.8			12.4			10.9	
Progression Factor	1.08	1.12			0.89			0.94			2.15	
Incremental Delay, d2	0.8	5.0			2.7			3.8			0.6	
Delay (s)	14.4	22.9			16.0			15.3			24.1	
Level of Service	B	C			B			B			C	
Approach Delay (s)		22.2			16.0			15.3			24.1	
Approach LOS		C			B			B			C	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	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		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	150	750	22	22	470	15	27	115	70	55	160	265
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)	163	815	24	24	511	16	29	125	76	60	174	288

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	1002	551	230	522
Volume Left (vph)	163	24	29	60
Volume Right (vph)	24	16	76	288
Hadj (s)	0.05	0.02	-0.14	-0.27
Departure Headway (s)	8.6	8.6	9.4	8.3
Degree Utilization, x	2.39	1.31	0.60	1.20
Capacity (veh/h)	428	428	372	433
Control Delay (s)	652.7	181.5	25.8	136.2
Approach Delay (s)	652.7	181.5	25.8	136.2
Approach LOS	F	F	D	F

Intersection Summary			
Delay	360.5		
HCM Level of Service	F		
Intersection Capacity Utilization	121.8%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	302	23	47	290	46	24	209	21	32	149	24
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.98			0.99			0.98	
Flt Protected		0.99			0.99			1.00			0.99	
Satd. Flow (prot)		1823			1806			1823			1804	
Flt Permitted		0.91			0.93			0.96			0.93	
Satd. Flow (perm)		1663			1682			1761			1691	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	318	24	49	305	48	25	220	22	34	157	25
RTOR Reduction (vph)	0	4	0	0	8	0	0	5	0	0	8	0
Lane Group Flow (vph)	0	398	0	0	394	0	0	262	0	0	209	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1026			1037			440			423	
v/s Ratio Prot												
v/s Ratio Perm		c0.24			0.23			c0.15			0.12	
v/c Ratio		0.39			0.38			0.59			0.49	
Uniform Delay, d1		5.8			5.8			19.8			19.2	
Progression Factor		0.52			0.33			1.41			1.00	
Incremental Delay, d2		1.0			1.0			4.3			4.1	
Delay (s)		4.0			2.9			32.3			23.3	
Level of Service		A			A			C			C	
Approach Delay (s)		4.0			2.9			32.3			23.3	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.3%	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)	65	775	56	83	549	30	39	161	90	29	176	73
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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	0.99			0.96			0.96	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1765	1828		1770	1845			1760			1778	
Flt Permitted	0.31	1.00		0.13	1.00			0.94			0.95	
Satd. Flow (perm)	585	1828		249	1845			1663			1704	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	816	59	87	578	32	41	169	95	31	185	77
RTOR Reduction (vph)	0	4	0	0	3	0	0	27	0	0	22	0
Lane Group Flow (vph)	68	871	0	87	607	0	0	278	0	0	271	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			18.5			18.5	
Effective Green, g (s)	34.0	34.0		34.0	34.0			18.0			18.0	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.30			0.30	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	332	1036		141	1046			499			511	
v/s Ratio Prot		c0.48			0.33							
v/s Ratio Perm	0.12			0.35				c0.17			0.16	
v/c Ratio	0.20	0.84		0.62	0.58			0.56			0.53	
Uniform Delay, d1	6.4	10.8		8.7	8.4			17.6			17.5	
Progression Factor	0.33	0.94		1.37	1.15			0.49			1.47	
Incremental Delay, d2	1.3	7.8		14.8	1.8			2.8			3.7	
Delay (s)	3.4	17.9		26.6	11.5			11.5			29.5	
Level of Service	A	B		C	B			B			C	
Approach Delay (s)		16.9			13.4			11.5			29.5	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	16.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
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)	80	228	9	393	219	286	2	1082	310	231	979	134
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1825	1538		1805	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.52	1.00		0.52	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		953	1538		972	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	84	240	9	414	231	301	2	1139	326	243	1031	141
RTOR Reduction (vph)	0	0	5	0	0	0	0	0	226	0	0	0
Lane Group Flow (vph)	0	324	4	0	645	301	2	1139	100	243	1031	141
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		39.0	39.0		39.0	82.4	0.8	25.4	25.4	8.0	33.6	82.4
Effective Green, g (s)		39.0	39.0		39.0	82.4	0.8	25.4	25.4	8.0	33.6	82.4
Actuated g/C Ratio		0.47	0.47		0.47	1.00	0.01	0.31	0.31	0.10	0.41	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		451	728		460	1583	17	1060	474	167	1402	1583
v/s Ratio Prot							0.00	c0.33		c0.14	0.30	
v/s Ratio Perm		0.34	0.00		c0.66	0.19			0.07			0.09
v/c Ratio		0.72	0.01		1.40	0.19	0.12	1.07	0.21	1.46	0.74	0.09
Uniform Delay, d1		17.3	11.5		21.7	0.0	40.5	28.5	21.1	37.2	20.6	0.0
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		5.4	0.0		193.7	0.3	3.1	50.0	1.0	234.8	3.5	0.1
Delay (s)		22.7	11.5		215.4	0.3	43.5	78.5	22.1	272.0	24.1	0.1
Level of Service		C	B		F	A	D	E	C	F	C	A
Approach Delay (s)		22.4			147.0			65.9			64.3	
Approach LOS		C			F			E			E	

Intersection Summary			
HCM Average Control Delay	80.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.29		
Actuated Cycle Length (s)	82.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	105.7%	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)	10	730	20	255	350	31	0	34	135	23	38	10
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	0.99			0.89			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.98	
Satd. Flow (prot)	1770	1855		1770	1840			1662			1798	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			0.88	
Satd. Flow (perm)	1770	1855		1770	1840			1662			1602	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	793	22	277	380	34	0	37	147	25	41	11
RTOR Reduction (vph)	0	1	0	0	4	0	0	117	0	0	8	0
Lane Group Flow (vph)	11	814	0	277	410	0	0	67	0	0	69	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	0.8	39.2		13.8	52.2			17.0			17.0	
Effective Green, g (s)	0.8	39.2		13.8	52.2			17.0			17.0	
Actuated g/C Ratio	0.01	0.48		0.17	0.64			0.21			0.21	
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)	17	887		298	1171			345			332	
v/s Ratio Prot	0.01	c0.44		c0.16	0.22			0.04				
v/s Ratio Perm											c0.04	
v/c Ratio	0.65	0.92		0.93	0.35			0.20			0.21	
Uniform Delay, d1	40.5	19.9		33.6	7.0			26.9			26.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	62.0	14.0		33.7	0.2			1.3			1.4	
Delay (s)	102.5	33.9		67.3	7.2			28.1			28.3	
Level of Service	F	C		E	A			C			C	
Approach Delay (s)		34.9			31.3			28.1			28.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	32.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	82.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.1%	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)	355	871	198	64	614	180	30	316	187	67	766	457
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	0.98		1.00	0.97		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1271	1496	2836		1547	2833		1547	3094	1316
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1271	1496	2836		1547	2833		1547	3094	1316
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	374	917	208	67	646	189	32	333	197	71	806	481
RTOR Reduction (vph)	0	0	124	0	21	0	0	66	0	0	0	28
Lane Group Flow (vph)	374	917	84	67	814	0	32	464	0	71	806	453
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	22.7	45.3	45.3	18.4	41.0		2.7	31.3		6.6	35.2	57.9
Effective Green, g (s)	22.7	45.3	45.3	18.4	41.0		2.7	32.3		6.6	36.2	59.9
Actuated g/C Ratio	0.19	0.38	0.38	0.16	0.35		0.02	0.27		0.06	0.31	0.51
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	536	1142	485	232	980		35	772		86	944	665
v/s Ratio Prot	c0.13	c0.31		0.04	0.29		0.02	0.16		c0.05	c0.26	c0.14
v/s Ratio Perm			0.07									0.21
v/c Ratio	0.70	0.80	0.17	0.29	0.83		0.91	0.60		0.83	0.85	0.68
Uniform Delay, d1	44.7	32.7	24.3	44.3	35.6		57.8	37.5		55.4	38.7	22.2
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	3.9	4.2	0.2	0.7	6.1		116.7	1.3		44.9	7.6	2.9
Delay (s)	48.7	36.8	24.4	45.0	41.7		174.5	38.9		100.3	46.3	25.0
Level of Service	D	D	C	D	D		F	D		F	D	C
Approach Delay (s)		38.1			41.9			46.6			41.6	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	118.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.6%	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)	470	383	240	110	381	127	304	241	28	86	844	59
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.98		1.00	1.00	0.93	1.00	1.00	0.93
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3192		1770	3246		3433	3539	1473	3335	3539	1437
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3192		1770	3246		3433	3539	1473	3335	3539	1437
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	495	403	253	116	401	134	320	254	29	91	888	62
RTOR Reduction (vph)	0	81	0	0	28	0	0	0	20	0	0	44
Lane Group Flow (vph)	495	575	0	116	507	0	320	254	9	91	888	18
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	35.1	35.1		24.4	24.4		12.0	37.9	37.9	5.7	31.6	31.6
Effective Green, g (s)	34.2	34.2		23.5	23.5		11.7	38.1	38.1	5.4	31.8	31.8
Actuated g/C Ratio	0.29	0.29		0.20	0.20		0.10	0.33	0.33	0.05	0.27	0.27
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	502	931		355	651		343	1150	479	154	960	390
v/s Ratio Prot	c0.29	0.18		0.07	c0.16		c0.09	0.07		0.03	c0.25	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.99	0.62		0.33	0.78		0.93	0.22	0.02	0.59	0.93	0.05
Uniform Delay, d1	41.3	35.8		40.1	44.4		52.4	28.8	26.9	54.8	41.5	31.5
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	36.2	0.9		0.2	5.4		31.3	0.0	0.0	4.0	14.0	0.0
Delay (s)	77.4	36.7		40.3	49.7		83.7	28.8	26.9	58.8	55.5	31.5
Level of Service	E	D		D	D		F	C	C	E	E	C
Approach Delay (s)		54.2			48.1			57.8			54.4	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM Average Control Delay	53.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	117.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	380	352	33	3	16	262	451	220	526	16	267	561
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1837				3529	1583		1831		1770	1863
Flt Permitted	0.49	1.00				0.81	1.00		0.58		0.95	1.00
Satd. Flow (perm)	912	1837				2861	1583		1082		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	400	371	35	3	17	276	475	232	554	17	281	591
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	400	409	0	0	0	293	475	0	802	0	281	591
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	29.6	29.6				29.6	112.7		51.3		9.0	63.3
Effective Green, g (s)	29.6	29.6				29.6	112.7		51.3		9.0	63.3
Actuated g/C Ratio	0.26	0.26				0.26	1.00		0.46		0.08	0.56
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	240	482				751	1583		493		141	1046
v/s Ratio Prot		0.22									c0.16	
v/s Ratio Perm	c0.44					0.10	0.30		c0.74			0.32
v/c Ratio	1.67	0.85				0.39	0.30		1.63		1.99	0.57
Uniform Delay, d1	41.5	39.4				34.1	0.0		30.7		51.9	15.9
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	317.7	13.1				0.3	0.5		291.6		471.1	0.7
Delay (s)	359.3	52.5				34.5	0.5		322.3		523.0	16.6
Level of Service	F	D				C	A		F		F	B
Approach Delay (s)		204.2				13.5			322.3			116.8
Approach LOS		F				B			F			F

Intersection Summary			
HCM Average Control Delay	155.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.59		
Actuated Cycle Length (s)	112.7	Sum of lost time (s)	14.4
Intersection Capacity Utilization	120.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	129	388	5	74	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	408	5	78	4
RTOR Reduction (vph)	83	0	0	0	0
Lane Group Flow (vph)	461	0	0	83	4
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	63.3			8.4	8.4
Effective Green, g (s)	63.3			8.4	8.4
Actuated g/C Ratio	0.56			0.07	0.07
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	889			132	118
v/s Ratio Prot				c0.05	
v/s Ratio Perm	0.29				0.00
v/c Ratio	0.52			0.63	0.03
Uniform Delay, d1	15.3			50.6	48.4
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.5			6.6	0.0
Delay (s)	15.8			57.2	48.4
Level of Service	B			E	D
Approach Delay (s)				56.8	
Approach LOS				E	

Intersection Summary

APPENDIX D:

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS (CUMULATIVE 2030 BASE PLUS PROJECT CONDITIONS)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	379	40	9	15	105	405	33	1331	26	58	1315	315
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.90			1.00		1.00	0.97	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1778			1589			3420		1719	3310	
Flt Permitted		0.30			0.98			0.61		0.95	1.00	
Satd. Flow (perm)		548			1564			2079		1719	3310	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	399	42	9	16	111	426	35	1401	27	61	1384	332
RTOR Reduction (vph)	0	1	0	0	0	0	0	1	0	0	17	0
Lane Group Flow (vph)	0	449	0	0	553	0	0	1462	0	61	1699	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		49.5			49.5			55.5		5.0	55.5	
Effective Green, g (s)		49.0			49.0			55.0		4.0	55.0	
Actuated g/C Ratio		0.41			0.41			0.46		0.03	0.46	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		224			639			953		57	1517	
v/s Ratio Prot										c0.04	0.51	
v/s Ratio Perm		c0.82			0.35			c0.70				
v/c Ratio		2.01			0.87			1.53		1.07	1.12	
Uniform Delay, d1		35.5			32.5			32.5		58.0	32.5	
Progression Factor		1.00			1.00			0.54		1.00	1.00	
Incremental Delay, d2		468.3			11.8			240.8		140.1	63.3	
Delay (s)		503.8			44.3			258.2		198.1	95.8	
Level of Service		F			D			F		F	F	
Approach Delay (s)		503.8			44.3			258.2			99.3	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	189.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.73		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	127.1%	ICU Level of Service	H
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)	331	199	36	39	373	218	9	986	25	89	879	411
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.98	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.95			1.00		1.00	0.95	
Flt Protected		0.97			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1739			1703			3421		1719	3209	
Flt Permitted		0.40			0.94			0.76		0.95	1.00	
Satd. Flow (perm)		724			1605			2584		1719	3209	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	348	209	38	41	393	229	9	1038	26	94	925	433
RTOR Reduction (vph)	0	2	0	0	16	0	0	1	0	0	46	0
Lane Group Flow (vph)	0	593	0	0	647	0	0	1072	0	94	1312	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2	
Permitted Phases	4			8			6					
Actuated Green, G (s)		62.5			62.5			41.5		6.0	50.5	
Effective Green, g (s)		62.0			62.0			41.0		5.0	50.0	
Actuated g/C Ratio		0.52			0.52			0.34		0.04	0.42	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		0.2			0.2			0.2		0.2	0.2	
Lane Grp Cap (vph)		374			829			883		72	1337	
v/s Ratio Prot										0.05	c0.41	
v/s Ratio Perm		c0.82			0.40			c0.41				
v/c Ratio		1.59			0.78			1.21		1.31	0.98	
Uniform Delay, d1		29.0			23.5			39.5		57.5	34.5	
Progression Factor		1.00			1.00			1.25		0.72	0.51	
Incremental Delay, d2		276.0			4.4			105.0		146.5	4.2	
Delay (s)		305.0			27.9			154.3		187.8	21.7	
Level of Service		F			C			F		F	C	
Approach Delay (s)		305.0			27.9			154.3			32.4	
Approach LOS		F			C			F			C	

Intersection Summary			
HCM Average Control Delay	109.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.39		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	146.0%	ICU Level of Service	H
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)	44	159	29	23	205	149	42	777	38	85	932	15
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			0.99			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.98			0.95			0.99			1.00	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1810			1746			3410			3422	
Flt Permitted	0.42	1.00			0.98			0.86			0.79	
Satd. Flow (perm)	775	1810			1712			2955			2710	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	46	167	31	24	216	157	44	818	40	89	981	16
RTOR Reduction (vph)	0	11	0	0	39	0	0	6	0	0	2	0
Lane Group Flow (vph)	46	187	0	0	358	0	0	897	0	0	1085	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	284	664			628			1478			1355	
v/s Ratio Prot		0.10										
v/s Ratio Perm	0.06				c0.21			0.30			c0.40	
v/c Ratio	0.16	0.28			0.57			0.61			0.80	
Uniform Delay, d1	12.8	13.4			15.2			10.8			12.5	
Progression Factor	0.97	0.95			1.47			0.40			1.00	
Incremental Delay, d2	1.2	1.0			2.7			1.4			2.0	
Delay (s)	13.6	13.8			25.1			5.7			14.4	
Level of Service	B	B			C			A			B	
Approach Delay (s)		13.8			25.1			5.7			14.4	
Approach LOS		B			C			A			B	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

4: Clement Ave & Oak

Cumulative+Prj AM PEAK
Alameda Boatworks

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	170	484	39	24	737	26	38	98	70	12	79	207
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)	185	526	42	26	801	28	41	107	76	13	86	225

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	753	855	224	324
Volume Left (vph)	185	26	41	13
Volume Right (vph)	42	28	76	225
Hadj (s)	0.05	0.02	-0.13	-0.37
Departure Headway (s)	7.8	7.7	8.7	8.0
Degree Utilization, x	1.63	1.84	0.54	0.72
Capacity (veh/h)	474	472	394	440
Control Delay (s)	311.3	404.8	21.5	29.1
Approach Delay (s)	311.3	404.8	21.5	29.1
Approach LOS	F	F	C	D

Intersection Summary			
Delay	275.9		
HCM Level of Service	F		
Intersection Capacity Utilization	115.3%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	278	14	16	247	12	13	182	37	10	127	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.98			1.00	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1840			1839			1801			1842	
Flt Permitted		0.98			0.98			0.98			0.97	
Satd. Flow (perm)		1813			1805			1774			1799	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	293	15	17	260	13	14	192	39	11	134	5
RTOR Reduction (vph)	0	3	0	0	3	0	0	11	0	0	2	0
Lane Group Flow (vph)	0	321	0	0	287	0	0	234	0	0	148	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1118			1113			444			450	
v/s Ratio Prot												
v/s Ratio Perm		c0.18			0.16			c0.13			0.08	
v/c Ratio		0.29			0.26			0.53			0.33	
Uniform Delay, d1		5.4			5.2			19.4			18.4	
Progression Factor		0.74			0.42			1.01			1.00	
Incremental Delay, d2		0.6			0.5			3.7			1.9	
Delay (s)		4.6			2.6			23.4			20.3	
Level of Service		A			A			C			C	
Approach Delay (s)		4.6			2.6			23.4			20.3	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.5%	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)	74	603	22	59	572	15	20	143	62	27	105	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	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.96			0.97	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1765	1845		1726	1854			1775			1788	
Flt Permitted	0.31	1.00		0.28	1.00			0.97			0.93	
Satd. Flow (perm)	574	1845		510	1854			1727			1681	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	635	23	62	602	16	21	151	65	28	111	36
RTOR Reduction (vph)	0	2	0	0	2	0	0	22	0	0	15	0
Lane Group Flow (vph)	78	656	0	62	616	0	0	215	0	0	160	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			18.5			18.5	
Effective Green, g (s)	34.0	34.0		34.0	34.0			18.0			18.0	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.30			0.30	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	325	1046		289	1051			518			504	
v/s Ratio Prot		c0.36			0.33							
v/s Ratio Perm	0.14			0.12				c0.12			0.09	
v/c Ratio	0.24	0.63		0.21	0.59			0.41			0.32	
Uniform Delay, d1	6.5	8.7		6.4	8.4			16.8			16.2	
Progression Factor	0.40	0.68		2.16	2.15			1.16			0.37	
Incremental Delay, d2	1.7	2.7		1.5	2.2			2.0			1.6	
Delay (s)	4.2	8.6		15.4	20.3			21.5			7.6	
Level of Service	A	A		B	C			C			A	
Approach Delay (s)		8.2			19.9			21.5			7.6	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.5%	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)	71	176	18	290	396	515	9	1334	393	369	938	188
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1821	1538		1824	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.27	1.00		0.62	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		507	1538		1162	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	75	185	19	305	417	542	9	1404	414	388	987	198
RTOR Reduction (vph)	0	0	11	0	0	217	0	0	197	0	0	44
Lane Group Flow (vph)	0	260	8	0	722	325	9	1404	217	388	987	154
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		48.0	48.0		48.0	48.0	0.8	34.4	34.4	20.0	54.6	54.6
Effective Green, g (s)		48.0	48.0		48.0	48.0	0.8	34.4	34.4	20.0	54.6	54.6
Actuated g/C Ratio		0.43	0.43		0.43	0.43	0.01	0.31	0.31	0.18	0.49	0.49
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		217	657		496	676	13	1052	471	306	1670	769
v/s Ratio Prot							0.01	c0.41		c0.23	0.29	
v/s Ratio Perm		0.51	0.01		c0.62	0.21			0.14			0.10
v/c Ratio		1.20	0.01		1.46	0.48	0.69	1.33	0.46	1.27	0.59	0.20
Uniform Delay, d1		32.2	18.5		32.2	23.2	55.7	39.0	31.5	46.2	20.8	16.5
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		125.0	0.0		216.0	0.5	96.3	157.1	3.2	143.9	1.5	0.6
Delay (s)		157.2	18.6		248.2	23.8	152.0	196.1	34.7	190.1	22.4	17.0
Level of Service		F	B		F	C	F	F	C	F	C	B
Approach Delay (s)		147.7			152.0			159.3			63.1	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM Average Control Delay	126.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	120.7%	ICU Level of Service	H
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)	10	388	20	167	520	35	0	37	221	20	46	10
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	0.99			0.88			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1770	1849		1770	1845			1647			1805	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			0.76	
Satd. Flow (perm)	1770	1849		1770	1845			1647			1384	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	422	22	182	565	38	0	40	240	22	50	11
RTOR Reduction (vph)	0	3	0	0	4	0	0	195	0	0	9	0
Lane Group Flow (vph)	11	441	0	182	599	0	0	85	0	0	74	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	0.6	18.0		7.0	24.4			8.5			8.5	
Effective Green, g (s)	0.6	18.0		7.0	24.4			8.5			8.5	
Actuated g/C Ratio	0.01	0.40		0.15	0.54			0.19			0.19	
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)	23	731		272	989			308			259	
v/s Ratio Prot	0.01	0.24		c0.10	c0.32			0.05				
v/s Ratio Perm											c0.05	
v/c Ratio	0.48	0.60		0.67	0.61			0.28			0.29	
Uniform Delay, d1	22.3	10.9		18.2	7.2			15.9			15.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	14.8	1.4		6.1	1.1			0.5			0.6	
Delay (s)	37.1	12.3		24.3	8.3			16.3			16.5	
Level of Service	D	B		C	A			B			B	
Approach Delay (s)		12.9			12.0			16.3			16.5	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	45.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.7%	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)	383	529	5	33	739	27	123	813	62	50	431	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	1.00		1.00	0.99		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1268	1496	2967		1547	3043		1547	3094	1319
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1268	1496	2967		1547	3043		1547	3094	1319
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	403	557	5	35	778	28	129	856	65	53	454	467
RTOR Reduction (vph)	0	0	3	0	2	0	0	5	0	0	0	32
Lane Group Flow (vph)	403	557	2	35	804	0	129	916	0	53	454	435
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	23.0	41.6	41.6	18.6	37.2		15.1	40.3		4.5	29.7	52.7
Effective Green, g (s)	23.0	41.6	41.6	18.6	37.2		15.1	41.3		4.5	30.7	54.7
Actuated g/C Ratio	0.19	0.34	0.34	0.15	0.30		0.12	0.34		0.04	0.25	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	528	1020	432	228	905		191	1030		57	779	591
v/s Ratio Prot	c0.14	0.19		0.02	c0.27		0.08	c0.30		c0.03	0.15	c0.14
v/s Ratio Perm			0.00									0.19
v/c Ratio	0.76	0.55	0.00	0.15	0.89		0.68	0.89		0.93	0.58	0.74
Uniform Delay, d1	46.9	32.6	26.5	44.9	40.4		51.1	38.2		58.6	40.0	27.7
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	6.5	0.6	0.0	0.3	10.6		9.1	9.6		92.7	1.1	4.8
Delay (s)	53.4	33.2	26.5	45.2	51.0		60.2	47.7		151.3	41.2	32.5
Level of Service	D	C	C	D	D		E	D		F	D	C
Approach Delay (s)		41.6			50.7			49.3			43.0	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	46.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	122.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.0%	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)	129	242	247	36	362	125	319	965	108	196	248	42
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.92		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3124		1770	3246		3433	3539	1481	3335	3539	1444
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3124		1770	3246		3433	3539	1481	3335	3539	1444
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	255	260	38	381	132	336	1016	114	206	261	44
RTOR Reduction (vph)	0	158	0	0	29	0	0	0	70	0	0	31
Lane Group Flow (vph)	136	357	0	38	484	0	336	1016	44	206	261	13
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	26.0	26.0		23.5	23.5		13.1	34.7	34.7	9.0	30.6	30.6
Effective Green, g (s)	25.1	25.1		22.6	22.6		12.8	34.9	34.9	8.7	30.8	30.8
Actuated g/C Ratio	0.23	0.23		0.21	0.21		0.12	0.33	0.33	0.08	0.29	0.29
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	402	731		373	684		410	1151	482	270	1016	414
v/s Ratio Prot	0.08	c0.11		0.02	c0.15		0.10	c0.29		c0.06	0.07	
v/s Ratio Perm									0.03			0.01
v/c Ratio	0.34	0.49		0.10	0.71		0.82	0.88	0.09	0.76	0.26	0.03
Uniform Delay, d1	34.2	35.5		34.2	39.3		46.1	34.3	25.2	48.3	29.4	27.5
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	0.2	0.2		0.0	2.7		11.5	8.0	0.0	10.9	0.0	0.0
Delay (s)	34.4	35.7		34.2	42.0		57.6	42.3	25.2	59.2	29.5	27.5
Level of Service	C	D		C	D		E	D	C	E	C	C
Approach Delay (s)		35.5			41.5			44.5			41.3	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	107.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Volume (vph)	408	655	149	7	2	4	469	282	116	473	3	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5					3.5	4.0		3.8		3.0
Lane Util. Factor	1.00	1.00					0.95	1.00		1.00		1.00
Frt	1.00	0.97					1.00	0.85		1.00		1.00
Flt Protected	0.95	1.00					1.00	1.00		0.99		0.95
Satd. Flow (prot)	1770	1809					3537	1583		1843		1770
Flt Permitted	0.37	1.00					0.80	1.00		0.68		0.95
Satd. Flow (perm)	685	1809					2820	1583		1266		1770
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	429	689	157	7	2	4	494	297	122	498	3	233
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	429	853	0	0	0	0	500	297	0	623	0	233
Turn Type	Perm				Perm	Perm		Free	Perm			Prot
Protected Phases		3					3			6		5
Permitted Phases	3				3	3		Free	6			
Actuated Green, G (s)	30.6	30.6					30.6	89.5		25.3		12.1
Effective Green, g (s)	30.6	30.6					30.6	89.5		25.3		12.1
Actuated g/C Ratio	0.34	0.34					0.34	1.00		0.28		0.14
Clearance Time (s)	3.5	3.5					3.5			3.8		3.0
Vehicle Extension (s)	3.0	3.0					3.0			3.0		3.0
Lane Grp Cap (vph)	234	618					964	1583		358		239
v/s Ratio Prot		0.47										c0.13
v/s Ratio Perm	c0.63						0.18	0.19		c0.49		
v/c Ratio	1.83	1.38					0.52	0.19		1.74		0.97
Uniform Delay, d1	29.4	29.4					23.6	0.0		32.1		38.5
Progression Factor	1.00	1.00					1.00	1.00		1.00		1.00
Incremental Delay, d2	391.2	181.1					0.5	0.3		344.5		50.7
Delay (s)	420.7	210.6					24.0	0.3		376.6		89.3
Level of Service	F	F					C	A		F		F
Approach Delay (s)		280.9					15.2			376.6		
Approach LOS		F					B			F		

Intersection Summary			
HCM Average Control Delay	161.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.4
Intersection Capacity Utilization	138.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR	SBR2	NEL	NER
Lane Configurations					
Volume (vph)	544	61	347	72	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8	3.8		4.1	4.1
Lane Util. Factor	1.00	1.00		1.00	1.00
Frt	1.00	0.85		1.00	0.85
Flt Protected	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1863	1583		1770	1583
Flt Permitted	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1863	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	573	64	365	76	3
RTOR Reduction (vph)	0	195	0	0	0
Lane Group Flow (vph)	573	234	0	76	3
Turn Type		Perm			Perm
Protected Phases	2			4	
Permitted Phases		2			4
Actuated Green, G (s)	40.4	40.4		7.1	7.1
Effective Green, g (s)	40.4	40.4		7.1	7.1
Actuated g/C Ratio	0.45	0.45		0.08	0.08
Clearance Time (s)	3.8	3.8		4.1	4.1
Vehicle Extension (s)	3.0	3.0		2.0	2.0
Lane Grp Cap (vph)	841	715		140	126
v/s Ratio Prot	0.31			c0.04	
v/s Ratio Perm		0.15			0.00
v/c Ratio	0.68	0.33		0.54	0.02
Uniform Delay, d1	19.5	15.8		39.6	38.0
Progression Factor	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.3	0.3		2.3	0.0
Delay (s)	21.7	16.1		41.9	38.0
Level of Service	C	B		D	D
Approach Delay (s)	32.5			41.8	
Approach LOS	C			D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	8	662	972	10	31	23
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)	9	720	1057	11	34	25
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	1067				1799	1062
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1067				1799	1062
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				61	91
cM capacity (veh/h)	653				87	272

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	728	1067	59
Volume Left	9	0	34
Volume Right	0	11	25
cSH	653	1700	122
Volume to Capacity	0.01	0.63	0.48
Queue Length 95th (ft)	1	0	54
Control Delay (s)	0.4	0.0	59.1
Lane LOS	A		F
Approach Delay (s)	0.4	0.0	59.1
Approach LOS			F

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	68	15	0	0	0	5	5	289	5	283	23
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)	0	74	16	0	0	0	5	5	314	5	308	25
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	504	661	320	558	517	162	333			320		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	504	661	320	558	517	162	333			320		
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 %	100	81	98	100	100	100	100			100		
cM capacity (veh/h)	475	379	721	364	458	882	1227			1240		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	90	0	325	338
Volume Left	0	0	5	5
Volume Right	16	0	314	25
cSH	415	1700	1227	1240
Volume to Capacity	0.22	0.00	0.00	0.00
Queue Length 95th (ft)	20	0	0	0
Control Delay (s)	16.1	0.0	0.2	0.2
Lane LOS	C	A	A	A
Approach Delay (s)	16.1	0.0	0.2	0.2
Approach LOS	C	A		

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	32.4%	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)	415	52	25	18	78	147	7	1581	26	50	1231	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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.98	
Flpb, ped/bikes		0.99			1.00			1.00		1.00	1.00	
Frt		0.99			0.92			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1760			1642			3425		1719	3260	
Flt Permitted		0.51			0.95			0.79		0.95	1.00	
Satd. Flow (perm)		937			1570			2708		1719	3260	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	437	55	26	19	82	155	7	1664	27	53	1296	509
RTOR Reduction (vph)	0	2	0	0	0	0	0	1	0	0	35	0
Lane Group Flow (vph)	0	516	0	0	256	0	0	1697	0	53	1770	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		46.5			46.5			59.5		4.0	59.5	
Effective Green, g (s)		46.0			46.0			59.0		3.0	59.0	
Actuated g/C Ratio		0.38			0.38			0.49		0.02	0.49	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		359			602			1331		43	1603	
v/s Ratio Prot										c0.03	0.54	
v/s Ratio Perm		c0.55			0.16			c0.63				
v/c Ratio		1.44			0.43			1.27		1.23	1.10	
Uniform Delay, d1		37.0			27.3			30.5		58.5	30.5	
Progression Factor		1.00			1.00			0.44		1.00	1.00	
Incremental Delay, d2		212.3			0.5			124.3		213.4	56.8	
Delay (s)		249.3			27.7			137.6		271.9	87.3	
Level of Service		F			C			F		F	F	
Approach Delay (s)		249.3			27.7			137.6			92.6	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM Average Control Delay	125.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.7%	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)	423	422	45	42	208	94	15	1116	43	182	971	309
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.96			0.99		1.00	0.96	
Flt Protected		0.98			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1747			1719			3413		1719	3264	
Flt Permitted		0.62			0.85			0.81		0.95	1.00	
Satd. Flow (perm)		1113			1475			2751		1719	3264	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	445	444	47	44	219	99	16	1175	45	192	1022	325
RTOR Reduction (vph)	0	1	0	0	11	0	0	2	0	0	25	0
Lane Group Flow (vph)	0	935	0	0	351	0	0	1234	0	192	1322	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2	
Permitted Phases	4			8			6					
Actuated Green, G (s)		61.5			61.5			39.5		9.0	51.5	
Effective Green, g (s)		61.0			61.0			39.0		8.0	51.0	
Actuated g/C Ratio		0.51			0.51			0.32		0.07	0.42	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		0.2			0.2			0.2		0.2	0.2	
Lane Grp Cap (vph)		566			750			894		115	1387	
v/s Ratio Prot										c0.11	0.40	
v/s Ratio Perm		c0.84			0.24			c0.45				
v/c Ratio		1.65			0.47			1.38		1.67	0.95	
Uniform Delay, d1		29.5			19.0			40.5		56.0	33.3	
Progression Factor		1.00			1.00			0.86		1.37	0.76	
Incremental Delay, d2		300.9			0.2			175.6		312.9	6.3	
Delay (s)		330.4			19.2			210.5		389.6	31.6	
Level of Service		F			B			F		F	C	
Approach Delay (s)		330.4			19.2			210.5			76.2	
Approach LOS		F			B			F			E	

Intersection Summary			
HCM Average Control Delay	170.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	150.7%	ICU Level of Service	H
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)	37	399	32	16	272	37	7	1189	28	20	874	43
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.98			1.00			0.99	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1838			1826			3426			3409	
Flt Permitted	0.46	1.00			0.97			0.95			0.92	
Satd. Flow (perm)	863	1838			1780			3257			3123	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	39	420	34	17	286	39	7	1252	29	21	920	45
RTOR Reduction (vph)	0	5	0	0	8	0	0	3	0	0	6	0
Lane Group Flow (vph)	39	449	0	0	334	0	0	1286	0	0	981	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	316	674			653			1629			1562	
v/s Ratio Prot		c0.24										
v/s Ratio Perm	0.05				0.19			c0.39			0.31	
v/c Ratio	0.12	0.67			0.51			0.79			0.63	
Uniform Delay, d1	12.6	15.9			14.8			12.4			10.9	
Progression Factor	1.09	1.12			0.89			0.94			2.15	
Incremental Delay, d2	0.8	5.0			2.7			3.8			0.6	
Delay (s)	14.6	22.9			16.0			15.4			24.0	
Level of Service	B	C			B			B			C	
Approach Delay (s)		22.2			16.0			15.4			24.0	
Approach LOS		C			B			B			C	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	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												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	158	764	27	22	494	17	35	123	70	56	165	272
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)	172	830	29	24	537	18	38	134	76	61	179	296

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	1032	579	248	536
Volume Left (vph)	172	24	38	61
Volume Right (vph)	29	18	76	296
Hadj (s)	0.05	0.02	-0.12	-0.27
Departure Headway (s)	8.7	8.7	9.4	8.4
Degree Utilization, x	2.50	1.40	0.65	1.25
Capacity (veh/h)	423	425	373	426
Control Delay (s)	699.5	217.3	28.4	156.0
Approach Delay (s)	699.5	217.3	28.4	156.0
Approach LOS	F	F	D	F

Intersection Summary			
Delay	391.8		
HCM Level of Service	F		
Intersection Capacity Utilization	124.0%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	302	23	47	290	46	24	225	21	32	158	24
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.98			0.99			0.98	
Flt Protected		0.99			0.99			1.00			0.99	
Satd. Flow (prot)		1823			1806			1825			1806	
Flt Permitted		0.91			0.93			0.97			0.93	
Satd. Flow (perm)		1663			1682			1770			1684	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	318	24	49	305	48	25	237	22	34	166	25
RTOR Reduction (vph)	0	4	0	0	8	0	0	5	0	0	8	0
Lane Group Flow (vph)	0	398	0	0	394	0	0	279	0	0	218	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1026			1037			443			421	
v/s Ratio Prot												
v/s Ratio Perm		c0.24			0.23			c0.16			0.13	
v/c Ratio		0.39			0.38			0.63			0.52	
Uniform Delay, d1		5.8			5.8			20.0			19.4	
Progression Factor		0.52			0.33			1.45			1.00	
Incremental Delay, d2		1.0			1.0			4.8			4.5	
Delay (s)		4.0			2.9			33.9			23.9	
Level of Service		A			A			C			C	
Approach Delay (s)		4.0			2.9			33.9			23.9	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.1%	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)	65	775	56	83	549	30	39	177	90	29	185	73
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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	0.99			0.96			0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1765	1828		1770	1845			1765			1781	
Flt Permitted	0.31	1.00		0.13	1.00			0.94			0.95	
Satd. Flow (perm)	585	1828		249	1845			1670			1708	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	816	59	87	578	32	41	186	95	31	195	77
RTOR Reduction (vph)	0	4	0	0	3	0	0	25	0	0	20	0
Lane Group Flow (vph)	68	871	0	87	607	0	0	297	0	0	283	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			18.5			18.5	
Effective Green, g (s)	34.0	34.0		34.0	34.0			18.0			18.0	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.30			0.30	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	332	1036		141	1046			501			512	
v/s Ratio Prot		c0.48			0.33							
v/s Ratio Perm	0.12			0.35				c0.18			0.17	
v/c Ratio	0.20	0.84		0.62	0.58			0.59			0.55	
Uniform Delay, d1	6.4	10.8		8.7	8.4			17.9			17.6	
Progression Factor	0.33	0.94		1.37	1.15			0.50			1.48	
Incremental Delay, d2	1.3	7.8		14.8	1.8			3.3			4.0	
Delay (s)	3.4	17.9		26.6	11.5			12.2			30.1	
Level of Service	A	B		C	B			B			C	
Approach Delay (s)		16.9			13.4			12.2			30.1	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
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)	89	228	9	393	219	286	2	1082	310	231	979	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1822	1538		1805	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.48	1.00		0.51	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		891	1538		954	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	94	240	9	414	231	301	2	1139	326	243	1031	158
RTOR Reduction (vph)	0	0	5	0	0	0	0	0	226	0	0	0
Lane Group Flow (vph)	0	334	4	0	645	301	2	1139	100	243	1031	158
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		39.0	39.0		39.0	82.4	0.8	25.4	25.4	8.0	33.6	82.4
Effective Green, g (s)		39.0	39.0		39.0	82.4	0.8	25.4	25.4	8.0	33.6	82.4
Actuated g/C Ratio		0.47	0.47		0.47	1.00	0.01	0.31	0.31	0.10	0.41	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		422	728		452	1583	17	1060	474	167	1402	1583
v/s Ratio Prot							0.00	c0.33		c0.14	0.30	
v/s Ratio Perm		0.37	0.00		c0.68	0.19			0.07			0.10
v/c Ratio		0.79	0.01		1.43	0.19	0.12	1.07	0.21	1.46	0.74	0.10
Uniform Delay, d1		18.3	11.5		21.7	0.0	40.5	28.5	21.1	37.2	20.6	0.0
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		9.8	0.0		204.6	0.3	3.1	50.0	1.0	234.8	3.5	0.1
Delay (s)		28.0	11.5		226.3	0.3	43.5	78.5	22.1	272.0	24.1	0.1
Level of Service		C	B		F	A	D	E	C	F	C	A
Approach Delay (s)		27.6			154.4			65.9			63.5	
Approach LOS		C			F			E			E	

Intersection Summary			
HCM Average Control Delay	81.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	82.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	106.2%	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)	10	730	20	274	350	31	0	34	168	23	38	10
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	0.99			0.89			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.98	
Satd. Flow (prot)	1770	1855		1770	1840			1654			1798	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			0.87	
Satd. Flow (perm)	1770	1855		1770	1840			1654			1584	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	793	22	298	380	34	0	37	183	25	41	11
RTOR Reduction (vph)	0	1	0	0	4	0	0	146	0	0	8	0
Lane Group Flow (vph)	11	814	0	298	410	0	0	74	0	0	69	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	0.8	39.1		14.9	53.2			17.0			17.0	
Effective Green, g (s)	0.8	39.1		14.9	53.2			17.0			17.0	
Actuated g/C Ratio	0.01	0.47		0.18	0.64			0.20			0.20	
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)	17	874		318	1179			339			324	
v/s Ratio Prot	0.01	c0.44		c0.17	0.22			c0.05				
v/s Ratio Perm											0.04	
v/c Ratio	0.65	0.93		0.94	0.35			0.22			0.21	
Uniform Delay, d1	41.0	20.7		33.6	6.9			27.5			27.4	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	62.0	16.2		34.0	0.2			1.5			1.5	
Delay (s)	103.0	36.9		67.6	7.1			29.0			28.9	
Level of Service	F	D		E	A			C			C	
Approach Delay (s)		37.8			32.4			29.0			28.9	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	83.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
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)	355	877	198	64	618	180	30	316	187	67	766	457
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	0.98		1.00	0.97		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1271	1496	2837		1547	2833		1547	3094	1316
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1271	1496	2837		1547	2833		1547	3094	1316
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	374	923	208	67	651	189	32	333	197	71	806	481
RTOR Reduction (vph)	0	0	123	0	21	0	0	66	0	0	0	27
Lane Group Flow (vph)	374	923	85	67	819	0	32	464	0	71	806	454
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	22.7	45.5	45.5	18.4	41.2		2.7	31.3		6.6	35.2	57.9
Effective Green, g (s)	22.7	45.5	45.5	18.4	41.2		2.7	32.3		6.6	36.2	59.9
Actuated g/C Ratio	0.19	0.38	0.38	0.15	0.35		0.02	0.27		0.06	0.30	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	535	1146	487	232	984		35	770		86	943	664
v/s Ratio Prot	c0.13	c0.31		0.04	0.29		0.02	0.16		c0.05	c0.26	c0.14
v/s Ratio Perm			0.07									0.21
v/c Ratio	0.70	0.81	0.17	0.29	0.83		0.91	0.60		0.83	0.85	0.68
Uniform Delay, d1	44.9	32.7	24.2	44.4	35.6		57.9	37.7		55.5	38.8	22.3
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	4.0	4.2	0.2	0.7	6.1		116.7	1.3		44.9	7.6	2.9
Delay (s)	48.8	36.9	24.4	45.1	41.7		174.6	39.0		100.4	46.5	25.2
Level of Service	D	D	C	D	D		F	D		F	D	C
Approach Delay (s)		38.2			42.0			46.7			41.8	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	118.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.7%	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)	470	389	240	110	385	130	304	241	28	91	844	59
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.98		1.00	1.00	0.93	1.00	1.00	0.93
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3195		1770	3245		3433	3539	1474	3335	3539	1437
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3195		1770	3245		3433	3539	1474	3335	3539	1437
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	495	409	253	116	405	137	320	254	29	96	888	62
RTOR Reduction (vph)	0	78	0	0	28	0	0	0	20	0	0	44
Lane Group Flow (vph)	495	584	0	116	514	0	320	254	9	96	888	18
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	35.0	35.0		24.5	24.5		12.0	35.9	35.9	6.9	30.8	30.8
Effective Green, g (s)	34.1	34.1		23.6	23.6		11.7	36.1	36.1	6.6	31.0	31.0
Actuated g/C Ratio	0.29	0.29		0.20	0.20		0.10	0.31	0.31	0.06	0.27	0.27
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	504	936		359	658		345	1098	457	189	943	383
v/s Ratio Prot	c0.29	0.18		0.07	c0.16		c0.09	0.07		0.03	c0.25	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.98	0.62		0.32	0.78		0.93	0.23	0.02	0.51	0.94	0.05
Uniform Delay, d1	40.8	35.6		39.6	44.0		51.9	29.8	27.9	53.3	41.8	31.7
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	35.2	0.9		0.2	5.6		29.8	0.0	0.0	0.8	16.8	0.0
Delay (s)	76.0	36.5		39.8	49.5		81.8	29.9	27.9	54.1	58.6	31.7
Level of Service	E	D		D	D		F	C	C	D	E	C
Approach Delay (s)		53.4			47.8			57.3			56.6	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	54.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	116.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	380	352	33	3	16	262	451	220	526	16	267	561
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1837				3529	1583		1831		1770	1863
Flt Permitted	0.49	1.00				0.81	1.00		0.58		0.95	1.00
Satd. Flow (perm)	912	1837				2861	1583		1082		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	400	371	35	3	17	276	475	232	554	17	281	591
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	400	409	0	0	0	293	475	0	802	0	281	591
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	29.6	29.6				29.6	112.7		51.3		9.0	63.3
Effective Green, g (s)	29.6	29.6				29.6	112.7		51.3		9.0	63.3
Actuated g/C Ratio	0.26	0.26				0.26	1.00		0.46		0.08	0.56
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	240	482				751	1583		493		141	1046
v/s Ratio Prot		0.22									c0.16	
v/s Ratio Perm	c0.44					0.10	0.30		c0.74			0.32
v/c Ratio	1.67	0.85				0.39	0.30		1.63		1.99	0.57
Uniform Delay, d1	41.5	39.4				34.1	0.0		30.7		51.9	15.9
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	317.7	13.1				0.3	0.5		291.6		471.1	0.7
Delay (s)	359.3	52.5				34.5	0.5		322.3		523.0	16.6
Level of Service	F	D				C	A		F		F	B
Approach Delay (s)		204.2				13.5			322.3			116.8
Approach LOS		F				B			F			F

Intersection Summary			
HCM Average Control Delay	155.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.59		
Actuated Cycle Length (s)	112.7	Sum of lost time (s)	14.4
Intersection Capacity Utilization	120.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	129	388	5	74	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	408	5	78	4
RTOR Reduction (vph)	83	0	0	0	0
Lane Group Flow (vph)	461	0	0	83	4
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	63.3			8.4	8.4
Effective Green, g (s)	63.3			8.4	8.4
Actuated g/C Ratio	0.56			0.07	0.07
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	889			132	118
v/s Ratio Prot				c0.05	
v/s Ratio Perm	0.29				0.00
v/c Ratio	0.52			0.63	0.03
Uniform Delay, d1	15.3			50.6	48.4
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.5			6.6	0.0
Delay (s)	15.8			57.2	48.4
Level of Service	B			E	D
Approach Delay (s)				56.8	
Approach LOS				E	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	26	929	766	35	20	15
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)	28	1010	833	38	22	16
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	871				1918	852
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	871				1918	852
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				70	95
cM capacity (veh/h)	774				71	360

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	1038	871	38
Volume Left	28	0	22
Volume Right	0	38	16
cSH	774	1700	109
Volume to Capacity	0.04	0.51	0.35
Queue Length 95th (ft)	3	0	35
Control Delay (s)	1.1	0.0	55.0
Lane LOS	A		F
Approach Delay (s)	1.1	0.0	55.0
Approach LOS			F

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	45	10	0	0	0	17	5	282	5	483	78
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)	0	49	11	0	0	0	18	5	307	5	525	85
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	774	927	567	809	816	159	610			312		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	774	927	567	809	816	159	610			312		
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 %	100	81	98	100	100	100	98			100		
cM capacity (veh/h)	310	262	523	246	304	887	969			1248		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	60	0	330	615
Volume Left	0	0	18	5
Volume Right	11	0	307	85
cSH	288	1700	969	1248
Volume to Capacity	0.21	0.00	0.02	0.00
Queue Length 95th (ft)	19	0	1	0
Control Delay (s)	20.7	0.0	0.7	0.1
Lane LOS	C	A	A	A
Approach Delay (s)	20.7	0.0	0.7	0.1
Approach LOS	C	A		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	41.7%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D:

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS (CUMULATIVE 2030 BASE PLUS ALTERNATIVE 1 CONDITIONS)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	346	32	9	15	102	405	33	1320	26	58	1312	304
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.90			1.00		1.00	0.97	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1777			1587			3420		1719	3314	
Flt Permitted		0.30			0.98			0.61		0.95	1.00	
Satd. Flow (perm)		549			1563			2079		1719	3314	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	364	34	9	16	107	426	35	1389	27	61	1381	320
RTOR Reduction (vph)	0	1	0	0	0	0	0	1	0	0	17	0
Lane Group Flow (vph)	0	406	0	0	549	0	0	1450	0	61	1684	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		49.5			49.5			55.5		5.0	55.5	
Effective Green, g (s)		49.0			49.0			55.0		4.0	55.0	
Actuated g/C Ratio		0.41			0.41			0.46		0.03	0.46	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		224			638			953		57	1519	
v/s Ratio Prot										c0.04	0.51	
v/s Ratio Perm		c0.74			0.35			c0.70				
v/c Ratio		1.81			0.86			1.52		1.07	1.11	
Uniform Delay, d1		35.5			32.4			32.5		58.0	32.5	
Progression Factor		1.00			1.00			0.53		1.00	1.00	
Incremental Delay, d2		383.6			11.4			235.1		140.1	59.0	
Delay (s)		419.1			43.8			252.3		198.1	91.5	
Level of Service		F			D			F		F	F	
Approach Delay (s)		419.1			43.8			252.3			95.2	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	174.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	124.4%	ICU Level of Service	H
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)	320	199	33	39	373	218	8	986	25	89	879	408
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.98	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.95			1.00		1.00	0.95	
Flt Protected		0.97			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1740			1703			3421		1719	3210	
Flt Permitted		0.41			0.94			0.77		0.95	1.00	
Satd. Flow (perm)		728			1606			2621		1719	3210	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	337	209	35	41	393	229	8	1038	26	94	925	429
RTOR Reduction (vph)	0	2	0	0	16	0	0	1	0	0	46	0
Lane Group Flow (vph)	0	579	0	0	647	0	0	1071	0	94	1309	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2	
Permitted Phases	4			8			6					
Actuated Green, G (s)		62.5			62.5			41.5		6.0	50.5	
Effective Green, g (s)		62.0			62.0			41.0		5.0	50.0	
Actuated g/C Ratio		0.52			0.52			0.34		0.04	0.42	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		0.2			0.2			0.2		0.2	0.2	
Lane Grp Cap (vph)		376			830			896		72	1338	
v/s Ratio Prot										0.05	c0.41	
v/s Ratio Perm		c0.80			0.40			c0.41				
v/c Ratio		1.54			0.78			1.19		1.31	0.98	
Uniform Delay, d1		29.0			23.5			39.5		57.5	34.5	
Progression Factor		1.00			1.00			1.25		0.72	0.50	
Incremental Delay, d2		256.0			4.3			97.1		146.5	3.9	
Delay (s)		285.0			27.7			146.3		187.8	21.1	
Level of Service		F			C			F		F	C	
Approach Delay (s)		285.0			27.7			146.3			31.9	
Approach LOS		F			C			F			C	

Intersection Summary			
HCM Average Control Delay	102.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	145.1%	ICU Level of Service	H
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)	44	159	29	23	205	149	42	776	38	85	929	15
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			0.99			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.98			0.95			0.99			1.00	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1810			1746			3410			3422	
Flt Permitted	0.42	1.00			0.98			0.86			0.79	
Satd. Flow (perm)	775	1810			1712			2955			2711	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	46	167	31	24	216	157	44	817	40	89	978	16
RTOR Reduction (vph)	0	11	0	0	39	0	0	6	0	0	2	0
Lane Group Flow (vph)	46	187	0	0	358	0	0	896	0	0	1082	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	284	664			628			1478			1356	
v/s Ratio Prot		0.10										
v/s Ratio Perm	0.06				c0.21			0.30			c0.40	
v/c Ratio	0.16	0.28			0.57			0.61			0.80	
Uniform Delay, d1	12.8	13.4			15.2			10.8			12.5	
Progression Factor	0.97	0.95			1.47			0.40			1.00	
Incremental Delay, d2	1.2	1.0			2.7			1.4			2.0	
Delay (s)	13.6	13.8			25.1			5.7			14.4	
Level of Service	B	B			C			A			B	
Approach Delay (s)		13.8			25.1			5.7			14.4	
Approach LOS		B			C			A			B	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.7%	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		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	167	472	35	24	733	25	37	97	70	11	75	203
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)	182	513	38	26	797	27	40	105	76	12	82	221

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	733	850	222	314
Volume Left (vph)	182	26	40	12
Volume Right (vph)	38	27	76	221
Hadj (s)	0.05	0.02	-0.14	-0.38
Departure Headway (s)	7.7	7.7	8.6	8.0
Degree Utilization, x	1.56	1.81	0.53	0.70
Capacity (veh/h)	476	477	397	441
Control Delay (s)	284.7	390.8	21.1	27.3
Approach Delay (s)	284.7	390.8	21.1	27.3
Approach LOS	F	F	C	D

Intersection Summary			
Delay	261.5		
HCM Level of Service	F		
Intersection Capacity Utilization	114.0%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	278	14	16	247	12	13	179	37	10	119	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.98			1.00	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1840			1839			1800			1841	
Flt Permitted		0.98			0.98			0.98			0.97	
Satd. Flow (perm)		1813			1805			1773			1796	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	293	15	17	260	13	14	188	39	11	125	5
RTOR Reduction (vph)	0	3	0	0	3	0	0	11	0	0	2	0
Lane Group Flow (vph)	0	321	0	0	287	0	0	230	0	0	139	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1118			1113			443			449	
v/s Ratio Prot												
v/s Ratio Perm		c0.18			0.16			c0.13			0.08	
v/c Ratio		0.29			0.26			0.52			0.31	
Uniform Delay, d1		5.4			5.2			19.4			18.3	
Progression Factor		0.74			0.42			1.02			1.00	
Incremental Delay, d2		0.6			0.5			3.6			1.8	
Delay (s)		4.6			2.6			23.3			20.1	
Level of Service		A			A			C			C	
Approach Delay (s)		4.6			2.6			23.3			20.1	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.2%	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)	74	603	22	59	572	15	20	140	62	27	97	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	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.96			0.97	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1765	1845		1726	1854			1773			1784	
Flt Permitted	0.31	1.00		0.28	1.00			0.97			0.93	
Satd. Flow (perm)	574	1845		510	1854			1726			1673	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	635	23	62	602	16	21	147	65	28	102	36
RTOR Reduction (vph)	0	2	0	0	2	0	0	23	0	0	17	0
Lane Group Flow (vph)	78	656	0	62	616	0	0	210	0	0	149	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			18.5			18.5	
Effective Green, g (s)	34.0	34.0		34.0	34.0			18.0			18.0	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.30			0.30	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	325	1046		289	1051			518			502	
v/s Ratio Prot		c0.36			0.33							
v/s Ratio Perm	0.14			0.12				c0.12			0.09	
v/c Ratio	0.24	0.63		0.21	0.59			0.41			0.30	
Uniform Delay, d1	6.5	8.7		6.4	8.4			16.7			16.1	
Progression Factor	0.40	0.68		2.16	2.15			1.16			0.37	
Incremental Delay, d2	1.7	2.7		1.5	2.2			2.0			1.5	
Delay (s)	4.2	8.6		15.4	20.3			21.4			7.5	
Level of Service	A	A		B	C			C			A	
Approach Delay (s)		8.2			19.9			21.4			7.5	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.5%	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)	63	176	18	290	396	515	9	1334	393	369	938	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1824	1538		1824	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.31	1.00		0.63	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		565	1538		1180	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	66	185	19	305	417	542	9	1404	414	388	987	195
RTOR Reduction (vph)	0	0	11	0	0	217	0	0	197	0	0	43
Lane Group Flow (vph)	0	251	8	0	722	325	9	1404	217	388	987	152
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		48.0	48.0		48.0	48.0	0.8	34.4	34.4	20.0	54.6	54.6
Effective Green, g (s)		48.0	48.0		48.0	48.0	0.8	34.4	34.4	20.0	54.6	54.6
Actuated g/C Ratio		0.43	0.43		0.43	0.43	0.01	0.31	0.31	0.18	0.49	0.49
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		241	657		504	676	13	1052	471	306	1670	769
v/s Ratio Prot							0.01	c0.41		c0.23	0.29	
v/s Ratio Perm		0.44	0.01		c0.61	0.21			0.14			0.10
v/c Ratio		1.04	0.01		1.43	0.48	0.69	1.33	0.46	1.27	0.59	0.20
Uniform Delay, d1		32.2	18.5		32.2	23.2	55.7	39.0	31.5	46.2	20.8	16.4
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		69.2	0.0		205.8	0.5	96.3	157.1	3.2	143.9	1.5	0.6
Delay (s)		101.4	18.6		238.0	23.8	152.0	196.1	34.7	190.1	22.4	17.0
Level of Service		F	B		F	C	F	F	C	F	C	B
Approach Delay (s)		95.6			146.1			159.3			63.2	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM Average Control Delay	121.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	120.3%	ICU Level of Service	H
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)	10	388	20	150	520	35	0	37	215	20	46	10
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	0.99			0.88			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1770	1849		1770	1845			1648			1805	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			0.77	
Satd. Flow (perm)	1770	1849		1770	1845			1648			1410	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	422	22	163	565	38	0	40	234	22	50	11
RTOR Reduction (vph)	0	3	0	0	4	0	0	191	0	0	9	0
Lane Group Flow (vph)	11	441	0	163	599	0	0	83	0	0	74	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	0.6	18.0		6.8	24.2			8.4			8.4	
Effective Green, g (s)	0.6	18.0		6.8	24.2			8.4			8.4	
Actuated g/C Ratio	0.01	0.40		0.15	0.54			0.19			0.19	
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)	23	736		266	988			306			262	
v/s Ratio Prot	0.01	0.24		c0.09	c0.32			0.05				
v/s Ratio Perm											c0.05	
v/c Ratio	0.48	0.60		0.61	0.61			0.27			0.28	
Uniform Delay, d1	22.1	10.7		18.0	7.2			15.8			15.8	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	14.8	1.3		4.1	1.1			0.5			0.6	
Delay (s)	37.0	12.1		22.1	8.3			16.3			16.4	
Level of Service	D	B		C	A			B			B	
Approach Delay (s)		12.7			11.2			16.3			16.4	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	45.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.7%	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)	383	528	5	33	736	27	123	813	62	50	431	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	1.00		1.00	0.99		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1268	1496	2967		1547	3043		1547	3094	1319
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1268	1496	2967		1547	3043		1547	3094	1319
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	403	556	5	35	775	28	129	856	65	53	454	467
RTOR Reduction (vph)	0	0	3	0	2	0	0	5	0	0	0	33
Lane Group Flow (vph)	403	556	2	35	801	0	129	916	0	53	454	434
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	23.0	41.5	41.5	18.6	37.1		15.1	40.3		4.5	29.7	52.7
Effective Green, g (s)	23.0	41.5	41.5	18.6	37.1		15.1	41.3		4.5	30.7	54.7
Actuated g/C Ratio	0.19	0.34	0.34	0.15	0.30		0.12	0.34		0.04	0.25	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	528	1018	432	228	903		192	1031		57	779	592
v/s Ratio Prot	c0.14	0.19		0.02	c0.27		0.08	c0.30		c0.03	0.15	c0.14
v/s Ratio Perm			0.00									0.18
v/c Ratio	0.76	0.55	0.00	0.15	0.89		0.67	0.89		0.93	0.58	0.73
Uniform Delay, d1	46.9	32.6	26.5	44.8	40.4		51.0	38.1		58.5	40.0	27.6
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	6.5	0.6	0.0	0.3	10.5		8.9	9.5		92.7	1.1	4.7
Delay (s)	53.3	33.2	26.6	45.1	50.9		59.9	47.6		151.2	41.1	32.3
Level of Service	D	C	C	D	D		E	D		F	D	C
Approach Delay (s)		41.6			50.6			49.1			42.9	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	46.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	121.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.0%	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)	129	241	247	36	359	123	319	965	108	196	248	42
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.92		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3124		1770	3248		3433	3539	1481	3335	3539	1444
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3124		1770	3248		3433	3539	1481	3335	3539	1444
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	254	260	38	378	129	336	1016	114	206	261	44
RTOR Reduction (vph)	0	162	0	0	28	0	0	0	70	0	0	31
Lane Group Flow (vph)	136	352	0	38	479	0	336	1016	44	206	261	13
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	26.0	26.0		23.5	23.5		13.1	34.7	34.7	9.0	30.6	30.6
Effective Green, g (s)	25.1	25.1		22.6	22.6		12.8	34.9	34.9	8.7	30.8	30.8
Actuated g/C Ratio	0.23	0.23		0.21	0.21		0.12	0.33	0.33	0.08	0.29	0.29
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	402	731		373	684		410	1151	482	270	1016	414
v/s Ratio Prot	0.08	c0.11		0.02	c0.15		0.10	c0.29		c0.06	0.07	
v/s Ratio Perm									0.03			0.01
v/c Ratio	0.34	0.48		0.10	0.70		0.82	0.88	0.09	0.76	0.26	0.03
Uniform Delay, d1	34.2	35.5		34.2	39.2		46.1	34.3	25.2	48.3	29.4	27.5
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	0.2	0.2		0.0	2.5		11.5	8.0	0.0	10.9	0.0	0.0
Delay (s)	34.4	35.7		34.2	41.7		57.6	42.3	25.2	59.2	29.5	27.5
Level of Service	C	D		C	D		E	D	C	E	C	C
Approach Delay (s)		35.4			41.2			44.5			41.3	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	107.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Volume (vph)	408	655	149	7	2	4	469	282	116	473	3	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5					3.5	4.0		3.8		3.0
Lane Util. Factor	1.00	1.00					0.95	1.00		1.00		1.00
Frt	1.00	0.97					1.00	0.85		1.00		1.00
Flt Protected	0.95	1.00					1.00	1.00		0.99		0.95
Satd. Flow (prot)	1770	1809					3537	1583		1843		1770
Flt Permitted	0.37	1.00					0.80	1.00		0.68		0.95
Satd. Flow (perm)	685	1809					2820	1583		1266		1770
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	429	689	157	7	2	4	494	297	122	498	3	233
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	429	853	0	0	0	0	500	297	0	623	0	233
Turn Type	Perm				Perm	Perm		Free	Perm			Prot
Protected Phases		3					3			6		5
Permitted Phases	3				3	3		Free	6			
Actuated Green, G (s)	30.6	30.6					30.6	89.5		25.3		12.1
Effective Green, g (s)	30.6	30.6					30.6	89.5		25.3		12.1
Actuated g/C Ratio	0.34	0.34					0.34	1.00		0.28		0.14
Clearance Time (s)	3.5	3.5					3.5			3.8		3.0
Vehicle Extension (s)	3.0	3.0					3.0			3.0		3.0
Lane Grp Cap (vph)	234	618					964	1583		358		239
v/s Ratio Prot		0.47										c0.13
v/s Ratio Perm	c0.63						0.18	0.19		c0.49		
v/c Ratio	1.83	1.38					0.52	0.19		1.74		0.97
Uniform Delay, d1	29.4	29.4					23.6	0.0		32.1		38.5
Progression Factor	1.00	1.00					1.00	1.00		1.00		1.00
Incremental Delay, d2	391.2	181.1					0.5	0.3		344.5		50.7
Delay (s)	420.7	210.6					24.0	0.3		376.6		89.3
Level of Service	F	F					C	A		F		F
Approach Delay (s)		280.9					15.2			376.6		
Approach LOS		F					B			F		

Intersection Summary			
HCM Average Control Delay	161.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.4
Intersection Capacity Utilization	138.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR	SBR2	NEL	NER
Lane Configurations					
Volume (vph)	544	61	347	72	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8	3.8		4.1	4.1
Lane Util. Factor	1.00	1.00		1.00	1.00
Frt	1.00	0.85		1.00	0.85
Flt Protected	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1863	1583		1770	1583
Flt Permitted	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1863	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	573	64	365	76	3
RTOR Reduction (vph)	0	195	0	0	0
Lane Group Flow (vph)	573	234	0	76	3
Turn Type		Perm			Perm
Protected Phases	2			4	
Permitted Phases		2			4
Actuated Green, G (s)	40.4	40.4		7.1	7.1
Effective Green, g (s)	40.4	40.4		7.1	7.1
Actuated g/C Ratio	0.45	0.45		0.08	0.08
Clearance Time (s)	3.8	3.8		4.1	4.1
Vehicle Extension (s)	3.0	3.0		2.0	2.0
Lane Grp Cap (vph)	841	715		140	126
v/s Ratio Prot	0.31			c0.04	
v/s Ratio Perm		0.15			0.00
v/c Ratio	0.68	0.33		0.54	0.02
Uniform Delay, d1	19.5	15.8		39.6	38.0
Progression Factor	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.3	0.3		2.3	0.0
Delay (s)	21.7	16.1		41.9	38.0
Level of Service	C	B		D	D
Approach Delay (s)	32.5			41.8	
Approach LOS	C			D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	3	661	968	4	13	9
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)	3	718	1052	4	14	10
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	1057				1779	1054
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1057				1779	1054
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				84	96
cM capacity (veh/h)	659				90	274

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	722	1057	24
Volume Left	3	0	14
Volume Right	0	4	10
cSH	659	1700	124
Volume to Capacity	0.00	0.62	0.19
Queue Length 95th (ft)	0	0	17
Control Delay (s)	0.1	0.0	40.8
Lane LOS	A		E
Approach Delay (s)	0.1	0.0	40.8
Approach LOS			E

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	61.2%	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)	0	28	6	0	0	0	2	5	287	5	282	10
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)	0	30	7	0	0	0	2	5	312	5	307	11
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	489	645	312	510	494	161	317			317		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	489	645	312	510	494	161	317			317		
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 %	100	92	99	100	100	100	100			100		
cM capacity (veh/h)	487	389	728	439	473	884	1243			1243		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	37	0	320	323
Volume Left	0	0	2	5
Volume Right	7	0	312	11
cSH	423	1700	1243	1243
Volume to Capacity	0.09	0.00	0.00	0.00
Queue Length 95th (ft)	7	0	0	0
Control Delay (s)	14.3	0.0	0.1	0.2
Lane LOS	B	A	A	A
Approach Delay (s)	14.3	0.0	0.1	0.2
Approach LOS	B	A		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	29.2%	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)	393	47	25	18	68	147	7	1573	26	50	1218	446
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.98	
Flpb, ped/bikes		0.99			1.00			1.00		1.00	1.00	
Frt		0.99			0.91			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1758			1632			3425		1719	3269	
Flt Permitted		0.52			0.95			0.79		0.95	1.00	
Satd. Flow (perm)		953			1559			2708		1719	3269	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	414	49	26	19	72	155	7	1656	27	53	1282	469
RTOR Reduction (vph)	0	2	0	0	0	0	0	1	0	0	31	0
Lane Group Flow (vph)	0	487	0	0	246	0	0	1689	0	53	1720	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		46.5			46.5			59.5		4.0	59.5	
Effective Green, g (s)		46.0			46.0			59.0		3.0	59.0	
Actuated g/C Ratio		0.38			0.38			0.49		0.02	0.49	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		365			598			1331		43	1607	
v/s Ratio Prot										c0.03	0.53	
v/s Ratio Perm		c0.51			0.16			c0.62				
v/c Ratio		1.33			0.41			1.27		1.23	1.07	
Uniform Delay, d1		37.0			27.1			30.5		58.5	30.5	
Progression Factor		1.00			1.00			0.43		1.00	1.00	
Incremental Delay, d2		168.2			0.5			121.6		213.4	43.9	
Delay (s)		205.2			27.6			134.7		271.9	74.4	
Level of Service		F			C			F		F	E	
Approach Delay (s)		205.2			27.6			134.7			80.2	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM Average Control Delay	113.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	100.2%	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)	415	422	44	42	208	94	13	1116	43	182	971	296
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.96			0.99		1.00	0.96	
Flt Protected		0.98			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1748			1719			3413		1719	3269	
Flt Permitted		0.62			0.85			0.83		0.95	1.00	
Satd. Flow (perm)		1116			1475			2839		1719	3269	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	437	444	46	44	219	99	14	1175	45	192	1022	312
RTOR Reduction (vph)	0	1	0	0	11	0	0	2	0	0	24	0
Lane Group Flow (vph)	0	926	0	0	351	0	0	1232	0	192	1310	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2	
Permitted Phases	4			8			6					
Actuated Green, G (s)		61.5			61.5			39.5		9.0	51.5	
Effective Green, g (s)		61.0			61.0			39.0		8.0	51.0	
Actuated g/C Ratio		0.51			0.51			0.32		0.07	0.42	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		0.2			0.2			0.2		0.2	0.2	
Lane Grp Cap (vph)		567			750			923		115	1389	
v/s Ratio Prot										c0.11	0.40	
v/s Ratio Perm		c0.83			0.24			c0.43				
v/c Ratio		1.63			0.47			1.33		1.67	0.94	
Uniform Delay, d1		29.5			19.0			40.5		56.0	33.1	
Progression Factor		1.00			1.00			0.86		1.38	0.75	
Incremental Delay, d2		292.5			0.2			155.4		315.1	6.3	
Delay (s)		322.0			19.2			190.3		392.1	31.2	
Level of Service		F			B			F		F	C	
Approach Delay (s)		322.0			19.2			190.3			76.6	
Approach LOS		F			B			F			E	

Intersection Summary			
HCM Average Control Delay	162.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	149.7%	ICU Level of Service	H
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)	37	399	32	16	272	37	7	1187	28	20	873	43
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.98			1.00			0.99	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1838			1826			3426			3409	
Flt Permitted	0.46	1.00			0.97			0.95			0.92	
Satd. Flow (perm)	863	1838			1780			3257			3124	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	39	420	34	17	286	39	7	1249	29	21	919	45
RTOR Reduction (vph)	0	5	0	0	8	0	0	3	0	0	6	0
Lane Group Flow (vph)	39	449	0	0	334	0	0	1283	0	0	980	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	316	674			653			1629			1562	
v/s Ratio Prot		c0.24										
v/s Ratio Perm	0.05				0.19			c0.39			0.31	
v/c Ratio	0.12	0.67			0.51			0.79			0.63	
Uniform Delay, d1	12.6	15.9			14.8			12.4			10.9	
Progression Factor	1.08	1.12			0.89			0.94			2.15	
Incremental Delay, d2	0.8	5.0			2.7			3.8			0.6	
Delay (s)	14.4	22.8			16.0			15.4			24.1	
Level of Service	B	C			B			B			C	
Approach Delay (s)		22.2			16.0			15.4			24.1	
Approach LOS		C			B			B			C	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	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		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	153	756	24	22	480	16	30	118	70	55	162	268
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)	166	822	26	24	522	17	33	128	76	60	176	291

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	1014	563	237	527
Volume Left (vph)	166	24	33	60
Volume Right (vph)	26	17	76	291
Hadj (s)	0.05	0.02	-0.13	-0.27
Departure Headway (s)	8.6	8.6	9.4	8.3
Degree Utilization, x	2.43	1.35	0.62	1.22
Capacity (veh/h)	426	427	373	424
Control Delay (s)	671.2	196.0	26.7	143.6
Approach Delay (s)	671.2	196.0	26.7	143.6
Approach LOS	F	F	D	F

Intersection Summary			
Delay	372.9		
HCM Level of Service	F		
Intersection Capacity Utilization	122.6%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	302	23	47	290	46	24	216	21	32	153	24
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.98			0.99			0.98	
Flt Protected		0.99			0.99			1.00			0.99	
Satd. Flow (prot)		1823			1806			1824			1805	
Flt Permitted		0.91			0.93			0.96			0.93	
Satd. Flow (perm)		1663			1682			1765			1689	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	318	24	49	305	48	25	227	22	34	161	25
RTOR Reduction (vph)	0	4	0	0	8	0	0	5	0	0	8	0
Lane Group Flow (vph)	0	398	0	0	394	0	0	269	0	0	213	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1026			1037			441			422	
v/s Ratio Prot												
v/s Ratio Perm		c0.24			0.23			c0.15			0.13	
v/c Ratio		0.39			0.38			0.61			0.50	
Uniform Delay, d1		5.8			5.8			19.9			19.3	
Progression Factor		0.52			0.33			1.44			1.00	
Incremental Delay, d2		1.0			1.0			4.5			4.2	
Delay (s)		4.0			2.9			33.1			23.6	
Level of Service		A			A			C			C	
Approach Delay (s)		4.0			2.9			33.1			23.6	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.7%	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)	65	775	56	83	549	30	39	168	90	29	180	73
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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	0.99			0.96			0.96	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1765	1828		1770	1845			1762			1779	
Flt Permitted	0.31	1.00		0.13	1.00			0.94			0.95	
Satd. Flow (perm)	585	1828		249	1845			1666			1706	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	816	59	87	578	32	41	177	95	31	189	77
RTOR Reduction (vph)	0	4	0	0	3	0	0	26	0	0	21	0
Lane Group Flow (vph)	68	871	0	87	607	0	0	287	0	0	276	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			18.5			18.5	
Effective Green, g (s)	34.0	34.0		34.0	34.0			18.0			18.0	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.30			0.30	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	332	1036		141	1046			500			512	
v/s Ratio Prot		c0.48			0.33							
v/s Ratio Perm	0.12			0.35				c0.17			0.16	
v/c Ratio	0.20	0.84		0.62	0.58			0.57			0.54	
Uniform Delay, d1	6.4	10.8		8.7	8.4			17.8			17.5	
Progression Factor	0.33	0.94		1.37	1.15			0.50			1.48	
Incremental Delay, d2	1.3	7.8		14.8	1.8			3.0			3.8	
Delay (s)	3.4	17.9		26.6	11.5			11.8			29.7	
Level of Service	A	B		C	B			B			C	
Approach Delay (s)		16.9			13.4			11.8			29.7	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.9%	ICU Level of Service	E
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)	84	228	9	393	219	286	2	1082	310	231	979	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1824	1538		1805	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.50	1.00		0.52	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		927	1538		965	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	88	240	9	414	231	301	2	1139	326	243	1031	147
RTOR Reduction (vph)	0	0	5	0	0	0	0	0	226	0	0	0
Lane Group Flow (vph)	0	328	4	0	645	301	2	1139	100	243	1031	147
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		39.0	39.0		39.0	82.4	0.8	25.4	25.4	8.0	33.6	82.4
Effective Green, g (s)		39.0	39.0		39.0	82.4	0.8	25.4	25.4	8.0	33.6	82.4
Actuated g/C Ratio		0.47	0.47		0.47	1.00	0.01	0.31	0.31	0.10	0.41	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		439	728		457	1583	17	1060	474	167	1402	1583
v/s Ratio Prot							0.00	c0.33		c0.14	0.30	
v/s Ratio Perm		0.35	0.00		c0.67	0.19			0.07			0.09
v/c Ratio		0.75	0.01		1.41	0.19	0.12	1.07	0.21	1.46	0.74	0.09
Uniform Delay, d1		17.7	11.5		21.7	0.0	40.5	28.5	21.1	37.2	20.6	0.0
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		6.8	0.0		197.8	0.3	3.1	50.0	1.0	234.8	3.5	0.1
Delay (s)		24.5	11.5		219.5	0.3	43.5	78.5	22.1	272.0	24.1	0.1
Level of Service		C	B		F	A	D	E	C	F	C	A
Approach Delay (s)		24.1			149.7			65.9			64.0	
Approach LOS		C			F			E			E	

Intersection Summary			
HCM Average Control Delay	80.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	82.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	106.0%	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)	10	730	20	263	350	31	0	34	148	23	38	10
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	0.99			0.89			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.98	
Satd. Flow (prot)	1770	1855		1770	1840			1658			1798	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			0.87	
Satd. Flow (perm)	1770	1855		1770	1840			1658			1595	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	793	22	286	380	34	0	37	161	25	41	11
RTOR Reduction (vph)	0	1	0	0	4	0	0	128	0	0	8	0
Lane Group Flow (vph)	11	814	0	286	410	0	0	70	0	0	69	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	0.8	39.1		14.6	52.9			17.0			17.0	
Effective Green, g (s)	0.8	39.1		14.6	52.9			17.0			17.0	
Actuated g/C Ratio	0.01	0.47		0.18	0.64			0.21			0.21	
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)	17	877		312	1177			341			328	
v/s Ratio Prot	0.01	c0.44		c0.16	0.22			0.04				
v/s Ratio Perm											c0.04	
v/c Ratio	0.65	0.93		0.92	0.35			0.21			0.21	
Uniform Delay, d1	40.8	20.5		33.5	6.9			27.2			27.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	62.0	15.6		30.1	0.2			1.4			1.5	
Delay (s)	102.8	36.1		63.6	7.1			28.6			28.7	
Level of Service	F	D		E	A			C			C	
Approach Delay (s)		37.0			30.2			28.6			28.7	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	33.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	82.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
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)	355	874	198	64	615	180	30	316	187	67	766	457
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	0.98		1.00	0.97		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1271	1496	2836		1547	2833		1547	3094	1316
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1271	1496	2836		1547	2833		1547	3094	1316
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	374	920	208	67	647	189	32	333	197	71	806	481
RTOR Reduction (vph)	0	0	124	0	21	0	0	66	0	0	0	28
Lane Group Flow (vph)	374	920	84	67	815	0	32	464	0	71	806	453
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	22.7	45.4	45.4	18.4	41.1		2.7	31.3		6.6	35.2	57.9
Effective Green, g (s)	22.7	45.4	45.4	18.4	41.1		2.7	32.3		6.6	36.2	59.9
Actuated g/C Ratio	0.19	0.38	0.38	0.16	0.35		0.02	0.27		0.06	0.30	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	536	1144	486	232	982		35	771		86	944	664
v/s Ratio Prot	c0.13	c0.31		0.04	0.29		0.02	0.16		c0.05	c0.26	c0.14
v/s Ratio Perm			0.07									0.21
v/c Ratio	0.70	0.80	0.17	0.29	0.83		0.91	0.60		0.83	0.85	0.68
Uniform Delay, d1	44.8	32.7	24.2	44.4	35.6		57.9	37.6		55.5	38.8	22.2
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	3.9	4.2	0.2	0.7	6.0		116.7	1.3		44.9	7.6	2.9
Delay (s)	48.7	36.9	24.4	45.1	41.6		174.6	38.9		100.4	46.4	25.1
Level of Service	D	D	C	D	D		F	D		F	D	C
Approach Delay (s)		38.1			41.9			46.7			41.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	118.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.6%	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)	470	386	240	110	382	128	304	241	28	88	844	59
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.98		1.00	1.00	0.93	1.00	1.00	0.93
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3194		1770	3246		3433	3539	1474	3335	3539	1437
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3194		1770	3246		3433	3539	1474	3335	3539	1437
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	495	406	253	116	402	135	320	254	29	93	888	62
RTOR Reduction (vph)	0	80	0	0	28	0	0	0	20	0	0	44
Lane Group Flow (vph)	495	579	0	116	509	0	320	254	9	93	888	18
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	35.1	35.1		24.4	24.4		12.0	35.8	35.8	6.9	30.7	30.7
Effective Green, g (s)	34.2	34.2		23.5	23.5		11.7	36.0	36.0	6.6	30.9	30.9
Actuated g/C Ratio	0.29	0.29		0.20	0.20		0.10	0.31	0.31	0.06	0.27	0.27
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	506	939		358	656		345	1095	456	189	940	382
v/s Ratio Prot	c0.29	0.18		0.07	c0.16		c0.09	0.07		0.03	c0.25	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.98	0.62		0.32	0.78		0.93	0.23	0.02	0.49	0.94	0.05
Uniform Delay, d1	40.7	35.4		39.6	43.9		51.9	29.9	27.9	53.2	41.9	31.8
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	33.9	0.9		0.2	5.2		29.8	0.0	0.0	0.7	17.2	0.0
Delay (s)	74.6	36.3		39.8	49.2		81.7	29.9	27.9	54.0	59.1	31.8
Level of Service	E	D		D	D		F	C	C	D	E	C
Approach Delay (s)		52.7			47.5			57.3			57.0	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	53.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	116.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	380	352	33	3	16	262	451	220	526	16	267	561
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1837				3529	1583		1831		1770	1863
Flt Permitted	0.49	1.00				0.81	1.00		0.58		0.95	1.00
Satd. Flow (perm)	912	1837				2861	1583		1082		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	400	371	35	3	17	276	475	232	554	17	281	591
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	400	409	0	0	0	293	475	0	802	0	281	591
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	29.6	29.6				29.6	112.7		51.3		9.0	63.3
Effective Green, g (s)	29.6	29.6				29.6	112.7		51.3		9.0	63.3
Actuated g/C Ratio	0.26	0.26				0.26	1.00		0.46		0.08	0.56
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	240	482				751	1583		493		141	1046
v/s Ratio Prot		0.22									c0.16	
v/s Ratio Perm	c0.44					0.10	0.30		c0.74			0.32
v/c Ratio	1.67	0.85				0.39	0.30		1.63		1.99	0.57
Uniform Delay, d1	41.5	39.4				34.1	0.0		30.7		51.9	15.9
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	317.7	13.1				0.3	0.5		291.6		471.1	0.7
Delay (s)	359.3	52.5				34.5	0.5		322.3		523.0	16.6
Level of Service	F	D				C	A		F		F	B
Approach Delay (s)		204.2				13.5			322.3			116.8
Approach LOS		F				B			F			F

Intersection Summary			
HCM Average Control Delay	155.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.59		
Actuated Cycle Length (s)	112.7	Sum of lost time (s)	14.4
Intersection Capacity Utilization	120.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	129	388	5	74	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	408	5	78	4
RTOR Reduction (vph)	83	0	0	0	0
Lane Group Flow (vph)	461	0	0	83	4
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	63.3			8.4	8.4
Effective Green, g (s)	63.3			8.4	8.4
Actuated g/C Ratio	0.56			0.07	0.07
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	889			132	118
v/s Ratio Prot				c0.05	
v/s Ratio Perm	0.29				0.00
v/c Ratio	0.52			0.63	0.03
Uniform Delay, d1	15.3			50.6	48.4
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.5			6.6	0.0
Delay (s)	15.8			57.2	48.4
Level of Service	B			E	D
Approach Delay (s)				56.8	
Approach LOS				E	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	11	925	764	14	8	6
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)	12	1005	830	15	9	7
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	846				1867	838
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	846				1867	838
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				89	98
cM capacity (veh/h)	791				78	366

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	1017	846	15
Volume Left	12	0	9
Volume Right	0	15	7
cSH	791	1700	118
Volume to Capacity	0.02	0.50	0.13
Queue Length 95th (ft)	1	0	11
Control Delay (s)	0.5	0.0	39.9
Lane LOS	A		E
Approach Delay (s)	0.5	0.0	39.9
Approach LOS			E

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	67.5%	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)	0	19	4	0	0	0	7	5	281	5	481	32
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)	0	21	4	0	0	0	8	5	305	5	523	35
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	724	877	540	739	742	158	558			311		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	724	877	540	739	742	158	558			311		
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 %	100	93	99	100	100	100	99			100		
cM capacity (veh/h)	338	284	542	309	340	887	1013			1250		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	25	0	318	563
Volume Left	0	0	8	5
Volume Right	4	0	305	35
cSH	309	1700	1013	1250
Volume to Capacity	0.08	0.00	0.01	0.00
Queue Length 95th (ft)	7	0	1	0
Control Delay (s)	17.7	0.0	0.3	0.1
Lane LOS	C	A	A	A
Approach Delay (s)	17.7	0.0	0.3	0.1
Approach LOS	C	A		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	39.6%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX D:

INTERSECTION LEVEL OF SERVICE CALCULATION SHEETS (CUMULATIVE 2030 BASE PLUS ALTERNATIVE 2 CONDITIONS)

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	369	37	9	15	104	405	33	1328	26	58	1314	312
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		1.00			0.90			1.00		1.00	0.97	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1777			1588			3420		1719	3312	
Flt Permitted		0.30			0.98			0.61		0.95	1.00	
Satd. Flow (perm)		549			1563			2079		1719	3312	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	388	39	9	16	109	426	35	1398	27	61	1383	328
RTOR Reduction (vph)	0	1	0	0	0	0	0	1	0	0	17	0
Lane Group Flow (vph)	0	435	0	0	551	0	0	1459	0	61	1694	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		49.5			49.5			55.5		5.0	55.5	
Effective Green, g (s)		49.0			49.0			55.0		4.0	55.0	
Actuated g/C Ratio		0.41			0.41			0.46		0.03	0.46	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		224			638			953		57	1518	
v/s Ratio Prot										c0.04	0.51	
v/s Ratio Perm		c0.79			0.35			c0.70				
v/c Ratio		1.94			0.86			1.53		1.07	1.12	
Uniform Delay, d1		35.5			32.4			32.5		58.0	32.5	
Progression Factor		1.00			1.00			0.53		1.00	1.00	
Incremental Delay, d2		440.7			11.7			239.4		140.1	61.7	
Delay (s)		476.2			44.1			256.7		198.1	94.2	
Level of Service		F			D			F		F	F	
Approach Delay (s)		476.2			44.1			256.7			97.8	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	184.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	126.3%	ICU Level of Service	H
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)	328	199	35	39	373	218	9	986	25	89	879	410
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.98	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.95			1.00		1.00	0.95	
Flt Protected		0.97			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1739			1703			3421		1719	3209	
Flt Permitted		0.41			0.94			0.76		0.95	1.00	
Satd. Flow (perm)		725			1605			2584		1719	3209	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	345	209	37	41	393	229	9	1038	26	94	925	432
RTOR Reduction (vph)	0	2	0	0	16	0	0	1	0	0	46	0
Lane Group Flow (vph)	0	589	0	0	647	0	0	1072	0	94	1311	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2	
Permitted Phases	4			8			6					
Actuated Green, G (s)		62.5			62.5			41.5		6.0	50.5	
Effective Green, g (s)		62.0			62.0			41.0		5.0	50.0	
Actuated g/C Ratio		0.52			0.52			0.34		0.04	0.42	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		0.2			0.2			0.2		0.2	0.2	
Lane Grp Cap (vph)		375			829			883		72	1337	
v/s Ratio Prot										0.05	c0.41	
v/s Ratio Perm		c0.81			0.40			c0.41				
v/c Ratio		1.57			0.78			1.21		1.31	0.98	
Uniform Delay, d1		29.0			23.5			39.5		57.5	34.5	
Progression Factor		1.00			1.00			1.25		0.72	0.50	
Incremental Delay, d2		269.5			4.4			105.0		146.5	4.1	
Delay (s)		298.5			27.9			154.3		187.8	21.6	
Level of Service		F			C			F		F	C	
Approach Delay (s)		298.5			27.9			154.3			32.3	
Approach LOS		F			C			F			C	

Intersection Summary			
HCM Average Control Delay	107.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	145.8%	ICU Level of Service	H
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)	44	159	29	23	205	149	42	777	38	85	931	15
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			0.99			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.98			0.95			0.99			1.00	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1810			1746			3410			3422	
Flt Permitted	0.42	1.00			0.98			0.86			0.79	
Satd. Flow (perm)	775	1810			1712			2955			2710	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	46	167	31	24	216	157	44	818	40	89	980	16
RTOR Reduction (vph)	0	11	0	0	39	0	0	6	0	0	2	0
Lane Group Flow (vph)	46	187	0	0	358	0	0	897	0	0	1084	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	284	664			628			1478			1355	
v/s Ratio Prot		0.10										
v/s Ratio Perm	0.06				c0.21			0.30			c0.40	
v/c Ratio	0.16	0.28			0.57			0.61			0.80	
Uniform Delay, d1	12.8	13.4			15.2			10.8			12.5	
Progression Factor	0.97	0.95			1.47			0.40			1.00	
Incremental Delay, d2	1.2	1.0			2.7			1.4			2.0	
Delay (s)	13.6	13.8			25.1			5.7			14.4	
Level of Service	B	B			C			A			B	
Approach Delay (s)		13.8			25.1			5.7			14.4	
Approach LOS		B			C			A			B	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	102.7%	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		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	169	480	38	24	736	25	38	98	70	11	78	205
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)	184	522	41	26	800	27	41	107	76	12	85	223

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	747	853	224	320
Volume Left (vph)	184	26	41	12
Volume Right (vph)	41	27	76	223
Hadj (s)	0.05	0.02	-0.13	-0.38
Departure Headway (s)	7.7	7.7	8.7	8.0
Degree Utilization, x	1.61	1.83	0.54	0.71
Capacity (veh/h)	475	474	395	440
Control Delay (s)	302.6	399.6	21.4	28.3
Approach Delay (s)	302.6	399.6	21.4	28.3
Approach LOS	F	F	C	D

Intersection Summary			
Delay	271.0		
HCM Level of Service	F		
Intersection Capacity Utilization	115.5%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	278	14	16	247	12	13	181	37	10	125	5
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			1.00			0.99			1.00	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.99			0.98			1.00	
Flt Protected		1.00			1.00			1.00			1.00	
Satd. Flow (prot)		1840			1839			1801			1842	
Flt Permitted		0.98			0.98			0.98			0.97	
Satd. Flow (perm)		1813			1805			1773			1798	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	293	15	17	260	13	14	191	39	11	132	5
RTOR Reduction (vph)	0	3	0	0	3	0	0	11	0	0	2	0
Lane Group Flow (vph)	0	321	0	0	287	0	0	233	0	0	146	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1118			1113			443			450	
v/s Ratio Prot												
v/s Ratio Perm		c0.18			0.16			c0.13			0.08	
v/c Ratio		0.29			0.26			0.53			0.32	
Uniform Delay, d1		5.4			5.2			19.4			18.4	
Progression Factor		0.74			0.41			1.01			1.00	
Incremental Delay, d2		0.6			0.5			3.7			1.9	
Delay (s)		4.6			2.6			23.4			20.3	
Level of Service		A			A			C			C	
Approach Delay (s)		4.6			2.6			23.4			20.3	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	10.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.5%	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)	74	603	22	59	572	15	20	142	62	27	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	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		0.98	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.96			0.97	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1765	1845		1726	1854			1774			1787	
Flt Permitted	0.31	1.00		0.28	1.00			0.97			0.93	
Satd. Flow (perm)	574	1845		510	1854			1727			1679	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	78	635	23	62	602	16	21	149	65	28	108	36
RTOR Reduction (vph)	0	2	0	0	2	0	0	23	0	0	16	0
Lane Group Flow (vph)	78	656	0	62	616	0	0	212	0	0	156	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			18.5			18.5	
Effective Green, g (s)	34.0	34.0		34.0	34.0			18.0			18.0	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.30			0.30	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	325	1046		289	1051			518			504	
v/s Ratio Prot		c0.36			0.33							
v/s Ratio Perm	0.14			0.12				c0.12			0.09	
v/c Ratio	0.24	0.63		0.21	0.59			0.41			0.31	
Uniform Delay, d1	6.5	8.7		6.4	8.4			16.8			16.2	
Progression Factor	0.40	0.68		2.16	2.15			1.16			0.36	
Incremental Delay, d2	1.7	2.7		1.5	2.2			2.0			1.5	
Delay (s)	4.2	8.6		15.4	20.3			21.4			7.4	
Level of Service	A	A		B	C			C			A	
Approach Delay (s)		8.2			19.9			21.4			7.4	
Approach LOS		A			B			C			A	

Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.5%	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)	68	176	18	290	396	515	9	1334	393	369	938	187
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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		0.99	1.00		0.98	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1822	1538		1824	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.28	1.00		0.63	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		525	1538		1168	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	72	185	19	305	417	542	9	1404	414	388	987	197
RTOR Reduction (vph)	0	0	11	0	0	217	0	0	197	0	0	44
Lane Group Flow (vph)	0	257	8	0	722	325	9	1404	217	388	987	153
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Perm	Prot		Perm	Prot		Perm
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Actuated Green, G (s)		48.0	48.0		48.0	48.0	0.8	34.4	34.4	20.0	54.6	54.6
Effective Green, g (s)		48.0	48.0		48.0	48.0	0.8	34.4	34.4	20.0	54.6	54.6
Actuated g/C Ratio		0.43	0.43		0.43	0.43	0.01	0.31	0.31	0.18	0.49	0.49
Clearance Time (s)		3.0	3.0		3.0	3.0	3.0	3.0	3.0	4.0	3.0	3.0
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)		224	657		499	676	13	1052	471	306	1670	769
v/s Ratio Prot							0.01	c0.41		c0.23	0.29	
v/s Ratio Perm		0.49	0.01		c0.62	0.21			0.14			0.10
v/c Ratio		1.15	0.01		1.45	0.48	0.69	1.33	0.46	1.27	0.59	0.20
Uniform Delay, d1		32.2	18.5		32.2	23.2	55.7	39.0	31.5	46.2	20.8	16.5
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		105.6	0.0		212.2	0.5	96.3	157.1	3.2	143.9	1.5	0.6
Delay (s)		137.8	18.6		244.4	23.8	152.0	196.1	34.7	190.1	22.4	17.0
Level of Service		F	B		F	C	F	F	C	F	C	B
Approach Delay (s)		129.6			149.8			159.3			63.1	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM Average Control Delay	124.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	120.6%	ICU Level of Service	H
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)	10	388	20	162	520	35	0	37	219	20	46	10
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	0.99			0.88			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.99	
Satd. Flow (prot)	1770	1849		1770	1845			1647			1805	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			0.76	
Satd. Flow (perm)	1770	1849		1770	1845			1647			1395	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	422	22	176	565	38	0	40	238	22	50	11
RTOR Reduction (vph)	0	3	0	0	4	0	0	194	0	0	9	0
Lane Group Flow (vph)	11	441	0	176	599	0	0	84	0	0	74	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	0.6	18.1		6.9	24.4			8.5			8.5	
Effective Green, g (s)	0.6	18.1		6.9	24.4			8.5			8.5	
Actuated g/C Ratio	0.01	0.40		0.15	0.54			0.19			0.19	
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)	23	736		268	989			308			261	
v/s Ratio Prot	0.01	0.24		c0.10	c0.32			0.05				
v/s Ratio Perm											c0.05	
v/c Ratio	0.48	0.60		0.66	0.61			0.27			0.28	
Uniform Delay, d1	22.3	10.8		18.2	7.2			15.9			15.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	14.8	1.3		5.7	1.1			0.5			0.6	
Delay (s)	37.1	12.2		23.9	8.3			16.3			16.5	
Level of Service	D	B		C	A			B			B	
Approach Delay (s)		12.8			11.8			16.3			16.5	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	45.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.7%	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)	383	529	5	33	738	27	123	813	62	50	431	444
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	1.00		1.00	0.99		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.99		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1268	1496	2967		1547	3043		1547	3094	1319
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1268	1496	2967		1547	3043		1547	3094	1319
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	403	557	5	35	777	28	129	856	65	53	454	467
RTOR Reduction (vph)	0	0	3	0	2	0	0	5	0	0	0	32
Lane Group Flow (vph)	403	557	2	35	803	0	129	916	0	53	454	435
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	23.0	41.5	41.5	18.6	37.1		15.1	40.3		4.5	29.7	52.7
Effective Green, g (s)	23.0	41.5	41.5	18.6	37.1		15.1	41.3		4.5	30.7	54.7
Actuated g/C Ratio	0.19	0.34	0.34	0.15	0.30		0.12	0.34		0.04	0.25	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	528	1018	432	228	903		192	1031		57	779	592
v/s Ratio Prot	c0.14	0.19		0.02	c0.27		0.08	c0.30		c0.03	0.15	c0.14
v/s Ratio Perm			0.00									0.19
v/c Ratio	0.76	0.55	0.00	0.15	0.89		0.67	0.89		0.93	0.58	0.73
Uniform Delay, d1	46.9	32.6	26.5	44.8	40.4		51.0	38.1		58.5	40.0	27.6
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	6.5	0.6	0.0	0.3	10.6		8.9	9.5		92.7	1.1	4.7
Delay (s)	53.3	33.2	26.6	45.1	51.1		59.9	47.6		151.2	41.1	32.4
Level of Service	D	C	C	D	D		E	D		F	D	C
Approach Delay (s)		41.6			50.8			49.1			42.9	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	46.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	121.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.0%	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)	129	242	247	36	361	124	319	965	108	196	248	42
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.98		1.00	1.00	0.94	1.00	1.00	0.94
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.92		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3124		1770	3246		3433	3539	1481	3335	3539	1444
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3124		1770	3246		3433	3539	1481	3335	3539	1444
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	255	260	38	380	131	336	1016	114	206	261	44
RTOR Reduction (vph)	0	158	0	0	28	0	0	0	70	0	0	31
Lane Group Flow (vph)	136	357	0	38	483	0	336	1016	44	206	261	13
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	26.0	26.0		23.5	23.5		13.1	34.7	34.7	9.0	30.6	30.6
Effective Green, g (s)	25.1	25.1		22.6	22.6		12.8	34.9	34.9	8.7	30.8	30.8
Actuated g/C Ratio	0.23	0.23		0.21	0.21		0.12	0.33	0.33	0.08	0.29	0.29
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	402	731		373	684		410	1151	482	270	1016	414
v/s Ratio Prot	0.08	c0.11		0.02	c0.15		0.10	c0.29		c0.06	0.07	
v/s Ratio Perm									0.03			0.01
v/c Ratio	0.34	0.49		0.10	0.71		0.82	0.88	0.09	0.76	0.26	0.03
Uniform Delay, d1	34.2	35.5		34.2	39.3		46.1	34.3	25.2	48.3	29.4	27.5
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	0.2	0.2		0.0	2.7		11.5	8.0	0.0	10.9	0.0	0.0
Delay (s)	34.4	35.7		34.2	42.0		57.6	42.3	25.2	59.2	29.5	27.5
Level of Service	C	D		C	D		E	D	C	E	C	C
Approach Delay (s)		35.5			41.4			44.5			41.3	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	107.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL2	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Volume (vph)	408	655	149	7	2	4	469	282	116	473	3	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5					3.5	4.0		3.8		3.0
Lane Util. Factor	1.00	1.00					0.95	1.00		1.00		1.00
Frt	1.00	0.97					1.00	0.85		1.00		1.00
Flt Protected	0.95	1.00					1.00	1.00		0.99		0.95
Satd. Flow (prot)	1770	1809					3537	1583		1843		1770
Flt Permitted	0.37	1.00					0.80	1.00		0.68		0.95
Satd. Flow (perm)	685	1809					2820	1583		1266		1770
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	429	689	157	7	2	4	494	297	122	498	3	233
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	429	853	0	0	0	0	500	297	0	623	0	233
Turn Type	Perm				Perm	Perm		Free	Perm			Prot
Protected Phases		3					3			6		5
Permitted Phases	3				3	3		Free	6			
Actuated Green, G (s)	30.6	30.6					30.6	89.5		25.3		12.1
Effective Green, g (s)	30.6	30.6					30.6	89.5		25.3		12.1
Actuated g/C Ratio	0.34	0.34					0.34	1.00		0.28		0.14
Clearance Time (s)	3.5	3.5					3.5			3.8		3.0
Vehicle Extension (s)	3.0	3.0					3.0			3.0		3.0
Lane Grp Cap (vph)	234	618					964	1583		358		239
v/s Ratio Prot		0.47										c0.13
v/s Ratio Perm	c0.63						0.18	0.19		c0.49		
v/c Ratio	1.83	1.38					0.52	0.19		1.74		0.97
Uniform Delay, d1	29.4	29.4					23.6	0.0		32.1		38.5
Progression Factor	1.00	1.00					1.00	1.00		1.00		1.00
Incremental Delay, d2	391.2	181.1					0.5	0.3		344.5		50.7
Delay (s)	420.7	210.6					24.0	0.3		376.6		89.3
Level of Service	F	F					C	A		F		F
Approach Delay (s)		280.9					15.2			376.6		
Approach LOS		F					B			F		

Intersection Summary			
HCM Average Control Delay	161.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	89.5	Sum of lost time (s)	14.4
Intersection Capacity Utilization	138.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBT	SBR	SBR2	NEL	NER
Lane Configurations					
Volume (vph)	544	61	347	72	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8	3.8		4.1	4.1
Lane Util. Factor	1.00	1.00		1.00	1.00
Frt	1.00	0.85		1.00	0.85
Flt Protected	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1863	1583		1770	1583
Flt Permitted	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1863	1583		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	573	64	365	76	3
RTOR Reduction (vph)	0	195	0	0	0
Lane Group Flow (vph)	573	234	0	76	3
Turn Type		Perm			Perm
Protected Phases	2			4	
Permitted Phases		2			4
Actuated Green, G (s)	40.4	40.4		7.1	7.1
Effective Green, g (s)	40.4	40.4		7.1	7.1
Actuated g/C Ratio	0.45	0.45		0.08	0.08
Clearance Time (s)	3.8	3.8		4.1	4.1
Vehicle Extension (s)	3.0	3.0		2.0	2.0
Lane Grp Cap (vph)	841	715		140	126
v/s Ratio Prot	0.31			c0.04	
v/s Ratio Perm		0.15			0.00
v/c Ratio	0.68	0.33		0.54	0.02
Uniform Delay, d1	19.5	15.8		39.6	38.0
Progression Factor	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.3	0.3		2.3	0.0
Delay (s)	21.7	16.1		41.9	38.0
Level of Service	C	B		D	D
Approach Delay (s)	32.5			41.8	
Approach LOS	C			D	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	6	662	971	9	25	19
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)	7	720	1055	10	27	21
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	1065				1793	1060
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1065				1793	1060
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				69	92
cM capacity (veh/h)	654				88	272

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	726	1065	48
Volume Left	7	0	27
Volume Right	0	10	21
cSH	654	1700	124
Volume to Capacity	0.01	0.63	0.39
Queue Length 95th (ft)	1	0	40
Control Delay (s)	0.3	0.0	51.2
Lane LOS	A		F
Approach Delay (s)	0.3	0.0	51.2
Approach LOS			F

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	61.7%	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)	0	56	12	0	0	0	4	5	288	5	283	19
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)	0	61	13	0	0	0	4	5	313	5	308	21
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	499	656	318	543	510	162	328			318		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	499	656	318	543	510	162	328			318		
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 %	100	84	98	100	100	100	100			100		
cM capacity (veh/h)	479	382	723	386	463	883	1231			1242		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	74	0	323	334
Volume Left	0	0	4	5
Volume Right	13	0	313	21
cSH	417	1700	1231	1242
Volume to Capacity	0.18	0.00	0.00	0.00
Queue Length 95th (ft)	16	0	0	0
Control Delay (s)	15.5	0.0	0.1	0.2
Lane LOS	C	A	A	A
Approach Delay (s)	15.5	0.0	0.1	0.2
Approach LOS	C	A		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	408	50	25	18	75	147	7	1578	26	50	1227	473
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.98			1.00		1.00	0.98	
Flpb, ped/bikes		0.99			1.00			1.00		1.00	1.00	
Frt		0.99			0.92			1.00		1.00	0.96	
Flt Protected		0.96			1.00			1.00		0.95	1.00	
Satd. Flow (prot)		1759			1639			3425		1719	3263	
Flt Permitted		0.51			0.95			0.79		0.95	1.00	
Satd. Flow (perm)		942			1567			2708		1719	3263	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	429	53	26	19	79	155	7	1661	27	53	1292	498
RTOR Reduction (vph)	0	2	0	0	0	0	0	1	0	0	34	0
Lane Group Flow (vph)	0	506	0	0	253	0	0	1694	0	53	1756	0
Confl. Peds. (#/hr)	10		9	9		10	14		22	22		14
Heavy Vehicles (%)	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%	5%	2%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			4			6		3	2	
Permitted Phases	4			4			6					
Actuated Green, G (s)		46.5			46.5			59.5		4.0	59.5	
Effective Green, g (s)		46.0			46.0			59.0		3.0	59.0	
Actuated g/C Ratio		0.38			0.38			0.49		0.02	0.49	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		3.0			3.0			3.0		0.2	3.0	
Lane Grp Cap (vph)		361			601			1331		43	1604	
v/s Ratio Prot										c0.03	0.54	
v/s Ratio Perm		c0.54			0.16			c0.63				
v/c Ratio		1.40			0.42			1.27		1.23	1.10	
Uniform Delay, d1		37.0			27.2			30.5		58.5	30.5	
Progression Factor		1.00			1.00			0.43		1.00	1.00	
Incremental Delay, d2		196.9			0.5			123.3		213.4	53.2	
Delay (s)		233.9			27.7			136.5		271.9	83.7	
Level of Service		F			C			F		F	F	
Approach Delay (s)		233.9			27.7			136.5			89.1	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM Average Control Delay	121.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	101.6%	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)	420	422	45	42	208	94	14	1116	43	182	971	305
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	
Lane Util. Factor		1.00			1.00			0.95		1.00	0.95	
Frpb, ped/bikes		1.00			0.99			1.00		1.00	0.99	
Flpb, ped/bikes		1.00			1.00			1.00		1.00	1.00	
Frt		0.99			0.96			0.99		1.00	0.96	
Flt Protected		0.98			0.99			1.00		0.95	1.00	
Satd. Flow (prot)		1747			1719			3413		1719	3266	
Flt Permitted		0.62			0.85			0.82		0.95	1.00	
Satd. Flow (perm)		1114			1475			2789		1719	3266	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	442	444	47	44	219	99	15	1175	45	192	1022	321
RTOR Reduction (vph)	0	1	0	0	11	0	0	2	0	0	25	0
Lane Group Flow (vph)	0	932	0	0	351	0	0	1233	0	192	1318	0
Confl. Peds. (#/hr)	8		13	13		8	15		6	6		15
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Perm			Perm			Perm			Prot		
Protected Phases		4			8			6		5	2	
Permitted Phases	4			8			6					
Actuated Green, G (s)		61.5			61.5			39.5		9.0	51.5	
Effective Green, g (s)		61.0			61.0			39.0		8.0	51.0	
Actuated g/C Ratio		0.51			0.51			0.32		0.07	0.42	
Clearance Time (s)		3.5			3.5			3.5		3.0	3.5	
Vehicle Extension (s)		0.2			0.2			0.2		0.2	0.2	
Lane Grp Cap (vph)		566			750			906		115	1388	
v/s Ratio Prot										c0.11	0.40	
v/s Ratio Perm		c0.84			0.24			c0.44				
v/c Ratio		1.65			0.47			1.36		1.67	0.95	
Uniform Delay, d1		29.5			19.0			40.5		56.0	33.3	
Progression Factor		1.00			1.00			0.86		1.37	0.76	
Incremental Delay, d2		298.5			0.2			167.0		313.5	6.2	
Delay (s)		328.0			19.2			201.9		390.3	31.4	
Level of Service		F			B			F		F	C	
Approach Delay (s)		328.0			19.2			201.9			76.3	
Approach LOS		F			B			F			E	

Intersection Summary			
HCM Average Control Delay	167.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	150.4%	ICU Level of Service	H
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)	37	399	32	16	272	37	7	1188	28	20	874	43
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	
Lane Util. Factor	1.00	1.00			1.00			0.95			0.95	
Frpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Flpb, ped/bikes	1.00	1.00			1.00			1.00			1.00	
Frt	1.00	0.99			0.98			1.00			0.99	
Flt Protected	0.95	1.00			1.00			1.00			1.00	
Satd. Flow (prot)	1767	1838			1826			3426			3409	
Flt Permitted	0.46	1.00			0.97			0.95			0.92	
Satd. Flow (perm)	863	1838			1780			3257			3124	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	39	420	34	17	286	39	7	1251	29	21	920	45
RTOR Reduction (vph)	0	5	0	0	8	0	0	3	0	0	6	0
Lane Group Flow (vph)	39	449	0	0	334	0	0	1285	0	0	981	0
Confl. Peds. (#/hr)	4		24	24		4	23		22	22		23
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	5%	2%	2%	5%	2%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Actuated Green, G (s)	22.5	22.5			22.5			30.5			30.5	
Effective Green, g (s)	22.0	22.0			22.0			30.0			30.0	
Actuated g/C Ratio	0.37	0.37			0.37			0.50			0.50	
Clearance Time (s)	3.5	3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)	316	674			653			1629			1562	
v/s Ratio Prot		c0.24										
v/s Ratio Perm	0.05				0.19			c0.39			0.31	
v/c Ratio	0.12	0.67			0.51			0.79			0.63	
Uniform Delay, d1	12.6	15.9			14.8			12.4			10.9	
Progression Factor	1.09	1.12			0.89			0.94			2.15	
Incremental Delay, d2	0.8	5.0			2.7			3.8			0.6	
Delay (s)	14.5	22.9			16.0			15.4			24.0	
Level of Service	B	C			B			B			C	
Approach Delay (s)		22.2			16.0			15.4			24.0	
Approach LOS		C			B			B			C	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.5%	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		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	157	761	26	22	490	17	34	122	70	56	164	271
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)	171	827	28	24	533	18	37	133	76	61	178	295

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	1026	575	246	534
Volume Left (vph)	171	24	37	61
Volume Right (vph)	28	18	76	295
Hadj (s)	0.05	0.02	-0.12	-0.27
Departure Headway (s)	8.7	8.7	9.4	8.4
Degree Utilization, x	2.48	1.39	0.64	1.24
Capacity (veh/h)	423	425	373	426
Control Delay (s)	691.7	211.9	28.0	153.1
Approach Delay (s)	691.7	211.9	28.0	153.1
Approach LOS	F	F	D	F

Intersection Summary			
Delay	386.6		
HCM Level of Service	F		
Intersection Capacity Utilization	123.6%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	302	23	47	290	46	24	222	21	32	157	24
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	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frpb, ped/bikes		1.00			0.99			1.00			0.99	
Flpb, ped/bikes		1.00			1.00			1.00			1.00	
Frt		0.99			0.98			0.99			0.98	
Flt Protected		0.99			0.99			1.00			0.99	
Satd. Flow (prot)		1823			1806			1825			1806	
Flt Permitted		0.91			0.93			0.96			0.93	
Satd. Flow (perm)		1663			1682			1769			1686	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	60	318	24	49	305	48	25	234	22	34	165	25
RTOR Reduction (vph)	0	4	0	0	8	0	0	5	0	0	8	0
Lane Group Flow (vph)	0	398	0	0	394	0	0	276	0	0	217	0
Confl. Peds. (#/hr)	14		15	15		14	18		14	14		18
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)		37.5			37.5			15.5			15.5	
Effective Green, g (s)		37.0			37.0			15.0			15.0	
Actuated g/C Ratio		0.62			0.62			0.25			0.25	
Clearance Time (s)		3.5			3.5			3.5			3.5	
Lane Grp Cap (vph)		1026			1037			442			422	
v/s Ratio Prot												
v/s Ratio Perm		c0.24			0.23			c0.16			0.13	
v/c Ratio		0.39			0.38			0.62			0.51	
Uniform Delay, d1		5.8			5.8			20.0			19.4	
Progression Factor		0.52			0.33			1.45			1.00	
Incremental Delay, d2		1.0			1.0			4.7			4.4	
Delay (s)		4.0			2.9			33.7			23.8	
Level of Service		A			A			C			C	
Approach Delay (s)		4.0			2.9			33.7			23.8	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	13.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.0%	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)	65	775	56	83	549	30	39	174	90	29	184	73
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	
Frpb, ped/bikes	1.00	0.99		1.00	1.00			0.99			1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	0.99			0.96			0.97	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1765	1828		1770	1845			1764			1780	
Flt Permitted	0.31	1.00		0.13	1.00			0.94			0.95	
Satd. Flow (perm)	585	1828		249	1845			1668			1708	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	816	59	87	578	32	41	183	95	31	194	77
RTOR Reduction (vph)	0	4	0	0	3	0	0	25	0	0	20	0
Lane Group Flow (vph)	68	871	0	87	607	0	0	294	0	0	282	0
Confl. Peds. (#/hr)	4		46	46		4	6		10	10		6
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		1			1			2			2	
Permitted Phases	1			1			2			2		
Actuated Green, G (s)	34.5	34.5		34.5	34.5			18.5			18.5	
Effective Green, g (s)	34.0	34.0		34.0	34.0			18.0			18.0	
Actuated g/C Ratio	0.57	0.57		0.57	0.57			0.30			0.30	
Clearance Time (s)	3.5	3.5		3.5	3.5			3.5			3.5	
Lane Grp Cap (vph)	332	1036		141	1046			500			512	
v/s Ratio Prot		c0.48			0.33							
v/s Ratio Perm	0.12			0.35				c0.18			0.16	
v/c Ratio	0.20	0.84		0.62	0.58			0.59			0.55	
Uniform Delay, d1	6.4	10.8		8.7	8.4			17.8			17.6	
Progression Factor	0.33	0.94		1.37	1.15			0.50			1.48	
Incremental Delay, d2	1.3	7.8		14.8	1.8			3.2			4.0	
Delay (s)	3.4	17.9		26.6	11.5			12.1			30.0	
Level of Service	A	B		C	B			B			C	
Approach Delay (s)		16.9			13.4			12.1			30.0	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
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)	87	228	9	393	219	286	2	1082	310	231	979	147
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0	3.0		3.0	4.0	3.0	3.0	3.0	4.0	3.0	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		0.99	1.00		0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1822	1538		1805	1583	1770	3438	1538	1719	3438	1583
Flt Permitted		0.49	1.00		0.51	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		903	1538		957	1583	1770	3438	1538	1719	3438	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	92	240	9	414	231	301	2	1139	326	243	1031	155
RTOR Reduction (vph)	0	0	5	0	0	0	0	0	226	0	0	0
Lane Group Flow (vph)	0	332	4	0	645	301	2	1139	100	243	1031	155
Heavy Vehicles (%)	5%	2%	5%	2%	2%	2%	2%	5%	5%	5%	5%	2%
Turn Type	Perm		Perm	Perm		Free	Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		Free			2			Free
Actuated Green, G (s)		39.0	39.0		39.0	82.4	0.8	25.4	25.4	8.0	33.6	82.4
Effective Green, g (s)		39.0	39.0		39.0	82.4	0.8	25.4	25.4	8.0	33.6	82.4
Actuated g/C Ratio		0.47	0.47		0.47	1.00	0.01	0.31	0.31	0.10	0.41	1.00
Clearance Time (s)		3.0	3.0		3.0		3.0	3.0	3.0	4.0	3.0	
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		427	728		453	1583	17	1060	474	167	1402	1583
v/s Ratio Prot							0.00	c0.33		c0.14	0.30	
v/s Ratio Perm		0.37	0.00		c0.67	0.19			0.07			0.10
v/c Ratio		0.78	0.01		1.42	0.19	0.12	1.07	0.21	1.46	0.74	0.10
Uniform Delay, d1		18.1	11.5		21.7	0.0	40.5	28.5	21.1	37.2	20.6	0.0
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		8.7	0.0		203.3	0.3	3.1	50.0	1.0	234.8	3.5	0.1
Delay (s)		26.7	11.5		225.0	0.3	43.5	78.5	22.1	272.0	24.1	0.1
Level of Service		C	B		F	A	D	E	C	F	C	A
Approach Delay (s)		26.3			153.5			65.9			63.7	
Approach LOS		C			F			E			E	

Intersection Summary			
HCM Average Control Delay	81.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	82.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	106.1%	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)	10	730	20	271	350	31	0	34	162	23	38	10
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	0.99			0.89			0.98	
Flt Protected	0.95	1.00		0.95	1.00			1.00			0.98	
Satd. Flow (prot)	1770	1855		1770	1840			1655			1798	
Flt Permitted	0.95	1.00		0.95	1.00			1.00			0.87	
Satd. Flow (perm)	1770	1855		1770	1840			1655			1588	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	793	22	295	380	34	0	37	176	25	41	11
RTOR Reduction (vph)	0	1	0	0	4	0	0	140	0	0	8	0
Lane Group Flow (vph)	11	814	0	295	410	0	0	73	0	0	69	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	0.8	39.2		14.0	52.4			17.0			17.0	
Effective Green, g (s)	0.8	39.2		14.0	52.4			17.0			17.0	
Actuated g/C Ratio	0.01	0.48		0.17	0.64			0.21			0.21	
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)	17	885		301	1173			342			328	
v/s Ratio Prot	0.01	c0.44		c0.17	0.22			c0.04				
v/s Ratio Perm											0.04	
v/c Ratio	0.65	0.92		0.98	0.35			0.21			0.21	
Uniform Delay, d1	40.6	20.0		34.0	7.0			27.1			27.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	62.0	14.3		46.2	0.2			1.4			1.5	
Delay (s)	102.6	34.3		80.2	7.1			28.5			28.5	
Level of Service	F	C		F	A			C			C	
Approach Delay (s)		35.2			37.5			28.5			28.5	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	35.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	82.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
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)	355	876	198	64	617	180	30	316	187	67	766	457
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	11	12	11	11	12	12	12	12	12	12	12
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	3.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.92	1.00	0.98		1.00	0.97		1.00	1.00	0.95
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	2801	2991	1271	1496	2837		1547	2833		1547	3094	1316
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	2801	2991	1271	1496	2837		1547	2833		1547	3094	1316
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	374	922	208	67	649	189	32	333	197	71	806	481
RTOR Reduction (vph)	0	0	124	0	21	0	0	66	0	0	0	27
Lane Group Flow (vph)	374	922	84	67	817	0	32	464	0	71	806	454
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%
Turn Type	Prot		Perm	Prot			Prot			Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4									6
Actuated Green, G (s)	22.7	45.4	45.4	18.4	41.1		2.7	31.3		6.6	35.2	57.9
Effective Green, g (s)	22.7	45.4	45.4	18.4	41.1		2.7	32.3		6.6	36.2	59.9
Actuated g/C Ratio	0.19	0.38	0.38	0.16	0.35		0.02	0.27		0.06	0.30	0.50
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	5.0		4.0	5.0	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)	536	1144	486	232	982		35	771		86	944	664
v/s Ratio Prot	c0.13	c0.31		0.04	0.29		0.02	0.16		c0.05	c0.26	c0.14
v/s Ratio Perm			0.07									0.21
v/c Ratio	0.70	0.81	0.17	0.29	0.83		0.91	0.60		0.83	0.85	0.68
Uniform Delay, d1	44.8	32.7	24.2	44.4	35.6		57.9	37.6		55.5	38.8	22.2
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	3.9	4.2	0.2	0.7	6.1		116.7	1.3		44.9	7.6	2.9
Delay (s)	48.7	37.0	24.4	45.1	41.7		174.6	38.9		100.4	46.4	25.1
Level of Service	D	D	C	D	D		F	D		F	D	C
Approach Delay (s)		38.2			42.0			46.7			41.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	41.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	118.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.7%	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)	470	388	240	110	384	129	304	241	28	90	844	59
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	0.95		1.00	0.95		0.97	0.95	1.00	0.97	0.95	1.00
Frpb, ped/bikes	1.00	0.97		1.00	0.98		1.00	1.00	0.93	1.00	1.00	0.93
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.94		1.00	0.96		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1719	3194		1770	3245		3433	3539	1474	3335	3539	1437
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1719	3194		1770	3245		3433	3539	1474	3335	3539	1437
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	495	408	253	116	404	136	320	254	29	95	888	62
RTOR Reduction (vph)	0	78	0	0	28	0	0	0	20	0	0	44
Lane Group Flow (vph)	495	583	0	116	512	0	320	254	9	95	888	18
Confl. Peds. (#/hr)	50		50	50		50	50		50	50		50
Heavy Vehicles (%)	5%	5%	2%	2%	5%	5%	2%	2%	2%	5%	2%	5%
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Actuated Green, G (s)	35.0	35.0		24.5	24.5		12.0	35.9	35.9	6.9	30.8	30.8
Effective Green, g (s)	34.1	34.1		23.6	23.6		11.7	36.1	36.1	6.6	31.0	31.0
Actuated g/C Ratio	0.29	0.29		0.20	0.20		0.10	0.31	0.31	0.06	0.27	0.27
Clearance Time (s)	3.1	3.1		3.1	3.1		3.7	4.2	4.2	3.7	4.2	4.2
Vehicle Extension (s)	2.0	2.0		2.0	2.0		2.0	2.0	2.0	2.0	2.0	2.0
Lane Grp Cap (vph)	504	936		359	658		345	1098	457	189	943	383
v/s Ratio Prot	c0.29	0.18		0.07	c0.16		c0.09	0.07		0.03	c0.25	
v/s Ratio Perm									0.01			0.01
v/c Ratio	0.98	0.62		0.32	0.78		0.93	0.23	0.02	0.50	0.94	0.05
Uniform Delay, d1	40.8	35.6		39.6	43.9		51.9	29.8	27.9	53.3	41.8	31.7
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	35.2	0.9		0.2	5.3		29.8	0.0	0.0	0.8	16.8	0.0
Delay (s)	76.0	36.5		39.8	49.2		81.8	29.9	27.9	54.1	58.6	31.7
Level of Service	E	D		D	D		F	C	C	D	E	C
Approach Delay (s)		53.4			47.5			57.3			56.6	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	53.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	116.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	380	352	33	3	16	262	451	220	526	16	267	561
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.5	3.5				3.5	4.0		3.8		3.0	3.8
Lane Util. Factor	1.00	1.00				0.95	1.00		1.00		1.00	1.00
Frt	1.00	0.99				1.00	0.85		1.00		1.00	1.00
Flt Protected	0.95	1.00				1.00	1.00		0.99		0.95	1.00
Satd. Flow (prot)	1770	1837				3529	1583		1831		1770	1863
Flt Permitted	0.49	1.00				0.81	1.00		0.58		0.95	1.00
Satd. Flow (perm)	912	1837				2861	1583		1082		1770	1863
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	400	371	35	3	17	276	475	232	554	17	281	591
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	1	0	0	0
Lane Group Flow (vph)	400	409	0	0	0	293	475	0	802	0	281	591
Turn Type	Perm				Perm		Free	Perm			Prot	
Protected Phases		3				3			6		5	
Permitted Phases	3				3		Free	6				2
Actuated Green, G (s)	29.6	29.6				29.6	112.7		51.3		9.0	63.3
Effective Green, g (s)	29.6	29.6				29.6	112.7		51.3		9.0	63.3
Actuated g/C Ratio	0.26	0.26				0.26	1.00		0.46		0.08	0.56
Clearance Time (s)	3.5	3.5				3.5			3.8		3.0	3.8
Vehicle Extension (s)	3.0	3.0				3.0			3.0		3.0	3.0
Lane Grp Cap (vph)	240	482				751	1583		493		141	1046
v/s Ratio Prot		0.22									c0.16	
v/s Ratio Perm	c0.44					0.10	0.30		c0.74			0.32
v/c Ratio	1.67	0.85				0.39	0.30		1.63		1.99	0.57
Uniform Delay, d1	41.6	39.4				34.1	0.0		30.7		51.8	15.9
Progression Factor	1.00	1.00				1.00	1.00		1.00		1.00	1.00
Incremental Delay, d2	317.7	13.1				0.3	0.5		291.6		471.1	0.7
Delay (s)	359.3	52.5				34.5	0.5		322.3		523.0	16.6
Level of Service	F	D				C	A		F		F	B
Approach Delay (s)		204.2				13.5			322.3			116.8
Approach LOS		F				B			F			F

Intersection Summary			
HCM Average Control Delay	155.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.59		
Actuated Cycle Length (s)	112.7	Sum of lost time (s)	14.4
Intersection Capacity Utilization	120.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SBR	SBR2	NEL2	NEL	NER
Lane Configurations					
Volume (vph)	129	388	5	74	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900
Total Lost time (s)	3.8			4.1	4.1
Lane Util. Factor	1.00			1.00	1.00
Frt	0.85			1.00	0.85
Flt Protected	1.00			0.95	1.00
Satd. Flow (prot)	1583			1770	1583
Flt Permitted	1.00			0.95	1.00
Satd. Flow (perm)	1583			1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	136	408	5	78	4
RTOR Reduction (vph)	83	0	0	0	0
Lane Group Flow (vph)	461	0	0	83	4
Turn Type	custom		Split		Perm
Protected Phases			4	4	
Permitted Phases	2				4
Actuated Green, G (s)	63.3			8.4	8.4
Effective Green, g (s)	63.3			8.4	8.4
Actuated g/C Ratio	0.56			0.07	0.07
Clearance Time (s)	3.8			4.1	4.1
Vehicle Extension (s)	3.0			2.0	2.0
Lane Grp Cap (vph)	889			132	118
v/s Ratio Prot				c0.05	
v/s Ratio Perm	0.29				0.00
v/c Ratio	0.52			0.63	0.03
Uniform Delay, d1	15.3			50.6	48.4
Progression Factor	1.00			1.00	1.00
Incremental Delay, d2	0.5			6.6	0.0
Delay (s)	15.8			57.2	48.4
Level of Service	B			E	D
Approach Delay (s)				56.8	
Approach LOS				E	

Intersection Summary

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	22	927	765	29	17	12
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)	24	1008	832	32	18	13
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	863				1903	847
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	863				1903	847
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				75	96
cM capacity (veh/h)	779				73	362

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	1032	863	32
Volume Left	24	0	18
Volume Right	0	32	13
cSH	779	1700	110
Volume to Capacity	0.03	0.51	0.29
Queue Length 95th (ft)	2	0	27
Control Delay (s)	0.9	0.0	50.6
Lane LOS	A		F
Approach Delay (s)	0.9	0.0	50.6
Approach LOS			F

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	37	8	0	0	0	14	5	281	5	483	64
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)	0	40	9	0	0	0	15	5	305	5	525	70
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	759	912	560	788	794	158	595			311		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	759	912	560	788	794	158	595			311		
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 %	100	85	98	100	100	100	98			100		
cM capacity (veh/h)	318	268	528	265	314	887	982			1250		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	49	0	326	600
Volume Left	0	0	15	5
Volume Right	9	0	305	70
cSH	294	1700	982	1250
Volume to Capacity	0.17	0.00	0.02	0.00
Queue Length 95th (ft)	15	0	1	0
Control Delay (s)	19.7	0.0	0.6	0.1
Lane LOS	C	A	A	A
Approach Delay (s)	19.7	0.0	0.6	0.1
Approach LOS	C	A		

Intersection Summary			
Average Delay	1.3		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix D

Percent Contribution to Cumulative Growth in Traffic Volumes at Intersections Operating at Unacceptable LOS

Name	Existing		Cumulative plus Project		Overall Growth=Existing to Cumulative plus Project		Project Traffic		Percent Growth=Project Traffic/Overall Growth	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1. Park/Blanding	2916	3025	4031	4114	1115	1089	120	163	**10.8%**	**15.0%**
2. Park/Clement	2339	2653	3595	3870	1256	1217	30	41	2.4%	**3.4%**
4. Oak/Clement	1014	923	1984	2203	970	1280	61	82	**6.3%**	**6.4%**
7. Tilden/Blanding	2551	2085	4697	3978	2146	1893	19	25	0.9%	1.3%
11. High/Fernside	2665	2987	3816	3687	1151	700	0	0	0.0%	0.0%

Name	Existing		Cumulative plus Project Alt 1		Overall Growth= Existing to Cumulative plus Project Alternative 1		Project Alt 1 Traffic		Percent Growth=Project Alt 1 Traffic/Overall Growth	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1. Park/Blanding	2916	3025	3962	4018	1046	993	51	67	**4.9%**	**6.7%**
2. Park/Clement	2339	2653	3577	3846	1238	1193	12	17	1.0%	1.4%
4. Oak/Clement	1014	923	1949	2154	935	1231	26	33	2.8%	2.7%
7. Tilden/Blanding	2551	2085	4686	3963	2135	1878	8	10	0.4%	0.5%
11. High/Fernside	2665	2987	3816	3687	1151	700	0	0	0.0%	0.0%

Name	Existing		Cumulative plus Project Alt 2		Overall Growth=Existing to Cumulative plus Project Alternative 2		Project Alt 2 Traffic		Percent Growth=Project Alt 2 Traffic/Overall Growth	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1. Park/Blanding	2916	3025	4010	4084	1094	1059	99	133	**9.0%**	**12.6%**
2. Park/Clement	2339	2653	3590	3862	1251	1209	25	33	2.0%	2.7%
4. Oak/Clement	1014	923	1972	2190	958	1267	49	69	**5.1%**	**5.4%**
7. Tilden/Blanding	2551	2085	4693	3973	2142	1888	15	20	0.7%	1.1%
11. High/Fernside	2665	2987	3816	3687	1151	700	0	0	0.0%	0.0%

Bold signifies that percent contribution exceeds the 3% threshold of significance

APPENDIX D:

TRANSIT LEVEL OF SERVICE CALCULATION SHEETS

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.9	120.5	0.80	24.0	B
Park St	IV	25	24.3	13.6	37.9	0.11	10.5	D
Tilden Wy	IV	25	28.0	19.1	47.1	0.16	11.9	D
Total	IV		167.9	37.6	205.5	1.07	18.7	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	21.5	49.5	0.16	11.3	D
Oak St	IV	25	24.3	3.3	27.6	0.11	14.4	C
Grand St	IV	25	115.6	16.4	132.0	0.80	21.9	B
Total	IV		167.9	41.2	209.1	1.07	18.4	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	22.2	48.2	0.14	10.8	D
Blanding Ave	IV	25	16.7	14.1	30.8	0.06	7.3	E
Total	IV		42.7	36.3	79.0	0.21	9.5	D

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	4.8	21.5	0.06	10.5	D
Buena Vista #1	IV	25	26.0	5.0	31.0	0.14	16.8	C
Total	IV		42.7	9.8	52.5	0.21	14.2	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	3.7	119.3	0.80	24.2	B
Park St	IV	25	24.3	21.4	45.7	0.11	8.7	E
Tilden Wy	IV	25	28.0	12.3	40.3	0.16	13.9	C
Total	IV		167.9	37.4	205.3	1.07	18.7	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	14.0	42.0	0.16	13.3	C
Oak St	IV	25	24.3	4.7	29.0	0.11	13.7	C
Grand St	IV	25	115.6	13.1	128.7	0.80	22.5	B
Total	IV		167.9	31.8	199.7	1.07	19.3	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	12.1	38.1	0.14	13.7	C
Blanding Ave	IV	25	16.7	12.9	29.6	0.06	7.6	E
Total	IV		42.7	25.0	67.7	0.21	11.0	D

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	4.2	20.9	0.06	10.8	D
Buena Vista #1	IV	25	26.0	12.2	38.2	0.14	13.6	C
Total	IV		42.7	16.4	59.1	0.21	12.6	D

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	5.9	121.5	0.80	23.8	B
Park St	IV	25	24.3	13.2	37.5	0.11	10.6	D
Tilden Wy	IV	25	28.0	19.8	47.8	0.16	11.7	D
Total	IV		167.9	38.9	206.8	1.07	18.6	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	22.1	50.1	0.16	11.2	D
Oak St	IV	25	24.3	5.6	29.9	0.11	13.3	C
Grand St	IV	25	115.6	21.0	136.6	0.80	21.2	B
Total	IV		167.9	48.7	216.6	1.07	17.8	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	24.0	50.0	0.14	10.4	D
Blanding Ave	IV	25	16.7	90.5	107.2	0.06	2.1	F
Total	IV		42.7	114.5	157.2	0.21	4.7	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	4.4	21.1	0.06	10.7	D
Buena Vista #1	IV	25	26.0	3.5	29.5	0.14	17.6	C
Total	IV		42.7	7.9	50.6	0.21	14.8	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.3	119.9	0.80	24.1	B
Park St	IV	25	24.3	21.7	46.0	0.11	8.7	E
Tilden Wy	IV	25	28.0	12.9	40.9	0.16	13.7	C
Total	IV		167.9	38.9	206.8	1.07	18.6	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	14.2	42.2	0.16	13.2	C
Oak	IV	25	24.3	7.5	31.8	0.11	12.5	D
Grand St	IV	25	115.6	12.4	128.0	0.80	22.6	B
Total	IV		167.9	34.1	202.0	1.07	19.0	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	22.8	48.8	0.14	10.7	D
Blanding Ave	IV	25	16.7	20.1	36.8	0.06	6.2	F
Total	IV		42.7	42.9	85.6	0.21	8.7	E

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	1.0	17.7	0.06	12.8	D
Buena Vista #1	IV	25	26.0	4.2	30.2	0.14	17.2	C
Total	IV		42.7	5.2	47.9	0.21	15.6	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	5.9	121.5	0.80	23.8	B
Park St	IV	25	24.3	13.2	37.5	0.11	10.6	D
Tilden Wy	IV	25	28.0	19.9	47.9	0.16	11.7	D
Total	IV		167.9	39.0	206.9	1.07	18.6	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	22.1	50.1	0.16	11.2	D
Oak St	IV	25	24.3	5.6	29.9	0.11	13.3	C
Grand St	IV	25	115.6	21.0	136.6	0.80	21.2	B
Total	IV		167.9	48.7	216.6	1.07	17.8	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	24.0	50.0	0.14	10.4	D
Blanding Ave	IV	25	16.7	102.2	118.9	0.06	1.9	F
Total	IV		42.7	126.2	168.9	0.21	4.4	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	4.5	21.2	0.06	10.7	D
Buena Vista #1	IV	25	26.0	3.7	29.7	0.14	17.5	C
Total	IV		42.7	8.2	50.9	0.21	14.7	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.3	119.9	0.80	24.1	B
Park St	IV	25	24.3	21.6	45.9	0.11	8.7	E
Tilden Wy	IV	25	28.0	12.9	40.9	0.16	13.7	C
Total	IV		167.9	38.8	206.7	1.07	18.6	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	14.2	42.2	0.16	13.2	C
Oak	IV	25	24.3	7.5	31.8	0.11	12.5	D
Grand St	IV	25	115.6	12.4	128.0	0.80	22.6	B
Total	IV		167.9	34.1	202.0	1.07	19.0	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	24.6	50.6	0.14	10.3	D
Blanding Ave	IV	25	16.7	32.7	49.4	0.06	4.6	F
Total	IV		42.7	57.3	100.0	0.21	7.5	E

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	0.8	17.5	0.06	12.9	D
Buena Vista #1	IV	25	26.0	4.2	30.2	0.14	17.2	C
Total	IV		42.7	5.0	47.7	0.21	15.7	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	5.9	121.5	0.80	23.8	B
Park St	IV	25	24.3	13.2	37.5	0.11	10.6	D
Tilden Wy	IV	25	28.0	19.8	47.8	0.16	11.7	D
Total	IV		167.9	38.9	206.8	1.07	18.6	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	22.1	50.1	0.16	11.2	D
Oak St	IV	25	24.3	5.6	29.9	0.11	13.3	C
Grand St	IV	25	115.6	21.0	136.6	0.80	21.2	B
Total	IV		167.9	48.7	216.6	1.07	17.8	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	24.0	50.0	0.14	10.4	D
Blanding Ave	IV	25	16.7	95.5	112.2	0.06	2.0	F
Total	IV		42.7	119.5	162.2	0.21	4.6	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	4.4	21.1	0.06	10.7	D
Buena Vista #1	IV	25	26.0	3.6	29.6	0.14	17.6	C
Total	IV		42.7	8.0	50.7	0.21	14.7	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.3	119.9	0.80	24.1	B
Park St	IV	25	24.3	21.7	46.0	0.11	8.7	E
Tilden Wy	IV	25	28.0	12.9	40.9	0.16	13.7	C
Total	IV		167.9	38.9	206.8	1.07	18.6	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	14.2	42.2	0.16	13.2	C
Oak	IV	25	24.3	7.5	31.8	0.11	12.5	D
Grand St	IV	25	115.6	12.4	128.0	0.80	22.6	B
Total	IV		167.9	34.1	202.0	1.07	19.0	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	23.2	49.2	0.14	10.6	D
Blanding Ave	IV	25	16.7	24.3	41.0	0.06	5.5	F
Total	IV		42.7	47.5	90.2	0.21	8.3	E

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	0.8	17.5	0.06	12.9	D
Buena Vista #1	IV	25	26.0	4.2	30.2	0.14	17.2	C
Total	IV		42.7	5.0	47.7	0.21	15.7	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	5.9	121.5	0.80	23.8	B
Park St	IV	25	24.3	13.2	37.5	0.11	10.6	D
Tilden Wy	IV	25	28.0	19.9	47.9	0.16	11.7	D
Total	IV		167.9	39.0	206.9	1.07	18.6	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	22.1	50.1	0.16	11.2	D
Oak St	IV	25	24.3	5.6	29.9	0.11	13.3	C
Grand St	IV	25	115.6	20.9	136.5	0.80	21.2	B
Total	IV		167.9	48.6	216.5	1.07	17.8	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	24.0	50.0	0.14	10.4	D
Blanding Ave	IV	25	16.7	100.5	117.2	0.06	1.9	F
Total	IV		42.7	124.5	167.2	0.21	4.5	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	4.5	21.2	0.06	10.7	D
Buena Vista #1	IV	25	26.0	3.7	29.7	0.14	17.5	C
Total	IV		42.7	8.2	50.9	0.21	14.7	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.3	119.9	0.80	24.1	B
Park St	IV	25	24.3	21.6	45.9	0.11	8.7	E
Tilden Wy	IV	25	28.0	12.9	40.9	0.16	13.7	C
Total	IV		167.9	38.8	206.7	1.07	18.6	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	14.2	42.2	0.16	13.2	C
Oak	IV	25	24.3	7.5	31.8	0.11	12.5	D
Grand St	IV	25	115.6	12.4	128.0	0.80	22.6	B
Total	IV		167.9	34.1	202.0	1.07	19.0	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	24.1	50.1	0.14	10.4	D
Blanding Ave	IV	25	16.7	31.3	48.0	0.06	4.7	F
Total	IV		42.7	55.4	98.1	0.21	7.6	E

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	0.8	17.5	0.06	12.9	D
Buena Vista #1	IV	25	26.0	4.2	30.2	0.14	17.2	C
Total	IV		42.7	5.0	47.7	0.21	15.7	C

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.6	120.2	0.80	24.0	B
Park St	IV	25	24.3	13.1	37.4	0.11	10.6	D
Tilden Wy	IV	25	28.0	24.1	52.1	0.16	10.7	D
Total	IV		167.9	41.8	209.7	1.07	18.3	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	22.6	50.6	0.16	11.0	D
Oak	IV	25	24.3	2.6	26.9	0.11	14.8	C
Grand St	IV	25	115.6	11.5	127.1	0.80	22.7	B
Total	IV		167.9	36.7	204.6	1.07	18.8	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	139.6	165.6	0.14	3.1	F
Blanding Ave	IV	25	16.7	252.0	268.7	0.06	0.8	F
Total	IV		42.7	391.6	434.3	0.21	1.7	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	21.4	38.1	0.06	5.9	F
Buena Vista #1	IV	25	26.0	14.7	40.7	0.14	12.8	D
Total	IV		42.7	36.1	78.8	0.21	9.5	D

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.0	119.6	0.80	24.2	B
Park St	IV	25	24.3	23.3	47.6	0.11	8.4	E
Tilden Wy	IV	25	28.0	13.4	41.4	0.16	13.5	C
Total	IV		167.9	40.7	208.6	1.07	18.4	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	15.8	43.8	0.16	12.8	D
Oak St	IV	25	24.3	2.8	27.1	0.11	14.7	C
Grand St	IV	25	115.6	11.7	127.3	0.80	22.7	B
Total	IV		167.9	30.3	198.2	1.07	19.4	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	167.6	193.6	0.14	2.7	F
Blanding Ave	IV	25	16.7	127.6	144.3	0.06	1.6	F
Total	IV		42.7	295.2	337.9	0.21	2.2	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	30.6	47.3	0.06	4.8	F
Buena Vista #1	IV	25	26.0	24.2	50.2	0.14	10.4	D
Total	IV		42.7	54.8	97.5	0.21	7.7	E

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.6	120.2	0.80	24.0	B
Park St	IV	25	24.3	13.0	37.3	0.11	10.7	D
Tilden Wy	IV	25	28.0	24.0	52.0	0.16	10.8	D
Total	IV		167.9	41.6	209.5	1.07	18.4	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	22.6	50.6	0.16	11.0	D
Oak	IV	25	24.3	2.6	26.9	0.11	14.8	C
Grand St	IV	25	115.6	11.6	127.2	0.80	22.7	B
Total	IV		167.9	36.8	204.7	1.07	18.8	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	147.1	173.1	0.14	3.0	F
Blanding Ave	IV	25	16.7	261.6	278.3	0.06	0.8	F
Total	IV		42.7	408.7	451.4	0.21	1.7	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	22.2	38.9	0.06	5.8	F
Buena Vista #1	IV	25	26.0	14.7	40.7	0.14	12.8	D
Total	IV		42.7	36.9	79.6	0.21	9.4	D

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.0	119.6	0.80	24.2	B
Park St	IV	25	24.3	23.4	47.7	0.11	8.3	E
Tilden Wy	IV	25	28.0	13.4	41.4	0.16	13.5	C
Total	IV		167.9	40.8	208.7	1.07	18.4	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	15.8	43.8	0.16	12.8	D
Oak St	IV	25	24.3	2.8	27.1	0.11	14.7	C
Grand St	IV	25	115.6	11.8	127.4	0.80	22.7	B
Total	IV		167.9	30.4	198.3	1.07	19.4	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	204.8	230.8	0.14	2.3	F
Blanding Ave	IV	25	16.7	141.6	158.3	0.06	1.4	F
Total	IV		42.7	346.4	389.1	0.21	1.9	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	31.5	48.2	0.06	4.7	F
Buena Vista #1	IV	25	26.0	24.1	50.1	0.14	10.4	D
Total	IV		42.7	55.6	98.3	0.21	7.6	E

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.6	120.2	0.80	24.0	B
Park St	IV	25	24.3	13.1	37.4	0.11	10.6	D
Tilden Wy	IV	25	28.0	24.1	52.1	0.16	10.7	D
Total	IV		167.9	41.8	209.7	1.07	18.3	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	22.6	50.6	0.16	11.0	D
Oak	IV	25	24.3	2.6	26.9	0.11	14.8	C
Grand St	IV	25	115.6	11.5	127.1	0.80	22.7	B
Total	IV		167.9	36.7	204.6	1.07	18.8	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	139.6	165.6	0.14	3.1	F
Blanding Ave	IV	25	16.7	255.9	272.6	0.06	0.8	F
Total	IV		42.7	395.5	438.2	0.21	1.7	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	21.7	38.4	0.06	5.9	F
Buena Vista #1	IV	25	26.0	14.7	40.7	0.14	12.8	D
Total	IV		42.7	36.4	79.1	0.21	9.4	D

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.0	119.6	0.80	24.2	B
Park St	IV	25	24.3	23.3	47.6	0.11	8.4	E
Tilden Wy	IV	25	28.0	13.4	41.4	0.16	13.5	C
Total	IV		167.9	40.7	208.6	1.07	18.4	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	15.8	43.8	0.16	12.8	D
Oak St	IV	25	24.3	2.8	27.1	0.11	14.7	C
Grand St	IV	25	115.6	11.7	127.3	0.80	22.7	B
Total	IV		167.9	30.3	198.2	1.07	19.4	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	185.9	211.9	0.14	2.5	F
Blanding Ave	IV	25	16.7	138.8	155.5	0.06	1.5	F
Total	IV		42.7	324.7	367.4	0.21	2.0	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	31.2	47.9	0.06	4.7	F
Buena Vista #1	IV	25	26.0	24.2	50.2	0.14	10.4	D
Total	IV		42.7	55.4	98.1	0.21	7.6	E

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.6	120.2	0.80	24.0	B
Park St	IV	25	24.3	13.1	37.4	0.11	10.6	D
Tilden Wy	IV	25	28.0	24.1	52.1	0.16	10.7	D
Total	IV		167.9	41.8	209.7	1.07	18.3	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	22.6	50.6	0.16	11.0	D
Oak	IV	25	24.3	2.6	26.9	0.11	14.8	C
Grand St	IV	25	115.6	11.6	127.2	0.80	22.7	B
Total	IV		167.9	36.8	204.7	1.07	18.8	C

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	147.1	173.1	0.14	3.0	F
Blanding Ave	IV	25	16.7	260.1	276.8	0.06	0.8	F
Total	IV		42.7	407.2	449.9	0.21	1.7	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	22.1	38.8	0.06	5.8	F
Buena Vista #1	IV	25	26.0	14.7	40.7	0.14	12.8	D
Total	IV		42.7	36.8	79.5	0.21	9.4	D

Arterial Level of Service: EB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Oak St	IV	25	115.6	4.0	119.6	0.80	24.2	B
Park St	IV	25	24.3	23.4	47.7	0.11	8.3	E
Tilden Wy	IV	25	28.0	13.4	41.4	0.16	13.5	C
Total	IV		167.9	40.8	208.7	1.07	18.4	C

Arterial Level of Service: WB Buena Vista #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Park St #1	IV	25	28.0	15.8	43.8	0.16	12.8	D
Oak St	IV	25	24.3	2.8	27.1	0.11	14.7	C
Grand St	IV	25	115.6	11.8	127.4	0.80	22.7	B
Total	IV		167.9	30.4	198.3	1.07	19.4	B

Arterial Level of Service: NB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	26.0	196.4	222.4	0.14	2.3	F
Blanding Ave	IV	25	16.7	140.6	157.3	0.06	1.4	F
Total	IV		42.7	337.0	379.7	0.21	2.0	F

Arterial Level of Service: SB Park St #1

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Clement Ave	IV	25	16.7	31.5	48.2	0.06	4.7	F
Buena Vista #1	IV	25	26.0	24.1	50.1	0.14	10.4	D
Total	IV		42.7	55.6	98.3	0.21	7.6	E

APPENDIX D: SUPPORTING TABLES FOR CMP/MTS EVALUATION

Congestion Management Program Land Use Analysis

Table D-1: Land Use Changes for Project Area

Project TAZ	Scenario	Baseline 2015	Cumulative 2030
		Total Households	Total Households
528	Proposed Project (242 du)	242	242
	Project Alternative 1 (100 du)	100	100
	Project Alternative 2 (200 du)	200	200

Baseline Conditions Impacts on Regional and Local Roadways

Table D-2 - LOS Summary for Baseline plus Project conditions for the AM peak hour

Table D -3 - LOS Summary for Baseline plus Project conditions for the PM peak hour.

Table D -4 - LOS Summary for Baseline plus Project Alternative 1 conditions for the AM peak hour

Table D -5 - LOS Summary for Baseline plus Project Alternative 1 conditions for the PM peak hour.

Table D -6 - LOS Summary for Baseline plus Project Alternative 2 conditions for the AM peak hour

Table D -7 - LOS Summary for Baseline plus Project Alternative 2 conditions for the PM peak hour.

Cumulative Conditions Impacts on Regional and Local Roadways

Table D -8 - LOS Summary for Cumulative plus Project conditions for the AM peak hour

Table D -9 - LOS Summary for Cumulative plus Project conditions for the PM peak hour.

Table D -10 - LOS Summary for Cumulative plus Project Alternative 1 conditions for the AM peak hour

Table D -11 - LOS Summary for Cumulative plus Project Alternative 1 conditions for the PM peak hour.

Table D -12 - LOS Summary for Cumulative plus Project Alternative 2 conditions for the AM peak hour

Table D -13 - LOS Summary for Cumulative plus Project Alternative 2 conditions for the PM peak hour.

MTS Transit Corridors

Transit Ridership / Load Factors on AC Transit Buses (**Table D -14 and Table D -15**)

Transit Ridership on BART (**Table D -16**)

Table D-2: CMP Segment Analysis for Baseline Conditions with and without Project -AM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2015 AM Vol	Project 2015 AM Vol	% Vol Diff	Vol Diff	No-Project 2015 AM LOS	Project 2015 AM LOS	Change in V/C > 3%	Change in LOS	No-Project 2015 AM Vol	Project 2015 AM Vol	% Vol Diff	Vol Diff	No-Project 2015 AM LOS	Project 2015 AM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	7,795	7,843	*0.6%*	48	E	E	no	no change	6,622	6,630	*0.1%*	8	D	D	no	no change
I-880 - south of High Street	7,542	7,546	*0.1%*	4	C	C	no	no change	6,022	6,041	*0.3%*	19	C	C	no	no change
Arterials																
Park St - south of Lincoln	1,562	1,563	*0.1%*	1	E	E	no	no change	1,075	1,079	*0.4%*	4	D	D	no	no change
Park St - Bridge	2,037	2,113	*3.6%*	76	**F**	**F**	**yes**	**no change**	1,340	1,365	*1.8%*	25	D	D	no	no change
29th Av-Oakland	1,215	1,219	*0.3%*	4	D	D	no	no change	1,033	1,039	*0.6%*	6	D	D	no	no change
23rd Av-Freeway Ent.	744	792	*6.1%*	48	D	D	no	no change	248	256	*3.1%*	8	D	D	no	no change
Fruitvale Av-south of Fernside	1,668	1,682	*0.8%*	14	E	E	no	no change	1,460	1,465	*0.3%*	5	D	D	no	no change
Fruitvale Av-south of San Leandro Blvd	925	929	*0.4%*	4	D	D	no	no change	829	830	*0.1%*	1	D	D	no	no change
Encinal Av - east of Grand	546	546	*0.0%*	0	D	D	no	no change	368	370	*0.5%*	2	D	D	no	no change
Encinal Av - east of Park	32	34	*5.9%*	2	D	D	no	no change	72	72	*0.0%*	0	D	D	no	no change
International Blvd-south of Fruitvale	1,753	1,755	*0.1%*	2	**F**	**F**	no	no change	159	165	*3.6%*	6	D	D	no	no change
International Blvd-north of 23rd	1,382	1,384	*0.1%*	2	D	D	no	no change	324	324	*0.0%*	0	D	D	no	no change

Table D-3: CMP Segment Analysis for Baseline Conditions with and without Project -PM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2015 PM Vol	Project 2015 PM Vol	% Vol Diff	Vol Diff	No-Project 2015 PM LOS	Project 2015 PM LOS	Change in V/C > 3%	Change in LOS	No-Project 2015 PM Vol	Project 2015 PM Vol	% Vol Diff	Vol Diff	No-Project 2015 PM LOS	Project 2015 PM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	7,025	7,057	*0.5%*	32	D	D	no	no change	8,057	8,115	*0.7%*	58	**F**	**F**	no	no change
I-880 - south of High Street	7,449	7,462	*0.2%*	13	C	C	no	no change	7,571	7,583	*0.2%*	12	E	E	no	no change
Arterials																
Park St - south of Lincoln	1,261	1,265	*0.3%*	4	D	D	no	no change	1,423	1,425	*0.1%*	2	D	D	no	no change
Park St - Bridge	1,701	1,752	*2.9%*	51	**F**	**F**	no	no change	1,965	2,052	*4.2%*	87	**F**	**F**	**yes**	**no change**
29th Av-Oakland	1,587	1,593	*0.4%*	6	E	E	no	no change	833	843	*1.2%*	10	D	D	no	no change
23rd Av-Freeway Ent.	138	170	*18.9%*	32	D	D	no	no change	655	713	*8.1%*	58	D	D	yes	no change
Fruitvale Av-south of Fernside	1,356	1,365	*0.7%*	9	D	D	no	no change	1,648	1,664	*1.0%*	16	E	E	no	no change
Fruitvale Av-south of San Leandro Blvd	1,312	1,314	*0.2%*	2	D	D	no	no change	645	648	*0.5%*	3	D	D	no	no change
Encinal Av - east of Grand	505	505	*0.0%*	0	D	D	no	no change	442	443	*0.2%*	1	D	D	no	no change
Encinal Av - east of Park	86	87	*1.1%*	1	D	D	no	no change	50	51	*2.0%*	1	D	D	no	no change
International Blvd-south of Fruitvale	484	491	*1.4%*	7	D	D	no	no change	1,762	1,766	*0.2%*	4	**F**	**F**	no	no change
International Blvd-north of 23rd	280	280	*0.0%*	0	D	D	no	no change	1,812	1,814	*0.1%*	2	**F**	**F**	no	no change

Table D-4: CMP Segment Analysis for Baseline Conditions with and without Project Alternative 1 -AM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2015 AM Vol	Project 2015 AM Vol	% Vol Diff	Vol Diff	No-Project 2015 AM LOS	Project 2015 AM LOS	Change in V/C > 3%	Change in LOS	No-Project 2015 AM Vol	Project 2015 AM Vol	% Vol Diff	Vol Diff	No-Project 2015 AM LOS	Project 2015 AM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	7,795	7,815	*0.3%*	20	E	E	no	no change	6,622	6,625	*0.0%*	3	D	D	no	no change
I-880 - south of High Street	7,542	7,544	*0.0%*	2	C	C	no	no change	6,022	6,030	*0.1%*	8	C	C	no	no change
Arterials																
Park St - south of Lincoln	1,562	1,562	*0.0%*	0	E	E	no	no change	1,075	1,077	*0.2%*	2	D	D	no	no change
Park St - Bridge	2,037	2,068	*1.5%*	31	**F**	**F**	no	no change	1,340	1,350	*0.7%*	10	D	D	no	no change
29th Av-Oakland	1,215	1,217	*0.2%*	2	D	D	no	no change	1,033	1,035	*0.2%*	2	D	D	no	no change
23rd Av-Freeway Ent.	744	764	*2.6%*	20	D	D	no	no change	248	251	*1.2%*	3	D	D	no	no change
Fruitvale Av-south of Fernside	1,668	1,674	*0.4%*	6	E	E	no	no change	1,460	1,462	*0.1%*	2	D	D	no	no change
Fruitvale Av-south of San Leandro Blvd	925	927	*0.2%*	2	D	D	no	no change	829	829	*0.0%*	0	D	D	no	no change
Encinal Av - east of Grand	546	546	*0.0%*	0	D	D	no	no change	368	369	*0.3%*	1	D	D	no	no change
Encinal Av - east of Park	32	33	*3.0%*	1	D	D	no	no change	72	72	*0.0%*	0	D	D	no	no change
International Blvd-south of Fruitvale	1,753	1,754	*0.1%*	1	**F**	**F**	no	no change	159	161	*1.2%*	2	D	D	no	no change
International Blvd-north of 23rd	1,382	1,383	*0.1%*	1	D	D	no	no change	324	324	*0.0%*	0	D	D	no	no change

Source: Dowling Associates, Inc.,2009

Table D-5: CMP Segment Analysis for Baseline Conditions with and without Project Alternative 1 -PM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2015 PM Vol	Project 2015 PM Vol	% Vol Diff	Vol Diff	No-Project 2015 PM LOS	Project 2015 PM LOS	Change in V/C > 3%	Change in LOS	No-Project 2015 PM Vol	Project 2015 PM Vol	% Vol Diff	Vol Diff	No-Project 2015 PM LOS	Project 2015 PM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	7,025	7,038	*0.2%*	13	D	D	no	no change	8,057	8,081	*0.3%*	24	**F**	**F**	no	no change
I-880 - south of High Street	7,449	7,454	*0.1%*	5	C	C	no	no change	7,571	7,576	*0.1%*	5	E	E	no	no change
Arterials																
Park St - south of Lincoln	1,261	1,263	*0.2%*	2	D	D	no	no change	1,423	1,424	*0.1%*	1	D	D	no	no change
Park St - Bridge	1,701	1,722	*1.2%*	21	**F**	**F**	no	no change	1,965	2,001	*1.8%*	36	**F**	**F**	no	no change
29th Av-Oakland	1,587	1,589	*0.1%*	2	E	E	no	no change	833	837	*0.5%*	4	D	D	no	no change
23rd Av-Freeway Ent.	138	151	*8.6%*	13	D	D	no	no change	655	679	*3.5%*	24	D	D	no	no change
Fruitvale Av-south of Fernside	1,356	1,360	*0.3%*	4	D	D	no	no change	1,648	1,655	*0.4%*	7	E	E	no	no change
Fruitvale Av-south of San Leandro Blvd	1,312	1,313	*0.1%*	1	D	D	no	no change	645	646	*0.2%*	1	D	D	no	no change
Encinal Av - east of Grand	505	505	*0.0%*	0	D	D	no	no change	442	442	*0.0%*	0	D	D	no	no change
Encinal Av - east of Park	86	86	*0.0%*	0	D	D	no	no change	50	50	*0.0%*	0	D	D	no	no change
International Blvd-south of Fruitvale	484	487	*0.6%*	3	D	D	no	no change	1,762	1,764	*0.1%*	2	**F**	**F**	no	no change
International Blvd-north of 23rd	280	280	*0.0%*	0	D	D	no	no change	1,812	1,813	*0.1%*	1	**F**	**F**	no	no change

Source: Dowling Associates, Inc.,2009

Table D-6: CMP Segment Analysis for Baseline Conditions with and without Project Alternative 2 -AM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2015 AM Vol	Project 2015 AM Vol	% Vol Diff	Vol Diff	No-Project 2015 AM LOS	Project 2015 AM LOS	Change in V/C > 3%	Change in LOS	No-Project 2015 AM Vol	Project 2015 AM Vol	% Vol Diff	Vol Diff	No-Project 2015 AM LOS	Project 2015 AM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	7,795	7,835	*0.5%*	40	E	E	no	no change	6,622	6,629	*0.1%*	7	D	D	no	no change
I-880 - south of High Street	7,542	7,545	*0.0%*	3	C	C	no	no change	6,022	6,038	*0.3%*	16	C	C	no	no change
Arterials																
Park St - south of Lincoln	1,562	1,563	*0.1%*	1	E	E	no	no change	1,075	1,078	*0.3%*	3	D	D	no	no change
Park St - Bridge	2,037	2,100	*3.0%*	63	**F**	**F**	yes	no change	1,340	1,361	*1.5%*	21	D	D	no	no change
29th Av-Oakland	1,215	1,218	*0.2%*	3	D	D	no	no change	1,033	1,038	*0.5%*	5	D	D	no	no change
23rd Av-Freeway Ent.	744	784	*5.1%*	40	D	D	no	no change	248	255	*2.7%*	7	D	D	no	no change
Fruitvale Av-south of Fernside	1,668	1,680	*0.7%*	12	E	E	no	no change	1,460	1,464	*0.3%*	4	D	D	no	no change
Fruitvale Av-south of San Leandro Blvd	925	928	*0.3%*	3	D	D	no	no change	829	830	*0.1%*	1	D	D	no	no change
Encinal Av - east of Grand	546	546	*0.0%*	0	D	D	no	no change	368	370	*0.5%*	2	D	D	no	no change
Encinal Av - east of Park	32	34	*5.9%*	2	D	D	no	no change	72	72	*0.0%*	0	D	D	no	no change
International Blvd-south of Fruitvale	1,753	1,755	*0.1%*	2	**F**	**F**	no	no change	159	164	*3.0%*	5	D	D	no	no change
International Blvd-north of 23rd	1,382	1,384	*0.1%*	2	D	D	no	no change	324	324	*0.0%*	0	D	D	no	no change

Source: Dowling Associates, Inc.,2009

Table D-7: CMP Segment Analysis for Baseline Conditions with and without Project Alternative 2 -PM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project	Project	% Vol Diff	Vol Diff	No-Project	Project	Change in V/C > 3%	Change in LOS	No-Project	Project	% Vol Diff	Vol Diff	No-Project	Project	Change in V/C > 3%	Change in LOS
	2015 PM Vol	2015 PM Vol			2015 PM LOS	2015 PM LOS			2015 PM Vol	2015 PM Vol			2015 PM LOS	2015 PM LOS		
Interstate/State Highways																
I-880 - north of 23rd	7,025	7,051	*0.4%*	26	D	D	no	no change	8,057	8,105	*0.6%*	48	**F**	**F**	no	no change
I-880 - south of High Street	7,449	7,460	*0.1%*	11	C	C	no	no change	7,571	7,581	*0.1%*	10	E	E	no	no change
Arterials																
Park St - south of Lincoln	1,261	1,264	*0.2%*	3	D	D	no	no change	1,423	1,425	*0.1%*	2	D	D	no	no change
Park St - Bridge	1,701	1,743	*2.4%*	42	**F**	**F**	no	no change	1,965	2,037	*3.5%*	72	**F**	**F**	**yes**	**no change**
29th Av-Oakland	1,587	1,592	*0.3%*	5	E	E	no	no change	833	841	*1.0%*	8	D	D	no	no change
23rd Av-Freeway Ent.	138	164	*15.9%*	26	D	D	no	no change	655	703	*6.8%*	48	D	D	no	no change
Fruitvale Av-south of Fernside	1,356	1,363	*0.5%*	7	D	D	no	no change	1,648	1,661	*0.8%*	13	E	E	no	no change
Fruitvale Av-south of San Leandro Blvd	1,312	1,314	*0.2%*	2	D	D	no	no change	645	647	*0.3%*	2	D	D	no	no change
Encinal Av - east of Grand	505	505	*0.0%*	0	D	D	no	no change	442	443	*0.2%*	1	D	D	no	no change
Encinal Av - east of Park	86	87	*1.1%*	1	D	D	no	no change	50	51	*2.0%*	1	D	D	no	no change
International Blvd-south of Fruitvale	484	490	*1.2%*	6	D	D	no	no change	1,762	1,765	*0.2%*	3	**F**	**F**	no	no change
International Blvd-north of 23rd	280	280	*0.0%*	0	D	D	no	no change	1,812	1,814	*0.1%*	2	**F**	**F**	no	no change

Source: Dowling Associates, Inc.,2009

Table D-8: CMP Segment Analysis for Cumulative Conditions with and without Project -AM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2035 AM Vol	Project 2035 AM Vol	% Vol Diff	Vol Diff	No-Project 2035 AM LOS	Project 2035 AM LOS	Change in V/C > 3%	Change in LOS	No-Project 2035 AM Vol	Project 2035 AM Vol	% Vol Diff	Vol Diff	No-Project 2035 AM LOS	Project 2035 AM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	8,723	8,771	*0.5%*	48	**F**	**F**	no	no change	7,930	7,938	*0.1%*	8	E	E	no	no change
I-880 - south of High Street	8,651	8,655	*0.0%*	4	D	D	no	no change	7,577	7,596	*0.3%*	19	E	E	no	no change
Arterials																
Park St - south of Lincoln	1,784	1,785	*0.1%*	1	**F**	**F**	no	no change	1,595	1,599	*0.3%*	4	E	E	no	no change
Park St - Bridge	2,709	2,785	*2.7%*	76	**F**	**F**	**yes**	**no change**	2,171	2,196	*1.1%*	25	**F**	**F**	no	no change
29th Av-Oakland	1,727	1,731	*0.2%*	4	**F**	**F**	no	no change	1,416	1,422	*0.4%*	6	D	D	no	no change
23rd Av-Freeway Ent.	976	1,024	*4.7%*	48	D	D	no	no change	530	538	*1.5%*	8	D	D	no	no change
Fruitvale Av-south of Fernside	1,927	1,941	*0.7%*	14	**F**	**F**	no	no change	1,808	1,813	*0.3%*	5	**F**	**F**	no	no change
Fruitvale Av-south of San Leandro Blvd	1,339	1,343	*0.3%*	4	D	D	no	no change	1,177	1,178	*0.1%*	1	D	D	no	no change
Encinal Av - east of Grand	788	788	*0.0%*	0	D	D	no	no change	406	408	*0.5%*	2	D	D	no	no change
Encinal Av - east of Park	303	305	*0.7%*	2	D	D	no	no change	84	84	*0.0%*	0	D	D	no	no change
International Blvd-south of Fruitvale	1,851	1,853	*0.1%*	2	**F**	**F**	no	no change	649	655	*0.9%*	6	D	D	no	no change
International Blvd-north of 23rd	1,823	1,825	*0.1%*	2	**F**	**F**	no	no change	936	936	*0.0%*	0	D	D	no	no change

Source: Dowling Associates, Inc.,2009

Table D-9: CMP Segment Analysis for Cumulative Conditions with and without Project -PM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2035 PM Vol	Project 2035 PM Vol	% Vol Diff	Vol Diff	No-Project 2035 PM LOS	Project 2035 PM LOS	Change in V/C > 3%	Change in LOS	No-Project 2035 PM Vol	Project 2035 PM Vol	% Vol Diff	Vol Diff	No-Project 2035 PM LOS	Project 2035 PM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	7,874	7,906	*0.4%*	32	E	E	no	no change	9,423	9,480	*0.6%*	58	**F**	**F**	no	no change
I-880 - south of High Street	8,499	8,512	*0.2%*	13	D	D	no	no change	8,103	8,115	*0.1%*	12	**F**	**F**	no	no change
Arterials																
Park St - south of Lincoln	1,645	1,649	*0.2%*	4	E	E	no	no change	1,743	1,745	*0.1%*	2	**F**	**F**	no	no change
Park St - Bridge	2,346	2,397	*2.1%*	51	**F**	**F**	no	no change	2,478	2,565	*3.4%*	87	**F**	**F**	**yes**	**no change**
29th Av-Oakland	1,746	1,752	*0.3%*	6	**F**	**F**	no	no change	1,621	1,631	*0.6%*	10	E	E	no	no change
23rd Av-Freeway Ent.	851	883	*3.6%*	32	D	D	no	no change	596	654	*8.8%*	58	D	D	yes	no change
Fruitvale Av-south of Fernside	1,922	1,931	*0.5%*	9	**F**	**F**	no	no change	1,864	1,880	*0.9%*	16	**F**	**F**	no	no change
Fruitvale Av-south of San Leandro Blvd	1,650	1,652	*0.1%*	2	E	E	no	no change	967	970	*0.3%*	3	D	D	no	no change
Encinal Av - east of Grand	559	559	*0.0%*	0	D	D	no	no change	710	711	*0.1%*	1	D	D	no	no change
Encinal Av - east of Park	97	98	*1.0%*	1	D	D	no	no change	360	361	*0.3%*	1	D	D	no	no change
International Blvd-south of Fruitvale	1,709	1,716	*0.4%*	7	E	E	no	no change	2,021	2,025	*0.2%*	4	**F**	**F**	no	no change
International Blvd-north of 23rd	1,467	1,467	*0.0%*	0	E	E	no	no change	1,972	1,974	*0.1%*	2	**F**	**F**	no	no change

Source: Dowling Associates, Inc.,2009

Table D-10: CMP Segment Analysis for Cumulative Conditions with and without Project Alternative 1 -AM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2035 AM Vol	Project 2035 AM Vol	% Vol Diff	Vol Diff	No-Project 2035 AM LOS	Project 2035 AM LOS	Change in V/C > 3%	Change in LOS	No-Project 2035 AM Vol	Project 2035 AM Vol	% Vol Diff	Vol Diff	No-Project 2035 AM LOS	Project 2035 AM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	8,723	8,743	*0.2%*	20	**F**	**F**	no	no change	7,930	7,933	*0.0%*	3	E	E	no	no change
I-880 - south of High Street	8,651	8,653	*0.0%*	2	D	D	no	no change	7,577	7,585	*0.1%*	8	E	E	no	no change
Arterials																
Park St - south of Lincoln	1,784	1,784	*0.0%*	0	**F**	**F**	no	no change	1,595	1,597	*0.1%*	2	E	E	no	no change
Park St - Bridge	2,709	2,740	*1.1%*	31	**F**	**F**	no	no change	2,171	2,181	*0.5%*	10	**F**	**F**	no	no change
29th Av-Oakland	1,727	1,729	*0.1%*	2	**F**	**F**	no	no change	1,416	1,418	*0.1%*	2	D	D	no	no change
23rd Av-Freeway Ent.	976	996	*2.0%*	20	D	D	no	no change	530	533	*0.6%*	3	D	D	no	no change
Fruitvale Av-south of Fernside	1,927	1,933	*0.3%*	6	**F**	**F**	no	no change	1,808	1,810	*0.1%*	2	**F**	**F**	no	no change
Fruitvale Av-south of San Leandro Blvd	1,339	1,341	*0.1%*	2	D	D	no	no change	1,177	1,177	*0.0%*	0	D	D	no	no change
Encinal Av - east of Grand	788	788	*0.0%*	0	D	D	no	no change	406	407	*0.2%*	1	D	D	no	no change
Encinal Av - east of Park	303	304	*0.3%*	1	D	D	no	no change	84	84	*0.0%*	0	D	D	no	no change
International Blvd-south of Fruitvale	1,851	1,852	*0.1%*	1	**F**	**F**	no	no change	649	651	*0.3%*	2	D	D	no	no change
International Blvd-north of 23rd	1,823	1,824	*0.1%*	1	**F**	**F**	no	no change	936	936	*0.0%*	0	D	D	no	no change

Source: Dowling Associates, Inc.,2009

Table D-11: CMP Segment Analysis for Cumulative Conditions with and without Project Alternative 1 -PM Peak Hour

Link Location	Northbound/Eastbound									Southbound/Westbound							
	No-Project 2035 PM Vol	Project 2035 PM Vol	% Vol Diff	Vol Diff	No-Project 2035 PM LOS	Project 2035 PM LOS	Change in V/C > 3%	Change in LOS		No-Project 2035 PM Vol	Project 2035 PM Vol	% Vol Diff	Vol Diff	No-Project 2035 PM LOS	Project 2035 PM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																	
I-880 - north of 23rd	7,874	7,887	*0.2%*	13	E	E	no	no change		9,423	9,447	*0.3%*	24	**F**	**F**	no	no change
I-880 - south of High Street	8,499	8,504	*0.1%*	5	D	D	no	no change		8,103	8,108	*0.1%*	5	**F**	**F**	no	no change
Arterials																	
Park St - south of Lincoln	1,645	1,647	*0.1%*	2	E	E	no	no change		1,743	1,744	*0.1%*	1	**F**	**F**	no	no change
Park St - Bridge	2,346	2,367	*0.9%*	21	**F**	**F**	no	no change		2,478	2,514	*1.4%*	36	**F**	**F**	no	no change
29th Av-Oakland	1,746	1,748	*0.1%*	2	**F**	**F**	no	no change		1,621	1,625	*0.2%*	4	E	E	no	no change
23rd Av-Freeway Ent.	851	864	*1.5%*	13	D	D	no	no change		596	620	*3.9%*	24	D	D	no	no change
Fruitvale Av-south of Fernside	1,922	1,926	*0.2%*	4	**F**	**F**	no	no change		1,864	1,871	*0.4%*	7	**F**	**F**	no	no change
Fruitvale Av-south of San Leandro Blvd	1,650	1,651	*0.1%*	1	E	E	no	no change		967	968	*0.1%*	1	D	D	no	no change
Encinal Av - east of Grand	559	559	*0.0%*	0	D	D	no	no change		710	710	*0.0%*	0	D	D	no	no change
Encinal Av - east of Park	97	97	*0.0%*	0	D	D	no	no change		360	360	*0.0%*	0	D	D	no	no change
International Blvd-south of Fruitvale	1,709	1,712	*0.2%*	3	E	E	no	no change		2,021	2,023	*0.1%*	2	**F**	**F**	no	no change
International Blvd-north of 23rd	1,467	1,467	*0.0%*	0	E	E	no	no change		1,972	1,973	*0.1%*	1	**F**	**F**	no	no change

Source: Dowling Associates, Inc.,2009

Table D 12: CMP Segment Analysis for Cumulative Conditions with and without Project Alternative 2 -AM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2035 AM Vol	Project 2035 AM Vol	% Vol Diff	Vol Diff	No-Project 2035 AM LOS	Project 2035 AM LOS	Change in V/C > 3%	Change in LOS	No-Project 2035 AM Vol	Project 2035 AM Vol	% Vol Diff	Vol Diff	No-Project 2035 AM LOS	Project 2035 AM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	8,723	8,763	*0.5%*	40	**F**	**F**	no	no change	7,930	7,937	*0.1%*	7	E	E	no	no change
I-880 - south of High Street	8,651	8,654	*0.0%*	3	D	D	no	no change	7,577	7,593	*0.2%*	16	E	E	no	no change
Arterials																
Park St - south of Lincoln	1,784	1,785	*0.1%*	1	**F**	**F**	no	no change	1,595	1,598	*0.2%*	3	E	E	no	no change
Park St - Bridge	2,709	2,772	*2.3%*	63	**F**	**F**	yes	no change	2,171	2,192	*1.0%*	21	**F**	**F**	no	no change
29th Av-Oakland	1,727	1,730	*0.2%*	3	**F**	**F**	no	no change	1,416	1,421	*0.4%*	5	D	D	no	no change
23rd Av-Freeway Ent.	976	1,016	*3.9%*	40	D	D	no	no change	530	537	*1.3%*	7	D	D	no	no change
Fruitvale Av-south of Fernside	1,927	1,939	*0.6%*	12	**F**	**F**	no	no change	1,808	1,812	*0.2%*	4	**F**	**F**	no	no change
Fruitvale Av-south of San Leandro Blvd	1,339	1,342	*0.2%*	3	D	D	no	no change	1,177	1,178	*0.1%*	1	D	D	no	no change
Encinal Av - east of Grand	788	788	*0.0%*	0	D	D	no	no change	406	408	*0.5%*	2	D	D	no	no change
Encinal Av - east of Park	303	305	*0.7%*	2	D	D	no	no change	84	84	*0.0%*	0	D	D	no	no change
International Blvd-south of Fruitvale	1,851	1,853	*0.1%*	2	**F**	**F**	no	no change	649	654	*0.8%*	5	D	D	no	no change
International Blvd-north of 23rd	1,823	1,825	*0.1%*	2	**F**	**F**	no	no change	936	936	*0.0%*	0	D	D	no	no change

Source: Dowling Associates, Inc.,2009

Table D-13: CMP Segment Analysis for Cumulative Conditions with and without Project Alternative 2 -PM Peak Hour

Link Location	Northbound/Eastbound								Southbound/Westbound							
	No-Project 2035 PM Vol	Project 2035 PM Vol	% Vol Diff	Vol Diff	No-Project 2035 PM LOS	Project 2035 PM LOS	Change in V/C > 3%	Change in LOS	No-Project 2035 PM Vol	Project 2035 PM Vol	% Vol Diff	Vol Diff	No-Project 2035 PM LOS	Project 2035 PM LOS	Change in V/C > 3%	Change in LOS
Interstate/State Highways																
I-880 - north of 23rd	7,874	7,900	*0.3%*	26	E	E	no	no change	9,423	9,471	*0.5%*	48	**F**	**F**	no	no change
I-880 - south of High Street	8,499	8,510	*0.1%*	11	D	D	no	no change	8,103	8,113	*0.1%*	10	**F**	**F**	no	no change
Arterials																
Park St - south of Lincoln	1,645	1,648	*0.2%*	3	E	E	no	no change	1,743	1,745	*0.1%*	2	**F**	**F**	no	no change
Park St - Bridge	2,346	2,388	*1.8%*	42	**F**	**F**	no	no change	2,478	2,550	*2.8%*	72	**F**	**F**	**yes**	**no change**
29th Av-Oakland	1,746	1,751	*0.3%*	5	**F**	**F**	no	no change	1,621	1,629	*0.5%*	8	E	E	no	no change
23rd Av-Freeway Ent.	851	877	*3.0%*	26	D	D	no	no change	596	644	*7.4%*	48	D	D	no	no change
Fruitvale Av-south of Fernside	1,922	1,929	*0.4%*	7	**F**	**F**	no	no change	1,864	1,877	*0.7%*	13	**F**	**F**	no	no change
Fruitvale Av-south of San Leandro Blvd	1,650	1,652	*0.1%*	2	E	E	no	no change	967	969	*0.2%*	2	D	D	no	no change
Encinal Av - east of Grand	559	559	*0.0%*	0	D	D	no	no change	710	711	*0.1%*	1	D	D	no	no change
Encinal Av - east of Park	97	98	*1.0%*	1	D	D	no	no change	360	361	*0.3%*	1	D	D	no	no change
International Blvd-south of Fruitvale	1,709	1,715	*0.3%*	6	E	E	no	no change	2,021	2,024	*0.1%*	3	**F**	**F**	no	no change
International Blvd-north of 23rd	1,467	1,467	*0.0%*	0	E	E	no	no change	1,972	1,974	*0.1%*	2	**F**	**F**	no	no change

Source: Dowling Associates, Inc.,2009

Table D-14: MTS Transit Analysis – AC Transit Ridership Comparison for Baseline Conditions without and with Project, Project Alternatives 1 and 2

Scenario	No-Project Trips Daily	With Project Trips Daily	No-Project Trips Peak Hour	With Project Trips Peak Hour	Difference Peak Hour	Percent Difference Peak Hour	Model Peak Bus Frequency (in minutes)	Total Buses Peak Hour	Project Trips Per bus Peak Hour	Existing Load Peak Hour	Maximum Load at capacity Peak Hour	Maximum Load with Project Peak Hour
Baseline - 2015 Project												
AC Route												
AC 19	9,382	9,440	2,346	2,360	15	1%	12.5	9	2	25	40	27
AC 50	10,886	10,886	2,722	2,722	-	0%	15	8	0	25	40	25
AC OX	223	222	56	56	(0)	0%	17	3	0	25	40	25
AC 51	21,507	21,507	5,377	5,377	-	0%	8	15	0	25	40	25
AC O	1,792	1,802	448	451	3	1%	20	6	0	25	40	25
	43,790	**43,857**	**10,948**	**10,964**	**17**	**0%**						
Baseline - 2015 Alt 1												
AC Route												
AC 19	9,382	9,398	2,346	2,350	4	0%	12.5	9	0	25	40	25
AC 50	10,886	10,885	2,722	2,721	(0)	0%	15	8	0	25	40	25
AC OX	223	223	56	56	-	0%	17	3	0	25	40	25
AC 51	21,507	21,505	5,377	5,376	(1)	0%	8	15	0	25	40	25
AC O	1,792	1,796	448	449	1	0%	20	6	0	25	40	25
	43,790	**43,807**	**10,948**	**10,952**	**4**	**0%**						
Baseline - 2015 Alt 2												
AC Route												
AC 19	9,382	9,425	2,346	2,356	11	0%	12.5	9	1	25	40	26
AC 50	10,886	10,886	2,722	2,722	-	0%	15	8	0	25	40	25
AC OX	223	222	56	56	(0)	0%	17	3	0	25	40	25
AC 51	21,507	21,504	5,377	5,376	(1)	0%	8	15	0	25	40	25
AC O	1,792	1,800	448	450	2	0%	20	6	0	25	40	25
	43,790	**43,837**	**10,948**	**10,959**	**12**	**0%**						

Source: Dowling Associates, Inc. 2009

Note:

Differences between the no-project and with-project scenarios are attributed to the project

Daily transit trips obtained from ACCMA Countywide Model

Peak Hour transit trips conservatively assumed as 25% of daily

Existing bus load assumed as 25 for all routes

Maximum bus loads are average based on 30 seat buses with 10 standing passengers

Table D-15: MTS Transit Analysis – AC Transit Ridership Comparison for Cumulative Conditions without and with Project, Project Alternatives 1 and 2

Scenario	No-Project Trips Daily	With Project Trips Daily	No-Project Trips Peak Hour	With Project Trips Peak Hour	Difference Peak Hour	Percent Difference Peak Hour	Model Peak Bus Frequency (in minutes)	Total Buses Peak Hour	Project Trips Per bus Peak Hour	Existing Load Peak Hour	Maximum Load at capacity Peak Hour	Maximum Load with Project Peak Hour
Cumulative - 2035 Project												
AC Route												
AC 19	13,655	13,730	3,414	3,433	19	1%	12.5	9	2	25	40	27
AC 50	19,923	19,927	4,981	4,982	1	0%	15	8	0	25	40	25
AC OX	186	186	47	47	-	0%	17	3	0	25	40	25
AC 51	16,678	16,678	4,170	4,170	-	0%	8	15	0	25	40	25
AC O	2,031	2,038	508	510	2	0%	20	6	0	25	40	25
	52,473	**52,559**	**13,118**	**13,140**	**22**	**0%**						
Cumulative - 2035 Alt 1												
AC Route												
AC 19	13,655	13,685	3,414	3,421	8	0%	12.5	9	1	25	40	26
AC 50	19,923	19,925	4,981	4,981	1	0%	15	8	0	25	40	25
AC OX	186	186	47	47	-	0%	17	3	0	25	40	25
AC 51	16,678	16,675	4,170	4,169	(1)	0%	8	15	0	25	40	25
AC O	2,031	2,033	508	508	1	0%	20	6	0	25	40	25
	52,473	**52,504**	**13,118**	**13,126**	**8**	**0%**						
Cumulative - 2035 Alt 2												
AC Route												
AC 19	13,655	13,719	3,414	3,430	16	0%	12.5	9	2	25	40	27
AC 50	19,923	19,926	4,981	4,982	1	0%	15	8	0	25	40	25
AC OX	186	186	47	47	-	0%	17	3	0	25	40	25
AC 51	16,678	16,677	4,170	4,169	(0)	0%	8	15	0	25	40	25
AC O	2,031	2,036	508	509	1	0%	20	6	0	25	40	25
	52,473	**52,544**	**13,118**	**13,136**	**18**	**0%**						

Source: Dowling Associates, Inc. 2009

Note:

Differences between the no-project and with-project scenarios are attributed to the project

Daily transit trips obtained from ACCMA Countywide Model

Peak Hour transit trips conservatively assumed as 25% of daily

Existing bus load assumed as 25 for all routes

Maximum bus loads are average based on 30 seat buses with 10 standing passengers

Table D-16: MTS Transit Analysis – BART Ridership Comparison

BART Station	2015 No Project	2015 Alt1	2015 Alt2	2015 Proj	2035 No Project	2035 Alt1	2035 Alt2	2035 Proj
<u>**Daily Trips (from model forecasts)**</u>								
Fruitvale Station	27,028	27,060	27,093	27,106	39,209	39,247	39,293	39,312
Increase between		32	65	78		38	84	103
No-Project and Project		0.12%	0.24%	0.29%		0.10%	0.21%	0.26%
<u>**Peak Hour Trips (estimated as 25% of daily)**</u>								
Fruitvale Station	6,757	6,765	6,773	6,777	9,802	9,812	9,823	9,828
Increase between		8	16	20		10	21	26
No-Project and Project		0.12%	0.24%	0.29%		0.14%	0.31%	0.38%
Number of BART lines crossing Study area		3	3	3		3	3	3
Bart Frequency in Study area (in minutes)		15	15	15		15	15	15
Number of BART Trains in Peak Hour - both directions		24	24	24		24	24	24
Average New Project trips per train		0.3	0.7	0.8		0.4	0.9	1
Estimated Average Load factor - average for both directions		1.0	1.0	1.0		1.0	1.0	1.0
Average seated capacity of BART train at load		700	700	700		700	700	700
Percent increase Load Factor with Project		0.0%	0.1%	0.1%		0.1%	0.1%	0.2%
Load Factor with Project Trips		100.0%	100.1%	100.1%		100.1%	100.1%	100.2%

Source: Dowling Associates, Inc. 2009

Note:

Differences between the no-project and with-project scenarios are attributed to the project

Daily transit trips obtained from ACCMA Countywide Model

Peak Hour transit trips conservatively assumed as 25% of daily

Existing BART train loads obtained from BART and are the average loads near the project site

Maximum loads are average based on 700 passengers

APPENDIX E

NAHC Response Letters

STATE OF CALIFORNIA Arnold Schwarzenegger, Governor

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-4082
Fax (916) 657-5390
Web Site www.nahc.ca.gov

February 17, 2009

Heidi Koenig
Cultural Resources Group
ESA
1425 N. McDowell Boulevard, Suite 105
Petaluma, CA 94954

Sent by Fax: 707-795-0902

Number of Pages: 2

Re: Proposed Boatworks Residential project, Alameda County

Dear Ms. Koenig:

A record search of the sacred land file has failed to indicate the presence of Native American cultural resources in the immediate project area. The absence of specific site information in the sacred lands file does not indicate the absence of cultural resources in any project area. Other sources of cultural resources should also be contacted for information regarding known and recorded sites.

Enclosed is a list of Native Americans individuals/organizations who may have knowledge of cultural resources in the project area. The Commission makes no recommendation or preference of a single individual, or group over another. This list should provide a starting place in locating areas of potential adverse impact within the proposed project area. I suggest you contact all of those indicated, if they cannot supply information, they might recommend others with specific knowledge. By contacting all those listed, your organization will be better able to respond to claims of failure to consult with the appropriate tribe or group. If a response has not been received within two weeks of notification, the Commission requests that you follow-up with a telephone call to ensure that the project information has been received.

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact me at (916) 653-4038.

Sincerely,

Debbie Pilas-Treadway

Debbie Pilas-Treadway
Environmental Specialist III

APPENDIX F

Air Quality

Calculation of GHGS from Electrical Usage

Per SCAQMD April 2009 document Survy of CEQA Documents on GHG Emissions Draft Work Plan

	kw-hr	
Residential electricty usage in California =	7175	kw-hr/household/yr
# Units =	242	units
Project consumption =	1736350	kW-hr/yr
	1736.35	MW-hr/year

Emission factors for electricity use from California Climate Action Registry General Reporting Protocol January 2009 Version 3.1

	CO2		**CH4**		**N2O**		
CALI Subregion	878.71	lbs/MW-hr	0.0067	lbs/MW-hr	0.0037	lbs/MW-hr	
Total Emissions =	1.53E+06	lb/yr	1.16E+01	lb/yr	6.42E+00	lb/yr	
Total emissions as eCO2 =							
	1525748	lb/yr	2.44E+02	lb/yr	1.99E+03	lb/yr	
	762.8741	ton/yr	0.122152	ton/yr	0.995797	ton/yr	
	691.9268	MT/yr	0.110792	MT/yr	0.903188	MT/yr	692.9407

TOTAL PROJECT ELECTRICITY EMISSIONS AS eCO2 =	**1527984**	**lb/yr**
	694538.2	**kg/yr**
	694.5382	**MT/yr**

MOTOR VEHICLE TRIPS

	CO2		CH4	N2O		
Trips emissions =	19626	pound/day (from URBEMIS)				
Car non-CO2 EF =			0.06	0.07	(gm/mile)	from CCAR GRP
Daily VMT (from URBE 19800						
	CO2		**CH4**	**N20**		
Trip Emissions =	19626		2.61	3.05	pound/day	
Total =	19626		2.61	3.05	pound/day	
	3581.745		0.476982	0.556479	Tons/year	
GWP =	1		21	310		per CCAR, Use GWP's from IPCC's SAR
CO2E emissions =	3581.745		10.01662	172.5085	Tons/year	
	3248.643		**9.085076**	**156.4652**	**MT/Year**	
Total EC02 =	**3414.193**	**MT/Year**				

AREA Source

	CO2		CH4	N2O		
	707	Tons/year (from URBEMIS)				
Emission Factor (nat gas) =	53.06	kg/MMBtu	0.0059	0.0001	kg/MMBtu	(From CCAR Tables C6 and C7
Emission =						
	707		0.078615	0.001332	Tons/Year	
GWP =	1		21	310		per CCAR, Use GWP's from IPCC's SAR
CO2E emissions =	707		1.65091	0.413061	Tons/year	
	641.249		**1.497376**	**0.374646**	**MT/Year**	
	643.121					

Construction Emissions

EMISSIONS in tons per year

CO2	CH4	N2O
797.28 (from URBEMIS)		

From CCAR GPR 3.1 (2009)

Diesel emission of CO2
10.15 kg CO2/gal
0.00074 kg CH4/gal
0.00026 kg N2O/gal

So for Mobile sources…
CH4 emission = 7.29E-05 percent of CO2 Emissions
N2O emissions = 2.56E-05 percent of CO2 Emissions

Total Construction emissions in tons/year=

	CO2	CH4	N2O	Total GHG
	797.28	**0.06**	**0.02**	**797.36**
Total mobile emissions as eCO2 in tons/year=	**797.28**	**1.22**	**6.33**	**804.83**
Total mobile Emissions as eCO2 on Metric tons/yr =	723.28	1.11	5.74	730.13

Total Construction emissions as eCO2 in pounds/day=

	CO2	CH4	N2O	Total GHG
	0.00	**0.00**	**0.00**	**0.00**
Total mobile emissions as eCO2 in tons/year=	**0.00**	**0.00**	**0.00**	**0.00**
Total mobile Emissions as eCO2 on Metric tons/yr =	0	0.00	0.00	0.00

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Urbemis 2007 Version 9.2.4

Detail Report for Summer Area Source Unmitigated Emissions (Pounds/Day)

File Name:

Project Name: ALameda Boatworks

Project Location: Alameda County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

AREA SOURCE EMISSION ESTIMATES (Summer Pounds Per Day, Unmitigated)

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.23	3.03	1.29	0.00	0.01	0.01	3,871.03
Hearth - No Summer Emissions							
Landscape	1.95	0.12	10.80	0.00	0.03	0.03	17.35
Consumer Products	11.84						
Architectural Coatings	3.44						
TOTALS (lbs/day, unmitigated)	17.46	3.15	12.09	0.00	0.04	0.04	3,888.38

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 35% to 0%

Percentage of residences with wood fireplaces changed from 10% to 0%

Percentage of residences with natural gas fireplaces changed from 55% to 100%

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Urbemis 2007 Version 9.2.4

Detail Report for Summer Operational Unmitigated Emissions (Pounds/Day)

File Name:

Project Name: ALameda Boatworks

Project Location: Alameda County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

OPERATIONAL EMISSION ESTIMATES (Summer Pounds Per Day, Unmitigated)

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	17.35	22.52	210.64	0.20	34.14	6.59	19,626.67
TOTALS (lbs/day, unmitigated)	17.35	22.52	210.64	0.20	34.14	6.59	19,626.67

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2011 Temperature (F): 85 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	9.50	9.57	dwelling units	242.00	2,315.94	19,800.59
					2,315.94	19,800.59

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	54.3	0.9	98.7	0.4

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Truck < 3750 lbs	12.4	1.6	96.0	2.4
Light Truck 3751-5750 lbs	19.8	0.5	99.5	0.0
Med Truck 5751-8500 lbs	6.3	0.0	100.0	0.0
Lite-Heavy Truck 8501-10,000 lbs	0.8	0.0	75.0	25.0
Lite-Heavy Truck 10,001-14,000 lbs	0.6	0.0	50.0	50.0
Med-Heavy Truck 14,001-33,000 lbs	1.3	0.0	15.4	84.6
Heavy-Heavy Truck 33,001-60,000 lbs	0.8	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.9	62.1	37.9	0.0
School Bus	0.0	0.0	0.0	0.0
Motor Home	0.6	0.0	83.3	16.7

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.8	7.3	7.5	9.5	7.4	7.4
Rural Trip Length (miles)	16.8	7.1	7.9	14.7	6.6	6.6
Trip speeds (mph)	35.0	35.0	35.0	35.0	35.0	35.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Operational Changes to Defaults

Page: 1

7/13/2009 12:07:59 PM

Urbemis 2007 Version 9.2.4

Summary Report for Winter Emissions (Pounds/Day)

File Name:

Project Name: ALameda Boatworks

Project Location: Alameda County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	201.21	57.88	79.10	0.05	47.61	3.75	49.45	9.94	3.44	11.64	9,633.07
2010 TOTALS (lbs/day mitigated)	201.21	57.88	79.10	0.05	26.93	3.75	28.77	5.63	3.44	7.32	9,633.07

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	15.63	5.04	2.14	0.01	0.17	0.17	6,433.38
TOTALS (lbs/day, mitigated)	15.59	4.44	1.88	0.01	0.16	0.16	5,659.18
Percent Reduction	0.26	11.90	12.15	0.00	5.88	5.88	12.03

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	18.48	32.91	221.72	0.17	34.14	6.59	17,047.93

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SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	34.11	37.95	223.86	0.18	34.31	6.76	23,481.31

Both Area and Operational Mitigation must be turned on to get a combined mitigated total.

APPENDIX G

Biology

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE

Common Name *Scientific Name*	**Listing Status USFWS/ CDFG/other**	**General Habitat**	**Potential for Species Occurrence Within Project Site**	**Period of Identification**
		Species Listed or Proposed for Listing		
Invertebrates				
Bay checkerspot butterfly *Euphydryas editha bayensis*	FT/--/--	Restricted to native grasslands on outcrops of serpentine soil in the vicinity of San Francisco Bay. *Plantago erecta* is the primary host plant; *Castilleja exserta,* and *C. densiflora* are the secondary host plants.	**Not present.** Suitable habitat not found onsite.	March-June
Fish				
Green sturgeon *Acipenser medirostris*	FT/--	Spends majority of life in ocean waters near shore, estuaries, and bays, spawns in fresh water rivers.	**Moderate.** Spawns upstream in Sacramento River, but is not known to spawn in San Francisco Bay. Travels through San Francisco Bay.	Year-round
Tidewater goby *Eucyclogobius newberryi*	FE/CSC	Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego Co. to the mouth of the Smith River. Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels.	**Low.** Suitable habitat not found onsite.	Year-round, varies with salinity
Coho salmon - Central California Coast ESU *Oncorhynchus kisutch*	FT/CE	Central and northern California coastal rivers and streams.	**Low**. Migrating individuals may occasionally move through Oakland Estuary.	Year-round
Steelhead - Central California Coast DPS *Oncorhynchus mykiss*	FT/--	Drainages of San Francisco and San Pablo bays, central Calif. Coastal rivers.	**Moderate**. Migrating individuals may occasionally move through Oakland Estuary.	Year-round
Chinook salmon – Central Valley spring run ESU *Oncorhynchus tshawytscha*	FT/CT	Central and northern California coastal rivers and streams.	**Moderate.** Migrating individuals may occasionally move through Oakland Estuary.	March - August
Chinook salmon – Sacramento River winter run ESU *Oncorhynchus tshawytscha*	FE/CT	Spawning and rearing restricted to Sacramento River basin, migrate through San Francisco Bay and Sacramento-San Joaquin Delta, require clean, cold water and gravel beds for spawning.	**Moderate.** Migrates through San Francisco Estuary. Seasonal stream flows and temperatures may not provide spawning habitat in South San Francisco Bay streams (H.T. Harvey and Associates, 2005).	July - October
Amphibians and Reptiles				
Alameda whipsnake *Masticophis lateralis euryxanthus*	FT/CT/--	Restricted to valley-foothill hardwood habitat of the coast ranges between Monterey and north San Francisco Bay. Inhabits south-facing slopes and ravines where shrubs form a vegetative mosaic with oak trees and grasses.	**Not present.** Suitable habitat not found onsite.	Year-round

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	Listing Status USFWS/ CDFG/other	General Habitat	Potential for Species Occurrence Within Project Site	Period of Identification
California red-legged frog *Rana draytonii*	FT/CSC/--	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development. Must have access to aestivation habitat.	**Not present.** Suitable habitat not found onsite.	Year-round
California tiger salamander *Ambystoma californiense*	FT/CSC/--	Central valley DPS listed as threatened. Santa Barbara and Sonoma Counties DPS listed as endangered. Needs underground refuges, especially ground squirrel burrows and vernal pools or other seasonal water sources for breeding	**Not present.** Suitable habitat not found onsite.	December-February (diurnal), otherwise nocturnal
Birds				
Bald eagle *Haliaeetus leucocephalus*	Delisted/CE, CFP/--	Ocean shore, lake margins, and rivers for both nesting and wintering. Most nests within 1 mi of water. Nests in large, old-growth, or dominant live tree with open branches, especially ponderosa pine. Roosts communally in winter.	**Low.** Transient individuals may pass through project site.	Year-round
California black rail *Laterallus jamaicensis coturniculus*	--/CT, CFP/AWLR	Inhabits freshwater marshes, wet meadows and shallow margins of saltwater marshes bordering larger bays. Needs water depths of about 1 inch that does not fluctuate during the year and dense vegetation for nesting habitat.	**Not present.** Suitable habitat not found onsite.	Year-round
California clapper rail *Rallus longirostris obsoletus*	FE/CE,CFP/ AWLY	Salt-water and brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay. Associated with abundant growths of pickleweed, but feeds away from cover on invertebrates from mud-bottomed sloughs.	**Not present.** Suitable habitat not found onsite.	Year-round
California least tern *Sternula antillarum browni*	FE/CE,CFP/ AWLR	Nests along the coast from San Francisco Bay south to northern Baja California. Colonial breeder on bare or sparsely vegetated, flat substrates: sand beaches, alkali flats, land fills, or paved areas.	**Low.** Transient individuals may pass through project site.	Year-round
Western snowy plover *Charadrius alexandrinus nivosus*	FT/CSC/ AWLY	Sandy beaches, salt pond levees and shores of large alkali lakes. Needs sandy, gravelly or friable soils for nesting.	**Low.** Transient individuals may pass through project site.	Year-round
White-tailed kite *Elanus leucurus*	--/CFP/--	Rolling foothills and valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	**Low.** Transient individuals may pass through project site.	Year-round
Mammals				
Salt-marsh harvest mouse *Reithrodontomys raviventris*	FE/CE,CFP/--	Only in the saline emergent wetlands of San Francisco Bay and its tributaries. Found primarily in pickleweed (*Salicornia* spp.). Does not burrow, builds loosely organized nests. Requires higher areas for flood escape.	**Not present.** Suitable habitat not found onsite.	Year-round, primarily nocturnal

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	**Listing Status USFWS/ CDFG/other**	**General Habitat**	**Potential for Species Occurrence Within Project Site**	**Period of Identification**
Plants				
Beach layia *Layia carnosa*	FE/CE/1B.1	On sparsely vegetated, semi-stabilized coastal dunes and coastal scrub. 0-60 m.	**Not present.** Suitable habitat not found onsite.	March-July
California seablite *Suaeda californica*	FE/--/1B.1	Margins of coastal salt marshes and swamps. 0-5 m.	**Not present.** Suitable habitat not found onsite.	July-October
Contra Costa goldfields *Lasthenia conjugens*	FE/--/1B.1	Valley and foothill grassland, vernal pools, cismontane woodland, swales, low depressions, in open grassy areas. 1-445 m.	**Not present.** Suitable habitat not found onsite.	March-June
Pallid manzanita *Arctostaphylos pallida*	FT/CE/1B.1	Broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, coastal scrub. May require fire. 185-465 m.	**Not present.** Suitable habitat not found onsite.	December-March
Presidio clarkia *Clarkia franciscana*	FE/CE/1B.1	Coastal scrub, valley and foothill grassland, and serpentine outcrops in grassland or scrub. 20-335 m.	**Not present.** Suitable habitat not found onsite.	May-July
Robust spineflower *Chorizanthe robusta* var. *robusta*	FE/--/1B.1	Cismontane woodland, coastal dunes, coastal scrub, sandy terraces and bluffs or in loose sand. 3-120 m.	**Not present.** Suitable habitat not found onsite.	April-September
San Francisco popcorn-flower *Plagiobothrys diffusus*	--/CE/1B.1	Coastal prairie, valley and foothill grasslands. 60-360 m.	**Not present.** Suitable habitat not found onsite.	March-June
Santa Cruz tarplant *Holocarpha macradenia*	FT/CE/1B.1	Coastal prairie, valley and foothill grassland. Found on light, sandy soil or sandy clay; often with non-natives. 10-260 m.	**Not present.** Suitable habitat not found onsite.	April-November
Santa Cruz tarplant *Holocarpha macradenia*	FT/CE/1B.1	Coastal prairie, valley and foothill grassland. Light, sandy soil or sandy clay; often with non-natives. 10-260m.	**Not present.** Suitable habitat not found onsite.	June-October
Other Special-Status Species				
Invertebrates				
A leaf-cutter bee *Trachusa gummifera*	--/*/--	Unknown.	**Low.** While exact habitat requirements of this species are unknown, there are no records of this species from the project site, and essentially no native habitat remaining here.	Unknown
Antioch efferian robberfly *Efferia antiochi*	--/*/--	Known only from Contra Costa and Fresno Counties.	**Not present.** Suitable habitat not found onsite.	Unknown
Bridges' coast range shoulderband *Helminthoglypta nickliniana bridgesi*	--/*/--	Inhabits open hillsides of Alameda and Contra Costa counties. Tends to colonize under tall grasses and weeds.	**Not present.** Suitable habitat not found onsite.	Unknown
Lee's micro-blind harvestman *Microcina leei*	--/*/--	Xeric habitats in the San Francisco Bay region. Found beneath sandstone rocks in open oak grassland.	**Not present.** Suitable habitat not found onsite.	Unknown
Lum's micro-blind harvestman *Microcina lumi*	--/*/--	Xeric habitats in San Francisco Bay region beneath serpentine rocks in grassland.	**Not present.** Suitable habitat not found onsite.	Unknown

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	**Listing Status USFWS/ CDFG/other**	**General Habitat**	**Potential for Species Occurrence Within Project Site**	**Period of Identification**
Mimic tryonia (=California brackishwater snail) *Tryonia imitator*	--/*/--	Inhabits coastal lagoons, estuaries and salt marshes, from Sonoma County south to San Diego County. Found only in permanently submerged areas in a variety of sediment types; able to withstand a wide range of salinities.	**Not present.** Suitable habitat not found onsite.	Unknown
Monarch butterfly *Danaus plexippus*	--/*/--	Winter roost sites extend along the coast from northern Mendocino to Baja California, Mexico. Roosts located in wind-protected tree groves (eucalyptus, Monterey pine, cypress), with nectar and water sources nearby.	**Not present.** Suitable habitat not found onsite.	October-February
Sandy beach tiger beetle *Cicindela hirticollis gravida*	--/*/--	Inhabits areas adjacent to non-brackish water along the coast of California from San Francisco Bay to northern Mexico. Clean, dry, light-colored sand in the upper zone. Subterranean larvae prefer moist sand not affected by wave action.	**Not present.** Suitable habitat not found onsite.	Unknown
Fish				
Sacramento perch *Archoplites interruptus*	--/CSC	Historically found in the sloughs, slow-moving rivers, and lakes of the central valley. Prefers warm water. Aquatic vegetation is essential for young. Tolerates wide range of water conditions.	**Not present.** Suitable habitat not found onsite.	Year-round
Pacific herring *Clupea pallasii*	MSFCMA	S.F. Bay has been a major spawning ground for species. Preferred spawning substrate is eelgrass and algae but will also use pier pilings, riprap, and other rigid, smooth structures within Bay waters.	**High.** This species spawns in San Francisco Bay, and occurs in the Oakland Estuary.	November-August
Chinook salmon Central Valley ESU -fall/late fall run *Oncorhynchus tshawytscha*	--/CSC	Spawning and rearing restricted to Sacramento River basin. Migrate through San Francisco Bay and Sacramento-San Joaquin Delta, require clean, cold water and gravel beds for spawning.	**Moderate.** Could travel through the Oakland Estuary.	October-March
Longfin smelt *Spirinchus thaleichthys*	--/CSC	Inhabits the freshwater section of the lower Delta, and has been observed from south San Francisco Bay to the Delta, with the bulk of the San Francisco Bay population occupying the region between the Carquinez Straight and the Delta. Spawns in the Delta.	**Low.** Not known to spawn in the area, but could occasionally travel through the area.	Year-round
Amphibians and Reptiles				
Foothill yellow-legged frog *Rana boylii*	--/CSC/--	Partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Needs at least some cobble-sized substrate for egg-laying. Needs at least 15 weeks to attain metamorphosis.	**Not present.** Suitable habitat not found onsite.	Year-round
Western pond turtle *Actinemys marmorata*	--/CSC/--	A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches with aquatic vegetation. Needs basking sites and suitable (sandy banks or grassy open fields) upland habitat for egg-laying.	**Not present.** Suitable habitat not found onsite.	Year-round

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	**Listing Status USFWS/ CDFG/other**	**General Habitat**	**Potential for Species Occurrence Within Project Site**	**Period of Identification**
Birds				
Alameda song sparrow *Melospiza melodia pusillula*	--/CSC/--	Resident of salt marshes bordering south arm of San Francisco Bay. Inhabits pickleweed marshes; nests low in *Grindelia* bushes (high enough to escape high tides) and in pickleweed.	**Low.** Transient individuals may pass through project site, and may nest in buildings or trees onsite.	Year-round
Black skimmer *Rynchops niger*	--/CSC/AWLY	Nests on gravel bars, low islets, and sandy beaches, in unvegetated sites.	**Low.** Transient individuals may pass through project site.	Summer
Black-crowned night heron *Nycticorax nycticorax*	--/*/-- (rookery site)	Colonial nester, usually in trees, occasionally in tule patches. Rookery sites located adjacent to foraging areas: lake margins, mud-bordered bays, marshy spots.	**Low.** May forage in water around project site.	Year-round
Burrowing owl *Athene cunicularia*	--/CSC/--	Open, dry annual or perennial grasslands, deserts and scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	**Not present.** Suitable habitat not found onsite.	Year-round
Cackling (=Aleutian Canada) goose *Branta hutchinsii leucopareia*	Delisted/*/-- (wintering)	Winters on lakes and inland prairies. Forages on natural pasture or that cultivated to grain; loafs on lakes, reservoirs, ponds.	**Low.** Transient individuals may pass through project site.	Winter
Caspian tern *Hydroprogne caspia*	--/*/-- (nesting colony)	Nests on sandy or gravely beaches and shell banks in small colonies inland and along the coast. Inland fresh-water lakes and marshes; also, brackish or salt waters of estuaries and bays.	**Low.** Transient individuals may pass through project site.	Summer
Cooper's hawk *Accipiter cooperii*	--/WL, 3503.5/--	Woodland, chiefly of open, interrupted or marginal type. Nest sites are mainly in riparian growths of deciduous trees, as in canyon bottoms on river flood-plains; also, live oaks.	**Low.** Transient individuals may pass through project site.	Year-round
Double-crested cormorant *Phalacrocorax auritus*	--/*/-- (rookery site)	Colonial nester on coastal cliffs, offshore islands, and along lake margins in the interior of the state. Nests along coast on sequestered islets, usually on ground with sloping surface, or in tall trees along lake margins.	**Low.** May forage in water around project site.	Year-round
Golden eagle *Aquila chrysaetos*	--/FP/--	Rolling foothills, mountain areas, sage-juniper flats, and desert. Cliff-walled canyons and large trees in open areas provide nesting habitat.	**Low.** Transient individuals may pass through project site.	Year-round
Great blue heron *Ardea herodias*	--/*/-- (rookery site)	Colonial nester in tall trees, cliff sides, and sequestered spots on marshes. Rookery sites in close proximity to foraging areas: marshes, lake margins, tide-flats, rivers and streams, wet meadows.	**Low.** Transient individuals may pass through project site.	Year-round
Northern harrier *Circus cyaneus*	--/CSC/--	Coastal salt and fresh-water marsh. Nests and forages in grasslands. Nests on ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas.	**Low.** Transient individuals may pass through project site.	Year-round

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	Listing Status USFWS/ CDFG/other	General Habitat	Potential for Species Occurrence Within Project Site	Period of Identification
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	--/CSC/--	Resident of the San Francisco Bay region, in fresh and salt water marshes. Requires thick, continuous cover down to water surface for foraging; tall grasses, tule patches, willows for nesting.	**Low.** Transient individuals may pass through project site.	Year-round
Sharp-shinned hawk *Accipiter striatus*	--/WL, 3503.5/--	Ponderosa pine, black oak, riparian deciduous, mixed conifer and Jeffrey pine habitats. Prefers riparian areas. North-facing slopes, with plucking perches are critical requirements. Nests usually within 275 ft of water.	**Low.** Transient individuals may pass through project site.	Year-round
Snowy egret *Egretta thula*	--/*/-- (rookery site)	Colonial nester, with nest sites situated in protected beds of dense tules. Rookery sites situated close to foraging areas: marshes, tidal-flats, streams, wet meadows, and borders of lakes.	**Low.** Transient individuals may pass through project site.	Year-round
Yellow warbler *Dendroica petechia brewsteri*	--/CSC/--	Riparian plant associations. Prefers willows, cottonwoods, aspens, sycamores, and alders for nesting and foraging. Also nests in montane shrubbery in open conifer forests.	**Low.** Transient individuals may pass through project site.	Summer
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	--/CSC/--	Nests in freshwater emergent wetlands with dense vegetation and deep water, often along borders of lakes or ponds. Nests only where large insects are abundant, nesting timed with maximum emergence of aquatic insects.	**Low.** Transient individuals may pass through project site.	Year-round
Mammals				
Alameda Island mole *Scapanus latimanus parvus*	--/CSC/--	Only known from alameda island. Found in a variety of habitats, especially annual and perennial grasslands. Prefers moist, friable soils. Avoids flooded soils.	**Not present.** Suitable habitat not found onsite.	Year-round
American badger *Taxidea taxus*	--/CSC/--	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Needs sufficient food, friable soils and open, uncultivated ground. Preys on burrowing rodents.	**Not present.** Suitable habitat not found onsite.	Year-round
Berkeley kangaroo rat *Dipodomys heermanni berkeleyensis*	--/*/--	Open grassy hilltops and open spaces in chaparral and blue oak/digger pine woodlands. Needs fine, deep, well-drained soil for burrowing.	**Not present.** Suitable habitat not found onsite.	Year-round
Big free-tailed bat *Nyctinomops macrotis*	--/CSC/ WBWG-M	Low-lying arid areas in southern California. Needs high cliffs or rocky outcrops for roosting sites. Feeds principally on large moths.	**Not present.** Suitable habitat not found onsite.	Year-round, nocturnal
Hoary bat *Lasiurus cinereus*	--/*/WBWG-M	Prefers open habitats or habitat mosaics, with access to trees for cover and open areas or habitat edges for feeding. Roosts in dense foliage of medium to large trees. Feeds primarily on moths.	**Low.** May roost in trees onsite, particularly during migration periods in spring and fall.	Fall-Spring
Pallid bat *Antrozous pallidus*	--/CSC/ WBWG-H	Deserts, grasslands, shrublands, woodlands and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites.	**Low.** May roost in buildings or trees.	Year-round, nocturnal

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	Listing Status USFWS/ CDFG/other	General Habitat	Potential for Species Occurrence Within Project Site	Period of Identification
Salt-marsh wandering shrew *Sorex vagrans halicoetes*	--/CSC/--	Salt marshes of the south arm of San Francisco Bay. Found at medium to high marsh 6-8 ft above sea level where abundant driftwood is scattered among pickleweed.	**Not present.** Suitable habitat not found onsite.	Year-round
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	--/CSC/--	Forest habitats of moderate canopy and moderate to dense understory. May prefer chaparral and redwood habitats. Constructs nests of shredded grass, leaves and other material. May be limited by availability of nest-building materials.	**Low.** Suitable habitat not found onsite.	Year-round
San Pablo vole *Microtus californicus sanpabloensis*	--/CSC/--	Salt marshes of San Pablo Creek, on the south shore of San Pablo Bay. Constructs burrow in soft soil. Feeds on grasses, sedges and herbs. Forms a network of runways leading from the burrow.	**Not present.** Suitable habitat not found onsite.	Year-round
Silver-haired bat *Lasionycteris noctivagans*	--/*/WBWG-M	Primarily a coastal and montane forest dweller. Roosts in hollow trees, beneath exfoliating bark, abandoned woodpecker holes and rarely under rocks. Needs drinking water.	**Low.** Habitat generally unsuitable for this species, although may migrate through the project site.	Year-round
Townsend's big-eared bat *Corynorhinus townsendii*	--/CSC/ WBWG-H	Mesic sites. Roosts in caves and open, hanging from walls and ceilings. Very sensitive to human disturbance.	**Medium.** Documented occurrences of this species roosting in nearby buildings; may roost in project site's buildings.	Year-round
Western mastiff bat *Eumops perotis californicus*	--/CSC/ WBWG-H	Many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, grasslands, chaparral. Roosts in crevices in cliff faces, high buildings, trees, and tunnels.	**Not present.** Suitable habitat not found onsite.	Year-round, nocturnal
Plants				
Adobe sanicle *Sanicula maritima*	--/CR/1B.1	Meadows and seeps, valley and foothill grassland, chaparral, coastal prairie. Found on moist clay or ultramafic soils. 30-240 m.	**Not present.** Suitable habitat not found onsite.	February-May
Alkali milk-vetch *Astragalus tener* var. *tener*	--/--/1B.2	Alkali playa and flats, valley, annual, and foothill grassland, vernal pools, low ground, and flooded lands. 1-170 m.	**Not present.** Suitable habitat not found onsite.	March-June
Bent-flowered fiddleneck *Amsinckia lunaris*	--/--/1B.2	Cismontane woodland, valley and foothill grassland. 50-500 m.	**Not present.** Suitable habitat not found onsite.	March-June
Big tarplant *Blepharizonia plumosa*	--/--/1B.1	Valley and foothill grasslands, dry hills and plains in annual grassland. Clay to clay-loam soils; usually on slopes and often in burned areas. 15-455 m.	**Not present.** Suitable habitat not found onsite.	July-October
Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	--/--/1B.2	Valley and foothill grassland, cismontane woodland, sometimes on serpentine. 35-1,000 m.	**Not present.** Suitable habitat not found onsite.	March-June
Blue coast gilia *Gilia capitata* ssp. *chamissonis*	--/--/1B.1	Coastal dunes, coastal scrub. 2-200 m.	**Not present.** Suitable habitat not found onsite.	April-July

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	Listing Status USFWS/ CDFG/other	General Habitat	Potential for Species Occurrence Within Project Site	Period of Identification
Bristly sedge *Carex comosa*	--/--/2.1	Marshes and swamps, lake margins, wet places. 5-1005 m.	**Not present.** Suitable habitat not found onsite.	May-September
Choris' popcorn-flower *Plagiobothrys chorisianus* var. *chorisianus*	--/--/1B.2	Mesic sites in chaparral, coastal scrub, coastal prairie. 15-100 m.	**Not present.** Suitable habitat not found onsite.	March-June
Coastal bluff morning-glory *Calystegia purpurata* ssp*. saxicola*	--/--/1B.2	Coastal dunes and coastal scrub. 15-105 m.	**Not present.** Suitable habitat not found onsite.	May-September
Congdon's tarplant *Centromadia parryi* ssp. *congdonii*	--/--/1B.2	Valley and foothill grassland. Alkaline soils, sometimes described as heavy white clay. 1-230 m.	**Not present.** Suitable habitat not found onsite.	May-October
Diablo helianthella *Helianthella castanea*	--/--/1B.2	Broadleaved upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland. Usually in chaparral/oak woodland interface in rocky, azonal soils. Often in partial shade. 25-1,150 m.	**Not present.** Suitable habitat not found onsite.	May-July
Fragrant fritillary *Fritillaria liliacea*	--/--/1B.2	Coastal scrub, valley and foothill grassland, coastal prairie. Often on serpentine; usually on clay soils, in grassland. 3-410 m.	**Not present.** Suitable habitat not found onsite.	February-April
Franciscan thistle *Cirsium andrewsii*	--/--/1B.2	Coastal bluff scrub, broadleaved upland forest, coastal scrub, sometimes serpentine seeps. 0-135 m.	**Not present.** Suitable habitat not found onsite.	May-September
Hairless popcorn-flower *Plagiobothrys glaber*	--/--/1A	Alkaline meadows and seeps, coastal salt marshes and swamps. 5-180 m.	**Not present.** Suitable habitat not found onsite.	March-May
Hall's bush-mallow *Malacothamnus hallii*	--/--/1B.2	Chaparral, some populations on serpentine. 10-550 m.	**Not present.** Suitable habitat not found onsite.	May-September
Kellogg's horkelia *Horkelia cuneata* ssp*. sericea*	--/--/1B.1	Openings in closed-cone coniferous forest, coastal scrub, chaparral, old dunes, coastal sandhills. 10-200 m.	**Not present.** Suitable habitat not found onsite.	April-September
Loma Prieta hoita *Hoita strobilina*	--/--/1B.1	Chaparral, cismontane woodland, riparian woodland. Serpentine and mesic sites.	**Not present.** Suitable habitat not found onsite.	May-July
Most beautiful jewel-flower *Streptanthus albidus* ssp. *peramoenus*	--/--/1B.2	Chaparral, valley and foothill grassland, cismontane woodland, serpentine outcrops, and on ridges and slopes. 120-730 m.	**Not present.** Suitable habitat not found onsite.	April-September
Mt. Diablo fairy-lantern *Calochortus pulchellus*	--/--/1B.2	Chaparral, cismontane woodland, riparian woodland, valley and foothill grassland. On wooded and brushy slopes. 200-800 m.	**Not present.** Suitable habitat not found onsite.	April-June
Northern California black walnut *Juglans hindsii*	--/--/1B.1	Riparian forest, riparian woodland. On deep alluvial soils associated with a creek or stream. 0-395 m.	**Not present.** Suitable habitat not found onsite.	Blooms April-May
Oregon meconella *Meconella oregana*	--/--/1B.1	Coastal prairie, coastal scrub in open, moist places. 250-500 m.	**Not present.** Suitable habitat not found onsite.	March-April
Point Reyes bird's-beak *Cordylanthus maritimus* ssp. *palustris*	--/--/1B.2	Coastal salt marsh usually with *Salicornia*, *Distichlis*, *Jaumea*, *Spartina*, etc. 0-15 m.	**Not present.** Suitable habitat not found onsite.	June-October

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	Listing Status USFWS/ CDFG/other	General Habitat	Potential for Species Occurrence Within Project Site	Period of Identification
Robust monardella *Monardella villosa* ssp. *globosa*	--/--/1B.2	Openings in broadleaved upland forest, chaparral, cismontane woodland, valley and foothill grassland. 30-300 m.	**Not present.** Suitable habitat not found onsite.	June-July
Rose leptosiphon *Leptosiphon rosaceus*	--/--/1B.1	Coastal bluff scrub. 0-100 m.	**Not present.** Suitable habitat not found onsite.	April-July
Round-leaved filaree *California macrophylla*	--/--/1B.1	Cismontane woodland, valley and foothill grassland. Clay soils. 15-1,200 m.	**Not present.** Suitable habitat not found onsite.	March-May
Saline clover *Trifolium depauperatum var. hydrophilum*	--/--/1B.2	Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites. 0-300 m.	**Not present.** Suitable habitat not found onsite.	April-June
San Francisco Bay spineflower *Chorizanthe cuspidata* var. *cuspidata*	--/--/1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, coastal scrub, on sandy soil on terraces and slopes. 5-550 m.	**Not present.** Suitable habitat not found onsite.	April-July
San Joaquin spearscale *Atriplex joaquiniana*	--/--/1B.2	Chenopod scrub, alkali meadow, valley and foothill grassland. In seasonal alkali wetlands or alkali sink scrub with species such as *Distichlis spicata* and *Frankenia*. 1-250 m.	**Not present.** Suitable habitat not found onsite.	April-October
Seaside tarplant *Hemizonia congesta* ssp*. congesta*	--/--/1B.2	Coastal scrub, valley and foothill grassland, on grassy valleys and hills, often in fallow fields. 25-200 m.	**Not present.** Suitable habitat not found onsite.	April-November
Slender silver moss *Anomobryum julaceum*	--/--/2.2	Broadleaf upland forest, lower montane coniferous forest, north coast coniferous forest. Moss which grows on damp rocks and soil; usually seen on roadcuts. 100-1,000 m.	**Not present.** Suitable habitat not found onsite.	Year-round
Slender-leaved pondweed *Potamogeton filiformis*	--/--/2.2	Marshes and swamps, in shallow, clear water of lakes and drainage channels. 15-2,310 m.	**Not present.** Suitable habitat not found onsite.	May-July
Tiburon buckwheat *Eriogonum luteolum var. caninum*	--/--/1B.2	Chaparral, valley and foothill grassland, cismontane woodland, coastal prairie. Found on serpentine soils; sandy to gravelly sites. 0-700 m.	**Not present.** Suitable habitat not found onsite.	May-September
Western leatherwood *Dirca occidentalis*	--/--/1B.2	Broadleaf upland forest, chaparral, closed-cone coniferous forest, cismontane woodland, north coast coniferous forest, riparian for and woodland. on brushy slopes, mesic sites; mostly in mixed evergreen and foothill woodland communities. 30-550 m.	**Not present.** Suitable habitat not found onsite.	January-March
Communities				
Northern Coastal Salt Marsh	--/--/--	Dense cover of salt-tolerant hydrophytes up to 1m tall. Found on sheltered inland margins of bays, lagoons, and estuaries. Hydric soils subject to regular tidal flooding.	**Not present.** Suitable habitat not found onsite.	Year-round
Northern Maritime Chaparral	--/--/--	Open chaparral dominated by *Manzanita* and *Ceanothus*. Located in sandy areas within coastal fog zone.	**Not present.** Suitable habitat not found onsite.	Year-round
Serpentine Bunchgrass	--/--/--	Open grassland dominated by perennial bunch grasses. Restricted to serpentine sites.	**Not present.** Suitable habitat not found onsite.	Year-round

SPECIAL-STATUS SPECIES CONSIDERED IN EVALUATION OF ALAMEDA BOATWORKS RESIDENTIAL PROJECT SITE (Continued)

Common Name *Scientific Name*	Listing Status USFWS/ CDFG/other	General Habitat	Potential for Species Occurrence Within Project Site	Period of Identification
Valley Needlegrass Grassland	--/--/--	Dominated by perennial *Nassella pulchra* up to 2 feet in height. On fine, often clay, soils, moist or waterlogged in the winter, dry in summer.	**Not present.** Suitable habitat not found onsite.	Year-round

STATUS CODES

Federal (U.S. Fish and Wildlife Service [USFWS]):
FE = Listed as Endangered (in danger of extinction) by the federal government.
FT = Listed as Threatened (likely to become Endangered within the foreseeable future) by the federal government.
FP = Proposed for Listing as Endangered or Threatened.
FC = Candidate to become a *proposed* species.
FSC = Former Federal Species of Concern. The USFWS no longer lists Species of Concern but recommends that species considered to be at potential risk by a number of organizations and agencies be addressed during project environmental review. *NMFS still lists Species of Concern.
MSFCMA = Magnuson-Stevens Fishery Conservation and Management Act

State (California Department of Fish and Game [CDFG]):
CE = Listed as Endangered by the State of California.
CT = Listed as Threatened by the State of California.
CR = Listed as Rare by the State of California (plants only).
CSC = California Species of Special Concern.
CFP = Fully Protected
WL = Watch List
3503.5 = Protection for nesting species of Falconiformes (hawks) and Strigiformes (owls).
4150 = Prohibits take of non-game mammals, such as bats
*Special animal—listed on CDFG's Special Animals List.

California Native Plant Society (CNPS):
List 1A=Plants presumed extinct in California.
List 1B=Plants rare, Threatened, or Endangered in California and elsewhere.
List 2= Plants rare, Threatened, or Endangered in California but more common elsewhere.

An extension reflecting the level of threat to each species is appended to each rarity category as follows:
.1 – Seriously endangered in California.
.2 – Fairly endangered in California.
.3 – Not very endangered in California.

Western Bay Working Group (WBWG):
WBWGH =High priority; Species that are imperiled or at a high risk of imperilment.
WBWGM = Medium priority; Species that warrant a closer evaluation due to potential imperilment.
WBWGL = Low priority; Species are stable based on supporting data.

Audubon Watch List
AWLR = Birds that are declining rapidly and/or have very small populations or limited ranges, face major threats.
AWLY = Declining or rare bird species.

SOURCE: CDFG, 2009; CNPS, 2009; USFWS, 2009.

APPENDIX H
Secretary of the Interior Standards

APPENDIX H

Secretary of the Interior's Standards for Rehabilitation

Presented below are the Secretary of the Interior's Standards for Rehabilitation, as codified in National Park Service regulations (36 CFR 68) and included in the 1995 National Park Service publication *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring & Reconstructing Historic* Properties, by Kay D. Weeks and Anne E. Grimmer, which is referenced in Section 15064.5 of the state CEQA Guidelines. (A slightly different version of the Secretary's Standards for Rehabilitation is codified separately for use in the federal Historic Preservation Tax Incentives program (36 CFR 67), under which property owners of certain historic properties can gain tax credits for restoring those properties.)

"Rehabilitation" is defined as "the process of returning a property to a state of utility, through repair or alteration, which makes possible an efficient contemporary use while preserving those portions and features of the property which are significant to its historic, architectural, and cultural values." According to Weeks and Grimmer, "The Standards are to be applied to specific rehabilitation projects in a reasonable manner, taking into consideration economic and technical feasibility."

Standards for Rehabilitation

1) A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces and spatial relationships.

2) The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.

3) Each property will be recognized as a physical record of its time, place and use. Changes that create a false sense of historical development, such as adding conjectural features or elements from other historic properties, will not be undertaken.

4) Changes to a property that have acquired historic significance in their own right will be retained and preserved.

5) Distinctive materials, features, finishes and construction techniques or examples of craftsmanship that characterize a property will be preserved.

6) Deteriorated historic features will be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature will match the old in design, color, texture and, where possible, materials. Replacement of missing features will be substantiated by documentary and physical evidence.

7) Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.

8) Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.

9) New additions, exterior alterations or related new construction will not destroy historic materials, features and spatial relationships that characterize the property. The new work will be differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.

10) New additions and adjacent or related new construction will be undertaken in such a manner that, if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.